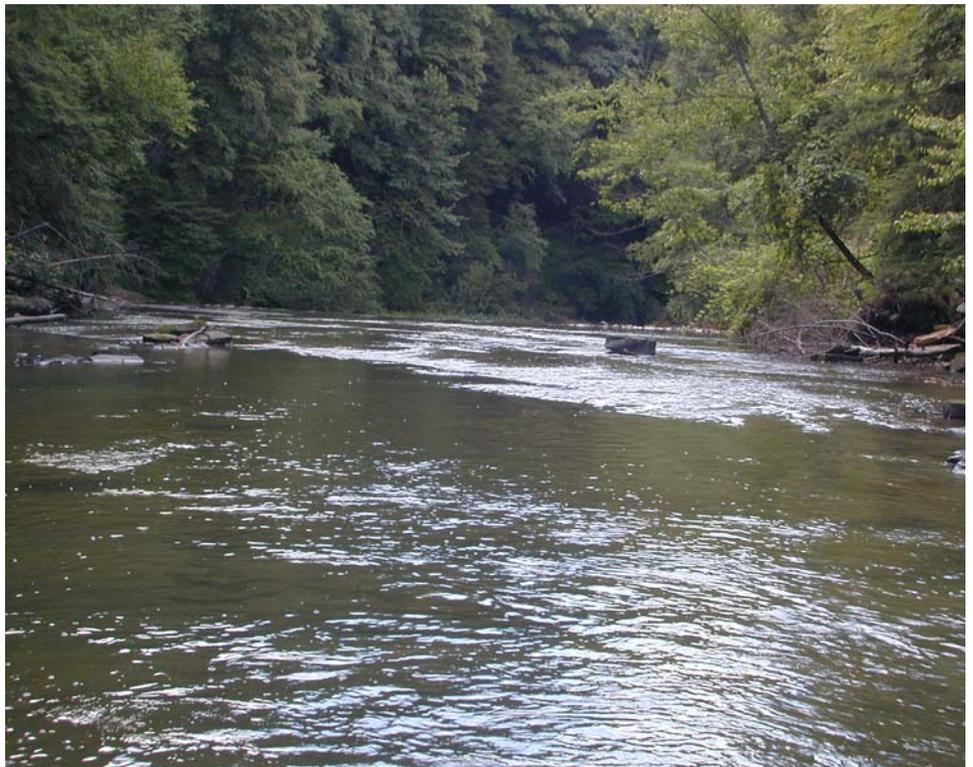


Division of Surface Water

**Biological and Water Quality
Study of the Chagrin River and
Selected Tributaries 2003-04**

Cuyahoga, Geauga, Lake, and Portage Counties



December 31, 2006

Bob Taft, Governor
Joseph P. Koncelik, Director

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December 31, 2006

OEPA Technical Report EAS/2006-12-7

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NOTICE TO USERS

Ohio EPA incorporated biological criteria into the Ohio Water Quality Standards (WQS; Ohio Administrative Code 3745-1) regulations in February 1990 (effective May 1990). These criteria consist of numeric values for the Index of Biotic Integrity (IBI) and Modified Index of Well-Being (MIwb), both of which are based on fish assemblage data, and the Invertebrate Community Index (ICI), which is based on macroinvertebrate assemblage data. Criteria for each index are specified for each of Ohio's five ecoregions (as described by Omernik 1988), and are further organized by organism group, index, site type, and aquatic life use designation. These criteria, along with the existing chemical and whole effluent toxicity evaluation methods and criteria, figure prominently in the monitoring and assessment of Ohio's surface water resources. The following documents support the use of biological criteria by outlining the rationale for using biological information, the methods by which the biocriteria were derived and calculated, the field methods by which sampling must be conducted, and the process for evaluating results:

Ohio Environmental Protection Agency. 1987a. Biological criteria for the protection of aquatic life: Volume I. The role of biological data in water quality assessment. Div. Water Qual. Monit. & Assess., Surface Water Section, Columbus, Ohio.

Ohio Environmental Protection Agency. 1987b. Biological criteria for the protection of aquatic life: Volume II. Users manual for biological field assessment of Ohio surface waters. Div. Water Qual. Monit. & Assess., Surface Water Section, Columbus, Ohio.

Ohio Environmental Protection Agency. 1989b. Addendum to Biological criteria for the protection of aquatic life: Volume II. Users manual for biological field assessment of Ohio surface waters. Div. Water Qual. Plan. & Assess., Ecological Assessment Section, Columbus, Ohio.

Ohio Environmental Protection Agency. 1989c. Biological criteria for the protection of aquatic life: Volume III. Standardized biological field sampling and laboratory methods for assessing fish and macroinvertebrate communities. Div. Water Quality Plan. & Assess., Ecol. Assess. Sect., Columbus, Ohio.

Ohio Environmental Protection Agency. 1990. The use of biological criteria in the Ohio EPA surface water monitoring and assessment program. Div. Water Qual. Plan. & Assess., Ecol. Assess. Sect., Columbus, Ohio.

Ohio Environmental Protection Agency. 2006a. 2006 updates to Biological Criteria for the Protection of Aquatic Life: Volume II and Volume II Addendum. Users manual for biological field assessment of Ohio surface waters. Div. Of Surface Water, Ecol. Assess. Sect., Columbus, Ohio.

Ohio Environmental Protection Agency. 2006b. 2006 updates to Biological Criteria for the

Protection of Aquatic Life: Volume III. Standardized biological field sampling and laboratory methods for assessing fish and macroinvertebrate communities. Div. Of Surface Water, Ecol. Assess. Sect., Columbus, Ohio.

Ohio Environmental Protection Agency. 2006c. Methods for assessing habitat in flowing waters: Using the Qualitative Habitat Evaluation Index (QHEI). Ohio EPA Tech. Bull. EAS/2006-06-1. Div. Of Surface Water, Ecol. Assess. Sect., Columbus, Ohio.

Omernik, J.M. 1987. Ecoregions of the conterminous United States. *Ann Assoc. Amer. Geogr.* 77(1): 118-125.

Rankin, E.T. 1989. The qualitative habitat evaluation index (QHEI): rationale, methods, and application. Div. Water Qual. Plan. & Assess., Ecol. Assess. Sect., Columbus, Ohio.

Since the publication of the preceding guidance documents, the following new publications by the Ohio EPA have become available. These publications should also be consulted as they represent the

latest information and analyses used by the Ohio EPA to implement the biological criteria.

DeShon, J.D. 1995. Development and application of the invertebrate community index (ICI), pp. 217-243. in W.S. Davis and T. Simon (eds.). *Biological Assessment and Criteria: Tools for Risk-based Planning and Decision Making*. Lewis Publishers, Boca Raton, FL.

Rankin, E. T. 1995. The use of habitat assessments in water resource management programs, pp. 181-208. in W. Davis and T. Simon (eds.). *Biological Assessment and Criteria: Tools for Water Resource Planning and Decision Making*. Lewis Publishers, Boca Raton, FL.

Yoder, C.O. and E.T. Rankin. 1995. Biological criteria program development and implementation in Ohio, pp. 109-144. in W. Davis and T. Simon (eds.). *Biological Assessment and Criteria: Tools for Water Resource Planning & Decision Making*. Lewis Publishers, Boca Raton, FL.

Yoder, C.O. and E.T. Rankin. 1995. Biological response signatures and the area of degradation value: new tools for interpreting multimetric data, pp. 263-286. in W. Davis and T. Simon (eds.). *Biological Assessment and Criteria: Tools for Water Resource Planning and Decision Making*. Lewis Publishers, Boca Raton, FL.

Yoder, C.O. 1995. Policy issues and management applications for biological criteria, pp. 327-344. in W. Davis and T. Simon (eds.). *Biological Assessment and Criteria: Tools for Water Resource Planning and Decision Making*. Lewis Publishers, Boca Raton, FL.

Yoder, C.O. and E.T. Rankin. 1995. The role of biological criteria in water quality monitoring, assessment, and regulation. *Environmental Regulation in Ohio: How to Cope With the*

Regulatory Jungle. Inst. of Business Law, Santa Monica, CA. 54 pp.

These documents and this report may be obtained by writing to:

Ohio EPA, Division of Surface Water
Monitoring and Assessment Section
4675 Homer Ohio Lane
Groveport, Ohio 43125
(614) 836-8777

ACKNOWLEDGMENTS

The following Ohio EPA staff are acknowledged for their contribution to this report:

Study Area -

Pollutant Loadings - Paul Anderson

Chemical Water Quality - Bob Davic, Paul Anderson

Sediment Quality - Bob Davic

Physical Habitat - Bob Miltner

Biological Assessment - Bob Miltner, Ed Moore, Jr.

Data Management - Dennis Mishne

TSD coordination - Ed Moore, Jr. (with thanks to Bob Davic and Bob Miltner)

Reviewers - Jeff DeShon, Marc Smith, Bob Davic, Paul Anderson, Bill Zawiski, Chris Skalski

This evaluation and report were possible only with the assistance of the study team, many full and part time field staff, and the chemistry analyses provided by the Ohio EPA Division of Environmental Services. Property owners who permitted access for sampling are also gratefully acknowledged for their cooperation.

Copies of this report are located on the Ohio EPA internet web page (www.epa.state.oh.us/dsw/document_index/psdindx.html) or may be available on CD from:

Division of Surface Water
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4675 Homer Ohio Lane
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FOREWORD

What is a Biological and Water Quality Survey?

A biological and water quality survey, or “biosurvey”, is an interdisciplinary monitoring effort coordinated on a waterbody specific or watershed scale. This effort may involve a relatively simple setting focusing on one or two small streams, one or two principal stressors, and a handful of sampling sites or a much more complex effort including entire drainage basins, multiple and overlapping stressors, and tens of sites. Each year Ohio EPA conducts biosurveys in 4-5 watersheds study areas with an aggregate total of 250-300 sampling sites.

The Ohio EPA employs biological, chemical, and physical monitoring and assessment techniques in biosurveys in order to meet three major objectives: 1) determine the extent to which use designations assigned in the Ohio Water Quality Standards (WQS) are either attained or not attained; 2) determine if use designations assigned to a given water body are appropriate and attainable; and 3) determine if any changes in key ambient biological, chemical, or physical indicators have taken place over time, particularly before and after the implementation of point source pollution controls or best management practices. The data gathered by a biosurvey is processed, evaluated, and synthesized in a biological and water quality report. Each biological and water quality study contains a summary of major findings and recommendations for revisions to WQS, future monitoring needs, or other actions possibly needed to resolve existing impairment of designated uses. While the principal focus of a biosurvey is on the status of aquatic life uses, the status of other uses such as recreation and water supply, as well as human health concerns, are also addressed.

The findings and conclusions of a biological and water quality study may factor into regulatory actions taken by Ohio EPA (*e.g.*, NPDES permits, Director’s Orders, the Ohio Water Quality Standards [OAC 3745-1], Water Quality Permit Support Documents [WQPSDs]), and are eventually incorporated into State Water Quality Management Plans, the Ohio Nonpoint Source Assessment, and the biennial Integrated Water Quality Monitoring and Assessment Report (305[b] and 303[d]).

Hierarchy of Indicators

A carefully conceived ambient monitoring approach, using cost-effective indicators consisting of ecological, chemical, and toxicological measures, can ensure that all relevant pollution sources are judged objectively on the basis of environmental results. Ohio EPA relies on a tiered approach in attempting to link the results of administrative activities with true environmental measures. This integrated approach includes a hierarchical continuum from administrative to true environmental indicators (Figure 1). The six “levels” of indicators include: 1) actions taken by regulatory agencies (permitting, enforcement, grants); 2) responses by the regulated community (treatment works, pollution prevention); 3) changes in discharged quantities (pollutant loadings); 4) changes in ambient conditions (water quality, habitat); 5) changes in uptake and/or assimilation (tissue contamination, biomarkers, wasteload allocation); and, 6) changes in health, ecology, or other effects (ecological condition, pathogens). In this process the administrative activity results (levels 1 and 2) can be linked to efforts to improve water quality (levels 3, 4, and 5) which should translate into

Superimposed on this hierarchy is the concept of stressor, exposure, and response indicators. *Stressor* indicators generally include activities which have the potential to degrade the aquatic environment such as pollutant discharges (permitted and unpermitted), land use effects, and habitat modifications. *Exposure* indicators are those which measure the effects of stressors and can include whole effluent toxicity tests, tissue residues, and biomarkers, each of which provides evidence of biological exposure to a stressor or bioaccumulative agent. *Response* indicators are generally composite measures of the cumulative effects of stress and exposure and include the more direct measures of community and population response that are represented here by the biological indices which comprise Ohio's biological criteria. Other response indicators could include target assemblages, *i.e.*, rare, threatened, endangered, special status, and declining species or bacterial levels which serve as surrogates for the recreational uses. These indicators represent the essential technical elements for watershed-based management approaches. The key, however, is to use the different indicators *within* the roles which are most appropriate for each.

Describing the causes and sources associated with observed impairments revealed by the biological criteria and linking this with pollution sources involves an interpretation of multiple lines of evidence including water chemistry data, sediment data, habitat data, effluent data, biomonitoring results, land use data, and biological response signatures within the biological data itself. Thus the assignment of principal causes and sources of impairment represents the association of impairments (defined by response indicators) with stressor and exposure indicators. The principal reporting venue for this process on a watershed or subbasin scale is a biological and water quality report. These reports then provide the foundation for aggregated assessments such as the Ohio Water Resource Inventory (305[b] report), the Ohio Nonpoint Source Assessment, and other technical bulletins.

Ohio Water Quality Standards: Designated Aquatic Life Use

The Ohio Water Quality Standards (WQS; Ohio Administrative Code 3745-1) consist of designated uses and chemical, physical, and biological criteria designed to represent measurable properties of the environment that are consistent with the goals specified by each use designation. Use designations consist of two broad groups, aquatic life and non-aquatic life uses. In applications of the Ohio WQS to the management of water resource issues in Ohio's rivers and streams, the aquatic life use criteria frequently result in the most stringent protection and restoration requirements, hence their emphasis in biological and water quality reports. The five different aquatic life uses currently defined in the Ohio WQS are described as follows:

- 1) *Warmwater Habitat (WWH)* - this use designation defines the "typical" warmwater assemblage of aquatic organisms for Ohio rivers and streams; *this use represents the principal restoration target for the majority of water resource management efforts in Ohio.*
- 2) *Exceptional Warmwater Habitat (EWH)* - this use designation is reserved for waters which support "unusual and exceptional" assemblages of aquatic organisms which are characterized by a high diversity of species, particularly those which are highly intolerant and/or rare,

threatened, endangered, or special status (*i.e.*, declining species); *this designation represents a protection goal for water resource management efforts dealing with Ohio's best water resources.*

- 3) *Cold Water Habitat (CWH)* - this use is intended for waters which support assemblages of cold water organisms and/or those which are stocked with salmonids with the intent of providing a put-and-take fishery on a year round basis which is further sanctioned by the Ohio DNR, Division of Wildlife; this use should not be confused with the Seasonal Salmonid Habitat (SSH) use which applies to the Lake Erie tributaries which support periodic "runs" of salmonids during the spring, summer, and/or fall.
- 4) *Modified Warmwater Habitat (MWH)* - this use applies to streams and rivers which have been subjected to extensive, maintained, and essentially permanent hydromodifications such that the biocriteria for the WWH use are not attainable *and where the activities have been sanctioned by state or federal law*; the representative aquatic assemblages are generally composed of species which are tolerant to low dissolved oxygen, silt, nutrient enrichment, and poor quality habitat.
- 5) *Limited Resource Water (LRW)* - this use applies to small streams (usually <3 mi² drainage area) and other water courses which have been irretrievably altered to the extent that no appreciable assemblage of aquatic life can be supported; such waterways generally include small streams in extensively urbanized areas, those which lie in watersheds with extensive drainage modifications, those which completely lack water on a recurring annual basis (*i.e.*, true ephemeral streams), or other irretrievably altered waterways.

Chemical, physical, and/or biological criteria are generally assigned to each use designation in accordance with the broad goals defined by each. As such the system of use designations employed in the Ohio WQS constitutes a "tiered" approach in that varying and graduated levels of protection are provided by each. This hierarchy is especially apparent for parameters such as dissolved oxygen, ammonia-nitrogen, temperature, and the biological criteria. For other parameters such as heavy metals, the technology to construct an equally graduated set of criteria has been lacking, thus the same water quality criteria may apply to two or three different use designations.

Ohio Water Quality Standards: Non-Aquatic Life Uses

In addition to assessing the appropriateness and status of aquatic life uses, each biological and water quality survey also addresses non-aquatic life uses such as recreation, water supply, and human health concerns as appropriate. The recreation uses most applicable to rivers and streams are the Primary Contact Recreation (PCR) and Secondary Contact Recreation (SCR) uses. The criterion for designating the PCR use can be having a water depth of at least one meter over an area of at least 100 square feet or, lacking this, where frequent human contact is a reasonable expectation. If a water body does not meet either criterion, the SCR use applies. The attainment status of PCR and SCR is determined using bacterial indicators (*e.g.*, fecal coliform, *E. coli*) and the criteria for each

are specified in the Ohio Water Quality Standards (WQS).

Attainment of recreation uses are evaluated based on monitored bacteria levels. The Ohio Water Quality Standards state that all waters should be free from any public health nuisance associated with raw or poorly treated sewage (Administrative Code 3745-1-04, Part F). Additional criteria (Administrative Code 3745-1-07) apply to waters that are designated as suitable for full body contact such as swimming (PCR- primary contact recreation) or for partial body contact such as wading (SCR- secondary contact recreation). These standards were developed to protect human health, because even though fecal coliform bacteria are relatively harmless in most cases, their presence indicates that the water has been contaminated with fecal matter.

Water supply uses include Public Water Supply (PWS), Agricultural Water Supply (AWS), and Industrial Water Supply (IWS). Public Water Supplies are simply defined as segments within 500 yards of a potable water supply or food processing industry intake. The Agricultural Water Supply (AWS) and Industrial Water Supply (IWS) use designations generally apply to all waters unless it can be clearly shown that they are not applicable. An example of this would be an urban area where livestock watering or pasturing does not take place, thus the AWS use would not apply. Chemical criteria are specified in the Ohio WQS for each use and attainment status is based primarily on chemical-specific indicators. Human health concerns are additionally addressed with fish tissue data, but any consumption advisories are issued by the Ohio Department of Health.

MECHANISMS FOR WATER QUALITY IMPAIRMENT

The following paragraphs are provided to present the varied causes of impairment that were encountered during the 2003-04 study. While the various perturbations are presented under separate headings, it is important to remember that they are often interrelated and cumulative in terms of the detrimental impact that can result.

Habitat and Flow Alterations

Habitat alteration, such as channelization, impacts biological communities directly by limiting the complexity of living spaces available to aquatic organisms. Consequently, fish and macroinvertebrate communities are not as diverse. Indirect impacts include the removal of riparian trees and field tiling to facilitate drainage. Following a rain event, most of the water is quickly removed from tiled fields rather than filtering through the soil, recharging groundwater, and reaching the stream at a lower volume and more sustained rate. As a result, small streams more frequently go dry or become intermittent.

Tree shade is important because it limits the energy input from the sun, moderates water temperature, and limits evaporation. Removal of the tree canopy further degrades conditions because it eliminates an important source of coarse organic matter essential for a balanced ecosystem. Erosion impacts channelized streams more severely due to the lack of a riparian buffer

zone to slow runoff, trap sediment and stabilize banks. Additionally, deep trapezoidal channels lack a functioning flood plain and therefore cannot expel sediment as would occur during flood events along natural watercourses.

The lack of water movement under low flow conditions can exacerbate impacts from organic loading and nutrient enrichment by limiting reaeration of the stream. The amount of oxygen soluble in water decreases as temperature increases. This is one reason why tree shade is so important. The two main sources of oxygen in water are diffusion from the atmosphere and plant photosynthesis. Turbulence at the water surface is critical because it increases surface area and promotes diffusion, but channelization eliminates turbulence produced by riffles, meanders, and debris snags. Plant photosynthesis produces oxygen, but at night, respiration reverses the process and consumes oxygen. Oxygen is also used by bacteria that decay dead organic matter. Nutrient enrichment can promote the growth of nuisance algae that subsequently dies and serves as food for bacteria. Under these conditions, oxygen can be depleted unless it is replenished from the air.

Sedimentation

Whenever the natural flow regime is altered to facilitate drainage, increased amounts of sediment are likely to enter streams either by overland transport or increased bank erosion. The removal of wooded riparian areas furthers the erosional process. Channelization keeps all but the highest flow events confined within the artificially high banks. As a result, areas that were formerly flood plains and allowed for the removal of sediment from the primary stream channel no longer serve this function. As water levels fall following a rain event, interstitial spaces between larger rocks fill with sand and silt and the diversity of available habitat to support fish and macroinvertebrates is reduced. Silt also can clog the gills of both fish and macroinvertebrates, reduce visibility thereby excluding site feeding fish species, and smother the nests of lithophilic fishes. Lithophilic spawning fish require clean substrates with interstitial voids in which to deposit eggs. Conversely, pioneering species benefit. They are generalists and best suited for exploiting disturbed and less heterogeneous habitats. The net result is a lower diversity of aquatic species compared with a typical warmwater stream with natural habitats.

Sediment also impacts water quality, recreation, and drinking water. Nutrients absorbed to soil particles remain trapped in the watercourse. Likewise, bacteria, pathogens, and pesticides which also attach to suspended or bedload sediments become concentrated in waterways where the channel is functionally isolated from the landscape. Community drinking water systems address these issues with more costly advanced treatment technologies.

Nutrients

The element of greatest concern is phosphorus because it critical for plant growth and it is often the limiting nutrient. The form that can be readily used by plants and therefore can stimulate nuisance algae blooms is orthophosphate (PO_4^{-3}). The amount of phosphorus tied up in the nucleic acids of

food and waste is actually quite low. This organic material is eventually converted to orthophosphate by bacteria. The amount of orthophosphate contained in synthetic detergents is a great concern however. It was for this reason that the General Assembly of the State of Ohio enacted a law in 1990 to limit phosphorus content in household laundry detergents sold in the Lake Erie drainage basin to 0.5 % by weight. Inputs of phosphorus originate from both point and nonpoint sources. Most of the phosphorus discharged by point sources is soluble. Another characteristic of point sources is they have a continuous impact and are human in origin, for instance, effluents from municipal sewage treatment plants. The contribution from failed on-lot septic systems can also be significant, especially if they are concentrated in a small area. The phosphorus concentration in raw waste water is generally 8-10 mg/l and after secondary treatment is generally 4-6 mg/l. Further removal requires the added cost of chemical addition. The most common methods use the addition of lime or alum to form a precipitate, so most phosphorus (80%) ends up in the sludge. A characteristic of phosphorus discharged by nonpoint sources is that the impact is intermittent and associated with stormwater runoff. Most of this phosphorus is bound tightly to soil particles and enters streams from erosion, although some comes from tile drainage. Urban stormwater is more of a concern if combined sewer overflows are involved. The impact from rural stormwater varies depending on land use and management practices and includes contributions from livestock feedlots and pastures and row crop agriculture. Crop fertilizer includes granular inorganic types and organic types such as manure or sewage sludge. Pasture land is especially a concern if the livestock have access to the stream. Large feedlots with manure storage lagoons create the potential for overflows and accidental spills. Land management is an issue because erosion is worse on streams without any riparian buffer zone to trap runoff. The impact is worse in streams that are channelized because they no longer have a functioning flood plain and cannot expel sediment during flooding. Oxygen levels must also be considered, because phosphorus is released from sediment at higher rates under anoxic conditions.

There is no numerical phosphorus criterion established in the Ohio Water Quality Standards, but there is a narrative criterion that states phosphorus should be limited to the extent necessary to prevent nuisance growths of algae and weeds (Administrative Code, 3745-1-04, Part E). Phosphorus loadings from large volume point source dischargers in the Lake Erie drainage basin are regulated by the National Pollutant Discharge Elimination System (NPDES). The permit limit is a concentration of 1.0 mg/l in final effluent. Research conducted by the Ohio EPA indicates that a significant correlation exists between phosphorus and the health of aquatic communities (Association Between Nutrients, Habitat, and Aquatic Biota in Ohio Rivers and Streams, MAS/1999-1-1). It was concluded that biological community performance in headwater and wadeable streams was highest where phosphorus concentrations were lowest. It was also determined that the lowest phosphorus concentrations were associated with the highest quality habitats, supporting the notion that habitat is a critical component of stream function. The report recommends WWH criteria of 0.08 mg/l in headwater streams (<20 mi² watershed size), 0.10 mg/l in wadeable streams (>20-200 mi²) and 0.17 mg/l in small rivers (>200-1000 mi²).

Organic Enrichment and Low Dissolved Oxygen

The amount of oxygen soluble in water is low and it decreases as temperature increases. This is one reason why tree shade is so important. The two main sources of oxygen in water are diffusion from the atmosphere and plant photosynthesis. Turbulence at the water surface is critical because it increases surface area and promotes diffusion. Drainage practices such as channelization eliminate turbulence produced by riffles, meanders, and debris snags. Although plant photosynthesis produces oxygen by day, it is consumed by the reverse process of respiration at night. Oxygen is also consumed by bacteria that decay organic matter, so it can be easily depleted unless it is replenished from the air. Sources of organic matter include poorly treated waste water, sewage bypasses, and dead plants and algae.

Dissolved oxygen criteria are established in the Ohio Water Quality Standards to protect aquatic life. The minimum and average limits are tiered values and linked to use designations (Administrative Code 3745-1-07, Table 7-1).

Ammonia

Ammonia gas (NH_3) readily dissolves in water to form the compound ammonium hydroxide (NH_4OH). In aquatic ecosystems an equilibrium is established as ammonia shifts from a gas to undissociated ammonium hydroxide to the dissociated ammonium ion (NH_4^{+1}). Under normal conditions (neutral pH 7 and 25°C) almost none of the total ammonia is present as gas, only 0.55% is present as ammonium hydroxide, and the rest is ammonium ion. Alkaline pH shifts the equation toward gaseous ammonia production, so the amount of ammonium hydroxide increases. This is important because while the ammonium ion is almost harmless to aquatic life, ammonium hydroxide is very toxic and can reduce growth and reproduction or cause mortality.

The concentration of ammonia in raw sewage is high, sometimes as much as 20-30 mg/l. Treatment to remove ammonia involves gaseous stripping to the atmosphere, biological nitrification and de-nitrification, and assimilation into plant and animal biomass. The nitrification process requires a long detention time and aerobic conditions like that provided in extended aeration treatment plants. Under these conditions, bacteria first convert ammonia to nitrite (*Nitrosomonas*) and then to nitrate (*Nitrobacter*). Nitrate can then be reduced by the de-nitrification process (*Pseudomonas*) and nitrogen gas and carbon dioxide are produced as by-products.

Ammonia criteria are established in the Ohio Water Quality Standards to protect aquatic life. The maximum and average limits are tiered values based on sample pH and temperature and linked to use designations (Administrative Code 3745-1-07, Tables 7-2 through 7-8).

Metals

Metals can be toxic to aquatic life and hazardous to human health. Although they are naturally

occurring elements many are extensively used in manufacturing and are by-products of human activity. Certain metals like copper and zinc are essential in the human diet, but excessive levels are usually detrimental. Lead and mercury are of particular concern because they often trigger fish consumption advisories. Mercury is used in the production of chlorine gas and caustic soda and in the manufacture of batteries and fluorescent light bulbs. In the environment it forms inorganic salts, but bacteria convert these to methyl-mercury and this organic form builds up in the tissues of fish. Extended exposure can damage the brain, kidneys, and developing fetus. The Ohio Department of Health (ODH) issued a statewide fish consumption advisory in 1997 advising women of child bearing age and children six and under not to eat more than one meal per week of any species of fish from waters of the state because of mercury. Lead is used in batteries, pipes, and paints and is emitted from burning fossil fuels. It affects the central nervous system and damages the kidneys and reproductive system. Copper is mined extensively and used to manufacture wire, sheet metal, and pipes. Ingesting large amounts can cause liver and kidney damage. Zinc is a by-product of mining, steel production, and coal burning and used in alloys such as brass and bronze. Ingesting large amounts can cause stomach cramps, nausea, and vomiting.

Metals criteria are established in the Ohio Water Quality Standards to protect human health, wildlife, and aquatic life. Three levels of aquatic life standards are established (Administrative Code 3745-1-07, Table 7-1) and limits for some elements are based on water hardness (Administrative Code 3745-1-07, Table 7-9). Human health and wildlife standards are linked to either the Lake Erie (Administrative Code 3745-1-33, Table 33-2) or Ohio River (Administrative Code 3745-1-34, Table 34-1) drainage basins. The drainage basins also have limits for additional elements not established elsewhere that are identified as Tier I and Tier II values.

Bacteria

Bacteria levels in streams are a concern because of human health. People can be exposed to contaminated water while wading, swimming, and fishing. Fecal coliform bacteria are relatively harmless in most cases, but their presence indicates that the water has been contaminated with feces from a warm-blooded animal. Although intestinal organisms eventually die off outside the body, some will remain virulent for a period of time and may be dangerous sources of infection. This is especially a problem if the feces contained pathogens or disease producing bacteria and viruses. Reactions to exposure can range from an isolated illness such as skin rash, sore throat, or ear infection to a more serious wide spread epidemic. Some types of bacteria that are a concern include *Escherichia*, which cause diarrhea and urinary tract infections, *Salmonella*, which cause typhoid fever and gastroenteritis (food poisoning), and *Shigella*, which cause severe gastroenteritis or bacterial dysentery. Some viruses that are a concern include polio, hepatitis A, and encephalitis. Disease causing microorganisms such as *Cryptosporidium* and *Giardia* are also a concern.

Since fecal coliform bacteria are associated with warm-blooded animals, there are both human and animal sources. Human sources, including effluent from sewage treatment plants or discharges by on-lot septic systems, are a more continuous problem. Bacterial contamination from combined

sewer overflows are associated with wet weather events. Animal sources are usually more intermittent and are also associated with rainfall, except when domestic livestock have access to the water. Large livestock farms store manure in holding lagoons and this creates the potential for an accidental spill. Liquid manure applied as fertilizer is a runoff problem if not managed properly and it sometimes seeps into field tiles.

Bacteria criteria are established in the Ohio Water Quality Standards to protect human health. The maximum and average limits are tiered values and linked to use designation, but only apply during the May 1-October 15 recreation season (Administrative Code 3745-1-07, Table 7-13). The standards also state that streams must be free of any public health nuisance associated with raw or poorly treated sewage during dry weather conditions (Administrative Code 3745-1-04, Part F).

Sediment Contamination

Chemical quality of sediment is a concern because many pollutants bind strongly to soil particles and are persistent in the environment. Some of these compounds accumulate in the aquatic food chain and trigger fish consumption advisories, but others are simply a contact hazard because they cause skin cancer and tumors. The physical and chemical nature of sediment is determined by local geology, land use, and contribution from manmade sources. As some materials enter the water column they are attracted to the surface electrical charges associated with suspended silt and clay particles. Others simply sink to the bottom due to their high specific gravity. Sediment layers form as suspended particles settle, accumulate, and combine with other organic and inorganic materials. Sediment is the most physically, chemically, and biologically reactive at the water interface because this is where it is affected by sunlight, current, wave action, and benthic organisms. Assessment of the chemical nature of this layer can be used to predict ecological impact.

The Ohio EPA evaluation of sediment chemistry results are evaluated using a dual approach, first by ranking relative concentrations based on a system developed by Ohio EPA (1996) and then by determining the potential for toxicity based on guidelines developed by MacDonald et al (2000). The Ohio EPA system was derived from samples collected at ecoregional reference sites. Classes are grouped in ranges that are based on the median analytical value (non-elevated) plus 1 (slightly elevated), 2 (elevated), 4 (highly elevated), and 8 (extremely elevated) inter-quartile values. The MacDonald guidelines are consensus based using previously developed values. The system predicts that sediments below the threshold effect concentration (TEC) are absent of toxicity and those greater than the probable effect concentration (PEC) are toxic.

Sediment samples collected by the Ohio EPA are measured for a number of physical and chemical properties. Physical attributes included % particle size distribution (sand $\geq 60 \mu$, silt 5-59 μ , clay $\leq 4 \mu$), % solids, and % organic carbon. Due to the dynamics of flowing water, most streams do not contain a lot of sediment and samples often consist mostly of inert sand. This scenario changes if the stream is impounded by a dam or channelized. Chemical attributes included metals, volatile and semi-volatile organic compounds, pesticides, and poly-chlorinated biphenyls (PCBs).

NONPOINT SOURCE POLLUTION IMPACTS AND REMEDIATION PROJECTS

It is clear that nonpoint source pollution is related to land use. Different land uses contribute to nonpoint sources of pollution that impair our watersheds. In the Chagrin River basin suburban / urban development is the land use change most responsible for much of the nonpoint pollution in area streams, especially for nutrients, sediments and herbicides. Land use also impacts water resources by affecting stream flow and stream habitat. Habitat destruction is a form of nonpoint source pollution. Specific sources of impacts under nonpoint source pollution would include increased flow alteration, sedimentation due to runoff and erosion, nutrient delivery from urban runoff and suburban lawn care.

Nonpoint Pollution and Land Use Impacts on Water Resources in the Chagrin Watershed

A. Impacts on Drinking Water

- High concentrations of suspended solids during runoff events.

