



A Biological Study of the Pike Island Pool of the Ohio River



Executive Summary

- Since 2004, ORSANCO has been using a probabilistic (random) design for monitoring fish communities in the Ohio River and conducting biological assessments.
- The Ohio River was divided into 20 assessment units based primarily on the locations of navigational dams. Using the random design, each assessment unit was assigned 15 sampling locations.
- Once sampled, each site is graded as passing or failing. For an assessment unit to meet its aquatic life use designation, more than 75% of the sites assessed must be in passing condition.
- In 2007, 100% of the sites assessed in Pike Island pool were in passing condition. Therefore the Pike Island pool will be reported to EPA as meeting (supporting) its aquatic life use designation.
- Previous analyses have identified a relationship between flow and ORFIn scores and the need for sampling thresholds and/or flow calibration. Increased flows appeared to cause lower ORFIn scores due to decreased sampling efficiency and changes in fish behavior.
- Flows were stable in 2007 and were not elevated when sampling was conducted.
- Recommendations include accepting the assessment of Pike Island pool as meeting its aquatic life use designation and moving to the next pool to be sampled while continuing to monitor flow and its influence on assessment results.

Table of Contents

	Executive Summary	i
1.0	Introduction.....	1
2.0	Study Area	
2.1	Ohio River.....	1
2.1.1	Figure 1. Ohio River Basin	2
2.2	Pike Island Pool.....	3
2.3	Pike Island Land Use	3
2.3.1	Figure 2. Land use within the Pike Island catchment area.....	3
3.0	Methods	
3.1	Survey Design and Site Location	3
3.2	Index Period and Sampling Restrictions	4
3.3	Fish Collections	4
3.4	Habitat Characterizations	4
3.5	Water Quality and Flow Condition Data	5
3.6	Pool Assessment.....	5
3.6.1	Figure 3. Biological Condition Ratings.....	5
3.6.2	Figure 4. Sites within Pike Island Pool	6
4.0	Results	
4.1	Fish Population.....	6
4.1.1	Figure 5. Species Composition	7
4.1.2	Figure 6. Family Composition.....	7
4.1.3	Table 1. Electrofishing Sites	7
4.1.4	Table 2. Species List.....	8
4.2	Metric Performance	9
4.3	Habitat Surveys	9
4.3.1	Figure 7. Substrate Composition by Pool.....	9
4.3.2	Figure 8. Substrate Composition by Site	9
4.3.3	Table 3. ORFIn Metrics and Scores.....	10
4.4	Water Quality and Flow Conditions.....	11
4.4.1	Figure 9. Flow Conditions.....	11
4.5	Assessment of Condition.....	11
4.5.1	Figure 10. Pool Assessment Results	11
4.5.2	Figure 11. Pool Condition Ratings	11
5.0	Discussion	
5.1	Fish Population.....	11
5.2	Metric Performance	12
5.3	Habitat Surveys	12
5.4	Water Quality and Flow Conditions.....	12
5.5	Conclusions and Assessment of Conditions.....	12
6.0	Interpool Comparisons	
6.1	Purpose.....	12
6.2	Land Use	12
6.2.1	Figure 12. Land-use within catchment area of each pool of the Ohio River	13
6.3	Substrate Composition.....	13
6.3.1	Figure 13. Substrate composition for each pool	13
6.4	Species Richness	13
6.4.1	Figure 14. Average number of native species.....	13
6.5	Number of Individuals.....	13
6.5.1	Figure 15. Average number of individual species.....	14
6.6	Noteworthy Fish Observations.....	14
6.6.1	Table 4. Compiled species list per pool.....	15
6.7	ORFIn Deviation	14
6.7.1	Figure 16. Average ORFIn Deviation	14
6.8	Assessment of Condition	14
6.8.1	Figure 17. Percentage of sites failing	14
	Literature Cited.....	17
	Appendix A. Assessment Criteria Details.....	18
	Appendix B. Fish Survey Data	20
	Appendix C. Habitat Survey Data	28
	Appendix D. Water Quality Data.....	28
	Appendix E. Water Quality Parameters Analyzed.....	29

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1.0 Introduction

The Ohio River Valley Water Sanitation Commission (ORSANCO) is an interstate water pollution control agency created in 1948 by an act of Congress to monitor and improve the water quality of the Ohio River. Until that time, water quality issues on the Ohio River had been charged to state water quality agencies. However, due to large-scale interstate implications and large pollution loads received by the Ohio River, these agencies were not sufficiently equipped to work with such a system. ORSANCO's role is to work in conjunction with state agencies to develop a set of pollution control standards exclusive to the Ohio River. The creation of these standards requires the establishment of monitoring programs that can efficiently be used on the Ohio River.

The routine ambient monitoring programs of ORSANCO are primarily directed at three monitoring and assessment priorities: spill detection (through an organics detection system), trend assessment (manual sampling system), and aquatic resource characterization (macroinvertebrate and fish studies). Another priority, water quality impacts assessment, is achieved through entire watershed intensive surveys.

In 1993, following direction from state and federal agencies, ORSANCO staff developed and implemented an intensive survey design that used electrofishing methods designed for the navigational pools of the Ohio River. This entailed extensive sampling of fish communities throughout the entire length of a particular pool. The surveys were intended to provide background information on fish populations and lay a foundation for establishing biological criteria (biocriteria) for the Ohio River. With appropriate biocriteria in place, information on the biological community provides insight into the health of the Ohio River.

After several years of collecting background data on the fish population of the Ohio River, ORSANCO developed the Ohio River Fish Index (ORFI_n, Emery et al. 2003). The ORFI_n incorporates 13

attributes, or metrics, of the fish community that when compiled provide an accurate representation of the overall condition of the Ohio River fish community. These 13 metrics take into account several different aspects of the fish population, including diversity, abundance, feeding and reproductive guilds, pollution tolerance/intolerance, and fish health.

An important aspect of biological monitoring is the reduction of human induced bias in the samples. The use of probability-based sample site selection was designed to reduce this bias. Within this design, sample sites are randomly selected by computer generation, eliminating the tendency to sample only in the best or worst locations. Many states already have programs in place that use this design for sampling on smaller streams, and it is also used by the U.S. Environmental Protection Agency's (USEPA) Environmental Monitoring and Assessment Program (EMAP). ORSANCO has now begun using this approach on the Ohio River for its biological monitoring. In 2007, the Emsworth, Pike Island, Meldahl, Cannelton and Newburgh pools were sampled as part of ORSANCO's normal monitoring. This report presents the 2007 survey of the Pike Island pool including the data collected and assessment results based on the fish population surveys.

2.0 Study Area

2.1 Ohio River

The Ohio River (Figure 1) begins at the confluence of the Monongahela and Allegheny rivers and flows 981 miles in a southwesterly direction to the confluence with the Mississippi River. Twenty navigational dams maintain a nine-foot minimum depth for commercial navigation throughout the entire length of the river. There are over 600 permitted discharges to the Ohio River, 49 of which are power-generating facilities. The Ohio River Basin contains nearly ten percent of the nation's population, more than 25 million people, and serves as an avenue for transportation of approximately 250 million tons of cargo each year (ORSANCO 1994). The Ohio River dissects four ecoregions: the Western Allegheny Plateau, the Interior Plateau, the Interior River Lowland, and the Mississippi Alluvial Plain (Omernik 1987).

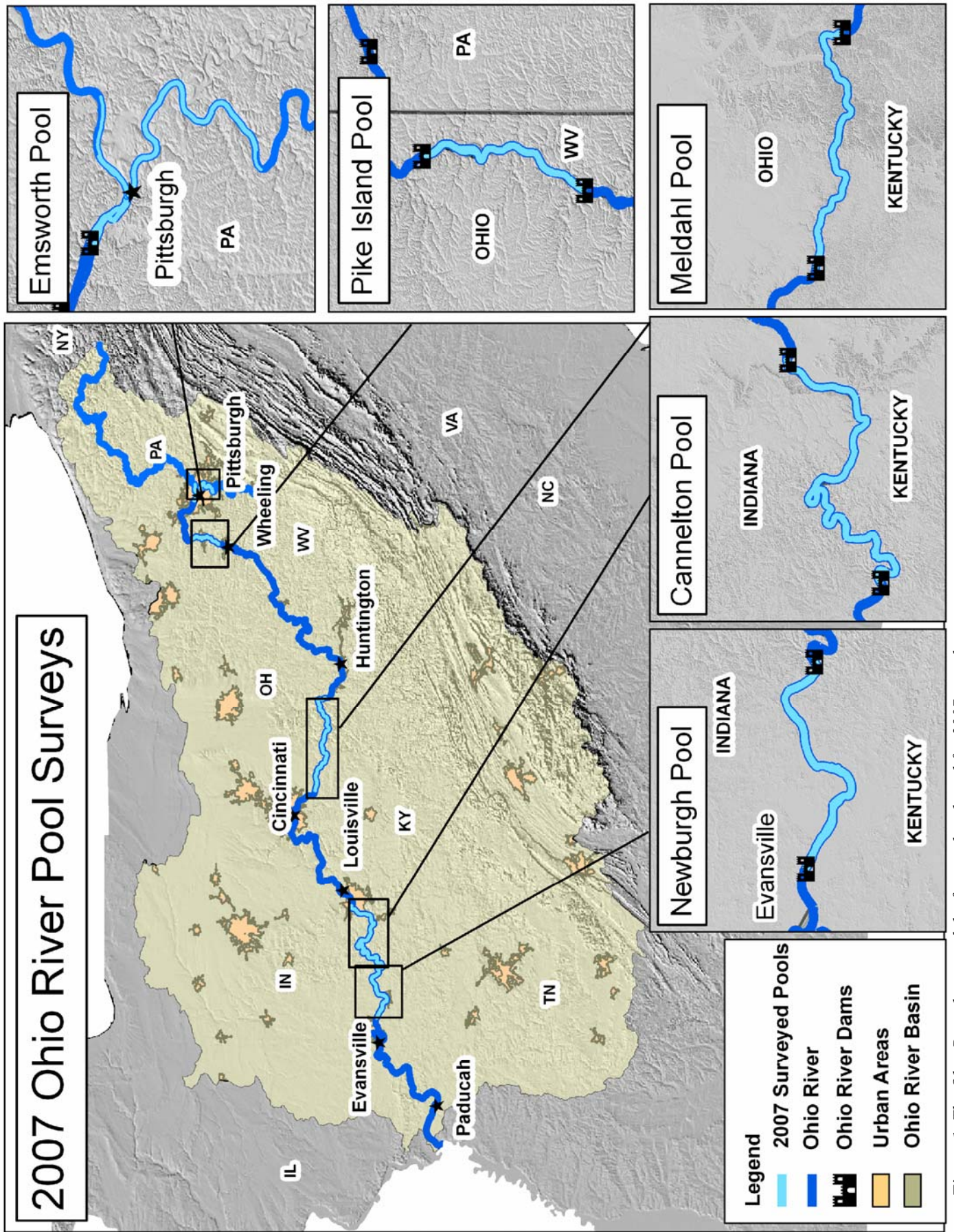


Figure 1. The Ohio River basin and the five pools selected for 2007 sampling.

2.2 Pike Island Pool

The Pike Island pool is 29.8 miles long, extending from New Cumberland Locks and Dam (ORM 54.4) to Pike Island Locks and Dam (ORM 84.2). The pool has a gradient drop of 0.4 feet per mile and averages 1,338 feet wide and 19 feet deep (ORSANCO 1994). The pool is bordered by the states of West Virginia and Ohio.

2.3 Pike Island Pool Land Use

This pool lies in a portion of the Ohio River heavily influenced by industry with a large amount of barge activity. The Pike Island pool receives water from the following tributaries: Buffalo Creek at mile point 74.7 with a drainage area of 160 square miles, and Short Creek at mile point 81.4 with a drainage area of 147 square miles. These watersheds are primarily forested (64.4%), but also have a

considerable amount of row crops (7.2%) and pasture lands (12.5%: Figure 2).

3.0 Methods

3.1 Survey Design and Site Location

A random, probability-based survey design was used to select sampling site locations within each Ohio River survey pool. The USEPA National Health and Environmental Effects Laboratory, Western Ecology Division provided assistance by generating the survey design for this project. The target population was the linear shorelines of the Pike Island pool of the Ohio River from mile marker 54.4 (New Cumberland Locks and Dam) to 84.2 (Pike Island Locks and Dam). The total linear extent of the target population was approximately 59.6 miles. The sample frame was generated

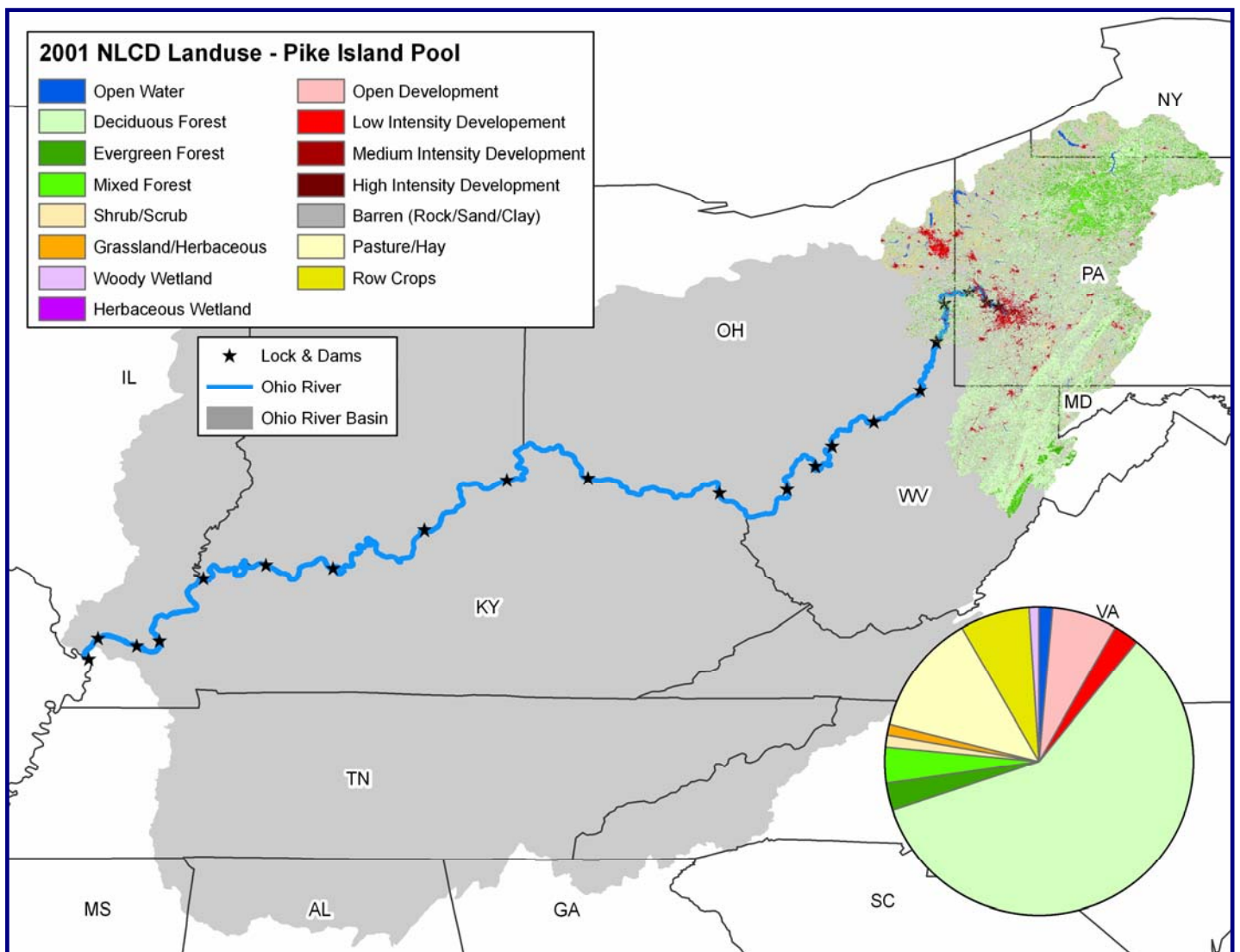


Figure 2. Land use within the Pike Island pool catchment area.

using RF3 river double lines for the Ohio River and river mile coverage provided by ORSANCO. A generalized random tessellation stratified (GRTS) survey design for a linear network with reverse hierarchical randomization (RHR) was used to select all sampling locations. This survey design provided coordinates for 15 sampling sites in each of the selected pools. The data collected from these sites were used to make an assessment of the pool (see Section 3.6 and Appendix A).

