Greater Cleveland Area Environmental Water Quality Assessment 1999-2002

Northeast Ohio Regional
Sewer District

Protecting Your Health and Environment

GREATER CLEVELAND AREA
ENVIRONMENTAL WATER QUALITY ASSESSMENT
1999 - 2002

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EXECUTIVE SUMMARY

The 1999-2002 Greater Cleveland Area Environmental Water Quality Assessment is the Northeast Ohio Regional Sewer District's (NEORSD) seventh comprehensive report on water quality within its service area. Previous reports were prepared for 1987, 1988, 1989-1990, 1991-1992, 1993-1995 and 1996-1998. Early responsibilities of the Water Quality and Industrial Surveillance Environmental Assessment program included visual surveys of area streams and follow-up inspections to environmental disruptions; in-field measurements of temperature, dissolved oxygen and stream flow rate; collection of samples for the analysis of chemical and bacteriological parameters; and qualitative sampling of benthic macroinvertebrates.

Since 1987, the Environmental Assessment program has been expanded to include the following:

- Routine monitoring of additional sites on a greater number of streams.
- The collection of samples for chemical and bacteriological analysis at 15 sites in the near shore area of Lake Erie.
- Quantitative and semi-quantitative sampling of benthic macroinvertebrates and the corresponding use of Ohio EPA's Invertebrate Community Index (ICI) and the Hilsenhoff Biotic Index (HBI) to evaluate macroinvertebrate communities.
- Quantitative sampling for fish using long-line and boat electroshocking techniques and the corresponding use of Ohio EPA's Modified Index of Well-Being (MIwb) and Index of Biotic Integrity (IBI) to evaluate fish communities.
- The evaluation of aquatic habitat using Ohio EPA's Qualitative Habitat Evaluation Index (QHEI).

The charge of the NEORSD Environmental Assessment program, which has remained in effect since the program's inception, is as follows:

1. To document water quality improvements due to NEORSD facilities and programs;

2. To determine sources of environmental disruptions and make recommendations for their elimination;

3. To coordinate monitoring activities with other agencies with interests in water quality;

4. To provide a scientifically sound current information basis for environmental planning and future abatement projects.

While past NEORSD Environmental Water Quality Assessment reports have presented data confirming the dramatic improvement in the area's surface water quality, a significant success of the program has been the discovery and resulting elimination of numerous unaddressed sources of pollution. The environmental disruptions discussed in this report, which include sewerage leaks and cross connections, dry weather combined/sanitary sewer overflows, industrial and commercial oil and chemical spills, and landfill leachate, were either discovered by NEORSD field personnel or reported to NEORSD by citizens or other agencies. In addition to the disruptions discussed in this report, WQIS investigators traced elevated concentrations of fecal coliform and/or *E. coli* bacteria discovered during dry weather outfall surveys conducted in conjunction with NEORSD Planning Department projects. In general, the results of those surveys are not included in this report.

When disruptions involving the dry weather discharge of sanitary sewage are caused by an acute problem, such as a blocked sewer, investigators contact the service department of the responsible community to report the occurrence. In cases involving the dry weather discharge of sanitary sewage which are caused by chronic problems, such as improper sanitary connections to storm sewers, investigators notify the NEORSD Planning Department, which prepares a letter notifying the Service Director of the responsible community and the Ohio EPA.

When a petroleum product or chemical is inappropriately discharged to the environment, the discharger is responsible for the cost of remediation. In cases where a responsible party cannot be identified, the Ohio EPA and/or local fire department ordinarily arrange for remediation of the discharge.

This report cites 94 specific environmental disruptions identified and/or responded to by NEORSD investigators from 1999 through 2002. Thirty-nine of the investigations concluded with effective remedial action being taken.

During 1999, 2000, 2001 and 2002, investigators collected 315 routine water quality samples, of which 259 were collected during the recreation season of May 1-October 15, from 75 sites on 18 area streams. Each sample, with the exception of samples obtained in 2000 and 2001, were analyzed for up to 35 physical, chemical and bacteriological parameters. Samples collected in 2000 and 2001 were analyzed for *E. coli* bacteria and 4 physical parameters because of a streamlining initiative implemented by NEORSD. Two hundred and forty-six of the samples were collected at stream sites that have been designated as surface waters by Ohio EPA.

Because the frequency with which the NEORSD Environmental Assessment Group is able to collect samples at each location is limited, the following qualifications are employed when comparing routine water quality sampling data to Ohio Water Quality Standards.

1. When no maximum criterion exists for a certain chemical parameter, the failure of a single sample to meet the 30-day average criterion for that parameter is not considered to be an excursion from Ohio Water Quality Standards.

2. The numerical and narrative criteria for Ohio's recreational use designations are shown in Table 7-13 of Chapter 3745-1 of the Ohio Administrative Code. The

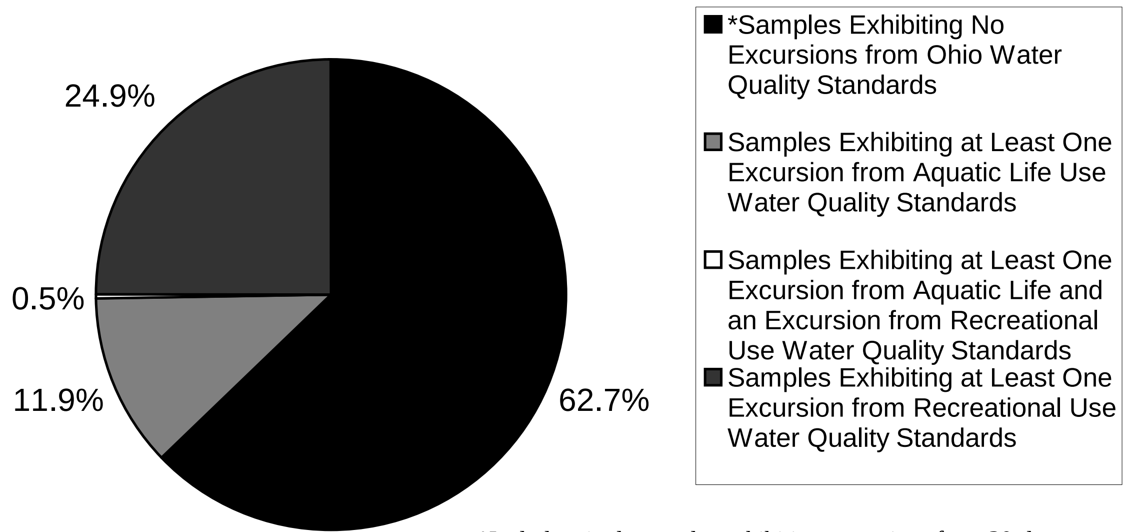
criteria apply outside of mixing zones, and for each designation, at least one of the two bacteriological standards (fecal coliform or *E. coli*) must be met. The first portion of the standard for each designation, which clearly requires the collection of at least five samples within a 30-day period, cannot be applied to routinely collected NEORSD data. Only the second portion, which for the fecal coliform standard of the primary contact recreational use designation states: "...shall not exceed 2,000 per 100 ml in more than ten percent of the samples taken during any thirty-day period," is applied to routine samples collected by NEORSD.

With the conditions listed above and the exclusion of 16 concentrations, which were measured below practical quantification levels, a total of 59 excursions from Ohio Water Quality Standards were recorded in 59 of the 259 samples taken during the recreation season. Fifty-one of the excursions were for parameters typically associated with sanitary sewage - fecal coliform and/or *E. coli* bacteria and dissolved oxygen. Samples also revealed excursions from criteria for silver (3), field temperature (3) and field pH (2). On 16 occasions, levels of selenium were detected above the analytical method detection limit. Figure ES-1 illustrates the proportion of routine stream samples that exhibited excursions from Ohio Water Quality Standards, and Figure ES-2 breaks the excursions down by parameter.

Fifty of the 59 excursions were caused by elevated densities of fecal coliform and/or *E. coli* bacteria. As noted in previous NEORSD Environmental Assessment reports, elevated fecal coliform levels have been the most valuable indicators in the identification of sources of stream pollution. Fecal coliform bacteria are found in the intestinal tracts of warm-blooded animals including humans. Elevation of their concentration by as much as several orders of magnitude in urban or suburban waterways provides an indication of contamination by sanitary sewage. Fecal coliform bacteria are not necessarily harmful to aquatic life or humans, but the sanitary sewage in which they are carried is likely to also carry heavy loads of decomposing organic waste, which is harmful to aquatic ecosystems, and pathogens, which can pose a threat of disease through human contact.

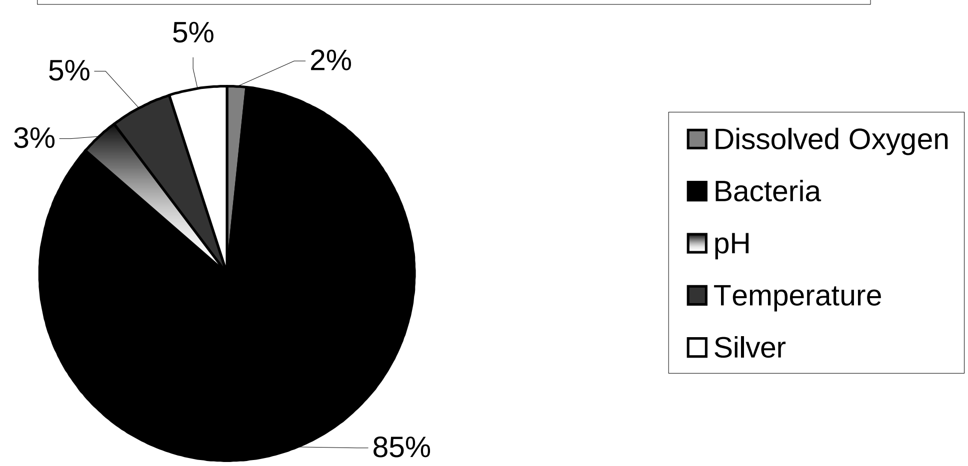
Another valuable indicator of environmental disruptions in streams is the benthic macroinvertebrate community. Benthic macroinvertebrates are aquatic organisms that inhabit the bottom regions of water bodies and include insect larvae, crustaceans, snails, clams, worms, etc. A high diversity of benthic macroinvertebrates is typically indicative of a healthy ecosystem, while a low diversity is usually indicative of an ecosystem under environmental stress, such as from pollution. Furthermore, various taxa of benthic macroinvertebrates exhibit various sensitivities to pollution, and through identification of the taxa and knowledge of their tolerance of pollution, the quality of a water body over time may be characterized. In this respect, benthic

Figure ES-1
Comparison of Routine NEORSD Stream Samples to OEPA Water Quality Standards
1999-2002



*Includes single samples exhibiting excursions from 30-day average criteria where maximum aquatic life criteria are lacking

Figure ES-2
Breakdown of NEORSD Measured Water Quality Standards Excursions by Parameter, Routine Stream Sample
1999-2002



Numerical indices of the benthic community utilized by the NEORSD include the Hilsenhoff Biotic Index (HBI) and Ohio EPA's Invertebrate Community Index (ICI). The HBI was calculated for 13 sites for the period 1998-2002. The ICI was calculated for a total of 7 sites on the Cuyahoga River and Abram Creek from 1999 through 2002.

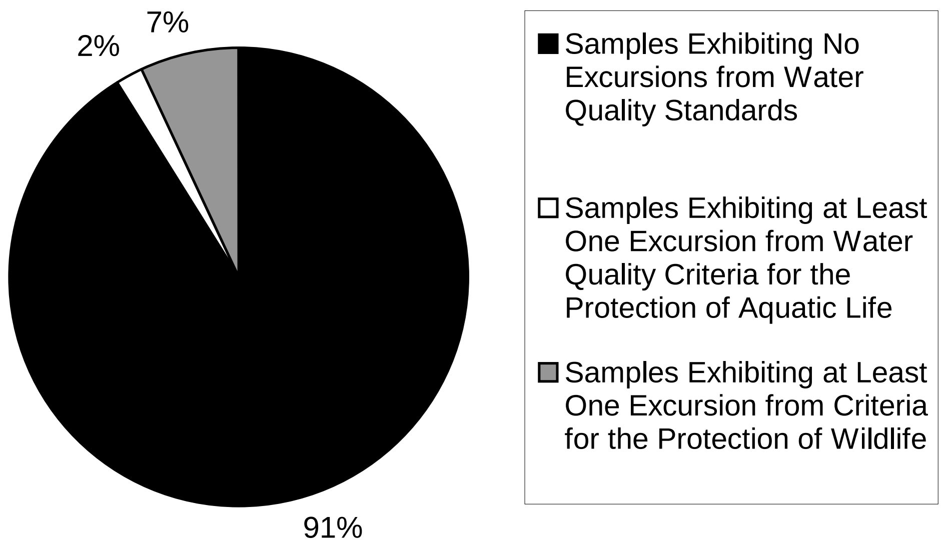
Despite the greater mobility of fish populations than of macroinvertebrate populations, fish community data can also provide useful water quality information. During 1999 and 2001, the NEORSD utilized its electrofishing boat to monitor the fish community upstream and downstream of the Southerly Wastewater Treatment Center (WWTC) and Big Creek. Results indicated, as they had in the past, that the river was not meeting the biological standards that have been set by Ohio EPA. However, in 1999 the MIwb criterion for warmwater habitat was achieved downstream of the Southerly WWTC. The results also indicated that the fish communities in this area of the river are improving.

Electrofishing using NEORSD's longline electrofishing equipment was also conducted on Brandywine Creek (2002), Rocky River and Blodgett Creek (2000), Big Creek (1999) and Abram Creek (1998). The Blodgett Creek sampling was conducted upstream and downstream of the former Strongsville "A" WWTP, before and after its decommissioning in 1994. Sample results indicated an improvement in the fish community downstream of the plant following its decommissioning and the corresponding diversion of flow to the Southwest Interceptor. Specifically, in 1996 and 2000, 477 and 313 fish, respectively, were collected as compared to 1994 when no fish were collected. For Brandywine Creek, Rocky River, and Abram Creek, the IBI scores either remained the same as in the past or slightly declined. The Big Creek sites had low IBI and MIwb scores and were dominated by pollution tolerant species.

Because habitat quality is at least as important to the well-being of aquatic biota as water quality, the NEORSD Environmental Assessment group evaluates aquatic habitat using Ohio EPA's Qualitative Habitat Evaluation Index (QHEI). QHEI scores can provide insight into the extent to which differences in biota can be attributed to water quality versus habitat. This report contains the results of the most recent habitat evaluations conducted by investigators at 59 stream locations. Narrative ratings of habitat quality using the QHEI ranged from "poor" to "excellent."

NEORSD Environmental Assessment efforts for the period 1999 through 2002 also included sampling near the surface of Lake Erie at 12 sites along the greater Cleveland shoreline and near the surface and near the bottom at three sites further offshore near the City of Cleveland's public water supply intakes. Fifty-five lake water samples were collected, each for analysis of up to 43 physical, chemical, and bacteriological parameters. One excursion from Ohio Water Quality Standards was measured in the 55 samples. The one excursion was for copper and was measured at Site K, which is located between Nine-Mile Creek and the NEORSD Easterly WWTP. Four out of the 55 samples had excursions for mercury from water quality criteria for the Protection of Wildlife Standards. They were measured at Site D, located east of the Rocky River mouth, Site E, located offshore of Edgewater Beach, Site G, located inside the Cleveland Harbor and east of the location of the NEORSD Westerly Combined Sewer Overflow Treatment Facility and Site H, located within the Cleveland Harbor and approximately 50 feet northwest of the mouth of the Cuyahoga River. The four excursions were found using USEPA Test Method 1631 for the determination of low-level mercury in water. Figure ES-3 illustrates the proportion of routine Lake Erie samples that failed to meet Ohio Water Quality Standards.

Figure ES-3
Comparison of Routine NEORSD Lake Erie Samples to Ohio EPA Water Quality Standards and Protection of Wildlife
1999-2002



Reports on special projects conducted by the NEORSD Environmental Assessment group, in addition to routine monitoring activities, are contained in the appendices to this report.

Finally, NEORSD Environmental Assessment efforts also included numerous follow-up investigations of dry weather discharges noted by NEORSD-hired consultants as part of several NEORSD facilities planning studies. These studies include the Southwest Interceptor Operational Evaluation Project (1996 – 1998), the Easterly CSO Phase II Facilities Plan (1997 – 2002), and the Southerly CSO Phase II Facilities Plan (2000 – 2002). As part of these studies, extensive evaluations of the major drainageways within NEORSD's service area were performed. As a result, a vast amount of data was collected that included dry weather outfall surveys.

In an effort to address the numerous identified outfalls with dry weather discharges, the Environmental Assessment group prioritized outfall inspections according to the bacteriological densities and flow volumes obtained during the surveys. Bacteriological densities exceeding 10,000 colony forming units per 100mL and flow measurements over 10,000 gallons per day were investigated. Where follow-up inspections were performed, the NEORSD Planning Department and appropriate community were notified of the environmental disruption investigation. Due to the considerable number of dry weather outfall investigations performed following these studies, those summary reports have not been included in the Problems and Remediation sections of this report.

Like past NEORSD Environmental Assessment reports, copies of this report will be distributed to researchers, academia, governmental agencies, and the general public. Peer review and comment are invited.

ACKNOWLEDGMENTS

This report was authored by Kathryn Crestani, Seth Hothem, Bill Mack, Tiffany Moore, John Rhoades, Elizabeth Toot-Levy, Tom Zablotny, and Cathy Zamborsky of the Northeast Ohio Regional Sewer District's Water Quality and Industrial Surveillance (WQIS) Department. The information contained herein was provided by numerous members of the NEORSD WQIS and Sewer System Maintenance & Operations Departments. The chemical and bacteriological analyses were performed by the NEORSD Analytical Services Department. Benthic macroinvertebrate identification was conducted by EA Engineering, Science, and Technology, Inc. and Bill Mack. Fish identification was conducted by Tom Zablotny. Maps were prepared by Rosalyn Brewer and Monica Day of the NEORSD Planning Department. The report was edited by Frank Foley, Seth Hothem, and John Rhoades.

CUYAHOGA RIVER

The Cuyahoga River and its tributaries drain approximately 813 square miles of land in northeastern Ohio (USEPA, 2003). The headwaters of the river originate in Geauga County and drop from approximately 1,300 feet above sea level at an average rate of three to four feet per mile. Flowing south/southwest, the river moves through Lake Rockwell in Portage County and then continues west/southwest through Kent. Entering Summit County, the river flows through Cuyahoga Falls and Akron. As the river moves through the Cuyahoga gorge above Akron, it falls at a rate of about 25 feet per mile. At Akron, the river moves north/northwest and continues down through Cuyahoga County and Cleveland, descending at a rate of about five feet per mile. Compared to its upstream stretches, the river is influenced less by dam structures and diversions as it moves from Akron to Lake Erie.

As the Cuyahoga River flows through northeastern Ohio and finally empties into Lake Erie through Cleveland Harbor, it passes through and around urban, suburban, and rural land. Each of the residential, commercial, industrial, agricultural, and recreational uses exert their influences on the river, either directly or indirectly.

The hydrologic characteristics of the Cuyahoga River vary widely depending on regional precipitation, predominant soil types and their water-holding capacities, and the proportion of the drainage basin covered by impermeable surfaces. The latter is especially influential as the river moves through the highly developed Cleveland area. An increase in low-flow levels may be related to this condition. The soils in the basin range from slightly erodible to highly erodible.

Flow data for the Cuyahoga River is measured by a United States Geological Survey (USGS) station at Old Rockside Road in Independence (RM 13.2). The average flow recorded at this station was 699 cubic feet per second (CFS) for water year 1999, 858 CFS for water year 2000, 643 CFS for water year 2001 and 849 CFS for water year 2002.

The flow in the Cuyahoga River in its navigable section, downstream of River Mile (RM) 5.6, is strongly influenced by Lake Erie. The dynamics of river and lake mixing near the confluence are primarily a function of the prevailing nearshore currents as well as the physical characteristics of the lower channel and the Lake Erie shoreline. The area where the mixing is most predominant can be considered a freshwater estuary. The effect of Lake Erie on the flow of the Cuyahoga River can be observed as far as six to seven miles upstream. Additionally, the slow moving current in the lower channel has led to the deposition of large amounts of sediment. A high rate of solids settling requires that the lower navigation channel be dredged routinely to maintain a depth of 25 to 30 feet.

In 1993, the Ohio EPA adopted modified aquatic life use designations for the Cuyahoga River Navigation Channel, based upon results of biological and water quality analyses and water quality modeling studies. The Ohio EPA has recognized the habitat restrictions in this river segment resulting from physical factors such as continual dredging, steel shoring of banks, and the total lack of riparian buffer and shallow water habitat.

Water quality modeling studies performed by the Ohio EPA have demonstrated that depressed dissolved oxygen levels in the navigation channel are attributable to the channel's modification for navigation maintenance. The studies showed that natural levels of oxygen-demanding materials would result in periodic failure to attain Warmwater Habitat standards as long as the channel remains at its current depth. However, sufficient decrease in the depth of the channel to ensure Warmwater Habitat standards attainment would preclude navigation.

The use attainability study performed by the Ohio EPA indicates that factors such as the physical habitat and dissolved oxygen levels in the ship channel are inadequate to support warmwater aquatic life habitation. A biological survey of the navigation channel showed substantially degraded fish and benthic macroinvertebrate communities. In addition, the modification of the channel for navigation precludes the potential for the recovery of balanced, reproducing populations of warmwater fish and invertebrate organisms. However, fish use the navigational channel as a migratory route to spawning locations upstream during spring months. Therefore, this seasonal and stream flow related use has been recognized and is protected through its use designation (Ohio EPA, 1993).

The Ohio EPA has designated the Cuyahoga River Navigation Channel as Limited Resource Water-Navigation Maintenance during the months of June through January and during the remaining months of the year whenever the river flow is less than 703 cubic feet per second at the USGS station in Independence. The minimum dissolved oxygen criterion for the Limited Resource Water-Navigation Maintenance aquatic life use is 1.5 mg/L. During the months of February through May, whenever the Cuyahoga River flow equals or exceeds 703 cubic feet per second at the USGS station, the aquatic life use is Fish Passage. The Fish Passage use is defined as: those rivers or other water bodies that, "... have been found to be incapable of supporting and maintaining a balanced, integrated, adaptive community of warmwater organisms but are capable of supporting the passage of warmwater fish during migratory periods." (Ohio EPA, 1993) The "minimum at any time" dissolved oxygen criterion for the Fish Passage Aquatic Life Use is 4.0 mg/L (Ohio EPA, 1993). The Cuyahoga River navigation channel has also been designated Industrial Water Supply and Primary Contact Recreational Use by the Ohio EPA.

Upstream of the navigation channel, the Cuyahoga River has been designated State Resource Water, Aquatic Life Warmwater Habitat, Agricultural Water Supply, Industrial Water Supply, and Primary Contact Recreational Use.

Routine sampling for chemical and bacteriological analysis was performed in 1999, 2000, 2001 and 2002 at 12 sites on the Cuyahoga River (Figure 1) between the river mouth at RM 0.3 and Bolanz Road in Cuyahoga Valley National Recreation Area at RM 33.2. Chemical and bacteriological data from the Cuyahoga River are presented in Appendix B.

Site #20 (41° 29.966' N, 81° 42.536' W) is off the east bank of the Cuyahoga River at RM 0.3 behind Fagan's Restaurant, located at the intersection of Old River Road and Front Street. The river at this location is approximately 300 feet wide and 30 feet deep. Unidirectional flow in the river is barely evident on most occasions during dry weather conditions. A cessation in flow or backflow, which are occasionally observed, are a result of the interfacing of the river with Lake Erie's waters. At this site and at all of the other sites where the depth is at least three feet, the river generally appears turbid or light brown in color. Small amounts of natural and/or man-made debris have often been observed near the river edge at Site #20. A substrate of fine sediment and muck is typical in the lower navigation channel, and the habitat type can be considered either a very slow run or large pool. It is not a natural, riverine habitat due to the extensive shoreline development, the existence of steel-lined banks with virtually no vegetative cover, and the fact that the channel is routinely dredged to maintain its depth. Site #20 obtained a QHEI score of 29.5 in 1998.

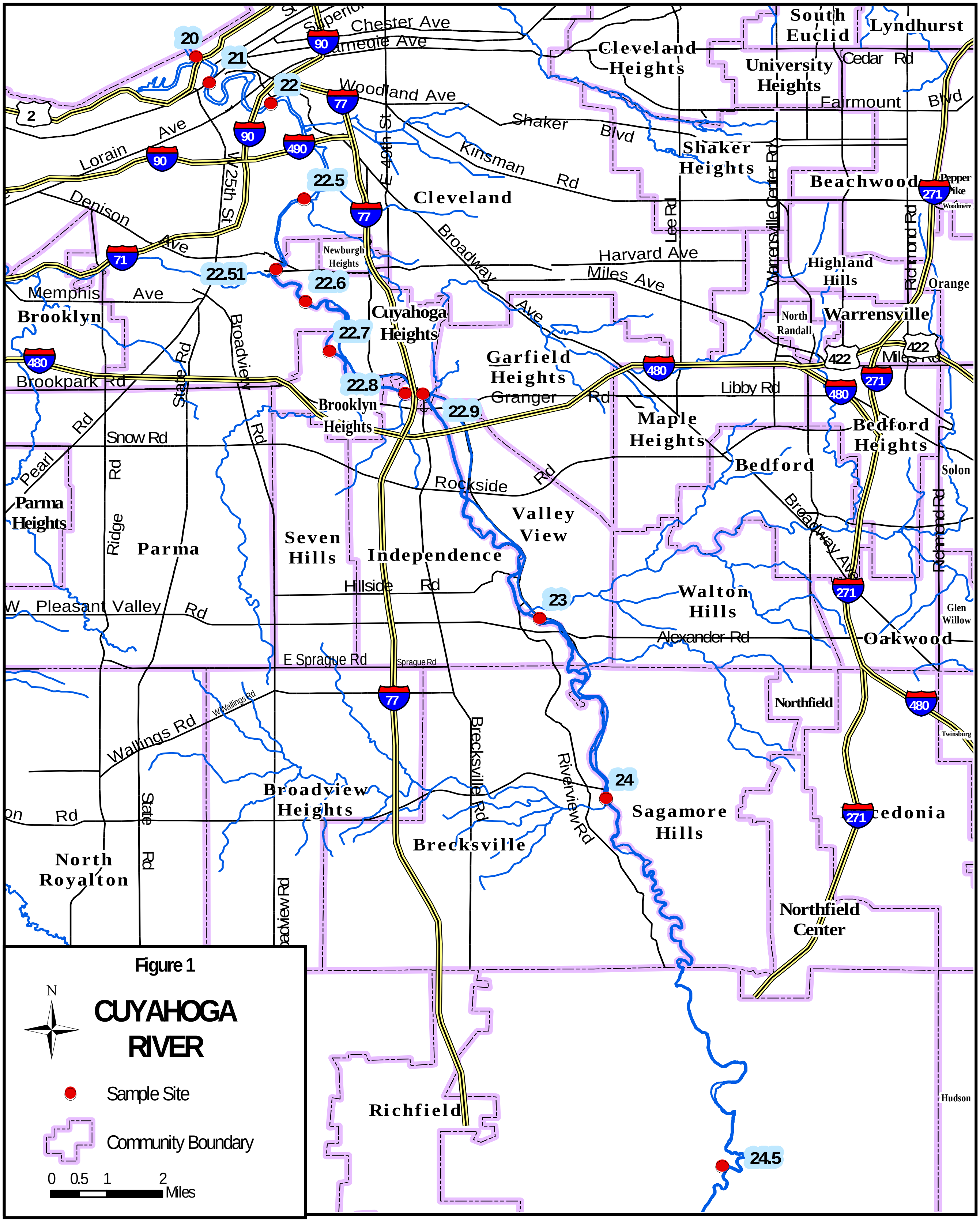


Figure 1
CUYAHOGA RIVER
N
Sample Site
Community Boundary
0 0.5 1 2
Miles
20
21
22
22.5
22.51
22.6
22.7
22.8
22.9
23
24
24.5
Cleveland
Cleveland Heights
South Euclid
Lyndhurst
University Heights
Shaker Heights
Beachwood
Pepper Pike
Woodmere
Highland Hills
Orange
North Randall
Warrensville
Newburgh Heights
Cuyahoga Heights
Garfield Heights
Maple Heights
Bedford
Bedford Heights
Solon
Brooklyn
Brooklyn Heights
Parma Heights
Parma
Seven Hills
Independence
Valley View
Walton Hills
Glen Willow
Oakwood
Northfield
Twinsburg
Broadview Heights
Brecksville
Sagamore Hills
Macedonia
North Royalton
Northfield Center
Richfield
Hudson
Chester Ave
Carnegie Ave
Woodland Ave
Shaker Blvd
Kinsman Rd
Cedar Rd
Fairmount Blvd
Lorain Ave
Denison Ave
Memphis Ave
W 25th St
E 49th St
Broadway Ave
Harvard Ave
Miles Ave
Lee Rd
Warrensville Center Rd
Richmond Rd
Libby Rd
Granger Rd
Brookpark Rd
State Rd
Broadview Rd
Snow Rd
Pearl Rd
Ridge Rd
Rockside Rd
Hillside Rd
Pleasant Valley Rd
Alexander Rd
E Sprague Rd
Sprague Rd
W Wallings Rd
Wallings Rd
Brecksville Rd
Riverview Rd
90
77
490
71
480
271
422
2

Site #21 (41° 29.656' N, 81° 42.224' W) is at the north downstream side of the Center Street bridge (RM 1.0). The river at this location is approximately 150 feet wide and 30 feet deep. Like Site #20, this segment of the river is within the navigation channel. Both banks consist of steel seawall with developed shorelines. The water color is light brown and the substrate is silt. Lake-effect backflow has been observed at this site. Samples are collected from the bridge at midstream. Site #21 obtained a QHEI score of 29.5 in 1998.

Site #22 (41° 29.332' N, 81° 41.166' W) is at the West 3rd Street bridge in the Cleveland Flats (RM 3.3). The river at this location is approximately 200 feet wide and 28 feet deep. Again, the velocity of flow in the river is very slow and barely evident on most occasions under dry weather conditions. The physical characteristics of the river are very similar to those of Sites #20 and #21, with the exception of a 0.1- to 0.2-mile stretch of exposed earthen bank along the west side of the river at this location. Substrate type and quality are also similar to those of Sites #20 and #21. Samples are collected from the bridge at midstream. Site #22 obtained a QHEI score of 29.5 in 1998.

Site #22.5 (41° 27.863' N, 81° 40.634' W) is at the Newburgh and South Shore Railroad bridge on the property of the LTV Steel Company and can be accessed by following the river onto the steel mill property from either Independence Road or Campbell Road (RM 5.6). There are two parallel railroad bridges located approximately 30 feet apart at the site. The Newburgh and South Shore Railroad bridge is located on the upstream side and is the downstream boundary of the Ohio EPA Warmwater Habitat designation. The bridge on the downstream side is at the head of the navigation channel. The river at this location is approximately 150 feet wide and the depth ranges from four feet nearshore to about ten feet midstream. On the upstream side of the twin bridges, the bottom contour is more riverine. On the downstream side, the depth is greater and more uniform due to maintenance dredging. On most occasions while sampling at this site, the accumulation of natural and/or man made debris at the bridge supports, especially near the east bank, has been noted. In this run-type habitat, the substrate is primarily composed of sand and fine gravel midstream and silt and muck along the margins. An industrial setting predominates in the upland area. Separating the river and the industry is a very narrow vegetative buffer upstream of the sampling site. The vegetative buffer begins at Site #22.5 and is more extensive along the east bank than the west bank. As one approaches Site #22.51, which is 1.6 miles upstream at the lower Harvard Avenue bridge, the buffer is intermittent and is interspersed with small sections of open or “raw” land. Also, immediately upstream of Site #22.5, the lower west bank is concrete-lined. Several industrial discharges are evident both upstream and downstream of this site. Site #22.5 obtained a QHEI score of 33.5 in 1998.

Site #22.51 (41° 26.835' N, 81° 41.053' W) is at the lower Harvard Avenue bridge (RM 7.1). It is located less than 0.2 miles downstream of the Cuyahoga River/Big Creek confluence. Downstream of the bridge, the river begins to slow as it moves through the "LTV stretch" from RM 7.1 to RM 4.3. Lake Erie has the potential to exert an effect on the river's velocity as far upstream as this site. Site #22.51 obtained a QHEI score of 64.75 in 2001 (Appendix D).

Site #22.6 (41° 26.665' N, 81° 40.695' W) is at the west bank of the river adjacent to River Recycling Industries, 4195 Bradley Road (RM 7.9). The site can be accessed from Bradley Road (RM 7.0), at the southeast end of the company's dirt-and-gravel front lot. Site #22.6 is about one-half mile upstream of the Cuyahoga River/Big Creek confluence. In 2002, Site #22.6 obtained a QHEI score of 54.75 (Appendix D).

Site #22.7 (41° 25.631' N, 81° 39.948' W) is at the east bank of the river underneath the crossing of the NEORSD Southwest Interceptor (RM 9.7). This site is located one mile downstream of the effluent discharge from the NEORSD Southerly Wastewater Treatment Center. The site can be accessed from the towpath that runs between the river and the Ohio Canal. Access can be made to the towpath at the Southerly ash lagoons off Canal Road or through the Cleveland Metroparks Ohio & Erie Canal Reservation. Located upstream between RM 10.0 and RM 10.5 are three demolition material disposal sites. Two disposal sites are situated on the west bank and one site is located on the east bank. Site #22.7 obtained a QHEI score of 56.75 in 1998.

Site #22.8 (41° 25.139' N, 81° 38.895' W) is at the chlorine-access railroad bridge to the Southerly WWTC and is located near the southwest end of the plant's ash lagoons (RM 11.3). This site is about one-half mile upstream of the effluent discharge from the NEORSD Southerly WWTC and 0.1 miles downstream of the West Creek confluence. The site can be accessed from Canal Road across from the NEORSD Southerly Wastewater Treatment Center's main entrance gate. Site #22.8 obtained a QHEI score of 59.25 in 2002 (Appendix D).

Site #22.9 (41° 25.080' N, 81° 38.473' W) is at the railroad bridge crossing southeast of the intersection of East 71st Street and Canal Road (RM 11.7). This site is located 0.2 miles downstream of the Mill Creek confluence. Site #22.9 obtained a QHEI score of 65.25 in 2002 (Appendix D).

Site #23 (41° 21.924' N, 81° 39.746' W) is located at the Old Riverview Road bridge (RM 16.8). This site is in the Cuyahoga Valley National Park (CVNP) and is located 0.2 miles downstream of the Cuyahoga River/Tinkers Creek confluence. The site can be accessed from Canal Road at the intersection with Tinkers Creek Road. Site #23 obtained a QHEI score of 72.5 in 2002 (Appendix D).

Site #24 (41° 19.259' N, 81° 35.231' W) is located upstream of the State Route 82 bridge (RM 20.8). This site is also in the CVNP and is located downstream of the Cuyahoga River/Chippewa Creek confluence. This site can be accessed from Riverview Road south of its intersection with State Route 82. Site #24 obtained a QHEI score of 64.5 in 2002 (Appendix D).

Site #24.5 (41° 12.058' N, 81° 34.108' W) is located east of the intersection of Bolanz Road and Riverview Road in Summit County at RM 33.2. This site is approximately four miles downstream of the City of Akron Wastewater Treatment Plant effluent discharge and less than 0.2 miles upstream of the Cuyahoga River/Furnace Run confluence. Site #24.5 was selected to evaluate Cuyahoga River water quality upstream and outside of the NEORSD service area for comparison with downstream water quality. In 2002, Site #24.5 obtained a QHEI score of 67 (Appendix D).

Benthic Macroinvertebrate Sampling on the Cuyahoga River

Results of benthic macroinvertebrate sampling conducted on the Cuyahoga River during 2002 are included in Appendices F and G. Additionally in 2002, benthic macroinvertebrate sampling was conducted on Brandywine Creek a tributary to the Cuyahoga River. Results of this sampling are located in Appendix H of this report.

Problems and Remediation

-1-

On April 2, 1999, NEORSD investigators received a report from the U.S. Coast Guard of an oil spill to the Cuyahoga River through CSO outfall 086 located just east of West 3rd Street and Mary Avenue. Although no overflow was occurring at that time through this outfall, investigators attempted to trace back the source of the oil. The oil was traced to the combined sewer on West 3rd Street at North Clark Avenue, just north of LTV Steel Company property. However, further investigation did not reveal the actual source of the oil contamination to the Cuyahoga River. LTV Steel Company personnel stated they would inspect this area of their property for possible sources and routes of entry for the oil contamination.

-2-

On June 25, 1999, NEORSD investigators discovered a sudsy, brown-colored discharge entering the Cuyahoga River through a 72-inch outfall just north of 4365 Bradley Road. The brown flow was traced to Bradley Road Incorporated, 4480 Bradley Road, a construction and demolition landfill. There, investigators learned that a pile of construction debris had begun smoldering on June 24, 1999. As a result, the runoff of water sprayed onto the debris pile was entering a creek tributary to the Cuyahoga River. The runoff water entering the creek was sudsy and brown in color. The Ohio EPA was notified of this situation.

-3-

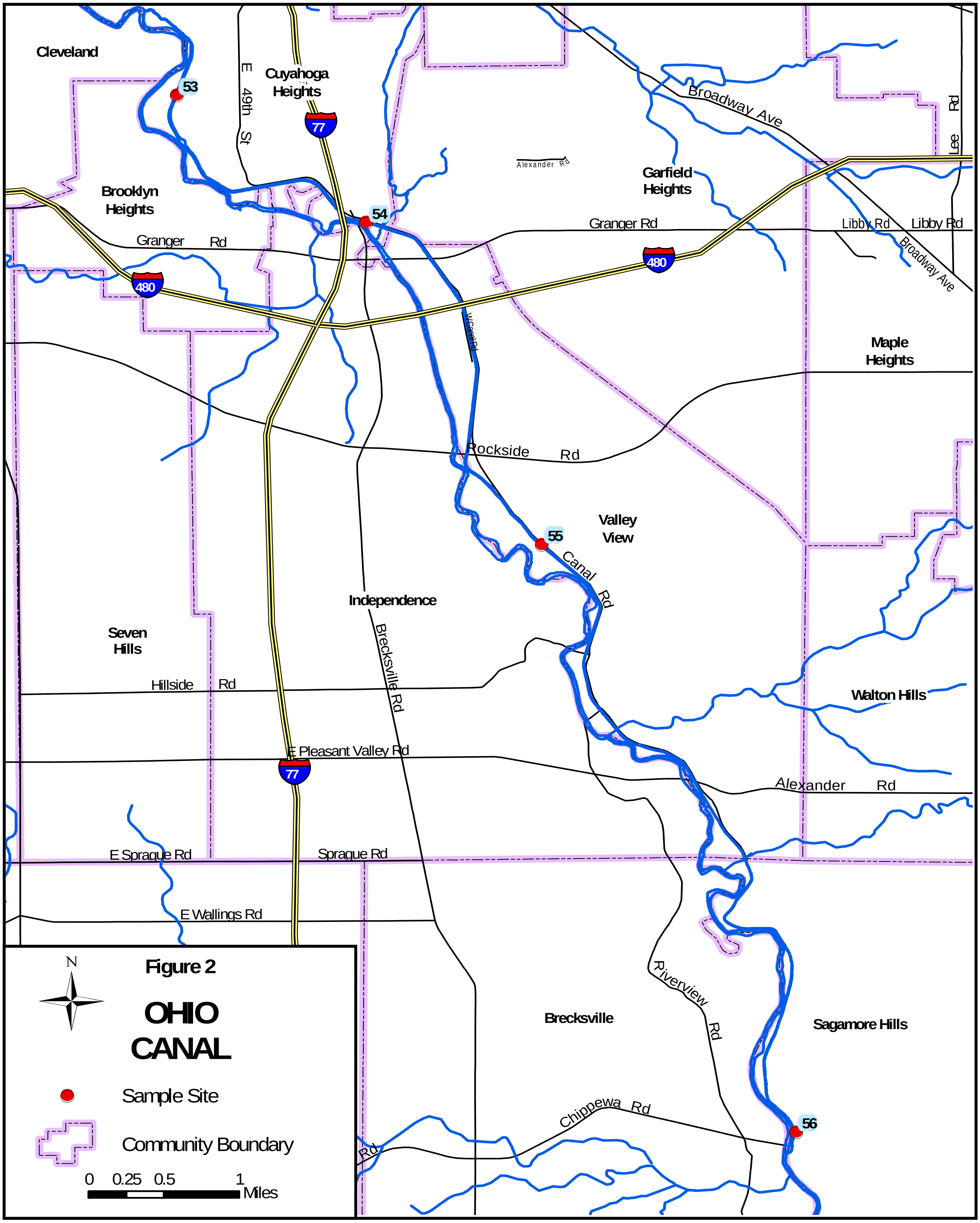
On May 1, 2002, NEORSD investigators responded to a report from the Cuyahoga Emergency Communications System (CECOMS) of an oil sheen entering the Cuyahoga River through a discharge from International Steel Group Company (ISG), formerly LTV Steel Company. ISG personnel stated that in preparation to resume their steel-making process, additional pumps were put into operation that overloaded ISG's wastewater treatment plant. As a result, wastewater contaminated with oil had overflowed into the Cuyahoga River. Inland Waters of Ohio was contracted to conduct the clean up, which was monitored by the U.S. Coast Guard.

OHIO CANAL

The Ohio Canal, which was opened between Cleveland and Akron in 1827, had replaced the Cuyahoga River as the major transportation artery in this region. The canal system opened Ohio and the Midwest to commerce and industrialization. Fifty-three years later, however, it was replaced as a transportation route by the railroads and subsequently abandoned. The only remaining wetted section stretches for eleven miles northward along the east bank of the Cuyahoga River from the State Route 82 bridge crossing between Brecksville and Sagamore Hills, to the confluence with the Cuyahoga River, approximately 0.7 miles west of the intersection of Grant Avenue and East 49th Street. The canal has become a recreational attraction for the area as evidenced by the opening of the Cleveland Metroparks Ohio and Erie Canal Reservation in August of 1999. A paved all-purpose trail (the Towpath Trail) follows the original Canal Towpath north from the northern boundary of the Cuyahoga Valley National Recreation Area at Rockside Road for 4.2 miles. Additional recreational activities planned for the canal within the reservation include canoeing and fishing. The Metroparks leases approximately 18 acres of land within the reservation from the Northeast Ohio Regional Sewer District.

The NEORSD incorporated sampling of the Ohio Canal into its Stream Monitoring Program as a result of arguments raised in early 1988 concerning designation of the Cuyahoga River as Warmwater Habitat from River Mile (RM) 10.8 to RM 5.6. Because the lower eleven miles of the canal are fed by the river, the two systems are expected to be quite similar in water quality characteristics. The NEORSD hypothesized that because of this similarity, any major differences in biological condition between the river and the canal must be related to differences in other factors, perhaps the quality of physical habitat and/or erosion and sedimentation. Thus, for experimental and informational purposes, chemical, bacteriological, and benthic sampling has been performed on the canal by the NEORSD.

The exact drainage area tributary to the canal's wetted section is unknown. It is fed by partial flow from the Cuyahoga River, near Site #24, through an inlet structure located just upstream of the low-head dam under the State Route 82 bridge. Downstream of the diversion of river water into the canal, no other large drainages that would significantly affect its flow are known to enter the canal. The flow in the canal is regulated by the inlet structure and five return structures located along its west bank. The water surface gradient is nearly zero for most of its length, and elevation drops are facilitated by lock structures and weirs.


Cleveland
Cuyahoga Heights
E 49th St
77
53
54
55
56
Brooklyn Heights
Granger Rd
480
Garfield Heights
Alexander Rd
Broadway Ave
Libby Rd
Lee Rd
Maple Heights
Rockside Rd
Valley View
Canal Rd
Independence
Brecksville Rd
Seven Hills
Hillside Rd
E Pleasant Valley Rd
Walton Hills
Alexander Rd
E Sprague Rd
Sprague Rd
E Wallings Rd
Riverview Rd
Brecksville
Sagamore Hills
Chippewa Rd
Figure 2
OHIO CANAL
Sample Site
Community Boundary
0 0.25 0.5 1 Miles
N

The Ohio EPA has no current use designation for the Ohio Canal. No QHEI's have been determined for the canal since it is not a natural watercourse. The NEORSD has selected four locations on the Ohio Canal for routine chemical, bacteriological and benthic sampling and analysis (Figure 2). Chemical and bacteriological data from the Ohio Canal are presented in Appendix B.

Site #53 (41^{o} 26.374' N, 81^{o} 40.107' W) is approximately 30 feet upstream of the confluence with the Cuyahoga River (RM 8.5). The site can be accessed from a walking trail that travels to the north between the river and the canal for 0.4 miles from the end of the old towpath.

Site #54 (41^{o} 25.107' N, 81^{o} 38.491' W) is located at the railroad bridge crossing near the intersection of East 71st Street and Canal Road. Parallel to this location is Site #22.9 on the Cuyahoga River.

Site #55 (41° 23.108' N, 81° 37.169' W) is located at the Stone Road Bridge and can be accessed from Canal Road. This site is located in the Cuyahoga Valley National Recreation Area.

Site #56 (41° 19.242' N, 81° 35.190' W) is located at the inlet structure through which Cuyahoga River flow is diverted into the canal. This site is located in the rural environment of the Cuyahoga Valley National Recreation Area.

Problems and Remediation

-1-

On February 22, 2000, NEORSD investigators discovered evidence of sanitary sewage in a creek tributary to the Ohio Canal, located just east of Turney Road and Thunderbird Drive. Investigators traced the sewage to the storm sewer on Summit Avenue. One source of the sewage was identified as an improper connection of a residential sanitary discharge to the storm sewer on Summit Avenue. Investigators further noted that additional residential sanitary discharges may have been improperly connected to the storm sewer in this area but were not identified during this investigation. These findings were reported to the City of Maple Heights Service Department.

BIG CREEK

Big Creek drains southwestern Cleveland and the southwest suburbs. It has a total drainage area of 38.6 square miles and a total length of 12.0 miles. Big Creek has two main branches: the East Branch, which originates in North Royalton south of Pleasant Valley Road and flows north through Parma and Parma Heights into Brooklyn; and the West Branch, which originates in Brook Park and flows northeast through the west side of Cleveland into Brooklyn, where it combines with the East Branch. From the confluence of the two main branches, Big Creek flows east through Brooklyn and Cleveland to the Cuyahoga River at River Mile 7.4. Additionally, each branch has a major tributary stream: Stickney Creek, which originates in Parma and flows northwest through a section of Cleveland into Brooklyn, where it combines with the East Branch; and the "Chevrolet" Branch, which originates in Parma south of Brookpark Road and flows northeast into Cleveland, where it combines with the West Branch.

Most of Big Creek is open, with only two major portions culverted: approximately 0.4 miles underneath the Cleveland Metroparks Zoo; and approximately 2.6 miles of the West Branch between West 117th Street and Puritas Avenue.

Along Interstate 71, from downstream of the East and West Branch confluence to Brookside Park, the creek has been relocated and channelized with concrete beds. Other than these 1.6 miles of channelization and the culverted portions, the creek's substrate is predominantly natural.

The creek's drainage area is largely residential and commercial but also includes significant portions of land used for industrial and recreational purposes. The Ohio EPA has designated Big Creek Aquatic Life Warmwater Habitat, Agricultural Water Supply, Industrial Water Supply and Primary Contact Recreational Use. The Ford Branch of Big Creek has been designated Limited Resource Water and Secondary Contact Recreational Use. Portions of Big Creek within the boundaries of the Cleveland Metroparks have also been designated State Resource Water. Big Creek has six locations that are routinely sampled by NEORSD investigators for chemical, bacteriological, and benthic analysis (Figure 3). Chemical and bacteriological data from Big Creek are presented in Appendix B.

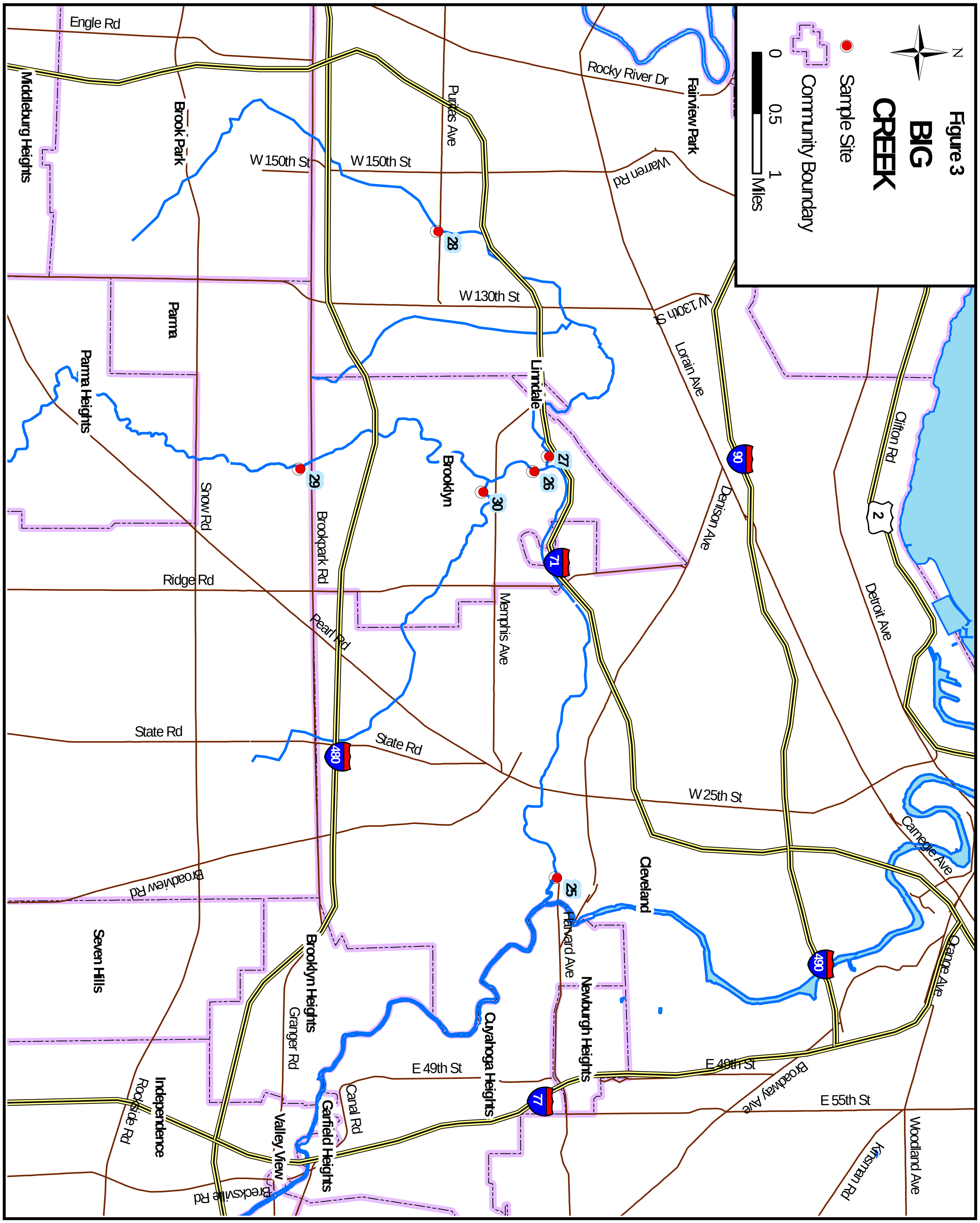


Figure 3
BIG CREEK
Sample Site
Community Boundary
0 0.5 1
Miles
N
Engle Rd
Middleburg Heights
Brook Park
W 150th St
W 150th St
Puritas Ave
Rocky River Dr
Fairview Park
Warren Rd
W 130th St
W 130th St
Parma
Parma Heights
Linndale
Lorain Ave
Clifton Rd
Brooklyn
Snow Rd
Brookpark Rd
Denison Ave
Ridge Rd
Pearl Rd
Memphis Ave
Detroit Ave
State Rd
State Rd
W 25th St
Carnegie Ave
Broadview Rd
Cleveland
Harvard Ave
Seven Hills
Brooklyn Heights
Granger Rd
Newburgh Heights
Cuyahoga Heights
E 49th St
E 49th St
Broadway Ave
E 55th St
Orange Ave
Independence
Rockside Rd
Valley View
Garfield Heights
Canal Rd
Brecksville Rd
Kinsman Rd
Woodland Ave
25
26
27
28
29
30
90
71
480
490
77
2

Site #25 (41° 26.747' N, 81° 41.194' W) is located on the main stem downstream of Jennings Road and approximately 900 feet upstream of the confluence with the Cuyahoga River. In 2002, Site #25 obtained a QHEI score of 69.25 (Appendix D).

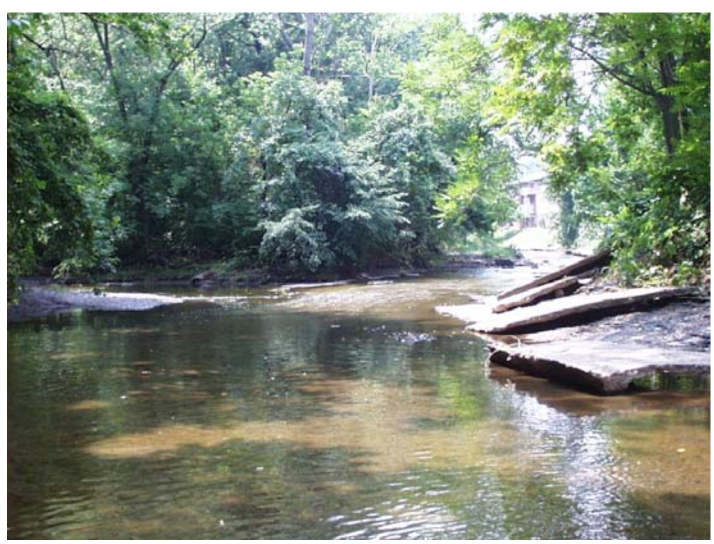
Site #26 (41° 26.747' N, 81° 45.243' W) is located on the East Branch of Big Creek approximately 100 feet upstream of its confluence with the West Branch. As is the case with Site #27, this section of the creek passes through a portion of the Cleveland Metroparks Big Creek Reservation north of Memphis Avenue and Tiedeman Road. Site #26 obtained a QHEI score of 55 in 2002 (Appendix D).

Site #27 (41° 26.812' N, 81° 45.294' W) is located on the West Branch of Big Creek approximately 100 feet upstream of the confluence with the East Branch. It is in a portion of the Cleveland Metroparks Big Creek Reservation north of Memphis Avenue and Tiedeman Road. In 2001, Site #27 obtained a QHEI score of 57 (Appendix D).

Site #28 (41° 25.964' N, 81° 47.527' W) is located on the West Branch of Big Creek immediately upstream of the beginning of the double-barrel culvert south of Puritas Avenue. The stream at this point has passed through a flat marshland with high grass. Near the culvert, it has concrete beds that are covered with sand and a dense growth of green algae. Site #28 obtained a QHEI score of 23.5 in 2002 (Appendix D).

Site #29 (41° 24.951' N, 81° 45.267' W) is located upstream on the East Branch of Big Creek at the Fernhill Picnic area in the Metroparks Big Creek Reservation, south of Brookpark Road. In 2002, Site #29 obtained a QHEI score of 48.25 (Appendix D).

Site #30 (41° 26.317' N, 81° 45.063' W) is located on Stickney Creek about 100 feet upstream of its confluence with the East Branch of Big Creek south of Memphis Avenue. In 2002, Site #30 obtained a QHEI score of 52.25 (Appendix D).



Problems and Remediation

-1-

On February 4, 1999, while performing wet weather sampling of Big Creek at Site #25, NEORSD investigators discovered an oil sheen entering the creek from the tributary Treadway Creek. The oil was traced to a catch basin on Jennings Road at Crestline Avenue. An inspection of the area revealed that oil was draining into a catch basin from Jennings Road. Although the exact source of the oil could not be identified, it appeared to be the result of a leakage from an automobile or truck onto the road.

In an effort to contain the oil, investigators placed absorbent pillows around the catch basin. On February 5, 1999, NEORSD investigators returned to the site and found that the pillows had absorbed a majority of the oil. In addition, no sheen was observed in Treadway Creek near its confluence with Big Creek. Finally, on February 12, 1999, investigators returned and removed all remaining absorbent pillows that had been placed around the catch basin.

-2-

On February 5, 1999, NEORSD investigators found a dry weather discharge of sanitary sewage to Big Creek through a 20-inch outfall in the vicinity of Calgary Park, south of Calgary Avenue in Cleveland. The source of the sewage was traced to an abandoned lift station on West 23rd Street. Investigators found that the sanitary sewers on West 22nd Street and West 23rd Street were still tributary to this lift station, despite having been abandoned some time prior to 1977. As a result, sanitary sewage was entering Big Creek through the lift station's overflow outfall.

Dye tests revealed that at least two of the four homes on these streets had sanitary discharges tributary to the lift station. Following notification of the City of Cleveland Division of Water Pollution Control, modifications to reroute the sanitary sewer on West 22nd Street and West 23rd Street were performed. A subsequent inspection by NEORSD investigators on May 4, 2000, revealed that this source of pollution in Big Creek had been eliminated.

-3-

On February 24, 1999, NEORSD investigators responded to a complaint of a green color in a tributary of Big Creek's East Branch at Zona Lane in Parma. Investigators attempted to trace back the green substance in the creek, but the color had dissipated during their investigation. Despite the effort, no source of the green colored flow was found.

-4-

On April 1, 1999, NEORSD investigators responded to a report of a red colored flow in the West Branch of Big Creek at 15601 Brookpark Road. The red flow was traced to the storm sewer on Lindmont Drive at Adair Drive in Brook Park. A water main leak at this location had resulted in red colored clay and water entering several catch basins and the storm sewer tributary to Big Creek. At the time of the investigation, the City of Cleveland Division of Water was on location to repair the water main.

-5-

On April 19, 1999, NEORSD investigators performed a general investigation at Dove Die and Stamping Company, 15665 Brookpark Road. A dye test showed that process wastewater from the company's parts washer had been improperly connected to a storm sewer thatt discharges to the West Branch of Big Creek. Following these findings, company officials were advised to perform the necessary modifications to eliminate this discharge from entering Big Creek.

-6-

On June 7, 1999, NEORSD investigators responded to a complaint of sanitary sewage in Big Creek behind 6004 Chestnut Hills Drive in Parma. The sewage was traced back to a blocked sanitary sewer at 8217 Thornton Drive. The blockage caused the sanitary sewer to become surcharged, resulting in leakage of sewage into the storm sewer. Following this discovery, the problem was reported to the City of Parma Service Department. A follow-up inspection by investigators on June 10, 1999, revealed that the sanitary sewer had been unblocked and this source of pollution in Big Creek had been eliminated.

-7-

On July 16, 1999, NEORSD investigators responded to a report by the Parma Fire Department (PFD) of a diesel fuel spill on Brookpark Road at Tiedeman Road. An estimated 50 gallons of diesel fuel had spilled onto Brookpark Road from a ruptured saddle tank on a C.F. Motor Freight truck. Although some of the fuel had been contained with absorbent material, an undetermined quantity had entered a storm sewer tributary to Big Creek through a nearby catch basin. In an effort to contain the diesel fuel within the storm sewer, investigators had deployed absorbent booms and pads in and around the outfall. At the time of the investigation, C.F. Motor Freight had reportedly contacted a clean-up company to perform site remediation.

A follow-up inspection by NEORSD investigators on July 19, 1999, revealed that the absorbent booms had not been removed and the diesel fuel remained in the storm sewer. On July 20, 1999, investigators returned to the site and found that the booms had been washed out due to heavy rains the previous night. On July 22, 1999, NEORSD investigators met with Ohio EPA personnel at this location on Big Creek and informed them of the situation. Ohio EPA stated that C.F. Motor Freight would be contacted about the site remediation performed.

-8-

On July 16th and July 19, 1999, an NEORSD contracted construction firm reported several temporary dry weather overflow events to Big Creek during a rehabilitation project to the Big Creek Interceptor. The repair work on the interceptor was in the vicinity of West 38th Street at Muriel Avenue and West 48th Street at Shadyside Avenue in Cleveland. The Ohio EPA was apprised of the situation.

-9-

On July 26, 1999, NEORSD investigators found a dry weather discharge to Big Creek through a 42-inch storm sewer outfall near Big Creek Parkway, south of Brookpark Road. The source of this flow was identified as a probable water main leak entering the storm sewer at 8308 Kenilworth Avenue. The rate of discharge was measured at approximately 40,000 gallons per day. The City of Cleveland Division of Water was notified of these findings.

-10-

On August 2, 1999, NEORSD investigators responded to a complaint of sanitary sewage in Stickney Creek near 3710 Burger Avenue in Cleveland. The sewage was traced upstream to the Stickney Creek culvert opening located just north of 4930 State Road. The source of sewage was identified as a blocked sanitary sewer on Brookpark Road, between Daleside Drive and Roseside Drive in Parma. The blockage caused the sanitary sewer to become surcharged, resulting in leakage of sewage into the Brookpark Road storm sewer, which discharges to the Stickney Creek culvert. The City of Parma Service Department was notified of the problem on August 2nd and removed the blockage that day.

On August 3, 1999, however, NEORSD investigators found a second occurrence of a blockage in the Brookpark Road sanitary sewer, again resulting in sewage entering the Stickney Creek culvert. The City of Parma Service Department was immediately notified of the problem. A follow-up inspection by investigators on August 4, 1999 revealed no further pollution to Stickney Creek from this source.

-11-

On October 8, 1999, NEORSD investigators responded to a complaint of sewage odors in the East Branch of Big Creek at Stumph Road and Big Creek Parkway in Parma Heights. The source of the odors was traced to dry weather discharges of sanitary sewage through two storm sewer outfalls under Pearl Road, just west of Stumph Road. The discharge through the storm sewer outfall from the west was measured at a flow rate of 7,000 gallons per day and had a fecal coliform density of 120,000 CFU per 100 mL. NEORSD investigators traced back the sanitary sewage in the storm sewer to Pearl Road near Maplecrest Avenue. Further investigation by personnel from the Cuyahoga County Sanitary Engineering Department and the City of Parma Heights revealed an improper connection of the sanitary discharge to the Pearl Road storm sewer from The Whip Restaurant, 6406 Pearl Road. Following these findings, the City of Parma Heights notified the restaurant owners to reroute this discharge to the sanitary sewer. A follow-up inspection by investigators on March 10, 2000 revealed that this facility's wastewater had been rerouted to the sanitary sewer, eliminating this source of pollution in Big Creek.

The remaining source of dry weather discharge of sewage to Big Creek was through a storm sewer outfall from the east under Pearl Road. The discharge was measured at a flow rate of 5,000 gallons per day and had a fecal coliform density of 600,000 CFU per

100 mL. Inspections by investigators revealed that the dry weather flow contaminated by sanitary sewage was from several sources throughout the sewer system. One source of the sewage was identified as improper connections of two residential sanitary discharges to the storm sewer on Aylesworth Drive and Lynden Oval. Investigators further noted that additional residential sanitary discharges may have been improperly connected to the storm sewer in this area, but were not identified during this investigation. The City of Parma Heights was apprised of these findings.

Following notification, the City of Parma Heights informed NEORSD that several residences on Olde York Road have septic systems and these effluents discharge to the storm sewer system contributing to the elevated bacterial contamination and dry weather discharge to Big Creek at Pearl Road. Following these findings, the City of Parma Heights notified the Cuyahoga County Board of Health in an effort to have the effluents from these remaining septic systems rerouted to the sanitary sewer.

-12-

During the period of November 1, 1999 to November 4, 1999, with Ohio EPA's approval, NEORSD diverted flow from the trunk sewer on Ridge Road to Big Creek in order to perform needed repairs to the Big Creek Interceptor. The diversion was measured at an average volume of approximately 800,000 gallons per day.

-13-

On November 5, 1999, NEORSD investigators discovered sanitary sewage entering Stickney Creek through a 72-inch storm sewer outfall under Ridge Road near West 66th Street. Investigations revealed that the sanitary sewage was from several sources throughout the sewer system. One source of the sewage was identified as an improper connection of a residential sanitary discharge to the storm sewer on Flowerdale Avenue. Investigators further noted that additional residential sanitary discharges may have been improperly connected to the storm sewer in this area but were not identified during this investigation. These findings were reported to the City of Cleveland Water Pollution Control.

-14-

On July 14, 2000, NEORSD investigators observed a dry weather discharge containing sanitary sewage entering Big Creek through a 42-inch storm sewer outfall located east of 8901 Evergreen Drive. Bacteriological analysis of the discharge revealed a fecal coliform concentration of 54,000 colonies per 100 mL. The sewage was traced back to the storm sewer on Ridgefield Road at Frankfort Avenue. A blockage of the sanitary sewer at this location had resulted in leakage of sewage into the storm sewer. Following this discovery, the problem was reported to the City of Parma Service Department.

-15-

On October 10, 2000, NEORSD personnel investigated dry weather discharges of sanitary sewage to Big Creek's West Branch through two 6-inch storm sewer outfalls located just west of 4860 West 150th Street. The source of the sanitary sewage contamination was identified as effluent from a failing septic system from Conrail's Rockport Yard, 4860 West 150th Street. Following these findings, the City of Cleveland Division of Environmental Health was notified.

-16-

On October 18, 2000, NEORSD investigators responded to a report of a fish kill in Ridgewood Lake in Parma. Investigators observed at least 50 dead fish floating in the lake, which had evidence of sanitary sewage contamination. According to City of Parma officials, the source of the sewage was identified as a blocked sanitary sewer on Ridge Road at Ridgewood Drive. The blockage caused the sanitary sewer to become surcharged, resulting in sewage infiltrating into the storm sewer system tributary to Ridgewood Lake. As a result, this sanitary sewage influent had depleted the dissolved oxygen levels in the lake, resulting in fish mortalities. The City of Parma Service Department removed the blockage on October 18, 2000, eliminating this source of pollution to Ridgewood Lake, which discharges into a tributary of Big Creek.

-17-

On November 8, 2000, NEORSD investigators responded to a report of a black colored flow in a tributary to the East Branch of Big Creek at Denison Boulevard and Pearl Road in Parma Heights. Although there was no discolored flow at the time of the investigation, NEORSD investigators observed that a gray colored sediment had covered the creek's substrate. Investigators further noted that the substrate, when disturbed, resulted in a turbid gray colored flow. Following these observations, investigators surmised that sediment from a recent culvert construction project under Pearl Road might have caused the creek's flow to become discolored.

-18-

On February 5, 2001, NEORSD investigators responded to a report of a white colored discharge entering the "Chevrolet" Branch of Big Creek through a storm sewer outfall under Brookpark Road. Investigators, along with personnel from Ohio EPA and several local fire departments, traced the white discharge to Shiloh Industries, 5389 West 130th Street. An inspection revealed that water-soluble lubricant from this company's stamping plant was improperly connected to the storm sewer that discharges to the "Chevrolet" Branch of Big Creek. Following these findings, company officials were advised to perform the necessary modifications to eliminate this discharge from entering the creek.

-19-

On May 9, 2001, NEORSD investigators responded to a report by the Brooklyn Fire Department (BFD) of a diesel fuel spill at the Wal-Mart Shopping Center parking lot, 10000 Brookpark Road. An estimated 100 gallons of diesel fuel had leaked from a punctured saddle tank on a Covenant Transport Incorporated truck. Although some of the fuel had been contained with absorbent material, an undetermined quantity had entered a storm sewer tributary to Big Creek through several nearby catch basins. The BFD had placed absorbent booms and pads in and around the outfall in an effort to contain the diesel fuel within the storm sewer. Inland Waters of Ohio was contracted to conduct site remediation, which was monitored by the Ohio EPA.

-20-

On March 22, 2002, NEORSD investigators responded to a complaint of sanitary sewage in the “Chevrolet” Branch of Big Creek at Brookpark Road. The sewage was traced back to a blocked sanitary sewer between 5441 and 5491 Chevrolet Boulevard. The blockage caused the sanitary sewer to become surcharged, resulting in leakage of sewage into the storm sewer. Following this discovery, the problem was reported to the City of Parma Service Department. A follow-up inspection by investigators on March 25, 2002, revealed that the sanitary sewer had been unblocked and this source of pollution in Big Creek had been eliminated.

-21-

On July 1, 2002, NEORSD investigators responded to a report of sanitary sewage entering Big Creek’s East Branch through the storm sewer outfall at Wesley Drive, south of Pearl Road. The source of sewage was traced to a surcharged sanitary sewer caused by a blockage at 8114 Dartworth Drive. Following this discovery, the City of Parma Service Department was notified.

MILL CREEK

Mill Creek drains southeastern Cleveland and the suburbs along the southeastern border of Cleveland. It has a total drainage area of 18.1 square miles and a total length of 9.0 miles. Mill Creek originates in the vicinity of Warrensville Township, flows southwest through Warrensville Heights and a small section of Cleveland to near Broadway Avenue in Maple Heights, which it parallels northwest through Garfield Heights into Cleveland, and then flows south along the border of Cuyahoga Heights and Garfield Heights to the Cuyahoga River at River Mile 11.9.

Almost the entire creek is open with the only significant culverted sections being short segments of the creek upstream of Garfield Park, under Interstate 480, and downstream of the detention basin east of Kerruish Park. Except for the concrete beds in the culverts, the creek's substrate is predominantly natural.

Mill Creek's drainage area is primarily residential and industrial. The Ohio EPA has designated Mill Creek Aquatic Life Warmwater Habitat, Agricultural Water Supply, Industrial Water Supply and Primary Contact Recreational Use.

The water quality of Mill Creek is of particular concern to the NEORSD as it discharges into the Cuyahoga River approximately one mile upstream of the Southerly WWTC discharge to the river. Historically, Mill Creek has been one of the most heavily polluted streams in the Greater Cleveland Area.

Six locations have been chosen on Mill Creek for routine chemical, bacteriological, and benthic sampling and analysis (Figure 4). Chemical and bacteriological data from Mill Creek are presented in Appendix B.

Site #31 (41° 25.054' N, 81° 38.301' W) is located on the main stem of Mill Creek, approximately 600 feet upstream of the confluence with the Cuyahoga River, under Canal Road. In 2002, Site #31 obtained a QHEI score of 61.5 (Appendix D).

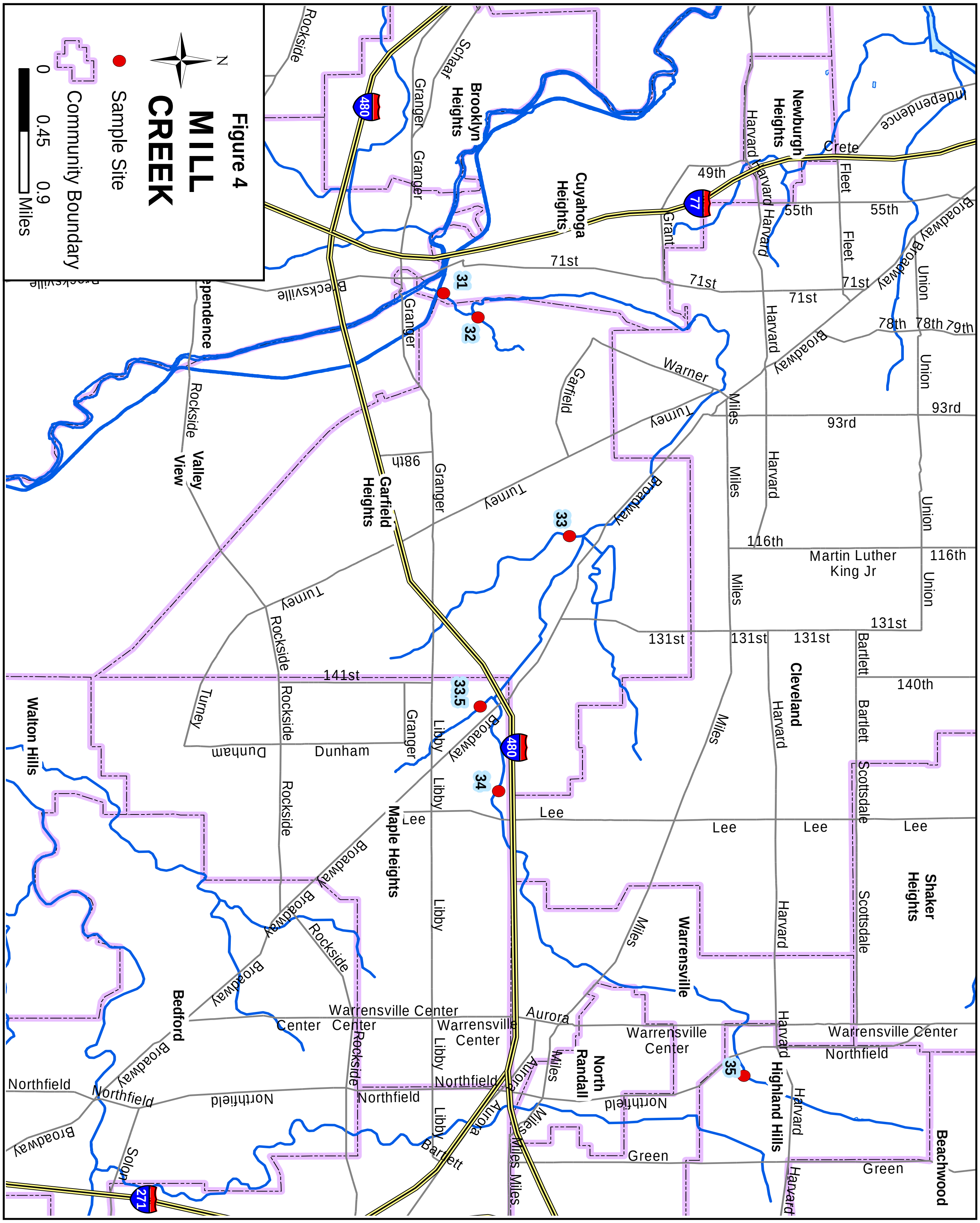


Figure 4
MILL CREEK
N
Sample Site
Community Boundary
0 0.45 0.9
Miles
31
32
33
33.5
34
35
Brooklyn Heights
Cuyahoga Heights
Newburgh Heights
Garfield Heights
Valley View
Walton Hills
Maple Heights
Bedford
Cleveland
Warrensville
North Randall
Highland Hills
Shaker Heights
Beachwood
480
77
271

Site #32 (41° 25.282' N, 81° 38.078' W) is located on a small tributary to Mill Creek from the northeast, which is culverted beneath Warner Road. The tributary enters the creek less than one half mile upstream of Mill Creek's confluence with the Cuyahoga River. Site #32 obtained a QHEI score of 51.25 in 2000 (Appendix D).

Site #33 (41° 25.80628' N, 81° 36.282' W) is located on the Wolf Creek tributary to Mill Creek in the Cleveland Metroparks Garfield Park Reservation, approximately 100 feet upstream of its confluence with Mill Creek. In 2000, this site obtained a QHEI score of 57.5 (Appendix D).

Site #33.5(41° 25.342' N, 81° 34.911' W) is located on a tributary to Mill Creek known as the Mapletown Branch, which flows in a northeastern direction parallel to Broadway Avenue in Maple Heights. This site is approximately thirty feet upstream of this tributary's confluence with Mill Creek, south of Interstate 480 at Broadway Avenue. In 2002, this site obtained a QHEI score of 56 (Appendix D).

Site #34 (41° 25.396' N, 81° 33.956' W) is located on Mill Creek at Rex Avenue and Glenburn Avenue in Maple Heights. Site #35 obtained a QHEI score of 56.5 in 2000 (Appendix D).

Site #35 (41° 26.753' N, 81° 33.956' W) is located on Mill Creek 100 feet upstream of Northfield Road in the Village of Highland Hills. In 2000, Site #35 obtained a QHEI score of 62.25 (Appendix D).

Problems and Remediation

-1-

On February 26, 1999, NEORSD investigators found a 36-inch storm sewer discharging sanitary sewage to Mill Creek under the Miles Road bridge. Investigators traced the source of sewage to a blocked sanitary sewer on Miles Road just west of Warrensville Center Road. The blockage caused the sanitary sewer to become surcharged, resulting in sewage infiltrating into the storm sewer. Following this discovery, the City of Warrensville Heights Service Department was notified.

A follow-up inspection by NEORSD investigators on March 2, 1999, revealed that the sanitary sewage influent to Mill Creek had continued. However, an inspection revealed no blockage in the sanitary sewer on Miles Road near Warrensville Center Road. The source of this sewage was traced to a blocked sanitary sewer just west of 19700 Miles Road. At the time of the investigation, the City of Warrensville Heights Service Department was on location to clear the blockage. A subsequent inspection on March 4, 1999, verified that the blockage had been removed, eliminating this source of pollution in Mill Creek.

-2-

On August 9, 1999, NEORSD investigators found another occurrence of a sanitary sewage influent to Mill Creek under the Miles Road bridge. Bacteriological analysis of this discharge revealed a fecal coliform density of 380,000 CFU per 100 mL. The source of sewage was traced to a blocked sanitary sewer at 20000 Miles Road. The blockage caused the sanitary sewer to become surcharged, resulting in sewage infiltrating into the storm sewer. The City of Warrensville Heights Service Department was notified and the blockage was removed. Correction of the problem was verified on August 13, 1999.

-3-

On March 2, 1999, NEORSD investigators discovered an oil sheen on Mill Creek downstream of Miles Road. The oil was traced to a storm sewer on the Cuyahoga County Engineer's Miles Construction Yard, 19700 Miles Road. An inspection by NEORSD investigators revealed that vehicle washing and maintenance was done in the facility's garage areas and rear parking area. Several of the catch basins located in these areas were found to contain oily residue similar to the oil entering Mill Creek. Dye tests showed that several catch basins in the garage area were connected to the Miles Road storm sewer.

Following these findings, representatives of the Cuyahoga County Engineers were advised to reroute or permanently seal the catch basins inside the facility that were connected to the storm sewer. A recommendation was also made to discontinue the outdoor washing of vehicles to prevent run-off from entering the storm sewer tributary to Mill Creek.

-4-

On October 12, 1999, NEORSD investigators responded to a report of a large quantity of oil in the Johnston Parkway Branch of Mill Creek, west of East 143rd Street near Saybrook Avenue. Investigators observed pockets of oil lining the creek banks from East 143rd Street downstream to near the intersection of Cranwood Park Boulevard and Lawrence Drive. Although the source of the oil was not identified that day, the Ohio EPA Emergency Response Unit on site contacted Chem-Tron Incorporated to perform clean-up of the oil in the creek.

On October 13, 1999, NEORSD investigators and the Ohio EPA traced the source of oil to SPS Technologies Incorporated, 4444 Lee Road. According to company officials, a pump on an oil separator had failed, resulting in leakage of oil from a scrap metal waste bin to overflow to a nearby storm sewer catch basin that is tributary to Mill Creek. SPS Technologies Incorporated assumed responsibility for the spill and provided clean-up of the oil. In addition, however, it should be noted that during clean-up on the afternoon of October 13, 1999, a thunderstorm with heavy rains had occurred resulting in much of the oil in the creek being washed away.

-5-

On September 2, 1999, NEORSD investigators found a dry weather discharge containing evidence of sanitary sewage entering Mill Creek through a 48-inch storm sewer outfall under the Broadway Avenue bridge. Bacteriological analysis of this flow revealed a fecal coliform density of 9,700 CFU per 100 mL. Investigations revealed that the dry weather flow was from several sources in the sewer system.

One source of flow identified by Investigators was a water main leak entering the storm sewer at 15111 Broadway Avenue in Maple Heights. The flow rate of this discharge was measured at approximately 7,500 gallons per day with a free chlorine concentration of 0.6 mg/L. Following these findings, the City of Cleveland Water Department was notified.

The source of sanitary sewage contamination to the storm sewer was identified as an improper connection of the sanitary discharge from Buck Savers Signs & Stamps, 15105 Broadway Avenue. Investigators further noted that additional commercial sanitary discharges may have been improperly connected to the storm sewer in this area, but were not identified during this investigation. The City of Maple Heights Service Department was notified of these findings.

-6-

On February 15, 2000, NEORSD investigators discovered a break in the Mill Creek Interceptor (MCI), southwest of Dorver Avenue at East 77th Street, following a complaint of sewage flowing into Mill Creek near this location. The NEORSD Engineering Department was notified of the situation, and on the following day, emergency repairs were initiated. On February 16th, the flow of sewage entering the creek from this source had been measured at approximately 24 million gallons per day. In order to repair the MCI, sanitary sewage was bypassed to Mill Creek through CSO 018 (at Mill Creek falls) and CSO 020 (East 93rd Street at Miles Avenue). At times, sewage was also diverted to Mill Creek directly from the interceptor near Broadway Avenue, upstream of CSO 020. Repair work to the MCI, which included replacement of approximately 700-feet of interceptor pipe, was hindered by the break's location on a steep slope through a landfill. On April 26, 2000, repairs to the MCI had been completed and all sanitary flow had been diverted back into the interceptor.

-7-

While performing an industrial inspection at North Coast Spring & Wire Forms, Incorporated at 7800 Finney Avenue, on June 19, 2001, NEORSD investigators found that process wastewater from the company's deburring process had been improperly connected to the storm sewer which discharges to Mill Creek. Following these findings, company officials were advised to perform the necessary modifications to eliminate this discharge from entering the storm sewer. A follow-up inspection by investigators on June 27, 2001, revealed that the floor drain tributary to the storm sewer had been sealed, eliminating this source of contamination to Mill Creek.

-8-

NEORSD investigators found another source of industrial wastewater in Mill Creek on June 26, 2001. While installing a Hester-Dendy artificial substrate sampler downstream of South Miles Road, investigators noted that the creek's flow was gray in color. In addition, the dissolved oxygen concentration was measured at 1.5 ppm. Investigators found the gray colored discharge entering Mill Creek from a hillside on the creek's east bank upstream of South Miles Road. The flow rate of this discharge was measured at approximately 36,000 gallons per day. Investigators traced the source to Godfrey & Wing Incorporated, 19800 Miles Road. Dye tests showed that process wastewater was overflowing a storage pit as the result of a malfunctioning pump. Further investigation revealed that the storage pit had an overflow outlet that discharges to a storm sewer drain tributary to Mill Creek. Following these findings, company officials were advised to install a new pump and perform the necessary modifications to eliminate this overflow structure on the storage pit. This information was forwarded to the Ohio EPA.

-9-

On February 25, 2002, NEORSD investigators responded to a complaint of a yellow color in Wolf Creek, east of Edgepark Drive and East 117th Street. While inspecting this section of Wolf Creek, investigators observed, rather, a turbid-brown colored flow. The source of this turbid flow was traced to the storm sewer on Oak Park Boulevard in Garfield Heights. A water main on Oak Park Boulevard had ruptured, resulting in muddy water entering the storm sewer tributary to Wolf Creek. The City of Cleveland Water Department was on location to repair the water main.

-10-

On April 10, 2002, NEORSD investigators responded to a report of a bright green color in a tributary to Mill Creek near 4897 Orchard Road, north of McCracken Road in Garfield Heights. An inspection of the creek downstream of Orchard Road revealed several pools that were very light green in color. In an effort to identify the source of the green substance, investigators inspected several storm sewer outfalls located near the affected areas of the creek. Despite these efforts, no source of the discolored flow was found.

-11-

On June 27, 2002, NEORSD investigators found sanitary sewage entering Mill Creek through a 36-inch storm sewer outfall under the Miles Road bridge. Investigators traced the source of the sewage to a blocked sanitary sewer at 19499 Miles Road. The blockage caused the sanitary sewer to become surcharged, resulting in sewage infiltrating into the storm sewer system. The City of Warrensville Heights Service Department was notified of the situation on June 27th. A follow-up inspection by investigators on June 28, 2002, verified the elimination of this dry weather discharge to Mill Creek.

-12-

On October 17, 2002, NEORSD investigators responded to a complaint of sanitary sewage odors in the Warrensville Heights Middle School at 4270 Warrensville Center Road. An inspection by investigators revealed that a sanitary sewer on the school's property was blocked and overflowing sewage into the storm sewer system. The sewer collection systems on the school property share a common trench where the sanitary sewer and storm sewer are situated side by side and are divided only by a common wall. As a result, sewage odors were back venting through the storm sewer and into the school. In addition, the sewage overflowing into the storm sewer was entering Mill Creek through a storm sewer outfall under Warrensville Road. Following these findings, the City of Warrensville Heights Service Department was notified. A follow-up inspection by investigators on October 18, 2002, revealed that the blockage had been removed, eliminating this source of sewage odors to the school building and pollution in Mill Creek.

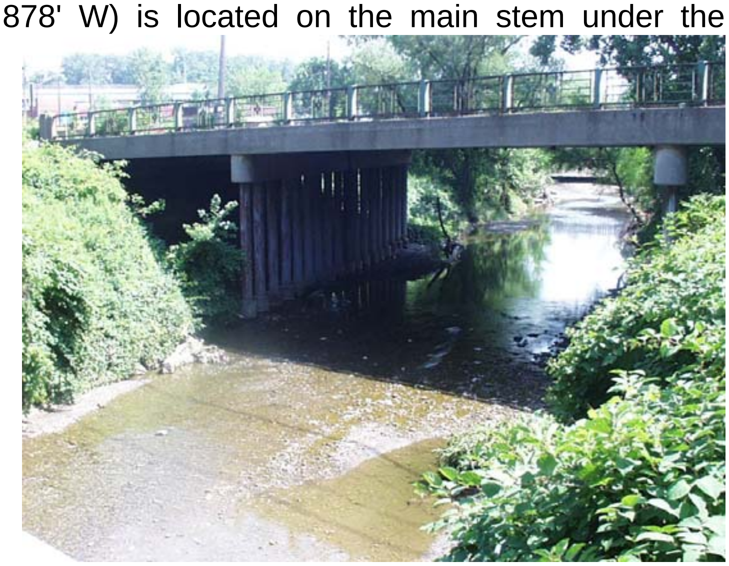
WEST CREEK

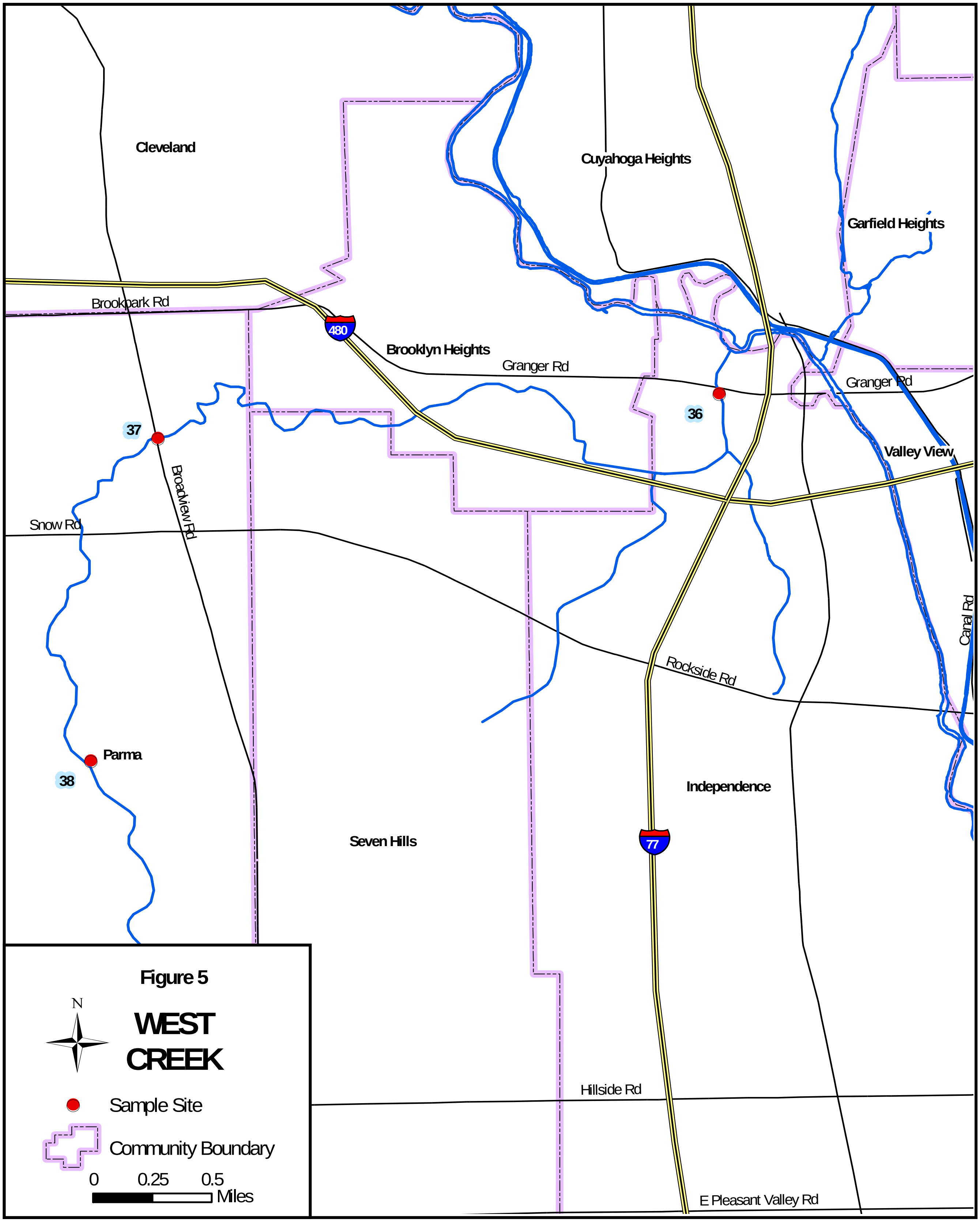
West Creek drains the eastern section of Parma and portions of Seven Hills, Brooklyn Heights, and Independence. It has an approximate drainage area of 20 square miles and a total length of approximately eight miles. West Creek has two branches: the main stem, which originates in Parma just south of the intersection of Broadview Road and Pleasant Valley Road and flows north through the eastern section of Parma, then east through Seven Hills, Brooklyn Heights, and Independence; and a smaller branch, originating in Independence north of the Chestnut Road and Oakwood Drive intersection, joining the main stem through a culvert under Interstate 480, west of the Interstate 77 interchange. From this confluence, West Creek flows north to the Cuyahoga River upstream of the Southerly WWTC chlorine-access railroad bridge (RM 11.3).

Most of West Creek is open and its substrate is predominantly natural. Along Interstate 480, the main stem has a short channelized section with concrete beds and sidewalls. Between Keynote Drive and Lancaster Drive in Brooklyn Heights, the stream has been re-routed to the northwest, with gabions installed on the banks to allow for construction of a commercial/industrial park.

West Creek's drainage area is largely residential. The Ohio EPA has designated West Creek Aquatic Life Warmwater Habitat, Agricultural Water Supply, Industrial Water Supply and Primary Contact Recreational Use. The NEORSD has selected three locations on West Creek for routine chemical, bacteriological, and benthic sampling and analysis (Figure 4). Chemical and bacteriological data from West Creek are presented in Appendix B.

Site #36 (41° 24.868' N, 81° 38.878' W) is located on the main stem under the Granger Road bridge, between Interstate 77 and Valley Belt Road, approximately 1,000 feet upstream of the confluence with the Cuyahoga River. In 1998, Site #36 obtained a QHEI score of 53 (Appendix D).




Cleveland
Cuyahoga Heights
Garfield Heights
Brookpark Rd
480
Brooklyn Heights
Granger Rd
Granger Rd
36
37
Valley View
Broadview Rd
Snow Rd
Canal Rd
Rockside Rd
Parma
38
Independence
Seven Hills
77
Figure 5
N
WEST CREEK
Sample Site
Community Boundary
0
0.25
0.5
Miles
Hillside Rd
E Pleasant Valley Rd

Site #37 (41° 24.692' N, 81° 41.572' W) is located on the main stem of West Creek under the Broadview Road bridge, between Brookdale Avenue and Sandpiper Drive in Parma. In 2002, Site #37 obtained a QHEI score of 42 (Appendix D).

Site #38 (41° 23.448' N, 81° 41.425' W) is located on the main stem of West Creek just upstream of the West Ridgewood Drive bridge, west of Post Road, in Parma. In 2002, Site #38 obtained a QHEI score of 53.5 (Appendix D).

Problems and Remediation

-1-

On February 26, 1999, NEORSD investigators responded to a report of a septic dry weather discharge entering West Creek through a storm sewer outfall under Broadview Road. The source of the discharge was traced to a blocked sanitary sewer on Broadview Road at Broadrock Court. The blockage caused the sanitary sewer to become surcharged, resulting in sewage infiltrating into the storm sewer system. Following these findings, the City of Parma Service Department was notified of the situation. A follow-up inspection by investigators verified the elimination of this dry weather discharge.

-2-

On May 3, 1999, NEORSD investigators responded to a complaint of sewage odors in the vicinity of West 8th Street and Tuxedo Avenue. The source of the sewage odors was traced to a surcharged sanitary sewer caused by a blockage at 919 Tuxedo Avenue. As a result of the blockage, sewage was infiltrating into the storm sewer system that discharges to a tributary of West Creek, north of North Avenue. The City of Parma Service Department was notified of the problem and a subsequent inspection by investigators on May 6, 1999, indicated no further pollution to West Creek from this source.

-3-

On June 11, 1999, NEORSD investigators responded to another complaint of sewage odors in a West Creek tributary located east of West 10th Street. Investigators discovered sewage entering the creek through a 42-inch storm sewer outfall behind 5245 West 10th Street. The flow of sewage was traced to a blocked sanitary sewer between 2199 and 2303 Brookpark Road. The blockage caused sewage to leak into the storm sewer and ultimately discharge to the creek. Following this discovery, the City of Parma Service Department was notified and the blockage was removed. NEORSD investigators, on June 15, 1999, verified that this source of sanitary sewage contamination in West Creek had been eliminated.

-4-

On May 23, 2000, NEORSD investigators discovered the recurrence of a dry weather sanitary sewage influent to the West Creek tributary, east of West 10th Street. The sewage was discharging into the creek through a 42-inch storm sewer outfall, located behind 5245 West 10th Street. The source of sewage was traced to a blocked sanitary sewer on West 24th Street at North Avenue. Following notification of the City of Parma Service Department, the blockage was removed. A subsequent inspection by investigators on May 24, 2000, revealed that this source of pollution in West Creek had been eliminated.

-5-

NEORSD investigators discovered another source of contamination to the West Creek tributary, located east of West 10th Street, on July 20, 2000. While inspecting the creek, investigators found a turbid-brown discharge entering the creek through the 42-inch storm sewer outfall behind 5245 West 10th Street. Investigators traced back the source of the turbid flow to United Rentals, 2415 Brookpark Road. An inspection by investigators revealed that run-off from outdoor construction equipment cleaning was entering a parking lot catch basin that is tributary to the storm sewer system. Following these findings, NEORSD investigators advised company officials to discontinue the outdoor washing of equipment to prevent run-off from entering the storm sewer tributary to West Creek. The Ohio EPA was notified of the situation.

-6-

On June 29, 2001, NEORSD investigators responded to a report of a gray colored flow in a tributary to West Creek located south of 2861 West Ridgewood Drive. The source of the gray flow was traced to a broken 8-inch sanitary sewer from Rustic Trail. The sanitary sewer runs west from the terminus of Rustic Trail into the West Creek valley. In this area, where a section of the sanitary sewer is exposed, investigators noted the break. The City of Parma Service Department was notified of the problem. A follow-up inspection by NEORSD investigators on July 13, 2001, verified that the sanitary sewer had been repaired and this source of contamination in West Creek had been eliminated.

-7-

On September 9, 2002, NEORSD investigators responded to a complaint of sewage odors in the West Creek tributary located east of 5245 West 10th Street. Investigators found sanitary sewage entering the creek through a 42-inch storm sewer outfall at this location. The source of the sewage was traced to a blocked sanitary sewer at 2112 Grovewood Avenue. The blockage caused the sanitary sewer to become surcharged, resulting in sewage infiltrating into the storm sewer. Following this discovery, the problem was reported to the City of Parma Service Department. A subsequent inspection by NEORSD investigators on September 9, 2002, revealed that this source of pollution in West Creek had been eliminated.

TINKERS CREEK

Tinkers Creek enters the Cuyahoga River at River Mile 17.0, south of Tinkers Creek Road in the Cuyahoga Valley National Park. Tinkers Creek is the largest tributary to the Cuyahoga River with a drainage area of 96 square miles.

A northern run of Tinkers Creek originates in Warrensville Heights and flows south through Orange Village and into the City of Solon. In Solon, the run turns westward south of Solon Road and continues flowing west through Oakwood and into Bedford Heights. A southern run begins in Reminderville in Summit County. This run flows south into Twinsburg and then turns northwest and flows into Glenwillow. The run continues northwest through Oakwood and into Bedford Heights where it merges with the northern run. This confluence is in the Cleveland Metroparks Hawthorne Parkway, south of Solon Road.

The creek then flows northwest out of Bedford Heights and into Bedford. In the Cleveland Metroparks Bedford Reservation, a southern run, originating from tributaries in Oakwood and Walton Hills, merges with Tinkers Creek north of Gorge Parkway. From Bedford the creek turns west and flows through Walton Hills, finally entering the Cuyahoga River in Valley View.

The Tinkers Creek drainage area is primarily residential and recreational, with some industry and agriculture. The Ohio EPA has designated the creek Aquatic Life Warmwater Habitat, Agricultural Water Supply, Industrial Water Supply and Primary Contact Recreational Use. Additionally, Tinkers Creek has been designated State Resource Water from its mouth to Richmond Road. Tinkers Creek has been assigned four sites for routine chemical, bacteriological and benthic sampling by the NEORSD (Figure 6). Chemical and bacteriological data from Tinkers Creek are presented in Appendix B.

Site #39 (41° 21.906' N, 81° 36.472' W) is located on Tinkers Creek approximately 500 feet upstream from the confluence of Tinkers Creek with the Cuyahoga River. This sample site is south of the intersection of Canal Road and Tinkers Creek Road. Sampling is performed upstream of the Ohio Canal viaduct over the creek. In 2000, Site #39 obtained a QHEI score of 61.75 (Appendix D).

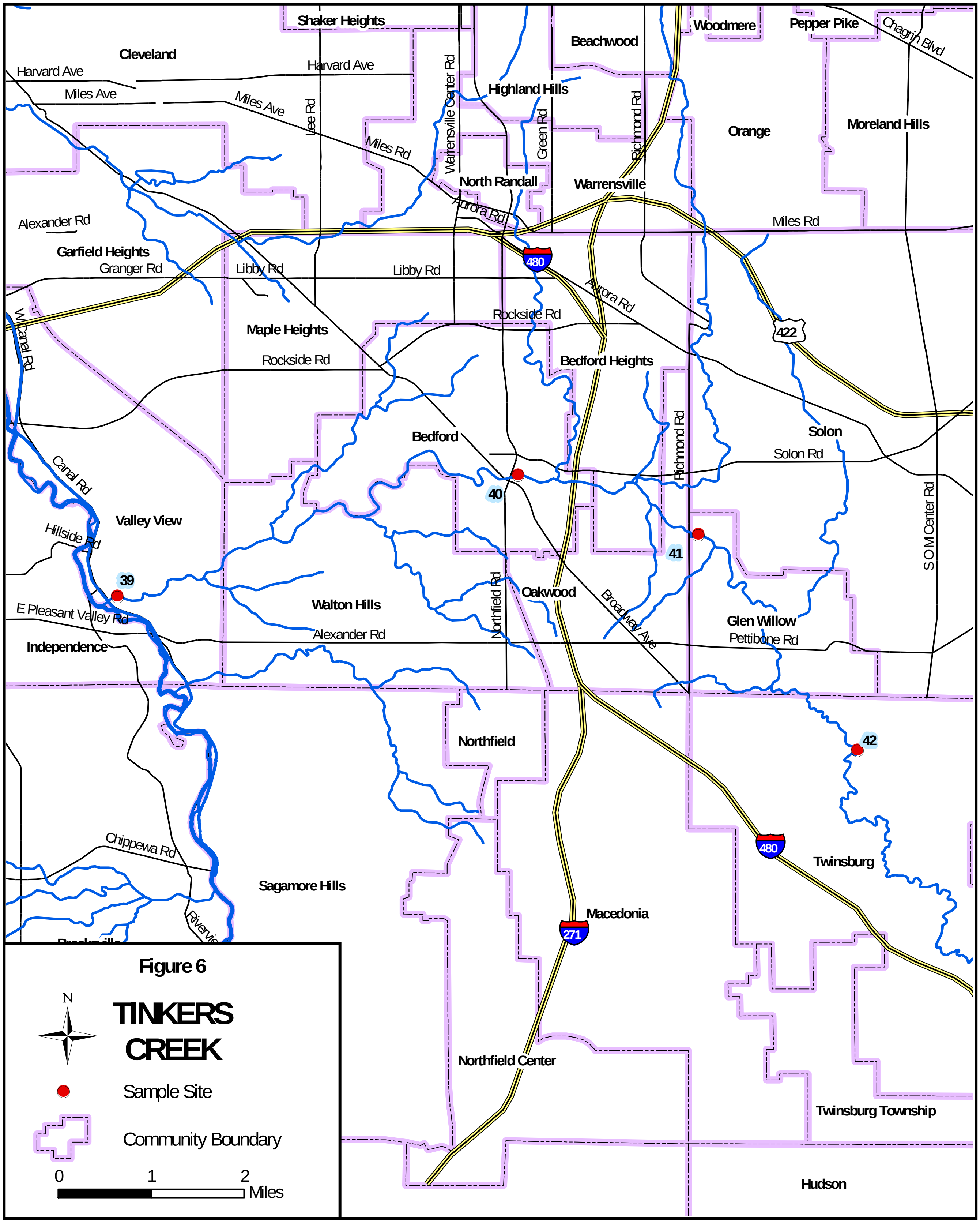


Figure 6

TINKERS CREEK

N

Sample Site

Community Boundary

0 1 2 Miles

Site #40 (41° 23.088' N, 81° 31.479' W) is located within the Cleveland Metroparks Bedford Chagrin Parkway. Specifically, the site is located off Bedford Chagrin Parkway, northeast of Broadway Avenue and underneath the Northfield Road bridge. In 2000, Site #40 obtained a QHEI score of 58.75 (Appendix D).

Site #41 (41° 22.566' N, 81° 29.379' W) is located just downstream of the Richmond Road bridge, north of the Bedford Chagrin Parkway in Oakwood. This site is located within the Cleveland Metroparks Bedford Chagrin Parkway. In 2000, Site #41 obtained a QHEI score of 67.75 (Appendix D).

Site #42 (41° 20.428' N, 81° 27.254' W) is located upstream of the southeast face of the Glenwood Drive bridge crossing Tinkers Creek. The bridge lies between Idlewood Drive and Gary Drive in Twinsburg. In 2000, Site #42 obtained a QHEI score of 62.25 (Appendix D).

Problems and Remediation

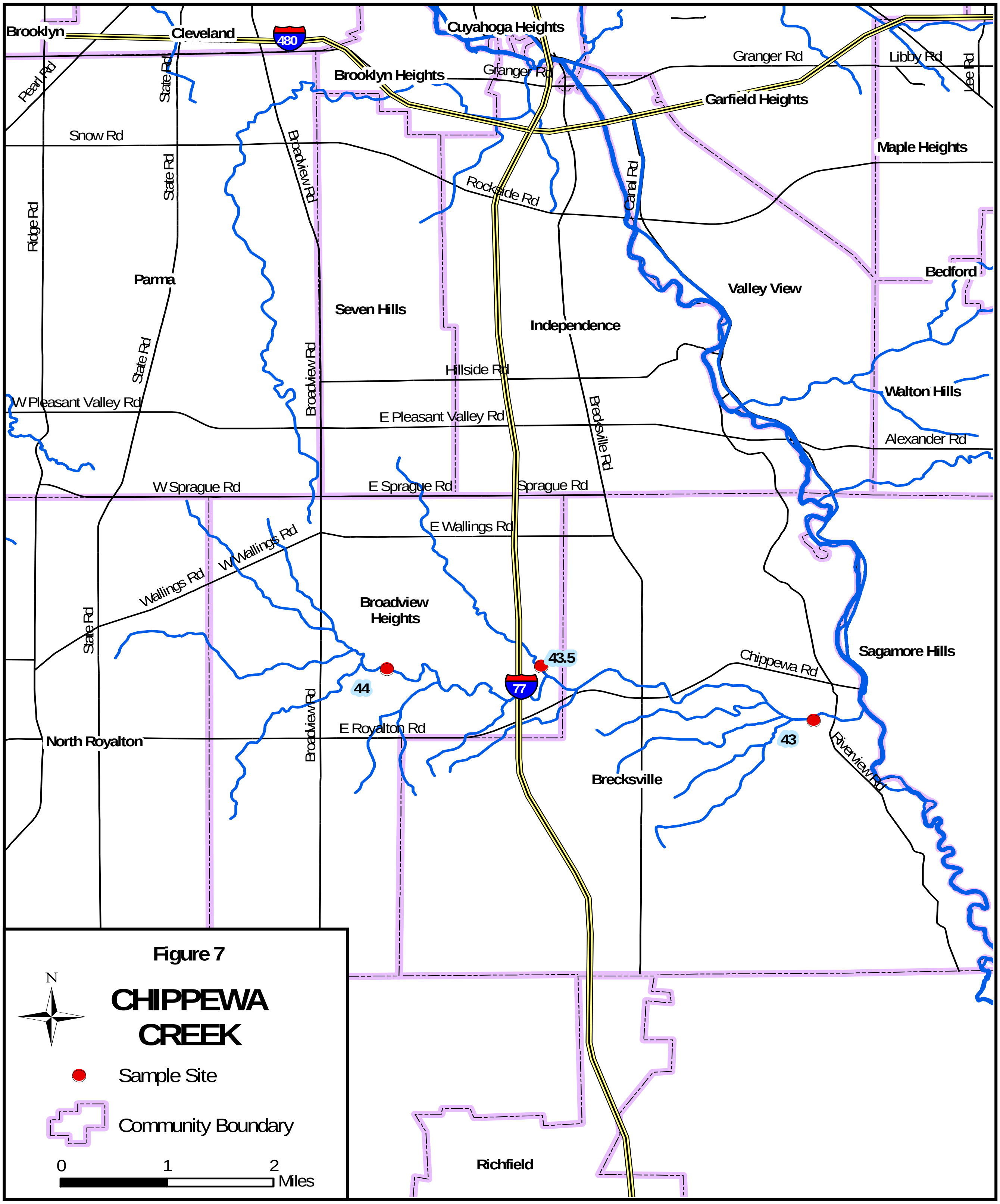
No environmental disruptions on Tinkers Creek were found by or reported to the NEORSD in 1999, 2000, 2001, or 2002.

CHIPPEWA CREEK

Chippewa Creek's drainage area includes the communities and parks in the southernmost part of Cuyahoga County west of the Cuyahoga River. From the creek's mouth upstream, these include: a portion of the Cuyahoga Valley National Park; the Cleveland Metroparks Brecksville Reservation; the City of Brecksville; the City of Broadview Heights; the southern tip of the City of Seven Hills; and the eastern portion of the City of North Royalton.

Chippewa Creek's drainage area is primarily residential and recreational. The Ohio EPA has designated Chippewa Creek Aquatic Life Warmwater Habitat, Agricultural Water Supply, Industrial Water Supply and Primary Contact Recreational Use. In addition, portions of Chippewa Creek within the boundaries of the Cleveland Metroparks have been designated State Resource Water. The NEORSD has selected three locations on Chippewa Creek that are routinely sampled for chemical, bacteriological, and benthic analysis (Figure 7). Chemical and bacteriological data from Chippewa Creek are presented in Appendix B.

Site #43 (41° 19.024' N, 81° 35.844' W) is located at a concrete ford on which Chippewa Creek Drive crosses the creek east of Valley Parkway. This location is approximately 3,000 feet upstream of the confluence with the Cuyahoga River at about River Mile 22.0 and represents the total flow of Chippewa Creek. In 2000, Site #43 obtained a QHEI score of 54.5 (Appendix D).


Brooklyn
Cleveland
480
Cuyahoga Heights
Brooklyn Heights
Granger Rd
Libby Rd
Lee Rd
Garfield Heights
Pearl Rd
State Rd
Snow Rd
Broadview Rd
Maple Heights
Rockside Rd
Canal Rd
Ridge Rd
Parma
Bedford
Valley View
Seven Hills
Independence
Hillside Rd
Walton Hills
W Pleasant Valley Rd
E Pleasant Valley Rd
Brecksville Rd
Alexander Rd
W Sprague Rd
E Sprague Rd
Sprague Rd
E Wallings Rd
W Wallings Rd
Wallings Rd
Broadview Heights
Sagamore Hills
Chippewa Rd
43.5
44
77
E Royalton Rd
North Royalton
43
Riverview Rd
Brecksville
Richfield
Figure 7
N
CHIPPEWA CREEK
Sample Site
Community Boundary
0
1
2
Miles

Site #43.5 (41° 19.411' N, 81° 38.671' W) is located on the Bramblewood Branch tributary to Chippewa Creek, just upstream of its confluence with the main stem of Chippewa Creek, east of Harris Road, north of Old Royalton Road. In 2000, Site #43.5 obtained a QHEI score of 47.5 (Appendix D).

Site #44 (41° 19.485' N, 81° 40.372' W) is located on the main stem of Chippewa Creek at the Avery Road bridge between Harris Road and East Royalton Road. It is downstream of the confluence of the Seneca Branch, the Royalwood Branch, and the Briarwood Branch. In 2000, Site #44 obtained a QHEI score of 57.25 (Appendix D).

Problems and Remediation

-1-

On March 8, 2001, NEORSD investigators found evidence of sanitary sewage entering a tributary to Chippewa Creek through a 4-inch outfall located behind 8873 Falls Lane. Bacteriological analysis of this discharge showed a fecal coliform density of 11,000 CFU per 100 mL. Following these findings, the City of Broadview Heights Service Department was notified.

SAGAMORE CREEK

Sagamore Creek enters the Cuyahoga River in Summit County, southwest of the intersection of Sagamore Road and Canal Road in the Cuyahoga Valley National Park. The creek originates in Macedonia and Sagamore Hills in Summit County as two intermittent runs flowing northwest and merging north of West Valley View Road. The combined intermittent run then flows in a mostly northwest direction, entering Cuyahoga County at Sagamore Road. While flowing toward Cuyahoga County, the creek adds five intermittent runs from the east and one intermittent run from the west.

In the area of the Summit County/Cuyahoga County boundary, the creek becomes a constant flow. North of the boundary, a sixth intermittent run enters from the east. Once in Walton Hills, Cuyahoga County, the creek turns and flows in a northwest direction until it reaches the intersection of Alexander Road and Dunham Road. At this intersection, the creek turns and flows generally southwest towards Canal Road. As the creek flows southwest, it takes on three intermittent runs from the south. At the intersection of Sagamore Road and Canal Road, the creek re-enters Summit County before it merges with the Cuyahoga River.

Sagamore Creek's drainage area is primarily low density residential with large undeveloped and recreational use areas. The Ohio EPA has no current use designation for Sagamore Creek.

Sagamore Creek has been assigned one sample location for routine chemical, bacteriological, and benthic sampling (Figure 8). Chemical and bacteriological data from Sagamore Creek are presented in Appendix B.

Site #57 (41° 21.074' N, 81° 35.548' W) is located upstream of Canal Road as it crosses the creek north of Sagamore Road. In 2001, Site #57 obtained a QHEI score of 62 (Appendix D).

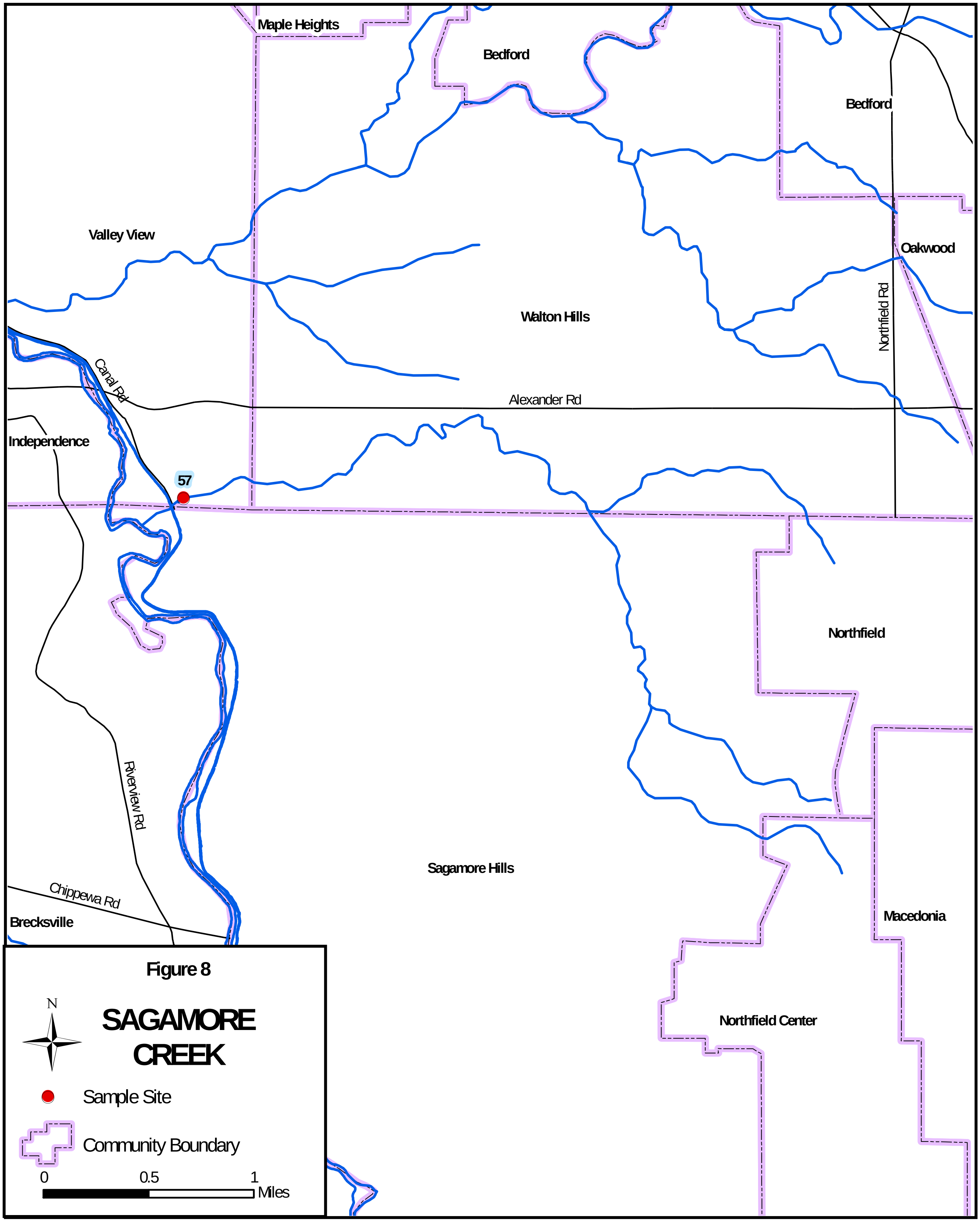


Figure 8

SAGAMORE CREEK

Problems and Remediation

No environmental disruptions on Sagamore Creek were found by or reported to the NEORSD in 1999, 2000, 2001, or 2002.

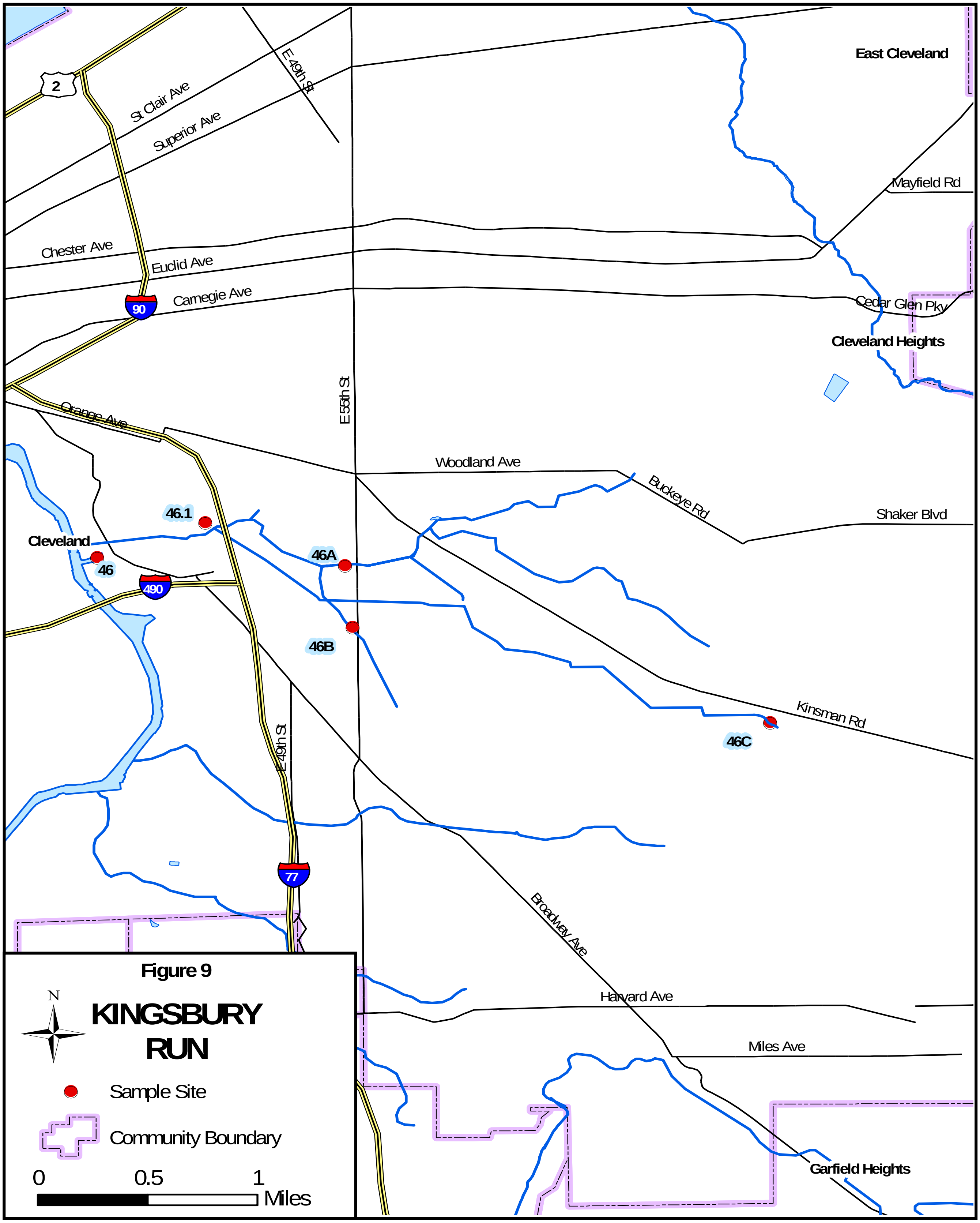
KINGSBURY RUN

Kingsbury Run drains the central portion of Cleveland east of the Cuyahoga River and a portion of the west end of Shaker Heights. It has a total drainage area of 7.8 square miles and a total length of 4.3 miles. Kingsbury Run flows predominantly east-to-west with two branches that merge east of East 37th Street, south of Woodland Avenue. The main stem begins at East 47th Street, south of Woodland Avenue, and eventually enters the Cuyahoga River at approximately River Mile 4.0, just north of the old Jefferson Avenue bridge, 2785 Broadway Avenue.

Kingsbury Run has the following open sections: a 1,000-foot section from the confluence with the Cuyahoga River to the mouth of the culvert; a 1,100-foot section between East 78th Street and Grand Avenue, 250 feet north of Colfax Road; and a 900-foot section between East 84th Street and East 87th Street, north of Kinsman Road. The remaining portion of Kingsbury Run is entirely underground and is a combination of culverted stream sections and storm sewers, serving as an overflow-receiving sewer for combined sewers during high flow conditions.

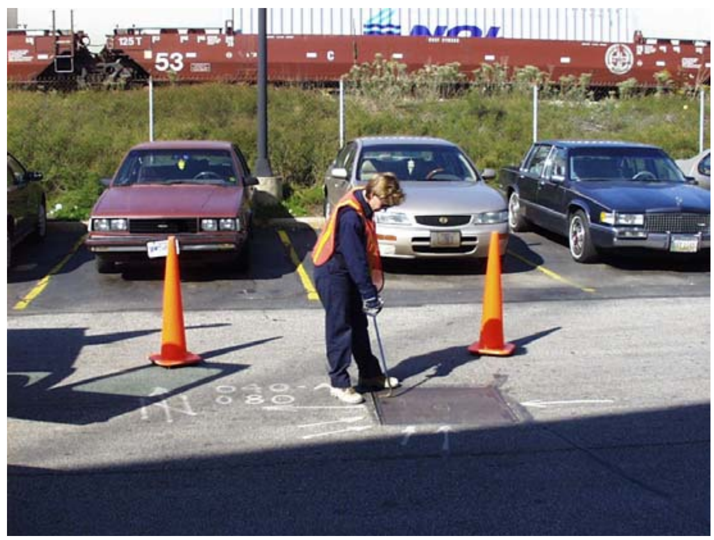
The Ohio EPA has no current use designation for Kingsbury Run. Kingsbury Run has been assigned five sample sites by the NEORSD Environmental Assessment group for routine chemical and bacteriological sampling (Figure 9). Because the sample sites are culverted, no QHEI's have been performed on Kingsbury Run. Chemical and bacteriological data from Kingsbury Run are presented in Appendix B.

Site #46 (41° 29.001' N, 81° 40.434' W) is located at the mouth of the culvert, approximately 1,000 feet upstream of the confluence with the Cuyahoga River and north of the old Jefferson Avenue bridge.


East Cleveland
Mayfield Rd
St Clair Ave
Superior Ave
E 49th St
Chester Ave
Euclid Ave
Carnegie Ave
Cedar Glen Pky
Cleveland Heights
Orange Ave
E 55th St
Woodland Ave
Buckeye Rd
Shaker Blvd
46.1
Cleveland
46A
46
46B
Kinsman Rd
46C
E 49th St
Broadway Ave
Harvard Ave
Miles Ave
Garfield Heights
2
90
490
77
Figure 9
N
KINGSBURY RUN
Sample Site
Community Boundary
0
0.5
1
Miles

Site #46.1 (41° 29.056' N, 81° 39.857' W) is located on the main stem of Kingsbury Run at a manhole on the culvert, in the center of East 37th Street, approximately 2,000 feet south of Woodland Avenue.

Site #46-A (41° 28.892' N, 81° 39.174' W) is located on Kingsbury Run's North Branch, at a rectangular manhole on the culvert adjacent to the RTA Power Control Administrative Offices, 5400 Grand Avenue, approximately 200 feet west of East 55th Street.



Site #46-B (41° 28.576' N, 81° 39.137' W) is located on a tributary to Kingsbury Run's North Branch. The sample site is located at a manhole on the culvert in the center of Sweeney Avenue, approximately 100 feet west of East 55th Street, near 5407 Sweeney Avenue.

Site #46-C (41° 28.245' N, 81° 37.015' W) is located on Kingsbury Run's South Branch, at a manhole in a grass field east of Kingsbury Boulevard and Carton Avenue, approximately 150 feet south of Kinsman Road. This site is approximately 30 feet downstream from the confluence of the 96-inch Kinsman/Union storm relief sewer and the Kingsbury Run culvert.

Problems and Remediation

-1-

On September 17, 1999, NEORSD investigators responded to a report of oil in Kingsbury Run near its confluence with the Cuyahoga River. Investigators installed a containment boom and absorbent booms across the creek to prevent further migration of oil to the Cuyahoga River. At that time, investigators were unable to identify the source of this oil contamination to the creek.

A follow-up inspection on September 20th revealed an oil sheen exiting the Kingsbury Run culvert. NEORSD investigators then began an extensive investigation of industrial facilities in proximity to the Kingsbury Run culvert that use large quantities of oil. On September 23rd, NEORSD contracted Pure Tech Systems, Inc. to remove the oil accumulated behind the containment boom at the culvert mouth.

On September 27th, NEORSD investigators began inspecting industrial facilities on Bessemer Avenue. While monitoring the sewers at 7225 Bessemer Avenue, investigators observed intermittent gray colored flows in the storm sewer. At that time, NEORSD investigators also happened to witness a sewer vacuum truck tank being drained and rinsed in the parking lot at AAA Pipe Cleaning Corp, 7277 Bessemer Avenue. Investigators further noted that the ground around this area was stained gray/black. Following these observations, investigators installed an automated sampler on the Bessemer Avenue storm sewer to monitor its flow.

On September 29th, NEORSD personnel met with special agents from U.S. EPA's Criminal Investigation Division to discuss the illicit discharge to the storm sewer and ultimately Kingsbury Run. During field inspections by these personnel on September 29th and 30th, the recurrence of the improper disposal of a AAA Pipe Cleaning Corporation's sewer vacuum truck's wastes onto the parking lot that drains to the storm sewer system tributary to Kingsbury Run was witnessed. These findings led to a criminal investigation in December conducted by the U.S. EPA's Criminal Investigation Division.

Despite these findings, NEORSD investigators continued to inspect and monitor the sewer system tributary to Kingsbury Run for the source of oil contamination. These efforts led investigators to the former Rockefeller Refinery No. 2 site, currently owned by BP Amoco, located at 5703 Hamlet Avenue. The oil was traced to a branch of the Kingsbury Run culvert that runs through this property. The Ohio EPA and U.S. EPA were notified of these findings on October 13, 1999.

On October 14, 1999, the EPA representatives met with NEORSD personnel to inspect the oil in the Kingsbury Run culvert near the Rockefeller Refinery No. 2 site and at its opening near the Cuyahoga River. Following the inspection, Ohio EPA notified BP Amoco of the situation and a meeting was held that day. As a result, BP Amoco assumed responsibility for the release of oil and provided for the clean up. Clean Harbors of Ohio was contracted to install containment booms at the Kingsbury Run culvert opening and to remove the oil from the culvert near East 65th Street, north of the property at 5703 Hamlet Avenue. An inspection of the monitoring wells at the Rockefeller Refinery No. 2 site on October 15, 1999, revealed numerous wells containing oil. The Ohio EPA then charged BP Amoco with developing a plan to eliminate the migration of oil from this property to Kingsbury Run. On October 29, 1999, BP Amoco submitted a conceptual plan for the Rockefeller Refinery No. 2 site.

-2-

On July 10, 2001, NEORSD personnel investigated a report of a dry weather discharge containing sanitary sewage entering the Kingsbury Run culvert at East 75th Street, just south of Holton Avenue. The source of the sewage was identified as an improper connection of the sanitary discharge to the storm sewer from OBO Demolition and Construction, 2824 East 75th Street. Following this discovery, the City of Cleveland Water Pollution Control was notified.

-3-

On August 28, 2001, NEORSD personnel investigated a report of a clear, dry weather discharge entering the Kingsbury Run culvert at 3075 East 80th Street. The discharge was traced to an apparent water main leak at 3052 East 80th Street. The flow was measured at an approximate rate of 10,000 gallons per day. The City of Cleveland Division of Water was notified of the situation on September 11, 2001.

-4-

In April 2001, an NEORSD-hired consultant identified an improper sanitary connection to the Kingsbury Run culvert on East 75th Street, between Dell Avenue and Grand Avenue. While inspecting various locations on the creek's culvert, a regulating structure with an overflow pipe connecting the combined sewer on East 75th Street to Kingsbury Run was discovered. Following these findings, the City of Cleveland Division of Water Pollution Control was notified on May 8, 2001.

MORGANA RUN

Morgana Run drains the central portion of the City of Cleveland east of the Cuyahoga River. It has a total drainage area of 2,280 acres and a total length of 4.8 miles. Morgana Run's culvert originates at East 97th Street between Sandusky Avenue and Way Avenue. It runs predominantly east-to-west to East 49th Street, where, in dry weather, its entire flow drops into the Southerly Interceptor and is tributary to the NEORSD Southerly WWTC. The remaining section of Morgana Run enters the Cuyahoga River on the LTV Steel Company's property, south of the former location of the Clark Avenue bridge, at approximately River Mile 4.9.

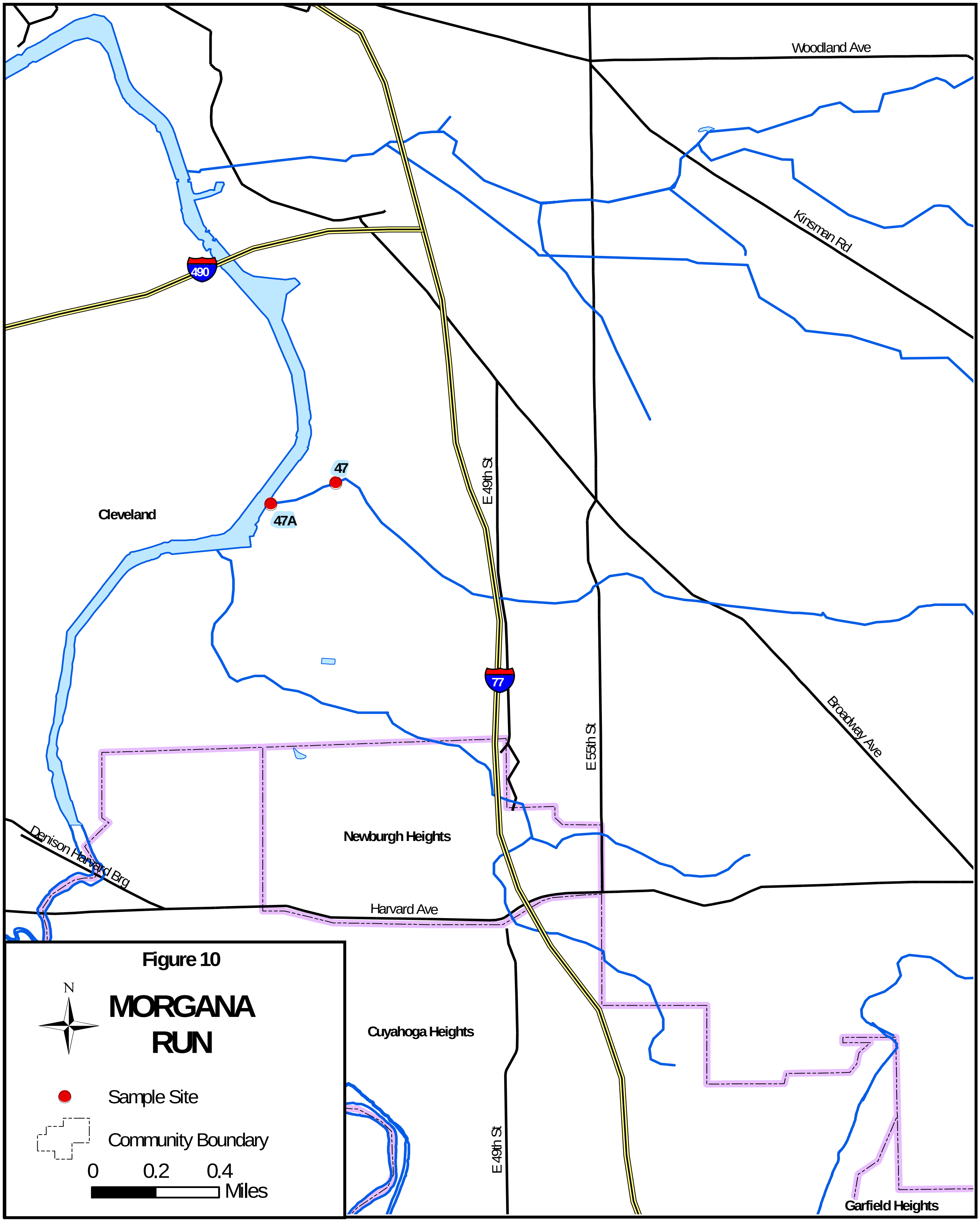
In about 1910, Morgana Run was culverted, and in some places, relocated to follow Morgana Avenue. In 1960 and 1961, the Morgana Run culvert from Interstate 77 to Independence Road was reinforced, allowing the Republic Steel Corporation to use the land above Morgana Run as a bulk storage facility for coal, coke, and ore.

In 1969, all of the dry weather flow in Morgana Run upstream of East 49th Street was diverted by a weir, through a 42-inch pipe, into the Southerly Interceptor. The weir is overflowed only in wet weather, when many combined sewer overflows are tributary to Morgana Run upstream.

Until December 1991, when the LTV Steel Company's coke plant was removed from service, its treated effluent and cooling waters were discharged to Morgana Run between the river and Independence Road at a rate of approximately 10,000 gallons per minute.

The Ohio EPA has no current use designation for Morgana Run. Morgana Run has been assigned two sampling locations for routine chemical and bacteriological analysis (Figure 10). Chemical and bacteriological data from Morgana Run are presented in Appendix B.

Site #47-A (41° 28.159' N, 81° 40.120' W) is located at the mouth of Morgana Run where it enters the Cuyahoga River, west of Independence Road on LTV Steel Company property. Since Site #47-A is at the mouth of the culvert, no QHEI has been determined at this site.


Woodland Ave
Kinsman Rd
490
47
47A
Cleveland
E 49th St
77
E 55th St
Broadway Ave
Newburgh Heights
Denison Harvard Brg
Harvard Ave
Cuyahoga Heights
E 49th St
Garfield Heights
Figure 10
N
MORGANA RUN
Sample Site
Community Boundary
0
0.2
0.4
Miles

Site #47 (41° 28.130' N, 81° 40.102' W) is located at a manhole on Independence Road, approximately 200 yards upstream of its confluence with the Cuyahoga River. Since Site #47 is culverted, no QHEI has been determined at this site.

Problems and Remediation

-1-

On January 22, 2001, NEORSD personnel investigated a report of sanitary sewage entering the Morgana Run culvert through a 48-inch storm water outlet (SWO) located on LTV Steel Company property, west of Interstate 77. This SWO is also located downstream of NEORSD-maintained CSO regulator S-01, on East 49th Street south of Dalton Avenue. Bacteriological analysis of this discharge to Morgana Run revealed a fecal coliform density of 35,000 CFU per 100 mL. An inspection of the overflow structure for regulator S-01 revealed that the weir had deteriorated, enabling sewage to enter the creek. Following these findings, emergency repair work to the weir was performed and completed by February 8, 2001, eliminating this source of sanitary sewage contamination to Morgana Run.

However, a subsequent inspection of the SWO on April 5, 2001, revealed that the dry weather flow continued. The fecal coliform density of the discharge was measured at approximately 440,000 CFU per 100 mL. Further inspection by investigators revealed that the dry weather discharge was occurring downstream of the overflow regulator. The source of the sewage was traced to the East 50th Street combined sewer, which was found directly connected to the SWO and Morgana Run. The City of Cleveland Division of Water Pollution Control and Ohio EPA were notified of the situation on May 7, 2001.

BURKE BROOK

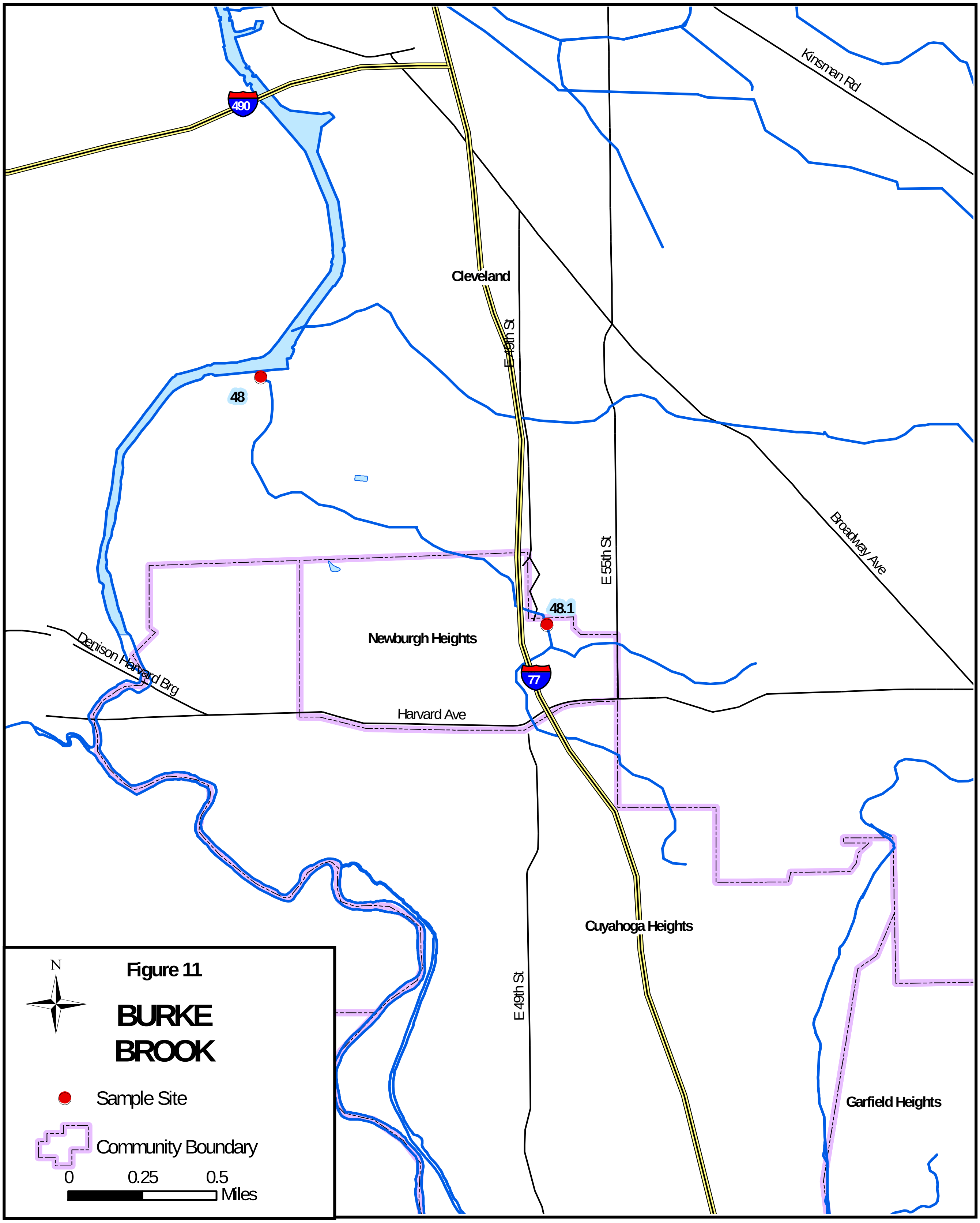
Burke Brook carries surface runoff water and combined sewer overflows from the southern part of Cleveland, east of the Cuyahoga River, and from sections of Cuyahoga Heights and Newburgh Heights. The total drainage area is 1,400 acres.