B. Impacts on Aquatic Life

- Failure to attain aquatic life uses set by Ohio Water Quality Standards
- Loss of some fish and macroinvertebrate species intolerant of silty, murky waters
- Sedimentation impairment to instream habitat for fish and macroinvertebrates

C. Impacts on Recreational Water Use

- Primary and secondary contact recreation limited by high bacteria events
- Aesthetic impairment from sediment and algal blooms

D. Impacts on Lake Erie through Pollutant Loading

- Phosphorus loading to Lake Erie
- Suspended sediment degradation to Chagrin R, the East Branch Chagrin River to some extent, and Lake Erie habitat
- Pesticides, nitrates, and other organic chemical pollutants transported by sediment

E. Impacts from Urban Land Use

- Impervious surfaces cause accelerated runoff volume to the river and more erosive power
- Combined sewer overflow events
- Contaminated storm runoff

**Biological and Water Quality Study
of the
Chagrin River Basin
2003-2004**

Cuyahoga, Geauga, Lake, and Portage Counties, OH

State of Ohio Environmental Protection Agency
Division of Surface Water
Lazarus Government Center
122 South Front St., Columbus OH 43215

INTRODUCTION

Ambient biological, water column chemical and sediment sampling was conducted in the Chagrin River basin from June 2003 to October 2004 as part of the five-year basin approach for monitoring, assessment, and the issuance of National Pollution Discharge Elimination System (NPDES) permits and to facilitate a Total Maximum Daily Load (TMDL) assessment. This study area included the whole mainstem of the Chagrin River beginning in the headwaters near Bass Lake (RM 49.2) and extending to just upstream from the lacustrine (lake-effect reach) zone at RM 1.7, in Eastlake, Ohio. Subwatersheds within the study area included East Fork Chagrin River, Silver Creek, McFarland Creek, Dewdale Creek, Beaver Creek and Griswold Creek. Where possible, tributary streams with at least 3-5 mi² of drainage were sampled (range dependent on initial final drainage).

Specific objectives of this evaluation were to:

- 1) Monitor and assess the chemical, physical and biological integrity of the streams within the 2003-04 Chagrin River study area;
- 2) Characterize the consequences of various land uses on water quality within the Chagrin River watershed;
- 3) Evaluate the influence of municipal wastewater treatment plants (WWTPs) and unsewered communities;
- 4) Evaluate the potential impacts from nonpoint source pollution (NPS) and habitat alterations on the receiving streams; and
- 5) Determine the attainment status of the current designated streams (aquatic life uses) and other non-aquatic use designations and recommend changes where appropriate.

The findings of this evaluation factor into regulatory actions taken by the Ohio EPA (*e.g.*, NPDES permits, Director's Orders, the Ohio Water Quality Standards [OAC 3745-1], Water Quality Permit Support Documents [WQPSDs]) and are incorporated into State Water Quality Management Plans, the Ohio Nonpoint Source Assessment and the biennial Integrated Water Quality Monitoring and Assessment Report (305[b] and 303[d]).

Study Area

The Chagrin River basin, a tributary of Lake Erie, is located in Cuyahoga, Lake, Geauga, and Portage Counties in northeast Ohio. The basin drains an area of 267 square miles (ODNR, 1980). The length of the mainstem is approximately 51.5 miles with an average fall of 15.9 feet per mile. The terrain of most of the watershed is generally rolling with a substantial percentage of woodland. The river is deeply entrenched over the lower 25 miles and flows on bedrock in a narrow valley through most of this length. The headwater source of the mainstem is near Chardon, which then flows southwesterly to Bass Lake, then to Chagrin Falls where it is joined by the Aurora Branch. The headwater source of the Aurora Branch is in northwest Portage county. From Chagrin Falls, the river flows northerly through the eastern suburbs of Cleveland to its confluence with the East Branch Chagrin River near Willoughby. The Chagrin River empties into Lake Erie at Eastlake, Ohio. It should be noted that the Daniels Park Dam just downstream from the confluence with the East Branch Chagrin River at RM 4.86 was blown out by high flows from winter storms during the winter of 2005.

On July 2, 1979 the State of Ohio designated 49 miles of the Chagrin River mainstem and two of its tributaries (the East Branch and the Aurora Branch) as Ohio's ninth Scenic River. The original designation begins on the Aurora Branch from the State Route 82 bridge (RM 12.00), downstream approximately 12 miles to a point where the Aurora Branch joins the Chagrin River. Also included is the mainstem of the Chagrin River from the confluence with the Aurora Branch (RM 27.09), downstream approximately 16 miles to the U.S. Route 6 bridge (RM 11.10). The East Branch of the Chagrin River is included from the Heath Road bridge (RM 14.49) to its confluence with the main stem of the Chagrin River. In November 2002 the Scenic River designation was extended to include the headwaters of the Chagrin River upstream from the confluence of the Aurora Branch. The new 22-mile designation runs from the Woodiebrook Road bridge (RM 49.15) continuing downstream to the confluence with the Aurora Branch of the Chagrin River in Bentleyville (RM 27.09).

Large segments of the Chagrin River are essentially natural in character, possessing excellent aquatic habitat, making it one of the highest quality water resources in northeast Ohio. The East Branch Chagrin River from RM 14.49 (Heath Road) to the mouth is designated Outstanding State Resource Water in OAC 3745-1-05, Table 5-5, and thus has the potential to support one of the highest diversity of aquatic communities in Ohio. The Aurora Branch Chagrin River is also an Outstanding State Water from St. Rt. 82 to RM 17.08. The Chagrin River basin has the highest percentage of tributaries assigned the Exceptional Warmwater Habitat (EWH) and Cold Water

Habitat (CWH) aquatic life uses of all the major rivers in northeast Ohio. Eighty percent of the stream segments and tributaries to the Chagrin mainstem currently are assigned either the EWH or CWH use designation in the Ohio WQS, Chapter 3745-1 of the Administrative Code. Based on data collected for this 2003-04 survey, a number of additional EWH and CWH stream designations are recommended, including dual EWH/CWH designation where the data indicate that the required biology is present.

The Chagrin River basin is within the Erie-Ontario Lake Plain (EOLP) ecoregion. The following discussion of land use within this ecoregion comes from the Ohio EPA (1991) report: “The nearly level to rolling terrain exhibits a mosaic of cropland, pasture, livestock and poultry production, woodland, and forest. Dairy cattle are raised throughout the ecoregion with approximately one-tenth of the region providing pasture for cattle. Cropland covers about one-third of the area and is interspersed with some pasture, woodland, and forest. About 20% of the ecoregion is urbanized with some oil and gas drilling and strip mining for coal also occurring.”

The Watershed Action Plan for the Chagrin River [Chagrin River Watershed Partners (CRWP), 2006] has the following update on land use: “The primary land use in the Chagrin River watershed is low density residential. Based on an impervious cover study completed by CRWP (2005), approximately 13% of the Chagrin River watershed communities are either zoned as open space or are protected by a park district or conservation easement. Approximately 50% of the Chagrin [River] watershed communities are not yet developed or are underdeveloped. Of the remaining 37% of the watershed that has been developed, the majority of this has been developed as residential with low density residential of more than two acres per home representing about half of the developed area of the watershed. The existing land use planning and zoning is also heavily focused on low density residential uses. Under existing zoning, the watershed at build out would be comprised of 79% residential, of which 46% is low density residential, 8% commercial/retail/industrial and 13% open space, which includes properties currently protected by a park district or conservation easement. Overall, based on 1994 LANDSAT data, impervious cover was estimated at approximately 13% in the watershed”. The highest percentage of impervious cover exists in the lower Chagrin River sub-watersheds (HUC-14 units: 04110003030-010 and 030) and the lowest percentage impervious cover in the East Branch Chagrin River (HUC-14 unit: 04110003030-020).

The entire 267 mi.² Chagrin River basin is divided into the following U. S. Geologic Survey (GS) hydrologic unit code (HUC) watersheds as shown below:

Table 1. List of U.S. Geological Survey HUC watersheds for the Chagrin River basin, Ohio.

11 digit HUC-11 watersheds:

04110003-030: Lower portion of Chagrin River from confluence of where upper main branch of the Chagrin River joins with the Aurora Branch at RM 27.09. Also includes the East Branch Chagrin River and Ward Creek.

Table 1 (cont.). List of USGS HUC watersheds for the Chagrin River basin, Ohio.

04110003-020: Upper portion of Chagrin River (upstream from RM 27.09) and Aurora Branch of the Chagrin River.

14 digit HUC-14 watersheds:

04110003030-010: Chagrin River below East Branch to Lake Erie including Corporation Creek and Ward Creek.

04110003030-020: East Branch Chagrin River including Pierson Creek, Stoney Brook, and Quarry Creek.

04110003030-030: Main Branch Chagrin River below Aurora Branch to above East Branch including Willey Creek, Pepper/Luce Creek, Griswold Creek, Caves Creek, and Gully Brook.

04110003020-010: Upper main branch Chagrin River to Aurora Branch, except Silver Creek. Includes Beaver Creek, Dewdale Creek, Spring Brook, Woodie Brook.

04110003020-020: Silver Creek including South Branch of Silver Creek

04110003020-030: Aurora Branch above McFarland Creek to Chagrin River including Linton Creek and Smith Creek.

04110003020-040: Aurora Branch headwaters to above McFarland Creek, includes McFarland Creek.

Previous Surveys

Previous surveys of the biological and water quality of the Chagrin River basin were conducted by the Ohio EPA in 1986 (Ohio EPA, 1987), 1990-91 (Ohio EPA, 1991), and 1995 (Ohio EPA, 1997). A Chagrin River Partners watershed action plan is final as of December 2006. The web page for the 2006 Chagrin River action plan is:

http://www.crwp.org/watershed_action_plan/watershed_action_plan.htm. These documents provide important historical information about the Chagrin River basin, including references to numerous additional reports and biological surveys. A report on the ecosystem condition of Bass Lake (Ohio EPA, 2005) is available on the OEPA Division of Surface Water website in documents: **http://www.epa.state.oh.us/dsw/documents/Bass_Lake_TSD_2.pdf**.

Present Survey

Chemical Water Quality Sampling

Chemical samples were collected from select locations within the two HUC-11 watersheds that comprise the Chagrin River basin (Table 2). Sample dates spanned two survey seasons: 8/7/2003 to 10/8/2003 and 4/29/2004 to 8/16/2004; frequency was 3 grab samples/site. All samples within each HUC-11 watershed were collected on the same day to help standardize analysis of data. Chemical sample locations were selected near biological stations to allow associations to be made between chemical stressor and biological response variables. A list of significant NPDES permitted dischargers within the basin is provided in Tables 8 and 11. Exceedences of chemical criteria are shown in Table 9. Raw chemical data are presented in Appendix Table 1 and bacteria data in Appendix Table 2. Beaver Creek and tributaries near Bass Lake were sampled in 2002; data are presented in the Ohio EPA (2005) Bass Lake report.

In addition to chemical sampling to support the biological survey, more frequent samples were collected at nine “sentinel” sites under various stream flow conditions to support development of Total Maximum Daily Load (TMDL) models. Sample frequency for sentinel sites ranged from 8-9 samples/site over a 12 month period. Long-term chemical and flow data (> 30 yrs.) also are available at the U.S. EPA National Ambient Water Quality Monitoring Network site (NAWQMN) on the Chagrin River at Daniels Park (RM 4.95). The following sentinel sites within the Chagrin River basin were sampled during the 2003-04 survey (with STORET codes): *Chagrin River mainstem* (D01S11 Miles Rd.), (D01G01 Sperry Rd.), (D01P04 Old Mill Rd.), (D01P07 Chagrin Blvd.), (502400 Daniels Park-at USGS gage); *Aurora Branch Chagrin River* (D01P22 Bainbridge Rd.), (D01P19 Solon Rd.); *East Branch Chagrin River* (D01P01 Markell Rd.), (D01S20 Mitchells Mill Rd.). The text that follows is summarized first by HUC-11 watersheds, then by smaller HUC-14 sub-watersheds.

Biological Sampling

Biological samples of fish populations, fish tissue, and macroinvertebrates (including mussels if present) to help determine stream resource quality and fish consumption status were initiated and collections began in the fall of 2003 (Sept. - Nov. 1). Most sampling was accomplished in 2004 (June - October) according to original planning. Site locations are similar to the chemical sample sites, but river miles may differ based on actual sample locations in that stream reach (Table 3).

Table 2. Chemical and bacteriological sampling locations in Chagrin River study area, 2003-04. Effluent sample -E; Conventional water chemistry -C, Bacteria (fecal coliform and/or *E. coli*) -B; Sediment chemistry -S; Organic chemicals in both water and sediment -O; Datasonde -D.

Stream RM	Type of Sampling	Latitude/Longitude (Decimal Deg.)	Landmark	STORET Code	USGS Quad. Map
Chagrin River (headwaters to below Aurora Branch) HUC 11 (04110003020)					
<i>HUC 14 (04110003020-010)</i>					
Chagrin River mainstem (15-001)					
49.15	C,B	41.56250 / -81.20690	Woodiebrook Rd.	D01G03	Chardon
46.54	C,B	41.53700 / -81.24310	Auburn Rd.	D01P26	Chardon
42.70	C,B	41.50950 / -81.27500	Rockhaven Rd.	D01G02	Chesterland
40.05	C,B	41.49060 / -81.29510	Sperry Rd.	D01G01	S. Russell
36.55	C,B,S,O	41.49080 / -81.33540	Fairmont Rd. (upper)	D01W20	S. Russell
33.35	C,B,S,O	41.46250 / -81.27500	SR 87 (upper)	D01P13	S. Russell
30.70	C,B	41.44090 / -81.37850	Dst old Ivex upper dam	D01W11	Chagrin Falls
29.80	C,B	41.43230 / -81.38960	City park, ust Main St.	D01S12	Chagrin Falls
28.96	C,B	41.42580 / -81.39800	Miles Rd.	D01S11	Chagrin Falls
28.30	C,B,D	41.41960 / -81.39870	Adj. Solon Rd., dst Chagrin Falls WWTP	D01S10	Chagrin Falls
Beaver Creek (15-008)					
0.55	C,B	41.53694 / -81.23028	Sherman Rd.	D01G09	Chardon
2.31	C,B	41.51611 / -81.22278	Bean Rd.	D01G10	Chardon
Trib. to Bass Lake (a.k.a. Spring Brook) RM 47.65 (15-015)					
0.10	C,B	41.54860 / -81.23110	Old inter-urban culvert	D01W32	Chardon
Trib. to Chagrin River (a.k.a. Woodiebrook) RM 48.3 (15-016)					
0.6	C,B	41.5619 / -81.2197	West trib at Woodiebrook Rd.	Q01K09	Chardon
--	C,B	41.5623 / -81.2186	East trib dst Woodiebrook Rd.	--	Chardon
Dewdale Creek (15-024)					
4.60	C,B	41.47580 / -81.24430	Auburn Rd.	D01G24	Burton
0.60	C,B	41.50040 / -81.31890	Rockhaven Rd.	D01G23	Chesterland
Trib. to Chagrin R. (a.k.a. Marsh Hawk Run) RM 38.32 (15-039)					
0.45	C,B	41.50480 / -81.30800	Marsh Hawk Run Rd.	D01G31	Chesterland
<i>HUC 14 (04110003020-020)</i>					
Silver Creek (15-007)					
5.07	C,B	41.44640 / -81.28780	Music St.	D01W22	S. Russell
0.54	C,B	41.46920 / -81.34360	Hitching Post Lane	D01W23	S. Russell
<i>HUC 14 (04110003020-030)</i>					
Aurora Branch Chagrin River (15-005)					
16.35	C,B	41.30480 / -81.28220	Chamberlain Rd.	D01S02	Aurora
14.48	C,B	41.30410 / -81.31080	Pioneer Trail (lower)	D01G04	Aurora
11.30	C,B	41.32010 / -81.33490	Ust. Central WWTP, at logging Rd.	D01W01	Aurora
11.10	C,B	41.32580 / -81.33610	Dst. Central WWTP, dst mix zone	D01W03	Aurora
9.00	C,B	41.34410 / -81.34240	Ust. SR 306 bridge, ust tributary	D01S24	Aurora

Stream RM	Type of Sampling	Latitude/Longitude (Decimal Deg.)	Landmark	STORET USGS	
				Code	Quad. Map
7.35	C,B	41.35720 / -81.36000	Brewster Rd.	D01W16	Aurora
5.52	C,B,S,O	41.37430 / -81.36820	Geauga Lake Rd.	D01W15	Aurora
3.80	C,B	41.38630 / -81.38850	Bainbridge Rd.	D01P22	Chagrin Falls
Smith Creek (15-014)					
0.50	C,B	41.34840 / -81.33650	YMCA camp walking bridge	D01G20	Aurora
<i>HUC 14 (04110003020-040)</i>					
Aurora Branch Chagrin River (15-005)					
3.30	C,B	41.39100 / -81.39180	Dst. McFarland Cr. WWTP mix zone	D01S22	Chagrin Falls
1.03	C,B	41.41130 / -81.41220	Solon Rd.	D01P19	Chagrin Falls
McFarland Creek (15-006)					
2.66	C,B	41.40030 / -81.35440	Chagrin Rd.	D01G17	S. Russell
2.30	C,B	41.39760 / -81.35440	Dst. Chagrin Rd., Dst. North Branch	D01G16	S. Russell
0.06	C,B	41.38670 / -81.38670	Chagrin River Rd.	D01P17	Chagrin Falls
Chagrin River (below Aurora Branch to Lake Erie) HUC 11 (04110003030)					
<i>HUC 14 (04110003030-010)</i>					
Chagrin River mainstem (15-001)					
26.80	C,B,D	41.4239 / -81.4172	Miles Rd.	D01P03	Chagrin Falls
25.30	C,B,D	41.43940 / -81.40790	Chagrin Blvd.	D01P07	Chagrin Falls
23.62	C,B	41.45870 / -81.40590	SR 87 (lower)	D01P06	Chagrin Falls
20.95	C,B,D	41.48900 / -81.39640	Fairmont Rd. (lower)	D01S09	Chagrin Falls
18.08	C,B	41.51790 / -81.40360	Old Mill Rd.	D01P04	Mayfield Heights
13.04	C,B,D	41.56980 / -81.41300	Rogers Rd.	D01S08	Mayfield Heights
10.95	C,B	41.58960 / -81.40270	old Pleasant Valley Rd.	D01G05	Mayfield Heights
Griswold Creek (15-003)					
4.40	C,B	41.49080 / -81.37690	Fairmont Rd.	D01G15	Chagrin Falls
0.02	C,B	41.45640 / -81.40360	Falls River Rd.	D01P12	Chagrin Falls
Trib. to Chagrin River (a.k.a. Gully Brook) at RM 5.5 (15-010)					
0.60	C,B	41.62140 / -81.41080	River Rd., SR 174	D01G18	Mayfield Heights
Caves Creek (15-011)					
0.88	C,B	41.57970 / -81.39140	Worrel Rd.	D01S15	Mayfield Heights
Trib. to Chagrin River (a.k.a. Pepper-Luce Creek) at RM 22.81 (15-018)					
0.20	C,B	41.47110 / -81.41060	Chagrin River Rd.	D01G21	Chagrin Falls
<i>HUC 14 (04110003030-020)</i>					
East Branch Chagrin River (15-002)					
14.50	C,B	41.56970 / -81.30530	Heath Rd.	D01S06	Chesterland
10.28	C,B	41.61670 / -81.28230	Mitchells Mill Rd.	D01S20	Chesterland
2.35	C,B	41.62950 / -81.37180	Markell Rd.	D01P01	Mentor
Trib. to East Br. Chagrin River at RM 10.13 (15-038)					
0.10	C,B,D	41.61820 / -81.27930	Wisner Rd., N of Mitchells Mill Rd.	D01G32	Chesterland

Stream RM	Type of Sampling	Latitude/Longitude (Decimal Deg.)	Landmark	STORET Code	USGS Quad. Map
Stoney Brook, RM 3.57 trib East Branch Chagrin River (15-032)					
0.10	C,B	41.62850 / -81.36000	Kirtland-Chardon Rd.	D01G27	Chagrin Falls
Trib. to East Br. Chagrin River (a.k.a. Stebbins Gulch) at RM 10.6 (15-039)					
0.20	C,B	41.61250 / -81.28470	Wisner Rd., S. of Mitchells Mill Rd.	D01G33	Chesterland
Trib. to East Br. Chagrin River at RM 15.35 (15-042)					
0.20	C,B	41.5574 / -81.3108	Sperry Rd.	D01G36	Chesterland
Trib. to East Br. Chagrin River at RM 16.20 (15-043)					
0.10	C,B	41.54600 / -81.30080	Wilson Mills Rd.	D01G35	Chesterland
<i>HUC 14 (04110003030-030)</i>					
Chagrin River mainstem (15-001)					
4.95	C,B,D	41.63120 / -81.40180	Daniels Park	502400	Eastlake
2.72	C,B	41.65800 / -81.40838	Adj Reeves Rd. at metropark	D01G06	Eastlake
Ward Creek (15-048)					
0.80	C,B	41.6704 / -81.4104	Robin Rd. pump station	D01G39	Eastlake

Table 3. Fish and Macroinvertebrate sampling locations in Chagrin River study area, 2003-04. F = Fish (2 passes/site unless listed as F1x = one pass fish) only) B = Benthic macroinvertebrates with artificial quantitative substrate collection and qual. sample; Bq = Benthic macroinvertebrate qual. sample only.

Stream RM F/B	Type of Sampling	Latitude/Longitude (Decimal Deg.)	Landmark	STORET USGS Code Quad. Map
Chagrin River (headwaters to below Aurora Branch) HUC 11 (04110003020)				
HUC 14 (04110003020-010)				
Chagrin River mainstem (15-001)				
49.1/49.2	Bq, F1x	41.5628 / -81.2067	Woodiebrook Rd.	D01G03 Chardon
46.5	Bq, F1x	41.5367 / -81.2436	Auburn Rd. (dst. Bass Lake and Beaver Cr.)	D01P26 Chardon
45.2/45.3	Bq, F1x	41.5300 / -81.2564	Fowlers Mill Rd.	Chesterland
42.6/42.8	Bq, F1x	41.50972 / -81.27389	Rockhaven Rd.	D01G02 Chesterland
40.0	B, F	41.4908 / -81.2953	Dst. Sperry Rd.	D01G01 S. Russell
36.4/36.6 ^R	B, F	41.4894 / -81.3386	Fairmont Rd. (upper) (at Novelty)	D01W20 S. Russell
33.4/33.5 ^R	B, F	41.46250 / -81.27500	Ust. SR 87 (upper) (ust. Chagrin Falls)	D01P13 S. Russell
30.6	B, F	41.4386 / -81.3783	Dst. old Ivex upper dam (between dams)	D01W11 Chagrin Falls
30.0	B, F	41.4342 / -81.3875	Dst. IVEX	D01S12 Chagrin Falls
28.9/28.8	B, F	41.4253 / -81.3994	Dst. Miles Rd.	D01S11 Chagrin Falls
28.2	B, F	41.4192 / -81.4008	Adj. Solon Rd., dst Chagrin Falls WWTP	D01S10 Chagrin Falls
Beaver Creek (15-008)				
0.6	B, F	41.5371 / -81.2304	Sherman Rd.	D01G09 Chardon
2.3	B,F	41.5165 / -81.2232	Dst. Bean Rd.	D01G10 Chardon
Dewdale Creek (15-024)				
4.6	Bq, F1x	41.47590 / -81.24394	Auburn Rd.	D01G24 Burton
0.6/0.7	B, F	41.50118 / -81.27456	Rockhaven Rd.	D01G23 Chesterland
Trib. to Chagrin R. (a.k.a. Marsh Hawk Run) RM 38.32 (15-039)				
07/0.3	Bq, F1x	41.50379 / -81.30890	March Hawk Run Rd. / Sperry Rd.	D01G31 Chesterland
HUC 14 (04110003020-020)				
Silver Creek (15-007)				
5.1	Bq, F1x	41.4464 / -81.2875	Ust. Music St.	D01W22 S. Russell
0.8/0.4	B, F	41.46978 / -81.34518	Hitching Post Lane	D01W23 S. Russell
South Branch Silver Creek (15-007)				
1.1	Bq, F1x	41.44553 / -81.31993	Dst. Music St.	S. Russell
HUC 14 (04110003020-030)				
Aurora Branch Chagrin River (15-005)				
16.3	Bq, F1x	41.3047 / -81.2822	Dst. Chamberlain Rd.	D01S02 Aurora
14.4	Bq, F1x	41.3047 / -81.3108	Dst. Pioneer Trail (lower), dst. Sunny Lake outlet	D01G04 Aurora
11.9	B, F	41.3175 / -81.3300	Dst. St. Rt. 82	Aurora
11.30	B, F	41.3253 / -81.3372	Ust. Aurora Central WWTP	D01W01 Aurora
11.1/11.0	B, F	41.3264 / -81.3347	Dst. Aurora Central WWTP, dst mix zone	D01W03 Aurora
9.1	B, F	41.3433 / -81.3422	Ust. St. Rt. 306 bridge, ust. tributary	D01S24 Aurora

Stream RM	Type of Sampling	Latitude/Longitude (Decimal Deg.)	Landmark	STORET Code	USGS Quad. Map
Aurora Branch Chagrin River (15-005) (cont.)					
7.4/7.3	Bq, F	41.3572 / -81.3600	Brewster Rd. , dst. sand and gravel operation	D01W16	Aurora
5.6/5.5,5.1	B, F	41.3736 / -81.3678	Geauga Lake Rd.	D01W15	Aurora
3.8,3.7/3.7	B, F	41.3861 / -81.3883	Bainbridge Rd., ust. McFarland Creek confluence	D01P22	Chagrin Falls
Smith Creek (15-014)					
1.1	Bq, Flx	41.35538 / -81.33367	Ust. South Valley Park Drive	D01G20	Aurora
Trib. to Smith Creek at RM 2.70 (15-045)					
0.6	Bq, Flx	41.34745 / -81.30669	Crackel Rd.	D01G20	Aurora
<i>HUC 14 (04110003020-040)</i>					
Aurora Branch Chagrin River (15-005)					
- / 3.5	B	41.3897 / -81.3894	Ust. McFarland Creek WWTP	D01W19	Chagrin Falls
3.4/3.4	B, F	41.3903 / -81.3894	Dst. McFarland Creek WWTP	D01S22	Chagrin Falls
1.0/0.9	B, F	41.4114 / -81.4125	Solon Rd.	D01P19	Chagrin Falls
- /0.3	B	41.4189 / -81.4128	Chagrin Falls Rd. near mouth (Bentleyville)	D01P18	Chagrin Falls
McFarland Creek (15-006)					
2.3	Bq, Flx	41.3976 / -81.3544	Dst. Chagrin Rd., Dst. North Branch	D01G16	S. Russell
0.2	B, F	41.38677 / -81.38623	Chagrin River Rd.	D01P17	Chagrin Falls
North Branch McFarland Creek (Trib. to McFarland Creek at RM 2.58) (15-044)					
0.1/0.2	Bq, Flx	41.40030 / -81.35440	Chagrin Rd.	D01G17	S. Russell
Chagrin River (below Aurora Branch to Lake Erie) HUC 11 (04110003030)					
<i>HUC 14 (04110003030-010)</i>					
Chagrin River mainstem (15-001)					
26.7	B, F	41.425 / -81.4175	Dst. Miles Rd. (Dst. Aurora Branch)	D01P03	Chagrin Falls
-/25.3	B, F	41.4394 / -81.4078	Chagrin Blvd.	D01P07	Chagrin Falls
24.2/23.7	B, F	41.4525 / -81.4047	Ust. Kinsman Road (St. Rt. 87) (lower)	D01P06	Chagrin Falls
19.4	B, F	41.5028 / -81.4033	Dst. Fairmount Rd. near Berkshire Rd. /River Rd.	D01S09	Mayfield Heights
13.0/12.8	B, F	41.5697 / -81.4131	Rogers Rd.	D01S08	Mayfield Heights
9.7/ -	F	41.5922 / -81.3944	Dodd Rd.	D01G05	Mayfield Heights
- / 8.3	B	41.6027 / -81.4052	Ust. Eagle Rd.	D01G05	Mayfield Heights
Griswold Creek (15-003)					
4.4	Bq, Flx	41.4908 / -81.3769	Fairmount Rd.	D01G15	Chagrin Falls
0.1	Bq, Flx	41.4561 / -81.4031	Near mouth @ Falls River Rd.	D01P12	Chagrin Falls
Trib. to Chagrin River (a.k.a. Gully Brook) at RM 5.54 (15-010)					
- / 0.6	Bq, Flx	41.62229 / -81.41319	Ust. Chagrin River Rd., St. Rt. 174	D01G18	Mayfield Heights
Caves Creek (15-011)					
0.9	Bq, Flx	41.5797 / -81.3914	County Line Rd.	D01S15	Mayfield Heights
Trib. to Chagrin River (a.k.a. Pepper-Luce Creek) at RM 22.81 (15-018)					
0.2	Bq, Flx	41.4711 / -81.4106	Near mouth @ Chagrin River Rd.	D01G21	Chagrin Falls

Stream RM	Type of Sampling	Latitude/Longitude (Decimal Deg.)	Landmark	STORET Code	USGS Quad. Map
<i>HUC 14 (04110003030-020)</i>					
East Branch Chagrin River (15-002)					
16.3	Bq, Flx	41.5475 / -81.3011	Heath Rd.	D01S06	Chesterland
10.3/10.2	Bq, Flx	41.6172 / -81.2817	Adj. Wisner Rd. ust. Mitchells Mill Rd.	D01S20	Chesterland
2.4	B, F	41.6294 / -81.3706	Dst. Markell Rd.	D01P01	Mentor
Quarry Creek (Trib. to East Branch Chagrin River @ RM 1.85) (15-031)					
0.1	Bq, Flx	41.62475 / -81.37598	Markell Rd.		Mayfld Hts./Eastlake
Stoney Brook (Trib. to East Branch Chagrin River @ RM 3.57) (15-032)					
0.1	Bq, Flx	41.62868 / -81.36087	Kirtland - Chardon Rd. (St. Rt. 615)	D01G27	Mentor
Pierson Creek (Trib. to East Branch Chagrin River @ RM 6.8) (15-033)					
0.1	Bq, Flx	41.62794 / -81.31492	Sperry Rd and Booth Rd.	D01G27	Mentor
Trib. to East Br. Chagrin River at RM 10.13 (15-038)					
0.1	B, F	41.61829 / -81.27960	Near mouth dst. Wisner Rd. N of Mitchells Mill Rd.	D01G32	Chesterland
Trib. to East Br. Chagrin River (a.k.a. Stebbins Gulch) at RM 10.60 (15-039)					
0.2	Bq, Flx	41.61699 / -81.28165	Ust. Wisner Rd. south of Mitchells Mill Rd.	D01G33	Chesterland
Trib. to East Br. Chagrin River at RM 14.62 (east side trib.) (15-040)					
0.1	Bq, Flx	41.56784 / -81.30464	Heath Rd.		Chesterland
Trib. to East Br. Chagrin River at RM 14.80 (west side trib.) (15-041)					
0.1	Bq, Flx	41.56593 / -81.31052	Sperry Rd.		Chesterland
Trib. to East Br. Chagrin River at RM 15.35 (west side trib.) (15-042)					
0.2	Bq, Flx	41.55764 / -81.31121	Sperry Rd.	D01G36	Chesterland
Trib. to East Br. Chagrin River at RM 16.20 (15-043)					
0.1	Bq, Flx	41.54756 / -81.30214	Wilson Mills Rd.	D01G35	Chesterland
<i>HUC 14 (04110003030-030)</i>					
Chagrin River mainstem (15-001)					
4.8/ -	F	41.6317 / -81.40280	Daniels Park	502400	Eastlake
- / 4.2	B	41.6398 / -81.4018	Todd Field		Eastlake
2.5	B, F	41.6567 / -81.4114	Adj Reeves Rd. in metropark	D01G06	Eastlake
1.5/1.7	B, F	41.6633 / -81.4222	Eastlake ust. Lake Shore Blvd.	D01G06	Eastlake
Ward Creek (15-048)					
0.4/0.8	B, F	41.67052 / -81.41104	Robin Drive off Reeves Rd.	D01G39	Eastlake

SUMMARY

Aquatic Life Use Attainment Status and Trends

The 2003-04 Chagrin River study area included two Watershed Assessment Units. The first subwatershed was the Upper Chagrin River basin which comprised the Headwaters of the Chagrin River to downstream (and including) Aurora Branch Chagrin River with a Hydrologic Unit Number of 04110003 020 (Upper Chagrin - Aurora Branch Assessment Unit). Sites ranged in drainage size from 1.4 square miles to 122 square miles. The Lower Chagrin River basin was comprised of the reach from downstream Aurora Branch Chagrin River to the mouth which includes the East Branch Chagrin River (Lower Chagrin - East Branch Assessment Unit). Sites ranged from 1.5 mi.² to 249 mi.² near the mouth at RM 1.5. Summary statistics related to aquatic life use and a brief synopsis for each assessment unit are provided in Table 4. The comments provided for each assessment unit include principal causes and sources of impact on aquatic life and recreational uses and significant contaminants in sediment and fish tissue.