Sites were sampled as closely as possible to the location generated from the design, but in cases of restricted access or unsafe sampling conditions (e.g. barge loading/mooring area), sampling zones were shifted if possible (up to a maximum of 500m up- or downstream). The survey design supplied additional sampling sites to be used if a site could not be placed within 500m of the original location.

3.2 Index Period and Sampling Restrictions

All sampling was conducted under the required conditions as described by Emery et al. (2003). This included sampling between July 1 and October 31 when water levels were within one meter of “normal flat pool” and Secchi depths were greater than 0.3m. These sampling restrictions were used to reduce community variability by increasing the likelihood that samples were collected during the stable, low-flow conditions usually present on the Ohio River during the summer and early fall months.

3.3 Fish Collections

Standard collection techniques were employed throughout the surveys as described by Emery et al. (2003). Fish were collected using boat electrofishing techniques at night because nighttime electrofishing typically yields samples of increased diversity and richness (Sanders 1992).



ORSANCO crew conducting night-time electrofishing

A sampling crew consisted of a three-person team working from an 18-foot aluminum johnboat. Each boat was equipped with a 5000-watt generator and a Smith-Root Type VI-A electrofishing unit. Sampling was conducted over a 500m long section of near-shore habitat (shoreline out to a maximum distance of 100 ft or a depth of 20 ft.) and was sampled for a minimum of 1800 seconds (Gammon 1998). Time could vary depending upon the complexity of the habitat within a given zone. Stunned fish were captured with nets and placed into large, aerated tubs for processing. Each fish was measured, inspected for anomalies, and identified to lowest possible taxonomic level (species) before being returned to the water. Fish that could not be confidently identified in the field (e.g. minnows) were preserved in a ten percent formalin solution and identified in the laboratory.



Typical 500 meter electrofishing reach

3.4 Habitat Characterizations

Large rivers have distinct habitat types, including unique microhabitats (Reash 1999). Therefore, extensive habitat surveys were conducted for each electrofishing zone, including thorough substrate and depth measurements. Descriptions of the riparian corridor adjacent to the sampling zone and the presence of woody material available as fish cover were also recorded. Depth and substrate composition were measured at 66 points throughout each 500m zone. Six points along the shoreline were selected throughout the length of the zone, at 0, 100, 200, 300, 400 and 500m. From each of these points, depth was recorded at 10ft intervals beginning at the shore/water interface and moving away from the shore for 100ft. Woody cover, which included submerged brush, logs, and stumps, was estimated visually. Using these data, each site, or electrofishing zone, was assigned to one of three existing classes of habitat: ‘A’, ‘B’, or ‘C’. By

assigning each sampling site to one of three habitat categories, biologists can reduce the amount of assessment variability, or ‘noise’, because each habitat class has a slightly different expectation. Sites assigned to habitat class ‘A’ are characterized by the presence of large substrates such as cobble and boulders. Sites that fall in habitat class ‘C’ are dominated by sand and other small substrates, and habitat class ‘B’ describes sites that fall between ‘A’ and ‘C’ with a mix of large and small substrate materials.

3.5 Water Quality and Flow Condition Data

Basic measures of water quality were collected at each site prior to sampling. The following parameters were measured with a YSI meter: water temperature, pH, dissolved oxygen (DO), and conductivity. Water samples were also collected using a Kemmerer and consisted of a single-point, mid-depth grab sample at the downstream end of each 500m zone. Samples were collected approximately 100ft from shore at each site on three separate occasions throughout the field season. Samples were kept at or below 4°C until sent off for laboratory analyses. Water quality parameters analyzed included: ammonia nitrogen, chloride, hardness, nitrate-nitrite, total Kjeldahl nitrogen (TKN), phenolics, sulfate, total suspended solids (TSS), total phosphorus, and total organic carbon (TOC).

Secchi depth was measured using a standard Secchi disk. Flow data were obtained from the U.S. Army Corps of Engineers. These included daily average flow volumes and velocities from the sampling station within or nearest to the sampled pool. Harmonic mean flow (HMF) values were determined by ORSANCO using 30-year means for the flow data obtained from the U.S. Army Corps of Engineers (ORSANCO 2003).

3.6 Pool Assessment

In 2007, ORSANCO employed a probability-based sampling and assessment approach to provide a thorough assessment of biological condition. For the purpose of assessment, individual navigational pools served as the primary assessment units. Therefore, the Pike Island pool served as one distinct assessment unit (AU) and will be reported on as such in the 305(b) report issued to EPA. The

approach to assessing each AU involved sampling a statistically determined number of sites (15) and comparing observed ORFIn scores to habitat derived expectations for each site (Emery et al. 2003).

The three distinct habitat classes (‘A’, ‘B’, and ‘C’) each exhibit different levels of ORFIn performance. Performance expectations for each habitat class were determined based on the statistical distribution of data (ORFIn scores) gathered from ‘least impacted’ (reference) sites within each habitat class. The 25th percentile value for each habitat class was established as the criterion for determining whether an individual site ‘passes’ (meets its aquatic life use designation) or ‘fails’ (does not meet its aquatic life use designation, Figure 3).

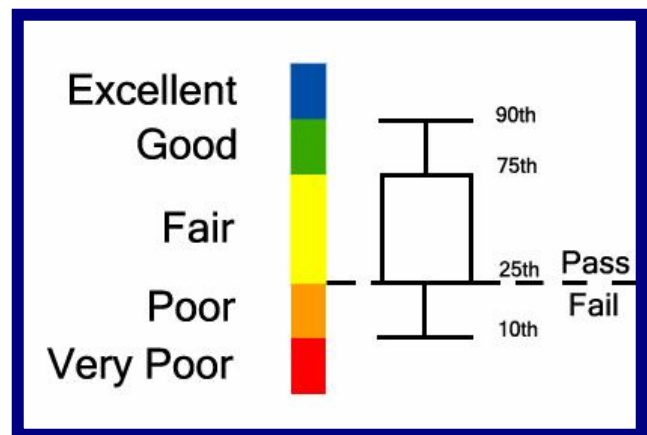


Figure 3. Approach used to assign habitat condition ratings.

Individual site scores were compared to expected values and the percentage of failing sites in the pool was then calculated. A precision estimate for the percentage of sites failing was also calculated (see Appendix A for a detailed explanation). The precision estimate was used to create a 90% confidence interval around the percentage of sites failing. The threshold for the pool assessment was set at 25% failure. The pool passed the assessment if the entire confidence interval fell below 25%. If the whole confidence interval was greater than 25%, the pool was assessed as failing. If the confidence interval overlapped the 25% threshold, the assessment required additional sampling to determine the result. To further characterize the condition of each pool, sites were given individual

condition ratings. These ratings were based on the same distribution of data from ‘least impacted’ sites used to determine expectations and consisted of Excellent, Good, Fair, Poor and Very Poor. The 90th, 75th, 25th, and 10th percentiles were used as

cutoff points for the different ratings. Any sites that were classified as Poor or Very Poor were also sites that failed to meet expectations (Figures 3 and 4).

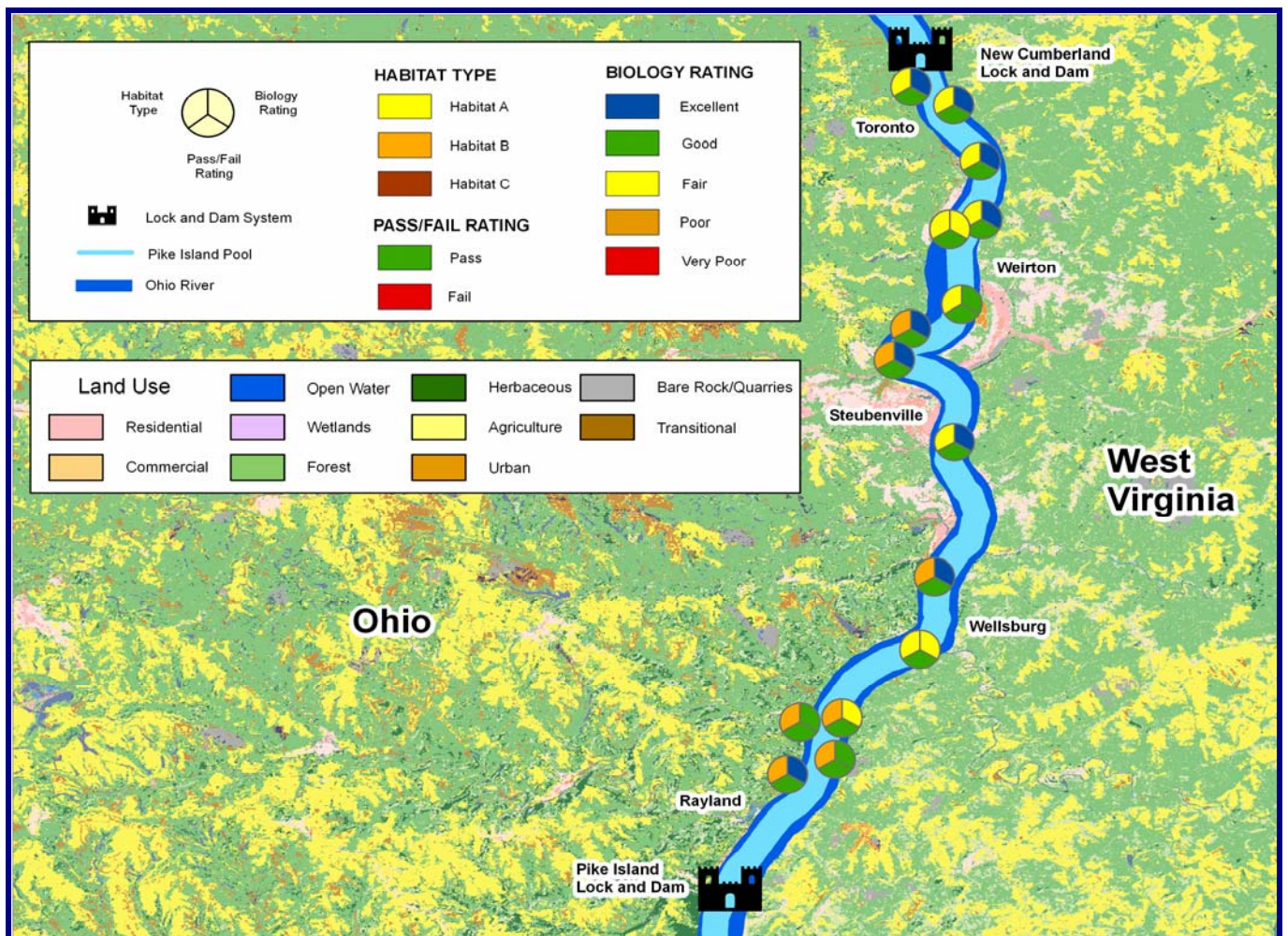


Figure 4. Locations and results of sampling at 15 sites within the Pike Island pool.

4.0 Results

4.1 Fish Population

In 2007, fish population data (Appendix B) were collected from 15 randomly selected locations throughout the length of the Pike Island pool (Table 1). These collections produced 41 species and 2 hybrid taxa, representing 10 different families (Table 2). Two of these taxa were listed in OH as either threatened [river darter (*Percina shumardi*)]

or of special concern [river redhorse (*Moxostoma carinatum*)]. WV has no system for listings species. No federally listed taxa were collected from the Pike Island pool. At the species level, gizzard shad (*Dorosoma cepedianum*) was the most abundant, comprising 73.6% of the catch (Figure 5). As a result the shad and herring family (Clupeidae), made up 73.6% of the total catch, followed by the drum family (Sciaenidae) which made up 5.0% of the catch (Figure 6).

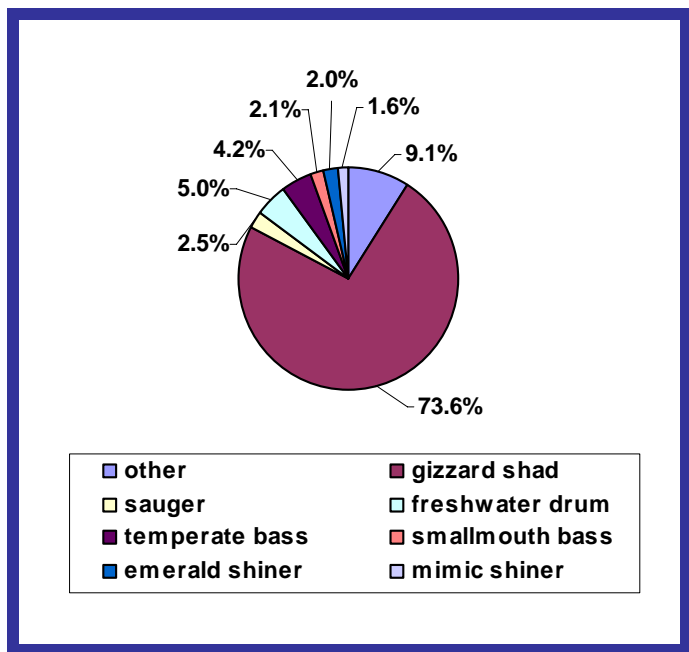


Figure 5. Species composition of fish sampled in Pike Island pool.