Tributary to Burke Brook are 13 combined sewer overflow (CSO) structures. These overflow structures receive flow from a drainage area of approximately 500 acres, which is over one third of the total drainage area of Burke Brook. Ten of these overflow structures are located on Burke Brook's main branch, east of Interstate 77. In July 1982, the NEORSD activated a diversion chamber east of Interstate 77, south of Fleet Avenue. This diversion chamber intercepts the entire dry weather flow of Burke Brook's main branch. From this chamber, the main branch's flow is diverted into the NEORSD Southerly Interceptor.

The south branch of Burke Brook originates as a 48-inch storm sewer on Grant Avenue in Cuyahoga Heights. It then flows through Newburgh Heights where it joins the former channel of the main branch downstream of the NEORSD's diversion chamber. From this point, Burke Brook flows under Interstate 77 and LTV Steel Company property northwest to its confluence with the Cuyahoga River at about River Mile 5.3.

Three combined sewer overflow structures are presently not tributary to the NEORSD's diversion chamber: one on Grant Avenue east of Interstate 77 in Cuyahoga Heights, and one on Harvard Avenue west of Interstate 77 in Newburgh Heights, both of which are maintained by the NEORSD; one in the Washington Park Horticultural Center, which the Village of Newburgh Heights is responsible for maintaining.

Except for 0.3 total miles of open section on both sides of Interstate 77 and about 100 yards of an open tributary near Bert Avenue, the entire length of Burke Brook is culverted. The Ohio EPA has no current use designation for the culverted sections of Burke Brook. The open section of the creek adjacent to Interstate 77 has been designated Limited Resource Water, Agricultural Water Supply, Industrial Water Supply and Secondary Contact Recreational Use. Burke Brook has been assigned two sampling locations for routine chemical and bacteriological analysis (Figure 11). Chemical and bacteriological data from Burke Brook are presented in Appendix B.



Kinsman Rd
490
Cleveland
E 49th St
48
E 55th St
Broadway Ave
48.1
Newburgh Heights
Denison Harvard Brg
77
Harvard Ave
Cuyahoga Heights
E 49th St
Garfield Heights
N
Figure 11
BURKE BROOK
Sample Site
Community Boundary
0
0.25
0.5
Miles

Site #48 (41° 27.898' N, 81° 40.281' W) is located at the mouth of Burke Brook where it enters the Cuyahoga River on LTV Steel Company property. No QHEI has been obtained for Site #48.

Site #48.1 (41° 27.154' N, 81° 39.401' W) is located off Independence Road, south of Fleet Avenue, on the open section of Burke Brook's main stem, just east of Interstate 77, downstream from the former confluence of the main and south branches. In 1997, Site #48.1 obtained a QHEI score of 45.5.

Problems and Remediation

No environmental disruptions to Burke Brook were found by or reported to the NEORSD in 1999, 2000, 2001, or 2002.

EUCLID CREEK

Euclid Creek's drainage area includes the communities of Cleveland, Euclid, Highland Heights, Richmond Heights, Willoughby Hills, Lyndhurst and South Euclid. The total drainage area is approximately 15,500 acres, and the creek has a length of 9.5 miles. With the exception of a culverted section under Interstate 90, the creek is predominantly open. The section between Lake Shore Boulevard and Nottingham Road has been channelized by the U.S. Army Corps of Engineers with concrete streambeds for flood control. A dam is located downstream of the St. Clair Avenue Bridge.

The Ohio EPA has designated Euclid Creek Aquatic Life Warmwater Habitat, Agricultural Water Supply, Industrial Water Supply and Primary Contact Recreational Use. In addition, portions of Euclid Creek within the boundaries of the Cleveland Metroparks have been designated State Resource Water. The NEORSD has selected five locations on Euclid Creek that are routinely sampled for chemical, bacteriological, and benthic analysis (Figure 12). Chemical and bacteriological data from Euclid Creek are presented in Appendix B.

Site #0.5 (41° 34.987' N, 81° 33.559' W) is located about 150 feet downstream of Lake Shore Boulevard. Site #0.5 was selected in 1990 to reflect the environmental impact on Euclid Creek from several upstream storm sewer outfalls, and this location is the furthest downstream sampling site prior to its discharge into Lake Erie. In 2002, Site #0.5 obtained a QHEI score of 53.5 (Appendix D).

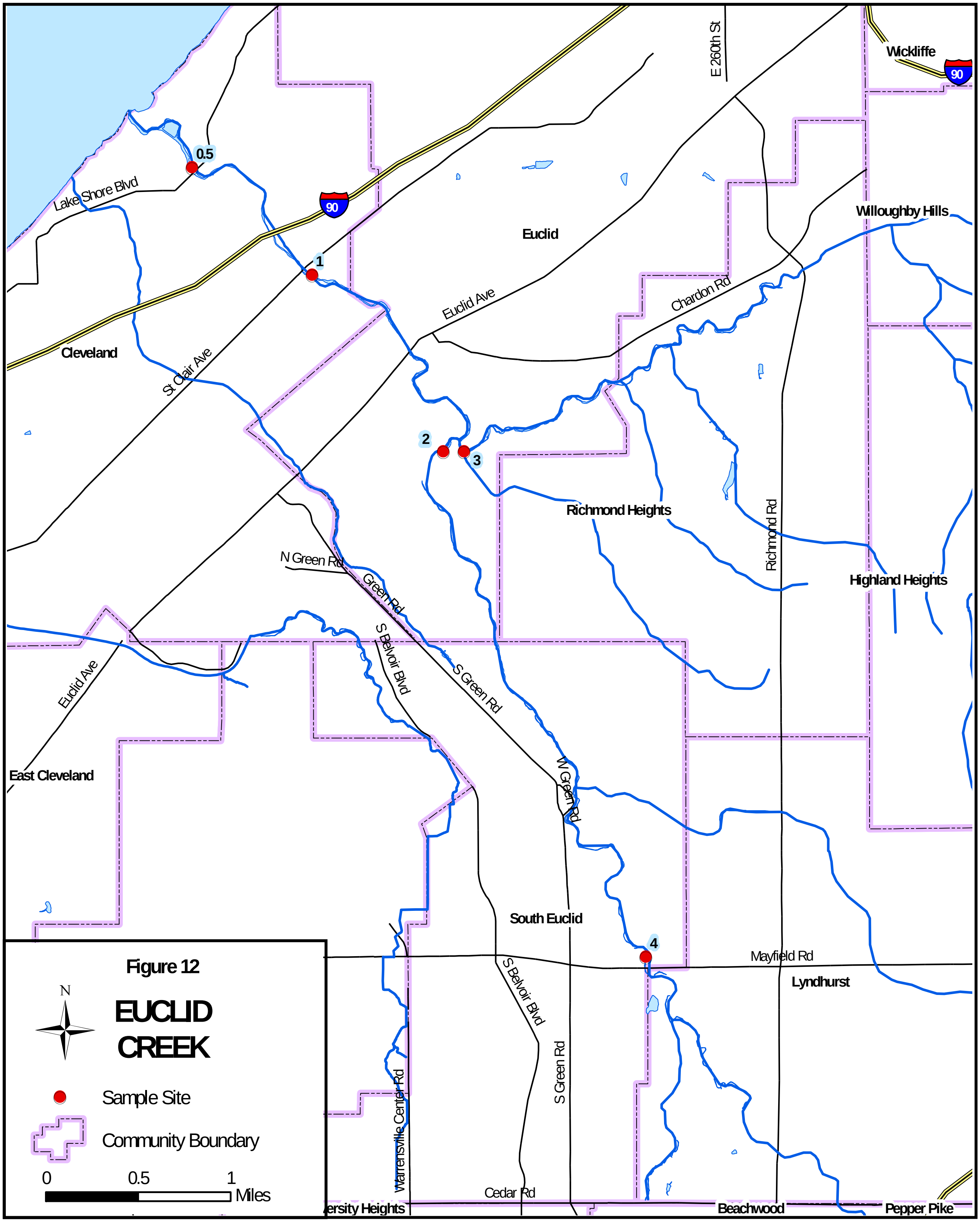


Figure 12
EUCLID CREEK
N
Sample Site
Community Boundary
0
0.5
1
Miles
0.5
1
2
3
4
90
Lake Shore Blvd
Euclid
Euclid Ave
Chardon Rd
E 260th St
Wickliffe
Willoughby Hills
Cleveland
St Clair Ave
Richmond Heights
Richmond Rd
Highland Heights
N Green Rd
Green Rd
S Belvoir Blvd
S Green Rd
W Green Rd
Euclid Ave
East Cleveland
South Euclid
Mayfield Rd
Lyndhurst
S Belvoir Blvd
S Green Rd
Warrensville Center Rd
Cedar Rd
Beachwood
Pepper Pike

Site #1 (41^{o} 34.498' N, 81^{o} 32.816' W) is located about 10 feet south of the St. Clair Avenue bridge. In 2000, Site #1 obtained a QHEI score of 68.75 (Appendix D).

Site #2 (41^{o} 33.671' N, 81^{o} 31.888' W) is located on the South Branch of Euclid Creek in the Highland Picnic Area of the Cleveland Metroparks Euclid Creek Reservation, about 100 feet upstream of its confluence with the North Branch. In 2000, Site #2 obtained a QHEI score of 53.75 (Appendix D).

Site #3 (41^{o} 33.613' N, 81^{o} 31.842' W) is located on the North Branch of Euclid Creek in the Highland Picnic Area of the Cleveland Metroparks Euclid Creek Reservation, about 100 feet upstream of the confluence with the South Branch. In 2000, Site #3 obtained a QHEI score of 44 (Appendix D).

Site #4 (41° 31.188' N, 81° 30.696' W) is located on the South Branch, adjacent to the South Euclid-Lyndhurst Public Library, 4645 Mayfield Road. In 2000, Site #4 obtained a QHEI score of 46.5 (Appendix D).

Problems and Remediation

-1-

On February 4, 1999, NEORSD investigators along with personnel from the Cleveland Fire Department, U.S. Coast Guard and Ohio EPA responded to a report of diesel fuel in Euclid Creek downstream of its triple barrel culvert opening at Villaview Drive. The Cleveland Fire Department had deployed booms at this location to contain the fuel. The creek upstream of the culvert was free of any fuel. Further inspection revealed that the fuel was entering the creek culvert via the 78-inch storm sewer outfall near 1201 East 185th Street. The fuel was further traced to the southbound curb lane of East 185th Street near Lakeland Freeway. An accumulation of fuel was observed along the street's curb, which drained to a nearby catch basin tributary to the storm sewer. It appeared that a truck had leaked diesel fuel onto the street earlier that day and was not reported. The U.S. Coast Guard contacted Inland Waters of Ohio to perform site remediation.

-2-

On February 9, 1999, NEORSD personnel investigated a report of a dry weather discharge of sanitary sewage entering Euclid Creek from a storm sewer outfall behind 17805 Brian Avenue. The source of the sewage was identified as an improper connection of a residential sanitary discharge to the storm sewer at 958 East 178th Street. Investigators noted that further dye testing of homes on East 178th Street could possibly reveal additional improper connections of residential sanitary discharges to the storm sewer system tributary to Euclid Creek. The City of Cleveland Water Pollution Control was notified of these findings on February 24, 1999.

-3-

On May 27, 1999, NEORSD investigators inspected a Euclid Creek tributary at its culvert opening located behind 1423 Dille Road. Bacteriological analysis of the creek revealed a fecal coliform density of 82,000 CFU per 100 mL. On June 2, 1999, investigators traced back sanitary sewage to the storm sewer on East 204th Street. The source of the sewage was identified as an improper connection of a residential sanitary discharge to the storm sewer at 1550 East 204th Street. Investigators noted that further dye testing of homes on East 204th Street could possibly reveal additional improper connections of residential sanitary discharges to the storm sewer system tributary to Euclid Creek. The City of Cleveland Water Pollution Control was notified of these findings on July 16, 1999.

-4-

On June 5, 1999, NEORSD investigators responded to a complaint of a brown substance entering Euclid Creek from a storm sewer outfall behind 18340 Marcella Road. The brown flow was traced to the storm sewer on Pawnee Avenue. Investigators found that a water main on Pawnee Avenue had ruptured earlier that day, resulting in a large volume of muddy water entering several catch basins and the storm sewer tributary to Euclid Creek. At the time of the investigation, the City of Cleveland Water Department was on location to repair the water main.

-5-

On June 23, 1999, NEORSD personnel investigated another report of sanitary sewage contamination to Euclid Creek from a storm sewer outfall west of 17501 Lakeport Road. The source of the sewage was identified as an improper connection of a residential sanitary discharge to the storm sewer at 17516 Lakeport Road. Investigators noted that additional residential sanitary discharges may have been improperly connected to the storm sewer in this area but were not identified during this investigation. The City of Cleveland Water Pollution Control was notified of these findings on August 4, 1999.

-6-

A problem, which was discussed in the NEORSD Greater Cleveland Area Environmental Water Quality Assessment 1996-1998 Report, was eliminated in 2000. In September 1998, investigators discovered a water leak at a fire hydrant located at 956 East Green Road. Flow measurements estimated the volume of potable water entering Euclid Creek from this source at 115,000 gallons per day. The City of Cleveland Division of Water was notified, and a follow-up inspection by NEORSD investigators on March 20, 2000, revealed that the necessary repairs were made to eliminate this discharge to Euclid Creek.

-7-

On May 1, 2001, NEORSD investigators discovered sanitary sewage entering Euclid Creek from a 36-inch storm sewer outfall near 1055 Anderson Road. On May 11th, investigators traced the sewage to a blocked sanitary sewer at 1014 West Green Road. The blockage caused the sanitary sewer to become surcharged, resulting in leakage of sewage into the storm sewer. Following these findings, the problem was reported to the City of South Euclid Service Department. A follow-up inspection on May 17, 2001, verified that the blockage had been removed, thereby eliminating this source of contamination to Euclid Creek.

However, the follow-up inspection of the 36-inch storm sewer outfall revealed a clear dry weather discharge entering the creek. The source of the flow was identified as a probable water main leak entering the storm sewer at 4441 Anderson Road. Flow measurements estimated the volume of potable water entering Euclid Creek at approximately 12,000 gallons per day and the residual chlorine concentration was measured at 0.4 mg/L. The City of Cleveland Division of Water was notified of the leak. A follow-up inspection by NEORSD investigators on July 13, 2001, verified that the water main had been repaired, eliminating this discharge to Euclid Creek.

-8-

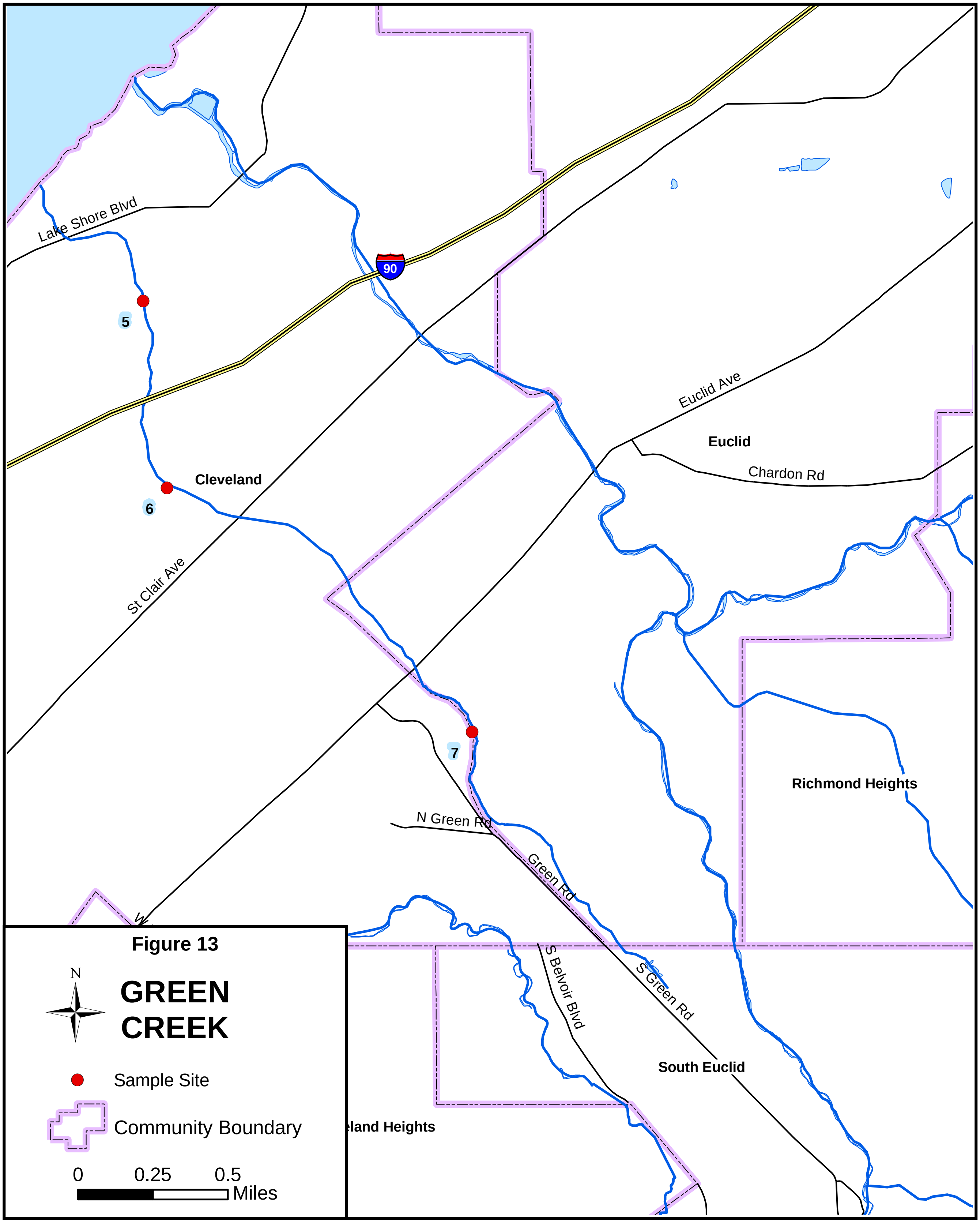
On December 4, 2001, NEORSD investigators responded to a report by the Cleveland Fire Department of oil entering Euclid Creek at St. Clair Avenue and Dille Road. An inspection of the area identified oil in the creek around a 36-inch storm sewer outfall under St. Clair Avenue. The U.S. Coast Guard placed containment booms at the storm sewer outfall to prevent migration of the oil downstream. Working in conjunction with the Cleveland Fire Department, U.S. Coast Guard, and the Ohio EPA, NEORSD investigators traced the oil to the vicinity of Neff Road and St. Clair Avenue. These personnel conducted inspections at industrial facilities in the area, but were unable to identify the source of the oil. The U.S. Coast Guard contacted Inland Waters of Ohio to perform site remediation.

GREEN CREEK

Green Creek drains a small portion of Cleveland and South Euclid. The drainage area, mostly residential and industrial, is approximately 660 acres, and the stream is 6.1 miles in length. Green Creek is culverted for 2.3 miles from Euclid Avenue to Lake Erie. The Ohio EPA has no current or proposed use designation for Green Creek. Green Creek has been assigned three sample sites by NEORSD Environmental Assessment for routine chemical, bacteriological and biological sampling (Figure 13). Chemical and bacteriological data from Green Creek are presented in Appendix B.

Site #5 (41° 34.420' N, 81° 33.800' W) is located at a manhole on the culvert at Arcade Avenue, west of East 167th Street. The culvert at Site #5 is 8 feet wide by 4 feet high. Since Site #5 is culverted, no QHEI has been determined.

Site #6 (41° 34.003' N, 81° 33.831' W) is located at a small opening on the culvert, northeast of East 170th Street and Saranac Road. This open section of the creek is 10 feet long by 8 feet wide. No QHEI has been determined at Site #6 since this location lacks habitat characteristics required for a QHEI. Specifically, Site #6 lacks the appropriate length (200-500 m) for determining a QHEI.


Lake Shore Blvd
90
5
Cleveland
6
St Clair Ave
Euclid Ave
Euclid
Chardon Rd
7
N Green Rd
Green Rd
S Belvoir Blvd
S Green Rd
South Euclid
Richmond Heights
land Heights
Figure 13
N
GREEN
CREEK
Sample Site
Community Boundary
0
0.25
0.5
Miles

Site #7 (41° 33.492' N, 81° 32.861' W) is located south of Euclid Avenue on Upper Valley Drive. Samples and measurements are obtained at the downstream end of the open creek before it enters the culvert. A metal grate, which functions as a debris screen, crosses the creek just upstream of the sample site. In 2002, Site #7 obtained a QHEI score of 44.5 (Appendix D).

Problems and Remediation

-1-

A problem in Cleveland, which had been discussed in the NEORSD Greater Cleveland Area Environmental Water Quality Assessment 1993-1995 Report, was eliminated in 2001. In September 1995, investigators found that sanitary discharges from two retail stores at the Greenlite Shopping Center (18235 Euclid Avenue) were improperly connected to the Euclid Avenue storm sewer. This storm sewer on Euclid Avenue is tributary to the Green Creek culvert at 18324 Euclid Avenue. The City of Cleveland Water Pollution Control was notified of the situation and, on October 29, 1996, required that Greenlite Shopping Center reconnect its sanitary discharges to the sanitary sewer. Inspections by investigators from October 1997 to May 2000 revealed that the discharges remained improperly connected to the storm sewer. Finally, on March 16, 2001, the City of Cleveland notified NEORSD that the sanitary discharges from the Greenlite Sopping Center had been rerouted to the sanitary sewer, thereby eliminating this source of pollution in Green Creek.

NINE-MILE CREEK

Nine-Mile Creek's drainage area includes the communities of South Euclid, University Heights, Cleveland Heights, East Cleveland, Cleveland, and Bratenahl. The total drainage area is approximately 5,000 acres. Nine-Mile Creek is culverted from near its mouth at Lake Shore Boulevard to east of Belvoir Road at the border between the cities of Cleveland and Cleveland Heights. Upstream of this location, the creek is open, and the "Nela Park" Branch, which enters the culverted main stem of Nine-Mile Creek south of Belvoir Boulevard, east of Hillside Avenue in East Cleveland, is also open.

The Ohio EPA has designated Nine-Mile Creek Aquatic Life Warmwater Habitat, Agricultural Water Supply, Industrial Water Supply and Primary Contact Recreational Use. The NEORSD has selected four locations on Nine-Mile Creek that are routinely sampled for chemical, bacteriological, and benthic analysis (Figure 14). Chemical and bacteriological data from Nine-Mile Creek are presented in Appendix B.

Site #8a (41° 33.489' N, 81° 36.014' W) is located approximately 500 yards upstream of Nine-Mile Creek's confluence with Lake Erie. Samples are obtained about 50 feet north of the Lake Shore Boulevard bridge. In 2002, Site #8a obtained a QHEI score of 55.75 (Appendix D).

Site #8b (41° 32.827' N, 81° 34.134' W) is located on the culverted section of the main stem of Nine-Mile Creek. This site is located at a manhole west of Ivanhoe Road and approximately 20 feet north of the railroad tracks which run perpendicular to Ivanhoe Road. Since Site #8b is culverted, no QHEI has been obtained.

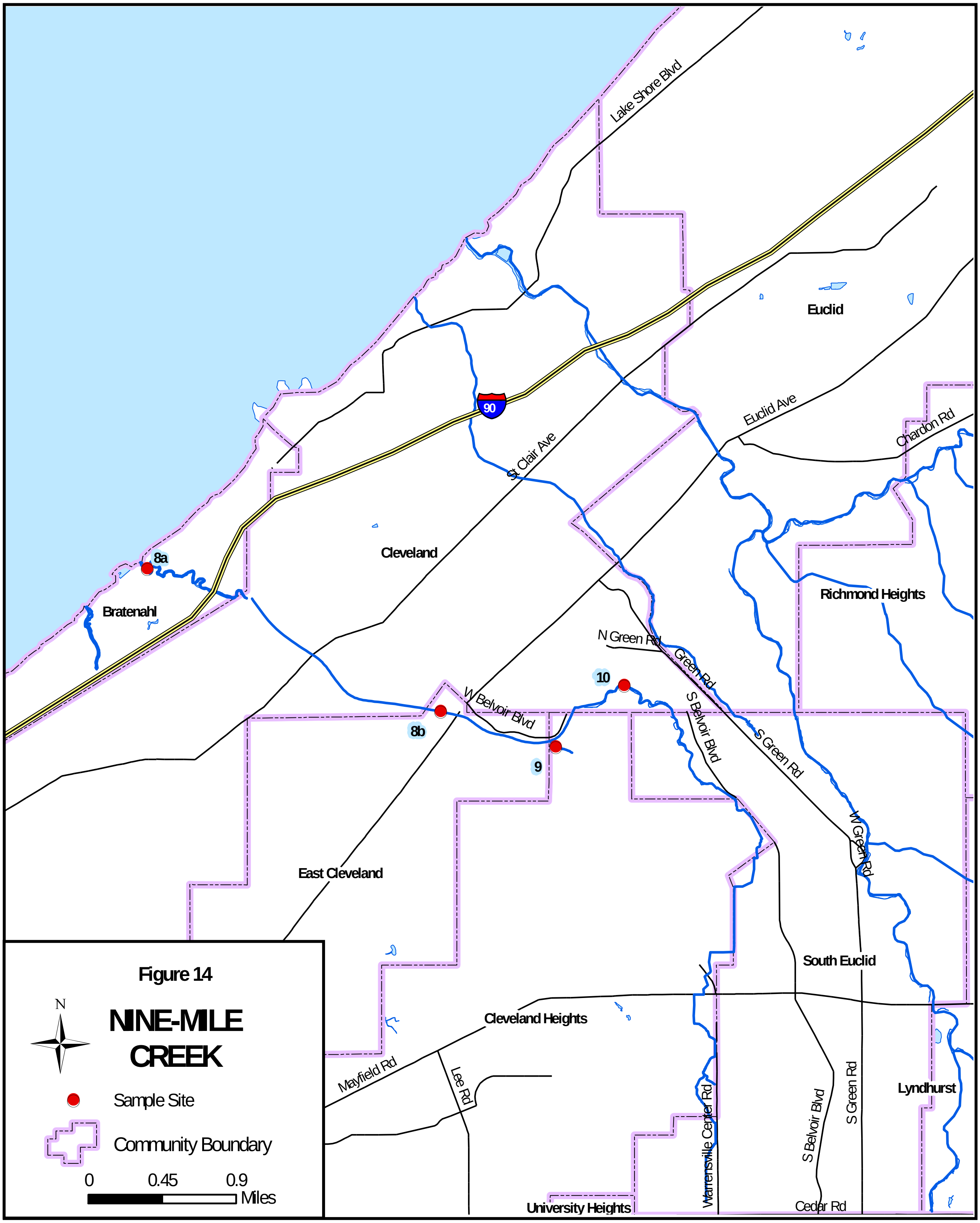


Figure 14
N
NINE-MILE CREEK
Sample Site
Community Boundary
0
0.45
0.9
Miles
Lake Shore Blvd
Euclid
Euclid Ave
Chardon Rd
90
St Clair Ave
Cleveland
8a
Bratenahl
Richmond Heights
N Green Rd
Green Rd
10
W Belvoir Blvd
S Belvoir Blvd
S Green Rd
8b
9
W Green Rd
East Cleveland
South Euclid
Cleveland Heights
Mayfield Rd
Lee Rd
Warrensville Center Rd
S Belvoir Blvd
S Green Rd
Lyndhurst
University Heights
Cedar Rd

Site #9 (41° 32.554' N, 81° 33.332' W) on the Nine-Mile Creek "Nela Park" Branch is located one-quarter mile southeast of Euclid Avenue on the southwest side of Belvoir Boulevard. Samples are obtained just upstream of this branch's entry into the Nine-Mile Creek culvert. In 2002, Site #9 obtained a QHEI score of 43.75 (Appendix D).

Site #10 (41° 32.769' N, 81° 33.196' W) is located on the main stem of Nine-Mile Creek, 10 feet upstream of its entry into the Nine-Mile Creek culvert. It is on the south side of Belvoir Boulevard about one-half mile east of Euclid Avenue. In 2002, Site #10 obtained a QHEI score of 42.75 (Appendix D).

Problems and Remediation

-1-

On January 21, 1999, NEORSD personnel investigated a report of a dry weather discharge of sanitary sewage entering Nine-Mile Creek from a storm sewer outfall near 628 Quilliams Road. Investigators traced the sewage to a sanitary sewer overflow (SSO) structure on Quilliams Road at Princeton Road. Investigators found sewage flowing from the sanitary sewer into the storm sewer through an SSO at this location. Investigators also found sewage leaking into the storm sewer through structural cracks in the sanitary sewer at 571 Quilliams Road.

On January 29, 1999, NEORSD investigators met with City of South Euclid officials to inspect these problems on Quilliams Road. A follow-up inspection by investigators on February 1, 1999, revealed that emergency repair work to this sanitary sewer had been completed, eliminating these sources of pollution in Nine-Mile Creek.

-2-

On May 17, 1999, NEORSD investigators responded to a report of sanitary sewage entering the Nine-Mile Creek culvert through a 24-inch storm sewer outfall at 16351 Euclid Avenue. Bacteriological analysis of the discharge revealed a fecal coliform density of 33,500 CFU per 100 mL. On June 1, 1999, the sewage was traced back to a blocked sanitary sewer between 1845 and 1869 Allendale Avenue. The blockage caused the sanitary sewer to become surcharged, resulting in leakage of the sewage into the storm sewer. Following this discovery, the problem was reported to the City of East Cleveland Service Department. However, follow-up inspections by investigators on June 10th and 17th, revealed that the sanitary sewage influent to Nine-Mile Creek continued as a result of the blocked Allendale Avenue sanitary sewer. The City of East Cleveland Service Department was again notified on July 21, 1999.

-3-

On July 9, 1999, NEORSD personnel investigated a report of a dry weather discharge of sanitary sewage entering the Nine-Mile Creek culvert from a storm sewer outfall on Belvoir Boulevard in the City of Cleveland Heights. The problem, however, was traced back to an area of Belvoir Boulevard within the City of Cleveland. The source of sewage was identified as an improper connection of a residential sanitary discharge to the storm sewer on Belvoir Boulevard. Investigators further noted that additional residential sanitary discharges may have been improperly connected to the storm sewer in this area, but were not identified during this investigation. These findings were reported to the City of Cleveland Division of Water Pollution Control on August 16, 1999.

-4-

On August 4, 1999, NEORSD investigators discovered a dry weather discharge of sanitary sewage entering Nine-Mile Creek through CSO outfall 212, off Belvoir Boulevard across from Quilliams Road. The source of the sewage was traced to a blocked overflow regulator structure at 2301 Greenvale Drive, east of Cliffview Road. Following these findings, NEORSD Sewer Maintenance and Control crews were notified and the blockage was cleared. A follow-up inspection by investigators on August 6, 1999, verified the elimination of this source of sanitary sewage contamination to Nine-Mile Creek.

DUGWAY BROOK

Dugway Brook's drainage area includes the communities of Cleveland, East Cleveland, Cleveland Heights, University Heights, and Bratenahl. The brook has two main branches, East and West, and has a total length of 7.9 miles and total drainage area of 9.4 square miles. Most of Dugway Brook is culverted, with the following exceptions which are open: near the mouth, north of Lake Shore Boulevard; on a tributary to the West Branch, between Derbyshire Road and Washington Boulevard in Cleveland Heights; on the West Branch, through Lakeview Cemetery, between Mayfield Road and Euclid Avenue; on a tributary to the East Branch downstream of the small lake located northwest of the intersection of Lee and Forest Hills Boulevards in Forest Hills Park in East Cleveland; on the East Branch through Cumberland Park, between Euclid Heights Boulevard and Hampshire Road, in Cleveland Heights.

The Ohio EPA has no current or proposed use designation for Dugway Brook. The NEORSD has selected four locations on Dugway Brook that are routinely sampled for chemical, bacteriological, and benthic analysis (Figure 15). Chemical and bacteriological data from Dugway Brook are presented in Appendix B.

Site #12 (41^{o} 32.984' N, 81^{o} 36.529' W) is located near the mouth of Dugway Brook, just north of Lake Shore Boulevard. In 1997, Site #12 obtained a QHEI score of 54.

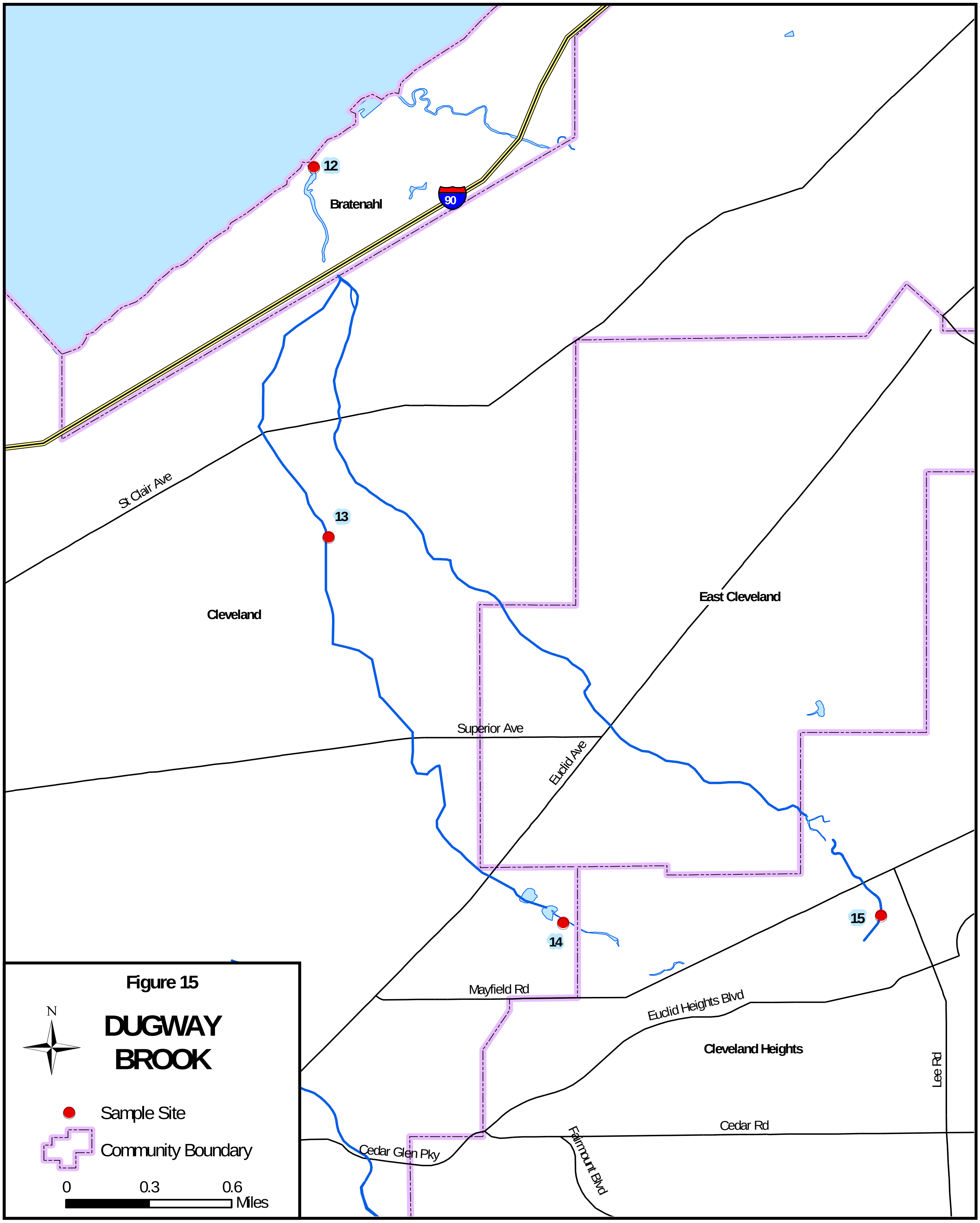


Figure 15
DUGWAY BROOK

Site #13 (41° 31.689' N, 81° 36.480' W) is located on Dugway Brook's West Branch at Primrose Avenue. The stream is culverted at this point and must be entered through the storm sewer outlet from the overflow regulator at Primrose Avenue and East 111th Street. Since Site #13 is culverted, no QHEI has been determined.

Site #14 (41° 30.732' N, 81° 35.430' W) is located on Dugway Brook's West Branch downstream of the NEORSD flood control dam at Lakeview Cemetery. In 1997, Site #14 obtained a QHEI score of 45.

Site #15 (41° 30.735' N, 81° 34.250' W) is located on the East Branch of Dugway Brook at Cumberland Park in Cleveland Heights, south of Mayfield Road. In 1997, Site #15 obtained a QHEI score of 50.

Problems and Remediation

-1-

On April 27, 1999, NEORSD investigators discovered sanitary sewage entering the West Branch of Dugway Brook through an 18-inch storm sewer outfall located upstream of the NEORSD flood control dam at Lakeview Cemetery. The discharge was measured at a flow rate of approximately 950 gallons per day and had a fecal coliform density of 37,000 CFU per 100 mL. The source of the sewage was identified as an improper connection of a residential sanitary discharge to the storm sewer on Mayfield Road. Investigators noted that additional residential sanitary discharges may have been improperly connected to the storm sewer in this area but were not identified during this investigation. The City of Cleveland Heights was notified of this situation on May 10, 1999.

-2-

On May 17, 1999, NEORSD investigators responded to a complaint of sanitary sewage in the East Branch of Dugway Brook behind 3590 Cummings Road. The source of sewage was traced to a blocked sanitary sewer on Edgerton Road at Bushnell Road. The blockage caused the sanitary sewer to become surcharged, resulting in sewage infiltrating into the storm sewer system. Following this discovery, the City of University Heights Service Department was notified. A subsequent inspection by NEORSD investigators on June 4, 1999, verified that the blockage had been removed, eliminating this source of pollution in Dugway Brook.

-3-

On October 28, 1999, NEORSD investigators responded to a report of sanitary sewage in Dugway Brook at its culvert opening, north of Lake Shore Boulevard. Investigators traced back the sanitary sewage contamination to the East Branch of Dugway Brook. Further investigations revealed that sewage was entering the Dugway Brook culvert as the result of a blocked sanitary sewer on Euclid Avenue, just east of Superior Avenue. The City of East Cleveland Service Department was notified of the problem on December 9, 1999.

A follow-up inspection by NEORSD investigators on January 19, 2000 revealed that, despite the removal of the blockage from the sanitary sewer, sewage continued to be discharged to the Dugway Brook culvert at this location. Further inspections by NEORSD investigators revealed potential structural problems with the Euclid Avenue sanitary sewer that runs under the Dugway Brook culvert. However, investigators were unable to identify the exact source of the sanitary sewage contamination to the creek. Following these findings, NEORSD personnel informed the City of East Cleveland of the situation. The City of East Cleveland then notified NEORSD of proposed corrective measures to be taken to address this issue including the construction of a flume on the Euclid Avenue sanitary sewer that runs under the Dugway Brook culvert. Construction was proposed to begin in the spring or summer of 2001.

-4-

While conducting routine sampling of Dugway Brook on September 26, 2002, NEORSD investigators observed evidence of sanitary sewage at Site #15. Bacteriological analysis of the creek at this location revealed a fecal coliform density of 97,000 CFU per 100 mL. The source of sewage was traced to a blocked sanitary sewer on Lee Road at Redwood Road, resulting in the leakage of sewage into the storm sewer system. The discharge of sewage entering the storm sewer was measured at a flow rate of approximately 114,000 gallons per day. The City of Cleveland Heights was notified of this situation and a subsequent inspection by investigators on October 1, 2002, verified no further contamination to Dugway Brook from this source.

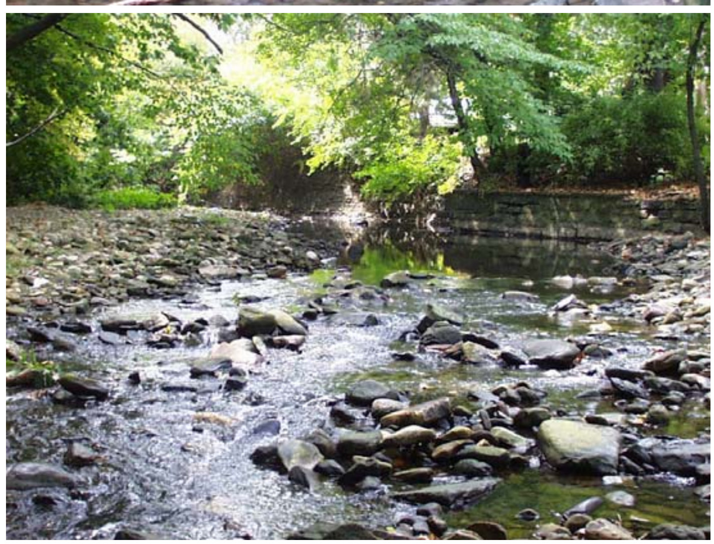
DOAN BROOK

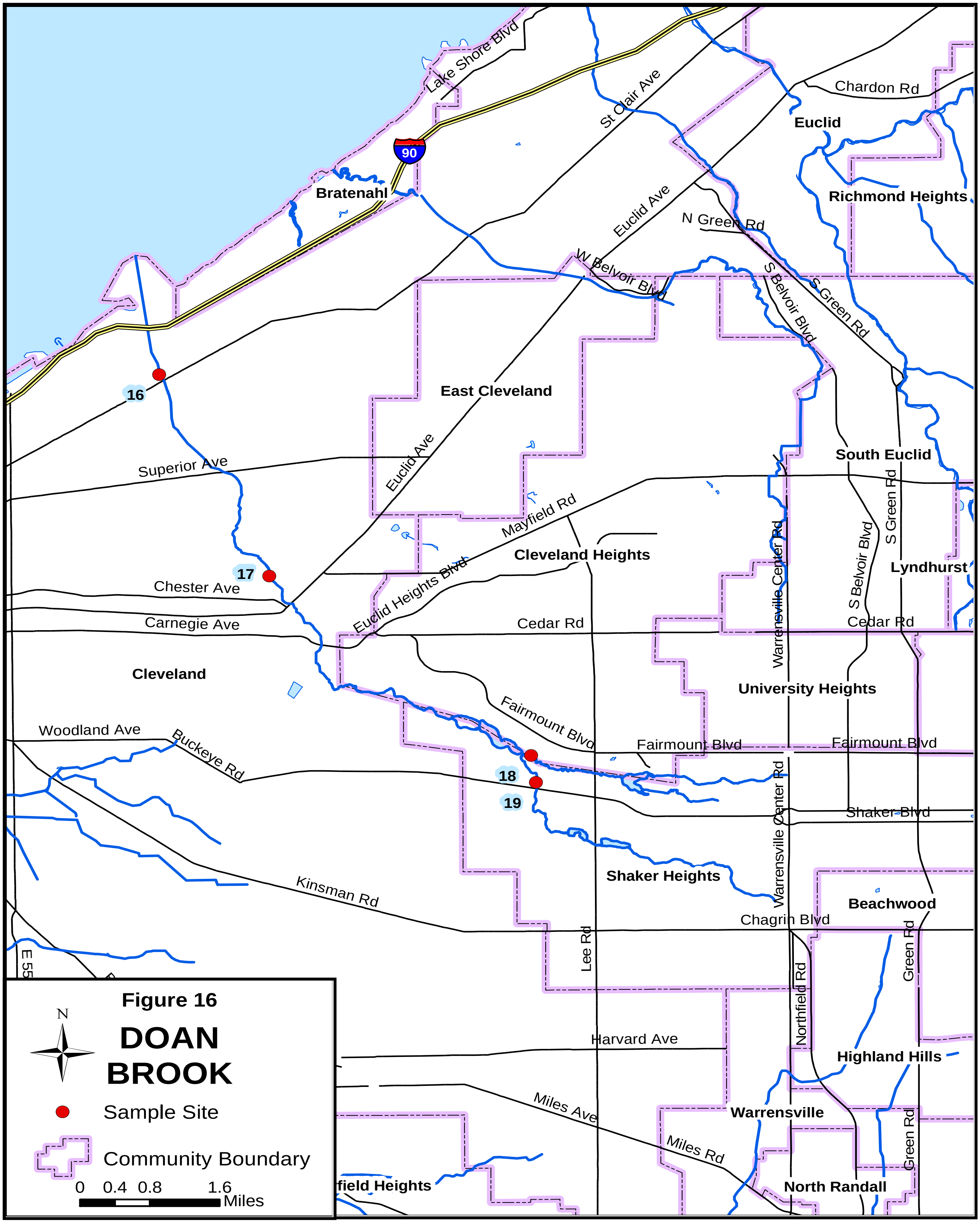
Doan Brook's drainage area includes the communities of Cleveland, Cleveland Heights, and Shaker Heights. Doan Brook has a total length of 8.1 miles and a drainage area of 11.7 square miles. Approximately 1.3 miles of the brook is culverted. The brook flows through Shaker Lakes Park, Ambler Park, University Circle, and Rockefeller Park into Lake Erie near Gordon Park.

The Ohio EPA has designated Doan Brook Aquatic Life Warmwater Habitat, Agricultural Water Supply, Industrial Water Supply and Primary Contact Recreational Use. Sections of Doan Brook within the boundaries of the Shaker Lakes Regional Nature Center have also been designated State Resource Water. The NEORSD has selected four locations on Doan Brook that are routinely sampled for chemical, bacteriological, and benthic analysis (Figure 16). Chemical and bacteriological data from Doan Brook are presented in Appendix B.

Site #16 (41^{o} 32.261' N, 81^{o} 37.807' W) is located on Doan Brook, north of St. Clair Avenue, east of Martin Luther King, Jr. Drive. In 2002, Site #16 obtained a QHEI score of 45.5 (Appendix D).

Site #17 (41^{o} 30.494' N, 81^{o} 36.791' W) is located on Doan Brook, north of the Cleveland Museum of Art, 11150 East Boulevard. In 1998, Site #17 obtained a QHEI score of 70.25.




Lake Shore Blvd
St Clair Ave
Chardon Rd
Euclid
90
Bratenahl
Richmond Heights
Euclid Ave
N Green Rd
W Belvoir Blvd
S Belvoir Blvd
S Green Rd
East Cleveland
16
Superior Ave
Euclid Ave
South Euclid
Mayfield Rd
S Green Rd
Cleveland Heights
S Belvoir Blvd
Lyndhurst
17
Chester Ave
Euclid Heights Blvd
Warrensville Center Rd
Carnegie Ave
Cedar Rd
Cedar Rd
Cleveland
University Heights
Fairmount Blvd
Fairmount Blvd
Fairmount Blvd
Woodland Ave
Buckeye Rd
18
19
Shaker Blvd
Warrensville Center Rd
Shaker Heights
Kinsman Rd
Beachwood
Chagrin Blvd
Lee Rd
Green Rd
E 55
Northfield Rd
Harvard Ave
Highland Hills
Miles Ave
Warrensville
Miles Rd
Green Rd
field Heights
North Randall
Figure 16
N
DOAN BROOK
Sample Site
Community Boundary
0 0.4 0.8 1.6
Miles

Site #18 (41^{o} 29.055' N, 81^{o} 34.443' W) is located on the North Branch of Doan Brook, northeast of the Shaker Lakes Regional Nature Center Office, 2600 South Park Boulevard. In 1997, Site #18 obtained a QHEI score of 68.25.

Site #19 (41^{o} 29.177' N, 81^{o} 34.485' W) is located on the South Branch of Doan Brook, southeast of the Shaker Lakes Regional Nature Center Office. In 1997, Site #19 obtained a QHEI score of 75.

Problems and Remediation

-1-

On June 14, 1999, NEORSD personnel investigated a report of a dry weather overflow of sewage entering Doan Brook via CSO outfall 225, located east of Kemper Road and Fairhill Road. The source of the sewage was traced to a blockage in a sanitary sewer on Kemper Road at Fairhill Road. As a result of the blockage, sanitary sewage was overflowing into a storm sewer that discharges to Doan Brook via CSO outfall 225. Following these findings, the City of Shaker Heights Service Department was apprised of the situation. A follow-up inspection on June 15, 1999, revealed that the blockage had been removed.

-2-

On April 30, 2001, NEORSD investigators responded to a complaint of a red color in Doan Brook, north of Euclid Avenue. Despite inspections at numerous locations along Doan Brook, no unusual conditions were observed. Investigators were unable to determine the source of the discolored flow.

-3-

On January 16, 2002, NEORSD investigators responded to a report of a blue color in Doan Brook near The Cleveland Museum of Art. The blue colored substance was traced to a 30-inch storm sewer outfall located just upstream of Jeptha Drive. The source of the discharge was traced to The Cleveland Museum of Art. A dye test performed by investigators showed that the discharge from a laundry room was improperly connected to the storm sewer. Museum personnel were notified of this problem on January 25, 2002. The Cleveland Museum of Art then notified NEORSD on February 21, 2002, that the discharge from the laundry room had been rerouted to the sanitary sewer. A follow-up inspection by investigators on May 6, 2002, revealed that this source of contamination to Doan Brook had been eliminated.

ROCKY RIVER

The Rocky River has two branches, East and West, the confluence of which is at Cedar Point Road in North Olmsted. The main stem of the Rocky River flows north from the confluence approximately ten miles through the communities of North Olmsted, Brook Park, Fairview Park, Cleveland, Rocky River, and Lakewood, where the river enters Lake Erie.

The East Branch of the Rocky River enters Cuyahoga County from Medina County and flows northwest through the communities of North Royalton, Strongsville, Middleburg Heights, Berea, and Olmsted Township to its confluence with the West Branch in North Olmsted. The West Branch of the Rocky River enters Cuyahoga County from Lorain County and flows north through the communities of Olmsted Falls and North Olmsted to the confluence.

Wastewater Treatment Plants that discharge effluents to the Rocky River include: Strongsville “B” and “C” WWTP’s; North Royalton “A” and “B” WWTP’s; Columbia Township Subdivision WWTP; Columbia Mobile Home Park WWTP; Olmsted Trailer Park WWTP; Vinewood subdivision WWTP; and others.

Major tributaries to the Rocky River include: Plum Creek, which joins the West Branch in Olmsted Falls; Blodgett Creek, which also joins the West Branch in Olmsted Falls; Baldwin Creek, which joins the East Branch in Berea, and includes the North Royalton “B” WWTP effluent; and Abram Creek, which joins the main stem in Cleveland.

The Ohio EPA has designated the Rocky River State Resource Water, Aquatic Life Warmwater Habitat, Agricultural Water Supply, Industrial Water Supply, Primary Contact Recreational Use and Seasonal Salmonid Habitat. The NEORSD has selected five locations on the Rocky River that are routinely sampled for chemical, bacteriological, and benthic analysis (Figure 17). Chemical and bacteriological data from Rocky River are presented in Appendix B.

Site #49 (40° 23.212' N, 81° 51.966' W) is located in Berea on the East Branch of the Rocky River, approximately 300 yards upstream of Valley Parkway, north of Falls Lane. In 1997, Site #49 obtained a QHEI score of 69.5.

Site #50 (41° 18.460' N, 81° 54.856' W) is located on the East Branch of the Rocky River at West Bridge Street in Berea. This site is upstream of the former Berea WWTP effluent discharge and about 100 yards downstream of the City of Berea Water Purification Plant. Site #50 obtained a QHEI score of 67 in 2000 (Appendix D).

Site #51 (41° 19.106' N, 81° 48.533' W) is located on the East Branch of the Rocky River in Strongsville, approximately 75 feet upstream of East Access Road in the Metroparks Mill Stream Run Reservation. In 2000, Site #51 obtained a QHEI score of 61.5 (Appendix D).

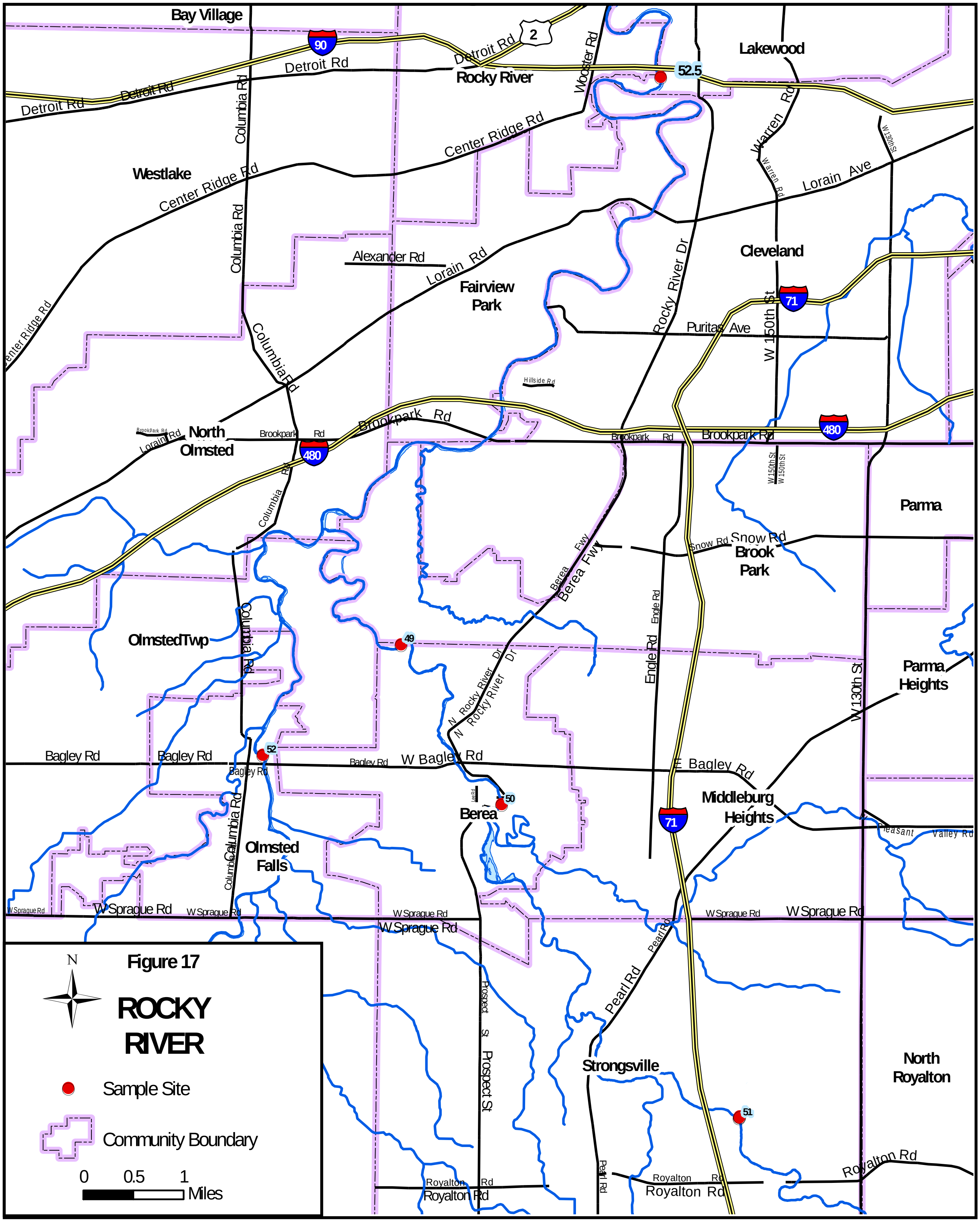


Figure 17
ROCKY RIVER
N
Sample Site
Community Boundary
0 0.5 1
Miles
Bay Village
Lakewood
Rocky River
Westlake
Cleveland
Fairview Park
North Olmsted
Parma
Brook Park
Olmsted Twp
Parma Heights
Middleburg Heights
Berea
Olmsted Falls
Strongsville
North Royalton
Detroit Rd
Center Ridge Rd
Columbia Rd
Wooster Rd
Warren Rd
Lorain Ave
Lorain Rd
Alexander Rd
Rocky River Dr
Puritas Ave
W 150th St
W 130th St
Brookpark Rd
Snow Rd
Berea Fwy
Engle Rd
Bagley Rd
W Bagley Rd
E Bagley Rd
N Rocky River Dr
W Sprague Rd
Pearl Rd
Prospect St
Royalton Rd
52.5
49
52
50
51
90
2
71
480

Site #52 (41° 22.679' N, 81° 53.958' W) is located on the West Branch of the Rocky River in Olmsted Falls north of Bagley Road. This site is immediately upstream of the confluence with Plum Creek. Site #52 obtained a QHEI score of 61 in 2000 (Appendix D).

Site #52.5 (41° 28.237' N, 81° 49.391' W) is located on the main stem of the Rocky River in the Cleveland Metroparks Rocky River Reservation, approximately 30 yards upstream of the Hilliard Road Bridge. This site is approximately 200 yards downstream of the storm sewer outfall at Riverside Drive and Hog's Back Lane, which is the northernmost point of the NEORSD service area on the Rocky River. Site #52.5 was selected to reflect the environmental impact on the Rocky River from seven upstream storm sewer outfalls, to which numerous combined sewer overflows are known to be tributary. In 2000, Site #52.5 obtained a QHEI score of 69 (Appendix D).

Benthic Macroinvertebrate Sampling on the Rocky River

Results of benthic macroinvertebrate sampling conducted on the Rocky River and Abram Creek (tributary of the Rocky River) during 1999 are included in Appendix K.

Problems and Remediation

-1-

While inspecting the storm sewer on Rocky River Drive near Chatfield Avenue, on September 10, 1999, NEORSD investigators found a dry weather discharge containing sanitary sewage. This storm sewer discharges to Albers Creek, a tributary to the Rocky River. The sewage was traced to Northern Ohio Cleaners, 4049 Rocky River Drive. A dye test showed that the facility's washing machines had been improperly connected to the storm sewer. Investigators also dye tested the sanitary facilities, which resulted in dye being present in both the storm and sanitary sewers located on Northern Ohio Cleaners' property. This indicated that sewage was exfiltrating from the sanitary sewer and infiltrating into the storm sewer. The City of Cleveland Water Pollution Control was notified of this situation. A follow-up inspection by NEORSD investigators on May 15, 2000, revealed that no corrective action had been taken to remediate this problem.

-2-

On September 17, 1999, NEORSD investigators discovered sanitary sewage entering a tributary of the Rocky River through a 36-inch storm sewer outfall located behind 4253 West 181st Street. The flow was measured at an approximate rate of 12,000 gallons per day. The source of the sewage was traced to a blocked sanitary sewer between 18002 and 18010 Fairway Drive. The blockage caused sewage to leak into the storm sewer and ultimately discharge to Rocky River. Following these findings, the City of Cleveland Water Pollution Control was notified of the problem. On September 28, 1999, NEORSD investigators verified that the blockage had been removed, eliminating this source of contamination in the Rocky River.

-3-

On November 19, 1999, NEORSD investigators responded to a report of sanitary sewage in a drainage ditch near 21480 Sheldon Road. This drainage ditch discharges to Abram Creek, a tributary to the Rocky River. Investigations revealed that the dry weather flow contaminated by sewage was from several sources throughout the sewer system. One source of sewage was traced to a blocked sanitary sewer between 804 and 834 Front Street. The blockage caused the sanitary sewer to become surcharged, resulting in sewage infiltrating into the storm sewer system. Following this discovery, the City of Berea Service Department was notified. A subsequent inspection by investigators on November 24, 1999, revealed that the blockage had been cleared, eliminating this source of sanitary sewage contamination in Abram Creek.

Investigators also found dry weather flow containing sanitary sewage entering the drainage ditch from the Bryant Avenue storm sewer. The sewage was traced to an apartment building at 872 Bryant Avenue. A dye test of the sanitary facilities from one of the apartment's units resulted in dye being present in both the storm and sanitary sewers located on the building's property. This indicated that sewage was exfiltrating from the sanitary sewer and infiltrating into the storm sewer. Investigators further noted that additional residential sanitary discharges may have been improperly connected to the storm sewer in this area, but were not identified during this investigation. These findings were reported to the City of Berea Service Department.

-4-

On October 20, 1999, NEORSD investigators found evidence of sanitary sewage entering Rocky River through a 36-inch storm sewer outfall located north of the old

Lorain Road bridge. The source of the sewage was identified as an improper connection of a residential sanitary discharge to the storm sewer at 17509 Fernshaw Avenue. NEORSD investigators noted that further dye testing of homes on Fernshaw Avenue could possibly reveal additional improper connections of residential sanitary discharges to the storm sewer system tributary to the 36-inch storm sewer outfall. These findings were reported to the City of Cleveland Water Pollution Control.

-5-

After conducting routine sampling of Rocky River on July 26, 2000, NEORSD investigators noted an elevated *E. coli* density (4,800 CFU per 100 mL) at Site #50, West Bridge Street. A follow-up inspection of the area on August 1, 2000, revealed dry weather flow with evidence of sanitary sewage entering Rocky River from a 12-inch storm sewer outfall under West Bridge Street. The source of the contaminated flow was traced to a blocked sanitary sewer on Riverside Drive, between Church Street and East Bridge Street. The blockage caused the sanitary sewer to become surcharged, resulting in the overflow of sewage into the river through a sanitary sewer overflow at Riverside Drive and East Bridge Street. Following this discovery, the City of Berea Service Department was notified. A subsequent inspection by NEORSD investigators on August 2, 2000, verified the elimination of this environmental disruption to the Rocky River.

-6-

On March 17, 1999, NEORSD investigators performed a routine inspection of Tuthill Corporation, 1000 West Bagley Road. While inspecting the exterior conditions of the property, NEORSD investigators found oil leaking from a scrap metal waste bin and into a nearby parking lot catch basin. Further investigation revealed that the catch basin discharges to a drainage ditch that flows to a tributary of Rocky River. Oil was also observed in this drainage ditch. Following these findings, company officials were advised to address the problem of oil leaking from the waste bin and to clean the oil from the parking lot and catch basin.

Following notification of the Ohio EPA by this company, EnviroServe was contracted to perform site remediation. A follow-up inspection by NEORSD investigators on March 18, 1999, revealed that the oil had been removed from the catch basin and drainage ditch and that corrective action had been taken to remediate this problem.

-7-

On September 20, 2000, NEORSD investigators responded to a complaint of sewage odors in a Rocky River tributary located in a ravine behind 17509 Oxford Avenue. An inspection of the Albers Creek culvert opening at this location revealed evidence of sanitary sewage. The source of the sewage was identified as an improper connection of residential sanitary discharges to the storm sewer from the Abbeyshire Apartment building at 4037 Rocky River Drive. Following this discovery, the City of Cleveland Water Pollution Control was notified of the situation.

-8-

On August 1, 2001, NEORSD investigators responded to another complaint of sewage odors in the ravine where the Albers Creek culvert opens between Allien Avenue and Oxford Avenue. Investigators observed evidence of sanitary sewage in the creek. The flow of sewage was traced to the sanitary sewer on Rocky River Drive at Chatfield Avenue. An investigation revealed that the inspection plate at this location was shifted, resulting in the flow of sewage being directed to the storm sewer. The City of Cleveland Division of Water Pollution Control was notified of the problem. A follow-up inspection by NEORSD investigators later that day revealed that the inspection plate had been repositioned, thereby eliminating the flow of sanitary sewage to the storm sewer and Albers Creek.

-9-

On May 4, 2001, NEORSD investigators responded to a report by the Strongsville Fire Department (SFD) of an oil spill at the Atlantic Tool & Die Company, 19963 Progress Road. An undetermined quantity of oil had leaked from the company's scrap metal waste bin into a nearby catch basin that discharges to Blodgett Creek. The SFD had erected an earthen dam around the storm sewer outfall in an effort to contain the oil that was discharging from the outfall. Chemtron Corporation was contracted to conduct site remediation that was monitored by the Ohio EPA. Finally, Ohio EPA required that Atlantic Tool & Die Company modify their waste metal storage area to prevent any further such discharges to Blodgett Creek.

-10-

On May 11, 2001, NEORSD investigators responded to a complaint of sanitary sewage entering Abram Creek through a storm sewer outfall at Webster Road, near Nethersole Drive in Middleburg Heights. The source of the sewage was traced to a blocked sanitary sewer at 16546 Webster Road. The blockage caused the sanitary sewer to become surcharged, resulting in leakage of sewage into the storm sewer. Following this discovery, the City of Middleburg Heights Service Department was notified. A follow-up inspection by NEORSD investigators on May 30, 2001, revealed that the blockage had been removed, eliminating this source of contamination in Abram Creek.

-11-

On June 26, 2001, NEORSD investigators discovered sanitary sewage in the Rocky River tributary, Blodgett Creek, downstream of Albion Road. An inspection revealed a break in an 8-inch sanitary sewer that runs under the creek approximately 300 feet downstream of Albion Road. As a result, sewage was leaking into Blodgett Creek. Following this discovery, the City of Strongsville Service Department was notified of the situation. A follow-up inspection by NEORSD investigators on July 3, 2001, revealed that the sanitary sewer had been replaced, eliminating this source of pollution in this Rocky River tributary.

-12-

On June 27, 2002, NEORSD investigators responded to a complaint of a blue substance in Blodgett Creek at 20082 Idlewood Trail. The blue colored flow was traced to Albion Industries, Incorporated, 20246 Progress Drive. The Strongsville Fire Department informed investigators that the blue substance was identified as enamel paint and water. Apparently an employee at this company had rinsed a chemical storage tote, containing approximately two gallons of enamel paint, onto the company's parking lot that drained to a nearby catch basin tributary to Blodgett Creek. Following this incident, Clean Harbors of Ohio, Incorporated was contracted to remove the contaminated water from the creek and catch basin. The Ohio EPA supervised the remediation efforts.

-13-

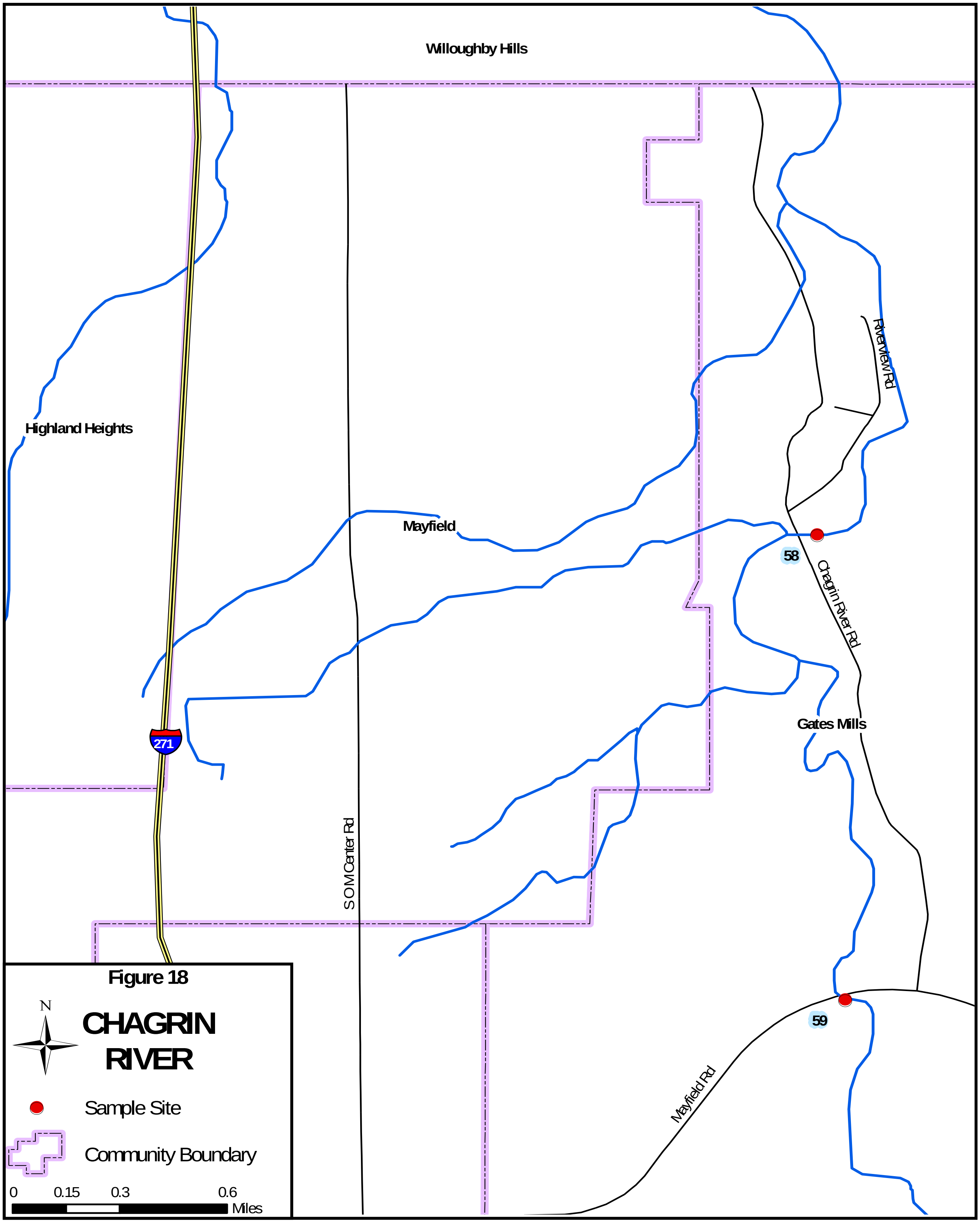
On July 1, 2002, NEORSD investigators responded to a report by the Strongsville Fire Department (SFD) of a chemical spill at 19963 Progress Drive. An undetermined quantity of phosphoric acid and nickel nitrate had spilled onto Progress Drive from a punctured 200-gallon storage tote on an L+D Transportation Services truck. Although some of the chemical had been contained with absorbant material, an unknown quantity had entered a storm sewer through a nearby catch basin on Progress Drive. This storm sewer is tributary to Blodgett Creek. The SFD noted that an undetermined quantity of product had entered the creek prior to their arrival. At the time of the investigation, the Cuyahoga County West HAZMAT team was on location to remove the chemical from the creek and catch basin.

CHAGRIN RIVER

The Chagrin River has a total length of 48 miles, with a drainage area of 267 square miles. The land use is primarily rural with a low density of residential housing. Communities located in the Chagrin River drainage area include: Aurora, Chagrin Falls, Chesterland, Eastlake, Mayfield Heights, the Village of Mayfield, Newbury, Solon, Willoughby, Willoughby Hills, and several other eastern suburbs of Cleveland. Development pressures in the drainage area are potential causes of degradation of the habitat. However, the majority of the Chagrin River has good to exceptional water quality with a healthy biological community.

The entire Chagrin River basin is considered a State Resource Water. The main stem of the Chagrin River from the headwaters to River Mile 4.8 has been designated by the Ohio EPA as Warmwater Habitat and Primary Contact Recreational Use. From River Mile 4.8 to the mouth, the river has been designated as Warmwater and Seasonal Salmonid Habitat, and Primary Contact Recreational Use. The Ohio EPA has designated the following tributaries of the Chagrin River as Exceptional Warmwater Habitat and Primary Contact Recreational Use: Griswald Creek, Willey Creek, McFarland Creek, and Beaver Creek. Coldwater Habitat and Primary Contact Recreational Use designations apply to Silver Creek and the East Branch, along with its tributaries.

The Chagrin River has been assigned two sites for routine sampling by the NEORSD. These sites had originally been chosen to evaluate the potential impact on Chagrin River water quality from the NEORSD-owned and operated Beech Hill Pump Station at 6830 Wilson Mills Road and the Bonnieview Comminutor Station at Beech Hill and Bonnieview Roads. The Bonnieview Station was decommissioned on May 26, 1995, and the Beech Hill Station was decommissioned on June 1, 1995. One site is located upstream of the former sewage pumping stations' bypass effluents (Site #59) and the other is located downstream of the effluents (Site #58). The NEORSD has selected two locations on the Chagrin River that are routinely sampled for chemical, bacteriological, and benthic analysis (Figure 18). Chemical and bacteriological data from the Chagrin River are presented in Appendix B.


Willoughby Hills
Highland Heights
Mayfield
Gates Mills
Riverview Rd
Chagrin River Rd
S O M Center Rd
Mayfield Rd
58
59
271
Figure 18
N
CHAGRIN RIVER
Sample Site
Community Boundary
0
0.15
0.3
0.6
Miles

Site #58 (41° 32.987' N, 81° 24.855' W) is located on the main stem of the Chagrin River at River Mile 15.1, approximately 3,500 feet downstream of the confluence with Beech Hill/Bonnieview Creek and 1,500 feet east of the Chagrin River Road bridge. Beech Hill/ Bonnieview Creek formerly received flow from the Beech Hill and Bonnieview Pump Stations during bypass events. In 2002, Site #58 obtained a QHEI score of 75.75 (Appendix D).

Site #59 (41° 31.770' N, 81° 24.704' W) is located on the main stem of the Chagrin River at River Mile 17.4, which is approximately 1.6 miles upstream of the confluence with Beech Hill/Bonnieview Creek. Samples are obtained from the south side of the Mayfield Road bridge. In 2002, Site #59 obtained a QHEI score of 72 (Appendix D).

Benthic Macroinvertebrate Sampling on the Chagrin River

Results of benthic macroinvertebrate sampling conducted on Beech Hill/Bonnieview Creek, a tributary of the Chagrin River, between 1992 and 2002 are included in Appendix I.

Problems and Remediation

-1-

On June 11, 2002, NEORSD investigators responded to a report by the Ohio EPA of a milky-white color in a tributary to the Chagrin River at Beta Drive in Mayfield Heights. An inspection of the creek revealed only a small pool containing the white substance at the creek's culvert opening at 6685 Beta Drive. In an effort to identify the source of the white substance, investigators inspected several upstream manholes on the culvert. Despite these efforts, no source of the discolored flow was found.

LAKE ERIE

In 1990, the NEORSD initiated sampling of Lake Erie water quality in the vicinity of Greater Cleveland. The NEORSD's service area is located entirely within the Lake Erie basin, and therefore all waters from NEORSD facilities are ultimately tributary to Lake Erie.

The lake is the site of the area's heaviest recreational water use, including bathing, boating, and fishing. Additionally, the City of Cleveland uses Lake Erie as its public water supply, pumping water for domestic, commercial, and industrial uses from intakes located offshore.

The 15 NEORSD Lake Erie routine sampling sites were selected to evaluate the impact of potential sources of pollution on ambient water quality at sites where it is most critical to the uses to be protected and where the impact is likely to be most severe (Figure 19). Samples are collected using a NEORSD-owned boat from near the lake surface at each site for chemical and bacteriological analysis and also near the lake bottom for chemical analysis at the three sites near the public water intakes.

No attempt has been made by the NEORSD to limit the routine lake sampling to conditions of dry weather pollution impacts. Wet weather sources may affect lake water quality for a much longer period of time than they affect stream water quality, although the impact is diminished by greater dilution in the lake. Water quality is less subject to variability in a large water body's lentic environment than in a stream's lotic environment.

The Ohio EPA has designated Lake Erie Exceptional Warmwater Habitat, State Resource Water, Public Water Supply, Agricultural Water Supply, Industrial Water Supply, and Bathing Waters for Recreational Use. Public Water Supply criteria only apply within 500 yards of surface water intakes. Chemical and bacteriological data from the NEORSD routine sampling of Lake Erie are presented in Appendix C.

Site A is located near the submerged Crown Water Intake, at 41° 31.16' N, 81° 52.80' W. The site is about 2.6 miles offshore on a heading of 310 degrees northwest from the east side of the mouth of the Rocky River. The average water depth at Site A has been measured at 46 feet.

Site B is located within 500 yards west of the visible Baldwin Water Intake Crib at 41° 32.90' N, 81° 45.00' W. Also in this vicinity is the submerged Garret A. Morgan (Division) Water Intake at 41° 32.83' N, 81° 45.83' W. The average water depth at Site B has been measured at 48 feet.

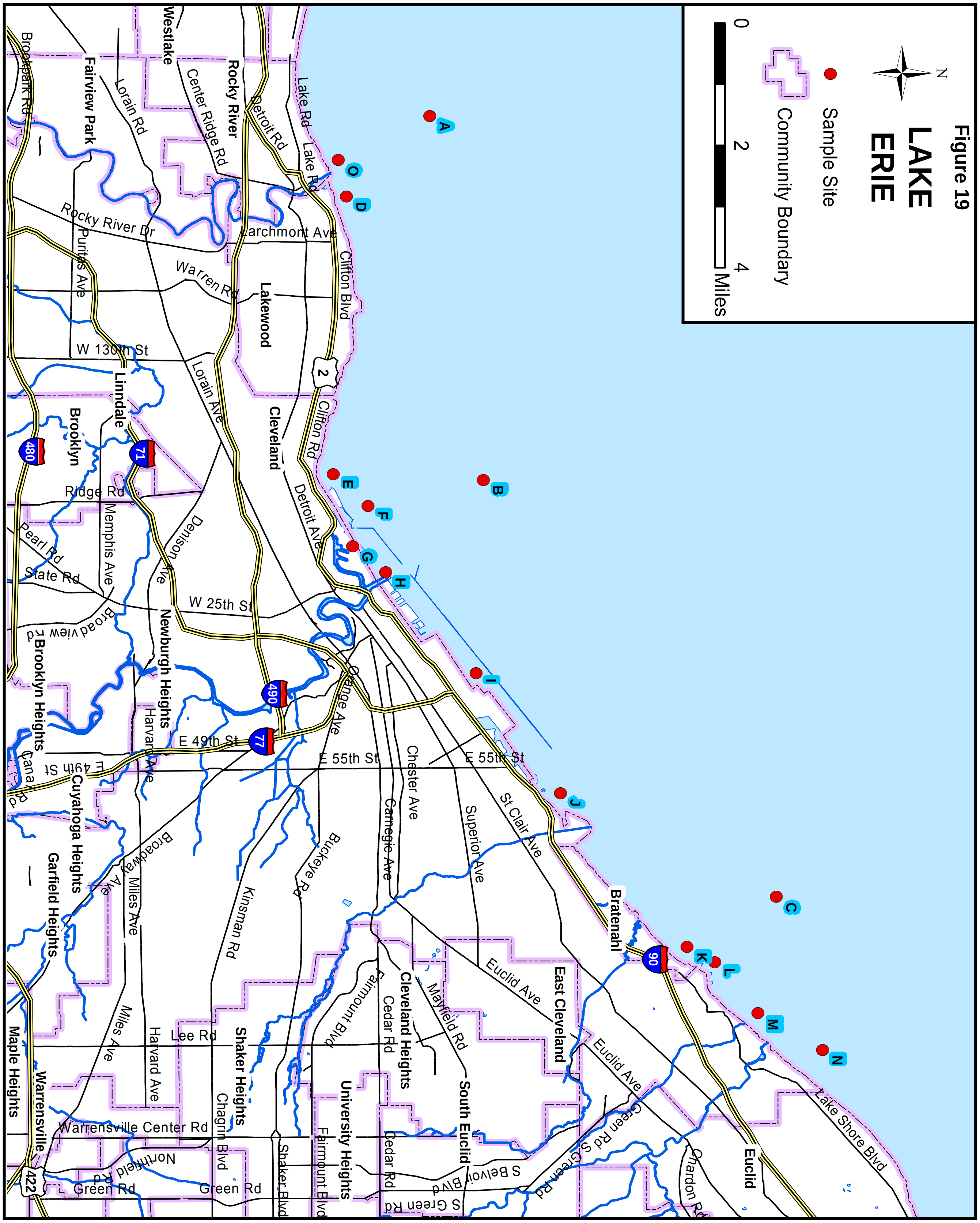


Figure 19
LAKE ERIE
N
Sample Site
Community Boundary
0
2
4
Miles
Lake Erie
A
B
C
D
E
F
G
H
I
J
K
L
M
N
O
Westlake
Rocky River
Fairview Park
Lakewood
Cleveland
Linndale
Brooklyn
Brooklyn Heights
Newburgh Heights
Cuyahoga Heights
Garfield Heights
Maple Heights
Warrensville
Shaker Heights
University Heights
Cleveland Heights
South Euclid
East Cleveland
Bratenahl
Euclid
Brookpark Rd
Lorain Rd
Center Ridge Rd
Detroit Rd
Lake Rd
Rocky River Dr
Puritas Ave
Warren Rd
Larchmont Ave
Clifton Blvd
W 130th St
Lorain Ave
Ridge Rd
Pearl Rd
State Rd
Memphis Ave
Denison Ave
W 25th St
Detroit Ave
Broadview Rd
Harvard Ave
E 49th St
E 55th St
Orange Ave
Chester Ave
Superior Ave
St Clair Ave
Carnegie Ave
Buckeye Rd
Kinsman Rd
Broadway Ave
Miles Ave
Canal Rd
Euclid Ave
Mayfield Rd
Fairmount Blvd
Cedar Rd
Lee Rd
Chagrin Blvd
Warrensville Center Rd
Northfield Rd
Green Rd
Shaker Blvd
S Green Rd
S Belvoir Blvd
Lake Shore Blvd
Chardon Rd
2
71
480
490
77
90
422

Site C is located near the submerged Nottingham Water Intake at 41.° 37.08' N, 81.° 37.05' W. The site is about 3.5 miles offshore on a heading of 315 degrees northwest of the mouth of Euclid Creek. The average water depth at Site C has been measured at 48 feet.

Site D (41° 29.57' N, 81° 50.09' W) is located east of the Rocky River mouth. Site D was selected to evaluate the impact of flow from the Rocky River on water quality in Lake Erie. The average depth at Site D has been measured at 12 feet.

Site E (41° 29.41' N, 81° 44.45' W) is located offshore of Edgewater Beach. This site was selected to evaluate the water quality of Lake Erie in this area of heavy recreational use. The average water depth at Site E has been measured at 10 feet.

Site F (41° 30.05' N, 81° 43.66' W) is located near the NEORSD Westerly WWTP treated effluent discharge to Lake Erie, which is submerged 185 feet north of the northwest corner of the Cleveland Harbor break wall. This site was selected to evaluate the water quality of Lake Erie within the plant's effluent mixing zone. The average water depth measured at this location has been 30 feet.

Site G (41° 29.74' N, 81° 43.58' W) is located inside the Cleveland Harbor, east of the location of the NEORSD Westerly Combined Sewer Overflow Treatment Facility (CSOTF) discharge to the harbor. This site was selected to evaluate the water quality in the west end of Cleveland Harbor, which is potentially impacted by flows from both the Westerly CSOTF discharge and the Cuyahoga River. The average water depth at this location has been measured at 20 feet.

Site H (41° 30.25' N, 81° 42.76' W) is located within the Cleveland Harbor, approximately 50 feet northwest of the mouth of the Cuyahoga River. This site was selected to evaluate the influence of the Cuyahoga River on the water quality of Lake Erie within the Cleveland Harbor. This location is in a high-traffic area during the commercial shipping and recreational boating season. The average water depth at Site H has been measured at 33 feet.

Site I (41° 31.22' N, 81° 40.93' W) is located inside the Cleveland Harbor break wall offshore from Burke Lakefront Airport, just east of Channel Marker #9. This site was selected to evaluate the water quality of Lake Erie within the eastern Cleveland Harbor and potential impacts on it, including five combined sewer overflows along the lakefront between East 20th Street and East 38th Street. The average water depth at Site I has been measured at 25 feet.

Site J (41° 32.33' N, 81° 38.77' W) is located approximately 200 feet offshore from Gordon Park, at the east end of the Cleveland Harbor. This site was selected to evaluate the water quality inside the harbor as it enters the open area of Lake Erie. The average water depth at Site J has been measured at 27 feet.

Site K (41° 34.15' N, 81° 35.54' W) is located between Nine-Mile Creek to the west and the NEORSD Easterly WWTP to the east, approximately 200 feet offshore from White City Beach, west of its break wall. This site was selected to evaluate the potential impact on Lake Erie water quality from several Cleveland East Side streams, including the severely polluted Dugway Brook and Nine-Mile Creek, and a major combined sewer overflow outlet located at the end of a pier between White City Beach and the Easterly WWTP. The average water depth at Site K has been measured at 10 feet.

Site L (41° 34.46' N, 81° 35.33' W) is located approximately 50 feet north of the Easterly WWTP discharge to Lake Erie. This site was selected to evaluate the water quality of Lake Erie within the Easterly WWTP effluent mixing zone. The average water depth at Site L has been measured at 19 feet.

Site M (41° 35.07' N, 81° 34.25' W) is located approximately 300 feet offshore from Euclid Beach and one mile northeast of the Easterly WWTP. This site was selected to evaluate the water quality of Lake Erie in the vicinity of the beach, where recreational use is relatively heavy. The average water depth at Site M has been measured at 13 feet.

Site N (41° 36.01' N, 81° 33.07' W) is located approximately 300 feet offshore from Euclid General Hospital, about one mile northeast of the mouth of Euclid Creek. This site was selected to evaluate the water quality of Lake Erie entirely “down-lake” from the NEORSD service area. The average water depth at Site N has been measured at 13 feet.

Site O (41° 29.34' N, 81° 50.86' W) is located west of the mouth of the Rocky River. This site was selected to evaluate the water quality of Lake Erie entirely “up-lake” and outside of any expected influence from the NEORSD service area. The average water depth at Site O has been measured at 11 feet.

Problems and Remediation

-1-

On March 16, 1999, NEORSD personnel investigated a report of sanitary sewage entering Lake Erie through a storm sewer outfall located north of East 185th Street. The source of the sewage was identified as an improper connection of the sanitary discharge to the storm sewer from the Hospice of the Western Reserve, 300 East 185th Street. The City of Cleveland Water Pollution Control was notified of the situation. A follow-up inspection by investigators on September 28, 1999, revealed that this facility’s wastewater had been rerouted to the East 185th Street sanitary sewer, eliminating this source of pollution to Lake Erie.

-2-

On June 12, 1999, NEORSD investigators responded to a report of a fluorescent orange colored material entering Lake Erie from a storm sewer outfall at the Forest City Yacht Club, 5301 North Marginal Road. Investigators determined that the discolored flow entered Lake Erie through a discharge from a combined sewer most likely due to a rain event earlier that day. Although at the time of the inspection no overflow was occurring, the orange material was identified as fluorescent powdered pigments manufactured by Day-Glo Color Corporation, 4515 St. Clair Avenue. Day-Glo Color Corporation contracted EnviroServe to remove the material from Lake Erie at the Forest City Yacht Club.

-3-

On July 21, 1999, while inspecting outfalls to Lake Erie in the vicinity of Euclid Beach, NEORSD investigators discovered a dry weather discharge of sanitary sewage through CSO outfall 206 located north of East 156th Street. Inspections revealed that no blockages or discharges were observed through the seven overflow regulator structures tributary to this outfall. The sewage was traced to the Euclid Beach Plaza at 16122 Lake Shore Boulevard. A dye test showed that the sanitary discharge from this facility had been improperly connected to the Lake Shore Boulevard storm sewer, which discharges to Lake Erie via CSO outfall 206. The City of Cleveland Water Pollution Control was notified of these findings on August 2, 1999. A follow-up inspection by NEORSD investigators on January 13, 2000, verified that this discharge had been rerouted to the sanitary sewer.

APPENDICES

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P. Big Creek Electrofishing Survey, 1999
Q. Abram Creek and Rocky River Electrofishing Survey, 1998

APPENDIX A
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APPENDIX B
CLEVELAND AREA STREAMS CHEMICAL AND BACTERIOLOGICAL DATA, 1999-2002

DATA TABLE KEY

Results for individual samples are presented by sampling date as month/day/year. The sampled water body, with the NEORSD-assigned sample site number and/or letter in parentheses, also appears in the heading. For streams, data presented are from analyses of surface grab samples obtained under dry weather conditions (following at least three days of no significant rainfall). Routine stream sampling was performed under dry weather conditions to maximize data comparability and to facilitate identification of dry weather pollutant sources. These sources have the greatest potential for environmental impact due to the combination of maximal pollutant concentration with minimal instream dilution.

Because of a streamlining initiative implemented by the NEORSD for 2000 and 2001, samples collected during those years were analyzed for only *E. coli* bacteria and/or 4 physical parameters. In 2002, the NEORSD Environmental Assessment Group returned to analyzing samples for up to 35 physical, chemical and bacteriological parameters.

All chemical and bacteriological parameters analyzed in the sample are listed in the first column, followed by analytical units in parentheses. When a measured value exceeds a State of Ohio water quality criterion, the applicable water use designation, with the exceeded numerical criterion in parentheses, appears in the “Excursion” column. An asterisk appears when no maximum criterion is applicable and the single value only exceeds an average criterion (therefore not necessarily representing an excursion from water quality standards). The Recreational Usage Criterion only applies during the recreation season (May 1 through October 15). Values exceeding the criterion outside of those dates are not considered to be excursions. It should be noted that some sites do not have use designations. A Recreational Usage Criterion does not apply to those sites.

Applicable Ohio EPA Water Use Designations

ASW	=	Agricultural Water Supply
BW	=	Bathing Waters Recreational Use
EWH	=	Exceptional Warmwater Habitat Aquatic Life Use
HHSR	=	Human Health (Single-Route Exposure)
LRW	=	Limited Resource Water
PCU	=	Primary Contact Recreational Use
PWS	=	Public Water Supply
SCU	=	Secondary Contact Recreational Use
SSH	=	Seasonal Salmonid Habitat Aquatic Life Use
WHAL	=	Warmwater Habitat Aquatic Life Use

WL	=	Protection of Wildlife

Other Acronyms and Abbreviations

BOD-5	=	Biochemical Oxygen Demand (5-day test)
COD	=	Chemical Oxygen Demand
E. Coli	=	*Escherichia coli*
N	=	Nitrogen
TKN	=	Total Kjeldahl Nitrogen
mg/L	=	milligrams per liter
mS/cm	=	millisiemens per centimeter
ug/L	=	micrograms per liter
s.u.	=	standard units
NTU	=	Nephelometric Turbidity Units

Samples were collected by direct immersion of the sample bottles below the water surface. At bridge or manhole sites, samples were collected with an acid-cleaned, de-ionized water-rinsed plastic bucket and drop line. The bucket was further rinsed with stream water from the sample site prior to the collection of each sample. All samples obtained at bridge or manhole sites were collected from midstream, while all other stream samples were collected near the bank.

Closed and labeled plastic containers were used to transport samples, on ice for preservation, to NEORSD Analytical Services. All bottles used to transport samples for bacteriological analysis had been sterilized prior to sampling.

Field measurements for water temperature and dissolved oxygen concentration were obtained at the time of sampling using a calibrated YSI Model 58 dissolved oxygen meter, or an 85 or 610 multi-parameter water quality meter. Specific conductance was measured in-field using a YSI Model 85 or 610 multi-parameter water quality meter. An Orion Model 260 pH meter or YSI Model 610 multi-parameter water quality meter was used to measure pH.

Site Number and Water Body Use Designation		Big Creek #25 WWH, AWS,IWS, & PCR										Big Creek #26 LRW, AWS,IWS, & PCR									
Sample Number		R99-0050 5/3/99		R00-0302 7/24/00		R00-0416 11/2/00		R01-0111 11/14/01		R02-0084 6/25/02		R99-0051 5/3/99		R00-0303 7/24/00		R00-0417 11/2/00		R01-0112 11/14/01		R02-0086 6/25/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)	2.5	-							3.12	-	3	-							3.19	-
COD	(mg/L)	20	-							22	-	26	-							14	-
Suspended Solids	(mg/L)	4	-							4.4	-	2.4	-							1.8	-
Dissolved Solids	(mg/L)	940	-							692	-	640	-							658	-
Total Solids	(mg/L)	960	-							953	-	700	-							710	-
Total Phosphorus	(mg/L)	0.11	-							0.131	-	0.047	-							0.129	-
Soluble Phosphorus	(mg/L)	0.042	-							0.13	-	0.037	-							0.12	-
Ammonia-N	(mg/L)	0.16	-							0.1	-	0.05	-							<0.01	-
Nitrite	(mg/L)	0.03	-							0.12	-	0.05	-							0.05	-
Nitrate	(mg/L)	0.67	-							0.31	-	0.39	-							0.31	-
TKN	(mg/L)	0.79	-									0.84	-								
Alkalinity	(mg/L)	122	-							136	-	126	-							148	-
Chloride	(mg/L)	370	-									200	-								
Sulfates	(mg/L)	150	-							94	-	120	-							86	-
E. coli	(Col/100 mL)	400	PCU (298)	800	PCU (298)	180	-	210	-	62 EC	-	210	-	1200	PCU (298)	180	-	380		29	-
Fecal Coliform	(Col/100 mL)	580	-							2000 EC	PCU (2000)	320	-							600	-
Turbidity	(NTU)	2.5	-							1.6	-	1.7	-							1	-
Conductance	micrmhos	770	-									531	-								
Hardness	(mg/L)	258	-							498	-	243	-							288	-
ICP Nickel	(ug/l)	4.5*	-							2	-	4.2*	-							<1	-
ICP Copper	(ug/l)	8.6*	-							8	-	6.2*	-							6	-
ICP Chromium	(ug/l)	2.2*	-							3	-	2.4*	-							1	-
Hexavalent Chromium	(ug/l)	<10	-							<10.0	-	<10	-							<10.0	-
ICP Iron	(ug/l)	351	-							353	-	162	-							77	-
ICP Cadmium	(ug/l)	<1*	-							<1	-	<1*	-							<1	-
ICP Silver	(ug/l)									<2	-									<2	-
ICP Arsenic	(ug/l)	<5*	-							4	-	<5*	-							3	-
ICP Selenium	(ug/l)	<5*	-							27		<5*	-							<10.0	-
GFAA Thallium	(ug/l)	<7	-									<7	-								
GFAA Antimony	(ug/l)	<7	-									<7	-								
GFAA Cobalt	(ug/l)	<1	-									<1	-								
ICP Beryllium	(ug/l)	<1*	-							<0.5	-	<1*	-							<0.5	-
ICP Lead	(ug/l)	<3*	-							<3	-	<3*	-							<3	-
ICP Zinc	(ug/l)	27	-							30	-	20	-							23	-
Mercury	(ug/l)	<.2	-							<0.05	-	<.2	-							<0.05	-
GFAA Silver	(ug/l)	<1	-							<1	-	<1	-							<1	-
pH	(s.u.)	7.5	-							7.9	-	7.7	-							8.3	-
Field Conductivity	(mS/cm)					1.2	-	1.4	-	1.5	-					0.8	-	0.8	-	1	-
Field D.O.	(mg/L)					12	-	10	-	6.6	-					13	-	14	-	8.5	-
Field Temperature	(°C)	14	-			8	-	9	-	24	-	12	-			9	-	9	-	23	-
Field pH	(s.u.)					8	-	7.5	-	7.6	-					8.2	-	7.7	-	8	-
= > criterion																					
* = GFAA																					

Site Number and Water Body Use Designation		Big Creek #27 LRW, AWS,IWS, & PCR										Big Creek #28 LRW, AWS,IWS, & PCR									
Sample Number		R99-0052 5/3/99		R00-0304 7/24/00		R00-0418 11/2/00		R01-0113 11/14/01		R02-0085 6/25/02		R99-0053 5/3/99		R00-0305 7/24/00		R00-0419 11/2/00		R01-0114 11/14/01		R02-0088 6/25/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)	3	-							2.58	-	3.9	-							3.85	
COD	(mg/L)	28	-							21	-	31	-							21	
Suspended Solids	(mg/L)	1.2	-							2.3	-	8	-							5.2	-
Dissolved Solids	(mg/L)	960	-							685	-	860	-							640	-
Total Solids	(mg/L)	1000	-							762	-	930	-							700	-
Total Phosphorus	(mg/L)	0.042	-							0.131	-	0.066	-							0.185	-
Soluble Phosphorus	(mg/L)	0.042	-							0.13	-	0.035	-							0.16	-
Ammonia-N	(mg/L)	0.01	-							<0.01	-	0.02	-							<0.01	-
Nitrite	(mg/L)	0.06	-							0.06	-	0.02	-							0.17	-
Nitrate	(mg/L)	2.1	-							0.8	-	0.32	-							1.58	-
TKN	(mg/L)	0.74	-									0.7	-								
Alkalinity	(mg/L)	149	-							170	-	126	-							136	-
Chloride	(mg/L)	310	-									320	-								
Sulfates	(mg/L)	170	-							83	-	130	-							66	-
E. coli	(Col/100 mL)	~34	-	350	PCU (298)	41	-	76	-	81	-	280	-	180	-	65	-	96	-	55	-
Fecal Coliform	(Col/100 mL)	~38	-							440	-	400	-							1000 EC	-
Turbidity	(NTU)	3.2	-							1.7	-	3.6	-							4.9	-
Conductance	micrmhos	750	-									696	-								
Hardness	(mg/L)	296	-							278	-	274	-							236	-
ICP Nickel	(ug/l)	4.3*	-							<1	-	3.5*	-							<1	-
ICP Copper	(ug/l)	7.3*	-							5	-	7.1*	-							6	-
ICP Chromium	(ug/l)	2.2*	-							1	-	6.7*	-							1	-
Hexavalent Chromium	(ug/l)	<10	-							<10.0	-	<10	-							<10.0	-
ICP Iron	(ug/l)	436	-							435	-	518	-							478	-
ICP Cadmium	(ug/l)	<1*	-							<1	-	<1*	-							<1	-
ICP Silver	(ug/l)									<2	-									<2	-
ICP Arsenic	(ug/l)	<5*	-							4	-	<5*	-							9	-
ICP Selenium	(ug/l)	<5*	-							<10.0	-	<5*	-							<10.0	-
GFAA Thallium	(ug/l)	<7	-									<7	-								
GFAA Antimony	(ug/l)	<7	-									<7	-								
GFAA Cobalt	(ug/l)	<1	-									<1	-								
ICP Beryllium	(ug/l)	<1*	-							<0.5	-	<1*	-							<0.5	-
ICP Lead	(ug/l)	<3*	-							<3	-	4*	-							5	-
ICP Zinc	(ug/l)	41	-							83	-	40	-							241	-
Mercury	(ug/l)	<.2	-							<0.05	-	<.2	-							<0.05	-
GFAA Silver	(ug/l)	<1	-							<1	-	<1	-							<1	-
pH	(s.u.)	8.1	-							7.8	-	7.7	-							8.2	-
Field Conductivity	(mS/cm)					1.2	-	1.1	-	1.2	-					0.7	-	0.8	-	1.1	-
Field D.O.	(mg/L)					14	-	11	-	7.1	-					15	-	12	-	9.7	-
Field Temperature	(°C)	14	-			9.5	-	9.5	-	21	-	16	-			11	-	10	-	26	-
Field pH	(s.u.)					7.9	-	7.8	-	7.6	-					8.3	-	8	-	8.1	-
= > criterion																					
* = GFAA																					

Site Number and Water Body Use Designation		Big Creek #29 WWH, AWS,IWS, & PCR									
Sample Number		R99-0054 5/3/99		R00-0306 7/24/00		R00-0420 11/2/00		R01-0115 11/14/01		R02-0089 6/25/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)	2.8	-							2.97	-
COD	(mg/L)	28	-							19	-
Suspended Solids	(mg/L)	2	-							3.5	-
Dissolved Solids	(mg/L)	750	-							640	-
Total Solids	(mg/L)	750	-							664	-
Total Phosphorus	(mg/L)	0.027	-							0.141	-
Soluble Phosphorus	(mg/L)	0.027	-							0.13	-
Ammonia-N	(mg/L)	0.04	-							<0.01	-
Nitrite	(mg/L)	0.01	-							0.05	-
Nitrate	(mg/L)	0.07	-							0.54	-
TKN	(mg/L)	0.51	-								
Alkalinity	(mg/L)	121	-							140	-
Chloride	(mg/L)	210	-								
Sulfates	(mg/L)	150	-							98	-
E. coli	(Col/100 mL)	240	-	2500	PCU (298)	1600		~1800		39	-
Fecal Coliform	(Col/100 mL)	~320	-							6000 EC	PCU (2000)
Turbidity	(NTU)	2	-							1.8	-
Conductance	micrmhos	551	-								
Hardness	(mg/L)	262	-							240	-
ICP Nickel	(ug/l)	3.5*	-							<1	-
ICP Copper	(ug/l)	9.4*	-							5	-
ICP Chromium	(ug/l)	3.3*	-							<1	-
Hexavalent Chromium	(ug/l)	<10	-							<10.0	-
ICP Iron	(ug/l)	234	-							155	-
ICP Cadmium	(ug/l)	<1*	-							<1	-
ICP Silver	(ug/l)									<2	-
ICP Arsenic	(ug/l)	<5*	-							3	-
ICP Selenium	(ug/l)	<5*	-							<10.0	-
GFAA Thallium	(ug/l)	<7	-								
GFAA Antimony	(ug/l)	<7	-								
GFAA Cobalt	(ug/l)	<1	-								
ICP Beryllium	(ug/l)	<1*	-							<0.5	-
ICP Lead	(ug/l)	<3*	-							<3	-
ICP Zinc	(ug/l)	24	-							32	-
Mercury	(ug/l)	<.2	-							<0.05	-
GFAA Silver	(ug/l)	<1	-							<1	-
pH	(s.u.)	7.4	-							7.7	-
Field Conductivity	(mS/cm)					0.7	-	0.8	-	1.1	-
Field D.O.	(mg/L)					13	-	12	-	8.3	-
Field Temperature	(°C)	15	-			10	-	10	-	24	-
Field pH	(s.u.)					8.1	-	8	-	7.9	-
= > criterion											
* = GFAA											

Site Number and Water Body Use Designation		Big Creek #30 WWH, AWS,IWS, & PCR									
Sample Number		R99-0055 5/3/99		R00-0307 7/24/00		R00-0421 11/2/00		R01-0116 11/14/01		R02-0087 6/25/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)	2.9	-							<2.0	-
COD	(mg/L)	<10	-							13	-
Suspended Solids	(mg/L)	2.4	-							1.3	-
Dissolved Solids	(mg/L)	630	-							597	-
Total Solids	(mg/L)	640	-							632	-
Total Phosphorus	(mg/L)	0.14	-							0.368	-
Soluble Phosphorus	(mg/L)	0.13	-							0.36	-
Ammonia-N	(mg/L)	0.06	-							<0.01	-
Nitrite	(mg/L)	0.03	-							0.05	-
Nitrate	(mg/L)	0.85	-							0.68	-
TKN	(mg/L)	0.76	-								
Alkalinity	(mg/L)	139	-							150	-
Chloride	(mg/L)	190	-								
Sulfates	(mg/L)	90	-							59	-
E. coli	(Col/100 mL)	330	PCU (298)	4000	PCU (298)	790		390		96	-
Fecal Coliform	(Col/100 mL)	720	-							1000 EC	-
Turbidity	(NTU)	1.2	-							0.85	-
Conductance	micrmhos	473	-								
Hardness	(mg/L)	217	-							276	-
ICP Nickel	(ug/l)	2*	-							<1	-
ICP Copper	(ug/l)	5*	-							6	-
ICP Chromium	(ug/l)	1.7*	-							<1	-
Hexavalent Chromium	(ug/l)	<10	-							<10.0	-
ICP Iron	(ug/l)	169	-							102	-
ICP Cadmium	(ug/l)	<1*	-							<1	-
ICP Silver	(ug/l)									<2	-
ICP Arsenic	(ug/l)	<5*	-							4	-
ICP Selenium	(ug/l)	<5*	-							<10.0	-
GFAA Thallium	(ug/l)	<7	-								
GFAA Antimony	(ug/l)	<7	-								
GFAA Cobalt	(ug/l)	<1	-								
ICP Beryllium	(ug/l)	<1*	-							<0.5	-
ICP Lead	(ug/l)	<3*	-							<3	-
ICP Zinc	(ug/l)	15	-							34	-
Mercury	(ug/l)	<.2	-							<0.05	-
GFAA Silver	(ug/l)	<1	-							<1	-
pH	(s.u.)	8	-							7.4	-
Field Conductivity	(mS/cm)					0.8	-	0.8	-	0.9	-
Field D.O.	(mg/L)					14	-	12	-	7.3	-
Field Temperature	(°C)	14	-			9.5	-	10	-	23	-
Field pH	(s.u.)					8.2	-	8	-	7.8	-

Site Number and Water Body Use Designation		Chagrin River #58 WWH & PCR								Chagrin River #59 WWH & PCR							
Sample Number		R99-0111 6/7/99		R99-0188 8/30/99		R00-0390 10/23/00		R02-0097 6/26/02		R99-0112 6/7/99		R99-0189 8/30/99		R00-0391 10/23/00		R02-0096 6/26/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)	2.8	-	<2				5.07	-	2.4	-	<2	-			5.25	-
COD	(mg/L)	13	-	<10				23	-	18	-	<10	-			22	-
Suspended Solids	(mg/L)	15	-	22				27.2	-	7.6	-	9.2	-			16.5	-
Dissolved Solids	(mg/L)	390	-	370				354	-	370	-	360	-			358	-
Total Solids	(mg/L)	400	-	400	-			401	-	380	-	380	-			386	-
Total Phosphorus	(mg/L)	0.054	-	0.1	-			0.119	-	0.054	-	0.094	-			0.198	-
Soluble Phosphorus	(mg/L)	0.044	-	0.086	-			0.07	-	0.035	-	0.081	-			0.15	-
Ammonia-N	(mg/L)	0.27	-	0.08	-			0.04	-	0.05	-	0.06	-			0.08	-
Nitrite	(mg/L)	0.02	-	0.01	-			0.03	-	0.02	-	0.01	-			0.04	-
Nitrate	(mg/L)	0.29	-	0.62	-			0.18	-	0.37	-	0.59	-			0.24	-
TKN	(mg/L)	0.77	-	0.63	-					0.74	-	0.55	-				
Alkalinity	(mg/L)	146	-	139	-			152	-	144	-	136	-			148	-
Chloride	(mg/L)	110	-	100	-					110	-	86	-				
Sulfates	(mg/L)	60	-	58	-			38	-	53	-	53	-			38	-
E. coli	(Col/100 mL)	130	-	240	-	30	-	800	PCU (298)	90	-	160	-	36	-	69	-
Fecal Coliform	(Col/100 mL)	280	-	390	-			1300	-	180	-	260	-			120	-
Turbidity	(NTU)	23	-	13	-			5.4	-	26	-	8	-			4	-
Conductance	micrmhos			445	-							431	-				
Hardness	(mg/L)	183	-	180	-			202	-	180	-	175	-			174	-
ICP Nickel	(ug/l)	6.3*	-	3.4*	-			<1	-	5.5*	-	1.3	-			<1	-
ICP Copper	(ug/l)	11*	-	4.6*	-			6	-	8.8*	-	2.2	-			7	-
ICP Chromium	(ug/l)	30*	-	4*	-			1	-	15*	-	2.8	-			1	-
Hexavalent Chromium	(ug/l)	<10	-	<10	-			<10	-	<10	-	<10	-			<10	-
ICP Iron	(ug/l)	381	-	877	-			1010	-	302	-	534	-			653	-
ICP Cadmium	(ug/l)	<1*	-	<1*	-			<1	-	<1*	-	<1	-			<1	-
ICP Silver	(ug/l)							4	-							<2	-
ICP Arsenic	(ug/l)	<5*	-	<5*	-			5	-	<5*	-	<5	-			5	-
ICP Selenium	(ug/l)	<5*	-	<5*	-			<10.0	-	<5*	-	<5	-			<10.0	-
GFAA Thallium	(ug/l)	<7	-	<7	-					<7	-	<7	-				
GFAA Antimony	(ug/l)	<7	-	<7	-					<7	-	<7	-				
GFAA Cobalt	(ug/l)	<1	-	<1	-					<1	-	<1	-				
ICP Beryllium	(ug/l)	<1*	-	<1*	-			<0.5	-	<1*	-	<1*	-			<0.5	-
ICP Lead	(ug/l)	<3*	-	<3*	-			<3	-	<3*	-	<3*	-			<3	-
ICP Zinc	(ug/l)	13	-	140	-			23	-	13	-	31	-			22	-
Mercury	(ug/l)	<.2	-	<.2	-			<0.05	-	<.2	-	<.2	-			<0.05	-
GFAA Silver	(ug/l)	<1	-	<1	-			<1.0	-	<1	-	<1	-			<1.0	-
pH	(s.u.)	8.1	-	7.8	-			8.5	-	7.9	-	8.3	-			8.5	-
Field Conductivity	(mS/cm)	0.6	-			0.4	-	0.6	-	0.5	-			0.4	-	0.7	-
Field D.O.	(mg/L)	8.8	-	8.8	-	12	-	9.2	-	11	-	10	-	13	-	11	-
Field Temperature	(°C)	25	WHAL (24.4)	19	-	12	-	28	-	27	WHAL (24.4)	20	-	13	-	28	-
Field pH	(s.u.)			8.2	-	8.3	-	7.8	-			8.2	-	8.2	-	7.8	-
= > criterion																	
* = GFAA																	

Site Number and Water Body Use Designation		Burke Brook #48											
Sample Number		R99-0107 5/18/99		R99-0194 9/2/99		R00-0356 8/30/00		R00-0422 11/2/00		R01-0077 8/30/01		R02-0082 6/25/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)	3.4	-	13	-							4.63	-
COD	(mg/L)	31	-	39	-					35.5	-	25	-
Suspended Solids	(mg/L)	39	-	9.2	-					2.00	-	2.9	-
Dissolved Solids	(mg/L)	730	-	1600	-							1180	-
Total Solids	(mg/L)	770	-	1700	-							1220	-
Total Phosphorus	(mg/L)	0.48	-	0.077	-							0.034	-
Soluble Phosphorus	(mg/L)	0.38	-	0.065	-							0.042	-
Ammonia-N	(mg/L)	0.36	-	3.4	-					2.16	-	2.06	-
Nitrite	(mg/L)	0.08	-	0.25	-					<0.010	-	0.28	-
Nitrate	(mg/L)	8.5	-	1.2	-					1.06	-	1.15	-
TKN	(mg/L)	2	-	4.2	-					3.50	-		
Alkalinity	(mg/L)	128	-	160	-							152	-
Chloride	(mg/L)	220	-	450	-								
Sulfates	(mg/L)	26	-	470	-							280	-
E. coli	(Col/100 mL)	190	-	~3400	-	360	-	2900	-			38	-
Fecal Coliform	(Col/100 mL)	560	-	~5300	-							190	-
Turbidity	(NTU)	13	-	22	-							1.7	-
Conductance	micrmhos												
Hardness	(mg/L)	258	-	613	-							434	-
ICP Nickel	(ug/l)	7.1*	-	55*	-					34.0	-	38	-
ICP Copper	(ug/l)	4.9*	-	7.1*	-					<10.0	-	6	-
ICP Chromium	(ug/l)	4.6*	-	3.7*	-					<10.0	-	3	-
Hexavalent Chromium	(ug/l)	<10	-	<10	-					330	-	<10	-
ICP Iron	(ug/l)	1222	-	688	-							296	-
ICP Cadmium	(ug/l)	<1*	-	<1*	-					<10.0	-	<1	-
ICP Silver	(ug/l)									<20.0	-	<2	-
ICP Arsenic	(ug/l)	<5*	-	<5*	-							8	-
ICP Selenium	(ug/l)	<5*	-	<5*	-							17	-
GFAA Thallium	(ug/l)	<7	-	<7	-								
GFAA Antimony	(ug/l)	<7	-	<7	-								
GFAA Cobalt	(ug/l)	<1	-	1	-								
ICP Beryllium	(ug/l)	<1*	-	<1*	-							<0.5	-
ICP Lead	(ug/l)	4.1*	-	<3*	-					<30.0	-	<3.0	-
ICP Zinc	(ug/l)	43	-	50	-					27.0	-	23	-
Mercury	(ug/l)	<.2	-	0.76	-							<0.05	-
GFAA Silver	(ug/l)	<1	-	<1	-							<1	-
pH	(s.u.)	7.7	-	7.9	-							8.2	-
Field Conductivity	(mS/cm)	1	-	2.3	-	1.7	-	1.9	-			1.2	-
Field D.O.	(mg/L)	7.2	-	5.4	-	6.6	-	9	-			7.9	-
Field Temperature	(°C)	22	-	17	-	18	-	13	-			16	-
Field pH	(s.u.)			7.5	-	8.2	-	8	-	8.2	-	8.1	-
= > criterion													
* = GFAA													

Site Number and Water Body Use Designation		Burke Brook #48.1 LRW. AWS, IWS, &SCR											
Sample Number		R99-0108 5/18/99		R99-0195 9/2/99		R00-0355 8/30/00		R00-0423 11/2/00		R01-0075 8/30/01		R02-0083 6/25/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)	3.1	-	<2	-							8.23	-
COD	(mg/L)	26	-	12	-					<10.0	-	17	-
Suspended Solids	(mg/L)	13	-	2.4	-					7.20	-	2.9	-
Dissolved Solids	(mg/L)	950	-	1100	-							1120	-
Total Solids	(mg/L)	980	-	1200	-							1230	-
Total Phosphorus	(mg/L)	0.082	-	0.079	-							0.0459	-
Soluble Phosphorus	(mg/L)	0.028	-	0.068	-							0.066	-
Ammonia-N	(mg/L)	0.08	-	0.13	-					0.160	-	0.08	-
Nitrite	(mg/L)	0.05	-	0.07	-					0.040	-	0.09	-
Nitrate	(mg/L)	1.1	-	1.3	-					0.750	-	0.84	-
TKN	(mg/L)	1.2	-	0.47	-					0.280	-		
Alkalinity	(mg/L)	205	-	241	-							228	-
Chloride	(mg/L)	290	-	350	-								
Sulfates	(mg/L)	170	-	170	-							180	-
E. coli	(Col/100 mL)	96	-	310	-	440	-	110	-			62	-
Fecal Coliform	(Col/100 mL)	200	-	470	-							420	-
Turbidity	(NTU)	2	-	2.3	-							1.9	-
Conductance	micrmhos												
Hardness	(mg/L)	436	-	488	-							487	-
ICP Nickel	(ug/l)	3.1*	-	47*	-					<20.0	-	<1	-
ICP Copper	(ug/l)	4.4*	-	11*	-					<10.0	-	4	-
ICP Chromium	(ug/l)	2.8*	-	2.5*	-					<10.0	-	1	-
Hexavalent Chromium	(ug/l)	<10	-	<10	-							<10	-
ICP Iron	(ug/l)	446	-	307	-					400	-	378	-
ICP Cadmium	(ug/l)	2.4*	-	7.6*	-					<10.0	-	<1	-
ICP Silver	(ug/l)									<20.0	-	<2	-
ICP Arsenic	(ug/l)	10*	-	11*	-							17	-
ICP Selenium	(ug/l)	<5*	-	<5*	-							16	-
GFAA Thallium	(ug/l)	<7	-	<7	-								
GFAA Antimony	(ug/l)	33	-	34	-								
GFAA Cobalt	(ug/l)	1	-	5	-								
ICP Beryllium	(ug/l)	<1*	-	2*	-							<0.5	-
ICP Lead	(ug/l)	6.1*	-	<3*	-					<30.0	-	<3.0	-
ICP Zinc	(ug/l)	32	-	36	-					29	-	52	-
Mercury	(ug/l)	<.2	-	<.2	-							<0.05	-
GFAA Silver	(ug/l)	<1	-	<1	-							<1	-
pH	(s.u.)	8.2	-	8.1	-					8	-	7.9	-
Field Conductivity	(mS/cm)	1.5	-	1.6	-	1.7	-	1.7	-			1.7	-
Field D.O.	(mg/L)	10	-	8.8	-	7.6	-	10	-			6.6	-
Field Temperature	(°C)	18	-	16	-	17	-	11	-			18	-
Field pH	(s.u.)			8.2	-	7.9	-	7.7	-			7.7	-
= > criterion													
* = GFAA													

Site Number and Water Body Use Designation	Chippewa Creek #43 WWH, AWS, IWS & PCR								Chippewa Creek #43.5 WWH, AWS, IWS & PCR								Chippewa Creek #44 WWH, AWS, IWS & PCR							
Sample Number	R99-0100 5/17/99		R00-0323 7/27/00		R01-0107 11/13/01		R02-0077 6/21/02		R99-0101 5/17/99		R00-0322 7/27/00		R01-0108 11/13/01		R02-0078 6/21/02		R99-0102 5/17/99		R00-0321 7/27/00		R01-0110 11/13/01		R02-0079 6/21/02	
	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD (mg/L)	<2	-					2.15	-	<2	-					<2.0	-	<2	-					<2.0	-
COD (mg/L)	<10	-					<10.0	-	<10	-					<10.0	-	<10	-					<10.0	-
Suspended Solids (mg/L)	2	-					1.6	-	1.6	-					1.5	-	7.2	-					3.1	-
Dissolved Solids (mg/L)	940	-					759	-	1200	-					1090	-	780	-					697	-
Total Solids (mg/L)	960	-					825	-	1200	-					1200	-	840	-					746	-
Total Phosphorus (mg/L)	<.01	-					0.019	-	<.01	-					0.031	-	0.011	-					0.041	-
Soluble Phosphoru (mg/L)	<.01	-					<0.01	-	<.01	-					0.01	-	<.01	-					0.014	-
Ammonia-N (mg/L)	0.37	-					0.01	-	0.02	-					<0.01	-	0.03	-					0.04	-
Nitrite (mg/L)	0.01	-					<0.01	-	<.01	-					<0.01	-	<.01	-					<0.01	-
Nitrate (mg/L)	0.37	-					0.21	-	0.04	-					0.35	-	0.12	-					0.25	-
TKN (mg/L)	0.56	-							0.32	-							0.51	-						
Alkalinity (mg/L)	177	-					178	-	266	-					275	-	246	-					236	-
Chloride (mg/L)	230	-							130	-							100	-						
Sulfates (mg/L)	58	-					180	-	420	-					390	-	220	-					170	-
E. coli (Col/100 mL)	40	-	32	-	~10	-	80	-	~24	-	52	-	~8	-	150	-	120	-	240	-	150	-	500	PCU (298)
Fecal Coliform (Col/100 mL)	42	-					130	-	~30	-					110	-	200	-					560	-
Turbidity (NTU)	0.5	-					0.84	-	0.5	-					0.96	-	2.5	-					2	-
Conductance micrmhos																								
Hardness (mg/L)	436	-					381	-	689	-					694	-	438	-					440	-
ICP Nickel (ug/l)	24*	-					1	-	1*	-					<1.0	-	<1*	-					<1.0	-
ICP Copper (ug/l)	19*	-					<1.0	-	<1*	-					<1.0	-	2.2*	-					<1.0	-
ICP Chromium (ug/l)	12*	-					2	-	2.3*	-					<1.0	-	2.4*	-					<1.0	-
Hexavalent Chrom (ug/l)	<10	-					<10.0	-	<10	-					<10.0	-	<10	-					<10.0	-
ICP Iron (ug/l)	194	-					58	-	71	-					60	-	460	-					354	-
ICP Cadmium (ug/l)	5.5*	-					<1.0	-	<1*	-					<1.0	-	<1*	-					<1.0	-
ICP Silver (ug/l)							<2.0	-							<2.0	-							<2.0	-
ICP Arsenic (ug/l)	7*	-					<2.0	-	<5*	-					2	-	<5*	-					3	-
ICP Selenium (ug/l)	<5*	-					13	-	<5*	-					<10.0	-	<5*	-					<10.0	-
GFAA Thallium (ug/l)	<7	-							<7	-							<7	-						
GFAA Antimony (ug/l)	59	-							<7	-							<7	-						
GFAA Cobalt (ug/l)	44	-							<1	-							<1	-						
ICP Beryllium (ug/l)	13*	-					<0.5	-	<1*	-					<0.5	-	<1*	-					<0.5	-
ICP Lead (ug/l)	5.2*	-					<3.0	-	<3*	-					<3.0	-	<3*	-					<3.0	-
ICP Zinc (ug/l)	30	-					10	-	5	-					14	-	11	-					10	-
Mercury (ug/l)	<.2	-					<0.05	-	<.2	-					<0.05	-	<.2	-					<0.05	-
GFAA Silver (ug/l)	8.2	-					<1.0	-	<1	-					<1.0	-	<1	-					<1.0	-
pH (s.u.)	8	-					7.85	-	8.1	-					8.2	-	7.7	-					7.7	-
Field Conductivity (mS/cm)	1.3	-	1	-	0.9	-	1	-	1.4	-	1.4	-	1.2	-	0.6	-	1	-			0.7	-	0.8	-
Field D.O. (mg/L)	9.7	-	8.6	-	15	-	6.3	-	10	-	10	-	14	-	7.1	-	10	-			13	-	6.8	-
Field Temperature (°C)	21	-	19	-	6	-	19	-	17	-	16	-	8	-	17	-	17	-			7.5	-	18	-
Field pH (s.u.)			7.8	-	7.8	-	7.2	-			8.2	-	8.3	-	7.4	-					8.3	-	7.6	-
=> criterion																								
* = GFAA																								

Site Number and Water Body Use Designation		Cuyahoga River #20 LRW-NM, IWS, & PCR							
Sample Number		R00-0371 8/31/00		R00-0403 10/31/00		R01-0052 7/24/01		R02-0229 9/10/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)							<2.0	-
COD	(mg/L)							<10.0	-
Suspended Solids	(mg/L)							7.2	-
Dissolved Solids	(mg/L)							473	-
Total Solids	(mg/L)							522	-
Total Phosphorus	(mg/L)							0.194	-
Soluble Phosphorus	(mg/L)							0.018	-
Ammonia-N	(mg/L)							0.28	-
Nitrite	(mg/L)							0.07	-
Nitrate	(mg/L)							5.47	-
Alkalinity	(mg/L)							114	-
Sulfates	(mg/L)								
E. coli	(Col/100 mL)	72	-	40	-	~20	-	47	-
Fecal Coliform	(Col/100 mL)							91	-
Turbidity	(NTU)							6.5	-
Conductance	micrmhos								
Hardness	(mg/L)							213	-
ICP Nickel	(ug/l)							6	-
ICP Copper	(ug/l)							6	-
ICP Chromium	(ug/l)							2	-
Hexavalent Chromium	(ug/l)							<10.0	-
ICP Iron	(ug/l)							433	-
ICP Cadmium	(ug/l)							<1.0	-
ICP Silver	(ug/l)							<2.0	-
ICP Arsenic	(ug/l)							5	-
ICP Selenium	(ug/l)							<10.0	-
ICP Beryllium	(ug/l)							<0.5	-
ICP Lead	(ug/l)							4.5	-
ICP Zinc	(ug/l)							39.5	-
Mercury	(ug/l)							<0.05	-
GFAA Nickel	(ug/l)								
GFAA Copper	(ug/l)								
GFAA Chromium	(ug/l)								
GFAA Cadmium	(ug/l)								
GFAA Selenium	(ug/l)								
GFAA Thallium	(ug/l)								
GFAA Antimony	(ug/l)								
GFAA Cobalt	(ug/l)								
GFAA Lead	(ug/l)								
GFAA Silver	(ug/l)							<1.0	-
GFAA Arsenic	(ug/l)								
GFAA Beryllium	(ug/l)								
pH	(s.u.)							7.55	-
Field Conductivity	(mS/cm)	0.6	-	0.8	-	0.9	-	0.6	-
Field D.O.	(mg/L)	4.1	-	5.4	-	4	-	3.1	-
Field Temperature	(°C)	26	-	18	-	28	-	25	-
Field pH	(s.u.)	7.6	-	7.4	-	7.7	-	7.4	-
= > criterion									

Site Number and Water Body Use Designation		Cuyahoga River #21 LRW-NM, IWS, & PCR							
Sample Number		R00-0370 8/31/00		R00-0402 10/31/00		R01-0051 7/24/01		R02-0230 9/10/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)							<2.0	-
COD	(mg/L)							12	-
Suspended Solids	(mg/L)							7.6	-
Dissolved Solids	(mg/L)							564	-
Total Solids	(mg/L)							630	-
Total Phosphorus	(mg/L)							0.237	-
Soluble Phosphorus	(mg/L)							0.22	-
Ammonia-N	(mg/L)							0.34	-
Nitrite	(mg/L)							0.08	-
Nitrate	(mg/L)							7.19	-
Alkalinity	(mg/L)							125	-
Sulfates	(mg/L)								
E. coli	(Col/100 mL)	52	-	55	-	42	-	46	-
Fecal Coliform	(Col/100 mL)							51	-
Turbidity	(NTU)							6.5	-
Conductance	micrmhos								
Hardness	(mg/L)							244	-
ICP Nickel	(ug/l)							9	-
ICP Copper	(ug/l)							7	-
ICP Chromium	(ug/l)							3	-
Hexavalent Chromium	(ug/l)							<10.0	-
ICP Iron	(ug/l)							437	-
ICP Cadmium	(ug/l)							<1.0	-
ICP Silver	(ug/l)							<2.0	-
ICP Arsenic	(ug/l)							6	-
ICP Selenium	(ug/l)							<10.0	-
ICP Beryllium	(ug/l)							<0.5	-
ICP Lead	(ug/l)							5	-
ICP Zinc	(ug/l)							49	-
Mercury	(ug/l)							<0.05	-
GFAA Nickel	(ug/l)								
GFAA Copper	(ug/l)								
GFAA Chromium	(ug/l)								
GFAA Cadmium	(ug/l)								
GFAA Selenium	(ug/l)								
GFAA Thallium	(ug/l)								
GFAA Antimony	(ug/l)								
GFAA Cobalt	(ug/l)								
GFAA Lead	(ug/l)								
GFAA Silver	(ug/l)							<1.0	-
GFAA Arsenic	(ug/l)								
GFAA Beryllium	(ug/l)								
pH	(s.u.)							7.5	-
Field Conductivity	(mS/cm)	0.8	-	0.8	-	0.9	-	0.8	-
Field D.O.	(mg/L)	3.6	-	5.5	-	3.5	-	2.4	-
Field Temperature	(°C)	28	-	17	-	28	-	26	-
Field pH	(s.u.)	7.6	-	7.4	-	7.7	-	7.1	-

Site Number and Water Body Use Designation		Cuyahoga River #22 LRW-NM, IWS, & PCR							
Sample Number		R00-0369 8/31/00		R00-0401 10/31/00		R01-0050 7/24/01		R02-0231 9/10/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)							2	-
COD	(mg/L)							14	-
Suspended Solids	(mg/L)							9.3	-
Dissolved Solids	(mg/L)							576	-
Total Solids	(mg/L)							660	-
Total Phosphorus	(mg/L)							0.319	-
Soluble Phosphorus	(mg/L)							0.29	-
Ammonia-N	(mg/L)							0.44	-
Nitrite	(mg/L)							0.1	-
Nitrate	(mg/L)							8.4	-
Alkalinity	(mg/L)							133	-
Sulfates	(mg/L)								
E. coli	(Col/100 mL)	50	-	53	-	360	PCU (298)	37	-
Fecal Coliform	(Col/100 mL)							46	-
Turbidity	(NTU)							8.5	-
Conductance	micrmhos								
Hardness	(mg/L)							258	-
ICP Nickel	(ug/l)							13	-
ICP Copper	(ug/l)							8	-
ICP Chromium	(ug/l)							3	-
Hexavalent Chromium	(ug/l)							<10.0	-
ICP Iron	(ug/l)							543	-
ICP Cadmium	(ug/l)							<1.0	-
ICP Silver	(ug/l)							<2.0	-
ICP Arsenic	(ug/l)							7	-
ICP Selenium	(ug/l)							<10.0	-
ICP Beryllium	(ug/l)							<0.5	-
ICP Lead	(ug/l)							5	-
ICP Zinc	(ug/l)							79	-
Mercury	(ug/l)							<0.05	-
GFAA Nickel	(ug/l)								
GFAA Copper	(ug/l)								
GFAA Chromium	(ug/l)								
GFAA Cadmium	(ug/l)								
GFAA Selenium	(ug/l)								
GFAA Thallium	(ug/l)								
GFAA Antimony	(ug/l)								
GFAA Cobalt	(ug/l)								
GFAA Lead	(ug/l)								
GFAA Silver	(ug/l)							<1.0	-
GFAA Arsenic	(ug/l)								
GFAA Beryllium	(ug/l)								
pH	(s.u.)							7.5	-
Field Conductivity	(mS/cm)	0.8	-	0.8	-	0.8	-	0.8	-
Field D.O.	(mg/L)	5.2	-	6.3	-	6.8	-	3.4	-
Field Temperature	(°C)	27	-	16	-	30	-	27	-
Field pH	(s.u.)	7.7	-	7.5	-	7.7	-	7.1	-

Site Number and Water Body Use Designation: Cuyahoga River #22.5 LRW-NM, IWS, & PCR

Sample Number		R00-0368 8/31/00		R00-0400 10/31/00		R01-0049 7/24/01		R02-0232 9/10/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)							2.7	-
COD	(mg/L)							17	-
Suspended Solids	(mg/L)							21.7	-
Dissolved Solids	(mg/L)							577	-
Total Solids	(mg/L)							668	-
Total Phosphorus	(mg/L)							0.495	-
Soluble Phosphorus	(mg/L)							0.42	-
Ammonia-N	(mg/L)							0.25	-
Nitrite	(mg/L)							0.08	-
Nitrate	(mg/L)							10.7	-
Alkalinity	(mg/L)							130	-
Sulfates	(mg/L)								
E. coli	(Col/100 mL)	360	PCU (298)	140	-	~1300	PCU (298)	74	-
Fecal Coliform	(Col/100 mL)							110	-
Turbidity	(NTU)							18	-
Conductance	micrmhos								
Hardness	(mg/L)							264	-
ICP Nickel	(ug/l)							12	-
ICP Copper	(ug/l)							10	-
ICP Chromium	(ug/l)							3	-
Hexavalent Chromium	(ug/l)							<10.0	-
ICP Iron	(ug/l)							1150	-
ICP Cadmium	(ug/l)							<1.0	-
ICP Silver	(ug/l)							<2.0	-
ICP Arsenic	(ug/l)							6	-
ICP Selenium	(ug/l)							<10.0	-
ICP Beryllium	(ug/l)							<0.5	-
ICP Lead	(ug/l)							6	-
ICP Zinc	(ug/l)							43	-
Mercury	(ug/l)							<0.05	-
GFAA Nickel	(ug/l)								
GFAA Copper	(ug/l)								
GFAA Chromium	(ug/l)								
GFAA Cadmium	(ug/l)								
GFAA Selenium	(ug/l)								
GFAA Thallium	(ug/l)								
GFAA Antimony	(ug/l)								
GFAA Cobalt	(ug/l)								
GFAA Lead	(ug/l)								
GFAA Silver	(ug/l)							<1.0	-
GFAA Arsenic	(ug/l)								
GFAA Beryllium	(ug/l)								
pH	(s.u.)							7.65	-
Field Conductivity	(mS/cm)	0.8	-	0.7	-	0.8	-	0.8	-
Field D.O.	(mg/L)	7.7	-	7.2	-	6.9	-	5.9	-
Field Temperature	(°C)	25	-	13	-	27	-	26	-
Field pH	(s.u.)	7.8	-	7.5	-	7.8	-	7.5	-

Site Number and Water Body Use Designation: Cuyahoga River #22.51 SWR, WWH, AWS,IWS, & PCR

Sample Number		R99-0060 5/4/99		R00-0367 8/31/00		R00-0399 10/31/00		R01-0048 7/24/01		R02-0233 9/10/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)	3	-							<2.0	-
COD	(mg/L)	23	-							16	-
Suspended Solids	(mg/L)	14	-							16	-
Dissolved Solids	(mg/L)	620	-							571	-
Total Solids	(mg/L)	630	-							653	-
Total Phosphorus	(mg/L)	0.19	-							0.459	-
Soluble Phosphorus	(mg/L)	0.14	-							0.43	-
Ammonia-N	(mg/L)	0.12	-							0.11	-
Nitrite	(mg/L)	0.04	-							0.06	-
Nitrate	(mg/L)	5.7	-							9.95	-
Alkalinity	(mg/L)	1.4	-							131	-
Sulfates	(mg/L)	96	-								
E. coli	(Col/100 mL)	~34	-	270	-	130	-	~1200	PCU (298)	150	-
Fecal Coliform	(Col/100 mL)	64	-							300	-
Turbidity	(NTU)	5.5	-							11	-
Conductance	micrmhos	468	-								
Hardness	(mg/L)	222	-							260	-
ICP Nickel	(ug/l)									10	-
ICP Copper	(ug/l)									10	-
ICP Chromium	(ug/l)									3	-
Hexavalent Chromium	(ug/l)	<10	-							<10.0	-
ICP Iron	(ug/l)	594	-							767	-
ICP Cadmium	(ug/l)									<1.0	-
ICP Silver	(ug/l)									<2.0	-
ICP Arsenic	(ug/l)									6	-
ICP Selenium	(ug/l)									<10.0	-
ICP Beryllium	(ug/l)									<0.5	-
ICP Lead	(ug/l)									5	-
ICP Zinc	(ug/l)	41	-							51	-
Mercury	(ug/l)	<.2	-							<0.05	-
GFAA Nickel	(ug/l)	8	-								
GFAA Copper	(ug/l)	6.8	-								
GFAA Chromium	(ug/l)	7.9	-								
GFAA Cadmium	(ug/l)	<1	-								
GFAA Selenium	(ug/l)	<5	-								
GFAA Thallium	(ug/l)	<7	-								
GFAA Antimony	(ug/l)	<7	-								
GFAA Cobalt	(ug/l)	<1	-								
GFAA Lead	(ug/l)	<3	-								
GFAA Silver	(ug/l)	<1	-							<1.0	-
GFAA Arsenic	(ug/l)	<5	-								
GFAA Beryllium	(ug/l)	<1	-								
pH	(s.u.)									7.6	-
Field Conductivity	(mS/cm)	0.9	-	0.8	-	0.6	-	1	-	0.8	-
Field D.O.	(mg/L)	8.2	-	7.7	-	7.7	-	6.8	-	6.5	-
Field Temperature	(°C)	17	-	24	-	12	-	28	-	24	-
Field pH	(s.u.)			7.8	-	7.5	-	7.8	-	7.6	-

Site Number and Water Body Use Designation: Cuyahoga River #22.6 WWH, AWS,IWS, & PCR

Sample Number		R00-0366 8/31/00		R00-0398 10/31/00		R01-0047 7/24/01		R02-0234 9/10/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)							2.3	-
COD	(mg/L)							14	-
Suspended Solids	(mg/L)							33.4	-
Dissolved Solids	(mg/L)							574	-
Total Solids	(mg/L)							675	-
Total Phosphorus	(mg/L)							0.474	-
Soluble Phosphorus	(mg/L)							0.41	-
Ammonia-N	(mg/L)							0.1	-
Nitrite	(mg/L)							0.05	-
Nitrate	(mg/L)							9.34	-
Alkalinity	(mg/L)							133	-
Sulfates	(mg/L)								
E. coli	(Col/100 mL)	260	-	170	-	~1300	PCU (298)	320	PCU (298)
Fecal Coliform	(Col/100 mL)							440	-
Turbidity	(NTU)							16	-
Conductance	micrmhos								
Hardness	(mg/L)							269	-
ICP Nickel	(ug/l)							8	-
ICP Copper	(ug/l)							12	-
ICP Chromium	(ug/l)							3	-
Hexavalent Chromium	(ug/l)							<10.0	-
ICP Iron	(ug/l)							1320	-
ICP Cadmium	(ug/l)							<1.0	-
ICP Silver	(ug/l)							<2.0	-
ICP Arsenic	(ug/l)							6	-
ICP Selenium	(ug/l)							<10.0	-
ICP Beryllium	(ug/l)							<0.5	-
ICP Lead	(ug/l)							6	-
ICP Zinc	(ug/l)							41	-
Mercury	(ug/l)							<0.05	-
GFAA Nickel	(ug/l)								
GFAA Copper	(ug/l)								
GFAA Chromium	(ug/l)								
GFAA Cadmium	(ug/l)								
GFAA Selenium	(ug/l)								
GFAA Thallium	(ug/l)								
GFAA Antimony	(ug/l)								
GFAA Cobalt	(ug/l)								
GFAA Lead	(ug/l)								
GFAA Silver	(ug/l)							<1.0	-
GFAA Arsenic	(ug/l)								
GFAA Beryllium	(ug/l)								
pH	(s.u.)							7.6	-
Field Conductivity	(mS/cm)	0.8	-	0.6	-	0.9	-	0.8	-
Field D.O.	(mg/L)	7.7	-	7.5	-	6.7	-	6.7	-
Field Temperature	(°C)	24	-	12	-	27	-	24	-
Field pH	(s.u.)	7.9	-	7.6	-	7.7	-	7.5	-