Within the entire Chagrin River study area, aquatic life uses were assessed at 44 sites with drainage areas of less than 50 mi² (Table 5). Of these sites, 22 fully met the designated or recommended use. Fourteen partially met, and eight sites were not attaining the current or recommended aquatic life use. Sixteen sites, representing 37.11 miles of streams draining between 50 mi² and 500 mi², were sampled (comprised of the Chagrin River mainstem and the lower reach of Aurora Branch Chagrin River). Listed aquatic life uses fully met at 100 percent of the larger stream miles of 50 to 500 mi.² drainage which improved compared to previous biological surveys. Better effluent treatment, intact riparian corridors, and more stormwater controls were factors contributing to this improvement. Several stream reaches only marginally met their uses (≤ 4 points of required aquatic life use score - within statistically variability termed nonsignificant departure or ns) which means some stress or pressure is being exerted on the aquatic community and actions, if appropriate, should be initiated for greater protection to maintain quality.

Assessed CWH streams are listed in Table 6 along with their CWH aquatic life use attainment status. Attainment of CWH aquatic life use was evaluated on the presence and absence and quality of CW fish and \geq four CW macroinvertebrate taxa. The fish evaluation includes the OEPA CW list (trouts, sculpins, brook stickleback, redbreast dace) and other additional species (e.g., longnose dace, American brook lamprey, mudminnow, blacknose dace, other dace, and white sucker) with specific interpretation based on local collection - presence, distribution, and habitat. If cold water fish from OEPA CW list were present, the total number of different CW fish were listed, and a footnote (+) was added if additional potential CW fish were present from the additional species considered. Full attainment but declining conditions were noted where there was a lack of quality or decreased quality documented by historical decreases in the CW fish assemblages or CW macroinvertebrate assemblages over time. The data indicate that 57% of 14 assessed CWH stream segments within the lower HUC-11 watershed were not fully attaining their designated use, compared to 22 % of 9 CWH segments in the upper HUC-11 watershed. Increased urbanization in the lower Chagrin River

watershed may be an important cause of the greater loss of cold water habitats. Regardless, protection of those streams that were documented to be fully attaining the CWH aquatic life designation should be given a very high priority for future watershed and riparian zone management plans.

Table 4. Aquatic life use attainment status for each Watershed Assessment Unit (WAU) in the Chagrin River Basin sampled in 2003 and 2004. The assessment unit score is an average grade of aquatic life use status. The method of calculation is presented in the 2006 Integrated Water Quality Monitoring and Assessment Report (Ohio EPA 2006). An assessment unit score of 80 is used as the benchmark above which a watershed is considered to be in good condition relative to aquatic life uses. A maximum assessment unit score of 100 is possible if all monitored sites meet designated aquatic life uses. The comments provided for each assessment unit include principal causes and sources of impact on aquatic life and recreational uses and significant contaminants in sediment and fish tissue. The OEPA website is below: (www.epa.state.oh.us/dsw/tmdl/2006IntReport/2006OhioIntegratedReport.html).

Upper Chagrin - Aurora Branch Unit (headwaters to dst. Aurora Br. - ≥ RM 27.09) WAU# 04110003-020	Total	Aquatic Life Attainment Status			Assessment Unit Score
		Full	Partial	NON	
		%	%	%	
Sites < 50mi ² drainage area	28	62	26	12	81
Miles of assessed streams with >50mi ² and <500mi ² drainage area	10.02	100	0	0	
Comments					
<ul style="list-style-type: none"> • The lower ~15.5 river miles to downstream from the Aurora Branch confluence attained the designated WWH aquatic life use, while ~7.5 miles in the upper headwaters were impaired. Flow and habitat alteration of the upper mainstem due to hydromodification, channelization, and riparian losses from upstream Dewdale Creek (RM 42.6) to upstream Woodiebrook Rd. (RM 49) were the most common impacts on aquatic life use attainment. These habitat modifications were partially to drain wetlands and control water retention to utilize land for development. • Excess nutrients, sedimentation, and organic enrichment with possible periodic toxicity occurred in Aurora Branch due to impacts from small STPs, Sunny Lake, NPS inputs (urban runoff from storm sewers or septic tanks), or larger WWTPs (McFarland Cr. WWTP). Overall, there were only 42% of sites impaired in Aurora Branch (some improvement) compared to 60% during 1995 survey. • Some habitat alteration, nutrients, and/or organic enrichment from land development (storm sewers, STP wastewater, septic runoff) affected a couple of tributaries (see attainment table). Approximately two-thirds of the tributaries sampled in this WAU are designated Cold Water Habitat Use. • Where habitat is intact and stable, brook trout reintroductions have been successful in a good number of small tribs. in the upper Chagrin and Aurora Branch subwatersheds. For example, CWH Woodie Brook (Trib. To Bass Lake (Chagrin R. @ RM 48.30)) was restored (channel and riparian area) allowing expansion of native brook trout further upstream and into a tributary. Spring Brook, a nearby trib. to Bass Lake, is designated CWH below a waterfall fish barrier. The upper reach is a Class III Primary Headwater Habitat (PHWH) that has diverse cold water macroinvertebrate and salamander populations. It is imperative that attempts be made to protect and preserve high quality primary headwater habitat in these small intact or forested headwaters which enable CWH communities to exist. Riparian corridors needs to be protected and storm water runoff from development needs to be controlled to protect NPS inputs into these fragile subwatersheds. • The Ohio Department of Health advises that meals of largemouth bass and rock bass caught in the Chagrin River (Cuyahoga, Geauga, and Lake Counties) be limited to one per month because of mercury and lead levels. • Bass Lake Management strategies with regard to decreasing nutrient concentrations, NPS inputs, and increasing D.O. concentrations could positively affect water quality in the Chagrin River downstream from outlet. • Positive improvements downstream from IVEX (now closed) in the Chagrin River mainstem and near Aurora Central WWTP in Aurora Branch resulted in full attainment in those reaches. 					

Table 4 continued.

Lower Chagrin - East Branch Unit (Dst. Aurora Branch (\leq RM 27.09) to mouth) WAU# 0411000- 030	Aquatic Life Attainment Status				Assessment Unit Score
	Total	Full	Partial	NON	
		%	%	%	
Sites < 50mi ² drainage area	17	54	11	35	77
Miles of assessed streams with >50mi ² and < 500mi ² drainage area	27.09	100	0	0	
Comments					
<ul style="list-style-type: none"> • Full attainment in the mainstem Chagrin River occurred throughout this lower subbasin. • The East Branch Chagrin River, due to suburban development, associated riparian removal, dredge mining, and small sediment dams, was declining in the upstream reaches or did not meet its designated CWH aquatic life use in the lower mainstem. Sand bedload, some embeddedness, and thermal temperature increases in downstream reaches were related to these habitat and flow alterations. • Ward Creek, with sedimentation and erosion from flow alteration and nutrient nonpoint (NPS) inputs from suburban/urban runoff and storm sewers, was impaired and did not meet the WWH aquatic life use. • Due to increased suburbanization, small package plants, home sewage treatment systems (HSTS) and some loss of riparian area, NPS stormwater runoff into Stoney Brook caused higher peak storm flows, increased nutrients, and associated bank destabilization. Many of these smaller dischargers to Stoney Brook are recommended to tie into a regional wastewater plant. Loss of riparian corridor in some reaches decreased shading and is allowing slight temperature increases. • Increased siltation (sand / silt bedload with increased embeddedness) and increased nutrients are a concern, as suburban development, storm runoff and possible septic inputs have caused biological community quality decreases in Pepper-Luce Creek (Trib. To Chagrin R. @ RM 22.81) compared to 1995 data. • Modification of some bridge structures are needed to allow fish migration upstream in several East Branch Chagrin River tributaries. • Where habitat is still more intact, recent Brook trout reintroductions have been successful in several tributaries in the Chagrin and East Branch Chagrin River subwatersheds. The CWH streams in East Branch and nearby areas usually met their aquatic life use performance where the wooded riparian corridors adjacent the reach and along upstream tributaries and PHWH tribs. were largely intact. The Ohio Department of Health advises that meals of largemouth bass and rock bass caught in the Chagrin River (Cuyahoga and Lake Counties) be limited to one per month because of mercury and lead levels. 					

Table 5. Aquatic life use attainment status for stations sampled in the Chagrin River basin from June 2003 to October 2004. The Index of Biotic Integrity (IBI) and Modified Index of Well-being (MIwb), and Invertebrate Community Index (ICI) are scores derived, respectively, from the assemblage composition of the sampled fish and macroinvertebrate communities. The Qualitative Habitat Evaluation Index (QHEI) is a measure of the ability of the physical habitat at a given sampling location to support a biotic community. All sites are located within the Erie- Ontario Lake Plain (EOLP) Ecoregion.

RIVER MILE Fish/Invert.	2003/04 IBI	2003/04 MIwb ^a	2003/04 ICI ^b	2003/04 # CW ^c Fish / bugs	2003/04 QHEI	2003/04 Attainment Status	Site Location	Causes ^d	Sources	
Chagrin River (2003-04 Results)							EOLP: WWH Use Designation (Existing)			
49.1/49.2	26*	--	P*	0/0	23.0	NON	Ust. Woodiebrook Road	Habitat Alteration, Flow Alteration	Hydromodification - riparian vegetation loss, drained wetlands, channelization	
46.5	--	--	F	0/0	--	Not Assessed	Auburn Rd. (Lentic - dst. Bass Lake & Beaver Cr.)			
45.2/45.3	32*	--	G	0/3	82.5	PARTIAL	Ust. Fowler Mills Road (lotic)	Habitat Alteration, Flow Alteration	Hydromodification - riparian vegetation loss, drained wetlands, channelization	
42.6/42.8	30*	--	G	0/1	58.0	PARTIAL	Rock Haven Rd. (ust. Dewdale Cr.)	Habitat Alteration, Flow Alteration	Hydromodification - riparian vegetation loss, drained wetlands, channelization	
40.0	48	8.8	50	0/1	82.0	FULL	Dst. Sperry Road (Sentinel Site)			
36.4/36.6 ^R	52	9.7	50	0/0	85.0	FULL	Ust. Fairmount Rd.			
33.4/33.5 ^R	50	9.5	38	0/0	86.0	FULL	Ust. St. Rt. 87			
30.6	34 ^{ns}	8.2	50	0/1	72.5	FULL	Ust. Ivex between the lakes			
30.0	40	9.1	VG	0/1	75.5	FULL	Dst. Ivex			

RIVER MILE Fish/Invert.	2003/04 IBI	2003/04 MIwb ^a	2003/04 ICI ^b	2003/04 # CW ^c Fish / bugs	2003/04 QHEI	2003/04 Attainment Status	Site Location	Causes ^d	Sources
Chagrin River (2003-04 Results)							EOLP: WWH Use Designation (Existing) and SSH Use Designation (Recommended)		
28.9 / 28.8	48	9.2	48	0/2	77.5	FULL	Ust. Miles Rd. (Sent. Site) Bugs		
28.2	46	8.9	48	0/1	82.0	FULL	Adj. Solon Rd. dst. Chagrin Falls		
26.7	46	8.8	VG	0/0	-	FULL	Dst. Miles Rd & Aur. Br. confl.		
25.3	-	-	50	0/2	-	(FULL)	Dst. Chagrin Blvd. in park		
24.2 / 23.7	40	7.7 ^{ms}	42	0/3	73.5	FULL	Ust. SR 87 or ust. Kinsman Rd.		
19.4	46	9.3	44	0/0	87.5	FULL	Adj. Chagrin R. Rd dst. Fairmount		
13.0 / 12.8	40	9.2	38	0/0	71.0	FULL	Rodgers Rd. bridge		
9.7 / 8.3	46	8.4	VG	0/2	73.0	FULL	Eagle Rd.		
4.8 / 4.2	48	8.3	38	0/2	74.5	FULL	Todd Field		
2.5	44	7.9	VG	0/1	78.5	FULL	At Park off Reeves Rd.		
1.5 / 1.7	44	8.5	G	0/0	-	FULL	Ust. lacustuary in park near powerline crossing		
Ward Creek (2004) (Trib. To Chagrin R. @ RM 1.0)							EOLP: WWH Use Designation and SSH (Recommended)		
0.4 / 0.8	32*	--	F*	1+/0	67.5	NON	Robin Dr. off Reeves Rd.	Sedimentation, flow alteration, organic enrichment, nutrients	Urban runoff & storm sewers
East Branch Chagrin River (2004)							EOLP: CWH Use Designation (Existing)		
16.3	42	--	E	1+/6	76.0	FULL but Declining ^e	at Heath Rd.		

RIVER MILE Fish/Invert.	2003/04 IBI	2003/04 MIwb ^a	2003/04 ICI ^b	2003/04 # CW ^c Fish / bugs	2003/04 QHEI	2003/04 Attainment Status	Site Location	Causes ^d	Sources
East Branch Chagrin River (2004) (cont.)							EOLP: CWH Use Designation (Existing)		
10.3 / 10.2	42	4.5	E	1+/7	70.0	FULL but Declining ^f	Adj. Wisner Rd. dst. Mitchells Mills Rd.		
2.4	42	8.2	VG	0+/2	76.0	NON	Ust. Markell Rd.	Thermal modifications, Direct habitat alterations, Flow alteration, Sedimentation	Dredge Mining, Dams, Removal of riparian vegetation, Suburban development
Quarry Creek (2004) (Trib. To E. Br. Chagrin R. @ RM 1.85)							EOLP: CWH (Existing) and EWH Use Designation (Recommended)		
0.1	56	--	VG ^{ns}	1+/5	55.0	FULL/FULL	Markell Rd.		
Stoney Brook (2004) (Trib. To E. Br. Chagrin R. @ RM 3.57)							EOLP: CWH Use Designation (Existing)		
0.1	40	--	VG	0+/4	65.5	PARTIAL	@ Kirtland Chardon Rd. (SR 615)	Thermal modification, nutrients, flow alteration, habitat alteration	Removal of wooded riparian vegetation, suburban NPS storm water runoff, suburbanization, Package plants, onsite septic tanks or HSTS
Pierson Creek (2004) (Trib. To E. Br. Chagrin R. @ RM 6.73)							EOLP: CWH (Existing) and EWH Use Designation (Recommended)		
0.1	56	--	VG ^{ns}	1+/11	66.5	FULL/FULL	Sperry Rd. and Booth Rd.		
Trib. to E. Br. Chagrin R. @ RM 10.13 (2004)							EOLP: CWH (Existing) and EWH Use Designation (Recommended)		
0.1	48 ^{ns}	--	54	1+/12	78.0	FULL/FULL	near mouth dst. Wisner Rd.		
Stebbins Gulch (2004) (Trib. To E. Br. Chagrin R. @ RM 10.60)							EOLP: CWH Use Designation (Existing)		
0.2	38	--	E	1+/14	68.5	FULL	Ust. Wisner Rd. & south of Mitchell Mill Rd.		

RIVER MILE Fish/Invert.	2003/04 IBI	2003/04 MIwb ^a	2003/04 ICI ^b	2003/04 # CW ^c Fish / bugs	2003/04 QHEI	2003/04 Attainment Status	Site Location	Causes ^d	Sources
Trib. to E. Br. Chagrin R. @ RM 14.62 (east side trib.) (Harris Cr.) (2004)							EOLP: CWH Use Designation (Existing)		
0.1	38	--	E	0+/8	62.5	PARTIAL	Heath Rd.	Habitat Alteration	bridge construction (fish barrier), some removal of riparian vegetation
Trib. to E. Br. Chagrin R. @ RM 14.80 (west side trib.) (2004)							EOLP: CWH Use Designation (Existing)		
0.1	48	--	G	0+/6	63.5	PARTIAL	Sperry Rd.	Habitat alteration, Flow alteration, Sedimentation	Dam / bridge construction, Riparian vegetation removal, Suburban NPS storm- water runoff
Trib. to E. Br. Chagrin R. @ RM 15.35 (west side trib.) (2004)							EOLP: CWH (Existing) and EWH Use Designation		
0.2	46 ^{ns}	--	VG ^{ns}	0+/7	72.5	PARTIAL (CWH) / FULL (EWH)	Sperry Rd.	Habitat alteration, Flow alteration, Sedimentation	Road construction (bridge fish barrier), suburban NPS stormwater runoff, Riparian vegetation removal
Trib. to E. Br. Chagrin R. @ RM 16.2 (2004)							EOLP: CWH (Existing) and EWH Use Designation (Recommended)		
0.2 / 0.1	50	--	E	1+/12	72.5	FULL/FULL	Wilson Mills Rd.		
Gully Brook (Trib. to Chagrin R. @ RM 5.54) (2004)							EOLP: WWH Use Designation and SSH (Recommended)		
0.6	-	--	MG ^{ns}	- /1	-	-	River Rd.		
Caves Creek (2004) (Trib. to Chagrin R. @ RM 11.52) (2004)							EOLP: CWH Use Designation (Recommended)		
0.9	36	--	E	1+/8	71.0	FULL	County Line Rd.		
Trib. to Chagrin R. @ RM 22.81 (2004) (Pepper-Luce Creek)							EOLP: WWH Use Designation (Existing)		
0.2	38	--	MG ^{ns}	0/1	66.5	FULL	Chagrin River Rd.		

RIVER MILE Fish/Invert.	2003/04 IBI	2003/04 MIwb ^a	2003/04 ICI ^b	2003/04 # CW ^c Fish / bugs	2003/04 QHEI	2003/04 Attainment Status	Site Location	Causes ^d	Sources
Griswold Creek (2004)				EOLP: CWH Use Designation (Existing)					
4.4	46	--	G	1+/1	86.0	PARTIAL	Fairmount Rd.	Habitat alteration, Thermal modification	Suburban development, NPS stormwater runoff, Removal of riparian vegetation
0.1	40	--	VG	0+/2	67.5	NON	Falls River Rd.	Habitat alteration, Thermal modification	Streambank modification / dredging, NPS stormwater runoff, Removal of riparian vegetation
Aurora Branch Chagrin River (2003-04 Results)				EOLP: WWH Use (Existing)					
16.3	40	--	<u>P</u> *	0+/0	66.5	NON	Dst. Chamberlain Rd.	Nutrients, Unknown Toxicity, Habitat Alteration	Package Plants (Small plants), NPS runoff, Riparian vegetation removal
14.4	<u>22</u> *	--	G	0/0	77.0	NON	Dst. Pioneer Trail and Sunny Lake	Periodic Toxicity	Algal discharges from Sunny Lake
11.9	32*	--	42	0+/2	79.5	PARTIAL	SR 82	Periodic Toxicity, Siltation	Algal discharges from Sunny Lake, Land development/Suburbanization
11.3	36 ^{ns}	--	42	0+/1	76.5	FULL	Ust. Aurora Central WWTP		
11.1 / 11.0	40	--	42	0 ^h +/2	71.5	FULL	Dst. Aurora Central WWTP		
9.1	40	--	48	0 ^h +/1	83.0	FULL	Ust. SR 306		
Aurora Branch Chagrin River (2003-04 Results)				EOLP: WWH Use (Existing) / CWH^{h1} (Recommended) (RM 8.98 - RM 3.73)					
7.4 / 7.3	32*	7.7 ^{ns}	VG	(0) ^{hi} +/5	74.5	PARTIAL	Brewster Road, dst. sand & gravel operation @ RM 9.0	Organic enrichment, siltation	Urban runoff/Storm sewers, Septic tanks; Urban runoff, gravel mining
5.6/5.1 ^R , 5.5 ^R	38	8.5	48/56	(0) ⁱ +/5	74.0	FULL	Adj. Geauga Lk. Rd near Fields Rd.		
3.8 ⁺	44	8.3	--	(0) ⁱ +/-	79.5	(FULL)	Ust. McFarland Creek		
Aurora Branch Chagrin River (2003-04 Results)				EOLP: WWH Use (Existing) (RM 3.73 - 0.0)					
3.7 / 3.5, 3.7 ⁺	38	8.4	54/50	0+/4,2	79.5	FULL	Ust. McFarland Cr. WWTP		
3.4	30*	7.8 ^{ns}	48	0+/6	79.5	PARTIAL	Dst. McFarland Cr. WWTP	Organic enrichment including P, Siltation	Major Municipal Point Source, Hydromodification - Streambank destabilization (bridge construction)

RIVER MILE Fish/Invert.	2003/04 IBI	2003/04 MIwb ^a	2003/04 ICI ^b	2003/04 # CW ^c Fish / bugs	2003/04 QHEI	2003/04 Attainment Status	Site Location	Causes ^d	Sources
Aurora Branch Chagrin River (2003-04 Results) (cont.) EOLP: WWH Use (Existing) (RM 3.73 - 0.0)									
1.0 / 0.9	36 ^{ns}	7.9	VG	0+/1	54.0	FULL	Dst Solon Rd.		
Aurora Branch Chagrin River (2003-04 Results) EOLP: WWH Use (Existing) & SSH Use Designation (Recommended) (≤ RM 0.5)									
0.3	-	-	46	- /1	-	(FULL)	Ust. bridge abutment (Bentleyville)		
McFarland Creek (2004) EOLP: EWH Use Designation (Existing)									
2.3	38*	--	VG ^{ns}	0+/3	78.5	PARTIAL	Dst. Chagrin Rd (dst. development)	Flow Alteration, Direct Habitat Alteration, Sedimentation, organic enrichment	Suburbanization, NPS stormwater runoff, riparian vegetation removal
0.2	44*	--	VG ^{ns}	0+/3	75.0	PARTIAL	Chagrin River Rd. (near mouth)	Flow Alteration, Direct Habitat Alteration, Sedimentation	Suburbanization, NPS stormwater runoff, riparian vegetation removal
N. Branch McFarland Creek (2004) (trib. @ RM 2.58) EOLP: CWH Use Designation (Recommended)									
0.1 / 0.2	34	--	VG	1+/6	70.0	FULL	Ust. Chagrin Blvd.		
Smith Creek (2004) EOLP: CWH Use Designation (Recommended)									
1.1	38	--	E	1+/4	79.0	FULL	South Spring Valley Park Drive		
Trib. to Smith Creek (confl. @ RM 2.70) (2004) EOLP: CWH Use Designation (Recommended)									
0.6	30	--	VG	1+/6	67.5	FULL	Crackel Rd.		
Silver Creek (2004) EOLP: CWH Use Designation (Existing)									
5.1	46	--	E	0+/4	76.0	FULL	Music St.		

RIVER MILE Fish/Invert.	2003/04 IBI	2003/04 MIwb ^a	2003/04 ICI ^b	2003/04 # CW ^c Fish / bugs	2003/04 QHEI	2003/04 Attainment Status	Site Location	Causes ^d	Sources
Silver Creek (2004) (cont.)						EOLP: CWH Use Designation (Existing)			
0.8 / 04	40	--	54	0/3	81.0	--	Ust. St. Rt. 306/ Dst.306 and Hitching Post Lane	Deferred attainment status and any use designation decisions for lower reaches until future assessment after recovery from park dam failure and ongoing subsequent restoration project upstream (stream restoration / riparian revegetation).	
South Branch Silver Creek (2004)						EOLP: WWH Use Designation (Existing)			
1.1	36 ^{ns}	--	G	0/0	79.5	FULL	Music St.		
Trib. to Chagrin R. (@ 38.32) (Marsh Hawk Run) (2004)						EOLP: WWH Use Designation (Recommended)			
0.7 / 0.3	32*	--	F*	0+/3	60.5	NON	Sperry Rd.	Nutrients, organic enrichment / D.O., NH ₃	Wastewater (package plant), On-site septic runoff, Storm sewers
Dewdale Creek (2004)						EOLP: CWH Use Designation (Recommended)			
4.6	36	--	MG	0+/2	76.0	NON	Auburn Rd.	Nutrients (P), possible NH ₃ toxicity, organic enrichment / low D.O. thermal modification	suburban NPS stormwater runoff inputs, onsite septic or HSTS inputs, removal of riparian vegetation
0.6/0.7	44	--	56	(1) ^G +/5	77.0	FULL	Rockhaven Rd.		
Beaver Creek (2004)						EOLP: CWH Use Designation (Existing)			
2.3	32 ^J	--	52	0+ ^J /12	47 ^J	(FULL)	Dst. Bean Rd.		
Beaver Creek (2004)						EOLP: WWH Use Designation (based on previous consultant data - not on OEPA data)			
0.6	-	--	54	- /1	-	(FULL)	Sherman Rd.		

a- MIwb is not applicable to headwater streams with drainage areas ≤ 20 mi².

b- A qualitative narrative evaluation based on community composition, EPT taxa richness, and other attributes. E = Exceptional, VG = Very Good, G = Good, MG = Marginally Good, F = Fair, P = Poor, VP = Very Poor.

- c- Attainment of CWH evaluated on presence and quality of CW fish {OEPA CW list (trouts, sculpins, brook stickleback, redbreast dace) & other additional species (e.g., Longnose dace, American Brook lamprey, mudminnow, blacknose dace, and white sucker - specific interpretation based on local collection - presence, distribution & habitat)} and ≥ 4 CW macroinvertebrates (from OEPA current list) & narrative quality. If CW fish from OEPA CW list were present, the total number of different CW fish taxa were listed, and a footnote (+) was added if additional potential coolwater/cold water fish were present from the additional species list. Full but Declining is noted when a lack of quality or decreased quality is documented by decreases in the cold water fish assemblages or macroinvertebrate assemblages over time.
- d- Causes and Sources listed are considered to be a primary influence on water quality, but may not be the only issue leading to impairment or declines. See discussion in text of additional causes that cumulatively have led to impairment.
- *- Indicates significant departure from biocriteria (> 4 IBI or ICI units, or > 0.5 MIwb units).
- R- Regional Reference site.
- ns- Nonsignificant departure from biocriteria (≤ 4 IBI or ICI units, or ≤ 0.5 MIwb units).
- + Potential coolwater/cold water fish listed were collected during present sampling (e.g., Longnose dace, American Brook lamprey, mudminnow, blacknose dace, and white sucker - specific interpretation based on local collection - presence, distribution & habitat from OEPA data and historical distributions).
- E- This upper reach showed a documented historical decrease in quality of the CW community (no rainbow trout, American brook lamprey, and only a remnant Longnose dace population present compared to earlier data).
- F- This reach sampled had a low fish biomass quality score & high sediment load - directly related to dredging. Also there was historical decrease in CW fish community quality (loss of brook trout, American brook lamprey, and large decreases (60-80%) in Blacknose dace and Longnose dace). Some stretches of reach contained sandy bedload covering large substrates. Where habitat was better as indicated by QHEI, the macroinvertebrate community was present in those areas.
- G- Observed trout juveniles during macroinvertebrate sampling.
- h- CW fish Redside Dace present at RMs 11.1 and 9.0 in 1991 and 1995.
- I- Upper reach historical presence of CW Redside Dace (1991,1995). CW fish are present in Smith Creek watershed (2004) (confluence to Aurora Branch @ RM 8.98) - Redside Dace and Brook Stickleback. CW fish Brook Trout present in Linton Creek (confluence to Aurora Branch @ RM 5.27). CW fish Brook Stickleback is present in North Branch McFarland Creek (2004).
- J- Sampled by consultant in 2005.

<u>INDEX -Site Type</u>	<u>WWH</u>	<u>EWB</u>	<u>CWH^c</u>
IBI - Headwaters	40	50	No
IBI - Wading	38	50	Numerical
MIwb-Wading	7.9	9.4	Criteria
ICI	34	46	Available

RECOMMENDATIONS

Status of Aquatic Life Uses

- Several of the streams evaluated during this study were originally designated for aquatic life uses in the 1978 Ohio WQS. The techniques used then did not include standardized approaches to the collection of instream biological data or numerical biological criteria. Therefore, because this study represents a first use of this type of biological data to evaluate and establish aquatic life use designations for some streams within the watershed, several revisions are recommended. While some of the changes may appear to constitute "downgrades" (*i.e.* EWH to WWH, WWH to MWH, etc.) or "upgrades" (*i.e.* LWH to WWH, WWH to EWH, etc.), any changes should not be construed as such because this constitutes the first use of an objective and robust use evaluation system and database. Ohio EPA is under obligation by a 1981 public notice to review and evaluate all aquatic life use designations outside of the WWH use prior to basing any permitting actions on the existing, unverified use designations. Thus some of the following aquatic life use recommendations constitute a fulfillment of that obligation. The designations apply to the entire length of the streams unless otherwise noted.
- The Chagrin River mainstem was surveyed and is recommended to retain its current WWH aquatic life use designation. Additionally, due to the failure of Daniels Park Dam, the Chagrin River mainstem is recommended to be Seasonal Salmonid Habitat from Chagrin Falls (RM 29.65) to the mouth, and the lower 0.5 miles of Aurora Branch Chagrin River is recommended to be Seasonal Salmonid Habitat as well.
- The Chagrin River mainstem is recommended to maintain its Antidegradation Rule designation of Outstanding State Waters (OSW) from RM 49.11 to RM 11.1. It is also recommended that the OSW antidegradation designation for the Chagrin River mainstem be extended to the mouth. Similar biological scores to the upstream reach already designated were consistent in this lower reach. There were three different declining species collected through the reach: River Chubs at five locations; Rosyface Shiners at four locations; and a Bigeye Chub at RM 1.3. This lower reach is also a very popular fishing area and many people recreate in lower Chagrin River mainstem by utilizing the metro park and regular park accesses. There have been resident rainbow trout collected during the normal sampling period (June-Oct.) through this lower reach. During the 1995 survey, some natural reproduction had occurred in some Chagrin River tributaries upstream. With access to more of the small CWH tributaries upstream from Daniels Park (in the East Branch Chagrin River and off the mainstem) the resident rainbow trout population might increase in localized areas. The rainbow trout (steelhead) fishery from Lake Erie during the fall, winter, and early spring is very popular and, with the Daniels Park Dam gone, this fishery should extend upstream throughout the lower 11 miles and potentially upstream to RM 29.65.

- Aurora Branch Chagrin River was surveyed and is recommended to retain its current WWH aquatic life use designation *except* for the middle reach of Aurora Branch Chagrin River from RM 8.98 (Smith Creek confluence) to RM 3.73 (McFarland Creek confluence). Aurora Branch Chagrin River is recommended as Cold Water Habitat (CWH) from RM 8.98 (confluence with Smith Creek) to RM 3.73 (confluence with McFarland Creek). The number of cold water macroinvertebrate taxa meet requirements through this reach and further downstream. This reach and upstream has had documented occurrences of the cold water fish, Redside dace (*Clinostomus elongatus*), at RMs 9.0 and 11.1 in 1995 and 1991. Three sampled CWH tributaries within this reach have documented populations of resident cold water fish species. Redside dace and brook stickleback (*Culaea inconstans*) are present in the Smith Creek subwatershed (confluence at RM 8.98). Redside dace are present in North Branch McFarland Creek. There was also the reestablishment of native brook trout (*Salvelinus fontinalis*) in Linton Creek (confluence at RM 5.27). Designated a CWH aquatic life use stream after the 1995 survey, Linton Creek (a.k.a. Stoney Brook) was a candidate restocking stream for brook trout (Ohio EPA, 1996). As a state threatened species that needs protection, a proactive step of designating this reach of the mainstem Aurora Branch Chagrin River as CWH is appropriate and judicious.
- The Outstanding State Waters (OSW) designation under the Antidegradation Rule (3745-1-05) for Aurora Branch Chagrin River from St. Rt. 82 (RM 17.08) to the mouth is recommended to continue to ensure protection for this unique watershed.
- The Outstanding State Waters (OSW) designation under the Antidegradation Rule (3745-1-05) for East Branch Chagrin River from RM 14.49 (Heath Rd.) to the mouth is recommended to continue to ensure protection for this unique CW watershed. It is recommended that the OSW designation be extended upstream to RM 20.00 (at Fowlers Mills Rd. near Mulberry Rd.). High quality habitat persists up through a gorge with wide continuous riparian corridors. The upstream site at RM 16.3 supported redside dace (declining species), and a successful native brook trout restocking has occurred in the Tributary to East Branch Chagrin River @ RM 16.2 (recommended OSW below). Many similar tributaries exist upstream and have similarly intact riparian areas.
- Corporation Creek (Trib. to Chagrin River @ RM 0.27) is recommended to be designated Seasonal Salmonid Habitat based on a confirmed rainbow trout (steelhead) present in February 2006 by Lake Co. Soil and Water Conservation District staff.
- Ward Creek and Gully Brook (Trib. to Chagrin R. @ RM 5.54) are recommended to be designated as WWH aquatic life use and Seasonal Salmonid Habitat. Rainbow trout were confirmed as present (April 2005 and February 2006) by Lake Co. Soil and Water Conservation District staff.

- The following Chagrin River basin streams have confirmed native or stocked native populations of threatened native brook trout (*Salvelinus fontinalis*) that were present or propagated and distributed as part of a state brook trout recovery plan. These streams are recommended to be designated Cold Water Habitat (CWH) and to be listed as Outstanding State Waters under the Antidegradation Rule (3745-1-05). Diverse high quality cold water macroinvertebrate communities were also present (below).