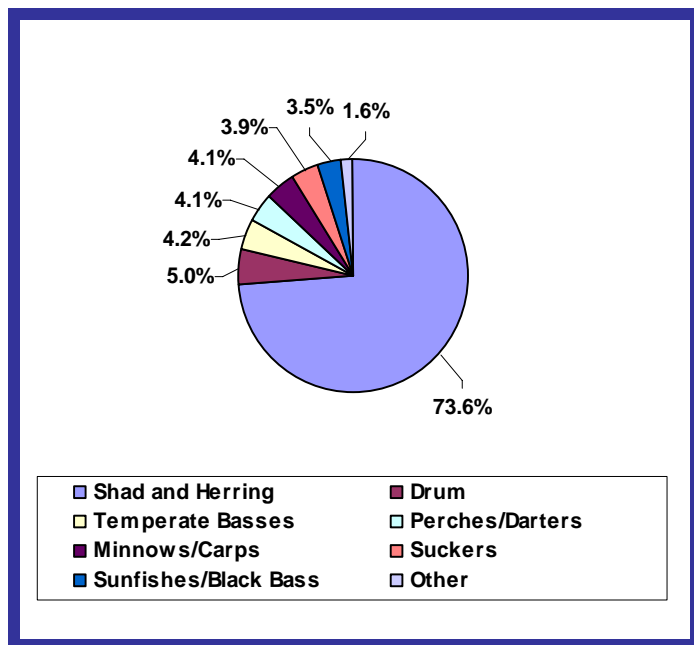


Figure 6. Sampled fish composition by family in the Pike Island pool.

Table 1. Electrofishing site list for the Pike Island pool, including habitat designation, ORFIn scores and status.

Site #	River Mile	Bank	Date	Latitude	Longitude	Habitat Class	ORFIn Expectation	Observed ORFIn	Site Result	Rating
1	55.5	RDB	10-Jul-07	40.51078	80.62189	A	39	51	PASS	EXCELLENT
2	56.2	LDB	10-Jul-07	40.50249	80.61394	A	39	55	PASS	EXCELLENT
3	58.2	RDB	09-Jul-07	40.47733	80.59778	A	39	51	PASS	EXCELLENT
4	60.1	LDB	09-Jul-07	40.45117	80.60039	A	39	53	PASS	EXCELLENT
5	60.4	LDB	11-Jul-07	40.44677	80.60294	A	39	45	PASS	FAIR
6	62.8	LDB	18-Jul-07	40.41337	80.60549	A	39	49	PASS	GOOD
7	64.3	RDB	18-Jul-07	40.39915	80.62283	B	33	51	PASS	EXCELLENT
8	64.8	RDB	17-Jul-07	40.39525	80.63226	B	33	49	PASS	EXCELLENT
9	68.4	LDB	16-Jul-07	40.35182	80.60862	A	39	53	PASS	EXCELLENT
10	72.9	RDB	16-Jul-07	40.29150	80.61700	B	33	49	PASS	EXCELLENT
11	75.2	LDB	25-Jul-07	40.25910	80.62311	A	39	45	PASS	FAIR
12	78.1	RDB	25-Jul-07	40.23105	80.66182	B	33	41	PASS	FAIR
13	79.0	RDB	24-Jul-07	40.21913	80.66526	B	33	43	PASS	GOOD
14	79.2	RDB	24-Jul-07	40.21436	80.66559	B	33	45	PASS	GOOD
15	79.8	RDB	24-Jul-07	40.20588	80.66795	B	33	47	PASS	EXCELLENT

LDB = Left Descending Bank

RDB = Right Descending Bank

Table 2. Species collected in the Pike Island pool during the 2007 survey

Family	Species	Latin Name	WV	OH
Lepisosteidae	longnose gar	<i>Lepisosteus osseus</i>		
Hiodontidae	mooneye	<i>Hiodon tergisus</i>	S3	
Clupeidae	skipjack herring	<i>Alosa chrysochloris</i>		
Clupeidae	gizzard shad	<i>Dorosoma cepedianum</i>		
Cyprinidae	spotfin shiner	<i>Cyprinella spiloptera</i>		
Cyprinidae	common carp	<i>Cyprinus carpio</i>		
Cyprinidae	silver chub	<i>Macrhybopsis storeriana</i>	S3S4	
Cyprinidae	river chub	<i>Nocomis micropogon</i>		
Cyprinidae	emerald shiner	<i>Notropis atherinoides</i>		
Cyprinidae	spottail shiner	<i>Notropis hudsonius</i>		
Cyprinidae	mimic shiner	<i>Notropis volucellus</i>		
Cyprinidae	bluntnose minnow	<i>Pimephales notatus</i>		
Catostomidae	Carpiodes sp	<i>Carpiodes sp</i>		
Catostomidae	river carpsucker	<i>Carpiodes carpio</i>	S2S3	
Catostomidae	quillback	<i>Carpiodes cyprinus</i>		
Catostomidae	highfin carpsucker	<i>Carpiodes velifer</i>	S1	
Catostomidae	northern hog sucker	<i>Hypentelium nigricans</i>		
Catostomidae	smallmouth buffalo	<i>Ictiobus bubalus</i>		
Catostomidae	black buffalo	<i>Ictiobus niger</i>	S2	
Catostomidae	silver redhorse	<i>Moxostoma anisurum</i>		
Catostomidae	smallmouth redhorse	<i>Moxostoma breviceps</i>		
Catostomidae	river redhorse	<i>Moxostoma carinatum</i>	S3	SC
Catostomidae	golden redhorse	<i>Moxostoma erythrurum</i>		
Ictaluridae	channel catfish	<i>Ictalurus punctatus</i>		
Ictaluridae	flathead catfish	<i>Pylodictis olivaris</i>		
Moronidae	Morone sp	<i>Morone sp</i>		
Moronidae	white bass	<i>Morone chrysops</i>		
Centrarchidae	rock bass	<i>Ambloplites rupestris</i>		
Centrarchidae	green sunfish	<i>Lepomis cyanellus</i>		
Centrarchidae	bluegill	<i>Lepomis macrochirus</i>		
Centrarchidae	redecor sunfish	<i>Lepomis microlophus</i>		
Centrarchidae	bluegill x green sunfish	<i>Lepomis macrochirus x L. cyanellus</i>		
Centrarchidae	smallmouth bass	<i>Micropterus dolomieu</i>		
Centrarchidae	spotted bass	<i>Micropterus punctulatus</i>		
Centrarchidae	largemouth bass	<i>Micropterus salmoides</i>		
Centrarchidae	black crappie	<i>Pomoxis nigromaculatus</i>		
Percidae	greenside darter	<i>Etheostoma blennioides</i>		
Percidae	logperch	<i>Percina caprodes</i>		
Percidae	river darter	<i>Percina shumardi</i>		T
Percidae	sauger	<i>Sander canadensis</i>		
Percidae	walleye	<i>Sander vitreus</i>		
Percidae	saugeye	<i>Sander canadensis x S. vitreus</i>		
Sciaenidae	freshwater drum	<i>Aplodinotus grunniens</i>		

4.2 Metric Performance

Thirteen metrics were used to calculate ORFI scores for each electrofishing site (Emery et al. 2003). Each site's performance and scores for the ORFI metrics are shown in Table 3. The number of native species collected at each site ranged from 14 to 26, with an average of 21.3 species per site. Eleven of the fifteen sites scored a 5 for the number of native species metric and the remaining sites scored a 3. The number of sucker species found at each site ranged from 2 to 9 and the majority of sites scored a 3 or 5 for this metric. The number of centrarchid species varied from 2 to 5 and the metric scores were either a 1 or 3. The number of great river species ranged from 0 to 2, scoring a 1 or 3. The number of intolerant species ranged from 2 to 7 at the sampled sites. The percentage of tolerant individuals at each site ranged between 0 and 3.6%, and fourteen of the sites scored a 5 for this metric. The percentage of simple lithophils was between 0.8% and 43%, and scores for this metric were mostly 1 and 3. All sites had below 3.3% non-native individuals and scored a 5 for this metric. The percent detritivores ranged from 0.0% to 21.6% and ten sites scored a 5. The percent invertivores had a large range, 2.9% to 50.4%, with eleven sites scoring a 1 for this metric. The percent piscivores ranged from 30.7% to 72.3%. Twelve sites scored a 5 and the others scored a 3 for this metric. None of the sites had a single DELT (deformities, eroded fins, lesions and tumors) anomaly therefore all sites scored a 5. The CPUE (catch per unit effort) ranged from 193 to 2,407 individuals per site. All the sites scored a 5, except for five sites with CPUEs less than 297 which received a 3.

4.3 Habitat Surveys

Intensive habitat surveys at each of the 15 sampling locations revealed that the bottom substrate in the Pike Island pool was in nearly equal proportions of fines, sand, gravel and cobble, with a smaller percentage of boulders (Figure 7). The percentage of fines increased as river miles increased. There was some variation among the individual sites (Figure 8). The percentages of substrate variables were used to give each site a habitat classification of 'A', 'B', or 'C'. Eight sites in the Pike Island pool were classified as class 'A' habitats and the remaining

sites were class 'B' habitats. There were no class 'C' habitats sampled in the pool (Table 1).

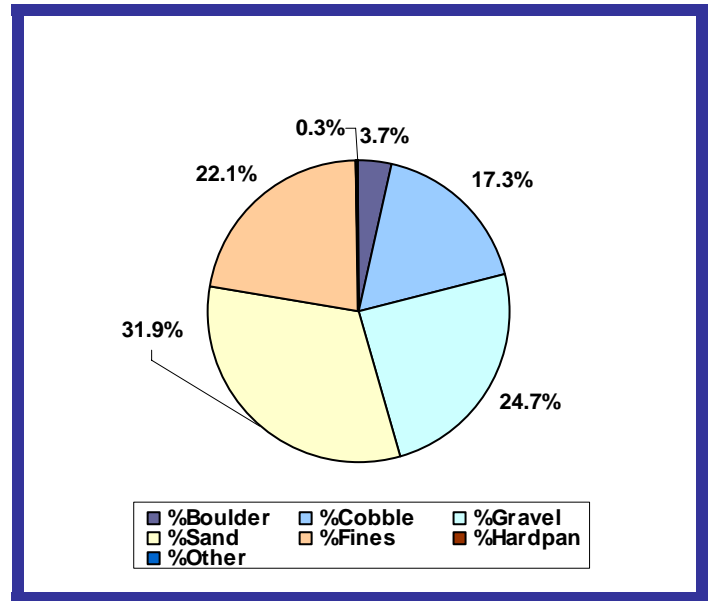


Figure 7. Substrate composition of the Pike Island pool.

Woody cover was present at 12 of the 15 sites sampled and overhanging vegetation was present at all but one site. Riparian land use was primarily natural forest with some residential and industrial uses present. Barge activity was heavy throughout the pool, while mooring structures were present at only one of the sites sampled (see Appendix C).

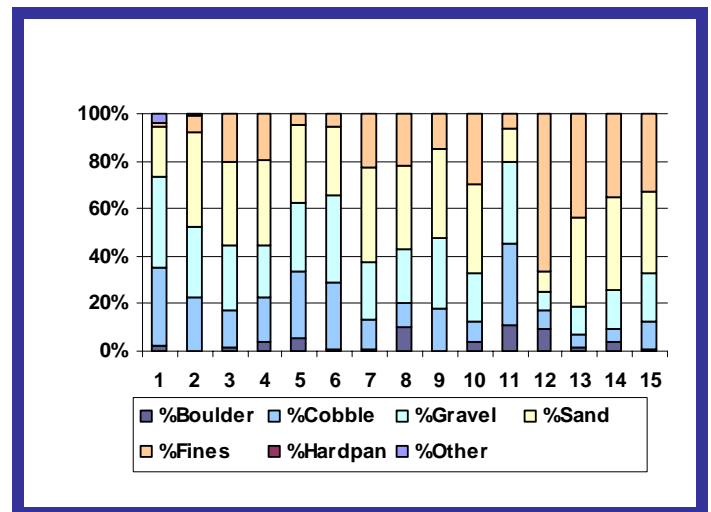


Figure 8. Substrate composition at each site sampled in the Pike Island pool.

Table 3. ORFIn metrics and scores from the 2007 survey of Pike Island pool.

Site #	River Mile	Bank	# Individuals	# Individuals w/o G & E	# Individuals w/o GETHEX	# Species	# Species Score	# Suckers	Suckers Score	# Centrarchid Species	Centrarchid Species Score	# Great River Species	Great River Species Score	# Intolerant Species	Intolerant Species Score	% Tolerant Individuals	Tolerant Individuals Score	% Simple Lithophils	Simple Lithophils Score	% Non-native Individuals	Non-native Individuals Score	% Detritivores	% Detritivores Score	% Invertivores	Invertivores Score	% Piscivores	% Piscivores Score	# DELTs	DELt score	CPUE	CPUE score	ORFIn Expectation	Observed ORFIn	Site Result
1	55.5	R	1165	220	218	19	3	5	3	3	3	0	1	6	5	0.0	5	34.5	3	0.9	5	1.8	5	31.4	3	58.2	5	0	5	1163	5	39	51	PASS
2	56.2	L	849	244	244	26	5	9	5	3	3	2	3	6	5	0.0	5	36.9	3	0.0	5	3.7	5	48.8	3	38.1	3	0	5	849	5	39	55	PASS
3	58.2	R	1142	121	120	21	5	7	5	4	3	1	1	4	3	0.0	5	38.8	3	0.8	5	5.0	5	50.4	3	35.5	3	0	5	1141	5	39	51	PASS
4	60.1	L	450	156	154	24	5	7	5	4	3	2	3	5	3	0.6	5	41.0	3	1.3	5	9.0	5	23.7	1	44.2	5	0	5	448	5	39	53	PASS
5	60.4	L	591	123	123	17	3	2	1	3	3	1	1	3	3	0.0	5	36.6	3	0.0	5	0.0	5	23.6	1	57.7	5	0	5	591	5	39	45	PASS
6	62.8	L	264	140	138	24	5	8	5	5	3	1	1	6	5	1.4	5	32.1	3	1.4	5	14.3	3	30.7	3	30.7	3	0	5	262	3	39	49	PASS
7	64.3	R	2407	100	100	21	5	8	5	2	1	1	1	5	3	0.0	5	43.0	5	0.0	5	4.0	5	21.0	1	58.0	5	0	5	2407	5	33	51	PASS
8	64.8	R	352	183	181	20	5	4	3	4	3	2	3	3	3	1.1	5	13.7	1	0.0	5	3.8	5	5.5	1	39.9	5	0	5	350	5	33	49	PASS
9	68.4	L	386	254	254	22	5	8	5	3	3	2	3	7	5	0.0	5	24.8	3	0.0	5	7.5	5	18.9	1	37.8	3	0	5	386	5	39	53	PASS
10	72.9	R	299	183	181	25	5	7	5	4	3	2	3	5	3	0.5	5	30.1	3	0.5	5	12.0	3	9.8	1	40.4	5	0	5	297	3	33	49	PASS
11	75.2	L	229	150	149	19	3	5	3	3	3	2	3	5	3	0.7	5	27.3	3	0.7	5	8.0	5	16.7	1	38.7	3	0	5	228	3	39	45	PASS
12	78.1	R	194	119	118	14	3	2	1	5	3	1	1	3	3	0.0	5	0.8	1	0.8	5	6.7	5	4.2	1	72.3	5	0	5	193	3	33	41	PASS
13	79.0	R	350	175	172	20	5	5	3	4	3	1	1	2	1	1.7	5	12.0	1	1.7	5	17.7	3	2.9	1	59.4	5	0	5	347	5	33	43	PASS
14	79.2	R	308	111	107	24	5	7	5	3	3	2	3	5	3	3.6	3	20.7	1	2.7	5	21.6	1	11.7	1	41.4	5	0	5	304	5	33	45	PASS
15	79.8	R	972	156	151	23	5	5	3	5	3	2	3	4	3	3.2	5	10.9	1	3.2	5	14.7	3	7.7	1	47.4	5	0	5	967	5	33	47	PASS

R = Right Descending Bank

L = Left Descending Bank

w/o G & E = Individuals minus gizzard shad and emerald shiners

w/o GETHEX = Individuals minus gizzard shad, emerald shiners, tolerants, hybrids, and exotics

Centrarchid Species = black bass, sunfishes, crappie

Great River Species = fish expected to be predominant in great rivers

Intolerant Species = species with low pollution/disturbance tolerance

Tolerant Individuals = individuals with high pollution/disturbance tolerance

Simple Lithophils = fish that are sensitive to substrate disturbance based on reproductive needs

Detritivore = fish that feed primarily on detritus

Invertivore = fish that feed primarily on invertebrates

Piscivore = fish that feed primarily on other fish

DELt = individuals with Deformities, Eroded fins, Lesions, and/or Tumors

CPUE = Catch Per Unit Effort

4.4 Water Quality and Flow Conditions

Rain events were sparse throughout the sampling period in 2007; therefore river levels and flows were stable. Sampling was conducted in Pike Island pool when flows were below the harmonic mean flow (HMF) for the pool. The HMF values used for the upstream (sites 1-3) and downstream (sites 4-15) portions of this pool were 18.2 and 19.2 kcfs respectively, and sampling was conducted between 44.3% and 83.5% of the HMF (Figure 9). Measurements of water quality parameters did not reveal any unusual or poor water conditions present at the time of fish sampling (Appendix D). Secchi depths at the time of sampling ranged from 30 to 66 inches.