= > criterion

Site Number and Water Body Use Designation		Cuyahoga River #22.7 WWH, AWS,IWS, & PCR							
Sample Number		R00-0364 8/31/00		R00-0397 10/31/00		R01-0046 7/24/01		R02-0240 9/10/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)					5	-	2.5	-
COD	(mg/L)					31	-	13	-
Suspended Solids	(mg/L)					36.7	-	12.1	-
Dissolved Solids	(mg/L)					593	-	596	-
Total Solids	(mg/L)					660	-	704	-
Total Phosphorus	(mg/L)					0.394	-	0.475	-
Soluble Phosphorus	(mg/L)					0.33	-	0.48	-
Ammonia-N	(mg/L)					0.09	-	0.12	-
Nitrite	(mg/L)					0.09	-	0.04	-
Nitrate	(mg/L)					7.58	-	11.1	-
Alkalinity	(mg/L)					122	-	125	-
Sulfates	(mg/L)					88	-		
E. coli	(Col/100 mL)	200	-	110	-	~1400	PCU (298)	65	-
Fecal Coliform	(Col/100 mL)					~3000	PCU (2000)	130	-
Turbidity	(NTU)					11	-	6.3	-
Conductance	micrmhos								
Hardness	(mg/L)					245	-	253	-
ICP Nickel	(ug/l)							9	-
ICP Copper	(ug/l)							8	-
ICP Chromium	(ug/l)							3	-
Hexavalent Chromium	(ug/l)					<10	-	<10.0	-
ICP Iron	(ug/l)					1500	-	482	-
ICP Cadmium	(ug/l)							<1.0	-
ICP Silver	(ug/l)							<2.0	-
ICP Arsenic	(ug/l)							7	-
ICP Selenium	(ug/l)							<10.0	-
ICP Beryllium	(ug/l)					<0.500	-	<0.5	-
ICP Lead	(ug/l)							5	-
ICP Zinc	(ug/l)					32	-	40	-
Mercury	(ug/l)					<0.0500	-	<0.05	-
GFAA Nickel	(ug/l)					8.1	-		
GFAA Copper	(ug/l)					8.14	-		
GFAA Chromium	(ug/l)					2.6	-		
GFAA Cadmium	(ug/l)					<1.00	-		
GFAA Selenium	(ug/l)					<5.0	-		
GFAA Thallium	(ug/l)					<7.0	-		
GFAA Antimony	(ug/l)					<7.0	-		
GFAA Cobalt	(ug/l)								
GFAA Lead	(ug/l)					<3.0	-		
GFAA Silver	(ug/l)					<1.00	-	<1.0	-
GFAA Arsenic	(ug/l)					<5.00	-		
GFAA Beryllium	(ug/l)								
pH	(s.u.)					7.5	-	7.7	-
Field Conductivity	(mS/cm)	0.8	-	0.7	-			1	-
Field D.O.	(mg/L)	8	-	8.5	-				
Field Temperature	(°C)	24	-	12	-			24	-
Field pH	(s.u.)	7.8	-	7.3	-			7.4	-

Site Number and Water Body Use Designation		Cuyahoga River #22.8 WWH, AWS,IWS, & PCR							
Sample Number		R00-0363 8/31/00		R00-0396 10/31/00		R01-0045 7/24/01		R02-0239 9/10/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)					4.4	-	<2.0	-
COD	(mg/L)					25	-	<10.0	-
Suspended Solids	(mg/L)					49.3	-	17.1	-
Dissolved Solids	(mg/L)					576	-	559	-
Total Solids	(mg/L)					648	-	737	-
Total Phosphorus	(mg/L)					0.282	-	0.219	-
Soluble Phosphorus	(mg/L)					0.2	-	0.21	-
Ammonia-N	(mg/L)					0.07	-	0.05	-
Nitrite	(mg/L)					0.07	-	0.03	-
Nitrate	(mg/L)					3.66	-	5.61	-
Alkalinity	(mg/L)					129	-	157	-
Sulfates	(mg/L)					85	-		
E. coli	(Col/100 mL)	300	PCU (298)	150	-	~1600	PCU (298)	82	-
Fecal Coliform	(Col/100 mL)					~3000	PCU (2000)	200	-
Turbidity	(NTU)					16	-	9.2	-
Conductance	micrmhos								
Hardness	(mg/L)					241	-	288	-
ICP Nickel	(ug/l)							3	-
ICP Copper	(ug/l)							8.5	-
ICP Chromium	(ug/l)							1.5	-
Hexavalent Chromium	(ug/l)					<10	-	5	-
ICP Iron	(ug/l)					1980	-	776	-
ICP Cadmium	(ug/l)							<1.0	-
ICP Silver	(ug/l)							<2.0	-
ICP Arsenic	(ug/l)							5.5	-
ICP Selenium	(ug/l)							<10.0	-
ICP Beryllium	(ug/l)					<0.500	-	<0.5	-
ICP Lead	(ug/l)							5	-
ICP Zinc	(ug/l)					28	-	43	-
Mercury	(ug/l)					<0.0500	-	<0.05	-
GFAA Nickel	(ug/l)					7.6	-		
GFAA Copper	(ug/l)					11.1	-		
GFAA Chromium	(ug/l)					2.3	-		
GFAA Cadmium	(ug/l)					<1.00	-		
GFAA Selenium	(ug/l)					<5.0	-		
GFAA Thallium	(ug/l)					<7.0	-		
GFAA Antimony	(ug/l)					<7.00	-		
GFAA Cobalt	(ug/l)								
GFAA Lead	(ug/l)					<3.0	-		
GFAA Silver	(ug/l)					<1.00	-	<1.0	-
GFAA Arsenic	(ug/l)					<5.00	-		
GFAA Beryllium	(ug/l)								
pH	(s.u.)					7.6	-	7.8	-
Field Conductivity	(mS/cm)	0.7	-	0.6	-			0.8	-
Field D.O.	(mg/L)	7.8	-	9	-				
Field Temperature	(°C)	24	-	10	-			23	-
Field pH	(s.u.)	8.1	-	7.4	-			7.3	-

Site Number and Water Body Use Designation		Cuyahoga River #22.9 WWH, AWS,IWS, & PCR							
Sample Number		R00-0362 8/31/00		R00-0395 10/31/00		R01-0044 7/24/01		R02-0238 9/10/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)							<2.0	-
COD	(mg/L)							12	-
Suspended Solids	(mg/L)							14.2	-
Dissolved Solids	(mg/L)							599	-
Total Solids	(mg/L)							685	-
Total Phosphorus	(mg/L)							0.219	-
Soluble Phosphorus	(mg/L)							0.21	-
Ammonia-N	(mg/L)							0.06	-
Nitrite	(mg/L)							0.03	-
Nitrate	(mg/L)							5.51	-
Alkalinity	(mg/L)							153	-
Sulfates	(mg/L)								
E. coli	(Col/100 mL)	230	-	190	-	~1300	PCU (298)	81	-
Fecal Coliform	(Col/100 mL)							200	-
Turbidity	(NTU)							10	-
Conductance	micrmhos								
Hardness	(mg/L)							293	-
ICP Nickel	(ug/l)							3	-
ICP Copper	(ug/l)							7	-
ICP Chromium	(ug/l)							1	-
Hexavalent Chromium	(ug/l)							<10.0	-
ICP Iron	(ug/l)							718	-
ICP Cadmium	(ug/l)							<1.0	-
ICP Silver	(ug/l)							<2.0	-
ICP Arsenic	(ug/l)							6	-
ICP Selenium	(ug/l)							<10.0	-
ICP Beryllium	(ug/l)							<0.5	-
ICP Lead	(ug/l)							5	-
ICP Zinc	(ug/l)							32	-
Mercury	(ug/l)							<0.05	-
GFAA Nickel	(ug/l)								
GFAA Copper	(ug/l)								
GFAA Chromium	(ug/l)								
GFAA Cadmium	(ug/l)								
GFAA Selenium	(ug/l)								
GFAA Thallium	(ug/l)								
GFAA Antimony	(ug/l)								
GFAA Cobalt	(ug/l)								
GFAA Lead	(ug/l)								
GFAA Silver	(ug/l)							<1.0	-
GFAA Arsenic	(ug/l)								
GFAA Beryllium	(ug/l)								
pH	(s.u.)							8	-
Field Conductivity	(mS/cm)	0.7	-	0.6	-			1.1	-
Field D.O.	(mg/L)	7.9	-	9	-				
Field Temperature	(°C)	23	-	10	-			23	-
Field pH	(s.u.)	8	-	7.4	-			7.2	-

= > criterion

Site Number and Water Body Use Designation		Cuyahoga River #23 WWH, AWS,IWS, & PCR							
Sample Number		R00-0361 8/31/00		R00-0394 10/31/00		R01-0043 7/24/01		R02-0237 9/10/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)							<2.0	-
COD	(mg/L)							10	-
Suspended Solids	(mg/L)							12.3	-
Dissolved Solids	(mg/L)							628	-
Total Solids	(mg/L)							666	-
Total Phosphorus	(mg/L)							0.259	-
Soluble Phosphorus	(mg/L)							0.25	-
Ammonia-N	(mg/L)							0.03	-
Nitrite	(mg/L)							0.03	-
Nitrate	(mg/L)							6.39	-
Alkalinity	(mg/L)							155	-
Sulfates	(mg/L)								
E. coli	(Col/100 mL)	300	-	170	-	760	PCU (298)	100	-
Fecal Coliform	(Col/100 mL)							180	-
Turbidity	(NTU)							9	-
Conductance	micrmhos								
Hardness	(mg/L)							280	-
ICP Nickel	(ug/l)							2	-
ICP Copper	(ug/l)							7	-
ICP Chromium	(ug/l)							1	-
Hexavalent Chromium	(ug/l)							<10.0	-
ICP Iron	(ug/l)							745	-
ICP Cadmium	(ug/l)							<1.0	-
ICP Silver	(ug/l)							<2.0	-
ICP Arsenic	(ug/l)							5	-
ICP Selenium	(ug/l)							<10.0	-
ICP Beryllium	(ug/l)							<0.5	-
ICP Lead	(ug/l)							5	-
ICP Zinc	(ug/l)							34	-
Mercury	(ug/l)							<0.05	-
GFAA Nickel	(ug/l)								
GFAA Copper	(ug/l)								
GFAA Chromium	(ug/l)								
GFAA Cadmium	(ug/l)								
GFAA Selenium	(ug/l)								
GFAA Thallium	(ug/l)								
GFAA Antimony	(ug/l)								
GFAA Cobalt	(ug/l)								
GFAA Lead	(ug/l)								
GFAA Silver	(ug/l)							<1.0	-
GFAA Arsenic	(ug/l)								
GFAA Beryllium	(ug/l)								
pH	(s.u.)							7.9	-
Field Conductivity	(mS/cm)	0.6	-	0.6	-			0.9	-
Field D.O.	(mg/L)	8	-	9.8	-				
Field Temperature	(°C)	23	-	10	-			23	-
Field pH	(s.u.)	8.1	-	7.2	-			7.5	-

Site Number and Water Body Use Designation		Cuyahoga River #24 WWH, AWS,IWS, & PCR							
Sample Number		R00-0360 8/31/00		R00-0393 10/31/00		R01-0042 7/24/01		R02-0236 9/10/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)							<2.0	-
COD	(mg/L)							<10.0	-
Suspended Solids	(mg/L)							6.4	-
Dissolved Solids	(mg/L)							587	-
Total Solids	(mg/L)							687	-
Total Phosphorus	(mg/L)							0.328	-
Soluble Phosphorus	(mg/L)							0.33	-
Ammonia-N	(mg/L)							0.04	-
Nitrite	(mg/L)							0.03	-
Nitrate	(mg/L)							6.19	-
Alkalinity	(mg/L)							154	-
Sulfates	(mg/L)								
E. coli	(Col/100 mL)	310	PCU (298)	310		130		120	-
Fecal Coliform	(Col/100 mL)							220	-
Turbidity	(NTU)							5.5	-
Conductance	micrmhos								
Hardness	(mg/L)							284	-
ICP Nickel	(ug/l)							1	-
ICP Copper	(ug/l)							7	-
ICP Chromium	(ug/l)							1	-
Hexavalent Chromium	(ug/l)							<10.0	-
ICP Iron	(ug/l)							460	-
ICP Cadmium	(ug/l)							<1.0	-
ICP Silver	(ug/l)							<2.0	-
ICP Arsenic	(ug/l)							6	-
ICP Selenium	(ug/l)							<10.0	-
ICP Beryllium	(ug/l)							<0.5	-
ICP Lead	(ug/l)							4	-
ICP Zinc	(ug/l)							33	-
Mercury	(ug/l)							<0.05	-
GFAA Nickel	(ug/l)								
GFAA Copper	(ug/l)								
GFAA Chromium	(ug/l)								
GFAA Cadmium	(ug/l)								
GFAA Selenium	(ug/l)								
GFAA Thallium	(ug/l)								
GFAA Antimony	(ug/l)								
GFAA Cobalt	(ug/l)								
GFAA Lead	(ug/l)								
GFAA Silver	(ug/l)							<1.0	-
GFAA Arsenic	(ug/l)								
GFAA Beryllium	(ug/l)								
pH	(s.u.)							7.8	-
Field Conductivity	(mS/cm)	0.6	-	0.6	-			0.4	-
Field D.O.	(mg/L)	7.3	-	9.5	-				
Field Temperature	(°C)	22	-	10	-			22	-
Field pH	(s.u.)	7.6	-	7.1	-			6.5	-

Site Number and Water Body Use Designation		Cuyahoga River #24.5 WWH, AWS,IWS, & PCR							
Sample Number		R00-0359 8/31/00		R00-0392 10/31/00		R01-0041 7/24/01		R02-0235 9/10/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)							2.3	-
COD	(mg/L)							<10.0	-
Suspended Solids	(mg/L)							6.6	-
Dissolved Solids	(mg/L)							640	-
Total Solids	(mg/L)							683	-
Total Phosphorus	(mg/L)							0.586	-
Soluble Phosphorus	(mg/L)							0.57	-
Ammonia-N	(mg/L)							0.08	-
Nitrite	(mg/L)							0.03	-
Nitrate	(mg/L)							7.45	-
Alkalinity	(mg/L)							154	-
Sulfates	(mg/L)								
E. coli	(Col/100 mL)	390	PCU (298)	280	-	280	-	340	PCU (298)
Fecal Coliform	(Col/100 mL)							~1300	-
Turbidity	(NTU)							4.8	-
Conductance	micrmhos								
Hardness	(mg/L)							278	-
ICP Nickel	(ug/l)							1	-
ICP Copper	(ug/l)							6	-
ICP Chromium	(ug/l)							1	-
Hexavalent Chromium	(ug/l)							<10.0	-
ICP Iron	(ug/l)							388	-
ICP Cadmium	(ug/l)							<1.0	-
ICP Silver	(ug/l)							<2.0	-
ICP Arsenic	(ug/l)							5	-
ICP Selenium	(ug/l)							<10.0	-
ICP Beryllium	(ug/l)							<0.5	-
ICP Lead	(ug/l)							4	-
ICP Zinc	(ug/l)							36	-
Mercury	(ug/l)							<0.05	-
GFAA Nickel	(ug/l)								
GFAA Copper	(ug/l)								
GFAA Chromium	(ug/l)								
GFAA Cadmium	(ug/l)								
GFAA Selenium	(ug/l)								
GFAA Thallium	(ug/l)								
GFAA Antimony	(ug/l)								
GFAA Cobalt	(ug/l)								
GFAA Lead	(ug/l)								
GFAA Silver	(ug/l)							<1.0	-
GFAA Arsenic	(ug/l)								
GFAA Beryllium	(ug/l)								
pH	(s.u.)							7.6	-
Field Conductivity	(mS/cm)	0.7	-	0.6	-			1	-
Field D.O.	(mg/L)	7.4	-	9.8	-				
Field Temperature	(°C)	22	-	11	-			21	-
Field pH	(s.u.)	7.6	-	7	-			6.5	-

= > criterion

Site Number and Water Body Use Designation		Doan Brook #16 WWH, AWS,IWS, & PCR					
Sample Number		R99-0096 5/17/99		R00-0342 8/14/00		R02-0073 6/20/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)	18	-			25.8	-
COD	(mg/L)	55	-			147	-
Suspended Solids	(mg/L)	13	-			1.4	-
Dissolved Solids	(mg/L)	1000	-			557	-
Total Solids	(mg/L)	1000	-			558	-
Total Phosphorus	(mg/L)	0.33	-			0.388	-
Soluble Phosphorus	(mg/L)	0.13	-			0.22	-
Ammonia-N	(mg/L)	0.18	-			0.07	-
Nitrite	(mg/L)	0.06	-			0.03	-
Nitrate	(mg/L)	0.76	-			0.86	-
TKN	(mg/L)	1.8	-				
Alkalinity	(mg/L)	192	-			130	-
Chloride	(mg/L)	400	-				
Sulfates	(mg/L)	100	-			45	-
E. coli	(Col/100 mL)	370	PCU (298)	170	-	500	PCU (298)
Fecal Coliform	(Col/100 mL)	420	-			700	-
Turbidity	(NTU)	4.5	-			1.8	-
Conductance	micrmhos						
Hardness	(mg/L)	354	-			212	-
ICP Nickel	(ug/l)	25*	-			1.5	-
ICP Copper	(ug/l)	20*	-			6.5	-
ICP Chromium	(ug/l)	10*	-			3.5	-
Hexavalent Chromium	(ug/l)	<10	-			<10.0	-
ICP Iron	(ug/l)	946	-			496	-
ICP Cadmium	(ug/l)	7.7*	-			<1.0	-
ICP Silver	(ug/l)					<2.0	-
ICP Arsenic	(ug/l)	7.3*	-			<2.0	-
ICP Selenium	(ug/l)	11*	-			14.5	-
GFAA Thallium	(ug/l)	<7	-				
GFAA Antimony	(ug/l)	56	-				
GFAA Cobalt	(ug/l)	48	-				
ICP Beryllium	(ug/l)	14*	-			<0.5	-
ICP Lead	(ug/l)	15*	-			<3.0	-
ICP Zinc	(ug/l)	160	-			27.5	-
Mercury	(ug/l)	<.2	-			<0.05	-
GFAA Silver	(ug/l)	8.6	-			<1.0	-
pH	(s.u.)	7.5	-			7.6	-
Field Conductivity	(mS/cm)	1.6	-	0.6	-	0.6	-
Field D.O.	(mg/L)	5.4	-	7.6	-	4	-
Field Temperature	(°C)	17	-	24	-	20	-
Field pH	(s.u.)			7.5	-	7.4	-

Site Number and Water Body Use Designation		Doan Brook #17 WWH, AWS,IWS, & PCR					
Sample Number		R99-0097 5/17/99		R00-0343 8/14/00		R02-0074 6/20/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)	<2	-			<2.0	-
COD	(mg/L)	<10	-			<10.0	-
Suspended Solids	(mg/L)	1.2	-			8.6	-
Dissolved Solids	(mg/L)	500	-			509	-
Total Solids	(mg/L)	550	-			669	-
Total Phosphorus	(mg/L)	0.24	-			0.217	-
Soluble Phosphorus	(mg/L)	0.24	-			0.2	-
Ammonia-N	(mg/L)	0.18	-			0.07	-
Nitrite	(mg/L)	0.07	-			0.03	-
Nitrate	(mg/L)	1	-			0.79	-
TKN	(mg/L)	0.66	-				
Alkalinity	(mg/L)	118	-			130	-
Chloride	(mg/L)	180	-				
Sulfates	(mg/L)	73	-			58	-
E. coli	(Col/100 mL)	~1800	PCU (298)	350	PCU (298)	280	-
Fecal Coliform	(Col/100 mL)	~1900	-			500	-
Turbidity	(NTU)	1.5	-			0.93	-
Conductance	micrmhos						
Hardness	(mg/L)	229	-			228	-
ICP Nickel	(ug/l)	18*	-			2	-
ICP Copper	(ug/l)	22*	-			11	-
ICP Chromium	(ug/l)	9.2*	-			4	-
Hexavalent Chromium	(ug/l)	<10	-			<10.0	-
ICP Iron	(ug/l)	267	-			159	-
ICP Cadmium	(ug/l)	6.7*	-			<1.0	-
ICP Silver	(ug/l)					<2.0	-
ICP Arsenic	(ug/l)	7.3*	-			3	-
ICP Selenium	(ug/l)	6.4*	-			13	-
GFAA Thallium	(ug/l)	7.8	-				
GFAA Antimony	(ug/l)	61	-				
GFAA Cobalt	(ug/l)	42	-				
ICP Beryllium	(ug/l)	10*	-			<0.5	-
ICP Lead	(ug/l)	8.3*	-			<3.0	-
ICP Zinc	(ug/l)	34	-			41	-
Mercury	(ug/l)	<.2	-			<0.05	-
GFAA Silver	(ug/l)	8.5	WHAL (6.6)			<1.0	-
pH	(s.u.)	7.7	-			7.7	-
Field Conductivity	(mS/cm)	0.8	-	0.7	-	1	-
Field D.O.	(mg/L)	8.7	-	7.8	-	5.8	-
Field Temperature	(°C)	16	-	22	-	18	-
Field pH	(s.u.)			8.2	-	7.3	-

Site Number and Water Body Use Designation		Doan Brook #18 WWH, AWS,IWS, & PCR					
Sample Number		R99-0098 5/17/99		R00-0344 8/14/00		R02-0075 6/20/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)	<2	-			<2.0	-
COD	(mg/L)	14	-			<10.0	-
Suspended Solids	(mg/L)	4.4	-			3.1	-
Dissolved Solids	(mg/L)	440	-			412	-
Total Solids	(mg/L)	470	-			444	-
Total Phosphorus	(mg/L)	0.29	-			0.18	-
Soluble Phosphorus	(mg/L)	0.27	-			0.17	-
Ammonia-N	(mg/L)	0.15	-			0.07	-
Nitrite	(mg/L)	0.04	-			0.02	-
Nitrate	(mg/L)	0.37	-			0.49	-
TKN	(mg/L)	0.88	-				
Alkalinity	(mg/L)	132	-			124	-
Chloride	(mg/L)	160	-				
Sulfates	(mg/L)	44	-			20	-
E. coli	(Col/100 mL)	430	PCU (298)	120	-	140	-
Fecal Coliform	(Col/100 mL)	530	-			150	-
Turbidity	(NTU)	2.1	-			1.6	-
Conductance	micrmhos						
Hardness	(mg/L)	208	-			163	-
ICP Nickel	(ug/l)	19*	-			1	-
ICP Copper	(ug/l)	22*	-			<1.0	-
ICP Chromium	(ug/l)	9.6*	-			1	-
Hexavalent Chromium	(ug/l)	<10	-			<10.0	-
ICP Iron	(ug/l)	414	-			363	-
ICP Cadmium	(ug/l)	7.1*	-			<1.0	-
ICP Silver	(ug/l)					<2.0	-
ICP Arsenic	(ug/l)	9.2*	-			4	-
ICP Selenium	(ug/l)	6.9*	-			<10.0	-
GFAA Thallium	(ug/l)	7.3	-				-
GFAA Antimony	(ug/l)	54	-				
GFAA Cobalt	(ug/l)	43	-				
ICP Beryllium	(ug/l)	12*	-			<0.5	-
ICP Lead	(ug/l)	9.4*	-			<3.0	-
ICP Zinc	(ug/l)	34	-			7	-
Mercury	(ug/l)	<.2	-			<0.05	-
GFAA Silver	(ug/l)	8.2	WHAL (5.6)			<1.0	-
pH	(s.u.)	7.7	-			7.7	-
Field Conductivity	(mS/cm)	0.7	-	0.4	-	0.5	-
Field D.O.	(mg/L)	7.2	-	7.5	-	4.2	-
Field Temperature	(°C)	16	-	20	-	19	-
Field pH	(s.u.)			7.8	-	7.3	-

Site Number and Water Body Use Designation		Doan Brook #19 WWH, AWS,IWS, & PCR					
Sample Number		R99-0099 5/17/99		R00-0345 8/14/00		R02-0076 6/20/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)	<2	-			2.1	-
COD	(mg/L)	15	-			<10.0	-
Suspended Solids	(mg/L)	3.6	-			3.3	-
Dissolved Solids	(mg/L)	640	-			402	-
Total Solids	(mg/L)	660	-			437	-
Total Phosphorus	(mg/L)	0.13	-			0.251	-
Soluble Phosphorus	(mg/L)	0.12	-			0.24	-
Ammonia-N	(mg/L)	0.16	-			0.08	-
Nitrite	(mg/L)	0.03	-			0.01	-
Nitrate	(mg/L)	0.41	-			0.32	-
TKN	(mg/L)	0.72	-				
Alkalinity	(mg/L)	152	-			128	-
Chloride	(mg/L)	260	-				
Sulfates	(mg/L)	50	-			18	-
E. coli	(Col/100 mL)	300	PCU (298)	110	-	72	-
Fecal Coliform	(Col/100 mL)	300	-			200	-
Turbidity	(NTU)	2.5	-			1.2	-
Conductance	micrmhos						
Hardness	(mg/L)	242	-			160	-
ICP Nickel	(ug/l)	24*	-			1	-
ICP Copper	(ug/l)	22*	-			<1	-
ICP Chromium	(ug/l)	10*	-			0.5	-
Hexavalent Chromium	(ug/l)	<10	-			ENM	-
ICP Iron	(ug/l)	522	-			294	-
ICP Cadmium	(ug/l)	7*	-			<1.0	-
ICP Silver	(ug/l)					<2.0	-
ICP Arsenic	(ug/l)	7.9*	-			8	-
ICP Selenium	(ug/l)	6*	-			<10.0	-
GFAA Thallium	(ug/l)	7.7	-				-
GFAA Antimony	(ug/l)	53	-				
GFAA Cobalt	(ug/l)	41	-				
ICP Beryllium	(ug/l)	13*	-			<0.5	-
ICP Lead	(ug/l)	12*	-			3.5	-
ICP Zinc	(ug/l)	32	-			14	-
Mercury	(ug/l)	<.2	-			<0.05	-
GFAA Silver	(ug/l)	8.2	WHAL (7.3)			<1.0	-
pH	(s.u.)	7.5	-			7.6	-
Field Conductivity	(mS/cm)	1.5	-	0.2	-	0.6	-
Field D.O.	(mg/L)	6	-	7.3	-	5.6	-
Field Temperature	(°C)	16	-	21	-	19	-
Field pH	(s.u.)			7.8	-	7.5	-

= > criterion
* = GFAA
ENM = Not Measured

Site Number and Water Body Use Designation		Dugway Brook #12						Dugway Brook #13						Dugway Brook #14						Dugway Brook #15					
Sample Number		R99-0116 6/8/99		R00-0386 10/23/00		R02-0260 9/26/02		R99-0115 6/8/99		R00-0387 10/23/00		R02-0257 9/26/02		R99-0114 6/8/99		R00-0388 10/23/00		R02-0258 9/26/02		R99-0113 6/8/99		R00-0389 10/23/00		R02-0259 9/26/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)	4.8	-			12.7	-	3.8	-			3.6	-	4.4	-			2.1	-	2.5	-			27.2	-
COD	(mg/L)	31	-			44	-	30	-			18	-	31	-			14	-	21	-			62	-
Suspended Solids	(mg/L)	4	-			6.5	-	5.2	-			7.3	-	2.8	-			2.3	-	6.6	-			29.8	-
Dissolved Solids	(mg/L)	830	-			775	-	640	-			366	-	760	-			472	-	420	-			421	-
Total Solids	(mg/L)	860	-			791	-	670	-			386	-	780	-			500	-	440	-			452	-
Total Phosphorus	(mg/L)	0.33	-			0.35	-	0.35	-			0.268	-	0.5	-			0.332	-	0.35	-			1.37	-
Soluble Phosphorus	(mg/L)	0.27	-			0.26	-	0.32	-			0.23	-	0.48	-			0.33	-	0.33	-			1.4	-
Ammonia-N	(mg/L)	0.64	-			0.815	-	0.15	-			0.06	-	4.3	-			0.06	-	0.34	-			14.4	-
Nitrite	(mg/L)	0.25	-			0.32	-	0.09	-			0.06	-	0.02	-			0.06	-	0.08	-			0.02	-
Nitrate	(mg/L)	1.7	-			1.36	-	1.1	-			1.19	-	0.05	-			1.03	-	0.56	-			0.01	-
TKN	(mg/L)	1.4	-					1	-					4.3	-					0.9	-				
Alkalinity	(mg/L)	182	-			190	-	141	-			116	-	215	-			132	-	126	-			188	-
Chloride	(mg/L)	320	-					240	-					280	-					130	-				
Sulfates	(mg/L)	98	-					75	-					65	-					69	-				
E. coli	(Col/100 mL)	~15000	-	110000	-	10000	-	760	-	14	-	57	-	320	-	95	-	1100	-	680	-	230	-	88000	-
Fecal Coliform	(Col/100 mL)	~25000	-			15000	-	860	-			540	-	400	-			3300	-	980	-			97000	-
Turbidity	(NTU)	17	-			5.1	-	6	-			2.8	-	17	-			1.1	-	40	-			1.1	-
Conductance	micrmhos		-																						
Hardness	(mg/L)	270	-			264	-	213	-			145	-	311	-			197	-	170	-			177	-
ICP Nickel	(ug/l)	4.8*	-			2	-	4.6*	-			1	-	3.2*	-			1	-	3.6*	-			3	-
ICP Copper	(ug/l)	17*	-			6	-	25*	-			8	-	8.4*	-			7	-	7.8*	-			12	-
ICP Chromium	(ug/l)	17*	-			2	-	17*	-			2	-	16*	-			2	-	17*	-			2	-
Hexavalent Chromium	(ug/l)	<10	-			<10.0	-	<10	-			<10.0	-	<10	-			<10.0	-	<10	-			<10.0	-
ICP Iron	(ug/l)	984	-			813	-	533	-			514	-	794	-			144	-	810	-			591	-
ICP Cadmium	(ug/l)	<1*	-			<1.0	-	<1*	-			<1.0	-	<1*	-			<1.0	-	1.1*	-			<1.0	-
ICP Silver	(ug/l)					<2.0	-					<2.0	-					<2.0	-					<2.0	-
ICP Arsenic	(ug/l)	<5*	-			5	-	<5*	-			5	-	<5*	-			4	-	<5*	-			6	-
ICP Selenium	(ug/l)	<5*	-			<10.0	-	<5*	-			<10.0	-	<5*	-			<10.0	-	<5*	-			<10.0	-
GFAA Thallium	(ug/l)	<7	-					<7	-					<7	-					<7	-				
GFAA Antimony	(ug/l)	<7	-					<7	-					<7	-					<7	-				
GFAA Cobalt	(ug/l)	<1	-					<1	-					1	-					3	-				
ICP Beryllium	(ug/l)	<1*	-			<0.5	-	<1*	-			<0.5	-	<1*	-			<0.5	-	<1*	-			<0.5	-
ICP Lead	(ug/l)	<3*	-			5	-	3.4*	-			7	-	<3*	-			4	-	<3*	-			5	-
ICP Zinc	(ug/l)	34	-			54	-	25	-			24	-	18	-			32	-	22	-			37	-
Mercury	(ug/l)	<.2	-			<0.05	-	<.2	-			<0.05	-	<.2	-			<0.05	-	<.2	-			<0.05	-
GFAA Silver	(ug/l)	<1	-			<1.0	-	<1	-			<1.0	-	<1	-			<1.0	-	<1	-			<1.0	-
pH	(s.u.)	7.3	-			7.6	-	7.25	-			7.3	-	7.3	-			8	-	7.3	-			7.7	-
Field Conductivity	(mS/cm)	1.3	-	1.2	-	1.2	-	1	-	0.8	-	0.3	-	0.6	-	1	-	0.8	-	1.2	-	1	-	0.7	-
Field D.O.	(mg/L)	6	-	3.8	-	5.6	-	8.2	-	9	-	7.5	-	7.2	-	12	-	8.8	-	3.6	-	7.5	-	2.7	-
Field Temperature	(°C)	17	-	16	-	19	-	22	-	16	-	19	-	20	-	12	-	16	-	18	-	12	-	17	-
Field pH	(s.u.)			7	-	7.3	-			7.3	-	7.4	-			8	-	7.9	-			7.8	-	7.4	-
= > criterion																									
* = GFAA																									

Site Number and Water Body Use Designation		Euclid Creek #0.5 WWH, AWS,IWS, & PCR							
Sample Number		R99-0088 5/13/99		R99-0183 8/30/99		R00-0252 6/5/00		R02-0033 5/23/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)	<2	-	<2	-			2.2	-
COD	(mg/L)	19	-	<10	-			18	-
Suspended Solids	(mg/L)	1.2	-	2.6	-			6.4	-
Dissolved Solids	(mg/L)	560	-	450	-			578	-
Total Solids	(mg/L)	590	-	470	-			648	-
Total Phosphorus	(mg/L)	0.033	-	0.058	-			0.084	-
Soluble Phosphoru	(mg/L)	0.023	-	0.055	-			0.037	-
Ammonia-N	(mg/L)	0.07	-	0.12	-			0.02	-
Nitrite	(mg/L)	0.01	-	0.01	-			<0.01	-
Nitrate	(mg/L)	0.1	-	0.4	-			0.29	-
TKN	(mg/L)	0.61	-	0.56	-				
Alkalinity	(mg/L)	117	-	113	-			122	-
Chloride	(mg/L)	200	-	140	-				
Sulfates	(mg/L)	81	-	82	-			91	-
E. coli	(Col/100 mL)	430	PCU (298)	430	PCU (298)	860	PCU (298)	42 EC	-
Fecal Coliform	(Col/100 mL)	590	-	1000	-			140	-
Turbidity	(NTU)	1.5	-	2	-			2.6	-
Conductance	micrmhos			565	-				
Hardness	(mg/L)	205	-	188	-			248	-
ICP Nickel	(ug/l)	4.3*	-	2.9*	-			4	-
ICP Copper	(ug/l)	11*	-	4.7*	-			6	-
ICP Chromium	(ug/l)	4.6*	-	2.9*	-			1	-
Hexavalent Chromi	(ug/l)	<10	-	<10	-			<10.0	-
ICP Iron	(ug/l)	234	-	167	-			269	-
ICP Cadmium	(ug/l)	<1*	-	<1*	-			<1.0	-
ICP Silver	(ug/l)							<2.0	-
ICP Arsenic	(ug/l)	<5*	-	<5*	-			<2.0	-
ICP Selenium	(ug/l)	<5*	-	<5*	-			<10.0	-
GFAA Thallium	(ug/l)	<7	-	<7	-				
GFAA Antimony	(ug/l)	<7	-	<7	-				
GFAA Cobalt	(ug/l)	<1	-	<1	-				
ICP Beryllium	(ug/l)	<1*	-	<1*	-			<0.5	-
ICP Lead	(ug/l)	<3*	-	<3*	-			<3.0	-
ICP Zinc	(ug/l)	44	-	90	-			15	-
Mercury	(ug/l)	<.2	-	<.2	-			<0.05	-
GFAA Silver	(ug/l)	<1	-	<1	-			<1.0	-
pH	(s.u.)	7.7	-	8.2	-			8.5	-
Field Conductivity	(mS/cm)	0.9	-					0.8	-
Field D.O.	(mg/L)	9.5	-	11	-	10	-	16	-
Field Temperature	(°C)	16	-	20	-	16	-	15	-
Field pH	(s.u.)			7.6	-	7.5	-	8.2	-

Site Number and Water Body Use Designation		Euclid Creek #1 WWH, AWS,IWS, & PCR							
Sample Number		R99-0089 5/13/99		R99-0184 8/30/99		R00-0253 6/5/00		R02-0034 5/23/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)	<2	-	<2	-			<2.0	-
COD	(mg/L)	23	-	<10	-			12	-
Suspended Solids	(mg/L)	1.2	-	2.4	-			1.6	-
Dissolved Solids	(mg/L)	540	-	440	-			577	-
Total Solids	(mg/L)	580	-	450	-			651	-
Total Phosphorus	(mg/L)	0.018	-	0.071	-			0.0422	-
Soluble Phosphoru	(mg/L)	0.015	-	0.061	-			0.031	-
Ammonia-N	(mg/L)	0.03	-	0.11	-			0.03	-
Nitrite	(mg/L)	0.05	-	<.01	-			<0.01	-
Nitrate	(mg/L)	0.06	-	0.53	-			0.4	-
TKN	(mg/L)	0.48	-	0.5	-				
Alkalinity	(mg/L)	114	-	110	-			125	-
Chloride	(mg/L)	190	-	130	-				
Sulfates	(mg/L)	75	-	82	-			97	-
E. coli	(Col/100 mL)	470	PCU (298)	400	PCU (298)	920	PCU (298)	100	-
Fecal Coliform	(Col/100 mL)	610	-	780	-			110	-
Turbidity	(NTU)	0.8	-	2	-			1.2	-
Conductance	micrmhos			550	-				
Hardness	(mg/L)	196	-	182	-			249	-
ICP Nickel	(ug/l)	6.6*	-	2.4*	-			6	-
ICP Copper	(ug/l)	10*	-	3.4*	-			4.5	-
ICP Chromium	(ug/l)	2.1*	-	3.1*	-			2	-
Hexavalent Chromi	(ug/l)	<10	-	<10	-			<10.0	-
ICP Iron	(ug/l)	190	-	214	-			193	-
ICP Cadmium	(ug/l)	<1*	-	<1*	-			<1.0	-
ICP Silver	(ug/l)							<2.0	-
ICP Arsenic	(ug/l)	<5*	-	<5*	-			4.5	-
ICP Selenium	(ug/l)	<5*	-	<5*	-			<10.0	-
GFAA Thallium	(ug/l)	<7	-	<7	-				
GFAA Antimony	(ug/l)	<7	-	<7	-				
GFAA Cobalt	(ug/l)	<1	-	<1	-				
ICP Beryllium	(ug/l)	<1*	-	<1*	-			<0.5	-
ICP Lead	(ug/l)	<3*	-	<3*	-			5	-
ICP Zinc	(ug/l)	11	-	15	-			12	-
Mercury	(ug/l)	<.2	-	<.2	-			<0.05	-
GFAA Silver	(ug/l)	<1	-	<1	-			<1.0	-
pH	(s.u.)	7.9	-	7.7	-			8.4	-
Field Conductivity	(mS/cm)	0.9	-					0.8	-
Field D.O.	(mg/L)	11	-	8.6	-	9.7	-	14	-
Field Temperature	(°C)	14	-	18	-	15	-	13	-
Field pH	(s.u.)			7.9	-	7.7	-	8.1	-

Site Number and Water Body Use Designation		Euclid Creek #2 WWH, AWS,IWS, & PCR							
Sample Number		R99-0090 5/13/99		R99-0185 8/30/99		R00-0254 6/5/00		R02-0035 5/23/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)	<2	-	9.9	-			<2.0	-
COD	(mg/L)	<10	-	<10	-			<10.0	-
Suspended Solids	(mg/L)	1.6	-	1.2	-			1	-
Dissolved Solids	(mg/L)	600	-	490	-			702	-
Total Solids	(mg/L)	590	-	500	-			808	-
Total Phosphorus	(mg/L)	<.01	-	0.05	-			0.0342	-
Soluble Phosphoru	(mg/L)	<.01	-	0.053	-			0.02	-
Ammonia-N	(mg/L)	0.01	-	0.08	-			0.03	-
Nitrite	(mg/L)	<.01	-	<.01	-			<0.01	-
Nitrate	(mg/L)	0.07	-	0.58	-			0.33	-
TKN	(mg/L)	0.48	-	0.39	-				
Alkalinity	(mg/L)	113	-	105	-			136	-
Chloride	(mg/L)	220	-	160	-				
Sulfates	(mg/L)	94	-	74	-			94	-
E. coli	(Col/100 mL)	54	-	88	-	160	-	90	-
Fecal Coliform	(Col/100 mL)	88	-	100	-			210	-
Turbidity	(NTU)	0.35	-	0.8	-			0.71	-
Conductance	micrmhos			578	-				
Hardness	(mg/L)	186	-	178	-			266	-
ICP Nickel	(ug/l)	2.7*	-	2.6*	-			5	-
ICP Copper	(ug/l)	8.8*	-	4.6*	-			4	-
ICP Chromium	(ug/l)	3.2*	-	3.9*	-			<1.0	-
Hexavalent Chromi	(ug/l)	<10	-	<10	-			<10.0	-
ICP Iron	(ug/l)	44	-	36	-			78	-
ICP Cadmium	(ug/l)	<1*	-	<1*	-			<1.0	-
ICP Silver	(ug/l)							<2.0	-
ICP Arsenic	(ug/l)	<5*	-	<5*	-			<2.0	-
ICP Selenium	(ug/l)	<5*	-	<5*	-			<10.0	-
GFAA Thallium	(ug/l)	<7	-	<7	-				
GFAA Antimony	(ug/l)	<7	-	<7	-				
GFAA Cobalt	(ug/l)	<1	-	2	-				
ICP Beryllium	(ug/l)	<1*	-	<1*	-			<0.5	-
ICP Lead	(ug/l)	<3*	-	<3*	-			3	-
ICP Zinc	(ug/l)	12	-	37	-			12	-
Mercury	(ug/l)	<.2	-	<.2	-			<0.05	-
GFAA Silver	(ug/l)	<1	-	<1	-			<1.0	-
pH	(s.u.)	7.9	-	7.7	-			8.2	-
Field Conductivity	(mS/cm)	0.9	-					1.1	-
Field D.O.	(mg/L)	10	-	8.6	-	9.6	-	13	-
Field Temperature	(°C)	14	-	18	-	14	-	12	-
Field pH	(s.u.)			8.1	-	8	-	8.3	-

= > criterion
* = GFAA

Site Number and Water Body Use Designation		Euclid Creek #3 WWH, AWS,IWS, & PCR							
Sample Number		R99-0091 5/13/99		R99-0186 8/30/99		R00-0255 6/5/00		R02-0036 5/23/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)	<2	-	<2	-			<2.0	-
COD	(mg/L)	15	-	<10	-			10	-
Suspended Solids	(mg/L)	1.2	-	4.8	-			3	-
Dissolved Solids	(mg/L)	480	-	400	-			471	-
Total Solids	(mg/L)	520	-	430	-			549	-
Total Phosphorus	(mg/L)	0.092	-	0.12	-			0.0872	-
Soluble Phosphoru:	(mg/L)	0.086	-	0.11	-			0.073	-
Ammonia-N	(mg/L)	0.02	-	0.08	-			0.05	-
Nitrite	(mg/L)	0.01	-	<.01	-			<0.01	-
Nitrate	(mg/L)	0.48	-	0.58	-			0.69	-
TKN	(mg/L)	0.53	-	0.49	-				
Alkalinity	(mg/L)	123	-	117	-			118	-
Chloride	(mg/L)	160	-	110	-				
Sulfates	(mg/L)	110	-	70	-			67	-
E. coli	(Col/100 mL)	~16	-	90	-	110	-	~22	-
Fecal Coliform	(Col/100 mL)	~28	-	200	-			90	-
Turbidity	(NTU)	0.7	-	2	-			1.1	-
Conductance	micrmhos			471	-				
Hardness	(mg/L)	200	-	188	-			218	-
ICP Nickel	(ug/l)	5*	-	2.5*	-			4	-
ICP Copper	(ug/l)	12*	-	2.8*	-			3	-
ICP Chromium	(ug/l)	4.3*	-	2.7*	-			<1.0	-
Hexavalent Chromiu	(ug/l)	<10	-	<10	-			<10.0	-
ICP Iron	(ug/l)	90	-	139	-			148	-
ICP Cadmium	(ug/l)	<1*	-	<1*	-			<1.0	-
ICP Silver	(ug/l)							<2.0	-
ICP Arsenic	(ug/l)	<5*	-	<5*	-			<2.0	-
ICP Selenium	(ug/l)	<5*	-	<5*	-			<10.0	-
GFAA Thallium	(ug/l)	<7	-	<7	-				
GFAA Antimony	(ug/l)	<7	-	<7	-				
GFAA Cobalt	(ug/l)	<1	-	<1	-				
ICP Beryllium	(ug/l)	<1*	-	<1*	-			<0.5	-
ICP Lead	(ug/l)	<3*	-	<3*	-			<3.0	-
ICP Zinc	(ug/l)	9	-	44	-			10	-
Mercury	(ug/l)	<.2	-	<.2	-			<0.05	-
GFAA Silver	(ug/l)	<1	-	<1	-			<1.0	-
pH	(s.u.)	7.9	-	7.7	-			8.3	-
Field Conductivity	(mS/cm)	0.8	-					0.6	-
Field D.O.	(mg/L)	10	-	9.4	-	11	-	15	-
Field Temperature	(°C)	14	-	18	-	14	-	14	-
Field pH	(s.u.)			8.1	-	8.2	-	8.5	-
= > criterion									
* = GFAA									

Site Number and Water Body Use Designation		Euclid Creek #4 WWH, AWS,IWS, & PCR							
Sample Number		R99-0092 5/13/99		R99-0187 8/30/99		R00-0256 6/5/00		R02-0037 5/23/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)	<2	-	<2	-			<2.0	-
COD	(mg/L)	15	-	<10	-			13	-
Suspended Solids	(mg/L)	2	-	2.4	-			2.7	-
Dissolved Solids	(mg/L)	630	-	580	-			899	-
Total Solids	(mg/L)	630	-	590	-			1010	-
Total Phosphorus	(mg/L)	0.13	-	0.057	-			0.0599	-
Soluble Phosphoru:	(mg/L)	0.11	-	0.05	-			0.05	-
Ammonia-N	(mg/L)	0.05	-	0.09	-			0.06	-
Nitrite	(mg/L)	0.02	-	0.01	-			<0.01	-
Nitrate	(mg/L)	0.47	-	0.55	-			0.59	-
TKN	(mg/L)	0.7	-	0.51	-				
Alkalinity	(mg/L)	103	-	97	-			137	-
Chloride	(mg/L)	240	-	200	-				
Sulfates	(mg/L)	96	-	76	-			91	-
E. coli	(Col/100 mL)	730	PCU (298)	200	-	260	-	140	-
Fecal Coliform	(Col/100 mL)	840	-	260	-			260	-
Turbidity	(NTU)	2.5	-	2	-			2.5	-
Conductance	micrmhos			686	-				
Hardness	(mg/L)	174	-	198	-			281	-
ICP Nickel	(ug/l)	4.3*	-	2.1*	-			3	-
ICP Copper	(ug/l)	8.7*	-	5.2*	-			5	-
ICP Chromium	(ug/l)	3.7*	-	3.7*	-			<1.0	-
Hexavalent Chromiu	(ug/l)	<10	-	<10	-			<10.0	-
ICP Iron	(ug/l)	239	-	268	-			398	-
ICP Cadmium	(ug/l)	<1*	-	<1*	-			<1.0	-
ICP Silver	(ug/l)							<2.0	-
ICP Arsenic	(ug/l)	<5*	-	<5*	-			2	-
ICP Selenium	(ug/l)	<5*	-	<5*	-			<10.0	-
GFAA Thallium	(ug/l)	<7	-	<7	-				
GFAA Antimony	(ug/l)	<7	-	<7	-				
GFAA Cobalt	(ug/l)	<1	-	<1	-				
ICP Beryllium	(ug/l)	<1*	-	<1*	-			<0.5	-
ICP Lead	(ug/l)	<3*	-	<3*	-			<3.0	-
ICP Zinc	(ug/l)	18	-	54	-			11	-
Mercury	(ug/l)	<.2	-	<.2	-			<0.05	-
GFAA Silver	(ug/l)	<1	-	<1	-			<1.0	-
pH	(s.u.)	8.1	-	7.6	-			7.8	-
Field Conductivity	(mS/cm)	1	-					1.3	-
Field D.O.	(mg/L)	12	-	8.4	-	9.6	-	12	-
Field Temperature	(°C)	15	-	18	-	15	-	14	-
Field pH	(s.u.)			8.1	-	8	-	8.2	-

Site Number and Water Body Use Designation		Green Creek #5									
Sample Number		R99-0093 5/13/99		R99-0214 9/16/99		R00-0257 6/5/00		R01-0099 10/11/01		R02-0038 5/23/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)	<2	-	<2	-					<2.0	-
COD	(mg/L)	<10	-	11	-					<10.0	-
Suspended Solids	(mg/L)	1.6	-	2.4	-					2.6	-
Dissolved Solids	(mg/L)	460	-	480	-					571	-
Total Solids	(mg/L)	470	-	480	-					645	-
Total Phosphorus	(mg/L)	0.086	-	0.24	-					0.0486	-
Soluble Phosphorus	(mg/L)	0.08	-	0.22	-					0.049	-
Ammonia-N	(mg/L)	0.11	-	0.03	-					0.08	-
Nitrite	(mg/L)	0.03	-	0.01	-					0.01	-
Nitrate	(mg/L)	0.81	-	0.68	-					0.9	-
TKN	(mg/L)	0.64	-	0.42	-						
Alkalinity	(mg/L)	142	-	174	-					151	-
Chloride	(mg/L)	97	-	110	-						
Sulfates	(mg/L)	97	-	90	-					100	-
E. coli	(Col/100 mL)	360	-	88	-	300	-	~2000	-	320	-
Fecal Coliform	(Col/100 mL)	600	-	110	-					600	-
Turbidity	(NTU)	1.6	-	1.5	-					2.8	-
Conductance	micrmhos										
Hardness	(mg/L)	227	-	246	-					288	-
ICP Nickel	(ug/l)	2.1*	-	4.2*	-					2	-
ICP Copper	(ug/l)	6.8*	-	20*	-					4	-
ICP Chromium	(ug/l)	3.9*	-	4.2*	-					<10.0	-
Hexavalent Chromium	(ug/l)	<10	-	<10	-					<10.0	-
ICP Iron	(ug/l)	158	-	173	-					292	-
ICP Cadmium	(ug/l)	<1*	-	1.4*	-					<10.0	-
ICP Silver	(ug/l)									25.5	-
ICP Arsenic	(ug/l)	<5*	-	<5*	-					1.5	-
ICP Selenium	(ug/l)	<5*	-	<5*	-					<10.0	-
GFAA Thallium	(ug/l)	<7	-	<7	-						
GFAA Antimony	(ug/l)	<7	-	<7	-						
GFAA Cobalt	(ug/l)	<1	-	<1	-						
ICP Beryllium	(ug/l)	<1*	-	<1*	-					<0.5	-
ICP Lead	(ug/l)	5.4*	-	6.1*	-					<9.0	-
ICP Zinc	(ug/l)	18	-	110	-					40	-
Mercury	(ug/l)	<.2	-	<.2	-					<0.05	-
GFAA Silver	(ug/l)	<1	-	<1	-					<1.0	-
pH	(s.u.)	7.8	-	7.6	-					7.8	-
Field Conductivity	(mS/cm)	0.6	-	0.7	-			0.7	-	0.8	-
Field D.O.	(mg/L)	9.8	-	9	-	9.6	-	9	-	12	-
Field Temperature	(°C)	12	-	18	-	14	-	17	-	11	-
Field pH	(s.u.)			7.7	-	8	-	7.3	-	8	-
= > criterion											
* = GFAA											

Site Number and Water Body Use Designation		Green Creek #6									
Sample Number		R99-0094 5/13/99		R99-0215 9/16/99		R00-0258 6/5/00		R01-0100 10/11/01		R02-0039 5/23/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)	5.2	-	<2	-					<2.0	-
COD	(mg/L)	12	-	14	-					17	-
Suspended Solids	(mg/L)	1.2	-	1.2	-					1.9	-
Dissolved Solids	(mg/L)	440	-	360	-					410	-
Total Solids	(mg/L)	440	-	360	-					491	-
Total Phosphorus	(mg/L)	0.14	-	0.37	-					0.0615	-
Soluble Phosphorus	(mg/L)	0.13	-	0.36	-					0.057	-
Ammonia-N	(mg/L)	0.35	-	0.05	-					0.1	-
Nitrite	(mg/L)	0.06	-	0.01	-					<0.01	-
Nitrate	(mg/L)	0.79	-	0.5	-					0.86	-
TKN	(mg/L)	1	-	0.46	-						
Alkalinity	(mg/L)	110	-	114	-					109	-
Chloride	(mg/L)	82	-	96	-						
Sulfates	(mg/L)	98	-	69	-					120	-
E. coli	(Col/100 mL)	~3300	-	220	-	440	-	32000	-	330	-
Fecal Coliform	(Col/100 mL)	~5200	-	350	-					600	-
Turbidity	(NTU)	2	-	0.95	-					2.4	-
Conductance	micrmhos				-						
Hardness	(mg/L)	207	-	165	-					233	-
ICP Nickel	(ug/l)	4.7*	-	7*	-					6	-
ICP Copper	(ug/l)	7.4*	-	22*	-					2	-
ICP Chromium	(ug/l)	<1*	-	3.9*	-					0.5	-
Hexavalent Chromium	(ug/l)	<10	-	<10	-					<10.0	-
ICP Iron	(ug/l)	145	-	150	-					287	-
ICP Cadmium	(ug/l)	<1*	-	1.3*	-					1	-
ICP Silver	(ug/l)									2.5	-
ICP Arsenic	(ug/l)	<5*	-	<5*	-					10	-
ICP Selenium	(ug/l)	<5*	-	<5*	-					<10.0	-
GFAA Thallium	(ug/l)	<7	-	<7	-						
GFAA Antimony	(ug/l)	<7	-	<7	-						
GFAA Cobalt	(ug/l)	1	-	<1	-						
ICP Beryllium	(ug/l)	<1*	-	<1*	-					<0.5	-
ICP Lead	(ug/l)	<3*	-	4.8*	-					<3.0	-
ICP Zinc	(ug/l)	22	-	100	-					18	-
Mercury	(ug/l)	<.2	-	<.2	-					<0.05	-
GFAA Silver	(ug/l)	<1	-	<1	-					<1.0	-
pH	(s.u.)	7.7	-	7.4	-					7.9	-
Field Conductivity	(mS/cm)	0.6	-	0.6	-			0.7	-	0.4	-
Field D.O.	(mg/L)	9.6	-	8.3	-	9.6	-	9.4	-	11	-
Field Temperature	(°C)	12	-	18	-	15	-	16	-	10	-
Field pH	(s.u.)			7.6	-	8	-	7.7	-	8.2	-

Site Number and Water Body Use Designation		Green Creek #7									
Sample Number		R99-0095 5/13/99		R99-0216 9/16/99		R00-0259 6/5/00		R01-0101 10/11/01		R02-0040 5/23/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)	<2	-	<2	-					<2.0	-
COD	(mg/L)	<10	-	10	-					<10.0	-
Suspended Solids	(mg/L)	<1	-	2	-					3.5	-
Dissolved Solids	(mg/L)	260	-	250	-					294	-
Total Solids	(mg/L)	290	-	250	-					367	-
Total Phosphorus	(mg/L)	0.04	-	0.071	-					0.0744	-
Soluble Phosphorus	(mg/L)	0.039	-	0.063	-					0.053	-
Ammonia-N	(mg/L)	0.04	-	0.11	-					0.08	-
Nitrite	(mg/L)	0.01	-	<.01	-					<0.01	-
Nitrate	(mg/L)	0.52	-	0.28	-					0.8	-
TKN	(mg/L)	0.51	-	0.22	-						
Alkalinity	(mg/L)	100	-	108	-					99	-
Chloride	(mg/L)	52	-	57	-						
Sulfates	(mg/L)	110	-	43	-					80	-
E. coli	(Col/100 mL)	120	-	250	-	98	-	450		75	-
Fecal Coliform	(Col/100 mL)	200	-	350	-					97	-
Turbidity	(NTU)	1.7	-	1.2	-					3.3	-
Conductance	micrmhos										
Hardness	(mg/L)	150	-	142	-					181	-
ICP Nickel	(ug/l)	2.2*	-	2.2*	-					4	-
ICP Copper	(ug/l)	5.2*	-	3.1*	-					1	-
ICP Chromium	(ug/l)	1.4*	-	2.7*	-					<1.0	-
Hexavalent Chromium	(ug/l)	<10	-	<10	-					<10.0	-
ICP Iron	(ug/l)	69	-	82	-					223	-
ICP Cadmium	(ug/l)	<1*	-	<1*	-					0.5	-
ICP Silver	(ug/l)									<2.0	-
ICP Arsenic	(ug/l)	<5*	-	<5*	-					7.5	-
ICP Selenium	(ug/l)	<5*	-	<5*	-					6.5	-
GFAA Thallium	(ug/l)	<7	-	<7	-						
GFAA Antimony	(ug/l)	<7	-	<7	-						
GFAA Cobalt	(ug/l)	<1	-	<1	-						
ICP Beryllium	(ug/l)	<1*	-	<1*	-					<0.5	-
ICP Lead	(ug/l)	3.4*	-	<3*	-					<3.0	-
ICP Zinc	(ug/l)	7	-	26	-					10	-
Mercury	(ug/l)	<.2	-	<.2	-					<0.05	-
GFAA Silver	(ug/l)	<1	-	<1	-					<1.0	-
pH	(s.u.)	7.6	-	7.4	-					7.6	-
Field Conductivity	(mS/cm)	0.4	-	0.4	-			0.2	-	0.3	-
Field D.O.	(mg/L)	10	-	8	-	9.2	-	8.8	-	11	-
Field Temperature	(°C)	13	-	16	-	14	-	15	-	12	-
Field pH	(s.u.)			7.5	-	8	-	7.8	-	8.2	-
= > criterion											
* = GFAA											

Site Number and Water Body Use Designation		Kingsbury Run #46					
Sample Number		R99-0117 6/9/99		R00-0372 9/7/00		R02-0116 7/8/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)	3.9	-			4.5	-
COD	(mg/L)	33	-			15	-
Suspended Solids	(mg/L)	8.8	-			6.3	-
Dissolved Solids	(mg/L)	690	-			752	-
Total Solids	(mg/L)	780	-			768	-
Total Phosphorus	(mg/L)	0.3	-			0.332	-
Soluble Phosphorus	(mg/L)	0.22	-			0.27	-
Ammonia-N	(mg/L)	0.94	-			0.53	-
Nitrite	(mg/L)	0.06	-			0.13	-
Nitrate	(mg/L)	0.56	-			6.26	-
TKN	(mg/L)	1.7	-				
Alkalinity	(mg/L)	157	-			190	-
Chloride	(mg/L)	210	-				
Sulfates	(mg/L)	120	-				
E. coli	(Col/100 mL)	640	-	400	-	240	-
Fecal Coliform	(Col/100 mL)	~1200	-			210	-
Turbidity	(NTU)	37	-			1.5	-
Conductance	micrmhos						
Hardness	(mg/L)	268	-			309	-
ICP Nickel	(ug/l)	11*	-			<20.0	-
ICP Copper	(ug/l)	14*	-			11	-
ICP Chromium	(ug/l)	28*	-			<10.0	-
Hexavalent Chromiun	(ug/l)	<10	-			<10.0	-
ICP Iron	(ug/l)	637	-			320	-
ICP Cadmium	(ug/l)	<1*	-			<10.0	-
ICP Silver	(ug/l)					2	-
ICP Arsenic	(ug/l)	<5*	-			<50.0	-
ICP Selenium	(ug/l)	<5*	-			<10.0	-
GFAA Thallium	(ug/l)	<7	-				
GFAA Antimony	(ug/l)	<7	-				
GFAA Cobalt	(ug/l)	1	-				
ICP Beryllium	(ug/l)	<1*	-			<0.5	-
ICP Lead	(ug/l)	9.9*	-			<30.0	-
ICP Zinc	(ug/l)	110	-			59	-
Mercury	(ug/l)	<.2	-			<0.05	-
GFAA Silver	(ug/l)	<1	-			<1.0	-
pH	(s.u.)	7.6	-			7.4	-
Field Conductivity	(mS/cm)	1	-	0.8	-	1.1	-
Field D.O.	(mg/L)	8.2	-	5.2	-	2.2	-
Field Temperature	(°C)	25	-	20	-	24	-
Field pH	(s.u.)			7	-	7	-

Site Number and Water Body Use Designation		Kingsbury Run #46A					
Sample Number		R99-0119 6/9/99		R00-0374 9/7/00		R02-0118 7/8/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)	6.4	-			6.4	-
COD	(mg/L)	24	-			19	-
Suspended Solids	(mg/L)	9.2	-			84.8	-
Dissolved Solids	(mg/L)	910	-			1040	-
Total Solids	(mg/L)	920	-			1200	-
Total Phosphorus	(mg/L)	0.31	-			1.05	-
Soluble Phosphorus	(mg/L)	0.11	-			0.059	-
Ammonia-N	(mg/L)	1.5	-			0.82	-
Nitrite	(mg/L)	0.08	-			0.06	-
Nitrate	(mg/L)	1	-			1.18	-
TKN	(mg/L)	2.3	-				
Alkalinity	(mg/L)	340	-			413	-
Chloride	(mg/L)	230	-				
Sulfates	(mg/L)	110	-				
E. coli	(Col/100 mL)	92	-	50	-	360	-
Fecal Coliform	(Col/100 mL)	240	-			400	-
Turbidity	(NTU)	53	-			3.9	-
Conductance	micrmhos						
Hardness	(mg/L)	433	-			522	-
ICP Nickel	(ug/l)	5.7*	-			<20.0	-
ICP Copper	(ug/l)	12*	-			23	-
ICP Chromium	(ug/l)	130*	-			280	-
Hexavalent Chromiun	(ug/l)	<10	-			<20.0	-
ICP Iron	(ug/l)	2002	-			18700	-
ICP Cadmium	(ug/l)	<1*	-			<10.0	-
ICP Silver	(ug/l)					<1.0	-
ICP Arsenic	(ug/l)	<5*	-			<50.0	-
ICP Selenium	(ug/l)	<5*	-			<10.0	-
GFAA Thallium	(ug/l)	<7	-				
GFAA Antimony	(ug/l)	<7	-				
GFAA Cobalt	(ug/l)	<1	-				
ICP Beryllium	(ug/l)	<1*	-			<0.5	-
ICP Lead	(ug/l)	5.4*	-			<30.0	-
ICP Zinc	(ug/l)	86	-			115	-
Mercury	(ug/l)	<.2	-			<0.05	-
GFAA Silver	(ug/l)	<1	-			<1.0	-
pH	(s.u.)	7.7	-			7.6	-
Field Conductivity	(mS/cm)	1.3	-	1.5	-	0.6	-
Field D.O.	(mg/L)	8	-	8	-	5.3	-
Field Temperature	(°C)	18	-	16	-	30	-
Field pH	(s.u.)			7.8	-	7	-

Site Number and Water Body Use Designation		Kingsbury Run #46B					
Sample Number		R99-0120 6/9/99		R00-0375 9/7/00		R02-120 7/8/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)	9.4	-			3	-
COD	(mg/L)	61	-			20	-
Suspended Solids	(mg/L)	18	-			12.5	-
Dissolved Solids	(mg/L)	1100	-			1140	-
Total Solids	(mg/L)	1200	-			1230	-
Total Phosphorus	(mg/L)	0.21	-			0.219	-
Soluble Phosphorus	(mg/L)	0.11	-			0.056	-
Ammonia-N	(mg/L)	0.58	-			0.24	-
Nitrite	(mg/L)	0.08	-			0.06	-
Nitrate	(mg/L)	0.44	-			0.84	-
TKN	(mg/L)	1.4	-				
Alkalinity	(mg/L)	428	-			459	-
Chloride	(mg/L)	190	-				
Sulfates	(mg/L)	170	-				
E. coli	(Col/100 mL)	~30	-	2.5	-	<~5.0	-
Fecal Coliform	(Col/100 mL)	~65	-			~10	-
Turbidity	(NTU)	62	-			5.7	-
Conductance	micrmhos						
Hardness	(mg/L)	665	-			637	-
ICP Nickel	(ug/l)	30*	-			<20.0	-
ICP Copper	(ug/l)	13*	-			39	-
ICP Chromium	(ug/l)	55*	-			<10.0	-
Hexavalent Chromiun	(ug/l)	<10	-			<10.0	-
ICP Iron	(ug/l)	3472	-			4740	-
ICP Cadmium	(ug/l)	<1*	-			<10.0	-
ICP Silver	(ug/l)						
ICP Arsenic	(ug/l)	<5*	-			<50.0	-
ICP Selenium	(ug/l)	<5*	-			<10.0	-
GFAA Thallium	(ug/l)	<7	-				
GFAA Antimony	(ug/l)	<7	-				
GFAA Cobalt	(ug/l)	1	-				
ICP Beryllium	(ug/l)	<1*	-			<0.5	-
ICP Lead	(ug/l)	8.2*	-			<30.0	-
ICP Zinc	(ug/l)	98	-			83	-
Mercury	(ug/l)	0.34	-			0.112	-
GFAA Silver	(ug/l)	<1	-			<1.0	-
pH	(s.u.)	7.5	-			7.5	-
Field Conductivity	(mS/cm)	1.5	-	1.5	-	0.8	-
Field D.O.	(mg/L)	5.5	-	7.1	-	6.5	-
Field Temperature	(°C)	15	-	16	-	17	-
Field pH	(s.u.)			7.6	-	7.5	-

= > criterion
* = GFAA

Site Number and Water Body Use Designation		Kingsbury Run #46C						Kingsbury Run #46.1					
Sample Number		R99-0121 6/9/99		R00-0376 9/7/00		R02-0119 7/8/02		R99-0118 6/9/99		R00-0373 9/7/00		R02-0117 7/8/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)	<2	-			2.5	-	<2	-			5	-
COD	(mg/L)	27	-			14	-	25	-			23	-
Suspended Solids	(mg/L)	44	-			23.6	-	1.6	-			111	-
Dissolved Solids	(mg/L)	770	-			742	-	710	-			966	-
Total Solids	(mg/L)	830	-			789	-	720	-			1160	-
Total Phosphorus	(mg/L)	0.27	-			0.453	-	0.07	-			0.717	-
Soluble Phosphorus	(mg/L)	0.1	-			0.33	-	0.05	-			0.09	-
Ammonia-N	(mg/L)	0.08	-			0.02	-	1.5	-			0.5	-
Nitrite	(mg/L)	0.03	-			0.01	-	0.08	-			0.15	-
Nitrate	(mg/L)	1.5	-			2.98	-	1	-			1.66	-
TKN	(mg/L)	0.47	-					1.8	-				
Alkalinity	(mg/L)	382	-			367	-	288	-			379	-
Chloride	(mg/L)	130	-					140	-				
Sulfates	(mg/L)	110	-					120	-				
E. coli	(Col/100 mL)	140	-	5600	-	~200	-	390	-	780	-	54000	-
Fecal Coliform	(Col/100 mL)	~260	-			2400	-	880	-			36000	-
Turbidity	(NTU)	50	-			1.3	-	30	-			3.4	-
Conductance	micrmhos												
Hardness	(mg/L)	188	-			202	-	328	-			502	-
ICP Nickel	(ug/l)	2.6*	-			<20.0	-	3.4*	-			<20.0	-
ICP Copper	(ug/l)	12*	-			<10.0	-	8.3*	-			30	-
ICP Chromium	(ug/l)	27*	-			<10.0	-	34*	-			<10.0	-
Hexavalent Chromiun	(ug/l)	<10	-			<10.0	-	<10	-			<10.0	-
ICP Iron	(ug/l)	1584	-			915	-	666	-			11600	-
ICP Cadmium	(ug/l)	<1*	-			<10.0	-	<1*	-			<10.0	-
ICP Silver	(ug/l)					<1.0	-					<1.0	-
ICP Arsenic	(ug/l)	<5*	-			<50.0	-	<5*	-			<50.0	-
ICP Selenium	(ug/l)	<5*	-			<10.0	-	<5*	-			<10.0	-
GFAA Thallium	(ug/l)	<7	-					<7	-				
GFAA Antimony	(ug/l)	<7	-					<7	-				
GFAA Cobalt	(ug/l)	1	-					<1	-				
ICP Beryllium	(ug/l)	<1*	-			<0.5	-	<1*	-			<0.5	-
ICP Lead	(ug/l)	6.9*	-			<30.0	-	7.1*	-			<30.0	-
ICP Zinc	(ug/l)	34	-			14	-	38	-			152	-
Mercury	(ug/l)	<.2	-			<0.05	-	<.2	-			<0.05	-
GFAA Silver	(ug/l)	<1	-			<1.0	-	<1	-			<1.0	-
pH	(s.u.)	8.3	-			8.2	-	7.8	-			7.8	-
Field Conductivity	(mS/cm)	1.2	-	1	-	1	-	1	-	1	-	0.7	-
Field D.O.	(mg/L)	10	-	9	-	8.5	-	9.4	-	7.7	-	5.2	-
Field Temperature	(°C)	15	-	17	-	18	-	18	-	16	-	26	-
Field pH	(s.u.)			8.3	-	7.5	-			7.9	-	7.4	-
= > criterion													
* = GFAA													

Site Number and Water Body Use Designation		Mill Creek #31 WWH, AWS,IWS, & PCR											
Sample Number		R99-0196 9/2/99		R00-0291 7/12/00		R00-0404 11/1/00		R01-0003 4/26/01		R01-0066 8/1/01		R02-0041 5/24/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)	2	-	15	-							<2.0	-
COD	(mg/L)	14	-	15	-							13	-
Suspended Solids	(mg/L)	4.8	-	4.5	-							11.7	-
Dissolved Solids	(mg/L)	870	-	754	-							905	-
Total Solids	(mg/L)	890	-	816	-							924	-
Total Phosphorus	(mg/L)	0.05	-	0.069	-							0.05	-
Soluble Phosphorus	(mg/L)	0.04	-	0.025	-							<0.01	-
Ammonia-N	(mg/L)	0.2	-	0.52	-							0.62	-
Nitrite	(mg/L)	0.11	-	0.19	-							0.09	-
Nitrate	(mg/L)	1.3	-	1.3	-							0.83	-
TKN	(mg/L)	0.84	-										
Alkalinity	(mg/L)	191	-	195	-							205	-
Chloride	(mg/L)	270	-										
Sulfates	(mg/L)	150	-	120	-							E N.M.	-
E. coli	(Col/100 mL)	100	-			44	-	~12	-	56	-	160	-
Fecal Coliform	(Col/100 mL)	200	-					76	-			780	-
Turbidity	(NTU)	9.5	-	4.9	-							4	-
Conductance	micrmhos												
Hardness	(mg/L)	373	-	330	-							380	-
ICP Nickel	(ug/l)	6.8*	-	13	-							5	-
ICP Copper	(ug/l)	7.4*	-	11	-							26	-
ICP Chromium	(ug/l)	2.9*	-	4.8	-							2	-
Hexavalent Chromium	(ug/l)	<10	-	<10	-							<10.0	-
ICP Iron	(ug/l)	1374	-	752	-							1350	-
ICP Cadmium	(ug/l)	<1*	-	<1	-							1	-
ICP Silver	(ug/l)											<2.0	-
ICP Arsenic	(ug/l)	<5*	-	<5	-							2	-
ICP Selenium	(ug/l)	<5*	-	<5	-							12	-
GFAA Thallium	(ug/l)	<7	-										
GFAA Antimony	(ug/l)	<7	-										
GFAA Cobalt	(ug/l)	<1	-										
ICP Beryllium	(ug/l)	<1*	-	<1	-							<0.5	-
ICP Lead	(ug/l)	<3*	-	<3	-							<3.0	-
ICP Zinc	(ug/l)	54	-	48	-							102	-
Mercury	(ug/l)	<.2	-	<0.05	-							<0.05	-
GFAA Silver	(ug/l)	<1	-	<1	-							<1.0	-
pH	(s.u.)	7.5	-	7.5	-							7.4	-
Field Conductivity	(mS/cm)	1.2	-	1.1	-	1.2	-	1.7	-	1.1	-	1.4	-
Field D.O.	(mg/L)	7.2	-	7.4	-	12	-	12	-	9.2	-	8.7	-
Field Temperature	(°C)	20	-	20	-	7.5	-	9.5	-	25	-	15	-
Field pH	(s.u.)	7.8	-	7.6	-	7.7	-	7.6	-	7.4	-	7.4	-
= > criterion													
* = GFAA													

Site Number and Water Body Use Designation		Mill Creek #32 WWH, AWS,IWS, & PCR													
Sample Number		R99-0069 5/5/99		R99-0197 9/2/99		R00-0293 7/20/00		R00-0405 11/1/00		R01-0004 4/26/01		R01-0065 8/1/01		R02-0042 5/24/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)	2.4	-	<2	-									<2.0	-
COD	(mg/L)	10	-	68	-									<10.0	-
Suspended Solids	(mg/L)	1.2	-	1.2	-									1.4	-
Dissolved Solids	(mg/L)	640	-	500	-									780	-
Total Solids	(mg/L)	640	-	510	-									778	-
Total Phosphorus	(mg/L)	0.069	-	0.081	-									0.107	-
Soluble Phosphorus	(mg/L)	0.046	-	0.076	-									0.071	-
Ammonia-N	(mg/L)	0.91	-	0.08	-									0.08	-
Nitrite	(mg/L)	0.02	-	<.01	-									0.01	-
Nitrate	(mg/L)	1.1	-	0.72	-									1.04	-
TKN	(mg/L)	1.2	-	0.36	-										
Alkalinity	(mg/L)	147	-	157	-									165	-
Chloride	(mg/L)	140	-	150	-										
Sulfates	(mg/L)	180	-	84	-									200	-
E. coli	(Col/100 mL)	52	-	93	-	770	PCU (298)	83	-	95	-	150	-	96	-
Fecal Coliform	(Col/100 mL)	68	-	120	-					200	-			100	-
Turbidity	(NTU)	2.2	-	0.7	-									2.1	-
Conductance	micrmhos	509	-												
Hardness	(mg/L)	303	-	214	-									358	-
ICP Nickel	(ug/l)	4.2*	-	2.3*	-									4	-
ICP Copper	(ug/l)	13*	-	4.1*	-									14	-
ICP Chromium	(ug/l)	4.6*	-	2.4*	-									1	-
Hexavalent Chromium	(ug/l)	<10	-	<10	-									<10.0	-
ICP Iron	(ug/l)	364	-	115	-									491	-
ICP Cadmium	(ug/l)	<1*	-	<1*	-									<1.0	-
ICP Silver	(ug/l)													<2.0	-
ICP Arsenic	(ug/l)	<5*	-	<5*	-									3	-
ICP Selenium	(ug/l)	<5*	-	<5*	-									<10.0	-
GFAA Thallium	(ug/l)	<7	-	<7	-										
GFAA Antimony	(ug/l)	<7	-	<7	-										
GFAA Cobalt	(ug/l)	<1	-	<1	-										
ICP Beryllium	(ug/l)	<1*	-	<1*	-									<0.5	-
ICP Lead	(ug/l)	<3*	-	<3*	-									<3.0	-
ICP Zinc	(ug/l)	21	-	21	-									10	-
Mercury	(ug/l)	<.2	-	<.2	-									<0.05	-
GFAA Silver	(ug/l)	<1	-	<1	-									<1.0	-
pH	(s.u.)	7.2	-	7.5	-									7.8	-
Field Conductivity	(mS/cm)	1	-	0.8	-	0.9	-	0.8	-	1.4	-	0.6	-	1	-
Field D.O.	(mg/L)	13	-	4.2	-	7.7	-	8.7	-	12	-	7.4	-	10	-
Field Temperature	(°C)	16	-	20	-	18	-	11	-	10	-	24	-	13	-
Field pH	(s.u.)			7.8	-	7.4	-	7.8	-	7.4	-	7	-	7.7	-
= > criterion															
* = GFAA															

Site Number and Water Body Use Designation		Mill Creek #33 WWH, AWS,IWS, & PCR											
Sample Number		R99-0198 9/2/99		R00-0294 7/20/00		R00-0406 11/1/00		R01-0005 4/26/01		R01-0064 8/1/01		R02-0043 5/24/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)	<2	-									<2.0	-
COD	(mg/L)	74	-									10	-
Suspended Solids	(mg/L)	1.2	-									3.2	-
Dissolved Solids	(mg/L)	640	-									885	-
Total Solids	(mg/L)	670	-									945	-
Total Phosphorus	(mg/L)	0.13	-									0.164	-
Soluble Phosphorus	(mg/L)	0.13	-									0.11	-
Ammonia-N	(mg/L)	0.07	-									0.365	-
Nitrite	(mg/L)	<.01	-									0.08	-
Nitrate	(mg/L)	1.6	-									1.3	-
TKN	(mg/L)	0.45	-										
Alkalinity	(mg/L)	129	-									165	-
Chloride	(mg/L)	220	-										
Sulfates	(mg/L)	110	-									140	-
E. coli	(Col/100 mL)	360	PCU (298)	1700	PCU (298)	1500		140	-	340	PCU (298)	10000	PCU (298)
Fecal Coliform	(Col/100 mL)	440	-					260	-			8000	PCU (2000)
Turbidity	(NTU)	0.6	-									4.7	-
Conductance	micrmhos												
Hardness	(mg/L)	233	-									342	-
ICP Nickel	(ug/l)	2.7*	-									4	-
ICP Copper	(ug/l)	7.6*	-									9	-
ICP Chromium	(ug/l)	2.6*	-									5	-
Hexavalent Chromium	(ug/l)	<10	-									<10.0	-
ICP Iron	(ug/l)	90	-									696	-
ICP Cadmium	(ug/l)	<1*	-									<1.0	-
ICP Silver	(ug/l)											<2.0	-
ICP Arsenic	(ug/l)	<5*	-									3	-
ICP Selenium	(ug/l)	<5*	-									17	-
GFAA Thallium	(ug/l)	<7	-										
GFAA Antimony	(ug/l)	<7	-										
GFAA Cobalt	(ug/l)	<1	-										
ICP Beryllium	(ug/l)	<1*	-									<0.5	-
ICP Lead	(ug/l)	<3*	-									<3.0	-
ICP Zinc	(ug/l)	31	-									14	-
Mercury	(ug/l)	<.2	-									<0.05	-
GFAA Silver	(ug/l)	<1	-									<1.0	-
pH	(s.u.)	7.6	-									7.4	-
Field Conductivity	(mS/cm)	1	-	1	-	0.8	-	1.4	-	1	-	1.4	-
Field D.O.	(mg/L)	8.4	-	7.6	-	7.8	-	12	-	6.5	-	5.8	-
Field Temperature	(°C)	18	-	16	-	8	-	7.5	-	22	-	18	-
Field pH	(s.u.)	8	-	7.6	-	7.6	-	7.5	-	7.3	-	7.5	-
= > criterion													
* = GFAA													

Site Number and Water Body Use Designation		Mill Creek #33.5 WWH, AWS,IWS, & PCR											
Sample Number		R99-0199 9/2/99		R00-0295 7/20/00		R00-0407 11/1/00		R01-0006 4/26/01		R01-0063 8/1/01		R02-0044 5/24/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)	<2	-									<2.0	-
COD	(mg/L)	49	-									<10.0	-
Suspended Solids	(mg/L)	1.2	-									1.1	-
Dissolved Solids	(mg/L)	470	-									583	-
Total Solids	(mg/L)	490	-									633	-
Total Phosphorus	(mg/L)	0.16	-									0.19	-
Soluble Phosphorus	(mg/L)	0.14	-									0.14	-
Ammonia-N	(mg/L)	0.05	-									0.3	-
Nitrite	(mg/L)	0.01	-									0.06	-
Nitrate	(mg/L)	0.49	-									0.85	-
TKN	(mg/L)	0.39	-										
Alkalinity	(mg/L)	139	-									148	-
Chloride	(mg/L)	150	-										
Sulfates	(mg/L)	54	-									89	-
E. coli	(Col/100 mL)	160	-	1600	PCU (298)	50	-	110	-	470	PCU (298)	2000	PCU (298)
Fecal Coliform	(Col/100 mL)	210	-					150	-			7400	PCU (2000)
Turbidity	(NTU)	1.5	-									3.5	-
Conductance	micrmhos												
Hardness	(mg/L)	191	-									278	-
ICP Nickel	(ug/l)	3.4*	-									3	-
ICP Copper	(ug/l)	4*	-									17	-
ICP Chromium	(ug/l)	1.9*	-									12	-
Hexavalent Chromium	(ug/l)	<10	-									<10.0	-
ICP Iron	(ug/l)	149	-									466	-
ICP Cadmium	(ug/l)	<1*	-									8	-
ICP Silver	(ug/l)											<2.0	-
ICP Arsenic	(ug/l)	<5*	-									3	-
ICP Selenium	(ug/l)	<5*	-									10	-
GFAA Thallium	(ug/l)	<7	-										
GFAA Antimony	(ug/l)	<7	-										
GFAA Cobalt	(ug/l)	<1	-										
ICP Beryllium	(ug/l)	<1*	-									<0.5	-
ICP Lead	(ug/l)	<3*	-									<3.0	-
ICP Zinc	(ug/l)	46	-									155	-
Mercury	(ug/l)	<.2	-									<0.05	-
GFAA Silver	(ug/l)	<1	-									1.06	-
pH	(s.u.)	7.5	-									7.8	-
Field Conductivity	(mS/cm)	0.7	-	0.6	-	0.4	-	1.1	-	0.5	-	0.8	-
Field D.O.	(mg/L)	7.3	-	6.3	-	9.2	-	12	-	7.8	-	9.7	-
Field Temperature	(°C)	18	-	17	-	10	-	9	-	22	-	14	-
Field pH	(s.u.)	8	-	7.4	-	8	-	7.5	-	7.3	-	7.8	-
= > criterion													
* = GFAA													

Site Number and Water Body Use Designation		Mill Creek #34 WWH, AWS,IWS, & PCR											
Sample Number		R99-0200 9/2/99		R00-0296 7/20/00		R00-0408 11/1/00		R01-0007 4/26/01		R01-0062 8/1/01		R02-0045 5/24/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)	<2	-									<2.0	-
COD	(mg/L)	56	-									<10.0	-
Suspended Solids	(mg/L)	1.4	-									1.5	-
Dissolved Solids	(mg/L)	440	-									800	-
Total Solids	(mg/L)	480	-									816	-
Total Phosphorus	(mg/L)	0.31	-									0.044	-
Soluble Phosphorus	(mg/L)	0.3	-									0.026	-
Ammonia-N	(mg/L)	0.065	-									0.08	-
Nitrite	(mg/L)	0.04	-									0.02	-
Nitrate	(mg/L)	0.31	-									0.28	-
TKN	(mg/L)	0.66	-										
Alkalinity	(mg/L)	124	-									167	-
Chloride	(mg/L)	160	-										
Sulfates	(mg/L)	48	-									85	-
E. coli	(Col/100 mL)	~3700	PCU (298)	1400	PCU (298)	480		1500	PCU (298)	1200	PCU (298)	440	PCU (298)
Fecal Coliform	(Col/100 mL)	~4600	PCU (2000)					~19000	PCU (2000)			540	-
Turbidity	(NTU)	0.94	-									1.5	-
Conductance	micrmhos												
Hardness	(mg/L)	166	-									269	-
ICP Nickel	(ug/l)	1.3*	-									1	-
ICP Copper	(ug/l)	3.5*	-									3	-
ICP Chromium	(ug/l)	2*	-									3	-
Hexavalent Chromium	(ug/l)	<10	-									<10.0	-
ICP Iron	(ug/l)	90	-									209	-
ICP Cadmium	(ug/l)	<1*	-									<1.0	-
ICP Silver	(ug/l)											<2.0	-
ICP Arsenic	(ug/l)	<5*	-									<2.0	-
ICP Selenium	(ug/l)	<5*	-									<10.0	-
GFAA Thallium	(ug/l)	<7	-										
GFAA Antimony	(ug/l)	<7	-										
GFAA Cobalt	(ug/l)	<1	-										
ICP Beryllium	(ug/l)	<1*	-									<0.5	-
ICP Lead	(ug/l)	<3*	-									<3.0	-
ICP Zinc	(ug/l)	36	-									8	-
Mercury	(ug/l)	<.2	-									<0.05	-
GFAA Silver	(ug/l)	<1	-									<1.0	-
pH	(s.u.)	8.2	-									8.8	-
Field Conductivity	(mS/cm)	0.6	-	1.1	-	1	-	1.7	-	1	-	1.1	-
Field D.O.	(mg/L)	11	-	7.2	-	15	-	14	-	10	-	15	-
Field Temperature	(°C)	21	-	17	-	9	-	9	-	22	-	14	-
Field pH	(s.u.)	8.7	-	7.6	-	8.4	-	7.5	-	7.1	-	8	-
= > criterion													
* = GFAA													

Site Number and Water Body Use Designation		Mill Creek #35 WWH, AWS,IWS, & PCR											
Sample Number		R99-0201 9/2/99		R00-0297 7/20/00		R00-0409 11/1/00		R01-0008 4/26/01		R01-0061 8/1/01		R02-0046 5/24/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)	<2	-									<2.0	-
COD	(mg/L)	76	-									10	-
Suspended Solids	(mg/L)	1.2	-									2.5	-
Dissolved Solids	(mg/L)	750	-									729	-
Total Solids	(mg/L)	780	-									752	-
Total Phosphorus	(mg/L)	0.094	-									0.089	-
Soluble Phosphorus	(mg/L)	0.08	-									0.053	-
Ammonia-N	(mg/L)	0.03	-									0.05	-
Nitrite	(mg/L)	0.02	-									0.05	-
Nitrate	(mg/L)	0.16	-									0.09	-
TKN	(mg/L)	0.56	-										
Alkalinity	(mg/L)	141	-									196	-
Chloride	(mg/L)	320	-										
Sulfates	(mg/L)	68	-									E N.M.	-
E. coli	(Col/100 mL)	490	PCU (298)	250	-	420		~34	-	340	PCU (298)	230	-
Fecal Coliform	(Col/100 mL)	620	-					50	-			260	-
Turbidity	(NTU)	2.5	-									3.7	-
Conductance	micrmhos												
Hardness	(mg/L)	222	-									274	-
ICP Nickel	(ug/l)	2.9*	-									1	-
ICP Copper	(ug/l)	4.4*	-									4	-
ICP Chromium	(ug/l)	2.3*	-									3	-
Hexavalent Chromium	(ug/l)	<10	-									<10.0	-
ICP Iron	(ug/l)	209	-									182	-
ICP Cadmium	(ug/l)	<1*	-									<1.0	-
ICP Silver	(ug/l)											<2.0	-
ICP Arsenic	(ug/l)	<5*	-									<2.0	-
ICP Selenium	(ug/l)	<5*	-									<10.0	-
GFAA Thallium	(ug/l)	<7	-										
GFAA Antimony	(ug/l)	<7	-										
GFAA Cobalt	(ug/l)	<1	-										
ICP Beryllium	(ug/l)	<1*	-									<0.5	-
ICP Lead	(ug/l)	<3*	-									<3.0	-
ICP Zinc	(ug/l)	28	-									5	-
Mercury	(ug/l)	<.2	-									<0.05	-
GFAA Silver	(ug/l)	<1	-									<1.0	-
pH	(s.u.)	7.7	-									8.2	-
Field Conductivity	(mS/cm)	1.2	-	1.3	-	1		2.4	-	1.7	-	1	-
Field D.O.	(mg/L)	8.4	-	8.7	-	11	-	12	-	7.8	-	16	-
Field Temperature	(°C)	20	-	18	-	8	-	8.5	-	22	-	13	-
Field pH	(s.u.)	8.1	-	7.7	-	8.1	-	8	-	7.2	-	8	-
= > criterion													
* = GFAA													

Site Number and Water Body Use Designation		Morgana Run #47						Morgana Run #47A					
Sample Number		R99-0110 6/7/99		R00-0357 8/30/00		R02-0081 6/21/02		R99-0109 6/7/99		R00-0358 8/30/00		R02-0080 6/21/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)	2.9	-			2.58	-	4	-			3.72	-
COD	(mg/L)	13	-			<10.0	-	30	-			<10.0	-
Suspended Solids	(mg/L)	4	-			1.8	-	17	-			25.7	-
Dissolved Solids	(mg/L)	1400	-			768	-	660	-			583	-
Total Solids	(mg/L)	1400	-			821	-	740	-			657	-
Total Phosphorus	(mg/L)	0.12	-			0.197	-	0.28	-			0.341	-
Soluble Phosphorus	(mg/L)	0.098	-			0.18	-	0.22	-			0.23	-
Ammonia-N	(mg/L)	1.2	-			0.21	-	1.4	-			0.24	-
Nitrite	(mg/L)	0.56	-			0.11	-	0.11	-			0.06	-
Nitrate	(mg/L)	0.75	-			0.84	-	8.7	-			5.55	-
TKN	(mg/L)	1.4	-					1.9	-				
Alkalinity	(mg/L)	88	-			124	-	131	-			138	-
Chloride	(mg/L)	570	-					200	-				
Sulfates	(mg/L)	200	-			120	-	110	-			79	-
E. coli	(Col/100 mL)	5400	-	970	-	360	-	3800	-	250	-	290	-
Fecal Coliform	(Col/100 mL)	~8100	-			520	-	4400	-			420	-
Turbidity	(NTU)	3.8	-			1	-	34	-			14	-
Conductance	micrmhos												
Hardness	(mg/L)	411	-			288	-	256	-			254	-
ICP Nickel	(ug/l)	2.5*	-			<1.0	-	21*	-			12	-
ICP Copper	(ug/l)	17*	-			<1.0	-	24*	-			1	-
ICP Chromium	(ug/l)	32*	-			2	-	34*	-			2	-
Hexavalent Chromium	(ug/l)	<10	-			<10.0	-	<10	-			<10.0	-
ICP Iron	(ug/l)	66	-			117	-	782	-			1490	-
ICP Cadmium	(ug/l)	<1*	-			<1.0	-	<1*	-				
ICP Silver	(ug/l)					<2.0	-						
ICP Arsenic	(ug/l)	<5*	-			3	-	<5*	-			4	-
ICP Selenium	(ug/l)	<5*	-			<10.0	-	<5*	-				
GFAA Thallium	(ug/l)	<7	-					<7	-				
GFAA Antimony	(ug/l)	<7	-					<7	-				
GFAA Cobalt	(ug/l)	<1	-					2	-				
ICP Beryllium	(ug/l)	<1*	-			<0.5	-	<1*	-				
ICP Lead	(ug/l)	<3*	-			<3.0	-	4.4*	-				
ICP Zinc	(ug/l)	46	-			86	-	46	-			43	-
Mercury	(ug/l)	<.2	-			<0.05	-	<.2	-			<0.05	-
GFAA Silver	(ug/l)	<1	-			<1.0	-	<1	-			<1.0	-
pH	(s.u.)	8.9	-			8.1	-	7.5	-			7.45	-
Field Conductivity	(mS/cm)	2.3	-	0.6	-	0.8	-	1	-	0.8	-	0.8	-
Field D.O.	(mg/L)	7.5	-	8.2	-	6.3	-	6	-	7	-	6.1	-
Field Temperature	(°C)	18	-	22	-	20	-	28	-	26	-	24	-
Field pH	(s.u.)			7.9	-	7.7	-			7.8	-	7.5	-
= > criterion													
* = GFAA													

Site Number and Water Body Use Designation		Nine-Mile Creek #8A WWH, AWS, IWS, & PCR								Nine-Mile Creek #8B							
Sample Number		R99-0103 5/18/99		R99-0210 9/16/99		R00-0346 8/14/00		R02-0092 6/26/02		R99-0104 5/18/99		R99-0211 9/16/99		R00-0347 8/14/00		R02-0093 6/26/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)	3.1	-	2	-			7.57	-	<2	-	<2	-			17.6	-
COD	(mg/L)	<10	-	<10	-			21	-	11	-	11	-			39	-
Suspended Solids	(mg/L)	4.4	-	1.6	-			9.5	-	7.2	-	1.2	-			125	-
Dissolved Solids	(mg/L)	550	-	310	-			557	-	620	-	360	-			479	-
Total Solids	(mg/L)	560	-	320	-			589	-	620	-	360	-			646	-
Total Phosphorus	(mg/L)	0.19	-	0.34	-			0.378	-	0.11	-	0.19	-			0.855	-
Soluble Phosphorus	(mg/L)	0.17	-	0.36	-			0.39	-	0.059	-	0.18	-			0.32	-
Ammonia-N	(mg/L)	0.66	-	0.37	-			0.43	-	0.09	-	0.37	-			0.56	-
Nitrite	(mg/L)	0.12	-	0.15	-			0.29	-	0.01	-	0.05	-			0.36	-
Nitrate	(mg/L)	0.74	-	0.7	-			1.48	-	0.93	-	0.93	-			1.05	-
TKN	(mg/L)	1.3	-	0.71	-					0.53	-	0.59	-				
Alkalinity	(mg/L)	150	-	119	-			158	-	132	-	109	-			148	-
Chloride	(mg/L)	160	-	120	-					170	-	110	-				
Sulfates	(mg/L)	96	-	49	-			72	-	110	-	58	-			52	-
E. coli	(Col/100 mL)	310	PCU (298)	470	PCU (298)	1200	PCU (298)	840	PCU (298)	590	-	~2700	-	640	-	710	-
Fecal Coliform	(Col/100 mL)	320	-	800	-			1000	-	980	-	~4100	-			2000 EC	-
Turbidity	(NTU)	2.8	-	3	-			2.7	-	2.9	-	0.6	-			4.6	-
Conductance	micrmhos																
Hardness	(mg/L)	222	-	151	-			268	-	277	-	150	-			248	-
ICP Nickel	(ug/l)	1.5*	-	3.7*	-			<1.0	-	10*	-	3.2*	-			8	-
ICP Copper	(ug/l)	5*	-	5.3*	-			7	-	2.8*	-	16*	-			20	-
ICP Chromium	(ug/l)	2.8*	-	2.6*	-			2	-	1.2*	-	4.4*	-			10	-
Hexavalent Chromium	(ug/l)	<10	-	<10	-			<10.0	-	<10	-	<10	-			<10.0	-
ICP Iron	(ug/l)	408	-	396	-			679	-	737	-	102	-			3080	-
ICP Cadmium	(ug/l)	<1*	-	<1*	-			<1.0	-	1.2*	-	<1*	-			3	-
ICP Silver	(ug/l)							<2.0	-							<2.0	-
ICP Arsenic	(ug/l)	<5*	-	<5*	-			6	-	<5*	-	<5*	-			12	-
ICP Selenium	(ug/l)	<5*	-	<5*	-			12	-	<5*	-	<5*	-			12	-
GFAA Thallium	(ug/l)	<7	-	<7	-					>7	-	<7	-				
GFAA Antimony	(ug/l)	<7	-	<7	-					<7	-	<7	-				
GFAA Cobalt	(ug/l)	<1	-	<1	-					<1	-	<1	-				
ICP Beryllium	(ug/l)	<1*	-	<1*	-			<0.5	-	<1*	-	<1*	-			<0.5	-
ICP Lead	(ug/l)	<3*	-	<3*	-			<3.0	-	5.6*	-	<3*	-			18	-
ICP Zinc	(ug/l)	25	-	29	-			34	-	130	-	18	-			90	-
Mercury	(ug/l)	<.2	-	<.2	-			<0.05	-	<.2	-	<.2	-			<0.05	-
GFAA Silver	(ug/l)	<1	-	<1	-			<1.0	-	<1	-	<1	-			<1.0	-
pH	(s.u.)	7.5	-	7.3	-			7.5	-	7.1	-	7.2	-			7.5	-
Field Conductivity	(mS/cm)	0.8	-	0.6	-	0.7	-	0.8	-	1	-	0.6	-	0.7	-	0.8	-
Field D.O.	(mg/L)	5.8	-	4.1	-	8	-	3.1	WHAL (4.0)	7.6	-	8.6	-	8.5	-	5.3	-
Field Temperature	(°C)	15	-	18	-	20	-	20	-	14	-	18	-	18	-	22	-
Field pH	(s.u.)			6.2	WHAL (6.5)	7.6	-	6.7	-			6.9	-	7.6	-	6.6	-
= > criterion																	
* = GFAA																	

Site Number and Water Body Use Designation		Nine-Mile Creek #9 WWH, AWS, IWS, & PCR								Nine-Mile Creek #10 WWH, AWS, IWS, & PCR							
Sample Number		R99-0105 5/18/99		R99-0212 9/16/99		R00-0348 8/14/00		R02-0094 6/26/02		R99-0106 5/18/99		R99-0213 9/16/99		R00-0349 8/14/00		R02-0095 6/26/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)	<2	-	<2	-			5.57	-	<2	-	<2	-			8.5	-
COD	(mg/L)	15	-	<10	-			17	-	12	-	<10	-			23	-
Suspended Solids	(mg/L)	1.2	-	1.2	-			3.4	-	1.2	-	1.2	-			3.8	-
Dissolved Solids	(mg/L)	480	-	340	-			343	-	460	-	380	-			494	-
Total Solids	(mg/L)	490	-	350	-			370	-	470	-	380	-			528	-
Total Phosphorus	(mg/L)	0.075	-	0.13	-			0.261	-	0.069	-	0.12	-			0.505	-
Soluble Phosphorus	(mg/L)	0.077	-	0.12	-			0.24	-	0.07	-	0.1	-			0.48	-
Ammonia-N	(mg/L)	0.04	-	0.07	-			0.67	-	0.05	-	0.02	-			3.51	-
Nitrite	(mg/L)	0.01	-	<.01	-			0.05	-	0.01	-	<.01	-			0.09	-
Nitrate	(mg/L)	1.7	-	1.3	-			0.61	-	0.55	-	0.66	-			0.08	-
TKN	(mg/L)	0.37	-	0.32	-					0.5	-	0.33	-				
Alkalinity	(mg/L)	125	-	105	-			108	-	137	-	119	-			162	-
Chloride	(mg/L)	120	-	78	-					150	-	130	-				
Sulfates	(mg/L)	110	-	85	-			62	-	64	-	56	-			48	-
E. coli	(Col/100 mL)	~8	-	91	-	83	-	250	-	86	-	120	-	110	-	2400	PCU (298)
Fecal Coliform	(Col/100 mL)	~10	-	110	-			370	-	130	-	200	-			3000	PCU (2000)
Turbidity	(NTU)	0.6	-	0.3	-			1.5	-	0.53	-	0.32	-			2	-
Conductance	micrmhos																
Hardness	(mg/L)	213	-	162	-			223	-	184	-	150	-			217	-
ICP Nickel	(ug/l)	7.2*	-	5.6*	-			12	-	2.2*	-	3.7*	-			<1.0	-
ICP Copper	(ug/l)	8.8*	-	8.8*	-			9	-	5*	-	9.5*	-			5	-
ICP Chromium	(ug/l)	1.5*	-	3*	-			<1.0	-	1.6*	-	2.5*	-			<1.0	-
Hexavalent Chromium	(ug/l)	<10	-	<10	-			<10.0	-	<10	-	<10	-			<10.0	-
ICP Iron	(ug/l)	108	-	21	-			372	-	86	-	52	-			321	-
ICP Cadmium	(ug/l)	4*	-	1.9*	-			11	-	<1*	-	<1*	-			<1.0	-
ICP Silver	(ug/l)							<2.0	-							<2.0	-
ICP Arsenic	(ug/l)	<5*	-	<5*	-			6	-	<5*	-	<5*	-			7	-
ICP Selenium	(ug/l)	<5*	-	<5*	-			<10.0	-	<5*	-	<5*	-			<10.0	-
GFAA Thallium	(ug/l)	<7	-	<7	-					<7	-	<7	-				
GFAA Antimony	(ug/l)	<7	-	<7	-					<7	-	<7	-				
GFAA Cobalt	(ug/l)	<1	-	<1	-					<1	-	<1	-				
ICP Beryllium	(ug/l)	<1*	-	<1*	-			<0.5	-	<1*	-	<1*	-			<0.5	-
ICP Lead	(ug/l)	<3*	-	<3*	-			<3.0	-	<3*	-	<3*	-			<3.0	-
ICP Zinc	(ug/l)	80	-	24	-			69	-	30	-	34	-			12	-
Mercury	(ug/l)	<.2	-	<.2	-			<0.05	-	<.2	-	<.2	-			<0.05	-
GFAA Silver	(ug/l)	<1	-	<1	-			<1.0	-	<1	-	<1	-			<1.0	-
pH	(s.u.)	7.6	-	7	-			7.5	-	7.7	-	7.3	-			7.6	-
Field Conductivity	(mS/cm)	0.7	-	0.6	-	0.8	-	0.6	-	0.8	-	0.6	-	0.7	-		
Field D.O.	(mg/L)	8	-	7.6	-	8.5	-	5.6	-	8.6	-	6.4	-	8.3	-		
Field Temperature	(°C)	16	-	16	-	19	-	20	-	18	-	16	-	20	-		
Field pH	(s.u.)			7.3	-	7.6	-	6.2	WHAL (6.5)			7.4	-	7.5	-		
= > criterion																	
* = GFAA																	

Site Number and Water Body Use Designation		Ohio Canal #53				Ohio Canal #54				Ohio Canal #55				Ohio Canal #56			
Sample Number		R99-0235 10/13/99		R02-0112 7/1/02		R99-0236 10/13/99		R02-0111 7/1/02		R99-0237 10/13/99		R02-0110 7/1/02		R99-0238 10/13/99		R02-0109 7/1/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)	4.4	-	2.4	-	2.4	-	3.9	-	2.3	-	3	-	4.2	-	2.4	-
COD	(mg/L)	27	-	15	-	10	-	14	-	12	-	13	-	14	-	12	-
Suspended Solids	(mg/L)	28	-	36.3	-	42	-	27.8	-	64	-	11.9	-	15	-	36.7	-
Dissolved Solids	(mg/L)	110	-	1620	-	500	-	573	-	530	-	561	-	540	-	591	-
Total Solids	(mg/L)	110	-	1730	-	570	-	628	-	600	-	659	-	590	-	695	-
Total Phosphorus	(mg/L)	0.19	-	0.149	-	0.3	-	0.209	-	0.36	-	0.219	-	0.28	-	0.3	-
Soluble Phosphorus	(mg/L)	0.1	-	0.093	-	0.2	-	0.18	-	0.24	-	0.24	-	0.25	-	0.07	-
Ammonia-N	(mg/L)	1	-	0.36	-	0.06	-	0.02	-	0.08	-	0.02	-	0.05	-	0.01	-
Nitrite	(mg/L)	0.14	-	E AE	-	0.02	-	E AE	-	0.02	-	E AE	-	0.02	-	E AE	-
Nitrate	(mg/L)	0.49	-	E 0.670	-	3.3	-	E 1.15	-	4	-	E 2.33	-	4.8	-	E 3.6	-
TKN	(mg/L)	1.7	-			0.99	-			1.1	-			0.83	-		
Alkalinity	(mg/L)	152	-	116	-	141	-	164	-	146	-	162	-	145	-	158	-
Chloride	(mg/L)	240	-			130	-			130	-			130	-		
Sulfates	(mg/L)	340	-	330	-	82	-	87	-	86	-	77	-	76	-	76	-
E. coli	(Col/100 mL)	240	-	33	-	310	-	78	-	250	-	50	-	290	-	84	-
Fecal Coliform	(Col/100 mL)	470	-	60	-	440	-	~90	-	390	-	57	-	550	-	190	-
Turbidity	(NTU)	20	-	4.6	-	30	-	7.8	-	27	-	6	-	7	-	0.84	-
Hardness	(mg/L)	479	-	679	-	221	-	256	-	221	-	261	-	227	-	268	-
ICP Nickel	(ug/l)	7*	-	<1	-	7.5*	-	<1.0	-	7.9*	-	<1.0	-	3.7*	-	<1.0	-
ICP Copper	(ug/l)	6.5*	-	7	-	8*	-	7	-	7.3*	-	6	-	7.4*	-	7	-
ICP Chromium	(ug/l)	3.2*	-	3	-	5.2*	-	2	-	4.1*	-	1	-	1.6*	-	1	-
Hexavalent Chromium	(ug/l)	<10	-	<10.0	-	<10	-	<10.0	-	<10	-	<10.0	-	<10	-	<10.0	-
ICP Iron	(ug/l)	1991	-	1790	-	2107	-	1620	-	2326	-	439	-	675	-	1450	-
ICP Cadmium	(ug/l)	<1*	-	<1	-	<1*	-	<1.0	-	<1*	-	<1.0	-	<1*	-	<1.0	-
ICP Silver	(ug/l)			<2	-			<2.0	-			<2.0	-			<2.0	-
ICP Arsenic	(ug/l)	<5*	-	8	-	<5*	-	7	-	<5*	-	7	-	<5*	-	5	-
ICP Selenium	(ug/l)	<5*	-	<10.0	-	<5*	-	<10.0	-	<5*	-	<10.0	-	<5*	-	<10.0	-
GFAA Thallium	(ug/l)	<7	-			<7	-			<7	-			<7	-		
GFAA Antimony	(ug/l)	<7	-			<7	-			<7	-			<7	-		
GFAA Cobalt	(ug/l)	2	-			2	-			2	-			<1	-		
ICP Beryllium	(ug/l)	<1*	-	<0.5	-	<1*	-	<0.5	-	<1*	-	<0.5	-	<1*	-	<0.5	-
ICP Lead	(ug/l)	3.2*	-	3	-	6.8*	-	6	-	6.2*	-	<3.0	-	<3*	-	<3.0	-
ICP Zinc	(ug/l)	43	-	26	-	40	-	29	-	60	-	15	-	53	-	27	-
Mercury	(ug/l)	<.2	-	<0.05	-	<.2	-	<0.05	-	<.2	-	<0.05	-	<.2	-	<0.05	-
GFAA Silver	(ug/l)	<1	-	<1.0	-	<1	-	<1.0	-	<1	-	<1.0	-	<1	-	<1.0	-
pH	(s.u.)	7.5	-	7.4	-	7.5	-	8.1	-	7.4	-	7.8	-	7.2	-	7.7	-
Field Conductivity	(mS/cm)	1.5	-	2.1	-	0.8	-	1	-	0.8	-	E AE	-	0.8	-	0.4	-
Field D.O.	(mg/L)	9	-	6.1	-	9.2	-	7	-	9.4	-	6.2	-	9	-	6.2	-
Field Temperature	(°C)	16	-	27	-	16	-	29	-	16	-	27	-	16	-	25	-
Field pH	(s.u.)			7.3	-			7.9	-			7.7	-			7.4	-

= > criterion

E AE = Instrument Down; Passed Holding Time

Site Number and Water Body Use Designation		Rocky River #49 WWH, AWS, IWS, & PCR									
Sample Number		R99-0080 5/12/99		R00-0316 7/26/00		R00-0426 11/16/00		R01-0092 10/9/01		R02-0056 6/11/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)	7.8	-							2.1	-
COD	(mg/L)	34	-							<10.0	-
Suspended Solids	(mg/L)	180	-							12.7	-
Dissolved Solids	(mg/L)	470	-							465	-
Total Solids	(mg/L)	680	-							511	-
Total Phosphorus	(mg/L)	0.45	-							0.113	-
Soluble Phosphorus	(mg/L)	0.064	-							0.09	-
Ammonia-N	(mg/L)	0.17	-							0.03	-
Nitrite	(mg/L)	0.05	-							0.02	-
Nitrate	(mg/L)	2.4	-							3.08	-
TKN	(mg/L)	2	-								
Alkalinity	(mg/L)	127	-							140	-
Chloride	(mg/L)	130	-								
Sulfates	(mg/L)	88	-							88	-
E. coli	(Col/100 mL)	3700	PCU (298)	600	PCU (298)	350	-	220	-	84	-
Fecal Coliform	(Col/100 mL)	4800	PCU (2000)							120	-
Turbidity	(NTU)	45	-							6.4	-
Conductance	micrmhos										
Hardness	(mg/L)	228	-							236	-
ICP Nickel	(ug/l)	19*	-							4	-
ICP Copper	(ug/l)	27*	-							4	-
ICP Chromium	(ug/l)	7.1*	-							1	-
Hexavalent Chromium	(ug/l)	<10	-							<10.0	-
ICP Iron	(ug/l)	6298	-							892	-
ICP Cadmium	(ug/l)	<1*	-							<1.0	-
ICP Silver	(ug/l)									<2.0	-
ICP Arsenic	(ug/l)	<5*	-							3	-
ICP Selenium	(ug/l)	<5*	-							6.5	-
GFAA Thallium	(ug/l)	<7	-								
GFAA Antimony	(ug/l)	<7	-								
GFAA Cobalt	(ug/l)	3	-								
ICP Beryllium	(ug/l)	<1*	-							<0.5	-
ICP Lead	(ug/l)	9.2*	-							<3.0	-
ICP Zinc	(ug/l)	86	-							41.5	-
Mercury	(ug/l)	<.2	-							<0.05	-
GFAA Silver	(ug/l)	<1	-							<1.0	-
pH	(s.u.)	7.95	-							8.3	-
Field Conductivity	(mS/cm)	0.8	-	0.7	-	0.6	-	0.7	-	6	-
Field D.O.	(mg/L)	8.5	-	10	-	14	-	12	-	8.2	-
Field Temperature	(°C)	18	-	21	-	5	-	12	-	24	-
Field pH	(s.u.)			7.8	-	7.4	-	8	-	8.2	-

Site Number and Water Body Use Designation		Rocky River #50 WWH, AWS, IWS, & PCR									
Sample Number		R99-0081 5/12/99		R00-0317 7/26/00		R00-0427 11/16/00		R01-0093 10/9/01		R02-0057 6/11/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)	3.4	-							2.3	-
COD	(mg/L)	22	-							10	-
Suspended Solids	(mg/L)	69	-							26.3	-
Dissolved Solids	(mg/L)	490	-							461	-
Total Solids	(mg/L)	550	-							516	-
Total Phosphorus	(mg/L)	0.16	-							0.163	-
Soluble Phosphorus	(mg/L)	0.064	-							0.11	-
Ammonia-N	(mg/L)	0.2	-							0.13	-
Nitrite	(mg/L)	0.08	-							0.04	-
Nitrate	(mg/L)	2.8	-							3.1	-
TKN	(mg/L)	1.1	-								
Alkalinity	(mg/L)	134	-							143	-
Chloride	(mg/L)	120	-								
Sulfates	(mg/L)	81	-							74	-
E. coli	(Col/100 mL)	150	-	4800	PCU (298)	30	-	320	PCU (298)	340	PCU (298)
Fecal Coliform	(Col/100 mL)	210	-							380	-
Turbidity	(NTU)	27	-							17	-
Conductance	micrmhos										
Hardness	(mg/L)	219	-							240	-
ICP Nickel	(ug/l)	6.7*	-							5	-
ICP Copper	(ug/l)	21*	-							3.6	-
ICP Chromium	(ug/l)	4.2*	-							5.5	-
Hexavalent Chromium	(ug/l)	<10	-							<10.0	-
ICP Iron	(ug/l)	2565	-							1890	-
ICP Cadmium	(ug/l)	<1*	-							<1.0	-
ICP Silver	(ug/l)									<2.0	-
ICP Arsenic	(ug/l)	<5*	-							3	-
ICP Selenium	(ug/l)	<5*	-							14.9	-
GFAA Thallium	(ug/l)	<7	-								
GFAA Antimony	(ug/l)	<7	-								
GFAA Cobalt	(ug/l)	1	-								
ICP Beryllium	(ug/l)	<1	-							<0.5	-
ICP Lead	(ug/l)	8.6*	-							<3.0	-
ICP Zinc	(ug/l)	37	-							43.5	-
Mercury	(ug/l)	<.2	-							<0.05	-
GFAA Silver	(ug/l)	<1	-							<1.0	-
pH	(s.u.)	7.5	-							7.8	-
Field Conductivity	(mS/cm)	0.7	-	0.6	-	0.7	-	0.7	-	0.6	-
Field D.O.	(mg/L)	8	-	10	-	10	-	12	-	7.3	-
Field Temperature	(°C)	17	-	22	-	6	-	12	-	23	-
Field pH	(s.u.)			7.9	-	7.4	-	7.8	-	7.6	-

= > criterion
* = GFAA

Site Number and Water Body Use Designation		Rocky River #51 WWH, AWS, IWS, & PCR									
Sample Number		R99-0082 5/12/99		R00-0318 7/26/00		R00-0428 11/16/00		R01-0094 10/9/01		R02-0058 6/11/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)	2.2	-							2.2	-
COD	(mg/L)	<10	-							<10.0	-
Suspended Solids	(mg/L)	8.8	-							12.3	-
Dissolved Solids	(mg/L)	420	-							402	-
Total Solids	(mg/L)	440	-							449	-
Total Phosphorus	(mg/L)	0.13	-							0.235	-
Soluble Phosphorus	(mg/L)	0.098	-							0.22	-
Ammonia-N	(mg/L)	0.06	-							0.06	-
Nitrite	(mg/L)	0.06	-							0.03	-
Nitrate	(mg/L)	4	-							3.91	-
TKN	(mg/L)	0.86	-								
Alkalinity	(mg/L)	132	-							146	-
Chloride	(mg/L)	110	-								
Sulfates	(mg/L)	83	-							63	-
E. coli	(Col/100 mL)	99	-	170	-	1100	-	140	-	200	-
Fecal Coliform	(Col/100 mL)	120	-							69	-
Turbidity	(NTU)	4.2	-							7.6	-
Conductance	micrmhos										
Hardness	(mg/L)	204	-							223	-
ICP Nickel	(ug/l)	2.9*	-							2	-
ICP Copper	(ug/l)	17*	-							3.7	-
ICP Chromium	(ug/l)	3.6*	-							4	-
Hexavalent Chromium	(ug/l)	<10	-							<10.0	-
ICP Iron	(ug/l)	370	-							598	-
ICP Cadmium	(ug/l)	<1*	-							<1.0	-
ICP Silver	(ug/l)									<2.0	-
ICP Arsenic	(ug/l)	<5*	-							3	-
ICP Selenium	(ug/l)	<5*	-							<10.0	-
GFAA Thallium	(ug/l)	<7	-								
GFAA Antimony	(ug/l)	<7	-								
GFAA Cobalt	(ug/l)	<1	-								
ICP Beryllium	(ug/l)	<1*	-							<0.5	-
ICP Lead	(ug/l)	<3*	-							<3.0	-
ICP Zinc	(ug/l)	18	-							15	-
Mercury	(ug/l)	<.2	-							<0.05	-
GFAA Silver	(ug/l)	<1	-							<1.0	-
pH	(s.u.)	7.7	-							7.8	-
Field Conductivity	(mS/cm)	0.6	-	0.6	-	0.6	-	0.7	-	0.6	-
Field D.O.	(mg/L)	8.9	-	9.3	-	13	-	13	-	7.7	-
Field Temperature	(°C)	16	-	20	-	5	-	12	-	22	-
Field pH	(s.u.)			7.3	-	7.7	-	8.1	-	7.7	-

Site Number and Water Body Use Designation		Rocky River #52 WWH, AWS, IWS, & PCR									
Sample Number		R99-0083 5/12/99		R00-0319 7/26/00		R00-0429 11/16/00		R01-0095 10/9/01		R02-0059 6/11/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)	<2	-							2.3	-
COD	(mg/L)	20	-							19	-
Suspended Solids	(mg/L)	2.8	-							6.2	-
Dissolved Solids	(mg/L)	500	-							405	-
Total Solids	(mg/L)	510	-							452	-
Total Phosphorus	(mg/L)	0.045	-							0.076	-
Soluble Phosphorus	(mg/L)	0.042	-							0.082	-
Ammonia-N	(mg/L)	0.13	-							0.09	-
Nitrite	(mg/L)	0.08	-							0.06	-
Nitrate	(mg/L)	1.5	-							1.89	-
TKN	(mg/L)	0.92	-								
Alkalinity	(mg/L)	168	-							158	-
Chloride	(mg/L)	110	-								
Sulfates	(mg/L)	120	-							76	-
E. coli	(Col/100 mL)	~28	-	530	PCU (298)	160	-	430	PCU (298)	150	-
Fecal Coliform	(Col/100 mL)	44	-							230	-
Turbidity	(NTU)	1.6	-							5.5	-
Conductance	micrmhos										
Hardness	(mg/L)	252	-							235	-
ICP Nickel	(ug/l)	47*	-							2	-
ICP Copper	(ug/l)	18*	-							2.3	-
ICP Chromium	(ug/l)	2.6*	-							3	-
Hexavalent Chromium	(ug/l)	<10	-							<10.0	-
ICP Iron	(ug/l)	146	-							440	-
ICP Cadmium	(ug/l)	<1*	-							<1.0	-
ICP Silver	(ug/l)									<2.0	-
ICP Arsenic	(ug/l)	<5*	-							2	-
ICP Selenium	(ug/l)	<5*	-							<10.0	-
GFAA Thallium	(ug/l)	<7	-								
GFAA Antimony	(ug/l)	<7	-								
GFAA Cobalt	(ug/l)	<1	-								
ICP Beryllium	(ug/l)	<1*	-							<0.5	-
ICP Lead	(ug/l)	<3*	-							<3.0	-
ICP Zinc	(ug/l)	21	-							14	-
Mercury	(ug/l)	<.2	-							<0.05	-
GFAA Silver	(ug/l)	<1	-							<1.0	-
pH	(s.u.)	7.8	-							8	-
Field Conductivity	(mS/cm)	0.8	-	0.7	-	0.6	-	0.7	-	0.5	-
Field D.O.	(mg/L)	8.5	-	10	-	14	-	11	-	8.1	-
Field Temperature	(°C)	16	-	22	-	5	-	11	-	24	-
Field pH	(s.u.)			7.7	-	7.5	-	8	-	7.9	-

= > criterion

* = GFAA

Site Number and Water Body Use Designation		Rocky River #52.5 WWH, SSH, AWS, IWS, & PCR									
Sample Number		R99-0084 5/12/99		R00-0320 7/26/00		R00-0430 11/16/00		R01-0096 10/9/01		R02-0060 6/11/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)	2.1	-							2.2	-
COD	(mg/L)	20	-							16	-
Suspended Solids	(mg/L)	2.4	-							9.2	-
Dissolved Solids	(mg/L)	560	-							467	-
Total Solids	(mg/L)	570	-							530	-
Total Phosphorus	(mg/L)	0.14	-							0.119	-
Soluble Phosphorus	(mg/L)	0.13	-							0.12	-
Ammonia-N	(mg/L)	0.33	-							0.05	-
Nitrite	(mg/L)	0.07	-							0.03	-
Nitrate	(mg/L)	2.5	-							2.22	-
TKN	(mg/L)	1	-								
Alkalinity	(mg/L)	139	-							146	-
Chloride	(mg/L)	160	-								
Sulfates	(mg/L)	100	-							78	-
E. coli	(Col/100 mL)	96	-	83	-	100	-	310	PCU (298)	58	-
Fecal Coliform	(Col/100 mL)	120	-							70	-
Turbidity	(NTU)	2.1	-							4.5	-
Conductance	micrmhos										
Hardness	(mg/L)	242	-							237	-
ICP Nickel	(ug/l)	5.5*	-							4	-
ICP Copper	(ug/l)	18*	-							3	-
ICP Chromium	(ug/l)	4.3*	-							2	-
Hexavalent Chromium	(ug/l)	<10	-							<10.0	-
ICP Iron	(ug/l)	188	-							450	-
ICP Cadmium	(ug/l)	<1*	-							<1.0	-
ICP Silver	(ug/l)									<2.0	-
ICP Arsenic	(ug/l)	<5*	-							2	-
ICP Selenium	(ug/l)	<5*	-							<10.0	-
GFAA Thallium	(ug/l)	<7	-								
GFAA Antimony	(ug/l)	<7	-								
GFAA Cobalt	(ug/l)	<1	-								
ICP Beryllium	(ug/l)	<1*	-							<0.5	-
ICP Lead	(ug/l)	<3*	-							<3.0	-
ICP Zinc	(ug/l)	26	-							21	-
Mercury	(ug/l)	<.2	-							<0.05	-
GFAA Silver	(ug/l)	<1	-							<1.0	-
pH	(s.u.)	8.4	-							8.2	-
Field Conductivity	(mS/cm)	0.9	-	0.8	-	0.6	-	0.6	-	6	-
Field D.O.	(mg/L)	9.8	-	10	-	14	-	11	-	7.9	-
Field Temperature	(°C)	19	-	25	-	5	-	12	-	28	WHAL (24.4)
Field pH	(s.u.)			8.3	-	8.2	-	7.7	-	8	-
= > criterion											
* = GFAA											

Site Number and Water Body Use Designation		Sagamore Creek #57					
Sample Number		R00-0354 8/30/00		R01-0106 11/13/01		R02-0108 7/1/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)					2.1	-
COD	(mg/L)					11	-
Suspended Solids	(mg/L)					7.4	-
Dissolved Solids	(mg/L)					611	-
Total Solids	(mg/L)					675	-
Total Phosphorus	(mg/L)					0.119	-
Soluble Phosphorus	(mg/L)					0.15	-
Ammonia-N	(mg/L)					0.01	-
Nitrite	(mg/L)					E AE	-
Nitrate	(mg/L)					E 0.28	-
Alkalinity	(mg/L)					156	-
Sulfates	(mg/L)					61	-
E. coli	(Col/100 mL)	47	-	~2	-	37	-
Fecal Coliform	(Col/100 mL)					54	-
Turbidity	(NTU)					3.2	-
Hardness	(mg/L)					272	-
ICP Nickel	(ug/l)					<1.0	-
ICP Copper	(ug/l)					5	-
ICP Chromium	(ug/l)					<1.0	-
Hexavalent Chromium	(ug/l)					5	-
ICP Iron	(ug/l)					193	-
ICP Cadmium	(ug/l)					<1.0	-
ICP Silver	(ug/l)					<2.0	-
ICP Arsenic	(ug/l)					4	-
ICP Selenium	(ug/l)					<10.0	-
ICP Beryllium	(ug/l)					<0.5	-
ICP Lead	(ug/l)					<3.0	-
ICP Zinc	(ug/l)					43	-
Mercury	(ug/l)					<0.05	-
GFAA Silver	(ug/l)					<1.0	-
pH	(s.u.)					7.7	-
Field Conductivity	(mS/cm)	0.7	-	0.8	-	0.9	-
Field D.O.	(mg/L)	6	-	12	-	6.8	-
Field Temperature	(°C)	19	-	8.5	-	21	-
Field pH	(s.u.)	6.9	-	7.7	-	7.3	-
= > criterion							
E AE = Instrument Down; Passed Holding Time							

Site Number and Water Body Use Designation		Tinkers Creek #39 WWH, AWS, IWS, & PCR									
Sample Number		R99-0076 5/6/99		R00-0324 7/27/00		R01-0088 10/4/01		R02-0052 6/10/02		R02-0265 10/15/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)	2.4	-							2.4	-
COD	(mg/L)	13	-							25	-
Suspended Solids	(mg/L)	2.8	-							2.2	-
Dissolved Solids	(mg/L)	760	-							716	-
Total Solids	(mg/L)	760	-							752	-
Total Phosphorus	(mg/L)	0.068	-							0.187	-
Soluble Phosphorus	(mg/L)	0.033	-							0.19	-
Ammonia-N	(mg/L)	0.04	-							0.018	-
Nitrite	(mg/L)	0.06	-							0.019	-
Nitrate	(mg/L)	1.1	-							8.31	-
TKN	(mg/L)	4.8	-								
Chloride	(mg/L)	150	-								
Alkalinity	(mg/L)	250	-							148	-
Sulfates	(mg/L)	98	-								
E. coli	(Col/100 mL)	86	-	120	-	96	-	320	PCU (298)	84	-
Fecal Coliform	(Col/100 mL)	120	-					480	-	120	-
Turbidity	(NTU)	2.3	-								
Conductance	micrmhos	666	-							1.5	-
Hardness	(mg/L)	259	-					228	-	249	-
ICP Nickel	(ug/l)	8.9*	-					3	-	4	-
ICP Copper	(ug/l)	8.1*	-					8.9	-	9	-
ICP Chromium	(ug/l)	2.5*	-					5	-	4	-
Hexavalent Chromium	(ug/l)	<10	-							<10.0	-
ICP Iron	(ug/l)	294	-					1090	-	188	-
ICP Cadmium	(ug/l)	<1*	-					<1.0	-	<1.0	-
ICP Silver	(ug/l)							4.2	-	<2.0	-
ICP Arsenic	(ug/l)	<5*	-					4	-	2	-
ICP Selenium	(ug/l)	<5*	-					13.4	WHAL (5.0)	<10.0	-
GFAA Thallium	(ug/l)	<7	-								
GFAA Antimony	(ug/l)	<7	-								
GFAA Cobalt	(ug/l)	<1	-								
ICP Beryllium	(ug/l)	<1*	-					<0.5	-	0.5	-
ICP Lead	(ug/l)	<3*	-					<3.0	-	4	-
ICP Zinc	(ug/l)	41	-							36	-
Mercury	(ug/l)	<.2	-					<0.05	-	<0.05	-
GFAA Silver	(ug/l)	<1	-					<1.0	-	<1.0	-
pH	(s.u.)									7.8	-
Field Conductivity	(mS/cm)	1.2	-	1	-	1	-	0.7	-	0.2	-
Field D.O.	(mg/L)	9.2	-	10	-	8.8	-	8.9	-	11	-
Field Temperature	(°C)	16	-	22	-	16	-	20	-	9.5	-
Field pH	(s.u.)			8.2	-	7.8	-	7.9	-	7.8	-

Site Number and Water Body Use Designation		Tinkers Creek #40 WWH, AWS, IWS, & PCR									
Sample Number		R99-0077 5/6/99		R00-0325 7/27/00		R01-0089 10/4/01		R02-0053 6/10/02		R02-0266 10/15/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)	2.4	-							2.5	-
COD	(mg/L)	19	-							29	-
Suspended Solids	(mg/L)	1.6	-							6.6	-
Dissolved Solids	(mg/L)	770	-							766	-
Total Solids	(mg/L)	770	-							807	-
Total Phosphorus	(mg/L)	0.12	-							0.299	-
Soluble Phosphorus	(mg/L)	0.054	-							0.21	-
Ammonia-N	(mg/L)	0.14	-							0.031	-
Nitrite	(mg/L)	0.07	-							0.13	-
Nitrate	(mg/L)	1.4	-							9.51	-
TKN	(mg/L)	4.8	-								
Chloride	(mg/L)	155	-								
Alkalinity	(mg/L)	260	-							146	-
Sulfates	(mg/L)	93	-								
E. coli	(Col/100 mL)	150	-	180	-	670	PCU (298)	480	PCU (298)	580	PCU (298)
Fecal Coliform	(Col/100 mL)	210	-					1000 EC	-	1200	-
Turbidity	(NTU)	3	-								
Conductance	micrmhos	690	-							2.6	-
Hardness	(mg/L)	257	-					225	-	251	-
ICP Nickel	(ug/l)	7.9*	-					3	-	4	-
ICP Copper	(ug/l)	7.2*	-					1.7	-	10	-
ICP Chromium	(ug/l)	4.1*	-					4	-	2	-
Hexavalent Chromium	(ug/l)	<10	-							<10.0	-
ICP Iron	(ug/l)	321	-					1170	-	436	-
ICP Cadmium	(ug/l)	<1*	-					<1.0	-	<1.0	-
ICP Silver	(ug/l)							<2.0	-	<2.0	-
ICP Arsenic	(ug/l)	<5*	-					4	-	5	-
ICP Selenium	(ug/l)	<5*	-					10	WHAL (5.0)	<10.0	-
GFAA Thallium	(ug/l)	<7	-								
GFAA Antimony	(ug/l)	<7	-								
GFAA Cobalt	(ug/l)	<1	-								
ICP Beryllium	(ug/l)	<1*	-					<0.5	-	<0.5	-
ICP Lead	(ug/l)	3.9*	-					<3.0	-	4	-
ICP Zinc	(ug/l)	45	-							40	-
Mercury	(ug/l)	<.2	-					<0.05	-	<0.05	-
GFAA Silver	(ug/l)	<1	-					<1.0	-	<1.0	-
pH	(s.u.)									8	-
Field Conductivity	(mS/cm)	1.2	-	1	-	1	-	0.7	-	0.2	-
Field D.O.	(mg/L)	13	-	12	-	8.6	-	9.1	-	11	-
Field Temperature	(°C)	18	-	23	-	17	-	22	-	11	-
Field pH	(s.u.)			8.4	-	7.6	-	8	-	7.8	-

= > criterion
* = GFAA

Site Number and Water Body Use Designation		Tinkers Creek #39 WWH, AWS, IWS, & PCR									
Sample Number		R99-0076 5/6/99		R00-0324 7/27/00		R01-0088 10/4/01		R02-0052 6/10/02		R02-0265 10/15/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)	2.4	-							2.4	-
COD	(mg/L)	13	-							25	-
Suspended Solids	(mg/L)	2.8	-							2.2	-
Dissolved Solids	(mg/L)	760	-							716	-
Total Solids	(mg/L)	760	-							752	-
Total Phosphorus	(mg/L)	0.068	-							0.187	-
Soluble Phosphorus	(mg/L)	0.033	-							0.19	-
Ammonia-N	(mg/L)	0.04	-							0.018	-
Nitrite	(mg/L)	0.06	-							0.019	-
Nitrate	(mg/L)	1.1	-							8.31	-
TKN	(mg/L)	4.8	-								
Chloride	(mg/L)	150	-								
Alkalinity	(mg/L)	250	-							148	-
Sulfates	(mg/L)	98	-								
E. coli	(Col/100 mL)	86	-	120	-	96	-	320	PCU (298)	84	-
Fecal Coliform	(Col/100 mL)	120	-					480	-	120	-
Turbidity	(NTU)	2.3	-								
Conductance	micrmhos	666	-							1.5	-
Hardness	(mg/L)	259	-					228	-	249	-
ICP Nickel	(ug/l)	8.9*	-					3	-	4	-
ICP Copper	(ug/l)	8.1*	-					8.9	-	9	-
ICP Chromium	(ug/l)	2.5*	-					5	-	4	-
Hexavalent Chromium	(ug/l)	<10	-							<10.0	-
ICP Iron	(ug/l)	294	-					1090	-	188	-
ICP Cadmium	(ug/l)	<1*	-					<1.0	-	<1.0	-
ICP Silver	(ug/l)							4.2	-	<2.0	-
ICP Arsenic	(ug/l)	<5*	-					4	-	2	-
ICP Selenium	(ug/l)	<5*	-					13.4	WHAL (5.0)	<10.0	-
GFAA Thallium	(ug/l)	<7	-								
GFAA Antimony	(ug/l)	<7	-								
GFAA Cobalt	(ug/l)	<1	-								
ICP Beryllium	(ug/l)	<1*	-					<0.5	-	0.5	-
ICP Lead	(ug/l)	<3*	-					<3.0	-	4	-
ICP Zinc	(ug/l)	41	-							36	-
Mercury	(ug/l)	<.2	-					<0.05	-	<0.05	-
GFAA Silver	(ug/l)	<1	-					<1.0	-	<1.0	-
pH	(s.u.)									7.8	-
Field Conductivity	(mS/cm)	1.2	-	1	-	1	-	0.7	-	0.2	-
Field D.O.	(mg/L)	9.2	-	10	-	8.8	-	8.9	-	11	-
Field Temperature	(°C)	16	-	22	-	16	-	20	-	9.5	-
Field pH	(s.u.)			8.2	-	7.8	-	7.9	-	7.8	-
= > limit											
* = GFAA											

Site Number and Water Body Use Designation		Tinkers Creek #40 WWH, AWS, IWS, & PCR									
Sample Number		R99-0077 5/6/99		R00-0325 7/27/00		R01-0089 10/4/01		R02-0053 6/10/02		R02-0266 10/15/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)	2.4	-							2.5	-
COD	(mg/L)	19	-							29	-
Suspended Solids	(mg/L)	1.6	-							6.6	-
Dissolved Solids	(mg/L)	770	-							766	-
Total Solids	(mg/L)	770	-							807	-
Total Phosphorus	(mg/L)	0.12	-							0.299	-
Soluble Phosphorus	(mg/L)	0.054	-							0.21	-
Ammonia-N	(mg/L)	0.14	-							0.031	-
Nitrite	(mg/L)	0.07	-							0.13	-
Nitrate	(mg/L)	1.4	-							9.51	-
TKN	(mg/L)	4.8	-								
Chloride	(mg/L)	155	-								
Alkalinity	(mg/L)	260	-							146	-
Sulfates	(mg/L)	93	-								
E. coli	(Col/100 mL)	150	-	180	-	670	PCU (298)	480	PCU (298)	580	PCU (298)
Fecal Coliform	(Col/100 mL)	210	-					1000 EC	-	1200	-
Turbidity	(NTU)	3	-								
Conductance	micrmhos	690	-							2.6	-
Hardness	(mg/L)	257	-					225	-	251	-
ICP Nickel	(ug/l)	7.9*	-					3	-	4	-
ICP Copper	(ug/l)	7.2*	-					1.7	-	10	-
ICP Chromium	(ug/l)	4.1*	-					4	-	2	-
Hexavalent Chromium	(ug/l)	<10	-							<10.0	-
ICP Iron	(ug/l)	321	-					1170	-	436	-
ICP Cadmium	(ug/l)	<1*	-					<1.0	-	<1.0	-
ICP Silver	(ug/l)							<2.0	-	<2.0	-
ICP Arsenic	(ug/l)	<5*	-					4	-	5	-
ICP Selenium	(ug/l)	<5*	-					10	WHAL (5.0)	<10.0	-
GFAA Thallium	(ug/l)	<7	-								
GFAA Antimony	(ug/l)	<7	-								
GFAA Cobalt	(ug/l)	<1	-								
ICP Beryllium	(ug/l)	<1*	-					<0.5	-	<0.5	-
ICP Lead	(ug/l)	3.9*	-					<3.0	-	4	-
ICP Zinc	(ug/l)	45	-							40	-
Mercury	(ug/l)	<.2	-					<0.05	-	<0.05	-
GFAA Silver	(ug/l)	<1	-					<1.0	-	<1.0	-
pH	(s.u.)									8	-
Field Conductivity	(mS/cm)	1.2	-	1	-	1	-	0.7	-	0.2	-
Field D.O.	(mg/L)	13	-	12	-	8.6	-	9.1	-	11	-
Field Temperature	(°C)	18	-	23	-	17	-	22	-	11	-
Field pH	(s.u.)			8.4	-	7.6	-	8	-	7.8	-

Site Number and Water Body Use Designation		Tinkers Creek #41 WWH, AWS, IWS, & PCR										Tinkers Creek #42 WWH, AWS, IWS, & PCR									
Sample Number		R99-0078 5/6/99		R00-0326 7/27/00		R01-0090 10/4/01		R02-0054 6/10/02		R02-0267 10/15/02		R99-0079 5/6/99		R00-0327 7/27/00		R01-0091 10/4/01		R02-0055 6/10/02		R02-0268 10/15/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)	2.5	-							3.5	-	2.7	-							2.4	-
COD	(mg/L)	19	-							15	-	15	-							15	-
Suspended Solids	(mg/L)	3.6	-							9.3	-	10	-							10.4	-
Dissolved Solids	(mg/L)	700	-							761	-	710	-							800	-
Total Solids	(mg/L)	710	-							794	-	740	-							850	-
Total Phosphorus	(mg/L)	0.16	-							0.293	-	0.19	-							0.495	-
Soluble Phosphorus	(mg/L)	0.088	-							0.28	-	0.13	-							0.52	-
Ammonia-N	(mg/L)	0.22	-							0.109	-	0.17	-							0.027	-
Nitrite	(mg/L)	0.06	-							0.091	-	0.07	-							0.018	-
Nitrate	(mg/L)	1.2	-							7.6	-	1	-							9.47	-
TKN	(mg/L)	4.1	-									4.8	-								
Chloride	(mg/L)	164	-									161	-								
Alkalinity	(mg/L)	230	-							162	-	230	-							162	-
Sulfates	(mg/L)	84	-									78	-								
E. coli	(Col/100 mL)	220	-	390	PCU (298)	600	PCU (298)	1000 EC	PCU (298)	1200	PCU (298)	88	-	140	-	250	-	420	PCU (298)	160	-
Fecal Coliform	(Col/100 mL)	480	-					3000 EC	PCU (2000)	~6000	PCU (2000)	110	-					460	-	220	-
Turbidity	(NTU)	3.8	-									8.9	-								
Conductance	micrmhos	630	-							2.9	-	652	-							3.6	-
Hardness	(mg/L)	250	-					229	-	287	-	263	-					216	-	283	-
ICP Nickel	(ug/l)	7.9*	-					3	-	4	-	9.9*	-					2	-	3.67	-
ICP Copper	(ug/l)	6.5*	-					3.3	-	7	-	11*	-					9.7	-	14	-
ICP Chromium	(ug/l)	3.4*	-					4	-	2	-	6.6*	-					4.5	-	3	-
Hexavalent Chromium	(ug/l)	<10	-							<10.0	-	<10	-							<10.0	-
ICP Iron	(ug/l)	528	-					2460	-	544	-	753	-					1620	-	578	-
ICP Cadmium	(ug/l)	<1*	-					<1.0	-	<1.0	-	<1*	-					<1.0	-	<1.0	-
ICP Silver	(ug/l)							<2.0	-	<2.0	-							<2.0	-	<2.0	-
ICP Arsenic	(ug/l)	<5*	-					4	-	5.5	-	<5*	-					5	-	4	-
ICP Selenium	(ug/l)	<5*	-					<10.0	-	<10.0	-	<5*	-					<10.0	-	<10.0	-
GFAA Thallium	(ug/l)	<7	-									<7	-								
GFAA Antimony	(ug/l)	<7	-									<7	-								
GFAA Cobalt	(ug/l)	<1	-									<1	-								
ICP Beryllium	(ug/l)	<1*	-					<0.5	-	<0.5	-	<1*	-					<0.5	-	<0.5	-
ICP Lead	(ug/l)	5.6*	-					<3.0	-	4	-	<3*	-					<3.0	-	5.5	-
ICP Zinc	(ug/l)	39	-							39	-	35	-					11	-	34	-
Mercury	(ug/l)	<.2	-					<0.05	-	<0.05	-	<.2	-					<0.05	-	<0.05	-
GFAA Silver	(ug/l)	<1	-					<1.0	-	<1.0	-	<1	-					<1.0	-	<1.0	-
pH	(s.u.)									8	-									7.9	-
Field Conductivity	(mS/cm)	1	-	1	-	1	-	0.6	-	0.9	-	1.1	-	1.1	-	1	-	0.6	-	0.9	-
Field D.O.	(mg/L)	7.6	-	8.6	-	6.6	-	6.8	-	8.8	-	9.4	-	9.4	-	8.2	-	7.5	-	9.3	-
Field Temperature	(°C)	18	-	22	-	17	-	21	-	11	-	18	-	22	-	16	-	22	-	12	-
Field pH	(s.u.)			7.8	-	7.7	-	7	-	7.7	-			7.8	-	7.7	-	7.8	-	7.8	-
= > criterion																					
* = GFAA																					

Site Number and Water Body Use Designation		West Creek #36 WWH, AWS, IWS, & PCR									
Sample Number		R99-0085 5/12/99		R00-0308 7/24/00		R00-0410 11/1/00		R01-0085 10/3/01		R02-0049 6/3/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)	<2	-							<2.0	-
COD	(mg/L)	<10	-							12	-
Suspended Solids	(mg/L)	2.4	-							1.3	-
Dissolved Solids	(mg/L)	810	-							760	-
Total Solids	(mg/L)	830	-							837	-
Total Phosphorus	(mg/L)	0.02	-							0.0406	-
Soluble Phosphorus	(mg/L)	0.018	-							0.042	-
Ammonia-N	(mg/L)	0.06	-							0.06	-
Nitrite	(mg/L)	0.01	-							0.01	-
Nitrate	(mg/L)	0.44	-							0.76	-
TKN	(mg/L)	0.48	-								
Alkalinity	(mg/L)	130	-							132	-
Chloride	(mg/L)	300	-								
Sulfates	(mg/L)	130	-							110	-
E. coli	(Col/100 mL)	110	-	140	-	46	-	300	PCU (298)	70	-
Fecal Coliform	(Col/100 mL)	120	-							75	-
Turbidity	(NTU)	0.8	-							1.4	-
Conductance	micrmhos										
Hardness	(mg/L)	262	-							285	-
ICP Nickel	(ug/l)	4.2*	-							3	-
ICP Copper	(ug/l)	13*	-							7	-
ICP Chromium	(ug/l)	1.5*	-							4	-
Hexavalent Chromium	(ug/l)	<10	-							<10.0	-
ICP Iron	(ug/l)	147	-							111	-
ICP Cadmium	(ug/l)	<1*	-							<1.0	-
ICP Silver	(ug/l)									<2.0	-
ICP Arsenic	(ug/l)	<5*	-							2	-
ICP Selenium	(ug/l)	<5*	-							10	-
GFAA Thallium	(ug/l)	<7	-								
GFAA Antimony	(ug/l)	<7	-								
GFAA Cobalt	(ug/l)	<1	-								
ICP Beryllium	(ug/l)	<1*	-							<0.5	-
ICP Lead	(ug/l)	3.1*	-							<3.0	-
ICP Zinc	(ug/l)	33	-							<5.0	-
Mercury	(ug/l)	<.2	-							<0.05	-
GFAA Silver	(ug/l)	<1	-							<1.0	-
pH	(s.u.)	8.3	-							7.9	-
Field Conductivity	(mS/cm)	1.3	-			0.9	-	1	-	0.932	-
Field D.O.	(mg/L)	12	-			13	-	8.8	-	10	-
Field Temperature	(°C)	18	-			7	-	16	-	16	-
Field pH	(s.u.)					8	-	7.7	-	7.2	-
= > criterion											
* = GFAA											

Site Number and Water Body Use Designation		West Creek #37 WWH, AWS, IWS, & PCR									
Sample Number		R99-0086 5/12/99		R00-0309 7/24/00		R00-0411 11/1/00		R01-0086 10/3/01		R02-0050 6/3/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)	<2	-							<2.0	-
COD	(mg/L)	10	-							11	-
Suspended Solids	(mg/L)	2.8	-							1	-
Dissolved Solids	(mg/L)	680	-							748	-
Total Solids	(mg/L)	690	-							782	-
Total Phosphorus	(mg/L)	0.048	-							0.0325	-
Soluble Phosphorus	(mg/L)	0.033	-							0.033	-
Ammonia-N	(mg/L)	0.05	-							0.02	-
Nitrite	(mg/L)	<.01	-							<0.01	-
Nitrate	(mg/L)	0.48	-							0.96	-
TKN	(mg/L)	0.4	-								
Alkalinity	(mg/L)	111	-							129	-
Chloride	(mg/L)	240	-								
Sulfates	(mg/L)	130	-							120	-
E. coli	(Col/100 mL)	81	-	660	PCU (298)	47	-	150	-	77	-
Fecal Coliform	(Col/100 mL)	97	-							92	-
Turbidity	(NTU)	0.65	-							1.4	-
Conductance	micrmhos										
Hardness	(mg/L)	238	-							291	-
ICP Nickel	(ug/l)	2.5*	-							3	-
ICP Copper	(ug/l)	16*	-							8	-
ICP Chromium	(ug/l)	2.2*	-							3	-
Hexavalent Chromium	(ug/l)	<10	-							<10.0	-
ICP Iron	(ug/l)	71	-							133	-
ICP Cadmium	(ug/l)	<1*	-							<1.0	-
ICP Silver	(ug/l)									<2.0	-
ICP Arsenic	(ug/l)	<5*	-							2	-
ICP Selenium	(ug/l)	<5*	-							<10.0	-
GFAA Thallium	(ug/l)	<7	-								
GFAA Antimony	(ug/l)	<7	-								
GFAA Cobalt	(ug/l)	<1	-								
ICP Beryllium	(ug/l)	<1*	-							<0.5	-
ICP Lead	(ug/l)	3.9*	-							<3.0	-
ICP Zinc	(ug/l)	35	-							5	-
Mercury	(ug/l)	<.2	-							<0.05	-
GFAA Silver	(ug/l)	<1	-							<1.0	-
pH	(s.u.)	8.7	-							7.9	-
Field Conductivity	(mS/cm)	1	-			0.8	-	1	-	1.05	-
Field D.O.	(mg/L)	15	-			16	-	11	-	11	-
Field Temperature	(°C)	17	-			8	-	15	-	16	-
Field pH	(s.u.)					7.9	-	8.1	-	7.3	-

Site Number and Water Body Use Designation		West Creek #38 WWH, AWS, IWS, & PCR									
Sample Number		R99-0087 5/12/99		R00-0310 7/24/00		R00-0412 11/1/00		R01-0087 10/3/01		R02-0051 6/3/02	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
BOD	(mg/L)	<2	-							<2.0	-
COD	(mg/L)	10	-							10	-
Suspended Solids	(mg/L)	2.7	-							1.3	-
Dissolved Solids	(mg/L)	830	-							867	-
Total Solids	(mg/L)	860	-							900	-
Total Phosphorus	(mg/L)	0.045	-							0.0358	-
Soluble Phosphorus	(mg/L)	0.042	-							0.031	-
Ammonia-N	(mg/L)	0.17	-							0.08	-
Nitrite	(mg/L)	0.02	-							0.02	-
Nitrate	(mg/L)	0.7	-							1.42	-
TKN	(mg/L)	0.6	-								
Alkalinity	(mg/L)	141	-							158	-
Chloride	(mg/L)	280	-								
Sulfates	(mg/L)	160	-							160	-
E. coli	(Col/100 mL)	76	-	990	PCU (298)	440	-	1300	PCU (298)	80	-
Fecal Coliform	(Col/100 mL)	93	-							93	-
Turbidity	(NTU)	0.8	-							0.89	-
Conductance	micrmhos										
Hardness	(mg/L)	307	-							349	-
ICP Nickel	(ug/l)	4.4*	-							4	-
ICP Copper	(ug/l)	16*	-							8	-
ICP Chromium	(ug/l)	3.1*	-							3	-
Hexavalent Chromium	(ug/l)	<10	-							<10.0	-
ICP Iron	(ug/l)	118	-							108	-
ICP Cadmium	(ug/l)	<1*	-							<1.0	-
ICP Silver	(ug/l)									<2.0	-
ICP Arsenic	(ug/l)	<5*	-							2	-
ICP Selenium	(ug/l)	<5*	-							10	WHAL (5.0)
GFAA Thallium	(ug/l)	<7	-								
GFAA Antimony	(ug/l)	<7	-								
GFAA Cobalt	(ug/l)	<1	-								
ICP Beryllium	(ug/l)	<1*	-							<0.5	-
ICP Lead	(ug/l)	<3*	-							<3.0	-
ICP Zinc	(ug/l)	28	-							9	-
Mercury	(ug/l)	<.2	-							<0.05	-
GFAA Silver	(ug/l)	<1	-							<1.0	-
pH	(s.u.)	8.4	-							8	-
Field Conductivity	(mS/cm)	1.3	-			1	-	1.1	-	1.19	-
Field D.O.	(mg/L)	12	-			10	-	9	-	10	-
Field Temperature	(°C)	18	-			8	-	15	-	15	-
Field pH	(s.u.)					7.6	-	7.9	-	7.4	-
= > criterion											
* = GFAA											

APPENDIX C
LAKE ERIE CHEMICAL AND BACTERIOLOGICAL DATA
1999-2002

DATA TABLE KEY

Individual data are presented by sampling date as month/day/year. The sampled water body, with the NEORSD-assigned sample site number and/or letter in parentheses, also appears in the heading. For Lake Erie, data presented are from analyses of surface grab samples, except A-1, B-1, and C-1, which were from analyses of grab samples collected from two feet above the lake bottom.