BASIN	RIVER CODE	BROOK TROUT STOCKING LOCATION	RM	STORET NO	ECO-REGION
15	15-007-004	TRIB TO SILVER CK (AFFELDER TRIB, 2.23) @ PARK HOUSE	0.60	Q01K01	EOLP
15	15-002-011	TRIB TO E BR CHAGRIN R (7.06, BALDWIN Cr. TROUT SITE) *	0.40	Q01K02	EOLP
15	15-001-022	TRIB TO CHAGRIN R (46.20) @ ECKLUND PROPERTY *	0.55	Q01K03	EOLP
15	15-007-003	TRIB TO SILVER CK (4.54) @ HRABAK PROPERTY	0.95	Q01K15	EOLP
15	15-007-002	TRIB TO SILVER CK (PEBBLE BK, 3.50) IN WEST WOODS PARK	0.20	Q01K10	EOLP
15	15-002-010	TRIB TO E BR CHAGRIN R (16.20) @ PALSA PROPERTY	1.66	Q01K07	EOLP
15	15-007-006	TRIB TO SILVER CK @ RM 4.58/ 0.4 PETTIBONE PROPERTY	0.40	Q01K08	EOLP
15	15-001-019	WOODIE BROOK (TRIB TO CHAGRIN R, 48.30) @ WOODIEBROOK RD	0.60	Q01K09	EOLP
15	15-002-012	TRIB(0.87) TO TRIB(10.13) E BR CHAGRIN R @ MT GLEN PROP.	0.20	Q01K11	EOLP
15	15-002-003	PIERSON CK UPST SPERRY RD	0.40	Q01K12	EOLP
15	15-005-004	LINTON CK (a.k.a. STONEYBROOK, 5.27) @ GEAUGA LAKE RD.	0.18	Q01K13	EOLP
15	15-001-021	TRIB TO CHAGRIN R (LEECH TRIBUTARY) TO ROOKERY PK	0.50	Q01K14	EOLP
15	15-001-017	SPRING BRK (TRIB TO CHAGRIN R, 47.65) @ INTER-URBAN	0.10	D01W32	EOLP

Rainbow trout also found by ODNR survey *

- The following table lists surveyed CWH stream sites and their attainment status with individual detailed discussions to follow.

Table 6. List of Cold Water Habitat (CWH) streams assessed during the Ohio EPA 2003-04 water quality survey of the Chagrin River basin. CWH aquatic life use is either existing in OAC 3745-1 or recommended based on the documented presence of representative cold water adapted taxa of fish and benthic macroinvertebrates. Non and partial status indicates that those stream segments do not meet Clean Water Act goals and may require a TMDL assessment.

Stream (code)	RM Sampled	Attainment/CWH Status
HUC-11 (04110003-020)		
Beaver Creek (15-008)	2.3	(Full)/Existing
Dewdale Creek (15-024)	4.6	NON /Recommended
	0.6/0.7	Full/Recommended
Silver Creek (15-007)	5.1	Full/Existing
	0.8/0.4	Insufficient data
Smith Creek (15-014)	1.1	Full/Recommended
Trib. to Smith Creek at RM 2.70 (15-045)	0.6	Full/Recommended
North Branch McFarland Creek (15-044)	0.1/0.2	Full/Recommended

Table 6. (cont.)

Stream (code)	RM Sampled	Attainment/CWH Status Status
HUC-11 (04110003-020) (cont.)		
Trib. to Chagrin River at RM 47.65 (Spring Brook) (15-015)	0.1/0.2	(Full)/Existing
Trib. to Chagrin River at RM 48.3 (Woodie Brook) (15-016)	0.6	(Full)/Existing
HUC-11 (04110003-030)		
East Branch Chagrin River (15-002)	16.3	Partial /Existing
	10.3/10.2	Partial /Existing
	2.4	NON /Existing
Griswold Creek (15-003)	4.4	Partial /Existing
Caves Creek (15-011)	0.9	Full/Recommended
Stoney Brook (15-032)	0.1	Partial /Existing
Quarry Creek (15-031)	0.1	Full/Recommended
Pierson Creek (15-033)	0.1	Full/Recommended
Trib. to East Branch at RM 10.13 (15-038)	0.1	Full/Recommended
Trib. East Branch at RM 10.6 (15-039) (Stebbins Gulch)	0.2	Full/Existing
Trib. to East Branch at RM 14.62 (15-040)	0.1	Partial /Recommended
Trib. to East Branch RM 14.80 (15-041)	0.1	Partial /Recommended
Trib. to East Branch RM 15.35 (15-042)	0.2	Partial /Recommended
Trib. to East Branch RM 16.2 (15-043)	0.2/0.1	Full/Recommended

- Quarry Creek (Trib. to E. Br. Chagrin R. @ RM 1.85) is a cold water stream supporting trout and an exceptional, diverse fish and cold water macroinvertebrate community. The high exceptional fish IBI of 56 and marginally exceptional macroinvertebrate narrative assessment reflects the presence of high quality habitat upstream in the Quarry Creek subwatershed. The presence of a small number of longnose dace, *Rhinichthys cataractae*, is characteristic of cold water streams in the East Branch Chagrin River basin. This species is recommended to be listed as a declining species under the Antidegradation Rule.
- Stoney Brook (Trib. to E. Br. Chagrin R. @ RM 3.57) is a cold water stream partially meeting CWH use criteria. It flows into the East Branch Chagrin River through private park and into open parkland surrounding the East Branch Chagrin River. As effluent discharge quality is improved upstream via NPDES implementation and increased nonpoint source stormwater

controls are implemented, the water quality in this tributary should improve in overall quality. Stoney Brook is recommended for General High Quality Waters under the Antidegradation Rule (3745-1-05).

- Pierson Creek (Trib. to E. Br. Chagrin R. @ RM 6.73) is a cold water stream supporting trout and an exceptional, diverse fish and cold water macroinvertebrate community. The exceptional fish IBI of 56 and marginally exceptional macroinvertebrate narrative assessment reflects the presence of high quality habitat upstream in the Pierson Creek watershed. The presence of river chubs (*Nocomus micropogon*), a declining species, indicates clear, intact headwater quality with clean, rocky substrates. The presence of a small number of longnose dace, *Rhinichthys cataractae*, is characteristic of cold water streams in the East Branch Chagrin River basin. Brook trout, a declining species, were stocked in a reach of Pierson Creek as part of restoration efforts. Pierson Creek is recommended for Outstanding State Waters under the Antidegradation Rule (3745-1-05) based on its biotic diversity, resource quality (including threatened species), and exceptional habitat.
- The Tributary to E. Br. Chagrin R. @ RM 10.13 is a cold water stream supporting trout and an exceptional fish and cold water macroinvertebrate communities. This highly intact subwatershed with its largely complete upstream tributary system protects the high water quality and diversity downstream in this tributary to the East Branch. The presence of longnose dace (*Rhinichthys cataractae*), a species recommended for the declining species list, is characteristic of cold water streams in the East Branch Chagrin River basin. Brook trout, a declining species, were stocked in an upstream tributary @ RM 0.87 as part of restoration efforts. The Tributary to E. Br. Chagrin R. @ RM 10.13 is recommended for the Outstanding State Water designation under the Antidegradation Rule (3745-1-05) based on its biotic diversity, resource quality (including threatened species), and pristine habitat.
- Stebbins Gulch (Trib. to E. Br. Chagrin R. @ RM 10.60) is a cold water stream with a highly diverse cold water macroinvertebrate community (14 cold water taxa collected). The rainbow trout population comprised more than ten percent of the total sampled population. Stebbins Gulch, with pristine rocky substrates and groundwater recharge from an intact riparian area upstream, is recommended for Superior High Quality or Outstanding State Waters under the Antidegradation Rule (3745-1-05) based on its diversity, quality, and exceptional habitat.
- The Tributary to E. Br. Chagrin R. @ RM 14.62 (Harris Creek) is a diverse cold water tributary with an exceptional macroinvertebrate community including eight cold water taxa. Fish migration can improve diversity, as the structure under the bridge needs to be modified to allow upstream migration. This stream is recommended to be Superior High Quality Water under the Antidegradation Rule (3745-1-05) based on high quality habitat and exceptional macroinvertebrate community quality.

- The Tributary to E. Br. Chagrin R. @ RM 14.80 is a diverse cold water tributary with a diverse and marginally exceptional fish community and six cold water macroinvertebrate taxa. Despite some riparian losses Southern redbelly dace, a declining fish species, are still present indicating some clearer water conditions. The bridge likely needs to be modified to allow upstream fish migration. The Tributary to E. Br. Chagrin R. @ RM 14.80 is recommended as Superior High Quality Water under the Antidegradation Rule (3745-1-05) based on good groundwater flow, presence of a declining fish species, and a marginally exceptional fish score.
- The Tributary to E. Br. Chagrin R. @ RM 15.35 is a cold water stream supporting a marginally exceptional fish and diverse macroinvertebrate community including seven cold water taxa. The higher QHEI score of 72.5 indicates more intact upstream riparian corridors. The bridge likely needs to be modified to allow upstream fish migration. Based on good groundwater flow and marginally exceptional biological quality, this stream is recommended as Superior High Quality Waters or General High Quality Waters under Antidegradation Rule (3745-1-05).
- The Tributary to E. Br. Chagrin R. @ RM 16.20 is a cold water stream supporting an exceptional fish and diverse cold water macroinvertebrate community (12 cold water taxa). The higher QHEI score of 72.5 indicates a more intact riparian corridor. Rainbow trout, American Brook Lamprey, and longnose dace (*Rhinichthys cataractae*), a species recommended for the declining species list, were present and confirmed the CWH use. This stream is recommended for Outstanding State Waters under the Antidegradation Rule (3745-1-05).
- In order to protect and preserve individual stream, subbasin, and East Branch Chagrin River quality, other East Branch Chagrin River tributaries are recommended to be designated as Superior High Quality Water, or, at minimum, General High Quality Waters under the Antidegradation Rule (3745-1-05), to protect .
- Caves Creek (Trib. to Chagrin R. @ RM 11.52) is a cold water trout stream and supports an exceptionally diverse cold water macroinvertebrate community whose quality is representative of the near pristine habitat upstream in this subwatershed. Caves Creek is recommended for Superior High Quality or Outstanding State Waters under the Antidegradation Rule (3745-1-05) based on its biotic diversity, resource quality, and exceptional habitat.
- Sulphur Springs Tributary (Trib. to Chagrin R. @ RM 26.68) has confirmed nonnative brook trout populations (*S. fontinalis*) that were stocked for local research. ODNR is removing the nonnative population in hopes that native brook trout can be stocked in this stream as part of the recovery plan. This stream is recommended to be listed as Superior High Quality Waters under the Antidegradation Rule (3745-1-05). Stream restoration and local land acquisition (Chagrin River Land Conservancy, City of Solon, WRRSP) has occurred.
- Trib. to Chagrin R. @ RM 15.42 (a regional reference site) was confirmed to have trout reproduction instream and 12 cold water taxa present. It is recommended for Superior High Quality or Outstanding State Waters under the Antidegradation Rule (3745-1-05) based on its

biotic diversity, resource quality, and exceptional habitat.

- Pepper-Luce Creek (Trib. to Chagrin R. @ RM 22.81) flows into Chagrin Metro Parks land and empties into the Chagrin River mainstem. An IBI of 50 was documented in the 1995 survey. In both surveys river chubs (*Nocomus micropogon*), a declining species, were present. It is recommended to receive a Superior High Quality Water or General High Quality Waters designation under the Antidegradation Rule (3745-1-05) based on its fish quality, the presence of declining species, and quality stream habitat flowing through the Chagrin Metro Park. The 2004 IBI score of 38 indicates variable effluent quality from upstream discharges is likely affecting the biological community.
- Griswold Creek was sampled in the upper reaches and scored an exceptional QHEI of 86.0. A declining fish species, the Redside dace (*Clinostomus elongatus*) is present, and despite some impairments, the upstream fish community was marginally exceptional (IBI=46). A marginally exceptional (VG) macroinvertebrate community was also found near the mouth. Griswold Creek is recommended for Superior High Quality Water or General High Quality Water designations under the Antidegradation Rule (3745-1-05) based on its exceptional habitat, declining species, and its high level of biological integrity.
- Willey Creek is recommended to be designated Superior High Quality Waters under the Antidegradation Rule (3745-1-05). Recommendation for this cold water bedrock stream is based on marginally exceptional biological communities (IBI=46 and VG macroinvertebrates), the presence of river chubs (*Nocomus micropogon*) - a declining fish species, and high quality habitat (QHEI of 72.0) as it flows through the Chagrin Metro Park to the Chagrin River.
- McFarland Creek is designated EWH, and despite some impairments from upstream development and riparian losses, still has a marginally exceptional macroinvertebrate community and high QHEIs of 78.5 and 75.0. It met exceptional fish performance biocriteria with a marginally exceptional score of 46 in 1995. Also, there were rosyface shiners (*Notropis rubellus*) and river chubs (*Nocomus micropogon*) present in the 1995 survey. McFarland Creek is recommended to be designated Superior High Quality Water under the Antidegradation Rule (3745-1-05) based on these attributes .
- North Branch McFarland Creek is recommended to be designated General High Quality Waters under the Antidegradation Rule (3745-1-05) based on its highly diverse cold water macroinvertebrate community and high quality habitat (QHEI = 70.0). It is currently under some development pressure. A couple of cold water dragonflies collected are among the more rare taxa collected (*Boyeria grafiana* and *Lanthus parvulus*).
- Smith Creek, a recommended CWH stream, had a high QHEI of 79.0, an exceptional macroinvertebrate community, and populations of the Redside Dace (*Clinostomus elongatus*) which is a species on the declining species list. Set aside protection is important as nearby development has occurred. Smith Creek is recommended for Superior High Quality Water

under the Antidegradation Rule (3745-1-05) based on these attributes.

- The Tributary to Smith Creek @ RM 2.70, a recommended CWH wetland stream, is recommended to be listed as General High Quality Waters under the Antidegradation Rule (3745-1-05). It contains a very good cold water macroinvertebrate community with six cold water taxa and has a moderately intact riparian area. There may be some development pressure in the area which could adversely affect continued CWH performance.
- The reintroduction of native brook trout (a declining species) into the Silver Creek watershed highlights the importance of maintaining and protecting Silver Creek as a Cold Water Habitat stream. The cumulative effect of thermal and chemical loadings from numerous small point source discharges to Silver Creek could have a negative impact on the future of native brook trout (*Salvelinus fontinalis* (Mitchill)) populations in this watershed. Chemical and thermal loadings to its tributaries in the future need to be carefully evaluated. The Silver Creek mainstem needs to be protected, as it potentially serves as a migration route between brook trout population areas. High quality habitat (QHEI scores of 76.0 and 81.0) is present in Silver Creek. An impoundment was removed after failure, and restoration has occurred upstream. Three of four biocriteria scores were marginally exceptional to Exceptional (IBI = 46 with an exceptional narrative macroinvertebrate evaluation at RM 5.1 and ICI = 54 at RM 0.4). There is still recovery in lower Silver Creek from the impoundment depositional bedload moving downstream (IBI = 40 in 2004) toward the mouth. A very small impoundment closer to the mouth interferes with recolonization migration from the Chagrin River and nearby tributaries of sediment intolerant fish including redbreast dace, river chubs, and rosyface shiners. All have been historically recorded in the upper Chagrin basin and in Silver Creek (Trautman, 1981). Silver Creek is recommended to be designated Outstanding State Waters or Superior High Quality Water under the Antidegradation Rule (3745-1-05) based on the presence of declining species, high quality habitat, high IBI/ICI scores, and high resource quality.
- Dewdale Creek is recommended for the CWH use designation and recommended for Superior High Quality under the Antidegradation Rule (3745-1-05). These recommendations are based on its biotic diversity, high biological scores in its lower reach (IBI=44, ICI= 56), and its probable function as a refuge and migration route for native brook trout.
- The Tributary to Dewdale Creek at RM 42.55/0.5 and at RM 42.55/0.31 are already designated CWH (OEPA 1996). ODNR has placed native brook trout into the Leech Tributary (Trib. to Chagrin R. 41.53 /0.5) in the trout reintroduction projects. The Rookery Park Wetland can connect, at times, to all three streams. These two Dewdale Creek tributaries are recommended for General High Quality Waters under the Antidegradation Rule (3745-1-05) based on being possible refuge tributaries for the native brook trout (streams connected to Leech Tributary via wetland).
- Beaver Creek should be designated Outstanding State Water under the Antidegradation Rule (3745-1-05) based on its cold water biotic diversity and high ICI scores. Additionally, it runs

through a wetland preserve possessing rare and endangered plant species. Native brook trout could be stocked in upper Beaver Creek and serve as a refuge population, as there is some highly suitable habitat in the upper reaches. Two of the last remaining native brook trout stock populations are still present in Spring Brook and Woodiebrook, which are two other tributaries to Bass Lake (Chagrin River mainstem). Likely brook trout previously inhabited Beaver Creek as well, based on its proximity and similar cold water macroinvertebrate communities.

Status of Non-Aquatic Life Uses

- Existing Primary Contact Recreation (PCR) designation for the previously designated streams should be retained based on sampling observations. All newly sampled streams were recommended to receive a PCR designation based on sampling/field observations (Table 7).
- Existing Water Supply Use designations were appropriate based on sampling/field observations and should be retained. All sampled and designated streams listed in Table 7 were recommended to have Agricultural and Industrial Water Supply use designations.

Other Recommendations

- Utilize Primary Headwater Habitat (PHWH) class designations in small upper watershed tributaries to identify and protect higher quality tributaries during evaluations for development or preservation planning.
- The Geauga County Health Department needs to investigate bacterial and ammonia (NH₃) sources in upstream areas of Dewdale Creek watershed.
- The Geauga Co. Health Dept. needs to investigate fecal bacteria sources in Bass Lake area.
- Decrease phosphorus and sediment inputs into Bass Lake and cold water tributaries in the area (more protective of Class III PHWH streams and local brook trout streams).
- Unsewered areas need to be periodically evaluated by local health departments to correct failed septic systems in the basin to protect the public during recreational contact.
- Based on low temperatures and high quality habitat, Smith Creek and its tributaries would be candidate streams for brook trout introduction.

Future Monitoring Issues (Some of these activities are already ongoing.)

- Chagrin basin streams supporting trout (with date/season observed) above Daniels Park should be compiled to document possible cold water use conditions for future use designation recommendations. The collapse of Daniels Park dam allows upstream migration.

- A biological survey of Aurora Branch Chagrin River tributaries downstream from RM 11.0 should be conducted to identify the possible status and refugia potential of these smaller tributaries. Many seem to have more complete riparian corridors and are more geographically isolated with less development. These tributaries might serve as refugia for cold water fish, macroinvertebrates, and salamanders.
- A biological survey of East Branch Chagrin River mainstem and tributaries upstream from RMs 16.3 to 20.0 should be conducted to identify their status. Many seem to have relatively complete riparian corridors and are more geographically isolated with more natural protected habitat and less anthropogenic development. They may serve as refugia for cold water fish, macroinvertebrates, and salamanders.
- Through various sources (e.g., 319 projects, local ordinance, etc.), an attempt to control nonpoint source runoff from developed areas in Solon that would discharge to tributaries in the lower Aurora Branch Chagrin River is recommended. Any “first-flush” controls or stormwater detention would also help decrease nutrient and sediment inputs. Bioretention systems with underground filtration would also help decrease temperatures for stormwater prior to release into an Aurora Branch tributary. Riparian protection of these western tributaries to Aurora Branch would also minimize negative nonpoint inputs.
- Through various sources (e.g., 319 projects, local ordinance, etc.) an attempt to control nonpoint source runoff from developed areas in the McFarland Creek subwatershed that discharge to the lower Aurora Branch Chagrin River is recommended. Any “first-flush” controls or stormwater detention would help decrease nutrient and sediment inputs. Embedded conditions were observed in lower McFarland Creek mainstem. Bioretention systems with underground filtration would also help decrease temperatures for stormwater prior to release. Riparian protection in McFarland Creek would reduce negative nonpoint inputs and better protect the McFarland Creek mainstem (EWH), North Branch McFarland Creek (CWH), and Aurora Branch in the vicinity of McFarland Creek.
- Significantly lower levels of phosphorus should now be present in Beaver Creek downstream from the Heather Hills Hospital WWTP discharge after upgrades. Future sampling is recommended to determine what effect these reductions are having on Beaver Creek, its trophic state, ambient chemistry, and the biological quality of Bass Lake.
- Investigate source(s) of nonpoint source inputs upstream from Dewdale Creek at Auburn Road.

Waterbody Use Designations

Verified & recommended designated use changes in Chagrin basin are compiled in Table 7 below.

Table 7. Waterbody use designations for the Chagrin River basin. Changes to existing use designations appear in **bold ▲**. Designations based on the 1978 water quality standards (denoted with *) for which results of biological field assessments are now available appear as plus signs (+) to the right of existing markers.

Water Body Segment	Use Designations													Comments
	Aquatic Life Habitat						Water Supply			Recreation				
	S R W	W W H	E W H	M W H	S S H	C W H	L R W	P W S	A W S	I W S	B W	P C R	S C R	
Chagrin River - Chagrin Falls (RM 29.65) to the mouth	*	+			▲				+	+		+		
-all other segments	*	+							+	+		+		
Corporation Creek (Trib. to Chagrin R. @ RM 0.27)		o			▲				▲	▲		▲		
Ward Creek (Trib. to Chagrin R. @ RM 1.00)		▲			▲				▲	▲		▲		
East Branch Chagrin River (@ RM 4.98) and tributaries	*								+	+		+		
Quarry Creek (Trib. to E. Br. Chagrin R. @ RM 1.85)			▲						+	+		+		
Stoney Brook (Trib. to E. Br. Chagrin R. @ RM 3.57)									+	+		+		
Pierson Creek (Trib. to E. Br. Chagrin R. @ RM 6.73)			▲						+	+		+		
Baldwin Creek (Trib. to E. Br. Chagrin R @ RM 7.06)									o	o		o		
Unnamed trib. (U. T.) to E. Br. Chagrin R @ RM10.13			▲						+	+		+		
U.T. to U.T. to E. Br. Chagrin R.@ RM 10.13/0.87(Mt. Glen Trib.)									o	o		o		
Stebbins Gulch (Trib. to E. Br. Chagrin R.@ RM 10.60)									+	+		+		
U. T. to E. Br. Chagrin R.@ RM 14.62 (Harris Creek)									+	+		+		
U. T. to E. Br. Chagrin R.@ RM 14.80									+	+		+		
U. T. to E. Br. Chagrin R @ RM15.35			▲						+	+		+		
U. T. to E. Br. Chagrin R @ RM16.20			▲						+	+		+		
Gully Brook (Trib. to Chagrin R. @ RM 5.54)		▲			▲				▲	▲		▲		
Caves Creek (Trib. to Chagrin R. @ RM 11.52)									▲	▲		▲		

Water Body Segment	Use Designations												Comments
	Aquatic Life Habitat						Water Supply			Recreation			
	S R W	W W H	E W H	M W H	S S H	C W H	L R W	P W S	A W S	I W S	B W	P C R	
Unnamed tributary to Chagrin River @ RM 14.88		+							+	+			+
Unnamed trib. (U.T.) to Chagrin River @ RM 15.42									+	+			+
Pepper - Luce Creek (Trib. to Chagrin River @ RM 22.81)		+							+	+			+
Trib. to Pepper - Luce Creek @ RM 2.17		+							+	+			+
Griswold Creek (RM 23.82)	*								+	+			+
Willey Creek (RM 26.32)	*								+	+			+
Sulphur Springs Brook (Trib. To Chagrin River @ RM26.68)									▲	▲			▲
Aurora Branch Chagrin River headwaters to Smith Creek (>RM 8.98)	*	+							+	+			+
from Smith Creek (RM 8.98) to McFarland Creek (>RM 3.73)	*								+	+			+
from McFarland Creek (RM 3.73) to RM 0.38	*	+							+	+			+
from RM 0.38 (waterfall barrier) to the confluence	*	+			▲				+	+			+
McFarland Creek (RM 3.73)	*		+						+	+			+
North Branch McFarland Creek (@ RM 2.58)									▲	▲			▲
Linton Creek (<i>Stoney Brook</i> , RM 5.27)									+	+			+
Smith Creek (confl. @ RM 8.98)									▲	▲			▲
Trib. to Smith Creek (@ RM 2.70)									▲	▲			▲
Sunny Lake Tributary to Aurora Branch (RM 14.61)		+							+	+			+
Silver Creek (RM 34.21)	*								+	+			+
Trib. to Silver Creek @ RM 2.23 (Affelder Tributary .)									▲	▲			▲
South Branch Silver Creek (RM 2.62)		+							+	+			+
Pebble Brook (U. T. to Silver Creek @ RM 3.50)									o	o			o
Trib. to Silver Creek @ RM 4.54 (Hrabak Tributary)									o	o			o

Water Body Segment	Use Designations												Comments
	Aquatic Life Habitat						Water Supply			Recreation			
	S R W	W W H	E W H	M W H	S S H	C W H	L R W	P W S	A W S	I W S	B W	P C R	
Trib. to Silver Creek @ RM 4.58 (Pettibone Tributary)						o			o	o		o	
Trib. to Chagrin River @ RM 38.32 (Marsh Hawk Run)		▲							▲	▲		▲	
Trib. to Chagrin River @ RM 41.53 (Leech Tributary)						o			o	o		o	
Dewdale Creek (Chagrin R. RM 42.55)						▲			▲	▲		▲	
Unnamed trib. to Dewdale Creek (RM 42.55 / 0.31)						o			o	o		o	
Unnamed trib. to Dewdale Creek (RM 42.55 / 0.5)						o			o	o		o	
Trib. to Chagrin River at RM 46.20 (Ecklund Tributary)						o			o	o		o	
Beaver Creek (RM 47.40) headwaters to ust, Sherman Rd (RM 1.0)	*					+			+	+		+	
-RM 1.0 to the mouth		o							+	+		+	
Spring Brook (Trib. to Chagrin R. @ RM 47.65)						+			+	+		+	
Woodie Brook (Trib. to Chagrin R. @ RM 48.30)						+			+	+		+	
<p>▲ Confirmed recommended designated use change * Designated use based on the 1978 water quality standards + Designated use based on the results of a biological field assessment performed by the Ohio Environmental Agency o Designated use based on justification other than the results of a biological field assessment performed by the Ohio Environmental Agency.</p>													

SRW = state resource water; WWH = Warmwater Habitat; EWH = Exceptional Warmwater Habitat; MWH = Modified Warmwater Habitat; SSH = Seasonal Salmonid Habitat; CWH = Cold Water Habitat; LRW = Limited Resource Water; PWS = public water supply; AWS = agricultural water supply; IWS = industrial water supply; BW = bathing water; PCR = primary contact recreation; SCR = secondary contact recreation.

CHEMICAL WATER QUALITY SURVEY

Upper Chagrin - Aurora Branch Assessment Unit (Hydrologic 11 Unit: 04110003-020)

The Upper Chagrin - Aurora Branch Assessment Unit comprises the drainage area beginning from the headwaters of the upper Chagrin River and Tributaries upstream from and including Aurora Branch.

*Chemical Water Quality Assessment for Upper Chagrin - Aurora Branch Assessment Unit****Chagrin River Mainstem (HUC-14 Unit: 04110003020-010)***

Chemical samples were collected from nine locations along the upper Chagrin River mainstem (RM 49.15 to RM 28.30) upstream from its confluence with the Aurora Branch (RM 27.09). The Chagrin Falls WWTP (design flow 1.0 mgd) has a discharge near the downstream boundary of this HUC-14 watershed - WWTP discharges at RM 28.3. The Geauga Co. Russell Park WWTP (0.08 mgd) discharges at RM 34.0. A number of minor WWTPs discharge to tributaries in the upper Chagrin basin including: Geauga Co. Wenhaven WWTP (RM 33.15 trib), Geauga Co. Belle Vernon WWTP (RM 36.22 trib), Geauga Co. Kimberly Estates WWTP (RM 42.55 trib), and Geauga Co. Scranton Woods WWTP (RM 42.55 trib.) (Table 8).

The extreme headwaters of the Chagrin River mainstem flows into Bass Lake, a natural lake of glacial origin that has been historically modified by placement of a dam at the outlet (dam at RM 47.31). The river has been extensively channelized both upstream and downstream from Bass Lake, and has connection with expansive wetland areas of glacial origin. Low levels of dissolved oxygen (<4.0 mg/l) were recorded in the channelized portions of the Chagrin River mainstem at locations both upstream and downstream from Bass Lake (Table 9). The most likely source of this low oxygenated water is the wetland complex (Figure 1). A survey of Bass Lake (Ohio EPA, 2005) showed elevated total phosphorus and high levels of algae biomass as estimated by chlorophyll concentrations during summer months. Although higher levels of total phosphorus were found in the Chagrin River downstream from Bass Lake than compared to upstream, the average concentration at both locations was less than the 0.08-0.10 mg/l ecoregion target goal for headwater and wading streams (Figure 2). With the exception of the low dissolved oxygen concentrations in the Bass Lake area (between RM 49.15 to 42.70), the water chemistry of the upper Chagrin River mainstem met WWH chemical criteria. Average total phosphorus and nitrate-nitrite concentrations were below ecoregion target goals of 0.08-0.1 and 0.1 mg/l, respectively (Figures 2, 3). The average concentration of nitrate-nitrite in this upper HUC-11 watershed (04110003-020) was significantly lower than the concentration recorded from samples collected in the lower HUC-11 watershed (04110003-039), however, both HUC-11 watersheds had nitrate-nitrite concentrations below the average 0.10 mg/l ecoregion target goal. Source of nitrate-nitrite to the upper Chagrin River watershed include the discharges from the Chagrin Falls WWTP and the McFarland Creek WWTP.

Table 8. List of significant (> 0.001 mgd) NPDES permitted wastewater dischargers within within the Upper Chagrin - Aurora Branch Assessment Unit (**04110003 020**) of the Chagrin River basin. Entities sorted by HUC-14 assessment units.

Entity/ (Stream-River Mile)	Ohio Permit	NPDES	Flow (mgd)	Latitude	Longitude	Permit Expires
HUC 11 : 04110003020						
Ivex Packing Corp. (Chagrin River-RM 30.09) [HUC: 04110003020-010]	3IA 00000	OH00 00400	0.250	41.4356	-81.3858	Abandoned August, 2004
Chagrin Falls WWTP (Chagrin River-RM 28.3) [HUC: 04110003020-010]	3PD 00038	OH00 21740	1.000	41.4197	-81.3986	10/31/2005 (draft renewal pending)
Opalocka WWTP (RM 38.32 trib. to Chagrin R- at RM 2.30) [HUC: 04110003020-010]	3PH 00000	OH00 28843	0.155	41.5171	-81.3320	7/31/2010
Heather Hill Hospital WWTP (Beaver Creek-RM 0.82) [HUC: 04110003020-010]	3PR 00075	OH00 83984	0.100 (old 0.060)	41.5348	-81.2267	9/30/2009
Geauga Co. Russell Park WWTP (Chagrin River-RM 33.6) [HUC: 04110003020-010]	3PG 00001	OH00 28860	0.080	41.4693	-81.3514	12/31/2006
Fowler Mill WWTP Chagrin River-RM 44.87 [HUC: 04110003020-010]	3PR 00368	OH01 34449	0.008	41.5256	-81.2606	04/31/2009
Geauga Co. Kimberly Estates WWTP (RM 42.55 trib Chagrin R at RM 1.77, 0.89) [HUC: 04110003020-010]	3PG 00004	OH00 28835	0.046	41.4893	-81.2437	11/30/2006
Geauga Co. Belle Vernon WWTP (RM 36.22 trib. Chagrin R at RM 0.3) [HUC: 04110003020-010]	3PG 00010	OH00 28887	0.040	41.4945	-81.3419	11/30/2006

Table 8 continued.