The water quality parameters measured from water samples, collected three times with Kemmerers, did not reveal any parameters exceeding water quality criteria (Appendix E).

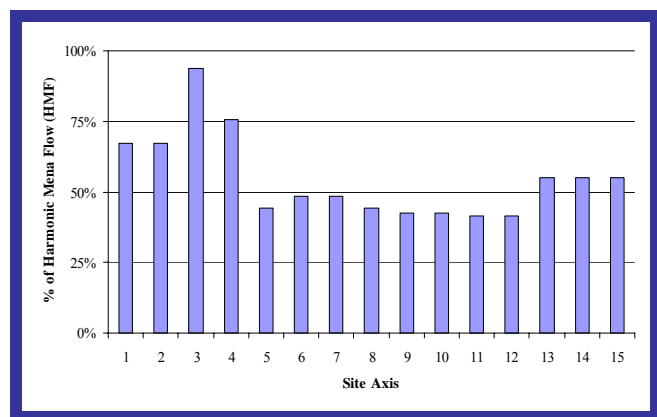


Figure 9. Relative flows (%HMF) at the time of sampling.

4.5 Assessment of Condition

ORFIn scores were calculated for each of the sites sampled. The maximum score achieved by any site in this pool out of a possible 65 was 55 and the minimum was 41. By comparing observed and expected ORFIn scores, ORSANCO assessed each site as either passing or failing (Table 3). All 15 sites sampled in 2007 scored higher than the minimum expected scores and received passing evaluations (Table 1, Figure 10). Nine sites (60%) received an excellent condition rating, three sites (20%) were in good condition, and three (20%) were in fair condition (Figure 11).

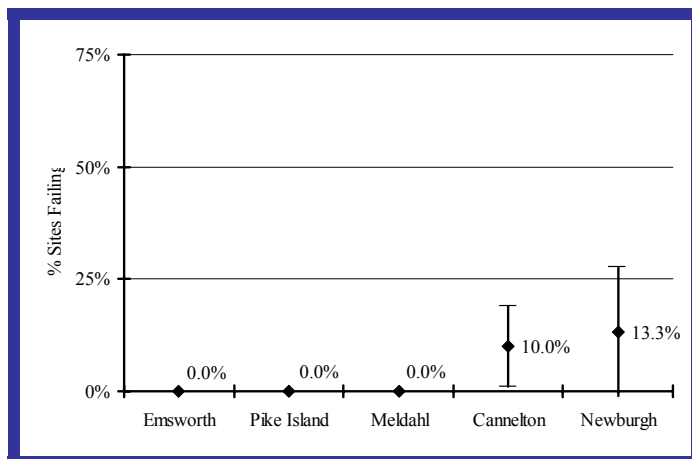


Figure 10. 2007 pool assessment results with 90% confidence intervals.

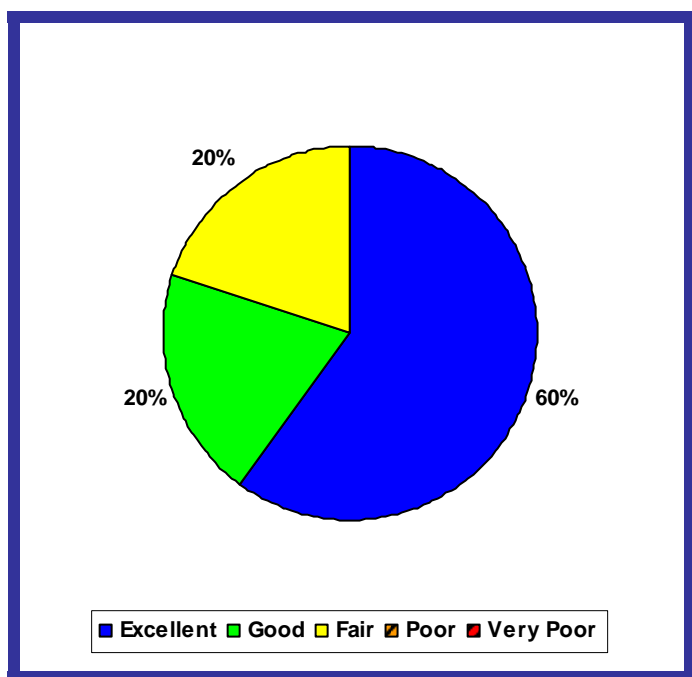


Figure 11. Condition of the Pike Island pool based on ORFIn scores at 15 sites (Pass=Excellent-Fair, Fail=Poor-Very Poor).

5.0 Discussion

5.1 Fish Population

In 2007, the fish population of Pike Island pool was in excellent condition. This was supported by the diversity and types of species collected from the pool. Multiple pollution intolerant species such as smallmouth redhorse (*Moxostoma breviceps*), river redhorse (*M. carinatum*), northern hogsucker (*Hypentelium nigricans*), mimic shiner (*Notropis volucellus*), smallmouth bass (*Micropterus*

dolomieu), greenside darter (*Etheostoma blennioides*), logperch (*Percina caprodes*), and mooneye (*Hiodon tergisus*) were collected from the Pike Island pool, indicating that pollution was not a problem in the area. Common carp (*Cyprinus carpio*) and redear sunfish (*Lepomis microlophus*) were the only two non-native species collected during the survey.

In addition to our random sampling protocol, several other collections were made within the pool during the sampling season. From one of these collections, a bluebreast darter (*Etheostoma camurum*) was collected. This species is listed in Ohio as threatened.

5.2 Metric Performance

Most of the metric scores in Pike Island pool were good with the exception of two metrics: # of great river species and % invertivores. The upstream location and the comparatively small size of Pike Island pool may be responsible for lower great river species scores. There was no known reason or explanation for the low percentage of invertivorous individuals.

Two metrics stood out as the highest performing in Pike Island pool; the % tolerant individuals, # of non-native species, and CPUE metrics. For these metrics, most sites scored a five. Low proportions of pollution-tolerant individuals and non-native species were collected. The average CPUE was 662 individuals per site and largely inflated due to the high abundance of shad within the pool. These metrics indicate that Pike Island pool is in good condition.

5.3 Habitat Surveys

The habitat assessments show that in Pike Island pool there was a relatively equal number of sites classified as class 'A' and class 'B' habitats. The heterogeneous substrate compositions,

supplemented with the presence of woody cover, provided adequate habitat to support the diverse populations of fishes in the pool.

5.4 Water Quality and Flow Conditions

The minor fluctuations in river level did not affect the survey of Pike Island pool. Rain events were sparse throughout the field season therefore sampling was conducted during low flows. Secchi depths indicated sufficient visibility for sampling. There were no water quality measurements that exceeded their respective criteria or provided any major insight into the assessment results for Pike Island pool.

5.5 Conclusions and Assessments of Condition

The data collected in 2007 indicated that the Pike Island pool met its aquatic life use designation and was in excellent condition. All sites were in passing condition. The assessment of Pike Island pool met the criteria established by ORSANCO biologists (Appendix A) and was therefore accepted as complete. No further monitoring of Pike Island is required at this time.

6.0 Interpool Comparisons

6.1 Purpose

As of 2007, 12 of 20 pools have been surveyed and assessed. This section was developed to compare Pike Island pool to other previously surveyed pools in the Ohio River.

6.2 Land Use

Pike Island pool lies in the upper portion of the Ohio River and therefore has a relatively small catchment area. Despite many industrial facilities immediately surrounding the pool, the primary land use within the watershed is deciduous forest. Agricultural practices are secondary land uses but in lower proportions than pools in the lower third of the Ohio River (Figure 12).

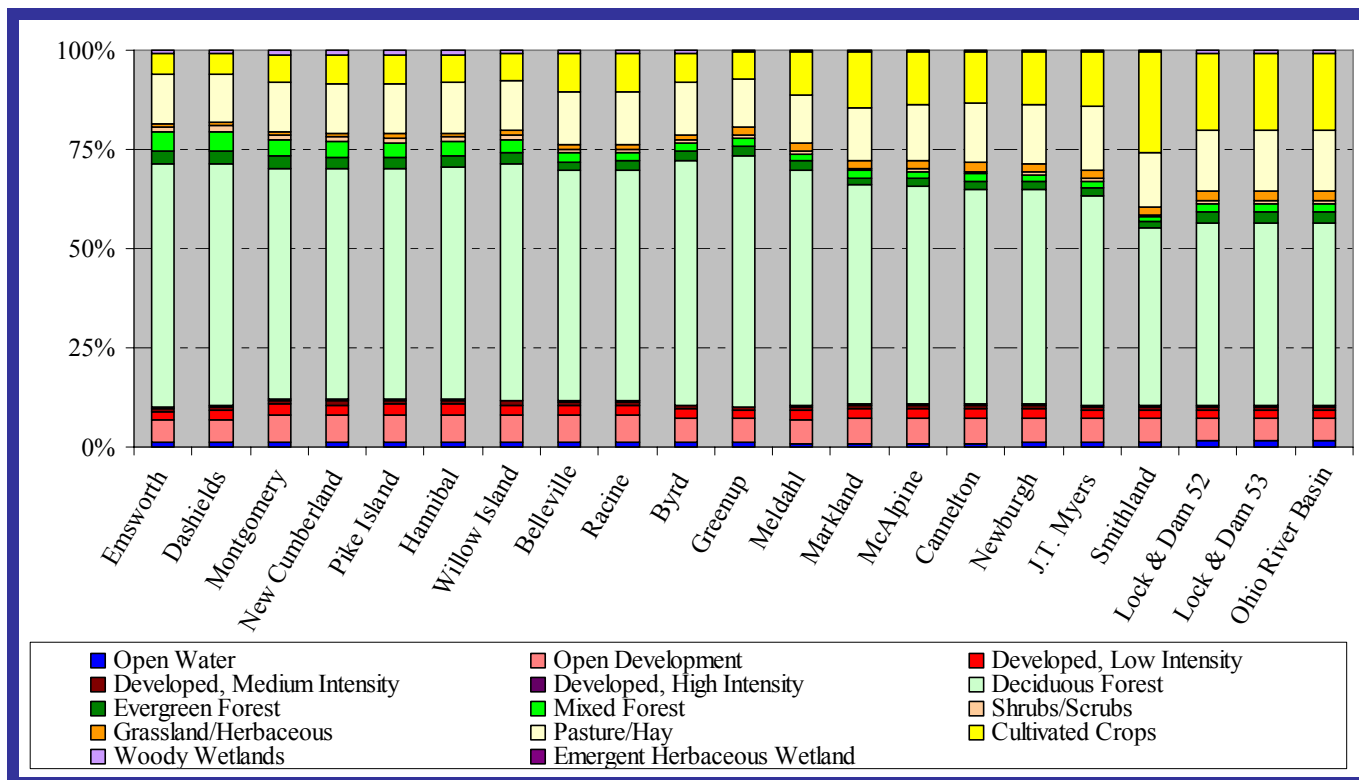


Figure 12. Land use within the catchment area of each pool of the Ohio River.

6.3 Substrate Composition

This pool had a relatively equal percentage of cobble, gravel, sand, and fines. The heterogeneous substrate composition is most similar to its closest upstream pool (New Cumberland). However, these percentages are quite different from the other pools assessed in the lower third of the river (Figure 13).

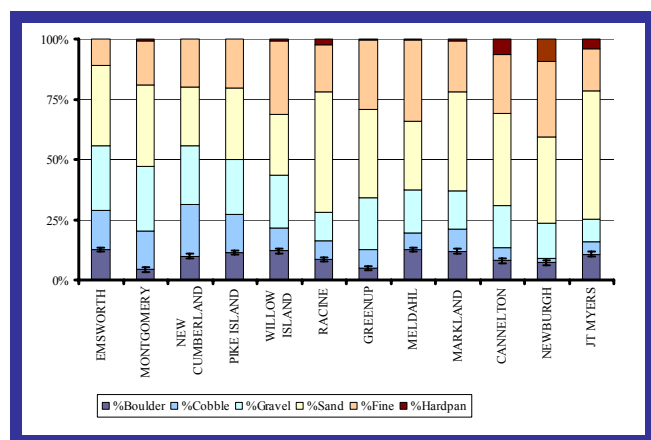


Figure 13. Substrate composition for each pool surveyed as of 2007.

6.4 Species Richness

Pike Island pool was similar to other surveyed pools in the average number of native species

per site (21.3) and ranked 3rd in comparison (Figure 14).

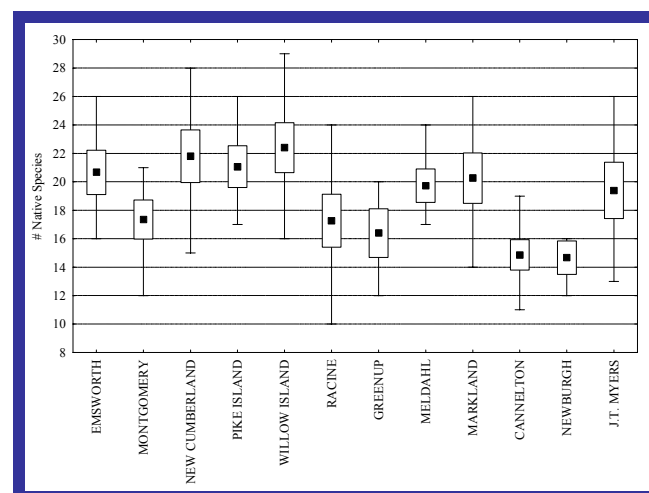


Figure 14. The average number of native species collected at each site within each pool surveyed as of 2007 (■ = Average, □ = 90% Confidence Interval, I = Non-Outlier Range).