All chemical and bacteriological parameters analyzed in the sample are listed in the first column, followed by analytical units in parentheses. When a measured value exceeds a State of Ohio water quality criterion, the applicable water use designation, with the exceeded numerical criterion in parentheses, appears in the "Excursion" column. An asterisk appears when no maximum criterion is applicable and the single value only exceeds an average criterion (therefore not necessarily representing an excursion from water quality standards).

Applicable Ohio EPA Water Use Designations

ASW	=	Agricultural Water Supply
BW	=	Bathing Waters Recreational Use
EWH	=	Exceptional Warmwater Habitat Aquatic Life Use
HHSR	=	Human Health (Single-Route Exposure)
LRW	=	Limited Resource Water
PCU	=	Primary Contact Recreational Use
PWS	=	Public Water Supply
SCU	=	Secondary Contact Recreational Use
SSH	=	Seasonal Salmonid Habitat Aquatic Life Use
WHAL	=	Warmwater Habitat Aquatic Life Use
PHH	=	Protection of Human Health (Dual-Route Exposure)
WL	=	Protection of Wildlife

Other Acronyms and Abbreviations

BOD-5	=	Biochemical Oxygen Demand (5-day test)
COD	=	Chemical Oxygen Demand
E coli	=	Escherichia coli
N	=	Nitrogen
TKN	=	Total Kjeldahl Nitrogen
mg/L	=	milligrams per liter
mS/cm	=	millisiemens per centimeter
ug/L	=	micrograms per liter
s.u.	=	standard units
NTU	=	Nephelometric Turbidity Units

Lake Erie samples were collected from boatside by direct immersion of the sample bottle below the water surface. Samples collected from near the lake bottom were obtained using a Kemmerer-type vertical sampler.

Closed and labeled plastic containers were used to transport samples, on ice for preservation, to NEORSD Analytical Services. All bottles used to transport samples for bacteriological analysis had been sterilized prior to sampling.

Field measurements for water temperature and dissolved oxygen concentration were obtained at the time of sampling using a calibrated YSI Model 58 dissolved oxygen meter, or an 85 or 610 multi-parameter water quality meter. Specific conductance was measured in-field using a YSI Model 85 or 610 multi-parameter water quality meter. An Orion Model 260 pH meter or YSI Model 610 multi-parameter water quality meter was used to measure pH. Water transparency was measured at each Lake Erie site using a Secchi disk.

Sample Locations		Lake Erie A									
Sample Numbers		L99-0020 8/17/99		L99-0031 9/27/99		L00-0002 8/29/00		L00-0034 10/12/00		L01-0015 9/5/01	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
Secchi Depth	(ft)	8	-	8	-	>15	-				
Sample Depth	(ft)	2	-	2	-	1	-	46	-		
Total Depth	(ft)					48	-	47	-		
HG1631	(ng/L)					0.794	-				
BOD	(mg/L)	2.7	-	<2	-	<2.0	-	<2	-		
COD	(mg/L)	<10	-	<10	-	<10	-	<10	-		
Suspended Solids	(mg/L)	1.6	-	3.6	-	1.2	-	3.6	-		
Dissolved Solids	(mg/L)	180	-	130	-	180	-	157	-		
Total Solids	(mg/L)	190	-	140	-	224	-	175	-		
Total Phosphorus	(mg/L)	<0.01	-	0.044	-	0.031	-	0.038	-		
Soluble Phosphorus	(mg/L)	<0.01	-	0.036	-	0.025	-	0.026	-		
Ammonia-N	(mg/L)	0.04	-	0.12	-	1.4	-	0.05	-		
Nitrite	(mg/L)	0.01	-	0.01	-	0.02	-	0.01	-		
Nitrate	(mg/L)	0.27	-	0.16	-	0.14	-	0.27	-		
TKN	(mg/L)	0.38	-	0.5	-						
Alkalinity	(mg/L)	88	-	100	-	89	-	85	-		
Chloride	(mg/L)	28	-	52	-						
Sulfates	(mg/L)	26	-	31	-	19	-	23	-		
E Coli	(Col/100 mL)			<2	-					~<2.0	-
Fecal Coliform	(Col/100 mL)			<2	-						
Turbidity	(NTU)	1.4	-	2.2	-	0.25	-	1.3	-		
Hardness	(mg/L)	110	-	107	-	112	-				
Hexavalent Chromium	(ug/l)	<10	-	<10	-	<10	-	<10	-		
ICP Iron	(ug/l)	52	-	83	-	23	-				
ICP Zinc	(ug/l)	19	-	14	-	8	-				
Mercury	(ug/l)	<.2	-	<.2	-						
GFAA Nickel	(ug/l)	1.7	-	4.6	-	<1	-				
GFAA Copper	(ug/l)	6.9	-	7.1	-	1.1	-				
GFAA Chromium	(ug/l)	3.4	-	6	-	<1	-				
GFAA Cadmium	(ug/l)	<1	-	1.2	-	<1	-				
GFAA Lead	(ug/l)	<3	-	4.3	-	<3	-				
GFAA Selenium	(ug/l)	<5	-	<5	-	<5	-				
GFAA Thallium	(ug/l)	<7	-	<7	-	<7	-				
GFAA Antimony	(ug/l)	<7	-	<7	-	<7	-				
GFAA Cobalt	(ug/l)	<1	-	<1	-	<1	-				
GFAA Silver	(ug/l)	<1	-	<1	-	<1	-				
GFAA Arsenic	(ug/l)	<5	-	<5	-	<5	-				
GFAA Beryllium	(ug/l)	<1	-	<1	-	<1	-				
pH	(s.u.)	8.4	-	7.8	-	8.4	-	7.8	-		
Field Conductivity	(mS/cm)	0.1	-	0.1	-	0.1	-	0.1	-	0.1	-
Field D.O.	(mg/L)	8.8	-	8.5	-	8.7	-			8.2	-
Field Temperature	(°C)	24	-	20	-	23	-	14	-	22	-
Field pH	(s.u.)	8.4	-	7.9	-	8.1	-	7.4	-	8.4	-
= > criterion											

Sample Locations		Lake Erie A-1				Lake Erie B					
Sample Numbers		L99-0021 8/17/99		L99-0032 9/27/99		L99-0022 8/17/99		L99-0033 9/27/99		L00-0004 8/29/00	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
Secchi Depth	(ft)					10	-	8	-	>15	-
Sample Depth	(ft)	47	-	48	-	2	-	2	-	1	-
Total Depth	(ft)									50	-
HG1631	(ng/L)									0.39398	-
BOD	(mg/L)	2.3	-	<2	-	<2	-	<2	-	<2	-
COD	(mg/L)	12	-	<10	-	16	-	10	-	<10	-
Suspended Solids	(mg/L)	2.8	-	4	-	1.2	-	3.2	-	1.2	-
Dissolved Solids	(mg/L)	195	-	140	-	180	-	160	-	182	-
Total Solids	(mg/L)	200	-	141	-	180	-	170	-	209	-
Total Phosphorus	(mg/L)	<.01	-	0.042	-	<0.01	-	0.037	-	0.016	-
Soluble Phosphorus	(mg/L)	<.01	-	0.039	-	<0.01	-	0.032	-	<0.01	-
Ammonia-N	(mg/L)	0.03	-	0.07	-	0.03	-	0.09	-	0.12	-
Nitrite	(mg/L)	<.01	-	0.01	-	<0.01	-	<.01	-	0.01	-
Nitrate	(mg/L)	0.22	-	0.14	-	0.22	-	0.31	-	0.12	-
TKN	(mg/L)	1.9	-	0.38	-	0.22	-	0.34	-		
Alkalinity	(mg/L)	88	-	90	-	93	-	91	-	90	-
Chloride	(mg/L)	20	-	24	-	38	-	28	-		
Sulfates	(mg/L)	24	-	26	-	26	-	25	-	18	-
E Coli	(Col/100 mL)							<2	-		
Fecal Coliform	(Col/100 mL)							<2	-		
Turbidity	(NTU)	1.7	-	2.2	-	1.2	-	1.8	-	0.27	-
Hardness	(mg/L)	110	-	109	-	109	-	112	-	112	-
Hexavalent Chromium	(ug/l)	<10	-	<10	-	<10	-	<10	-	<10	-
ICP Iron	(ug/l)	81	-	99	-	46	-	70	-	36	-
ICP Zinc	(ug/l)	34	-	8	-	27	-	9	-	6	-
Mercury	(ug/l)	<.2	-	<.2	-	<.2	-	<.2	-		
GFAA Nickel	(ug/l)	1	-	2.6	-	2	-	3.9	-	<1	-
GFAA Copper	(ug/l)	6	-	14	-	8.6	-	8.5	-	1	-
GFAA Chromium	(ug/l)	3.3	-	6.1	-	3.4	-	9.6	-	<1	-
GFAA Cadmium	(ug/l)	<1	-	<1	-	<1	-	<1	-	<1	-
GFAA Lead	(ug/l)	<3	-	<3	-	<3	-	<3	-	<3	-
GFAA Selenium	(ug/l)	<5	-	<5	-	<5	-	<5	-	<5	-
GFAA Thallium	(ug/l)	<7	-	<7	-	<7	-	<7	-	<7	-
GFAA Antimony	(ug/l)	<7	-	<7	-	<7	-	<7	-	<7	-
GFAA Cobalt	(ug/l)	<1	-	<1	-	<1	-	<1	-	<1	-
GFAA Silver	(ug/l)	<1	-	<1	-	<1	-	<1	-	<1	-
GFAA Arsenic	(ug/l)	<5	-	<5	-	<5	-	<5	-	<5	-
GFAA Beryllium	(ug/l)	<1	-	<1	-	<1	-	<1	-	<1	-
pH	(s.u.)	8	-	7.6	-	8.3	-	8.1	-	8.4	-
Field Conductivity	(mS/cm)	0.1	-	0.1	-	0.1	-	0.1	-	0.1	-
Field D.O.	(mg/L)	7.6	-	8.5	-	8.4	-	8.7	-	8.7	-
Field Temperature	(°C)	23	-	20	-	24	-	19	-	23	-
Field pH	(s.u.)	8.4	-	7.3	-	8.4	-	7.6	-	8.2	-

Sample Locations		Lake Erie B-1								Lake Erie C						Lake Erie C-1			
Sample Numbers		L99-0023 8/17/99		L99-0034 9/27/99		L99-0036 9/27/99		L00-0037 10/12/03		L99-0009 8/17/99		L99-0035 9/27/99		L00-0006 8/29/00		L99-0010 8/17/99		L00-0040 10/12/00	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
Secchi Depth	(ft)	10	-			11	-			14	-	11	-	>15	-	14	-		
Sample Depth	(ft)	46	-	48	-	48	-	49	-	2	-	2	-	1	-	47	-	50	-
Total Depth	(ft)							50	-					48	-			51	-
HG1631	(ng/L)													0.708	-				
BOD	(mg/L)	<2	-	<2	-	<2	-	<2	-	<2	-	<2	-	<2	-	<2	-	<2	-
COD	(mg/L)	12	-	10	-	<10	-	<10	-	<10	-	11	-	<10	-	<10	-	<10	-
Suspended Solids	(mg/L)	<1	-	3.2	-	1.6	-	3.6	-	1.2	-	2.8	-	<1	-	1.2	-	3.6	-
Dissolved Solids	(mg/L)	190	-	148	-	130	-	155	-	180	-	160	-	185	-	150	-	152	-
Total Solids	(mg/L)	190	-	159	-	130	-	176	-	180	-	170	-	205	-	170	-	168	-
Total Phosphorus	(mg/L)	<.01	-	0.037	-	0.029	-	0.03	-	<.01	-	0.034	-	0.031	-	<.01	-	0.025	-
Soluble Phosphorus	(mg/L)	<.01	-	0.036	-	0.026	-	0.025	-	<.01	-	0.026	-	0.012	-	<.01	-	0.013	-
Ammonia-N	(mg/L)	0.07	-	0.13	-	0.16	-	0.04	-	0.03	-	0.11	-	0.13	-	0.09	-	0.06	-
Nitrite	(mg/L)	0.01	-	0.01	-	0.01	-	0.01	-	<.01	-	<.01	-	0.01	-	<.01	-	0.01	-
Nitrate	(mg/L)	0.24	-	0.27	-	0.13	-	0.26	-	0.22	-	0.14	-	0.15	-	0.2	-	0.17	-
TKN	(mg/L)	0.22	-	0.42	-	0.37	-			0.4	-	0.38	-			0.75	-		
Alkalinity	(mg/L)	90	-	90	-	93	-	85	-	95	-	88	-	88	-	86	-	85	-
Chloride	(mg/L)	33	-	38	-	22	-			8	-	26	-			18	-		
Sulfates	(mg/L)	34	-	20	-	27	-	25	-	30	-	31	-	22	-	27	-	23	-
E Coli	(Col/100 mL)											<2	-						
Fecal Coliform	(Col/100 mL)											<2	-						
Turbidity	(NTU)	1.1	-	2	-	0.85	-	2.1	-	0.37	-	0.95	-	0.33	-	0.5	-	5	-
Hardness	(mg/L)	108	-	112	-	110	-			113	-	110	-	112	-	113	-	2	-
Hexavalent Chromium	(ug/l)	<10	-	<10	-	<10	-	<10	-	<10	-	<10	-	<10	-	<10	-	<10	-
ICP Iron	(ug/l)	54	-	84	-	38	-			30	-	42	-	25	-	33	-		
ICP Zinc	(ug/l)	21	-	14	-	9	-			20	-	22	-	10	-	27	-		
Mercury	(ug/l)	<.2	-	<.2	-	<.2	-			<.2	-	<.2	-			<.2	-		
GFAA Nickel	(ug/l)	1.9	-	3.6	-	1.4	-			1.4	-	1.8	-	<1	-	1.9	-		
GFAA Copper	(ug/l)	6.3	-	10	-	3.3	-			7.9	-	7	-	1.1	-	6	-		
GFAA Chromium	(ug/l)	3.9	-	9.3	-	4.3	-			3.6	-	8.2	-	<1	-	3.4	-		
GFAA Cadmium	(ug/l)	<1	-	<1	-	<1	-			<1	-	<1	-	<1	-	<1	-		
GFAA Lead	(ug/l)	<3	-	<3	-	<3	-			<3	-	<3	-	<3	-	<3	-		
GFAA Selenium	(ug/l)	<5	-	<5	-	<5	-			<5	-	<5	-	<5	-	<5	-		
GFAA Thallium	(ug/l)	<7	-	<7	-	<7	-			<7	-	<7	-	<7	-	<7	-		
GFAA Antimony	(ug/l)	<7	-	<7	-	<7	-			<7	-	<7	-	<7	-	<7	-		
GFAA Cobalt	(ug/l)	<1	-	<<1	-	<1	-			<1	-	<1	-	<1	-	<1	-		
GFAA Silver	(ug/l)	<1	-	<1	-	<1	-			<1	-	<1	-	<1	-	<1	-		
GFAA Arsenic	(ug/l)	<5	-	<5	-	<5	-			<5	-	<5	-	<5	-	<5	-		
GFAA Beryllium	(ug/l)	<1	-	<1	-	<1	-			<1	-	<1	-	<1	-	<1	-		
pH	(s.u.)	8.1	-	7.5	-	7.1	-	7.6	-	8	-	7.9	-	8.4	-	7.4	-	7.7	-
Field Conductivity	(mS/cm)	0	-	0.1	-	0.1	-	0.1	-			0.1	-	0.1	-	0.1	-	0.1	-
Field D.O.	(mg/L)	8.1	-	8.6	-	8.7	-	8.3	-			8.9	-	8.9	-			7.8	-
Field Temperature	(°C)	24	-	19	-	20	-	14	-	24	-	20	-	23	-	24	-	14	-
Field pH	(s.u.)	8.4	-	7.7	-	6.8	-	7.6	-	8.4	-	7	-	8.4	-	8.4	-	7.8	-
= > criterion																			

Sample Locations		Lake Erie D								Lake Erie E						Lake Erie F					
Sample Numbers		L99-0024 8/17/99		L99-0037 9/27/99		L00-0011 9/6/00		L01-0017 9/5/01		L99-0025 8/17/99		L99-0038 9/27/99		L00-0013 9/6/00		L99-0026 8/17/99		L99-0039 9/27/99		L00-0015 9/6/00	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
Secchi Depth	(ft)	6	-	9	-	6	-			5	-	7	-	5	-	6	-	5	-	5	-
Sample Depth	(ft)	2	-	2	-	12	-			2	-	2	-	8	-	2	-	2	-	29	-
Total Depth	(ft)																				
HG1631	(ng/L)					1.49	WL(1.3)							1.55	WL (1.3)					1.08	-
BOD	(mg/L)	3.5	-	<2	-	<2	-			3.7	-	<2	-	<2	-	2.5	-	<2	-	2.3	-
COD	(mg/L)	14	-	<10	-	<10	-			12	-	15	-	<10	-	14	-	12	-	<10	-
Suspended Solids	(mg/L)	<1	-	2	-	4.4	-			4	-	4	-	6.4	-	4.8	-	2	-	4	-
Dissolved Solids	(mg/L)	220	-	170	-	204	-			250	-	170	-	212	-	250	-	190	-	230	-
Total Solids	(mg/L)	230	-	170	-	206	-			260	-	200	-	219	-	260	-	190	-	233	-
Total Phosphorus	(mg/L)	0.016	-	0.036	-	0.057	-			0.028	-	0.039	-	0.074	-	0.028	-	0.065	-	0.079	-
Soluble Phosphorus	(mg/L)	0.012	-	0.039	-	0.048	-			0.015	-	0.029	-	0.065	-	0.02	-	0.055	-	0.079	-
Ammonia-N	(mg/L)	0.04	-	0.1	-	0.08	-			0.03	-	0.04	-	0.09	-	0.07	-	0.27	-	0.34	-
Nitrite	(mg/L)	0.01	-	0.01	-	0.02	-			0.02	-	0.01	-	0.02	-	0.03	-	0.04	-	0.15	-
Nitrate	(mg/L)	0.45	-	0.32	-	0.55	-			0.86	-	0.42	-	0.7	-	0.91	-	0.49	-	0.7	-
TKN	(mg/L)	0.34	-	0.39	-					0.5	-	0.4	-			0.64	-	0.66	-		
Alkalinity	(mg/L)	90	-	92	-	92	-			93	-	94	-	94	-	92	-	95	-	97	-
Chloride	(mg/L)	48	-	50	-					40	-	28	-			48	-	38	-		
Sulfates	(mg/L)	35	-	24	-	24	-			46	-	26	-	27	-	42	-	26	-	28	-
E Coli	(Col/100 mL)			2	-		-	~26	-			~6	-					~8	-		
Fecal Coliform	(Col/100 mL)			~2	-							~20	-					~10	-		
Turbidity	(NTU)	1.4	-	0.85	-	1.2	-			1.9	-	1.5	-	1.7	-	2	-	2	-	1.1	-
Hardness	(mg/L)	111	-	111	-	120	-			117	-	116	-	131	-	122	-	115	-	130	-
Hexavalent Chromium	(ug/l)	<10	-	<10	-	<10	-			<10	-	<10	-	<10	-	<10	-	<10	-	<10	-
ICP Iron	(ug/l)	62	-	35	-	206	-			97	-	69	-	247	-	131	-	69	-	200	-
ICP Zinc	(ug/l)	23	-	30	-	6	-			23	-	26	-	11	-	31	-	25	-	11	-
Mercury	(ug/l)	<.2	-	<.2	-					<.2	-	<.2	-			<.2	-	<.2	-		
GFAA Nickel	(ug/l)	1.3	-	4.8	-	1.3	-			4.9	-	5.4	-	3.5	-	3.5	-	2	-	2	-
GFAA Copper	(ug/l)	5.5	-	6.5	-	1.3	-			13	-	5.3	-	2	-	8.3	-	3.4	-	1.6	-
GFAA Chromium	(ug/l)	3.3	-	5.5	-	<1	-			3.9	-	5.8	-	<1	-	3.7	-	6.5	-	<1	-
GFAA Cadmium	(ug/l)	<1	-	<1	-	<1	-			<1	-	<1	-	<1	-	<1	-	<1	-	<1	-
GFAA Lead	(ug/l)	<3	-	<3	-	<3	-			3.4	-	<3	-	<3	-	<3	-	<3	-	<3	-
GFAA Selenium	(ug/l)	<5	-	<5	-	<5	-			<5	-	<5	-	<5	-	<5	-	<5	-	<5	-
GFAA Thallium	(ug/l)	<7	-	<7	-	<7	-			<7	-	<7	-	<7	-	<7	-	<7	-	<7	-
GFAA Antimony	(ug/l)	<7	-	<7	-	<7	-			<7	-	<7	-	<7	-	<7	-	<7	-	<7	-
GFAA Cobalt	(ug/l)	<1	-	<1	-	<1	-			<1	-	<1	-	<1	-	<1	-	<1	-	<1	-
GFAA Silver	(ug/l)	<1	-	<1	-	<1	-			<1	-	<1	-	<1	-	<1	-	<1	-	<1	-
GFAA Arsenic	(ug/l)	<5	-	<5	-	<5	-			<5	-	<5	-	<5	-	<5	-	<5	-	<5	-
GFAA Beryllium	(ug/l)	<1	-	<1	-	<1	-			<1	-	<1	-	<1	-	<1	-	<1	-	<1	-
pH	(s.u.)	8.3	-	8	-	7.7	-			8.7	-	8.2	-	7.4	-	8.2	-	8.1	-	7.7	-
Field Conductivity	(mS/cm)	0.1	-	0.1	-	0.1	-	0.1	-	0.2	-	0.1	-	0.1	-	0.2	-	0.2	-	0.2	-
Field D.O.	(mg/L)	7.8	-	8.9	-	8.4	-	7.8	-	9.8	-	9	-	8	-	8.6	-	9.1	-	7.5	-
Field Temperature	(°C)	24	-	19	-	22	-	23	-	24	-	19	-	22	-	24	-	19	-	22	-
Field pH	(s.u.)	8.2	-	8	-	7.8	-	8.1	-	8.6	-	8	-	7.7	-	8.2	-	8.1	-	7.8	-
= > criterion																					

Sample Locations		Lake Erie G						Lake Erie H						Lake Erie I			
Sample Numbers		L99-0011 8/17/99		L99-0040 9/27/99		L00-0017 9/6/00		L99-0012 8/17/99		L99-0041 9/27/99		L00-0019 9/6/00		L99-0013 8/17/99		L99-0043 9/27/99	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
Secchi Depth	(ft)	3	-	2	-	2	-	2	-	0	-	1	-	7	-		
Sample Depth	(ft)	1	-	2	-	21	-	1	-	2	-	33	-	1	-		
Total Depth	(ft)																
HG1631	(ng/L)					1.84	WL (1.3)					2.86	WL (1.3)				
BOD	(mg/L)	<2	-	<2	-	<2	-	<2	-	<2	-	2.2	-	<2	-	<2	-
COD	(mg/L)	13	-	<10	-	<10	-	<10	-	23	-	<10	-	12	-	<10	-
Suspended Solids	(mg/L)	7.2	-	4.2	-	10	-	15	-	22	-	13	-	3.6	-	5.2	-
Dissolved Solids	(mg/L)	330	-	270	-	290	-	380	-	570	-	398	-	190	-	250	-
Total Solids	(mg/L)	350	-	270	-	302	-	440	-	610	-	415	-	200	-	250	-
Total Phosphorus	(mg/L)	0.074	-	0.072	-	0.094	-	0.15	-	0.27	-	0.15	-	0.026	-	0.073	-
Soluble Phosphorus	(mg/L)	0.06	-	0.064	-	0.091	-	0.12	-	0.23	-	0.14	-	0.013	-	0.058	-
Ammonia-N	(mg/L)	0.27	-	0.2	-	0.19	-	0.39	-	0.4	-	0.29	-	0.08	-	0.41	-
Nitrite	(mg/L)	0.05	-	0.03	-	0.04	-	0.04	-	0.1	-	0.075	-	0.01	-	0.05	-
Nitrate	(mg/L)	2.2	-	1.7	-	1.6	-	3.6	-	6.6	-	3.3	-	0.53	-	1.3	-
TKN	(mg/L)	0.78	-	0.69	-			1	-	1.5	-			0.49	-	0.53	-
Alkalinity	(mg/L)	93	-	93	-	102	-	102	-	109	-	112	-	88	-	103	-
Chloride	(mg/L)	74	-	58	-		-	98	-	170	-			24	-	54	-
Sulfates	(mg/L)	53	-	35	-	39	-	61	-	95	-	56	-	32	-	31	-
E Coli	(Col/100 mL)	~12	-				-	~25	-					~10	-		
Fecal Coliform	(Col/100 mL)	~14	-					150	-					~30	-		
Turbidity	(NTU)	4.9	-	4.2	-	4.3	-	9	-	18	-	4.6	-	1.5	-	4	-
Hardness	(mg/L)	146	-	129	-	144	-	165	-	207	-	166	-	119	-	123	-
Hexavalent Chromium	(ug/l)	<10	-	<10	-	<10	-	<10	-	<10	-	<10	-	<10	-	<10	-
ICP Iron	(ug/l)	348	-	214	-	540	-	699	-	1099	-	696	-	203	-	237	-
ICP Zinc	(ug/l)	33	-	35	-	46	-	48	-	82	-	32	-	41	-	30	-
Mercury	(ug/l)	<.2	-	<.2	-			<.2	-	<.2	-			<.2	-	<.2	-
GFAA Nickel	(ug/l)	6.2	-	3	-	3.6	-	10	-	15	-	6	-	5.1	-	3.8	-
GFAA Copper	(ug/l)	7.8	-	3	-	2.4	-	7.1	-	9	-	3.2	-	11	-	4.8	-
GFAA Chromium	(ug/l)	5.2	-	3.7	-	<1	-	5	-	8.5	-	1.2	-	4.1	-	5.2	-
GFAA Cadmium	(ug/l)	<1	-	<1	-	<1	-	<1	-	<1	-	<1	-	<1	-	<1	-
GFAA Lead	(ug/l)	<3	-	<3	-	<3	-	3.8	-	4.6	-	3.3	-	3.1	-	<3	-
GFAA Selenium	(ug/l)	<5	-	<5	-	<5	-	<5	-	<5	-	<5	-	<5	-	<5	-
GFAA Thallium	(ug/l)	<7	-	<7	-	<7	-	<7	-	<7	-	<7	-	<7	-	<7	-
GFAA Antimony	(ug/l)	<7	-	<7	-	<7	-	<7	-	<7	-	<7	-	<7	-	<7	-
GFAA Cobalt	(ug/l)	<1	-	<1	-	<1	-	1	-	1	-	<1	-	<1	-	<1	-
GFAA Silver	(ug/l)	<1	-	<1	-	<1	-	<1	-	<1	-	<1	-	<1	-	<1	-
GFAA Arsenic	(ug/l)	<5	-	<5	-	<5	-	<5	-	<5	-	<5	-	<5	-	<5	-
GFAA Beryllium	(ug/l)	<1	-	<1	-	<1	-	<1	-	<1	-	<1	-	<1	-	<1	-
pH	(s.u.)	7.7	-	7.9	-	7.7	-	7.7	-	7.4	-	7.4	-	8.3	-	7.5	-
Field Conductivity	(mS/cm)	0.4	-	0.2	-	0.2	-	0.5	-	0.4	-	0.4	-	0.2	-	0.2	-
Field D.O.	(mg/L)	5.8	-	7.6	-	7.3	-	5.2	-	3.9	-	5.5	-	8.1	-	8.2	-
Field Temperature	(°C)	24	-	19	-	22	-	24	-	21	-	24	-	24	-	19	-
Field pH	(s.u.)	7.8	-	7.9	-	7.8	-	7.8	-	7.6	-	7.7	-	8.3	-	7.7	-
= > criterion																	

Sample Locations		Lake Erie J						Lake Erie K						Lake Erie L					
Sample Numbers		L99-0019 8/17/99		L99-0044 9/27/99		L01-0009 9/5/01		L99-0015 8/17/99		L99-0045 9/27/99		L01-0010 9/5/01		L99--0016 8/17/99		L99-0046 9/27/99		L01-0011 9/5/01	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
Secchi Depth	(ft)	8	-					7	-					9	-				
Sample Depth	(ft)	2	-					1	-					1	-				
Total Depth	(ft)																		
HG1631	(ng/L)																		
BOD	(mg/L)	3.1	-	<2	-			<2	-	<2	-			<2	-	<2	-		
COD	(mg/L)	<10	-	15	-			10	-	10	-			<10	-	<10	-		
Suspended Solids	(mg/L)	1.6	-	2.4	-			3.2	-	2.4	-			<1	-	1.2	-		
Dissolved Solids	(mg/L)	210	-	190	-			190	-	170	-			190	-	240	-		
Total Solids	(mg/L)	220	-	200	-			200	-	180	-			200	-	250	-		
Total Phosphorus	(mg/L)	0.013	-	0.037	-			0.039	-	0.045	-			0.013	-	0.13	-		
Soluble Phosphorus	(mg/L)	<.01	-	0.031	-			0.023	-	0.036	-			0.013	-	0.11	-		
Ammonia-N	(mg/L)	0.26	-	0.08	-			0.03	-	0.1	-			0.25	-	0.37	-		
Nitrite	(mg/L)	0.01	-	0.01	-			0.01	-	0.01	-			0.01	-	0.04	-		
Nitrate	(mg/L)	0.66	-	0.28	-			0.94	-	0.23	-			0.41	-	1.2	-		
TKN	(mg/L)	0.34	-	0.37	-			0.53	-	0.47	-			0.59	-	0.7	-		
Alkalinity	(mg/L)	86	-	101	-			85	-	90	-			87	-	101	-		
Chloride	(mg/L)	40	-	30	-			32	-	44	-			62	-	60	-		
Sulfates	(mg/L)	25	-	22	-			30	-	19	-			29	-	29	-		
E Coli	(Col/100 mL)					~28	-	50	-			90	-	~4	-			44	-
Fecal Coliform	(Col/100 mL)							110	-					~5	-				
Turbidity	(NTU)	0.82	-	1.5	-			2	-	1.3	-			0.72	-	1.3	-		
Hardness	(mg/L)	109	-	113	-			116	-	114	-			113	-	128	-		
Hexavalent Chromium	(ug/l)	<10	-	<10	-			<10	-	<10	-			<10	-	<10	-		
ICP Iron	(ug/l)	62	-	67	-			91	-	64	-			48	-	90	-		
ICP Zinc	(ug/l)	36	-	17	-			61	-	13	-			60	-	33	-		
Mercury	(ug/l)	<.2	-	<.2	-			<.2	-	<.2	-			<.2	-	<.2	-		
GFAA Nickel	(ug/l)	1.8	-	2.5	-			7.2	-	2.4	-			1.6	-	13	-		
GFAA Copper	(ug/l)	13	-	4	-			18	EWH (16.1)	3.3	-			6	-	4.4	-		
GFAA Chromium	(ug/l)	3.4	-	5.1	-			4	-	4.6	-			4.2	-	7.3	-		
GFAA Cadmium	(ug/l)	<1	-	<1	-			<1	-	<1	-			<1	-	<1	-		
GFAA Lead	(ug/l)	<3	-	<3	-			6.8	-	<3	-			<3	-	<3	-		
GFAA Selenium	(ug/l)	<5	-	<5	-			<5	-	<5	-			<5	-	<5	-		
GFAA Thallium	(ug/l)	<7	-	<7	-			<7	-	<7	-			<7	-	<7	-		
GFAA Antimony	(ug/l)	<7	-	<7	-			<7	-	<7	-			<7	-	<7	-		
GFAA Cobalt	(ug/l)	<1	-	<1	-			<1	-	<1	-			<1	-	<1	-		
GFAA Silver	(ug/l)	<1	-	<1	-			<1	-	<1	-			<1	-	<1	-		
GFAA Arsenic	(ug/l)	<5	-	<5	-			<5	-	<5	-			<5	-	<5	-		
GFAA Beryllium	(ug/l)	<1	-	<1	-			<1	-	<1	-			<1	-	<1	-		
pH	(s.u.)	8.4	-	8.1	-			8.5	-	7.9	-			8.3	-	7.7	-		
Field Conductivity	(mS/cm)	0.1	-	0.1	-	0.1	-	0.1	-	0.1	-	0.1	-	0.1	-	0.2	-	0.1	-
Field D.O.	(mg/L)	8.2	-	8.9	-	7.5	-	9.1	-	9.4	-	8	-	7.5	-	8.9	-	7.8	-
Field Temperature	(°C)	24	-	19	-	22	-	24	-	19	-	20	-	24	-	20	-	22	-
Field pH	(s.u.)	8	-	8	-	8.1	-	8.3	-	8.2	-	8.2	-	8.2	-	7.9	-	8.1	-
= > criterion																			

Sample Locations		Lake Erie M						Lake Erie N						Lake Erie O					
Sample Numbers		L99-0017 8/17/99		L99-0047 9/27/99		L01-0012 9/5/01		L99-0018 8/17/99		L99-0048 9/27/99		L01-0014 9/5/01		L99-0027 8/17/99		L99-0042 9/27/99		L00-0008 9/6/00	
		Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions	Analytical	Excursions
Secchi Depth	(ft)	11	-					10	-					5	-	7	-	6	-
Sample Depth	(ft)	1	-					1	-					2	-	2	-	8	-
Total Depth	(ft)																		
HG1631	(ng/L)																	1.14	-
BOD	(mg/L)	<2	-	<2	-			<2	-	<2	-			2.3	-	<2	-	<2	-
COD	(mg/L)	<10	-	<10	-			13	-	10	-			11	-	13	-	<10	-
Suspended Solids	(mg/L)	1.4	-	1.2	-			1.2	-	2.4	-			6.8	-	1.6	-	4	-
Dissolved Solids	(mg/L)	200	-	167	-			170	-	160	-			200	-	170	-	201	-
Total Solids	(mg/L)	200	-	179	-			180	-	170	-			210	-	170	-	204	-
Total Phosphorus	(mg/L)	0.011	-	0.045	-			0.013	-	0.04	-			0.024	-	0.045	-	0.055	-
Soluble Phosphorus	(mg/L)	<.01	-	0.04	-			<.01	-	0.032	-			0.015	-	0.037	-	0.045	-
Ammonia-N	(mg/L)	0.08	-	0.08	-			0.1	-	0.33	-			0.04	-	0.03	-	0.07	-
Nitrite	(mg/L)	0.01	-	0.01	-			0.01	-	0.01	-			0.01	-	0.01	-	0.02	-
Nitrate	(mg/L)	0.34	-	0.25	-			0.3	-	0.16	-			0.47	-	0.33	-	0.5	-
TKN	(mg/L)	0.49	-	0.4	-			0.58	-	0.36	-			0.54	-	0.4	-		
Alkalinity	(mg/L)	88	-	96	-			86	-	93	-			87	-	98	-	93	-
Chloride	(mg/L)	22	-	48	-			20	-	32	-			60	-	30	-		
Sulfates	(mg/L)	28	-	20	-			11	-	23	-			40	-	31	-	26	-
E Coli	(Col/100 mL)	~22	-			40	-	42	-			~10	-			40	-		
Fecal Coliform	(Col/100 mL)	52	-					54	-							78	-		
Turbidity	(NTU)	0.77	-	0.75	-			0.57	-	0.73	-			2.4	-	1.3	-	1.3	-
Hardness	(mg/L)	109	-	115	-			111	-	114	-			117	-	117	-	121	-
Hexavalent Chromium	(ug/l)	<10	-	<10	-			<10	-	<10	-			<10	-	<10	-	<10	-
ICP Iron	(ug/l)	52	-	54	-			78	-	40	-			138	-	55	-	174	-
ICP Zinc	(ug/l)	42	-	19	-			23	-	11	-			28	-	16	-	26	-
Mercury	(ug/l)	<.2	-	<.2	-			<.2	-	<.2	-			<.2	-	<.2	-		
GFAA Nickel	(ug/l)	1.7	-	3.1	-			1.2	-	2.6	-			1.9	-	2	-	1.2	-
GFAA Copper	(ug/l)	6.1	-	4.1	-			7.2	-	3.5	-			5.5	-	12	-	1.4	-
GFAA Chromium	(ug/l)	3.2	-	5.2	-			3.6	-	8.2	-			3.7	-	5.7	-	<1	-
GFAA Cadmium	(ug/l)	<1	-	<1	-			<1	-	<1	-			<1	-	<1	-	<1	-
GFAA Lead	(ug/l)	<3	-	<3	-			<3	-	<3	-			<3	-	<3	-	<3	-
GFAA Selenium	(ug/l)	<5	-	<5	-			<5	-	<5	-			<5	-	<5	-	<5	-
GFAA Thallium	(ug/l)	<7	-	<7	-			<7	-	<7	-			<7	-	<7	-	<7	-
GFAA Antimony	(ug/l)	<7	-	<7	-			<7	-	<7	-			<7	-	<7	-	<7	-
GFAA Cobalt	(ug/l)	<1	-	<1	-			<1	-	<1	-			<1	-	<1	-	<1	-
GFAA Silver	(ug/l)	<1	-	<1	-			<1	-	<1	-			<1	-	<1	-	<1	-
GFAA Arsenic	(ug/l)	<5	-	<5	-			<5	-	<5	-			<5	-	<5	-	<5	-
GFAA Beryllium	(ug/l)	<1	-	<1	-			<1	-	<1	-			<1	-	<1	-	<1	-
pH	(s.u.)	8.3	-	7.8	-			8.1	-	7.8	-			8.5	-	8.1	-	7.7	-
Field Conductivity	(mS/cm)	0.1	-	0.1	-	0.1	-	0.1	-	0.1	-	0.1	-	0.2	-	0.1	-	0.1	-
Field D.O.	(mg/L)	8.5	-	9.4	-	8	-	7.5	-	9.2	-	8.2	-	9.6	-	9.1	-	8.5	-
Field Temperature	(°C)	24	-	20	-	20	-	24	-	20	-	22	-	24	-	19	-	22	-
Field pH	(s.u.)	8.3	-	8.2	-	8.2	-	8.1	-	8.2	-	8.3	-	8.6	-	8	-	7.8	-
= > criterion																			

APPENDIX D
QUALITATIVE HABITAT EVALUATION INDEX SCORES
1999-2002

OEPA QHEI — **Qualitative Habitat Evaluation Index** — **Modified by NEORSD**

River Code:
RM:
Stream: Cuyahoga River
Date: 7/26/2001
Location: Site #22.51-DS Big Creek/Lower Harvard Ave.
Scorer's Initials: CZ/TZ
Comments: Electrofishing Site

Total Score: 64.75

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present) — Substrate: 12, Max 20

		Type	Pool%	Riffle%
		Bldr/Slbs		
		Boulder	5	
		Cobble	10	20
		Hardpan		
		Muck		
		Silt	5	
		Gravel	25	
x	x	Sand	75	
		Bedrock		
		Detritus		
		Artifical		

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [x] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [ ] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [x] Silt - *Heavy*
- [x] Silt - *Moderate*
- [ ] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [x] 5 or More
- [ ] 4 or Less

Embeddedness
- [x] Extensive
- [x] Moderate
- [ ] Normal
- [ ] None

Comments:

Instream Cover (Check *ALL* that apply) — Cover: 10, Max 20
- [ ] __ Undercut Banks
- [ ] __ Overhanging Vegetation
- [x] 1 Shallows (Slow water)
- [ ] __ Rootmats
- [x] 2 Deep Pools >70cm
- [ ] __ Rootwads
- [x] 1 Boulders
- [ ] __ Oxbows, backwaters
- [ ] __ Aquatic Macrophytes
- [x] 1 Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [x] Moderate 25-75%
- [x] Sparse 5-25%
- [ ] Nearly Absent <5%

Comments:

Channel Morphology: (Check 1, or 2 and average) — Channel: 15, Max 20

Sinuosity
- [ ] High
- [x] Moderate
- [x] Low
- [ ] None

Development
- [ ] Excellent
- [x] Good
- [x] Fair
- [ ] Poor

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Stability
- [x] High
- [x] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [ ] Bank Shaping
- [ ] 1-side channel modifications

Comments:

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average) — Riparian: 4.25, Max. 10

Riparian Width (per bank)

L	R	
		Wide > 50m
	x	Moderate 10-50m
	x	Narrow 5-10m
		Very Narrow <5m
x		None

Bank Erosion (per bank)

L	R	
x	x	None/Little
		Moderate
		Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
		Forest, Swamp
		Shrub or Old Field
		Residential, Park, New Field
		Fenced Pasture
		Conservation Tillage
x	x	Urban or Industrial
		Open Pasture, Row Crop
		Mining/Construction

Comments:

Pool/Glide Quality — Pool: 10, Max 12

Max. Depth (1 only)
- [x] >1m
- [ ] 0.7-1m
- [ ] 0.4-0.7m
- [ ] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [ ] Pool width > riffle width
- [ ] Pool width = riffle width
- [x] Pool width < riffle width

Current Velocity (Check all that apply)
- [x] Eddies
- [x] Fast
- [x] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Riffle/Run Quality (Check 1, or 2 and average) — Riffle/Run: 5.5, Max 8

Riffle Depth
- [x] Best Areas >10cm
- [ ] Best Areas 5-10cm
- [ ] Best Areas <5cm

Run Depth
- [x] Max >50
- [ ] Max <50

Riffle/Run Substrate
- [x] Stable
- [x] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [ ] Low
- [x] Moderate
- [ ] Extensive

Comments:

Gradient: 8

Gradient (ft/mi)	0.9	%Pool	25	%Glide	0
Drainage Area (sq.mi.)	786	%Riffle	30	%Run	45

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silviclulture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI — **Qualitative Habitat Evaluation Index** — **Modified by NEORSD**

River Code:
Date: 11/21/2002
Scorer's Initials: CZ
RM:
Location: #22.6 River Smelting
Comments:
Stream: Cuyahoga River

Total Score: 54.75

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present)

	Type	Pool%	Riffle%
	Bldr/Slbs		
	Boulder	5	
	Cobble	5	
	Hardpan		
	Muck		
	Silt	5	
x	Gravel	30	
x	Sand	55	
	Bedrock		
	Detritus		
	Artifical		

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [x] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [ ] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [x] Silt - *Heavy*
- [x] Silt - *Moderate*
- [ ] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [x] 5 or More
- [ ] 4 or Less

Embeddedness
- [x] Extensive
- [x] Moderate
- [ ] Normal
- [ ] None

Comments:

Substrate: 13 — Max 20

Instream Cover (Check *ALL* that apply)
- [ ] Undercut Banks
- [ ] Overhanging Vegetation
- [ ] Shallows (Slow water)
- [x] 1 Rootmats
- [x] 1 Deep Pools >70cm
- [ ] Rootwads
- [x] 1 Boulders
- [ ] Oxbows, backwaters
- [ ] Aquatic Macrophytes
- [x] 2 Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [ ] Moderate 25-75%
- [x] Sparse 5-25%
- [ ] Nearly Absent <5%

Comments: Difficult to assess

Cover: 8 — Max 20

Channel Morphology: (Check 1, or 2 and average)

Sinuosity
- [ ] High
- [ ] Moderate
- [ ] Low
- [x] None

Development
- [ ] Excellent
- [ ] Good
- [x] Fair
- [ ] Poor

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Stability
- [x] High
- [ ] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [ ] Bank Shaping
- [ ] 1-side channel modifications

Comments: No riffles but deep pools, runs deep

Channel: 13 — Max 20

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average)

Riparian Width (per bank)

L	R	
		Wide > 50m
		Moderate 10-50m
	x	Narrow 5-10m
		Very Narrow <5m
x		None

Bank Erosion (per bank)

L	R	
x	x	None/Little
	x	Moderate
		Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
		Forest, Swamp
		Shrub or Old Field
		Residential, Park, New Field
		Fenced Pasture
		Conservation Tillage
x	x	Urban or Industrial
		Open Pasture, Row Crop
		Mining/Construction

Comments: RL-veg. With sand base acts as an impermeable surface

Riparian: 3.75 — Max. 10

Pool/Glide Quality

Max. Depth (1 only)
- [x] >1m
- [ ] 0.7-1m
- [ ] 0.4-0.7m
- [ ] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [x] Pool width > riffle width
- [ ] Pool width = riffle width
- [ ] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [ ] Fast
- [ ] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Pool: 9 — Max 12

Riffle/Run Quality (Check 1, or 2 and average)

Riffle Depth
- [ ] Best Areas >10cm
- [ ] Best Areas 5-10cm
- [ ] Best Areas <5cm

Run Depth
- [ ] Max >50
- [ ] Max <50

Riffle/Run Substrate
- [ ] Stable
- [ ] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [ ] Low
- [ ] Moderate
- [ ] Extensive

Comments: No riffle

Riffle/Run: 0 — Max 8

Gradient (ft/mi)	0.9
Drainage Area (sq.mi.)	749

%Pool	20	%Glide	50
%Riffle	0	%Run	30

Gradient: 8

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silviclulture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI — **Qualitative Habitat Evaluation Index** — **Modified by NEORSD**

River Code:
RM:
Date: 11/20/2002
Location: #22.7 SWI Crossing
Stream: Cuyahoga River
Scorer's Initials: CZ
Comments:

Total Score: 53

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present)

		Type	Pool%	Riffle%
		Bldr/Slbs		
		Boulder	5	
		Cobble	5	
		Hardpan		
		Muck		
		Silt	10	
		Gravel	20	
x	x	Sand	60	
		Bedrock		
		Detritus		
		Artifical		

Substrate: 10 (Max 20)

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [x] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [ ] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [x] Silt - *Heavy*
- [x] Silt - *Moderate*
- [ ] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [ ] 5 or More
- [x] 4 or Less

Embeddedness
- [x] Extensive
- [x] Moderate
- [ ] Normal
- [ ] None

Comments: Different to x because of increased depth

Instream Cover (Check *ALL* that apply)
- [x] 1 Undercut Banks
- [ ] Overhanging Vegetation
- [ ] Shallows (Slow water)
- [x] 1 Rootmats
- [x] 2 Deep Pools >70cm
- [x] 1 Rootwads
- [x] 1 Boulders
- [ ] Oxbows, backwaters
- [ ] Aquatic Macrophytes
- [x] 1 Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [ ] Moderate 25-75%
- [x] Sparse 5-25%
- [ ] Nearly Absent <5%

Comments: Difficult to assess

Cover: 10 (Max 20)

Channel Morphology: (Check 1, or 2 and average)

Sinuosity
- [ ] High
- [ ] Moderate
- [ ] Low
- [x] None

Development
- [ ] Excellent
- [ ] Good
- [ ] Fair
- [x] Poor

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Stability
- [x] High
- [x] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [x] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [x] Bank Shaping
- [x] 1-side channel modifications

Comments: No riffles but deep pools, runs deep

Channel: 10.5 (Max 20)

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average)

Riparian Width (per bank)

L	R	
		Wide > 50m
		Moderate 10-50m
		Narrow 5-10m
	x	Very Narrow <5m
x	x	None

Bank Erosion (per bank)

L	R	
x	x	None/Little
	x	Moderate
		Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
		Forest, Swamp
		Shrub or Old Field
	x	Residential, Park, New Field
		Fenced Pasture
		Conservation Tillage
		Urban or Industrial
		Open Pasture, Row Crop
x		Mining/Construction

Comments: RL-mulch piles RR-park

Riparian: 3.5 (Max. 10)

Pool/Glide Quality

Max. Depth (1 only)
- [x] >1m
- [ ] 0.7-1m
- [ ] 0.4-0.7m
- [ ] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [x] Pool width > riffle width
- [ ] Pool width = riffle width
- [ ] Pool width < riffle width

Current Velocity (Check all that apply)
- [x] Eddies
- [ ] Fast
- [x] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Pool: 11 (Max 12)

Riffle/Run Quality (Check 1, or 2 and average)

Riffle Depth
- [ ] Best Areas >10cm
- [ ] Best Areas 5-10cm
- [ ] Best Areas <5cm

Riffle/Run Substrate
- [ ] Stable
- [ ] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [ ] Low
- [ ] Moderate
- [ ] Extensive

Run Depth
- [ ] Max >50
- [ ] Max <50

Comments: No riffle

Riffle/Run: 0 (Max 8)

Gradient (ft/mi): 0.9
Drainage Area (sq.mi.): 733

%Pool	10	%Glide	10
%Riffle	0	%Run	80

Gradient: 8

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silviculture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI — **Qualitative Habitat Evaluation Index** — **Modified by NEORSD**

River Code:
RM:
Stream: Cuyahoga River
Date: 11/20/2002
Location: #22.8
Scorer's Initials: CZ
Comments:

Total Score: 59.25

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present)

		Type	Pool%	Riffle%
		Bldr/Slbs		
		Boulder	5	5
		Cobble	5	15
		Hardpan		
		Muck		
		Silt	15	5
x		Gravel	25	30
x		Sand	50	45
		Bedrock		
		Detritus		
		Artifical		

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [x] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [ ] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [ ] Silt - *Heavy*
- [x] Silt - *Moderate*
- [ ] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [x] 5 or More
- [ ] 4 or Less

Embeddedness
- [x] Extensive
- [x] Moderate
- [ ] Normal
- [ ] None

Comments:

Substrate: 13.5 — Max 20

Instream Cover (Check *ALL* that apply)
- [x] 1 Undercut Banks
- [ ] Overhanging Vegetation
- [ ] Shallows (Slow water)
- [x] 1 Rootmats
- [x] 1 Deep Pools >70cm
- [ ] Rootwads
- [x] 1 Boulders
- [ ] Oxbows, backwaters
- [ ] Aquatic Macrophytes
- [x] 1 Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [ ] Moderate 25-75%
- [x] Sparse 5-25%
- [x] Nearly Absent <5%

Comments:

Cover: 8 — Max 20

Channel Morphology: (Check 1, or 2 and average)

Sinuosity
- [ ] High
- [ ] Moderate
- [ ] Low
- [x] None

Development
- [ ] Excellent
- [ ] Good
- [x] Fair
- [x] Poor

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Stability
- [x] High
- [ ] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [ ] Bank Shaping
- [ ] 1-side channel modifications

Comments:

Channel: 12 — Max 20

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average)

Riparian Width (per bank)

L	R	
		Wide > 50m
		Moderate 10-50m
x	x	Narrow 5-10m
		Very Narrow <5m
	x	None

Bank Erosion (per bank)

L	R	
x	x	None/Little
		Moderate
		Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
		Forest, Swamp
		Shrub or Old Field
	x	Residential, Park, New Field
		Fenced Pasture
		Conservation Tillage
x		Urban or Industrial
		Open Pasture, Row Crop
	x	Mining/Construction

Comments:

Riparian: 4.75 — Max. 10

Pool/Glide Quality

Max. Depth (1 only)
- [x] >1m
- [ ] 0.7-1m
- [ ] 0.4-0.7m
- [ ] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [ ] Pool width > riffle width
- [ ] Pool width = riffle width
- [x] Pool width < riffle width

Current Velocity (Check all that apply)
- [x] Eddies
- [x] Fast
- [x] Moderate
- [ ] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Pool: 9 — Max 12

Riffle/Run Quality (Check 1, or 2 and average)

Riffle Depth
- [x] Best Areas >10cm
- [ ] Best Areas 5-10cm
- [ ] Best Areas <5cm

Run Depth
- [x] Max >50
- [ ] Max <50

Riffle/Run Substrate
- [ ] Stable
- [x] Mod. Stable
- [x] Unstable

Riffle/Run Embeddedness
- [ ] None
- [ ] Low
- [x] Moderate
- [x] Extensive

Comments:

Riffle/Run: 4 — Max 8

Gradient (ft/mi): 0.9
Drainage Area (sq.mi.): 710

%Pool	5	%Glide	10
%Riffle	10	%Run	75

Gradient: 8

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silviculture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI | **Qualitative Habitat Evaluation Index** | **Modified by NEORSD**

River Code: | RM: | Stream: Cuyahoga River
Date: 11/20/2002 | Location: Site #22.9
Scorer's Initials: CZ | Comments: E. 71st St. and Canal Rd.

Total Score: 65.25

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present)

		Type	Pool%	Riffle%			Type	Pool%	Riffle%			Type	Pool%	Riffle%
		Bldr/Slbs					Muck					Bedrock		
		Boulder	5	5			Silt	5	0			Detritus		
		Cobble	5	15	x		Gravel	5	40			Artifical		
		Hardpan			x		Sand	70	25					

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [x] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [ ] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [x] Silt - *Heavy*
- [x] Silt - *Moderate*
- [ ] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [x] 5 or More
- [ ] 4 or Less

Embeddedness
- [x] Extensive
- [x] Moderate
- [ ] Normal
- [ ] None

Comments:

Substrate: 13 — Max 20

Instream Cover (Check *ALL* that apply)
- [x] 1 Undercut Banks
- [ ] Overhanging Vegetation
- [x] 1 Shallows (Slow water)
- [x] 1 Rootmats
- [x] 1 Deep Pools >70cm
- [ ] Rootwads
- [x] 1 Boulders
- [ ] Oxbows, backwaters
- [ ] Aquatic Macrophytes
- [x] 2 Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [ ] Moderate 25-75%
- [x] Sparse 5-25%
- [ ] Nearly Absent <5%

Comments:

Cover: 10 — Max 20

Channel Morphology: (Check 1, or 2 and average)

Sinuosity
- [ ] High
- [ ] Moderate
- [x] Low
- [ ] None

Development
- [ ] Excellent
- [x] Good
- [x] Fair
- [ ] Poor

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Stability
- [x] High
- [x] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [ ] Bank Shaping
- [ ] 1-side channel modifications

Comments:

Channel: 14.5 — Max 20

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average)

Riparian Width (per bank)

L	R	
		Wide > 50m
	x	Moderate 10-50m
x		Narrow 5-10m
x	x	Very Narrow <5m
		None

Bank Erosion (per bank)

L	R	
	x	None/Little
x		Moderate
		Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
		Forest, Swamp
		Shrub or Old Field
		Residential, Park, New Field
		Fenced Pasture
		Conservation Tillage
x	x	Urban or Industrial
		Open Pasture, Row Crop
		Mining/Construction

Comments:

Riparian: 4.25 — Max. 10

Pool/Glide Quality

Max. Depth (1 only)
- [x] >1m
- [ ] 0.7-1m
- [ ] 0.4-0.7m
- [ ] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [ ] Pool width > riffle width
- [ ] Pool width = riffle width
- [x] Pool width < riffle width

Current Velocity (Check all that apply)
- [x] Eddies
- [x] Fast
- [x] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Pool: 10 — Max 12

Riffle/Run Quality (Check 1, or 2 and average)

Riffle Depth
- [x] Best Areas >10cm
- [ ] Best Areas 5-10cm
- [ ] Best Areas <5cm

Run Depth
- [x] Max >50
- [ ] Max <50

Riffle/Run Substrate
- [x] Stable
- [x] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [ ] Low
- [x] Moderate
- [ ] Extensive

Comments:

Riffle/Run: 5.5 — Max 8

*Gradient (ft/mi): 0.9
Drainage Area (sq.mi.): 710

%Pool	10	%Glide	5
%Riffle	20	%Run	65

Gradient: 8

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silvicluture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI — **Qualitative Habitat Evaluation Index** — **Modified by NEORSD**

River Code: | RM: | Stream: Cuyahoga River
Date: 11/20/2002 | Location: Site #23
Scorer's Initials: CZ | Comments: Old Riverview Rd. Bridge

Total Score: 72.5

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present) — Substrate: 14 (Max 20)

	Type	Pool%	Riffle%
[ ]	Bldr/Slbs		
[ ]	Boulder	5	0
[ ]	Cobble	5	25
[ ]	Hardpan		
[ ]	Muck		
[ ]	Silt	5	0
[x]	Gravel	35	50
[x]	Sand	50	25
[ ]	Bedrock		
[ ]	Detritus		
[ ]	Artifical		

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [x] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [ ] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [ ] Silt - *Heavy*
- [x] Silt - *Moderate*
- [x] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [x] 5 or More
- [ ] 4 or Less

Embeddedness
- [x] Extensive
- [x] Moderate
- [ ] Normal
- [ ] None

Comments:

Instream Cover (Check *ALL* that apply) — Cover: 11 (Max 20)
- [ ] Undercut Banks
- [ ] Overhanging Vegetation
- [x] 1 Shallows (Slow water)
- [x] 1 Rootmats
- [x] 1 Deep Pools >70cm
- [ ] Rootwads
- [x] 1 Boulders
- [ ] Oxbows, backwaters
- [ ] Aquatic Macrophytes
- [x] 2 Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [x] Moderate 25-75%
- [x] Sparse 5-25%
- [ ] Nearly Absent <5%

Comments:

Channel Morphology: (Check 1, or 2 and average) — Channel: 15.5 (Max 20)

Sinuosity
- [ ] High
- [ ] Moderate
- [x] Low
- [ ] None

Development
- [ ] Excellent
- [x] Good
- [ ] Fair
- [ ] Poor

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Stability
- [x] High
- [x] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [ ] Bank Shaping
- [ ] 1-side channel modifications

Comments:

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average) — Riparian: 7.5 (Max. 10)

Riparian Width (per bank)

L	R	
[ ]	[x]	Wide > 50m
[ ]	[ ]	Moderate 10-50m
[ ]	[ ]	Narrow 5-10m
[x]	[ ]	Very Narrow <5m
[x]	[ ]	None

Bank Erosion (per bank)

L	R	
[x]	[ ]	None/Little
[ ]	[x]	Moderate
[ ]	[x]	Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
[x]	[x]	Forest, Swamp
[ ]	[ ]	Shrub or Old Field
[ ]	[ ]	Residential, Park, New Field
[ ]	[ ]	Fenced Pasture
[ ]	[ ]	Conservation Tillage
[ ]	[ ]	Urban or Industrial
[ ]	[ ]	Open Pasture, Row Crop
[ ]	[ ]	Mining/Construction

Comments:

Pool/Glide Quality — Pool: 9 (Max 12)

Max. Depth (1 only)
- [x] >1m
- [ ] 0.7-1m
- [ ] 0.4-0.7m
- [ ] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [ ] Pool width > riffle width
- [ ] Pool width = riffle width
- [x] Pool width < riffle width

Current Velocity (Check all that apply)
- [x] Eddies
- [x] Fast
- [x] Moderate
- [ ] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Riffle/Run Quality (Check 1, or 2 and average) — Riffle/Run: 5.5 (Max 8)

Riffle Depth
- [x] Best Areas >10cm
- [ ] Best Areas 5-10cm
- [ ] Best Areas <5cm

Run Depth
- [x] Max >50
- [ ] Max <50

Riffle/Run Substrate
- [x] Stable
- [x] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [ ] Low
- [x] Moderate
- [ ] Extensive

Comments:

Gradient: 10

Gradient (ft/mi)	5.9
Drainage Area (sq.mi.)	597

%Pool	10	%Glide	15
%Riffle	25	%Run	50

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silvicluture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI

Qualitative Habitat Evaluation Index

Modified by NEORSD

Total Score: 64.5

River Code:
RM:
Stream: Cuyahoga River
Date: 10/8/2002
Location: Site #24
Scorer's Initials: CZ
Comments: St. Rt. 82 Bridge

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present) — Substrate: 12.5, Max 20

		Type	Pool%	Riffle%
[ ]	[ ]	Bldr/Slbs		
[ ]	[ ]	Boulder	5	5
[x]	[ ]	Cobble	10	35
[ ]	[ ]	Hardpan		
[ ]	[ ]	Muck		
[ ]	[ ]	Silt		
[ ]	[ ]	Gravel	40	35
[x]	[ ]	Sand	45	25
[ ]	[ ]	Bedrock		
[ ]	[ ]	Detritus		
[ ]	[ ]	Artifical		

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [x] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [ ] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [ ] Silt - *Heavy*
- [x] Silt - *Moderate*
- [ ] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [ ] 5 or More
- [x] 4 or Less

Embeddedness
- [x] Extensive
- [x] Moderate
- [ ] Normal
- [ ] None

Comments:

Instream Cover (Check *ALL* that apply) — Cover: 7, Max 20
- [ ] Undercut Banks
- [ ] Overhanging Vegetation
- [x] 1 Shallows (Slow water)
- [ ] Rootmats
- [ ] Deep Pools >70cm
- [x] 1 Rootwads
- [x] 1 Boulders
- [ ] Oxbows, backwaters
- [ ] Aquatic Macrophytes
- [x] 1 Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [ ] Moderate 25-75%
- [x] Sparse 5-25%
- [ ] Nearly Absent <5%

Comments:

Channel Morphology: (Check 1, or 2 and average) — Channel: 14.5, Max 20

Sinuosity
- [ ] High
- [ ] Moderate
- [x] Low
- [ ] None

Development
- [ ] Excellent
- [x] Good
- [x] Fair
- [ ] Poor

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Stability
- [x] High
- [x] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [ ] Bank Shaping
- [ ] 1-side channel modifications

Comments:

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average) — Riparian: 7.5, Max. 10

Riparian Width (per bank)

L	R	
[ ]	[ ]	Wide > 50m
[ ]	[ ]	Moderate 10-50m
[x]	[x]	Narrow 5-10m
[x]	[ ]	Very Narrow <5m
[ ]	[ ]	None

Bank Erosion (per bank)

L	R	
[x]	[x]	None/Little
[x]	[ ]	Moderate
[ ]	[ ]	Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
[x]	[x]	Forest, Swamp
[ ]	[ ]	Shrub or Old Field
[ ]	[ ]	Residential, Park, New Field
[ ]	[ ]	Fenced Pasture
[ ]	[ ]	Conservation Tillage
[ ]	[ ]	Urban or Industrial
[ ]	[ ]	Open Pasture, Row Crop
[ ]	[ ]	Mining/Construction

Comments:

Pool/Glide Quality — Pool: 7, Max 12

Max. Depth (1 only)
- [ ] >1m
- [x] 0.7-1m
- [ ] 0.4-0.7m
- [ ] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [ ] Pool width > riffle width
- [ ] Pool width = riffle width
- [x] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [x] Fast
- [x] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Riffle/Run Quality (Check 1, or 2 and average) — Riffle/Run: 6, Max 8

Riffle Depth
- [x] Best Areas >10cm
- [ ] Best Areas 5-10cm
- [ ] Best Areas <5cm

Run Depth
- [x] Max >50
- [ ] Max <50

Riffle/Run Substrate
- [x] Stable
- [ ] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [ ] Low
- [x] Moderate
- [ ] Extensive

Comments:

Gradient: 10

Gradient (ft/mi)	5.9
Drainage Area (sq.mi.)	583

%Pool	5	%Glide	5
%Riffle	75	%Run	15

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silviculture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI

River Code:
Date: 10/8/2002
Scorer's Initials: CZ

Qualitative Habitat Evaluation Index

RM:
Location: Site #24.5
Comments: Bolanz Rd. Bridge

Modified by NEORSD
Stream: Cuyahoga River

Total Score: 67

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present)

Substrate: 13.5 (Max 20)

Check	Type	Pool%	Riffle%
	Bldr/Slbs		
	Boulder	5	5
	Cobble	10	20
	Hardpan		
	Muck		
	Silt	10	0
x	Gravel	35	45
x	Sand	40	30
	Bedrock		
	Detritus		
	Artifical		

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [x] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [ ] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [ ] Silt - *Heavy*
- [x] Silt - *Moderate*
- [ ] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [x] 5 or More
- [ ] 4 or Less

Embeddedness
- [x] Extensive
- [x] Moderate
- [ ] Normal
- [ ] None

Comments:

Instream Cover (Check *ALL* that apply)

Cover: 10 (Max 20)

- [ ] Undercut Banks
- [x] 1 Overhanging Vegetation
- [ ] Shallows (Slow water)
- [ ] Rootmats
- [x] 2 Deep Pools >70cm
- [x] 1 Rootwads
- [x] 1 Boulders
- [ ] Oxbows, backwaters
- [x] 1 Aquatic Macrophytes
- [x] 1 Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [ ] Moderate 25-75%
- [x] Sparse 5-25%
- [ ] Nearly Absent <5%

Comments:

Channel Morphology: (Check 1, or 2 and average)

Channel: 15 (Max 20)

Sinuosity
- [ ] High
- [ ] Moderate
- [x] Low
- [ ] None

Development
- [ ] Excellent
- [x] Good
- [x] Fair
- [ ] Poor

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Stability
- [x] High
- [ ] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [ ] Bank Shaping
- [ ] 1-side channel modifications

Comments:

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average)

Riparian: 3.5 (Max. 10)

Riparian Width (per bank)

L	R	
		Wide > 50m
		Moderate 10-50m
		Narrow 5-10m
x	x	Very Narrow <5m
	x	None

Bank Erosion (per bank)

L	R	
x	x	None/Little
x		Moderate
		Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
		Forest, Swamp
		Shrub or Old Field
		Residential, Park, New Field
		Fenced Pasture
		Conservation Tillage
		Urban or Industrial
x	x	Open Pasture, Row Crop
		Mining/Construction

Comments:

Pool/Glide Quality

Pool: 10 (Max 12)

Max. Depth (1 only)
- [x] >1m
- [ ] 0.7-1m
- [ ] 0.4-0.7m
- [ ] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [x] Pool width > riffle width
- [ ] Pool width = riffle width
- [ ] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [ ] Fast
- [x] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Riffle/Run Quality (Check 1, or 2 and average)

Riffle/Run: 5 (Max 8)

Riffle Depth
- [x] Best Areas >10cm
- [ ] Best Areas 5-10cm
- [ ] Best Areas <5cm

Run Depth
- [x] Max >50
- [ ] Max <50

Riffle/Run Substrate
- [ ] Stable
- [x] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [ ] Low
- [x] Moderate
- [ ] Extensive

Comments:

Gradient: 10

Gradient (ft/mi)	4.7
Drainage Area (sq.mi.)	480

%Pool	15	%Glide	5
%Riffle	5	%Run	75

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silviclture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI — **Qualitative Habitat Evaluation Index** — **Modified by NEORSD**

River Code:
RM:
Date: 6/27/2002
Location: Site #25
Stream: Big Creek
Scorer's Initials: CZ
Comments: Jennings Rd.

Total Score: 69.25

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present)

	Type	Pool%	Riffle%
	Bldr/Slbs		
	Boulder	5	15
	Cobble	5	25
	Hardpan	5	0
	Muck		
	Silt		
x	Gravel	25	45
x	Sand	60	0
	Bedrock		
	Detritus		
	Artifical	0	5

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [x] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [ ] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [ ] Silt - *Heavy*
- [ ] Silt - *Moderate*
- [x] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [x] 5 or More
- [ ] 4 or Less

Embeddedness
- [ ] Extensive
- [x] Moderate
- [ ] Normal
- [ ] None

Comments:

Substrate: 15 — Max 20

Instream Cover (Check *ALL* that apply)
- [x] 1 Undercut Banks
- [ ] Overhanging Vegetation
- [x] 1 Shallows (Slow water)
- [ ] Rootmats
- [x] 2 Deep Pools >70cm
- [ ] Rootwads
- [x] 1 Boulders
- [ ] Oxbows, backwaters
- [ ] Aquatic Macrophytes
- [x] 1 Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [x] Moderate 25-75%
- [x] Sparse 5-25%
- [ ] Nearly Absent <5%

Comments:

Cover: 11 — Max 20

Channel Morphology: (Check 1, or 2 and average)

Sinuosity
- [ ] High
- [x] Moderate
- [x] Low
- [ ] None

Development
- [ ] Excellent
- [x] Good
- [x] Fair
- [ ] Poor

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Stability
- [ ] High
- [x] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [x] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [ ] Bank Shaping
- [ ] 1-side channel modifications

Comments:

Channel: 14.5 — Max 20

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average)

Riparian Width (per bank)

L	R	
		Wide > 50m
		Moderate 10-50m
		Narrow 5-10m
	x	Very Narrow <5m
x	x	None

Bank Erosion (per bank)

L	R	
x	x	None/Little
		Moderate
	x	Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
		Forest, Swamp
		Shrub or Old Field
		Residential, Park, New Field
		Fenced Pasture
		Conservation Tillage
x	x	Urban or Industrial
		Open Pasture, Row Crop
		Mining/Construction

Comments:

Riparian: 2.75 — Max. 10

Pool/Glide Quality

Max. Depth (1 only)
- [x] >1m
- [ ] 0.7-1m
- [ ] 0.4-0.7m
- [ ] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [ ] Pool width > riffle width
- [x] Pool width = riffle width
- [ ] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [x] Fast
- [x] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Pool: 10 — Max 12

Riffle/Run Quality (Check 1, or 2 and average)

Riffle Depth
- [x] Best Areas >10cm
- [ ] Best Areas 5-10cm
- [ ] Best Areas <5cm

Run Depth
- [x] Max >50
- [ ] Max <50

Riffle/Run Substrate
- [x] Stable
- [x] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [x] Low
- [x] Moderate
- [ ] Extensive

Comments:

Riffle/Run: 6 — Max 8

Gradient (ft/mi): 17.6
Drainage Area (sq.mi.): 38.6

%Pool	10	%Glide	5
%Riffle	40	%Run	45

Gradient: 10

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silviclutre
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI — **Qualitative Habitat Evaluation Index** — **Modified by NEORSD**

Total Score: 55

River Code:
RM:
Stream: Big Creek
Date: 6/18/2002
Location: Site #26
Scorer's Initials: CZ
Comments: East Branch, Upstream of confluence

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present) — Substrate: 11 (Max 20)

	Type	Pool%	Riffle%
[ ]	Bldr/Slbs		
[ ]	Boulder		10
[ ]	Cobble		15
[ ]	Hardpan		
[ ]	Muck		
[ ]	Silt		
x	Gravel		25
[ ]	Sand		25
x	Bedrock		25
[ ]	Detritus		
[ ]	Artifical		

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [ ] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [x] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [ ] Silt - *Heavy*
- [x] Silt - *Moderate*
- [x] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [x] 5 or More
- [ ] 4 or Less

Embeddedness
- [x] Extensive
- [x] Moderate
- [ ] Normal
- [ ] None

Comments:

Instream Cover (Check *ALL* that apply) — Cover: 6 (Max 20)
- [ ] Undercut Banks
- [ ] Overhanging Vegetation
- [x] 1 Shallows (Slow water)
- [x] 1 Rootmats
- [ ] Deep Pools >70cm
- [ ] Rootwads
- [x] 1 Boulders
- [ ] Oxbows, backwaters
- [ ] Aquatic Macrophytes
- [ ] Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [ ] Moderate 25-75%
- [x] Sparse 5-25%
- [ ] Nearly Absent <5%

Comments:

Channel Morphology: (Check 1, or 2 and average) — Channel: 14 (Max 20)

Sinuosity
- [ ] High
- [ ] Moderate
- [x] Low
- [ ] None

Development
- [ ] Excellent
- [x] Good
- [ ] Fair
- [x] Poor

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Stability
- [x] High
- [ ] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [ ] Bank Shaping
- [ ] 1-side channel modifications

Comments:

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average) — Riparian: 5 (Max. 10)

Riparian Width (per bank)

L	R	
		Wide > 50m
	x	Moderate 10-50m
		Narrow 5-10m
		Very Narrow <5m
x		None

Bank Erosion (per bank)

L	R	
x	x	None/Little
		Moderate
		Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
		Forest, Swamp
		Shrub or Old Field
x		Residential, Park, New Field
		Fenced Pasture
		Conservation Tillage
	x	Urban or Industrial
		Open Pasture, Row Crop
		Mining/Construction

Comments:

Pool/Glide Quality — Pool: 4 (Max 12)

Max. Depth (1 only)
- [ ] >1m
- [ ] 0.7-1m
- [ ] 0.4-0.7m
- [x] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [ ] Pool width > riffle width
- [ ] Pool width = riffle width
- [x] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [x] Fast
- [x] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Riffle/Run Quality (Check 1, or 2 and average) — Riffle/Run: 5 (Max 8)

Riffle Depth
- [x] Best Areas >10cm
- [ ] Best Areas 5-10cm
- [ ] Best Areas <5cm

Run Depth
- [x] Max >50
- [ ] Max <50

Riffle/Run Substrate
- [x] Stable
- [x] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [ ] Low
- [x] Moderate
- [x] Extensive

Comments:

Gradient: 10

Gradient (ft/mi)	17.6
Drainage Area (sq.mi.)	21.1

%Pool	0	%Glide	0
%Riffle	30	%Run	70

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silviculture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI — **Qualitative Habitat Evaluation Index** — **Modified by NEORSD**

Total Score: 57

River Code:
Date: 11/16/2001
Scorer's Initials: CZ/ET
RM:
Location: Site #27
Comments: West Branch, Upstream of confluence
Stream: Big Creek

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present) — Substrate: 14, Max 20

		Type	Pool%	Riffle%
		Bldr/Slbs		
		Boulder	5	0
		Cobble	0	25
		Hardpan		
		Muck		
		Silt		
x	x	Gravel	30	50
		Sand	5	20
		Bedrock	60	5
		Detritus		
		Artifical		

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [ ] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [x] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [ ] Silt - *Heavy*
- [ ] Silt - *Moderate*
- [x] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [x] 5 or More
- [ ] 4 or Less

Embeddedness
- [ ] Extensive
- [x] Moderate
- [ ] Normal
- [ ] None

Comments:

Instream Cover (Check *ALL* that apply) — Cover: 7, Max 20
- [x] 1 Undercut Banks
- [ ] Overhanging Vegetation
- [x] 2 Shallows (Slow water)
- [x] 1 Rootmats
- [ ] Deep Pools >70cm
- [ ] Rootwads
- [x] 1 Boulders
- [ ] Oxbows, backwaters
- [ ] Aquatic Macrophytes
- [ ] Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [ ] Moderate 25-75%
- [x] Sparse 5-25%
- [ ] Nearly Absent <5%

Comments:

Channel Morphology: (Check 1, or 2 and average) — Channel: 12.5, Max 20

Sinuosity
- [ ] High
- [ ] Moderate
- [x] Low
- [x] None

Development
- [ ] Excellent
- [ ] Good
- [x] Fair
- [x] Poor

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Stability
- [x] High
- [ ] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [ ] Bank Shaping
- [ ] 1-side channel modifications

Comments:

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average) — Riparian: 8.5, Max. 10

Riparian Width (per bank)

L	R	
		Wide > 50m
x	x	Moderate 10-50m
		Narrow 5-10m
		Very Narrow <5m
		None

Bank Erosion (per bank)

L	R	
x	x	None/Little
		Moderate
		Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
		Forest, Swamp
		Shrub or Old Field
	x	Residential, Park, New Field
		Fenced Pasture
		Conservation Tillage
x		Urban or Industrial
		Open Pasture, Row Crop
		Mining/Construction

Comments:

Pool/Glide Quality — Pool: 4, Max 12

Max. Depth (1 only)
- [ ] >1m
- [ ] 0.7-1m
- [x] 0.4-0.7m
- [ ] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [ ] Pool width > riffle width
- [ ] Pool width = riffle width
- [x] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [ ] Fast
- [x] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Riffle/Run Quality (Check 1, or 2 and average) — Riffle/Run: 3, Max 8

Riffle Depth
- [ ] Best Areas >10cm
- [x] Best Areas 5-10cm
- [ ] Best Areas <5cm

Run Depth
- [ ] Max >50
- [x] Max <50

Riffle/Run Substrate
- [ ] Stable
- [x] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [ ] Low
- [x] Moderate
- [ ] Extensive

Comments:

Gradient (ft/mi): 13.2
Drainage Area (sq.mi.): 12.9

%Pool	10	%Glide	10
%Riffle	20	%Run	60

Gradient: 10

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silviclulture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI — **Qualitative Habitat Evaluation Index** — **Modified by NEORSD**

River Code: | RM: | Stream: Big Creek
Date: 9/3/2002 | Location: Site #28
Scorer's Initials: CZ | Comments: West Branch, Upstream of Puritas Ave.

Total Score: 23.5

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present)

		Type	Pool%	Riffle%
		Bldr/Slbs		
		Boulder		
		Cobble		
		Hardpan		
		Muck		
		Silt		
		Gravel	5	0
		Sand	5	0
		Bedrock		
		Detritus		
x	x	Artifical	90	0

Substrate: 0 (Max 20)

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [ ] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [x] Rip/Rap
- [ ] Lacustrine
- [ ] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [ ] Silt - *Heavy*
- [x] Silt - *Moderate*
- [ ] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [ ] 5 or More
- [x] 4 or Less

Embeddedness
- [ ] Extensive
- [ ] Moderate
- [ ] Normal
- [x] None

Comments: Concrete substrate.

Instream Cover (Check *ALL* that apply)
- [ ] Undercut Banks
- [ ] Overhanging Vegetation
- [ ] Shallows (Slow water)
- [ ] Rootmats
- [ ] Deep Pools >70cm
- [ ] Rootwads
- [ ] Boulders
- [ ] Oxbows, backwaters
- [x] 2 Aquatic Macrophytes
- [ ] Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [ ] Moderate 25-75%
- [x] Sparse 5-25%
- [ ] Nearly Absent <5%

Comments:

Cover: 4 (Max 20)

Channel Morphology: (Check 1, or 2 and average)

Sinuosity
- [ ] High
- [ ] Moderate
- [ ] Low
- [x] None

Development
- [ ] Excellent
- [ ] Good
- [ ] Fair
- [x] Poor

Channelization
- [ ] None
- [ ] Recovered
- [ ] Recovering
- [x] Recent or No Recovery

Stability
- [x] High
- [ ] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [x] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [x] Bank Shaping
- [x] 1-side channel modifications

Comments:

Channel: 6 (Max 20)

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average)

Riparian Width (per bank)

L	R	
		Wide > 50m
x		Moderate 10-50m
	x	Narrow 5-10m
		Very Narrow <5m
	x	None

Bank Erosion (per bank)

L	R	
x	x	None/Little
		Moderate
		Heavy/Severe

Flood Plain Quality (Past 100m Riparian)

L	R	(most predominant per bank)
		Forest, Swamp
		Shrub or Old Field
x		Residential, Park, New Field
		Fenced Pasture
		Conservation Tillage
	x	Urban or Industrial
		Open Pasture, Row Crop
		Mining/Construction

Comments:

Riparian: 5.5 (Max. 10)

Pool/Glide Quality

Max. Depth (1 only)
- [ ] >1m
- [ ] 0.7-1m
- [ ] 0.4-0.7m
- [ ] 0.2-0.4m
- [x] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [ ] Pool width > riffle width
- [ ] Pool width = riffle width
- [ ] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [ ] Fast
- [ ] Moderate
- [ ] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments: No defined pools.

Pool: 0 (Max 12)

Riffle/Run Quality (Check 1, or 2 and average)

Riffle Depth
- [ ] Best Areas >10cm
- [ ] Best Areas 5-10cm
- [ ] Best Areas <5cm

Run Depth
- [ ] Max >50
- [ ] Max <50

Riffle/Run Substrate
- [ ] Stable
- [ ] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [ ] Low
- [ ] Moderate
- [ ] Extensive

Comments: No defined riffles.

Riffle/Run: 0 (Max 8)

Gradient (ft/mi): 14.6
Drainage Area (sq.mi.): 7.2

%Pool: 0 | %Glide: 10
%Riffle: 0 | %Run: 90

Gradient: 8

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [x] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silviclulture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI — **Qualitative Habitat Evaluation Index** — Modified by NEORSD

Total Score: 48.25

River Code:
RM:
Stream: Big Creek
Date: 11/14/2002
Location: Site #29
Scorer's Initials: CZ
Comments: East Branch, Fernhill picnic area

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present)

Substrate: 9 (Max 20)

		Type	Pool%	Riffle%
		Bldr/Slbs		
		Boulder	5	
		Cobble	10	
		Hardpan		
		Muck		
		Silt		
		Gravel	20	
x		Sand	30	
x		Bedrock	35	
		Detritus		
		Artifical		

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [ ] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [x] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [x] Silt - *Heavy*
- [x] Silt - *Moderate*
- [ ] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [x] 5 or More
- [ ] 4 or Less

Embeddedness
- [x] Extensive
- [x] Moderate
- [ ] Normal
- [ ] None

Comments:

Instream Cover (Check *ALL* that apply)

Cover: 8 (Max 20)

- [ ] Undercut Banks
- [ ] Overhanging Vegetation
- [x] 1 Shallows (Slow water)
- [x] 1 Rootmats
- [x] 1 Deep Pools >70cm
- [ ] Rootwads
- [x] 1 Boulders
- [ ] Oxbows, backwaters
- [ ] Aquatic Macrophytes
- [ ] Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [ ] Moderate 25-75%
- [x] Sparse 5-25%
- [ ] Nearly Absent <5%

Comments:

Channel Morphology: (Check 1, or 2 and average)

Channel: 11 (Max 20)

Sinuosity
- [ ] High
- [ ] Moderate
- [x] Low
- [x] None

Development
- [ ] Excellent
- [ ] Good
- [ ] Fair
- [x] Poor

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Stability
- [x] High
- [x] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [x] Bank Shaping
- [ ] 1-side channel modifications

Comments:

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average)

Riparian: 5.25 (Max. 10)

Riparian Width (per bank)

L	R	
		Wide > 50m
x	x	Moderate 10-50m
		Narrow 5-10m
		Very Narrow <5m
x	x	None

Bank Erosion (per bank)

L	R	
x	x	None/Little
	x	Moderate
		Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
		Forest, Swamp
		Shrub or Old Field
x	x	Residential, Park, New Field
		Fenced Pasture
		Conservation Tillage
		Urban or Industrial
		Open Pasture, Row Crop
		Mining/Construction

Comments:

Pool/Glide Quality

Pool: 7 (Max 12)

Max. Depth (1 only)
- [ ] >1m
- [x] 0.7-1m
- [ ] 0.4-0.7m
- [ ] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [x] Pool width > riffle width
- [ ] Pool width = riffle width
- [ ] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [ ] Fast
- [ ] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Riffle/Run Quality (Check 1, or 2 and average)

Riffle/Run: 0 (Max 8)

Riffle Depth
- [ ] Best Areas >10cm
- [ ] Best Areas 5-10cm
- [x] Best Areas <5cm

Run Depth
- [ ] Max >50
- [ ] Max <50

Riffle/Run Substrate
- [ ] Stable
- [ ] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [ ] Low
- [ ] Moderate
- [ ] Extensive

Comments: No riffle.

Gradient: 8

Gradient (ft/mi): 22.9
Drainage Area (sq.mi.): 12.5

%Pool: 5 | %Glide: 80
%Riffle: 0 | %Run: 15

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silviculture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI — **Qualitative Habitat Evaluation Index** — **Modified by NEORSD**

River Code: | RM: | Stream: Big Creek
Date: 11/14/2002 | Location: Site #30
Scorer's Initials: CZ | Comments: Stickney Creek

Total Score: 52.25

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present)

		Type	Pool%	Riffle%
[ ]	[ ]	Bldr/Slbs		
[ ]	[ ]	Boulder	5	0
[ ]	[ ]	Cobble		
[ ]	[ ]	Hardpan		
[ ]	[ ]	Muck		
[ ]	[ ]	Silt		
[ ]	[ ]	Gravel	25	20
[ ]	[ ]	Sand	15	0
[x]	[x]	Bedrock	55	80
[ ]	[ ]	Detritus		
[ ]	[ ]	Artifical		

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [ ] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [x] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [ ] Silt - *Heavy*
- [ ] Silt - *Moderate*
- [x] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [ ] 5 or More
- [x] 4 or Less

Embeddedness
- [ ] Extensive
- [x] Moderate
- [ ] Normal
- [ ] None

Comments:

Substrate: 8 — Max 20

Instream Cover (Check *ALL* that apply)
- [x] 1 Undercut Banks
- [ ] Overhanging Vegetation
- [x] 2 Shallows (Slow water)
- [ ] Rootmats
- [ ] Deep Pools >70cm
- [ ] Rootwads
- [x] 1 Boulders
- [ ] Oxbows, backwaters
- [ ] Aquatic Macrophytes
- [x] 1 Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [ ] Moderate 25-75%
- [x] Sparse 5-25%
- [x] Nearly Absent <5%

Comments:

Cover: 6 — Max 20

Channel Morphology: (Check 1, or 2 and average)

Sinuosity
- [ ] High
- [ ] Moderate
- [x] Low
- [ ] None

Development
- [ ] Excellent
- [ ] Good
- [ ] Fair
- [x] Poor

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Stability
- [ ] High
- [x] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [ ] Bank Shaping
- [ ] 1-side channel modifications

Comments:

Channel: 11 — Max 20

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average)

Riparian Width (per bank)

L	R	
[ ]	[x]	Wide > 50m
[x]	[ ]	Moderate 10-50m
[x]	[ ]	Narrow 5-10m
[ ]	[ ]	Very Narrow <5m
[ ]	[ ]	None

Bank Erosion (per bank)

L	R	
[ ]	[ ]	None/Little
[x]	[x]	Moderate
[x]	[x]	Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
[ ]	[x]	Forest, Swamp
[ ]	[ ]	Shrub or Old Field
[x]	[x]	Residential, Park, New Field
[ ]	[ ]	Fenced Pasture
[ ]	[ ]	Conservation Tillage
[ ]	[ ]	Urban or Industrial
[ ]	[ ]	Open Pasture, Row Crop
[ ]	[ ]	Mining/Construction

Comments:

Riparian: 6.25 — Max. 10

Pool/Glide Quality

Max. Depth (1 only)
- [ ] >1m
- [ ] 0.7-1m
- [x] 0.4-0.7m
- [ ] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [x] Pool width > riffle width
- [ ] Pool width = riffle width
- [ ] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [x] Fast
- [x] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Pool: 7 — Max 12

Riffle/Run Quality (Check 1, or 2 and average)

Riffle Depth
- [ ] Best Areas >10cm
- [x] Best Areas 5-10cm
- [ ] Best Areas <5cm

Run Depth
- [ ] Max >50
- [x] Max <50

Riffle/Run Substrate
- [ ] Stable
- [x] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [x] Low
- [ ] Moderate
- [ ] Extensive

Comments:

Riffle/Run: 4 — Max 8

Gradient (ft/mi)	26.9	%Pool 5	%Glide 10
Drainage Area (sq.mi.)	4.1	%Riffle 10	%Run 75

Gradient: 10

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silviculture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI — **Qualitative Habitat Evaluation Index** — **Modified by NEORSD**

River Code:
Date: 6/25/2002
Scorer's Initials: CZ
RM:
Location: Site #31
Comments: Canal Rd.
Stream: Mill Creek

Total Score: 61.5

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present)

Check	Type	Pool%	Riffle%
	Bldr/Slbs		
	Boulder	5	5
	Cobble	5	35
	Hardpan		
	Muck		
	Silt	15	5
x	Gravel	30	45
x	Sand	40	5
	Bedrock		
	Detritus		
	Artifical	5	5

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [x] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [ ] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [x] Silt - *Heavy*
- [ ] Silt - *Moderate*
- [ ] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [x] 5 or More
- [ ] 4 or Less

Embeddedness
- [ ] Extensive
- [x] Moderate
- [ ] Normal
- [ ] None

Comments:

Substrate: 13 (Max 20)

Instream Cover (Check *ALL* that apply)
- [x] 1 Undercut Banks
- [ ] Overhanging Vegetation
- [x] 2 Shallows (Slow water)
- [x] 1 Rootmats
- [x] 1 Deep Pools >70cm
- [ ] Rootwads
- [x] 1 Boulders
- [ ] Oxbows, backwaters
- [ ] Aquatic Macrophytes
- [x] 1 Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [ ] Moderate 25-75%
- [x] Sparse 5-25%
- [ ] Nearly Absent <5%

Comments:

Cover: 10 (Max 20)

Channel Morphology: (Check 1, or 2 and average)

Sinuosity
- [ ] High
- [x] Moderate
- [x] Low
- [ ] None

Development
- [ ] Excellent
- [ ] Good
- [x] Fair
- [ ] Poor

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [x] Recent or No Recovery

Stability
- [ ] High
- [x] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [ ] Bank Shaping
- [x] 1-side channel modifications

Comments:

Channel: 11 (Max 20)

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average)

Riparian Width (per bank)

L	R	
		Wide > 50m
		Moderate 10-50m
		Narrow 5-10m
x	x	Very Narrow <5m
x	x	None

Bank Erosion (per bank)

L	R	
x	x	None/Little
		Moderate
		Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
		Forest, Swamp
		Shrub or Old Field
	x	Residential, Park, New Field
		Fenced Pasture
		Conservation Tillage
x		Urban or Industrial
		Open Pasture, Row Crop
		Mining/Construction

Comments:

Riparian: 4 (Max. 10)

Pool/Glide Quality

Max. Depth (1 only)
- [x] >1m
- [ ] 0.7-1m
- [ ] 0.4-0.7m
- [ ] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [ ] Pool width > riffle width
- [ ] Pool width = riffle width
- [x] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [x] Fast
- [x] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Pool: 9 (Max 12)

Riffle/Run Quality (Check 1, or 2 and average)

Riffle Depth
- [x] Best Areas >10cm
- [x] Best Areas 5-10cm
- [ ] Best Areas <5cm

Run Depth
- [ ] Max >50
- [x] Max <50

Riffle/Run Substrate
- [x] Stable
- [x] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [x] Low
- [x] Moderate
- [ ] Extensive

Comments:

Riffle/Run: 4.5 (Max 8)

Gradient (ft/mi): 11.9
Drainage Area (sq.mi.): 18.1

%Pool	5	%Glide	5
%Riffle	15	%Run	75

Gradient: 10

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silviculture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI — **Qualitative Habitat Evaluation Index** — **Modified by NEORSD**

River Code:
RM:
Stream: Mill Creek
Date: 9/7/2000
Location: Site #32
Scorer's Initials: CZ
Comments: Warner Rd. Branch

Total Score: 51.25

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present)

	Type	Pool%	Riffle%
	Bldr/Slbs		
	Boulder		
	Cobble	x	
	Hardpan	x	
	Muck		
	Silt		
x	Gravel	x	
x	Sand	x	
	Bedrock		
	Detritus		
	Artifical		

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [x] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [ ] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [ ] Silt - *Heavy*
- [ ] Silt - *Moderate*
- [x] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [ ] 5 or More
- [x] 4 or Less

Embeddedness
- [ ] Extensive
- [x] Moderate
- [ ] Normal
- [ ] None

Comments:

Substrate: 13 — Max 20

Instream Cover (Check *ALL* that apply)
- [x] 1 Undercut Banks
- [ ] Overhanging Vegetation
- [x] 2 Shallows (Slow water)
- [x] 2 Rootmats
- [x] 1 Deep Pools >70cm
- [ ] Rootwads
- [ ] Boulders
- [ ] Oxbows, backwaters
- [ ] Aquatic Macrophytes
- [x] 1 Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [ ] Moderate 25-75%
- [x] Sparse 5-25%
- [ ] Nearly Absent <5%

Comments:

Cover: 9 — Max 20

Channel Morphology: (Check 1, or 2 and average)

Sinuosity
- [ ] High
- [x] Moderate
- [ ] Low
- [ ] None

Development
- [ ] Excellent
- [ ] Good
- [ ] Fair
- [x] Poor

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Stability
- [ ] High
- [x] Moderate
- [x] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [ ] Bank Shaping
- [ ] 1-side channel modifications

Comments:

Channel: 11.5 — Max 20

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average)

Riparian Width (per bank)

L	R	
		Wide > 50m
	x	Moderate 10-50m
x		Narrow 5-10m
		Very Narrow <5m
x	x	None

Bank Erosion (per bank)

L	R	
x	x	None/Little
	x	Moderate
		Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
	x	Forest, Swamp
		Shrub or Old Field
		Residential, Park, New Field
		Fenced Pasture
		Conservation Tillage
x	x	Urban or Industrial
		Open Pasture, Row Crop
		Mining/Construction

Comments:

Riparian: 4.75 — Max. 10

Pool/Glide Quality

Max. Depth (1 only)
- [x] >1m
- [ ] 0.7-1m
- [ ] 0.4-0.7m
- [ ] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [x] Pool width > riffle width
- [ ] Pool width = riffle width
- [ ] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [ ] Fast
- [ ] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Pool: 9 — Max 12

Riffle/Run Quality (Check 1, or 2 and average)

Riffle Depth
- [ ] Best Areas >10cm
- [ ] Best Areas 5-10cm
- [ ] Best Areas <5cm

Riffle/Run Substrate
- [ ] Stable
- [ ] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [ ] Low
- [ ] Moderate
- [ ] Extensive

Run Depth
- [ ] Max >50
- [ ] Max <50

Comments: No riffle.

Riffle/Run: 0 — Max 8

Gradient (ft/mi): 81.2
Drainage Area (sq.mi.): 2.4

%Pool: 5 | %Glide: 40
%Riffle: 0 | %Run: 55

Gradient: 4

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silviculture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI — Qualitative Habitat Evaluation Index

Modified by NEORSD

River Code: | RM: | Stream: Mill Creek
Date: 8/30/2000 | Location: Site #33 Wolf Creek
Scorer's Initials: CZ | Comments: Garfield Park Reservation

Total Score: 56

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present) — Substrate 10.5, Max 20

		Type	Pool%	Riffle%
		Bldr/Slbs		
		Boulder		
		Cobble	x	
x		Hardpan	x	
		Muck		
		Silt		
x		Gravel	x	
		Sand	x	
		Bedrock		
		Detritus		
		Artifical		

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [x] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [ ] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [ ] Silt - *Heavy*
- [ ] Silt - *Moderate*
- [x] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [ ] 5 or More
- [x] 4 or Less

Embeddedness
- [x] Extensive
- [x] Moderate
- [ ] Normal
- [ ] None

Comments:

Instream Cover (Check *ALL* that apply) — Cover 11, Max 20

- [x] 2 Undercut Banks
- [ ] Overhanging Vegetation
- [x] 2 Shallows (Slow water)
- [x] 2 Rootmats
- [x] 1 Deep Pools >70cm
- [ ] Rootwads
- [ ] Boulders
- [ ] Oxbows, backwaters
- [ ] Aquatic Macrophytes
- [x] 1 Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [x] Moderate 25-75%
- [x] Sparse 5-25%
- [ ] Nearly Absent <5%

Comments:

Channel Morphology: (Check 1, or 2 and average) — Channel 9, Max 20

Sinuosity
- [ ] High
- [ ] Moderate
- [x] Low
- [ ] None

Development
- [ ] Excellent
- [ ] Good
- [x] Fair
- [x] Poor

Channelization
- [ ] None
- [ ] Recovered
- [x] Recovering
- [ ] Recent or No Recovery

Stability
- [ ] High
- [x] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [ ] Bank Shaping
- [ ] 1-side channel modifications

Comments:

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average) — Riparian 8.5, Max. 10

Riparian Width (per bank)

L	R	
x	x	Wide > 50m
		Moderate 10-50m
		Narrow 5-10m
		Very Narrow <5m
		None

Bank Erosion (per bank)

L	R	
x	x	None/Little
x	x	Moderate
		Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
	x	Forest, Swamp
		Shrub or Old Field
x		Residential, Park, New Field
		Fenced Pasture
		Conservation Tillage
		Urban or Industrial
		Open Pasture, Row Crop
		Mining/Construction

Comments:

Pool/Glide Quality — Pool 7, Max 12

Max. Depth (1 only)
- [ ] >1m
- [x] 0.7-1m
- [ ] 0.4-0.7m
- [ ] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [x] Pool width > riffle width
- [ ] Pool width = riffle width
- [ ] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [ ] Fast
- [ ] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Riffle/Run Quality (Check 1, or 2 and average) — Riffle/Run 0, Max 8

Riffle Depth
- [ ] Best Areas >10cm
- [ ] Best Areas 5-10cm
- [ ] Best Areas <5cm

Run Depth
- [ ] Max >50
- [ ] Max <50

Riffle/Run Substrate
- [ ] Stable
- [ ] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [ ] Low
- [ ] Moderate
- [ ] Extensive

Comments: No riffle.

Gradient — 10

Gradient (ft/mi)	27.7
Drainage Area (sq.mi.)	1.5

%Pool	5	%Glide	85
%Riffle	0	%Run	10

Impacts (Check all that apply)

- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silvicluture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI — Qualitative Habitat Evaluation Index

Modified by NEORSD

River Code: RM: Stream: Mill Creek
Date: 10/28/2002 Location: Site #33.5
Scorer's Initials: CZ Comments: Mapletown Branch

Total Score: 56

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present) — Substrate: 14.5 (Max 20)

	Type	Pool%	Riffle%
	Bldr/Slbs		
	Boulder	5	0
	Cobble	10	40
	Hardpan	5	0
	Muck		
	Silt		
x	Gravel	35	55
x	Sand	45	5
	Bedrock		
	Detritus		
	Artifical		

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [x] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [ ] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [ ] Silt - *Heavy*
- [ ] Silt - *Moderate*
- [x] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [x] 5 or More
- [ ] 4 or Less

Embeddedness
- [x] Extensive
- [x] Moderate
- [ ] Normal
- [ ] None

Comments:

Instream Cover (Check *ALL* that apply) — Cover: 9 (Max 20)
- [x] 1 Undercut Banks
- [ ] Overhanging Vegetation
- [x] 1 Shallows (Slow water)
- [x] 1 Rootmats
- [ ] Deep Pools >70cm
- [x] 1 Rootwads
- [x] 1 Boulders
- [ ] Oxbows, backwaters
- [ ] Aquatic Macrophytes
- [x] 1 Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [ ] Moderate 25-75%
- [x] Sparse 5-25%
- [ ] Nearly Absent <5%

Comments:

Channel Morphology: (Check 1, or 2 and average) — Channel: 14 (Max 20)

Sinuosity
- [ ] High
- [x] Moderate
- [ ] Low
- [ ] None

Development
- [ ] Excellent
- [ ] Good
- [x] Fair
- [ ] Poor

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Stability
- [ ] High
- [x] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [ ] Bank Shaping
- [ ] 1-side channel modifications

Comments:

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average) — Riparian: 3.5 (Max. 10)

Riparian Width (per bank)

L	R	
		Wide > 50m
		Moderate 10-50m
		Narrow 5-10m
x	x	Very Narrow <5m
		None

Bank Erosion (per bank)

L	R	
x	x	None/Little
x	x	Moderate
		Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
		Forest, Swamp
		Shrub or Old Field
		Residential, Park, New Field
		Fenced Pasture
		Conservation Tillage
x	x	Urban or Industrial
		Open Pasture, Row Crop
		Mining/Construction

Comments:

Pool/Glide Quality — Pool: 7 (Max 12)

Max. Depth (1 only)
- [ ] >1m
- [ ] 0.7-1m
- [x] 0.4-0.7m
- [ ] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [x] Pool width > riffle width
- [ ] Pool width = riffle width
- [ ] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [x] Fast
- [x] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Riffle/Run Quality (Check 1, or 2 and average) — Riffle/Run: 0 (Max 8)

Riffle Depth
- [ ] Best Areas >10cm
- [ ] Best Areas 5-10cm
- [x] Best Areas <5cm

Run Depth
- [ ] Max >50
- [ ] Max <50

Riffle/Run Substrate
- [ ] Stable
- [ ] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [ ] Low
- [ ] Moderate
- [ ] Extensive

Comments: No riffle.

Gradient: 8

Gradient (ft/mi)	36.4
Drainage Area (sq.mi.)	1.8

%Pool	10	%Glide	50
%Riffle	0	%Run	40

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silviculture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI — Qualitative Habitat Evaluation Index

Modified by NEORSD

River Code:
Date: 8/30/2000
Scorer's Initials: CZ/TZ
RM:
Location: Site #34
Comments: Rex Ave. and Glenburn Ave.
Stream: Mill Creek

Total Score: 56.5

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present) — Substrate: 13, Max 20

		Type	Pool%	Riffle%
		Bldr/Slbs		
		Boulder		
		Cobble		
		Hardpan		
		Muck		
		Silt		
x		Gravel		
x		Sand		
		Bedrock		
		Detritus		
		Artifical		

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [x] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [ ] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [ ] Silt - *Heavy*
- [ ] Silt - *Moderate*
- [x] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [ ] 5 or More
- [x] 4 or Less

Embeddedness
- [ ] Extensive
- [x] Moderate
- [ ] Normal
- [ ] None

Comments: % Estimations not given.

Instream Cover (Check *ALL* that apply) — Cover: 8, Max 20
- [x] 1 Undercut Banks
- [ ] Overhanging Vegetation
- [x] 2 Shallows (Slow water)
- [ ] Rootmats
- [ ] Deep Pools >70cm
- [x] 1 Rootwads
- [x] 1 Boulders
- [ ] Oxbows, backwaters
- [ ] Aquatic Macrophytes
- [x] 1 Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [ ] Moderate 25-75%
- [x] Sparse 5-25%
- [ ] Nearly Absent <5%

Comments:

Channel Morphology: (Check 1, or 2 and average) — Channel: 13, Max 20

Sinuosity
- [ ] High
- [x] Moderate
- [ ] Low
- [ ] None

Development
- [ ] Excellent
- [ ] Good
- [x] Fair
- [x] Poor

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Stability
- [ ] High
- [x] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [ ] Bank Shaping
- [ ] 1-side channel modifications

Comments:

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average) — Riparian: 6, Max. 10

Riparian Width (per bank)

L	R	
		Wide > 50m
		Moderate 10-50m
x	x	Narrow 5-10m
		Very Narrow <5m
		None

Bank Erosion (per bank)

L	R	
x	x	None/Little
		Moderate
		Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
		Forest, Swamp
		Shrub or Old Field
x	x	Residential, Park, New Field
		Fenced Pasture
		Conservation Tillage
		Urban or Industrial
		Open Pasture, Row Crop
		Mining/Construction

Comments:

Pool/Glide Quality — Pool: 5, Max 12

Max. Depth (1 only)
- [ ] >1m
- [ ] 0.7-1m
- [x] 0.4-0.7m
- [ ] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [ ] Pool width > riffle width
- [x] Pool width = riffle width
- [ ] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [ ] Fast
- [x] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Riffle/Run Quality (Check 1, or 2 and average) — Riffle/Run: 3.5, Max 8

Riffle Depth
- [x] Best Areas >10cm
- [x] Best Areas 5-10cm
- [ ] Best Areas <5cm

Run Depth
- [ ] Max >50
- [x] Max <50

Riffle/Run Substrate
- [ ] Stable
- [x] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [ ] Low
- [x] Moderate
- [ ] Extensive

Comments:

Gradient — Gradient: 8

Gradient (ft/mi)	26.9
Drainage Area (sq.mi.)	16

%Pool	5	%Glide	10
%Riffle	40	%Run	45

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silviculture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI | **Qualitative Habitat Evaluation Index** | **Modified by NEORSD**

River Code: | RM: | Stream: Mill Creek
Date: 9/7/2000 | Location: Site #35
Scorer's Initials: CZ | Comments: Upstream of Northfield Rd.

Total Score: 62.25

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present) — Substrate: 13, Max 20

	Type	Pool%	Riffle%		Type	Pool%	Riffle%		Type	Pool%	Riffle%
[ ]	Bldr/Slbs			[ ]	Muck			[ ]	Bedrock		
[ ]	Boulder			[ ]	Silt			[ ]	Detritus		
[ ]	Cobble			[x]	Gravel			[ ]	Artifical		
[ ]	Hardpan			[x]	Sand						

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [x] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [ ] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [ ] Silt - *Heavy*
- [ ] Silt - *Moderate*
- [x] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [ ] 5 or More
- [x] 4 or Less

Embeddedness
- [ ] Extensive
- [x] Moderate
- [ ] Normal
- [ ] None

Comments:

Instream Cover (Check *ALL* that apply) — Cover: 14, Max 20
- [x] 1 Undercut Banks
- [ ] Overhanging Vegetation
- [x] 2 Shallows (Slow water)
- [x] 3 Rootmats
- [x] 2 Deep Pools >70cm
- [x] 2 Rootwads
- [ ] Boulders
- [ ] Oxbows, backwaters
- [ ] Aquatic Macrophytes
- [x] 3 Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [x] Moderate 25-75%
- [ ] Sparse 5-25%
- [ ] Nearly Absent <5%

Comments:

Channel Morphology: (Check 1, or 2 and average) — Channel: 13.5, Max 20

Sinuosity
- [ ] High
- [x] Moderate
- [ ] Low
- [ ] None

Development
- [ ] Excellent
- [ ] Good
- [x] Fair
- [ ] Poor

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Stability
- [ ] High
- [x] Moderate
- [x] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [x] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [ ] Bank Shaping
- [ ] 1-side channel modifications

Comments:

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average) — Riparian: 4.75, Max. 10

Riparian Width (per bank)

L	R	
[x]	[ ]	Wide > 50m
[ ]	[ ]	Moderate 10-50m
[ ]	[ ]	Narrow 5-10m
[x]	[x]	Very Narrow <5m
[ ]	[x]	None

Bank Erosion (per bank)

L	R	
[x]	[ ]	None/Little
[x]	[x]	Moderate
[ ]	[x]	Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
[x]	[ ]	Forest, Swamp
[x]	[ ]	Shrub or Old Field
[ ]	[ ]	Residential, Park, New Field
[ ]	[ ]	Fenced Pasture
[ ]	[ ]	Conservation Tillage
[ ]	[x]	Urban or Industrial
[ ]	[ ]	Open Pasture, Row Crop
[ ]	[ ]	Mining/Construction

Comments:

Pool/Glide Quality — Pool: 9, Max 12

Max. Depth (1 only)
- [x] >1m
- [ ] 0.7-1m
- [ ] 0.4-0.7m
- [ ] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [x] Pool width > riffle width
- [ ] Pool width = riffle width
- [ ] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [ ] Fast
- [ ] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Riffle/Run Quality (Check 1, or 2 and average) — Riffle/Run: 0, Max 8

Riffle Depth
- [ ] Best Areas >10cm
- [ ] Best Areas 5-10cm
- [ ] Best Areas <5cm

Riffle/Run Substrate
- [ ] Stable
- [ ] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [ ] Low
- [ ] Moderate
- [ ] Extensive

Run Depth
- [ ] Max >50
- [ ] Max <50

Comments: No riffle.

Gradient — Gradient: 8

Gradient (ft/mi)	22.9	%Pool	10	%Glide	50
Drainage Area (sq.mi.)	9.3	%Riffle	0	%Run	40

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silvicluture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI — **Qualitative Habitat Evaluation Index** — **Modified by NEORSD**

Total Score: 42.25

River Code:
RM:
Stream: West Creek
Date: 6/14/2002
Location: Site #37
Scorer's Initials: CZ
Comments: Broadview Road Bridge

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present) — Substrate 11.5, Max 20

		Type	Pool%	Riffle%
		Bldr/Slbs		
		Boulder	5	
		Cobble	5	
		Hardpan		
		Muck		
		Silt		
		Gravel	5	
		Sand	5	
x	x	Bedrock	80	
		Detritus		
		Artifical		

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [ ] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [x] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [ ] Silt - *Heavy*
- [x] Silt - *Moderate*
- [x] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [x] 5 or More
- [ ] 4 or Less

Embeddedness
- [ ] Extensive
- [ ] Moderate
- [ ] Normal
- [x] None

Comments:

Instream Cover (Check *ALL* that apply) — Cover 4, Max 20
- [ ] Undercut Banks
- [ ] Overhanging Vegetation
- [ ] Shallows (Slow water)
- [x] 2 Rootmats
- [ ] Deep Pools >70cm
- [ ] Rootwads
- [x] 1 Boulders
- [ ] Oxbows, backwaters
- [ ] Aquatic Macrophytes
- [ ] Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [ ] Moderate 25-75%
- [x] Sparse 5-25%
- [x] Nearly Absent <5%

Comments:

Channel Morphology: (Check 1, or 2 and average) — Channel 11.5, Max 20

Sinuosity
- [ ] High
- [ ] Moderate
- [x] Low
- [x] None

Development
- [ ] Excellent
- [ ] Good
- [ ] Fair
- [x] Poor

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Stability
- [x] High
- [ ] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [ ] Bank Shaping
- [ ] 1-side channel modifications

Comments:

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average) — Riparian 5.25, Max. 10

Riparian Width (per bank)

L	R	
		Wide > 50m
	x	Moderate 10-50m
	x	Narrow 5-10m
x		Very Narrow <5m
x		None

Bank Erosion (per bank)

L	R	
x	x	None/Little
		Moderate
		Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
		Forest, Swamp
		Shrub or Old Field
x	x	Residential, Park, New Field
		Fenced Pasture
		Conservation Tillage
x		Urban or Industrial
		Open Pasture, Row Crop
		Mining/Construction

Comments:

Pool/Glide Quality — Pool 6, Max 12

Max. Depth (1 only)
- [ ] >1m
- [ ] 0.7-1m
- [ ] 0.4-0.7m
- [x] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [x] Pool width > riffle width
- [ ] Pool width = riffle width
- [ ] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [x] Fast
- [x] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Riffle/Run Quality (Check 1, or 2 and average) — Riffle/Run 0, Max 8

Riffle Depth
- [ ] Best Areas >10cm
- [ ] Best Areas 5-10cm
- [ ] Best Areas <5cm

Run Depth
- [ ] Max >50
- [ ] Max <50

Riffle/Run Substrate
- [ ] Stable
- [ ] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [ ] Low
- [ ] Moderate
- [ ] Extensive

Comments: No riffle

Gradient 4, Max 10

Gradient (ft/mi)	66	%Pool	<5	%Glide	5
Drainage Area (sq.mi.)	6.5	%Riffle	0	%Run	90

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silviculture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI | **Qualitative Habitat Evaluation Index** | **Modified by NEORSD**

River Code: | RM: | Stream: West Creek
Date: 6/14/2002 | Location: Site #38
Scorer's Initials: CZ | Comments: Ridgewood Drive

Total Score: 53.5

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present) — Substrate: 12 (Max 20)

	Type	Pool%	Riffle%
[ ]	Bldr/Slbs		
[ ]	Boulder	5	0
[ ]	Cobble	0	5
[ ]	Hardpan		
[ ]	Muck		
[ ]	Silt		
[x]	Gravel	25	50
[ ]	Sand	5	30
[x]	Bedrock	65	15
[ ]	Detritus		
[ ]	Artifical		

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [ ] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [x] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [ ] Silt - *Heavy*
- [ ] Silt - *Moderate*
- [x] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [x] 5 or More
- [ ] 4 or Less

Embeddedness
- [ ] Extensive
- [x] Moderate
- [ ] Normal
- [ ] None

Comments:

Instream Cover (Check *ALL* that apply) — Cover: 8 (Max 20)
- [x] 1 Undercut Banks
- [ ] Overhanging Vegetation
- [x] 2 Shallows (Slow water)
- [x] 1 Rootmats
- [ ] Deep Pools >70cm
- [ ] Rootwads
- [x] 1 Boulders
- [ ] Oxbows, backwaters
- [ ] Aquatic Macrophytes
- [x] 1 Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [ ] Moderate 25-75%
- [x] Sparse 5-25%
- [ ] Nearly Absent <5%

Comments:

Channel Morphology: (Check 1, or 2 and average) — Channel: 12 (Max 20)

Sinuosity
- [ ] High
- [x] Moderate
- [x] Low
- [ ] None

Development
- [ ] Excellent
- [ ] Good
- [x] Fair
- [x] Poor

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Stability
- [ ] High
- [x] Moderate
- [x] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [ ] Bank Shaping
- [ ] 1-side channel modifications

Comments:

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average) — Riparian: 6.5 (Max. 10)

Riparian Width (per bank)

L	R	
	x	Wide > 50m
x		Moderate 10-50m
		Narrow 5-10m
x		Very Narrow <5m
	x	None

Bank Erosion (per bank)

L	R	
x	x	None/Little
		Moderate
	x	Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
x	x	Forest, Swamp
		Shrub or Old Field
x	x	Residential, Park, New Field
		Fenced Pasture
		Conservation Tillage
		Urban or Industrial
		Open Pasture, Row Crop
		Mining/Construction

Comments:

Pool/Glide Quality — Pool: 3 (Max 12)

Max. Depth (1 only)
- [ ] >1m
- [ ] 0.7-1m
- [ ] 0.4-0.7m
- [x] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [ ] Pool width > riffle width
- [ ] Pool width = riffle width
- [x] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [ ] Fast
- [x] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Riffle/Run Quality (Check 1, or 2 and average) — Riffle/Run: 2 (Max 8)

Riffle Depth
- [ ] Best Areas >10cm
- [x] Best Areas 5-10cm
- [ ] Best Areas <5cm

Run Depth
- [ ] Max >50
- [x] Max <50

Riffle/Run Substrate
- [ ] Stable
- [ ] Mod. Stable
- [x] Unstable

Riffle/Run Embeddedness
- [ ] None
- [ ] Low
- [x] Moderate
- [ ] Extensive

Comments:

Gradient: 10

Gradient (ft/mi)	27.8
Drainage Area (sq.mi.)	4

%Pool	5	%Glide	5
%Riffle	10	%Run	80

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silviculture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI — **Qualitative Habitat Evaluation Index** — **Modified by NEORSD**

River Code:
Date: 11/1/2000
Scorer's Initials: CZ
RM:
Location: Site #39
Comments: Ohio Canal Viaduct
Stream: Tinkers Creek

Total Score: 59

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present) — Substrate: 11, Max 20

	Type	Pool%	Riffle%
	Bldr/Slbs		
	Boulder		
	Cobble	x	x
	Hardpan		
	Muck		
	Silt		
x	Gravel	x	x
x	Sand	x	x
	Bedrock		
	Detritus		
	Artifical		

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [x] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [ ] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [x] Silt - *Heavy*
- [x] Silt - *Moderate*
- [ ] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [ ] 5 or More
- [x] 4 or Less

Embeddedness
- [x] Extensive
- [x] Moderate
- [ ] Normal
- [ ] None

Comments:

Instream Cover (Check *ALL* that apply) — Cover: 11, Max 20
- [ ] Undercut Banks
- [x] 2 Overhanging Vegetation
- [x] 2 Shallows (Slow water)
- [x] 1 Rootmats
- [x] 1 Deep Pools >70cm
- [ ] Rootwads
- [ ] Boulders
- [ ] Oxbows, backwaters
- [ ] Aquatic Macrophytes
- [x] 1 Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [x] Moderate 25-75%
- [x] Sparse 5-25%
- [ ] Nearly Absent <5%

Comments:

Channel Morphology: (Check 1, or 2 and average) — Channel: 13.5, Max 20

Sinuosity
- [ ] High
- [ ] Moderate
- [x] Low
- [x] None

Development
- [ ] Excellent
- [x] Good
- [x] Fair
- [ ] Poor

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Stability
- [ ] High
- [x] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [x] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [ ] Bank Shaping
- [ ] 1-side channel modifications

Comments:

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average) — Riparian: 5, Max. 10

Riparian Width (per bank)

L	R	
		Wide > 50m
		Moderate 10-50m
x		Narrow 5-10m
x	x	Very Narrow <5m
		None

Bank Erosion (per bank)

L	R	
		None/Little
x	x	Moderate
	x	Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
x		Forest, Swamp
		Shrub or Old Field
	x	Residential, Park, New Field
		Fenced Pasture
		Conservation Tillage
		Urban or Industrial
		Open Pasture, Row Crop
		Mining/Construction

Comments:

Pool/Glide Quality — Pool: 9, Max 12

Max. Depth (1 only)
- [x] >1m
- [ ] 0.7-1m
- [ ] 0.4-0.7m
- [ ] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [ ] Pool width > riffle width
- [ ] Pool width = riffle width
- [x] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [x] Fast
- [x] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Riffle/Run Quality (Check 1, or 2 and average) — Riffle/Run: 3.5, Max 8

Riffle Depth
- [x] Best Areas >10cm
- [ ] Best Areas 5-10cm
- [ ] Best Areas <5cm

Run Depth
- [ ] Max >50
- [x] Max <50

Riffle/Run Substrate
- [ ] Stable
- [x] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [ ] Low
- [x] Moderate
- [x] Extensive

Comments:

Gradient: 6

Gradient (ft/mi)	20.3
Drainage Area (sq.mi.)	96

%Pool	5	%Glide	5
%Riffle	10	%Run	80

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silviclulture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI — Qualitative Habitat Evaluation Index — Modified by NEORSD

River Code:
RM:
Stream: Tinkers Creek
Date: 11/3/2000
Location: Site #40
Scorer's Initials: CZ
Comments: Upstream of Northfield Rd.

Total Score: 58.75

SUBSTRATE (Check ONLY two substrate TYPE Boxes; Estimate % present)

Type	Pool%	Riffle%	Type	Pool%	Riffle%	Type	Pool%	Riffle%
Bldr/Slbs	x		Muck			[x][x] Bedrock	x	x
Boulder			Silt			Detritus		
Cobble	x		Gravel	x		Artifical		
Hardpan			Sand	x				

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [ ] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [x] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [ ] Silt - *Heavy*
- [ ] Silt - *Moderate*
- [x] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [x] 5 or More
- [ ] 4 or Less

Embeddedness
- [ ] Extensive
- [ ] Moderate
- [x] Normal
- [ ] None

Comments:

Substrate: 11 — Max 20

Instream Cover (Check ALL that apply)
- [ ] Undercut Banks
- [ ] Overhanging Vegetation
- [x] 2 Shallows (Slow water)
- [ ] Rootmats
- [ ] Deep Pools >70cm
- [ ] Rootwads
- [x] 2 Boulders
- [ ] Oxbows, backwaters
- [ ] Aquatic Macrophytes
- [x] 1 Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [x] Moderate 25-75%
- [ ] Sparse 5-25%
- [ ] Nearly Absent <5%

Comments:

Cover: 10 — Max 20

Channel Morphology: (Check 1, or 2 and average)

Sinuosity
- [ ] High
- [ ] Moderate
- [x] Low
- [ ] None

Development
- [ ] Excellent
- [x] Good
- [x] Fair
- [ ] Poor

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Stability
- [x] High
- [ ] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [ ] Bank Shaping
- [ ] 1-side channel modifications

Comments:

Channel: 15 — Max 20

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average)

Riparian Width (per bank)

L	R	
	x	Wide > 50m
x		Moderate 10-50m
x		Narrow 5-10m
		Very Narrow <5m
		None

Bank Erosion (per bank)

L	R	
x	x	None/Little
		Moderate
		Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
		Forest, Swamp
		Shrub or Old Field
x		Residential, Park, New Field
		Fenced Pasture
		Conservation Tillage
	x	Urban or Industrial
		Open Pasture, Row Crop
		Mining/Construction

Comments:

Riparian: 6.75 — Max. 10

Pool/Glide Quality

Max. Depth (1 only)
- [ ] >1m
- [ ] 0.7-1m
- [x] 0.4-0.7m
- [ ] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [ ] Pool width > riffle width
- [ ] Pool width = riffle width
- [x] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [x] Fast
- [x] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Pool: 5 — Max 12

Riffle/Run Quality (Check 1, or 2 and average)

Riffle Depth
- [x] Best Areas >10cm
- [ ] Best Areas 5-10cm
- [ ] Best Areas <5cm

Run Depth
- [x] Max >50
- [ ] Max <50

Riffle/Run Substrate
- [x] Stable
- [ ] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [x] Low
- [ ] Moderate
- [ ] Extensive

Comments:

Riffle/Run: 7 — Max 8

Gradient

Gradient (ft/mi)	43.9
Drainage Area (sq.mi.)	84

%Pool	<5	%Glide	0
%Riffle	35	%Run	60

Gradient: 4

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silviclulture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI — **Qualitative Habitat Evaluation Index** — **Modified by NEORSD**

River Code:
RM:
Stream: Tinkers Creek
Date: 11/3/2000
Location: Site #41
Scorer's Initials: CZ
Comments: Downstream of Richmond Rd.

Total Score: 67.75

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present) — Substrate: 12, Max 20

		Type	Pool%	Riffle%
		Bldr/Slbs		
		Boulder		
		Cobble	x	x
		Hardpan		
		Muck	x	
		Silt		
x		Gravel	x	x
x		Sand	x	
		Bedrock		
		Detritus		
		Artifical		

Substrate Origin (Check 1, or 2 and average)
[ ] Limestone
[x] Tills
[ ] Wetlands
[ ] Hardpan
[ ] Sandstone
[ ] Rip/Rap
[ ] Lacustrine
[ ] Shale
[ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
[ ] Silt - *Heavy*
[x] Silt - *Moderate*
[ ] Silt - *Normal*
[ ] Silt - *Free*

Number of Substrate Types
[ ] 5 or More
[x] 4 or Less

Embeddedness
[ ] Extensive
[x] Moderate
[ ] Normal
[ ] None
Comments:

Instream Cover (Check *ALL* that apply) — Cover: 12, Max 20
[x] 1 Undercut Banks
[ ] Overhanging Vegetation
[x] 1 Shallows (Slow water)
[x] 2 Rootmats
[ ] Deep Pools >70cm
[x] 2 Rootwads
[ ] Boulders
[ ] Oxbows, backwaters
[ ] Aquatic Macrophytes
[x] 2 Logs or Woody Debris

Amount (Check 1, or 2 and average)
[ ] Extensive >75%
[x] Moderate 25-75%
[ ] Sparse 5-25%
[ ] Nearly Absent <5%

Comments:

Channel Morphology: (Check 1, or 2 and average) — Channel: 13.5, Max 20

Sinuosity
[ ] High
[ ] Moderate
[x] Low
[ ] None

Development
[ ] Excellent
[ ] Good
[x] Fair
[ ] Poor

Channelization
[x] None
[ ] Recovered
[ ] Recovering
[ ] Recent or No Recovery

Stability
[x] High
[x] Moderate
[ ] Low

Modifications/Other
[ ] Snagging
[ ] Relocation
[ ] Canopy Removal
[ ] Dredging
[ ] Impoundment
[ ] Islands
[ ] Leveed
[ ] Bank Shaping
[x] 1-side channel modifications

Comments:

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average) — Riparian: 8.25, Max. 10

Riparian Width (per bank)

L	R	
		Wide > 50m
x	x	Moderate 10-50m
x		Narrow 5-10m
		Very Narrow <5m
		None

Bank Erosion (per bank)

L	R	
x	x	None/Little
		Moderate
		Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
x	x	Forest, Swamp
		Shrub or Old Field
x		Residential, Park, New Field
		Fenced Pasture
		Conservation Tillage
		Urban or Industrial
		Open Pasture, Row Crop
		Mining/Construction

Comments:

Pool/Glide Quality — Pool: 8, Max 12

Max. Depth (1 only)
[ ] >1m
[x] 0.7-1m
[ ] 0.4-0.7m
[ ] 0.2-0.4m
[ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
[x] Pool width > riffle width
[ ] Pool width = riffle width
[ ] Pool width < riffle width

Current Velocity (Check all that apply)
[ ] Eddies
[ ] Fast
[x] Moderate
[x] Slow
[ ] Torrential
[ ] Interstitial
[ ] Intermittent

Comments:

Riffle/Run Quality (Check 1, or 2 and average) — Riffle/Run: 4, Max 8

Riffle Depth
[ ] Best Areas >10cm
[x] Best Areas 5-10cm
[ ] Best Areas <5cm

Run Depth
[x] Max >50
[ ] Max <50

Riffle/Run Substrate
[ ] Stable
[x] Mod. Stable
[ ] Unstable

Riffle/Run Embeddedness
[ ] None
[ ] Low
[x] Moderate
[ ] Extensive

Comments:

Gradient: 10

Gradient (ft/mi): 10.7
Drainage Area (sq.mi.): 74

%Pool: 25 | %Glide: 40
%Riffle: <5 | %Run: 30

Impacts (Check all that apply)
[ ] None
[ ] Industrial
[ ] WWTP
[ ] Agricultural
[ ] Livestock
[ ] Silviculture
[ ] Construction
[ ] Urban Runoff
[ ] CSO's
[ ] Suburban Impacts
[ ] Mining
[ ] Channelization
[ ] Riparian Removal
[ ] Landfills
[ ] Natural
[ ] Dams
[ ] Other Flow Alteration

Comments:

OEPA QHEI — **Qualitative Habitat Evaluation Index** — Modified by NEORSD

River Code:
Date: 11/8/2000
Scorer's Initials: CZ
RM:
Location: Site #42
Comments: Upstream of Glenwood Dr.
Stream: Tinkers Creek

Total Score: 62.25

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present) — Substrate 13.5, Max 20

		Type	Pool%	Riffle%
		Bldr/Slbs		
		Boulder		
		Cobble	x	x
		Hardpan	x	
		Muck	x	
		Silt		
x		Gravel	x	x
x		Sand	x	x
		Bedrock		
		Detritus		
		Artifical		

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [x] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [ ] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [ ] Silt - *Heavy*
- [x] Silt - *Moderate*
- [ ] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [x] 5 or More
- [ ] 4 or Less

Embeddedness
- [x] Extensive
- [x] Moderate
- [ ] Normal
- [ ] None

Comments:

Instream Cover (Check *ALL* that apply) — Cover 11, Max 20
- [ ] __ Undercut Banks
- [x] 3 Overhanging Vegetation
- [x] 1 Shallows (Slow water)
- [ ] __ Rootmats
- [ ] __ Deep Pools >70cm
- [x] 1 Rootwads
- [ ] __ Boulders
- [ ] __ Oxbows, backwaters
- [ ] __ Aquatic Macrophytes
- [x] 3 Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [x] Moderate 25-75%
- [ ] Sparse 5-25%
- [ ] Nearly Absent <5%

Comments:

Channel Morphology: (Check 1, or 2 and average) — Channel 14.5, Max 20

Sinuosity
- [ ] High
- [ ] Moderate
- [x] Low
- [x] None

Development
- [ ] Excellent
- [x] Good
- [x] Fair
- [ ] Poor

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Stability
- [x] High
- [ ] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [ ] Bank Shaping
- [ ] 1-side channel modifications

Comments:

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average) — Riparian 6.75, Max. 10

Riparian Width (per bank)

L	R	
		Wide > 50m
x		Moderate 10-50m
x	x	Narrow 5-10m
		Very Narrow <5m
		None

Bank Erosion (per bank)

L	R	
x	x	None/Little
		Moderate
		Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
x		Forest, Swamp
		Shrub or Old Field
x	x	Residential, Park, New Field
		Fenced Pasture
		Conservation Tillage
		Urban or Industrial
		Open Pasture, Row Crop
		Mining/Construction

Comments:

Pool/Glide Quality — Pool 7, Max 12

Max. Depth (1 only)
- [ ] >1m
- [x] 0.7-1m
- [ ] 0.4-0.7m
- [ ] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [ ] Pool width > riffle width
- [ ] Pool width = riffle width
- [x] Pool width < riffle width

Current Velocity (Check all that apply)
- [x] Eddies
- [x] Fast
- [x] Moderate
- [ ] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Riffle/Run Quality (Check 1, or 2 and average) — Riffle/Run 5.5, Max 8

Riffle Depth
- [x] Best Areas >10cm
- [ ] Best Areas 5-10cm
- [ ] Best Areas <5cm

Riffle/Run Substrate
- [ ] Stable
- [x] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [x] Low
- [x] Moderate
- [ ] Extensive

Run Depth
- [x] Max >50
- [ ] Max <50

Comments:

Gradient (ft/mi): 2.2 — Gradient 4
Drainage Area (sq.mi.): 64

%Pool 10 — %Glide 20
%Riffle 10 — %Run 60

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silviclulture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI — **Qualitative Habitat Evaluation Index** — **Modified by NEORSD**

River Code:
RM: ______
Stream: Chippewa Creek
Date: 10/30/2000
Location: Site # 43
Scorer's Initials: CZ
Comments: Chippewa Creek Drive Ford

Total Score: 54.5

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present)

Substrate: 12.5 (Max 20)

		Type	Pool%	Riffle%
		Bldr/Slbs		
		Boulder		
		Cobble	x	x
		Hardpan		
x		Muck		
		Silt		
x		Gravel	x	x
x		Sand	x	
		Bedrock		
		Detritus		
		Artifical		

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [x] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [ ] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [ ] Silt - *Heavy*
- [ ] Silt - *Moderate*
- [x] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [ ] 5 or More
- [x] 4 or Less

Embeddedness
- [x] Extensive
- [x] Moderate
- [ ] Normal
- [ ] None

Comments:

Instream Cover (Check *ALL* that apply)

Cover: 6 (Max 20)

- [ ] __ Undercut Banks
- [ ] __ Overhanging Vegetation
- [x] 3 Shallows (Slow water)
- [ ] __ Rootmats
- [x] 1 Deep Pools >70cm
- [ ] __ Rootwads
- [ ] __ Boulders
- [ ] __ Oxbows, backwaters
- [ ] __ Aquatic Macrophytes
- [ ] __ Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [ ] Moderate 25-75%
- [x] Sparse 5-25%
- [ ] Nearly Absent <5%

Comments:

Channel Morphology: (Check 1, or 2 and average)

Channel: 9.5 (Max 20)

Sinuosity
- [ ] High
- [ ] Moderate
- [ ] Low
- [x] None

Development
- [ ] Excellent
- [ ] Good
- [x] Fair
- [x] Poor

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [x] Recent or No Recovery

Stability
- [x] High
- [ ] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [x] Bank Shaping
- [ ] 1-side channel modifications

Comments:

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average)

Riparian: 7.5 (Max. 10)

Riparian Width (per bank)

L	R	
	x	Wide > 50m
x		Moderate 10-50m
		Narrow 5-10m
		Very Narrow <5m
	x	None

Bank Erosion (per bank)

L	R	
x	x	None/Little
		Moderate
		Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
	x	Forest, Swamp
		Shrub or Old Field
x		Residential, Park, New Field
		Fenced Pasture
		Conservation Tillage
		Urban or Industrial
		Open Pasture, Row Crop
		Mining/Construction

Comments:

Pool/Glide Quality

Pool: 9 (Max 12)

Max. Depth (1 only)
- [x] >1m
- [ ] 0.7-1m
- [ ] 0.4-0.7m
- [ ] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [x] Pool width > riffle width
- [ ] Pool width = riffle width
- [ ] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [ ] Fast
- [ ] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Riffle/Run Quality (Check 1, or 2 and average)

Riffle/Run: 4 (Max 8)

Riffle Depth
- [ ] Best Areas >10cm
- [x] Best Areas 5-10cm
- [ ] Best Areas <5cm

Run Depth
- [ ] Max >50
- [x] Max <50

Riffle/Run Substrate
- [x] Stable
- [x] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [x] Low
- [x] Moderate
- [ ] Extensive

Comments:

Gradient: 6

Gradient (ft/mi)	35.2	%Pool	5	%Glide	75
Drainage Area (sq.mi.)	16	%Riffle	5	%Run	15

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silvicluture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI — **Qualitative Habitat Evaluation Index** — **Modified by NEORSD**

River Code:
Date: 10/30/2000
Scorer's Initials: CZ
RM:
Location: Site #43.5
Comments: Bramblewood Branch
Stream: Chippewa Creek

Total Score: 47.5

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present)

		Type	Pool%	Riffle%
		Bldr/Slbs		
		Boulder	x	
		Cobble	x	
		Hardpan		
		Muck		
		Silt		
		Gravel	x	
		Sand	x	
x	x	Bedrock	x	x
		Detritus		
		Artifical		

Substrate: 11 — Max 20

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [ ] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [x] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [ ] Silt - *Heavy*
- [ ] Silt - *Moderate*
- [x] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [x] 5 or More
- [ ] 4 or Less

Embeddedness
- [ ] Extensive
- [ ] Moderate
- [x] Normal
- [ ] None

Comments:

Instream Cover (Check *ALL* that apply)
- [ ] __ Undercut Banks
- [ ] __ Overhanging Vegetation
- [x] 1 Shallows (Slow water)
- [ ] __ Rootmats
- [ ] __ Deep Pools >70cm
- [ ] __ Rootwads
- [x] 1 Boulders
- [ ] __ Oxbows, backwaters
- [ ] __ Aquatic Macrophytes
- [ ] __ Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [ ] Moderate 25-75%
- [x] Sparse 5-25%
- [ ] Nearly Absent <5%

Comments:

Cover: 5 — Max 20

Channel Morphology: (Check 1, or 2 and average)

Sinuosity
- [ ] High
- [x] Moderate
- [ ] Low
- [ ] None

Development
- [ ] Excellent
- [ ] Good
- [x] Fair
- [x] Poor

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Stability
- [ ] High
- [x] Moderate
- [x] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [ ] Bank Shaping
- [ ] 1-side channel modifications

Comments:

Channel: 12.5 — Max 20

Riparian Zone and Bank Erosion: (Check 1 box per bank; or 2 and average)

Riparian Width (per bank)

L	R	
x		Wide > 50m
		Moderate 10-50m
	x	Narrow 5-10m
		Very Narrow <5m
	x	None

Bank Erosion (per bank)

L	R	
x		None/Little
		Moderate
	x	Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
x		Forest, Swamp
		Shrub or Old Field
	x	Residential, Park, New Field
		Fenced Pasture
		Conservation Tillage
		Urban or Industrial
		Open Pasture, Row Crop
		Mining/Construction

Comments:

Riparian: 6.5 — Max. 10

Pool/Glide Quality

Max. Depth (1 only)
- [ ] >1m
- [ ] 0.7-1m
- [ ] 0.4-0.7m
- [x] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [ ] Pool width > riffle width
- [ ] Pool width = riffle width
- [x] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [x] Fast
- [x] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Pool: 4 — Max 12

Riffle/Run Quality (Check 1, or 2 and average)

Riffle Depth
- [ ] Best Areas >10cm
- [x] Best Areas 5-10cm
- [ ] Best Areas <5cm

Run Depth
- [ ] Max >50
- [x] Max <50

Riffle/Run Substrate
- [x] Stable
- [x] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [x] Low
- [ ] Moderate
- [ ] Extensive

Comments:

Riffle/Run: 4.5 — Max 8

Gradient (ft/mi): 87.9
Drainage Area (sq.mi.): 2.3

%Pool	<5	%Glide	40
%Riffle	20	%Run	35

Gradient: 4

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silviclulture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI — Qualitative Habitat Evaluation Index

Modified by NEORSD

River Code:
RM:
Stream: Chippewa Creek
Date: 10/30/2000
Location: Site #44
Scorer's Initials: CZ
Comments: Upstream of Avery Rd.