Entity/ (Stream-River Mile)	Ohio Permit	NPDES	Flow (mgd)	Latitude	Longitude	Permit Expires
Geauga Co. Scranton Woods WWTP (RM 42.55 trib Chagrin R. at RM 0.99,0.3) [HUC: 04110003020-010]	3PG 00155	OH01 25873	0.014	41.4721	-81.2444	5/31/2008
Geauga Co. Wenhaven WWTP (RM 33.15 trib Chagrin R. at RM 1.35) [HUC: 04110003020-010]	3PG 00008	OH00 28886	0.007	41.4489	-81.3491	11/30/2006
Geauga Co. Surry Downs WWTP (Silver Creek-RM 1.80) [HUC: 04110003020-020]	3PG 00006	OH00 28878	0.010	41.4626	-81.3322	7/31/2007
Aurora Central WWTP (Aurora Branch-RM 11.15) [HUC: 04110003020-030]	3PC 00016	OH00 21903	1.500	41.3250	-81.3361	6/30/2005 (draft renewal pending)
Geauga Lake Funtime WWTP (RM 6.78 trib to Aurora Br. at RM 0.70) [HUC: 04110003020-030]	3PR 00061	OH00 45080	0.155	41.3527	-81.3794	2/28/2008
Robin MHPs Inc. WWTP (Aurora Branch-RM 16.60) [HUC: 04110003020-030]	3PV 00058	OH01 07212	0.066	41.3069	-81.2793	7/31/2010
Yogi Bear's Jellystone Park WWTP (RM 16.42 trib. Aurora Branch at RM 0.02) [HUC:04110003020-030]	3PR 00090	OH00 88081	0.030	41.3038	-81.2790	3/31/2008
Cantex Inc. (RM 16.42 trib Aurora Branch at RM 0.2) [HUC: 04110003020-030]	3IF 00024	OH00 00922	0.002 (sanitary) 0.272 (cooling)	41.3025	-81.2819	11/20/2004 (draft renewal pending)
Geauga Co. McFarland Creek WWTP (Aurora Branch-RM 3.46) [HUC: 04110003020-040]	3PK 00010	OH00 43494	1.800 (old 1.200)	41.3902	-81.3896	7/31/2006 (expanded 7/2005)
HUC-11 Total	# = 17		5.535			

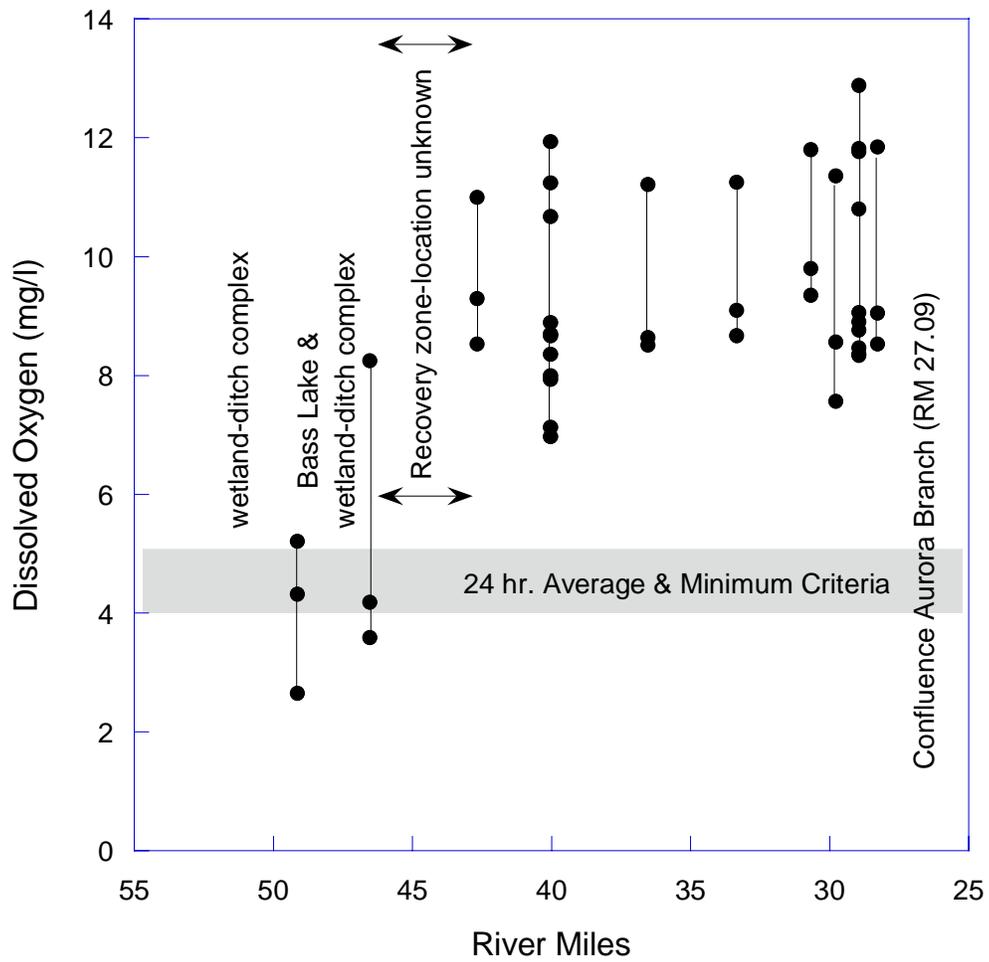


Figure 1. Concentration of dissolved oxygen in the upper Chagrin River mainstem.

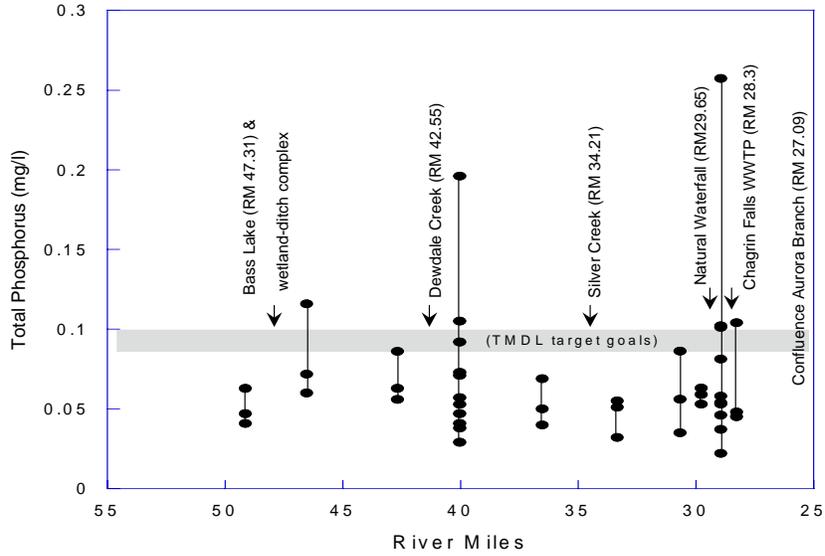


Figure 2. Total phosphorus concentrations (mg/l) for upper Chagrin River mainstem, 2003-04.

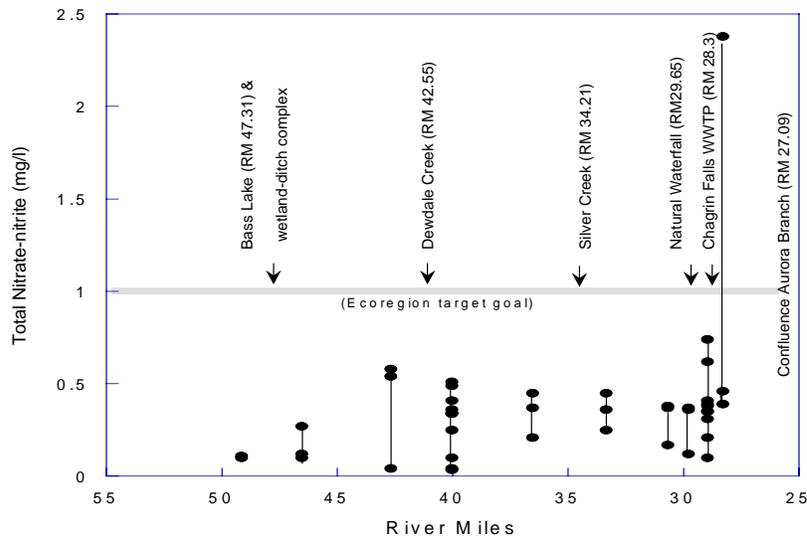


Figure 3. Total nitrate-nitrite concentrations (mg/l) for upper Chagrin River mainstem, 2003-04.

Table 9. Exceedences of Ohio EPA (OAC 3745-1) chemical criteria (WWH, EWH, CWH) detected in the Chagrin River study area during the 2003-04 survey (units are mg/l for dissolved oxygen, S.U. for pH). Chemical data in Appendix 1. Bacteria exceedences are provided in Appendix Table 2.

Stream (HUC unit)	River Mile	Parameter (value)
Chagrin River mainstem-WWH (HUC 14: 04110003020-010)		
	49.15	Dissolved oxygen (2.65, 4.32); pH (9.84)
	46.54	Dissolved oxygen (3.59, 4.18)
	4.95	Dissolved oxygen (2.51)
Dewdale Creek-CWH recommended (HUC 14:04110003020-010)		
	4.60	Dissolved oxygen (3.15, 4.06, 4.86)

Dewdale Creek (HUC-14 Unit: 04110003020-010)

Chemical samples were collected at two locations along Dewdale Creek (RM 0.60, 2.60). Dewdale Creek is currently designated WWH, although the CWH aquatic life use has been recommended based on the documented presence of required numbers of CWH adapted taxa. No significant WWTP dischargers are located in the watershed. Violations of the dissolved oxygen criteria were recorded at the upper RM 2.60 location (range 3.15 - 4.86 mg/l, n=3) (Table 9). The most likely sources of low dissolved oxygen is the large wetland complex connected to the stream in the headwaters of Dewdale Creek *or* potential sources from failing septic tanks (NPS inputs). Some other evidence pointing toward this nonpoint source is the elevated bacterial concentration from upstream sources (Appendix 2a). Dissolved oxygen increased significantly at RM 0.6 (range 8.03 - 8.98 mg/l, n=4), and the pH was lower at the RM 4.60 location (but well within criteria). Elevated levels of total phosphorus were present upstream at RM 2.60 (range 0.130 - 0.308 mg/l, n=3) as compared to the downstream station at RM 0.60 (range 0.014 - 0.154 mg/l, n=4). Water temperature was relatively similar between the two sample stations (range for both stations 16.14 to 21.51 C°).

Beaver Creek (HUC-14 Unit: 04110003020-010)

Chemical samples were collected in 2002 from Beaver Creek at two locations: Bean Road (RM 2.31) and Sherman Road (RM 0.55). Water temperature and select chemicals also are available from two locations immediately upstream and downstream from the discharge location where the Heather Hills Hospital WWTP empties into Beaver Creek at RM 0.82: RMs 0.90 and 0.76 (HzW Environmental Consultants, Inc. 2002). No significant effect on water temperature due to the WWTP discharge was

found from monthly samples collected March to November, 2002 (HzW, 2002). Ohio EPA data collected during the same time period showed significantly higher stream temperature at RM 0.55 (range 19.8-21.0 C°, n=3) than RM 2.31 (range 15.4-15.4 C°, n=3). Total phosphorus concentrations were 20-30 times higher downstream from the Heather Hills Hospital WWTP discharge than upstream concentrations (upstream range 0.050 - 0.052 mg/l, downstream 0.530 - 1.510 mg/l, n=3). Beaver Creek flows directly into Bass Lake at a location above the lake dam, thus the discharge from Heather Hills Hospital WWTP was a significant source of nutrients for Bass Lake in 2002. Low dissolved oxygen values (2.9 mg/l and 2.1 mg/l) were recorded at both RM 2.31 and 0.55, respectively. The cause of these low dissolved oxygen is unknown, but may be related to inflow from wetlands located adjacent to the Beaver Creek mainstem in a number of areas along its length.

The Heather Hills Hospital WWTP was expanded to a maximum effluent flow of 0.100 mgd effective as of May, 2003. The expanded plant includes a replacement of the influent trash trap with fine screens, the replacement of the two 30,000 gallon extended aeration tanks with 60,000 gallon extended aeration tanks, the addition of phosphorus removal through the use of chemical inactivation equipment, the replacement of the slow sand filter tertiary treatment with rapid sand filters, and the replacement of the chlorine disinfection system with an ultraviolet system. Final effluent limits for the WWTP became effective on May 1, 2003. Final effluent limits were based upon *de minimus* load increases for cBOD₅, ammonia nitrogen, and suspended solids. A thirty-day average total phosphorus limit of 1.0 mg/l was included as a final effluent limit in order to reduce nutrient loadings to Beaver Creek and Bass Lake. Because the 2002 water quality survey was conducted prior to these WWTP upgrades, it would be expected that significantly lower levels of phosphorus should now be present in Beaver Creek downstream from the Heather Hills Hospital WWTP discharge. Future sampling is recommended to determine what effect, if any, these reductions are having on Beaver Creek, its trophic state water and sediment chemistry, and biology of Bass Lake (see Ohio EPA 2005 Bass Lake report).

Unnamed Tributaries (HUC-14 Unit: 04110003020-010)

The Ohio Department of Natural Resources is conducting research on the introduction of native Brook Trout into headwater streams within the Chagrin River basin. Table 10 presents a summary for select chemicals from four streams where Brook Trout populations are known to be fully reproducing. These data represent the range of chemical water quality conditions required to support full reproduction and age class recruitment, and thus can serve as baseline chemical conditions that should be present before any attempt is made to introduce native Brook Trout into streams in the basin.

An elevated ammonia-N value (1.32 mg/l) was observed from the unnamed tributary to Chagrin River at RM 38.32, also known as ***Marsh Hawk Run***. This sample was collected downstream from the discharge of the Opalocka WWTP. Elevated levels of nitrate-nitrate (range 4.34-1.7 mg/l, n=3) and total phosphorus were also recorded (0.798-0.302 mg/l). Conductivity was elevated and a total suspended solid value of 354 mg/l was observed. Although no violations of chemical criteria were recorded, nutrient enrichment, ammonia toxicity, and siltation should be considered potential stressors to help explain the non attainment of biological communities observed.

Table 10. Chemical profile of four CWH streams with either native or introduced fully breeding populations of Brook Trout, *Salvelinus fontinalis*. Sampled streams are: Woodiebrook (RM 48.3 trib. to Chagrin River); Spring Brook (RM 47.65 trib. to Chagrin River); Hrabak Stream (trib. to Silver Creek); Pebble Brook (trib. to Silver Creek). Multiple year samples for Spring Brook and Woodiebrook, 2005 samples only for other streams. N = composite number of samples from all streams, SD = standard deviation.

Parameter	N	Mean	SD	Min.	Max
(Sample dates between May 1 and September 30 for each year sampled)					
Field Measurements					
Stream Temperature (C°)	31	13.87	1.81	9.6	17.36
pH (s.u.)	31	8.1	0.16	7.69	8.27
Conductivity (umho)	27	422	65	279	634
Dissolved Oxygen (mg/l)	31	10.3	0.76	8.8	12.76
Laboratory Measurements					
Total Dissolved Solid (mg/l)	29	246	36	162	368
Calcium (mg/l)	28	47	8	38	80
Magnesium (mg/l)	28	12	2	9	18
Hardness (mg/l)	28	164	26	132	274
Alkalinity (mg/l)	27	116	22	90	214
Chloride (mg/l)	29	40	12	9.6	59
Sodium (mg/l)	26	22	7	6	35
Strontium (ug/l)	26	100	17	65	146
Sulfate (mg/l)	27	30	6	21	48.6
Barium (ug/l)	26	43	5	35	58
Nitrate+Nitrite (mg/l)	29	1.61	0.46	0.88	2.28
Total Phosphorus (mg/l)	29	0.085	0.037	0.182	<0.010

Silver Creek (HUC-14 Unit: 04110003020-020)

Chemical samples were collected at two locations on Silver Creek (RM 0.54, 5.07). Silver Creek has an existing Cold Water Habitat (CWH) designated use. The Geauga County Surry Downs WWTP has a discharge to Silver Creek at RM 1.8 (0.010 mgd design flow).

Results from the biology surveys indicate that Silver Creek is fully meeting its CWH potential at Music Street (RM 5.07), however insufficient information was available to make a determination on use attainment at the downstream location (RM 0.54). The Ohio DNR has successfully introduced breeding populations of the Brook Trout into two tributary streams of Silver Creek, the Hrabak Stream and Pebble Brook. All chemical parameters were within CWH chemical criteria. Water temperature in Silver Creek ranged from 14.73 to 18.45 C° (n=3) at the upstream site, 16.57 to 21.39 (n=3) at the downstream site on the same days sampled, an average increase of about 2.0 C°. Total phosphorus was

less than 0.05 mg/l for all but one of the samples collected (a 0.235 mg/l at RM 5.07), which suggests that nutrient enrichment is not a significant stressor on aquatic life. Dissolved oxygen at both sites ranged from 7.73 to 9.10 mg/l. Removal of riparian habitat, residential development near the mouth may be important stressors on biological communities. The Geauga County Parks has conducted stream restoration projects in the area where a dam and impoundment have been removed.

No chemical samples were collected from the South Branch of Silver Creek at Music Street. This location was found to be in full attainment of WWH biological criteria.

Aurora Branch Chagrin River (HUC-14 Unit:04110003020-030)/04110003020-040)

Chemical samples were collected from ten locations along the Aurora Branch Chagrin River mainstem (RM 16.35 to RM 1.03). The Aurora Branch receives treated effluent from two major WWTPs (Table 8), the city of Aurora Central WWTP (RM 11.15) and Geauga County McFarland Creek WWTP (RM 3.46). Minor WWTPs that discharge to the Aurora Branch and various tributaries include the Geauga Lake Funtime Park WWTP (via RM 6.78 tributary), Robin Mobile Home Park WWTP (RM 17.0), Yogi Bear's Jellystone Park WWTP (RM 16.75 tributary), and non-contact cooling water from Cantex, Inc. (RM 16.75 tributary) (Table 8).

Evidence of nutrient enrichment in the Aurora Branch was found at the uppermost sample location at Chamberlain Road (RM 16.35) for both total phosphorus and nitrate-nitrite concentrations (Figure 4). Elevated nutrients may contribute to the non-attainment of aquatic life observed at RM 16.35, based on the very poor quality benthic macroinvertebrate assemblage present. Potential sources of nutrients include the three WWTP discharges cited above. No chemical impact was noted downstream from the Sunny Lake inlet. Historical evidence exists that potentially toxic levels of blue-green algae are released from Sunny Lake in late summer. Results of the biological survey showed an 18 point decrease in IBI scores (40 to 22) at RM 14.5 which is just downstream from where the Sunny Lake overflow stream enters the Aurora Branch. The cause of the significant reduction in IBI at RM 14.5 still remains suspect but uncertain and should be a focus of the next survey.

Nutrient levels declined to ecoregional target goals immediately upstream from the city of Aurora Central WWTP discharge, but significantly increased immediately downstream from the discharge. Nitrate-nitrite levels gradually declined for the subsequent lower ten river miles to the mouth of the Aurora Branch. Total phosphorus significantly increased downstream from the McFarland Creek WWTP, on days when low levels were found at the mouth of McFarland Creek and upstream from the WWTP discharge (Figure 4). Chemical samples were not collected at RM 12.0 (State Route 82), where the integrity of the fish community was depressed below the IBI ecoregion criterion. Turbid water with elevated total suspended solids (TSS) was observed at Bainbridge Road during baseflow conditions (RM 3.80) in 2004, just upstream from the confluence of McFarland Creek (Figure 5). A reconnaissance of the upstream watershed revealed excessive soil erosion adjacent to the Aurora Branch from a highway project involved with replacement of an upstream bridge. Overall, total suspended solid concentrations were on average relatively low and within background ecoregion conditions for the

entire Aurora Branch mainstem. Acceptable levels of dissolved oxygen (> 6.0 mg/l) also were found at all ten stations along the Aurora Branch, with the exception of a single value that fell within the range of 4-5 mg/l at RM 9.00, upstream from the State Route 306 bridge and nearby tributary (Figure 5).

Smith Creek (HUC-14 Unit:04110003020-030)

Chemical samples were collected from RM 0.50 on Smith Creek. This chemical sample location was 0.6 miles downstream from the zone where the biological survey was conducted, thus direct comparison between potential chemical stressors and biological communities is not possible. Smith Creek is designated CWH stream and was found to be fully attaining its aquatic life use at RM 1.1. In general, all chemical parameters at RM 0.50 were within CWH criteria for protection of aquatic life, however, a future biological survey will need to be conducted at the RM 0.50 location to determine if the CWH aquatic life use is being obtained. The stream at RM 0.55 was channelized.

No chemical samples were collected on the tributary to Smith Creek where biological data indicated full attainment of a recommended CWH use designation.

McFarland Creek (HUC-14:04110003020-040)

McFarland Creek empties into the mainstem of Aurora Branch Chagrin River at RM 3.73. The McFarland Creek WWTP discharges to the Aurora Branch at RM 3.46. Chemical samples were collected at three locations along McFarland Creek (RM 0.06, 2.30, 2.50). McFarland Creek has an existing Exceptional Warmwater Habitat (EWH) aquatic life use, and was found to be in partial attainment of EWH biocriteria from below Lake Lucerne and the North Branch McFarland Creek (at RM 2.3) down to the mouth. Field observations indicated excessive siltation and embedded rocky substrate as a significant cause of non attainment at the two sample locations. However, no violations of EWH chemical criteria were observed, and both total phosphorus and nitrate-nitrites were below ecoregion target goals. Total suspended solids were less than detection (< 5 mg/l) under base flow conditions. Future surveys should focus on identification of non-point sources in the McFarland Creek watershed that could contribute to siltation problems. Loss of riparian cover has been observed between Chagrin River Road and Chagrin Road.

No chemical samples were collected from the North Fork McFarland Creek. The results of the biological surveys indicate that the North Branch McFarland Creek supports a recommended CWH use designation. No chemical or biological samples were collected from Linton Creek during the survey.

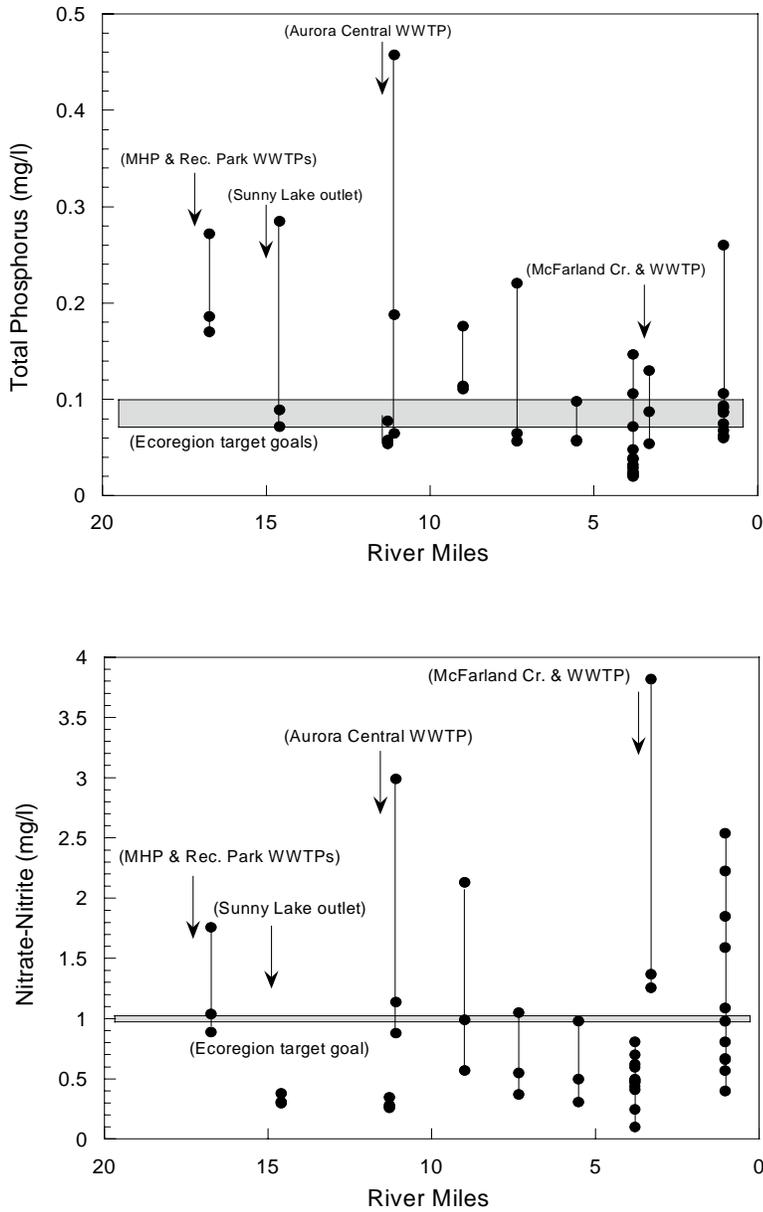


Figure 4. Measurements longitudinally downstream of total phosphorus and nitrate - nitrite concentrations (mg/l) in Aurora Branch Chagrin River, 2003-04.

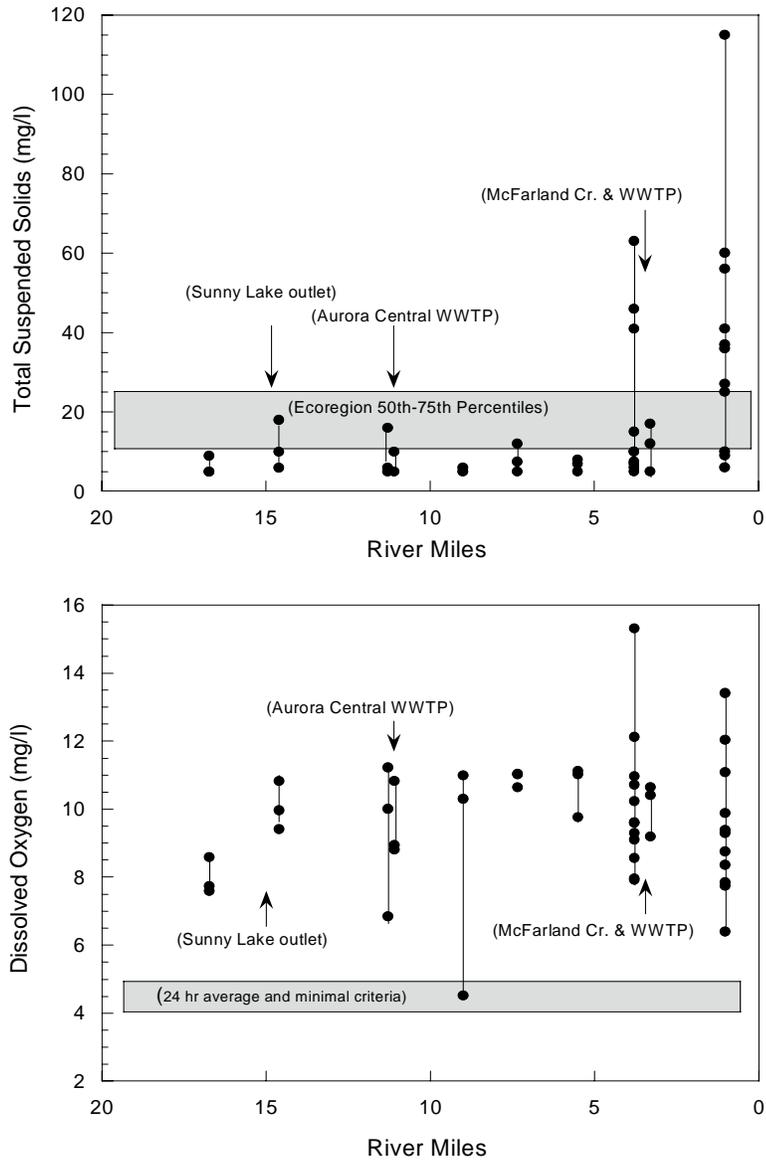


Figure 5. Total suspended solids and dissolved oxygen concentrations (mg/l) measured longitudinally downstream in Aurora Branch Chagrin River, 2003-04.

Pollutant Loadings (1994-2005) for Upper Chagrin - Aurora Branch Assessment Unit

Chagrin River Mainstem and Select Tributaries (HUC-14 Unit: 04110003020-010)

Chagrin Falls WWTP 3PD00038 (Chagrin River at RM 28.3)

- Treatment processes include equalization basin, bar screen, grit tank, primary settling, aeration, final settling tanks, sand filter, and chlorination disinfection with dechlorination. The design flow is 1.0 mgd. The plant treats to reduce the concentration of total phosphorus. Current monthly NPDES permit limits are cBOD₅ (10 mg/l; 37.9 kg/day); TSS (12 mg/l; 45.4 kg/day); total phosphorus (1.0 mg/l; 3.8 kg/day); and summer ammonia-N (2.5 mg/l; 9.5 kg/day). A compliance inspection letter dated June 20, 2001 indicated general compliance with permit conditions, however, the city has a long history of reporting “untreated bypasses” at the flow equalization basin after rainfall and snow melt events. A review of monthly reported flow data shows that the 95th percentile of annual daily flows has consistently exceeded the average plant design flow of 1.0 mgd over the previous ten years.

Ivex Packing Corporation WWTP 3IA00000 (Chagrin River at RM 30.09)

- The facility stopped discharging to the Chagrin River on August 19, 2004 due to plant shutdown. The NPDES discharge permit was revoked, effective February 1, 2005, due to closing of the plant. Although the facility was discharging during the time period of this water quality survey, the flow was significantly reduced.
- Ivex was a manufacturer of natural and bleached kraft paper and had one discharge, outfall 001. The design flow for the wastewater treatment plant was 0.250 mgd. The most recent NPDES permit was issued on July 3, 2003. Waste treatment included sedimentation-clarification, moving-bed bioreactors, DAF clarification and sand filtration before discharge to the Chagrin River. Paper pulp sludge produced during clarification was filtered and the dry sludge was sent to a landfill. The treatment system was installed via PTI 02-9670 approved on October 19, 1995. Modifications to the treatment system were installed which included an additional bioreactor.
- In 1997 the treatment system was upgraded to include biological treatment and dissolved air floatation. These changes were made to meet permit-mandated lowering of effluent limits from TSS = 137 mg/l and BOD = 120 mg/l to TSS = 30 mg/l and BOD = 10 mg/l. Directors Final Findings and Orders were issued to Ivex on March 14, 2000 requiring PTI submittal to maintain compliance with permit effluent limits. The facility experienced a number of permit violations from 2000 through 2002, but no violations were recorded in 2003 until the plant shut down in August 2004 (TSS-2 violations in 2000; CBOD-20 violations in 2000; total lead-10 violations from 2000 thru 2002; total copper-3 violations in 2000).

Geauga County Wenhaven WWTP 3PG00008 (RM 33.15 trib Chagrin River at RM 1.35)

- Treatment processes include trash trap, flow equalization, extended aeration treatment, clarifiers, fixed media filters, slow sand filters, and chlorine disinfection with dechlorination. The design flow is 0.007 mgd. Current monthly NPDES permit limits are cBOD5 (10 mg/l; 0.27 kg/day); TSS (12 mg/l; 0.33 kg/day); and summer ammonia-N (1.5 mg/l; 0.04 kg/day). A compliance inspection letter dated January 6, 2004 indicated that the plant was in general compliance with its NPDES permit, with a few violations noted for chlorine residual in 2002.

Geauga County Russell Park WWTP 3PG00001 (Chagrin River at RM 33.60)

- Treatment processes include trash trap, flow equalization, extended aeration treatment, clarifiers, fixed media filters, slow sand filters, and ultraviolet disinfection. The design flow is 0.080 mgd. Current monthly NPDES permit limits are cBOD5 (10 mg/l; 3.03 kg/day); TSS (12 mg/l; 3.65 kg/day); and summer ammonia-N (1.5 mg/l; 0.45 kg/day). A compliance inspection letter dated January 6, 2004 indicated violations of chlorine residual and dissolved oxygen during 2001-2002. Ultraviolet disinfection was installed in early 2002. A December 2, 2005 indicated that the plant was in “poor operating condition” at the time of the inspection. Both rapid sand filters were plugged with solids and overflowing. A wet weather by-pass that is diverted around disinfection was observed that discharges via a storm sewer to the river. A single violation of permit limits was for dissolved oxygen occurred in a review of data between January 1, 2004 through October 10, 2005.

Geauga County Belle Vernon WWTP 3PG00010 (RM 36.22 trib Chagrin River at RM 2.3)

- Treatment processes include extended aeration, sand filters, flow equalization, and ultraviolet disinfection. The design flow is 0.040 mgd. Current monthly NPDES permit limits are cBOD5 (10 mg/l; 1.5 kg/day); TSS (12 mg/l; 1.8 kg/day); and summer ammonia-N (1.5 mg/l; 0.23 kg/day). A compliance inspection letter dated January 6, 2004 indicated that the plant was in general compliance with its NPDES permit, with a few violations for chlorine residual in 2002. Ultraviolet disinfection was installed in 2003. A follow-up inspection letter dated December 2, 2005 indicated the plant was in general compliance of permit limitations.

West Geauga School District WWTP 3PT00008 (RM 37.24 trib Chagrin River via un trib)

- Treatment processes include extended aeration, sand filters, flow equalization, and chlorine disinfection with dechlorination. The design flow is 0.060 mgd. Current monthly NPDES permit limits are cBOD5 (10 mg/l; 2.3 kg/day); TSS (12 mg/l; 2.7 kg/day); and summer ammonia-N (1.5 mg/l; 0.34 kg/day). The permit is in the process of being renewed. A review of monthly operating report data from 1/1/04 through 6/1/05 indicated violations of permit limits for TSS, residual chlorine, pH, ammonia-N, CBOD, and dissolved oxygen.

The plant has problems with inflow and infiltration into the sewerage system.

Opalocka (Geauga County) WWTP 3PH00000 (RM 38.32 Trib Chagrin River at RM 2.3)

- Treatment processes include extended aeration, sand filters, flow equalization, and ultraviolet disinfection. The design flow is 0.155 mgd. Current monthly NPDES permit limits are cBOD5 (10 mg/l; 6.1 kg/day); TSS (12 mg/l; 7.3 kg/day); and summer ammonia-N (3.8 mg/l; 2.3 kg/day). An inspection report dated December 2, 2005 indicated that the WWTP has experienced frequent overflows and bypasses of treatment. From the period between January 2004 and October 2005 a large number of permit violations were reported: CBOD (# violations = 9), ammonia-N (# = 33), TSS (# = 12).

Sisters of Notre Dame Educational Center 3PR00066 (RM 44.6 trib to Chagrin River via un trib)

- Treatment processes include extended aeration treatment, sand filters, and uv disinfection. The design flow is 0.040 mgd. Current monthly NPDES permit limits are cBOD5 (10 mg/l; 1.5 kg/day); TSS (12 mg/l; 1.8 kg/day); and summer ammonia-N (1.0 mg/l; 0.15 kg/day). An inspection report dated September 28, 2001 indicated the plant was in general compliance with its NPDES permit.

Fowler Mill WWTP 3PR00368 (Chagrin River at RM 44.87 via roadside ditch)

- Treatment processes include trash/grease trap, extended aeration treatment, sand filters, and chlorine disinfection with dechlorination. The design flow is 0.008 mgd. Current monthly NPDES permit limits are cBOD5 (10 mg/l; 0.30 kg/day); TSS (12 mg/l; 0.36 kg/day); and summer ammonia-N (1.0 mg/l; 0.03 kg/day). The plant was upgraded in 2004 to add flow equalization, trash trap, dechlorination. Prior to 2004 the entity was discharging as approved by a PTI without a NPDES permit, which was issued April 21, 2004. Because no permit was issued no historical effluent data are available.