6.5 Number of Individuals

An average of 162.3 individuals (excluding gizzard shad and emerald shiner) was collected at each site in Pike Island pool which ranked 5th in comparison (Figure 15). If gizzard shad and emerald shiners were included, only Racine pool (average = 733.7) had more individuals

collected per site than Pike Island pool (average = 663.9).

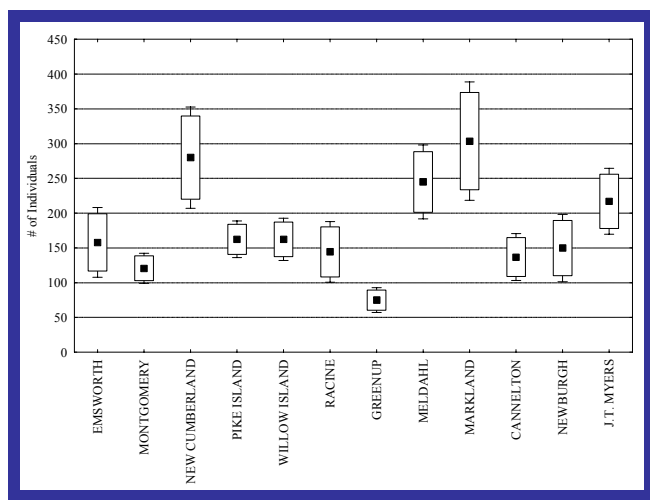


Figure 15. The average number of individuals (excluding gizzard shad & emerald shiner) collected at each site within each pool surveyed as of 2007 (■=Average, □=90% Confidence Interval, I=Non-Outlier Range).

6.6 Noteworthy Fish Observations

None of the species collected in Pike Island were unique to the pool. However, several species were collected from this pool that were only found in the upper portions of the Ohio River such as: rock bass, river chub, and spottail shiner. Several other species were quite abundant in the pool in comparison to others such as: gizzard shad, river redhorse, walleye, and black buffalo (See table 4).

6.7 ORFIn Deviation

The ORFIn deviation is a measure of how well the pool performed with regard to expected ORFIn values. Positive values indicate that scores were greater than expected. Pike Island pool had an average deviation of 12.3 and was among the highest of other pools surveyed as of 2007 (Figure 16). In comparison to other pools, the fish community was in excellent condition.

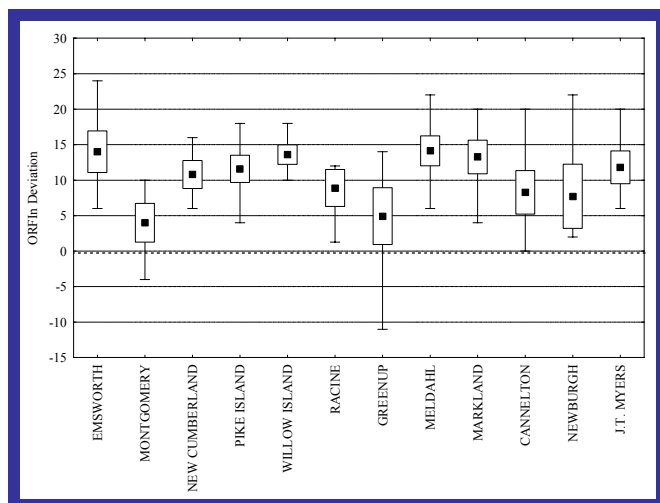


Figure 16. The average ORFIn deviation of each site within pools surveyed as of 2007 (■=Average, □=90% Confidence Interval, I=Non-Outlier Range).

6.8 Assessment of Condition

All sites in Pike Island pool were in passing condition. The nearest surveyed pool to Pike Island was New Cumberland pool (immediately upstream) which, in 2005, was assessed as being in passing condition (Figure 17).

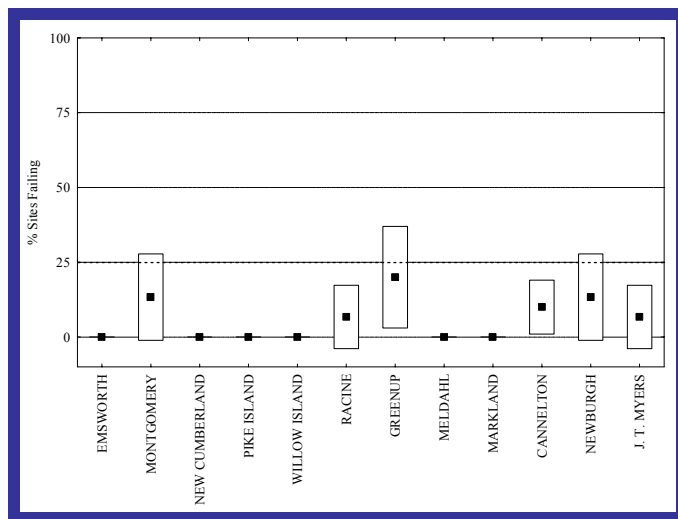


Figure 17. The percentage of sites (including +/- precision) failing in each pool surveyed as of 2007 (■=Average, □=90% Confidence Interval).

Table 4. A compiled species list containing the number of individuals collected per pool.

#	Species	Emsworth 07	Montgomery 06	New Cumberland 05	Pike Island 07	Willow Island 06	Racine 05	Greenup 06	Meldahl 07	Markland 05	Cannelton (30) 06-07	Newburgh 07	Myers 05
1	Silver Lamprey							1					
2	Paddlefish											1	
3	Spotted Gar											1	
4	Longnose Gar	13	10	11	43	46	24	23	22	15	48	20	
5	Shortnose Gar											9	2
6	Goldeye											12	
7	Mooneye	20	6	22	37		1		48	12	8	10	4
8	Skipjack Herring	8		3	6		1		64	145	174	70	249
9	Gizzard Shad	167	266	1202	7326	216	8048	267	2408	1743	3527	600	444
10	Threadfin Shad										1	9	112
11	Central Stoneroller			4		1				1			
12	Goldfish			1									
13	Grass Carp			1								1	
14	Spotfin Shiner		1	21	14	24	63	2	32	2	63	8	12
15	Common Carp	63	44	25	15	22	9	9	8	20	5	4	10
16	Gravel Chub								1				
17	Miss. Silvery Minnow												1
18	Silver Carp											2	
19	Bighead Carp											2	
20	Striped Shiner						2						
21	Silver Chub	26	12	20	11	57	44	33	90	171	130	126	206
22	River Chub			1	1								
23	Golden Shiner	1		1									
24	Emerald Shiner	82	8	342	197	728	795	50	637	303	1331	166	801
25	River Shiner	1							54	8	276	3	91
26	Spottail Shiner			6	2								
27	Mimic Shiner	35	13	76	162	306	402	61	7	5	195	6	43
28	Bluntnose Minnow			2	2	120	3	1	1		2		
29	Fathead Minnow						6						
30	Bullhead Minnow					4	5		23	2			8
31	Creek Chub			1					3				
32	Ictiobinae Sp			20									
33	Carpoides Sp				14		2		1		2		
34	River Carpsucker	18	13	46	36	18	50	49	87	47	122	179	86
35	Quillback	17	30	80	27	66	16	17	31	137	21	34	57
36	Highfin Carpsucker		37	3	10	1	7	4		2	1	12	3
37	Northern Hog Sucker	3	3	132	4	15				14	1	1	
38	Smallmouth Buffalo	97	217	283	94	60	96	49	123	150	147	72	314
39	Bigmouth Buffalo						1					3	7
40	Black Buffalo	1			5	2		1		2	1	7	3

Table 4. A compiled species list containing the number of individuals collected per pool.

#	Species	Emsworth 07	Montgomery 06	New Cumberland 05	Pike Island 07	Willow Island 06	Racine 05	Greenup 06	Meldahl 07	Markland 05	Cannelton (30) 06-07	Newburgh 07	Myers 05
41	Spotted Sucker					1	1	5	1		1		
42	Moxostoma Sp			58									
43	Silver Redhorse	221	157	63	78	51	11	12	25	19	3		
44	Smallmouth Redhorse	61	110	110	28	168	5	30	62	31	12	3	11
45	River Redhorse	39	3	5	27	2		6	1	1		1	
46	Black Redhorse	18		11		4				1	1		
47	Golden Redhorse	7	227	90	66	277	11	39	120	105	4	14	
48	Brown Bullhead							1					
49	Blue Catfish												1
50	Channel Catfish	32	34	123	40	61	70	58	89	247	48	11	330
51	Flathead Catfish	14	11	15	35	21	32	32	49	38	63	11	43
52	Muskellunge	1											
53	Trout-Perch						3						
54	Banded Killifish					1							
55	Brook Silverside						1			1	1	1	1
56	Morone Sp	27	6	568	419	17	561	2	152	250	625	403	253
57	White Perch	5		4		3				5			
58	White Bass	9	36	6	2	58	3	64	18	22	66	4	17
59	Striped Bass					1					6		12
60	Hybrid Striper		4	17		1	46			40	6		11
61	Rock Bass	16	8	5	1	3							1
62	Lepomis Hybrid		1			9							
63	Lepomis Sp					16	1				1		1
64	Green Sunfish	12	2	4	2	4	6	4	3	10	2	4	10
65	Pumpkinseed		2			18							
66	Warmouth					1			1	1			1
67	Orangespotted Sunfish			1		2	1		1	1			2
68	Bluegill	379	216	53	46	232	58	112	207	245	103	11	31
69	Longear Sunfish					23	3	14	35	53	39	3	11
70	Redear Sunfish		4		1	1	1	1		2	16		1
71	Bluegill X Green Sunfish				1						1		
72	Longear X Green Sunfish												1
73	Smallmouth Bass	339	185	262	208	61	6	7	4	28	7	1	4
74	Spotted Bass	125	15	79	74	62	22	43	90	123	53	49	104
75	Largemouth Bass	4	8	8	16	16	22	65	16	56	37	2	70
76	White Crappie	5						4		1	1	1	
77	Black Crappie	3	6	2	2		3			2	3		
78	Greenside Darter	5	2	11	5					1			
79	Rainbow Darter		4	1		2				8			12
80	Fantail Darter	3	1						1				
81	Johnny Darter	1				2							

Table 4. A compiled species list containing the number of individuals collected per pool.

#	Species	Emsworth 07	Montgomery 06	New Cumberland 05	Pike Island 07	Willow Island 06	Racine 05	Greenup 06	Meldahl 07	Markland 05	Cannelton (30) 06-07	Newburgh 07	Myers 05
82	Banded Darter		1	4						1			1
83	Yellow Perch		4	2									
84	Logperch	141	67	244	85	108	6	12	20	60	39	4	3
85	Channel Darter	16	1	9		3		20					1
86	Slenderhead Darter									5			5
87	Dusky Darter												3
88	River Darter				2	1	2	1	6	4	11		4
89	Sauger	283	243	180	244	341	173	220	1174	664	1314	747	484
90	Walleye	44	11	31	70	1	4	1	3	1		7	
91	Saugeye	2		5	4		4			17			7
92	Freshwater Drum	254	47	1468	496	120	375	121	1000	1778	435	378	612
	Total # of Taxa	43	42	53	43	51	46	38	41	51	46	44	50
	Total # of Individuals	2618	2076	5742	9958	3378	11006	1441	6718	6600	8953	3013	4501

Literature Cited

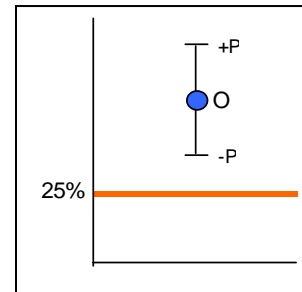
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Appendix A: Assessment Unit Criteria Details

- Each individual navigational pool will serve as a separate and distinct Assessment Unit (AU).
- All AUs will be sampled and assessed on a 5-year rotating basis. This is consistent with state schedules, and it allows ORSANCO (after one full rotation) in each 305(b) report, to incorporate 5 years worth of data and report on 100% of the resource. USEPA accepts 305(b) reports which use the most recent 5 years of data.
- AUs that yield >25% failure will be considered for listing as non-supporting.
 - Recognizing that even the least impacted (LI) sites in the Ohio River exhibit variability in condition, the 25th percentile of LI sites is used as the biocriteria within each habitat class.
 - Even among a random draw of LI sites, up to 25% of sites could be expected to fail, or fall below the criterion.
 - AUs with more than 25% failure rate could be listed as impaired if the BWQSC feels an “adequate assessment”, as defined below, is made.
- Characteristics of “Adequate Assessments”
 - Each AU is assessed with a minimum of 15 sites, regardless of pool length.
 - 1 of 3 situations occurs after sampling 15 sites (illustrated in figure below):

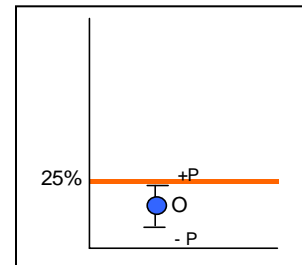
Situation ‘A’

- If an observation ‘O’ of > 25% of the sites failing is made and O minus (-) the estimated precision (P) is >25%, the assessment is accepted as valid, the AU is listed as ‘Assessed’ and failing to meet the established aquatic life use. The entire AU will be properly listed on the 303(d) list.
 - If $O - P > 25\%$ then AU fails.



$$\text{Precision } (P) = Z_{1-\alpha} * 100 * \text{Sqrt}[p(1-p)/n]$$

$Z_{1-\alpha}$ is related to the desired level of confidence
1.645 is used for 90% confidence
(use 1.96 for 95% confidence)

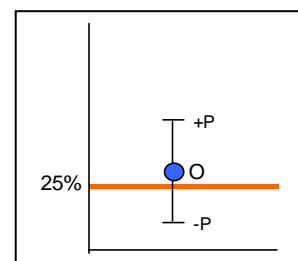


Situation ‘B’

- If an observation ‘O’ of < 25% of the sites failing is made and $O + P$ (precision) is <25%, the assessment is accepted as valid, the AU is listed as ‘Assessed’ and as meeting the established aquatic life use.
 - If $O + P < 25\%$ then AU passes.

Situation ‘C’

- If after sampling 15 sites, $O \pm P$ includes (overlaps) the criterion (25%), 1 of 2 scenarios will occur:
 - **C1:** if resources allow, an “Optimal Assessment” as defined below, will be conducted.
 - Additional probability sites will be sampled the next year to increase the sample size and improve precision (reducing the error bars).



- This process is repeated until one of the following occurs:
 - either Situation A or Situation B (above) is achieved.
 - precision of +/- 12 is achieved.
 - maximum of 45 samples is reached.
 - At that point the AU will be considered 'Assessed', the results will be considered valid and accepted, and condition will be reported.
- **C2:** in cases where resources are limited, the BWQSC will consider other available and relevant information when deciding to accept the assessment as valid or to require more sampling.
 - Additional information to be considered in these cases include (but are not limited to):
 - additional available statistics from the current assessment
 - additional available biological & water chemistry data
 - prior performance
 - presence of known impacts
 - In these cases, ORSANCO biologists will provide a narrative justification explaining how information other than the assessment in question was used to make the assessment
 - If O + P includes 25% and multiple lines of evidence indicate that the AU is in acceptable condition, then the AU may be listed as attaining.
 - If O – P includes 25% and multiple lines of evidence indicate that the AU is in unacceptable condition, then the AU may be listed as impaired.
 - If O +/- P includes 25% and multiple lines of evidence are inconclusive, then the AU will be listed as “unassessed” and additional samples would be needed.
- Listing on the 303(d) list as
 - 4a if the determined case already has an approved TMDL in place
 - 4b if the impairment is expected to be removed by other programs (SF, RCRA, NPDES, 319, harbor dredging)
 - 4c if the impairment is caused by something other than a pollutant
 - Habitat, natural, hydrologic, etc.
 - 5a if there is an impaired biological condition due to unknown stressor/cause.
 - Follow-up work would be needed.
 - e.g., examining WQ/Habitat/Bio interactions as a data exercise or through additional field work.
 - 5b if it is determined impairment is based on fish tissue contamination, in which case no TMDL is required.
 - 5c if a pollutant is positively identified, triggering the need for the development of a TMDL for that pollutant.