Total Score: 57.25

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present) — Substrate: 14.5 (Max 20)

	Type	Pool%	Riffle%
	Bldr/Slbs		
	Boulder	x	x
	Cobble	x	x
	Hardpan	x	
x	Muck		
	Silt		
x	Gravel	x	x
x	Sand	x	
	Bedrock		
	Detritus		
	Artifical		

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [x] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [ ] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [ ] Silt - *Heavy*
- [ ] Silt - *Moderate*
- [x] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [x] 5 or More
- [ ] 4 or Less

Embeddedness
- [x] Extensive
- [x] Moderate
- [ ] Normal
- [ ] None

Comments:

Instream Cover (Check *ALL* that apply) — Cover: 8 (Max 20)
- [ ] Undercut Banks
- [ ] Overhanging Vegetation
- [x] 2 Shallows (Slow water)
- [ ] Rootmats
- [ ] Deep Pools >70cm
- [ ] Rootwads
- [x] 2 Boulders
- [ ] Oxbows, backwaters
- [ ] Aquatic Macrophytes
- [x] 2 Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [x] Moderate 25-75%
- [x] Sparse 5-25%
- [ ] Nearly Absent <5%

Comments:

Channel Morphology: (Check 1, or 2 and average) — Channel: 13.5 (Max 20)

Sinuosity
- [ ] High
- [ ] Moderate
- [x] Low
- [ ] None

Development
- [ ] Excellent
- [ ] Good
- [x] Fair
- [ ] Poor

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Stability
- [x] High
- [x] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [ ] Bank Shaping
- [ ] 1-side channel modifications

Comments:

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average) — Riparian: 6.25 (Max. 10)

Riparian Width (per bank)

L	R	
		Wide > 50m
	x	Moderate 10-50m
		Narrow 5-10m
x		Very Narrow <5m
x		None

Bank Erosion (per bank)

L	R	
x		None/Little
	x	Moderate
		Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
x		Forest, Swamp
		Shrub or Old Field
	x	Residential, Park, New Field
		Fenced Pasture
		Conservation Tillage
		Urban or Industrial
		Open Pasture, Row Crop
		Mining/Construction

Comments:

Pool/Glide Quality — Pool: 7 (Max 12)

Max. Depth (1 only)
- [ ] >1m
- [x] 0.7-1m
- [ ] 0.4-0.7m
- [ ] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [ ] Pool width > riffle width
- [x] Pool width = riffle width
- [ ] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [ ] Fast
- [x] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Riffle/Run Quality (Check 1, or 2 and average) — Riffle/Run: 4 (Max 8)

Riffle Depth
- [ ] Best Areas >10cm
- [x] Best Areas 5-10cm
- [ ] Best Areas <5cm

Run Depth
- [ ] Max >50
- [x] Max <50

Riffle/Run Substrate
- [x] Stable
- [ ] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [ ] Low
- [x] Moderate
- [ ] Extensive

Comments:

Gradient: 4

Gradient (ft/mi)	58.6
Drainage Area (sq.mi.)	6.3

%Pool	10	%Glide	10
%Riffle	30	%Run	50

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silvicluture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI | **Qualitative Habitat Evaluation Index** | **Modified by NEORSD**

River Code: | RM: | Stream: Sagamore Creek
Date: 11/16/2001 | Location: Site #57
Scorer's Initials: CZ/ET | Comments: Upstream of Canal Rd.

Total Score: 62

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present) — Substrate: 16 (Max 20)

Check	Type	Pool%	Riffle%
	Bldr/Slbs		
	Boulder		
x	Cobble	20	60
	Hardpan		
	Muck		
	Silt		
x	Gravel	40	25
	Sand	35	15
	Bedrock		
	Detritus	5	0
	Artifical		

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [x] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [ ] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [ ] Silt - *Heavy*
- [ ] Silt - *Moderate*
- [x] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [ ] 5 or More
- [x] 4 or Less

Embeddedness
- [ ] Extensive
- [ ] Moderate
- [x] Normal
- [ ] None

Comments:

Instream Cover (Check *ALL* that apply) — Cover: 7 (Max 20)
- [ ] Undercut Banks
- [ ] Overhanging Vegetation
- [x] 1 Shallows (Slow water)
- [x] 1 Rootmats
- [ ] Deep Pools >70cm
- [x] 1 Rootwads
- [ ] Boulders
- [ ] Oxbows, backwaters
- [x] 1 Aquatic Macrophytes
- [ ] Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [ ] Moderate 25-75%
- [x] Sparse 5-25%
- [ ] Nearly Absent <5%

Comments:

Channel Morphology: (Check 1, or 2 and average) — Channel: 15 (Max 20)

Sinuosity
- [ ] High
- [x] Moderate
- [ ] Low
- [ ] None

Development
- [ ] Excellent
- [x] Good
- [x] Fair
- [ ] Poor

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Stability
- [ ] High
- [x] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [x] Islands
- [ ] Leveed
- [ ] Bank Shaping
- [ ] 1-side channel modifications

Comments:

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average) — Riparian: 8.5 (Max. 10)

Riparian Width (per bank)

L	R	
	x	Wide > 50m
x		Moderate 10-50m
		Narrow 5-10m
		Very Narrow <5m
		None

Bank Erosion (per bank)

L	R	
x	x	None/Little
		Moderate
		Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
x	x	Forest, Swamp
		Shrub or Old Field
x	x	Residential, Park, New Field
		Fenced Pasture
		Conservation Tillage
		Urban or Industrial
		Open Pasture, Row Crop
		Mining/Construction

Comments:

Pool/Glide Quality — Pool: 7 (Max 12)

Max. Depth (1 only)
- [ ] >1m
- [x] 0.7-1m
- [ ] 0.4-0.7m
- [ ] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [ ] Pool width > riffle width
- [x] Pool width = riffle width
- [ ] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [ ] Fast
- [x] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Riffle/Run Quality (Check 1, or 2 and average) — Riffle/Run: 4.5 (Max 8)

Riffle Depth
- [ ] Best Areas >10cm
- [x] Best Areas 5-10cm
- [ ] Best Areas <5cm

Run Depth
- [ ] Max >50
- [x] Max <50

Riffle/Run Substrate
- [x] Stable
- [x] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [x] Low
- [ ] Moderate
- [ ] Extensive

Comments:

Gradient (ft/mi): 81.2 — Gradient: 4
Drainage Area (sq.mi.): 6.2

%Pool 15 | %Glide 5
%Riffle 75 | %Run 5

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silviculture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI | **Qualitative Habitat Evaluation Index** | **Modified by NEORSD**

Total Score: 53.5

River Code: | RM: | Stream: Euclid Creek
Date: 6/20/2002 | Location: Site #0.5
Scorer's Initials: CZ | Comments: Downstream of Lakeshore Blvd.

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present) — Substrate: 13.5, Max 20

		Type	Pool%	Riffle%			Type	Pool%	Riffle%			Type	Pool%	Riffle%
		Bldr/Slbs					Muck					Bedrock		
		Boulder	5				Silt					Detritus		
		Cobble	5		x		Gravel	35				Artifical		
		Hardpan	5		x		Sand	50						

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [x] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [ ] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [ ] Silt - *Heavy*
- [x] Silt - *Moderate*
- [ ] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [x] 5 or More
- [ ] 4 or Less

Embeddedness
- [x] Extensive
- [x] Moderate
- [ ] Normal
- [ ] None

Comments:

Instream Cover (Check *ALL* that apply) — Cover: 9, Max 20
- [x] 1 Undercut Banks
- [x] 1 Overhanging Vegetation
- [x] 2 Shallows (Slow water)
- [x] 1 Rootmats
- [x] 2 Deep Pools >70cm
- [ ] Rootwads
- [x] 1 Boulders
- [ ] Oxbows, backwaters
- [ ] Aquatic Macrophytes
- [ ] Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [ ] Moderate 25-75%
- [x] Sparse 5-25%
- [x] Nearly Absent <5%

Comments:

Channel Morphology: (Check 1, or 2 and average) — Channel: 11.5, Max 20

Sinuosity
- [ ] High
- [ ] Moderate
- [x] Low
- [ ] None

Development
- [ ] Excellent
- [ ] Good
- [x] Fair
- [x] Poor

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Stability
- [ ] High
- [x] Moderate
- [x] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [x] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [ ] Bank Shaping
- [ ] 1-side channel modifications

Comments:

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average) — Riparian: 4.5, Max. 10

Riparian Width (per bank)

L	R	
		Wide > 50m
		Moderate 10-50m
x		Narrow 5-10m
		Very Narrow <5m
x	x	None

Bank Erosion (per bank)

L	R	
x	x	None/Little
		Moderate
		Heavy/Severe

Flood Plain Quality (Past 100m Riparian)

L	R	(most predominant per bank)
		Forest, Swamp
		Shrub or Old Field
x	x	Residential, Park, New Field
		Fenced Pasture
		Conservation Tillage
		Urban or Industrial
		Open Pasture, Row Crop
		Mining/Construction

Comments:

Pool/Glide Quality — Pool: 9, Max 12

Max. Depth (1 only)
- [x] >1m
- [ ] 0.7-1m
- [ ] 0.4-0.7m
- [ ] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [x] Pool width > riffle width
- [ ] Pool width = riffle width
- [ ] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [ ] Fast
- [ ] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Riffle/Run Quality (Check 1, or 2 and average) — Riffle/Run: 0, Max 8

Riffle Depth
- [ ] Best Areas >10cm
- [ ] Best Areas 5-10cm
- [ ] Best Areas <5cm

Run Depth
- [ ] Max >50
- [ ] Max <50

Riffle/Run Substrate
- [ ] Stable
- [ ] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [ ] Low
- [ ] Moderate
- [ ] Extensive

Comments: No riffle.

Gradient (ft/mi): 5.9 | Gradient: 6
Drainage Area (sq.mi.): 24.2

%Pool	20	%Glide	30
%Riffle	0	%Run	50

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silviculture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI — **Qualitative Habitat Evaluation Index** — **Modified by NEORSD**

River Code:
Date: 10/26/2000
Scorer's Initials: CZ
RM:
Location: Site #1
Comments: Upstream of St. Clair Ave.
Stream: Euclid Creek

Total Score: 68.75

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present) — Substrate: 13, Max 20

	Type	Pool%	Riffle%
	Bldr/Slbs		
	Boulder	x	
x	Cobble	x	x
	Hardpan		
	Muck		
	Silt		
	Gravel	x	x
	Sand	x	
x	Bedrock	x	
	Detritus		
	Artifical		

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [ ] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [x] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [ ] Silt - *Heavy*
- [ ] Silt - *Moderate*
- [x] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [x] 5 or More
- [ ] 4 or Less

Embeddedness
- [ ] Extensive
- [x] Moderate
- [ ] Normal
- [ ] None

Comments:

Instream Cover (Check *ALL* that apply) — Cover: 9, Max 20
- [x] 1 Undercut Banks
- [ ] Overhanging Vegetation
- [x] 1 Shallows (Slow water)
- [ ] Rootmats
- [x] 2 Deep Pools >70cm
- [ ] Rootwads
- [x] 1 Boulders
- [ ] Oxbows, backwaters
- [ ] Aquatic Macrophytes
- [x] 1 Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [ ] Moderate 25-75%
- [x] Sparse 5-25%
- [ ] Nearly Absent <5%

Comments:

Channel Morphology: (Check 1, or 2 and average) — Channel: 15, Max 20

Sinuosity
- [ ] High
- [ ] Moderate
- [x] Low
- [ ] None

Development
- [ ] Excellent
- [x] Good
- [ ] Fair
- [ ] Poor

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Stability
- [ ] High
- [x] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [ ] Bank Shaping
- [x] 1-side channel modifications

Comments:

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average) — Riparian: 5.75, Max. 10

Riparian Width (per bank)

L	R	
	x	Wide > 50m
		Moderate 10-50m
	x	Narrow 5-10m
		Very Narrow <5m
x		None

Bank Erosion (per bank)

L	R	
x		None/Little
	x	Moderate
		Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
	x	Forest, Swamp
		Shrub or Old Field
x		Residential, Park, New Field
		Fenced Pasture
		Conservation Tillage
x		Urban or Industrial
		Open Pasture, Row Crop
		Mining/Construction

Comments:

Pool/Glide Quality — Pool: 11, Max 12

Max. Depth (1 only)
- [x] >1m
- [ ] 0.7-1m
- [ ] 0.4-0.7m
- [ ] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [x] Pool width > riffle width
- [ ] Pool width = riffle width
- [ ] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [x] Fast
- [x] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Riffle/Run Quality (Check 1, or 2 and average) — Riffle/Run: 5, Max 8

Riffle Depth
- [x] Best Areas >10cm
- [ ] Best Areas 5-10cm
- [ ] Best Areas <5cm

Run Depth
- [ ] Max >50
- [x] Max <50

Riffle/Run Substrate
- [x] Stable
- [x] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [x] Low
- [x] Moderate
- [ ] Extensive

Comments:

Gradient (ft/mi): 16.2 — Gradient: 10
Drainage Area (sq.mi.): 22.2

%Pool 5 | %Glide 5 | %Riffle 40 | %Run 50

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silviclture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI — **Qualitative Habitat Evaluation Index** — **Modified by NEORSD**

River Code: RM: Stream: Euclid Creek
Date: 10/16/2000 Location: Site #2
Scorer's Initials: CZ Comments: South Branch, Highland Picnic Area

Total Score: 54.75

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present) — Substrate: 12, Max 20

	Type	Pool%	Riffle%
[ ]	Bldr/Slbs		
[ ]	Boulder	x	
[ ]	Cobble	x	x
[ ]	Hardpan		
[ ]	Muck		
[ ]	Silt		
[x]	Gravel	x	x
[ ]	Sand	x	
[x]	Bedrock	x	x
[ ]	Detritus		
[ ]	Artifical		

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [ ] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [x] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [ ] Silt - *Heavy*
- [ ] Silt - *Moderate*
- [x] Silt - *Normal*
- [x] Silt - *Free*

Number of Substrate Types
- [x] 5 or More
- [ ] 4 or Less

Embeddedness
- [x] Extensive
- [x] Moderate
- [ ] Normal
- [ ] None

Comments:

Instream Cover (Check *ALL* that apply) — Cover: 6, Max 20
- [ ] Undercut Banks
- [ ] Overhanging Vegetation
- [ ] Shallows (Slow water)
- [ ] Rootmats
- [x] 1 Deep Pools >70cm
- [ ] Rootwads
- [x] 1 Boulders
- [ ] Oxbows, backwaters
- [ ] Aquatic Macrophytes
- [ ] Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [ ] Moderate 25-75%
- [x] Sparse 5-25%
- [ ] Nearly Absent <5%

Comments:

Channel Morphology: (Check 1, or 2 and average) — Channel: 14, Max 20

Sinuosity
- [ ] High
- [ ] Moderate
- [x] Low
- [ ] None

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [x] Bank Shaping
- [x] 1-side channel modifications

Development
- [ ] Excellent
- [x] Good
- [x] Fair
- [ ] Poor

Stability
- [ ] High
- [x] Moderate
- [ ] Low

Comments:

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average) — Riparian: 5.25, Max. 10

Riparian Width (per bank)

L	R	
[ ]	[ ]	Wide > 50m
[ ]	[ ]	Moderate 10-50m
[ ]	[x]	Narrow 5-10m
[ ]	[ ]	Very Narrow <5m
[x]	[ ]	None

Bank Erosion (per bank)

L	R	
[x]	[x]	None/Little
[x]	[ ]	Moderate
[ ]	[ ]	Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
[ ]	[x]	Forest, Swamp
[ ]	[ ]	Shrub or Old Field
[x]	[x]	Residential, Park, New Field
[ ]	[ ]	Fenced Pasture
[ ]	[ ]	Conservation Tillage
[ ]	[ ]	Urban or Industrial
[ ]	[ ]	Open Pasture, Row Crop
[ ]	[ ]	Mining/Construction

Comments:

Pool/Glide Quality — Pool: 9, Max 12

Max. Depth (1 only)
- [x] >1m
- [ ] 0.7-1m
- [ ] 0.4-0.7m
- [ ] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [ ] Pool width > riffle width
- [ ] Pool width = riffle width
- [x] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [x] Fast
- [x] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Riffle/Run Quality (Check 1, or 2 and average) — Riffle/Run: 4.5, Max 8

Riffle Depth
- [x] Best Areas >10cm
- [x] Best Areas 5-10cm
- [ ] Best Areas <5cm

Riffle/Run Substrate
- [x] Stable
- [ ] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [ ] Low
- [x] Moderate
- [ ] Extensive

Run Depth
- [ ] Max >50
- [x] Max <50

Comments:

Gradient (ft/mi): 60.3 — Gradient: 4
Drainage Area (sq.mi.): 12.5

%Pool	10	%Glide	5
%Riffle	40	%Run	45

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silviclture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI — **Qualitative Habitat Evaluation Index** — **Modified by NEORSD**

River Code: | RM: | Stream: Euclid Creek
Date: 10/16/2000 | Location: Site #3
Scorer's Initials: CZ | Comments: North Branch, Highland Picnic Area

Total Score: 44

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present) — Substrate: 8, Max 20

		Type	Pool%	Riffle%
		Bldr/Slbs		
		Boulder		
		Cobble		x
		Hardpan		
		Muck		
		Silt		
		Gravel		x
		Sand	x	
x	x	Bedrock	x	x
		Detritus		
		Artifical		

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [ ] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [x] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [ ] Silt - *Heavy*
- [ ] Silt - *Moderate*
- [x] Silt - *Normal*
- [x] Silt - *Free*

Number of Substrate Types
- [ ] 5 or More
- [x] 4 or Less

Embeddedness
- [x] Extensive
- [x] Moderate
- [ ] Normal
- [ ] None

Comments:

Instream Cover (Check *ALL* that apply) — Cover: 4, Max 20
- [ ] Undercut Banks
- [ ] Overhanging Vegetation
- [x] 1 Shallows (Slow water)
- [ ] Rootmats
- [ ] Deep Pools >70cm
- [ ] Rootwads
- [ ] Boulders
- [ ] Oxbows, backwaters
- [ ] Aquatic Macrophytes
- [x] 1 Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [ ] Moderate 25-75%
- [x] Sparse 5-25%
- [x] Nearly Absent <5%

Comments:

Channel Morphology: (Check 1, or 2 and average) — Channel: 12, Max 20

Sinuosity
- [ ] High
- [ ] Moderate
- [x] Low
- [ ] None

Development
- [ ] Excellent
- [ ] Good
- [x] Fair
- [x] Poor

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Stability
- [ ] High
- [x] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [ ] Bank Shaping
- [ ] 1-side channel modifications

Comments:

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average) — Riparian: 8.5, Max. 10

Riparian Width (per bank)

L	R	
	x	Wide > 50m
x		Moderate 10-50m
		Narrow 5-10m
		Very Narrow <5m
		None

Bank Erosion (per bank)

L	R	
	x	None/Little
x		Moderate
		Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
x	x	Forest, Swamp
		Shrub or Old Field
x		Residential, Park, New Field
		Fenced Pasture
		Conservation Tillage
		Urban or Industrial
		Open Pasture, Row Crop
		Mining/Construction

Comments:

Pool/Glide Quality — Pool: 4, Max 12

Max. Depth (1 only)
- [ ] >1m
- [ ] 0.7-1m
- [ ] 0.4-0.7m
- [x] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [ ] Pool width > riffle width
- [ ] Pool width = riffle width
- [x] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [x] Fast
- [x] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Riffle/Run Quality (Check 1, or 2 and average) — Riffle/Run: 3.5, Max 8

Riffle Depth
- [x] Best Areas >10cm
- [x] Best Areas 5-10cm
- [ ] Best Areas <5cm

Run Depth
- [ ] Max >50
- [x] Max <50

Riffle/Run Substrate
- [ ] Stable
- [x] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [ ] Low
- [x] Moderate
- [ ] Extensive

Comments:

Gradient: 4

Gradient (ft/mi)	50.6	%Pool	5	%Glide	5
Drainage Area (sq.mi.)	8.5	%Riffle	15	%Run	75

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silviclulture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI — **Qualitative Habitat Evaluation Index** — **Modified by NEORSD**

River Code:
RM:
Stream: Euclid Creek
Date: 10/26/2000
Location: Site #4
Scorer's Initials: CZ
Comments: South Branch, Downstream of Mayfield Rd.

Total Score: 46.5

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present)

	Type	Pool%	Riffle%		Type	Pool%	Riffle%		Type	Pool%	Riffle%
	Bldr/Slbs				Muck			x	Bedrock	x	x
	Boulder				Silt				Detritus		
	Cobble	x		x	Gravel	x	x		Artifical		
	Hardpan				Sand	x					

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [ ] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [x] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [ ] Silt - *Heavy*
- [ ] Silt - *Moderate*
- [x] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [ ] 5 or More
- [x] 4 or Less

Embeddedness
- [x] Extensive
- [x] Moderate
- [ ] Normal
- [ ] None

Comments:

Substrate: 9.5 — Max 20

Instream Cover (Check *ALL* that apply)
- [ ] Undercut Banks
- [ ] Overhanging Vegetation
- [x] 2 Shallows (Slow water)
- [ ] Rootmats
- [ ] Deep Pools >70cm
- [ ] Rootwads
- [ ] Boulders
- [ ] Oxbows, backwaters
- [ ] Aquatic Macrophytes
- [x] 1 Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [ ] Moderate 25-75%
- [x] Sparse 5-25%
- [ ] Nearly Absent <5%

Comments:

Cover: 5 — Max 20

Channel Morphology: (Check 1, or 2 and average)

Sinuosity
- [ ] High
- [x] Moderate
- [x] Low
- [ ] None

Development
- [ ] Excellent
- [ ] Good
- [x] Fair
- [x] Poor

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Stability
- [ ] High
- [x] Moderate
- [x] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [ ] Bank Shaping
- [ ] 1-side channel modifications

Comments:

Channel: 12 — Max 20

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average)

Riparian Width (per bank)

L	R	
		Wide > 50m
x	x	Moderate 10-50m
		Narrow 5-10m
x	x	Very Narrow <5m
		None

Bank Erosion (per bank)

L	R	
		None/Little
x	x	Moderate
		Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
		Forest, Swamp
		Shrub or Old Field
x	x	Residential, Park, New Field
		Fenced Pasture
		Conservation Tillage
		Urban or Industrial
		Open Pasture, Row Crop
		Mining/Construction

Comments:

Riparian: 5 — Max. 10

Pool/Glide Quality

Max. Depth (1 only)
- [ ] >1m
- [ ] 0.7-1m
- [ ] 0.4-0.7m
- [x] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [x] Pool width > riffle width
- [ ] Pool width = riffle width
- [ ] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [ ] Fast
- [ ] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Pool: 4 — Max 12

Riffle/Run Quality (Check 1, or 2 and average)

Riffle Depth
- [ ] Best Areas >10cm
- [x] Best Areas 5-10cm
- [ ] Best Areas <5cm

Run Depth
- [ ] Max >50
- [x] Max <50

Riffle/Run Substrate
- [ ] Stable
- [x] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [ ] Low
- [x] Moderate
- [ ] Extensive

Comments:

Riffle/Run: 3 — Max 8

Gradient (ft/mi): 30.2
Drainage Area (sq.mi.): 3.4

%Pool	<5	%Glide	60
%Riffle	<5	%Run	30

Gradient: 8

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silviculture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI — **Qualitative Habitat Evaluation Index** — **Modified by NEORSD**

River Code: RM: Stream: Green Creek
Date: 11/21/2002 Location: Site #7
Scorer's Initials: CZ Comments: Upper Valley Dr.

Total Score: 44.5

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present) — Substrate: 12.5 (Max 20)

	Type	Pool%	Riffle%
[ ]	Bldr/Slbs		
[ ]	Boulder		
[ ]	Cobble	5	10
[ ]	Hardpan		
[ ]	Muck		
[ ]	Silt		
[x]	Gravel	45	55
[x]	Sand	40	40
[ ]	Bedrock	10	
[ ]	Detritus		
[ ]	Artifical		

Substrate Origin (Check 1, or 2 and average)
[ ] Limestone
[x] Tills
[ ] Wetlands
[ ] Hardpan
[ ] Sandstone
[ ] Rip/Rap
[ ] Lacustrine
[ ] Shale
[ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
[ ] Silt - *Heavy*
[ ] Silt - *Moderate*
[x] Silt - *Normal*
[ ] Silt - *Free*

Number of Substrate Types
[ ] 5 or More
[x] 4 or Less

Embeddedness
[x] Extensive
[x] Moderate
[ ] Normal
[ ] None
Comments:

Instream Cover (Check *ALL* that apply) — Cover: 5 (Max 20)
[ ] Undercut Banks
[ ] Overhanging Vegetation
[x] 1 Shallows (Slow water)
[ ] Rootmats
[ ] Deep Pools >70cm
[ ] Rootwads
[ ] Boulders
[ ] Oxbows, backwaters
[ ] Aquatic Macrophytes
[x] 1 Logs or Woody Debris

Amount (Check 1, or 2 and average)
[ ] Extensive >75%
[ ] Moderate 25-75%
[x] Sparse 5-25%
[ ] Nearly Absent <5%

Comments:

Channel Morphology: (Check 1, or 2 and average) — Channel: 11.5 (Max 20)

Sinuosity
[ ] High
[x] Moderate
[x] Low
[ ] None

Development
[ ] Excellent
[ ] Good
[ ] Fair
[x] Poor

Channelization
[x] None
[ ] Recovered
[ ] Recovering
[ ] Recent or No Recovery

Stability
[ ] High
[x] Moderate
[ ] Low

Modifications/Other
[ ] Snagging
[ ] Relocation
[ ] Canopy Removal
[ ] Dredging
[ ] Impoundment
[ ] Islands
[ ] Leveed
[x] Bank Shaping
[ ] 1-side channel modifications

Comments: Riffles: 2-3", Best Pool: 5", lacks good depth

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average) — Riparian: 4.5 (Max. 10)

Riparian Width (per bank)

L	R	
[ ]	[x]	Wide > 50m
[ ]	[x]	Moderate 10-50m
[ ]	[ ]	Narrow 5-10m
[x]	[ ]	Very Narrow <5m
[x]	[ ]	None

Bank Erosion (per bank)

L	R	
[ ]	[ ]	None/Little
[x]	[x]	Moderate
[x]	[x]	Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
[ ]	[ ]	Forest, Swamp
[ ]	[ ]	Shrub or Old Field
[x]	[x]	Residential, Park, New Field
[ ]	[ ]	Fenced Pasture
[ ]	[ ]	Conservation Tillage
[ ]	[ ]	Urban or Industrial
[ ]	[ ]	Open Pasture, Row Crop
[ ]	[ ]	Mining/Construction

Comments:

Pool/Glide Quality — Pool: 4 (Max 12)

Max. Depth (1 only)
[ ] >1m
[ ] 0.7-1m
[ ] 0.4-0.7m
[x] 0.2-0.4m
[ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
[ ] Pool width > riffle width
[x] Pool width = riffle width
[ ] Pool width < riffle width

Current Velocity (Check all that apply)
[ ] Eddies
[ ] Fast
[x] Moderate
[x] Slow
[ ] Torrential
[ ] Interstitial
[ ] Intermittent

Comments:

Riffle/Run Quality (Check 1, or 2 and average) — Riffle/Run: 3 (Max 8)

Riffle Depth
[ ] Best Areas >10cm
[x] Best Areas 5-10cm
[ ] Best Areas <5cm

Run Depth
[ ] Max >50
[x] Max <50

Riffle/Run Substrate
[ ] Stable
[x] Mod. Stable
[ ] Unstable

Riffle/Run Embeddedness
[ ] None
[ ] Low
[x] Moderate
[ ] Extensive

Comments:

Gradient: 4

Gradient (ft/mi)	105.6	%Pool	<5	%Glide	0
Drainage Area (sq.mi.)	0.4	%Riffle	35	%Run	60

Impacts (Check all that apply)
[ ] None
[ ] Industrial
[ ] WWTP
[ ] Agricultural
[ ] Livestock
[ ] Silviclutura
[ ] Construction
[ ] Urban Runoff
[ ] CSO's
[ ] Suburban Impacts
[ ] Mining
[ ] Channelization
[ ] Riparian Removal
[ ] Landfills
[ ] Natural
[ ] Dams
[ ] Other Flow Alteration

Comments:

OEPA QHEI — **Qualitative Habitat Evaluation Index** — Modified by NEORSD

Total Score: 55.75

River Code: | RM: | Stream: Nine Mile Creek
Date: 10/21/2002 | Location: Site #8A
Scorer's Initials: CZ | Comments: Downstream of Lakeshore Blvd.

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present) — Substrate: 11.5 (Max 20)

		Type	Pool%	Riffle%
		Bldr/Slbs		
		Boulder		
		Cobble	5	
		Hardpan	10	
		Muck		
		Silt		
x		Gravel	40	
x		Sand	45	
		Bedrock		
		Detritus		
		Artifical		

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [x] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [ ] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [ ] Silt - *Heavy*
- [x] Silt - *Moderate*
- [ ] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [ ] 5 or More
- [x] 4 or Less

Embeddedness
- [x] Extensive
- [x] Moderate
- [ ] Normal
- [ ] None

Comments:

Instream Cover (Check *ALL* that apply) — Cover: 9 (Max 20)
- [ ] Undercut Banks
- [ ] Overhanging Vegetation
- [x] 1 Shallows (Slow water)
- [x] 1 Rootmats
- [x] 1 Deep Pools >70cm
- [x] 1 Rootwads
- [ ] Boulders
- [ ] Oxbows, backwaters
- [ ] Aquatic Macrophytes
- [x] 1 Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [ ] Moderate 25-75%
- [x] Sparse 5-25%
- [ ] Nearly Absent <5%

Comments:

Channel Morphology: (Check 1, or 2 and average) — Channel: 13.5 (Max 20)

Sinuosity
- [ ] High
- [x] Moderate
- [ ] Low
- [ ] None

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [ ] Bank Shaping
- [ ] 1-side channel modifications

Development
- [ ] Excellent
- [ ] Good
- [x] Fair
- [x] Poor

Stability
- [x] High
- [x] Moderate
- [ ] Low

Comments:

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average) — Riparian: 4.75 (Max. 10)

Riparian Width (per bank)

L	R	
		Wide > 50m
		Moderate 10-50m
		Narrow 5-10m
x	x	Very Narrow <5m
		None

Bank Erosion (per bank)

L	R	
x	x	None/Little
	x	Moderate
		Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
		Forest, Swamp
		Shrub or Old Field
x	x	Residential, Park, New Field
		Fenced Pasture
		Conservation Tillage
		Urban or Industrial
		Open Pasture, Row Crop
		Mining/Construction

Comments:

Pool/Glide Quality. — Pool: 7 (Max 12)

Max. Depth (1 only)
- [ ] >1m
- [x] 0.7-1m
- [ ] 0.4-0.7m
- [ ] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [x] Pool width > riffle width
- [ ] Pool width = riffle width
- [ ] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [ ] Fast
- [ ] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Riffle/Run Quality (Check 1, or 2 and average) — Riffle/Run: 0 (Max 8)

Riffle Depth
- [ ] Best Areas >10cm
- [ ] Best Areas 5-10cm
- [ ] Best Areas <5cm

Riffle/Run Substrate
- [ ] Stable
- [ ] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [ ] Low
- [ ] Moderate
- [ ] Extensive

Run Depth
- [ ] Max >50
- [ ] Max <50

Comments: No riffles.

Gradient: 10

Gradient (ft/mi)	15.1	%Pool 10	%Glide 40
Drainage Area (sq.mi.)	8.3	%Riffle 0	%Run 50

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silvicluture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI — **Qualitative Habitat Evaluation Index** — **Modified by NEORSD**

River Code:
RM:
Stream: Nine Mile Creek
Date: 10/21/2002
Location: Site #9
Scorer's Initials: CZ
Comments: Nela Park

Total Score: 43.75

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present) — Substrate: 10 (Max 20)

	Type	Pool%	Riffle%
	Bldr/Slbs		
	Boulder		
	Cobble	10	
	Hardpan		
	Muck		
	Silt		
x	Gravel	45	70
x	Sand	35	25
	Bedrock	10	5
	Detritus		
	Artifical		

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [ ] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [x] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [ ] Silt - *Heavy*
- [x] Silt - *Moderate*
- [x] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [ ] 5 or More
- [x] 4 or Less

Embeddedness
- [x] Extensive
- [x] Moderate
- [ ] Normal
- [ ] None

Comments:

Instream Cover (Check *ALL* that apply) — Cover: 4 (Max 20)
- [ ] Undercut Banks
- [ ] Overhanging Vegetation
- [x] 1 Shallows (Slow water)
- [ ] Rootmats
- [ ] Deep Pools >70cm
- [ ] Rootwads
- [ ] Boulders
- [ ] Oxbows, backwaters
- [ ] Aquatic Macrophytes
- [x] 1 Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [ ] Moderate 25-75%
- [x] Sparse 5-25%
- [x] Nearly Absent <5%

Comments:

Channel Morphology: (Check 1, or 2 and average) — Channel: 11 (Max 20)

Sinuosity
- [ ] High
- [ ] Moderate
- [x] Low
- [ ] None

Development
- [ ] Excellent
- [ ] Good
- [ ] Fair
- [x] Poor

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Stability
- [ ] High
- [x] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [ ] Bank Shaping
- [ ] 1-side channel modifications

Comments: Poor - Riffles, pools

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average) — Riparian: 7.25 (Max. 10)

Riparian Width (per bank)

L	R	
		Wide > 50m
x	x	Moderate 10-50m
	x	Narrow 5-10m
		Very Narrow <5m
		None

Bank Erosion (per bank)

L	R	
x		None/Little
	x	Moderate
		Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
x	x	Forest, Swamp
		Shrub or Old Field
x	x	Residential, Park, New Field
		Fenced Pasture
		Conservation Tillage
		Urban or Industrial
		Open Pasture, Row Crop
		Mining/Construction

Comments:

Pool/Glide Quality — Pool: 5 (Max 12)

Max. Depth (1 only)
- [ ] >1m
- [ ] 0.7-1m
- [ ] 0.4-0.7m
- [x] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [x] Pool width > riffle width
- [ ] Pool width = riffle width
- [ ] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [ ] Fast
- [x] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Riffle/Run Quality (Check 1, or 2 and average) — Riffle/Run: 2.5 (Max 8)

Riffle Depth
- [ ] Best Areas >10cm
- [x] Best Areas 5-10cm
- [ ] Best Areas <5cm

Run Depth
- [ ] Max >50
- [x] Max <50

Riffle/Run Substrate
- [ ] Stable
- [x] Mod. Stable
- [x] Unstable

Riffle/Run Embeddedness
- [ ] None
- [ ] Low
- [x] Moderate
- [ ] Extensive

Comments:

Gradient: 4

Gradient (ft/mi)	57.6	%Pool 5	%Glide 45
Drainage Area (sq.mi.)	1.8	%Riffle 0	%Run 50

Impacts (Check all that apply)
- [ ] None
- [x] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silvicluture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [x] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI — **Qualitative Habitat Evaluation Index** — **Modified by NEORSD**

River Code:
Date: 10/28/2002
Scorer's Initials: CZ
RM:
Location: Site #10
Comments: So Belvoir
Stream: Nine Mile Creek

Total Score: 42.75

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present) — Substrate: 12.5 (Max 20)

	Type	Pool%	Riffle%
	Bldr/Slbs		
	Boulder		
x	Cobble	30	
	Hardpan		
	Muck		
	Silt		
x	Gravel	35	
	Sand	25	
	Bedrock	10	
	Detritus		
	Artifical		

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [ ] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [x] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [ ] Silt - *Heavy*
- [ ] Silt - *Moderate*
- [x] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [ ] 5 or More
- [x] 4 or Less

Embeddedness
- [x] Extensive
- [x] Moderate
- [ ] Normal
- [ ] None

Comments:

Instream Cover (Check *ALL* that apply) — Cover: 3 (Max 20)
- [ ] Undercut Banks
- [ ] Overhanging Vegetation
- [x] 1 Shallows (Slow water)
- [x] 1 Rootmats
- [ ] Deep Pools >70cm
- [ ] Rootwads
- [ ] Boulders
- [ ] Oxbows, backwaters
- [ ] Aquatic Macrophytes
- [ ] Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [ ] Moderate 25-75%
- [ ] Sparse 5-25%
- [x] Nearly Absent <5%

Comments:

Channel Morphology: (Check 1, or 2 and average) — Channel: 10.5 (Max 20)

Sinuosity
- [ ] High
- [ ] Moderate
- [x] Low
- [ ] None

Development
- [ ] Excellent
- [ ] Good
- [ ] Fair
- [x] Poor

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Stability
- [ ] High
- [x] Moderate
- [x] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [x] Islands
- [ ] Leveed
- [ ] Bank Shaping
- [ ] 1-side channel modifications

Comments: Poor def. Pools & riffle areas poor/absent

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average) — Riparian: 7.75 (Max. 10)

Riparian Width (per bank)

L	R	
x		Wide > 50m
	x	Moderate 10-50m
	x	Narrow 5-10m
		Very Narrow <5m
		None

Bank Erosion (per bank)

L	R	
x	x	None/Little
x	x	Moderate
		Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
x	x	Forest, Swamp
		Shrub or Old Field
x	x	Residential, Park, New Field
		Fenced Pasture
		Conservation Tillage
		Urban or Industrial
		Open Pasture, Row Crop
		Mining/Construction

Comments:

Pool/Glide Quality — Pool: 5 (Max 12)

Max. Depth (1 only)
- [ ] >1m
- [ ] 0.7-1m
- [ ] 0.4-0.7m
- [x] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [x] Pool width > riffle width
- [ ] Pool width = riffle width
- [ ] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [ ] Fast
- [x] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Riffle/Run Quality (Check 1, or 2 and average) — Riffle/Run: 0 (Max 8)

Riffle Depth
- [ ] Best Areas >10cm
- [ ] Best Areas 5-10cm
- [x] Best Areas <5cm

Run Depth
- [ ] Max >50
- [ ] Max <50

Riffle/Run Substrate
- [ ] Stable
- [ ] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [ ] Low
- [ ] Moderate
- [ ] Extensive

Comments: Riffles <2"; non-func. No riffle

Gradient (ft/mi): 57.6 — Gradient: 4
Drainage Area (sq.mi.): 1.8

%Pool	5	%Glide	45
%Riffle	0	%Run	50

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silvicluture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [x] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI — **Qualitative Habitat Evaluation Index** — **Modified by NEORSD**

River Code: RM: Stream: Doan Brook
Date: 11/21/2002 Location: #16 N. of St. Clair
Scorer's Initials: CZ Comments: (Routine Sample Site)

Total Score: 45.5

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present)

	Type	Pool%	Riffle%
	Bldr/Slbs		
	Boulder		
	Cobble	5	
	Hardpan		
	Muck		
	Silt		
x	Gravel	40	
x	Sand	50	
	Bedrock		
	Detritus		
	Artifical	5	

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [x] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [ ] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [ ] Silt - *Heavy*
- [x] Silt - *Moderate*
- [x] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [ ] 5 or More
- [x] 4 or Less

Embeddedness
- [x] Extensive
- [ ] Moderate
- [ ] Normal
- [ ] None

Comments:

Substrate: 11.5 — Max 20

Instream Cover (Check *ALL* that apply)
- [ ] Undercut Banks
- [ ] Overhanging Vegetation
- [x] 1 Shallows (Slow water)
- [ ] Rootmats
- [x] 1 Deep Pools >70cm
- [ ] Rootwads
- [ ] Boulders
- [ ] Oxbows, backwaters
- [ ] Aquatic Macrophytes
- [ ] Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [ ] Moderate 25-75%
- [ ] Sparse 5-25%
- [x] Nearly Absent <5%

Comments:

Cover: 4 — Max 20

Channel Morphology: (Check 1, or 2 and average)

Sinuosity
- [ ] High
- [x] Moderate
- [x] Low
- [ ] None

Development
- [ ] Excellent
- [ ] Good
- [ ] Fair
- [x] Poor

Channelization
- [ ] None
- [ ] Recovered
- [ ] Recovering
- [x] Recent or No Recovery

Stability
- [x] High
- [ ] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [x] Bank Shaping
- [ ] 1-side channel modifications

Comments: Non-Functional for sinuosity to be effective due to slow flow.

Channel: 7.5 — Max 20

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average)

Riparian Width (per bank)

L	R	
		Wide > 50m
		Moderate 10-50m
		Narrow 5-10m
		Very Narrow <5m
x	x	None

Bank Erosion (per bank)

L	R	
x	x	None/Little
		Moderate
		Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
		Forest, Swamp
		Shrub or Old Field
	x	Residential, Park, New Field
		Fenced Pasture
		Conservation Tillage
x		Urban or Industrial
		Open Pasture, Row Crop
		Mining/Construction

Comments:

Riparian: 3.5 — Max. 10

Pool/Glide Quality

Max. Depth (1 only)
- [x] >1m
- [ ] 0.7-1m
- [ ] 0.4-0.7m
- [ ] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [x] Pool width > riffle width
- [ ] Pool width = riffle width
- [ ] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [ ] Fast
- [ ] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Pool: 9 — Max 12

Riffle/Run Quality (Check 1, or 2 and average)

Riffle Depth
- [ ] Best Areas >10cm
- [ ] Best Areas 5-10cm
- [ ] Best Areas <5cm

Run Depth
- [ ] Max >50
- [ ] Max <50

Riffle/Run Substrate
- [ ] Stable
- [ ] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [ ] Low
- [ ] Moderate
- [ ] Extensive

Comments: No riffle

Riffle/Run: 0 — Max 8

Gradient (ft/mi): 15.8
Drainage Area (sq.mi.): 9.6

%Pool: 10 %Glide: 75
%Riffle: 0 %Run: 15

Gradient: 10

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silviculture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI — Qualitative Habitat Evaluation Index

Modified by NEORSD

River Code:
RM:
Stream: Rocky River
Date: 9/19/2000
Location: Site #50
Scorer's Initials: CZ
Comments: East Branch, West Bridge St.

Total Score: 67

SUBSTRATE (Check ONLY two substrate TYPE Boxes; Estimate % present)

Substrate: 14 (Max 20)

	Type	Pool%	Riffle%
	Bldr/Slbs		
	Boulder	x	x
x	Cobble	x	x
	Hardpan		
	Muck		
	Silt	x	
	Gravel	x	x
x	Sand	x	
	Bedrock		
	Detritus		
	Artifical		

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [x] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [ ] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [x] Silt - *Heavy*
- [x] Silt - *Moderate*
- [ ] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [x] 5 or More
- [ ] 4 or Less

Embeddedness
- [x] Extensive
- [x] Moderate
- [ ] Normal
- [ ] None

Comments:

Instream Cover (Check ALL that apply)

Cover: 10 (Max 20)

- [ ] __ Undercut Banks
- [ ] __ Overhanging Vegetation
- [x] 1 Shallows (Slow water)
- [ ] __ Rootmats
- [x] 2 Deep Pools >70cm
- [ ] __ Rootwads
- [x] 3 Boulders
- [ ] __ Oxbows, backwaters
- [ ] __ Aquatic Macrophytes
- [x] 1 Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [x] Moderate 25-75%
- [x] Sparse 5-25%
- [ ] Nearly Absent <5%

Comments:

Channel Morphology: (Check 1, or 2 and average)

Channel: 14.5 (Max 20)

Sinuosity
- [ ] High
- [ ] Moderate
- [x] Low
- [ ] None

Development
- [ ] Excellent
- [x] Good
- [x] Fair
- [ ] Poor

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Stability
- [x] High
- [x] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [x] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [x] Bank Shaping
- [x] 1-side channel modifications

Comments:

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average)

Riparian: 3.5 (Max. 10)

Riparian Width (per bank)

L	R	
		Wide > 50m
		Moderate 10-50m
		Narrow 5-10m
x	x	Very Narrow <5m
x	x	None

Bank Erosion (per bank)

L	R	
x	x	None/Little
		Moderate
		Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
		Forest, Swamp
		Shrub or Old Field
		Residential, Park, New Field
		Fenced Pasture
		Conservation Tillage
x	x	Urban or Industrial
		Open Pasture, Row Crop
		Mining/Construction

Comments:

Pool/Glide Quality

Pool: 10 (Max 12)

Max. Depth (1 only)
- [x] >1m
- [ ] 0.7-1m
- [ ] 0.4-0.7m
- [ ] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [x] Pool width > riffle width
- [ ] Pool width = riffle width
- [ ] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [ ] Fast
- [x] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Riffle/Run Quality (Check 1, or 2 and average)

Riffle/Run: 7 (Max 8)

Riffle Depth
- [x] Best Areas >10cm
- [ ] Best Areas 5-10cm
- [ ] Best Areas <5cm

Run Depth
- [x] Max >50
- [ ] Max <50

Riffle/Run Substrate
- [x] Stable
- [ ] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [x] Low
- [ ] Moderate
- [ ] Extensive

Comments:

Gradient

Gradient: 8

Gradient (ft/mi)	15.4
Drainage Area (sq.mi.)	74

%Pool	20	%Glide	40
%Riffle	5	%Run	35

Impacts (Check all that apply)

- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silvicluture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI — **Qualitative Habitat Evaluation Index** — Modified by NEORSD

River Code:
RM:
Stream: Rocky River
Date: 9/19/2000
Location: Site #51
Scorer's Initials: CZ
Comments: East Branch, Upstream of East Access Road

Total Score: 81.5

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present)

		Type	Pool%	Riffle%
		Bldr/Slbs		
		Boulder	x	x
x		Cobble		x
		Hardpan		
		Muck		
		Silt		
		Gravel	x	
		Sand	x	
x		Bedrock	x	x
		Detritus		
		Artifical		

Substrate: 14.5 (Max 20)

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [x] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [ ] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [ ] Silt - *Heavy*
- [x] Silt - *Moderate*
- [ ] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [x] 5 or More
- [ ] 4 or Less

Embeddedness
- [ ] Extensive
- [x] Moderate
- [x] Normal
- [ ] None

Comments:

Instream Cover (Check *ALL* that apply)
- [x] 1 Undercut Banks
- [ ] Overhanging Vegetation
- [x] 1 Shallows (Slow water)
- [x] 1 Rootmats
- [ ] Deep Pools >70cm
- [ ] Rootwads
- [x] 1 Boulders
- [ ] Oxbows, backwaters
- [ ] Aquatic Macrophytes
- [ ] Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [ ] Moderate 25-75%
- [x] Sparse 5-25%
- [x] Nearly Absent <5%

Cover: 6 (Max 20)

Comments:

Channel Morphology: (Check 1, or 2 and average)

Sinuosity
- [ ] High
- [ ] Moderate
- [x] Low
- [ ] None

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [x] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [x] Bank Shaping
- [ ] 1-side channel modifications

Development
- [ ] Excellent
- [ ] Good
- [x] Fair
- [ ] Poor

Stability
- [x] High
- [ ] Moderate
- [ ] Low

Channel: 14 (Max 20)

Comments:

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average)

Riparian Width (per bank)

L	R	
x		Wide > 50m
		Moderate 10-50m
		Narrow 5-10m
	x	Very Narrow <5m
x		None

Bank Erosion (per bank)

L	R	
x	x	None/Little
		Moderate
		Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
x		Forest, Swamp
		Shrub or Old Field
	x	Residential, Park, New Field
		Fenced Pasture
		Conservation Tillage
		Urban or Industrial
		Open Pasture, Row Crop
		Mining/Construction

Comments:

Riparian: 6.5 (Max. 10)

Pool/Glide Quality

Max. Depth (1 only)
- [ ] >1m
- [x] 0.7-1m
- [ ] 0.4-0.7m
- [ ] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [ ] Pool width > riffle width
- [ ] Pool width = riffle width
- [x] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [ ] Fast
- [x] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Pool: 6 (Max 12)

Riffle/Run Quality (Check 1, or 2 and average)

Riffle Depth
- [x] Best Areas >10cm
- [ ] Best Areas 5-10cm
- [ ] Best Areas <5cm

Riffle/Run Substrate
- [x] Stable
- [x] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [x] Low
- [ ] Moderate
- [ ] Extensive

Run Depth
- [x] Max >50
- [ ] Max <50

Comments:

Riffle/Run: 6.5 (Max 8)

Gradient (ft/mi)	6.5
Drainage Area (sq.mi.)	62

%Pool	<5	%Glide	0
%Riffle	20	%Run	75

Gradient: 8

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silvicluture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI — **Qualitative Habitat Evaluation Index** — **Modified by NEORSD**

River Code:
Date: 9/29/2000
Scorer's Initials: CZ
RM:
Location: Site #52
Comments: West Branch, North of Bagley Rd.
Stream: Rocky River

Total Score: 61

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present) — Substrate: 11.5, Max 20

		Type	Pool%	Riffle%
		Bldr/Slbs	x	x
		Boulder	x	x
		Cobble		x
		Hardpan		
		Muck		
		Silt		
		Gravel	x	
		Sand	x	
x	x	Bedrock	x	x
		Detritus		
		Artifical		

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [x] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [ ] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [ ] Silt - *Heavy*
- [x] Silt - *Moderate*
- [ ] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [x] 5 or More
- [ ] 4 or Less

Embeddedness
- [ ] Extensive
- [x] Moderate
- [x] Normal
- [ ] None

Comments:

Instream Cover (Check *ALL* that apply) — Cover: 9, Max 20
- [ ] __ Undercut Banks
- [ ] __ Overhanging Vegetation
- [x] 2 Shallows (Slow water)
- [ ] __ Rootmats
- [ ] __ Deep Pools >70cm
- [ ] __ Rootwads
- [x] 3 Boulders
- [ ] __ Oxbows, backwaters
- [ ] __ Aquatic Macrophytes
- [ ] __ Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [x] Moderate 25-75%
- [ ] Sparse 5-25%
- [ ] Nearly Absent <5%

Comments:

Channel Morphology: (Check 1, or 2 and average) — Channel: 14.5, Max 20

Sinuosity
- [ ] High
- [ ] Moderate
- [x] Low
- [x] None

Development
- [ ] Excellent
- [x] Good
- [x] Fair
- [ ] Poor

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Stability
- [x] High
- [ ] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [ ] Bank Shaping
- [ ] 1-side channel modifications

Comments:

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average) — Riparian: 6, Max. 10

Riparian Width (per bank)

L	R	
		Wide > 50m
		Moderate 10-50m
x	x	Narrow 5-10m
		Very Narrow <5m
		None

Bank Erosion (per bank)

L	R	
x	x	None/Little
		Moderate
		Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
		Forest, Swamp
		Shrub or Old Field
x	x	Residential, Park, New Field
		Fenced Pasture
		Conservation Tillage
		Urban or Industrial
		Open Pasture, Row Crop
		Mining/Construction

Comments:

Pool/Glide Quality — Pool: 7, Max 12

Max. Depth (1 only)
- [ ] >1m
- [x] 0.7-1m
- [ ] 0.4-0.7m
- [ ] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [ ] Pool width > riffle width
- [ ] Pool width = riffle width
- [x] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [x] Fast
- [x] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Riffle/Run Quality (Check 1, or 2 and average) — Riffle/Run: 7, Max 8

Riffle Depth
- [x] Best Areas >10cm
- [ ] Best Areas 5-10cm
- [ ] Best Areas <5cm

Run Depth
- [x] Max >50
- [ ] Max <50

Riffle/Run Substrate
- [x] Stable
- [ ] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [x] Low
- [ ] Moderate
- [ ] Extensive

Comments:

Gradient: 6

Gradient (ft/mi)	15.7
Drainage Area (sq.mi.)	180

%Pool	10	%Glide	0
%Riffle	25	%Run	65

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silviclulture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI

Qualitative Habitat Evaluation Index

Modified by NEORSD

River Code:
RM:
Date: 9/20/2000
Location: Site #52.5
Stream: Rocky River
Scorer's Initials: CZ
Comments: Hilliard Rd. Bridge

Total Score: 69

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present)

Check	Type	Pool%	Riffle%
	Bldr/Slbs		
	Boulder	x	x
x	Cobble	x	x
	Hardpan		
	Muck		
	Silt	x	
	Gravel	x	x
	Sand	x	x
x	Bedrock	x	x
	Detritus		
	Artifical		

Substrate: 14 — Max 20

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [x] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [ ] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [x] Silt - *Heavy*
- [x] Silt - *Moderate*
- [ ] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [x] 5 or More
- [ ] 4 or Less

Embeddedness
- [ ] Extensive
- [x] Moderate
- [x] Normal
- [ ] None

Comments:

Instream Cover (Check *ALL* that apply)
- [ ] __ Undercut Banks
- [ ] __ Overhanging Vegetation
- [x] 2 Shallows (Slow water)
- [ ] __ Rootmats
- [x] 1 Deep Pools >70cm
- [ ] __ Rootwads
- [x] 2 Boulders
- [ ] __ Oxbows, backwaters
- [ ] __ Aquatic Macrophytes
- [x] 1 Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [ ] Moderate 25-75%
- [x] Sparse 5-25%
- [ ] Nearly Absent <5%

Comments:

Cover: 8 — Max 20

Channel Morphology: (Check 1, or 2 and average)

Sinuosity
- [ ] High
- [ ] Moderate
- [x] Low
- [ ] None

Development
- [ ] Excellent
- [x] Good
- [x] Fair
- [ ] Poor

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Stability
- [x] High
- [ ] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [ ] Bank Shaping
- [ ] 1-side channel modifications

Comments:

Channel: 15 — Max 20

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average)

Riparian Width (per bank)

L	R	
x		Wide > 50m
x	x	Moderate 10-50m
		Narrow 5-10m
		Very Narrow <5m
		None

Bank Erosion (per bank)

L	R	
x	x	None/Little
	x	Moderate
		Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
		Forest, Swamp
		Shrub or Old Field
x	x	Residential, Park, New Field
		Fenced Pasture
		Conservation Tillage
		Urban or Industrial
		Open Pasture, Row Crop
		Mining/Construction

Comments:

Riparian: 7 — Max. 10

Pool/Glide Quality

Max. Depth (1 only)
- [x] >1m
- [ ] 0.7-1m
- [ ] 0.4-0.7m
- [ ] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [ ] Pool width > riffle width
- [ ] Pool width = riffle width
- [x] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [x] Fast
- [x] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Pool: 9 — Max 12

Riffle/Run Quality (Check 1, or 2 and average)

Riffle Depth
- [ ] Best Areas >10cm
- [x] Best Areas 5-10cm
- [ ] Best Areas <5cm

Run Depth
- [x] Max >50
- [ ] Max <50

Riffle/Run Substrate
- [x] Stable
- [ ] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [x] Low
- [ ] Moderate
- [ ] Extensive

Comments:

Riffle/Run: 6 — Max 8

Gradient (ft/mi): 8.9
Drainage Area (sq.mi.): 291

%Pool	10	%Glide	10
%Riffle	20	%Run	60

Gradient: 10

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silviclulture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI | **Qualitative Habitat Evaluation Index** | **Modified by NEORSD** | Total Score 75.75

River Code: | RM: | Stream: Chagrin River
Date: 8/20/2002 | Location: Site #58
Scorer's Initials: CZ | Comments: Downstream of Beech Hill/Bonnieview Creeks

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present) — Substrate 18, Max 20

		Type	Pool%	Riffle%
		Bldr/Slbs		
		Boulder	5	15
x	x	Cobble	45	45
		Hardpan	5	

		Type	Pool%	Riffle%
		Muck		
		Silt		
		Gravel	10	30
		Sand	35	10

		Type	Pool%	Riffle%
		Bedrock		
		Detritus		
		Artifical		

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [x] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [ ] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [ ] Silt - *Heavy*
- [x] Silt - *Moderate*
- [x] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [x] 5 or More
- [ ] 4 or Less

Embeddedness
- [ ] Extensive
- [x] Moderate
- [x] Normal
- [ ] None

Comments:

Instream Cover (Check *ALL* that apply) — Cover 10, Max 20
- [ ] __ Undercut Banks
- [ ] __ Overhanging Vegetation
- [x] 2 Shallows (Slow water)
- [x] 1 Rootmats
- [x] 1 Deep Pools >70cm
- [x] 1 Rootwads
- [x] 2 Boulders
- [ ] __ Oxbows, backwaters
- [ ] __ Aquatic Macrophytes
- [x] 1 Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [ ] Moderate 25-75%
- [x] Sparse 5-25%
- [ ] Nearly Absent <5%

Comments:

Channel Morphology: (Check 1, or 2 and average) — Channel 16, Max 20

Sinuosity
- [ ] High
- [ ] Moderate
- [x] Low
- [ ] None

Development
- [ ] Excellent
- [x] Good
- [ ] Fair
- [ ] Poor

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Stability
- [x] High
- [ ] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [ ] Bank Shaping
- [ ] 1-side channel modifications

Comments:

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average) — Riparian 6.25, Max. 10

Riparian Width (per bank)

L	R	
		Wide > 50m
x	x	Moderate 10-50m
		Narrow 5-10m
		Very Narrow <5m
x	x	None

Bank Erosion (per bank)

L	R	
x	x	None/Little
	x	Moderate
		Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
x	x	Forest, Swamp
		Shrub or Old Field
x	x	Residential, Park, New Field
		Fenced Pasture
		Conservation Tillage
		Urban or Industrial
		Open Pasture, Row Crop
		Mining/Construction

Comments:

Pool/Glide Quality — Pool 9, Max 12

Max. Depth (1 only)
- [x] >1m
- [ ] 0.7-1m
- [ ] 0.4-0.7m
- [ ] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [ ] Pool width > riffle width
- [ ] Pool width = riffle width
- [x] Pool width < riffle width

Current Velocity (Check all that apply)
- [x] Eddies
- [x] Fast
- [x] Moderate
- [ ] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Riffle/Run Quality (Check 1, or 2 and average) — Riffle/Run 6.5, Max 8

Riffle Depth
- [x] Best Areas >10cm
- [ ] Best Areas 5-10cm
- [ ] Best Areas <5cm

Run Depth
- [x] Max >50
- [ ] Max <50

Riffle/Run Substrate
- [x] Stable
- [ ] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [x] Low
- [x] Moderate
- [ ] Extensive

Comments:

Gradient 10

Gradient (ft/mi)	6	%Pool	5	%Glide	5
Drainage Area (sq.mi.)	161	%Riffle	60	%Run	30

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silviculture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI — Qualitative Habitat Evaluation Index

Modified by NEORSD

River Code: | RM: | Stream: Chagrin River
Date: 7/25/2002 | Location: Site #59
Scorer's Initials: CZ | Comments: Mayfield Road Bridge

Total Score: 72

SUBSTRATE (Check ONLY two substrate TYPE Boxes; Estimate % present)

	Type	Pool%	Riffle%
	Bldr/Slbs		
	Boulder	10	
x	Cobble	30	60
	Hardpan		
	Muck		
	Silt	5	
	Gravel	5	35
x	Sand	50	5
	Bedrock		
	Detritus		
	Artifical		

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [x] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [ ] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [x] Silt - *Heavy*
- [x] Silt - *Moderate*
- [ ] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [x] 5 or More
- [ ] 4 or Less

Embeddedness
- [x] Extensive
- [x] Moderate
- [ ] Normal
- [ ] None

Comments:

Substrate: 14 — Max 20

Instream Cover (Check ALL that apply)
- [ ] Undercut Banks
- [ ] Overhanging Vegetation
- [x] 3 Shallows (Slow water)
- [ ] Rootmats
- [ ] Deep Pools >70cm
- [ ] Rootwads
- [x] 1 Boulders
- [ ] Oxbows, backwaters
- [ ] Aquatic Macrophytes
- [ ] Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [x] Moderate 25-75%
- [x] Sparse 5-25%
- [ ] Nearly Absent <5%

Comments:

Cover: 7 — Max 20

Channel Morphology: (Check 1, or 2 and average)

Sinuosity
- [ ] High
- [x] Moderate
- [x] Low
- [ ] None

Development
- [ ] Excellent
- [x] Good
- [ ] Fair
- [ ] Poor

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Stability
- [x] High
- [ ] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [ ] Bank Shaping
- [ ] 1-side channel modifications

Comments:

Channel: 16.5 — Max 20

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average)

Riparian Width (per bank)

L	R	
x	x	Wide > 50m
		Moderate 10-50m
		Narrow 5-10m
		Very Narrow <5m
		None

Bank Erosion (per bank)

L	R	
x	x	None/Little
		Moderate
		Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
x		Forest, Swamp
		Shrub or Old Field
	x	Residential, Park, New Field
		Fenced Pasture
		Conservation Tillage
		Urban or Industrial
		Open Pasture, Row Crop
		Mining/Construction

Comments:

Riparian: 9 — Max. 10

Pool/Glide Quality

Max. Depth (1 only)
- [ ] >1m
- [ ] 0.7-1m
- [ ] 0.4-0.7m
- [ ] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [ ] Pool width > riffle width
- [ ] Pool width = riffle width
- [ ] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [ ] Fast
- [ ] Moderate
- [ ] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Pool: 10.5 — Max 12

Riffle/Run Quality (Check 1, or 2 and average)

Riffle Depth
- [ ] Best Areas >10cm
- [ ] Best Areas 5-10cm
- [ ] Best Areas <5cm

Run Depth
- [ ] Max >50
- [ ] Max <50

Riffle/Run Substrate
- [ ] Stable
- [ ] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [ ] Low
- [ ] Moderate
- [ ] Extensive

Comments:

Riffle/Run: 5 — Max 8

Gradient

Gradient (ft/mi): 8.8
Drainage Area (sq.mi.): 158

%Pool	5	%Glide	5
%Riffle	45	%Run	45

Gradient: 10

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silviculture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI | **Qualitative Habitat Evaluation Index** | **Modified by NEORSD**

River Code:
Date: 9/10/1999
Scorer's Initials: CZ/TZ
RM:
Location: US of Southerly WWTP
Comments: Electrofishing Site
Stream: Cuyahoga River

Total Score: 76.5

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present)

Type	Pool%	Riffle%	Type	Pool%	Riffle%	Type	Pool%	Riffle%
Bldr/Slbs			Muck			Bedrock		
Boulder	x		Silt	x		Detritus		
Cobble	x		[x] Gravel	x		Artifical		
Hardpan			[x] Sand	x				

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [x] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [ ] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [x] Silt - *Heavy*
- [x] Silt - *Moderate*
- [ ] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [x] 5 or More
- [ ] 4 or Less

Embeddedness
- [ ] Extensive
- [x] Moderate
- [ ] Normal
- [ ] None

Comments:

Substrate: 13.5 (Max 20)

Instream Cover (Check *ALL* that apply)
- [x] 2 Undercut Banks
- [x] 1 Overhanging Vegetation
- [x] 1 Shallows (Slow water)
- [x] 2 Rootmats
- [x] 2 Deep Pools >70cm
- [x] 2 Rootwads
- [x] 1 Boulders
- [ ] Oxbows, backwaters
- [ ] Aquatic Macrophytes
- [x] 2 Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [x] Moderate 25-75%
- [ ] Sparse 5-25%
- [ ] Nearly Absent <5%

Comments:

Cover: 16 (Max 20)

Channel Morphology: (Check 1, or 2 and average)

Sinuosity
- [ ] High
- [ ] Moderate
- [ ] Low
- [x] None

Development
- [ ] Excellent
- [x] Good
- [x] Fair
- [ ] Poor

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Stability
- [x] High
- [ ] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [ ] Bank Shaping
- [ ] 1-side channel modifications

Comments:

Channel: 14 (Max 20)

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average)

Riparian Width (per bank)

L	R	
		Wide > 50m
	x	Moderate 10-50m
x		Narrow 5-10m
		Very Narrow <5m
		None

Bank Erosion (per bank)

L	R	
x	x	None/Little
		Moderate
		Heavy/Severe

Flood Plain Quality (Past 100m Riparian)

L	R	(most predominant per bank)
		Forest, Swamp
	x	Shrub or Old Field
		Residential, Park, New Field
		Fenced Pasture
		Conservation Tillage
x		Urban or Industrial
		Open Pasture, Row Crop
		Mining/Construction

Comments: RL(50-20'):companies
RR(200'):ash lagoon

Riparian: 6.5 (Max. 10)

Pool/Glide Quality

Max. Depth (1 only)
- [x] >1m
- [ ] 0.7-1m
- [ ] 0.4-0.7m
- [ ] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [x] Pool width > riffle width
- [ ] Pool width = riffle width
- [ ] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [x] Fast
- [x] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Pool: 11 (Max 12)

Riffle/Run Quality (Check 1, or 2 and average)

Riffle Depth
- [x] Best Areas >10cm
- [ ] Best Areas 5-10cm
- [ ] Best Areas <5cm

Run Depth
- [x] Max >50
- [ ] Max <50

Riffle/Run Substrate
- [x] Stable
- [x] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [ ] Low
- [x] Moderate
- [ ] Extensive

Comments:

Riffle/Run: 5.5 (Max 8)

Gradient (ft/mi): 1.75
Drainage Area (sq.mi.): 710

%Pool	30	%Glide	30
%Riffle	10	%Run	30

Gradient: 10

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silvicluture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI | **Qualitative Habitat Evaluation Index** | **Modified by NEORSD** | Total Score: 69

River Code:
Date: 9/10/1999
Scorer's Initials: CZ/TZ
RM:
Location: DS of Southerly WWTP
Comments: Electrofishing Site
Stream: Cuyahoga River

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present) — Substrate: 12.5, Max 20

Type	Pool%	Riffle%
[ ] [ ] Bldr/Slbs		
[ ] [ ] Boulder	x	
[ ] [ ] Cobble	x	
[ ] [ ] Hardpan		
[ ] [ ] Muck		
[ ] [ ] Silt	x	
[x] [ ] Gravel	x	
[ ] [x] Sand	x	
[ ] [ ] Bedrock		
[ ] [ ] Detritus	x	
[ ] [ ] Artifical	x	

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [x] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [ ] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [x] Silt - *Heavy*
- [x] Silt - *Moderate*
- [ ] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [x] 5 or More
- [ ] 4 or Less

Embeddedness
- [x] Extensive
- [ ] Moderate
- [ ] Normal
- [ ] None

Comments:

Instream Cover (Check *ALL* that apply) — Cover: 13, Max 20
- [x] Undercut Banks
- [ ] Overhanging Vegetation
- [x] 1 Shallows (Slow water)
- [x] 1 Rootmats
- [x] 3 Deep Pools >70cm
- [x] 1 Rootwads
- [x] Boulders
- [ ] Oxbows, backwaters
- [ ] Aquatic Macrophytes
- [x] 3 Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [x] Moderate 25-75%
- [x] Sparse 5-25%
- [ ] Nearly Absent <5%

Comments:

Channel Morphology: (Check 1, or 2 and average) — Channel: 14.5, Max 20

Sinuosity
- [ ] High
- [ ] Moderate
- [x] Low
- [x] None

Development
- [ ] Excellent
- [x] Good
- [ ] Fair
- [ ] Poor

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Stability
- [ ] High
- [x] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [x] Bank Shaping
- [x] 1-side channel modifications

Comments:

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average) — Riparian: 3.5, Max. 10

Riparian Width (per bank) L R
- [ ] [ ] Wide > 50m
- [ ] [ ] Moderate 10-50m
- [ ] [ ] Narrow 5-10m
- [x] [x] Very Narrow <5m
- [x] [x] None

Bank Erosion (per bank) L R
- [x] [x] None/Little
- [ ] [ ] Moderate
- [ ] [ ] Heavy/Severe

Flood Plain Quality (Past 100m Riparian) L R (most predominant per bank)
- [ ] [ ] Forest, Swamp
- [ ] [ ] Shrub or Old Field
- [ ] [ ] Residential, Park, New Field
- [ ] [ ] Fenced Pasture
- [ ] [ ] Conservation Tillage
- [x] [x] Urban or Industrial
- [ ] [ ] Open Pasture, Row Crop
- [ ] [ ] Mining/Construction

Comments: RR: companies and small tree area
RL: landfill

Pool/Glide Quality — Pool: 11, Max 12

Max. Depth (1 only)
- [x] >1m
- [ ] 0.7-1m
- [ ] 0.4-0.7m
- [ ] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [x] Pool width > riffle width
- [ ] Pool width = riffle width
- [ ] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [x] Fast
- [x] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Riffle/Run Quality (Check 1, or 2 and average) — Riffle/Run: 4.5, Max 8

Riffle Depth
- [x] Best Areas >10cm
- [ ] Best Areas 5-10cm
- [ ] Best Areas <5cm

Run Depth
- [x] Max >50
- [ ] Max <50

Riffle/Run Substrate
- [ ] Stable
- [x] Mod. Stable
- [x] Unstable

Riffle/Run Embeddedness
- [ ] None
- [ ] Low
- [x] Moderate
- [ ] Extensive

Comments:

Gradient: 10

Gradient (ft/mi)	2
Drainage Area (sq.mi.)	733

%Pool	40	%Glide	
%Riffle	3	%Run	40

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silviculture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI — **Qualitative Habitat Evaluation Index** — **Modified by NEORSD**

River Code:
Date: 9/10/1999
Scorer's Initials: CZ
RM:
Location: Lower Harvard
Comments: Electrofishing Site
Stream: Cuyahoga River

Total Score: 68.25

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present)

	Type	Pool%	Riffle%
	Bldr/Slbs	x	
	Boulder		
x	Cobble	x	x
	Hardpan		
	Muck		
	Silt	x	
x	Gravel	x	x
	Sand		
	Bedrock		
	Detritus		
	Artifical	x	

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [x] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [ ] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [ ] Silt - *Heavy*
- [x] Silt - *Moderate*
- [ ] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [x] 5 or More
- [ ] 4 or Less

Embeddedness
- [ ] Extensive
- [x] Moderate
- [ ] Normal
- [ ] None

Comments:

Substrate: 16 (Max 20)

Instream Cover (Check *ALL* that apply)
- [ ] Undercut Banks
- [ ] Overhanging Vegetation
- [ ] Shallows (Slow water)
- [ ] Rootmats
- [x] Deep Pools >70cm
- [ ] Rootwads
- [x] Boulders
- [ ] Oxbows, backwaters
- [ ] Aquatic Macrophytes
- [x] Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [ ] Moderate 25-75%
- [x] Sparse 5-25%
- [ ] Nearly Absent <5%

Comments:

Cover: 7 (Max 20)

Channel Morphology: (Check 1, or 2 and average)

Sinuosity
- [ ] High
- [ ] Moderate
- [x] Low
- [ ] None

Development
- [ ] Excellent
- [x] Good
- [x] Fair
- [ ] Poor

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Stability
- [x] High
- [x] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [ ] Bank Shaping
- [ ] 1-side channel modifications

Comments:

Channel: 14.5 (Max 20)

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average)

Riparian Width (per bank)

L	R	
x	x	Wide > 50m
		Moderate 10-50m
		Narrow 5-10m
x	x	Very Narrow <5m
		None

Bank Erosion (per bank)

L	R	
x	x	None/Little
		Moderate
		Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
	x	Forest, Swamp
x		Shrub or Old Field
		Residential, Park, New Field
		Fenced Pasture
		Conservation Tillage
x	x	Urban or Industrial
		Open Pasture, Row Crop
		Mining/Construction

Comments:

Riparian: 6.75 (Max. 10)

Pool/Glide Quality

Max. Depth (1 only)
- [x] >1m
- [ ] 0.7-1m
- [ ] 0.4-0.7m
- [ ] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [ ] Pool width > riffle width
- [ ] Pool width = riffle width
- [x] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [ ] Fast
- [x] Moderate
- [ ] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Pool: 7 (Max 12)

Riffle/Run Quality (Check 1, or 2 and average)

Riffle Depth
- [x] Best Areas >10cm
- [ ] Best Areas 5-10cm
- [ ] Best Areas <5cm

Run Depth
- [ ] Max >50
- [x] Max <50

Riffle/Run Substrate
- [x] Stable
- [ ] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [ ] Low
- [x] Moderate
- [ ] Extensive

Comments:

Riffle/Run: 5 (Max 8)

Gradient (ft/mi)	2	%Pool	10	%Glide	60
Drainage Area (sq.mi.)	786	%Riffle	20	%Run	10

Gradient: 10

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silvicluture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI — **Qualitative Habitat Evaluation Index** — **Modified by NEORSD**

River Code:
Date: 7/26/2001
Scorer's Initials: CZ/TZ
RM:
Location: US of Southerly Effluent Channel
Comments: Electrofishing Site
Stream: Cuyahoga River

Total Score: 72.75

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present) — Substrate: 13.5, Max 20

Check	Type	Pool%	Riffle%
	Bldr/Slbs		
	Boulder	10	5
	Cobble	5	10
	Hardpan		
	Muck		
	Silt	25	
x	Gravel	50	50
x	Sand	50	20
	Bedrock		
	Detritus		
	Artifical	15	10

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [x] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [ ] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [ ] Silt - *Heavy*
- [x] Silt - *Moderate*
- [ ] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [x] 5 or More
- [ ] 4 or Less

Embeddedness
- [x] Extensive
- [x] Moderate
- [ ] Normal
- [ ] None

Comments:

Instream Cover (Check *ALL* that apply) — Cover: 14, Max 20
- [x] 3 Undercut Banks
- [ ] Overhanging Vegetation
- [x] 1 Shallows (Slow water)
- [ ] Rootmats
- [x] 3 Deep Pools >70cm
- [x] 3 Rootwads
- [x] 1 Boulders
- [ ] Oxbows, backwaters
- [ ] Aquatic Macrophytes
- [x] 3 Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [x] Moderate 25-75%
- [ ] Sparse 5-25%
- [ ] Nearly Absent <5%

Comments:

Channel Morphology: (Check 1, or 2 and average) — Channel: 14, Max 20

Sinuosity
- [ ] High
- [ ] Moderate
- [x] Low
- [x] None

Development
- [ ] Excellent
- [x] Good
- [x] Fair
- [ ] Poor

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Stability
- [x] High
- [x] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [ ] Bank Shaping
- [ ] 1-side channel modifications

Comments:

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average) — Riparian: 7.75, Max. 10

Riparian Width (per bank)

L	R	
	x	Wide > 50m
x		Moderate 10-50m
x		Narrow 5-10m
		Very Narrow <5m
		None

Bank Erosion (per bank)

L	R	
x	x	None/Little
		Moderate
		Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
	x	Forest, Swamp
		Shrub or Old Field
		Residential, Park, New Field
		Fenced Pasture
		Conservation Tillage
x		Urban or Industrial
		Open Pasture, Row Crop
		Mining/Construction

Comments: RR: ash lagoons
RL: industry, Valley Belt Rd.

Pool/Glide Quality — Pool: 10, Max 12

Max. Depth (1 only)
- [x] >1m
- [ ] 0.7-1m
- [ ] 0.4-0.7m
- [ ] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [ ] Pool width > riffle width
- [ ] Pool width = riffle width
- [x] Pool width < riffle width

Current Velocity (Check all that apply)
- [x] Eddies
- [x] Fast
- [x] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Riffle/Run Quality (Check 1, or 2 and average) — Riffle/Run: 5.5, Max 8

Riffle Depth
- [x] Best Areas >10cm
- [ ] Best Areas 5-10cm
- [ ] Best Areas <5cm

Run Depth
- [x] Max >50
- [ ] Max <50

Riffle/Run Substrate
- [x] Stable
- [x] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [ ] Low
- [x] Moderate
- [ ] Extensive

Comments:

Gradient: 8

Gradient (ft/mi)	0.9
Drainage Area (sq.mi.)	733

%Pool	30	%Glide	5
%Riffle	5	%Run	60

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silviclulture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI — **Qualitative Habitat Evaluation Index** — **Modified by NEORSD**

River Code: RM: Stream: Cuyahoga River
Date: 7/26/2001 Location: DS of Southerly WWTP
Scorer's Initials: CZ/TZ Comments: Electrofishing Site

Total Score: 68.75

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present)

Substrate: 13.5 (Max 20)

		Type	Pool%	Riffle%			Type	Pool%	Riffle%			Type	Pool%	Riffle%
[ ]	[ ]	Bldr/Slbs			[ ]	[ ]	Muck			[ ]	[ ]	Bedrock		
[ ]	[ ]	Boulder	5	5	[ ]	[ ]	Silt	25		[ ]	[ ]	Detritus		
[ ]	[ ]	Cobble	15	20	[x]	[ ]	Gravel	50	50	[ ]	[ ]	Artifical	20	
[ ]	[ ]	Hardpan			[ ]	[x]	Sand	50	5					

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [x] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [ ] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [ ] Silt - *Heavy*
- [x] Silt - *Moderate*
- [ ] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [x] 5 or More
- [ ] 4 or Less

Embeddedness
- [x] Extensive
- [x] Moderate
- [ ] Normal
- [ ] None

Comments:

Instream Cover (Check *ALL* that apply)

Cover: 13 (Max 20)

- [ ] __ Undercut Banks
- [ ] __ Overhanging Vegetation
- [x] 1 Shallows (Slow water)
- [ ] __ Rootmats
- [x] 3 Deep Pools >70cm
- [x] 1 Rootwads
- [x] 2 Boulders
- [ ] __ Oxbows, backwaters
- [ ] __ Aquatic Macrophytes
- [x] 2 Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [x] Moderate 25-75%
- [ ] Sparse 5-25%
- [ ] Nearly Absent <5%

Comments:

Channel Morphology: (Check 1, or 2 and average)

Channel: 14.5 (Max 20)

Sinuosity
- [ ] High
- [ ] Moderate
- [x] Low
- [ ] None

Development
- [ ] Excellent
- [x] Good
- [x] Fair
- [ ] Poor

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Stability
- [x] High
- [x] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [ ] Bank Shaping
- [ ] 1-side channel modifications

Comments:

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average)

Riparian: 4.25 (Max. 10)

Riparian Width (per bank)

L	R	
[ ]	[ ]	Wide > 50m
[ ]	[ ]	Moderate 10-50m
[x]	[ ]	Narrow 5-10m
[x]	[x]	Very Narrow <5m
[ ]	[ ]	None

Bank Erosion (per bank)

L	R	
[x]	[x]	None/Little
[ ]	[ ]	Moderate
[ ]	[ ]	Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
[ ]	[ ]	Forest, Swamp
[ ]	[ ]	Shrub or Old Field
[ ]	[ ]	Residential, Park, New Field
[ ]	[ ]	Fenced Pasture
[ ]	[ ]	Conservation Tillage
[x]	[x]	Urban or Industrial
[ ]	[ ]	Open Pasture, Row Crop
[ ]	[ ]	Mining/Construction

Comments: RR: landfill and Towpath
RL: landfill

Pool/Glide Quality

Pool: 10 (Max 12)

Max. Depth (1 only)
- [x] >1m
- [ ] 0.7-1m
- [ ] 0.4-0.7m
- [ ] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [ ] Pool width > riffle width
- [ ] Pool width = riffle width
- [x] Pool width < riffle width

Current Velocity (Check all that apply)
- [x] Eddies
- [x] Fast
- [x] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Riffle/Run Quality (Check 1, or 2 and average)

Riffle/Run: 5.5 (Max 8)

Riffle Depth
- [x] Best Areas >10cm
- [ ] Best Areas 5-10cm
- [ ] Best Areas <5cm

Run Depth
- [x] Max >50
- [ ] Max <50

Riffle/Run Substrate
- [x] Stable
- [x] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [ ] Low
- [x] Moderate
- [ ] Extensive

Comments:

Gradient

Gradient: 8

Gradient (ft/mi): 0.9
Drainage Area (sq.mi.): 733

%Pool	30	%Glide	5
%Riffle	10	%Run	55

Impacts (Check all that apply)

- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silvicluture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI — **Qualitative Habitat Evaluation Index** — **Modified by NEORSD**

River Code:
RM:
Stream: Cuyahoga River
Date: 7/26/2001
Location: US of Big Creek
Scorer's Initials: CZ/TZ
Comments: Electrofishing Site (1500')

Total Score: 63

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present)

	Type	Pool%	Riffle%
[ ] [ ]	Bldr/Slbs		
[ ] [ ]	Boulder	10	
[ ] [ ]	Cobble	15	
[ ] [ ]	Hardpan		
[ ] [ ]	Muck		
[ ] [ ]	Silt	20	
[ ] [ ]	Gravel	30	
[x] [x]	Sand	100	
[ ] [ ]	Bedrock		
[ ] [ ]	Detritus		
[ ] [ ]	Artifical	20	

Substrate: 12 — Max 20

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [x] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [ ] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [x] Silt - *Heavy*
- [x] Silt - *Moderate*
- [ ] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [x] 5 or More
- [ ] 4 or Less

Embeddedness
- [x] Extensive
- [x] Moderate
- [ ] Normal
- [ ] None

Comments:

Instream Cover (Check *ALL* that apply)
- [ ] Undercut Banks
- [ ] Overhanging Vegetation
- [x] 1 Shallows (Slow water)
- [ ] Rootmats
- [x] 3 Deep Pools >70cm
- [x] 2 Rootwads
- [x] 1 Boulders
- [ ] Oxbows, backwaters
- [ ] Aquatic Macrophytes
- [x] 1 Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [x] Moderate 25-75%
- [x] Sparse 5-25%
- [ ] Nearly Absent <5%

Comments:

Cover: 11 — Max 20

Channel Morphology: (Check 1, or 2 and average)

Sinuosity
- [x] High
- [x] Moderate
- [ ] Low
- [ ] None

Development
- [ ] Excellent
- [ ] Good
- [x] Fair
- [ ] Poor

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Stability
- [x] High
- [ ] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [ ] Bank Shaping
- [ ] 1-side channel modifications

Comments:

Channel: 15.5 — Max 20

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average)

Riparian Width (per bank) L R
- [ ] [ ] Wide > 50m
- [ ] [x] Moderate 10-50m
- [ ] [x] Narrow 5-10m
- [x] [ ] Very Narrow <5m
- [x] [ ] None

Bank Erosion (per bank) L R
- [x] [x] None/Little
- [ ] [ ] Moderate
- [ ] [ ] Heavy/Severe

Flood Plain Quality (Past 100m Riparian) L R (most predominant per bank)
- [ ] [ ] Forest, Swamp
- [ ] [ ] Shrub or Old Field
- [ ] [ ] Residential, Park, New Field
- [ ] [ ] Fenced Pasture
- [ ] [ ] Conservation Tillage
- [x] [x] Urban or Industrial
- [ ] [ ] Open Pasture, Row Crop
- [ ] [ ] Mining/Construction

Comments: RR: industry
RL:industry, Mg/Al- recovery

Riparian: 4.5 — Max. 10

Pool/Glide Quality

Max. Depth (1 only)
- [x] >1m
- [ ] 0.7-1m
- [ ] 0.4-0.7m
- [ ] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [x] Pool width > riffle width
- [ ] Pool width = riffle width
- [ ] Pool width < riffle width

Current Velocity (Check all that apply)
- [x] Eddies
- [x] Fast
- [x] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Pool: 12 — Max 12

Riffle/Run Quality (Check 1, or 2 and average)

Riffle Depth
- [ ] Best Areas >10cm
- [ ] Best Areas 5-10cm
- [ ] Best Areas <5cm

Run Depth
- [ ] Max >50
- [ ] Max <50

Riffle/Run Substrate
- [ ] Stable
- [ ] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [ ] Low
- [ ] Moderate
- [ ] Extensive

Comments: No riffle.

Riffle/Run: 0 — Max 8

Gradient (ft/mi): 0.9
Drainage Area (sq.mi.): 749

%Pool	30	%Glide	20
%Riffle	0	%Run	50

Gradient: 8

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silvicluture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI — **Qualitative Habitat Evaluation Index** — **Modified by NEORSD**

River Code:
RM:
Stream: Brandywine Creek
Date: 9/6/2002
Location: Upstream of the former Hudson WWTP effluent
Scorer's Initials: CZ
Comments:

Total Score: 44.25

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present) — Substrate: 9.5, Max 20

	Type	Pool%	Riffle%
	Bldr/Slbs		
	Boulder		
x	Cobble	30	
x	Hardpan	40	
	Muck		
	Silt		
	Gravel	20	
	Sand	10	
	Bedrock		
	Detritus		
	Artifical		

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [ ] Tills
- [ ] Wetlands
- [x] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [ ] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [ ] Silt - *Heavy*
- [x] Silt - *Moderate*
- [ ] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [ ] 5 or More
- [x] 4 or Less

Embeddedness
- [x] Extensive
- [x] Moderate
- [ ] Normal
- [ ] None

Comments:

Instream Cover (Check *ALL* that apply) — Cover: 5, Max 20
- [ ] __ Undercut Banks
- [ ] __ Overhanging Vegetation
- [x] 1 Shallows (Slow water)
- [x] 1 Rootmats
- [ ] __ Deep Pools >70cm
- [ ] __ Rootwads
- [ ] __ Boulders
- [ ] __ Oxbows, backwaters
- [x] 1 Aquatic Macrophytes
- [ ] __ Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [ ] Moderate 25-75%
- [x] Sparse 5-25%
- [x] Nearly Absent <5%

Comments:

Channel Morphology: (Check 1, or 2 and average) — Channel: 11.5, Max 20

Sinuosity
- [ ] High
- [ ] Moderate
- [x] Low
- [x] None

Development
- [ ] Excellent
- [ ] Good
- [ ] Fair
- [x] Poor

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Stability
- [x] High
- [ ] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [ ] Bank Shaping
- [ ] 1-side channel modifications

Comments:

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average) — Riparian: 5.25, Max. 10

Riparian Width (per bank)

L	R	
		Wide > 50m
x		Moderate 10-50m
	x	Narrow 5-10m
		Very Narrow <5m
x	x	None

Bank Erosion (per bank)

L	R	
x	x	None/Little
		Moderate
		Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
		Forest, Swamp
		Shrub or Old Field
x	x	Residential, Park, New Field
		Fenced Pasture
		Conservation Tillage
		Urban or Industrial
		Open Pasture, Row Crop
		Mining/Construction

Comments:

Pool/Glide Quality — Pool: 5, Max 12

Max. Depth (1 only)
- [ ] >1m
- [ ] 0.7-1m
- [x] 0.4-0.7m
- [ ] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [x] Pool width > riffle width
- [ ] Pool width = riffle width
- [ ] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [ ] Fast
- [ ] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Riffle/Run Quality (Check 1, or 2 and average) — Riffle/Run: 0, Max 8

Riffle Depth
- [ ] Best Areas >10cm
- [ ] Best Areas 5-10cm
- [x] Best Areas <5cm

Run Depth
- [ ] Max >50
- [ ] Max <50

Riffle/Run Substrate
- [ ] Stable
- [ ] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [ ] Low
- [ ] Moderate
- [ ] Extensive

Comments: No riffle.

Gradient: 8

Gradient (ft/mi)	10.6
Drainage Area (sq.mi.)	9
%Pool	<5
%Glide	90
%Riffle	0
%Run	5

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silvicluture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI — **Qualitative Habitat Evaluation Index** — **Modified by NEORSD**

River Code:
RM:
Date: 9/6/2002
Location: Downstream of the former Hudson WWTP effluent
Stream: Brandywine Creek
Scorer's Initials: CZ
Comments:

Total Score: 41

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present)

	Type	Pool%	Riffle%
	Bldr/Slbs		
	Boulder		
	Cobble		
x	Hardpan	35	
	Muck		
	Silt		
	Gravel	20	
x	Sand	40	
	Bedrock		
	Detritus	5	
	Artifical		

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [ ] Tills
- [ ] Wetlands
- [x] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [ ] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [ ] Silt - *Heavy*
- [x] Silt - *Moderate*
- [ ] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [ ] 5 or More
- [x] 4 or Less

Embeddedness
- [x] Extensive
- [x] Moderate
- [ ] Normal
- [ ] None

Comments:

Substrate: 7.5 (Max 20)

Instream Cover (Check *ALL* that apply)
- [ ] Undercut Banks
- [ ] Overhanging Vegetation
- [x] 1 Shallows (Slow water)
- [x] 1 Rootmats
- [ ] Deep Pools >70cm
- [ ] Rootwads
- [ ] Boulders
- [ ] Oxbows, backwaters
- [x] 2 Aquatic Macrophytes
- [x] 1 Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [x] Moderate 25-75%
- [ ] Sparse 5-25%
- [ ] Nearly Absent <5%

Comments:

Cover: 11 (Max 20)

Channel Morphology: (Check 1, or 2 and average)

Sinuosity
- [ ] High
- [ ] Moderate
- [x] Low
- [x] None

Development
- [ ] Excellent
- [ ] Good
- [ ] Fair
- [x] Poor

Channelization
- [ ] None
- [ ] Recovered
- [x] Recovering
- [ ] Recent or No Recovery

Stability
- [x] High
- [ ] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [ ] Bank Shaping
- [ ] 1-side channel modifications

Comments:

Channel: 8.5 (Max 20)

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average)

Riparian Width (per bank)

L	R	
	x	Wide > 50m
		Moderate 10-50m
x	x	Narrow 5-10m
x		Very Narrow <5m
		None

Bank Erosion (per bank)

L	R	
x	x	None/Little
		Moderate
		Heavy/Severe.

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
		Forest, Swamp
	x	Shrub or Old Field
	x	Residential, Park, New Field
		Fenced Pasture
		Conservation Tillage
x		Urban or Industrial
		Open Pasture, Row Crop
		Mining/Construction

Comments:

Riparian: 6 (Max. 10)

Pool/Glide Quality

Max. Depth (1 only)
- [ ] >1m
- [ ] 0.7-1m
- [ ] 0.4-0.7m
- [ ] 0.2-0.4m
- [x] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [ ] Pool width > riffle width
- [ ] Pool width = riffle width
- [ ] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [ ] Fast
- [ ] Moderate
- [ ] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments: No defined pool area.

Pool: 0 (Max 12)

Riffle/Run Quality (Check 1, or 2 and average)

Riffle Depth
- [ ] Best Areas >10cm
- [ ] Best Areas 5-10cm
- [x] Best Areas <5cm

Run Depth
- [ ] Max >50
- [ ] Max <50

Riffle/Run Substrate
- [ ] Stable
- [ ] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [ ] Low
- [ ] Moderate
- [ ] Extensive

Comments: No riffle.

Riffle/Run: 0 (Max 8)

Gradient (ft/mi)	10.6	%Pool	0	%Glide	90
Drainage Area (sq.mi.)	9	%Riffle	0	%Run	10

Gradient: 8

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silviclulture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI — **Qualitative Habitat Evaluation Index** — **Modified by NEORSD**

Total Score: 64.25

River Code:
RM:
Stream: Blodgett Creek
Date: 7/6/2000
Location: Upstream of the former Strongsville "A" WWTP Effluent
Scorer's Initials: CZ/TZ
Comments:

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present) — Substrate: 14.5, Max 20

	Type	Pool%	Riffle%
[ ]	Bldr/Slbs		
[ ]	Boulder	x	
[ ]	Cobble	x	
[ ]	Hardpan		
[ ]	Muck		
[ ]	Silt		
[x]	Gravel	x	x
[x]	Sand	x	
[ ]	Bedrock	x	
[ ]	Detritus		
[ ]	Artifical		

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [x] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [ ] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [ ] Silt - *Heavy*
- [x] Silt - *Moderate*
- [x] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [x] 5 or More
- [ ] 4 or Less

Embeddedness
- [ ] Extensive
- [x] Moderate
- [ ] Normal
- [ ] None

Comments:

Instream Cover (Check *ALL* that apply) — Cover: 10, Max 20
- [ ] Undercut Banks
- [x] 2 Overhanging Vegetation
- [x] 2 Shallows (Slow water)
- [x] 3 Rootmats
- [ ] Deep Pools >70cm
- [ ] Rootwads
- [x] 1 Boulders
- [ ] Oxbows, backwaters
- [ ] Aquatic Macrophytes
- [x] 1 Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [x] Moderate 25-75%
- [x] Sparse 5-25%
- [ ] Nearly Absent <5%

Comments:

Channel Morphology: (Check 1, or 2 and average) — Channel: 13, Max 20

Sinuosity
- [ ] High
- [x] Moderate
- [x] Low
- [ ] None

Development
- [ ] Excellent
- [ ] Good
- [x] Fair
- [x] Poor

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Stability
- [x] High
- [x] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [ ] Bank Shaping
- [ ] 1-side channel modifications

Comments:

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average) — Riparian: 8.75, Max. 10

Riparian Width (per bank)

L	R	
x	x	Wide > 50m
	x	Moderate 10-50m
		Narrow 5-10m
		Very Narrow <5m
		None

Bank Erosion (per bank)

L	R	
x	x	None/Little
		Moderate
		Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
x	x	Forest, Swamp
		Shrub or Old Field
x	x	Residential, Park, New Field
		Fenced Pasture
		Conservation Tillage
		Urban or Industrial
		Open Pasture, Row Crop
		Mining/Construction

Comments:

Pool/Glide Quality — Pool: 5, Max 12

Max. Depth (1 only)
- [ ] >1m
- [ ] 0.7-1m
- [ ] 0.4-0.7m
- [x] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [x] Pool width > riffle width
- [ ] Pool width = riffle width
- [ ] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [ ] Fast
- [x] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Riffle/Run Quality (Check 1, or 2 and average) — Riffle/Run: 3, Max 8

Riffle Depth
- [ ] Best Areas >10cm
- [x] Best Areas 5-10cm
- [ ] Best Areas <5cm

Run Depth
- [ ] Max >50
- [x] Max <50

Riffle/Run Substrate
- [ ] Stable
- [x] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [ ] Low
- [x] Moderate
- [ ] Extensive

Comments:

Gradient: 10

Gradient (ft/mi)	16.5
Drainage Area (sq.mi.)	0.8

%Pool	5	%Glide	80
%Riffle	5	%Run	10

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silviclulture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI — Qualitative Habitat Evaluation Index

Modified by NEORSD

Total Score: 59.25

River Code:
RM:
Stream: Blodgett Creek
Date: 7/6/2000
Location: Downstream of the former Strongsville "A" WWTP Effluent
Scorer's Initials: CZ/TZ
Comments:

SUBSTRATE (Check ONLY two substrate TYPE Boxes; Estimate % present)

Substrate: 13.5 (Max 20)

	Type	Pool%	Riffle%
[ ]	Bldr/Slbs		
[ ]	Boulder	x	
[ ]	Cobble		
[ ]	Hardpan	x	
[ ]	Muck		
[ ]	Silt	x	
[x]	Gravel	x	
[x]	Sand	x	
[ ]	Bedrock		
[ ]	Detritus		
[ ]	Artifical		

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [x] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [ ] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [x] Silt - *Heavy*
- [x] Silt - *Moderate*
- [ ] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [x] 5 or More
- [ ] 4 or Less

Embeddedness
- [ ] Extensive
- [x] Moderate
- [ ] Normal
- [ ] None

Comments:

Instream Cover (Check ALL that apply)

Cover: 13 (Max 20)

- [x] 2 Undercut Banks
- [x] 2 Overhanging Vegetation
- [x] 1 Shallows (Slow water)
- [x] 1 Rootmats
- [x] 1 Deep Pools >70cm
- [ ] Rootwads
- [x] 1 Boulders
- [ ] Oxbows, backwaters
- [ ] Aquatic Macrophytes
- [x] 3 Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [x] Moderate 25-75%
- [x] Sparse 5-25%
- [ ] Nearly Absent <5%

Comments:

Channel Morphology: (Check 1, or 2 and average)

Channel: 12 (Max 20)

Sinuosity
- [ ] High
- [ ] Moderate
- [x] Low
- [x] None

Development
- [ ] Excellent
- [ ] Good
- [x] Fair
- [x] Poor

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Stability
- [x] High
- [x] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [ ] Bank Shaping
- [ ] 1-side channel modifications

Comments:

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average)

Riparian: 3.75 (Max. 10)

Riparian Width (per bank)

L	R	
[ ]	[ ]	Wide > 50m
[ ]	[ ]	Moderate 10-50m
[ ]	[ ]	Narrow 5-10m
[x]	[x]	Very Narrow <5m
[x]	[x]	None

Bank Erosion (per bank)

L	R	
[x]	[x]	None/Little
[ ]	[ ]	Moderate
[ ]	[ ]	Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
[ ]	[ ]	Forest, Swamp
[ ]	[ ]	Shrub or Old Field
[ ]	[x]	Residential, Park, New Field
[ ]	[ ]	Fenced Pasture
[ ]	[ ]	Conservation Tillage
[x]	[x]	Urban or Industrial
[ ]	[ ]	Open Pasture, Row Crop
[ ]	[ ]	Mining/Construction

Comments:

Pool/Glide Quality

Pool: 9 (Max 12)

Max. Depth (1 only)
- [x] >1m
- [ ] 0.7-1m
- [ ] 0.4-0.7m
- [ ] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [x] Pool width > riffle width
- [ ] Pool width = riffle width
- [ ] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [ ] Fast
- [ ] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Riffle/Run Quality (Check 1, or 2 and average)

Riffle/Run: 0 (Max 8)

Riffle Depth
- [ ] Best Areas >10cm
- [ ] Best Areas 5-10cm
- [ ] Best Areas <5cm

Run Depth
- [ ] Max >50
- [ ] Max <50

Riffle/Run Substrate
- [ ] Stable
- [ ] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [ ] Low
- [ ] Moderate
- [ ] Extensive

Comments: No riffle.

Gradient

Gradient: 8

Gradient (ft/mi): 31
Drainage Area (sq.mi.): 0.9

%Pool	10	%Glide	85
%Riffle	0	%Run	5

Impacts (Check all that apply)

- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silviclulture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI — **Qualitative Habitat Evaluation Index** — Modified by NEORSD

River Code:
Date: 7/6/2000
Scorer's Initials: CZ/TZ
RM:
Location: Upstream of Blodgett Creek Confluence
Comments:
Stream: Rocky River

Total Score: 62.25

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present) — Substrate: 12.5 (Max 20)

	Type	Pool%	Riffle%
	Bldr/Slbs		
	Boulder	x	x
	Cobble	x	
	Hardpan		
	Muck		
	Silt	x	
	Gravel	x	
	Sand	x	
x x	Bedrock	x	x
	Detritus		
	Artifical		

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [ ] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [ ] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [ ] Silt - *Heavy*
- [x] Silt - *Moderate*
- [x] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [x] 5 or More
- [ ] 4 or Less

Embeddedness
- [ ] Extensive
- [ ] Moderate
- [x] Normal
- [ ] None

Comments: Substrate Origin not given.

Instream Cover (Check *ALL* that apply) — Cover: 7 (Max 20)
- [ ] __ Undercut Banks
- [ ] __ Overhanging Vegetation
- [ ] __ Shallows (Slow water)
- [x] 1 Rootmats
- [ ] __ Deep Pools >70cm
- [x] 1 Rootwads
- [x] 1 Boulders
- [ ] __ Oxbows, backwaters
- [ ] __ Aquatic Macrophytes
- [x] 1 Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [ ] Moderate 25-75%
- [x] Sparse 5-25%
- [ ] Nearly Absent <5%

Comments:

Channel Morphology: (Check 1, or 2 and average) — Channel: 16 (Max 20)

Sinuosity
- [ ] High
- [ ] Moderate
- [x] Low
- [ ] None

Development
- [ ] Excellent
- [x] Good
- [ ] Fair
- [ ] Poor

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Stability
- [x] High
- [ ] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [ ] Bank Shaping
- [ ] 1-side channel modifications

Comments:

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average) — Riparian: 7.25 (Max. 10)

Riparian Width (per bank)

L	R	
	x	Wide > 50m
		Moderate 10-50m
		Narrow 5-10m
x		Very Narrow <5m
x		None

Bank Erosion (per bank)

L	R	
x	x	None/Little
		Moderate
		Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
	x	Forest, Swamp
		Shrub or Old Field
x		Residential, Park, New Field
		Fenced Pasture
		Conservation Tillage
		Urban or Industrial
		Open Pasture, Row Crop
		Mining/Construction

Comments:

Pool/Glide Quality — Pool: 5 (Max 12)

Max. Depth (1 only)
- [ ] >1m
- [ ] 0.7-1m
- [x] 0.4-0.7m
- [ ] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [ ] Pool width > riffle width
- [ ] Pool width = riffle width
- [x] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [x] Fast
- [x] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Riffle/Run Quality (Check 1, or 2 and average) — Riffle/Run: 6.5 (Max 8)

Riffle Depth
- [x] Best Areas >10cm
- [ ] Best Areas 5-10cm
- [ ] Best Areas <5cm

Run Depth
- [x] Max >50
- [x] Max <50

Riffle/Run Substrate
- [x] Stable
- [ ] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [x] Low
- [ ] Moderate
- [ ] Extensive

Comments:

Gradient: 8

Gradient (ft/mi)	3.3	%Pool	10	%Glide	5
Drainage Area (sq.mi.)	162	%Riffle	25	%Run	60

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silvicluture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI — **Qualitative Habitat Evaluation Index** — **Modified by NEORSD**

River Code: RM: Stream: Rocky River
Date: 7/7/2000 Location: Downstream of Blodgett Creek
Scorer's Initials: Comments:

Total Score: 69.25

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present) — Substrate: 15.5, Max 20

	Type	Pool%	Riffle%
[ ]	Bldr/Slbs		
[ ]	Boulder		
[x]	Cobble		
[ ]	Hardpan		
[ ]	Muck		
[ ]	Silt		
[ ]	Gravel		
[ ]	Sand		
[x]	Bedrock		
[ ]	Detritus		
[ ]	Artifical		

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [x] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [ ] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [ ] Silt - *Heavy*
- [x] Silt - *Moderate*
- [x] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [x] 5 or More
- [ ] 4 or Less

Embeddedness
- [ ] Extensive
- [ ] Moderate
- [x] Normal
- [ ] None

Comments: % Estimations not given.

Instream Cover (Check *ALL* that apply) — Cover: 9, Max 20
- [ ] Undercut Banks
- [x] 1 Overhanging Vegetation
- [x] 3 Shallows (Slow water)
- [ ] Rootmats
- [ ] Deep Pools >70cm
- [ ] Rootwads
- [x] 3 Boulders
- [ ] Oxbows, backwaters
- [ ] Aquatic Macrophytes
- [x] 3 Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [x] Moderate 25-75%
- [x] Sparse 5-25%
- [ ] Nearly Absent <5%

Comments:

Channel Morphology: (Check 1, or 2 and average) — Channel: 16, Max 20

Sinuosity
- [ ] High
- [ ] Moderate
- [x] Low
- [ ] None

Development
- [ ] Excellent
- [x] Good
- [ ] Fair
- [ ] Poor

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Stability
- [x] High
- [ ] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [x] Islands
- [ ] Leveed
- [ ] Bank Shaping
- [ ] 1-side channel modifications

Comments:

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average) — Riparian: 8.75, Max. 10

Riparian Width (per bank)

L	R	
[ ]	[x]	Wide > 50m
[x]	[ ]	Moderate 10-50m
[x]	[ ]	Narrow 5-10m
[ ]	[ ]	Very Narrow <5m
[ ]	[ ]	None

Bank Erosion (per bank)

L	R	
[x]	[x]	None/Little
[ ]	[ ]	Moderate
[ ]	[ ]	Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
[ ]	[x]	Forest, Swamp
[x]	[ ]	Shrub or Old Field
[ ]	[ ]	Residential, Park, New Field
[ ]	[ ]	Fenced Pasture
[ ]	[ ]	Conservation Tillage
[ ]	[ ]	Urban or Industrial
[ ]	[ ]	Open Pasture, Row Crop
[ ]	[ ]	Mining/Construction

Comments:

Pool/Glide Quality — Pool: 5, Max 12

Max. Depth (1 only)
- [ ] >1m
- [ ] 0.7-1m
- [x] 0.4-0.7m
- [ ] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [ ] Pool width > riffle width
- [ ] Pool width = riffle width
- [x] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [x] Fast
- [x] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Riffle/Run Quality (Check 1, or 2 and average) — Riffle/Run: 7, Max 8

Riffle Depth
- [x] Best Areas >10cm
- [ ] Best Areas 5-10cm
- [ ] Best Areas <5cm

Run Depth
- [x] Max >50
- [ ] Max <50

Riffle/Run Substrate
- [x] Stable
- [ ] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [x] Low
- [ ] Moderate
- [ ] Extensive

Comments:

Gradient (ft/mi): 3.3 — Gradient: 8
Drainage Area (sq.mi.): 160

%Pool 5 %Glide 5
%Riffle 10 %Run 80

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silviculture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI

Qualitative Habitat Evaluation Index — Modified by NEORSD

River Code:
Date: 9/18/2000
Scorer's Initials: CZ
RM: 3.6
Location: Upstream of the former Berea WWTP
Comments:
Stream: Rocky River

Total Score: 68.25

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present)

		Type	Pool%	Riffle%
		Bldr/Slbs		
		Boulder		x
x		Cobble	x	x
		Hardpan		
		Muck		
		Silt		
		Gravel	x	x
		Sand	x	
x		Bedrock	x	x
		Detritus		
		Artifical		

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [x] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [ ] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [ ] Silt - *Heavy*
- [x] Silt - *Moderate*
- [ ] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [x] 5 or More
- [ ] 4 or Less

Embeddedness
- [ ] Extensive
- [ ] Moderate
- [x] Normal
- [ ] None

Comments:

Substrate: 15 — Max 20

Instream Cover (Check *ALL* that apply)
- [x] 1 Undercut Banks
- [ ] Overhanging Vegetation
- [x] 1 Shallows (Slow water)
- [x] 1 Rootmats
- [ ] Deep Pools >70cm
- [ ] Rootwads
- [x] 2 Boulders
- [ ] Oxbows, backwaters
- [ ] Aquatic Macrophytes
- [x] 1 Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [ ] Moderate 25-75%
- [x] Sparse 5-25%
- [ ] Nearly Absent <5%

Comments:

Cover: 8 — Max 20

Channel Morphology: (Check 1, or 2 and average)

Sinuosity
- [ ] High
- [x] Moderate
- [ ] Low
- [ ] None

Development
- [ ] Excellent
- [x] Good
- [x] Fair
- [ ] Poor

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Stability
- [ ] High
- [x] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [ ] Bank Shaping
- [ ] 1-side channel modifications

Comments:

Channel: 15 — Max 20

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average)

Riparian Width (per bank)

L	R	
x	x	Wide > 50m
		Moderate 10-50m
		Narrow 5-10m
		Very Narrow <5m
		None

Bank Erosion (per bank)

L	R	
	x	None/Little
x		Moderate
x		Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
	x	Forest, Swamp
		Shrub or Old Field
x		Residential, Park, New Field
		Fenced Pasture
		Conservation Tillage
		Urban or Industrial
		Open Pasture, Row Crop
		Mining/Construction

Comments:

Riparian: 6.25 — Max. 10

Pool/Glide Quality

Max. Depth (1 only)
- [ ] >1m
- [ ] 0.7-1m
- [x] 0.4-0.7m
- [ ] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [ ] Pool width > riffle width
- [ ] Pool width = riffle width
- [x] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [x] Fast
- [x] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Pool: 5 — Max 12

Riffle/Run Quality (Check 1, or 2 and average)

Riffle Depth
- [x] Best Areas >10cm
- [ ] Best Areas 5-10cm
- [ ] Best Areas <5cm

Run Depth
- [x] Max >50
- [ ] Max <50

Riffle/Run Substrate
- [x] Stable
- [ ] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [x] Low
- [ ] Moderate
- [ ] Extensive

Comments:

Riffle/Run: 7 — Max 8

Gradient (ft/mi): 10.5
Drainage Area (sq.mi.): 75

%Pool	5	%Glide	0
%Riffle	40	%Run	55

Gradient: 10

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silviclutre
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI — **Qualitative Habitat Evaluation Index** — **Modified by NEORSD**

River Code:
RM: 3
Stream: Rocky River
Date: 9/6/2000
Location: Downstream of the former Berea WWTP
Scorer's Initials: CZ
Comments:

Total Score: 65

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present) — Substrate: 14.5 (Max 20)

	Type	Pool%	Riffle%
	Bldr/Slbs		
	Boulder	x	
x	Cobble		x
	Hardpan		
	Muck		
	Silt		
	Gravel	x	x
	Sand	x	
x	Bedrock	x	x
	Detritus		
	Artifical		

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [x] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [ ] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [ ] Silt - *Heavy*
- [x] Silt - *Moderate*
- [ ] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [x] 5 or More
- [ ] 4 or Less

Embeddedness
- [ ] Extensive
- [x] Moderate
- [x] Normal
- [ ] None

Comments:

Instream Cover (Check *ALL* that apply) — Cover: 8 (Max 20)
- [x] 1 Undercut Banks
- [ ] Overhanging Vegetation
- [x] 2 Shallows (Slow water)
- [x] 2 Rootmats
- [ ] Deep Pools >70cm
- [ ] Rootwads
- [x] 1 Boulders
- [ ] Oxbows, backwaters
- [ ] Aquatic Macrophytes
- [x] 1 Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [ ] Moderate 25-75%
- [x] Sparse 5-25%
- [ ] Nearly Absent <5%

Comments:

Channel Morphology: (Check 1, or 2 and average) — Channel: 15 (Max 20)

Sinuosity
- [ ] High
- [x] Moderate
- [ ] Low
- [ ] None

Development
- [ ] Excellent
- [x] Good
- [x] Fair
- [ ] Poor

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Stability
- [ ] High
- [x] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [ ] Bank Shaping
- [ ] 1-side channel modifications

Comments:

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average) — Riparian: 7.5 (Max. 10)

Riparian Width (per bank)

L	R	
	x	Wide > 50m
x		Moderate 10-50m
x		Narrow 5-10m
		Very Narrow <5m
		None

Bank Erosion (per bank)

L	R	
x	x	None/Little
x		Moderate
	x	Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
	x	Forest, Swamp
		Shrub or Old Field
x		Residential, Park, New Field
		Fenced Pasture
		Conservation Tillage
		Urban or Industrial
		Open Pasture, Row Crop
		Mining/Construction

Comments:

Pool/Glide Quality — Pool: 4 (Max 12)

Max. Depth (1 only)
- [ ] >1m
- [ ] 0.7-1m
- [x] 0.4-0.7m
- [ ] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [ ] Pool width > riffle width
- [ ] Pool width = riffle width
- [x] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [ ] Fast
- [x] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Riffle/Run Quality (Check 1, or 2 and average) — Riffle/Run: 6 (Max 8)

Riffle Depth
- [x] Best Areas >10cm
- [ ] Best Areas 5-10cm
- [ ] Best Areas <5cm

Run Depth
- [ ] Max >50
- [x] Max <50

Riffle/Run Substrate
- [x] Stable
- [x] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [x] None
- [x] Low
- [ ] Moderate
- [ ] Extensive

Comments:

Gradient: 10 (Max 10)

Gradient (ft/mi)	10.5	%Pool	5	%Glide	15
Drainage Area (sq.mi.)	75	%Riffle	30	%Run	50

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silviclulture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI — **Qualitative Habitat Evaluation Index** — **Modified by NEORSD**

River Code:
Date: 7/15/1999
Scorer's Initials: CZ/JS
RM:
Location: Site #30
Comments:
Stream: Stickney Creek

Total Score: 47.25

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present) — Substrate: 9, Max 20

	Type	Pool%	Riffle%
	Bldr/Slbs		
	Boulder	x	x
	Cobble		x
	Hardpan		
	Muck		
	Silt		x
	Gravel		x
	Sand		
x x	Bedrock	x	x
	Detritus		
	Artifical	x	

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [ ] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [x] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [ ] Silt - *Heavy*
- [ ] Silt - *Moderate*
- [x] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [x] 5 or More
- [ ] 4 or Less

Embeddedness
- [x] Extensive
- [ ] Moderate
- [ ] Normal
- [ ] None

Comments:

Instream Cover (Check *ALL* that apply) — Cover: 6, Max 20
- [x] Undercut Banks
- [ ] Overhanging Vegetation
- [x] Shallows (Slow water)
- [x] Rootmats
- [ ] Deep Pools >70cm
- [ ] Rootwads
- [x] Boulders
- [ ] Oxbows, backwaters
- [ ] Aquatic Macrophytes
- [x] Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [ ] Moderate 25-75%
- [ ] Sparse 5-25%
- [x] Nearly Absent <5%

Comments:

Channel Morphology: (Check 1, or 2 and average) — Channel: 11.5, Max 20

Sinuosity
- [ ] High
- [ ] Moderate
- [x] Low
- [x] None

Development
- [ ] Excellent
- [ ] Good
- [ ] Fair
- [x] Poor

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Stability
- [x] High
- [ ] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [ ] Bank Shaping
- [ ] 1-side channel modifications

Comments:

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average) — Riparian: 7.75, Max. 10

Riparian Width (per bank)

L	R	
	x	Wide > 50m
x		Moderate 10-50m
x		Narrow 5-10m
		Very Narrow <5m
		None

Bank Erosion (per bank)

L	R	
x	x	None/Little
		Moderate
		Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
	x	Forest, Swamp
		Shrub or Old Field
x	x	Residential, Park, New Field
		Fenced Pasture
		Conservation Tillage
		Urban or Industrial
		Open Pasture, Row Crop
		Mining/Construction

Comments:

Pool/Glide Quality — Pool: 3, Max 12

Max. Depth (1 only)
- [ ] >1m
- [ ] 0.7-1m
- [ ] 0.4-0.7m
- [x] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [ ] Pool width > riffle width
- [ ] Pool width = riffle width
- [x] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [ ] Fast
- [x] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Riffle/Run Quality (Check 1, or 2 and average) — Riffle/Run: 0, Max 8

Riffle Depth
- [ ] Best Areas >10cm
- [ ] Best Areas 5-10cm
- [ ] Best Areas <5cm

Run Depth
- [ ] Max >50
- [ ] Max <50

Riffle/Run Substrate
- [ ] Stable
- [ ] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [ ] Low
- [ ] Moderate
- [ ] Extensive

Comments: No riffle

Gradient: 10

Gradient (ft/mi)	26.9
Drainage Area (sq.mi.)	4.1

%Pool	5	%Glide	75
%Riffle	10	%Run	10

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silviculture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [x] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI — **Qualitative Habitat Evaluation Index** — **Modified by NEORSD**

River Code:
Date: 7/19/1999
Scorer's Initials: CZ
RM: 7.4
Location: Site #29
Comments: East Branch, Fernhill Picnic Area
Stream: Big Creek

Total Score: 52.5

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present) — Substrate: 12.5 (Max 20)

Type	Pool%	Riffle%
Bldr/Slbs		
Boulder	x	
Cobble	x	x
Hardpan		
Muck		
Silt	x	
[x] Gravel	x	x
Sand	x	
[x] Bedrock	x	x
Detritus		
Artifical		

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [ ] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [x] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [ ] Silt - *Heavy*
- [x] Silt - *Moderate*
- [x] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [x] 5 or More
- [ ] 4 or Less

Embeddedness
- [ ] Extensive
- [ ] Moderate
- [x] Normal
- [ ] None

Comments:

Instream Cover (Check *ALL* that apply) — Cover: 8 (Max 20)
- [x] Undercut Banks
- [ ] Overhanging Vegetation
- [x] Shallows (Slow water)
- [x] Rootmats
- [ ] Deep Pools >70cm
- [x] Rootwads
- [x] Boulders
- [ ] Oxbows, backwaters
- [ ] Aquatic Macrophytes
- [x] Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [ ] Moderate 25-75%
- [x] Sparse 5-25%
- [x] Nearly Absent <5%

Comments:

Channel Morphology: (Check 1, or 2 and average) — Channel: 6.5 (Max 20)

Sinuosity
- [ ] High
- [ ] Moderate
- [x] Low
- [x] None

Development
- [ ] Excellent
- [ ] Good
- [x] Fair
- [ ] Poor

Channelization
- [ ] None
- [ ] Recovered
- [x] Recovering
- [x] Recent or No Recovery

Stability
- [x] High
- [ ] Moderate
- [x] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [x] Bank Shaping
- [x] 1-side channel modifications

Comments:

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average) — Riparian: 6 (Max. 10)

Riparian Width (per bank)

L	R	
x		Wide > 50m
		Moderate 10-50m
		Narrow 5-10m
	x	Very Narrow <5m
	x	None

Bank Erosion (per bank)

L	R	
	x	None/Little
x		Moderate
x		Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
x		Forest, Swamp
		Shrub or Old Field
x	x	Residential, Park, New Field
		Fenced Pasture
		Conservation Tillage
		Urban or Industrial
		Open Pasture, Row Crop
		Mining/Construction

Comments:

Pool/Glide Quality — Pool: 6 (Max 12)

Max. Depth (1 only)
- [ ] >1m
- [x] 0.7-1m
- [ ] 0.4-0.7m
- [ ] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [ ] Pool width > riffle width
- [ ] Pool width = riffle width
- [x] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [ ] Fast
- [x] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Riffle/Run Quality (Check 1, or 2 and average) — Riffle/Run: 3.5 (Max 8)

Riffle Depth
- [ ] Best Areas >10cm
- [x] Best Areas 5-10cm
- [ ] Best Areas <5cm

Riffle/Run Substrate
- [x] Stable
- [ ] Mod. Stable
- [x] Unstable

Riffle/Run Embeddedness
- [x] None
- [x] Low
- [ ] Moderate
- [ ] Extensive

Run Depth
- [ ] Max >50
- [ ] Max <50

Comments: Run Depth measurement not taken.

Gradient: 8

Gradient (ft/mi)	22.9
Drainage Area (sq.mi.)	12.5

%Pool: | %Glide: | %Riffle: | %Run:

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silviclulture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI — **Qualitative Habitat Evaluation Index** — Modified by NEORSD

River Code:
Date: 7/19/1999
Scorer's Initials: CZ
RM: 3.4
Location: Site #28
Comments: West Branch, Upstream of Puritas Ave.
Stream: Big Creek

Total Score: 24.5

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present)

		Type	Pool%	Riffle%
[ ]	[ ]	Bldr/Slbs		
[ ]	[ ]	Boulder		
[ ]	[ ]	Cobble		
[ ]	[ ]	Hardpan		
[ ]	[ ]	Muck		
[ ]	[ ]	Silt		
[ ]	[ ]	Gravel		
[ ]	[ ]	Sand	x	
[ ]	[ ]	Bedrock		
[ ]	[ ]	Detritus		
x	x	Artifical	x	-

Substrate: -2.5 (Max 20)

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [ ] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [x] Rip/Rap
- [ ] Lacustrine
- [ ] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [ ] Silt - *Heavy*
- [x] Silt - *Moderate*
- [x] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [ ] 5 or More
- [x] 4 or Less

Embeddedness
- [x] Extensive
- [ ] Moderate
- [ ] Normal
- [ ] None

Comments: Concrete Channel

Instream Cover (Check *ALL* that apply)
- [ ] Undercut Banks
- [x] Overhanging Vegetation
- [ ] Shallows (Slow water)
- [ ] Rootmats
- [ ] Deep Pools >70cm
- [ ] Rootwads
- [x] Boulders
- [ ] Oxbows, backwaters
- [x] Aquatic Macrophytes
- [ ] Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [x] Moderate 25-75%
- [ ] Sparse 5-25%
- [x] Nearly Absent <5%

Comments:

Cover: 7 (Max 20)

Channel Morphology: (Check 1, or 2 and average)

Sinuosity
- [ ] High
- [ ] Moderate
- [ ] Low
- [x] None

Development
- [ ] Excellent
- [ ] Good
- [ ] Fair
- [x] Poor

Channelization
- [ ] None
- [ ] Recovered
- [ ] Recovering
- [x] Recent or No Recovery

Stability
- [x] High
- [ ] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [x] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [x] Bank Shaping
- [ ] 1-side channel modifications

Comments:

Channel: 6 (Max 20)

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average)

Riparian Width (per bank)

L	R	
[ ]	[ ]	Wide > 50m
x	[ ]	Moderate 10-50m
[ ]	[ ]	Narrow 5-10m
[ ]	[ ]	Very Narrow <5m
[ ]	x	None

Bank Erosion (per bank)

L	R	
x	x	None/Little
[ ]	[ ]	Moderate
[ ]	[ ]	Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
[ ]	[ ]	Forest, Swamp
[ ]	[ ]	Shrub or Old Field
x	[ ]	Residential, Park, New Field
[ ]	[ ]	Fenced Pasture
[ ]	[ ]	Conservation Tillage
[ ]	x	Urban or Industrial
[ ]	[ ]	Open Pasture, Row Crop
[ ]	[ ]	Mining/Construction

Comments:

Riparian: 5 (Max. 10)

Pool/Glide Quality

Max. Depth (1 only)
- [ ] >1m
- [ ] 0.7-1m
- [ ] 0.4-0.7m
- [ ] 0.2-0.4m
- [x] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [ ] Pool width > riffle width
- [ ] Pool width = riffle width
- [x] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [ ] Fast
- [ ] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Pool: 1 (Max 12)

Riffle/Run Quality (Check 1, or 2 and average)

Riffle Depth
- [ ] Best Areas >10cm
- [ ] Best Areas 5-10cm
- [x] Best Areas <5cm

Riffle/Run Substrate
- [ ] Stable
- [ ] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [ ] Low
- [ ] Moderate
- [ ] Extensive

Run Depth
- [ ] Max >50
- [ ] Max <50

Comments: No Riffle. Run Depth measurement not taken.

Riffle/Run: 0 (Max 8)

Gradient (ft/mi): 14.6
Drainage Area (sq.mi.): 7.2
%Pool: %Glide:
%Riffle: %Run:

Gradient: 8

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silviculture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI — **Qualitative Habitat Evaluation Index** — **Modified by NEORSD**

Total Score: 56.25

River Code:
RM:
Stream: Big Creek
Date: 6/25/1999
Location: Site #27
Scorer's Initials: CZ
Comments: West Branch, Upstream of Confluence

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present) — Substrate: 15.5 (Max 20)

		Type	Pool%	Riffle%
[ ]	[ ]	Bldr/Slbs		
[ ]	[ ]	Boulder	x	x
[ ]	[ ]	Cobble	x	
[ ]	[ ]	Hardpan		
[ ]	[ ]	Muck		
[ ]	[ ]	Silt	x	
[x]	[x]	Gravel	x	x
[ ]	[ ]	Sand	x	
[ ]	[ ]	Bedrock	x	
[ ]	[ ]	Detritus		
[ ]	[ ]	Artifical		

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [x] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [ ] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [ ] Silt - *Heavy*
- [x] Silt - *Moderate*
- [x] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [x] 5 or More
- [ ] 4 or Less

Embeddedness
- [ ] Extensive
- [x] Moderate
- [ ] Normal
- [ ] None

Comments:

Instream Cover (Check *ALL* that apply) — Cover: 7 (Max 20)
- [ ] Undercut Banks
- [x] Overhanging Vegetation
- [x] Shallows (Slow water)
- [x] Rootmats
- [ ] Deep Pools >70cm
- [ ] Rootwads
- [x] Boulders
- [ ] Oxbows, backwaters
- [ ] Aquatic Macrophytes
- [x] Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [ ] Moderate 25-75%
- [x] Sparse 5-25%
- [x] Nearly Absent <5%

Comments:

Channel Morphology: (Check 1, or 2 and average) — Channel: 9 (Max 20)

Sinuosity
- [ ] High
- [ ] Moderate
- [x] Low
- [x] None

Development
- [ ] Excellent
- [ ] Good
- [ ] Fair
- [x] Poor

Channelization
- [ ] None
- [x] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Stability
- [x] High
- [x] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [ ] Bank Shaping
- [ ] 1-side channel modifications

Comments:

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average) — Riparian: 6.75 (Max. 10)

Riparian Width (per bank)

L	R	
[ ]	[x]	Wide > 50m
[x]	[ ]	Moderate 10-50m
[x]	[ ]	Narrow 5-10m
[ ]	[ ]	Very Narrow <5m
[ ]	[ ]	None

Bank Erosion (per bank)

L	R	
[x]	[x]	None/Little
[ ]	[ ]	Moderate
[ ]	[ ]	Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
[ ]	[ ]	Forest, Swamp
[ ]	[x]	Shrub or Old Field
[ ]	[ ]	Residential, Park, New Field
[ ]	[ ]	Fenced Pasture
[ ]	[ ]	Conservation Tillage
[x]	[x]	Urban or Industrial
[ ]	[ ]	Open Pasture, Row Crop
[ ]	[ ]	Mining/Construction

Comments:

Pool/Glide Quality — Pool: 6 (Max 12)

Max. Depth (1 only)
- [ ] >1m
- [ ] 0.7-1m
- [x] 0.4-0.7m
- [ ] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [x] Pool width > riffle width
- [ ] Pool width = riffle width
- [ ] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [ ] Fast
- [x] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Riffle/Run Quality (Check 1, or 2 and average) — Riffle/Run: 2 (Max 8)

Riffle Depth
- [ ] Best Areas >10cm
- [x] Best Areas 5-10cm
- [x] Best Areas <5cm

Riffle/Run Substrate
- [x] Stable
- [ ] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [ ] Low
- [x] Moderate
- [x] Extensive

Run Depth
- [ ] Max >50
- [ ] Max <50

Comments: Run Depth measurement not taken.

Gradient: 10

Gradient (ft/mi)	13.2
Drainage Area (sq.mi.)	12.9

%Pool | %Glide | %Riffle | %Run

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silviculture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI — **Qualitative Habitat Evaluation Index** — **Modified by NEORSD**

River Code:
Date: 7/16/1999
Scorer's Initials: CZ
RM: 4.4
Location: Site #26
Comments: East Branch, Upstream of Confluence
Stream: Big Creek

Total Score: 55

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present) — Substrate: 15.5, Max 20

		Type	Pool%	Riffle%
		Bldr/Slbs		x
x		Boulder		x
		Cobble		x
		Hardpan		
		Muck		
		Silt		
		Gravel		x
		Sand	x	x
x		Bedrock		x
		Detritus		
		Artifical		

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [x] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [ ] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [ ] Silt - *Heavy*
- [ ] Silt - *Moderate*
- [x] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [x] 5 or More
- [ ] 4 or Less

Embeddedness
- [x] Extensive
- [x] Moderate
- [ ] Normal
- [ ] None

Comments:

Instream Cover (Check *ALL* that apply) — Cover: 7, Max 20
- [ ] Undercut Banks
- [ ] Overhanging Vegetation
- [x] Shallows (Slow water)
- [ ] Rootmats
- [ ] Deep Pools >70cm
- [ ] Rootwads
- [x] Boulders
- [ ] Oxbows, backwaters
- [ ] Aquatic Macrophytes
- [ ] Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [x] Moderate 25-75%
- [x] Sparse 5-25%
- [ ] Nearly Absent <5%

Comments:

Channel Morphology: (Check 1, or 2 and average) — Channel: 9, Max 20

Sinuosity
- [ ] High
- [ ] Moderate
- [ ] Low
- [x] None

Development
- [ ] Excellent
- [x] Good
- [ ] Fair
- [x] Poor

Channelization
- [ ] None
- [ ] Recovered
- [x] Recovering
- [x] Recent or No Recovery

Stability
- [x] High
- [ ] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [x] Bank Shaping
- [x] 1-side channel modifications

Comments:

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average) — Riparian: 5.5, Max. 10

Riparian Width (per bank)

L	R	
	x	Wide > 50m
	x	Moderate 10-50m
		Narrow 5-10m
		Very Narrow <5m
x		None

Bank Erosion (per bank)

L	R	
x	x	None/Little
		Moderate
		Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
		Forest, Swamp
		Shrub or Old Field
x	x	Residential, Park, New Field
		Fenced Pasture
		Conservation Tillage
	x	Urban or Industrial
		Open Pasture, Row Crop
		Mining/Construction

Comments:

Pool/Glide Quality — Pool: 3, Max 12

Max. Depth (1 only)
- [ ] >1m
- [ ] 0.7-1m
- [ ] 0.4-0.7m
- [x] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [ ] Pool width > riffle width
- [ ] Pool width = riffle width
- [x] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [ ] Fast
- [x] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Riffle/Run Quality (Check 1, or 2 and average) — Riffle/Run: 5, Max 8

Riffle Depth
- [x] Best Areas >10cm
- [ ] Best Areas 5-10cm
- [ ] Best Areas <5cm

Riffle/Run Substrate
- [x] Stable
- [x] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [x] Low
- [x] Moderate
- [ ] Extensive

Run Depth
- [ ] Max >50
- [ ] Max <50

Comments: Run Depth measurement not taken.

Gradient: 10

Gradient (ft/mi)	17.6
Drainage Area (sq.mi.)	21.1

%Pool | %Glide | %Riffle | %Run

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silviculture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI — **Qualitative Habitat Evaluation Index** — **Modified by NEORSD**

River Code:
Date: 7/16/1999
Scorer's Initials: CZ
RM: 0.2
Location: Site #25
Comments: Jennnings Rd.
Stream: Big Creek

Total Score: 67

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present) — Substrate: 14.5 (Max 20)

		Type	Pool%	Riffle%
[ ]	[ ]	Bldr/Slbs		
[ ]	[ ]	Boulder		x
[ ]	[ ]	Cobble	x	x
[ ]	[ ]	Hardpan		
[ ]	[ ]	Muck		
[ ]	[ ]	Silt	x	
[x]	[ ]	Gravel	x	x
[x]	[ ]	Sand		
[ ]	[ ]	Bedrock		
[ ]	[ ]	Detritus		
[ ]	[ ]	Artifical	x	x

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [x] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [ ] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [ ] Silt - *Heavy*
- [ ] Silt - *Moderate*
- [x] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [x] 5 or More
- [ ] 4 or Less

Embeddedness
- [x] Extensive
- [x] Moderate
- [ ] Normal
- [ ] None

Comments:

Instream Cover (Check *ALL* that apply) — Cover: 13 (Max 20)
- [x] Undercut Banks
- [ ] Overhanging Vegetation
- [x] Shallows (Slow water)
- [x] Rootmats
- [x] Deep Pools >70cm
- [x] Rootwads
- [x] Boulders
- [ ] Oxbows, backwaters
- [ ] Aquatic Macrophytes
- [x] Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [x] Moderate 25-75%
- [x] Sparse 5-25%
- [ ] Nearly Absent <5%

Comments:

Channel Morphology: (Check 1, or 2 and average) — Channel: 11.5 (Max 20)

Sinuosity
- [ ] High
- [x] Moderate
- [x] Low
- [ ] None

Development
- [ ] Excellent
- [x] Good
- [ ] Fair
- [ ] Poor

Channelization
- [ ] None
- [ ] Recovered
- [x] Recovering
- [ ] Recent or No Recovery

Stability
- [ ] High
- [ ] Moderate
- [x] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [ ] Bank Shaping
- [x] 1-side channel modifications

Comments:

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average) — Riparian: 3.5 (Max. 10)

Riparian Width (per bank)

L	R	
[ ]	[ ]	Wide > 50m
[ ]	[ ]	Moderate 10-50m
[x]	[ ]	Narrow 5-10m
[ ]	[x]	Very Narrow <5m
[ ]	[x]	None

Bank Erosion (per bank)

L	R	
[x]	[ ]	None/Little
[ ]	[x]	Moderate
[ ]	[x]	Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
[ ]	[ ]	Forest, Swamp
[ ]	[ ]	Shrub or Old Field
[ ]	[ ]	Residential, Park, New Field
[ ]	[ ]	Fenced Pasture
[ ]	[ ]	Conservation Tillage
[x]	[x]	Urban or Industrial
[ ]	[ ]	Open Pasture, Row Crop
[ ]	[ ]	Mining/Construction

Comments:

Pool/Glide Quality — Pool: 10 (Max 12)

Max. Depth (1 only)
- [x] >1m
- [ ] 0.7-1m
- [ ] 0.4-0.7m
- [ ] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [ ] Pool width > riffle width
- [x] Pool width = riffle width
- [ ] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [x] Fast
- [x] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Riffle/Run Quality (Check 1, or 2 and average) — Riffle/Run: 4.5 (Max 8)

Riffle Depth
- [x] Best Areas >10cm
- [ ] Best Areas 5-10cm
- [ ] Best Areas <5cm

Riffle/Run Substrate
- [x] Stable
- [ ] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [ ] Low
- [x] Moderate
- [x] Extensive

Run Depth
- [ ] Max >50
- [ ] Max <50

Comments: Run Depth measurement not taken.