Dewdale Creek (HUC-14 Unit: 04110003020-010)

Geauga County Scranton Woods WWTP 3PG00155 (RM 42.55 trib Chagrin River (a.k.a. Dewdale Creek) via RM 0.99 trib)

- Treatment processes include extended aeration, sand filters, and chlorine disinfection with dechlorination. The design flow is 0.014 mgd. Current monthly NPDES permit limits are cBOD5 (10 mg/l; 0.53 kg/day); TSS (12 mg/l; 0.64 kg/day); and summer ammonia-N (0.8 mg/l; 0.04 kg/day). The plant discharges to the headwaters of a headwater tributary that enters Dewdale Creek at RM 0.99. An inspection report dated January 6, 2004 indicated a large number of permit violations for chlorine residual in a review of data between March 2002 through September 2003. A smaller number of violations were noted for dissolved

oxygen, TSS, CBOD, and ammonia-N. A follow-up inspection letter dated December 2, 2005 showed 124 permit violations for the same parameters between April 2004 through June 2005, mostly for chlorine residual.

Geauga County Kimberly Estates WWTP 3PG00004 (RM 42.55 trib Chagrin River (a.k.a. Dewdale Creek) via RM 1.77 trib)

- Treatment processes include extended aeration, sand filters, and chlorine disinfection with dechlorination. The design flow is 0.046 mgd. Current monthly NPDES permit limits are cBOD5 (10 mg/l; 1.74 kg/day); TSS (12 mg/l; 2.09 kg/day); and summer ammonia-N (1.5 mg/l; 0.26 kg/day). The plant discharges to the headwaters of a headwater tributary that enters Dewdale Creek at RM 1.77. An inspection report dated January 6, 2004 indicated numerous chlorine residual violations in 2003, which suggests that the dechlorination system was not functioning properly. A small number of violations for dissolved oxygen and ammonia-N were also reported between March 2002 and September 2003. Continued problems with effluent levels of chlorine residual were also noted in a follow-up inspection letter dated December 2, 2005.

Holly Hill Nursing Home WWTP 3PR00351 (RM 42.55 trib Chagrin River (a.k.a. Dewdale Creek) via RM 2.05 trib)

- Treatment processes include trash trap, flow equalization, extended aeration, surface sand filters, and chlorination disinfection with dechlorination. The design flow is 0.015 mgd. Current monthly NPDES permit limits are cBOD5 (10 mg/l; 0.6 kg/day); TSS (12 mg/l; 0.68 kg/day); and summer ammonia-N (1.0 mg/l; 0.06 kg/day). An inspection letter dated November 1, 1999 indicated general compliance with permit limitations.

Camp Ho Mita Koda WWTP 3PR00261 (RM 42.55 trib Chagrin River (a.k.a. Dewdale Creek) via RM 2.05 trib)

- Treatment processes include trash trap, flow equalization, extended aeration, surface sand filters, and chlorination disinfection with dechlorination. The design flow is 0.00625 mgd. Current monthly NPDES permit limits are cBOD5 (10 mg/l; 0.24 kg/day); TSS (12 mg/l; 0.28 kg/day); and summer ammonia-N (1.0 mg/l; 0.02 kg/day).

Ricca Plaza WWTP 3PR00296 (RM 42.55 trib Chagrin River (a.k.a. Dewdale Creek))

- Treatment processes include trash trap, flow equalization, extended aeration, surface sand filters, and chlorination disinfection with dechlorination. The design flow is 0.003 mgd. Current monthly NPDES permit limits are cBOD5 (10 mg/l; 0.11 kg/day); TSS (12 mg/l; 0.14 kg/day); and summer ammonia-N (1.0 mg/l; 0.01 kg/day). An inspection letter dated July 19, 2002 indicated general compliance with permit limitations.

PC Tavern WWTP 3PR00369 (RM 42.55 trib Chagrin River (a.k.a. Dewdale Creek))

- Treatment processes include trash trap, flow equalization, extended aeration, surface sand filters, and chlorination disinfection with dechlorination. The design flow is 0.00175 mgd. Current monthly NPDES permit limits are cBOD5 (10 mg/l; 0.07 kg/day); TSS (12 mg/l; 0.08 kg/day); and summer ammonia-N (1.0 mg/l; 0.007 kg/day). A new WWTP became operational in January 2004. The previous system was an onsite septic tank with failing leach field.

Speedway SuperAmerica WWTP 3PR00226 (RM 42.55 trib Chagrin River (a.k.a. Dewdale Creek))

- Treatment processes include trash trap, flow equalization, extended aeration, surface sand filters, and chlorination disinfection with dechlorination. The design flow is 0.0015 mgd. Current monthly NPDES permit limits are cBOD5 (10 mg/l; 0.06 kg/day); TSS (12 mg/l; 0.07 kg/day); and summer ammonia-N (1.0 mg/l; 0.01 kg/day). A new WWTP became operational in August 1999.

Newbury High School WWTP 3PT00026 (RM 42.55 trib Chagrin River (a.k.a. Dewdale Creek))

- Treatment processes include trash trap, flow equalization, extended aeration, rapid sand filters, and chlorination disinfection with dechlorination. The design flow is 0.030 mgd. Current monthly NPDES permit limits are cBOD5 (10 mg/l; 1.14 kg/day); TSS (12 mg/l; 1.36 kg/day); and summer ammonia-N (1.1 mg/l; 0.13 kg/day). An inspection letter dated November 30, 2005 indicated the plant appeared to be operating satisfactorily, however, a large number of residual chlorine violations were noted, most likely from improper dechlorination.

Beaver Creek (HUC-14 Unit: 04110003020-010)***Heather Hill Hospital WWTP 3PR00075 (Beaver Creek at RM 0.82)***

- Treatment processes include bar/fine screen, extended aeration, flow equalization, sand filters, and ultraviolet disinfection. The plant was expanded around November 2003 and design flow increased from 0.060 mgd to the current 0.100 mgd. Current monthly NPDES permit limits are cBOD5 (10 mg/l; 2.3 kg/day); TSS (12 mg/l; 2.7 kg/day); and summer ammonia-N (1.8 mg/l; 0.41 kg/day). After October 1, 2004 final total phosphorus permit limits of 1.0 mg/l and 0.38 kg/day monthly average became effective. During the 2002-2004 Ohio EPA survey of Beaver Creek and Bass Lake the WWTP was not treating to reduce total phosphorus loadings.
- A compliance inspection letter dated July 19, 2004 indicated that the WWTP appeared to be

in satisfactory operating condition. A review of monthly operating report data from May 2003 through May 2004 showed numerous permit violations, perhaps related to transition of treatment process while the plant was being expanded.

- In 2002 Bass Lake was found to be phosphorus enriched. The fish community in Beaver Creek downstream from the WWTP discharge was not sampled during the 2003-2004 survey. Future surveys of biological and nutrient conditions in Beaver Creek are recommended to monitor effects of phosphorus reductions at the Heather Hill WWTP.

Silver Creek (HUC-14 Unit: 04110003020-020)

Geauga County Surry Downs WWTP 3PG00006 (Silver Creek at RM 1.80)

- Treatment processes include extended aeration, flow equalization, sand filters, and ultraviolet disinfection. The design flow is 0.010 mgd. Current monthly NPDES permit limits are cBOD5 (25 mg/l; 0.90 kg/day); TSS (30 mg/l; 1.1 kg/day); and summer ammonia-N (1.5 mg/l; 0.06 kg/day). A compliance inspection letter dated January 6, 2004 indicated that the plant was in general compliance with its NPDES permit, with some violations for chlorine residual in 2002. The plant was modified in 2003 for ultraviolet disinfection.

ASM International WWTP 3PR00245 (Silver Creek via RM 3.5 trib)

- Treatment processes include extended aeration, flow equalization, sand filters, and chlorination disinfection with dechlorination. The design flow is 0.004 mgd. Current monthly NPDES permit limits are cBOD5 (10 mg/l; 0.15 kg/day); TSS (12 mg/l; 0.18 kg/day); and summer ammonia-N (1.0 mg/l; 0.02 kg/day). The plant began discharging in mid 2000. A review of monthly operating report data from 2003 to 2005 indicated general compliance with permit limits, with the exception of a single elevated ammonia-N value in June 2003.

Aurora Branch Chagrin River (HUC-14 Unit:04110003020-030 & 04110003020-040)

McFarland Creek WWTP, 3PK00010 (Aurora Branch at RM 3.46)

- The McFarland Creek WWTP is a tertiary wastewater treatment works with a design capacity of 1.2 mgd at the time of the 2003 stream survey. Treatment processes include bar screen, grit removal, extended aeration, clarification, rapid sand filters, UV disinfection, and post-aeration. Sludge is aerobically digested and routed to a sludge press and sludge storage pad. The collection system is 100% separate and the influent flow is primarily residential. Current monthly NPDES permit limits are: cBOD5 (8 mg/l; 36 kg/day), TSS (8 mg/l, 36 kg/day), and ammonia-N (1.5 mg/l, 6.8 kg/day), total phosphorus (1.0 mg/l, 4.6 kg/day).

- A compliance inspection letter dated December 15, 2003 indicated violations for total suspended solids and fecal coliform bacteria for the time period of September 2002 through September 2003. A review of self monitoring data showed violations in 2004 and 2005 mostly for total phosphorus, and a single violation for both total lead and CBOD₅. A large number (>100) of reporting violations were also noted. Trends of effluent quality from 1994 to 2004 show stable concentrations, with gradual increase in median discharge flow to near design capacity (Figures 6, 7). By 2003 the WWTP was routinely exceeding its daily average design flow of 1.2 mgd. The WWTP is currently undergoing expansion and effluent flow will increase from 1.2 mgd to 1.8 mgd by installation of membrane bioreactor technology in the existing aeration tanks. This process will allow flow to increase and maintain current loadings by decreasing concentration of pollutants. As of January 2006 the new treatment process was not fully functional but was expected to be in full operation by March 2006. Compliance and bioassay sampling was conducted in May and July of 2006. No permit violations were detected and the effluent was not acutely toxic in tests.

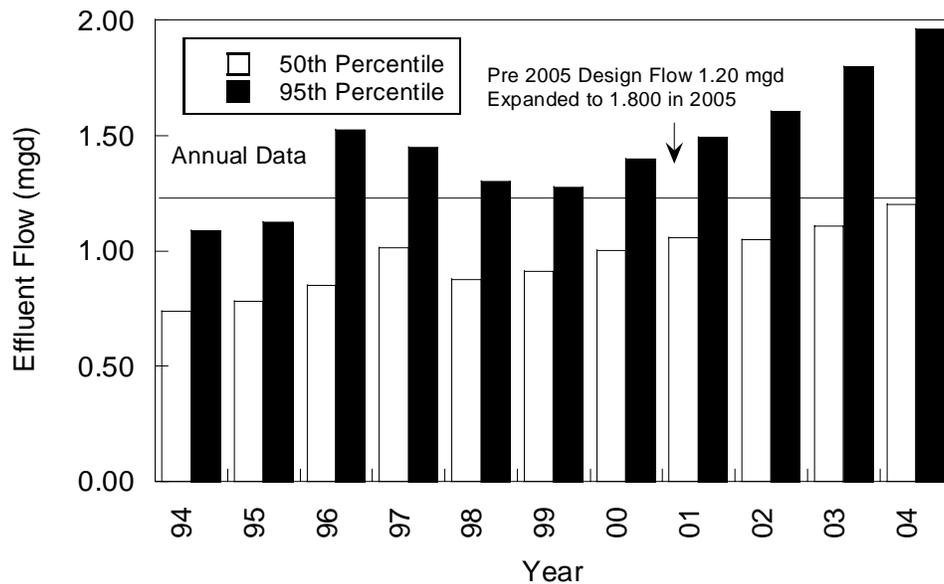


Figure 6. Annual median discharge flow for Geauga Co. McFarland Creek WWTP, 1994-2004.

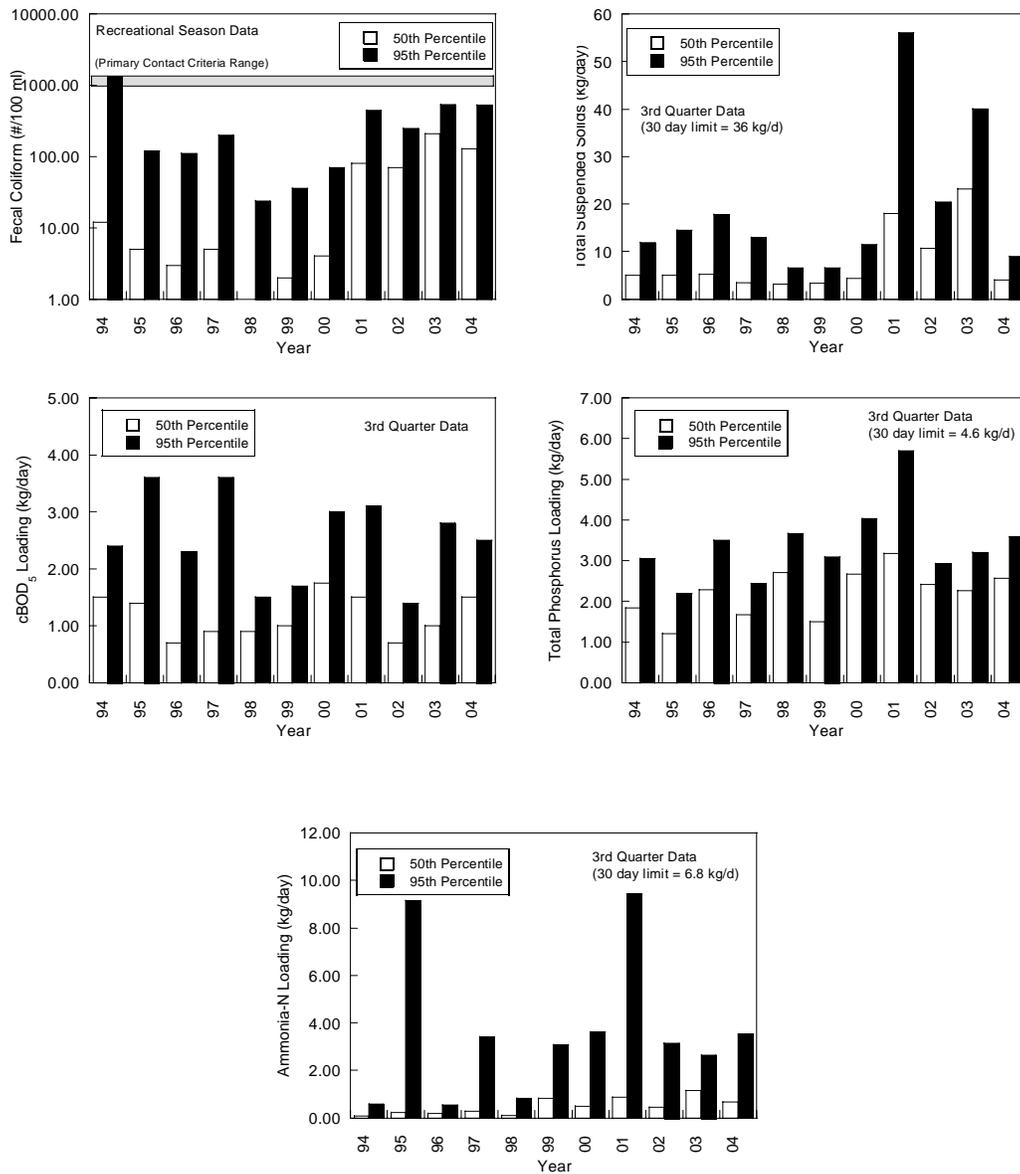


Figure 7. Annual fecal coliform bacteria, total suspended solids (TSS), carbonaceous biochemical oxygen demand (cBOD5), total phosphorus (TP), & ammonia-N concentrations for Geauga Co. McFarland Creek WWTP effluent discharge, 1994-2004.

- The results from the 2003 biological survey showed decline in all three indices at a sample location downstream from the McFarland Creek WWTP discharge as compared to upstream (IBI = 44/38 upst, 30 dwst; MIwb = 8.3/8.4 upst, 7.8 dwst, ICI = 54/50 upst, 48 dwst). The 2003 data reveal a shift from full WWH use attainment upstream from the WWTP discharge to partial attainment downstream from the WWTP. An IBI = 44 was recorded at the mouth of the McFarland Creek tributary of the Aurora Branch, which suggests that the 8-12 point decline in IBI observed in the Aurora Branch downstream from the WWTP is not related to poor fish communities in McFarland Creek.
- The results of the 2003 biological survey differ from conditions observed in 1995, when the Aurora Branch Chagrin River was found to be in full attainment downstream from the McFarland Creek WWTP with partial attainment upstream. For many years the McFarland Creek WWTP has exceeded design flow (Figure 6). Inefficient wastewater treatment due to hydraulic overload above design flow may be a significant causal factor of biological non-attainment observed in 2003 that was not present in 1995. Overall habitat quality in the Aurora Branch as measured by QHEI was identical upstream and downstream from the WWTP (e.g., QHEI = 79.5). It is recommended that a site specific biological survey of the Aurora Branch upstream and downstream from the WWTP should be conducted a few years after the 2006 upgrade to determine ambient biological conditions.

Funtime, Inc. (a.k.a. Geauga Lake Park) WWTP, 3PR00061 (RM 6.78 trib to Aurora Branch Chagrin River at RM 0.70)

- This plant serves the sewage treatment needs for the northern area of the amusement park complex once known as “Gauga Lake Park”. The design flow is 0.155 mgd. Treatment processes include an equalization basin, aeration, clarifier, rapid sand filters, and ultraviolet disinfection. The discharge is to a wetland then to an unnamed tributary that empties into the Aurora Branch Chagrin River just upstream from Pettibone Road at RM 6.78. Current monthly NPDES permit limits are: cBOD5 (10 mg/l; 5.87 kg/day), TSS (12 mg/l, 7.04 kg/day), and ammonia-N (1.5 mg/l, 0.88 kg/day), and total phosphorus (1.0 mg/l, 0.59 kg/day). The most recent inspection of the WWTP noted permit violations for dissolved oxygen and total phosphorus from April 1999 to June 2000. Any potential impact on receiving waters is highly seasonal and greatest when the amusement park is open to the public. Sanitary waste from the previous “Sea World” area of the Funtime, Inc. property is treated by the city of Aurora WWTP. All stormwater flows into Geauga Lake which connects to the headwaters of Pond Brook, a tributary of the Cuyahoga River.

Aurora Central WWTP, 3PC00016 (Aurora Branch at RM 11.15)

- The Aurora Central WWTP is a tertiary wastewater treatment plant with grit removal, flow equalization, extended aeration (oxidation ditch), sand filters, post-aeration, sludge holding,

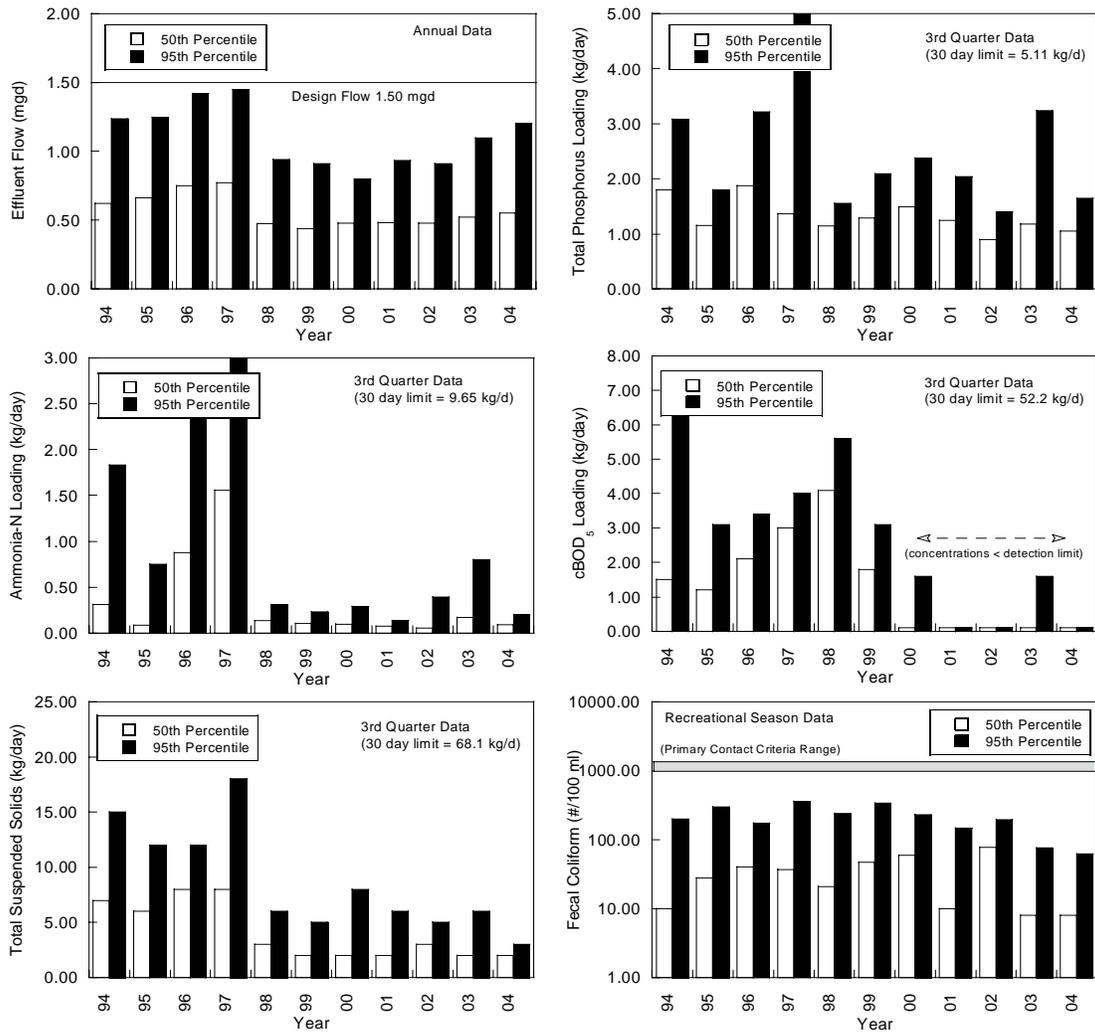


Figure 8. Annual flows, total phosphorus (TP), ammonia - N (NH₃-N), carbonaceous biochemical oxygen demand (cBOD₅), total suspended solids (TSS), fecal coliform bacteria concentrations for Aurora Central WWTP treated effluent, 1994-2004.

and UV disinfection. The City of Aurora received a permit to install for the expansion on May 30, 1996 and initiated construction in November 1996 with the project completed in 1997. This expansion increased design flow from 1.0 mgd to the current 1.5 mgd at an estimated cost of \$4,600,000. The current NPDES permit became effective July 1, 2000 and expired June 30, 2005, a draft renewal permit was public noticed on February 15, 2006. Current monthly NPDES permit limits are cBOD5 (10 mg/l; 56.8 kg/day - winter, 9.2 mg/l; 52.2 kg/day - summer), TSS (12 mg/l; 68.1 kg/day), ammonia-N (1.75 mg/l; 9.94 kg/day - winter, 1.7 mg/l; 9.65 kg/day - summer), total phosphorus (0.87 mg/l; 4.94 kg/day - winter, 0.9 mg/l; 5.11 kg/day - summer).

- An analysis of self-monitoring data from 2002 to 2004 indicates NPDES violations at outfall 001 for total phosphorus (2 violations of monthly average; November 2003, October 2004) and total recoverable copper (2002, 3 monthly average violations; 2003, 4 monthly average violations, 2 weekly concentration violations). Fecal coliform bacteria numbers have remained well below the 1000/100 ml permit limit (2002-2004; geometric mean 15.9/100 ml). Trends of effluent quality from 1994 to 2004 are shown in (Figure 8).
- Bioassay data on potential chronic toxicity of the 001 outfall was collected quarterly by the city during the time period June 2002 through August 2004. The data indicate variable toxicity to both fish (*Pimephales*) which had TUc values of 1.2 in June 2003 and June 2004 and *Ceriodaphnia*, one TUc result of 1.0 in March 2004. Additional bioassay testing is recommended in the draft renewal NPDES permit. Should chronic toxicity be identified in this testing, the permit has conditions which would trigger a toxicity reduction evaluation and effluent chronic toxicity permit limits. The results from the biological surveys indicate full attainment of aquatic life upstream from, and two river miles downstream from, the Aurora Central WWTP discharge.

Yogi Bear's Jellystone Park 3PR00090 (Aurora Branch via RM 16.42 trib, 0.02)

- The current plant has extended aeration treatment, sand filters, flow equalization, and ultraviolet disinfection. The design flow is 0.030 mgd. Current monthly NPDES permit limits are cBOD5 (10 mg/l; 1.1 kg/day); TSS (12 mg/l; 1.4 kg/day); and summer ammonia-N (2.0 mg/l; 0.2 kg/day). An analysis of self monitoring effluent data from 2002 indicated continued violations of NPDES permit limits for ammonia-N, TSS, total residual chlorine, dissolved oxygen, and pH. The potential exists for downstream toxicity from ammonia and low dissolved oxygen and nutrient enrichment since the WWTP does not treat to limit total phosphorus.

Cantex Inc. (a.k.a. Carlon Products, a.k.a. Lamson and Sessions) 3IF00024 (Aurora Branch via RM 16.42 trib, 0.2)

- This facility is a manufacturer of rigid PVC conduit, flexible PVC conduit, PVC piping and PVC compound. Processes include compounding and extrusion. Well water is used for both non-contact and contact cooling water. Cooling water (0.272 mgd design flow) is

discharged via outfall 001. Sanitary wastewater (0.002 mgd design flow) is discharged via outfall 002. A review of monthly operating report data from January 2003 to December 2005 showed a number of permit violations at sanitary outfall 001 for CBOD, ammonia-N, TSS, and oil & grease. Loadings between 1994 and 2004 appear to be stable for those parameters where long-term data are available.

Rockin Robin Mobile Home Park WWTP, 3PV00058 (Aurora Branch via RM 16.60 trib)

- This is an extended aeration plant that serves about 648 people living in a mobile home park on a yearly basis. The design flow is 0.066 mgd. Current treatment includes aeration, flow equalization, dosing, slow sand filters, chlorine disinfection, dechlorination, and sludge holding. The effluent discharges to an unnamed tributary within the headwaters of the Aurora Branch of the Chagrin River. Current monthly NPDES permit limits are cBOD5 (10 mg/l; 2.5 kg/day); TSS (12 mg/l; 3.0 kg/day); and summer ammonia-N (2.0 mg/l; 0.5 kg/day).
- An analysis of self monitoring effluent data from 2002 to March 2005 showed NPDES permit violations for TSS, ammonia-N, fecal coliform, and dissolved oxygen. A March 24, 2005 Ohio EPA compliance report indicated that TSS has been consistently violated during this time period, due to problems with plugging of sand filters. The potential exists for downstream nutrient enrichment since the WWTP does not treat to limit total phosphorus.

McFarland Creek (HUC 14:04110003020-040)

Kenston Local Schools WWTP 3PT00051 (McFarland Creek between RM 5.2-5.6)

- One plant serves the Gardiner Elementary School (permit outfall 001) and a second plant serves the Kenston Middle School and High School (outfall 003). Both plants discharge to small tributaries that empty into the headwaters of McFarland Creek. Permit limits are TSS (12 mg/l, 0.45, 1.36 kg/day); cBOD5 (10 mg/l, 0.38, 1.14), ammonia-N (1.0 mg/l, 0.04; 0.11 kg/day) for outfalls 001 and 003. Treatment processes at both plants include extended aeration, sand filters, and UV disinfection. The permit was recently renewed and no permit violations were noted in a review of the compliance data.

Lower Chagrin - East Branch Assessment Unit (Hydrologic 11 Unit: 04110003-030)

The Lower Chagrin - East Branch Assessment Unit (**HUC 04110003 030**) comprises the drainage area and all lower Chagrin River tributaries beginning from downstream from the Aurora Branch Chagrin River confluence (\leq RM 27.09) to the mouth including the East Branch Chagrin River drainage area.

*Chemical Water Quality Assessment for Lower Chagrin - East Branch Assessment Unit****Chagrin River Mainstem (HUC-14 Units: 04110003030-010; 04110003030-030)***

Chemical samples were collected from eight locations along the lower Chagrin River mainstem (RM 25.30 to RM 2.72). These sites are located within two HUC-14 watersheds. Samples were not collected downstream from RM 2.72. In January, 2005 the low head dam at Daniels Park (RM 4.96) was breached as a result of ice damage. Because this event occurred after the 2003-04 Ohio EPA survey, the removal of this dam has no bearing on interpretation of the data in this report. This segment of the Chagrin River mainstem is designated WWH for protection of aquatic life.

In general, the chemical water quality in the lower Chagrin River mainstem was well within water quality criteria. A list of chemical exceedences of water quality criteria for protection of aquatic life is found in Table 5. All sample sites within the lower segment of the Chagrin River supported full attainment of aquatic life for both fish and benthic macroinvertebrate communities. Long-term chemical, bacteria, and flow data are available at RM 4.95 (Daniels Park), just downstream from the confluence of the East Branch. Analysis of data collected at this location (1998-2004) showed only a few grab samples where two heavy metals (total copper, lead) were elevated above concentrations that exceed water quality criteria. These sample events were associated with turbid water and high stream flow. The average concentration of heavy metals within this segment of the Chagrin River were well below chronic water quality criteria. Similar observations of spikes of heavy metals associated with elevated stream flow and turbid conditions were made during the previous chemical survey of this river segment (Ohio EPA, 1997).

Nutrient data (total phosphorus and nitrate-nitrite) collected at Daniels Park (1995 to 2004) show relatively stable concentrations over time (Figure 9). Average total phosphorus concentration has been maintained at a level less than 0.10 mg/l, total nitrate-nitrite less than 1.0 mg/l. These values are within Ohio EOLP ecoregion background concentrations expected from large river systems (Rankin & Miltner, 1998). During the 2003-04 survey nutrient concentrations in the lower Chagrin River mainstem did not differ significantly from site to site (Figure 10). It does not appear that the loadings of nutrients from the numerous wastewater treatment plants that discharge into the lower Chagrin River mainstem are at levels that exceed the ability of the aquatic ecosystem to remove them. Relatively stable concentrations of total suspended solids (TSS) were also observed throughout the lower mainstem (Figure 10). Concentrations of total phosphorus were significantly and positively associated with concentrations of TSS, however, nitrate-nitrite concentrations were not positively associated with TSS concentrations (Figure 10). Over 90 % of the variance in total phosphorus concentration from grab water samples was predicted by the concentrations of total suspended solids.

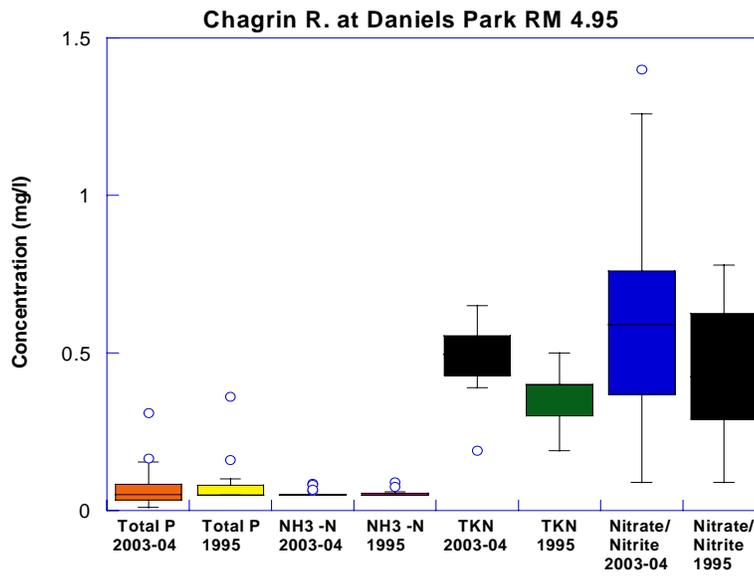
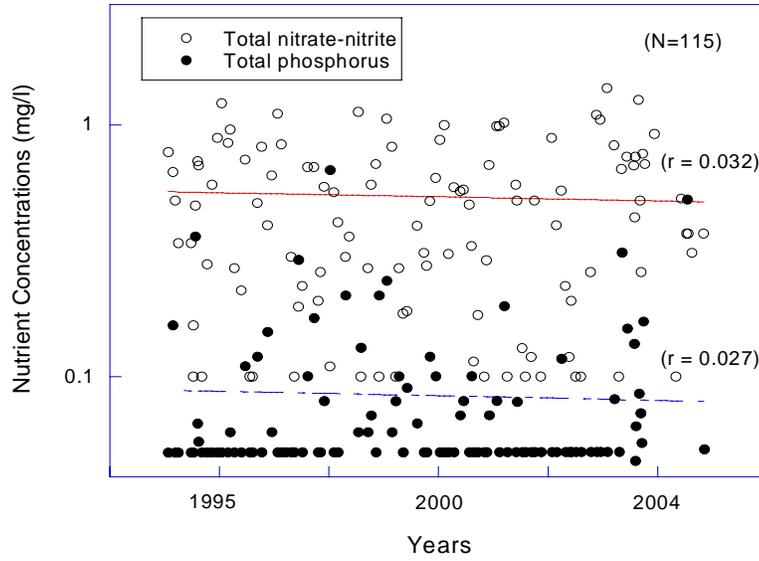


Figure 9. Comparisons of nutrient concentrations (total nitrate-nitrites, total Kjeldahl nitrogen (TKN), ammonia-nitrogen (NH₃ - N), and total phosphorus (TP)) for lower Chagrin River at Daniels Park, RM 4.95.