It is most likely that if any of the AUs fail, it will be listed as Category 5a.

- If follow-up work determines that a pollutant is the cause, it will be listed as Category 5c.
- If follow-up work shows impairment due to something other than a pollutant, it will be listed as Category 4c.

It will be possible to list an AU under any one of the categories shown above, although listing in any category other than 5a will require additional work, data integration, and the utmost certainty beforehand because of the resource implications of potentially triggering the need to develop a TMDL.

Appendix B. Fish survey data from the Pike Island pool.

Site #	River Mile	Bank	Date	Common Name	Latin Name	Count
1	55.5	RDB	10-Jul-07	bluegill	<i>Lepomis macrochirus</i>	15
1	55.5	RDB	10-Jul-07	flathead catfish	<i>Pylodictis olivaris</i>	3
1	55.5	RDB	10-Jul-07	freshwater drum	<i>Aplodinotus grunniens</i>	17
1	55.5	RDB	10-Jul-07	gizzard shad	<i>Dorosoma cepedianum</i>	945
1	55.5	RDB	10-Jul-07	golden redhorse	<i>Moxostoma erythrurum</i>	11
1	55.5	RDB	10-Jul-07	logperch	<i>Percina caprodes</i>	8
1	55.5	RDB	10-Jul-07	longnose gar	<i>Lepisosteus osseus</i>	2
1	55.5	RDB	10-Jul-07	mimic shiner	<i>Notropis volucellus</i>	31
1	55.5	RDB	10-Jul-07	morone sp	<i>Morone sp</i>	24
1	55.5	RDB	10-Jul-07	northern hog sucker	<i>Hypentelium nigricans</i>	1
1	55.5	RDB	10-Jul-07	river chub	<i>Nocomis micropogon</i>	1
1	55.5	RDB	10-Jul-07	river redhorse	<i>Moxostoma carinatum</i>	1
1	55.5	RDB	10-Jul-07	sauger	<i>Sander canadensis</i>	42
1	55.5	RDB	10-Jul-07	saugeye	<i>Sander canadensis x S. vitreus</i>	2
1	55.5	RDB	10-Jul-07	smallmouth bass	<i>Micropterus dolomieu</i>	36
1	55.5	RDB	10-Jul-07	smallmouth buffalo	<i>Ictiobus bubalus</i>	4
1	55.5	RDB	10-Jul-07	smallmouth redhorse	<i>Moxostoma breviceps</i>	2
1	55.5	RDB	10-Jul-07	spotfin shiner	<i>Cyprinella spiloptera</i>	1
1	55.5	RDB	10-Jul-07	spotted bass	<i>Micropterus punctulatus</i>	10
1	55.5	RDB	10-Jul-07	walleye	<i>Sander vitreus</i>	9
2	56.2	LDB	10-Jul-07	black buffalo	<i>Ictiobus niger</i>	1
2	56.2	LDB	10-Jul-07	bluegill	<i>Lepomis macrochirus</i>	4
2	56.2	LDB	10-Jul-07	channel catfish	<i>Ictalurus punctatus</i>	1
2	56.2	LDB	10-Jul-07	emerald shiner	<i>Notropis atherinoides</i>	38
2	56.2	LDB	10-Jul-07	flathead catfish	<i>Pylodictis olivaris</i>	1
2	56.2	LDB	10-Jul-07	freshwater drum	<i>Aplodinotus grunniens</i>	17
2	56.2	LDB	10-Jul-07	gizzard shad	<i>Dorosoma cepedianum</i>	567
2	56.2	LDB	10-Jul-07	golden redhorse	<i>Moxostoma erythrurum</i>	17
2	56.2	LDB	10-Jul-07	logperch	<i>Percina caprodes</i>	1
2	56.2	LDB	10-Jul-07	longnose gar	<i>Lepisosteus osseus</i>	3
2	56.2	LDB	10-Jul-07	mimic shiner	<i>Notropis volucellus</i>	70
2	56.2	LDB	10-Jul-07	morone sp	<i>Morone sp</i>	31
2	56.2	LDB	10-Jul-07	northern hog sucker	<i>Hypentelium nigricans</i>	1
2	56.2	LDB	10-Jul-07	quillback	<i>Carpiodes cyprinus</i>	1
2	56.2	LDB	10-Jul-07	river carpsucker	<i>Carpiodes carpio</i>	2
2	56.2	LDB	10-Jul-07	river redhorse	<i>Moxostoma carinatum</i>	8
2	56.2	LDB	10-Jul-07	sauger	<i>Sander canadensis</i>	34
2	56.2	LDB	10-Jul-07	silver chub	<i>Macrhybopsis storeriana</i>	1
2	56.2	LDB	10-Jul-07	silver redhorse	<i>Moxostoma anisurum</i>	15
2	56.2	LDB	10-Jul-07	skipjack herring	<i>Alosa chrysochloris</i>	3
2	56.2	LDB	10-Jul-07	smallmouth bass	<i>Micropterus dolomieu</i>	11
2	56.2	LDB	10-Jul-07	smallmouth buffalo	<i>Ictiobus bubalus</i>	5
2	56.2	LDB	10-Jul-07	smallmouth redhorse	<i>Moxostoma breviceps</i>	2
2	56.2	LDB	10-Jul-07	spotfin shiner	<i>Cyprinella spiloptera</i>	2
2	56.2	LDB	10-Jul-07	spotted bass	<i>Micropterus punctulatus</i>	2

Site #	River Mile	Bank	Date	Common Name	Latin Name	Count
2	56.2	LDB	10-Jul-07	walleye	<i>Sander vitreus</i>	11
3	58.2	RDB	09-Jul-07	bluegill	<i>Lepomis macrochirus</i>	3
3	58.2	RDB	09-Jul-07	bluegill x green sunfish	<i>Lepomis macrochirus x L. cyanellus</i>	1
3	58.2	RDB	09-Jul-07	emerald shiner	<i>Notropis atherinoides</i>	7
3	58.2	RDB	09-Jul-07	freshwater drum	<i>Aplodinotus grunniens</i>	8
3	58.2	RDB	09-Jul-07	gizzard shad	<i>Dorosoma cepedianum</i>	1014
3	58.2	RDB	09-Jul-07	golden redhorse	<i>Moxostoma erythrurum</i>	15
3	58.2	RDB	09-Jul-07	largemouth bass	<i>Micropterus salmoides</i>	3
3	58.2	RDB	09-Jul-07	longnose gar	<i>Lepisosteus osseus</i>	3
3	58.2	RDB	09-Jul-07	mimic shiner	<i>Notropis volucellus</i>	31
3	58.2	RDB	09-Jul-07	morone sp	<i>Morone sp</i>	12
3	58.2	RDB	09-Jul-07	northern hog sucker	<i>Hypentelium nigricans</i>	1
3	58.2	RDB	09-Jul-07	quillback	<i>Carpionodes cyprinus</i>	3
3	58.2	RDB	09-Jul-07	river carpsucker	<i>Carpionodes carpio</i>	1
3	58.2	RDB	09-Jul-07	sauger	<i>Sander canadensis</i>	16
3	58.2	RDB	09-Jul-07	silver chub	<i>Macrhybopsis storeriana</i>	1
3	58.2	RDB	09-Jul-07	silver redhorse	<i>Moxostoma anisurum</i>	9
3	58.2	RDB	09-Jul-07	smallmouth bass	<i>Micropterus dolomieu</i>	1
3	58.2	RDB	09-Jul-07	smallmouth buffalo	<i>Ictiobus bubalus</i>	2
3	58.2	RDB	09-Jul-07	smallmouth redhorse	<i>Moxostoma breviceps</i>	1
3	58.2	RDB	09-Jul-07	spotfin shiner	<i>Cyprinella spiloptera</i>	2
3	58.2	RDB	09-Jul-07	spotted bass	<i>Micropterus punctulatus</i>	4
3	58.2	RDB	09-Jul-07	walleye	<i>Sander vitreus</i>	4
4	60.1	LDB	09-Jul-07	black buffalo	<i>Ictiobus niger</i>	3
4	60.1	LDB	09-Jul-07	black crappie	<i>Pomoxis nigromaculatus</i>	1
4	60.1	LDB	09-Jul-07	bluegill	<i>Lepomis macrochirus</i>	3
4	60.1	LDB	09-Jul-07	channel catfish	<i>Ictalurus punctatus</i>	1
4	60.1	LDB	09-Jul-07	common carp	<i>Cyprinus carpio</i>	1
4	60.1	LDB	09-Jul-07	emerald shiner	<i>Notropis atherinoides</i>	1
4	60.1	LDB	09-Jul-07	flathead catfish	<i>Pylodictis olivaris</i>	4
4	60.1	LDB	09-Jul-07	freshwater drum	<i>Aplodinotus grunniens</i>	33
4	60.1	LDB	09-Jul-07	gizzard shad	<i>Dorosoma cepedianum</i>	293
4	60.1	LDB	09-Jul-07	golden redhorse	<i>Moxostoma erythrurum</i>	3
4	60.1	LDB	09-Jul-07	logperch	<i>Percina caprodes</i>	2
4	60.1	LDB	09-Jul-07	longnose gar	<i>Lepisosteus osseus</i>	3
4	60.1	LDB	09-Jul-07	mimic shiner	<i>Notropis volucellus</i>	7
4	60.1	LDB	09-Jul-07	mooneye	<i>Hiodon tergisus</i>	1
4	60.1	LDB	09-Jul-07	morone sp	<i>Morone sp</i>	6
4	60.1	LDB	09-Jul-07	quillback	<i>Carpionodes cyprinus</i>	4
4	60.1	LDB	09-Jul-07	river carpsucker	<i>Carpionodes carpio</i>	1
4	60.1	LDB	09-Jul-07	sauger	<i>Sander canadensis</i>	28
4	60.1	LDB	09-Jul-07	saugeye	<i>Sander canadensis x S. vitreus</i>	1
4	60.1	LDB	09-Jul-07	silver chub	<i>Macrhybopsis storeriana</i>	3
4	60.1	LDB	09-Jul-07	silver redhorse	<i>Moxostoma anisurum</i>	14
4	60.1	LDB	09-Jul-07	smallmouth bass	<i>Micropterus dolomieu</i>	19
4	60.1	LDB	09-Jul-07	smallmouth buffalo	<i>Ictiobus bubalus</i>	5

Site #	River Mile	Bank	Date	Common Name	Latin Name	Count
4	60.1	LDB	09-Jul-07	smallmouth redhorse	<i>Moxostoma breviceps</i>	5
4	60.1	LDB	09-Jul-07	spotted bass	<i>Micropterus punctulatus</i>	1
4	60.1	LDB	09-Jul-07	walleye	<i>Sander vitreus</i>	7
5	60.4	LDB	11-Jul-07	bluegill	<i>Lepomis macrochirus</i>	2
5	60.4	LDB	11-Jul-07	emerald shiner	<i>Notropis atherinoides</i>	10
5	60.4	LDB	11-Jul-07	flathead catfish	<i>Pylodictis olivaris</i>	4
5	60.4	LDB	11-Jul-07	freshwater drum	<i>Aplodinotus grunniens</i>	15
5	60.4	LDB	11-Jul-07	gizzard shad	<i>Dorosoma cepedianum</i>	458
5	60.4	LDB	11-Jul-07	golden redhorse	<i>Moxostoma erythrurum</i>	3
5	60.4	LDB	11-Jul-07	logperch	<i>Percina caprodes</i>	1
5	60.4	LDB	11-Jul-07	longnose gar	<i>Lepisosteus osseus</i>	2
5	60.4	LDB	11-Jul-07	mimic shiner	<i>Notropis volucellus</i>	20
5	60.4	LDB	11-Jul-07	morone sp	<i>Morone sp</i>	7
5	60.4	LDB	11-Jul-07	sauger	<i>Sander canadensis</i>	36
5	60.4	LDB	11-Jul-07	silver chub	<i>Macrhybopsis storeriana</i>	2
5	60.4	LDB	11-Jul-07	silver redhorse	<i>Moxostoma anisurum</i>	1
5	60.4	LDB	11-Jul-07	smallmouth bass	<i>Micropterus dolomieu</i>	14
5	60.4	LDB	11-Jul-07	spotfin shiner	<i>Cyprinella spiloptera</i>	8
5	60.4	LDB	11-Jul-07	spotted bass	<i>Micropterus punctulatus</i>	6
5	60.4	LDB	11-Jul-07	walleye	<i>Sander vitreus</i>	2
6	62.8	LDB	18-Jul-07	black buffalo	<i>Ictiobus niger</i>	1
6	62.8	LDB	18-Jul-07	bluegill	<i>Lepomis macrochirus</i>	6
6	62.8	LDB	18-Jul-07	carpiodes sp	<i>Carpiodes sp</i>	1
6	62.8	LDB	18-Jul-07	channel catfish	<i>Ictalurus punctatus</i>	2
6	62.8	LDB	18-Jul-07	common carp	<i>Cyprinus carpio</i>	2
6	62.8	LDB	18-Jul-07	emerald shiner	<i>Notropis atherinoides</i>	7
6	62.8	LDB	18-Jul-07	flathead catfish	<i>Pylodictis olivaris</i>	1
6	62.8	LDB	18-Jul-07	freshwater drum	<i>Aplodinotus grunniens</i>	31
6	62.8	LDB	18-Jul-07	gizzard shad	<i>Dorosoma cepedianum</i>	117
6	62.8	LDB	18-Jul-07	golden redhorse	<i>Moxostoma erythrurum</i>	1
6	62.8	LDB	18-Jul-07	highfin carpsucker	<i>Carpiodes velifer</i>	1
6	62.8	LDB	18-Jul-07	largemouth bass	<i>Micropterus salmoides</i>	1
6	62.8	LDB	18-Jul-07	logperch	<i>Percina caprodes</i>	7
6	62.8	LDB	18-Jul-07	longnose gar	<i>Lepisosteus osseus</i>	8
6	62.8	LDB	18-Jul-07	mimic shiner	<i>Notropis volucellus</i>	3
6	62.8	LDB	18-Jul-07	mooneye	<i>Hiodon tergisus</i>	1
6	62.8	LDB	18-Jul-07	quillback	<i>Carpiodes cyprinus</i>	1
6	62.8	LDB	18-Jul-07	river redhorse	<i>Moxostoma carinatum</i>	12
6	62.8	LDB	18-Jul-07	rock bass	<i>Ambloplites rupestris</i>	1
6	62.8	LDB	18-Jul-07	sauger	<i>Sander canadensis</i>	6
6	62.8	LDB	18-Jul-07	silver redhorse	<i>Moxostoma anisurum</i>	8
6	62.8	LDB	18-Jul-07	smallmouth bass	<i>Micropterus dolomieu</i>	16
6	62.8	LDB	18-Jul-07	smallmouth buffalo	<i>Ictiobus bubalus</i>	14
6	62.8	LDB	18-Jul-07	smallmouth redhorse	<i>Moxostoma breviceps</i>	6
6	62.8	LDB	18-Jul-07	spotted bass	<i>Micropterus punctulatus</i>	6
6	62.8	LDB	18-Jul-07	walleye	<i>Sander vitreus</i>	4