Gradient: 10

Gradient (ft/mi)	17.6	%Pool	%Glide
Drainage Area (sq.mi.)	38.6	%Riffle	%Run

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silviculture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI
River Code:
Date: 10/1/1998
Scorer's Initials: CZ/TZ

Qualitative Habitat Evaluation Index

RM: 4.9
Location: Upstream of Middleburg WWTP
Comments:

Modified by NEORSD
Stream: Abram Creek

Total Score: 48.5

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present) — Substrate: 3, Max 20

Check	Type	Pool%	Riffle%
	Bldr/Slbs		
	Boulder	x	
	Cobble	x	
	Hardpan		
x	Muck	x	
	Silt	x	
	Gravel	x	
	Sand	x	
	Bedrock		
x	Detritus	x	
	Artifical		

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [ ] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [x] Lacustrine
- [ ] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [ ] Silt - *Heavy*
- [x] Silt - *Moderate*
- [ ] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [ ] 5 or More
- [x] 4 or Less

Embeddedness
- [ ] Extensive
- [x] Moderate
- [ ] Normal
- [ ] None

Comments:

Instream Cover (Check *ALL* that apply) — Cover: 12, Max 20
- [x] Undercut Banks
- [x] Overhanging Vegetation
- [ ] Shallows (Slow water)
- [x] Rootmats
- [x] Deep Pools >70cm
- [x] Rootwads
- [ ] Boulders
- [ ] Oxbows, backwaters
- [ ] Aquatic Macrophytes
- [x] Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [x] Moderate 25-75%
- [x] Sparse 5-25%
- [ ] Nearly Absent <5%

Comments:

Channel Morphology: (Check 1, or 2 and average) — Channel: 9, Max 20

Sinuosity
- [ ] High
- [ ] Moderate
- [ ] Low
- [x] None

Development
- [ ] Excellent
- [ ] Good
- [ ] Fair
- [x] Poor

Channelization
- [ ] None
- [x] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Stability
- [x] High
- [ ] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [ ] Bank Shaping
- [ ] 1-side channel modifications

Comments:

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average) — Riparian: 9.5, Max. 10

Riparian Width (per bank)

L	R	
x	x	Wide > 50m
		Moderate 10-50m
		Narrow 5-10m
		Very Narrow <5m
		None

Bank Erosion (per bank)

L	R	
x	x	None/Little
		Moderate
		Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
x		Forest, Swamp
	x	Shrub or Old Field
		Residential, Park, New Field
		Fenced Pasture
		Conservation Tillage
		Urban or Industrial
		Open Pasture, Row Crop
		Mining/Construction

Comments:

Pool/Glide Quality — Pool: 9, Max 12

Max. Depth (1 only)
- [x] >1m
- [ ] 0.7-1m
- [ ] 0.4-0.7m
- [ ] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [x] Pool width > riffle width
- [ ] Pool width = riffle width
- [ ] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [ ] Fast
- [ ] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Riffle/Run Quality (Check 1, or 2 and average) — Riffle/Run: 0, Max 8

Riffle Depth
- [ ] Best Areas >10cm
- [ ] Best Areas 5-10cm
- [ ] Best Areas <5cm

Run Depth
- [ ] Max >50
- [ ] Max <50

Riffle/Run Substrate
- [ ] Stable
- [ ] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [ ] Low
- [ ] Moderate
- [ ] Extensive

Comments: No riffle

Gradient (ft/mi): 7.5 — Gradient: 6
Drainage Area (sq.mi.): 1.9

%Pool: 50 — %Glide: 50
%Riffle: — %Run:

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silvicluture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI — **Qualitative Habitat Evaluation Index** — **Modified by NEORSD**

River Code:
Date: 10/1/1998
Scorer's Initials: CZ/TZ
RM: 4.6
Location: Downstream of Middleburg WWTP
Comments: Upstream of Sheldon Rd.
Stream: Abram Creek

Total Score: 35

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present) — Substrate: 2.5 (Max 20)

Type	Pool%	Riffle%
Bldr/Slbs		
Boulder	x	
Cobble		
Hardpan		
[x] Muck	x	
Silt	x	
Gravel		
Sand	x	
Bedrock		
[x] Detritus	x	
Artifical		

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [ ] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [x] Lacustrine
- [ ] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [ ] Silt - *Heavy*
- [x] Silt - *Moderate*
- [ ] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [ ] 5 or More
- [x] 4 or Less

Embeddedness
- [x] Extensive
- [x] Moderate
- [ ] Normal
- [ ] None

Comments:

Instream Cover (Check *ALL* that apply) — Cover: 8 (Max 20)
- [x] Undercut Banks
- [x] Overhanging Vegetation
- [ ] Shallows (Slow water)
- [x] Rootmats
- [ ] Deep Pools >70cm
- [x] Rootwads
- [ ] Boulders
- [ ] Oxbows, backwaters
- [ ] Aquatic Macrophytes
- [x] Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [ ] Moderate 25-75%
- [x] Sparse 5-25%
- [ ] Nearly Absent <5%

Comments:

Channel Morphology: (Check 1, or 2 and average) — Channel: 9 (Max 20)

Sinuosity
- [ ] High
- [ ] Moderate
- [ ] Low
- [x] None

Development
- [ ] Excellent
- [ ] Good
- [ ] Fair
- [x] Poor

Channelization
- [ ] None
- [x] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Stability
- [x] High
- [ ] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [x] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [ ] Bank Shaping
- [ ] 1-side channel modifications

Comments:

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average) — Riparian: 4.5 (Max. 10)

Riparian Width (per bank)

L	R	
		Wide > 50m
		Moderate 10-50m
	x	Narrow 5-10m
x		Very Narrow <5m
		None

Bank Erosion (per bank)

L	R	
x	x	None/Little
		Moderate
		Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
		Forest, Swamp
		Shrub or Old Field
		Residential, Park, New Field
		Fenced Pasture
		Conservation Tillage
x	x	Urban or Industrial
		Open Pasture, Row Crop
		Mining/Construction

Comments:

Pool/Glide Quality — Pool: 5 (Max 12)

Max. Depth (1 only)
- [ ] >1m
- [ ] 0.7-1m
- [x] 0.4-0.7m
- [ ] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [x] Pool width > riffle width
- [ ] Pool width = riffle width
- [ ] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [ ] Fast
- [ ] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Riffle/Run Quality (Check 1, or 2 and average) — Riffle/Run: 0 (Max 8)

Riffle Depth
- [ ] Best Areas >10cm
- [ ] Best Areas 5-10cm
- [ ] Best Areas <5cm

Run Depth
- [ ] Max >50
- [ ] Max <50

Riffle/Run Substrate
- [ ] Stable
- [ ] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [ ] Low
- [ ] Moderate
- [ ] Extensive

Comments: No riffle

Gradient: 6

Gradient (ft/mi)	7.5	%Pool	50	%Glide	50
Drainage Area (sq.mi.)	1.9	%Riffle		%Run	

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silviclulture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI

River Code:
Date: 10/1/1998
Scorer's Initials: CZ/TZ

Qualitative Habitat Evaluation Index

RM: 4.6
Location: Downstream of Middleburg WWTP
Comments: Upstream of Sheldon Rd.

Modified by NEORSD
Stream: Abram Creek

Total Score: 35

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present)

	Type	Pool%	Riffle%
[ ]	Bldr/Slbs		
[ ]	Boulder	x	
[ ]	Cobble		
[ ]	Hardpan		
[x]	Muck	x	
[ ]	Silt	x	
[ ]	Gravel		
[ ]	Sand	x	
[ ]	Bedrock		
[x]	Detritus	x	
[ ]	Artifical		

Substrate Origin
(Check 1, or 2 and average)
- [ ] Limestone
- [ ] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [x] Lacustrine
- [ ] Shale
- [ ] Coal Fines

Substrate Quality
(Check 1, or 2 and average)
- [ ] Silt - *Heavy*
- [x] Silt - *Moderate*
- [ ] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [ ] 5 or More
- [x] 4 or Less

Embeddedness
- [x] Extensive
- [x] Moderate
- [ ] Normal
- [ ] None

Comments:

Substrate: 2.5 (Max 20)

Instream Cover (Check *ALL* that apply)
- [x] Undercut Banks
- [x] Overhanging Vegetation
- [ ] Shallows (Slow water)
- [x] Rootmats
- [ ] Deep Pools >70cm
- [x] Rootwads
- [ ] Boulders
- [ ] Oxbows, backwaters
- [ ] Aquatic Macrophytes
- [x] Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [ ] Moderate 25-75%
- [x] Sparse 5-25%
- [ ] Nearly Absent <5%

Comments:

Cover: 8 (Max 20)

Channel Morphology: (Check 1, or 2 and average)

Sinuosity
- [ ] High
- [ ] Moderate
- [ ] Low
- [x] None

Development
- [ ] Excellent
- [ ] Good
- [ ] Fair
- [x] Poor

Channelization
- [ ] None
- [x] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Stability
- [x] High
- [ ] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [x] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [ ] Bank Shaping
- [ ] 1-side channel modifications

Comments:

Channel: 9 (Max 20)

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average)

Riparian Width (per bank)

L	R	
[ ]	[ ]	Wide > 50m
[ ]	[ ]	Moderate 10-50m
[ ]	[x]	Narrow 5-10m
[x]	[ ]	Very Narrow <5m
[ ]	[ ]	None

Bank Erosion (per bank)

L	R	
[x]	[x]	None/Little
[ ]	[ ]	Moderate
[ ]	[ ]	Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
[ ]	[ ]	Forest, Swamp
[ ]	[ ]	Shrub or Old Field
[ ]	[ ]	Residential, Park, New Field
[ ]	[ ]	Fenced Pasture
[ ]	[ ]	Conservation Tillage
[x]	[x]	Urban or Industrial
[ ]	[ ]	Open Pasture, Row Crop
[ ]	[ ]	Mining/Construction

Comments:

Riparian: 4.5 (Max. 10)

Pool/Glide Quality

Max. Depth (1 only)
- [ ] >1m
- [ ] 0.7-1m
- [x] 0.4-0.7m
- [ ] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology
(Check 1, or 2 and average)
- [x] Pool width > riffle width
- [ ] Pool width = riffle width
- [ ] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [ ] Fast
- [ ] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Pool: 5 (Max 12)

Riffle/Run Quality (Check 1, or 2 and average)

Riffle Depth
- [ ] Best Areas >10cm
- [ ] Best Areas 5-10cm
- [ ] Best Areas <5cm

Riffle/Run Substrate
- [ ] Stable
- [ ] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [ ] Low
- [ ] Moderate
- [ ] Extensive

Run Depth
- [ ] Max >50
- [ ] Max <50

Comme: No riffle

Riffle/Run: 0 (Max 8)

Gradient (ft/mi): 7.5
Drainage Area (sq.mi.): 1.9

%Pool: 50 %Glide: 50
%Riffle: %Run:

Gradient: 6

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silviclture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI — **Qualitative Habitat Evaluation Index** — **Modified by NEORSD**

River Code:
Date: 10/1/1998
Scorer's Initials: CZ/TZ
RM: 4.4
Location: US of Brookpark WWTP Old Effluent
Comments:
Stream: Abram Creek

Total Score: 56

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present) — Substrate 8.5, Max 20

	Type	Pool%	Riffle%
[ ]	Bldr/Slbs		
[ ]	Boulder	x	
[ ]	Cobble		
[ ]	Hardpan		
[x]	Muck	x	
[ ]	Silt	x	
[ ]	Gravel	x	
[x]	Sand	x	
[ ]	Bedrock		
[ ]	Detritus	x	
[ ]	Artifical		

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [x] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [x] Lacustrine
- [ ] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [ ] Silt - *Heavy*
- [x] Silt - *Moderate*
- [ ] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [x] 5 or More
- [ ] 4 or Less

Embeddedness
- [ ] Extensive
- [x] Moderate
- [ ] Normal
- [ ] None

Comments:

Instream Cover (Check *ALL* that apply) — Cover 15, Max 20
- [x] Undercut Banks
- [x] Overhanging Vegetation
- [ ] Shallows (Slow water)
- [x] Rootmats
- [x] Deep Pools >70cm
- [x] Rootwads
- [x] Boulders
- [ ] Oxbows, backwaters
- [ ] Aquatic Macrophytes
- [x] Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [x] Moderate 25-75%
- [ ] Sparse 5-25%
- [ ] Nearly Absent <5%

Comments:

Channel Morphology: (Check 1, or 2 and average) — Channel 10.5, Max 20

Sinuosity
- [ ] High
- [ ] Moderate
- [x] Low
- [x] None

Development
- [ ] Excellent
- [ ] Good
- [ ] Fair
- [x] Poor

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Stability
- [ ] High
- [x] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [ ] Bank Shaping
- [ ] 1-side channel modifications

Comments:

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average) — Riparian 9, Max. 10

Riparian Width (per bank)

L	R	
x	x	Wide > 50m
		Moderate 10-50m
		Narrow 5-10m
		Very Narrow <5m
		None

Bank Erosion (per bank)

L	R	
x		None/Little
	x	Moderate
		Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
x		Forest, Swamp
	x	Shrub or Old Field
		Residential, Park, New Field
		Fenced Pasture
		Conservation Tillage
		Urban or Industrial
		Open Pasture, Row Crop
		Mining/Construction

Comments: RL: some forest and homes.
RR: WWTP and Park

Pool/Glide Quality — Pool 7, Max 12

Max. Depth (1 only)
- [ ] >1m
- [x] 0.7-1m
- [ ] 0.4-0.7m
- [ ] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [x] Pool width > riffle width
- [ ] Pool width = riffle width
- [ ] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [ ] Fast
- [ ] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Riffle/Run Quality (Check 1, or 2 and average) — Riffle/Run 0, Max 8

Riffle Depth
- [ ] Best Areas >10cm
- [ ] Best Areas 5-10cm
- [ ] Best Areas <5cm

Run Depth
- [ ] Max >50
- [ ] Max <50

Riffle/Run Substrate
- [ ] Stable
- [ ] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [ ] Low
- [ ] Moderate
- [ ] Extensive

Commei No riffle

Gradient (ft/mi): 7.5
Drainage Area (sq.mi.): 3.1
%Pool: 50 %Glide: 50
%Riffle: %Run:
Gradient 6

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silvicluture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

Total Score: 48.75

OEPA QHEI — **Qualitative Habitat Evaluation Index** — **Modified by NEORSD**

River Code:
Date: 10/1/1998
Scorer's Initials: CZ/TZ
RM: 4.2
Location: Downstream of Brookpark WWTP
Comments: HD Site
Stream: Abram Creek

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present) — Substrate: 6.5, Max 20

Type	Pool%	Riffle%
[ ] Bldr/Slbs		
[ ] Boulder		
[ ] Cobble		
[ ] Hardpan		
[x] Muck	x	
[ ] Silt	x	
[ ] Gravel		
[x] Sand	x	
[ ] Bedrock		
[ ] Detritus	x	
[ ] Artifical		

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [x] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [x] Lacustrine
- [ ] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [ ] Silt - *Heavy*
- [x] Silt - *Moderate*
- [ ] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [ ] 5 or More
- [x] 4 or Less

Embeddedness
- [ ] Extensive
- [x] Moderate
- [ ] Normal
- [ ] None

Comments:

Instream Cover (Check *ALL* that apply) — Cover: 14, Max 20
- [x] Undercut Banks
- [x] Overhanging Vegetation
- [ ] Shallows (Slow water)
- [x] Rootmats
- [x] Deep Pools >70cm
- [x] Rootwads
- [ ] Boulders
- [ ] Oxbows, backwaters
- [ ] Aquatic Macrophytes
- [x] Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [x] Moderate 25-75%
- [ ] Sparse 5-25%
- [ ] Nearly Absent <5%

Comments:

Channel Morphology: (Check 1, or 2 and average) — Channel: 11, Max 20

Sinuosity
- [ ] High
- [ ] Moderate
- [x] Low
- [ ] None

Development
- [ ] Excellent
- [ ] Good
- [ ] Fair
- [x] Poor

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Stability
- [ ] High
- [x] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [ ] Bank Shaping
- [ ] 1-side channel modifications

Comments:

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average) — Riparian: 4.25, Max. 10

Riparian Width (per bank)

L	R	
[ ]	[ ]	Wide > 50m
[ ]	[ ]	Moderate 10-50m
[ ]	[ ]	Narrow 5-10m
[x]	[x]	Very Narrow <5m
[ ]	[ ]	None

Bank Erosion (per bank)

L	R	
[x]	[x]	None/Little
[x]	[ ]	Moderate
[ ]	[ ]	Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
[ ]	[ ]	Forest, Swamp
[ ]	[ ]	Shrub or Old Field
[x]	[ ]	Residential, Park, New Field
[ ]	[ ]	Fenced Pasture
[ ]	[ ]	Conservation Tillage
[ ]	[x]	Urban or Industrial
[ ]	[ ]	Open Pasture, Row Crop
[ ]	[ ]	Mining/Construction

Comments:

Pool/Glide Quality — Pool: 7, Max 12

Max. Depth (1 only)
- [ ] >1m
- [x] 0.7-1m
- [ ] 0.4-0.7m
- [ ] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [x] Pool width > riffle width
- [ ] Pool width = riffle width
- [ ] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [ ] Fast
- [ ] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Riffle/Run Quality (Check 1, or 2 and average) — Riffle/Run: 0, Max 8

Riffle Depth
- [ ] Best Areas >10cm
- [ ] Best Areas 5-10cm
- [ ] Best Areas <5cm

Run Depth
- [ ] Max >50
- [ ] Max <50

Riffle/Run Substrate
- [ ] Stable
- [ ] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [ ] Low
- [ ] Moderate
- [ ] Extensive

Comments: No riffle

Gradient: 6

Gradient (ft/mi)	7.5
Drainage Area (sq.mi.)	3.4
%Pool	
%Glide	
%Riffle	
%Run	

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silviculture
- [ ] Construction
- [x] Urban Runoff
- [ ] CSO's
- [x] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI — **Qualitative Habitat Evaluation Index** — **Modified by NEORSD**

River Code:
Date: 10/21/1998
Scorer's Initials: CZ/TZ
RM: 10.6
Location: Upstream of Rocky River Confluence
Comments:
Stream: Abram Creek

Total Score: 62.5

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present) — Substrate: 11.5 (Max 20)

Type	Pool%	Riffle%
Bldr/Slbs		
Boulder	x	
Cobble	x	
Hardpan		
Muck		
Silt	x	x
Gravel	x	
Sand	x	x
[x] [x] Bedrock	x	x
Detritus		
Artifical		

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [x] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [x] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [ ] Silt - *Heavy*
- [x] Silt - *Moderate*
- [x] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [x] 5 or More
- [ ] 4 or Less

Embeddedness
- [ ] Extensive
- [ ] Moderate
- [x] Normal
- [ ] None

Comments:

Instream Cover (Check *ALL* that apply) — Cover: 7 (Max 20)
- [ ] Undercut Banks
- [ ] Overhanging Vegetation
- [x] Shallows (Slow water)
- [x] Rootmats
- [ ] Deep Pools >70cm
- [ ] Rootwads
- [x] Boulders
- [ ] Oxbows, backwaters
- [ ] Aquatic Macrophytes
- [x] Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [ ] Moderate 25-75%
- [x] Sparse 5-25%
- [ ] Nearly Absent <5%

Comments:

Channel Morphology: (Check 1, or 2 and average) — Channel: 14.5 (Max 20)

Sinuosity
- [ ] High
- [ ] Moderate
- [x] Low
- [x] None

Development
- [ ] Excellent
- [x] Good
- [x] Fair
- [ ] Poor

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Stability
- [x] High
- [ ] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Islands
- [ ] Leveed
- [ ] Bank Shaping
- [ ] 1-side channel modifications

Comments:

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average) — Riparian: 9.5 (Max. 10)

Riparian Width (per bank)

L	R	
x	x	Wide > 50m
		Moderate 10-50m
		Narrow 5-10m
		Very Narrow <5m
		None

Bank Erosion (per bank)

L	R	
x	x	None/Little
		Moderate
		Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
x	x	Forest, Swamp
		Shrub or Old Field
x		Residential, Park, New Field
		Fenced Pasture
		Conservation Tillage
		Urban or Industrial
		Open Pasture, Row Crop
		Mining/Construction

Comments:

Pool/Glide Quality — Pool: 5 (Max 12)

Max. Depth (1 only)
- [ ] >1m
- [ ] 0.7-1m
- [x] 0.4-0.7m
- [ ] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [ ] Pool width > riffle width
- [ ] Pool width = riffle width
- [x] Pool width < riffle width

Current Velocity (Check all that apply)
- [ ] Eddies
- [x] Fast
- [x] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Riffle/Run Quality (Check 1, or 2 and average) — Riffle/Run: 5 (Max 8)

Riffle Depth
- [ ] Best Areas >10cm
- [x] Best Areas 5-10cm
- [ ] Best Areas <5cm

Run Depth
- [ ] Max >50
- [ ] Max <50

Riffle/Run Substrate
- [ ] Stable
- [x] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [x] Low
- [ ] Moderate
- [ ] Extensive

Comments:

Gradient: 10

Gradient (ft/mi)	7.2
Drainage Area (sq.mi.)	268

%Pool	2	%Glide	8
%Riffle	45	%Run	45

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silviculture
- [ ] Construction
- [x] Urban Runoff
- [ ] CSO's
- [x] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

OEPA QHEI | **Qualitative Habitat Evaluation Index** | **Modified by NEORSD**

River Code:
Date: 7/15/1998
Scorer's Initials: JJ
RM: 10
Location: Downstream of Abram Creek
Comments:
Stream: Rocky River

Total Score: 63.5

SUBSTRATE (Check *ONLY* two substrate *TYPE* Boxes; Estimate % present)

Check	Type	Pool%	Riffle%
	Bldr/Slbs		
	Boulder	x	
	Cobble		
	Hardpan		
	Muck		
	Silt	x	
x	Gravel	x	x
	Sand	x	x
x	Bedrock	x	
	Detritus		
	Artifical		

Substrate Origin (Check 1, or 2 and average)
- [ ] Limestone
- [x] Tills
- [ ] Wetlands
- [ ] Hardpan
- [ ] Sandstone
- [ ] Rip/Rap
- [ ] Lacustrine
- [x] Shale
- [ ] Coal Fines

Substrate Quality (Check 1, or 2 and average)
- [x] Silt - *Heavy*
- [ ] Silt - *Moderate*
- [ ] Silt - *Normal*
- [ ] Silt - *Free*

Number of Substrate Types
- [x] 5 or More
- [ ] 4 or Less

Embeddedness
- [x] Extensive
- [ ] Moderate
- [ ] Normal
- [ ] None

Comments:

Substrate: 10 (Max 20)

Instream Cover (Check *ALL* that apply)
- [ ] Undercut Banks
- [x] Overhanging Vegetation
- [x] Shallows (Slow water)
- [x] Rootmats
- [ ] Deep Pools >70cm
- [ ] Rootwads
- [x] Boulders
- [ ] Oxbows, backwaters
- [ ] Aquatic Macrophytes
- [x] Logs or Woody Debris

Amount (Check 1, or 2 and average)
- [ ] Extensive >75%
- [x] Moderate 25-75%
- [x] Sparse 5-25%
- [ ] Nearly Absent <5%

Comments:

Cover: 10 (Max 20)

Channel Morphology: (Check 1, or 2 and average)

Sinuosity
- [ ] High
- [ ] Moderate
- [ ] Low
- [x] None

Development
- [ ] Excellent
- [x] Good
- [x] Fair
- [ ] Poor

Channelization
- [x] None
- [ ] Recovered
- [ ] Recovering
- [ ] Recent or No Recovery

Stability
- [x] High
- [ ] Moderate
- [ ] Low

Modifications/Other
- [ ] Snagging
- [ ] Relocation
- [ ] Canopy Removal
- [ ] Dredging
- [ ] Impoundment
- [ ] Leveed
- [ ] Bank Shaping
- [ ] 1-side channel modifications

Comments:

Channel: 14 (Max 20)

Riparian Zone and Bank Erosion: (Check 1 box per bank, or 2 and average)

Riparian Width (per bank)

L	R	
x		Wide > 50m
	x	Moderate 10-50m
		Narrow 5-10m
		Very Narrow <5m
		None

Bank Erosion (per bank)

L	R	
x	x	None/Little
		Moderate
		Heavy/Severe

Flood Plain Quality (Past 100m Riparian) (most predominant per bank)

L	R	
x		Forest, Swamp
		Shrub or Old Field
		Residential, Park, New Field
		Fenced Pasture
		Conservation Tillage
	x	Urban or Industrial
		Open Pasture, Row Crop
		Mining/Construction

Comments:

Riparian: 8 (Max. 10)

Pool/Glide Quality

Max. Depth (1 only)
- [ ] >1m
- [ ] 0.7-1m
- [x] 0.4-0.7m
- [ ] 0.2-0.4m
- [ ] <0.2m [pool = 0]

Morphology (Check 1, or 2 and average)
- [ ] Pool width > riffle width
- [x] Pool width = riffle width
- [ ] Pool width < riffle width

Current Velocity (Check all that apply)
- [x] Eddies
- [x] Fast
- [x] Moderate
- [x] Slow
- [ ] Torrential
- [ ] Interstitial
- [ ] Intermittent

Comments:

Pool: 7 (Max 12)

Riffle/Run Quality (Check 1, or 2 and average)

Riffle Depth
- [x] Best Areas >10cm
- [ ] Best Areas 5-10cm
- [ ] Best Areas <5cm

Run Depth
- [ ] Max >50
- [x] Max <50

Riffle/Run Substrate
- [ ] Stable
- [x] Mod. Stable
- [ ] Unstable

Riffle/Run Embeddedness
- [ ] None
- [x] Low
- [x] Moderate
- [ ] Extensive

Comments:

Riffle/Run: 4.5 (Max 8)

Gradient (ft/mi): 9.96
Drainage Area (sq.mi.): 273

%Pool | %Glide | %Riffle | %Run

Gradient: 10

Impacts (Check all that apply)
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [ ] Agricultural
- [ ] Livestock
- [ ] Silvicluture
- [ ] Construction
- [ ] Urban Runoff
- [ ] CSO's
- [ ] Suburban Impacts
- [ ] Mining
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Landfills
- [ ] Natural
- [ ] Dams
- [ ] Other Flow Alteration

Comments:

APPENDIX E
MACROINVERTEBRATE SAMPLING SUMMARY
1999-2002

Introduction

Aquatic ecosystems are complex environments that can be affected by a myriad of factors that include biological, chemical and physical processes. The natural tendency for any ecosystem, including aquatic ones, is to be in a balanced state called homeostasis (Odum, 1969). Imbalances can occur when some stream constituents are altered. This is especially true when there are changes in the amount of available nutrients, types of substrates, and dissolved oxygen levels (see Hynes, 1966 and 1970 and Odum, 1975). Other causes of imbalances impacting urban watersheds include non-point sources (storm sewer discharges), combined sewer overflows, sanitary sewer overflows, habitat modifications, riparian zone quality, and high percentages of impervious ground. The reduction in and/or the elimination of environmental stressors should eventually lead to an improvement in the health of the aquatic ecosystem.

In addition to environmental stressors, habitat is also an important influence on community structure and must be analyzed to accurately assess biological community balance. It is expected that stream ecosystems with a diversity of habitat types will sustain smaller populations of many species, whereas ecosystems with uniform habitat types support larger populations comprised of only a few species (Hellawell, 1986 and Patrick, 1988).

Interactions among environmental factors can make determining sources of impairment to water bodies a difficult task. Often, the use of alternative methods to help determine the source and type of impairment is required. Biological signatures of various environmental stressors may aid in discriminating what type and to what degree those stressors are influencing the structure and function of biological communities in urban watersheds.

Macroinvertebrates are important components in the food web of aquatic ecosystems, and substantial imbalances can alter their communities. Because of their sensitivity to pollution and other stresses to their ecosystems, macroinvertebrates have often been used for the biological assessment of aquatic ecosystems. Many individuals have researched the response of these organisms to both biotic and abiotic environmental influences. This research has resulted in the creation of several biological indices and other data analysis tools that can aid in determining the source of impairment to a water body. Indices such as the Hilsenhoff Biotic Index (Hilsenhoff, 1984 and 1987) and the North Carolina Biotic Index (Lenat, 1993) can be useful in determining the degree of organic pollution.

An ecological monitoring program utilizing multi-metric and additive indices for the analysis of fish and macroinvertebrate data has been established and implemented in the state of Ohio by the Ohio Environmental Protection Agency (Ohio EPA) and is incorporated within the State’s Water Quality Criteria and point source discharge permits. NEORSD has adopted a stream-monitoring program that incorporates Ohio

EPA protocols and methods for data analysis to provide data that is compatible with our permit requirements.

In 1988, the Environmental Assessment Group in NEORSD's Water Quality and Industrial Surveillance section initiated a biomonitoring program to evaluate the effectiveness of capital improvements to the sewer system and various district facilities. This program includes lake and river sampling for chemical and bacteriological water quality assessment, stream habitat assessments and macroinvertebrate and fish community surveys. The benthic macroinvertebrate data is also compared to Ohio EPA data and biological criteria developed by the State.

Benthos Collection Methods

Bioassessments by the Environmental Assessment Group included analyzing macroinvertebrate community structure using the Ohio EPA Invertebrate Community Index (ICI) to determine a stream's attainment of the biological criteria for the Erie Ontario Lake Plan (EOLP). The ICI includes the following metrics: taxa richness, total Ephemeroptera (mayfly) taxa and percent composition, total Trichoptera (Caddisfly) taxa and percent composition, total Diptera taxa, percent pollution tolerant composition, percent Tanytarsini midge composition, percent other Diptera and non-insect composition, and qualitative Ephemeroptera, Plecoptera, and Trichoptera (EPT). In conjunction with the analysis of artificial substrate samples, qualitative kick samples collected from available natural substrates were used to analyze the macroinvertebrate community structure by examining species diversity, functional feeding levels, and pollution sensitivity of the taxa collected. The following indices were also utilized to evaluate the macroinvertebrate community: Shannon Diversity Index, Hilsenhoff Biotic Index (HBI), Ohio EPA Qualitative Community Tolerance Value (QCTV) index, and Ohio EPA Toxic Tolerant, Selected Toxic Tolerant, and Organic Tolerant Organism index.

The NEORSD Environmental Assessment Group performed qualitative, semi-quantitative and quantitative sampling for benthic macroinvertebrates. Organisms were collected using a D-frame kick net, hand picking, and Hester-Dendy artificial substrate samplers. Only organisms large enough to be retained by a No. 30 mesh screen were collected. Samples were retained in labeled vials and preserved with AGW (a mixture of 85% denatured ethanol, 5% glycerol, and 10% water) for laboratory identification. All organisms were identified to the lowest possible taxonomic level.

Qualitative multiple habitat sampling was performed at all accessible microhabitats at a site until no new taxa were collected. This period of time usually ranged from one-half hour to one hour at each site. The qualitative, multiple habitat sampling provided a list of taxa present within a sample site.

Semi-quantitative samples were collected using a D-frame kick net that was placed in the stream with the open end facing upstream. The substrate upstream of the net was disturbed by kicking for approximately 30 seconds. All large rocks were scraped to dislodge all invertebrates. The large rocks and debris were then visually inspected for any organisms that may have been clinging to the surface. These were removed using forceps and placed in a vial. All large and/or rare taxa were placed in vials because they may interfere with sample splitting and/or be lost when large samples are split using a Folsom sample splitter. Due to the naturally irregular distribution of benthic macroinvertebrates in streams, 3 to 5 kick samples within a sampling reach were collected and composited. The semi-quantitative samples provide data for Hilsenhoff Biotic Index (HBI) calculations.

Quantitative samples were obtained using five replicate Hester-Dendy artificial substrate samplers per sample site. The five Hester-Dendy samplers were secured to an object (i.e. block, brick etc.) and submerged in the stream for approximately six weeks. The quantitative samples were used for the calculation of the ICI.

ICI

The ICI is a multi-metric index developed and used by Ohio EPA to measure a stream's overall macroinvertebrate community condition. The ICI consists of 10 structural and functional community metrics, each with four scoring categories of 6, 4, 2, and 0 points. Six represents the best conditions and 0 the worst. Eight of the ten ICI metrics are drainage area dependant. The sum of the metrics produces the ICI score (range 0-60) and narrative rating (*Very Poor* to *Exceptional*). The ICI score is used to determine the stream's attainment of biological criteria for its aquatic life use designation.

Hilsenhoff Biotic Index

The Hilsenhoff Biotic Index (HBI), developed in Wisconsin by Dr. William Hilsenhoff in 1977 and later revised in 1987, is used to evaluate levels of organic and nutrient pollution in streams using macroinvertebrates. This index is semi-quantitative and can be convenient for use in rapid bioassessments. Although the HBI is considered one of the most reliable indices available (Szcytko, 1988), it is best used in conjunction with other indices when assessing water quality because of its semi-quantitative nature. The HBI uses an average of tolerance values for all individuals collected from a site. Tolerance values from 0 to 10 are assigned to 359 species used in the calculation of the index (Hilsenhoff, 1987). These values increase with the ability of an organism to withstand organic pollution. In general, streams with higher HBI scores exhibit higher levels of pollution through organic enrichment.

The HBI evaluation uses a sample of 100 to 200 arthropods collected from rock or gravel riffles. In deeper streams that have no riffles, samples from rock or gravel runs may be substituted. In sand-bottomed streams, samples from debris that accumulates on sticks or other objects wedged into the sand in swift current may be used (Hilsenhoff, 1987). It is suggested that the stream sites to be sampled have a current velocity of 0.3 m/sec (1.0 ft/sec) or greater (Hilsenhoff, 1987). Sample collection should be performed in the spring before June 1st or between September 1st and October 15th. Samples collected during summer months, when water temperatures are higher and dissolved oxygen levels tend to be lower, may demonstrate much higher scores (falsely indicating worsened water quality conditions) than those collected in spring or fall. The use of seasonal correction factors for the summer has been suggested (Hilsenhoff, 1982, 1987).

$$HBI = \sum \frac{n_i a_i}{N}$$

Where:

n_i = Total number of individuals in the ith taxa
a_i = Tolerance value of ith taxa
N = Total number of individuals in a sample

The tolerance values provided by Dr. Hilsenhoff were developed in Wisconsin and may require some modification for Northeast Ohio. However, this modification may not be very significant because both regions are within the Great Lakes region and have ecologically similar streams and rivers. Modified tolerance values have been assigned to many invertebrates and can be found in the U.S. EPA Rapid Bioassessment Protocols, Volume 2 (Barbour, 1999). Site-specific tolerance values for arthropods collected by the NEORSD may eventually be determined for future use. Until then, the tolerance values provided by Hilsenhoff will serve as an adequate default.

Approximate tolerance values were assigned to organisms when tolerance values were not available for that species or when the taxonomic level of identification was to the genus only. The approximate tolerance value was determined by averaging the assigned tolerance values for all species within the genus. This approximate tolerance value was then used in the calculation of the HBI score. The range of tolerance values within most genera where approximate values were used was not greater than one. Therefore, the use of this approximate tolerance value should not have a significant effect on the accuracy of the HBI narrative rating.

Using the HBI to evaluate water quality of streams has some advantages. The use of only arthropods helps to simplify collection, sorting and identification. Sample collection time for HBI evaluations (about 1 hour) is much less than that for artificial substrate samples (six weeks for sampler colonization and many hours of sorting). The relatively small number of arthropods required for an evaluation reduces processing time, compared to artificial substrate samples that may contain thousands of organisms and require many more hours to process. The requirement to sample only riffles or fast runs for HBI evaluation makes data more comparable between sample locations, because habitat will not be as variable. HBI values are not strongly affected by stream width, unlike Ephemeroptera, Plecoptera, Trichoptera (EPT) taxa richness values. For this reason, biotic indices are more reliable than taxa richness when ratings are assigned to smaller streams (Lenat, 1993).

HBI values are divided into seven narrative water quality ratings: *Excellent*, *Very Good*, *Good*, *Fair*, *Fairly Poor*, *Poor*, and *Very Poor*. The water quality ratings are based on biotic index scores, with higher scores indicating poorer water quality (Table E-1), assuming physical habitability of sites to be equal.

Table E-1
Evaluation of Water Quality using the Hilsenhoff Biotic Index

Index Score	Water Quality	Degree of Organic Pollution
0.00-3.50	Excellent	No Apparent Organic Pollution
3.51-4.50	Very Good	Possible Slight Organic Pollution
4.51-5.50	Good	Some Organic Pollution
5.51-6.50	Fair	Fairly Significant Organic Pollution
6.51-7.50	Fairly Poor	Significant Organic Pollution
7.51-8.50	Poor	Very Significant Organic Pollution
8.51-10.00	Very Poor	Severe Organic Pollution

Source: Hilsenhoff, 1987

Some disadvantages associated with HBI stream evaluations are:

A) Selective sampling techniques. Sampling techniques that examine a specific type of habitat (i.e. riffles, swift runs) and exclude non-arthropods (i.e. snails, worms, leeches, etc.) and other organisms endemic to pools and margins will not provide sufficient data to characterize the entire benthic community of a stream location.

B) The HBI is only reliable in determining the impact of organic pollution on benthic fauna and was not designated to evaluate non-organic impacts.

Consideration of one index in isolation can lead to misinterpretation of stream conditions. Therefore, multi-metric analysis is used to assess the health of the benthic macroinvertebrate community and water quality at each sample location. NEORSD investigators also frequently use the following macroinvertebrate indices to evaluate water quality conditions:

Additional Metrics

Taxa Richness is the total number of distinct taxa identified in the sample. In most cases, the higher the number (diversity) of total taxa, the healthier the community. Increasing diversity correlates with increasing health of the assemblage and suggests that niche space, habitat, and food source are adequate to support survival and propagation of many species. Number of taxa measures the overall variety of the macroinvertebrate assemblage. Taxa richness usually consists of species level identifications, but can also be evaluated as higher taxonomic groups (i.e., genera, families, orders, etc.) in assessment of invertebrate assemblages. This metric can be affected by the experience and taxonomic skill of the investigator.

EPT Taxa Richness is the total number of different Ephemeroptera, Plecoptera and Trichoptera taxa identified in the sample. The EPT taxa include organisms that are usually sensitive to stressors such as organic pollution, toxic pollution and detrimental land uses within the watershed. The greater the numbers of EPT taxa present in the sample, the healthier the benthic macroinvertebrate community and the better the water quality and/or habitat of the stream. As with the taxa richness metric, this metric is also sensitive to the taxonomic skill of the investigator.

Percent EPT Composition is the proportion of EPT organisms identified in the sample. Since these groups of organisms are considered sensitive to various types of environmental disruptions, the greater the percent composition, the healthier the benthic macroinvertebrate community and the better the water quality.

Percent Mayfly Composition and **Percent Caddisfly Composition** are individual components of EPT composition. When examined, these metrics may be used to identify the macroinvertebrate community structure and determine the type(s) of impact present. Both mayflies and caddisflies are sensitive to organic pollution, siltation, and habitat diversity and quality. Because of the mobility of certain mayflies, extremely high numbers of Baetidae mayflies may indicate that recovery from a recent disruption may have occurred.

Total Dipteran Taxa measures the total number of different taxa in this large and diverse order of insects. This order contains many genera with widely diverse ecological requirements. Generally, the greater the number of different dipteran taxa present, the healthier the benthic macroinvertebrate community.

Percent Tribe Tanytarsini Composition measures the abundance of this pollution sensitive group of Chironomidae.

Percent Other Dipterans and Non-Insects measures the abundance of all dipterans (except tribe Tanytarsini midges) and other invertebrates that are not insects. These organisms tend to predominate the macroinvertebrate community when water quality conditions are adverse.

Dominant 5-10 Taxa measures the proportions of the most abundant organisms. A high abundance of a few taxa is indicative of an impacted benthic macroinvertebrate community.

EPT/Chironomidae Ratio uses these two indicator groups as a measure of community balance. A healthy, non-impacted site will have greater representation of EPT than the generally pollution tolerant group of Chironomidae. Generally, the higher the EPT/Chironomidae ratio, the healthier the stream is.

(*Cricotopus + Chironomus)*/Chironomidae measures the abundance of the pollution tolerant genera *Cricotopus* and *Chironomus* to the total abundance of the family

Chironomidae. The greater the abundance is of these two genera, the greater the impact on the benthic macroinvertebrate community.

Qualitative Community Tolerance Value

An Ohio EPA water quality assessment tool is the Qualitative Community Tolerance Value (QCTV) index, an offshoot of the ICI. The QCTV is calculated from semi-quantitative kick-net samples from natural substrates to substitute for the installation, retrieval, and processing of Hester-Dendy artificial substrate samplers (DeShon, 1995). The QCTV index utilizes Qualitative Community Tolerance Values derived from macroinvertebrate collections in Ohio using Hester-Dendy artificial substrates. The tolerance value is determined from all ICI scores at all locations and weighted by abundance data for each taxon. The tolerance value of a given taxon represents the level of tolerance to environmental stressors in terms of the 0-60 scale of the ICI. The most pollution intolerant taxa, which have the greatest abundance at undisturbed sites and a high ICI score, receive high tolerance values. Conversely, the most pollution tolerant taxa, with the greatest abundance at highly impacted sites and which had low ICI scores, receive low tolerance values. This tool can be used in the same fashion as the HBI. The advantage of the QCTV is that all tolerance values are determined from macroinvertebrates collected specifically from Ohio. The results can be analyzed using ICI narrative ratings. Unless Hester-Dendy artificial substrates are installed, NEORSD investigators calculate the QCTV using semi-quantitative macroinvertebrate samples collected from natural substrates and utilize the index in the same fashion as the HBI.

The following metrics, when used in conjunction with other measures of macroinvertebrate health, also aid in determining the source of impact on a benthic macroinvertebrate community.

Percent Tolerant Organisms measures the proportion of organisms considered by the Ohio EPA to be tolerant to pollution. The abundance of tolerant organisms is relative to the degree of impact on the benthic macroinvertebrate community.

Percent Toxic Tolerant Organism composition measures the proportion of organisms tolerant to toxic pollution.

Percent Selected Toxic Tolerant Organism composition measures the proportion of a subset of the toxic tolerant organisms.

Percent Organic Tolerant Organism composition measures the proportion of organisms tolerant to organic pollution.

A summary of the metrics used by NEORSD to evaluate macroinvertebrate communities is presented in Table E-2. NEORSD kick net data are presented in Table E-3. Numbers of organisms used in the calculations are on file at the NEORSD Water Quality & Industrial Surveillance offices.

Table E-2 Biological Metrics Used for the Analysis of Benthic Macroinvertebrate Data

	Biological Metrics	Description	Response to Impairment
Richness Measures	Taxa Richness	Total number of individual taxa	Decrease
	EPT Taxa Richness	Number of taxa in the Ephemeroptera (mayfly), Plecoptera (stonefly), and Trichoptera (caddisfly) insect orders	Decrease
	Ephemeroptera Taxa Richness	Total number mayfly taxa (genus or species)	Decrease
	Trichoptera Taxa Richness	Total number Caddisfly taxa (genus or species)	Decrease
	Dipteran Taxa Richness	Total number of Diptera (fly) taxa	Decrease
Composition Metrics	Percent EPT Composition	Percent composition mayfly, stonefly and Caddisfly larvae	Decrease
	Percent Mayfly Composition	Percent of mayfly larvae in sample	Decrease
	Percent Caddisfly Composition	Percent Caddisfly larvae in sample	Decrease
	Percent Tribe Tanytarsini Composition	Percent of Tanytarsini midge larvae in sample	Decrease
	Percent Other Dipterans & Non-Insects	Percent composition of dipterans other than the Tanytarsini midge larvae and non-insects.	Increase
	Shannon Diversity Index	General measure of sample diversity that incorporates richness and evenness	Decrease
	Percent Composition Dominant 5-10 Taxa	Percent composition of most abundant taxa	Increase
Tolerance/Intolerance	Percent Tolerant Organisms	Percent of tolerant organisms listed by OEPA for the calculation of the ICI.	Increase
	Percent Toxic Tolerant Organisms	Percent of organisms found to be tolerant of toxic stress, listed by the OEPA.	Increase
	Percent Selected Toxic Tolerant Organisms	Percent of organisms found to be tolerant to specific toxic stressors, listed by the OEPA	Increase
	Percent Organic Tolerant Organisms	Percent of organisms known to be tolerant to organic pollution	Increase
	EPT/Chironomidae ratio	Ratio between the less tolerant mayfly, stonefly and Caddisfly taxa and the more tolerant midge taxa.	Decrease

Table E-2 Biological Metrics Used for the Analysis of Benthic Macroinvertebrate Data

	Biological Metrics	Description	Response to Impairment
Tolerance/Intolerance Measures	*Cricotopus+Chironomus*/ Chironomidae	Composition of the more tolerant midge genera compared to the entire family of midges.	Increase
	Hilsenhoff Biotic Index (HBI)	Measure of organic pollution using assigned tolerance values from 0-10, with 10 being the most tolerant	Increase
	Qualitative Community Tolerance Value Index (OEPA)	Invertebrate community index based on qualitative samples with assigned tolerance values from 0-60, with 60 being the least tolerant, based on OEPA ICI.	Decrease
	Invertebrate Community Index (OEPA)	Multi-metric index based on 10-community metrics used to analyze data generated from Hester-Dendy artificial substrate samplers.	Decrease

Table E-3
Kick Net Benthic Macroinvertebrate Data
1999-2002

Sample Location	Date	Total Taxa	EPT Taxa	Percent EPT	HBI Score	QCTV Score	Shannon Diversity Index	Percent Toxic Tolerant	Percent Selected Toxic	Percent Organic Tolerant
Abram Creek										
AC-1	08/04/99	24	2	12.60	5.92	21.2	2.91	3.40	3.40	21.80
AC-2	08/04/99	27	2	0.80	6.73	19.2	1.49	15.70	15.70	76.90
AC-3	08/04/99	29	3	5.80	6.69	23.0	3.04	14.40	14.40	16.40
AC-4	08/04/99	26	1	1.80	7.26	19.2	2.82	5.50	4.60	19.30
AC-5	09/03/99	31	8	56.30	4.44	39.3	2.73	7.30	4.40	6.50
Rocky River										
RR-6	08/09/99	48	10	46.64	3.78	35.5	2.77	1.30	0.87	22.34
RR-7	08/11/99	41	8	45.12	4.24	36.2	3.00	2.82	1.52	16.92
Beech Hill/Bonnieview Creek										
BBC-1	07/03/02	51	6	39.21	4.80	36.1	2.86	13.92	10.90	24.71
BV-4	07/18/02	44	5	23.39	5.71	33.3	2.88	3.23	2.96	27.15
BV-5	07/03/02	68	6	51.94	4.18	35.2	2.74	8.93	3.05	15.37
Brandywine Creek										
Upstream	09/06/02	49	8	28.37	4.12	32.5	3.05	4.19	3.95	5.12
Upstream	07/12/02	31	5	19.66	5.77	27.7	2.69	4.75	4.41	14.24
Downstream	09/06/02	56	9	36.49	4.33	35.9	3.23	7.77	4.90	4.39
Downstream	07/17/02	55	7	26.92	5.02	33.2	3.42	6.51	4.73	10.36
Cuyahoga River										
22.51	07/13/00	75	13	40.69	4.17		3.40	21.69	19.46	7.66
22.6	11/21/02	40	8	20.00	4.25		2.49	8.24	3.92	32.55
River Mile 8.0	09/08/00	65	14	48.70	3.89		3.27	5.99	5.00	12.54
River Mile 10.5	08/29/02	33	10	41.32	3.47		3.02	2.48	2.48	9.09
River Mile 10.5	07/17/02	60	11	36.09	4.43		3.23	15.04	14.14	20.75
River Mile 10.5	08/28/00	45	14	43.03	4.08		3.37	14.95	14.43	12.37
River Mile 11.0	08/29/02	44	12	54.64	3.17		3.13	2.58	2.58	10.31
River Mile 11.0	07/17/02	56	10	50.53	3.75		3.37	8.77	7.37	10.35
River Mile 11.0	08/28/00	34	7	43.09	3.48		3.08	5.69	5.69	8.13
22.8	11/19/02	57	11	15.30	4.27		3.14	12.02	6.01	26.23
22.9	11/19/02	63	10	30.54	3.98		3.36	11.78	3.99	16.17
23	11/19/02	85	16	44.44	3.25		2.96	3.91	1.42	11.72
24	11/08/02	76	17	46.06	3.56		3.20	11.24	6.35	4.57
24.5	11/08/02	70	10	47.80	3.34		2.82	6.29	4.20	3.82
Mill Creek Kerruish Park										
Upstream	11/20/00	46	2	0.58	6.58		2.60	49.35	46.04	30.50
Downstream	11/20/00	37	1	0.46	6.64		2.23	63.50	59.82	25.46
Tinkers Creek										
39	11/01/00	34	10	49.63	3.77	36.6	2.96	5.93	5.19	9.63
40	11/03/00	27	8	63.26	3.59	39.3	2.49	0.47	0.47	5.12
41	11/03/00	32	8	62.00	3.62	37.4	2.39	3.00	0.50	6.00
42	11/08/00	26	8	77.41	3.50	40.7	1.91	3.35	0.42	3.77

Table E-4
Hester-Dendy Benthic Macroinvertebrate Data
1999-2002

Sample Location	Date	Total Taxa	EPT Taxa	Percent EPT	ICI Score	ICI Narrative Rating	Shannon Diversity Index	Percent Toxic Tolerant	Percent Selected Toxic	Percent Organic Tolerant
Abram Creek										
AC-1	08/04/99	32	3	2.41	18	Fair	1.54	46.08	46.08	46.48
AC-2	08/04/99	27	2	0.78	12	Poor/Fair	1.49	15.74	15.66	76.90
AC-3	08/04/99	39	4	1.58	26	Fair	1.80	37.96	37.83	52.06
AC-4	08/04/99	30	2	0.29	14	Fair	2.31	12.34	12.19	54.57
AC-5	09/03/99	43	9	30.16	48	Exceptional	2.53	6.51	3.61	3.21
Rocky River										
RR-6	09/09/99	50	12	64.39	42	Good	1.93	1.24	0.21	9.70
RR-7	09/09/99	45	10	45.72	40	Good	2.19	10.44	2.85	7.43
Cuyahoga River										
River Mile 10.5	08/29/02	20	6	55.41	32	Marginally Good	1.45	0.66	0.66	0.99
River Mile 11.0	08/29/02	27	7	26.18	32	Marginally Good	2.49	0.53	0.53	10.66

APPENDIX F
CUYAHOGA RIVER QUANTITATIVE MACROINVERTEBRATE SAMPLING
2000 and 2002

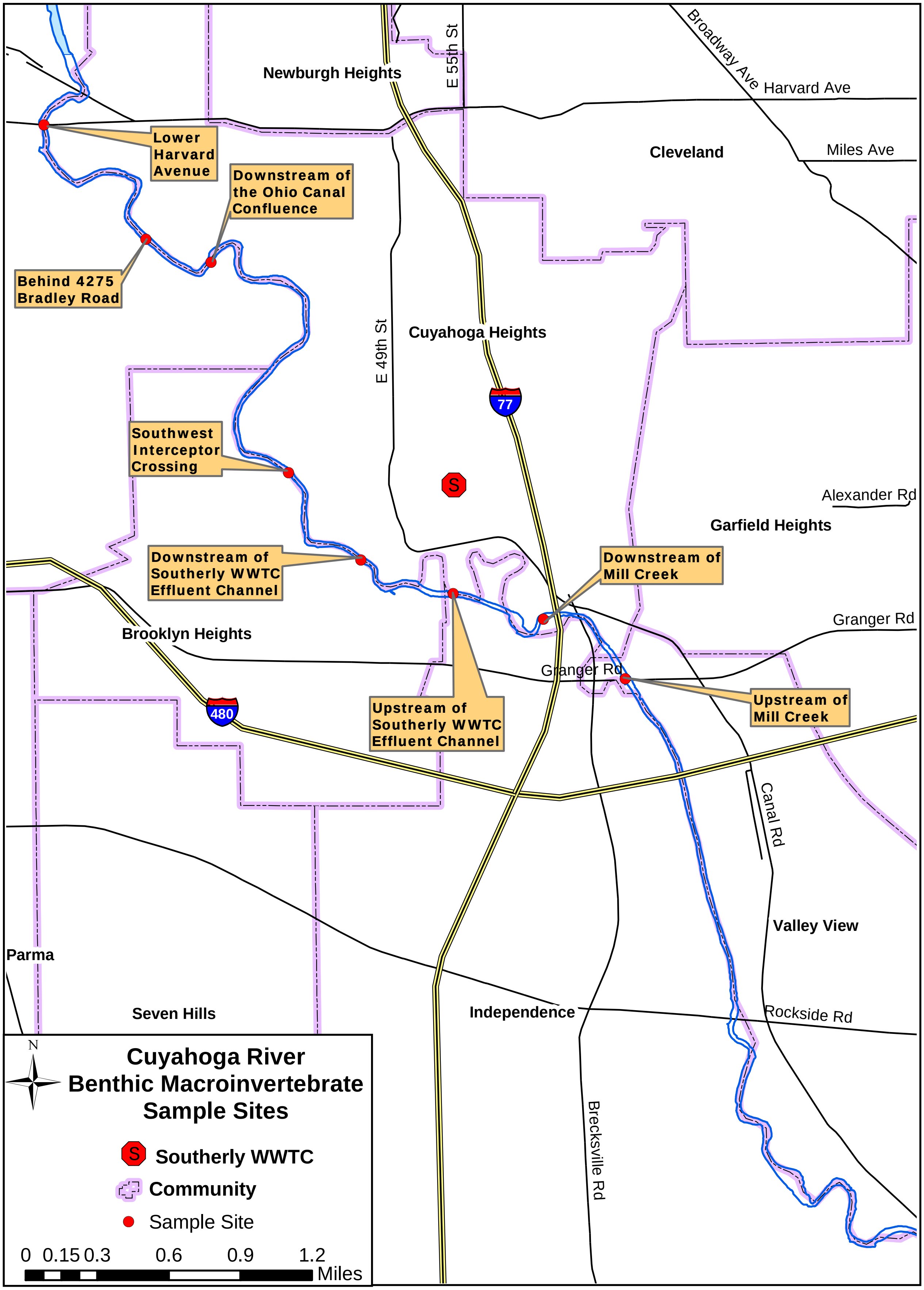
Introduction
During 2000 and 2002, the Northeast Ohio Regional Sewer District (NEORSD) collected quantitative macroinvertebrate samples upstream and downstream of Southerly Wastewater Treatment Center (WWTC). An additional six sites were sampled only in 2000. The location of all sites that were sampled is listed in Table F-1 and shown in Figure 1.

Table F-1. Sample Site Locations

Site Description	Approximate River Mile	Latitude (^oN)	Longitude (^oW)
Upstream of Mill Creek	11.66	41.41416	81.63799
Downstream of Mill Creek	11.35	41.41772	81.64457
Upstream of Southerly WWTC	11.00	41.41888	81.65180
Downstream of Southerly WWTC	10.50	41.42145	81.65900
Southwest Interceptor Crossing	9.70	41.42685	81.66480
Downstream of Ohio Canal Confluence	8.30	41.43914	81.67119
Behind 4275 Bradley Road	8.00	41.44032	81.67665
Lower Harvard Avenue	7.10	41.44737	81.68458

Samples were obtained using five multi-plate, artificial substrate samplers (modified Hester-Dendy). Ohio EPA protocols call for a six-week sampling period between June 15 and September 30. Because of elevated river flows during 2000, several samplers could not be removed after six weeks and remained in place for up to 15 additional days. The samplers at the site behind 4275 Bradley Road had to be reinstalled late in the season and remained in place until October 19.

All samples were collected by members of the NEORSD Water Quality and Industrial Surveillance (WQIS) staff. EA Engineering, Science and Technology of Deerfield, Illinois identified the macroinvertebrates and calculated Invertebrate Community Index (ICI) scores.


Newburgh Heights
E 55th St
Broadway Ave
Harvard Ave
Cleveland
Miles Ave
Lower Harvard Avenue
Downstream of the Ohio Canal Confluence
Behind 4275 Bradley Road
E 49th St
Cuyahoga Heights
77
Southwest Interceptor Crossing
S
Alexander Rd
Garfield Heights
Downstream of Southerly WWTC Effluent Channel
Downstream of Mill Creek
Granger Rd
Brooklyn Heights
Granger Rd
480
Upstream of Southerly WWTC Effluent Channel
Upstream of Mill Creek
Canal Rd
Valley View
Parma
Seven Hills
Independence
Rockside Rd
Brecksville Rd
N
Cuyahoga River
Benthic Macroinvertebrate
Sample Sites
Southerly WWTC
Community
Sample Site
0 0.15 0.3 0.6 0.9 1.2
Miles

Results and Discussion

Table F-2 summarizes the results of quantitative macroinvertebrate sampling conducted on the Cuyahoga River upstream and downstream of Southerly in 2000 and 2002. Table F-3 gives the results for the additional sites sampled only in 2000. A list of collected taxa for all sites is on file at the NEORSD WQIS office.

Table F-2. Cuyahoga River Upstream and Downstream Southerly ICI Metric and Index Scores

	2000		**2002**	
	US Southerly	**DS Southerly**	**US Southerly**	**DS Southerly**
Index/Metric	Value (Score)	Value (Score)	Value (Score)	Value (Score)
Total Organisms	1182	2521	1501	2413
Total Taxa	30 (4)	29 (4)	27 (4)	20 (2)
Mayfly Taxa	4 (2)	3 (2)	4 (2)	3 (2)
Caddisfly Taxa	6 (6)	6 (6)	3 (4)	3 (4)
Dipteran Taxa	13 (4)	14 (6)	9 (4)	9 (4)
% Mayfly Composition	1.8 (2)	2.1 (2)	9.8 (2)	3.3 (2)
% Caddisfly Composition	39.5 (6)	46.8 (6)	16.4 (4)	52.1 (6)
% Tanytarsini Composition	15.9 (4)	27.9 (6)	1.1 (2)	1.3 (2)
% Other Dipteran Composition	37.1 (2)	19.4 (4)	44.2 (0)	40.0 (2)
% Tolerant Organisms	2.0 (6)	1.3 (6)	0.5 (6)	0.7 (6)
Qualitative EPT Taxa	7 (2)	14 (4)	12 (4)	10 (2)
Total ICI Score	38	46	32	32
Narrative Rating	Good	Exceptionally Good	Marginally Good	Marginally Good

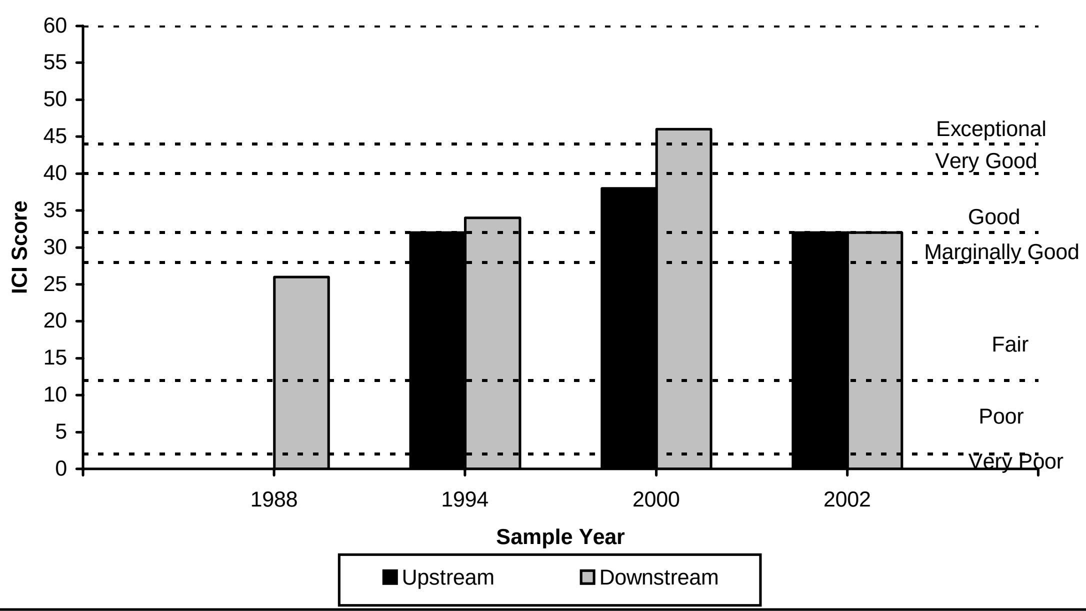
Table F-3. Cuyahoga River ICI Metric and Index Scores						
	2000					
	US Mill Creek	**DS Mill Creek**	**SW Interceptor**	**DS Ohio Canal**	**4275 Bradley Rd**	**Lower Harvard**
Index/Metric	Value (Score)	Value (Score)	Value (Score)	Value (Score)	Value (Score)	Value (Score)
Total Organisms	1109	1181	1237	2667	1496	312
Total Taxa	41 (6)	31 (4)	33 (4)	35 (6)	22 (2)	33 (4)
Mayfly Taxa	6 (4)	3 (2)	3 (2)	4 (2)	1 (0)	3 (2)
Caddisfly Taxa	4 (4)	4 (4)	3 (4)	6 (6)	4 (4)	2 (2)
Dipteran Taxa	17 (6)	19 (6)	19 (6)	17 (6)	9 (4)	19 (6)
% Mayfly Composition	4.7 (2)	7.4 (2)	13.2 (4)	1.2 (2)	3.3 (2)	12.8 (4)
% Caddisfly Composition	17.0 (4)	31.6 (6)	34.2 (6)	24.5 (4)	53.4 (6)	4.2 (0)
% Tanytarsini Composition	20.9 (4)	23.0 (4)	13.9 (4)	40.8 (6)	1.6 (2)	15.4 (4)
% Other Dipteran Composition	41.7 (0)	28.4 (4)	28.5 (4)	31.2 (2)	37.0 (2)	61.9 (0)
% Tolerant Organisms	2.0 (6)	1.8 (6)	2.9 (4)	3.9 (2)	1.1 (6)	7.4 (0)
Qualitative EPT Taxa	15 (4)	10 (2)	8 (2)	10 (2)	10 (2)	8 (2)
Total ICI Score	40	40	40	38	30	24
Narrative Rating	Good	Good	Good	Good	Marginally Good	Fair

Invertebrate Community Index

ICI scores obtained in 2000 met the Warmwater Habitat criterion of 34 for macroinvertebrates at all sites except the site located behind 4275 Bradley Road, where the score was within the area of insignificant departure from the criterion, and at Lower Harvard Avenue. Generally, the sites that were furthest upstream had higher scores. The highest score came from the site just downstream of Southerly WWTC.

The 2002 ICI scores for Cuyahoga River sites RM 11.0 and RM 10.5 were not in attainment of the Warmwater Habitat Criterion. They were, however, within the range of insignificant departure from the criterion. Similar scores upstream and downstream suggest that the Southerly WWTC had no detectable impact on the benthic macroinvertebrate community in the Cuyahoga River. However, when compared with scores calculated in 1994 (34) and 2000 (46), the 2002 RM 10.5 score indicates a potential response to negative environmental factors (Figure F-2). The RM 11.0 2002 ICI score was the same as calculated in 1994 and 6 points lower than 2000, indicating some fluctuation in the benthic macroinvertebrate community structure.

Figure F-2
Cuyahoga River, Upstream and Downstream Southerly WWTC, Historic ICI Scores



For the sites upstream and downstream of Southerly WWTP, a historical comparison of ICI metrics was completed and the following metrics were those with the most significant changes.

Total Caddisfly Taxa
The total number of Caddisfly taxa in the samples declined from 6 to 3 at both locations between 1994 and 2002.

Percent Caddisfly Composition
In 2002, Caddisflies were more abundant at RM 10.5 (52.1%) than RM 11.0 (16.4%) and received an individual ICI metric score of 6 compared with 4 for RM 11.0. Caddisfly composition at RM 10.5 has increased from 29.8% in 1988 to 52.1% in 2002 compared to the decline from 24.4% in 1994 to 16.4% in 2002 at RM 11.0. These fluctuations are a possible response to negative environmental conditions or perturbation upstream of Southerly WWTC.

Total Mayfly Taxa
Between 1994 and 2000, Total Mayfly taxa at RM 10.5 had decreased from 6 to 3, and remained unchanged from 2000 to 2002. In contrast, Mayfly taxa remained unchanged at 4 between 1994 and 2002 at RM 11.0.

Total Diptera Taxa
Between 1994 and 2000, a dramatic decline in the total number of Diptera taxa occurred at both RM 10.5 (39 to 15) and RM 11.0 (45 to 14), followed by a continued decline between 2000 and 2002 at RM 10.5 (15 to 9) and RM 11.0 (14 to 9), indicating a possible response to negative environmental influences.

Tanytarsini Midge Composition
Significant declines in the abundance of the environmentally sensitive Tanytarsini Midges occurred between 2000 and 2002 at RM 10.5 (27.9% to 1.3%) and RM 11.0 (15.9% to 1.1%), indicating a possible response to negative environmental influences.

Percent ICI Tolerant Organism Composition
Examination of the 1994 to 2002 data revealed significant declines in Tolerant organism composition at RM 10.5 (18.7% to 0.7%) and RM 11.0 (9.4% to 0.5%). Declines may indicate recovery from environmental perturbation.

Other Biological Metrics of Interest
Five additional measures were used to evaluate the conditions at the sampled sites upstream and downstream of Southerly WWTP (Table F-4) and were compared to historical values when possible. Generally, the results show that RM 10.5, the site downstream of Southerly WWTP, has been less impacted by pollution than RM 11.0. Historically, there have been significant declines in the abundance of organisms tolerant to toxic conditions at RM 11.0 (10.4% to 0.5%) and RM 10.5 (20.6% to 0.7%) from 1994-2002. The data for RM 10.5 also reveal a significant decline in organisms tolerant to organic enrichment (9.2% to 1%). In contrast, between 1994 and 2002, the abundance of organic tolerant organisms

increased at RM 11.0 (7% to 10.7%), indicating that organic enrichment is lower downstream of the Southerly WWTC effluent.

Table F-4 Biological Metric and Index Scores for Cuyahoga River Sites RM 10.5 and RM 11.0						
	1994		2000		2002	
Index / Metric	RM 11.0	RM 10.5	RM 11.0	RM 10.5	RM 11.0	RM 10.5
Shannon Diversity Index	2.7	2.8	2.4	1.9	2.5	1.5
Percent Toxic Tolerant Organism Composition	10.4%	20.6%	2.4%	2.5%	0.5%	0.7%
Percent Organic Tolerant Organism Composition	7.0%	9.2%	3.0%	0.2%	10.7%	1.0%
EPT / Chironomidae	0.5	0.5	0.8	1.1	0.6	1.4
Cricotopus + *Chironomus* / Chironomidae	0.12	0.31	0.01	0.05	0.01	0.02

Table F-5 2000 Biological Metric and Index Scores for Cuyahoga River Sites						
Index / Metric	US Mill Creek	DS Mill Creek	SW Interceptor	DS Ohio Canal	4275 Bradley Rd	Lower Harvard
Shannon Diversity Index	3.7	3.5	3.4	3.2	2.6	4.2
Percent Toxic Tolerant Organism Composition	1.4	1.7	3.2	4.8	1.6	6.4
Percent Organic Tolerant Organism Composition	8.3	4.7	2.0	2.1	0.27	13.8
EPT / Chironomidae	0.37	0.78	1.15	0.36	1.54	0.25
Cricotopus + *Chironomus* / Chironomidae	0	0	0.04	0.04	0.01	0.05

The other measures used to characterize the additional sites sampled in 2000 support most of the results obtained from use of the ICI (Table F-5). The Lower Harvard site, which had the lowest ICI score, had the highest percentages of toxic tolerant and organic tolerant species, the highest tolerant midge ratio, and the lowest EPT/Chironomidae ratio. These results are all characteristic of a site that has been impacted by pollution. The site behind 4275 Bradley Road had low percentages of toxic and organic tolerant species, further supporting the score of 6 it received in the ICI metric for pollution tolerance. For the other sites, as seen in the ICI, there was a general improvement in the scores for the locations further upstream.

Conclusions

Benthic macroinvertebrate data collected from the Cuyahoga River from 1988 to 2002 indicate improved benthic macroinvertebrate community health and water quality. Generally, healthier communities were found at the more upstream sites. The Cuyahoga River attained the WWH criterion for macroinvertebrates at RM 10.5 and 11.0 in 1994 and at six sites in 2000, but failed to do so in 2002. However, a return to attainment of the Warmwater Habitat Criteria for the EOLP is possible. Fluctuations in many of the biological metrics indicate that the river is constantly exposed to changing environmental conditions, some natural and some human induced.

In 2002, the abundance of Caddisflies was greater in the Hester-Dendy sample for RM 10.5 compared with RM 11.0, indicating better water quality at RM 10.5. Nevertheless, the increase in Caddisfly composition at RM 10.5 in the 2002 Hester-Dendy sample was from the contribution by larvae in the family Hydropsychidae. Larvae in the family Hydropsychidae are considered moderately tolerant to negative environmental influences and the relative abundances of these organisms increase in response to negative environmental influences (Barbour et al. 1992, Hayslip 1993).

Continued monitoring of the Cuyahoga River and macroinvertebrate communities upstream and downstream of the Southerly WWTC will be required to determine the cause(s) of the fluctuating conditions that have been observed. Additional monitoring will also be necessary to determine whether the river is meeting the WWH criterion for macroinvertebrates at these locations, as it did in 2000.

APPENDIX G
CUYAHOGA RIVER SEMI-QUANTITATIVE MACROINVERTEBRATE SAMPLING
2002

In 2002, Northeast Ohio Regional Sewer District (NEORSD) conducted semi-quantitative macroinvertebrate sampling at eight sites on the Cuyahoga River between River Mile 33.2 (Site #24.50, the Bolanz Road Bridge) and River Mile 7.1 (Site #22.51, the Lower Harvard Avenue Bridge). Additionally, semi-quantitative sampling was conducted in 2000 in conjunction with quantitative sampling (see Appendix F) at four sites. The semi-quantitative results of these sampling events were incorporated into data from historic sampling conducted by NEORSD on the Cuyahoga River in this report. See Table G-1 for a summary of the years sampled for each site. Please see the Macroinvertebrate Sampling Summary (Appendix E) for an explanation of Hilsenhoff Biotic Index (HBI), Shannon Diversity Index (SDI), and Qualitative Community Tolerance Value Index (QCTV) scores, as well as Ephemeroptera, Plecoptera, and Trichoptera (EPT) and Tolerant Organisms percentages of composition. The location of all sites that were sampled is listed below.

- Site #24.50, the Bolanz Road Bridge located approximately four miles downstream of the City of Akron Wastewater Treatment Plant. This site was selected to evaluate water quality upstream and outside of the NEORSD service area for comparison with downstream water quality.
- Site #24.00, the Station Road Bridge located between the low level dam at Station Road and the confluence with Chippewa Creek
- Site #23.00, located 0.2 miles downstream of the confluence with Tinkers Creek
- Site #22.90, southeast of the intersection of East 71st Street and Canal Road, 0.2 miles downstream of the confluence with Mill Creek
- Site #22.80, the chlorine access railroad bridge located approximately 0.5 miles upstream of the effluent discharge from the NEORSD Southerly Wastewater Treatment Center (WWTC) and 0.1 miles downstream of the confluence with West Creek
- River Mile 11.0, located approximately 1,000 feet upstream of the Southerly WWTC effluent channel.
- River Mile 10.5, located approximately 1,700 feet downstream of the Southerly WWTC effluent channel confluence with the Cuyahoga River and is referred to as the Far Field Site.
- Site #22.7, Southwest Interceptor Crossing, one mile downstream of the effluent discharge from the Southerly WWTC
- River Mile 8.0, located approximately 530 feet upstream of Site #22.6, “River Smelting”.
- Site #22.60, behind 4195 Bradley Road (River Recycling Industries, formerly “River Smelting”)
- Site #22.51, the Lower Harvard Avenue Bridge, less than 0.2 miles downstream of the confluence with Big Creek

Methods

Semi-quantitative samples were collected using a D-frame kick net that was placed in the stream with the open end facing upstream. The substrate upstream of the net was disturbed by kicking for approximately 30 seconds. All large rocks were scraped to dislodge all invertebrates. The large rocks and debris were then visually inspected for any organisms that may have been clinging to the surface. These were removed using forceps and placed in a vial. Due to the naturally irregular distribution of benthic macroinvertebrates in streams, three to five kick samples within a sampling reach were collected and composited. The semi-quantitative samples provide data for calculations of the indices discussed in this report.

All samples were collected by members of the NEORSD Water Quality and Industrial Surveillance (WQIS) staff. WQIS investigators identified the macroinvertebrates and calculated HBI, SDI and QCTV scores.

Results and Discussion

HBI, SDI and QCTV scores are depicted in Table G-2 and Figure G-1 at the end of this report. A list of collected taxa for all sites is on file at the NEORSD WQIS office.

Hilsenhoff Biotic Index

The HBI measures organic pollution. This index uses tolerance values from 0 to 10.00, with 10.00 being the most tolerant. HBI scores increase in response to impairment. As shown in Figure G-1, individual HBI scores along the Cuyahoga River within the study area have ranged from 3.00 (*Excellent*) to 4.59 (*Good*), with most scores falling in the *Excellent* and *Very Good* categories. Over time, individual HBI scores have increased at all of the sites except for Site #24.50 (the most upstream site) and #22.70 (downstream of SWWTP). Moving from upstream to downstream (see Figure G-2), average HBI scores remained in the range between 3.31 and 4.25 (*Excellent* to *Very Good* ranges) except at Site #22.70. The average HBI for this site was 4.46. Notably, the lowest average HBI scores (showing the least amount of organic pollution) were at Sites #24.00 and #23.00 and River Mile 11.0. Site #24.00 is downstream of the confluence with Chippewa Creek, Site #23.00 is downstream of the confluence with Tinkers Creek, and both these sites are upstream of the confluences with Mill and West Creeks. River Mile 11.0 is just upstream of the confluence with SWWTC's effluent channel. The HBI scores at all sites sampled in 2000 and 2002 ranged from 3.00 (*Excellent*) to 4.25 (*Very Good*).

Shannon Diversity Index

The SDI measures diversity incorporating richness and evenness. SDI scores decrease in response to impairment. As shown in Figure G-1, individual SDI scores along the Cuyahoga River within the study area have ranged from 2.19 to 3.40. Over time, individual SDI scores have increased (shown less impairment) at all sites except River Mile 10.5 and Site #22.70. River Mile 10.5 is located just downstream of the confluence with SWWTC's effluent channel and showed a slight decrease from 2000 to 2002. Site #22.70's SDI scores remained relatively unchanged from 1991 to 2000. As depicted in Figure G-2, average SDI scores over time have only ranged from 2.49 to 3.27.

Qualitative Community Tolerance Value
QCTV is a tolerance metric with assigned tolerance values from 0 to 60.00, with 60.00 being the least tolerant. QCTV scores decrease in response to impairment. As depicted in Figure G-1, historic QCTV scores along the Cuyahoga River within the study area have ranged from 33.00 (*Good*) to 41.00 (*Very Good*). Over time, individual QCTV scores have decreased at all of the sites upstream of SWWTC, but have increased at all of the sites downstream of SWWTC. As depicted in Figure G-2, average QCTV scores have ranged from 35.83 (*Good*) to 41.00 (*Very Good*). River Mile 8.0 had the lowest average QCTV at 36.00. The two highest average QCTV scores (showing least impairment) were at Sites #24.00 and #22.90.

EPT Taxa and Tolerant Organisms
The 1991 to 2002 EPT and tolerant organisms metrics are depicted in Table G-3 and Figure G-3. As Figure G-3 shows, the EPT percentage of composition has dropped from 1991 to 2002 at all sites with more than one sampling, except River Mile 11.0 and Site #22.70. The taxa included in EPT are particularly sensitive to water pollution, and a decrease in percentage of composition of these organisms may indicate that over time all of the sites have become more stressed. The tolerant organisms percentage of composition has increased at all sites where more than one sampling occurred from 1991 to 2002, except for River Mile 11.0 and River Mile 10.5. In particular, Sites #22.80 and #22.60 had tolerant organisms percentages that surpassed their EPT percentages in 2002. Thus it would appear that except for River Mile 11.0, water quality may be decreasing across the entire study area.

Conclusions
Several conclusions can be drawn from the data in this study. First of all, more data is needed. As depicted in Table G-1, there is no single year during which all of these sites were sampled. Furthermore, some sites were only sampled one or two times. The method used (kick sampling of natural substrate) has limitations. While it can provide a “snapshot” of the organisms in an area, results vary greatly with flow conditions. High flows can restrict sampling to the river’s margins, and can scour macroinvertebrates from the substrate. Low flow conditions may allow access to a greater portion of the substrate, but may concentrate organisms in the limited area reached by the water. Use of artificial substrate samplers (such as “Hester-Dendy” samplers), which are colonized over a standard time period and provide a uniform surface area, would present a more objective picture of macroinvertebrate communities in the study area. A sampling program that utilized artificial substrate samplers at all of the sites at least once per year would produce much more meaningful data, and data which could be better compared both longitudinally and temporally. This type of program would be much better for assessing as well as monitoring the condition of the Cuyahoga River. However, useful information can be extracted from the existing study.

Since recent individual HBI scores are generally higher (i.e. worse) than historic HBI scores, it would appear that over time organic pollution is increasing on the studied section of the Cuyahoga River except at Site #24.50.

Average diversity has not varied much between sites. The three sites with the highest average SDI (showing least impairment) are River Miles 11.0, 10.5, and 8.0. The sites upstream of SWWTC (#24.50 to #22.80) show relatively consistent SDI scores, while the sites downstream of SWWTC (River Mile 11 to #22.51) show more varied SDI scores.

Upon examination of the average HBI, SDI and QCTV per site (depicted from upstream to downstream on Figure G-3), it would appear that the most upstream site (#24.50, Bolanz Road) was not the least stressed site; it would appear that either Site #24.00 (Station Road) or Site #23.00 is the least impacted site. Site #22.70 appears to be the most impacted by organic pollution, while River Mile 8 appears to have the least diversity. It should be noted that Site #22.70 is located downstream of three demolition material disposal sites, and the outfalls from the Ohio Canal and SWWTC. However, all of the indices are affected by habitat quality. A review of Qualitative Habitat Evaluation Index Field Sheets for the listed sites (see Appendix D) shows that Sites #22.70 and River Mile 8 are deep pools with no riffles. Sites #24.50, #24.00, and #23.00 all have a variety of local habitats that include riffles, runs and pools. According to the United States Environmental Protection Agency's (USEPA) *Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates, and Fish, Second Edition*, "Riffles are a source of high-quality habitat and diverse fauna". It is possible that lower index scores at Sites #22.70 and River Mile 8 are reflective of poorer habitat conditions as opposed to pollutions impacts.

The decline in water quality demonstrated by the EPT and tolerant organisms metrics in Figure G-3 (EPT decreasing and tolerant organisms increasing at all sites) is not supported by the HBI and QCTV scores. However, the trend demonstrated by the EPT and tolerant organisms may be due to limitations in the method (kick sampling of natural substrate) and inconsistency with timing of the sampling: some sampling was conducted early in the season, while some was conducted late in the season. Inconsistent timing may produce results more reflective of emergence of certain organisms rather than a lack of those organisms. Further sampling and monitoring is necessary to determine the extent of impacts to the studied section of the Cuyahoga River.

Table G-1, Historic and Current Years Sampled		
Site Number	**Previous Years Sampled**	**Current Report Years Sampled**
#24.50	1991, 1994, 1996	2002
#24.00	1991, 1994, 1996	2002
#23.00	1991, 1994, 1996	2002
#22.90	1991, 1993, 1996	2002
#22.80	1991, 1996	2002
River Mile 11.0	1994	2000, 2002
River Mile 10.5	1994	2000, 2002
#22.70	1991, 1994, 1996	-
River Mile 8.0	-	2000
#22.60	-	2002
#22.51	1991, 1996	2000

Table G-2, Index Scores									
Site Number	**Year**	**HBI Score**	**SDI Score**	**QCTV Score**	**Site Number**	**Year**	**HBI Score**	**SDI Score**	**QCTV Score**
#24.50	1991	4.42 (VG)	2.27	40.00 (VG)	River Mile 11.0*	1994	3.36 (E)		40.00 (VG)
	1994	4.00 (VG)	2.91	38.00 (G)		2000	3.48 (E)	3.08	39.00 (G)
	1996	4.07 (VG)	2.85	39.00 (G)		2002	3.46 (E)	3.25	38.50 (G)
	2002	3.00 (E)	2.82	39.00 (G)		Average	3.43 (E)	3.17	39.17 (MG)
	Average	3.87 (G)	2.71	39.00 (G)	River Mile 10.5*	1994	3.65 (VG)		37.00 (G)
#24.00	1991	3.41 (E)	2.19	41.00 (VG)		2000	4.08 (VG)	3.37	40.00 (VG)
	1994	3.39 (E)	2.84	40.00 (VG)		2002	3.95 (VG)	3.13	39.50 (G)
	1996	3.31 (VG)	2.52	40.00 (VG)		Average	3.89 (VG)	3.25	38.83 (G)
	2002	3.56 (VG)	3.20	38.00 (G)	#22.70	1991	4.57 (G)	2.90	33.00 (G)
	Average	3.42 (E)	2.69	39.75 (G)		1994	4.59 (G)	2.94	36.00 (G)
#23.00	1991	3.30 (E)	2.40	40.00 (VG)		1996	4.23 (VG)	2.90	40.00 (G)
	1994	3.41 (E)	2.72	40.00 (VG)		Average	4.46 VG)	2.91	36.33 (G)
	1996	3.51 (VG)	2.85	40.00 (VG)	River Mile 8.0	2000	3.89 (VG)	3.27	36.00 (G)
	2002	3.00 (E)	2.96	38.00 (MG)		Average	3.89 (VG)	3.27	36.00 (G)
	Average	3.31 (E)	2.73	40.00 (VG)	#22.60	2002	4.25 (VG)	2.49	38.00 (G)
#22.90	1991	3.20 (E)	2.28	41.00 (VG)		Average	4.25 (VG)	2.49	38.00 (G)
	1993	3.50 (E)	2.81	41.00 (VG)	#22.51	1991	3.30 (E)	2.40	35.50 (G)
	1996	3.89 (VG)	2.98	41.00 (VG)		1996	3.52 (VG)	2.70	36.00 (G)
	2002	3.98 (VG)	3.36	36.00 (G)		2000	4.17 (VG)	3.40	36.00 (G)
	Average	3.64 (VG)	2.86	39.75 (G)		Average	3.66 (VG)	2.83	35.83 (G)
#22.80	1991	3.21 (E)	2.40	41.00 (VG)					
	1996	3.48 (E)	2.61	40.00 (VG)	* = 2002 scores are an average of two sampling events				
	2002	4.27 (VG)	3.14	38.00 (G)	E=Excellent, VG=Very Good, G=Good				
	Average	3.65 (VG)	2.72	39.67 (G)	MG=Marginally Good, G/F=Good-Fair, F=Fair				

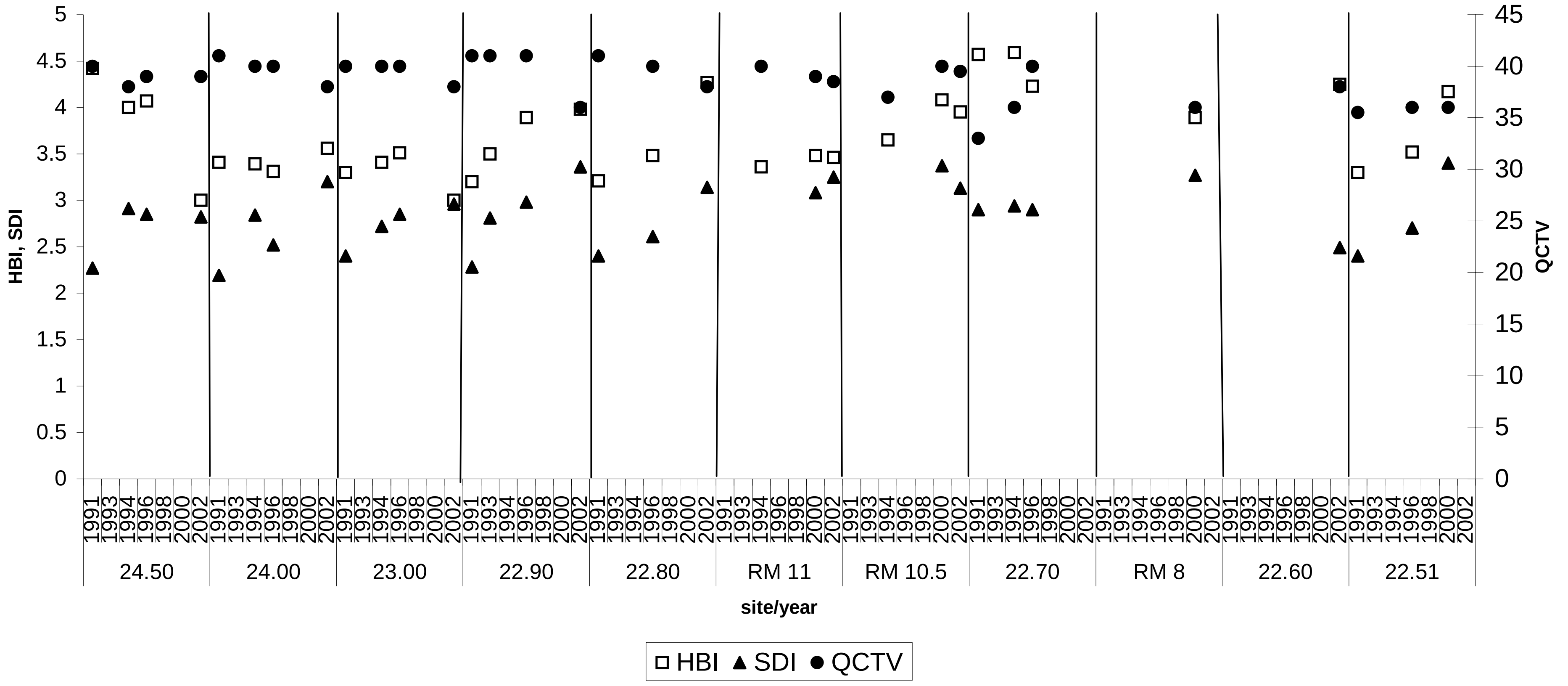
Table G-3, Other Metrics

Site Number/ Description	Year	Total Taxa	Percent EPT	Percent Mayfly	Percent Caddisfly	Percent Tribe Tanytarsini	Percent Other Dipterans and Non-Insects	Percent Tolerant Organisms	Percent Toxic Tolerant Organisms	Percent Organic Tolerant Organisms
#24.50, Bolanz Road Bridge	1991	34	63.9	12.6	51.4	0.2	35.2	2.7	1.8	20.6
	1994	49	49.8	11.6	38.2	8.5	38.6	11.0	11.4	11.8
	1996	34	56.9	12.4	51.4	2.0	34.6	15.7	3.3	15.7
	2002	70	47.8	0.1	47.7	10.3	34.2	4.6	6.3	3.8
#24.00, Station Road Bridge	1991	45	75.8	33.0	42.7	2.4	18.5	0.3	0.3	1.8
	1994	37	49.8	14.0	35.8	5.0	36.7	2.3	5.2	5.2
	1996	34	64.5	10.5	54.0	1.6	18.6	2.4	1.6	2.8
	2002	76	46.1	6.8	39.2	11.2	40.5	5.1	11.2	4.6
#23.00, Tinkers Creek	1991	37	75.8	26.0	49.6	4.7	17.1	1.5	2.4	3.7
	1994	37	52.5	14.0	38.5	3.3	34.2	2.3	4.7	10.0
	1996	42	50.5	11.3	39.1	9.9	33.2	1.1	3.5	6.6
	2002	85	44.4	1.9	42.5	3.9	40.4	6.2	3.9	11.7
#22.90, East 71st Street	1991	45	75.8	33.0	42.7	2.4	18.5	0.3	0.3	1.8
	1993	32	74.6	40.3	31.3	3.1	23.7	3.38	2.82	9.0
	1996	34	50.0	20.5	29.5	8.3	36.5	5.8	4.49	16.7
	2002	63	30.5	15.0	15.6	0.4	57.5	14.6	11.78	16.1
#22.80, Chlorine Access Bridge	1991	24	76.0	40.1	35.9	1.8	21.2	0.0	0.5	1.4
	1996	29	68.2	31.8	36.4	2.8	20.3	2.3	6.5	4.6
	2002	57	15.3	6.0	9.3	1.1	73.8	25.4	12.0	26.2
River Mile 11.0*	2000	34	43.1	27.6	15.5	1.6	35.8	9.8	5.7	8.1
	2002	50	52.6	25.0	27.5	1.5	32.0	7.5	5.7	10.33
River Mile 10.5*****	2000	45	43.3	28.4	15.0	4.6	47.4	13.9	15.0	12.4
	2002	47	38.7	12.5	26.2	1.9	41.6	7.9	8.8	14.9
#22.70, Southwest Interceptor	1991	27	20.7	18.4	2.3	1.2	54.0	4.6	1.2	18.4
	1994	26	45.8	31.3	14.5	4.8	45.8	24.1	25.3	8.4
	1996	29	32.2	15.4	16.8	12.6	37.1	22.4	22.4	1.4
River Mile 8.0	2000	65	48.7	24.7	24.0	8.9	31.8	13.6	6.0	5.0
#22.60, River Smelting	2002	40	20.0	15.3	4.7	1.6	74.5	34.1	8.2	32.6
#22.51, Lower Harvard Avenue Bridge	1991	32	61.4	52.3	9.2	0.5	34.4	5.6	6.3	5.6
	1996	35	62.6	47.7	14.9	5.5	28.9	11.9	10.2	5.5
	2000	75	40.7	26.9	13.8	2.2	53.0	21.7	21.7	7.7

Data not available for #22.70 for 1998

Toxic tolerant and organic tolerant organisms determined by "Biological Signature Taxa Lists, Urban Stream Impacts OEPA, 1998"

Figure G-1 1991-2002 Cuyahoga River Historic HBI, SDI and QCTV Scores



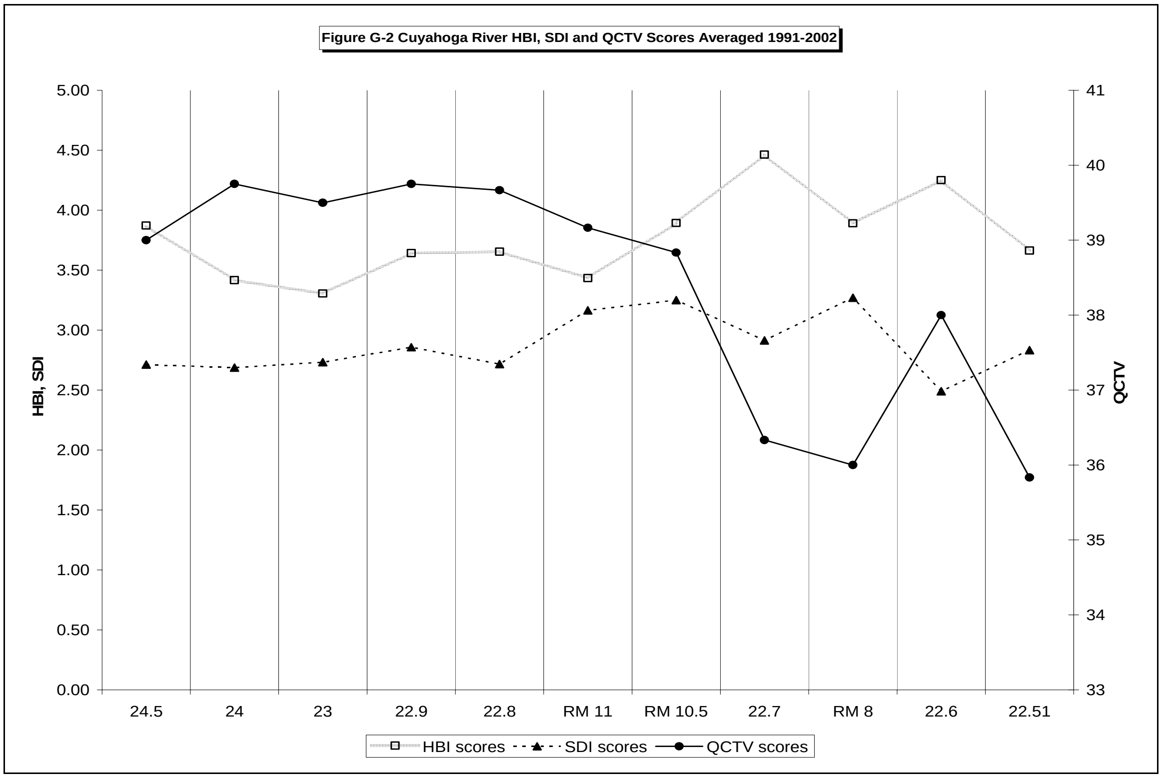


Figure G-2 Cuyahoga River HBI, SDI and QCTV Scores Averaged 1991-2002
HBI, SDI
QCTV
5.00
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
41
40
39
38
37
36
35
34
33
24.5
24
23
22.9
22.8
RM 11
RM 10.5
22.7
RM 8
22.6
22.51
HBI scores
SDI scores
QCTV scores

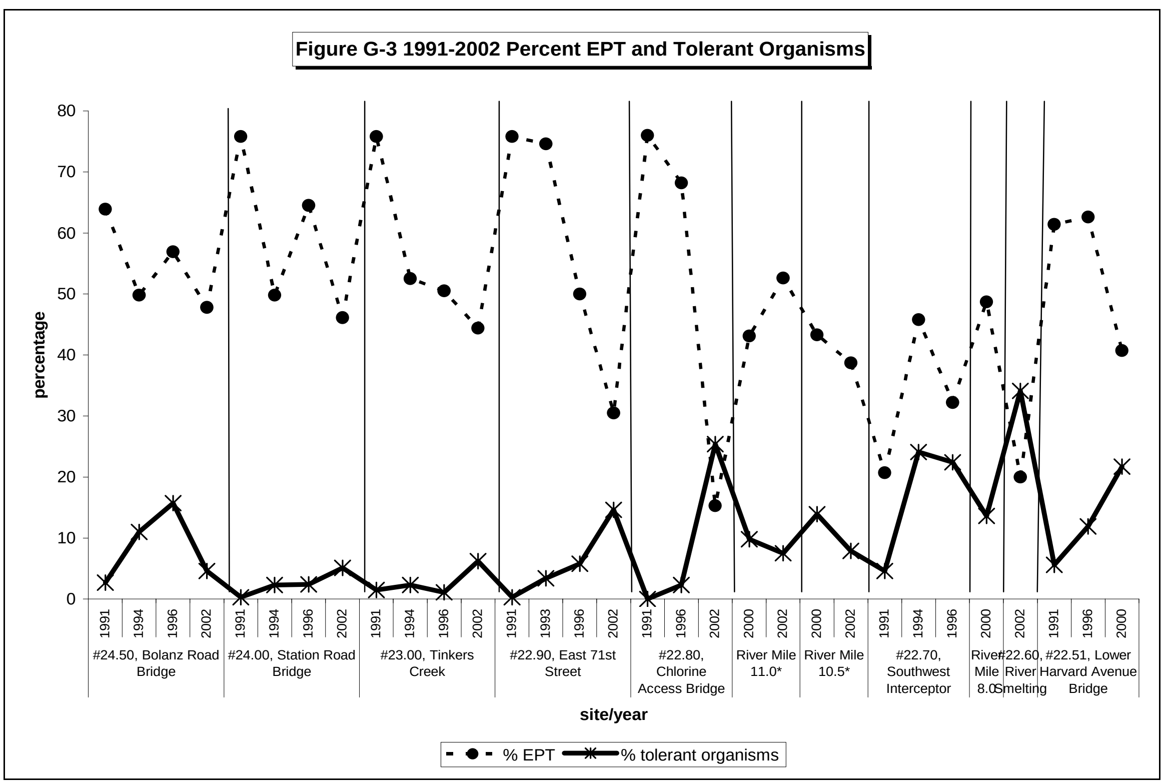


Figure G-3 1991-2002 Percent EPT and Tolerant Organisms
percentage
80
70
60
50
40
30
20
10
0
#24.50, Bolanz Road Bridge
#24.00, Station Road Bridge
#23.00, Tinkers Creek
#22.90, East 71st Street
#22.80, Chlorine Access Bridge
River Mile 11.0*
River Mile 10.5*
#22.70, Southwest Interceptor
River Mile 8.0
#22.60, River Smelting
#22.51, Lower Harvard Avenue Bridge
site/year
% EPT
% tolerant organisms

APPENDIX H
BRANDYWINE CREEK MACROINVERTEBRATE SAMPLING
1998-2002

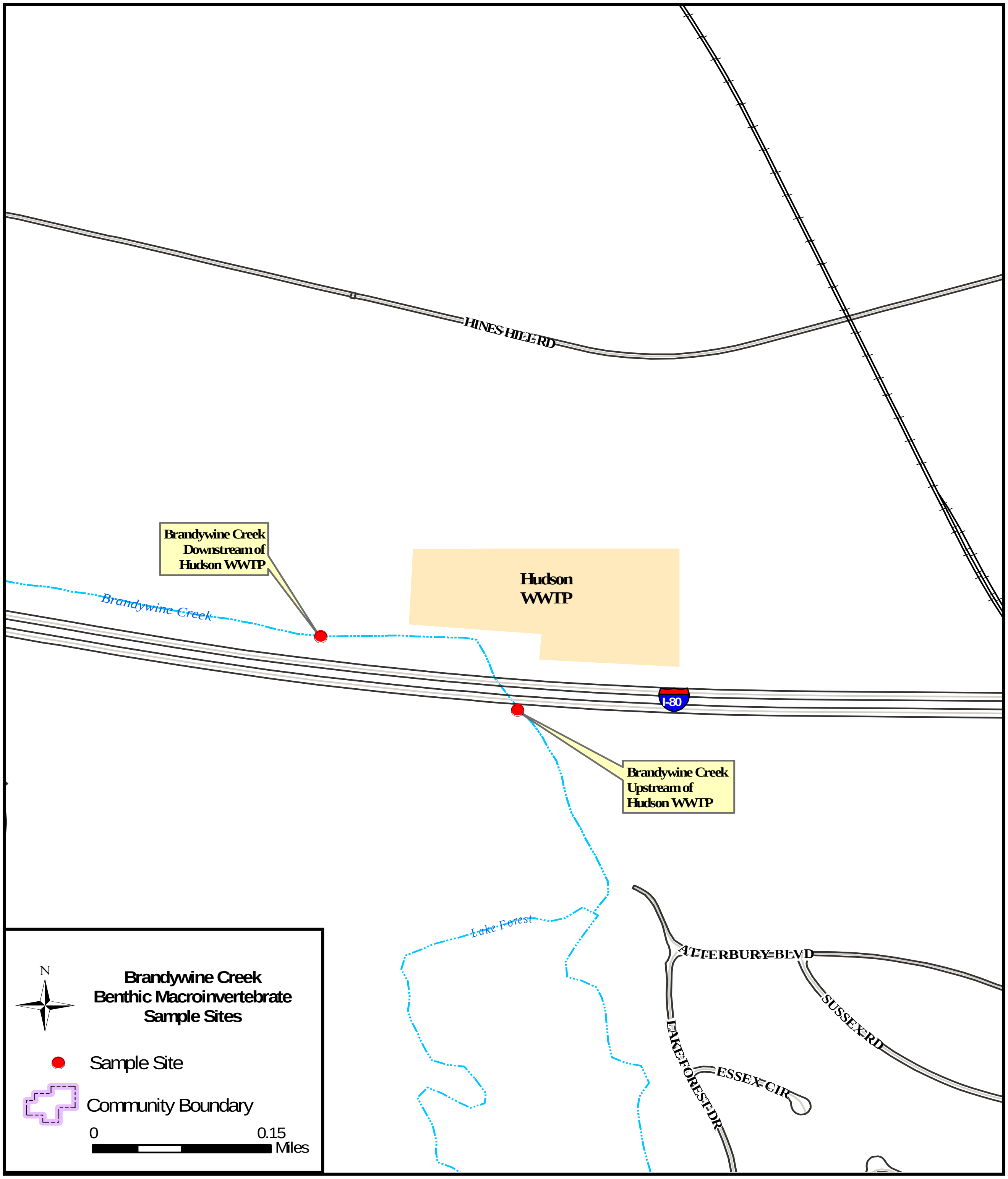
Introduction
The Hudson Wastewater Treatment Plant (WWTP) had an average daily effluent discharge of 1.5 million gallons per day to Brandywine Creek, a tributary of the Cuyahoga River that enters at River Mile (RM) 24.16. The raw influent that was tributary to the Hudson WWTP was permanently diverted to the NEORSD Southerly WWTC via the Cuyahoga Valley Interceptor when the Hudson WWTP was decommissioned in July 1998.

This study used semi-quantitative kick samples collected from available natural substrates to analyze Brandywine Creek's benthic macroinvertebrate community health and structure. Changes in water quality attributed to the decommissioning of the Hudson Wastewater Treatment Plant were determined by examining species diversity, functional feeding groups, and pollution sensitivity of the taxa collected.

Two sites were sampled in 1998 and 2002. The upstream sample site was located approximately 500 feet upstream of the Hudson WWTP, while the downstream site was approximately 500 feet downstream of the WWTP. Between the upstream and downstream locations, there were potentially two sources that could negatively influence the benthic macroinvertebrate community of Brandywine Creek during wet weather events. The potential sources were the Ohio Turnpike overpass, located approximately 100 feet downstream of the upstream site and a small, unnamed tributary with an average daily flow of 53,500 gallons per day entering under the overpass through a concrete outfall pipe structure on River Right.

Upstream land uses included the Ohio Turnpike and Lake Forest Country Club, which has a large, well-maintained golf course, through which Brandywine Creek flows. The area surrounding the country club was mainly residential. Brandywine Creek also flows through Lake Forest and Pine Lake in this area.

Habitat conditions in 1998, upstream of the WWTP, included above average instream cover that consisted of undercut banks, overhanging vegetation, rootmats, rootwads, boulders, logs and woody debris. Cobble and gravel were the main substrate types, and the sinuosity of the creek was low to moderate with good development of riffles and runs. Maximum pool depth was greater than 3 feet with a riparian zone consisting of forest swamp. A QHEI score of 75 was obtained at the upstream site. The downstream site demonstrated below average instream cover with no rootwads, boulders, or deep pools. Poor development of riffles and runs was evident, while the predominant flood plain quality was shrub or old field. A QHEI score of 57.75 was obtained at the downstream site in 1998.


HINES HILL RD
Brandywine Creek Downstream of Hudson WWTP
Hudson WWTP
Brandywine Creek
I-80
Brandywine Creek Upstream of Hudson WWTP
Lake Forest
ATTERBURY BLVD
SUSSEX RD
LAKE FOREST DR
ESSEX CIR
N
Brandywine Creek Benthic Macroinvertebrate Sample Sites
Sample Site
Community Boundary
0
0.15
Miles

2002 QHEI scores revealed below average (*poor*) habitat conditions upstream (44.25) and downstream (41) of the WWTP. The QHEI assessments showed a variety of conditions that point to poor aquatic habitat conditions. Low flow conditions may have influenced the physical habitat of the sampling zone. Examples of poor habitat features exacerbated by low flow conditions include underdeveloped pools and riffles, absence of deep pools (pools > 3 foot depths) and lack of functional substrate such as submerged boulders. In 2002, The Ohio Department of Trasportation (ODOT) initiated bridge reconstruction work on the Ohio Turnpike (Route 80). This reconstruction project took place on the bridge crossing Brandywine Creek approximately 100 feet upstream of the former Hudson WWTP effluent discharge. After completion of the bridgework, stream habitat alterations may have contributed to the lower QHEI score. The deep pools that had existed prior to bridge reconstruction had filled in with soil following excavation work. Furthermore, extensive embeddedness of stream bottom substrates from sedimentation, sparse to absent instream cover, and no riffles also appear to be a result from the work performed by ODOT in 2002.

Methods

Benthic macroinvertebrates were collected from the two locations on Brandywine Creek using a D-frame kick net. A composite of five kicks was collected at each location on the following dates: October 20, 1998; July 11, 2002; and September 6, 2002.

Quantitative sampling for macroinvertebrates was not performed on Brandywine Creek. Although semi-quantitative data was utilized in this case to evaluate individual metrics ordinarily associated with the Ohio EPA's Invertebrate Community Index (ICI), it would be inappropriate to calculate ICI scores using semi-quantitative data. The following indices were utilized to determine the presence and degree of contamination by toxic and organic pollution: Hilsenhoff Biotic Index (HBI); Ohio EPA Qualitative Community Tolerance Value (QCTV) index; Shannon Diversity Index; and Ohio EPA Toxic Tolerant, Selected Toxic Tolerant, and Organic Tolerant Organism indices. Analysis of the benthic macroinvertebrate community also included the following metrics: taxa richness; total Ephemeroptera (Mayfly) taxa and percent composition; total Trichoptera (Caddisfly) taxa and percent composition; total Diptera taxa; percent pollution tolerant composition, percent Tanytarsini midge composition; percent other Diptera and non-insect composition; and Percent Ephemeroptera, Plecoptera, and Trichoptera (EPT) composition.

Results and Discussion

The results of sampling conducted on Brandywine Creek upstream and downstream of the Hudson WWTP in 1998 and 2002 are presented in Table H-1. It should be noted that observations indicated lower than normal flow conditions in Brandywine Creek. The data for the July 11, 2002, sampling date may not be representative of normal flow conditions, and therefore, are only being presented for informational purposes and not as an indication of changes in water quality. A list of collected taxa for all sites is on file at the NEORSD WQIS office.

Hilsenhoff Biotic Index (HBI) Scores
In 1998, the HBI score for the upstream site (5.06 *Good*) was better than the downstream site (5.66 *Fair*). The difference may have been attributable to the WWTP effluent discharge to Brandywine Creek. The 2002 scores for upstream (4.12 *Very Good*) and downstream (4.33 *Very Good*) indicate notable improvement at both locations, and little to no contamination by organic pollution.

Qualitative Community Tolerance Value (QCTV) Index Scores
Between 1998 and 2002, QCTV scores stayed about the same at the upstream location while increasing at the downstream location.

Shannon Diversity Index (SDI)
In 1998, the downstream location had a SDI score of 2.16 compared with the upstream location score of 2.67. Both scores are indicative of a moderately disturbed stream, as minimally disturbed streams generally have SDI scores of 3.0 or greater. The 2002 SDI scores indicate that the downstream location (3.23) had slightly greater diversity than the upstream location (3.05). Both scores are indicative of a minimally disturbed stream. The larger increase in diversity at the downstream location may have been attributable to the decommissioning of the Hudson WWTP.

Taxa Richness
Prior to decommissioning, taxa richness upstream and downstream of the WWTP was similar (29 and 28). However, notable increases in taxa richness occurred between 1998 and 2002 at the upstream (29 to 49) and downstream (28 to 56) locations, indicating improved environmental conditions.

Ephemeroptera Plecoptera Trichoptera (EPT) Taxa
The group of organisms Ephemeroptera, Plecoptera, Trichoptera (EPT) are considered sensitive to various environmental stressors, including water quality, habitat diversity, land uses, and riparian zone quality. The number of taxa from this group of environmentally sensitive organisms increases as water, habitat, and riparian quality improve. EPT taxa richness, which prior to decommissioning was lower at the downstream (2) location than the upstream location (3), increased to 9 and 8, respectively, following decommissioning.

Total Mayfly Taxa
Examination of the 1998-2002 Mayfly taxa richness upstream and downstream of the Hudson WWTP revealed notable increases upstream (1 to 4) and downstream (2 to 4).

Total Caddisfly Taxa
Examination of the 1998–2002 Caddisfly richness for upstream and downstream of the Hudson WWTP revealed notable increases upstream (2 to 4) and downstream (0 to 5), indicating improved environmental conditions at both locations.

Total Diptera Taxa
Between 1998 and 2002, notable increases in the number of Dipteran taxa occurred at the upstream (9 to 18) and downstream locations (9 to 21).

Percent EPT Composition
In 1998, the percent EPT composition at the downstream location (1.5%) was lower than the upstream location (2.1%). In 2002, the composition at both locations increased significantly to 36.5% at the downstream location and 28.4% at the upstream location.

Percent Mayfly Composition
In 1998, Mayfly abundance at the downstream location (1.5%) was slightly higher than upstream (1.1%). In 2002, Mayfly abundance increased to 6.9% downstream and 9.3% upstream, indicating that, although slightly improved, the stream remained impacted.

Percent Caddisfly Composition
Prior to decommissioning of the WWTP, there were no Caddisflies at the downstream location, compared with 1.1% at the upstream location. In 2002, Caddisfly abundance increased to 29.6% downstream and 19.1% upstream, indicating improved water quality conditions at both locations.

Percent Tribe Tanytarsini Midge Composition
Tanytarsini Midge composition increased at both locations between 1998 and 2002. The downstream location improved from 2% to 7.1%, compared with the upstream location's change from 5.8% to 29.8%.

Percent Other Diptera and Non- Insect Composition
In 1998, the abundances of Diptera other than Tanytarsini Midges and non-insects were higher upstream of the Hudson WWTP (59%) than abundances downstream (36.5%). However, in 2002, the abundances upstream declined to 23%, while they remained relatively unchanged at the downstream location (37%). In 1998, ODOT personnel replaced fences and filled in the deep pool at the upstream site. Some of the decline may have been attributable to this change in upstream habitat.

Percent Tolerant Organism Composition
The abundance of organisms tolerant to adverse environmental conditions increased at both the downstream location (1.5% to 6.8%) and the upstream location (1.6% to 7%) in 2002.

Percent Toxic Tolerant Organism Composition
The proportion of organisms tolerant to toxic conditions increased between 1998 and 2002 at the upstream (0.5% to 4.2%) and downstream locations (0.5% to 7.8%).

Percent Organic Tolerant Organism Composition
A notable decline in the abundance of organisms tolerant to organic pollution occurred between 1998 and 2002 at both the upstream location (17% to 5%) and the downstream location (18% to 4%). The abundance of organisms tolerant to organic pollution remained slightly higher upstream of the Hudson WWTP than the downstream location following decommissioning.

Conclusions

The results suggest that decommissioning of the Hudson WWTP appears to not have had a significant impact on the benthic macroinvertebrate community of Brandywine Creek. Prior to decommissioning of the WWTP, the index scores used indicate that relatively similar conditions existed at both locations, although the downstream location exhibited a slightly greater degree of organic pollution. Between 1998 and 2002, the macroinvertebrate community improved both upstream and downstream. The degree of organic pollution as measured by the HBI decreased, while the species diversity and number of the EPT organisms present in the stream increased. The only metrics that indicated decreased water quality were those that measured the percent of pollution tolerant and toxic tolerant organisms. The scores for both locations fluctuated in a similar manner; therefore, there may be influences other than the Hudson WWTP that impact the macroinvertebrate community in Brandywine Creek.

Table H-1
Brandywine Creek Benthic Macroinvertebrate Kick Net Data
1998 and 2002

Site #	Collection Date	Number of Organisms	HBI Score	HBI Narrative Rating	QCTV Score	Shannon Diversity Index	Taxa Richness	EPT Taxa Richness	Percent EPT Composition	EPT/ Chironomidae	(Crictopus + Chironomus)/Chironomidae	Total Mayfly Taxa
Upstream	10/98	188	5.06	Good	32.1	2.67	29	3	2.1%	0.31	0.08	1
	07/02	295	5.77	Fair	27.7	2.69	31	5	19.7%	1.87	0.42	1
	09/02	430	4.12	Very Good	32.5	3.05	49	8	28.4%	0.7	0.09	4
Downstream	10/98	200	5.66	Fair	30.2	2.16	28	2	1.5%	0.43	0.14	2
	07/02	338	5.02	Good	33.2	3.42	55	7	26.9%	0.79	0.16	2
	09/02	592	4.33	Very Good	35.9	3.23	56	9	36.5%	0.99	0.13	4

Site #	Collection Date	Total Caddisfly Taxa	Total Dipteran Taxa	Percent Mayfly Composition	Percent Caddisfly Composition	Percent Tribe Tanytarsini Composition	Percent Other Dipterans and Non-Insects	Percent Tolerant Organisms	Percent Toxic Tolerant Organisms	Percent Selected Toxic Tolerant Organisms	Percent Organic Tolerant Organisms
Upstream	10/98	2	9	1.1%	1.1%	5.8%	59.0%	1.6%	0.5%	0.5%	17.0%
	07/02	4	8	2.4%	17.3%	3.4%	37.6%	13.6%	4.8%	4.4%	14.2%
	09/02	4	18	9.3%	19.1%	29.8%	23.0%	7.0%	4.2%	4.0%	5.1%
Downstream	10/98	0	9	1.5%	0.0%	2.0%	36.5%	1.5%	0.5%	0.5%	17.5%
	07/02	5	26	2.7%	24.3%	15.1%	37.3%	11.0%	6.5%	4.7%	10.4%
	09/02	5	21	6.9%	29.6%	7.1%	37.0%	6.8%	7.8%	4.9%	4.4%

APPENDIX I
BEECH HILL/BONNIEVIEW CREEK MACROINVERTEBRATE SAMPLING
1992-2002

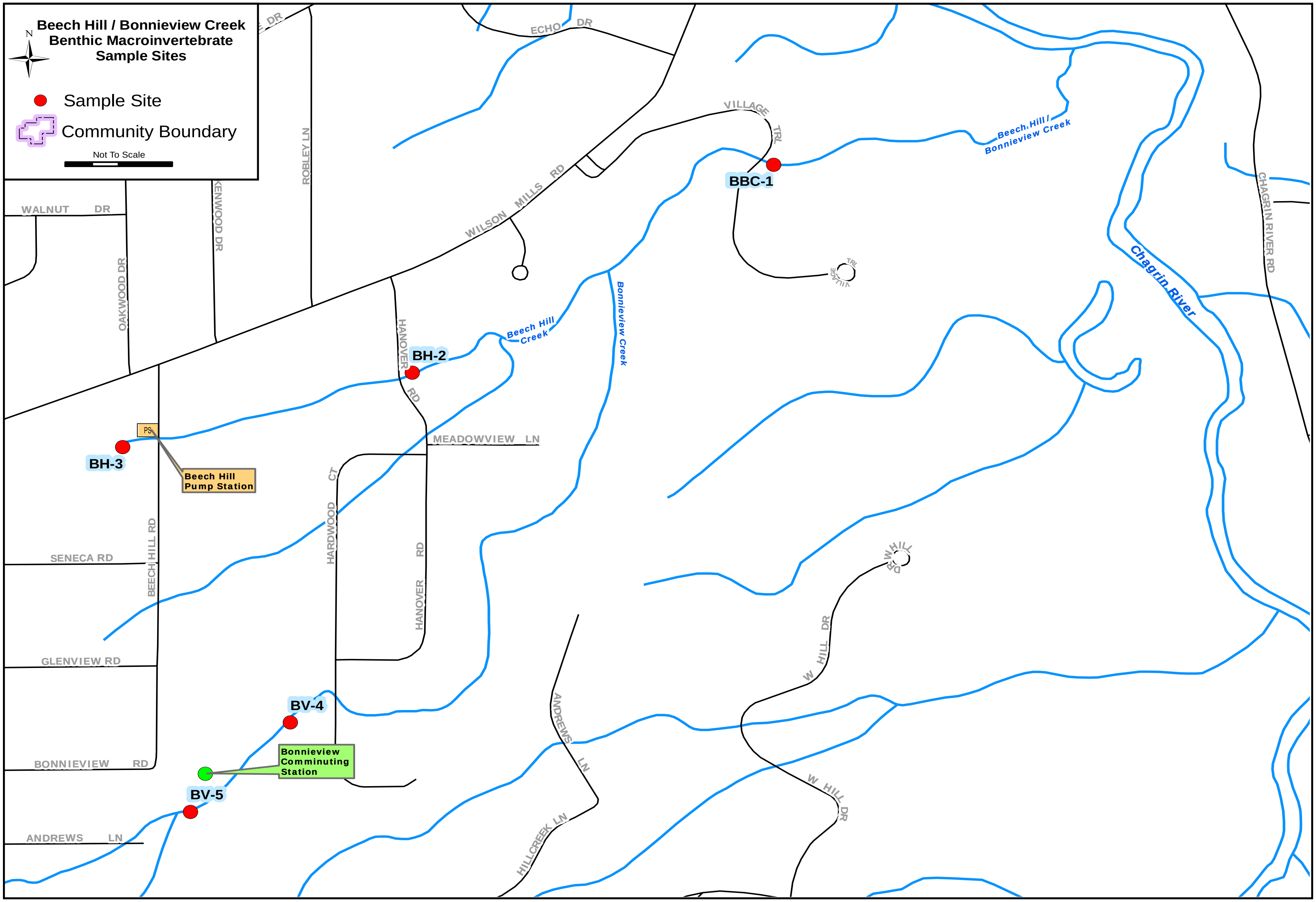
Introduction
As a result of its construction of the Heights-Hilltop Interceptor, the Northeast Ohio Regional Sewer District decommissioned the Bonnieview Comminutor Station (Beech Hill and Bonnieview Roads) on May 26, 1995, and the Beech Hill Pump Station (6330 Wilson Mills Road) on June 1, 1995. Wastewater previously tributary to the stations, now flows by gravity to the Heights-Hilltop Interceptor, and ultimately, to the Easterly Wastewater Treatment Plant.

Beech Hill Creek is a small stream which, during occasional bypass events, had received the effluent from the Beech Hill Pump Station. The creek flows east, where it is joined by the Bonnieview Creek near Village Circle. During bypass events, Bonnieview Creek had previously received flow from the Bonnieview Comminutor Station. Downstream of the confluence of Beech Hill and Bonnieview Creeks, the stream is referred to by NEORSD investigators as the Beech Hill/Bonnieview Creek (see map). The Beech Hill/Bonnieview Creek flows in an easterly direction until its confluence with the Chagrin River (RM 15.7), upstream of Site #58 (Rm 15.1).

NEORSD conducted semi-quantitative kick sampling of benthic macroinvertebrates on Beech Hill and Bonnieview Creeks in 1992, 1994 and 2002. These collections were conducted in an effort to evaluate and compare benthic macroinvertebrate community health before and after the Bonnieview Comminuting Station and Beech Hill pump station were decommissioned.

Site BBC-1 was originally located approximately 150 feet downstream from the confluence of the Beech Hill and Bonnieview Creeks, east of Village Trails. This site was selected in 1992 for an initial water quality assessment of the Beech Hill/Bonnieview Creek. During the initial survey, several septic tank effluents from residential areas tributary to Beech Hill Creek were noted. Benthic macroinvertebrate data collected at this site in 1992 indicated that fairly significant organic pollution existed. A portion of this organic pollution was attributed to the occasional bypass events at the Bonnieview and Beech Hill stations, with the remaining portion being attributed to septic tank effluents. Site BBC-1 was later moved to a location approximately 500 feet downstream of the confluence.

Four additional sampling sites were established in 1994, and sampling was conducted prior to the decommissioning of the Beech Hill Pump Station and the Bonnieview Comminutor Station. All four of the additional sites were located upstream of Site BBC-1. At the time of sampling in 1994, several housing developments, adjacent to both the Beech Hill and Bonnieview Creeks, were near completion. Sample locations were as follows:


Beech Hill / Bonnieview Creek
Benthic Macroinvertebrate
Sample Sites
N
Sample Site
Community Boundary
Not To Scale
BBC-1
BH-2
BH-3
BV-4
BV-5
PS
Beech Hill Pump Station
Bonnieview Comminuting Station
Beech Hill / Bonnieview Creek
Beech Hill Creek
Bonnieview Creek
Chagrin River
WALNUT DR
OAKWOOD DR
KENWOOD DR
ROBLEY LN
WILSON MILLS RD
ECHO DR
VILLAGE TRL
HANOVER RD
MEADOWVIEW LN
HARDWOOD CT
SENECA RD
BEECH HILL RD
GLENVIEW RD
BONNIEVIEW RD
ANDREWS LN
HILLCREEK LN
W HILL DR
CHAGRIN RIVER RD

Site BH-2 was located on Beech Hill Creek, upstream from the confluence with Bonnieview creek and downstream of the former Beech Hill Pump Station. This location is approximately 100 feet east of Hanover Road.

Site BH-3 was located on Beech Hill Creek, approximately 75 feet upstream from the former Beech Hill pump station. At this location, the creek has the characteristic of an intermittent stream with very little flow and volume. The habitat at this location was not conducive to kick-net sampling because of a lack of adequate flow velocity.

Site BV-4 was located on Bonnieview Creek at Hardwood Court, approximately 500 feet downstream of the former Bonnieview Comminutor Station and upstream of the confluence of Beech Hill Creek

Site BV-5 was located on Bonnieview Creek, approximately 100 yards upstream of the former Bonnieview Comminutor Station.

Methods

Semi-quantitative kick samples of benthic macroinvertebrates were collected using a D-frame kick net that was placed in the stream with the open end facing upstream. The substrate upstream of the net was disturbed by kicking for approximately 30 seconds. All large rocks were scraped to dislodge all invertebrates. The large rocks and debris were then visually inspected for any organisms that may have been clinging to the surface. These were removed using forceps and placed in a vial. Due to the naturally irregular distribution of benthic macroinvertebrates in streams, 3 to 5 kick samples were collected within a sampling reach and composited.

As mentioned previously, in 1992 an initial assessment was performed at Site BBC-1 only. In July 2002, when macroinvertebrate sampling was being conducted at these sites, dry weather rendered conditions at Site BH-2 non-conducive to collecting macroinvertebrates, so no samples were collected at this location. Additionally, because of the lack of permanent flow and limited habitat, no samples were collected at Site BH-3 at this time. As a result, no information is available on the condition of the macroinvertebrate community on Beech Hill Creek following the decommissioning of the Beech Hill Pump Station.

Results and Discussion

Quantitative sampling for macroinvertebrates was not performed on Beech Hill and Bonnieview Creeks. Although semi-quantitative data was utilized in this case to evaluate individual metrics ordinarily associated with the Ohio EPA's Invertebrate Community Index (ICI), it would be inappropriate to calculate ICI scores using semi-quantitative data. The macroinvertebrate community was examined using the following indices: Hilsenhoff Biotic Index (HBI); Shannon Diversity Index (SDI); and the Qualitative Community Tolerance Value (QCTV) index. The following biological metrics and measures of pollution tolerance were also used: Ephemeroptera, Plecoptera, Trichoptera (EPT) taxa richness and percent composition; total Trichoptera (Caddisfly) taxa and percent composition; total Ephemeroptera (Mayfly) taxa and percent composition; EPT/Chironomidae ratio; *Cricotopus* sp. + *Chironomus* sp. / Chironomidae ratio; total Diptera taxa; percent Tanytarsini midge composition; percent other Diptera and non-insect composition, percent Toxic Tolerant organisms, percent selected Toxic Tolerant organisms, and percent Organic Tolerant organisms. These parameters were used to determine the capacity of the aquatic ecosystem to support a balanced macroinvertebrate community.

Table I-1 summarizes the results of semi-quantitative macroinvertebrate sampling conducted on Beech Hill Creek and Bonnieview Creek in 1992, 1994, and 2002. A list of collected taxa for all sites is on file at the NEORSD WQIS office.

In 1994, 16 of the measures listed in Table I-1 (all except QCTV, percent Caddisfly composition, and total Dipteran taxa) indicate the presence of a healthier macroinvertebrate community at Site BBC-1, than at Site BV-4 or BV-5. In 2002, however, the majority of the measures examined indicated that Site BV-5 supported a healthier macroinvertebrate community than either Site BBC-1 or BV-4.

Seventeen of the 19 measures listed In Table I-1 (all except QCTV and percent caddisfly composition) indicate an improvement in the macroinvertebrate community at Site BV-5 between 1994 and 2002. Moving downstream to Site BV-4, nine of the 19 measures listed (taxa richness, Shannon Diversity Index, (Cricotopus + Chironomus)/ Chironomidae, total Dipteran taxa, percent Mayfly composition, percent tribe Tanytarsini composition, percent toxic tolerant organisms, percent selected toxic tolerant organisms, and percent organic tolerant organisms) indicated an improvement in the macroinvertebrate community between 1994 and 2002. At Site BBC-1, Table I-1 indicates that only four of the measures (taxa richness, Shannon Diversity Index, total dipteran taxa, and percent tribe tanytarsini composition) evaluated indicated an improvement in the macroinvertebrate community from 1994 to 2002.

Conclusions

Following the Northeast Ohio Regional Sewer District's decommissioning of the Bonnieview Comminutor Station and the Beech Hill Pump Station, an improvement in water quality conditions was expected downstream of these facilities as a result of the elimination of occasional discharges from the facilities to the environment. However, because of the absence of adequate flow conditions in 2002, no data were able to be obtained to ascertain the effects of the decommissioning of the Beech Hill Pump Station on downstream water quality in Beech Hill Creek.

Semi–quantitative macroinvertebrate sampling conducted following the decommissioning of the former Bonnieview Comminutor Station generally indicated an improved macroinvertebrate community upstream at Site BV-5. However, despite the expectation of an improved macroinvertebrate community, mixed results were observed downstream of the Bonnieview Comminutor Station at Site BV-4, and a general decline in the condition of the macroinvertebrate community was noted at Site BBC-1, the furthest downstream site. The decline suggests that factors other than the elimination of the discharge from the former comminutor station may be influencing the downstream macroinvertebrate community. One potential factor is the effects of increased urbanization that has occurred in the area since 1994. Since this time, fifteen homes have been constructed on two streets, Village Trails and Village Circle, near Beechhill and Bonnieview Creeks. Changes in catchment land cover attributed to urbanization can impact stream ecosystems through altered hydrology and subsequent increases in sedimentation and non-point source pollutants (Roy et al. 2003). Urban non-point source insults, including excessive sediment yield, particularly from construction sites (Wolman and Schnick, 1967), increases in impervious surfaces (Meade et al. 1990, Trimble 1997), reduced riparian forest cover (Waters 1995), chemical inputs and flash flows can decrease diversity (biological and habitat), and modify stream morphology. These can also result in adverse hydrological conditions and a poor macroinvertebrate community.

Table I-1
Beech Hill / Bonnieview Creek Benthic Macroinvertebrate Kick Net Data
1992, 1994 and 2002

Site #	Collection Date	Number of Organisms	HBI Score	HBI Narrative Rating	QCTV Score	Taxa Richness	Shannon Diversity Index	EPT Taxa Richness	Percent EPT Composition	EPT / Chironomidae	(Cricotopus+ Chironomus)/ Chironomidae	Total Mayfly Taxa
1	07/03/02	862	4.80	Good	36.1	51	2.86	6	39.2	1.09	0.48	1
	07/12/94	232	4.45	Very Good	39.5	34	2.63	10	46.1	1.75	0.03	2
	07/02/92	639	4.84	Good	36.6	49	2.94	4	8.6	0.18	0.12	1
2	07/12/94	193	3.42	Excellent	35.9	25	2.09	4	40.9	1.46	0.13	1
4	07/18/02	372	5.71	Fair	33.3	44	2.88	5	23.4	0.43	0.42	1
	07/11/94	219	5.36	Good	34.5	29	2.52	5	32.0	1.00	0.60	1
5	07/03/02	1444	4.18	Very Good	35.2	68	2.74	6	51.9	2.68	0.17	1
	07/11/94	143	5.70	Fair	36.4	19	2.41	3	21.0	0.79	0.26	0

Site #	Collection Date	Total Caddisfly Taxa	Total Dipteran Taxa	Percent Mayfly Composition	Percent Caddisfly Composition	Percent Tribe Tanytarsini Composition	Percent Other Dipterans and Non-Insects	Percent Tolerant Organisms	Percent Toxic Tolerant Organisms	Percent Selected Toxic Tolerant Organisms	Percent Organic Tolerant Organisms
1	07/03/02	5	31	27.0	12.2	3.5	55.7	20.8	13.9	10.9	24.7
	07/12/94	8	16	29.3	16.8	1.3	50.9	4.7	6.9	1.7	22.0
	07/02/92	3	33	7.8	0.8	9.9	77.0	29.3	5.6	2.5	34.0
2	07/12/94	3	14	1.0	39.9	7.8	48.2	4.2	14.0	4.2	24.9
4	07/03/02	4	26	10.2	13.2	6.7	65.1	25.5	3.2	3.0	27.2
	07/11/94	4	18	5.5	26.5	0.9	66.2	6.4	21.0	18.7	30.6
5	07/03/02	5	39	32.8	19.1	2.0	41.4	6.2	8.9	3.1	15.4
	07/11/94	3	10	0.0	21.0	0.0	74.8	7.7	12.6	7.0	39.9

APPENDIX J
TINKERS CREEK MACROINVERTEBRATE SAMPLING
2000

Introduction

In 2000, the Northeast Ohio Regional Sewer District (NEORSD) conducted semi-quantitative benthic macroinvertebrate sampling at Tinkers Creek Sites #42, #41, #40 and #39 to analyze the stream's benthic macroinvertebrate community health and structure. Please see the Tinkers Creek section of this report for a description of sampling locations.

Methods

Semi-quantitative kick samples of benthic macroinvertebrates were collected using a D-frame kick net that was placed in the stream with the open end facing upstream. The substrate upstream of the net was disturbed by kicking for approximately 30 seconds. All large rocks were scraped to dislodge all invertebrates. The large rocks and debris were then visually inspected for any organisms that may have been clinging to the surface. These were removed using forceps and placed in a vial. Due to the naturally irregular distribution of benthic macroinvertebrates in streams, 3 to 5 kick samples were collected within a sampling reach and composited.

Quantitative sampling for macroinvertebrates was not performed on Tinkers Creek. Although semi-quantitative data was utilized in this case to evaluate individual metrics ordinarily associated with the Ohio EPA's Invertebrate Community Index (ICI), it would be inappropriate to calculate ICI scores using semi-quantitative data. The following indices were utilized to determine the presence and degree of contamination by toxic and organic pollution: Hilsenhoff Biotic Index (HBI); Ohio EPA Qualitative Community Tolerance Value (QCTV) index; Shannon Diversity Index; and Ohio EPA Toxic Tolerant, Selected Toxic Tolerant, and Organic Tolerant Organism indices. Analysis of the benthic macroinvertebrate community also included the following metrics: taxa richness; total Ephemeroptera (Mayfly) taxa and percent composition; total Trichoptera (Caddisfly) taxa and percent composition; total Diptera taxa; percent pollution tolerant composition, percent Tanytarsini midge composition; percent other Diptera and non-insect composition; and Percent Ephemeroptera, Plecoptera, and Trichoptera (EPT) composition.

Results and Discussion

Table J-1 summarizes the results from sampling conducted on Tinkers Creek in 2000 and includes results from 1991, 1994, and 1998 for comparison. Note that Sites #39 and #42 were not sampled in 1991. HBI scores for Tinkers Creek are displayed in Figure J-1. A list of collected taxa for all sites is on file at the NEORSD Water Quality and Industrial Surveillance offices.

In 2000, the macroinvertebrate community in Tinkers Creek was either *Very Good* or *Excellent* at all locations according to the HBI and QCTV index. These ratings are supported by the low percentage of tolerant organisms and high percentage of caddisflies at each site. There were no longitudinal trends when moving from the upstream to downstream sites, although improvements occurred at all four sites when comparing the 2000 results to past sampling years.

HBI scores improved at Site #42 since 1994 from *Good* to *Very Good* to *Excellent*. Other measures that suggest improvements in water quality at this location from 1994 to 2000 include the following: increases in the percentage of EPT Taxa (36.9% to 77.4%) and Caddisfly (21.93% to 74.48%) and decreases in the percentage of Other Dipteran and Non-insects (50.80% to 15.90%), Tolerant Organisms (15.78% to 4.6%), Toxic Tolerant Organisms (18.98% to 3.35%), and Organic Tolerant Organisms (22.73% to 3.77%). Measures that indicate a decline in water quality include the Shannon Diversity Index (SDI) and percent Mayfly and Tribe Tanytarsini compositions.

HBI scores at Site #41 improved from *Good* to *Very Good* from 1991 to 2000. The SDI score also increased from 1.53 in 1991 to 2.39 in 2000. These increases, along with a greater number of taxa collected indicate that improvements in the health of the benthic macroinvertebrate community may have occurred during this time period. However, the abundance of tolerant organisms also increased from 2.3% to 5.0% for Tolerant, 0.9% to 3.0% for Toxic Tolerant, and 1.7% to 6.0% for Organic Tolerant organisms, potentially indicating higher levels of pollution.

The HBI score at Site #40 improved from 4.52 (*Good*) in 1991 to 3.59 (*Very Good*) in 2000. In addition, SDI scores increased from 1.85 in 1991 to 2.49 in 2000. The sample collected in 1994 had the highest Taxa richness (40), while the highest SDI score (2.83) was recorded in 1998. The increases in taxa richness and diversity, along with steady improvement in HBI scores indicate possible improvements in the health of the benthic macroinvertebrate community. This may be attributable to changes in the water quality of Tinkers Creek. However, between 1991 and 2000, the abundance of tolerant organisms increased slightly from 1.51% to 5.12% for Percent Tolerant and 3.21% to 5.12% for Organic Tolerant organisms, potentially indicating higher levels of pollution.

As with the upstream locations, the HBI score at Site #39 also improved over the period from 1994 to 2000, although the narrative rating remained *Very Good*. The total number of taxa declined slightly in 2000 compared to 1991. However, the SDI score increased from 2.53 to 2.96, indicting slightly increased diversity. The abundance of tolerant organisms decreased from 13.27% to 5.95% for Toxic Tolerant and 11.44% to 9.63% for Organic Tolerant. The SDI scores and tolerant organism abundances indicate that the water quality of Tinkers Creek may have changed, with the benthic macroinvertebrate community responding positively.

Conclusions

Results from sampling in Tinkers Creek from 1991 to 2000 generally show that water quality has improved over that time period. Decreases in HBI scores at all sites suggest water quality improvements that may be attributable to reductions in organic pollution in the stream. However, at Sites #41 and #40, the percentage of organic tolerant organisms increased, contradicting trends indicated by the HBI. A decrease in the abundance of mayflies at all of the sites also indicates that more pollution may be present. Continued monitoring may be warranted to determine if sources of stress are present, and therefore, impacting Tinkers Creek macroinvertebrate communities.

Table J-1
Tinkers Creek Benthic Macroinvertebrate Kick Net Data
1991, 1994, 1998, and 2000

Site #	Collection Date	Number of Organisms	HBI Score	HBI Narrative Rating	QCTV Score	Shannon Diversity Index	Taxa Richness	EPT Taxa Richness	Percent EPT Composition	EPT/ Chironomidae	(Crictopus + Chironomus)/ Chironomidae	Total Mayfly Taxa
42	-		-	-	-	-	-	-	-	-	-	-
	09/30/94	374	4.88	Good	38.4	2.91	42	8	36.9	1.17	0.38	3
	09/16/98	193	3.53	Very Good	38.1	2.95	34	8	57.5	3.26	0.12	4
	11/08/00	239	3.50	Excellent	40.7	1.91	26	8	77.4	14.23	0.08	3
41	07/11/91	451	5.03	Good	38.0	1.53	23	6	89.5	22.00	0.07	3
	09/30/94	344	3.64	Very Good	36.4	1.97	33	8	77.6	10.94	0.22	4
	09/14/98	119	3.42	Excellent	37.9	2.73	24	7	50.4	2.73	0.00	5
	11/03/00	200	3.62	Very Good	37.4	2.39	32	8	62.0	6.20	0.20	4
40	07/11/91	529	4.52	Good	38.4	1.85	21	8	76.4	28.86	0.14	4
	09/23/94	683	4.02	Very Good	36.8	2.38	40	6	65.5	3.96	0.20	2
	09/15/98	130	3.95	Very Good	40.2	2.83	31	9	58.5	2.62	0.10	4
	11/03/00	215	3.59	Very Good	39.3	2.49	27	8	63.3	12.36	0.36	3
39	-		-	-	-	-	-	-	-	-	-	-
	09/23/94	603	4.18	Very Good	39.7	2.53	36	9	58.7	2.01	0.46	3
	09/14/98	190	3.74	Very Good	37.5	2.82	35	10	50.5	1.37	0.14	4
	11/01/00	135	3.77	Very Good	36.6	2.96	34	10	49.6	2.91	0.35	5

Site #	Collection Date	Total Caddisfly Taxa	Total Dipteran Taxa	Percent Mayfly Composition	Percent Caddisfly Composition	Percent Tribe Tanytarsini Composition	Percent Other Dipterans and Non-Insects	Percent Tolerant Organisms	Percent Toxic Tolerant Organisms	Percent Selected Toxic Tolerant Organisms	Percent Organic Tolerant Organisms
42	-	-	-	-	-	-	-	-	-	-	-
	09/30/94	5	25	14.97	21.93	8.56	50.80	15.78	18.98	15.51	22.73
	09/16/98	4	17	24.87	32.64	6.74	20.73	3.63	3.11	2.07	5.18
	11/08/00	4	6	2.51	74.48	0.00	15.90	4.60	3.35	0.42	3.77
41	07/11/91	3	10	26.45	63.08	0.87	6.69	2.33	0.87	0.29	1.74
	09/30/94	4	17	13.08	64.52	1.11	19.51	4.66	4.66	2.22	5.99
	09/14/98	2	10	36.13	14.29	5.88	29.41	5.04	2.52	0.00	4.20
	11/03/00	4	9	19.00	43.00	1.00	26.00	5.00	3	0.50	6.00
40	07/11/91	4	8	35.35	41.02	0.19	23.44	1.51	0.95	0.38	3.21
	09/23/94	4	25	17.72	47.73	1.90	32.36	2.20	4.83	4.39	15.96
	09/15/98	5	12	13.85	44.62	0.77	37.69	0.77	2.31	2.31	6.15
	11/03/00	5	6	18.60	44.65	0.00	32.56	5.12	0.47	0.47	5.12
39	-	-	-	-	-	-	-	-	-	-	-
	09/23/94	6	24	17.08	41.63	4.64	36.32	3.32	13.27	12.94	11.44
	09/14/98	6	18	24.21	26.32	4.74	42.11	2.63	9.47	5.79	7.89
	11/01/00	5	12	10.37	39.26	0.00	40.74	4.44	5.93	5.19	9.63

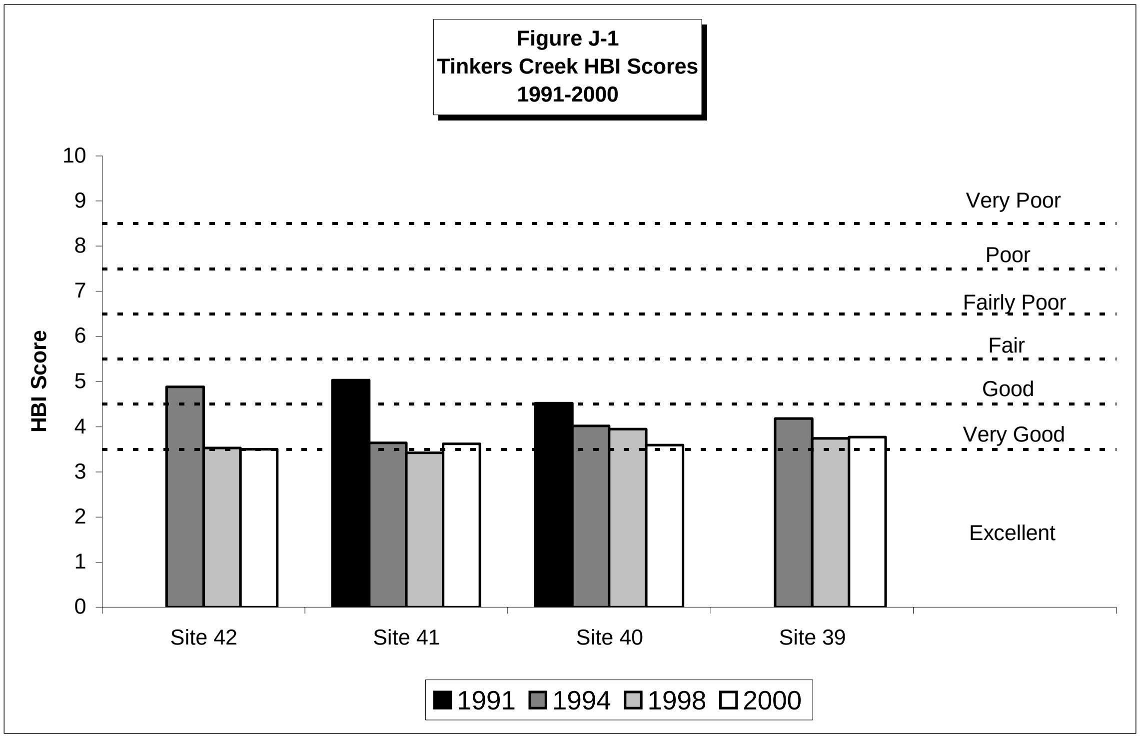


Figure J-1
Tinkers Creek HBI Scores
1991-2000
HBI Score
10
9
8
7
6
5
4
3
2
1
0
Very Poor
Poor
Fairly Poor
Fair
Good
Very Good
Excellent
Site 42
Site 41
Site 40
Site 39
1991
1994
1998
2000

APPENDIX K
ABRAM CREEK AND ROCKY RIVER MACROINVERTEBRATE SAMPLING
1999

Introduction
Abram Creek is a tributary of the Rocky River, which flows into Lake Erie. This study analyzed macroinvertebrate community health and structure in Abram Creek and the Rocky River prior to and following the decommissioning of two wastewater treatment plants. The Middleburg Heights WWTP, located at 18825 Sheldon Road, was a secondary treatment facility that discharged an average daily flow of 2 million gallons per day (mgd) to Abram Creek at River Mile (RM) 4.8. The Brook Park WWTP, located at 19400 Plant Lane, was another secondary treatment facility that discharged an average daily flow of 900,000 gallons per day to Abram Creek at RM 4.3. The Middleburg Heights plant was decommissioned on December 30, 1992, and the Brook Park plant was decommissioned on January 6, 1993. The combined influent flow of 2.9 mgd is now conveyed to the NEORSD Southerly WWTC via the Southwest Interceptor (SWI).