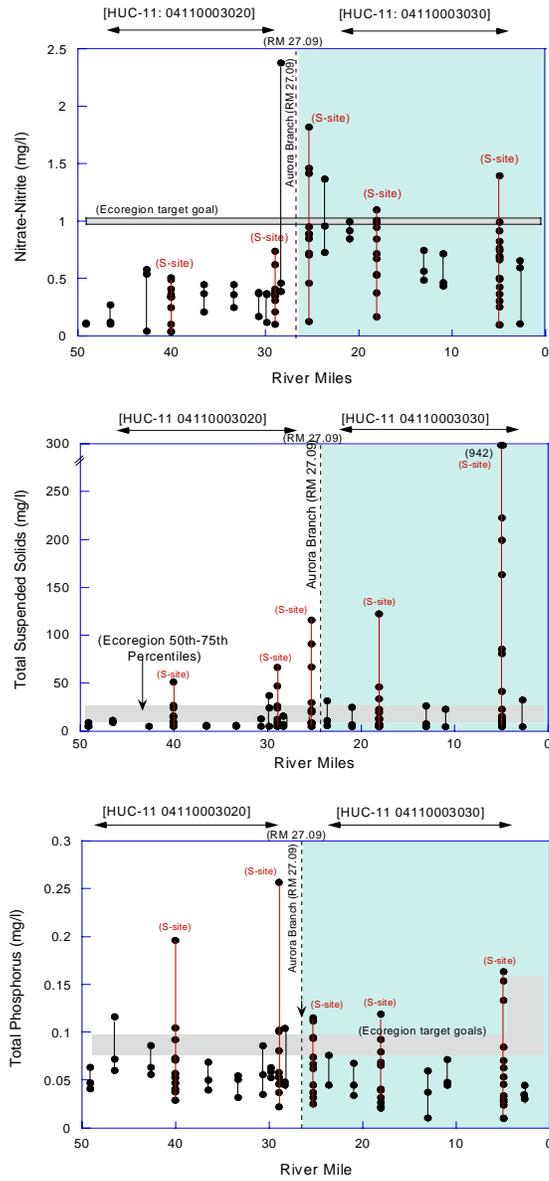


Figure 10. Ambient nitrate-nitrite, total suspended solids (TSS), and total phosphorus (TP) concentrations (mg/l) for Chagrin River mainstem, 2003-04.

Table 11. List of significant (> 0.001 mgd) NPDES permitted wastewater dischargers within the Lower Chagrin - East Branch Assessment Unit (**04110003 030**) of the Chagrin River basin. Entities sorted by HUC-14 assessment units.

Entity/ (Stream-River Mile)	Ohio Permit	NPDES	Flow (mgd)	Latitude	Longitude	Permit Expires
HUC 11: 04110003030						
Woodbran Realty WWTP (Willey Creek-RM 4.66) [HUC: 04110003030-010]	3PU 00001	OH00 44555	0.520	41.4561	-81.4750	6/30/2005 (draft renewal pending)
Pepper Pike Creekside WWTP (RM 22.81 trib. to Chagrin R-at RM 3.43.) [HUC: 04110003030-010]	3PH 00018	OH00 21130	0.350	41.4717	-81.4423	10/31/2010
Geauga Co. Valley View WWTP (Griswold Creek-RM 7.6) [HUC: 04110003030-010]	3PG 00153	OH01 23625	0.200	41.5177	-81.3496	12/31/2007
Pepper Pike-Pepper Hill WWTP (RM 22.81 trib. to Chagrin R. at RM 5.59) [HUC: 04110003030-010]	3PG 00048	OH00 21199	0.094	41.4934	-81.4576	To be abandoned 6/2006
Moreland Hills Woodland Glen WWTP (RM 22.81 trib Chagrin R. at RM 2.17,0.34) [HUC: 04110003030-010]	3PA 00011	OH00 21245	0.080	41.4601	-81.4305	10/31/2007
Moreland Hills Jackson Valley WWTP (Willey Creek-RM 2.01) [HUC: 04110003030-010]	3PA 00023	OH00 63878	0.060	41.4601	-81.4305	8/31/2007
Geauga Co. Scarsdale WWTP (RM 24.91 trib. Chagrin R at RM 0.84.) [HUC: 04110003030-010]	3PG 00000	OH00 28916	0.026	41.4529	-81.3889	1/31/2007
Moreland Hills Quail Hollow WWTP (RM 23.93 trib Chagrin R. at RM 0.86) [HUC: 04110003030-010]	3PA 00009	OH00 21202	0.020	41.4528	-81.4189	8/31/2007
Gates Mills WWTP (RM 16.9 to Chagrin R.) [HUC: 04110003030-010]	3PA 00035	OH01 28643	0.015	41.5294	-81.4113	6/30/2006 (draft renewal pending)

Table 11 continued.

Entity/ (Stream-River Mile)	Ohio Permit	NPDES	Flow (mgd)	Latitude	Longitude	Permit Expires
Geauga Co. Willow Hill WWTP (Caves Creek-RM 4.20) [HUC: 04110003030-010]	3PG 00009	OH00 28894	0.013	41.5619	-81.3595	12/31/2006
Kirtland Shenandoah Estates WWTP (Caves Creek-RM 3.34) [HUC: 04110003030-010]	3PG 00065	OH00 39004	0.0125	41.5707	-81.3570	8/31/2007
Moreland Village Greentree WWTP (Chagrin River-RM 25.77) [HUC: 04110003030-010]	3PA 00010	OH00 21229	0.010	41.4340	-81.4110	8/31/2007
Western Reserve Health Center WWTP (Stoney Brook-RM 1.80) [HUC: 04110003030-020]	3PR 00137	OH01 00994	0.041	41.6089	-81.3477	4/30/2008
Geauga Co. Sherman Hills WWTP (RM 15.87 trib. E.Br.Chagrin R. at RM 1.93) [HUC: 04110003030-020]	3PG 00005	OH00 28851	0.040	41.5358	-81.3224	2/28/2007
Kirtland Hickory Hill Colony WWTP (RM 1.10 trib. Stoney Brook at RM 2.10) [HUC: 04110003030-020]	3PG 00059	OH00 36803	0.030	41.6043	-81.3276	10/31/2006
Kirtland Local Schools WWTP (RM 1.85 trib Quarry Creek at RM 0.47, 0.6) [HUC: 04110003030-020]	3PT 00023	OH00 44644	0.030	41.6211	-81.3619	4/30/2208 (to regional Mentor plant, 9/08)
Olde Towne Tavern WWTP (RM 0.78 trib to Caves Creek, at RM 1.70) [HUC: 04110003030-020]	3PR 00170	OH01 17803	0.0025	41.5836 (for WWTP)	-81.3715	10/31/2010
Eagle Road MHP WWTP (RM 1.37 trib. Stoney Brook at ~ RM 0.80) [HUC: 04110003030-020]	3PV 00071	OH01 03365	0.025	41.6085	-81.3440	10/31/2009

Table 11 continued.

Entity/ (Stream-River Mile)	Ohio Permit	NPDES	Flow (mgd)	Latitude	Longitude	Permit Expires
Kirtland Templeview WWTP (Stoney Brook-RM 1.0) [HUC: 04110003030-020]	3PR 00240	OH01 28783	(not built)	41.6184	-81.3542	12/31/2005 (to regional Mentor plant, 9/08)
Hilltop Apartments WWTP (Stoney Brook-RM 0.55) [HUC: 04110003030-020]	3PR 00106	OH00 89877	0.020	41.6233 (for WWTP)	-81.3592	6/30/2010 (to regional Mentor plant, 9/08)
Kirtland MHP WWTP (Stoney Brook-RM 2.15) [HUC: 04110003030-020]	3PV 00074	OH01 11953	0.020	41.6070	-81.3471	12/31/2007
Kirtland Plaza WWTP (RM 1.85 trib Quarry Creek, at RM 0.47 trib, at 0.50) [HUC: 04110003030-020]	3PR 00160	OH01 17471	0.010	41.6188 (for WWTP)	-81.3607	2/29/2008 (to regional Mentor plant, 9/08)
Kirtland City Tavern WWTP (Stoney Brook-RM 3.10) [HUC: 04110003030-020]	3PR 00238	OH01 28767	0.002	41.5991	-81.3466	5/31/2005 (permit action pending)
Kirtland Shopping Center WWTP (Stoney Brook-RM 0.68) [HUC: 04110003030-020]	3PR 00152	OH01 03101	0.006	41.6211 (for WWTP)	-81.3574	8/31/2005 (to regional Mentor plant, 9/08)
Lake Metroparks Penitentiary Glen WWTP (RM 1.1 trib Stoney Brook at RM 0.6) [HUC: 04110003030-020]	3PR 00375	OH01 34643	0.005	41.6131 constructed wetland	-81.3335	6/30/2009
Latter Day Saints Visitor Center WWTP (East Br. Chagrin R.-RM 2.85) [HUC: 04110003030-020]	3PR 00115	OH00 90123	0.005	41.6306 (for WWTP)	-81.3622	3/31/2010 (to regional Mentor plant, 9/08)
Edgewood Condominiums WWTP (Stoney Brook-RM 0.92) [HUC: 04110003030-020]	3PW 00022	OH01 03098	0.0025	41.6195 (for WWTP)	-81.3560	6/30/2010 (to regional Mentor plant, 9/08)
HUC-11 Total	# = 26		1.6395			

Other Tributaries except Ward Creek (HUC-14 Unit: 04110003030-010)

Chemical samples were collected from a select number of tributaries to the lower Chagrin River mainstem including “Pepper-Luce Creek” (unnamed RM 22.81 trib), Griswold Creek, Caves Creek, and “Gully Brook” (unnamed RM 5.54 trib). Pepper-Luce Creek and Gully Brook have an existing WWH aquatic life use designation, Griswold Creek is designated CWH, and the currently undesignated Caves Creek is recommended for CWH aquatic life use based on the presence of cold water adapted fish and benthic macroinvertebrate taxa during the 2003-04 survey.

“Gully Brook” (unnamed RM 5.54 tributary to Chagrin River) is a highly urbanized watershed with no significant WWTPs present in the basin. In general, WWH chemical criteria were met at the RM 0.6 location, however, lab conductivity was elevated (1280-1490 umhos, n=3), mostly from elevated sodium and chloride ions. The source of salt ions in the watershed is unknown, but a significant amount of stormwater runoff from Interstate I-70 and large commercial areas enters this stream. High conductivity is known to negatively affect mayflies. Total phosphorus was not elevated (<0.010-0.039 mg/l, n=3). Water temperature ranged from 16.95 to 22.12 C°, n=3. The stream channel was deeply incised with visual evidence of highly fluctuating flows and severe bank erosion. The aquatic life attainment status of Gully Brook could not be determined because no biotic index values (IBI, ICI) were measured, although the macroinvertebrate community was found to be Marginally Good. Future surveys are recommended to determine the status of aquatic life use, potential sources of salt runoff, and effects of urban runoff on the stability of the stream channel.

Caves Creek (RM 11.52 tributary to Chagrin River) receives treated effluent from three minor WWTPs (Geauga County Willow Creek WWTP, Kirtland Shenandoah Estates WWTP, Olde Towne Tavern WWTP), which have a combined design flow of 0.029 mgd. Chemical samples collected at RM 0.88, downstream from these WWTPs, showed a single elevated total phosphorus value (0.137 mg/l on 7/22/2004). All chemical parameters met CWH criteria. Water temperature in Caves Creek ranged from 16.15 to 20.52 C°, n=3. The results of the biological surveys indicate that Caves Creek was in full attainment of a recommended CWH aquatic life use.

A survey of primary headwater habitat (PHWH) streams within the Caves Creek watershed has been completed by the Lake County Soil and Water Conservation district following assessment methods developed by the Ohio EPA (2002):[http://www.epa.state.oh.us/dsw/wqs/headwaters/PHWHManual_2002_102402.pdf]; [http://www.epa.state.oh.us/dsw/wqs/headwaters/PHWHManual_2002_att3update_apr05.pdf] (Communication with Matt Sharver, Lake County SWCD). A primary headwater habitat stream is defined by Ohio EPA as a surface water of the state having a defined bed and bank, with either continuous or periodical flowing water, with a watershed area less than or equal to 1.0 mi² (259 ha), and maximum depth of water pools equal to or less than 40 cm (Ohio EPA, 2002). The Lake County SWCD survey identified 27 primary headwater waterways within the Caves Creek watershed, with 19 meeting the definition of a PHWH stream.

Of the 19 assessed streams, 68.4 % were found to be Class III-PHWH, 21.0 % Class II-PHWH, 5.2 % Class I-PHWH, and 5.2 % modified Class I. Class III-PHWH streams represent perennial flowing waterways with good taxa diversity and representative vertebrate (fish and amphibian) and macroinvertebrate taxa adapted to cold or cool habitats having ground water origin. The high percentage of documented cool to cold water Class III-PHWH streams flowing into the mainstem of Caves Creek underscores the importance of including the primary headwaters of watersheds into future land use management plans.

Pepper-Luce Creek (unnamed RM 22.81 tributary to Chagrin River) receives treated wastewater from the Pepper Pike Creekside and Pepper Hill WWTPs, and the Moreland Hills Woodland WWTP (combined effluent design flow of the three WWTPs = 0.524 mgd). Although full attainment (with non-significant departure for fish IBI) of WWH aquatic life use was achieved at RM 0.3-0.2, nutrient enrichment, as well as siltation from urban runoff, were determined to be stressors that threaten the ability of this tributary to maintain future WWH biological communities. There has been a 12 point decline in the fish IBI compared to the previous Ohio EPA survey in 1995 (IBI = 50 in 1995, IBI = 38 in 2004), while the benthic macroinvertebrate community has maintained a Marginally Good narrative evaluation, with little change in habitat quality (QHEI = 60.5 in 1995, QHEI = 66.5 in 2004). The stability in habitat quality over time suggests a differential response of the fish and macroinvertebrate communities to chemical stressors, perhaps associated with the many WWTP discharges, which may account for the 12 point reduction in IBI score. The concentration of total phosphorus was elevated on average in Pepper-Luce Creek at RM 0.2 (median = 0.124, n=3). Water temperature in Pepper-Luce Creek ranged from 18.71 to 21.77 C°, n=3.

Griswold Creek (RM 23.82 tributary to Chagrin River) is a designated CWH stream for protection of aquatic life. It carries treated effluent from the Geauga County Valley View WWTP (discharge at RM 7.6). Higher nutrient concentrations (total phosphorus, nitrate-nitrite) were recorded in the headwaters of Griswold Creek at RM 4.4, closer to the WWTP discharge, compared to RM 0.02. Water temperature in Griswold Creek at the two sample locations ranged from 14.86 to 20.47 C° (n=6), with cooler temperatures at the upstream location (RM 4.4). All other chemical parameters met CWH water quality criteria.

Tributaries not sampled in 2003-04

The unnamed tributary to the Chagrin River at RM 14.88 was not sampled during the 2003-04 survey. This tributary was determined to be in partial attainment of its recommended WWH aquatic life use in the previous survey (Ohio EPA, 1997). The Cuyahoga County Hickory Hills WWTPs discharge was eliminated in 1996. This tributary should be targeted for a future biological and chemical survey to determine how the biology has responded to the elimination of the Hickory Hills WWTP discharge.

The unnamed tributary to the Chagrin River at RM 23.93 was not sampled during the 2003-04

survey. This stream currently receives treated effluent from the city of Moreland Hills Quail Hollow WWTP. This tributary should be targeted for a future biological and chemical survey to determine current conditions. No previous survey of this tributary has been conducted.

The unnamed tributary to Chagrin River at RM 24.19 was not sampled during the 2003-04 survey. This stream currently receives treated effluent from the Geauga County Scarsdale WWTP. This tributary should be targeted for a future biological and chemical survey to determine current conditions. No previous survey of this tributary has been conducted.

Willey Creek (RM 26.31 tributary to Chagrin River) was not sampled during the 2003-04 survey. Previous sampling (Ohio EPA, 1997) showed full attainment of CWH biological criteria. Willey Creek was re-designated CWH after the 1997 survey based on the presence of cold water adapted taxa. Willey Creek currently receives treated effluent from the Woodbran Reality WWTP (0.520 mgd design flow) and the Moreland Hills Jackson Valley WWTP (0.060 design flow). A future biological and chemical survey is recommended to determine if these point sources are having a negative impact on the designated CWH aquatic life potential of Willey Creek.

East Branch Chagrin River and Tributaries (HUC-14 Unit: 04110003030-020)

East Branch Mainstem

The East Branch Chagrin River is designated Cold Water Habitat (CWH) for protection of aquatic life, including all tributaries. The East Branch from RM 14.49 (Heath Road) to the mouth also is designated Outstanding State Resource Water in OAC 3745-1-05, and thus has the potential to support aquatic communities of high diversity. The East Branch watershed was not sampled biologically during the previous Ohio EPA surveys.

Chemical samples were collected from three stations along the East Branch Chagrin River mainstem (RM 14.5 to 2.35). In general, chemical water quality at all sites met the CWH chemical criteria, although it is unknown if summer water temperature has been elevated above historical background levels due to human activities. According to OAC (3745-1-07, Table 7-1), for CWH streams, "at no time shall the water temperature exceed the temperature which would occur if there were no temperature change attributable to human activities". The stream temperatures recorded for the three East Branch mainstem sites over summer months (July, August) ranged from 22.52 to 14.67° C. (mean = 19.62, SD = 2.59, n=12). Analysis of data from the East Branch mainstem did show that the most downstream site at Markell Rd.(RM 2.35) was, on average, 2.89° C. warmer than the most upstream site at Heath Rd. (14.50). Analysis of a larger set of data collected from the two East Branch sentinel sites (Markell Rd., Mitchells Mill Rd.) confirmed that water temperature at the downstream site at Markell Rd. was significantly higher throughout the year (mean 16.79° C.) compared to the upstream station at Mitchell Mill Rd. (mean 15.50° C.; paired sites *t*-test, *p* = 0.0002, DF = 11). Water temperature would be expected to increase in a downstream direction as more treated effluent is added to the system and as loss of riparian shade cover increases. Biological

sampling indicated that the East Branch was in non attainment of its CWH use potential at Markell Road, and the two sampled upstream locations were in full attainment but were of declining quality. Future studies are recommended to determine the stressors that are negatively impacting the ability of the East Branch Chagrin River to fully attain its CWH aquatic life designation. Attention should be given to water temperature and its association with loss of riparian habitat.

East Branch Chagrin River Tributaries

Chemical samples were collected from a select number of tributaries of the East Branch Chagrin River, including Stoney Brook, three unnamed streams, and the locally named “Stebbins Gulch” (Table 2). In general, no violations of either WWH or CWH chemical criteria were recorded in any of the tributaries to the East Branch.

The unnamed tributary to the East Branch at RM 10.13 had the lowest range of summer temperature of all the tributaries sampled within this HUC-11 watershed (15.40° C. to 13.00 ° C., n=3). No significant NPDES wastewater treatment plants are known to discharge to this tributary. These data suggest that this tributary may maintain seasonal water temperatures at values that represent ecoregion background conditions with minimal impact from humans. In contrast to the very cold RM 10.13 tributary, Stoney Brook had a much higher range of temperatures on the same sample dates (average 20.47° C. compared to 17.03° C., n=3). One likely source of warm water is the presence of ten WWTPs that add treated effluent to the Stoney Brook watershed upstream from the chemical sample location (Table 11). Stoney Brook also receives sewage water from failing home sewage systems that discharge to primary headwater streams and ditches. Detailed plans have been submitted to Ohio EPA to eliminate many of these WWTPs and unsewered areas. One option is to have the widespread minor WWTPs and unsewered areas connect to the regional treatment plant in Mentor, which has direct discharge to Lake Erie. For this project, attention should be directed to an assessment of best management practices that would be needed to ensure that the increase in urbanization that would result from expanding sanitary sewers to the Kirtland area, does not negatively impact the existing CWH aquatic community due to increased runoff of warm water from impervious areas and storm water detention basins.

No chemical samples were collected from Pierson Creek. The unnamed tributary that empties into the East Branch at RM 10.6 (Stebbins Gulch) showed good chemical quality. Stream temperature ranged from 13.98 to 19.59 C°, n=3. Results of biological surveys indicate that both streams maintain CWH biological communities of fish and benthic macroinvertebrates. A survey of the primary headwater stream network for these two watersheds has been completed by the Lake County Soil Water Conservation district (see discussion for Caves Creek for details). For the Stebbins Gulch watershed, 39.5 % of 43 assessed primary headwater streams were found to be Class III-PHWH, 25.5 % Class II, 9.3 % modified Class II, 20.9 % Class I, and 4.6 % modified Class I. For the Pierson Creek watershed, of 42 assessed streams, 35.7 % were Class III-PHWH, 50 % Class II, 2.3 % modified Class II, 9.5 % Class I, and 2.3 % modified Class I. Watershed management plans will be needed to target protection of water temperature and intact riparian zones for the Class

III-PHWH stream corridors in order to maintain the very high quality CWH biological communities currently present in the Stebbins Gulch and Pierson Creek watersheds. Portions of each watershed are owned by the Holden Arboretum.

Ward Creek (HUC-14 Unit: 04110003030-030)

Ward Creek is designated WWH for protection of aquatic life and empties into the Chagrin River mainstem at RM 1.0. It is the major waterway within its HUC-14 watershed. Ward Creek was sampled at a single location at RM 0.80 near the Robin Road pump station. No significant WWTPs discharge to Ward Creek, however, urban runoff is extensive (about 25% of the watershed is in urban land use) and includes residential and commercial sources as well as a golf course and airport. Results from the biological survey indicate that Ward Creek at RM 0.8 was in non-attainment of its WWH aquatic life designated use. However, no specific chemical stressors were identified. Total phosphorus was not elevated (0.033 - 0.058 mg/l, n=3). A future survey will need to be conducted for the Ward Creek watershed to identify the causes and sources of the documented non-attainment for biological communities. Excessive water energy from impervious area runoff, siltation and loss of riparian habitat are likely stressors on biology given the urban nature of the watershed, and should be the focus of future water quality studies.

Pollutant Loadings (1994-2004) for Lower Chagrin - East Branch Assessment Unit

Chagrin River Mainstem (HUC-14 Units: 04110003030-010; 04110003030-030)

Village of Moreland Hills Greentree WWTP 3PA00010 (Chagrin River at RM 25.77)

- Treatment processes include trash trap, flow equalization, aeration/clarifier, fixed media filters, sand filters, and chlorine disinfection with dechlorination. The design flow is 0.010 mgd. Current monthly NPDES permit limits are cBOD5 (10 mg/l; 0.4 kg/day); TSS (12 mg/l; 0.5 kg/day); and summer ammonia-N (2.0 mg/l; 0.08 kg/day). A compliance inspection letter dated June 13, 2002 indicated that the plant was in general compliance with its NPDES permit.

Village of Gates Mills WWTP 3PA00035 (Chagrin River at RM 16.9)

- This plant is operated by the Cuyahoga County Engineers office for the village of Gates Mills. Treatment processes include trash trap, flow equalization, extended aeration, fixed media filters, sand filters, chlorine disinfection and dechlorination. The design flow is 0.015 mgd. Monthly NPDES permit limits are cBOD5 (10 mg/l; 0.57 kg/day); TSS (12 mg/l; 0.68 kg/day); and summer ammonia-N (1.0 mg/l; 0.06 kg/day). A compliance inspection report dated December 14, 2005 identified diverting and bypassing of treatment processes, and recurring effluent violations were noted for ammonia-N, chlorine residual, D.O., and pH.

Other Tributaries except Ward Creek (HUC-14 Unit: 04110003030-010)***Woodbran Realty WWTP 3PU00001 (Willey Creek, RM 4.66)***

- Treatment processes include extended aeration treatment, clarifiers, rapid sand filters, phosphorus removal, and ultraviolet disinfection. The design flow is 0.520 mgd. Current monthly NPDES permit limits are cBOD5 (8 mg/l; 15.7 kg/day); TSS (8 mg/l; 15.7 kg/day); and summer ammonia-N (1.67 mg/l; 3.3 kg/day). An inspection report dated October 12, 2005 indicated the presence of a bypass around the sand filters during high flows that receives disinfection before discharge. This bypass was identified as a violation of current NPDES permit conditions. A review of monthly operating report data from January 2002 through August 2005 showed general compliance with NPDES permit limitations, although some reporting violations were noted.

Village of Moreland Hills Jackson Valley WWTP 3PA00023 (Willey Creek at RM 2.01)

- Treatment processes include trash trap, flow equalization, extended aeration, slow sand filters, clarification, and chlorination plus dechlorination. Current monthly NPDES permit limits are cBOD5 (10 mg/l; 2.3 kg/day); TSS (12 mg/l; 2.7 kg/day); and summer ammonia-N (2.2 mg/l; 0.5 kg/day). The design flow is 0.060 mgd. A compliance inspection letter dated June 13, 2002 indicated that “daily flows continue to significantly exceed the plant design flow”. No permit violations were noted.

Hawken School WWTP 3PT00110 (RM 17.80 trib Chagrin River at RM ~ 1.5)

- Treatment processes include extended aeration, slow sand filters, and chlorination plus dechlorination. The design flow is 0.015 mgd. Current monthly NPDES permit limits are cBOD5 (10 mg/l; 0.57 kg/day); TSS (12 mg/l; 0.68 kg/day); and summer ammonia-N (1.0 mg/l; 0.05 kg/day). An inspection report dated June 14, 2001 indicated that the plant was in general compliance with NPDES permit limitations.

Pepper Pike Creekside WWTP 3PH00018 (RM 22.81 trib Chagrin River [a.k.a. Pepper-Luce Creek] at RM 3.43)

- This WWTP is owned by the city of Pepper Pike but operation and maintenance is under control of Cuyahoga County Sanitary Engineer via a 1983 memorandum of agreement. Treatment processes include extended aeration, clarifiers, sand filters, and ultraviolet disinfection replaced chlorine in mid 2005. Phosphorus is not removed but monitored, thus the potential exists for the discharge to contribute to nutrient enrichment to Pepper-Luce

Creek. The design flow is 0.350 mgd. An inspection report dated July 14, 2005 indicated that flow exceeded average design flow on 699 of 1,917 reporting days since 1997. A review of monthly operating report data from March 2000 through May 2005 showed a number of permit violations for TSS. Some reporting violations also were noted. Current monthly NPDES permit limits are cBOD5 (10 mg/l; 13.2 kg/day); TSS (12 mg/l; 15.9 kg/day); and summer ammonia-N (1.49 mg/l; 1.97 kg/day).

Pepper Pike Pepper Hill WWTP 3PG00048 (RM 22.81 trib Chagrin River [a.k.a. Pepper-Luce Creek] at RM 5.59)

- This plant is owned by the city of Pepper Pike but operation and maintenance of the sewerage system is under control of Cuyahoga County Sanitary Engineer via a 1983 memorandum of agreement. The plant (0.094 mgd design flow) will be eliminated and tied into the NEORSD Easterly WWTP by July 2006. A review of the monthly operating report data from 1995 to 2005 shows on-going violations for TSS, chlorine, fecal coliform bacteria and plant by-passes during wet weather. The NPDES permit expired on September 27, 1992 and has been in long-term litigation. The complete elimination of the discharge should significantly reduce pollutant loadings to Pepper-Luce Creek. The discharge has been eliminated as of December 31, 2006.

Village of Moreland Hills Woodland Glen WWTP 3PA00011 (RM 22.81 trib Chagrin River [a.k.a. Pepper-Luce Creek] at RM 2.17, 0.34)

- Treatment processes include trash trap, flow equalization, extended aeration, clarifiers, fixed media filters, rapid sand filters, and ultraviolet disinfection. The design flow is 0.080 mgd. Current monthly NPDES permit limits are cBOD5 (5 mg/l; 1.5 kg/day); TSS (6 mg/l; 1.8 kg/day); and summer ammonia-N (1.75 mg/l; 0.53 kg/day). A compliance inspection report dated June 13, 2002 indicated general compliance with NPDES permit limitations.

Geauga County Valley View WWTP 3PG00153 (Griswold Creek at RM 7.6)

- This plant is owned by the Geauga County Board of Commissioners. It has a design flow of 0.200 mgd. The plant began operation in 1997 to eliminate widespread problems with failing home septic tank systems. Current monthly NPDES permit limits are cBOD5 (10 mg/l; 7.57 kg/day); TSS (12 mg/l; 9.08 kg/day); and summer ammonia-N (1.00 mg/l; 0.76 kg/day). An inspection report dated December 2, 2005 indicated general compliance with NPDES permit limitations with the exception of occasionally low dissolved oxygen values less than 6.0 mg/l (range 4.4 to 5.7 mg/l, n=16 from review of data between August 2004 through September 2005). Griswold Creek was found to be in non attainment of its Cold

Water Habitat aquatic life use at a location downstream from the WWTP discharge.

Metzemaum Opportunity School WWTP 3PG00076 (Griswold Creek at ~ RM 7.0)

- This plant has a design flow of 0.020 mgd. Current monthly NPDES permit limits are cBOD5 (10 mg/l; 0.76 kg/day); TSS (12 mg/l; 0.91 kg/day); and summer ammonia-N (1.00 mg/l; 0.08 kg/day). An inspection report dated December 2, 2005 indicated the plant would need upgrades to meet final effluent limitations. A single violation of total residual chlorine was noted.

Kirtland Shenandoah Estates WWTP 3PG00065 (Caves Creek at RM 3.34)

- Treatment processes include trash trap, extended aeration, surface sand filters, and chlorination and a constructed wetland. The design flow is 0.0125 mgd. Current monthly NPDES permit limits are cBOD5 (10 mg/l; 0.5 kg/day); TSS (12 mg/l; 0.6 kg/day); and summer ammonia-N (1.0 mg/l; 0.05 kg/day). A compliance inspection letter dated May 14, 2002 indicated the plant appeared to be operating satisfactorily.

Geauga County Willow Hill WWTP 3PG00009 (Caves Creek at RM 4.20)

- Treatment processes include trash trap, flow equalization, extended aeration, clarifiers, fixed media filters, slow sand filters, and chlorine disinfection and dechlorination. The design flow is 0.013 mgd. Current monthly NPDES permit limits are cBOD5 (10 mg/l; 0.47 kg/day); TSS (12 mg/l; 0.57 kg/day); and summer ammonia-N (1.5 mg/l; 0.08 kg/day). A compliance inspection letter dated December 2, 2005 indicated 122 chlorine residual, 9 TSS, and 14 dissolved oxygen permit violations in the period January 2004 through December 2005. The county has submitted plans to install ultraviolet disinfection to address the ongoing problems with chlorine.

Olde Towne Tavern WWTP 3PR00170 (RM 0.78 trib to Caves Creek at RM 1.70)

- Treatment processes include trash trap, flow equalization, extended aeration, clarifiers, fixed media filters, slow sand filters, and ultraviolet disinfection. The design flow is 0.0025 mgd. Current monthly NPDES permit limits are cBOD5 (10 mg/l; 0.76 kg/day); TSS (12 mg/l; 0.9 kg/day); and summer ammonia-N (1.9 mg/l; 0.14 kg/day). A compliance inspection report dated June 20, 2005 indicated violations of permit limits for dissolved oxygen, ammonia-N, CBOD, fecal coliform, and pH from December 2000 through May 2005.

Village of Moreland Hills Quail Hollow WWTP 3PA00009 (RM 23.93 trib Chagrin R. at RM 0.86)

- Treatment processes include grease trap, aeration, sand filters, and chlorine disinfection with dechlorination. The design flow is 0.020 mgd. Current monthly NPDES permit limits are cBOD5 (10 mg/l; 0.09 kg/day); TSS (12 mg/l; 0.11 kg/day); and summer ammonia-N (1.0 mg/l; 0.009 kg/day). A compliance inspection report dated June 13, 2002 indicated general compliance with NPDES permit limitations.

Geauga County Scarsdale WWTP 3PG00000 (RM 24.91 trib Chagrin River at RM 0.84)

- Treatment processes include trash trap, flow equalization, extended aeration, clarifiers, fixed media filters, slow sand filters, and ultraviolet disinfection. The design flow is 0.026 mgd. Current monthly NPDES permit limits are cBOD5 (10 mg/l; 0.97 kg/day); TSS (12 mg/l; 1.16 kg/day); and summer ammonia-N (1.5 mg/l; 0.15 kg/day). A compliance inspection report dated January 6, 2004 indicated numerous violations for dissolved oxygen from 2001 through 2002, but general compliance with NPDES permit limitations during 2003. A review of monthly operating report data from January 2004 through January 2005 showed a few violations for pH and ammonia-N but no violations for dissolved oxygen. Average monthly flow has been above design flow suggesting problems with infiltration and inflow.