Site #	River Mile	Bank	Date	Common Name	Latin Name	Count
7	64.3	RDB	18-Jul-07	channel catfish	<i>Ictalurus punctatus</i>	2
7	64.3	RDB	18-Jul-07	emerald shiner	<i>Notropis atherinoides</i>	9
7	64.3	RDB	18-Jul-07	flathead catfish	<i>Pylodictis olivaris</i>	1
7	64.3	RDB	18-Jul-07	freshwater drum	<i>Aplodinotus grunniens</i>	7
7	64.3	RDB	18-Jul-07	gizzard shad	<i>Dorosoma cepedianum</i>	2298
7	64.3	RDB	18-Jul-07	golden redhorse	<i>Moxostoma erythrurum</i>	1
7	64.3	RDB	18-Jul-07	highfin carpsucker	<i>Carpionodes velifer</i>	1
7	64.3	RDB	18-Jul-07	logperch	<i>Percina caprodes</i>	5
7	64.3	RDB	18-Jul-07	longnose gar	<i>Lepisosteus osseus</i>	4
7	64.3	RDB	18-Jul-07	mooneye	<i>Hiodon tergisus</i>	8
7	64.3	RDB	18-Jul-07	morone sp	<i>Morone sp</i>	30
7	64.3	RDB	18-Jul-07	quillback	<i>Carpionodes cyprinus</i>	1
7	64.3	RDB	18-Jul-07	river carpsucker	<i>Carpionodes carpio</i>	1
7	64.3	RDB	18-Jul-07	river redhorse	<i>Moxostoma carinatum</i>	2
7	64.3	RDB	18-Jul-07	sauger	<i>Sander canadensis</i>	13
7	64.3	RDB	18-Jul-07	silver redhorse	<i>Moxostoma anisurum</i>	11
7	64.3	RDB	18-Jul-07	smallmouth bass	<i>Micropterus dolomieu</i>	5
7	64.3	RDB	18-Jul-07	smallmouth buffalo	<i>Ictiobus bubalus</i>	1
7	64.3	RDB	18-Jul-07	smallmouth redhorse	<i>Moxostoma breviceps</i>	2
7	64.3	RDB	18-Jul-07	spotted bass	<i>Micropterus punctulatus</i>	3
7	64.3	RDB	18-Jul-07	walleye	<i>Sander vitreus</i>	1
7	64.3	RDB	18-Jul-07	white bass	<i>Morone chrysops</i>	1
8	64.8	RDB	17-Jul-07	bluegill	<i>Lepomis macrochirus</i>	1
8	64.8	RDB	17-Jul-07	carpiodes sp	<i>Carpionodes sp</i>	2
8	64.8	RDB	17-Jul-07	channel catfish	<i>Ictalurus punctatus</i>	5
8	64.8	RDB	17-Jul-07	emerald shiner	<i>Notropis atherinoides</i>	27
8	64.8	RDB	17-Jul-07	freshwater drum	<i>Aplodinotus grunniens</i>	81
8	64.8	RDB	17-Jul-07	gizzard shad	<i>Dorosoma cepedianum</i>	142
8	64.8	RDB	17-Jul-07	golden redhorse	<i>Moxostoma erythrurum</i>	1
8	64.8	RDB	17-Jul-07	green sunfish	<i>Lepomis cyanellus</i>	2
8	64.8	RDB	17-Jul-07	logperch	<i>Percina caprodes</i>	5
8	64.8	RDB	17-Jul-07	longnose gar	<i>Lepisosteus osseus</i>	2
8	64.8	RDB	17-Jul-07	mooneye	<i>Hiodon tergisus</i>	4
8	64.8	RDB	17-Jul-07	morone sp	<i>Morone sp</i>	39
8	64.8	RDB	17-Jul-07	sauger	<i>Sander canadensis</i>	7
8	64.8	RDB	17-Jul-07	silver chub	<i>Macrhybopsis storeriana</i>	1
8	64.8	RDB	17-Jul-07	silver redhorse	<i>Moxostoma anisurum</i>	2
8	64.8	RDB	17-Jul-07	smallmouth bass	<i>Micropterus dolomieu</i>	16
8	64.8	RDB	17-Jul-07	smallmouth buffalo	<i>Ictiobus bubalus</i>	5
8	64.8	RDB	17-Jul-07	spottail shiner	<i>Notropis hudsonius</i>	1
8	64.8	RDB	17-Jul-07	spotted bass	<i>Micropterus punctulatus</i>	3
8	64.8	RDB	17-Jul-07	walleye	<i>Sander vitreus</i>	5
8	64.8	RDB	17-Jul-07	white bass	<i>Morone chrysops</i>	1
9	68.4	LDB	16-Jul-07	bluegill	<i>Lepomis macrochirus</i>	1
9	68.4	LDB	16-Jul-07	carpiodes sp	<i>Carpionodes sp</i>	3
9	68.4	LDB	16-Jul-07	emerald shiner	<i>Notropis atherinoides</i>	91

Site #	River Mile	Bank	Date	Common Name	Latin Name	Count
9	68.4	LDB	16-Jul-07	freshwater drum	<i>Aplodinotus grunniens</i>	86
9	68.4	LDB	16-Jul-07	gizzard shad	<i>Dorosoma cepedianum</i>	41
9	68.4	LDB	16-Jul-07	golden redhorse	<i>Moxostoma erythrurum</i>	6
9	68.4	LDB	16-Jul-07	greenside darter	<i>Etheostoma blennioides</i>	1
9	68.4	LDB	16-Jul-07	logperch	<i>Percina caprodes</i>	23
9	68.4	LDB	16-Jul-07	longnose gar	<i>Lepisosteus osseus</i>	2
9	68.4	LDB	16-Jul-07	mooneye	<i>Hiodon tergisus</i>	2
9	68.4	LDB	16-Jul-07	morone sp	<i>Morone sp</i>	40
9	68.4	LDB	16-Jul-07	northern hog sucker	<i>Hypentelium nigricans</i>	1
9	68.4	LDB	16-Jul-07	quillback	<i>Carpionodes cyprinus</i>	2
9	68.4	LDB	16-Jul-07	river carpsucker	<i>Carpionodes carpio</i>	11
9	68.4	LDB	16-Jul-07	river redhorse	<i>Moxostoma carinatum</i>	3
9	68.4	LDB	16-Jul-07	sauger	<i>Sander canadensis</i>	9
9	68.4	LDB	16-Jul-07	silver redhorse	<i>Moxostoma anisurum</i>	7
9	68.4	LDB	16-Jul-07	skipjack herring	<i>Alosa chrysochloris</i>	3
9	68.4	LDB	16-Jul-07	smallmouth bass	<i>Micropterus dolomieu</i>	28
9	68.4	LDB	16-Jul-07	smallmouth buffalo	<i>Ictiobus bubalus</i>	3
9	68.4	LDB	16-Jul-07	smallmouth redhorse	<i>Moxostoma breviceps</i>	6
9	68.4	LDB	16-Jul-07	spotted bass	<i>Micropterus punctulatus</i>	11
9	68.4	LDB	16-Jul-07	walleye	<i>Sander vitreus</i>	6
10	72.9	RDB	16-Jul-07	bluegill	<i>Lepomis macrochirus</i>	1
10	72.9	RDB	16-Jul-07	bluntnose minnow	<i>Pimephales notatus</i>	1
10	72.9	RDB	16-Jul-07	channel catfish	<i>Ictalurus punctatus</i>	5
10	72.9	RDB	16-Jul-07	emerald shiner	<i>Notropis atherinoides</i>	2
10	72.9	RDB	16-Jul-07	flathead catfish	<i>Pylodictis olivaris</i>	3
10	72.9	RDB	16-Jul-07	freshwater drum	<i>Aplodinotus grunniens</i>	62
10	72.9	RDB	16-Jul-07	gizzard shad	<i>Dorosoma cepedianum</i>	114
10	72.9	RDB	16-Jul-07	golden redhorse	<i>Moxostoma erythrurum</i>	2
10	72.9	RDB	16-Jul-07	greenside darter	<i>Etheostoma blennioides</i>	1
10	72.9	RDB	16-Jul-07	highfin carpsucker	<i>Carpionodes velifer</i>	1
10	72.9	RDB	16-Jul-07	largemouth bass	<i>Micropterus salmoides</i>	3
10	72.9	RDB	16-Jul-07	logperch	<i>Percina caprodes</i>	6
10	72.9	RDB	16-Jul-07	longnose gar	<i>Lepisosteus osseus</i>	1
10	72.9	RDB	16-Jul-07	mooneye	<i>Hiodon tergisus</i>	2
10	72.9	RDB	16-Jul-07	morone sp	<i>Morone sp</i>	18
10	72.9	RDB	16-Jul-07	quillback	<i>Carpionodes cyprinus</i>	2
10	72.9	RDB	16-Jul-07	river carpsucker	<i>Carpionodes carpio</i>	2
10	72.9	RDB	16-Jul-07	river darter	<i>Percina shumardi</i>	1
10	72.9	RDB	16-Jul-07	river redhorse	<i>Moxostoma carinatum</i>	1
10	72.9	RDB	16-Jul-07	sauger	<i>Sander canadensis</i>	29
10	72.9	RDB	16-Jul-07	saugeye	<i>Sander canadensis x S. vitreus</i>	1
10	72.9	RDB	16-Jul-07	silver redhorse	<i>Moxostoma anisurum</i>	6
10	72.9	RDB	16-Jul-07	smallmouth bass	<i>Micropterus dolomieu</i>	8
10	72.9	RDB	16-Jul-07	smallmouth buffalo	<i>Ictiobus bubalus</i>	16
10	72.9	RDB	16-Jul-07	spotted bass	<i>Micropterus punctulatus</i>	4
10	72.9	RDB	16-Jul-07	walleye	<i>Sander vitreus</i>	7

Site #	River Mile	Bank	Date	Common Name	Latin Name	Count
11	75.2	LDB	25-Jul-07	bluegill	<i>Lepomis macrochirus</i>	1
11	75.2	LDB	25-Jul-07	common carp	<i>Cyprinus carpio</i>	1
11	75.2	LDB	25-Jul-07	flathead catfish	<i>Pylodictis olivaris</i>	3
11	75.2	LDB	25-Jul-07	freshwater drum	<i>Aplodinotus grunniens</i>	46
11	75.2	LDB	25-Jul-07	gizzard shad	<i>Dorosoma cepedianum</i>	79
11	75.2	LDB	25-Jul-07	greenside darter	<i>Etheostoma blennioides</i>	1
11	75.2	LDB	25-Jul-07	logperch	<i>Percina caprodes</i>	17
11	75.2	LDB	25-Jul-07	longnose gar	<i>Lepisosteus osseus</i>	1
11	75.2	LDB	25-Jul-07	mooneye	<i>Hiodon tergisus</i>	9
11	75.2	LDB	25-Jul-07	morone sp	<i>Morone sp</i>	23
11	75.2	LDB	25-Jul-07	quillback	<i>Carpionodes cyprinus</i>	1
11	75.2	LDB	25-Jul-07	river carpsucker	<i>Carpionodes carpio</i>	3
11	75.2	LDB	25-Jul-07	river darter	<i>Percina shumardi</i>	1
11	75.2	LDB	25-Jul-07	sauger	<i>Sander canadensis</i>	7
11	75.2	LDB	25-Jul-07	silver redhorse	<i>Moxostoma anisurum</i>	4
11	75.2	LDB	25-Jul-07	smallmouth bass	<i>Micropterus dolomieu</i>	19
11	75.2	LDB	25-Jul-07	smallmouth buffalo	<i>Ictiobus bubalus</i>	7
11	75.2	LDB	25-Jul-07	smallmouth redhorse	<i>Moxostoma breviceps</i>	1
11	75.2	LDB	25-Jul-07	spotted bass	<i>Micropterus punctulatus</i>	3
11	75.2	LDB	25-Jul-07	walleye	<i>Sander vitreus</i>	2
12	78.1	RDB	25-Jul-07	bluegill	<i>Lepomis macrochirus</i>	3
12	78.1	RDB	25-Jul-07	carpiodes sp	<i>Carpionodes sp</i>	3
12	78.1	RDB	25-Jul-07	channel catfish	<i>Ictalurus punctatus</i>	2
12	78.1	RDB	25-Jul-07	flathead catfish	<i>Pylodictis olivaris</i>	6
12	78.1	RDB	25-Jul-07	freshwater drum	<i>Aplodinotus grunniens</i>	17
12	78.1	RDB	25-Jul-07	gizzard shad	<i>Dorosoma cepedianum</i>	75
12	78.1	RDB	25-Jul-07	greenside darter	<i>Etheostoma blennioides</i>	1
12	78.1	RDB	25-Jul-07	largemouth bass	<i>Micropterus salmoides</i>	1
12	78.1	RDB	25-Jul-07	longnose gar	<i>Lepisosteus osseus</i>	7
12	78.1	RDB	25-Jul-07	mooneye	<i>Hiodon tergisus</i>	1
12	78.1	RDB	25-Jul-07	morone sp	<i>Morone sp</i>	56
12	78.1	RDB	25-Jul-07	redeer sunfish	<i>Lepomis microlophus</i>	1
12	78.1	RDB	25-Jul-07	river carpsucker	<i>Carpionodes carpio</i>	1
12	78.1	RDB	25-Jul-07	smallmouth bass	<i>Micropterus dolomieu</i>	12
12	78.1	RDB	25-Jul-07	smallmouth buffalo	<i>Ictiobus bubalus</i>	4
12	78.1	RDB	25-Jul-07	spotted bass	<i>Micropterus punctulatus</i>	4
13	79	RDB	24-Jul-07	bluegill	<i>Lepomis macrochirus</i>	1
13	79	RDB	24-Jul-07	carpiodes sp	<i>Carpionodes sp</i>	5
13	79	RDB	24-Jul-07	channel catfish	<i>Ictalurus punctatus</i>	6
13	79	RDB	24-Jul-07	common carp	<i>Cyprinus carpio</i>	3
13	79	RDB	24-Jul-07	emerald shiner	<i>Notropis atherinoides</i>	1
13	79	RDB	24-Jul-07	flathead catfish	<i>Pylodictis olivaris</i>	2
13	79	RDB	24-Jul-07	freshwater drum	<i>Aplodinotus grunniens</i>	24
13	79	RDB	24-Jul-07	gizzard shad	<i>Dorosoma cepedianum</i>	174
13	79	RDB	24-Jul-07	golden redhorse	<i>Moxostoma erythrurum</i>	4
13	79	RDB	24-Jul-07	highfin carpsucker	<i>Carpionodes velifer</i>	1