Sampling Methods
Macroinvertebrates in Abram Creek and the Rocky River were sampled quantitatively, prior to and following the decommissioning, for six-week periods in 1992 and 1999 using multi-plate artificial substrate samplers (modified Hester-Dendy). The data generated from the samples were used to calculate Invertebrate Community Index scores.

Qualitative and semi-quantitative sampling was also conducted in 1992 and 1999 at all sites, in 1993 at sites AC-3 and AC-5, in 1994 at sites AC-5, RR-6 and RR-7, and in 1996 at RR-6 and RR-7. It consisted of 5 kicks from available habitats including riffles/runs and margins. Hand picking of all available substrates was also performed. The following indices were utilized to examine the macroinvertebrate community: the Shannon Diversity Index (SDI); the Hilsenhoff Biotic Index (HBI); the Ohio EPA Qualitative Community Tolerance Value (QCTV) index; and the Ohio EPA Toxic Tolerant, Selected Toxic Tolerant, and Organic Tolerant Organism indices.

Study Sites
Benthic macroinvertebrate samples were collected at five locations on Abram Creek: upstream and downstream of both the Middleburg Heights and Brook Park WWTP effluents, 0.04 miles upstream from the confluence with the Rocky River, and in the Rocky River upstream and downstream of the confluence with Abram Creek.

Descriptions of the sites are as follows:

<u>Site AC-1 (RM 4.9)</u>
Site AC-1 (41° 23.226 N 81° 50.153 W) is located 50 feet upstream of the Middleburg Heights WWTP effluent.

Abram Creek Site AC-2 (RM 4.6)
Site AC-2 (41° 23.308 N 81° 50.146 W) is located about 100 yards downstream of the Middleburg Heights WWTP effluent.

Site AC-3 (RM 4.4)
Site AC-3 (41° 23.417 N 81° 50.137 W) is located about 25 yards upstream of the Brook Park WWTP effluent.

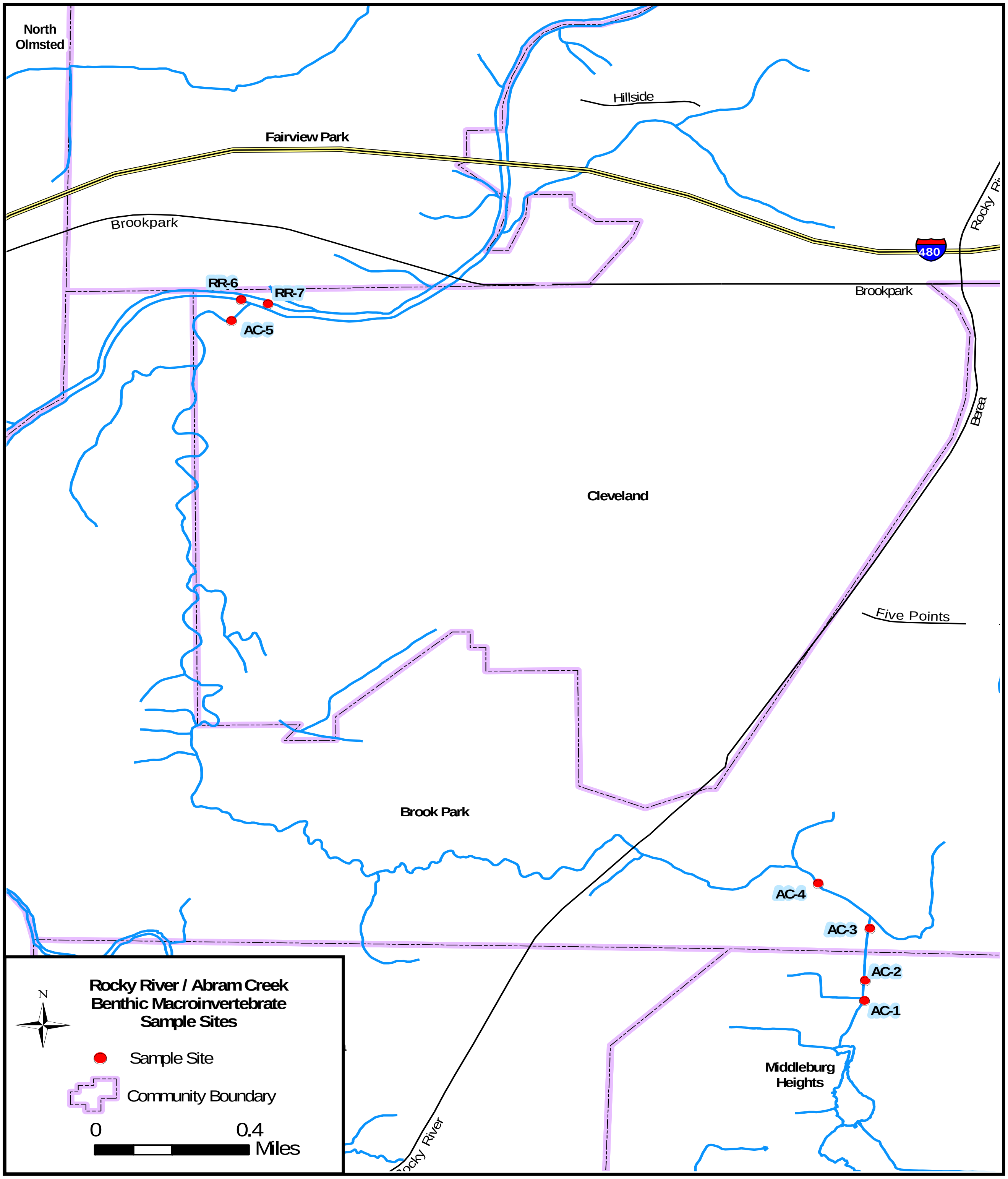
Site AC-4 (RM 4.2)
Site AC-4 (41° 23.486 N 81° 50.199 W) is located about 100 yards downstream of the Brook Park WWTP effluent.

Site AC-5 (RM 0.04)
Site AC-5 (41° 25.030 N 81° 52.049 W) is located about 75 yards upstream of the confluence with the Rocky River.

Site RR-6
Site RR-6 (41° 25.075N 81° 52.011W) is located upstream of the confluence with Abram Creek.

Site RR-7
Site RR-7 (41° 25.077N 81° 51.924W) is located downstream of the confluence with the Rocky River.

In this area, Abram Creek flows through a channelized section with low banks on both sides. The gradient between sites AC-1 and AC-4 is approximately 7.5 feet per mile, with a predominately residential land use. The riparian zone on both sides is less than 50 yards. The creek in this section is channelized, with a maximum depth of 1.5 to 3.0 feet. The substrate has a significant amount of peat and muck deposited at an average thickness of 3 to 5 inches. There are no riffles present at these locations, and the flow is nearly undetectable. The slow current and increased depth downstream of Site AC-2 may be attributed to the presence of a concrete box culvert structure that is narrower than the stream channel at the Sheldon Road Bridge. This structure restricts the flow of the creek, allowing suspended peat to settle on the substrate. At Site AC-5, the predominately forested riparian zone is greater than 50 yards wide on both banks.


North Olmsted
Hillside
Fairview Park
Brookpark
RR-6
RR-7
AC-5
480
Brookpark
Rocky River
Berea
Cleveland
Five Points
Brook Park
AC-4
AC-3
AC-2
AC-1
Middleburg Heights
Rocky River
Rocky River / Abram Creek Benthic Macroinvertebrate Sample Sites
N
Sample Site
Community Boundary
0
0.4
Miles

The Rocky River macroinvertebrate collection sites upstream and downstream of Abram Creek are located within the Rocky River Reservation of the Cleveland Metroparks. The riparian zone is greater than 100 yards on both banks, with river left consisting of a forested floodplain and river right consisting of shale cliffs with woods beyond. The sites are separated by the narrow forested gorge that contains Abram Creek. The Rocky River is approximately 120 feet wide at this location with a stable substrate comprised of cobble to boulder sized rocks. The river in this area is predominantly fast riffles and deep runs. Other WWTPs located upstream of the Rocky River sites that may have affected the macroinvertebrate community when they were in use include the Berea and Strongsville "A" plants. They were decommissioned on October 15, 1993 and July 18, 1994, respectively.

Results and Discussion

Tables K-1 through K-3 summarize the results of quantitative and semi-quantitative macroinvertebrate sampling conducted on Abram Creek and the Rocky River in 1992, 1993, 1994, 1996 and 1999. Although semi-quantitative data was utilized in this case to evaluate individual metrics ordinarily associated with the Ohio EPA's Invertebrate Community Index (ICI), it would be inappropriate to calculate ICI scores using semi-quantitative data. A list of collected taxa for all sites is on file at the NEORSD WQIS office.

Invertebrate Community Index

Following decommissioning of the two WWTPs, ICI scores increased at all sites except for AC-1, which was located upstream of the Middleburg Heights WWTP effluent (Figure K-1). In 1999, AC-5 scored 48 (*Exceptional*), a significant increase over the 18 received in 1992. This location, along with the two sites in the Rocky River, exceeded the warmwater habitat criterion score of 34. The increases in ICI scores downstream of the WWTPs in Abram Creek suggest that water quality has improved following decommissioning. In the Rocky River, the upstream site improved more than the downstream site, suggesting that decommissioning of the WWTPs had no effect on water quality in the river.

Hilsenhoff Biotic Index

Tolerance values adjusted for Ohio (Barbour, et. al, 1999) were used in the calculation of the HBI in samples from sites AC-1 to AC-5 for the period 1992 to 1999. In 1999, Abram Creek Sites AC-1, AC-3 and AC-4 had scores with narrative ratings of *Fairly Poor*, which were similar to 1992. Sites AC-2 and AC-5 scored higher, with a 6.45 (*Fair*) and 3.85 (*Very Good*), respectively.

The 1999 HBI scores for AC-1 to AC-4 indicate that fairly significant levels of organic enrichment may have been present in Abram Creek. The samples at sites AC-2, AC-3, and AC-4 were collected outside of the recommended sampling period, and therefore, the higher scores may be due to higher water temperatures and lower dissolved oxygen concentrations found in summer compared to those in spring or fall. These scores may also reflect the influence that habitat and hydrological conditions (deep and extremely slow flow, with high water temperature and low dissolved oxygen) have on the structure of the benthic macroinvertebrate community (increased abundance of organisms tolerant to extreme environmental and hydrological conditions).

In the Rocky River, the HBI scores calculated from the semi-quantitative sampling improved at both sites from 1992-1999. Site RR-6 improved from 5.01 (*Good)* to 3.14 (*Excellent*) while Site RR-7 improved from 4.79 (*Good*) to 3.60 (*Very Good*). The ratings calculated from the kick samples were all in the *Very Good* or *Excellent* categories for the same time period. These scores indicate the presence of low levels of organic pollution in the Rocky River.

Qualitative Community Tolerance Value index
Between 1992 and 1999, the QCTV scores calculated from the kick sampling increased at AC-1, AC-2 and AC-5, with the scores at the other two Abram Creek sites remaining generally the same and the two Rocky River sites decreasing slightly. The scores from both years, at all of the sites except for AC-5, indicate a disturbed invertebrate community. Examination of the various community metrics used in the calculation of the ICI indicate that the benthic macroinvertebrate community may be impacted by negative environmental influences and poor hydrological conditions such as poor habitat and nonpoint sources of organic enrichment within the watershed upstream of this location.

Shannon Diversity Index and Taxa Richness
In Abram Creek, the SDI remained about the same from 1992 to 1999, except at AC-3, where it increased. The number of taxa increased at all five sites during the same time period, with the greatest increase at sites AC-4 and AC-5. The SDI and number of taxa decreased at both locations in the Rocky River from 1992 to 1999. A larger decrease occurred at Site RR-6 for both measures. A large proportion of the decrease in Taxa Richness came from a reduction in the number of Dipteran taxa.

Percent EPT, Mayfly, and Caddisfly Composition
Following the decommissioning of the two WWTPs, the number of EPT taxa and their percent composition in the Hester-Dendy samples remained relatively unchanged at sites AC-1, AC-2, AC-3, and AC-4. There were, however, significant increases in these organisms at sites AC-5, RR-6 and RR-7. These increases came mostly from Caddisflies, as the percentage of Mayflies remained relatively the same at all three sites from 1992 to 1999.

Percent Tanytarsini Midge Composition
An increase in Hester-Dendy Tanytarsini Midge composition at Site AC-5 (0.4% to 33.6%) and RR-7 (1.94 to 7.28) occurred between 1992 and 1999. In contrast, sites AC-2 to AC-4 and RR-6 had a decreased composition following decommissioning. The decreases in Abram Creek may actually be attributable to reduced flow velocities, whereas the increase at AC-5 and RR-7 may be attributable to water quality improvements. Tanytarsini Midges were absent from Hester-Dendy samples at AC-1 in 1992 and 1999.

Percent Other Dipterans and Non-Insect Composition
Examination of the 1992 and 1999 Hester-Dendy other Dipterans and Non-Insect composition showed a decline at all locations on both Abram Creek and the Rocky River. The greatest decline was at Site AC-5, where composition declined from 99.4% to 35.8%.

Percent Tolerant, Toxic Tolerant, Selected Toxic Tolerant, and Organic Tolerant Organism Composition
In Abram Creek, the group of organisms used in the calculation of the ICI that are listed by the Ohio EPA as tolerant to negative environmental conditions had a decline in abundance between 1992 and 1999 at all sites except for Site AC-3 (63.3% to 75.6%), where the abundance increased. The most significant declines were recorded for AC-2 (92.1% to 33.1%) and AC-5 (56.7%to 5.9%). There was a decline in the abundance of Toxic Tolerant organisms at all locations in the artificial substrate samplers during this same time period, with the greatest reduction recorded for Site AC-5 (67.6% to 6.5%). At Site AC-1, Toxic Tolerant organisms declined slightly, from 46.9% to 46.1%. The proportion of Organic Tolerant organisms in artificial substrate samplers increased from 1992 to 1999 at AC-2 (72.3% to 76.9%), AC-3 (30% to 52.1%), and AC-4 (34.9% to 54.6%). At sites AC-1 and AC-5, Organic Tolerant organism composition declined (48.2% to 46.5% and 17.4% to 3.2%)

In the Rocky River, a decline in the proportions of Tolerant organisms, Toxic Tolerant organisms, and Selected Toxic Tolerant organisms occurred between 1992 and 1999 at both sites. A decline in the proportion of Organic Tolerant organisms was also observed at RR-7; however, this measure remained approximately the same at RR-6. These changes suggest that improvements in water quality occurred at both locations over this time period.

Conclusions
Improvements in water quality and benthic macroinvertebrate communities at the furthest downstream location, Site AC-5, have been observed since the decommissioning of the two WWTPs within the Abram Creek watershed in 1992 and 1993. The results of the benthic macroinvertebrate data, as indicated by the ICI and QCTV scores, indicate that Abram Creek at this site is capable of supporting a moderately diverse benthic macroinvertebrate community. The lower degree of improvement observed at Abram Creek sites AC-2 through AC-4 may be attributable to the presence of some organic pollution and unidentified stresses influencing the stream at these locations. Habitat and hydrological conditions, especially lower flows that may have resulted from decommissioning of the WWTPs, can negatively impact the benthic macroinvertebrate community. However, as indicated by AC-5, the macroinvertebrate community at the upstream locations has the potential to improve once these stressors are identified and eliminated.

In general, the ICI, HBI, and QCTV scores collected between 1992 and 1999 in the Rocky River upstream and downstream of its confluence with Abram Creek indicate improvement in the health of the benthic macroinvertebrate community that may be indicative of improvements in water quality. This is supported by increases in Caddisflies, along with significant declines in tolerant organisms. These changes may be attributable to the decommissioning of the Berea and Strongsville “A” WWTPs on October 15, 1993 and July 18, 1994, respectively. It is unclear whether decommissioning of the Middleburg Heights and Brook Park WWTPs had a significant impact on water quality since both locations improved in a similar manner.

Table K-1
Abram Creek and Rocky River Benthic Macroinvertebrate Hester-Dendy Data
1992, 1993, 1994, and 1999

Site #	Collection Date	ICI Score	HBI Score	HBI Narrative Rating	QCTV Score	Shannon Diversity Index	Taxa Richness	EPT Taxa Richness	Percent EPT Composition	EPT/ Chironomidae	(Crictopus + Chironomus)/ Chironomidae	Total Mayfly Taxa
AC-1	09/15/92	20	7.13	Fairly Poor	28.4	1.53	30	4	0.18	0	0.02	1
	09/04/99	18	6.86	Fairly Poor	24.6	1.54	32	3	2.41	0.03	0.01	2
AC-2	9/17/1992	6	7.06	Fairly Poor	22.2	1.27	21	0	0.00	0	0.12	0
	08/04/99	12	6.45	Fair	22.7	1.49	27	2	0.78	0.01	0.01	2
AC-3	09/17/92	12	6.70	Fairly Poor	23.8	2.43	35	0	0.00	0	0.11	0
	08/04/99	26	6.76	Fairly Poor	27.0	1.80	39	4	1.58	0.02	0.05	2
AC-4	09/17/92	8	6.97	Fairly Poor	23.2	2.26	20	0	0.00	0	0.37	0
	08/04/99	14	6.99	Fairly Poor	24.3	2.31	30	2	0.29	0.01	0.13	1
AC-5	09/28/92	18	5.80	Fair	32.8	2.24	34	2	0.16	0	0.04	1
	09/03/99	48	3.85	Very Good	38.3	2.53	43	9	30.16	0.46	0.02	3
RR-6	09/25/92	28	5.01	Good	36.2	3.07	80	11	8.19	0.10	0.25	6
	09/09/99	42	3.14	Excellent	38.7	1.93	50	12	64.4	2.14	0.00	6
RR-7	09/25/92	32	4.79	Good	37.3	3.11	57	12	22.39	0.43	0.11	6
	08/11/99	40	3.60	Very Good	38.1	2.19	45	10	45.7	0.93	0.03	5

Site #	Collection Date	Total Caddisfly Taxa	Total Dipteran Taxa	Percent Mayfly Composition	Percent Caddisfly Composition	Percent Tribe Tanytarsini Composition	Percent Other Dipterans and Non-Insects	Percent Tolerant Organisms	Percent Toxic Tolerant Organisms	Percent Selected Toxic Tolerant Organisms	Percent Organic Tolerant Organisms
AC-1	09/15/92	3	18	0.04	0.13	0	99.6	80.22	46.90	46.77	48.45
	09/04/99	1	15	2.36	0.04	0	95.36	64.25	46.08	46.08	46.48
AC-2	9/17/1992	0	15	0.00	0	0.08	99.92	92.14	24.10	23.57	72.27
	08/04/99	0	15	0.78	0	0	97.57	33.05	15.74	15.66	76.9
AC-3	09/17/92	0	22	0.00	0	0.09	99.61	75.61	57.85	47.61	29.98
	08/04/99	2	21	1.10	0.48	0.07	97.59	63.27	37.96	37.83	52.06
AC-4	09/17/92	0	17	0.00	0	0.25	99.75	74.78	41.87	39.97	34.93
	08/04/99	1	18	0.15	0.15	0	99.56	49.06	12.34	12.19	54.57
AC-5	09/28/92	1	26	0.08	0.08	0.40	99.44	56.73	67.63	44.31	17.39
	09/03/99	6	25	2.51	27.66	33.57	35.77	5.91	6.51	3.61	3.21
RR-6	09/25/92	5	50	1.22	6.97	2.59	88.79	31.42	39.10	32.09	10.45
	09/09/99	6	23	9.46	54.94	0.89	34.09	0.37	1.24	0.21	9.70
RR-7	09/25/92	6	32	3.70	18.69	1.94	74.16	28.70	17.68	14.14	21.63
	08/11/99	5	21	4.58	41.14	7.28	45.95	2.93	10.44	2.85	7.43

Table K-2
Abram Creek Benthic Macroinvertebrate Kick Net Data
1992, 1993, 1994, and 1999

Site #	Collection Date	HBI Score	HBI Narrative Rating	QCTV Score	Shannon Diversity Index	Taxa Richness	EPT Taxa Richness	Percent EPT Composition	EPT/ Chironomidae	(Crictopus + Chironomus)/ Chironomidae	Total Mayfly Taxa	Total Caddisfly Taxa
AC-1	09/15/92	6.45	Fair	23.3	2.14	15	0	0.00	0	0.125	0	0
	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
	08/04/99	5.92	Fair	21.2	2.91	24	2	12.6	0.38	0.00	2	0
AC-2	09/17/92	6.74	Fairly Poor	29.5	2.55	18	0	0.0	0	0.39	0	0
	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
	08/04/99	6.73	Fairly Poor	19.2	2.99	28	2	6.0	0.25	0.00	2	0
AC-3	09/17/92	6.79	Fairly Poor	20.8	2.37	18	0	0.0	0	0.02	0	0
	-	-	-	-	-	-	-	-	-	-	-	-
	09/21/94	6.40	Fair	23.0	1.70	17	4	7.9	0.19	0.03	2	2
	08/04/99	6.69	Fairly Poor	23.0	3.04	29	3	5.8	0.11	0.00	2	1
AC-4	09/17/92	7.09	Fairly Poor	18.7	2.44	16	0	0.0	0	0.31	0	0
	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
	08/04/99	7.26	Fairly Poor	19.2	2.82	26	1	1.8	0.05	0.17	1	0
AC-5	09/28/92	5.94	Fair	34.5	2.58	19	3	22.8	0.39	0.35	0	3
	07/20/93	4.02	Very Good	36.3	1.95	23	4	20.8	0.47	0.07	2	2
	09/21/94	4.78	Good	36.4	2.41	23	4	59.2	2.71	0.20	2	2
	09/03/99	4.44	Very Good	39.3	2.73	31	8	56.3	3.76	0.27	4	4

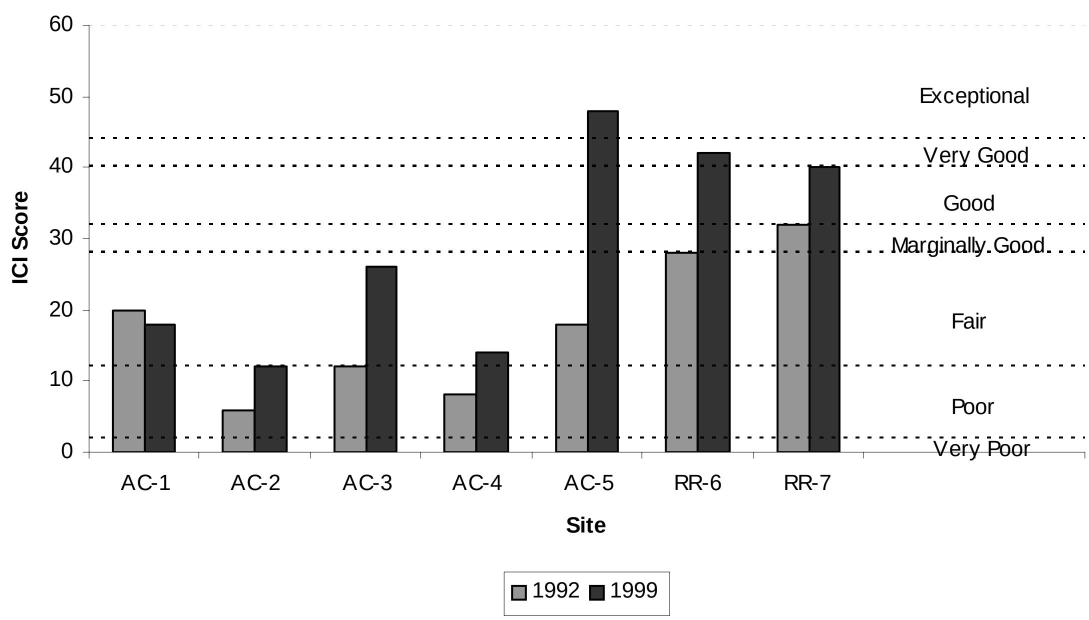
Site #	Collection Date	Total Dipteran Taxa	Percent Mayfly Composition	Percent Caddisfly Composition	Percent Tribe Tanytarsini Composition	Percent Other Dipterans and Non-Insects	Percent Tolerant Organisms	Percent Toxic Tolerant Organisms	Percent Selected Toxic Tolerant Organisms	Percent Organic Tolerant Organisms	Percent Organic Tolerant Organisms
AC-1	09/15/92	6	0	0	0	71.74	6.52	6.52	6.52	26.09	26.09
	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-
	08/04/99	8	12.64	0	0.00	48.28	5.75	3.45	3.45	21.84	21.84
AC-2	09/17/92	13	0	0	1.02	83.67	50	38.78	38.78	19.39	19.39
	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-
	08/04/99	10	5.97	0	1.49	58.21	4.48	1.49	1.49	5.97	5.97
AC-3	09/17/92	11	0	0	0.00	71.54	26.02	18.7	18.7	20.33	20.33
	-	-	-	-	-	-	-	-	-	-	-
	09/21/94	8	2.85	5.06	0.00	92.09	12.03	5.38	5.38	85.13	85.13
	08/04/99	12	4.81	0.96	0.00	77.88	21.15	14.42	14.42	16.35	16.35
AC-4	09/17/92	7	0	0	0.00	83.50	51.46	22.33	22.33	13.59	13.59
	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-
	08/04/99	13	1.83	0	0.00	83.49	20.18	5.5	4.59	19.27	19.27
AC-5	09/28/92	13	0	22.78	0.00	77.22	25.32	34.18	30.38	11.39	11.39
	07/20/93	9	11.13	9.67	0.00	78.28	19.53	5.66	4.93	32.12	32.12
	09/21/94	16	27.67	31.55	1.94	38.35	5.34	9.22	6.31	16.5	16.5
	09/03/99	13	29.55	26.72	2.02	36.44	2.02	7.29	4.45	6.48	6.48

Table K-3
Rocky River Benthic Macroinvertebrate Kick Net Data
1992, 1994, 1996, and 1999

Site #	Collection Date	HBI Score	HBI Narrative Rating	QCTV Score	Shannon Diversity Index	Taxa Richness	EPT Taxa Richness	Percent EPT Composition	EPT/ Chironomidae	(Crictopus + Chironomus)/Chironomidae	Total Mayfly Taxa
RR-6	09/25/92	4.51	Very Good	36.2	2.77	32	9	57.20	1.67	0.42	4
	09/22/94	3.55	Very Good	37.6	2.68	44	11	61.08	1.97	0.20	6
	08/08/96	3.06	Excellent	40.7	2.46	29	11	71.14	3.75	0.01	5
	08/09/99	3.78	Very Good	35.5	2.77	48	10	46.64	1.25	0.05	4
RR-7	09/25/92	4.05	Very Good	39.7	2.53	18	7	54.29	1.97	0.35	3
	-	-	-	-	-	-	-	-	-	-	-
	08/08/96	3.28	Excellent	34.5	2.43	24	8	63.57	2.97	0.00	4
	08/11/99	4.24	Very Good	36.2	3.00	41	8	45.12	1.06	0.14	4

Site #	Collection Date	Total Caddisfly Taxa	Total Dipteran Taxa	Percent Mayfly Composition	Percent Caddisfly Composition	Percent Tribe Tanytarsini Composition	Percent Other Dipterans and Non-Insects	Percent Tolerant Organisms	Percent Toxic Tolerant Organisms	Percent Selected Toxic Tolerant Organisms	Percent Organic Tolerant Organisms
RR-6	09/25/92	5	18	11.93	45.27	0.82	40.74	14.40	15.64	14.81	7.41
	09/22/94	5	23	8.66	52.42	14.51	23.40	7.31	7.65	6.19	6.30
	08/08/96	6	9	26.84	44.30	0.25	26.08	0.76	2.53	0.25	5.57
	08/09/99	6	19	14.75	31.89	3.47	41.21	2.60	1.30	0.87	22.34
RR-7	09/25/92	4	7	6.67	47.62	0.00	40.95	3.81	10.48	9.52	11.43
	-	-	-	-	-	-	-	-	-	-	-
	08/08/96	4	9	21.43	42.14	0.36	33.93	1.43	3.57	1.07	7.86
	08/11/99	4	17	14.97	30.15	3.04	46.64	7.16	2.82	1.52	16.92

Figure K-1
Abram Creek and Rocky River ICI Scores



APPENDIX L
SUMMARY OF ELECTROFISHING RESULTS
1998-2002

The Northeast Ohio Regional Sewer District performed quantitative sampling for fish during 1999-2002 utilizing its 17' Coffelt aluminum electrofishing boat and generator-powered longline electrofishing equipment. Fish were collected, identified to species level, weighed, counted, examined for the presence of DELT anomalies (deformities, eroded fins, lesions and tumors) and returned to the stream from which they were collected. Fish that were not identified in the field were placed in formalin and sent to the Ohio State University's Museum of Biological Diversity, were they were identified by the Curator of Fishes. Electrofishing was performed at the following areas:

- Abram Creek (upstream and downstream of the former Brook Park WWTP)
- Cuyahoga River (upstream and downstream of the Southerly WWTC)
- Brandywine Creek (upstream and downstream of the former Hudson WWTP)
- Blodgett Creek (upstream and downstream of the former Strongsville "A" WWTP)
- Rocky River (upstream and downstream of Blodgett Creek) and (upstream and downstream of Abram Creek)
- Big Creek (at NEORSD's six routine sampling locations)

Longline generator electrofishing consists of wading in a sampling zone in an upstream direction for a distance of 150-200 meters and electroshocking all habitat types including undercut banks, brush piles, log jams, boulders and other submerged structures. Fish are then netted and placed in a nylon floating live well where they are later processed. Ohio EPA protocols require two or three individual sampling passes in a particular field season to assess fish community health.

Boat electrofishing consists of shocking all habitat types within a sampling zone, which is 0.5 kilometers in length, while moving from upstream to downstream. In zones with extensive woody debris and abundant cover, a slower speed is necessary to maneuver the boat. The stunned fish are collected and placed in an on-board live well for later processing. According to Ohio EPA protocols, each boat sampling zone should be electrofished two or three times during the sampling season.

The electrofishing data collected by NEORSD were compiled and used to evaluate fish community health through the use of two Ohio EPA indices, the Index of Biotic Integrity (IBI) and the Modified Index of Well Being (MIwb). The IBI incorporates 12 community metrics representing structural and functional attributes. The structural attributes are based upon fish community aspects such as fish numbers and diversity. Functional attributes are based upon fish community aspects such as feeding strategies, environmental tolerances and disease symptoms. These metrics are individually scored by comparing the data collected at a survey site with values expected at reference sites located in a similar geographic region. The maximum IBI score is 60 and the minimum is 12. The summation of the 12 individual metric scores provides a single value IBI score, which determines the narrative rating (Exceptional, Good, Fair, or Poor) of a fish community.

The MIwb, which is calculated only at sites having a tributary drainage area greater than 20 square miles, incorporates four fish community measures: numbers of individuals, biomass, and the Shannon Diversity Index (H) based on numbers and weight of fish. Unlike the IBI score, the MIwb score is the result of a mathematical calculation based upon the formula:

$$MIwb = 0.5\ lnN + 0.5\ lnB + \overline{H}(No.) + \overline{H}(Wt.)$$

where:

N = Relative numbers of all species excluding species designated "highly tolerant", hybrids and exotics

B = Relative weights of all species excluding species designated "highly tolerant", hybrids and exotics

$\overline{H}(No.)$ = Shannon Diversity Index based on numbers

$\overline{H}(Wt.)$ = Shannon Diversity Index based on weight

Shannon Diversity Index

$$\overline{H} = -\sum\left[\left(\frac{n_i}{N}\right)log_e\left(\frac{n_i}{N}\right)\right]$$

where:

n_i = Relative numbers or weight of species

N = Total number or weight of the sample

A detailed description of the sampling and analysis methods utilized in fish surveys including calculations of IBI and MIwb scores can be found in OEPA's *Biological Criteria for the Protection of Aquatic Life Volumes ll* (1987, Updated January 1988) and lll (1989). The following is a summary of electrofishing results obtained by NEORSD during 1999-2002.

Table L-1
NEORSD Electrofishing Summary
1999-2002

Sample Location	Date	IBI Score	IBI Narrative Rating	MIwb Score	MIwb Narrative Rating
Abram Creek					
Upstream of Brook Park WWTP	07/14/98	12	Very Poor	N/A	N/A
	09/01/98	22	Poor	N/A	N/A
Downstream of Brook Park WWTP	07/14/98	18	Poor	N/A	N/A
	09/01/98	12	Very Poor	N/A	N/A
Blodgett Creek					
Upstream of Strongsville "A" WWTP	06/28/00	22	Poor	N/A	N/A
	08/04/00	28	Fair	N/A	N/A
	09/28/00	28	Fair	N/A	N/A
Downstream of Strongsville "A" WWTP	06/28/00	24	Poor	N/A	N/A
	08/04/00	24	Poor	N/A	N/A
	09/28/00	24	Poor		
Brandywine Creek					
Upstream of Hudson WWTP	07/11/02	34	Fair	N/A	N/A
	08/15/02	34	Fair	N/A	N/A
Downstream of Hudson WWTP	07/11/02	20	Poor	N/A	N/A
	08/15/02	22	Poor	N/A	N/A
Cuyahoga River					
Upstream of Southerly WWTC	06/25/99	32	Fair	8.5	Marginally Good
	08/05/99	30	Fair	7.6	Fair
	09/08/99	26	Fair	8.3	Marginally Good
	07/25/01	26	Fair	6.9	Fair
	10/01/01	30	Fair	7.9	Fair
Downstream of Southerly WWTC	06/25/99	30	Fair	8.3	Marginally Good
	08/05/99	32	Fair	8.3	Marginally Good
	09/08/99	32	Fair	9.2	Very Good
	07/25/01	32	Fair	8.1	Fair
	10/01/01	26	Fair	8.2	Fair
Upstream of Big Creek	07/27/01	18	Poor	5.6	Poor
	10/02/01	18	Poor	6.7	Fair
Downstream of Big Creek (Harvard)	06/24/99	16	Poor	6.8	Fair
	07/28/99	20	Poor	6.3	Poor
	09/10/99	30	Fair	7.6	Fair
	07/27/01	22	Poor	6.1	Poor
	10/02/01	22	Poor	7.1	Fair
Big Creek					
Downstream of Jennings Road	07/13/99	28	Fair	7.1	Fair
	08/31/99	34	Marginally Good	7.7	Marginally Good
	10/07/99	24	Poor	6.9	Fair
West Branch Tiedeman Road	07/14/99	20	Poor	N/A	N/A
	09/01/99	32	Fair	N/A	N/A
Puritas Road	07/16/99	12	Very Poor	N/A	N/A
	08/18/99	16	Very Poor	N/A	N/A

Table L-1
NEORSD Electrofishing Summary
1999-2002

Sample Location	Date	IBI Score	IBI Narrative Rating	MIwb Score	MIwb Narrative Rating
East Branch Tiedeman Road	07/14/99	24	Poor	5.8	Poor
	09/01/99	26	Poor	6.1	Fair
Stickney Creek	07/15/99	28	Fair	N/A	N/A
	08/18/99	28	Fair	N/A	N/A
Fernhill Picnic Area	07/15/99	22	Poor	N/A	N/A
	08/18/99	22	Poor	N/A	N/A
Rocky River					
Upstream of Blodgett Creek	06/29/00	40	Good	8.2	Good
	08/16/00	38	Good	7.5	Marginally Good
Downstream of Blodgett Creek	06/29/00	40	Good	7.4	Marginally Good
	08/16/00	38	Good	7.9	Good
Upstream of Abram Creek	07/20/98	38	Good	7.3	Fair
	09/02/98	42	Good	5.8	Poor
Downstream of Abram Creek	07/15/98	40	Good	5.5	Poor
	09/02/98	34	Marginally Good	4.9	Poor

APPENDIX M
CUYAHOGA RIVER ELECTROFISHING SURVEYS
1999-2001

Introduction
During June, July, August, September and October of 1999 and 2001, the Northeast Ohio Regional Sewer District's (NEORSD) Water Quality and Industrial Surveillance Department (WQIS) conducted electrofishing surveys on the Cuyahoga River. NEORSD investigators conducted electrofishing upstream of the Southerly Wastewater Treatment Center (WWTC) at River Mile (RM) 11.0, downstream of the Southerly WWTC at RM 10.5, and downstream of Big Creek, near the Lower Harvard Avenue Bridge, at RM 7.1. The purpose of these surveys was to evaluate and characterize the fish communities at these locations. In 2001, NEORSD began conducting electrofishing surveys upstream of Big Creek at RM 7.9. The addition of this new site will help to facilitate the evaluation of potential water quality impacts from Big Creek on the Cuyahoga River.

The electrofishing data collected by NEORSD was compiled and used to evaluate fish community health through the application of two indices, the Ohio Environmental Protection Agency's (Ohio EPA) Index of Biotic Integrity (IBI) and the Modified Index of Well Being (MIwb). The IBI incorporates 12 metrics representing structural and functional attributes of the fish community. The structural attributes are based upon fish community aspects such as fish numbers and diversity. Functional attributes are based upon fish community aspects such as feeding strategies, environmental tolerances, and disease symptoms. These metrics are individually scored by comparing the data collected at a survey site with values expected at reference sites located in a similar geographic region. The maximum IBI score is 60 and the minimum is 12. The summation of 12 individual metric scores provides a single value IBI score, which corresponds to a narrative rating of Exceptional, Good, Fair, or Poor.

The MIwb incorporates four fish community measures: numbers of individuals, biomass, and the Shannon Diversity Index $(\overline{H})$ based on numbers and weight of fish. Unlike the IBI score, the MIwb score is the result of a mathematical calculation based upon the formula:

Modified Index of Well-Being

$$MIwb = 0.5\ lnN + 0.5\ lnB + \overline{H}(No.) + \overline{H}(Wt.)$$

where:

N = Relative numbers of all species excluding species designated "highly tolerant", hybrids and exotics

B = Relative weights of all species excluding species designated "highly tolerant", hybrids and exotics

$\overline{H}(No.) =$ Shannon Diversity Index based on numbers

$\overline{H}(Wt.) =$ Shannon Diversity Index based on weight

Shannon Diversity Index

$$\overline{H} = -\sum\left[\left(\frac{n_i}{N}\right)log_e\left(\frac{n_i}{N}\right)\right]$$

where:

$n_i =$ Relative numbers or weight of species

$N =$ Total number or weight of the sample

Fish Collection Methods

NEORSD performed quantitative sampling for fish utilizing its 17' Coffelt aluminum electrofishing boat. Boat electrofishing consists of shocking all habitat types within a sampling zone, which is 0.5 kilometers in length, while moving from upstream to downstream. In zones which have extensive woody debris and abundant cover, a slower boat speed is necessary to maneuver the boat. The stunned fish are collected and put in an on-board live well for later identification. According to Ohio EPA protocols, each boat sampling zone should be electroshocked two or three times during the sampling season.

Specimens were identified to species level, weighed, counted, and examined for the presence of DELT anomalies, which include deformities, eroded fins, lesions, and tumors. Fish were returned to the site from which they were collected (except for voucher specimens and those which could not be identified in the field, which were identified in the laboratory).

A detailed description of the sampling and analysis methods utilized in fish community surveys, including calculations of the IBI and MIwb, can be found in Ohio EPA's *Biological Criteria for the Protection of Aquatic Life, Volumes II* (1987, updated January 1,1988) and *III* (1987).

Ohio EPA's Qualitative Habitat Evaluation Index (QHEI) was used to assess aquatic habitat conditions at each sample location.

Results and Discussion

Cuyahoga River IBI and MIwb scores from 1990 through 2001 are listed in Tables M-1 and displayed graphically in Figures M-1 and M-2. Data tables located at the end of this report list the species, numbers, weights, pollution tolerances and the incidence of DELT anomalies of fishes collected on the Cuyahoga River from June 1999 through October 2001. The data tables also show the IBI and MIwb scores for each site.

During 1999 and 2001, IBI scores obtained by NEORSD upstream and downstream of the Southerly WWTP were in the *Fair* range, while MIwb scores were generally in the *Fair* to *Marginally Good* range. IBI scores at the same locations were generally in the *Very Poor* and *Poor* ranges from 1990 to 1992, and in the *Poor and Fair* ranges during 1997 and 1998. MIwb scores at these locations ranged from *Very Poor* to *Fair* from 1990 to 1992, and were generally in the *Poor* to *Fair* range from 1997 to 1998. This trend of improving fish community index scores can be seen in Figures M-1 and M-2.

Fish surveys conducted in 1999, downstream of the Southerly WWTC, showed individual MIwb scores achieving narrative ratings of *Marginally Good* to *Very Good*. This was the first time the NEORSD has documented attainment of the Warmwater Habitat aquatic life use designation (WWH) MIwb criterion for the fish community in this section of the Cuyahoga River. (The MIwb criterion for WWH is 8.7; a score of 9.2 was achieved on September 8, 1999.)

From 1999 to 2001, however, fish surveys upstream and downstream of Southerly WWTC showed a slight decline in index scores. This decline may have been attributable to a Mill Creek Interceptor break that was discovered on February 15, 2000. This slight decline in index scores upstream and downstream of Southerly WWTC can be observed in Figures M-3 and M-4.

IBI scores upstream of Big Creek in 2001 and downstream of Big Creek from 1991 through 2001 were generally in the *Poor* range. MIwb scores upstream of Big Creek were in the *Poor* range in 2001. MIwb scores downstream of Big Creek were in the *Poor* range from 1991-1998, but improved to the *Fair* range in 1999 and 2001.

Another indication of the improvement in Cuyahoga River fish community health is the increase in the proportion of pollution intolerant fish collected in recent years. According to Ohio EPA's *Biological Criteria for the Protection of Aquatic Life: Volume II*, fish species which are tolerant of pollution tend toward community predominance with decreasing water and/or habitat quality (p. 4-29). Therefore, the opposite would be expected in the case of improving water and/or habitat quality. This trend can be observed in Figure M-5, which shows the proportion of pollution intolerant species collected from 1990 through 2001.

The incidence of DELT anomalies observed on fish collected from the Cuyahoga River upstream of the Southerly WWTC improved from 9.1% in 1991 to 5.3 % in 1992. Since 1992, the incidence of DELT anomalies at this location has fluctuated between 2.8 and 5.6%. The situation is similar at the sites downstream of the Southerly WWTC and downstream of Big Creek. The incidence of DELT anomalies downstream of Southerly decreased from 6.1% in 1992 to 2.4% in 1997. Since that time, however, the incidence has fluctuated from 2.8% to 3.5%. The incidence of DELT anomalies downstream of Big Creek declined from 5.3% in 1991 to 3.3% in 1992. Since 1997, however, it has fluctuated between 2.1% and 4.6%. These trends can be observed in Figure M-6.

QHEI scores from 1999 and 2001 for each Cuyahoga River site where NEORSD conducted electrofishing surveys are shown in the table below. Except for the construction/demolition material disposal sites located downstream of the Southerly WWTC along both banks of the river, no major habitat modifications were evident in the area where electrofishing was conducted. QHEI scores from 1993 through 2001 are displayed graphically in Figure M-7. Since 1997, QHEI scores upstream and downstream of Southerly have been in the *Good-Fair* to *Excellent* ranges. Downstream of Big Creek, QHEI scores have been in the *Good-Fair* range since 1998. Figure M-7 shows a trend of slightly improving QHEI scores, which may be the result of more instream cover, better pool/riffle development and increased substrate stability due to the decrease of operations from the construction/demolition material disposal sites downstream of Southerly WWTC.

According to Ohio EPA's *The Qualitative Habitat Evaluation Index (QHEI): Rationale, Methods, and Application*, "Stream reaches with QHEI scores averaging > 60 will likely have the potential to attain the WWH use" (p. 40). Aquatic habitat should, therefore, not be a limiting factor in the attainment of biocriteria at any of the Cuyahoga River locations where NEORSD investigators have conducted electrofishing surveys.

Cuyahoga River QHEI Scores 1999-2001				
	1999		2001	
Sample Location	Score	Narrative Rating	Score	Narrative Rating
Upstream of Southerly WWTC	76.5	Excellent	72.75	Good
Downstream of Southerly WWTC	69	Good	68.75	Good
Upstream of Big Creek	--	--	63	Good
Downstream of Big Creek	66.25	Good	64.75	Good

QHEI field sheets for Cuyahoga River sites, which were electrofished by NEORSD during 1999 and 2001, are located in Appendix D of the 1999-2002 Greater Cleveland Area Environmental Water Quality Assessment report.

Summary and Conclusions

The Northeast Ohio Regional Sewer District has documented a general improvement in fish community health upstream and downstream of the Southerly WWTC since 1990. In 1999, NEORSD documented, for the first time, attainment of the WWH MIwb criterion downstream of the Southerly WWTC. Fish community index scores, however, declined slightly in 2001. One potential cause of the lower index scores observed in 2001 was a break in the Mill Creek Interceptor, which occurred in 2000. QHEI scores indicate that fish communities in the Cuyahoga River upstream and downstream of the Southerly WWTC and Big Creek have the potential to meet the numerical criteria for WWH. NEORSD Water Quality and Industrial Surveillance investigators will continue to monitor fish communities to determine the effects of NEORSD's operations, maintenance and capital improvement programs on water quality in this area.

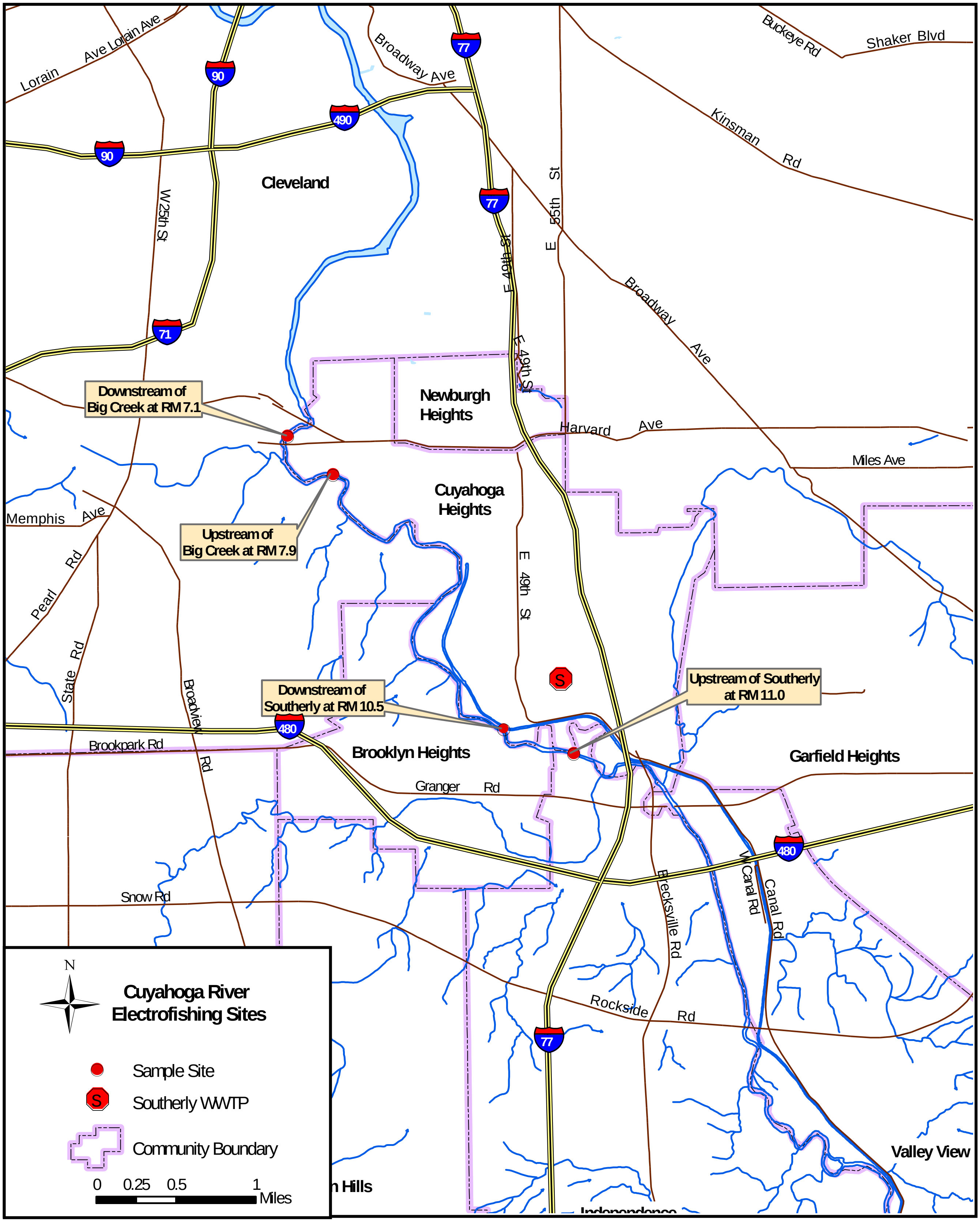

Cuyahoga River
Electrofishing Sites
N
Sample Site
Southerly WWTP
Community Boundary
0 0.25 0.5 1
Miles
Downstream of Big Creek at RM 7.1
Upstream of Big Creek at RM 7.9
Downstream of Southerly at RM 10.5
Upstream of Southerly at RM 11.0
Cleveland
Newburgh Heights
Cuyahoga Heights
Brooklyn Heights
Garfield Heights
Valley View
Lorain Ave
Lorain Ave
Broadway Ave
Buckeye Rd
Shaker Blvd
Kinsman Rd
W 25th St
E 55th St
E 49th St
Broadway Ave
Harvard Ave
Miles Ave
Memphis Ave
Pearl Rd
State Rd
Broadview Rd
Brookpark Rd
Granger Rd
Snow Rd
Rockside Rd
Brecksville Rd
W Canal Rd
Canal Rd
90
490
77
71
480
S

Table M-1
Cuyahoga River Index of Biotic Integrity (IBI) and Modified Index of Well-Being (MIwb) Scores
1990-2001

Upstream of Southerly WWTP			Downstream of Southerly WWTP			Upstream of Big Creek			Downstream of Big Creek		
Date	IBI	MIwb	Date	IBI	MIwb	Date	IBI	MIwb	Date	IBI	MIwb
08/30/90	16	4.1	08/30/90	18	4.7	-	-	-	-	-	
09/28/90	14	4.6	09/28/90	14	4.8	-	-	-	-	-	
Average	15	4.4	Average	16	4.8	-	-	-	-	-	
06/25/91	12	4.0	06/25/91	12	4.8	-	-	-	06/26/91	18	5.7
08/22/91	16	5.7	08/22/91	18	6.2	-	-	-	08/25/91	18	6.1
09/30/91	22	6.9	09/30/91	18	5.8	-	-	-	10/01/91	22	6.4
Average	17	5.5	Average	16	5.6	-	-	-	Average	19	6.1
07/01/92	18	5.7	07/01/92	22	6.9	-	-	-	07/06/92	22	5.9
09/09/92	22	5.8	09/09/92	18	6.0	-	-	-	-	-	-
10/09/92	20	5.1	10/09/92	18	6.9	-	-	-	10/13/92	18	5.8
Average	20	5.5	Average	19	6.6	-	-	-	Average	20	5.9
09/15/97	28	7.0	09/15/97	14	4.7	-	-	-	09/16/97	16	6.4
10/16/97	24	7.9	10/16/97	22	7.4	-	-	-	10/17/97	20	5.7
Average	26	7.5	Average	18	6.1	-	-	-	Average	18	6.1
08/04/98	24	7.5	08/04/98	24	7.5	-	-	-	08/05/98	22	4.8
09/30/98	26	7.5	09/30/98	28	7.6	-	-	-	10/02/98	22	6.1
Average	25	7.5	Average	26	7.6	-	-	-	Average	22	5.5
09/08/99	26	8.3	09/08/99	32	9.2	-	-	-	09/10/99	30	7.6
08/05/99	30	7.6	08/05/99	32	8.3	-	-	-	07/28/99	20	6.3
06/25/99	32	8.5	06/25/99	30	8.3	-	-	-	06/24/99	16	6.8
Average	29	8.1	Average	31	8.6	-	-	-	Average	22	6.9
10/01/01	34	7.9	10/01/01	26	8.2	10/02/01	18	6.7	10/02/01	22	7.1
07/25/01	26	6.9	07/25/01	32	8.1	07/27/01	18	5.6	07/27/01	22	6.1
Average	30	7.4	Average	29	8.2	Average	18	6.2	Average	22	6.6

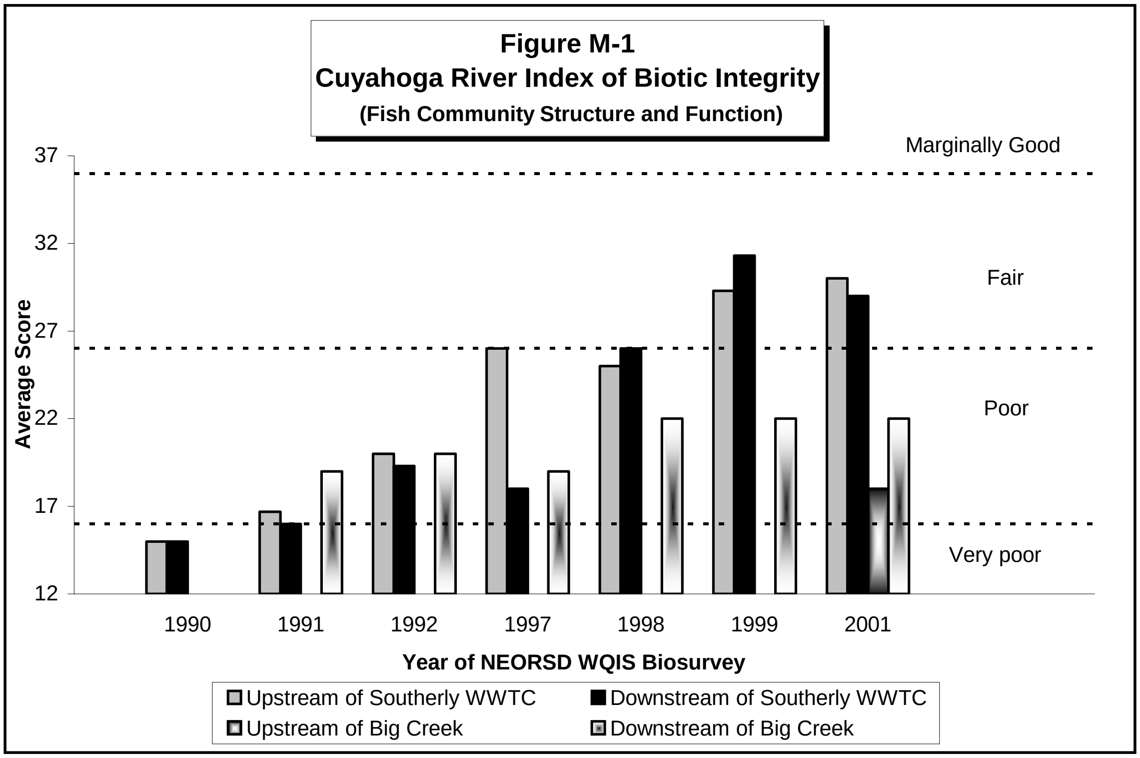


Figure M-1
Cuyahoga River Index of Biotic Integrity
(Fish Community Structure and Function)
Marginally Good
Fair
Poor
Very poor
Average Score
37
32
27
22
17
12
1990
1991
1992
1997
1998
1999
2001
Year of NEORSD WQIS Biosurvey
Upstream of Southerly WWTC
Downstream of Southerly WWTC
Upstream of Big Creek
Downstream of Big Creek

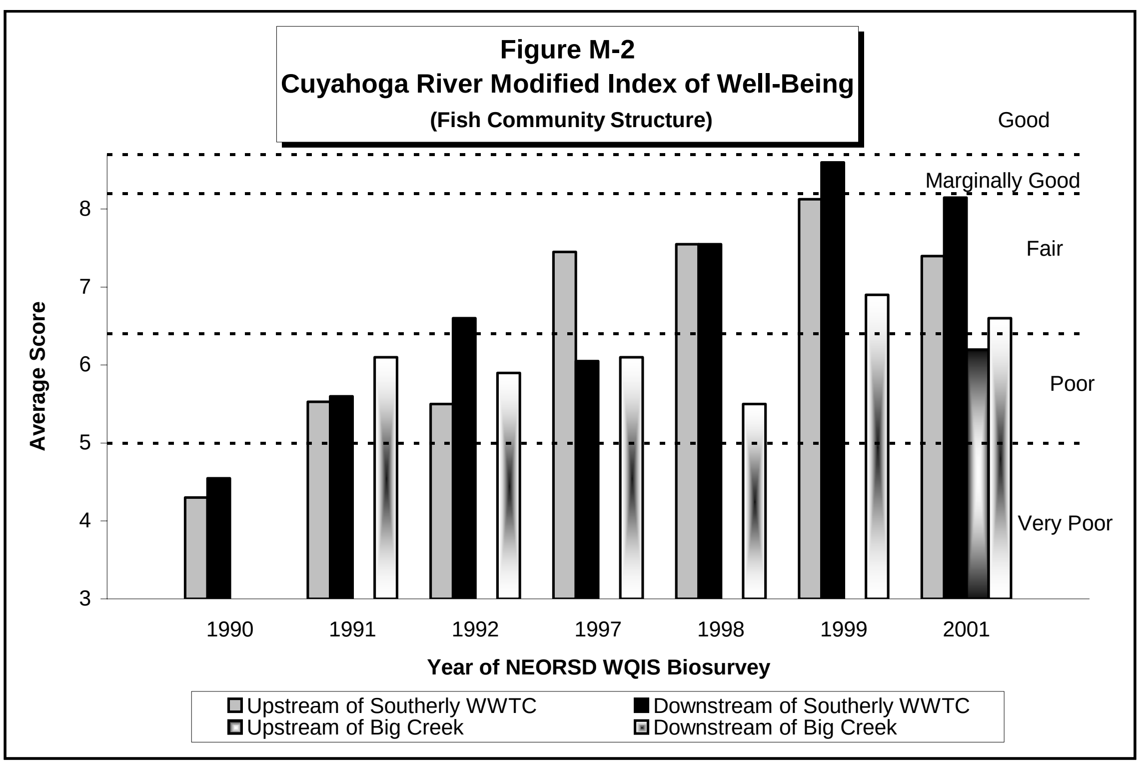


Figure M-2
Cuyahoga River Modified Index of Well-Being
(Fish Community Structure)
Good
Marginally Good
Fair
Poor
Very Poor
Average Score
8
7
6
5
4
3
1990
1991
1992
1997
1998
1999
2001
Year of NEORSD WQIS Biosurvey
Upstream of Southerly WWTC
Downstream of Southerly WWTC
Upstream of Big Creek
Downstream of Big Creek

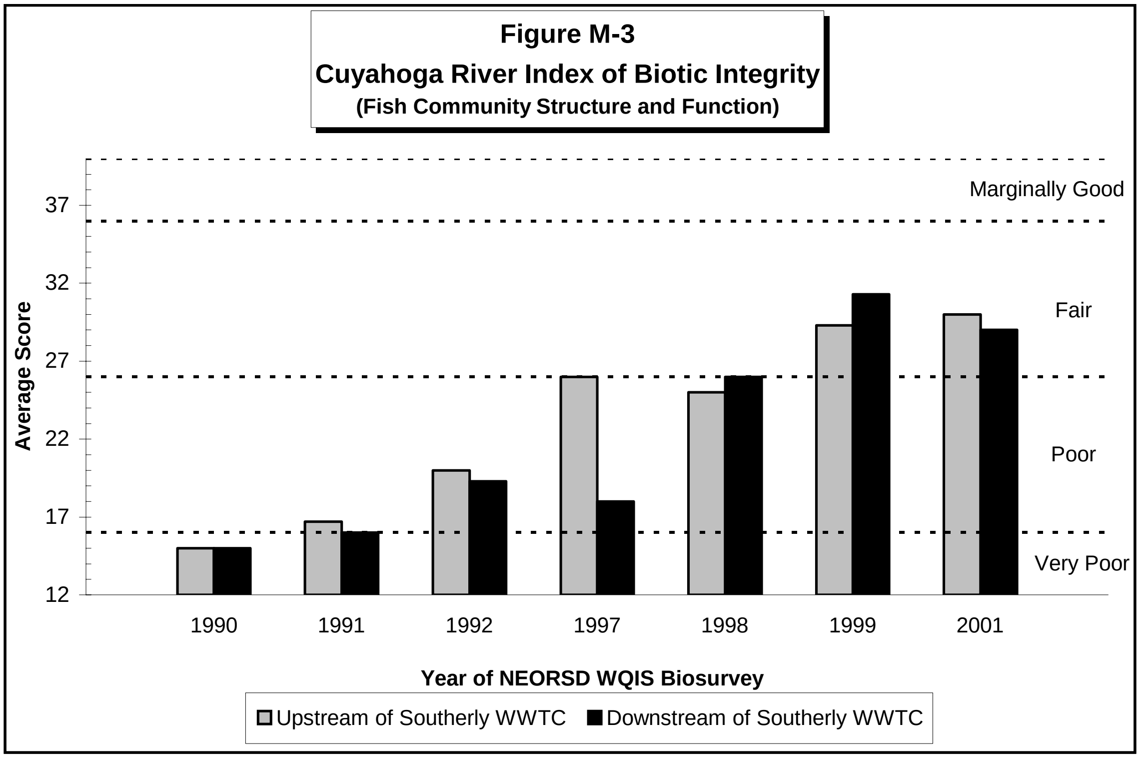


Figure M-3
Cuyahoga River Index of Biotic Integrity
(Fish Community Structure and Function)
Marginally Good
Fair
Poor
Very Poor
Average Score
37
32
27
22
17
12
1990
1991
1992
1997
1998
1999
2001
Year of NEORSD WQIS Biosurvey
Upstream of Southerly WWTC
Downstream of Southerly WWTC

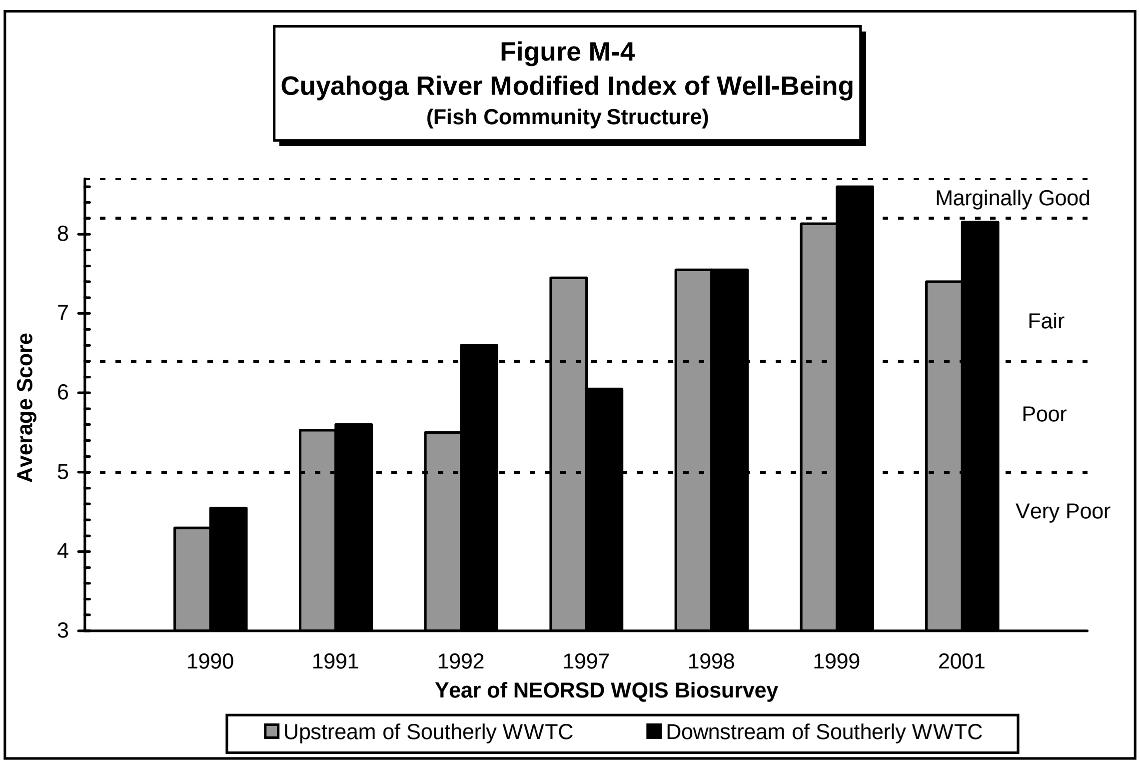


Figure M-4
Cuyahoga River Modified Index of Well-Being
(Fish Community Structure)
Marginally Good
Fair
Poor
Very Poor
Average Score
8
7
6
5
4
3
1990
1991
1992
1997
1998
1999
2001
Year of NEORSD WQIS Biosurvey
Upstream of Southerly WWTC
Downstream of Southerly WWTC

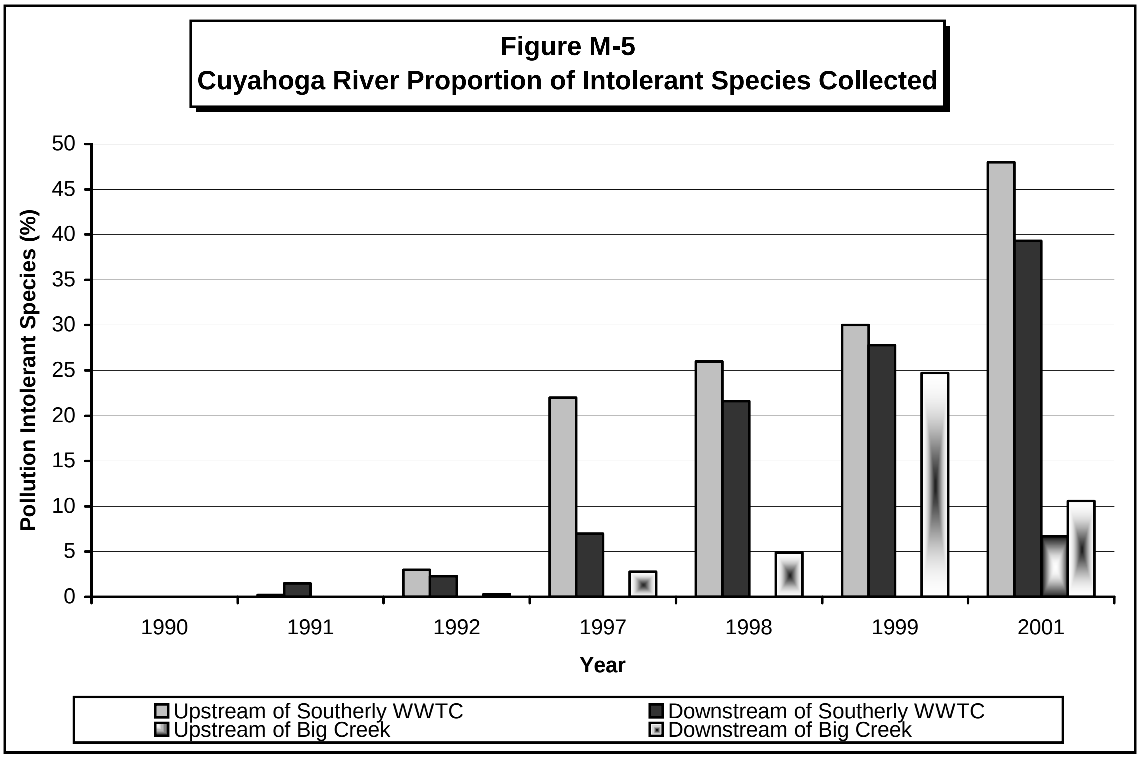


Figure M-5
Cuyahoga River Proportion of Intolerant Species Collected
Pollution Intolerant Species (%)
0
5
10
15
20
25
30
35
40
45
50
1990
1991
1992
1997
1998
1999
2001
Year
Upstream of Southerly WWTC
Downstream of Southerly WWTC
Upstream of Big Creek
Downstream of Big Creek

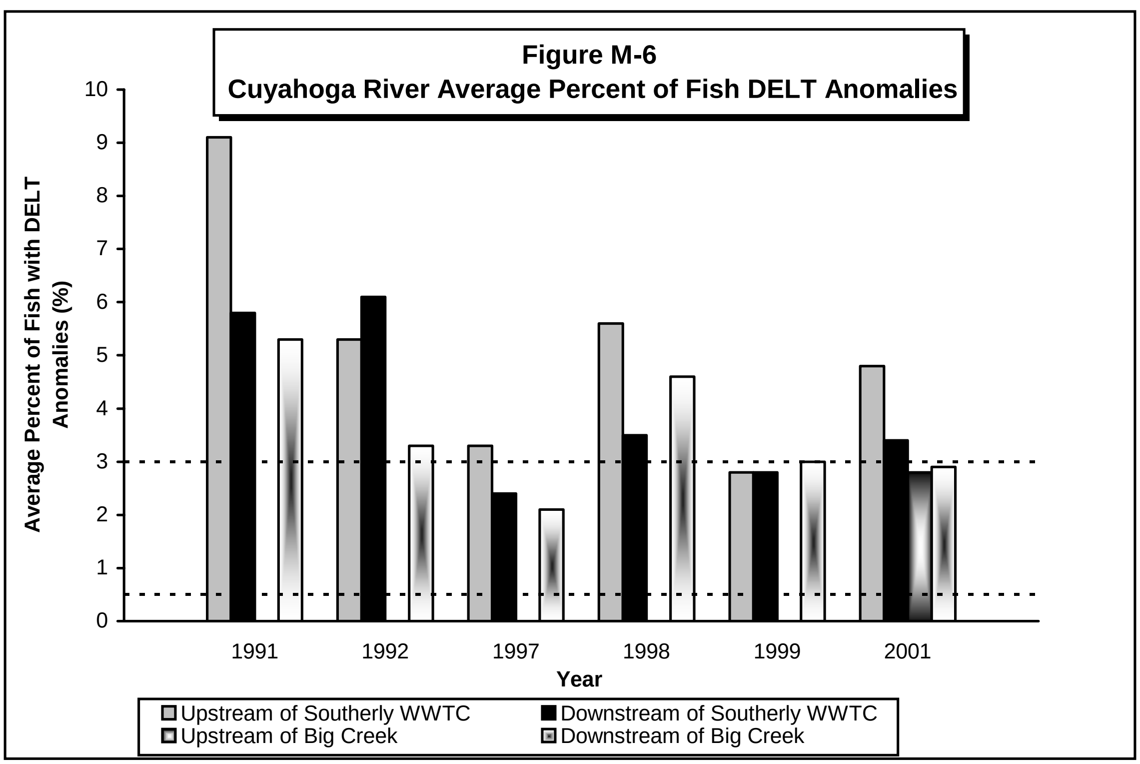
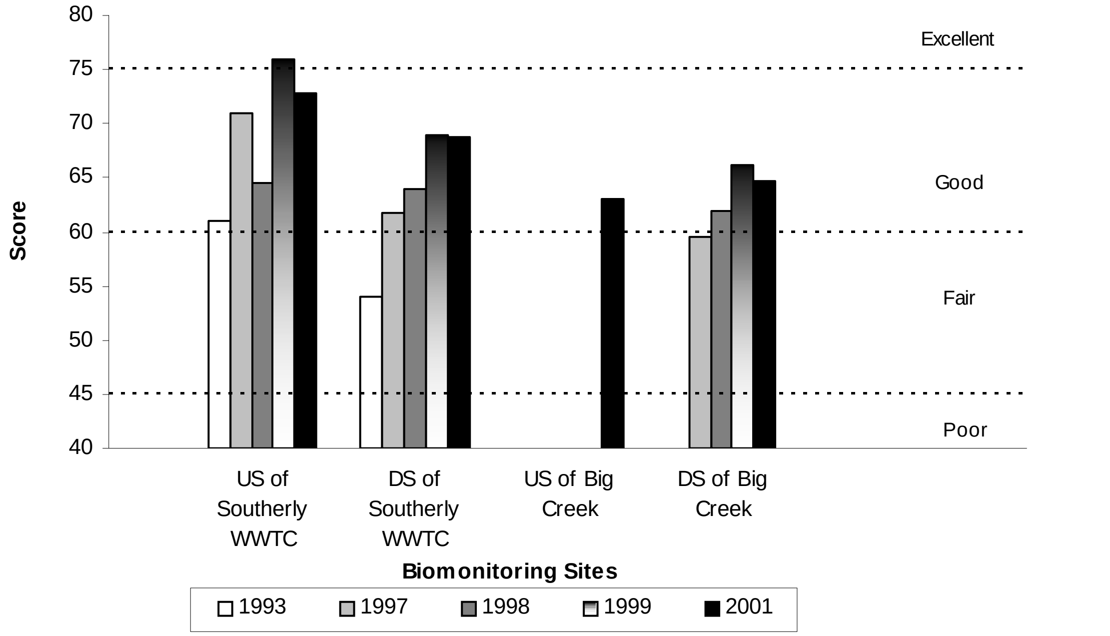


Figure M-6
Cuyahoga River Average Percent of Fish DELT Anomalies
Average Percent of Fish with DELT Anomalies (%)
0
1
2
3
4
5
6
7
8
9
10
1991
1992
1997
1998
1999
2001
Year
Upstream of Southerly WWTC
Downstream of Southerly WWTC
Upstream of Big Creek
Downstream of Big Creek

Figure M-7
Cuyahoga River Qualitative Habitat Evaluation Index Scores



Cuyahoga River Upstream of Southerly WWTC
June 25, 1999
Collection Distance: 0.5 km
Collection Method: Boat Electroshocking

Species	Number	Weight (kg)	Pollution Tolerance	#	DELT Anomalies
Dorosoma cepedianum Eastern gizzard shad	10	0.706	--	0	--
Ictiobus cyprinellus Bigmouth buffalo	3	20.430	--	0	--
Moxostoma erythrurum Golden redhorse	1	0.012	Moderately Intolerant	0	--
Hypentelium nigricans Northern hog sucker	40	4.137	Moderately Intolerant	1	Eroded Fin
Catostomus commersoni Common white sucker	8	0.992	Highly Tolerant	1	Eroded Fin
Cyprinus carpio Common carp	16	24.647	Highly Tolerant	0	--
Notropis chrysocephalus Striped shiner	1	0.040	--	0	--
Notropis spilopterus Spotfin shiner	37	0.452	--	0	--
Notropis stramineus Sand shiner	4	0.016	Moderately Intolerant	0	--
Pimephales notatus Bluntnose minnow	19	0.132	Highly Tolerant	0	--
Ictalurus punctatus Channel catfish	3	2.780	--	1	Eroded Fin
Ictalurus natalis Yellow bullhead	4	0.314	Highly Tolerant	1	Deformed Fin
Ictalurus melas Black bullhead	1	0.240	Moderately Tolerant	1	Eroded Fins & Barbels
Ambloplites rupestris Northern rockbass	1	0.080	--	0	--

Cuyahoga River Upstream of Southerly WWTC
June 25, 1999

Species	Number	Weight (kg)	Pollution Tolerance	#	DELT Anomalies
Micropterus dolomieui Smallmouth bass	5	0.752	Moderately Intolerant	0	--
Lepomis cyanellus Green sunfish	1	0.040	Highly Tolerant	0	--
Lepomis macrochirus Northern bluegill sunfish	5	0.156	Moderately Tolerant	0	--
Lepomis gibbosus Pumpkinseed sunfish	2	0.050	Moderately Tolerant	0	--
Percina caprodes Northern logperch darter	6	0.110	Moderately Intolerant	0	--
Totals	167	56.086		5	

*DELT anomalies were observed on 3.0% (5) of the fish collected.

Index of Biotic Integrity (IBI) =	32	(Fair)
Modified Index of Well-Being (MIwb)	8.5	(Marginally Good)
Shannon Diversity Index, no.	2.321	
Shannon Diversity Index, wt.	1.419	
N	238	
B	59.92	

Page 2 of 2

Cuyahoga River Upstream of Southerly WWTC
August 5, 1999
Collection Distance: 0.5 km
Collection Method: Boat Electroshocking

Species	Number	Weight (kg)	Pollution Tolerance	#	DELT Anomalies
Dorosoma cepedianum Eastern gizzard shad	18	0.754	--	0	--
Moxostoma erythrurum Golden redhorse	3	1.155	Moderately Intolerant	0	--
Hypentelium nigricans Northern hog sucker	45	5.547	Moderately Intolerant	2	Eroded Fin
Catostomus commersoni Common white sucker	12	3.041	Highly Tolerant	1	Eroded Fin
Cyprinus carpio Common carp	16	36.268	Highly Tolerant	0	--
Carassius auratus Goldfish	4	0.344	Highly Tolerant	0	--
Notropis chrysocephalus Striped shiner	1	0.030	--	0	--
Notropis spilopterus Spotfin shiner	20	0.106	--	0	--
Notropis stramineus Sand shiner	1	0.004	Moderately Intolerant	0	--
Pimephales promelas Northern fathead minnow	2	0.010	Highly Tolerant	0	--
Pimephales notatus Bluntnose minnow	2	0.008	Highly Tolerant	0	--
Ictalurus punctatus Channel catfish	2	1.275	--	1	Lesion
Micropterus dolomieui Smallmouth bass	4	1.679	Moderately Intolerant	0	--
Micropterus salmoides Largemouth bass	1	0.002	--	0	--

Cuyahoga River Upstream of Southerly WWTC
August 5, 1999

Species	Number	Weight (kg)	Pollution Tolerance	#	DELT Anomalies
Lepomis macrochirus Northern bluegill sunfish	4	0.040	Moderately Tolerant	0	--
Lepomis gibbosus Pumpkinseed sunfish	3	0.050	Moderately Tolerant	0	--
Percina caprodes Northern logperch darter	2	0.034	Moderately Intolerant	0	--
Aplodinotus grunniens Freshwater drum	1	0.200	Moderately Tolerant	0	--
hybrid	1	0.010	--	1	Lesion
Totals	142	50.557		5	

*DELT anomalies were observed on 3.5% (5) of the fish collected.

Index of Biotic Integrity (IBI) =	30	(Fair)
Modified Index of Well-Being (MIwb)	7.6	(Fair)
Shannon Diversity Index, no.	2.236	
Shannon Diversity Index, wt.	1.101	
N	210	
B	21.75	

Cuyahoga River Upstream of Southerly WWTC
September 8, 1999
Collection Distance: 0.5 km
Collection Method: Boat Electroshocking

Species	Number	Weight (kg)	Pollution Tolerance	#	DELT Anomalies
Dorosoma cepedianum Eastern gizzard shad	53	2.278	--	0	--
Moxostoma erythrurum Golden redhorse	3	0.698	Moderately Intolerant	0	--
Hypentelium nigricans Northern hog sucker	38	3.696	Moderately Intolerant	0	--
Moxostoma macrolepidotum Shorthead redhorse	2	0.314	Moderately Intolerant	0	
Catostomus commersoni Common white sucker	36	4.386	Highly Tolerant	2	Fin Lesion
Cyprinus carpio Common carp	21	28.541	Highly Tolerant	2	Eroded Fins Lesion
Carassius auratus Goldfish	1	0.200	Highly Tolerant	0	--
Notropis atherinoides Common Emerald shiner	9	0.150	--	0	--
Notropis spilopterus Spotfin shiner	41	0.278	--	0	--
Notropis stramineus Sand shiner	9	0.048	Moderately Intolerant	0	--
Pimephales notatus Bluntnose minnow	16	0.078	Highly Tolerant	0	--
Campostoma anomalum Central stoneroller minnow	3	0.010	--	0	--
Ictalurus punctatus Channel catfish	4	2.779	--	0	--
Ictalurus natalis Yellow bullhead	1	0.312	Highly Tolerant	0	--

Cuyahoga River Upstream of Southerly WWTC
September 8, 1999

Species	Number	Weight (kg)	Pollution Tolerance	#	DELT Anomalies
Morone chrysops White bass	3	0.086	--	0	--
Pomoxis nigromaculatus Black crappie	1	0.100	--	0	--
Micropterus salmoides Largemouth bass	1	0.022	--	0	--
Lepomis macrochirus Northern bluegill sunfish	3	0.054	Moderately Tolerant	0	--
Lepomis gibbosus Pumpkinseed sunfish	2	0.060	Moderately Tolerant	1	Deformed Tail
Percina caprodes Northern logperch darter	6	0.108	Moderately Intolerant	0	--
Etheostoma blenniodes Greenside darter	1	0.004	Moderately Intolerant	0	--
Aplodinotus grunniens Freshwater drum	2	0.620	Moderately Tolerant	0	--
hybrid	2	0.016	--	0	--
Totals	258	44.838		5	

*DELT anomalies were observed on 1.9% (5) of the fish collected.

Index of Biotic Integrity (IBI) =	26	(Fair)
Modified Index of Well-Being (MIwb)	8.3	(Marginally Good)
Shannon Diversity Index, no.	2.403	
Shannon Diversity Index, wt.	1.397	
N	362	
B	22.61	

Cuyahoga River Upstream of Southerly WWTC
July 25,2001
Collection Distance: 0.5 km
Collection Method: Boat Electroshocking

Species	Number	Weight (kg)	Pollution Tolerance	#	DELT Anomalies
Moxostoma erythrurum Golden redhorse	1	0.322	Moderately Intolerant	0	--
Moxostoma macrolepidotum Shorthead redhorse	1	0.262	Moderately Intolerant	0	--
Hypentelium nigricans Northern hog sucker	33	6.302	Moderately Intolerant	0	--
Catostomus commersoni Common white sucker	14	2.744	Highly Tolerant	2	Tail lesion
Cyprinus carpio Common carp	22	35.460	Highly Tolerant	2	Lesions
Notropis spilopterus Spotfin shiner	22	0.174	--	0	--
Notropis stramineus Sand shiner	2	0.010	Moderately Intolerant	0	--
Ictalurus punctatus Channel catfish	2	1.100	--	0	--
Ictalurus natalis Yellow bullhead	1	0.262	Highly Tolerant	0	--
Morone chrysops White bass	1	0.102	--	0	--
Pomoxis annularis White crappie	1	0.110	--	0	--
Micropterus dolomieui Smallmouth bass	2	0.256	Moderately Intolerant	0	--
Lepomis gibbosus Pumpkinseed sunfish	3	0.092	Moderately Tolerant	0	--
Percina caprodes Northern logperch darter	1	0.022	Moderately Intolerant	0	--

Cuyahoga River Upstream of Southerly WWTC
July 25,2001

Species	Number	Weight (kg)	Pollution Tolerance	#	DELT Anomalies
Aplodinotus grunniens Freshwater drum	1	0.860	Moderately Tolerant	1	Body lesion
Totals	107	48.078		5	

*DELT anomalies were observed on 4.65% (5) of the fish collected.

Index of Biotic Integrity (IBI) =	26	(Fair)
Modified Index of Well-Being (MIwb)	6.9	(Fair)
Shannon Diversity Index, wt.	0.995	
Shannon Diversity Index, no.	1.908	
N	140	
B	19.22	

Cuyahoga River Upstream of Southerly WWTC
October 1, 2001
Collection Distance: 0.5 km
Collection Method: Boat Electroshocking

Species	Number	Weight (kg)	Pollution Tolerance	#	DELT Anomalies
Dorosoma cepedianum Eastern gizzard shad	5	0.264	--	0	--
Lepisosteus osseus Longnose gar	1	0.172	--	0	--
Carpiodes cyprinus Central quillback carpsucker	1	1.525	--	0	--
Moxostoma macrolepidotum Shorthead redhorse	1	0.020	Moderately Intolerant	0	--
Hypentelium nigricans Northern hog sucker	62	12.994	Moderately Intolerant	4	Deformed & Eroded Tail
Catostomus commersoni Common white sucker	27	5.351	Highly Tolerant	1	Eroded Tail
Cyprinus carpio Common carp	9	15.547	Highly Tolerant	1	Eroded fin
Semotilus atromaculatus Creek chub	1	0.010	Highly Tolerant	0	--
Notropis spilopterus Spotfin shiner	9	0.042	--	0	--
Notropis stramineus Sand shiner	2	0.008	Moderately Intolerant	0	--
Pimephales notatus Bluntnose minnow	1	0.004	Highly Tolerant	0	--
Campostoma anomalum Central stoneroller minnow	4	0.024	--	0	--
Ictalurus punctatus Channel catfish	1	1.875	--	1	Mouth lesion
Morone chrysops White bass	1	0.022	--	0	--

Cuyahoga River Upstream of Southerly WWTC
October 1, 2001

Species	Number	Weight (kg)	Pollution Tolerance	#	DELT Anomalies
Ambloplites rupestris Northern rockbass	1	0.120	--	0	--
Micropterus dolomieui Smallmouth bass	11	2.653	Moderately Intolerant	0	--
Etheostoma blenniodes Greenside darter	1	0.004	Moderately Intolerant	0	--
Totals	138	40.635		7	

*DELT anomalies were observed on 5% (7) of the fish collected.

Index of Biotic Integrity (IBI) =	34	(Fair)
Modified Index of Well-Being (MIwb)	7.9	(Fair)
Shannon Diversity Index, wt.	1.54	
Shannon Diversity Index, no.	1.842	
N	200	
B	39.45	

Page 2 of 2

Cuyahoga River Downstream of Southerly WWTC
June 25, 1999
Collection Distance: 0.5 km
Collection Method: Boat Electroshocking

Species	Number	Weight (kg)	Pollution Tolerance	#	DELT Anomalies
Dorosoma cepedianum Eastern gizzard shad	2	0.540	--	0	--
Ictiobus cyprinellus Bigmouth buffalo	2	16.798	--	0	--
Moxostoma erythrurum Golden redhorse	8	1.490	Moderately Intolerant	1	Eroded Fins
Hypentelium nigricans Northern hog sucker	16	2.402	Moderately Intolerant	1	Eroded Tail
Catostomus commersoni Common white sucker	13	2.650	Highly Tolerant	1	Dorsal Lesion, Eroded Fins
Cyprinus carpio Common carp	5	4.507	Highly Tolerant	1	Body Tumor
Notropis chrysocephalus Striped shiner	1	0.028	--	0	--
Notropis spilopterus Spotfin shiner	10	0.130	--	0	--
Notropis stramineus Sand shiner	18	0.140	Moderately Intolerant	0	--
Pimephales promelas Northern fathead minnow	1	0.004	Highly Tolerant	0	--
Pimephales notatus Bluntnose minnow	2	0.012	Highly Tolerant	0	--
Ictalurus punctatus Channel catfish	1	0.420	--	1	Deformed Eye
Ictalurus natalis Yellow bullhead	2	0.300	Highly Tolerant	0	--
Ictalurus melas Black bullhead	1	0.300	Moderately Tolerant	1	Mouth Lesion

Cuyahoga River Downstream of Southerly WWTC
June 25, 1999

Species	Number	Weight (kg)	Pollution Tolerance	#	DELT Anomalies
Morone chrysops White bass	1	0.020	--	0	--
Micropterus dolomieui Smallmouth bass	1	0.200	Moderately Intolerant	0	--
Lepomis cyanellus Green sunfish	1	0.030	Highly Tolerant	0	--
Lepomis macrochirus Northern bluegill sunfish	1	0.032	Moderately Tolerant	0	--
Lepomis gibbosus Pumpkinseed sunfish	1	0.040	Moderately Tolerant	0	--
Percina caprodes Northern logperch darter	3	0.038	Moderately Intolerant	0	--
Totals	90	30.081		6	

*DELT anomalies were observed on 6.7% (6) of the fish collected.

Index of Biotic Integrity (IBI) =	30	(Fair)
Modified Index of Well-Being (MIwb)	8.3	(Marginally Good)
Shannon Diversity Index, not.	2.43	
Shannon Diversity Index, wt.	1.527	
N	132	
B	45.16	

Cuyahoga River Downstream of Southerly WWTC
August 5, 1999
Collection Distance: 0.5 km
Collection Method: Boat Electroshocking

Species	Number	Weight (kg)	Pollution Tolerance	#	DELT Anomalies
Dorosoma cepedianum Eastern gizzard shad	23	1.170	--	0	--
Moxostoma erythrurum Golden redhorse	14	4.903	Moderately Intolerant	2	Eroded Fins
Hypentelium nigricans Northern hog sucker	15	2.259	Moderately Intolerant	0	--
Catostomus commersoni Common white sucker	15	1.924	Highly Tolerant	0	--
Cyprinus carpio Common carp	23	46.197	Highly Tolerant	0	--
Carassius auratus Goldfish	4	0.066	Highly Tolerant	0	--
Notemigonus crysoleucas Golden shiner	1	0.010	Highly Tolerant	0	--
Semotilus atromaculatus Creek chub	2	0.004	Highly Tolerant	0	--
Notropis cornutus Common shiner	14	0.076	--	0	--
Notropis spilopterus Spotfin shiner	63	0.302	--	0	--
Notropis stramineus Sand shiner	19	0.040	Moderately Intolerant	0	--
Pimephales promelas Northern fathead minnow	5	0.018	Highly Tolerant	0	--
Pimephales notatus Bluntnose minnow	4	0.010	Highly Tolerant	0	--
Ictalurus punctatus Channel catfish	2	0.810	--	0	--

Cuyahoga River Downstream of Southerly WWTC
August 5, 1999

Species	Number	Weight (kg)	Pollution Tolerance	#	DELT Anomalies
Ictalurus natalis Yellow bullhead	2	0.330	Highly Tolerant	0	--
Morone chrysops White bass	4	0.502	--	0	--
Ambloplites rupestris Northern rockbass	2	0.244	--	0	--
Micropterus dolomieui Smallmouth bass	12	3.716	Moderately Intolerant	0	--
Lepomis cyanellus Green sunfish	4	0.064	Highly Tolerant	0	--
Lepomis macrochirus Northern bluegill sunfish	2	0.042	Moderately Tolerant	0	--
Lepomis gibbosus Pumpkinseed sunfish	6	0.066	Moderately Tolerant	0	--
Percina caprodes Northern logperch darter	1	0.012	Moderately Intolerant	0	--
hybrid	6	0.130	--	0	--
Totals	243	62.895		2	

*DELT anomalies were observed on 0.8% (2) of the fish collected.

Index of Biotic Integrity (IBI) =	32	(Fair)
Modified Index of Well-Being (MIwb)	8.3	(Marginally Good)
Shannon Diversity Index, no.	2.593	
Shannon Diversity Index, wt.	1.122	
N	354	
B	28.28	

Note: 5 individuals identified as Moxostoma erythrurum (Golden redhorse) may have been another Moxostoma species or Moxostoma macrolepidotum (Shorthead redhorse)
If identified as Shorthead redhorse IBI Score would = 34 (Fair)

Cuyahoga River Downstream of Southerly WWTC
September 8, 1999

Collection Distance: 0.5 km
Collection Method: Boat Electroshocking

Species	Number	Weight (kg)	Pollution Tolerance	#	DELT Anomalies
Dorosoma cepedianum Eastern gizzard shad	46	2.248	--	0	--
Moxostoma erythrurum Golden redhorse	12	3.746	Moderately Intolerant	1	Eroded Tail
Moxostoma macrolepidotum Shorthead redhorse	3	0.402	Moderately Intolerant	0	--
Hypentelium nigricans Northern hog sucker	31	2.984	Moderately Intolerant	0	--
Catostomus commersoni Common white sucker	21	4.474	Highly Tolerant	1	Dorsal Lesion
Cyprinus carpio Common carp	16	18.751	Highly Tolerant	1	Deformed Fin
Semotilus atromaculatus Creek chub	2	0.008	Highly Tolerant	0	--
Notropis cornutus Common shiner	6	0.070	--	0	--
Notropis spilopterus Spotfin shiner	49	0.248	--	0	--
Notropis stramineus Sand shiner	5	0.016	Moderately Intolerant	0	--
Pimephales promelas Northern fathead minnow	5	0.016	Highly Tolerant	0	--
Pimephales notatus Bluntnose minnow	20	0.062	Highly Tolerant	0	--
Campostoma anomalum Central stoneroller minnow	1	0.012	--	0	--
Ictalurus punctatus Channel catfish	5	2.769	--	0	--

Cuyahoga River Downstream of Southerly WWTC
September 8, 1999

Species	Number	Weight (kg)	Pollution Tolerance	#	DELT Anomalies
Ictalurus natalis Yellow bullhead	5	1.110	Highly Tolerant	0	--
Morone chrysops White bass	1	0.010	--	0	--
Pomoxis nigromaculatus Black crappie	1	0.070	--	0	--
Ambloplites rupestris Northern rockbass	3	0.350	--	0	--
Micropterus dolomieui Smallmouth bass	13	2.020	Moderately Intolerant	0	--
Micropterus salmoides Largemouth bass	1	0.032	--	0	--
Lepomis gulosus Warmouth sunfish	1	0.040	--	0	--
Lepomis cyanellus Green sunfish	16	0.274	Highly Tolerant	0	--
Lepomis macrochirus Northern bluegill sunfish	4	0.032	Moderately Tolerant	0	--
Lepomis gibbosus Pumpkinseed sunfish	9	0.158	Moderately Tolerant	0	--
hybrid	6	0.076	--	0	--
Totals	282	39.978		3	

*DELT anomalies were observed on 1.1% (3) of the fish collected.

Index of Biotic Integrity (IBI) =	32	(Fair)
Modified Index of Well-Being (MIwb)	9.2	(Very Good)
Shannon Diversity Index, no.	2.677	
Shannon Diversity Index, wt.	1.863	
N	382	
B	30.41	

Cuyahoga River Downstream of Southerly WWTC
July 25, 2001
Collection Distance: 0.5 km
Collection Method: Boat Electroshocking

Species	Number	Weight (kg)	Pollution Tolerance	#	DELT Anomalies Description
Dorosoma cepedianum Eastern gizzard shad	13	2.365	--	0	--
Moxostoma erythrurum Golden redhorse	5	1.270	Moderately Intolerant	0	--
Moxostoma macrolepidotum Shorthead redhorse	17	5.425	Moderately Intolerant	0	--
Hypentelium nigricans Northern hog sucker	23	4.090	Moderately Intolerant	1	Body Lesion
Catostomus commersoni Common white sucker	17	4.500	Highly Tolerant	0	--
Cyprinus carpio Common carp	11	22.889	Highly Tolerant	0	--
Notropis spilopterus Spotfin shiner	3	0.002	--	0	--
Ictalurus punctatus Channel catfish	3	1.600	--	0	--
Ictalurus natalis Yellow bullhead	1	0.200	Highly Tolerant	0	--
Morone americana White perch	2	0.125	--	0	--
Ambloplites rupestris Northern rockbass	1	0.125	--	0	--
Micropterus dolomieui Smallmouth bass	2	0.500	Moderately Intolerant	0	--
Lepomis cyanellus Green sunfish	2	0.075	Highly Tolerant	0	--
Percina caprodes Northern logperch darter	1	0.100	Moderately Intolerant	0	--

Cuyahoga River Downstream of Southerly WWTC
July 25, 2001

Species	Number	Weight (kg)	Pollution Tolerance	#	DELT Anomalies Description
Aplodinotus grunniens Freshwater drum	1	1.000	Moderately Tolerant	0	--
Totals	102	44.266		1	

*DELT anomalies were observed on .9% (1) of the fish collected.

Index of Biotic Integrity (IBI) =	32	(Fair)
Modified Index of Well-Being (MIwb)	8.1	(Fair)
Shannon Diversity Index, wt.	1.648	
Shannon Diversity Index, no.	2.204	
N	138	
B	32.95	

Cuyahoga River Downstream of Southerly WWTC
October 1, 2001
Collection Distance: 0.5 km
Collection Method: Boat Electroshocking

Species	Number	Weight (kg)	Pollution Tolerance	#	DELT Anomalies
Dorosoma cepedianum Eastern gizzard shad	36	1.111	--	0	--
Esox lucius Northern pike	1	1.100	--	0	--
Moxostoma erythrurum Golden redhorse	1	0.400	Moderately Intolerant	0	--
Moxostoma macrolepidotum Shorthead redhorse	9	4.574	Moderately Intolerant	2	Deformed Tail
Hypentelium nigricans Northern hog sucker	25	5.108	Moderately Intolerant	4	Eroded & Deformed Tail
Catostomus commersoni Common white sucker	21	5.697	Highly Tolerant	0	--
Cyprinus carpio Common carp	16	27.428	Highly Tolerant	0	--
Notemigonus crysoleucas Golden shiner	2	0.024	Highly Tolerant	1	Deformed Tail
Notropis atherinoides Common Emerald shiner	2	0.020	--	0	--
Notropis cornutus Common shiner	2	0.140	--	0	--
Notropis spilopterus Spotfin shiner	2	0.024	--	0	--
Campostoma anomalum Central stoneroller minnow	1	0.020	--	0	--
Ictalurus punctatus Channel catfish	3	2.385	--	1	Eroded barbel
Morone chrysops White bass	1	0.022	--	0	--

Cuyahoga River Downstream of Southerly WWTC
October 1, 2001

Species	Number	Weight (kg)	Pollution Tolerance	#	DELT Anomalies
Micropterus dolomieui Smallmouth bass	10	2.164	Moderately Intolerant	0	--
Lepomis cyanellus Green sunfish	3	0.118	Highly Tolerant	0	--
Lepomis megalotis Northern longear sunfish	1	0.068	Moderately Intolerant	0	--
Aplodinotus grunniens Freshwater drum	1	0.250	Moderately Tolerant	0	--
Totals	137	50.653		8	

*DELT anomalies were observed on 5.9% (8) of the fish collected.

Index of Biotic Integrity (IBI) =	26	(Fair)
Modified Index of Well-Being (MIwb)	8.2	(Marginally Good)
Shannon Diversity Index, wt.	1.592	
Shannon Diversity Index, no.	2.199	
N	190	
B	34.77	

Cuyahoga River Upstream of Big Creek
July 27, 2001
Collection Distance: 0.5 km
Collection Method: Boat Electroshocking

Species	Number	Weight (kg)	Pollution Tolerance	#	DELT Anomalies
Dorosoma cepedianum Eastern gizzard shad	9	1.601	--	0	--
Carpiodes cyprinus Central quillback carpsucker	1	1.000	--	1	Deformed fin
Catostomus commersoni Common white sucker	5	0.966	Highly Tolerant	1	Eroded Fin
Cyprinus carpio Common carp	16	37.180	Highly Tolerant	3	Deformed Tail Lesions
Notropis atherinoides Common Emerald shiner	1	0.006	--	0	--
Notropis spilopterus Spotfin shiner	4	0.028	--	0	--
Ictalurus punctatus Channel catfish	2	1.050	--	0	--
Pomoxis annularis White crappie	1	0.130	--	0	--
Micropterus dolomieui Smallmouth bass	3	0.457	Moderately Intolerant	0	--
Lepomis gulosus Warmouth sunfish	1	0.050	--	0	--
Lepomis cyanellus Green sunfish	1	0.038	Highly Tolerant	0	--

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Cuyahoga River Upstream of Big Creek
July 27, 2001

Species	Number	Weight (kg)	Pollution Tolerance	#	DELT Anomalies
Lepomis macrochirus Northern bluegill sunfish	1	0.032	Moderately Tolerant	0	--
Totals	45	42.538		5	

*DELT anomalies were observed on 11.1% (5) of the fish collected.

Index of Biotic Integrity (IBI) =	18	(Poor)
Modified Index of Well-Being (MIwb)	5.6	(Poor)
Shannon Diversity Index, wt.	0.599	
Shannon Diversity Index, no.	1.975	
N	46	
B	8.708	

Cuyahoga River Downstream of Big Creek
June 24, 1999
Collection Distance: 0.5 km
Collection Method: Boat Electroshocking

Species	Number	Weight (kg)	Pollution Tolerance	#	DELT Anomalies
Dorosoma cepedianum Eastern gizzard shad	38	4.156	--	1	Deformed Eye
Moxostoma erythrurum Golden redhorse	2	0.132	Moderately Intolerant	0	--
Hypentelium nigricans Northern hog sucker	3	0.172	Moderately Intolerant	0	--
Catostomus commersoni Common white sucker	9	4.246	Highly Tolerant	0	--
Cyprinus carpio Common carp	12	36.875	Highly Tolerant	0	--
Notemigonus crysoleucas Golden shiner	1	0.030	Highly Tolerant	0	--
Notropis spilopterus Spotfin shiner	12	0.126	--	0	--
Pimephales notatus Bluntnose minnow	2	0.012	Highly Tolerant	0	--
Ictalurus punctatus Channel catfish	2	3.550	--	1	Eroded Barbels
Ictalurus natalis Yellow bullhead	1	0.090	Highly Tolerant	0	--
Micropterus dolomieui Smallmouth bass	3	0.224	Moderately Intolerant	0	--
Lepomis gibbosus Pumpkinseed sunfish	2	0.122	Moderately Tolerant	0	--
Percina caprodes Northern logperch darter	1	0.014	Moderately Intolerant	0	--
Aplodinotus grunniens Freshwater drum	1	0.560	Moderately Tolerant	0	--

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Cuyahoga River Downstream of Big Creek
June 24, 1999

Species	Number	Weight (kg)	Pollution Tolerance	#	DELT Anomalies
Totals	89	50.309		2	

*DELT anomalies were observed on 3.4% (3) of the fish collected.

Index of Biotic Integrity (IBI) =	16	(Poor)
Modified Index of Well-Being (MIwb)	6.8	(Fair)
Shannon Diversity Index, no.	1.907	
Shannon Diversity Index, wt.	0.988	
N	128	
B	18.11	

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Cuyahoga River Downstream of Big Creek
July 28, 1999
Collection Distance: 0.5 km
Collection Method: Boat Electroshocking

Species	Number	Weight (kg)	Pollution Tolerance	#	DELT Anomalies
Dorosoma cepedianum Eastern gizzard shad	14	0.928	--	0	--
Moxostoma erythrurum Golden redhorse	9	0.819	Moderately Intolerant	0	--
Hypentelium nigricans Northern hog sucker	21	2.054	Moderately Intolerant	0	--
Catostomus commersoni Common white sucker	9	3.358	Highly Tolerant	2	Body Lesion Eroded Fin
Cyprinus carpio Common carp	12	32.800	Highly Tolerant	2	Eroded Fins
Semotilus atromaculatus Creek chub	4	0.004	Highly Tolerant	0	--
Notropis spilopterus Spotfin shiner	4	0.022	--	0	--
Notropis stramineus Sand shiner	3	0.006	Moderately Intolerant	0	--
Micropterus dolomieui Smallmouth bass	4	0.536	Moderately Intolerant	0	--
Lepomis cyanellus Green sunfish	1	0.030	Highly Tolerant	0	--
hybrid	1	0.070	--	0	--
Totals	82	40.627		4	

*DELT anomalies were observed on 4.9% (4) of the fish collected.

Index of Biotic Integrity (IBI) =	20	(Poor)
Modified Index of Well-Being (MIwb)	6.3	(Poor)
Shannon Diversity Index, no.	2.087	
Shannon Diversity Index, wt.	0.774	
N	110	
B	8.73	

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Cuyahoga River Downstream of Big Creek
September 10, 1999
Collection Distance: 0.5 km
Collection Method: Boat Electroshocking

Species	Number	Weight (kg)	Pollution Tolerance	#	DELT Anomalies
Dorosoma cepedianum Eastern gizzard shad	61	4.764	--	0	--
Moxostoma erythrurum Golden redhorse	11	2.284	Moderately Intolerant	0	--
Hypentelium nigricans Northern hog sucker	16	1.970	Moderately Intolerant	0	--
Catostomus commersoni Common white sucker	8	2.606	Highly Tolerant	0	--
Cyprinus carpio Common carp	5	24.138	Highly Tolerant	1	Deformed Tail
Notemigonus crysoleucas Golden shiner	1	0.006	Highly Tolerant	0	--
Notropis spilopterus Spotfin shiner	24	0.148	--	0	--
Pimephales notatus Bluntnose minnow	3	0.010	Highly Tolerant	0	--
Ambloplites rupestris Northern rockbass	4	0.508	--	0	--
Micropterus dolomieui Smallmouth bass	7	1.000	Moderately Intolerant	0	--
Lepomis macrochirus Northern bluegill sunfish	2	0.054	Moderately Tolerant	0	--
Lepomis gibbosus Pumpkinseed sunfish	8	0.354	Moderately Tolerant	0	--
Aplodinotus grunniens Freshwater drum	1	0.050	Moderately Tolerant	0	--
hybrid	1	0.120	--	0	--

Cuyahoga River Downstream of Big Creek
September 10, 1999

Species	Number	Weight (kg)	Pollution Tolerance	#	DELT Anomalies
Totals	152	38.012		1	

*DELT anomalies were observed on 0.66% (1) of the fish collected.

Index of Biotic Integrity (IBI) =	30	(Fair)
Modified Index of Well-Being (MIwb)	7.6	(Fair)
Shannon Diversity Index, no.	1.978	
Shannon Diversity Index, wt.	1.313	
N	268	
B	22.26	

Cuyahoga River Downstream of Big Creek
July 27, 2001
Collection Distance: 0.5 km
Collection Method: Boat Electroshocking

Species	Number	Weight (kg)	Pollution Tolerance	#	DELT Anomalies
Dorosoma cepedianum Eastern gizzard shad	15	1.348	--	0	--
Hypentelium nigricans Northern hog sucker	14	3.214	Moderately Intolerant	2	Eroded Tail
Catostomus commersoni Common white sucker	19	3.727	Highly Tolerant	0	--
Cyprinus carpio Common carp	11	36.270	Highly Tolerant	0	--
Carassius auratus Goldfish	1	0.010	Highly Tolerant	0	--
Notropis atherinoides Common Emerald shiner	2	0.012	--	0	--
Notropis spilopterus Spotfin shiner	6	0.042	--	0	--
Campostoma anomalum Central stoneroller minnow	1	0.002	--	0	--
Ambloplites rupestris Northern rockbass	1	0.190	--	0	--
Micropterus dolomieui Smallmouth bass	2	0.275	Moderately Intolerant	0	--
Lepomis megalotis Northern longear sunfish	1	0.042	Moderately Intolerant	0	--

Cuyahoga River Downstream of Big Creek
July 27, 2001

Species	Number	Weight (kg)	Pollution Tolerance	#	DELT Anomalies
Lepomis gibbosus Pumpkinseed sunfish	1	0.052	Moderately Tolerant	0	--
Totals	74	45.184		2	

*DELT anomalies were observed on 2.7% (2) of the fish collected.

Index of Biotic Integrity (IBI) =	22	(Poor)
Modified Index of Well-Being (MIwb)	6.1	(Poor)
Shannon Diversity Index, wt.	0.754	
Shannon Diversity Index, no.	1.961	
N	86	
B	10.35	

APPENDIX N
BRANDYWINE CREEK ELECTROFISHING SURVEY
2002

Introduction

Northeast Ohio Regional Sewer District (NEORSD) investigators conducted generator-powered longline electrofishing sampling on Brandywine Creek on July 11 and August 15, 2002. The purpose of the survey was to evaluate the overall fish community health following the decommissioning of the Hudson Wastewater Treatment Plant. Sampling was also conducted in 1998, prior to the plant's decommissioning. During the survey, fish were identified to species level, weighed, counted, examined for the presence of DELT anomalies (deformities, eroded fins, lesions and tumors), and returned to the stream where they were collected.

Longline electrofishing consists of wading in an upstream direction for a distance of 150-200 meters and sampling all habitat types including undercut banks, brush piles, log jams, boulders and other submerged structures. Fish are then netted and placed in a nylon floating live well where they are later processed. Ohio Environmental Protection Agency (Ohio EPA) protocols require two or three individual sampling passes during a season to assess fish community health at each site.

The electrofishing data collected by NEORSD were compiled and used to calculate the Index of Biotic Integrity (IBI). The IBI incorporates 12 metrics representing structural and functional attributes of a fish community. Structural attributes are based upon fish community aspects such as fish numbers and diversity. Functional attributes are based upon fish community aspects such as feeding strategies, environmental tolerances and disease symptoms. The metrics are individually scored by comparing the results obtained at the survey site with values expected at reference sites located in the same geographic ecoregion. The summation of the 12 individual metric scores provides an IBI score between 12 and 60 and an associated narrative rating (*Exceptional*, *Good*, *Fair*, or *Poor*) of fish community health.

Detailed descriptions of sampling and analysis methods utilized in fish surveys, including IBI calculations and the relationship between narrative ratings and index scores can be found in Ohio EPA's *Biological Criteria for the Protection of Aquatic Life* (1987) and *Compendium of Biological Results from Ohio Rivers, Streams and Lakes* (1989).

Results and Discussion

The upstream fish sampling site is located at River Mile 8.0, approximately 0.2 kilometers upstream of the former plant effluent discharge to Brandywine Creek, while the downstream site began approximately 10 to 15 feet downstream of the former WWTP effluent discharge. A map of the electrofishing sites may be viewed at the end of this report. Investigators assessed aquatic habitat conditions at each site using Ohio EPA's Qualitative Habitat Evaluation Index (QHEI).

2002 QHEI scores revealed below average (*Fair and Poor*) habitat conditions upstream and downstream of the WWTP, respectively. The habitat assessments showed a variety of conditions that point to poor fish community conditions. Extremely low flow conditions influenced the physical habitat of the sampling zone. Examples of poor habitat features exacerbated by low flow conditions include underdeveloped pools and riffles, absence of deep pools (pools > 3 foot depths) and lack of functional substrate such as submerged boulders. Submerged boulders would provide cover for fish and also serve as habitat structure for macroinvertebrate colonization, which is a source of food for fish. In 2002, The Ohio Department of Transportation (ODOT) initiated bridge reconstruction work on the Ohio Turnpike (Route 80). This reconstruction project took place on the bridge crossing Brandywine Creek approximately 100 feet upstream of the former Hudson WWTP effluent discharge. After completion of the bridgework, stream habitat alterations may have attributed to the lower QHEI score. The habitat prior to bridge reconstruction consisted of deep pools, but these were filled in with soil from excavation work. Furthermore, extensive embeddedness of stream bottom substrates from sedimentation, sparse to absent instream cover, and no riffles also appear to be a result from the work performed by ODOT in 2002.

Habitat conditions in 1998, upstream of the WWTP included above average instream cover which consisted of undercut banks, overhanging vegetation, rootmats, rootwads, boulders, logs and woody debris. Cobble and gravel were the main substrate types, and the sinuosity of the creek was low to moderate with good development of riffle and runs. Maximum pool depth was greater than 3 feet with a riparian zone consisting of forest swamp. A QHEI score of 75 was obtained at the upstream site. The downstream site demonstrated below average instream cover with no rootwads, boulders, or deep pools. Poor development of riffles and runs was evident, while the predominant flood plain quality was shrub or old field. A QHEI score of 57.75 was obtained at the downstream site. According to Ohio EPA's *The Qualitative Habitat Evaluation Index (QHEI): Rationale, Methods, and Application*, "Stream reaches with QHEI scores averaging > 60 will likely have the potential to attain the WWH use" (p. 40). Brandywine Creek QHEI scores are shown graphically in Figure N-1. QHEI Field Sheets are located in Appendix D of this report.

Brandywine Creek has been assigned the Warmwater Habitat (WWH) aquatic life use designation by the Ohio EPA. Index scores must fall into the *Good* range (minimum score of 40 for wading sites such as these) to meet the WWH biological criteria. The Brandywine Creek sites electrofished by NEORSD in 2002 obtained average IBI scores in the *Fair* range. A summary of electrofishing results, which includes NEORSD scores obtained in 1998 as well as Ohio EPA scores from 1984 and 1996 is presented in Table N-1. Additional tables which, for each 2002 sampling event, list the species collected, number of individuals, weights, pollution tolerances and incidence of DELT anomalies, can be found at the end of this report. IBI scores from 2002 and average IBI scores from 1984-2002 are shown graphically in Figures N-2 and N-3, respectively.

Water quality samples were obtained from each of the Brandywine Creek electroshocking zones for bacteriological and chemical analysis. Four samples were collected and analyzed at the Brandywine Creek sites in 2002. At both the upstream and downstream sites, bacteriological data revealed excursions from Ohio EPA's primary contact recreational use designation *Escherichia coli* (*E. coli*) and fecal coliform criteria of 298 colonies/100mL and 2,000 colonies/100mL on two occasions as listed below:

	Brandywine Creek			
	Upstream of Hudson WWTP		Downstream of Hudson WWTP	
Parameter	07/11/02	08/15/02	07/11/02	08/15/02
E. coli	-	1,400	-	2,400
Fecal Coliform	359	4,200	450	4,800
Bacteriological densities in colonies/100mL				

Water quality samples were collected on Brandywine Creek in 1998 upstream and downstream of the former WWTP. Chemical parameters were analyzed, however, no bacteriological parameters were not. Chemical parameters met warmwater habitat criteria upstream and downstream of the former Hudson WWTP on Brandywine Creek during both sampling events in 1998 and 2002.

Average IBI scores remained relatively constant from 1984 to 2002 upstream of the Hudson WWTP. Average IBI scores declined from 1984 to 2002 downstream of the Hudson WWTP. The proportion of pollution tolerant fish was showing improvement up to 1998, but in 2002 the proportion of pollution tolerant fish increased. The increase in the proportion of pollution tolerant fish, which is shown graphically in Figure N-4, may be indicative of a water quality impairment consisting of elevated bacteriological densities or drought-like conditions during the time of the biosurveys on Brandywine Creek. See table above for bacteriological results.

According to "Fish Communities as Indicators of Environmental Degradation" by Kurt D. Fausch et al, in *Biological Indicators of Stress in Fish*, the following nine primary underlying assumptions of the Index of Biotic Integrity indicate how stream fish communities change with environmental degradation.

1) *The number of all native species and those in specific taxa or habitat guilds declines.*
2) *The number of intolerant species declines.*
3) *The proportion of tolerant species increases.*
4) *The proportion of insectivores and carnivores decline.*
5) *The proportion of generalists and omnivores increases.*
6) *Fish abundance declines.*
7) *The proportion of Lithophilic spawning fish (fish requiring silt free substrates to spawn) decline and the number of hybrid fish increase.*
8) *The incidence of DELT (Deformities, Erosions, Lesions, Tumors and external anomalies) increase.*
9) *Introduced species increases.*

The following is an examination of Fausch's nine assumptions as they relate to the Brandywine Creek fish community downstream of Hudson WWTP (Table N-2).

IBI scores were calculated on Brandywine Creek upstream and downstream of the former Hudson WWTP however, Fausch's principals were used in a comparative study looking at how the fish community was rated before and after decommissioning of the

Hudson wastewater treatment plant. Fausche's principles were examined at the downstream sites in 1998 and 2000.

Assumption 1: The number of native species collected downstream of the former Hudson WWTP decreased from 1998 to 2000. The decrease in the number of native species may indicate that an environmental degradation has occurred. Fourteen native species were collected in 1998 downstream of the former Hudson WWTP as compared to twelve native species collected in 2002. This change had no effect on the scoring criteria of the IBI metric.

Assumption 2: There were no intolerant species collected downstream of Hudson WWTP in 1998 or 2002 on Brandywine Creek. The absence of intolerant species indicates some type of stress occurring in the environment.

Assumption 3: An increase in the proportion of tolerant species downstream of the former Hudson WWTP on Brandywine Creek was observed in 2002, 26.8% in 1998 versus 67% in 2002. The increase of proportion of tolerant species may indicate that some type of environmental degradation is occurring.

Assumption 4: The percentage of insectivores and carnivores increased from 1998 to 2002, downstream of Hudson WWTP on Brandywine Creek. As the water quality in the stream improves, insect populations increase, therefore the percentage of fish which feed on insects increases. An 8.2% increase in insectivores and carnivores was evident in 2002 compared to 1998. 1998 NEORSD data show 21.2% of the total fish collected were insectivores and carnivores versus 29.4% of total fish collected comprising insectivores and carnivores in 2002 downstream of the former Hudson WWTP. The increase in insectivores and carnivores indicates an improvement in water quality.

Assumption 5: The proportion of generalists and omnivores increases. A 33.2% increase in generalist feeders and omnivores was noted downstream from the former Hudson WWTP in 2002 compared to 1998 data. This correlates to an environmental degradation.

Assumption 6: Average fish numbers increased at the downstream location in 2002 compared to average numbers of fish collected in 1998. A 68% increase in average fish numbers was noted in 2002 compared to 1998. An increase in the numbers of fish downstream of Hudson WWTP is indicative of an environmental improvement in water quality.

Assumption 7: Lithophilic spawning fish require clean gravel or cobble for successful reproduction and are the most environmentally sensitive of the fish spawning guilds. In 1998, 4.4% of the total fish collected were comprised of lithophils compared to 0.27% in 2002. Sampling results showed a decrease in the proportion of lithophilic spawning fish from 1998 to 2002 at the downstream site. A decrease in lithophilic spawning fish indicates an environmental degradation.

Assumption 8: A decline in the incidence of DELT (Deformities Erosions, Lesions and Tumors) anomalies was evident. 2002 sampling results downstream of Hudson WWTP showed 0.82% of total fish collected had DELT anomalies compared to 1% of the fish collected in 1998. Sampling results indicated an improvement in water quality downstream of the former Hudson WWTP on Brandywine Creek due to a low percentage of fish contracting DELT anomalies.

Assumption 9: Little change in the proportion of introduced species was observed from 1998 to 2002 on Brandywine Creek downstream of Hudson WWTP. One common carp was the only introduced species collected in 2002. A 0.13 percent increase in carp was noted downstream from the former Hudson WWTP in 2002 compared to 1998 data. This slight increase in the collection of introduced species suggests an environmental degradation.

Three of nine of Fausch's assumptions (#4, #6, and #8) indicate an improvement in the Brandywine Creek water quality downstream from the former Hudson WWTP from 1998 to 2002, while the remaining six assumptions (#1, #2, #3, #5, #7, and #9) may indicate a decline in water quality.

Conclusion

The proportion of pollution tolerant fish collected on Brandywine Creek, both upstream and downstream of the Hudson WWTP has increased since 1989. During the same time period, IBI scores have remained relatively constant at the upstream location, but have decreased at the downstream location. Upstream IBI scores were rated *Marginally Good* to *Fair* in 1998 and were rated *Fair* in 2002. Downstream IBI scores have fallen from the *Fair* range in 1998 to the *Poor* range in 2002. Low flow conditions or the presence of other pollutants (indicated by increased bacterial densities) may be contributing to the reduction in index scores. Future biosurveys and water quality sampling on Brandywine Creek during normal stream flow conditions are warranted to determine the cause of the decline in fish community scores downstream of the former Hudson WWTP.

Table N-1
Brandywine Creek Index of Biotic Integrity Scores
1984-2002

		Upstream of Hudson WWTP		Downstream of Hudson WWTP	
Date	Collected By	Score	Narrative Rating	Score	Narrative Rating
07/11/02	NEORSD	34	Fair	20	Poor
08/15/02	NEORSD	34	Fair	22	Poor
2002 Average		34	Fair	21	Poor
07/02/98	NEORSD	34	Fair	30	Fair
09/11/98	NEORSD	36	Marginally Good	34	Fair
1998 Average		35	Fair	32	Fair
08/02/96	OEPA			30	Fair
07/23/84	OEPA	32	Fair	28	Fair
08/15/84	OEPA	38	Marginally Good	38	Marginally Good
08/29/84	OEPA	34	Fair	24	Poor
1984 Average		35	Fair	30	Fair

Figure N-1
Brandywine Creek Qualitative Habitat Evaluation Index Scores
1998-2002

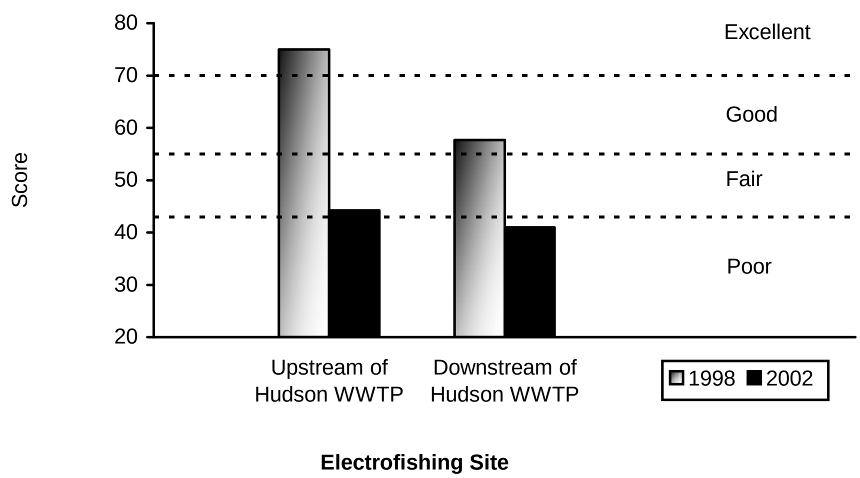


Figure N-2
Brandywine Creek Index of Biotic Integrity Scores
2002

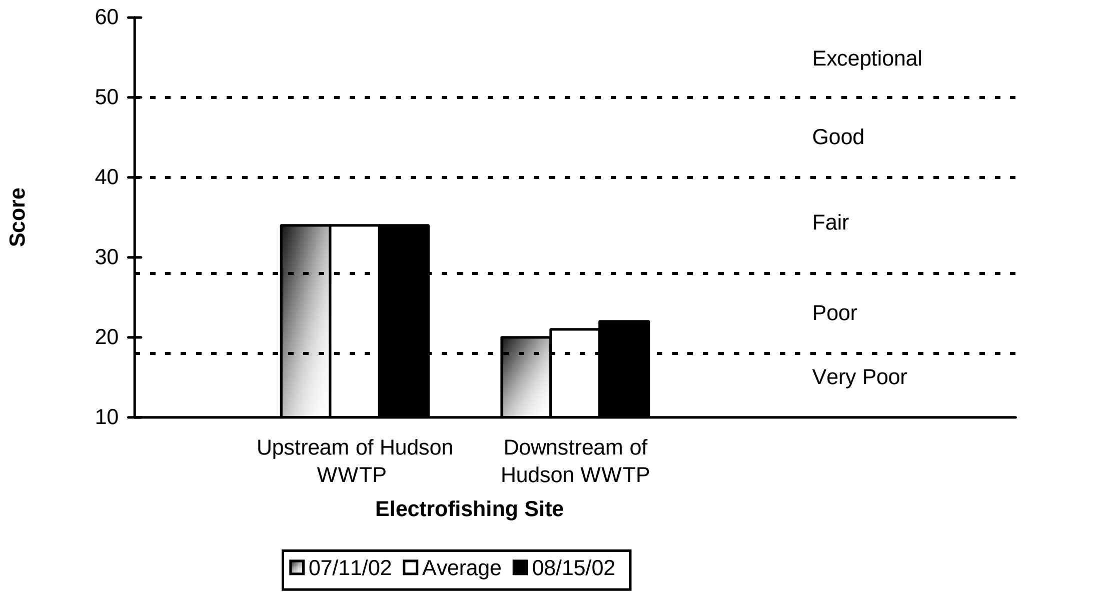


Figure N-3
Average Brandywine Creek Index of Biotic Integrity Scores
1984-2002

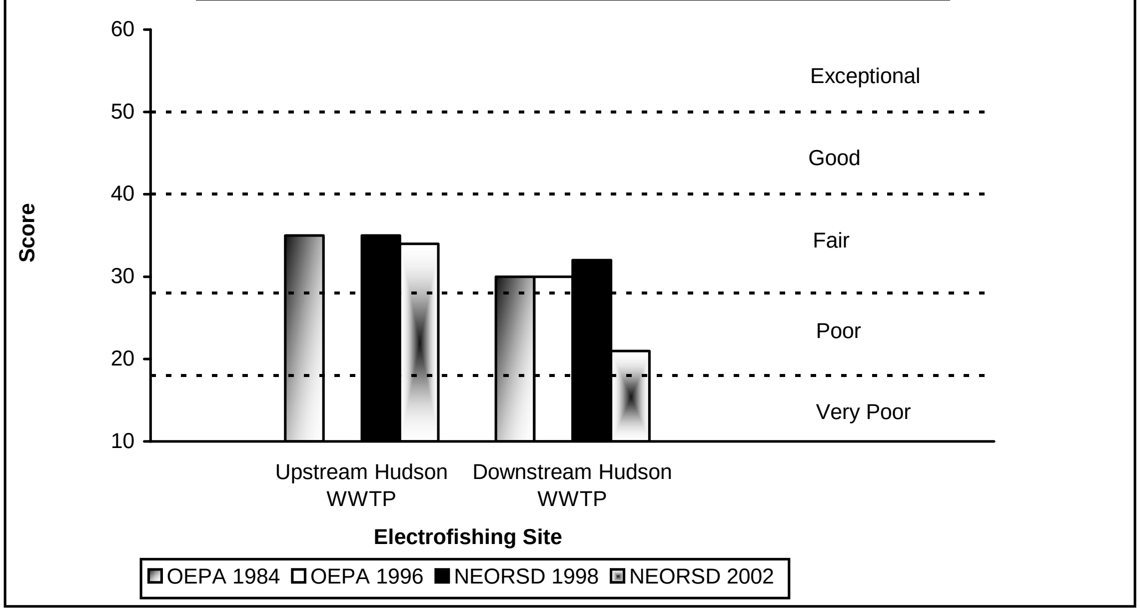
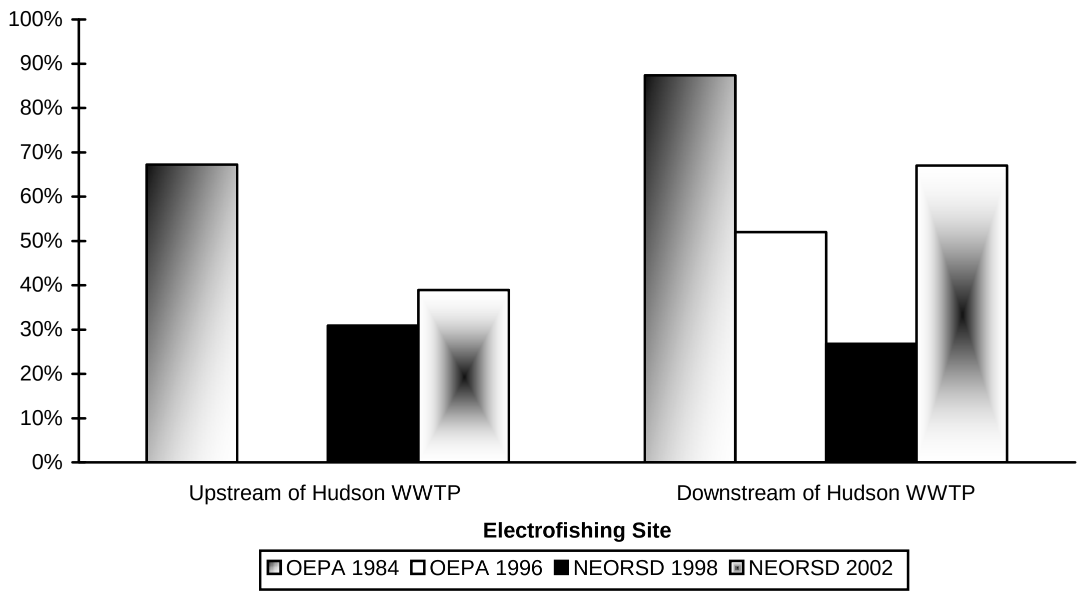
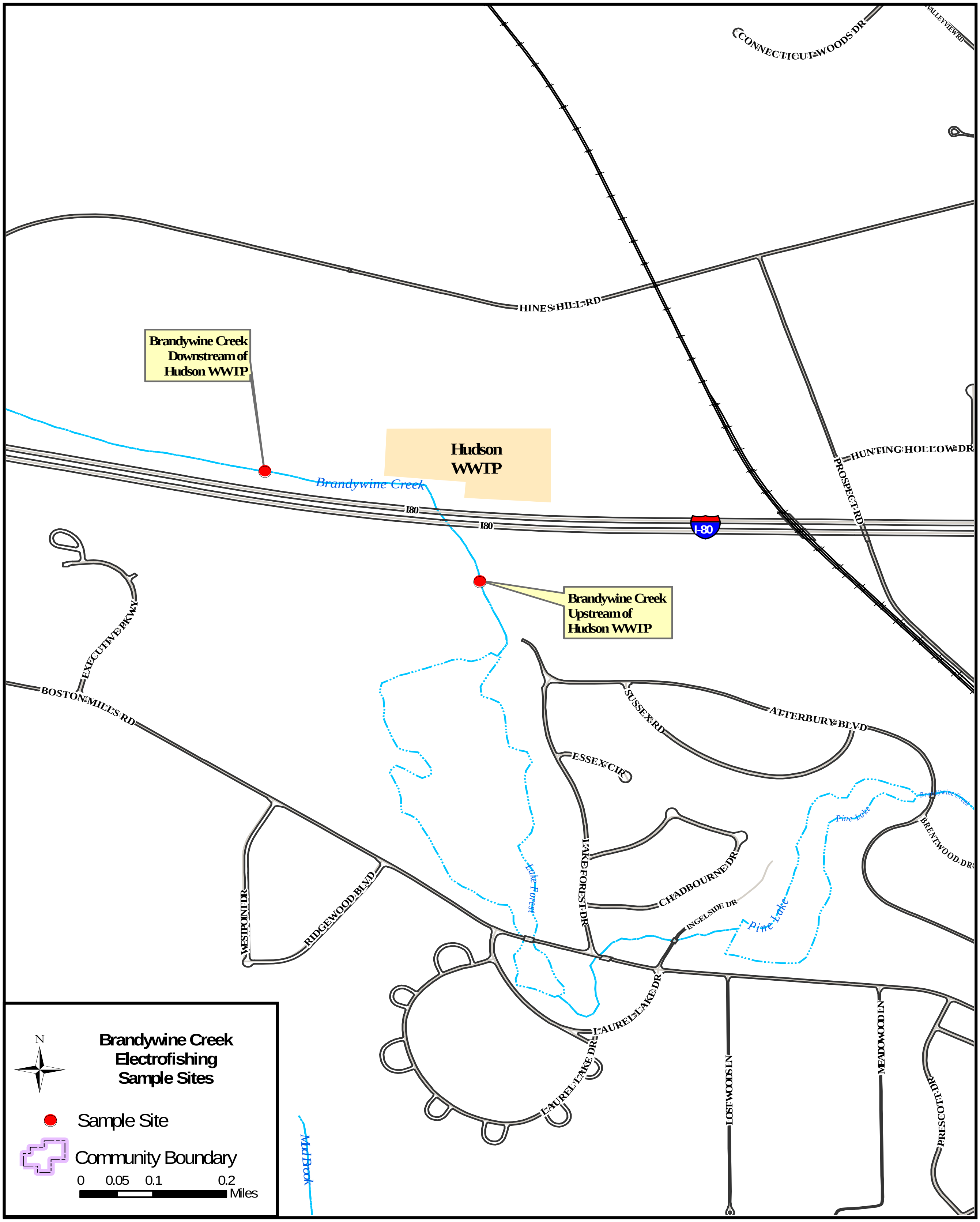


Figure N-4
Proportion of Highly Tolerant Fishes Collected
Brandywine Creek, 1984-2002




Brandywine Creek Electrofishing Sample Sites
Sample Site
Community Boundary
0 0.05 0.1 0.2 Miles
N
Brandywine Creek Downstream of Hudson WWTP
Brandywine Creek Upstream of Hudson WWTP
Hudson WWTP
Brandywine Creek
I-80
HINES HILL RD
CONNECTICUT WOODS DR
HUNTING HOLLOW DR
PROSPECT RD
EXECUTIVE PKWY
BOSTON MILLS RD
ATTERBURY BLVD
SUSSEX RD
ESSEX CIR
LAKE FOREST DR
CHADBOURNE DR
INGELSIDE DR
Pine Lake
BRENTWOOD DR
WESTPOINT DR
RIDGEWOOD BLVD
Lake Forest
LAUREL LAKE DR
LOST WOODS LN
MEADOWOOD LN
PRESCOTT DR
Mud Brook

Brandywine Creek: Upstream of Hudson Wastewater Treatment Plant
Sample Date: 7/11/02
Collection Distance: 0.2 km
Collection Method: Longline Electroshocking

Species	Number	Weight (kg)	Pollution Tolerance	#	DELT Anomalies Description
Catostomus commersoni Common white sucker	3	0.054	Highly Tolerant	1	Body Lesion
Cyprinus carpio Common carp	7	9.600	Highly Tolerant	2	Body Lesions Deformed Fin
Notemigonus crysoleucas Golden shiner	67	0.506	Highly Tolerant	0	--
Rhinicthys atratulus Blacknose dace	1	0.010	Highly Tolerant	0	--
Semotilus atromaculatus Creek chub	2	0.018	Highly Tolerant	0	--
Pimephales notatus Bluntnose minnow	2	0.012	Highly Tolerant	0	--
Campostoma anomalum Central stoneroller minnow	46	0.277	--	1	Body Lesion
Ictalurus punctatus Channel catfish	1	0.120	--	0	--
Ictalurus natalis Yellow bullhead	8	1.032	Highly Tolerant	1	Mouth Lesions
Ictalurus nebulosus Brown bullhead	1	0.110	Highly Tolerant	1	Body Lesions
Pomoxis annularis White crappie	8	0.150	--	0	--
Pomoxis nigromaculatus Black crappie	63	1.510	--	0	--
Micropterus salmoides Largemouth bass	8	0.370	--	0	--
Lepomis cyanellus Green sunfish	151	0.923	Highly Tolerant	0	--

Brandywine Creek: Upstream of Hudson Wastewater Treatment Plant
Sample Date: 7/11/02

Species	Number	Weight (kg)	Pollution Tolerance	DELT Anomalies #	DELT Anomalies Description
Lepomis macrochirus Northern bluegill sunfish	182	2.733	Moderately Tolerant	2	Deformed Mouth Eroded Fins
Lepomis gibbosus Pumpkinseed sunfish	25	0.406	Moderately Tolerant	0	--
Perca flavescens Yellow perch	8	0.074	--	0	--
hybrid	3	0.030	--	0	--
Totals	586	17.935		8	

*DELT anomalies were observed on 1.4% of the fish collected.
Index of Biotic Integrity (IBI) = 34 (Marginally Good)

Brandywine Creek: Upstream of Hudson Wastewater Treatment Plant
Sample Date: 8/15/02
Collection Distance: 0.2 km
Collection Method: Longline Electroshocking

Species	Number	Weight (kg)	Pollution Tolerance	#	DELT Anomalies Description
Cyprinus carpio Common carp	5	4.400	Highly Tolerant	0	--
Notemigonus crysoleucas Golden shiner	16	0.230	Highly Tolerant	3	Body lesion Deformed mouth
Semotilus atromaculatus Creek chub	15	0.072	Highly Tolerant	0	--
Pimephales notatus Bluntnose minnow	7	0.022	Highly Tolerant	0	--
Campostoma anomalum Central stoneroller minnow	15	0.090	--	0	--
Ictalurus natalis Yellow bullhead	3	0.062	Highly Tolerant	0	--
Pomoxis annularis White crappie	3	0.072	--	0	--
Micropterus salmoides Largemouth bass	16	0.106	--	0	--
Lepomis cyanellus Green sunfish	39	0.387	Highly Tolerant	0	--
Lepomis macrochirus Northern bluegill sunfish	92	0.700	Moderately Tolerant	1	Body lesion
Lepomis gibbosus Pumpkinseed sunfish	38	0.422	Moderately Tolerant	0	--
Perca flavescens Yellow perch	1	0.006	--	0	--

Brandywine Creek: Upstream of Hudson Wastewater Treatment Plant
Sample Date: 8/15/02

Species	Number	Weight (kg)	Pollution Tolerance	#	DELT Anomalies Description
hybrid/sunfish	5		--	0	--
Totals	255	6.569		4	

*DELT anomalies were observed on 1.6% of the fish collected.
Index of Biotic Integrity (IBI) = 34 (Marginally Good)

Brandywine Creek: Downstream of Hudson Wastewater Treatment Plant
Sample Date: 7/11/02
Collection Distance: 0.2 km
Collection Method: Longline Electroshocking

Species	Number	Weight (kg)	Pollution Tolerance	#	DELT Anomalies Description
Umbra limi Central Mudminnow	1	0.014	Highly Tolerant	0	
Rhinicthys atratulus Blacknose dace	1	0.006	Highly Tolerant	0	--
Semotilus atromaculatus Creek chub	29	0.272	Highly Tolerant	1	Body Lesion
Notropis cornutus Common shiner	1	0.020	--	0	--
Pimephales notatus Bluntnose minnow	192	0.396	Highly Tolerant	0	--
Campostoma anomalum Central stoneroller minnow	51	0.178	--	0	--
Ictalurus natalis Yellow bullhead	1	0.150	Highly Tolerant	0	--
Micropterus salmoides Largemouth bass	18	0.094	--	0	--
Lepomis cyanellus Green sunfish	47	0.364	Highly Tolerant	0	--
Lepomis macrochirus Northern bluegill sunfish	28	0.132	Moderately Tolerant	0	--
Lepomis gibbosus Pumpkinseed sunfish	4	0.028	--	1	Tail Lesions
Totals	373	1.654		2	

*DELT anomalies were observed on 0.5% of the fish collected.
Index of Biotic Integrity (IBI) = 20 (Poor)

Brandywine Creek: Downstream of Hudson Wastewater Treatment Plant
Sample Date: 8/15/02
Collection Distance: 0.2 km
Collection Method: Longline Electroshocking

Species	Number	Weight (kg)	Pollution Tolerance	#	DELT Anomalies Description
Cyprinus carpio Common carp	13	6.800	Highly Tolerant	3	Body Lesion Eroded opercle
Notemigonus crysoleucas Golden shiner	3	0.016	Highly Tolerant	1	Body lesion
Semotilus atromaculatus Creek chub	13	0.088	Highly Tolerant	0	--
Pimephales notatus Bluntnose minnow	143	0.288	Highly Tolerant	0	--
Campostoma anomalum Central stoneroller minnow	62	0.098	--	0	--
Micropterus salmoides Largemouth bass	10	0.070	--	0	--
Lepomis cyanellus Green sunfish	43	0.312	Highly Tolerant	0	--
Lepomis macrochirus Northern bluegill sunfish	35	0.140	Moderately Tolerant	0	--
Lepomis gibbosus Pumpkinseed sunfish	19	0.178	Moderately Tolerant	0	--
Hybrid/sunfish	11	0.082			
Totals	352	8.072		4	

*DELT anomalies were observed on 1.1% of the fish collected.
Index of Biotic Integrity (IBI) = 22 (Poor)

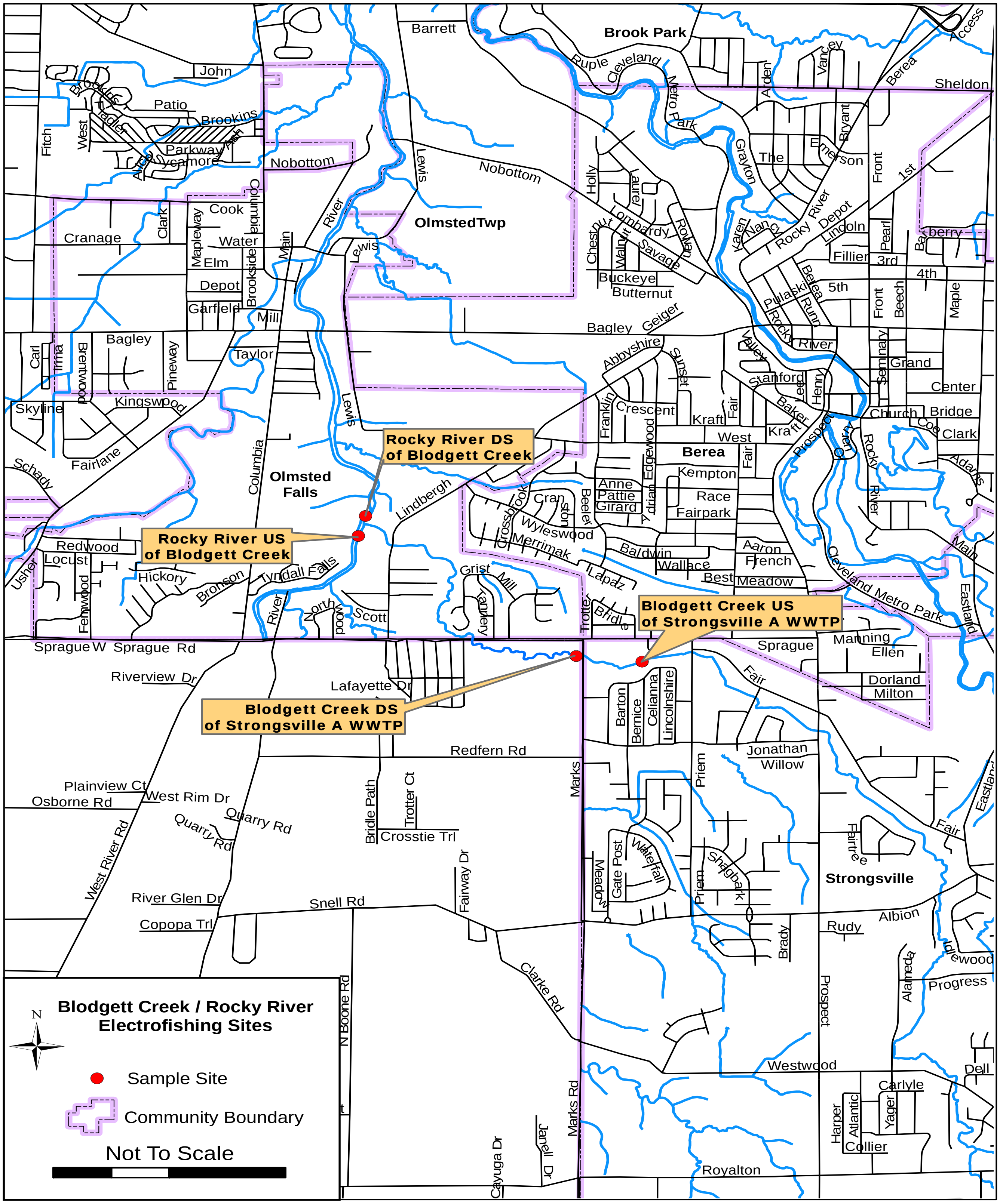
APPENDIX O
BLODGETT CREEK AND ROCKY RIVER ELECTROFISHING SURVEYS
2000

Introduction
Northeast Ohio Regional Sewer District (NEORSD) investigators completed quantitative electrofishing surveys on Blodgett Creek and Rocky River in 2000. Electrofishing was conducted on Blodgett Creek upstream and downstream of the former Strongsville "A" WWTP and on the Rocky River upstream and downstream of the confluence of Blodgett Creek. The purpose of this study was to determine if the fish community health further improved since the previous survey. The Strongsville "A" Wastewater Treatment Plant (WWTP) was decommissioned July 18, 1994. Electrofishing was conducted in 1994, before the plant was taken off line and in 1996, after the plant was decommissioned. After the plant was decommissioned, wastewater flow was diverted to the west leg of the NEORSD Southwest Interceptor.