Site #	River Mile	Bank	Date	Common Name	Latin Name	Count
13	79	RDB	24-Jul-07	largemouth bass	<i>Micropterus salmoides</i>	2
13	79	RDB	24-Jul-07	longnose gar	<i>Lepisosteus osseus</i>	3
13	79	RDB	24-Jul-07	mooneye	<i>Hiodon tergisus</i>	4
13	79	RDB	24-Jul-07	morone sp	<i>Morone sp</i>	74
13	79	RDB	24-Jul-07	quillback	<i>Carpionodes cyprinus</i>	5
13	79	RDB	24-Jul-07	river carpsucker	<i>Carpionodes carpio</i>	7
13	79	RDB	24-Jul-07	sauger	<i>Sander canadensis</i>	6
13	79	RDB	24-Jul-07	smallmouth bass	<i>Micropterus dolomieu</i>	9
13	79	RDB	24-Jul-07	smallmouth buffalo	<i>Ictiobus bubalus</i>	10
13	79	RDB	24-Jul-07	spotfin shiner	<i>Cyprinella spiloptera</i>	1
13	79	RDB	24-Jul-07	spotted bass	<i>Micropterus punctulatus</i>	1
13	79	RDB	24-Jul-07	walleye	<i>Sander vitreus</i>	7
14	79.2	RDB	24-Jul-07	bluegill	<i>Lepomis macrochirus</i>	2
14	79.2	RDB	24-Jul-07	bluntnose minnow	<i>Pimephales notatus</i>	1
14	79.2	RDB	24-Jul-07	channel catfish	<i>Ictalurus punctatus</i>	9
14	79.2	RDB	24-Jul-07	common carp	<i>Cyprinus carpio</i>	3
14	79.2	RDB	24-Jul-07	emerald shiner	<i>Notropis atherinoides</i>	3
14	79.2	RDB	24-Jul-07	flathead catfish	<i>Pylodictis olivaris</i>	4
14	79.2	RDB	24-Jul-07	freshwater drum	<i>Aplodinotus grunniens</i>	15
14	79.2	RDB	24-Jul-07	gizzard shad	<i>Dorosoma cepedianum</i>	194
14	79.2	RDB	24-Jul-07	golden redhorse	<i>Moxostoma erythrurum</i>	2
14	79.2	RDB	24-Jul-07	greenside darter	<i>Etheostoma blennioides</i>	1
14	79.2	RDB	24-Jul-07	highfin carpsucker	<i>Carpionodes velifer</i>	4
14	79.2	RDB	24-Jul-07	logperch	<i>Percina caprodes</i>	4
14	79.2	RDB	24-Jul-07	longnose gar	<i>Lepisosteus osseus</i>	1
14	79.2	RDB	24-Jul-07	mooneye	<i>Hiodon tergisus</i>	4
14	79.2	RDB	24-Jul-07	morone sp	<i>Morone sp</i>	15
14	79.2	RDB	24-Jul-07	quillback	<i>Carpionodes cyprinus</i>	4
14	79.2	RDB	24-Jul-07	river carpsucker	<i>Carpionodes carpio</i>	4
14	79.2	RDB	24-Jul-07	sauger	<i>Sander canadensis</i>	5
14	79.2	RDB	24-Jul-07	silver chub	<i>Macrhybopsis storeriana</i>	1
14	79.2	RDB	24-Jul-07	silver redhorse	<i>Moxostoma anisurum</i>	1
14	79.2	RDB	24-Jul-07	smallmouth bass	<i>Micropterus dolomieu</i>	9
14	79.2	RDB	24-Jul-07	smallmouth buffalo	<i>Ictiobus bubalus</i>	8
14	79.2	RDB	24-Jul-07	smallmouth redhorse	<i>Moxostoma breviceps</i>	2
14	79.2	RDB	24-Jul-07	spotted bass	<i>Micropterus punctulatus</i>	8
14	79.2	RDB	24-Jul-07	walleye	<i>Sander vitreus</i>	4
15	79.8	RDB	24-Jul-07	black crappie	<i>Pomoxis nigromaculatus</i>	1
15	79.8	RDB	24-Jul-07	bluegill	<i>Lepomis macrochirus</i>	3
15	79.8	RDB	24-Jul-07	channel catfish	<i>Ictalurus punctatus</i>	7
15	79.8	RDB	24-Jul-07	common carp	<i>Cyprinus carpio</i>	5
15	79.8	RDB	24-Jul-07	emerald shiner	<i>Notropis atherinoides</i>	1
15	79.8	RDB	24-Jul-07	flathead catfish	<i>Pylodictis olivaris</i>	3
15	79.8	RDB	24-Jul-07	freshwater drum	<i>Aplodinotus grunniens</i>	37
15	79.8	RDB	24-Jul-07	gizzard shad	<i>Dorosoma cepedianum</i>	815
15	79.8	RDB	24-Jul-07	highfin carpsucker	<i>Carpionodes velifer</i>	2

Site #	River Mile	Bank	Date	Common Name	Latin Name	Count
15	79.8	RDB	24-Jul-07	largemouth bass	<i>Micropterus salmoides</i>	6
15	79.8	RDB	24-Jul-07	logperch	<i>Percina caprodes</i>	6
15	79.8	RDB	24-Jul-07	longnose gar	<i>Lepisosteus osseus</i>	1
15	79.8	RDB	24-Jul-07	mooneye	<i>Hiodon tergisus</i>	1
15	79.8	RDB	24-Jul-07	morone sp	<i>Morone sp</i>	44
15	79.8	RDB	24-Jul-07	quillback	<i>Carpionodes cyprinus</i>	3
15	79.8	RDB	24-Jul-07	river carpsucker	<i>Carpionodes carpio</i>	3
15	79.8	RDB	24-Jul-07	sauger	<i>Sander canadensis</i>	6
15	79.8	RDB	24-Jul-07	silver chub	<i>Macrhybopsis storeriana</i>	2
15	79.8	RDB	24-Jul-07	smallmouth bass	<i>Micropterus dolomieu</i>	5
15	79.8	RDB	24-Jul-07	smallmouth buffalo	<i>Ictiobus bubalus</i>	10
15	79.8	RDB	24-Jul-07	smallmouth redhorse	<i>Moxostoma breviceps</i>	1
15	79.8	RDB	24-Jul-07	spottail shiner	<i>Notropis hudsonius</i>	1
15	79.8	RDB	24-Jul-07	spotted bass	<i>Micropterus punctulatus</i>	8
15	79.8	RDB	24-Jul-07	walleye	<i>Sander vitreus</i>	1

Appendix C. Habitat survey data from the Pike Island pool.

Site #	River Mile	Bank	% Boulder	% Cobble	% Gravel	% Sand	% Fine	% Hardpan	% Other	Depth	% Submerged Vegetation	% Woody Cover	% Overhanging Vegetation	Land Use	Human Influence	Bank Profile
1	55.5	RDB	2.5	32.9	38.0	21.5	1.3	0	3.8	15.8	0	0.7	10.0	NF, R	none	gradual
2	56.2	LDB	0.0	22.4	29.9	40.1	6.8	0	0.7	10.3	0	2.0	20.0	R, NF, A	wall, boats, docks	sloped
3	58.2	RDB	1.7	15.8	26.7	35.8	20.0	0	0.0	11.1	0	9.3	19.0	NF, R	none	steep
4	60.1	LDB	4.1	18.4	21.8	36.1	19.7	0	0.0	5.9	0	3.0	0.0	NF, R	none	sloped
5	60.4	LDB	5.5	27.9	29.1	32.7	4.8	0	0.0	9.5	0	2.0	11.7	NF, A	boats, docks	sloped
6	60.1	LDB	0.7	28.1	37.3	28.8	5.2	0	0.0	9.4	0	2.3	30.0	NF, I	moorings	steep
7	64.3	RDB	0.7	12.6	24.4	39.3	23.0	0	0.0	10.5	0	2.3	37.5	NF, I	none	steep
8	64.8	RDB	10.0	10.0	23.0	35.0	22.0	0	0.0	13.8	0	3.3	26.7	NF	none	sloped
9	68.4	LDB	0.0	18.3	29.6	37.3	14.8	0	0.0	11.2	0	2.5	28.3	NF, I	none	steep
10	72.9	RDB	3.7	9.2	19.6	38.0	29.4	0	0.0	6.8	0	11.2	32.5	NF	none	steep
11	75.2	LDB	11.3	33.8	35.0	13.8	6.3	0	0.0	15.3	0	5.7	38.0	NF	none	steep
12	78.1	RDB	9.2	7.7	7.7	9.2	66.2	0	0.0	7.7	0	14.2	20.0	NF	none	steep
13	78.9	RDB	1.6	5.7	11.4	37.4	43.9	0	0.0	5.5	0	13.4	36.7	NF, R, A	boats, docks	sloped
14	79.2	RDB	3.9	5.2	16.8	38.7	35.5	0	0.0	7.2	0	6.5	22.5	NF	none	steep
15	79.8	RDB	1.1	11.2	20.2	34.8	32.6	0	0.0	13.7	0	3.0	30.0	NF	none	sloped

I = Industry, NF = Natural Forest, R = Residential lawns, A = Agriculture (Listed in order of prevalence)

Appendix D. Water quality parameters measured prior to fish sampling in Pike Island pool.

Site #	River Mile	Bank	pH	Temp (C)	Dissolved Oxygen (mg/L)	Conductivity	Secchi (in)
1	55.5	RDB	7.2	28.13	8.07	514	36
2	56.2	LDB	7.2	28.13	8.07	514	36
3	58.2	RDB	7.5	27.60	8.28	501	30
4	60.1	LDB	7.5	27.81	8.11	501	30
5	60.4	LDB	7.4	27.96	7.79	514	48
6	62.8	LDB	7.9	28.98	8.17	546	48
7	64.3	RDB	8.5	29.15	9.40	535	42
8	64.8	RDB	8.6	28.65	9.70	528	48
9	68.4	LDB	8.2	28.44	9.25	522	48
10	72.9	RDB	8.7	29.00	11.27	518	48
11	75.2	LDB	8.1	27.61	7.93	586	66
12	78.1	RDB	8.1	29.42	7.77	591	60
13	79.0	RDB	8.0	28.46	7.54	586	60
14	79.2	RDB	7.9	28.27	7.75	586	48
15	79.8	RDB	7.3	28.28	7.30	586	66

Appendix E. Water quality parameters analyzed from Pike Island pool in 2007. Values in bold exceed water quality criteria for respective analyte.

Site #	River Mile	Round	Ammonia	Chloride	Hardness	Nitrate-Nitrite	Phenolics	Sulfate	TKN	TOC	Phosphorus	TSS
1	55.5	1	0.04	38	156	1.06	<7.0	142	0.590	2.89	0.038	8.4
		2	0.11	40	128	1.21	<5.0	88	0.347	3.64	0.025	12.6
		3	0.12	36	120	1.07	<5.0	94	0.709	3.40	0.048	8.6
2	56.2	1	0.03	38	156	1.05	<7.0	130	0.485	4.03	0.031	10.0
		2	0.13	40	132	1.20	<5.0	92	0.502	3.98	0.023	14.8
		3	0.13	40	156	1.13	<5.0	96	0.561	3.00	0.035	8.4
3	58.2	1	0.05	36	152	1.07	<7.0	144	0.620	2.77	0.032	6.5
		2	0.10	36	136	1.21	<5.0	88	0.649	3.84	0.033	13.6
		3	0.11	37	132	1.04	<5.0	94	0.577	3.40	0.049	10.8
4	60.1	1	0.04	36	152	1.07	<7.0	134	0.546	3.09	0.042	7.5
		2	0.13	40	140	1.18	<5.0	78	0.426	3.90	0.032	14.0
		3	0.10	36	128	1.07	<5.0	94	0.483	4.25	0.041	7.4
5	60.4	1	0.03	38	140	1.02	<7.0	125	0.523	2.98	0.036	6.5
		2	0.11	46	128	1.21	<5.0	86	0.425	3.86	0.050	12.0
		3	0.10	40	132	0.98	<5.0	100	0.518	4.41	0.035	6.4
6	62.8	1	0.03	38	156	0.95	<5.0	138	0.826	2.80	0.038	8.0
		2	0.13	38	124	1.15	<5.0	90	0.498	3.93	0.032	9.8
		3	0.11	35	124	1.01	<5.0	100	0.603	4.60	0.041	5.8
7	64.3	1	0.03	40	148	0.92	<7.0	128	0.551	3.13	0.031	6.8
		2	0.11	42	128	1.37	<5.0	92	0.588	4.04	0.116	8.8
		3	0.15	28	128	1.07	<5.0	100	0.651	4.20	0.059	7.4
8	64.8	1	0.03	44	144	0.94	<7.0	142	0.652	2.91	0.041	6.8
		2	0.11	42	116	1.26	<5.0	84	0.575	4.80	0.051	13.6
		3	0.16	46	132	1.03	<5.0	100	0.585	2.30	0.044	7.4
9	68.4	1	0.03	46	152	1.33	<5.0	140	0.450	2.48	0.029	5.8
		2	0.14	42	124	1.26	<5.0	116	0.588	3.61	0.039	8.2
		3	0.14	38	124	1.02	<5.0	92	0.611	2.70	0.044	6.4
10	72.9	1	0.04	46	148	0.92	<5.0	146	0.617	2.83	0.026	7.0
		2	0.12	38	136	1.15	<5.0	112	0.549	3.44	0.017	5.6
		3	0.12	36	148	1.03	<5.0	70	0.593	3.75	0.034	5.8
11	75.2	1	0.04	40	168	0.99	<5.0	122	0.660	2.86	0.033	6.4
		2	0.10	40	148	1.11	<5.0	110	0.837	3.76	0.015	5.8
		3	0.09	34	128	1.05	<5.0	94	0.557	3.42	0.033	4.8
12	78.1	1	0.03	40	144	1.13	<5.0	122	0.625	3.02	0.030	5.4
		2	0.11	38	132	1.19	<5.0	120	0.451	3.60	0.027	5.2
		3	0.09	32	128	1.11	<5.0	94	0.521	3.26	0.030	4.4
13	78.9	1	0.06	44	148	1.15	<5.0	126	0.553	3.52	0.036	5.8
		2	0.11	44	132	1.12	<5.0	104	0.642	3.68	0.021	10.0
		3	0.08	34	128	1.04	<5.0	84	0.523	3.99	0.032	6.0
14	79.2	1	0.04	46	152	1.20	<5.0	130	0.652	2.85	0.036	6.4
		2	0.11	40	136	1.11	<5.0	92	0.574	3.67	0.042	7.2
		3	0.08	34	132	1.01	<5.0	96	0.407	4.47	0.037	8.2
15	79.8	1	0.07	40	160	1.13	<5.0	128	0.614	2.67	0.030	5.4
		2	0.11	38	144	1.15	<5.0	114	0.589	3.92	0.021	5.8
		3	0.04	40	136	0.99	<5.0	88	0.459	4.06	0.026	5.6

TKN = Total Kjeldahl Nitrogen

TOC = Total Organic Carbon

TSS = Total Suspended Solids