Fish were collected using a generator powered longline method and electroshocking zones were fished a distance of 0.2 kilometers. The zone upstream of Strongsville "A" WWTP ended 25 feet upstream of the former wastewater discharge. The zone downstream started at the Marks Road Bridge and continued 0.2 kilometers downstream. Fish collected at each site were identified to species level, weighed, counted, examined for the presence of external anomalies including DELTs (deformities, eroded fins, lesions and tumors), and returned to the stream where they were collected.

Data collected were used to calculate two indices of fish community health, the Index of Biotic Integrity (IBI) and, at sites having a tributary drainage area greater that 20 square miles, the Modified Index of Well Being (MIwb). Corresponding narrative ratings of *Exceptional*, *Good*, *Fair*, or *Poor*, were assigned to the fish community at each site based upon index scores. Detailed descriptions of the sampling and analysis methods utilized in fish surveys, including calculations and the relationship between narrative ratings and index scores can be found in Ohio EPA's: *Biological Criteria for the Protection of Aquatic Life* (1987) and *Compendium of Biological Results from Ohio Rivers and Streams and Lakes* (1989).

Results and Discussion
Ohio EPA's Qualitative Habitat Evaluation Index (QHEI) was utilized to assess aquatic habitat conditions at the Blodgett Creek and Rocky River sites in 2000. According to Ohio EPA's *The Qualitative Habitat Evaluation Index (QHEI): Rationale, Methods, and Application*, "Stream reaches with QHEI scores averaging > 60 will likely have the potential to attain the WWH use" (p. 40). Blodgett Creek and Rocky River are designated Warmwater Habitat aquatic life use. Blodgett Creek and Rocky River QHEI scores for 1994, 1996 and 2000 are listed on the following page and are displayed graphically in Figure O-1. Copies of the QHEI field data sheets for Rocky River and Blodgett Creek are located in Appendix D.


Rocky River DS of Blodgett Creek
Rocky River US of Blodgett Creek
Blodgett Creek US of Strongsville A WWTP
Blodgett Creek DS of Strongsville A WWTP
Brook Park
OlmstedTwp
Olmsted Falls
Berea
Strongsville
Blodgett Creek / Rocky River Electrofishing Sites
N
Sample Site
Community Boundary
Not To Scale

QHEI Scores in 2000 were in the *Good* range at all the electrofishing sites, however, downstream of the former Strongsville “A” WWTP, scored the lowest with a score of 59.25. The downstream site scored lower because of the absence of riffles, and a riparian zone that ranged from very narrow to nonexistent. The upstream site had a riffle, however, the quality of the riffle was average to below average. The best areas of the riffle were shallow in depth (less than three inches), and the embeddedness of the substrate was moderate to extensive. (Embeddedness is the extent which rocks and boulders are buried into the substrate of the stream.) The high embeddedness does not allow for invertebrates, food for fish, to hide in the interstitial spaces of cobble and boulders in the creek. The habitat quality, specifically the lack of deep pools, developed riffles, and sinuosity of the creek appears to be affecting the fish diversity in the creek. If more desirable habitat was present for fish in Blodgett Creek that included faster flowing riffles with large boulder and cobble substrates, deeper pools (greater than 3 feet) and more sinuosity, better fish diversity would likely occur which would potentially lead to higher index scores.

QHEI scores on Blodgett Creek upstream of Strongsville “A” showed a general decrease from 1994 through 2000. The most noticeable difference was an 8 point decrease in the Instream Cover metric. This metric includes undercut banks, deep pools, rootwads, and aquatic macrophytes, which were present in 1994, but absent in 2000.

QHEI scores on Blodgett Creek downstream of Strongsville “A” showed a general decrease from 1994 through 2000 with the most noticeable difference in the riparian zone and riffle/run features. Since the stream area was mostly a glide and no riffles were present, a score of zero was given to this site for this metric. Favorable habitat features such as undercut banks, deep pools, rootwads, aquatic macrophytes and moderate instream cover, which were observed in 1994, were not observed in 2000.

QHEI scores on Rocky River in 2000 showed scores in the *Good* range both upstream and downstream of Blodgett Creek. The upstream and downstream sites showed good development of pools and riffles, high stability of the stream channel, and little to no stream bank erosion. These qualities are essential for a diverse fish community, and correlate positively with IBI fish community scores.

	1994		1996		2000	
Electrofishing Site	Score	Narrative Rating	Score	Narrative Rating	Score	Narrative Rating
Rocky River Upstream of Blodgett Creek	71.5	Good	--	--	62.25	Good
Rocky River Downstream of Blodgett Creek	82.0	Excellent	--	--	69.25	Good
Blodgett Creek Upstream of Strongsville “A” WWTP	79.5	Excellent	65.25	Good	64.25	Good
Blodgett Creek Downstream of Strongsville “A” WWTP	69.5	Good	63.5	Good	59.25	Good

NEORSD investigators collected grab samples for chemical and bacteriological analysis at the Blodgett Creek and Rocky River sites in 2000. Samples were collected and analyzed at each Blodgett Creek site in 2000 on two occasions. Bacteriological data revealed excursions of Ohio EPA’s primary contact recreational use designation criteria of 298 and 2,000 colonies/100 mL for *E. coli* and fecal coliform as listed below:

	Blodgett Creek			
	Upstream of Strongsville “A” WWTP		Downstream of Strongsville “A” WWTP	
Date	*E. coli*	Fecal coliform	*E. coli*	Fecal coliform
08/15/00	1,100	1,200	1,100	1,900
09/27/00	1,600	2,100	580	-
Bacteriological concentrations are in colonies/100 mL				

Chemical parameters met warmwater habitat criteria at both Blodgett Creek sites in 2000. In 1994, however, prior to the plant’s decommissioning, ammonia concentrations were elevated (8.2 to 12.7 mg/L) at the downstream location. These elevated ammonia concentrations may have been the reason no fish were collected downstream of the treatment plant by investigators in 1994. Ammonia concentrations decreased after the wastewater treatment plant was decommissioned. The highest ammonia concentration obtained at either site in 2000 was 0.1 mg/L. Average Blodgett Creek ammonia concentrations for 1994, 1996 and 2000 are shown graphically in Figure O-8.

In 2000, two water samples were collected for this survey on Rocky River, one upstream and one downstream of Blodgett Creek. Here too, the ten percent portion of the *E. coli* and fecal coliform criteria were exceeded at both sites as listed below:

	Rocky River			
	Upstream of Blodgett Creek		Downstream of Blodgett Creek	
Date	*E. coli*	Fecal coliform	*E. coli*	Fecal coliform
08/15/00	9,000	6,100	5,700	8,100
Bacteriological concentrations are in colonies/100 mL				

Samples collected on Rocky River upstream and downstream of Blodgett Creek in 2000 met chemical water quality criteria.

In 2000, average IBI sores for Blodgett Creek were in the *Poor* range upstream and downstream of the former Strongsville "A" WWTP. Average fish index scores in the previous sampling years of 1994 and 1996 were similar, in the *Poor* range, except in 1994 at the downstream site. No fish were collected at this site during either of the two sampling events, that year, resulting in an average IBI score in the *Very Poor* range. A noted improvement was evident in the fish community downstream of Strongsville "A" WWTP in 1996 and 2000 when 477 and 313 fish, respectively, were collected. This improvement may have been was attributable to the decommissioning of the Strongsville "A" WWTP; refer to the Greater Cleveland Area Environmental Water Quality Assessment report 1996-1998.

Greater than 97 percent of the fish collected in 2000 upstream and downstream of the former Strongsville "A" WWTP on Blodgett Creek were pollution tolerant species, as displayed in Figure O-2. The creek chub (*Semotilus atromaculatus*) was the numerically abundant pollution tolerant fish collected. In 2000, 56 percent of the fish collected at the upstream site and 67 percent of the fish collected at the downstream site were creek chubs.

According to the Ohio EPA's *Biological Criteria for the Protection of Aquatic Life: Volume ll*, the creek chub is a highly pollution tolerant fish that has no specialized feeding guild. It is a generalist feeder that is tolerant of both chemical degradation and stream desiccation. Blodgett Creek currently lacks the more specialized feeding group fish, such as insectivores and carnivores, that when present, lead to higher fish community index scores. The creek chub is also considered a pioneering species. Pioneering species predominate in unstable or stressed environments. A high proportion of pioneering species indicates a habitat that is temporally not available or that is under stress. Some of the stressors may be sedimentation and silt entering the creek. The creek chub is also a fish that may return to a creek that is undergoing a recovery. The proportion of pioneering species collected in Blodgett Creek before and after decommissioning of the Strongsville "A" WWTP is displayed graphically in Figure O-3.

Upstream and downstream of Blodgett Creek on the Rocky River, average IBI scores decreased slightly from 1996 to 2000, but the narrative ratings remained in the *Good* range. MIwb scores, however, which were in the *Fair* range in 1996 upstream of Blodgett Creek, and increased to the *Marginally Good* range in 2000. Downstream of Blodgett Creek, average MIwb scores stayed the same (7.7, *Marginally Good*) from 1996 to 2000. The *Good*/*Marginally Good* IBI and MIwb scores at the Rocky River sites in 2000 indicate that these sites were meeting Ohio EPA's Warmwater Habitat aquatic life criteria of 38 and 7.9, respectively.

Average IBI and MIwb scores for Blodgett Creek and Rocky River are listed in Table O-1 and displayed graphically in Figures O-4 through O-6. Tables which, for each sampling event, list the species collected, number of individuals, weights, pollution tolerances and incidence of DELT anomalies, can be found at the end of this report.

During 2000, less than 21 percent of the fish collected upstream and downstream of Blodgett Creek on Rocky River on each electroshocking pass were pollution tolerant species. Twenty-one percent of the total fish collected on Rocky River upstream of Blodgett Creek were pollution sensitive sand shiners (*Notropis stramineus*). Forty-two percent of the total fish collected on the Rocky River upstream of Blodgett Creek were pollution sensitive species. The sensitive species collected included greenside darters, rainbow darters, northern hog suckers, sand shiners, golden redhorse and smallmouth bass. The sand shiner comprised twenty-one percent of the total fish collected on the Rocky River upstream of Blodgett Creek. Fifty-three percent of the total fish collected on the Rocky River downstream of Blodgett Creek were pollution sensitive species. Except the golden redhorse, which was found only upstream of Blodgett Creek, the same pollution sensitive species observed at the upstream site were present at the downstream site. The proportion of pollution intolerant species in the Rocky River upstream and downstream of Blodgett Creek is displayed graphically in Figure O-7.

Conclusion

The average Index of Biotic Integrity score on Blodgett Creek upstream of the former Strongsville “A” WWTP was virtually unchanged from 1994 to 2000. Downstream of the former WWTP, however, IBI scores improved from *Very Poor* in 1994 to *Poor* in 1996 and 2000. Habitat conditions, as measured by Ohio EPA’s Qualitative Habitat Evaluation Index, have decreased slightly. Favorable features of the Instream Cover metric, such as, undercut banks, deep pools, rootwads, and aquatic macrophytes, which were present in 1994, were absent in 2000. Chemical data, however, indicate that ammonia concentrations downstream of the former WWTP decreased following the plant’s decommissioning and the diversion of wastewater to the west leg of the NEORSD’s Southwest Interceptor. The increased abundance of fish collected at the downstream location in 1996 and 2000 may be attributable to the decreased ammonia concentrations resulting from the plant’s decommissioning/diversion of flow. Although fish community scores on Blodgett Creek downstream of the decommissioned treatment plant are still poor, the “Pioneering” fish species are beginning to repopulate and level out, indicating that this section of Blodgett Creek is recovering.

Average IBI scores improved from 1994 to 1996, but decreased slightly in 2000, both upstream and downstream of Blodgett Creek on the Rocky River. IBI scores at both of these sites met Ohio EPA’s Warmwater Habitat criterion of 38 (*Good*) in 1996 and 2000. At the upstream site, average MIwb scores declined slightly from 1994 to 1996, but then improved from 1996 to 2000. Average MIwb scores were slightly higher at the downstream site in 1996 and 2000 than in 1994. The MIwb in 2000 returned to a narrative rating of *Marginally Good.* The average ammonia concentration measured by NEORSD investigators downstream of Blodgett Creek on the Rocky River decreased from 1.9 mg/L in 1994 to 0.07 mg/L in 1996 and 0.04 mg/L in 2000.

Table O-1
Northeast Ohio Regional Sewer District
Blodgett Creek and Rocky River Index Scores, 1994-2000

Blodgett Creek US Strongsville A WWTP			Blodgett Creek DS Strongsville A WWTP		
Date	IBI Score	Narrative Rating	Date	IBI Score	Narrative Rating
05/17/94	22	Poor	05/17/94	12	Very Poor
06/17/94	26	Poor	06/17/94	12	Very Poor
07/11/94	24	Poor	07/11/94	12	Very Poor
Average, 1994	24	Poor	Average, 1994	12	Very Poor
08/19/96	20	Poor	08/19/96	24	Poor
10/07/96	28	Fair	10/07/96	22	Poor
Average, 1996	24	Poor	Average, 1996	23	Poor
06/28/00	22	Poor	06/28/00	24	Poor
08/04/00	28	Fair	08/04/00	24	Poor
09/28/00	28	Fair	09/28/00	24	Poor
Average, 2000	26	Poor	Average, 2000	24	Poor
Rocky River Upstream of Blodgett Creek			Rocky River Downstream of Blodgett Creek		
Date	IBI Score	Narrative Rating	Date	IBI Score	Narrative Rating
05/18/94	36	Marginally Good	05/18/94	32	Fair
07/12/94	32	Fair	07/12/94	36	Marginally Good
Average, 1994	34	Marginally Good	Average, 1994	34	Marginally Good
08/22/96	42	Good	08/22/96	46	Very Good
10/08/96	42	Good	10/08/96	40	Good
Average, 1996	42	Good	Average, 1996	43	Good
06/29/00	40	Good	06/29/00	40	Good
08/16/00	38	Good	08/16/00	38	Good
Average, 2000	39	Good	Average, 2000	39	Good
Date	MIwb Score	Narrative Rating	Date	MIwb Score	Narrative Rating
05/18/94	7.4	Marginally Good	05/18/94	7.1	Fair
07/12/94	7.8	Marginally Good	07/12/94	7.6	Marginally Good
Average, 1994	7.6	Marginally Good	Average, 1994	7.4	Fair
08/22/96	7.9	Good	08/22/96	7.8	Marginally Good
10/08/96	6.6	Fair	10/08/96	7.6	Marginally Good
Average, 1996	7.3	Fair	Average, 1996	7.7	Marginally Good
06/29/00	8.2	Good	06/29/00	7.4	Marginally Good
08/16/00	7.5	Marginally Good	08/16/00	7.9	Good
Average, 2000	7.9	Marginally Good	Average, 2000	7.7	Marginally Good

Figure O-1
Blodgett Creek and Rocky River
Qualitative Habitat Evaluation Index Scores,
1994, 1996 and 2000

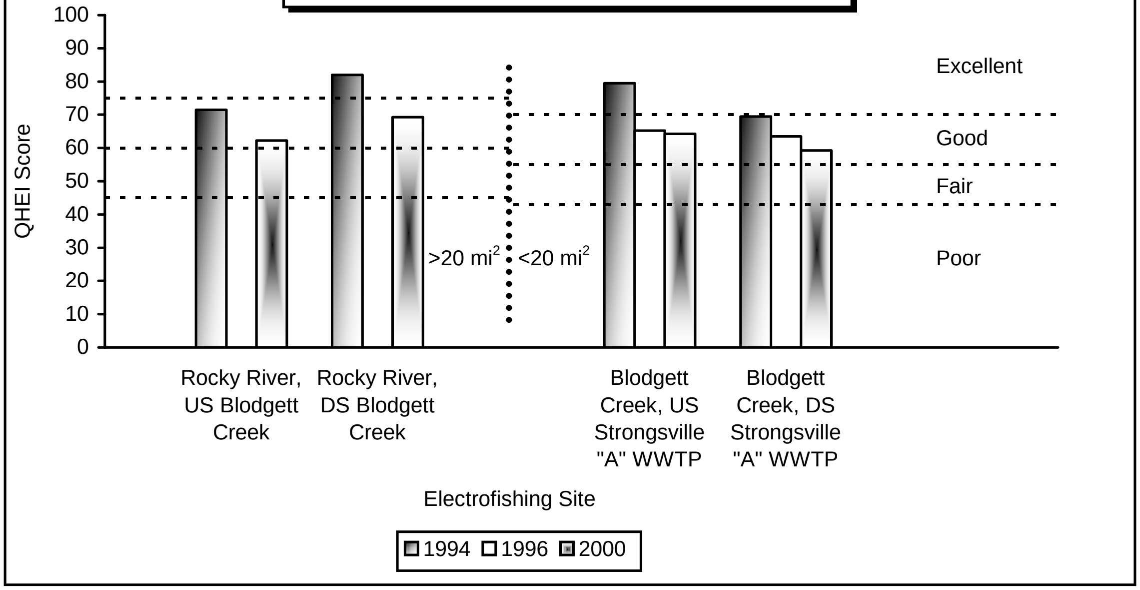


Figure O-2
Proportion of Pollution Tolerant Species collected in Blodgett Creek
1994, 1996 and 2000

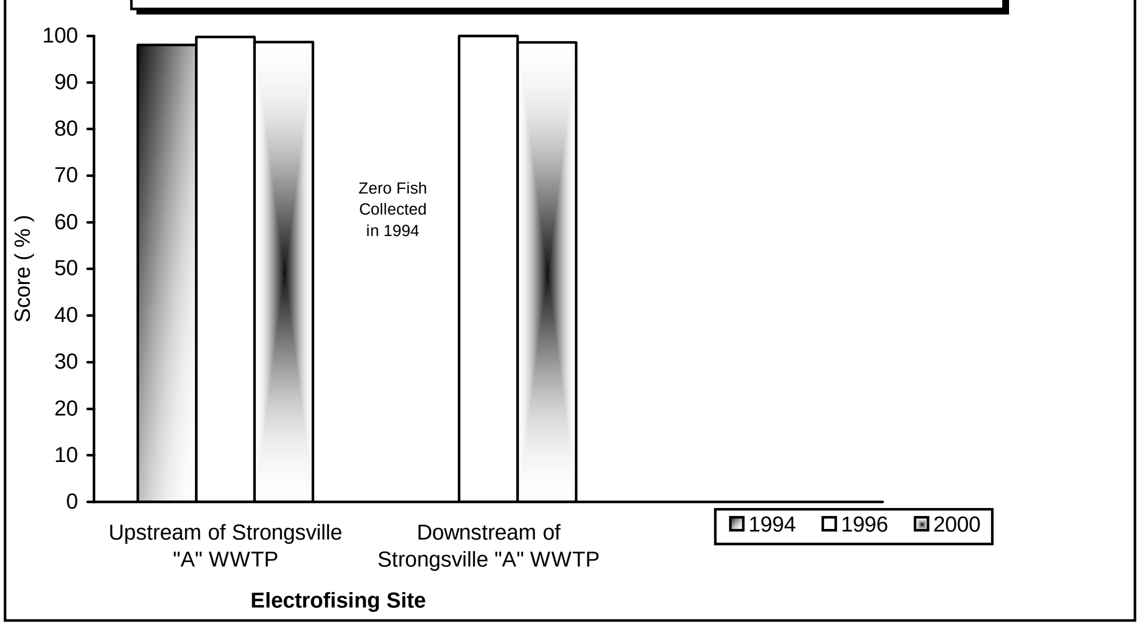


Figure O-3
Proportion of Pioneering Species collected in Blodgett Creek
1994, 1996 and 2000

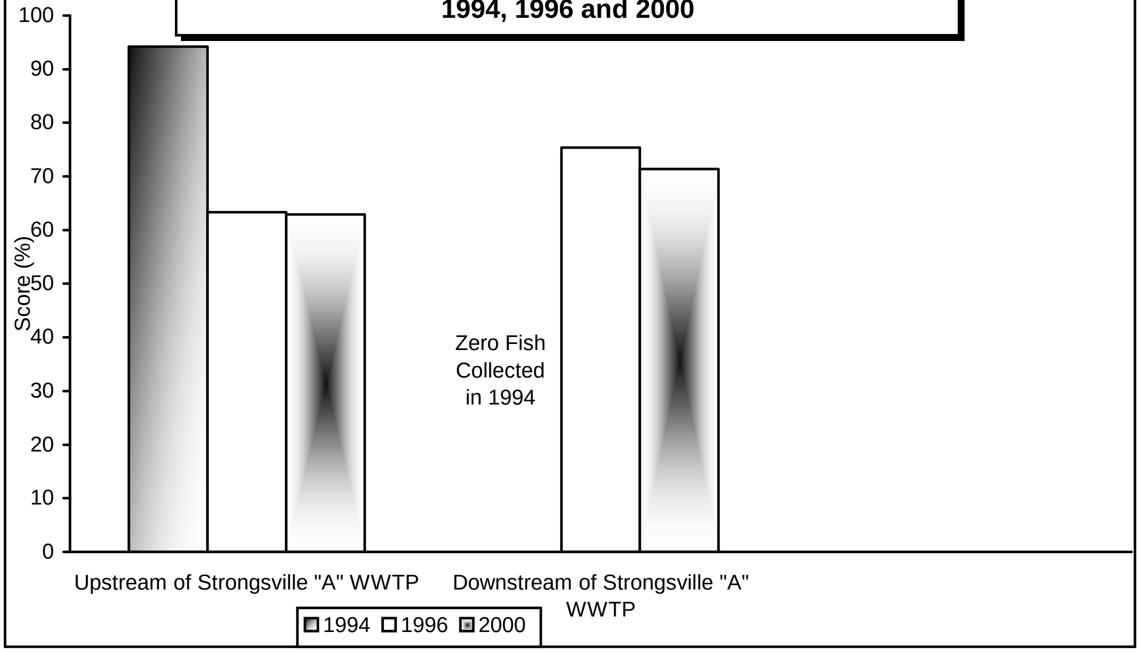


Figure O-4
Average Index of Biotic Integrity Scores
Blodgett Creek, 1994, 1996 and 2000

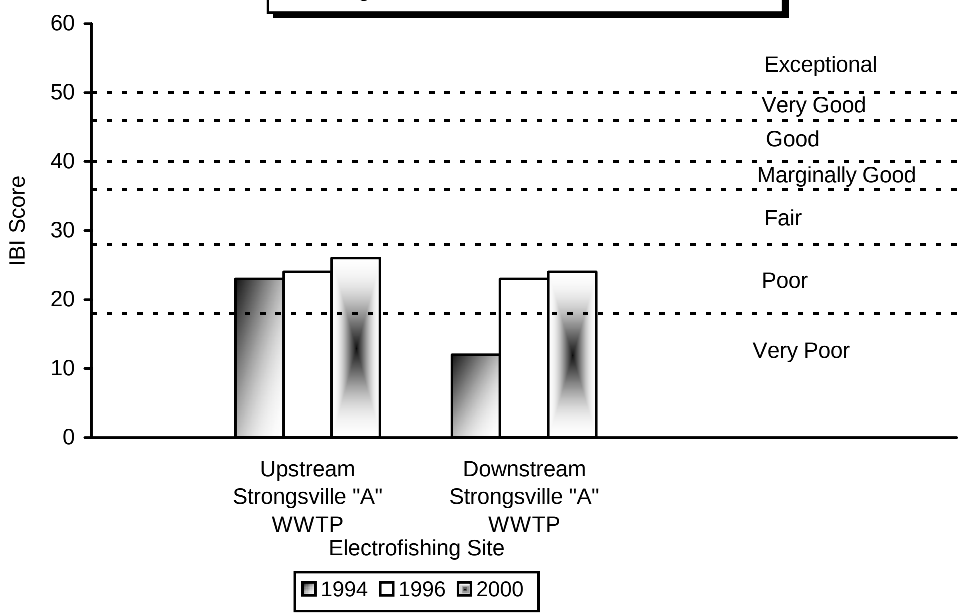


Figure O-5
Average Index of Biotic Integrity Scores
Rocky River, 1994, 1996 and 2000

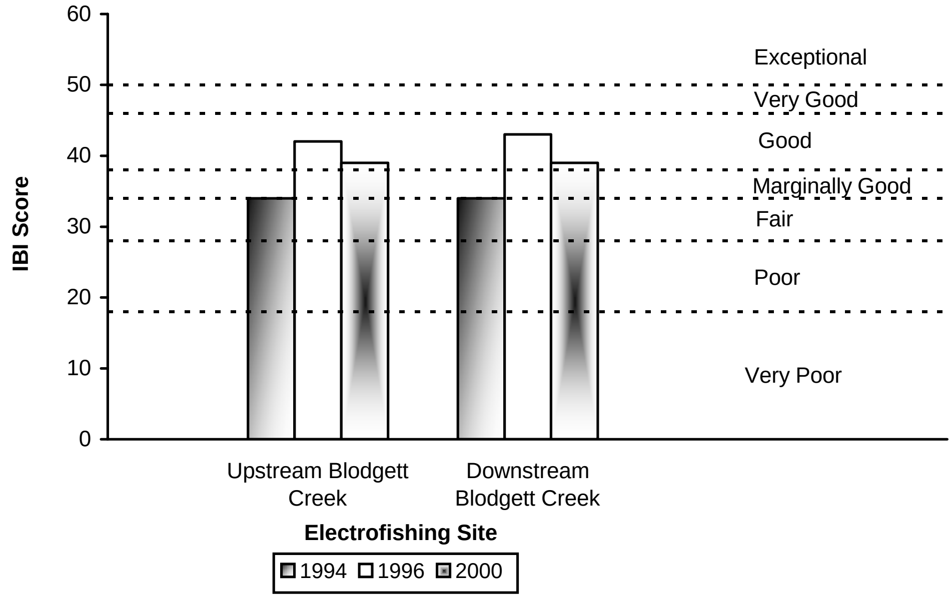


Figure O-6
Average Modified Index of Well-Being Scores
Rocky River, 1994, 1996 and 2000

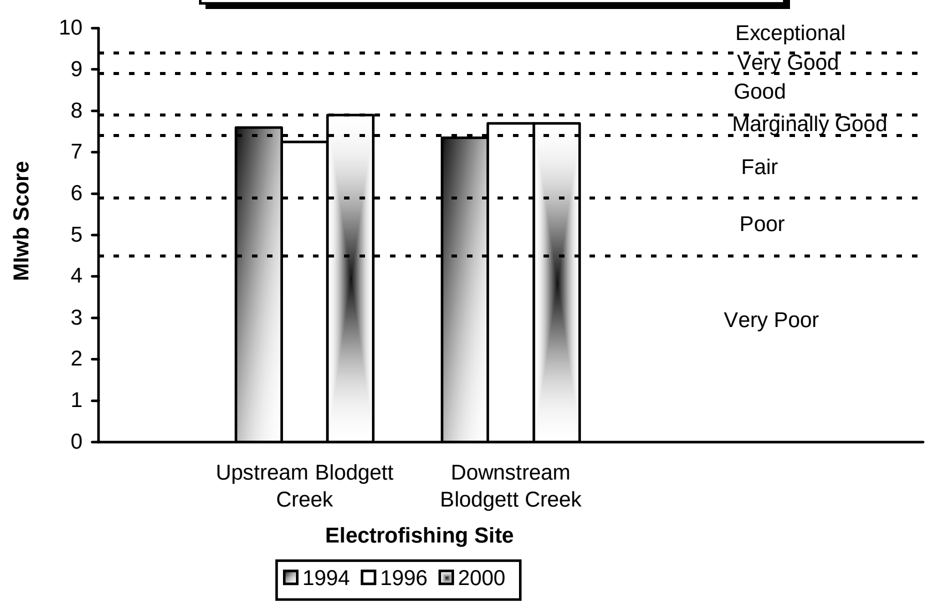


Figure O-7
Proportion of Pollution Intolerant Species collected in Rocky River
1994, 1996, and 2000

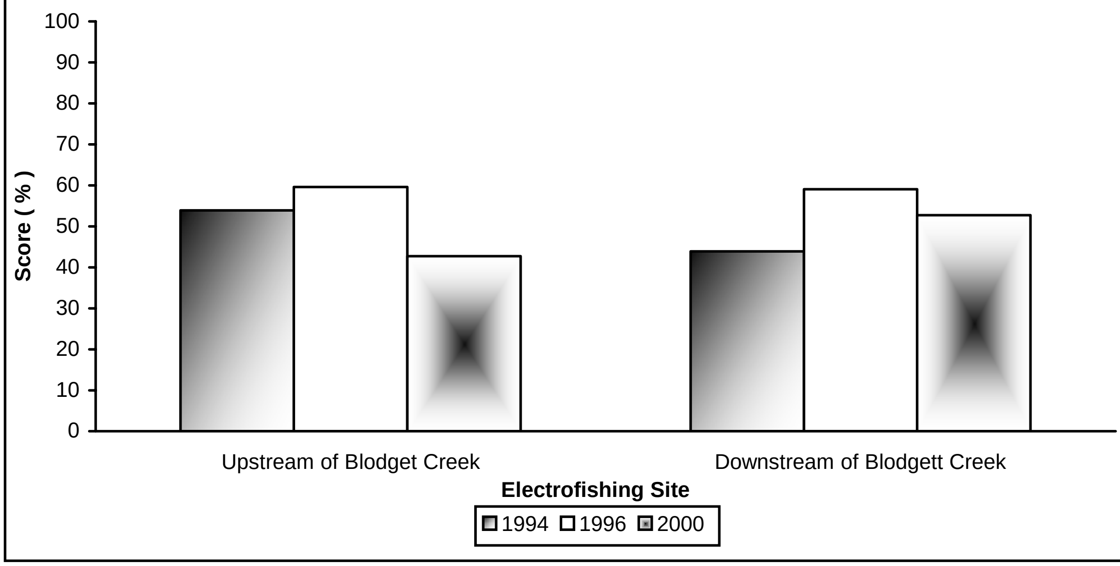
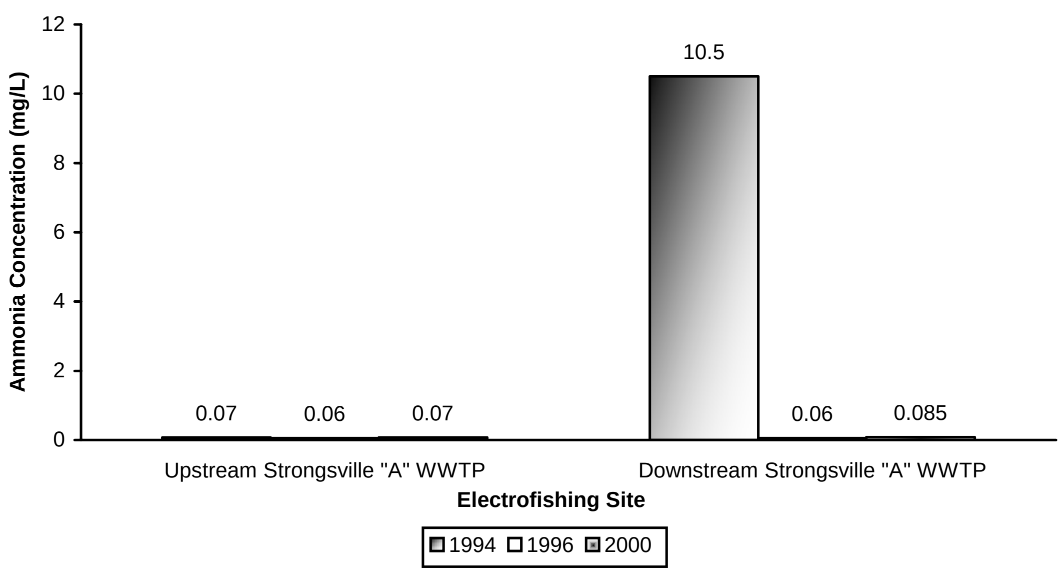


Figure O-8
Average Ammonia Concentrations
Blodgett Creek, 1994, 1996 and 2000



Blodgett Creek Upstream of Former Strongsville "A" WWTP
Sample Date: 6/28/00
Collection Distance: 0.2 km
Collection Method: Longline Electroshocking

Species	Number	Weight (kg)	Pollution Tolerance	#	DELT Anomalies Description
Catostomus commersoni Common white sucker	17	0.185	Highly Tolerant	0	--
Rhinicthys atratulus Blacknose dace	99	0.265	Highly Tolerant	0	--
Semotilus atromaculatus Creek chub	149	1.000	Highly Tolerant	0	--
Pimephales notatus Bluntnose minnow	49	0.125	Highly Tolerant	0	--
Totals	314	1.575		0	

*DELT anomalies were observed on 0.0% of the fish collected.
Index of Biotic Integrity (IBI) = 22 (Poor)

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Blodgett Creek Upstream of Former Strongsville "A" WWTP
Sample Date: 8/04/00
Collection Distance: 0.2 km
Collection Method: Longline Electroshocking

Species	Number	Weight (kg)	Pollution Tolerance	#	DELT Anomalies Description
Catostomus commersoni Common white sucker	18	0.222	Highly Tolerant	0	--
Rhinicthys atratulus Blacknose dace	194	0.436	Highly Tolerant	0	--
Semotilus atromaculatus Creek chub	452	2.804	Highly Tolerant	0	--
Pimephales notatus Bluntnose minnow	19	0.060	Highly Tolerant	0	--
Campostoma anomalum Central stoneroller minnow	10	0.050	--	0	--
Totals	693	3.572		0	

*DELT anomalies were observed on 0.0% of the fish collected.
Index of Biotic Integrity (IBI) = 28 (Fair)

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Blodgett Creek Upstream of Former Strongsville "A" WWTP
Sample Date: 9/28/00
Collection Distance: 0.2 km
Collection Method: Longline Electroshocking

Species	Number	Weight (kg)	Pollution Tolerance	#	DELT Anomalies Description
Catostomus commersoni Common white sucker	20	0.350	Highly Tolerant	0	--
Rhinicthys atratulus Blacknose dace	98	0.230	Highly Tolerant	0	--
Semotilus atromaculatus Creek chub	101	0.832	Highly Tolerant	0	--
Pimephales notatus Bluntnose minnow	13	0.062	Highly Tolerant	0	--
Campostoma anomalum Central stoneroller minnow	5	0.030	--	0	--
Totals	237	1.504		0	

*DELT anomalies were observed on 0.0% of the fish collected.
Index of Biotic Integrity (IBI) = 28 (Fair)

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Blodgett Creek Downstream of Former Strongsville "A" WWTP
Sample Date: 6/28/00
Collection Distance: 0.2 km
Collection Method: Longline Electroshocking

Species	Number	Weight (kg)	Pollution Tolerance	#	DELT Anomalies Description
Catostomus commersoni Common white sucker	47	0.525	Highly Tolerant	0	--
Rhinicthys atratulus Blacknose dace	51	0.150	Highly Tolerant	0	--
Semotilus atromaculatus Creek chub	141	1.050	Highly Tolerant	0	--
Pimephales notatus Bluntnose minnow	9	0.070	Highly Tolerant	0	--
Campostoma anomalum Central stoneroller minnow	3	0.020	--	0	--
Totals	251	1.815		0	

*DELT anomalies were observed on 0.0% of the fish collected.
Index of Biotic Integrity (IBI) = 24 (Poor)

Blodgett Creek Downstream of Former Strongsville "A" WWTP
Sample Date: 8/04/00
Collection Distance: 0.2 km
Collection Method: Longline Electroshocking

Species	Number	Weight (kg)	Pollution Tolerance	DELT Anomalies #	DELT Anomalies Description
Catostomus commersoni Common white sucker	68	0.624	Highly Tolerant	1	Deformed Tail
Rhinicthys atratulus Blacknose dace	24	0.050	Highly Tolerant	0	--
Semotilus atromaculatus Creek chub	337	1.864	Highly Tolerant	0	--
Pimephales notatus Bluntnose minnow	22	0.040	Highly Tolerant	0	--
Campostoma anomalum Central stoneroller minnow	5	0.012	--	0	--
Totals	456	2.590		1	

*DELT anomalies were observed on 0.2% of the fish collected.
Index of Biotic Integrity (IBI) = 24 (Poor)

Blodgett Creek Downstream of Former Strongsville "A" WWTP
Sample Date: 9/28/00
Collection Distance: 0.2 km
Collection Method: Longline Electroshocking

Species	Number	Weight (kg)	Pollution Tolerance	DELT Anomalies #	DELT Anomalies Description
Catostomus commersoni Common white sucker	36	0.574	Highly Tolerant	0	--
Rhinicthys atratulus Blacknose dace	29	0.066	Highly Tolerant	0	--
Semotilus atromaculatus Creek chub	141	1.042	Highly Tolerant	0	--
Pimephales notatus Bluntnose minnow	22	0.086	Highly Tolerant	0	--
Campostoma anomalum Central stoneroller minnow	5	0.054	--	0	--
Totals	233	1.822		0	

*DELT anomalies were observed on 0.0% of the fish collected.
Index of Biotic Integrity (IBI) = 24 (Poor)

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Rocky River Upstream of Blodgett Creek
Sample Date: 6/29/00
Collection Distance: 0.2 km
Collection Method: Longline Electroshocking

Species	Number	Weight (kg)	Pollution Tolerance	DELT Anomalies #	DELT Anomalies Description
Moxostoma erythrurum Golden redhorse	1	0.030	Moderately Intolerant	0	--
Hypentelium nigricans Northern hog sucker	10	0.325	Moderately Intolerant	0	--
Catostomus commersoni Common white sucker	38	2.614	Highly Tolerant	1	Eroded tail
Notropis cornutus Common shiner	38	0.618	--	0	--
Notropis spilopterus Spotfin shiner	3	0.022	--	0	--
Notropis stramineus Sand shiner	112	0.398	Moderately Intolerant	0	--
Ericymba buccata Silverjaw minnow	11	0.052	--	0	--
Pimephales notatus Bluntnose minnow	42	0.238	Highly Tolerant	0	--
Campostoma anomalum Central stoneroller minnow	75	0.914	--	0	--
Ambloplites rupestris Northern rockbass	20	0.519	--	4	Body Lesions
Micropterus dolomieui Smallmouth bass	9	0.352	Moderately Intolerant	0	--
Lepomis cyanellus Green sunfish	5	0.050	Highly Tolerant	0	--
Lepomis macrochirus Northern bluegill sunfish	13	0.094	Moderately Tolerant	0	--

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Rocky River Upstream of Blodgett Creek
Sample Date: 6/29/00

Species	Number	Weight (kg)	Pollution Tolerance	#	DELT Anomalies Description
Etheostoma blenniodes Greenside darter	66	0.434	Moderately Intolerant	0	--
Ethestoma caeruleum Rainbow darter	2	0.014	Moderately Intolerant	0	--
Totals	445	6.674		5	

*DELT anomalies were observed on 1.1% of the fish collected.
Index of Biotic Integrity (IBI) = 40 (Good)
Modified Index of Well-Being (MIwb) 8.2 (Good)

Rocky River Upstream of Blodgett Creek
Sample Date: 8/16/00
Collection Distance: 0.2 km
Collection Method: Longline Electroshocking

Species	Number	Weight (kg)	Pollution Tolerance	#	DELT Anomalies Description
Hypentelium nigricans Northern hog sucker	3	0.128	Moderately Intolerant	0	--
Catostomus commersoni Common white sucker	27	2.542	Highly Tolerant	0	--
Semotilus atromaculatus Creek chub	2	0.008	Highly Tolerant	0	--
Notropis cornutus Common shiner	15	0.246	--	0	--
Notropis spilopterus Spotfin shiner	1	0.008	--	0	--
Notropis stramineus Sand shiner	26	0.116	Moderately Intolerant	0	--
Ericymba buccata Silverjaw minnow	3	0.026	--	0	--
Pimephales notatus Bluntnose minnow	7	0.042	Highly Tolerant	0	--
Campostoma anomalum Central stoneroller minnow	29	0.584	--	0	--
Ambloplites rupestris Northern rockbass	33	1.152	--	1	Eroded Fin Eroded Tail
Micropterus dolomieui Smallmouth bass	17	0.738	Moderately Intolerant	0	--
Micropterus salmoides Largemouth bass	1	0.004	--	0	--
Lepomis cyanellus Green sunfish	6	0.072	Highly Tolerant	0	--

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Rocky River Upstream of Blodgett Creek
Sample Date: 8/16/00

Species	Number	Weight (kg)	Pollution Tolerance	#	DELT Anomalies Description
Lepomis macrochirus Northern bluegill sunfish	2	0.014	Moderately Tolerant	0	--
Etheostoma blenniodes Greenside darter	31	0.208	Moderately Intolerant	0	--
Totals	203	5.888		1	

*DELT anomalies were observed on	0.5%	of the fish collected.
Index of Biotic Integrity (IBI) =	38	(Good)
Modified Index of Well-Being (MIwb)	7.5	(Marginally Good)
Shannon Diversity Index, wt.	2.28	
Shannon Diversity Index, no.	1.733	
N	241.5	
B	4.836	

Rocky River Downstream of Blodgett Creek
Sample Date : 6/29/00
Collection Distance: 0.2 km
Collection Method: Longline Electroshocking

Species	Number	Weight (kg)	Pollution Tolerance	DELT Anomalies #	DELT Anomalies Description
Hypentelium nigricans Northern hog sucker	15	1.430	Moderately Intolerant	0	--
Catostomus commersoni Common white sucker	2	0.270	Highly Tolerant	1	Eroded Tail
Notropis cornutus Common shiner	12	0.184	--	0	--
Notropis stramineus Sand shiner	8	0.040	Moderately Intolerant	0	--
Pimephales notatus Bluntnose minnow	2	0.016	Highly Tolerant	0	--
Campostoma anomalum Central stoneroller minnow	7	0.058	--	0	--
Pomoxis annularis White crappie	1	0.100	--	0	--
Ambloplites rupestris Northern rockbass	48	2.710	--	3	Body Lesion
Micropterus dolomieui Smallmouth bass	9	0.408	Moderately Intolerant	0	--
Micropterus salmoides Largemouth bass	1	0.002	--	0	--
Lepomis cyanellus Green sunfish	8	0.172	Highly Tolerant	0	--
Lepomis macrochirus Northern bluegill sunfish	2	0.012	Moderately Tolerant	0	--
Etheostoma blenniodes Greenside darter	57	0.364	Moderately Intolerant	0	--

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Rocky River Downstream of Blodgett Creek
Sample Date : 6/29/00

Species	Number	Weight (kg)	Pollution Tolerance	#	DELT Anomalies Description
Ethestoma caeruleum Rainbow darter	3	0.010	Moderately Intolerant	0	--
Totals	175	5.776		4	

*DELT anomalies were observed on	2.3%	of the fish collected.
Index of Biotic Integrity (IBI) =	40	(Good)
Modified Index of Well-Being (MIwb)	7.4	(Fair)
Shannon Diversity Index, wt.	1.613	
Shannon Diversity Index, no.	1.96	
N	244.5	
B	7.977	

Rocky River Downstream of Blodgett Creek
Sample Date: 8/16/00
Collection Distance: 0.2 km
Collection Method: Longline Electroshocking

Species	Number	Weight (kg)	Pollution Tolerance	DELT Anomalies #	DELT Anomalies Description
Hypentelium nigricans Northern hog sucker	31	3.965	Moderately Intolerant	0	--
Catostomus commersoni Common white sucker	12	1.850	Highly Tolerant	0	--
Cyprinus carpio Common carp	1	0.600	Highly Tolerant	0	--
Notropis cornutus Common shiner	13	0.144	--	0	--
Notropis spilopterus Spotfin shiner	1	0.008	--	0	--
Notropis stramineus Sand shiner	10	0.038	Moderately Intolerant	0	--
Pimephales notatus Bluntnose minnow	6	0.030	Highly Tolerant	0	--
Campostoma anomalum Central stoneroller minnow	13	0.220	--	0	--
Ictalurus natalis Yellow bullhead	1	0.062	Highly Tolerant	0	--
Ambloplites rupestris Northern rockbass	30	2.327	--	1	Body Lesion
Micropterus dolomieui Smallmouth bass	12	1.632	Moderately Intolerant	0	--
Micropterus salmoides Largemouth bass	1	0.004	--	0	--
Lepomis macrochirus Northern bluegill sunfish	2	0.050	Moderately Tolerant	0	--

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Rocky River Downstream of Blodgett Creek
Sample Date: 8/16/00

Species	Number	Weight (kg)	Pollution Tolerance	#	DELT Anomalies Description
Etheostoma blenniodes Greenside darter	36	0.164	Moderately Intolerant	0	--
Ethestoma caeruleum Rainbow darter	1	0.006	Moderately Intolerant	0	--
Totals	170	11.100		1	

*DELT anomalies were observed on	0.6%	of the fish collected.
Index of Biotic Integrity (IBI) =	38	(Good)
Modified Index of Well-Being (MIwb)	7.9	(Good)
Shannon Diversity Index, wt.	1.731	
Shannon Diversity Index, no.	2.201	
N	225	
B	12.84	

APPENDIX P
BIG CREEK ELECTROFISHING SURVEY
1999

INTRODUCTION

The Northeast Ohio Regional Sewer District's (NEORSD's) Water Quality and Industrial Surveillance department (WQIS) performed quantitative electrofish sampling on Big Creek and Stickney Creek in 1999 utilizing its generator-powered longline electrofishing equipment. The objective of the project was to characterize the health of the existing fish community through electrofish sampling. Fish were identified to species level, weighed, counted, examined for the presence of DELT anomalies (deformities, eroded fins, lesions and tumors), and returned to the stream where they were collected.

Longline electrofishing consists of wading in an upstream direction for a distance of 150-200 meters and sampling all habitat types including undercut banks, brush piles, log jams, boulders and other submerged structures. Fish are then netted and placed in a nylon floating live well where they are later processed.

The electrofishing data collected by NEORSD were compiled and used to calculate two Ohio EPA indices, the Index of Biotic Integrity (IBI) and the Modified Index of Well Being (MIwb), which are used to assess fish community health. The IBI incorporates 12 metrics representing structural and functional attributes of a fish community. Structural attributes are based upon fish community aspects such as fish numbers and diversity. Functional attributes are based upon fish community aspects such as feeding strategies, environmental tolerances and disease symptoms. The metrics are individually scored by comparing the results obtained at the survey site with values expected at reference sites located in the same geographic ecoregion. The summation of the 12 individual metric scores provides an IBI score between 12 and 60 and an associated narrative rating (*Exceptional, Good, Fair, or Poor*) of fish community health.

The MIwb, which is based upon the structural aspects of a fish community, is calculated at sites which have a tributary drainage area greater than 20 square miles. The MIwb incorporates the following four fish community measures: number of individuals, biomass, the Shannon Diversity Index based on numbers of fishes, and the Shannon Diversity Index based on weight of fishes. The MIwb score is the result of a mathematical calculation based upon the formula:

$$MIwb = 0.5\ lnN + 0.5\ lnB + \overline{H}(No.) + \overline{H}(Wt.)$$

where:

N = Relative numbers of all species excluding species designated "highly tolerant", hybrids and exotics

B = Relative weights of all species excluding species designated "highly tolerant", hybrids and exotics

$\overline{H}(No.)$ = Shannon Diversity Index based on numbers

$\overline{H}(Wt.)$ = Shannon Diversity Index based on weight

Shannon Diversity Index

$$\overline{H} = -\sum\left[\left(\frac{n_i}{N}\right)log_e\left(\frac{n_i}{N}\right)\right]$$

where:

n_i = Relative numbers or weight of species

N = Total number or weight of the sample

Detailed descriptions of sampling and analysis methods utilized in fish surveys, including IBI and MIwb calculations and the relationship between narrative ratings and index scores can be found in Ohio EPA's *Biological Criteria for the Protection of Aquatic Life* (1987) and *Compendium of Biological Results from Ohio Rivers, Streams and Lakes* (1989).

Results

Electrofishing was performed at the following Big Creek sites:

Site #25: Big Creek at Jennings Road
Site #26: Big Creek East Branch, upstream of confluence
Site #27: Big Creek West Branch, upstream of confluence
Site #28: Big Creek West Branch, upstream of Puritas Avenue
Site #29: Big Creek East Branch, at Fernhill Picnic Area
Site #30: Stickney Creek, upstream of Big Creek confluence

Investigators assessed aquatic habitat at each site using Ohio EPA's Qualitative Habitat Evaluation Index (QHEI). QHEI scores ranged from 24.5 at Site #28 to 67 at Site #25. According to Ohio EPA's *The Qualitative Habitat Evaluation Index (QHEI): Rationale, Methods, and Application*, "Stream reaches with QHEI scores averaging > 60 will likely have the potential to attain the WWH use" (p. 40). Figure P-1 shows QHEI scores for the Big Creek electrofishing sites. QHEI field sheets are located in appendix D of this report.

Electrofish sampling was conducted three times at Site #25, the remaining five sites were sampled twice during the 1999 field season. The IBI was calculated at all of the above sites. The MIwb was calculated only at Sites #25 and #26, where the tributary drainage area is greater than 20 square miles. The MIwb was not calculated for Sites #27, #28, #29 and #30 since the drainage areas at these sites are less than 20 square miles.

Each of the Big Creek sites sampled in 1999 has been assigned the Warmwater Habitat (WWH) aquatic life use designation by the Ohio EPA, except for Sites #27 and #28, which are designated Limited Resource Water (LRW). Index scores must fall into the *Good* range to meet biological criteria. The minimum score required to meet the WWH IBI criterion is 38 for wading sites and 40 for headwater sites. The minimum score required to meet the MIwb criterion is 7.9 for wading sites. Site #27 and Site #28 are designated Limited Resource Water, therefore, biocriteria do not apply (see Ohio Water Quality Standards, Ohio Environmental Protection Agency, March 29, 2001, 3745-1-07 D-6). IBI scores were calculated at Site #27 and Site #28 for comparison with other Big Creek sampling sites.

The Big Creek sites electrofished by NEORSD in 1999 obtained scores in the *Very Poor* to *Fair* ranges. A summary of 1999 Big Creek electrofishing results is presented in Table P-1. Additional tables which, for each sampling event, list the species collected, number of individuals, weights, pollution tolerances and incidence of DELT anomalies, can be found at the end of this report. Index of Biotic Integrity and MIwb scores are displayed graphically in Figures P-2 through P-7. Even though biological criteria do not apply to LRW, Sites #27 and #28 are graphically displayed in Figures P-3 and P-5 for comparison purposes only.

NEORSD investigators collected large percentages of pollution tolerant fish at each sample location in 1999. The average proportion of pollution tolerant fish collected ranged from approximately 28.5% at Site #26 to approximately 81% at Site #29. According to Ohio EPA's *Biological Criteria for the Protection of Aquatic Life: Volume II*, tolerant fish species tend toward community predominance with decreasing water and/or habitat quality (p. 4-29). The proportion of pollution tolerant fish collected at each site is shown in Table P-1 and displayed graphically in Figures P-8 and P-9.

The sampling results obtained at all sites other than Site #25 exhibited poor fish diversity. The poor diversity may be a result of poor stream habitat features. Specifically, these sites lacked quality pools and well-defined riffles and runs. The predominant substrate type at each of these sites consisted of bedrock, gravel and sand. Bedrock, gravel and sand substrates score lower on the QHEI and do not attract diverse fish communities as well as boulder and cobble substrates do.

Excluding Big Creek Site #25, Big Creek and Stickney Creek species were dominated numerically by Creek chubs (*Semotilus atromaculatus*), Central stonerollers (*Campostoma anomalum*) and Blacknose dace (*Rhinicthys atratulus*). Creek chubs are minnows classified as highly tolerant of pollution. They belong to no specialized feeding guild and can feed on a variety of insects, plants and animal matter. They inhabit both riffles and pools. Central stoneroller minnows are plant-consuming fish (herbivores) that inhabit both pools and riffles. According to the Ohio Environmental Protection Agency

(OEPA), stonerollers have no pollution tolerance classification. The blacknose dace is a minnow that is highly tolerant of pollution and is generally found in riffle areas of streams. These fish have no specialized diet and they generally feed on insects, plants and animal matter. Collectively, these three species accounted for 90 percent of the total catch at these five locations. Creek chubs accounted for 27 percent, Central stonerollers accounted for 52 percent, and Blacknose dace accounted for 11 percent of the total catch.

During routine dry weather sampling conducted on Big Creek from 1996 through 1998, NEORSD investigators measured bacteria levels in excess of Ohio EPA's Primary Contact recreational use designation criteria at all sites. Big Creek Site #25 exceeded the Primary Contact recreation use (PCU) criteria three out of five times from samples collected in sampling years 1996-1998. Big Creek Site #26 exceeded the PCU criteria two out of four times in sampling years 1996-1998. Big Creek Site #27 exceeded the PCU criteria three out of four times in sampling years 1996-1998. Big Creek Site #28 exceeded the PCU criteria three out of four times in sampling years 1996-1998. Big Creek Site #29 exceeded the PCU criteria three out of four times in sampling years 1996-1998. Stickney Creek Site #30 exceeded the PCU criteria three out of four times in sampling years 1996-1998 (See Appendix B of the NEORSD's 1996-1998 Greater Cleveland Area Environmental Water Quality Assessment reports). Dry weather discharges through storm sewer outfall pipes to Big Creek containing elevated bacteria levels were discovered in 1997 during NEORSD's Southwest Interceptor Operational Evaluation Project Dry Weather Outfall Survey. Although the elevated concentrations of *E. coli* and fecal coliform bacteria may not directly impact the fish community, they may indicate the presence of other pollutants which could cause an adverse impact on the fish community.

Conclusions

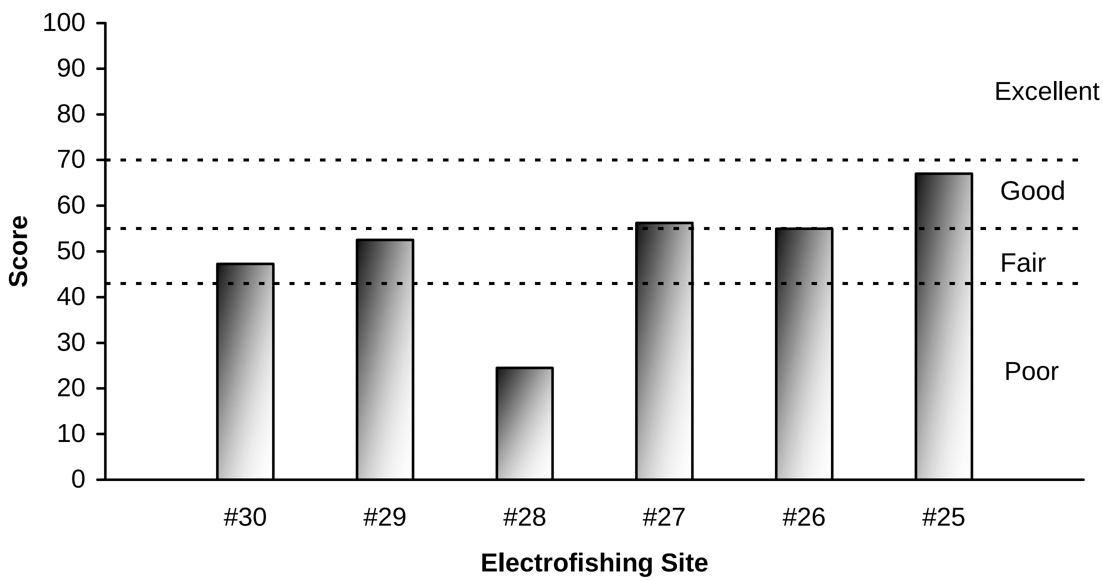
IBI scores measured on Big Creek in 1999 were generally in the *Poor* to *Fair* range at sites where biological criteria apply. MIwb scores obtained at sites #25 and #26 were in the *Fair* to *Marginally Good* range. Generally, Big Creek sampling sites exhibited low fish diversity. The generally low IBI and MIwb scores reflect the fact that the fish community is dominated by tolerant species. The lack of more specialized intolerant species is evident on Big Creek and more pollution intolerant species are needed to improve the fish community scores.

Results of the study suggest a correlation between stream habitat quality and fish community structure. Habitat quality appears to be a limiting factor in the failure of Big Creek's fish communities to attain IBI and MIwb warmwater habitat biological criteria. The predominant substrate type at each of the electrofishing zones consisted of bedrock, gravel and sand, and with the exception of Site #25, all electrofishing sites lacked quality pools and well-defined riffles and runs. Fish index scores obtained on Big Creek in 1999 are consistent with those obtained on Mill Creek in 1995 (see 1993-1995 Greater Cleveland Area Water Quality Assessment) and not unusual for an urbanized stream.

Table P-1
1999 Big Creek Fish Collection Summary

Site #	Location	Date	Fish Collected (#)	Tolerant Fish (%)	DELT Anomalies (%)	IBI Numerical Score	IBI Narrative Rating	MIwb Numerical Score	MIwb Narrative Rating
30	Stickney Creek	07/15/99	209	55.5	0.0	28	Fair	-	-
		08/18/99	380	48.4	0.0	28	Fair	-	-
		Average	295	52.0	0.0	28	Fair	-	-
29	East Branch at Fernhill Picnic Area	07/15/99	533	80.0	0.2	22	Poor	-	-
		08/18/99	423	82.0	0.5	22	Poor	-	-
		Average	478	81.0	0.4	22	Poor	-	-
28	West Branch upstream of Puritas Avenue	07/16/99	6	66.6	0.0	12	V. Poor	-	-
		08/18/99	8	16.6	0.0	16	V. Poor	-	-
		Average	12	41.6	0.0	14	V. Poor	-	-
27	West Branch upstream of Big Creek Confluence	07/14/99	427	91.1	0.0	20	Poor	-	-
		09/01/99	888	34.9	0.0	32	Fair	-	-
		Average	658	63.0	0.0	26	Poor	-	-
26	East Branch upstream of Big Creek Confluence	07/14/99	632	33.0	0.0	24	Poor	5.8	Poor
		09/01/99	1250	24.0	0.2	26	Poor	6.1	Fair
		Average	941	28.5	0.1	25	Poor	6.0	Fair
25	At Jennings Road	07/13/99	363	43.2	1.4	28	Fair	7.1	Fair
		08/31/99	291	24.7	0.7	34	M. Good	7.7	M. Good
		10/07/99	98	54.0	2.0	24	Poor	6.9	Fair
		Average	251	40.6	1.1	29	Fair	7.2	M. Good

Figure P-1
Big Creek Qualitative Habitat Evaluation Index Scores
1999



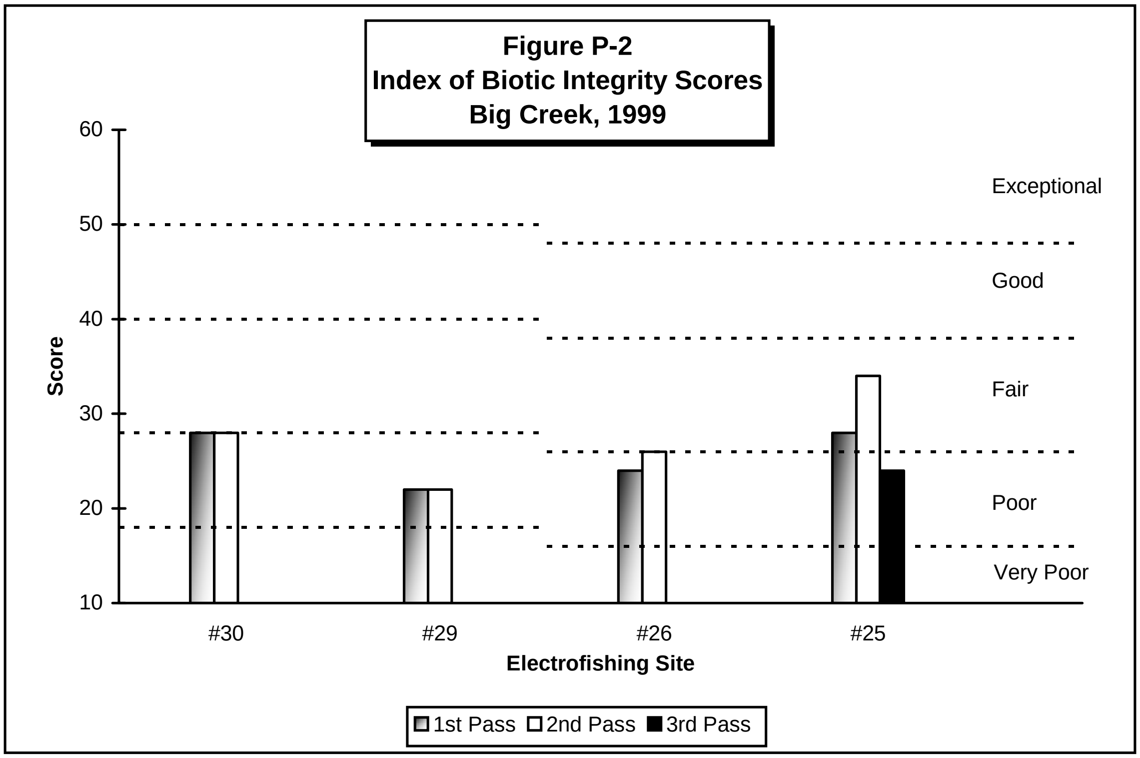


Figure P-2
Index of Biotic Integrity Scores
Big Creek, 1999
Score
60
50
40
30
20
10
Exceptional
Good
Fair
Poor
Very Poor
#30
#29
#26
#25
Electrofishing Site
1st Pass
2nd Pass
3rd Pass

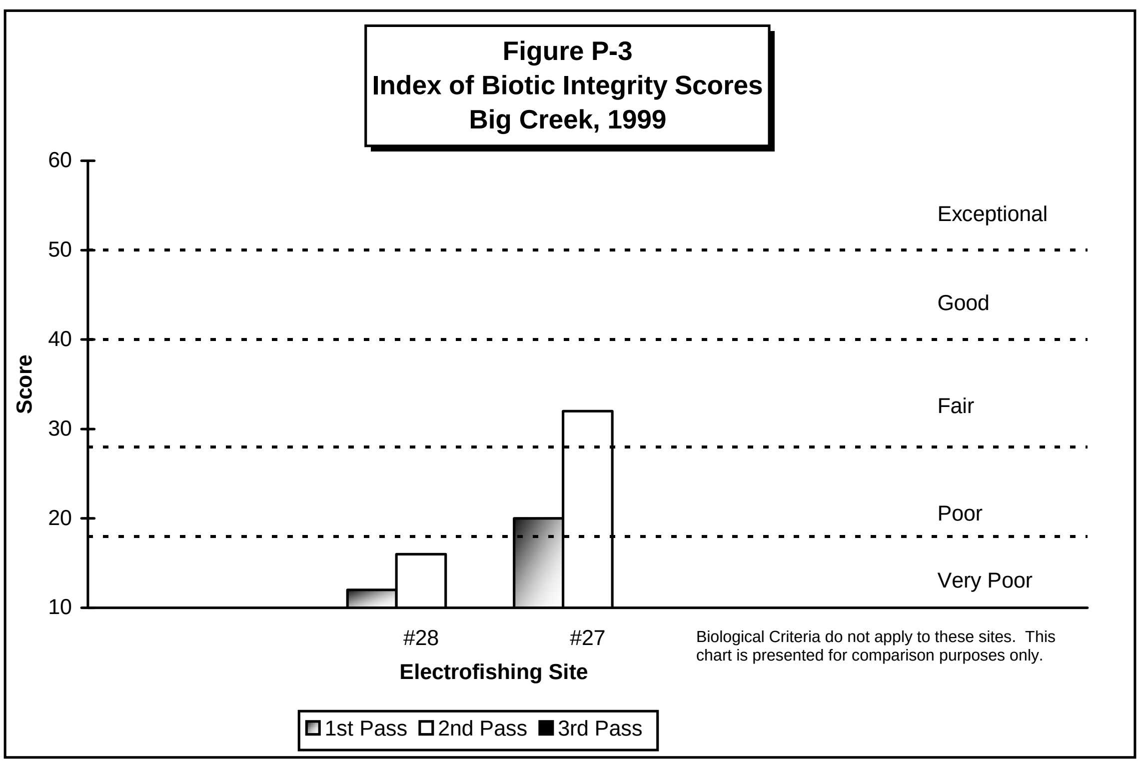


Figure P-3
Index of Biotic Integrity Scores
Big Creek, 1999
Score
60
50
40
30
20
10
Exceptional
Good
Fair
Poor
Very Poor
#28
#27
Electrofishing Site
Biological Criteria do not apply to these sites. This chart is presented for comparison purposes only.
1st Pass
2nd Pass
3rd Pass

Figure P-4
Average Index of Biotic Integrity Scores
Big Creek, 1999

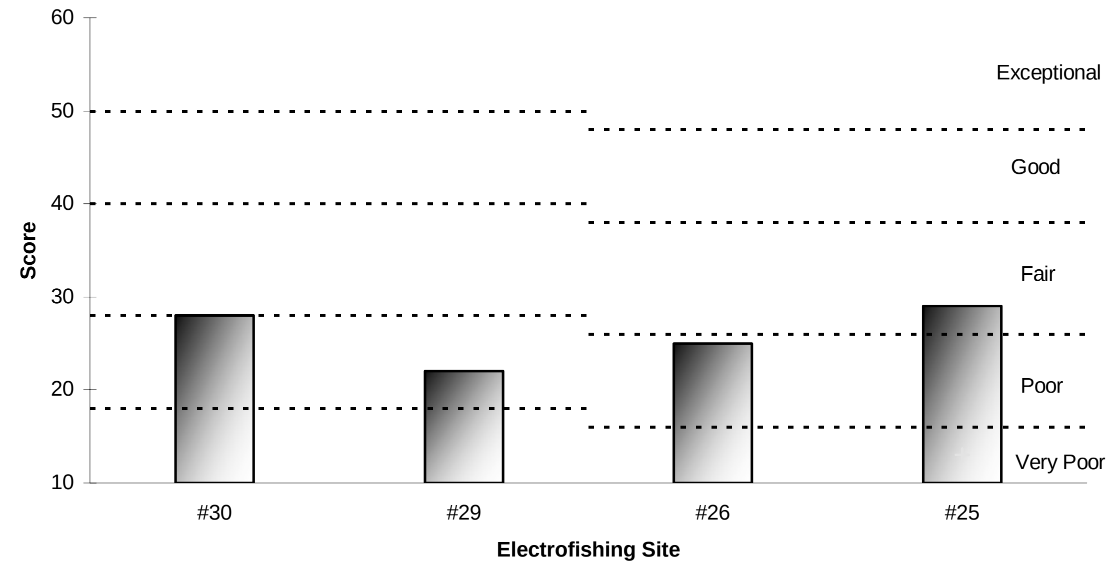
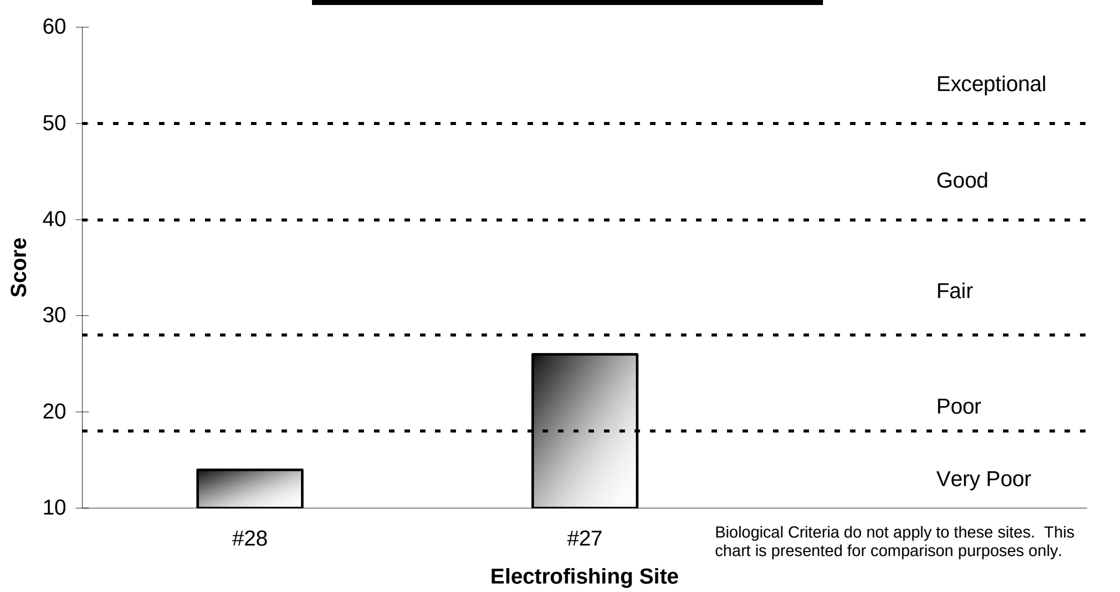


Figure P-5
Average Index of Biotic Integrity Scores
Big Creek, 1999



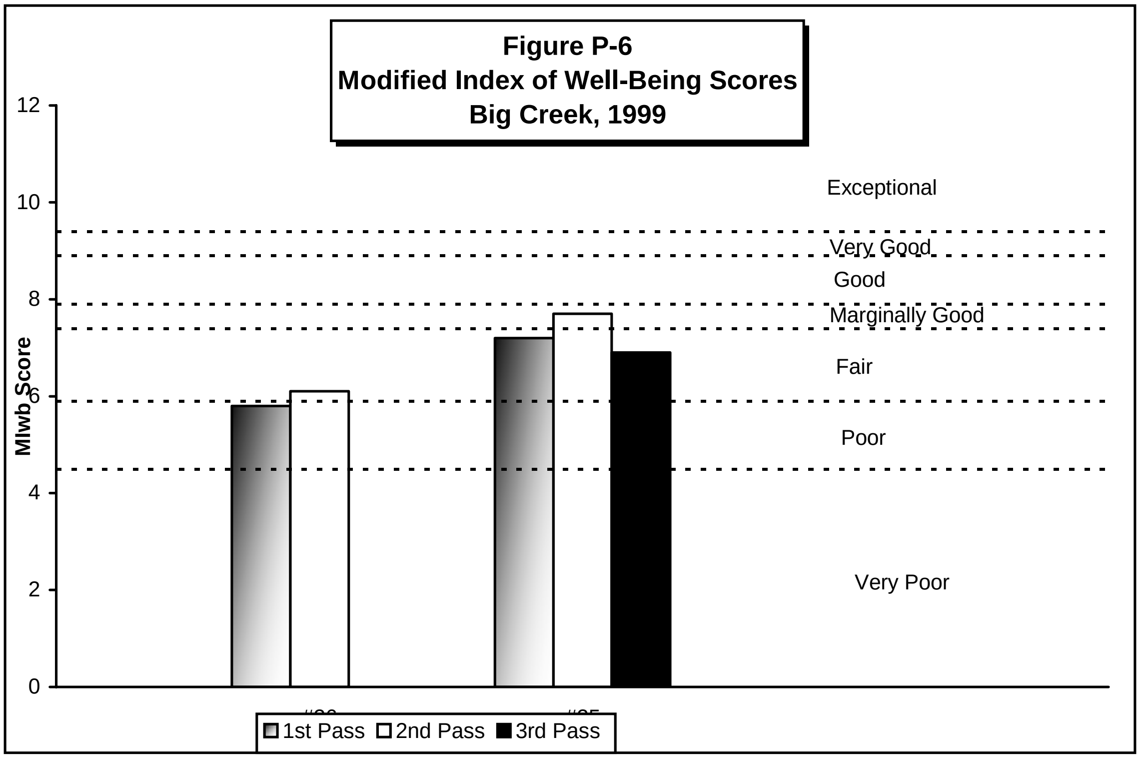


Figure P-6
Modified Index of Well-Being Scores
Big Creek, 1999
MIwb Score
12
10
8
6
4
2
0
Exceptional
Very Good
Good
Marginally Good
Fair
Poor
Very Poor
1st Pass
2nd Pass
3rd Pass

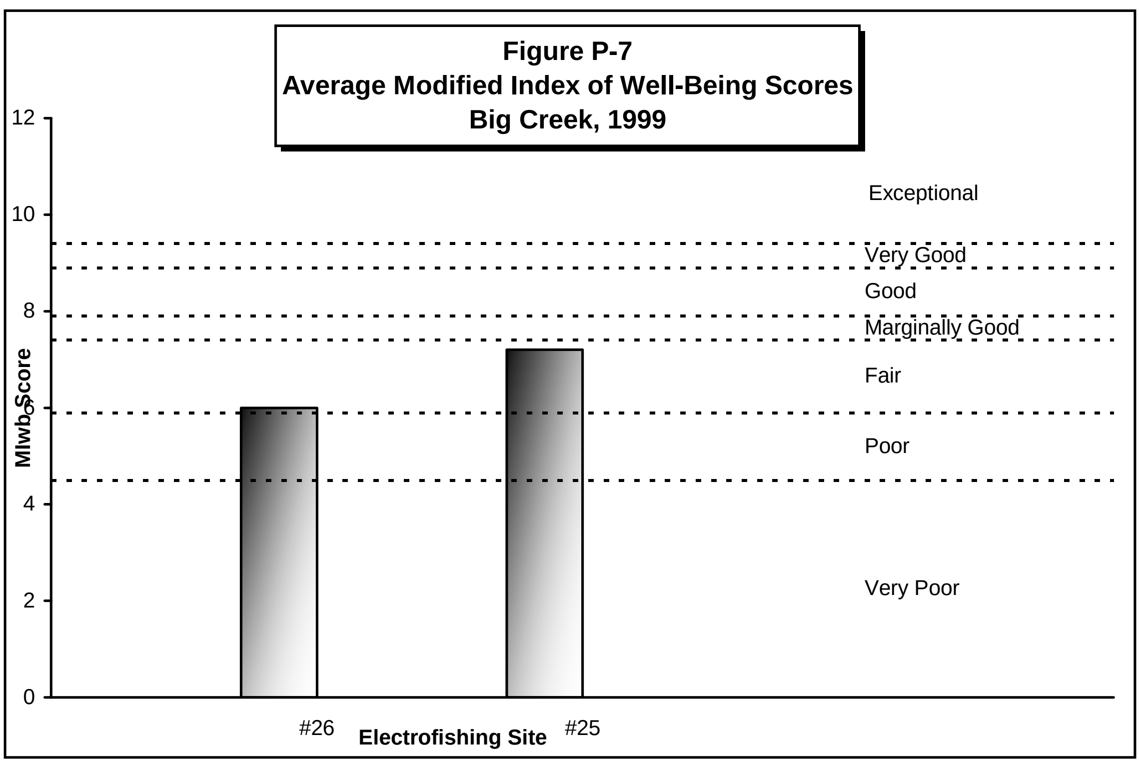


Figure P-7
Average Modified Index of Well-Being Scores
Big Creek, 1999
MIwb Score
12
10
8
6
4
2
0
Exceptional
Very Good
Good
Marginally Good
Fair
Poor
Very Poor
#26
Electrofishing Site
#25

Figure P-8
Proportion of Pollution Tolerant Fish Collected
Big Creek, 1998

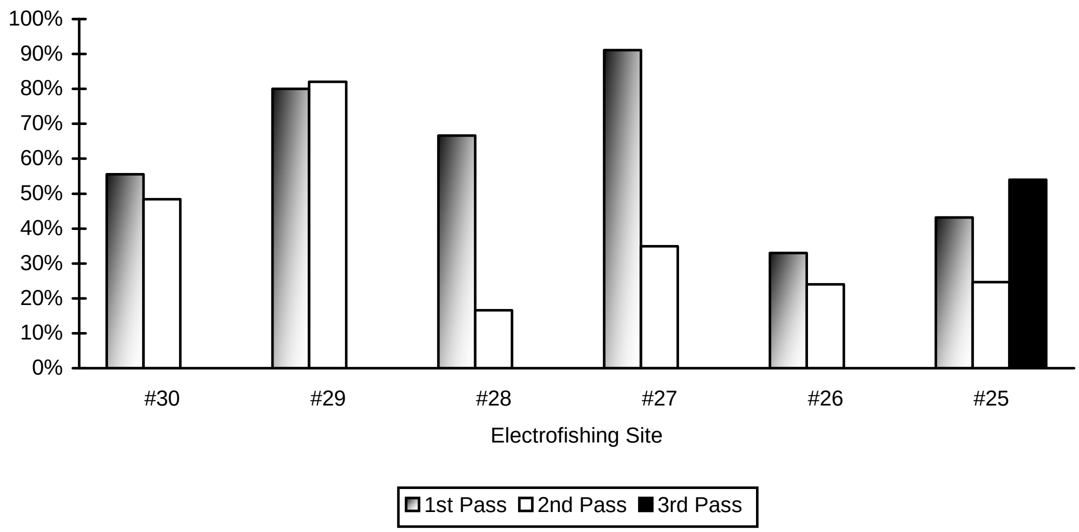
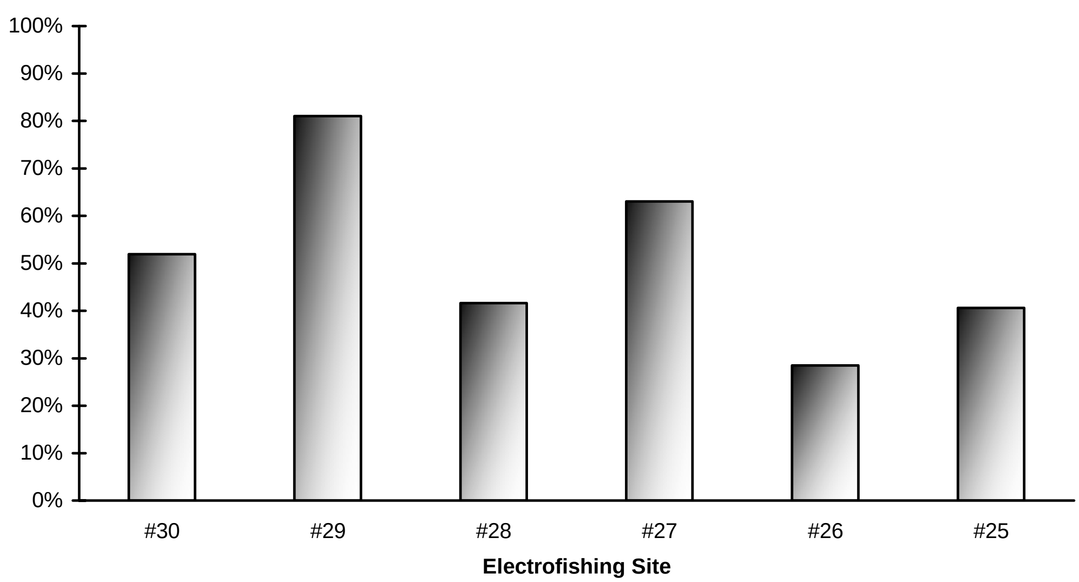


Figure P-9
Average Proportion of Pollution Tolerant Fish Collected
Big Creek, 1999



Big Creek: Downstream of Jennings Road
Sample Date: 07/13/99
Collection Distance: 0.2 km
Collection Method: Longline Electroshocking

Species	Number	Weight (kg)	Pollution Tolerance	#	*DELT Anomalies Description
Hypentelium nigricans Northern hog sucker	3	0.134	Moderately Intolerant	0	--
Catostomus commersoni Common white sucker	36	0.805	Highly Tolerant	2	Deformed Mouth Eroded fins
Cyprinus carpio Common carp	22	0.092	Highly Tolerant	0	--
Carassius auratus Goldfish	1	0.004	Highly Tolerant	0	--
Rhinicthys atratulus Blacknose dace	34	0.072	Highly Tolerant	0	--
Semotilus atromaculatus Creek chub	53	0.492	Highly Tolerant	1	Deformed Tail
Pimephales notatus Bluntnose minnow	4	0.014	Highly Tolerant	0	--
Campostoma anomalum Central stoneroller minnow	189	1.246	--	1	Eroded Fins
Ictalurus natalis Yellow bullhead	1	0.300	Highly Tolerant	0	--
Ictalurus melas Black bullhead	1	0.550	Moderately Tolerant	1	Eroded fins
Micropterus salmoides Largemouth bass	1	0.080	--	0	--
Lepomis cyanellus Green sunfish	6	0.246	Highly Tolerant	0	--
Lepomis macrochirus Northern bluegill sunfish	7	0.124	Moderately Tolerant	0	--
Lepomis gibbosus Pumpkinseed sunfish	4	0.118	Moderately Tolerant	0	--

Big Creek: Downstream of Jennings Road
Sample Date: 07/13/99

Species	Number	Weight (kg)	Pollution Tolerance	Anomalies #	Anomalies Description
hybrid	1	0.048	--	0	--
Totals	363	4.325		5	

*DELT anomalies were observed on 1.4% of the fish collected.
Index of Biotic Integrity (IBI) = 28 (Fair)
Modified Index of Well-Being (MIwb) 7.1 (Fair)

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Big Creek: Downstream of Jennings Road
Sample Date: 08/31/99
Collection Distance: 0.2 km
Collection Method: Longline Electroshocking

Species	Number	Weight (kg)	Pollution Tolerance	*DELT Anomalies #	*DELT Anomalies Description
Dorosoma cepedianum Eastern gizzard shad	17	0.422	--	0	--
Hypentelium nigricans Northern hog sucker	3	0.268	Moderately Intolerant	0	--
Catostomus commersoni Common white sucker	11	0.416	Highly Tolerant	0	--
Cyprinus carpio Common carp	5	0.392	Highly Tolerant	0	--
Carassius auratus Goldfish	1	0.086	Highly Tolerant	0	--
Semotilus atromaculatus Creek chub	34	0.104	Highly Tolerant	0	--
Notropis spilopterus Spotfin shiner	3	0.012	--	0	--
Notropis stramineus Sand shiner	3	0.008	Moderately Intolerant	0	--
Pimephales promelas Northern fathead minnow	2	0.008	Highly Tolerant	0	--
Pimephales notatus Bluntnose minnow	11	0.034	Highly Tolerant	0	--
Campostoma anomalum Central stoneroller minnow	161	0.464	--	0	--
Ictalurus natalis Yellow bullhead	3	0.143	Highly Tolerant	1	Lesion
Micropterus dolomieui Smallmouth bass	5	0.576	Moderately Intolerant	0	--
Micropterus salmoides Largemouth bass	2	0.272	--	0	--

Big Creek: Downstream of Jennings Road
Sample Date: 08/31/99

Species	Number	Weight (kg)	Pollution Tolerance	#	Anomalies Description
Lepomis gulosus Warmouth sunfish	1	0.050	--	0	--
Lepomis cyanellus Green sunfish	5	0.100	Highly Tolerant	0	--
Lepomis macrochirus Northern bluegill sunfish	9	0.296	Moderately Tolerant	0	--
Lepomis gibbosus Pumpkinseed sunfish	6	0.252	Moderately Tolerant	0	--
hybrid	9	0.294	--	1	Deformed Tail
Totals	291	4.197		2	

*DELT anomalies were observed on 0.7% of the fish collected.
Index of Biotic Integrity (IBI) = 34 (Marginally Good)
Modified Index of Well-Being (MIwb) 7.7 (Marginally Good)

Big Creek: Downstream of Jennings Road
Sample Date: 10/07/99
Collection Distance: 0.2 km
Collection Method: Longline Electroshocking

Species	Number	Weight (kg)	Pollution Tolerance	#	*DELT Anomalies Description
Dorosoma cepedianum Eastern gizzard shad	3	0.090	--	0	--
Hypentelium nigricans Northern hog sucker	7	0.782	Moderately Intolerant	0	--
Catostomus commersoni Common white sucker	13	0.175	Highly Tolerant	0	--
Cyprinus carpio Common carp	8	0.318	Highly Tolerant	1	Eroded fin
Rhinicthys atratulus Blacknose dace	4	0.004	Highly Tolerant	0	--
Semotilus atromaculatus Creek chub	8	0.038	Highly Tolerant	0	--
Notropis spilopterus Spotfin shiner	1	0.002	--	0	--
Pimephales promelas Northern fathead minnow	2	0.004	Highly Tolerant	0	--
Pimephales notatus Bluntnose minnow	10	0.040	Highly Tolerant	0	--
Campostoma anomalum Central stoneroller minnow	17	0.068	--	0	--
Ictalurus natalis Yellow bullhead	1	0.050	Highly Tolerant	0	--
Micropterus dolomieui Smallmouth bass	1	0.020	Moderately Intolerant	0	--
Lepomis cyanellus Green sunfish	7	0.094	Highly Tolerant	0	--
Lepomis macrochirus Northern bluegill sunfish	12	0.230	Moderately Tolerant	1	Lesion

Big Creek: Downstream of Jennings Road
Sample Date: 10/07/99

Species	Number	Weight (kg)	Pollution Tolerance	#	Anomalies Description
Lepomis gibbosus Pumpkinseed sunfish	4	0.132	Moderately Tolerant	0	--
hybrid			--	0	--
Totals	98	2.047		2	

*DELT anomalies were observed on 2.0% of the fish collected.
Index of Biotic Integrity (IBI) = 24 (Poor)
Modified Index of Well-Being (MIwb) 6.9 (Fair)

Big Creek: East Branch, Downstream of Tiedeman Road
Sample Date: 07/14/99
Collection Distance: 0.2 km
Collection Method: Longline Electroshocking

Species	Number	Weight (kg)	Pollution Tolerance	#	*DELT Anomalies Description
Rhinicthys atratulus Blacknose dace	106	0.407	Highly Tolerant	0	--
Semotilus atromaculatus Creek chub	77	0.484	Highly Tolerant	0	--
Pimephales notatus Bluntnose minnow	26	0.092	Highly Tolerant	0	--
Campostoma anomalum Central stoneroller minnow	421	1.186	--	0	--
Ictalurus natalis Yellow bullhead	1	0.180	Highly Tolerant	0	--
Lepomis cyanellus Green sunfish	1	0.002	Highly Tolerant	0	--
Totals	632	2.351		0	

*DELT anomalies were observed on 0.0% of the fish collected.
Index of Biotic Integrity (IBI) = 24 (Poor)
Modified Index of Well-Being (MIwb) 5.8 (Poor)

Big Creek: East Branch, Downstream of Tiedeman Road
Sample Date: 09/01/99
Collection Distance: 0.2 km
Collection Method: Longline Electroshocking

Species	Number	Weight (kg)	Pollution Tolerance	#	*DELT Anomalies Description
Catostomus commersoni Common white sucker	7	0.178	Highly Tolerant	0	--
Rhinicthys atratulus Blacknose dace	75	0.112	Highly Tolerant	0	--
Semotilus atromaculatus Creek chub	214	1.486	Highly Tolerant	2	Deformed Mouth
Pimephales notatus Bluntnose minnow	3	0.022	Highly Tolerant	0	--
Campostoma anomalum Central stoneroller minnow	950	4.344	--	1	Eroded Fins
Ictalurus natalis Yellow bullhead	1	0.030	Highly Tolerant	0	--
Totals	1250	6.172		3	

*DELT anomalies were observed on 0.2% of the fish collected.
Index of Biotic Integrity (IBI) = 26 (Poor)
Modified Index of Well-Being (MIwb) 6.1 (Fair)

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****Big Creek: West Branch, Downstream of Tiedeman Road**
Sample Date: 07/14/99
Collection Distance: 0.2 km
Collection Method: Longline Electroshocking

Species	Number	Weight (kg)	Pollution Tolerance	#	*DELT Anomalies Description
Catostomus commersoni Common white sucker	106	-	Highly Tolerant	0	--
Rhinicthys atratulus Blacknose dace	9	-	Highly Tolerant	0	--
Semotilus atromaculatus Creek chub	263	-	Highly Tolerant	0	--
Pimephales notatus Bluntnose minnow	11	-	Highly Tolerant	0	--
Campostoma anomalum Central stoneroller minnow	38	-	--	0	--
Totals	427	-		0	

*DELT anomalies were observed on 0.0% of the fish collected.
Index of Biotic Integrity (IBI) = 20 (Poor)
**Big Creek: West Branch at Tiedeman Rd is designated Limited Resource Water therefore biological criteria do not apply

****Big Creek: West Branch, Downstream of Tiedeman Road**
Sample Date: 09/01/99
Collection Distance: 0.2 km
Collection Method: Longline Electroshocking

Species	Number	Weight (kg)	Pollution Tolerance	#	*DELT Anomalies Description
Catostomus commersoni Common white sucker	96	-	Highly Tolerant	0	--
Rhinicthys atratulus Blacknose dace	6	-	Highly Tolerant	0	--
Semotilus atromaculatus Creek chub	194	-	Highly Tolerant	0	--
Notropis stramineus Sand shiner	1	-	Moderately Intolerant	0	--
Pimephales promelas Northern fathead minnow	1	-	Highly Tolerant	0	--
Pimephales notatus Bluntnose minnow	12	-	Highly Tolerant	0	--
Campostoma anomalum Central stoneroller minnow	577	-	--	0	--
Lepomis cyanellus Green sunfish	1	-	Highly Tolerant	0	--
Totals	888	-		0	

*DELT anomalies were observed on 0.0% of the fish collected.
Index of Biotic Integrity (IBI) = 32 (Fair)
**Big Creek: West Branch at Tiedeman Rd is designated Limited Resource Water therefore biological criteria do not apply

****Big Creek: West Branch, Downstream of Tiedeman Road**
Sample Date: 07/14/99
Collection Distance: 0.2 km
Collection Method: Longline Electroshocking

Species	Number	Weight (kg)	Pollution Tolerance	*DELT Anomalies #	*DELT Anomalies Description
Catostomus commersoni Common white sucker	106	-	Highly Tolerant	0	--
Rhinicthys atratulus Blacknose dace	9	-	Highly Tolerant	0	--
Semotilus atromaculatus Creek chub	263	-	Highly Tolerant	0	--
Pimephales notatus Bluntnose minnow	11	-	Highly Tolerant	0	--
Campostoma anomalum Central stoneroller minnow	38	-	--	0	--
Totals	427	-		0	

*DELT anomalies were observed on 0.0% of the fish collected.
Index of Biotic Integrity (IBI) = 20 (Poor)
**Big Creek: West Branch at Tiedeman Rd is designated Limited Resource Water therefore biological criteria do not apply

****Big Creek: West Branch, Downstream of Tiedeman Road**
Sample Date: 09/01/99
Collection Distance: 0.2 km
Collection Method: Longline Electroshocking

Species	Number	Weight (kg)	Pollution Tolerance	#	*DELT Anomalies Description
Catostomus commersoni Common white sucker	96	-	Highly Tolerant	0	--
Rhinicthys atratulus Blacknose dace	6	-	Highly Tolerant	0	--
Semotilus atromaculatus Creek chub	194	-	Highly Tolerant	0	--
Notropis stramineus Sand shiner	1	-	Moderately Intolerant	0	--
Pimephales promelas Northern fathead minnow	1	-	Highly Tolerant	0	--
Pimephales notatus Bluntnose minnow	12	-	Highly Tolerant	0	--
Campostoma anomalum Central stoneroller minnow	577	-	--	0	--
Lepomis cyanellus Green sunfish	1	-	Highly Tolerant	0	--
Totals	888	-		0	

*DELT anomalies were observed on 0.0% of the fish collected.
Index of Biotic Integrity (IBI) = 32 (Fair)
**Big Creek: West Branch at Tiedeman Rd is designated Limited Resource Water therefore biological criteria do not apply

****Big Creek: Puritas Road**
Sample Date:07/16/99
Collection Distance: 0.2 km
Collection Method: Longline Electroshocking

Species	Number	Weight (kg)	Pollution Tolerance	#	*DELT Anomalies Description
Semotilus atromaculatus Creek chub	4	0.062	Highly Tolerant	0	--
Campostoma anomalum Central stoneroller minnow	2	0.030	--	0	--
Totals	6	0.092		0	

*DELT anomalies were observed on 0.0% of the fish collected.
Index of Biotic Integrity (IBI) = 12 (Very Poor)
**Big Creek Puritas Road is designated Limited Resource Water therefore, biological criteria do not apply

****Big Creek: Puritas Road**
Sample Date: 08/18/99
Collection Distance: 0.2 km
Collection Method: Longline Electroshocking

Species	Number	Weight (kg)	Pollution Tolerance	#	*DELT Anomalies Description
Carassius auratus Goldfish	1	-	Highly Tolerant	0	--
Semotilus atromaculatus Creek chub	2	-	Highly Tolerant	0	--
Campostoma anomalum Central stoneroller minnow	15	-	--	0	--
Totals	18	-		0	

*DELT anomalies were observed on 0.0% of the fish collected.
Index of Biotic Integrity (IBI) = 16 (Very Poor)
**Big Creek Puritas Road is designated Limited Resource Water therefore, biological criteria do not apply

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Big Creek: Fernhill Picnic Area
Sample Date: 07/15/99
Collection Distance: 0.2 km
Collection Method: Longline Electroshocking

Species	Number	Weight (kg)	Pollution Tolerance	*DELT Anomalies #	*DELT Anomalies Description
Catostomus commersoni Common white sucker	86	-	Highly Tolerant	0	--
Rhinicthys atratulus Blacknose dace	150	-	Highly Tolerant	0	--
Semotilus atromaculatus Creek chub	158	-	Highly Tolerant	1	Body Lesion
Pimephales notatus Bluntnose minnow	33	-	Highly Tolerant	0	--
Campostoma anomalum Central stoneroller minnow	106	-	--	0	--
Totals	533	-		1	

*DELT anomalies were observed on 0.2% of the fish collected.
Index of Biotic Integrity (IBI) = 22 (Poor)

Big Creek: Fernhill Picnic Area
Sample Date: 08/18/99
Collection Distance: 0.2 km
Collection Method: Longline Electroshocking

Species	Number	Weight (kg)	Pollution Tolerance	#	*DELT Anomalies Description
Catostomus commersoni Common white sucker	35	-	Highly Tolerant	0	--
Rhinicthys atratulus Blacknose dace	118	-	Highly Tolerant	0	--
Semotilus atromaculatus Creek chub	157	-	Highly Tolerant	1	Body Lesion
Pimephales promelas Northern fathead minnow	3	-	Highly Tolerant	0	--
Pimephales notatus Bluntnose minnow	26	-	Highly Tolerant	0	--
Campostoma anomalum Central stoneroller minnow	74	-	--	0	--
Ictalurus natalis Yellow bullhead	1	-	Highly Tolerant	1	Body Lesion
Lepomis cyanellus Green sunfish	7	-	Highly Tolerant	0	--
Lepomis macrochirus Northern bluegill sunfish	1	-	Moderately Tolerant	0	--
hybrid	1	-	--	0	--
Totals	423	-		2	

*DELT anomalies were observed on 0.5% of the fish collected.
Index of Biotic Integrity (IBI) = 22 (Poor)

Stickney Creek: Upstream of the East Branch of Big Creek
Sample Date: 08/18/99
Collection Distance: 0.2 km
Collection Method: Longline Electroshocking

Species	Number	Weight (kg)	Pollution Tolerance	#	*DELT Anomalies Description
Catostomus commersoni Common white sucker	4	-	Highly Tolerant	0	--
Rhinicthys atratulus Blacknose dace	19	-	Highly Tolerant	0	--
Semotilus atromaculatus Creek chub	161	-	Highly Tolerant	0	--
Campostoma anomalum Central stoneroller minnow	196	-	--	0	--
Totals	380	-		0	

*DELT anomalies were observed on 0.0% of the fish collected.
Index of Biotic Integrity (IBI) = 28 (Fair)

Stickney Creek: Upstream of the East Branch of Big Creek
Sample Date: 07/15/99
Collection Distance: 0.2 km
Collection Method: Longline Electroshocking

Species	Number	Weight (kg)	Pollution Tolerance	#	*DELT Anomalies Description
Catostomus commersoni Common white sucker	2	-	Highly Tolerant	0	--
Rhinicthys atratulus Blacknose dace	64	-	Highly Tolerant	0	--
Semotilus atromaculatus Creek chub	50	-	Highly Tolerant	0	--
Campostoma anomalum Central stoneroller minnow	93	-	--	0	--
Totals	209	-		0	

*DELT anomalies were observed on 0.0% of the fish collected.
Index of Biotic Integrity (IBI) = 28 (Fair)

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APPENDIX Q
ABRAM CREEK AND ROCKY RIVER ELECTROFISHING SURVEY
1998

Introduction

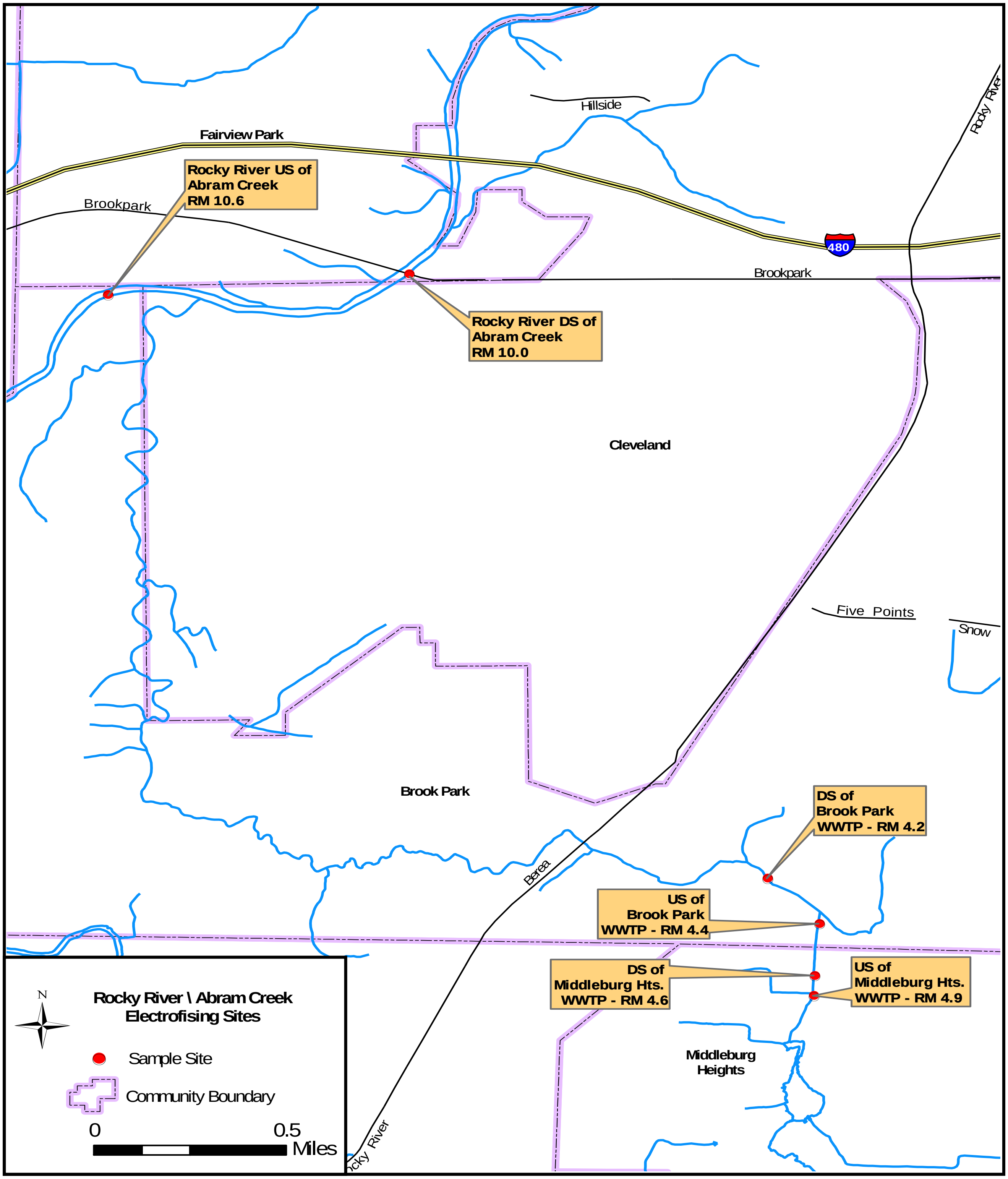
The Middleburg Heights and Brook Park Wastewater Treatment Plants (WWTP), which discharged treated effluent to Abram Creek, were decommissioned on December 30, 1992 and January 6, 1993, respectively. Wastewater previously tributary to the Middleburg Heights and Brook Park WWTP's now flows to the Northeast Ohio Regional Sewer District's (NEORSD) Southerly Wastewater Treatment Center via the Southwest Interceptor. NEORSD conducted quantitative electrofishing surveys on Abram Creek upstream and downstream of the Brook Park WWTP and on the Rocky River upstream and downstream of Abram Creek before and after the decommissioning of the Brook Park WWTP. These samplings were performed to characterize the water quality based on fish community structure. In 1998, electrofish sampling was not conducted on Abram Creek upstream and downstream of Middleburg Heights WWTP (RM 4.9) because the Investigators were unable to walk through the soft peat bottom substrate of the creek. Electrofishing was conducted in Abram Creek and Rocky River in 1998 at the following locations:

Sample Location	1998 Sampling Dates
Abram Creek Upstream of Brook Park WWTP – RM 4.4	July 14, September 1
Abram Creek Downstream of Brook Park WWTP – RM 4.2	July 14, September 1
Rocky River Upstream of Abram Creek – RM 10.6	July 15, September 2
Rocky River Downstream of Abram Creek – RM 10.0	July 20, September 2

Fish were collected utilizing generator-powered long-line electrofishing equipment. Electrofishing was performed on all habitat types located within a 150-200 meter sampling zone at the aforementioned sampling locations. The fish collected were identified to the species level, weighed, counted and examined for the presence of DELT anomalies (deformities, eroded fins, lesions and tumors) and returned to the location where they were collected. According to Ohio EPA protocols, each sampling zone should be electrofished two or three times during the sampling season.

The data compiled during these samplings were used to calculate the Index of Biotic Integrity (IBI) for each sample location. The Modified Index of Well Being (MIwb) was also calculated for the Rocky River sample locations. Narrative values corresponding to the IBI and MIwb scores were also derived. A detailed description of the sampling and analysis methods used for fish sampling, including the calculation of index scores can be found in Ohio EPA's *User Manual for Biological Field Assessment of Ohio Surface Waters* (1987).

Abram Creek was the receiving stream for the Brook Park and Middleburg Heights WWTP effluents, so an evaluation of the fish community was conducted. This evaluation examined the nine underlying assumptions of the Index of Biotic Integrity related and how stream fish communities change with environmental degradation. This was accomplished using “Fish Communities as Indicators of Environmental Degradation” by Kurt D. Fausch et al, in *Biological Indicators of Stress in Fish.*



Sampling Results and Discussion

Qualitative Habitat Evaluation Index Scores (Table Q-1) were calculated to assess the aquatic habitat conditions on Abram Creek and Rocky River in 1998. QHEI scores were calculated upstream and downstream of Middleburg Heights WWTP to document the habitat conditions. However, electrofishing was not completed at either site because the investigators' mobility was impaired by the creek's soft bottom substrate. QHEI field sheets are located in appendix D of this report.

Table Q-1
Abram Creek and Rocky River QHEI Scores

Sample Location	Score	Narrative Rating
Abram Creek Upstream of Middleburg Hts. WWTP – RM 4.9	48.5	Fair
Abram Creek Downstream of Middleburg Hts WWTP – RM 4.6	35.0	Poor
Abram Creek Upstream of Brook Park WWTP – RM 4.4	56.0	Good
Abram Creek Downstream of Brook Park WWTP – RM 4.2	48.8	Fair
Rocky River Upstream of Abram Creek – RM 10.6	62.5	Good
Rocky River Downstream of Abram Creek – RM 10.0	63.5	Good

Abram Creek and Rocky River sample locations were electrofished once in 1992 and twice in 1998. IBI scores for 1992 and 1998 are shown in Figures Q-1 and Q-2. Tables of electrofishing data, which list the species, number of individuals, weights, pollution tolerances and percent DELT anomalies of fish collected during these samplings, can be found at the end of this report.

Fish community index scores on Abram Creek showed little to no improvement from 1992 to 1998 (Figure Q-1 and Table Q-2). All IBI scores obtained at these locations during this time period were in the *Very Poor* range. Upstream of the former Brook Park WWTP, the IBI score improved from 12 in 1992 to 17 in 1998. Downstream of the former Brook Park WWTP, IBI scores declined from 16 in 1992 to 15 in 1998. QHEI scores on Abram Creek were in a range of 35 to 56 (*Fair to Good*).

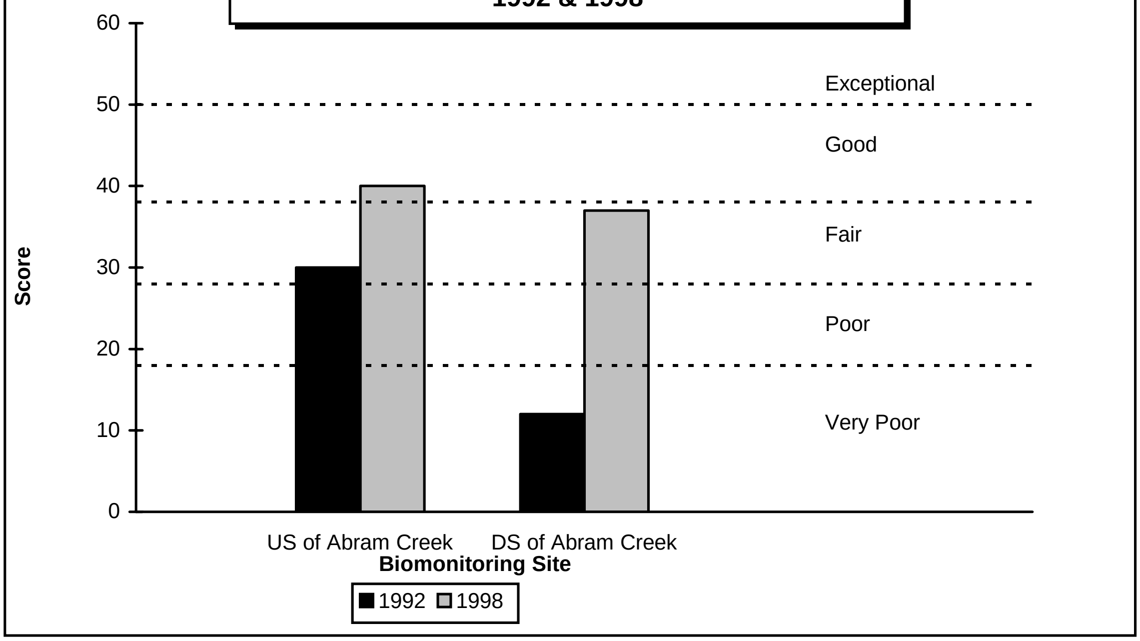
Fish community index scores obtained on the Rocky River upstream and downstream of Abram Creek, however, showed a significant improvement from 1992 to 1998 (Figure Q-1 and Table Q-2). Upstream of Abram Creek, IBI scores improved from 30 (*Fair*) in 1992 to 40 (*Good*) in 1998. At the site downstream of Abram Creek, IBI scores improved dramatically, from 12 (*Very Poor*) in 1992 to 37 (*Marginally Good*) in 1998. From 1992 to 1998 MIwb scores on Rocky River improved upstream downstream of Abram Creek from 6.6 to 7.0 and 4.5 to 6.1, respectively (Figure Q-3).

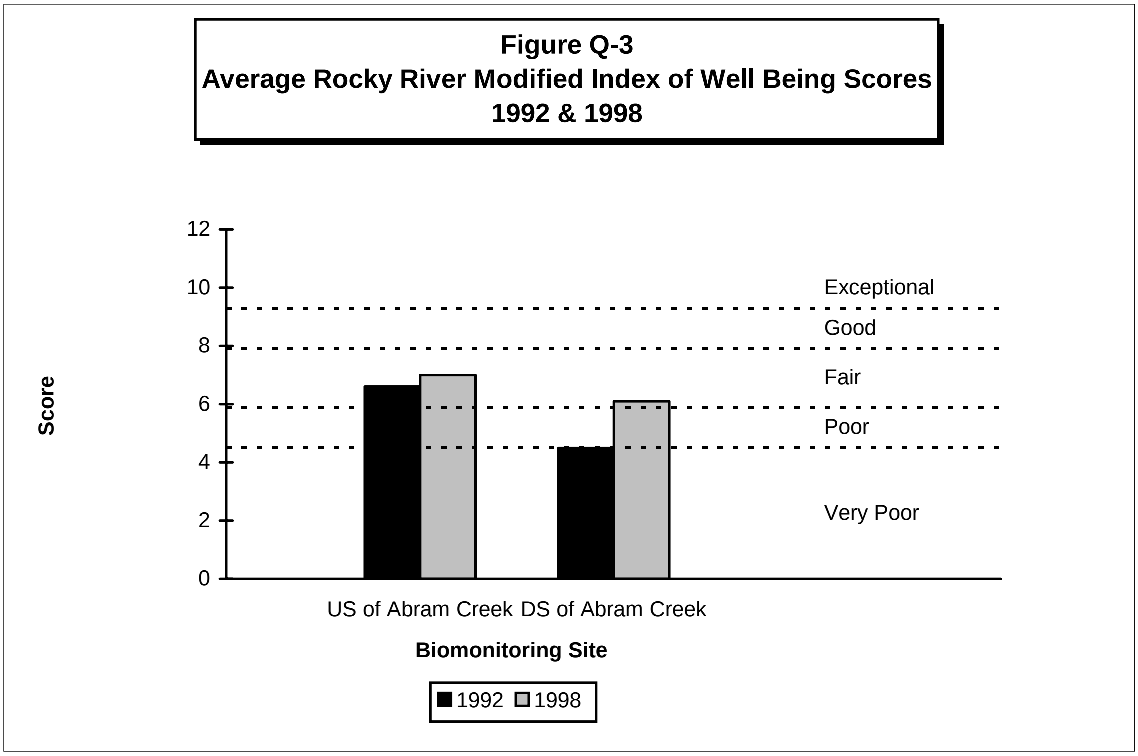
Table Q-2
1992 - 1998 Abram Creek and Rocky River Average Index Scores

		1992		1998	
Location	River Mile	IBI	MIwb	IBI	MIwb
Abram Creek US of Middleburg Hts. WWTP	4.9	14	-	-	-
Abram Creek DS of Middleburg Hts. WWTP	4.6	-	-	-	-
Abram Creek US of Brook Park WWTP	4.4	12	-	17	-
Abram Creek DS of Brook Park WWTP	4.2	16	-	15	-
Rocky River US of Abram Creek	10.6	30	6.6	40	7.0
Rocky River DS of Abram Creek	10.0	12	4.5	37	6.1

Figure Q-1
Abram Creek Index of Biotic Integrity Average Scores
1992 & 1998

Figure Q-2
Average Rocky River Index of Biotic Integrity Scores
1992 & 1998





Eight grab samples for chemical and bacteriological analysis were obtained from Abram Creek and Rocky River in 1998. As with human health, the presence of pathogens is also a concern for fish communities. One bacteriological sample obtained from Abram Creek downstream of the former Brook Park WWTP revealed an *E. coli* density of 410 colony forming units (CFU) per 100 ml. This density exceeds Ohio EPA's primary contact recreational use designation *E. coli* criterion of 298 CFU per 100 ml. No other bacteriological excursions were encountered from the other sample locations.

As shown in Table Q-4, field measurements revealed excursions from Ohio EPA's Warmwater Habitat dissolved oxygen criterion of 4.0 mg/L on three occasions on July 15, upstream and downstream of the former Brook Park WWTP and on September 1, downstream of Brook Park WWTP.

Table Q-4
Abram Creek Dissolved Oxygen Concentrations (mg/L)

Sample Location	July 15, 1998	September 1, 1998
Abram Creek Upstream of the former Brook Park WWTP – RM 4.4	3.8	2.8
Abram Creek Downstream of the former Brook Park WWTP – RM 4.2	3.7	4.2

The dissolved oxygen concentrations noted above are at levels that may stress fish life. Abram Creek has a very low watershed drainage area and has a very low stream gradient. The drainage area of Abram Creek is 1.9 square miles. Abram Creek decreases in elevation approximately 7.5 feet per mile. These factors may be contributing to lower oxygen levels. No other parameters measured on Abram Creek or Rocky River exceeded Ohio EPA's Warmwater Habitat criteria.

Additionally, 1992 and 1998 data on Abram Creek and Rocky River were evaluated utilizing the nine underlying assumptions of the Index of Biotic Integrity concerning how stream fish communities change with environmental degradation. According to "Fish Communities as Indicators of Environmental Degradation" by Kurt D. Fausch et al, in *Biological Indicators of Stress in Fish*, the following nine primary underlying assumptions of the Index of Biotic Integrity indicate how stream fish communities change with environmental degradation.

1) *The number of all native species and those in specific taxa or habitat guilds declines.*
2) *The number of intolerant species declines.*
3) *The proportion of tolerant species increases.*
4) *The proportion of insectivores and carnivores decline.*
5) *The proportion of generalists and omnivores increases.*
6) *Fish abundance declines.*
7) *The proportion of Lithophilic spawning fish (fish requiring silt free substrates to spawn) decline and the number of hybrid fish increase.*
8) *The incidence of DELT (Deformities, Erosions, Lesions, Tumors and external anomalies increase).*
9) *Introduced species increases.*

The following is an examination of Fausch's nine assumptions as they relate to the Abram Creek and Rocky River fish community.

Assumption 1: The number of native species and those in specific taxa or habitat guilds decline.
1998 data exhibited an increase in the numbers of native species in Abram Creek compared with the 1992 data. Five native species each were collected upstream and downstream of the Brook Park WWTP in 1998. This would suggest an improvement in water quality when compared to the three native species collected upstream and downstream of the Brook Park WWTP in 1992.

Four new native species were collected in Rocky River in 1998 upstream of Abram Creek and nine new species were collected downstream of Abram Creek. This also suggests an improvement in water quality.

Assumption 2: The number of intolerant species declines.
No intolerant fish species were collected on Abram Creek. Two new intolerant fish were collected on the Rocky River in 1998 upstream and downstream of Abram Creek, suggesting an environmental improvement.

Assumption 3: The proportion of individuals that are members of tolerant species increases.
Ninety-nine to 100 percent of fish collected on Abram Creek in 1992 and 1998 were pollution tolerant species. Assumption three does not show degradation or environmental improvement on Abram Creek. A sharp decline in tolerant species was noted in Rocky River both upstream and downstream of Abram Creek.

Twenty-nine and one half percent of the fish species collected in 1992 in Rocky River upstream of Abram Creek were tolerant species compared to 2.6% tolerant species collected in 1998. Eighty-four percent of the fish species collected in 1992 in Rocky River downstream of Abram Creek were tolerant species compared to 30.1% tolerant species collected in 1998. This assumption shows an environmental improvement in the river.

Assumption 4: The proportion of insectivores and carnivores decline.
An increase in the proportion of insectivores was observed in Abram Creek, both upstream and downstream of the former treatment plant, from 1992 to 1998. During this time period, a 45.6% increase was observed at the upstream location, while at the downstream site there was a 10.2% increase. The increase in insectivore fish would suggest an improvement in water quality.

Rocky River's insectivore and carnivore fish species increased both upstream and downstream of Abram Creek suggesting an improvement in water quality. Sixty-six percent of the fish species collected in 1992 in Rocky River upstream of Abram Creek were insectivore and carnivore species compared to 86.2% tolerant species collected in 1998.

Assumption 5: The proportion of trophic generalists and omnivores increases.
The data show a decrease in the proportion of omnivores and generalist feeding fish in Abram Creek both upstream and downstream of the former Brook Park WWTP from 1992 to 1998. A 46% decrease was observed at the upstream site, while a 3.2% decrease was documented at the downstream location. Since fewer omnivores and generalists were collected on Abram Creek, this metric would suggest an improvement in water quality.

Rocky River's generalists and omnivore fish species decreased upstream of Abram Creek in 1998 compared to 1992 and increased in 1998 compared to 1992 downstream of Abram Creek. These results suggest improvement upstream and degradation downstream of Abram Creek.

Assumption 6: Fish abundance declines.
The data show that the average fish numbers in Abram Creek increased from 1992 to 1998 at the upstream site and decreased at the downstream site during the same time period. At the upsteam site, an average of 75 fish were collected in 1992, while an average of 129 fish were collected in 1998. At the downstream site, an average of 192 fish were collected in 1992, while that number decreased to 116.5 in 1998. This would suggest environmental improvement upstream and degradation downstream.

Rocky River results showed fish numbers decreased upstream of Abram Creek and increased downstream of Abram Creek. This suggests environmental degradation upstream and improvement downstream.

Assumption 7: The proportion of lithophilic spawning fish (fish requiring silt-free substrates to spawn) declines, and the number of hybrid fish increases.
No lithophilic spawning fish were collected in Abram Creek in either 1992 or in 1998. One hybrid bluegill was collected at the upstream and downstream location on Abram

Creek in 1998. Therefore, this metric suggests neither an environmental improvement nor degradation.

Rocky River scores showed an increase in lithophilic spawners, indicating an improvement in water qualityl both upstream and downstream of Abram Creek. In 1998, upstream of Abram Creek, 22.9% of the fish were lithophils compared to 11.2 % lithophils collected in 1992. In 1998, downstream of Abram Creek, 14.6% of the fish were lithophils compared to 13.1% in 1992.

Assumption 8: The incidence of DELT and external anomalies increases.
A slight increase in the incidence of DELT and external anomalies was evident from 1992 to 1998 at both the upstream and downstream sampling locations on Abram Creek. A 0.2% increase was noted at the upstream location, and a 1.4% increase was recorded at the downstream location. An increase in the incidence of anomalies reflects an environmental degradation.

A slight increase in the incidence of DELT and external anomalies was evident from 1992 to 1998 on Rocky River upstream of Abram Creek. In 1998 0.47% of the fish collected exhibited anomalies compared to 0% in 1992. The 1998 results downstream of Abram Creek showed 0.3% of the fish collected exhibited anomalies. These results indicate an environmental degradation is evident at the upstream location and an improvement is shown at the downstream location.

Assumption 9: Introduced species increases.
A decrease was evident in the proportion of introduced species collected. A 22.8% decrease in introduced species was recorded during this time period at the Abram Creek upstream location, while a 34.2% decrease was recorded at the downstream location. This decrease suggests an environmental improvement. In both 1992 and 1998, the common carp was the only introduced species collected in Abram Creek.

Introduced species collected on Rocky River upstream and downstream of Abram Creek showed a decline in species collected upstream and an increase in species collected downstream. Zero percent of the species collected in 1998 upstream of Abram Creek were introduced species compared to 0.38% collected in 1992. The results suggest an improvement upstream and degradation downstream of Abram Creek on Rocky River.

Five of Fausch's nine assumptions (#1, #4, #5, #6, and #9) suggest an improvement of water quality in Abram Creek upstream and downstream of Brook Park WWTP. Assumption #8, external anomalies, may suggest a decline in water quality because of a slight increase in fish that exhibited anomalies. Assumptions #2 and #7 do not apply because no pollution intolerant or lithophilic species were collected on Abram Creek. Assumption #3 shows no environmental improvement or degradation because the same proportion of pollution tolerant species were collected upstream and downstream of the Brook Park WWTP.

Five of Fausch's nine assumptions (#1, #2, #3, #4, and #7) suggest an improvement of water quality in Rocky River upstream and downstream of Abram Creek. Assumptions #5 and #9 show an improvement in water quality upstream of Abram Creek and degradation downstream of Abram Creek. Assumptions #6 and # 8 show degradation in water quality upstream of Abram Creek and an improvement downstream of Abram Creek on Rocky River.

Summary and Conclusions

Average IBI scores on Abram Creek upstream and downstream of the Brook Park WWTP remained relatively unchanged from 1992 to 1998 (*Very Poor*). However, evaluations of the individual metrics show a possible recovery process underway in Abram Creek. Habitat quality and low dissolved oxygen may have played a part in Abram Creek not obtaining good fish community scores at the electrofishing sites.

The low dissolved oxygen in Abram Creek may be attributable to the very slow moving shallow (<2 feet) water depth. Abram Creek has a very small watershed drainage area and a very low stream gradient. The drainage area of Abram Creek is 1.9 square miles. Abram Creek decreases in elevation approximately 7.5 feet per mile. These factors may be contributing to lower oxygen levels. Until the habitat and dissolved oxygen improve, there may not be any significant shifts in the fish community structure observed on Abram Creek.

An evaluation of the fish community health on Rocky River in 1998, downstream of Abram Creek exhibited higher IBI scores than in 1992. Increased fish index scores are due to the following: (1) an increase in the number of native species, (2) an increase in the number of intolerant species and a decrease in the percent of tolerant species, and (3) an increase in percentages of insectivores, carnivores and lithophilic spawning fish. It cannot be conclusively determined what influenced higher fish community scores on Rocky River in 1998, but it may be attributable to improved water quality on Abram Creek resulting from the decommissioning of the Brook Park WWTP. Further sampling is warranted to determine why fish community scores were higher in Rocky River downstream of Abram Creek.

Abram Creek Upstream of Brookpark WWTP
July 14, 1998
Collection Distance: 0.2 km
Collection Method: Longline Electroshocking

Species	Number	Weight (kg)	Pollution Tolerance	DELT Anomalies #	DELT Anomalies Description
Cyprinus carpio Common carp	1	0.160	Highly Tolerant	0	--
Semotilus atromaculatus Creek chub	15	0.268	Highly Tolerant	1	nose Lesion
Pimephales promelas Northern fathead minnow	50	0.198	Highly Tolerant	0	--
Ictalurus nebulosus Brown bullhead	7	0.044	Highly Tolerant	0	--
Lepomis cyanellus Green sunfish	35	0.336	Highly Tolerant	2	Deformed Tail
Bluegill hybrid	1	0.004	--	0	--
Totals	109	1.010		3	

*DELT anomalies were observed on 2.8% of the fish collected.
Index of Biotic Integrity (IBI) = 12 (Very Poor)

Abram Creek Upstream of Brook Park WWTP
September 1, 1998
Collection Distance: 0.2 km
Collection Method: Longline Electroshocking

Species	Number	Weight (kg)	Pollution Tolerance	DELT Anomalies #	DELT Anomalies Description
Cyprinus carpio Common carp	8	5.374	Highly Tolerant	0	--
Semotilus atromaculatus Creek chub	3	0.066	Highly Tolerant	0	--
Pimephales promelas Northern fathead minnow	53	0.092	Highly Tolerant	0	--
Ictalurus nebulosus Brown bullhead	3	0.190	Highly Tolerant	0	--
Lepomis cyanellus Green sunfish	64	0.490	Highly Tolerant	0	--
Lepomis macrochirus Northern bluegill sunfish	18	0.036	Moderately Tolerant	0	--
Totals	149	6.248		0	

*DELT anomalies were observed on 0.0% of the fish collected.
Index of Biotic Integrity (IBI) = 22 (Poor)

Abram Creek Downstream of Brook Park WWTP
July 14, 1998
Collection Distance: 0.2 km
Collection Method: Longline Electroshocking

Species	Number	Weight (kg)	Pollution Tolerance	#	DELT Anomalies Description
Cyprinus carpio Common carp	7	3.394	Highly Tolerant	0	--
Semotilus atromaculatus Creek chub	3	0.070	Highly Tolerant	0	--
Pimephales promelas Northern fathead minnow	38	0.132	Highly Tolerant	0	--
Ictalurus nebulosus Brown bullhead	4	0.476	Highly Tolerant	0	--
Lepomis cyanellus Green sunfish	11	0.098	Highly Tolerant	0	--
Bluegill hybrid	1		--	0	--
Totals	64	4.170		0	

*DELT anomalies were observed on 0.0% of the fish collected.
Index of Biotic Integrity (IBI) = 18 (Poor)

Abram Creek Downstream of Brook Park WWTP
September 1, 1998
Collection Distance: 0.2 km
Collection Method: Longline Electroshocking

Species	Number	Weight (kg)	Pollution Tolerance	DELT Anomalies #	DELT Anomalies Description
Cyprinus carpio Common carp	8	6.220	Highly Tolerant	2	--
Semotilus atromaculatus Creek chub	2	0.038	Highly Tolerant	0	--
Pimephales promelas Northern fathead minnow	143	0.162	Highly Tolerant	2	--
Ictalurus nebulosus Brown bullhead	1	0.152	Highly Tolerant	0	--
Lepomis cyanellus Green sunfish	9	0.148	Highly Tolerant	0	--
Lepomis macrochirus Northern bluegill sunfish	6	0.012	Moderately Tolerant	0	--
Totals	169	6.732		4	

*DELT anomalies were observed on 2.4% of the fish collected.
Index of Biotic Integrity (IBI) = 12 (Very Poor)

Rocky River Upstream of Abram Creek
July 20, 1998
Collection Distance: 0.2 km
Collection Method: Longline Electroshocking

Species	Number	Weight (kg)	Pollution Tolerance	#	DELT Anomalies Description
Hypentelium nigricans Northern hog sucker	2	0.006	Moderately Intolerant	0	--
Catostomus commersoni Common white sucker	3	0.012	Highly Tolerant	0	--
Notropis chrysocephalus Striped shiner	47	0.433	--	0	--
Notropis spilopterus Spotfin shiner	15	0.126	--	1	Tail Lesion
Notropis stramineus Sand shiner	91	0.424	Moderately Intolerant	0	--
Ericymba buccata Silverjaw minnow	2	0.008	--	0	--
Campostoma anomalum Central stoneroller minnow	43	0.428	--	1	Body Lesion
Ictalurus natalis Yellow bullhead	1	0.002	Highly Tolerant	0	--
Ambloplites rupestris Northern rockbass	18	0.156	--	0	--
Micropterus dolomieui Smallmouth bass	35	0.252	Moderately Intolerant	0	--
Lepomis cyanellus Green sunfish	1	0.006	Highly Tolerant	0	--
Etheostoma blenniodes Greenside darter	8	0.062	Moderately Intolerant	0	--

Rocky River Upstream of Abram Creek
July 20, 1998

Species	Number	Weight (kg)	Pollution Tolerance	#	DELT Anomalies Description
Ethestoma caeruleum Rainbow darter	1	0.004	Moderately Intolerant	0	--
Ethestoma nigrum Johnny darter	1	0.004	--	0	--
Totals	268	1.923		2	

*DELT anomalies were observed on	0.7%	of the fish collected.
Index of Biotic Integrity (IBI) =	38	(Good)
Modified Index of Well-Being (MIwb)	7.3	(Fair)
Shannon Diversity Index, wt.	1.886	
Shannon Diversity Index, no.	1.886	
N	394.5	
B	2.855	

Rocky River Upstream of Abram Creek
September 2, 1998
Collection Distance: 0.2 km
Collection Method: Longline Electroshocking

Species	Number	Weight (kg)	Pollution Tolerance	DELT Anomalies #	DELT Anomalies Description
Hypentelium nigricans Northern hog sucker	1	0.020	Moderately Intolerant	0	--
Notropis cornutus Common shiner	22	0.154	--	0	--
Notropis chrysocephalus Striped shiner	3	0.030	--	0	--
Notropis spilopterus Spotfin shiner	1	0.006	--	0	--
Notropis stramineus Sand shiner	37	0.100	Moderately Intolerant	0	--
Ericymba buccata Silverjaw minnow	2	0.006	--	0	--
Pimephales notatus Bluntnose minnow	1	0.002	Highly Tolerant	0	--
Campostoma anomalum Central stoneroller minnow	11	0.068	--	0	--
Ambloplites rupestris Northern rockbass	8	0.078	--	0	--
Micropterus dolomieui Smallmouth bass	48	0.610	Moderately Intolerant	0	--
Lepomis cyanellus Green sunfish	2	0.020	Highly Tolerant	0	--
Lepomis macrochirus Northern bluegill sunfish	3	0.006	Moderately Tolerant	0	--
Etheostoma blenniodes Greenside darter	8	0.046	Moderately Intolerant	0	--
Ethestoma caeruleum Rainbow darter	2	0.006	Moderately Intolerant	0	--

Rocky River Upstream of Abram Creek
September 2, 1998

Species	Number	Weight (kg)	Pollution Tolerance	#	DELT Anomalies Description
Ethestoma nigrum Johnny darter	5	0.010	--	0	--
Totals	154	1.162		0	

*DELT anomalies were observed on	0.0%	of the fish collected.
Index of Biotic Integrity (IBI) =	42	(Good)
Modified Index of Well-Being (MIwb)	6.7	(Fair)
Shannon Diversity Index, wt.	2.012	
Shannon Diversity Index, no.	1.66	
N	226.5	
B	1.71	

Rocky River Downstream of Abram Creek
July 15, 1998
Collection Distance: 0.2 km
Collection Method: Longline Electroshocking

Species	Number	Weight (kg)	Pollution Tolerance	#	DELT Anomalies Description
Hypentelium nigricans Northern hog sucker	3	0.032	Moderately Intolerant	0	--
Catostomus commersoni Common white sucker	7	0.044	Highly Tolerant	0	--
Cyprinus carpio Common carp	9	13.375	Highly Tolerant	0	--
Notropis chrysocephalus Striped shiner	15	0.132	--	0	--
Notropis spilopterus Spotfin shiner	7	0.048	--	0	--
Notropis stramineus Sand shiner	36	0.188	Moderately Intolerant	0	--
Ericymba buccata Silverjaw minnow	1	0.010	--	0	--
Pimephales promelas Northern fathead minnow	11	0.076	Highly Tolerant	0	--
Pimephales notatus Bluntnose minnow			Highly Tolerant	0	--
Campostoma anomalum Central stoneroller minnow	3	0.010	--	0	--
Ictalurus natalis Yellow bullhead	3	0.234	Highly Tolerant	0	--
Ambloplites rupestris Northern rockbass	34	1.114	--	0	--
Micropterus dolomieui Smallmouth bass	13	0.084	Moderately Intolerant	0	--
Micropterus salmoides Largemouth bass	2	0.010	--	0	--

Rocky River Downstream of Abram Creek
July 15, 1998

Species	Number	Weight (kg)	Pollution Tolerance	#	DELT Anomalies Description
Lepomis cyanellus Green sunfish	11	0.106	Highly Tolerant	0	--
Lepomis macrochirus Northern bluegill sunfish	17	0.200	Moderately Tolerant	0	--
Lepomis gibbosus Pumpkinseed sunfish	2	0.040	Moderately Tolerant	0	--
Etheostoma blenniodes Greenside darter	8	0.060	Moderately Intolerant	0	--
Ethestoma nigrum Johnny darter	4	0.012	--	0	--
Bluegill hybrid	1	0.020	--	0	--
Totals	187	15.795		0	

*DELT anomalies were observed on	0.0%	of the fish collected.
Index of Biotic Integrity (IBI) =	40	(Good)
Modified Index of Well-Being (MIwb)	6.5	(Fair)
Shannon Diversity Index, wt.	2.499	
Shannon Diversity Index, no.	0.728	
N	217.5	
B	2.91	

Rocky River Downstream of Abram Creek
September 2, 1998
Collection Distance: 0.2 Km
Collection Method: Longline Electroshocking

Species	Number	Weight (Kg)	Pollution Tolerance	#	DELT Anomalies Description
Catostomus commersoni Common white sucker	2	0.092	Highly Tolerant	0	--
Cyprinus carpio Common carp	16	23.900	Highly Tolerant	1	Body Lesion
Notropis chrysocephalus Striped shiner	6	0.014	--	0	--
Notropis stramineus Sand shiner	8	0.024	Moderately Intolerant	0	--
Ericymba buccata Silverjaw minnow	2	0.004	--	0	--
Pimephales notatus Bluntnose minnow	1	0.002	Highly Tolerant	0	--
Ictalurus natalis Yellow bullhead	5	0.208	Highly Tolerant	0	--
Ambloplites rupestris Northern rockbass	47	1.228	--	0	--
Micropterus dolomieui Smallmouth bass	27	0.924	Moderately Intolerant	0	--
Micropterus salmoides Largemouth bass	1	0.040	--	0	--
Lepomis cyanellus Green sunfish	7	0.058	Highly Tolerant	0	--
Lepomis macrochirus Northern bluegill sunfish	8	0.048	Moderately Tolerant	0	--
Etheostoma blenniodes Greenside darter	5	0.024	Moderately Intolerant	0	--
Ethestoma nigrum Johnny darter	4	0.014	--	0	--

Species	Number	Weight (Kg)	Pollution Tolerance	DELT Anomalies #	DELT Anomalies Description
Etheostoma maculata Blackside darter	2	0.008	--	0	--
Totals	141	26.588		1	

*DELT anomalies were observed on 0.7% of the fish collected.
Index of Biotic Integrity (IBI) = 34 (Marginally Good)
Modified Index of Well-Being (MIwb) = 5.8 (Poor)

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