East Branch Chagrin River and Tributaries (HUC-14 Unit: 04110003030-020)***Latter Day Saints Visitor Center WWTP 3PR00115 (East Branch Chagrin River at RM 2.85)***

- Treatment processes include trash trap, extended aeration, surface sand filters, and chlorine disinfection with dechlorination. The design flow is 0.005 mgd. Current monthly NPDES permit limits are cBOD5 (10 mg/l; 0.2 kg/day); TSS (12 mg/l; 0.2 kg/day); and summer ammonia-N (1.0 mg/l; 0.02 kg/day). Post aeration was added in November 2005. A compliance inspection letter dated September 13, 2004 noted marginal effluent quality but no permit violations were identified. This plant is scheduled to be tied into the regional Lake County Mentor WWTP by September 2008.

Berkshire Hills County Club WWTP 3PR00321 (RM 15.35 trib East Branch Chagrin River)

- This WWTP was upgraded in 2004. New treatment processes include extended aeration, slow sand filters, and ultraviolet disinfection. The design flow of the new plant is 0.005 mgd. Current monthly NPDES permit limits are cBOD5 (10 mg/l; 0.2 kg/day); TSS (12 mg/l; 0.23 kg/day); and summer ammonia-N (1.0 mg/l; 0.02 kg/day). A review of monthly operating report data for 2004 and 2005 indicated general compliance with permit limitations

with the exception of one elevated total dissolved solids value > 5000 mg/l in April of 2004.

Geauga County Sherman Hills WWTP 3PG00005 (RM 15.87 trib East Branch Chagrin River at RM 1.93)

- Treatment processes include trash trap, flow equalization, extended aeration, clarifiers, fixed media filters, slow sand filters, and ultraviolet disinfection. The design flow is 0.040 mgd. Current monthly NPDES permit limits are cBOD5 (10 mg/l; 1.51 kg/day); TSS (12 mg/l; 1.82 kg/day); and summer ammonia-N (1.5 mg/l; 0.23 kg/day). A compliance inspection letter dated December 2, 2005 indicated problems with the structural integrity of the plant tank walls. The plant was had 177 permit violations between January 1, 2004 and December 1, 2005 for parameters including dissolved oxygen, TSS, and mostly chlorine residual. A permit to install was issued in November 2004 for the plant to be replaced by a pump station, but this action has not yet occurred.

Hilltop Apartment WWTP 3PR00106 (Stoney Brook [RM 3.57 trib to East Branch] at RM 0.55)

- Treatment processes include trash trap, extended aeration, surface sand filters, and chlorination disinfection with dechlorination. The design flow is 0.020 mgd. Current monthly NPDES permit limits are cBOD5 (10 mg/l; 0.8 kg/day); TSS (12 mg/l; 0.9 kg/day); and summer ammonia-N (1.0 mg/l; 0.08 kg/day). A compliance inspection letter dated March 29, 2005 indicated a small number of permit violations for dissolved oxygen, ammonia-N, and chlorine residual for the period December 1, 1999 through February 2005.

Kirtland Shopping Center WWTP 3PR00152 (Stoney Brook [RM 3.57 trib to East Branch] at RM 0.68)

- Treatment processes include trash trap, extended aeration, surface sand filters, and chlorination disinfection with dechlorination. The design flow is 0.006 mgd. Current monthly NPDES permit limits are cBOD5 (10 mg/l; 0.2 kg/day); TSS (12 mg/l; 0.3 kg/day); and summer ammonia-N (1.0 mg/l; 0.02 kg/day). A compliance inspection letter dated January 18, 2006 indicated a small number of permit violations for dissolved oxygen, ammonia-N, pH, and chlorine residual for the period January 2003 through December 2005. This plant is scheduled to be tied into the regional Lake County Mentor WWTP by September 2008.

Edgewood Condominiums WWTP 3PW00022 (Stoney Brook [RM 3.57 trib to East Branch] at RM 0.92)

- Treatment processes include trash trap, extended aeration, surface sand filters, and

chlorination disinfection with dechlorination. The design flow is 0.0025 mgd. Current monthly NPDES permit limits are cBOD5 (10 mg/l; 0.1 kg/day); TSS (12 mg/l; 0.1 kg/day); and summer ammonia-N (1.0 mg/l; 0.01 kg/day). A compliance inspection letter dated December 9, 2004 indicated the plant was in general compliance of permit limitations. This plant is scheduled to be tied into regional Lake County Mentor WWTP by September 2008.

Kirtland Templeview WWTP 3PR00240 (Stoney Brook [RM 3.57 trib to East Branch] at RM 1.0)

- This WWTP was never constructed. It was proposed to be constructed to eliminate widespread human health concerns from high fecal coliform bacteria counts in streams and ditches in the Temple View Subdivision area caused by failing home septic systems. In a letter dated January 30, 2006 the City of Kirtland indicated that the homes in the area in question would be connected to the regional Lake County Mentor WWTP sewage system, and that the current NPDES permit for the Kirtland Templeview WWTP would not be renewed (expired on December 31, 2005).

Western Reserve Health Center WWTP 3PR00137 (Stoney Brook [RM 3.57 trib to East Branch] at RM 1.80)

- Treatment processes include grease & trash trap, flow equalization, extended aeration, clarifiers, fixed media filters, sand filters, and chlorination disinfection with dechlorination. The design flow is 0.041 mgd. Current monthly NPDES permit limits are cBOD5 (10 mg/l; 1.6 kg/day); TSS (12 mg/l; 1.9 kg/day); and summer ammonia-N (1.0 mg/l; 0.16 kg/day). A compliance inspection letter dated September 28, 2005 indicated permit violations for dissolved oxygen, TSS, CBOD, ammonia-N, and chlorine residual.

Kirtland Mobile Home Park WWTP 3PV00074 (Stoney Brook [RM 3.57 trib to East Branch] at RM 2.15)

- Treatment processes include trash trap, extended aeration, surface sand filters, and chlorination disinfection with dechlorination. The design flow is 0.020 mgd. Current monthly NPDES permit limits are cBOD5 (10 mg/l; 0.8 kg/day); TSS (12 mg/l; 0.9 kg/day); and summer ammonia-N (1.0 mg/l; 0.08 kg/day). A compliance inspection letter dated July 30, 2002 indicated a small number of permit violations for dissolved oxygen, ammonia-N, and chlorine residual over the previous year.

Kirtland City Tavern WWTP 3PR00238 (Stoney Brook [RM 3.57 trib to East Branch] at RM 3.10)

- Treatment processes include grease trap, extended aeration, and chlorination disinfection with dechlorination. The design flow is 0.002 mgd. Current monthly NPDES permit limits

are cBOD5 (10 mg/l; 0.08 kg/day); TSS (12 mg/l; 0.1 kg/day); and summer ammonia-N (1.0 mg/l; 0.01 kg/day). At the time the NPDES permit became effective (June 1, 2000) the plant was to have been modified to include additional treatment processes such as grease trap, flow equalization, dosing chamber, surface sand filter, chlorine tank with dechlorination. All of these upgrades have not been constructed. The entity was referred for enforcement action for non compliance of permit conditions in a letter dated June 8, 2005.

Lake Metroparks Penitentiary Glen WWTP 3PR00375 (RM 1.1 trib to Stoney Brook [RM 3.57 trib to East Branch] at RM 0.6)

- Treatment processes include trash trap, extended aeration, surface sand filters, and chlorination and a constructed wetland. The design flow is 0.005 mgd. Current monthly NPDES permit limits are cBOD5 (10 mg/l; 0.189 kg/day); TSS (12 mg/l; 0.227 kg/day); and summer ammonia-N (1.0 mg/l; 0.019 kg/day). A compliance inspection letter dated April 7, 2004 indicated the plant appeared to be operating satisfactorily.

Kirtland Hickory Hill WWTP 3PG00059 (RM 1.1 trib to Stoney Brook [RM 3.57 trib to East Branch] at RM 2.1)

- Treatment processes include trash trap, extended aeration, surface sand filters, and chlorination and a constructed wetland. The design flow is 0.030 mgd. Current monthly NPDES permit limits are cBOD5 (10 mg/l; 1.14 kg/day); TSS (12 mg/l; 1.36 kg/day); and summer ammonia-N (1.0 mg/l; 0.11 kg/day). A compliance inspection letter dated June 18, 2001 indicated the plant appeared to be operating satisfactorily.

Eagle Road Mobile Home Park WWTP 3PV00071 (RM 1.37 trib to Stoney Brook [RM 3.57 trib to East Branch] at RM 0.80)

- Treatment processes include trash trap, extended aeration, surface sand filters, and chlorination disinfection with dechlorination. The design flow is 0.025 mgd. Current monthly NPDES permit limits are cBOD5 (10 mg/l; 0.9 kg/day); TSS (12 mg/l; 1.1 kg/day); and summer ammonia-N (1.0 mg/l; 0.09 kg/day). A compliance inspection letter dated September 26, 2005 indicated 32 permit violations for pH, one dissolved oxygen violation, two TSS violations, and six permit violations for chlorine residual for the period August 2000 through August 2005.

Kirtland Plaza WWTP 3PR00160 (Quarry Creek [RM 1.85 trib to East Branch] at RM 0.47 trib)

- Treatment processes include trash trap, extended aeration, surface sand filters, and chlorination disinfection with dechlorination. The design flow is 0.010 mgd. Current

monthly NPDES permit limits are cBOD5 (10 mg/l; 0.38 kg/day); TSS (12 mg/l; 0.45 kg/day); and summer ammonia-N (1.0 mg/l; 0.038 kg/day). A compliance inspection letter dated May 2, 2003 indicated the plant appeared to be operating satisfactorily. Permit violations were noted for dissolved oxygen, TSS, CBOD, ammonia-N, and chlorine residual. This plant is scheduled to be tied into the regional Lake County Mentor WWTP by September 2008.

Kirtland Local School District WWTP 3PT00023 (Quarry Creek [RM 1.85 trib to East Branch] at RM 0.47, 0.6)

- Treatment processes include trash trap, extended aeration, surface sand filters, and chlorination disinfection with dechlorination. The design flow is 0.030 mgd. Current monthly NPDES permit limits are cBOD5 (10 mg/l; 1.1 kg/day); TSS (12 mg/l; 1.4 kg/day); and summer ammonia-N (1.0 mg/l; 0.11 kg/day). This plant is scheduled to be tied into the regional Lake County Mentor WWTP by September 2008.

YOPS Time Out Grill WWTP 3PR00206 (RM 21.8 trib to East Branch Chagrin River)

- Treatment processes include trash trap, flow equalization, extended aeration, surface sand filters, and chlorination disinfection with dechlorination. The design flow is 0.0035 mgd. Current monthly NPDES permit limits are cBOD5 (10 mg/l; 0.13 kg/day); TSS (12 mg/l; 0.16 kg/day); and summer ammonia-N (1.0 mg/l; 0.01 kg/day). A compliance inspection letter dated July 1, 2003 indicated the plant appeared to be operating satisfactorily.

West End Express WWTP 3PR00334 (RM 21.3 trib to East Branch Chagrin River)

- Treatment processes include trash trap, flow equalization, extended aeration, surface sand filters, and chlorination disinfection with dechlorination. The design flow is 0.0021 mgd. Current monthly NPDES permit limits are cBOD5 (10 mg/l; 0.08 kg/day); TSS (12 mg/l; 0.10 kg/day); and summer ammonia-N (1.0 mg/l; 0.008 kg/day). A review of monthly operating report data from 1/1/2004 through 6/1/2005 indicated permit violations for dissolved oxygen, TSS, CBOD, and ammonia-N.

PHYSICAL HABITAT FOR AQUATIC LIFE

Upper Chagrin - Aurora Branch Assessment Unit (Hydrologic 11 Unit 04110003 020)

Chagrin River mainstem

Habitat quality in the Chagrin River mainstem upstream from the confluence with the Aurora Branch is good to excellent, and similarly influenced in a positive way like the lower mainstem by thick glacial deposits and pervious sandstone bedrock. The notable exception was the entire headwater reach upstream from Rockhaven Road (Table 12). There, historic channelization to drain wetlands and land development have left the local habitat largely denuded. Habitat restoration (*i.e.*, stream naturalization, wetland restoration, and riparian reforestation) are needed to restore the aquatic life use to this reach.

Silver Creek

Stream habitats in the Silver Creek drainage are excellent where not influenced by instream impoundments. Silver Creek also has a very stable summer baseflow owing to the thick glacial deposits in its drainage.

Dewdale Creek

Dewdale Creek drains an extensive area of wetlands, and, like the upper Chagrin River, has had portions channelized to facilitate drainage. Wetland-influenced substrates, unlike coarse-grained glacial till are generally fine-grained (sand/clay), and consequently are naturally limiting to stream aquatic life. Despite these natural limitations, the habitat in Dewdale Creek is capable of supporting warmwater fish assemblages.

Aurora Branch and Tributaries

The Aurora Branch and its tributaries, despite having the highest combined intensity of agricultural and residential land use in the basin, generally have good to excellent habitat. However, most riffle locations sampled were moderately embedded with sediment due to these land uses. Site-specific problems noted during the survey included habitat alteration associated with recent bridge construction where Chagrin Road crosses the North Branch of McFarland Creek, and sedimentation in McFarland Creek associated with housing development.

Lower Chagrin River - East Branch Assessment Unit (Hydrologic Unit 04110003 030)

Chagrin River mainstem

Habitat quality in the mainstem of the Chagrin River downstream from the confluence with the Aurora Branch is good to excellent, and possesses all the necessary attributes to fully support a diverse and robust fish community. Glacial till and sandstone bedrock in the reach downstream from Chagrin Falls provide a very heterogeneous mix of substrates, especially slabs, boulders and cobbles, and the depth of glacial till combined with porous sandstone allow for a high sustained baseflow during the summer. These two features are particularly favorable for smallmouth bass, and help to ameliorate the generally marginal condition of the riparian zone. This latter deficiency was likely responsible for the moderately embedded riffles observed at four of the seven sites sampled in the lower mainstem (Table 12).

East Branch Chagrin River and Tributaries

Remnants of near pristine habitat exist in two tributaries to the East Branch of the Chagrin River: Stebbins Gulch (confluence with East Branch at RM ~10.60), and an unnamed tributary at RM 10.20. Both have very clean, nearly silt-free substrates composed of glacial till and sandstone, a rarity in Ohio streams. Stebbins Gulch has the coldest water of all the tributaries to the East Branch sampled in 2004, with a water temperature of 14.0 C measured on 8 July 2004. These two tributaries should be earmarked for protection. The remaining tributaries and the East Branch mainstem all have good to excellent habitat, but show some degree of anthropogenic stress, particularly sedimentation. Pierson Creek has an unusually large bedload of sand and gravel, and the East Branch mainstem downstream from US 6 suffers from the effects of gravel mining. Also, bridge crossings of tributaries and the East Branch along Heath Road and Sperry Road have concrete dam aprons that pose effective fish passage barriers and raise water temperatures.

Other Tributaries

Excessive stormwater effects (e.g., down-cutting, bank erosion, sedimentation) were observed in Ward Creek, Pepper-Luce Creek (Trib. to the Chagrin R. @ RM 22.81), and the lower reaches of Griswold Creek. Caves Creek has very good habitat, and appeared less affected by stormwater. The high gradient at the location sampled (County Line Road) may have partially attenuated stormwater impacts. Some impact was evident with riffles moderately embedded with sediment.

BIOLOGICAL QUALITY - FISH COMMUNITY

Upper Chagrin - Aurora Branch Assessment Unit (Hydrologic 11 Unit 04110003 020)

Summary

Most of the problems facing the Chagrin basin are found within the Hydrologic Unit comprising the watershed upstream from and including the Aurora Branch. Channelization of the Chagrin River headwaters, organic enrichment of the Aurora Branch, and toxicity from algal blooms in Sunny Lake are the main problems.

Chagrin River Mainstem

Upstream from the confluence with the Aurora Branch, impacts to the Chagrin mainstem are primarily from habitat alteration in the headwaters (Figures 11, 12). Fish communities in the upstream-most three sampling locations were all degraded by direct channelization, and by removal of riparian habitat for golf courses (Figures 11, 12). The ICI improved at Fairmount Rd.(RM 36.4)

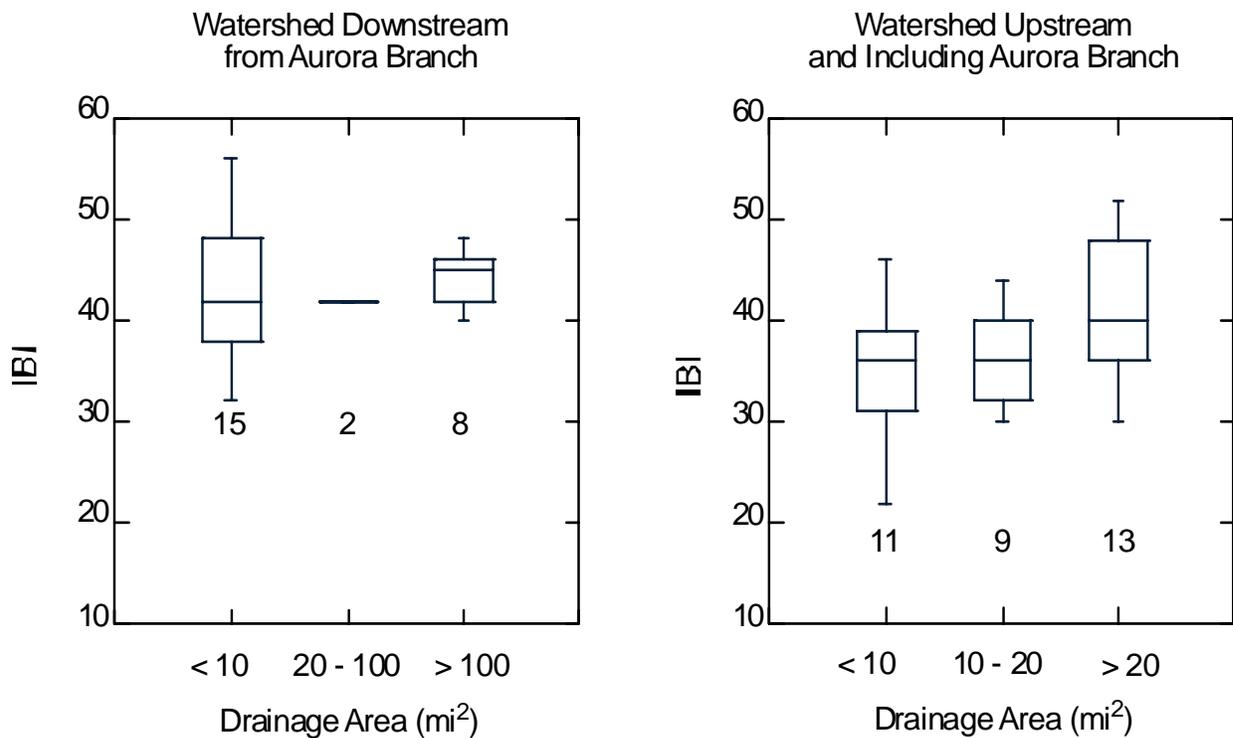


Figure 11. Box and whisker plots of Index of Biotic Integrity scores, stratified by drainage area, from sites sampled in the two 11-digit Hydrologic Units comprising the Chagrin River basin, 2003 and 2004.

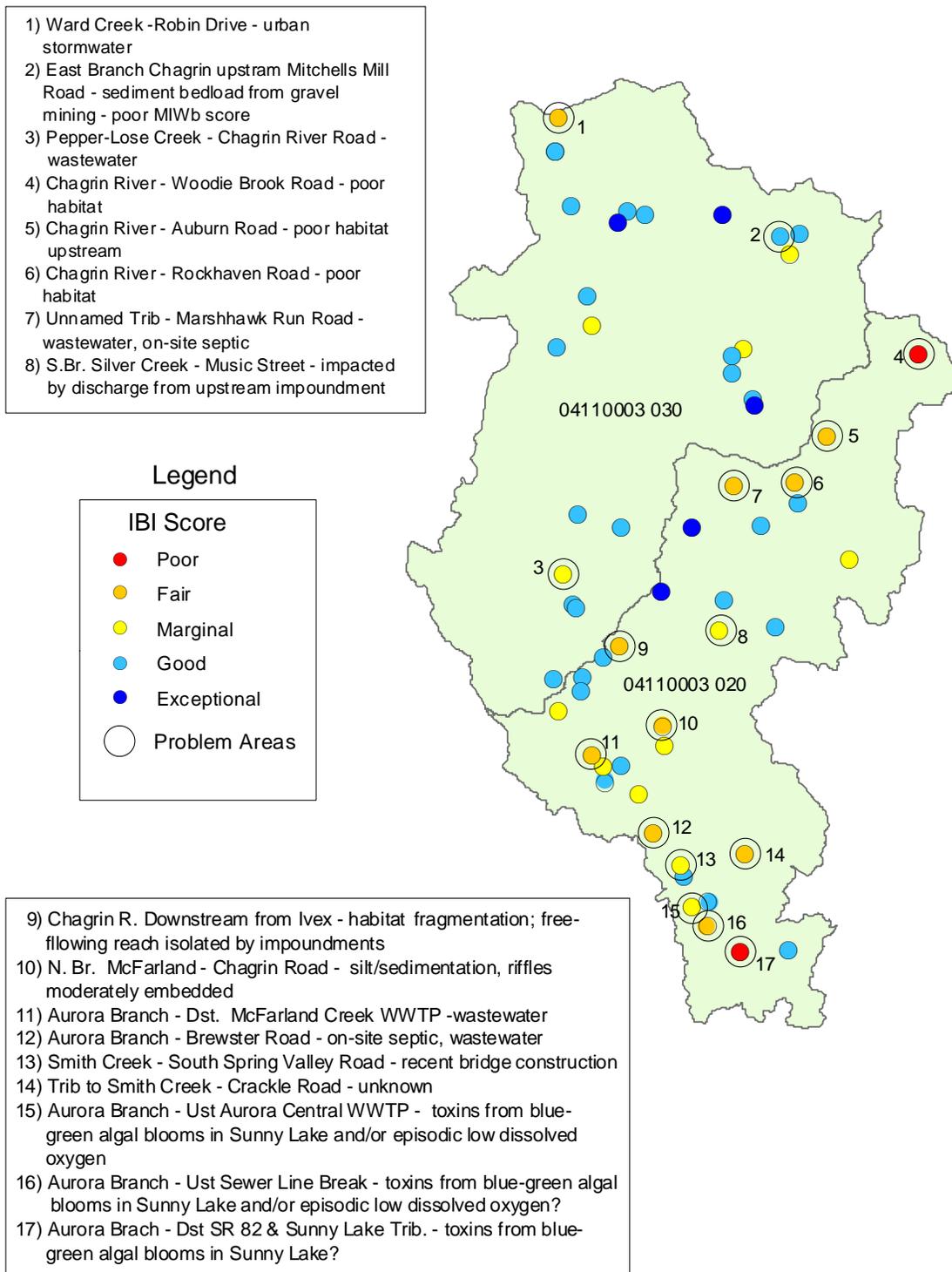


Figure 12. IBI scores color-coded by narrative quality range for sites sampled in the Chagrin River basin, 2003 and 2004.

Table 13. Aquatic Life use attainment status for stations sampled in the Chagrin River basin in **HUC 04110003 020 (Headwaters Chagrin River to downstream Aurora Branch Chagrin River) (Upper Chagrin - Aurora Branch Unit)**, 2003 - 2004. The Index of Biotic Integrity (IBI) and Modified Index of Well-being (MIwb), and Invertebrate Community Index (ICI) are scores derived, respectively, from the assemblage composition of sampled fish and macroinvertebrate communities. The Qualitative Habitat Evaluation Index (QHEI) is a measure of the ability of the physical habitat at a given sampling location to support a biotic community. All sites are located within the EOLP Ecoregion.

RIVER MILE Fish/Invert.	2003/4 IBI	2003/4 MIwb ^a	2003/4 ICI ^b	2003/4 # CW ^c Fish / bugs	2003/4 QHEI	2003/4 Attain- ment Status	Site Location	Causes ^d	Sources
Chagrin River (2003-04 Results)			EOLP: WWH Use Designation (Existing)						
49.1/49.2	26*	--	P*	0/0	23.0	NON	Ust. Woodiebrook Road	Habitat Alteration, Flow Alteration	Hydromodification - riparian vegetation loss, drained wetlands, channelization
46.5	--	--	F	0/0	--	Not Assessed	Auburn Rd. (Lentic - dst. Bass Lake & Beaver Cr.)		
45.2/45.3	32*	--	G	0/3	82.5	PARTIAL	Ust. Fowler Mills Road (lotic)	Habitat Alteration, Flow Alteration	Hydromodification - riparian vegetation loss, drained wetlands, channelization
42.6/42.8	30*	--	G	0/1	58.0	PARTIAL	Rock Haven Rd. (ust. Dewdale Cr.)	Habitat Alteration, Flow Alteration	Hydromodification - riparian vegetation loss, drained wetlands, channelization
40.0	48	8.8	50	0/1	82.0	FULL	Dst. Sperry Road (Sentinel Site)		
36.4/36.6 ^R	52	9.7	50	0/0	85.0	FULL	Ust. Fairmount Rd.		
33.4/33.5 ^R	50	9.5	38	0/0	86.0	FULL	Ust. St. Rt. 87		
30.6	34 ^{ns}	8.2	50	0/1	72.5	FULL	Ust. Ivex between the lakes		
30.0	40	9.1	VG	0/1	75.5	FULL	Dst. Ivex		
Chagrin River (2003-04 Results)			EOLP: WWH Use Designation (Existing) and SSH Use Designation (Recommended)						
28.9 / 28.8	48	9.2	48	0/2	77.5	FULL	Ust. Miles Rd. (Sent. Site) Bugs		
28.2	46	8.9	48	0/1	82.0	FULL	Adj. Solon Rd. dst. Chagrin Falls WWTP		

RIVER MILE Fish/Invert.	2003/4 IBI	2003/4 MIwb ^a	2003/4 ICI ^b	2003/4 # CW ^c Fish / bugs	2003/4 QHEI	2003/4 Attain- ment Status	Site Location	Causes ^d	Sources	
Aurora Branch Chagrin River (2003-04 Results)							EOLP: WWH Use (Existing)			
16.3	40	NA	<u>P</u> *	0+/0	66.5	NON	Dst. Chamberlain Rd.	Nutrients, Unknown Toxicity, Habitat Alteration	Package Plants (Small plants), NPS runoff, Riparian vegetation removal	
14.4	<u>22</u> *	NA	G	0/0	77.0	NON	Dst. Pioneer Trail and Sunny Lake	Periodic Toxicity	Algal discharges from Sunny Lake	
11.9	32*	NA	42	0+/2	79.5	PARTIAL	SR 82	Periodic Toxicity, Siltation	Algal discharges from Sunny Lake, Land development / Suburbanization	
11.3	36 ^{ns}	NA	42	0+/1	76.5	FULL	Ust. Aurora Central WWTP			
11.1 / 11.0	40	NA	42	0 ^h +/2	71.5	FULL	Dst. Aurora Central WWTP			
9.1	40	NA	48	0 ^h +/1	83.0	FULL	Ust. SR 306			
Aurora Branch Chagrin River (2003-04 Results) EOLP: WWH Use (Existing) / CWH^{h1} (Recommended) (RM 8.98 - RM 3.73)										
7.4 / 7.3	32*	7.7 ^{ns}	VG	(0) ^{hi} +/5	74.5	PARTIAL	Brewster Road, dst sand & gravel operation @ RM 9.0	Organic enrichment, siltation	Urban runoff/storm sewers, Septic tanks; Urban runoff, gravel mining	
5.6/5.1 ^R , 5.5 ^R	38	8.5	48/56	(0) ^l +/5	74.0	FULL	Adj. Geauga Lk. Rd near Fields Rd.			
3.8 ⁺	44	8.3	--	(0) ^l +/-	79.5	(FULL)	Ust. McFarland Creek			
Aurora Branch Chagrin River (2003-04 Results) (cont.) EOLP: WWH Use (Existing) (RM 3.73 - 0.0)										
3.7 / 3.5, 3.7 ⁺	38	8.4	54/50	0+/4,2	79.5	FULL	Ust. McFarland Cr. WWTP			
3.4	30*	7.8 ^{ns}	48	0+/6	79.5	PARTIAL	Dst. McFarland Cr. WWTP	Organic enrichment including P, Siltation	Major Municipal Point Source, Hydromodification - Streambank	
1.0 / 0.9	36 ^{ns}	7.9	VG	0+/1	54.0	FULL	Dst Solon Rd.			
Aurora Branch Chagrin River (2003-04 Results) EOLP: WWH Use (Existing) & SSH Use Designation (Recommended)										
0.3	-	-	46	- /1	-	(FULL)	Ust. bridge abutment (Bentleyville)			

RIVER MILE Fish/Invert.	2003/4 IBI	2003/4 MIwb ^a	2003/4 ICI ^b	2003/4 # CW ^c Fish / bugs	2003/4 QHEI	2003/4 Attain- ment Status	Site Location	Causes ^d	Sources	
McFarland Creek (2004)							EOLP: EWH Use Designation (Existing)			
2.3	38*	--	VG ^{ns}	0+/3	78.5	PARTIAL	Dst. Chagrin Rd (dst. development)	Flow Alteration, Direct Habitat Alteration, Sedimentation, organic enrichment	Suburbanization, NPS stormwater runoff, riparian vegetation removal	
0.2	44*	--	VG ^{ns}	0+/3	75.0	PARTIAL	Chagrin River Rd. (near mouth)	Flow Alteration, Direct Habitat Alteration, Sedimentation	Suburbanization, NPS stormwater runoff, riparian vegetation removal	
N. Branch McFarland Creek (2004) (trib. @ RM 2.58)							EOLP: CWH Use Designation (Recommended)			
0.1 / 0.2	34	--	VG	1+/6	70.0	FULL	Ust. Chagrin Blvd.			
Smith Creek (2004)							EOLP: CWH Use Designation (Recommended)			
1.1	38	--	E	1+/4	79.0	FULL	South Spring Valley Park Drive			
Trib. to Smith Creek (confl. @ RM 2.70) (2004)							EOLP: CWH Use Designation (Recommended)			
0.6	30	--	VG	1+/6	67.5	FULL	Crackel Rd.			
Silver Creek (2004)							EOLP: CWH Use Designation (Existing)			
5.1	46	--	E	0+/4	76.0	FULL	Music St.			
0.8 / 04	40	--	54	0/3	81.0	--	Ust. St. Rt. 306/ Dst.306 and Hitching Post Lane	Deferred attainment status and any use designation decisions for lower reaches until future assessment after recovery from park dam failure and ongoing restoration project upstream (stream restoration / riparian revegetation).		
South Branch Silver Creek (2004)							EOLP: WWH Use Designation (Existing)			
1.1	36 ^{ns}	--	G	0/0	79.5	FULL	Music St.			

RIVER MILE Fish/Invert.	2003/4 IBI	2003/4 MIwb ^a	2003/4 ICI ^b	2003/4 # CW ^c Fish / bugs	2003/4 QHEI	2003/4 Attain- ment Status	Site Location	Causes ^d	Sources
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Trib. to Chagrin R. (@ 38.32) (Marsh Hawk Run) EOLP: WWH Use Designation (Recommended)

0.7 / 0.3 32* -- F* 0+/3 60.5 NON Sperry Rd. Nutrients, organic Wastewater (package plant), On-site

Dewdale Creek (2004)

EOLP: CWH Use Designation (Recommended)

4.6 36 -- MG 0+/2 76.0 NON Auburn Rd. Nutrients (P), possible NH₃ toxicity, organic enrichment / low D.O., thermal modification Suburban NPS stormwater runoff inputs, onsite septic or HSTS inputs, removal of riparian vegetation

0.6/0.7 44 -- 56 (1)^g+/5 77.0 FULL Rockhaven Rd.

Beaver Creek (2004)

EOLP: CWH Use Designation (Existing)

2.3 32^J -- 52 0+^J/12 47.0^J (FULL) Dst. Bean Rd.

Beaver Creek (2004)

EOLP: WWH Use Designation (based on previous consultant data - not on OEPA data))

0.6 - -- 54 - /1 - (FULL) Sherman Rd.

a- MIwb is not applicable to headwater streams with drainage areas ≤ 20 mi².

b- A qualitative narrative evaluation based on community composition, EPT taxa richness, and other attributes. E = Exceptional, VG = Very Good, G = Good, MG = Marginally Good, F = Fair, P = Poor, VP = Very Poor.

c- Attainment of CWH evaluated on presence and quality of cold water fish {OEPA CW list (trouts, sculpins, brook stickleback, redbreast dace) & other additional species (e.g., Longnose dace, American Brook lamprey, mudminnow, blacknose dace, and white sucker - specific interpretation based on local collection - presence, distribution & habitat) and ≥ 4 CW macroinvertebrates (from OEPA current list) & narrative quality. If cold water fish from OEPA CW list were present, the total number of different CW fish taxa were listed, and a footnote (+) was added if additional potential coolwater/cold water fish were present from the additional species list. Full but declining is noted when a lack of quality or decreased quality is documented by decreases in the cold water fish assemblages or macroinvertebrate assemblages over time.

d- Causes and Sources listed are considered to be a primary influence on water quality, but may not be the only issue leading to impairment. See discussion in text of additional causes that cumulatively have led to impairment.

- g- Observed trout juveniles during macroinvertebrate sampling.
- *- Indicates significant departure from biocriteria (> 4 IBI or ICI units, or > 0.5 MIwb units).
- ns- Nonsignificant departure from biocriteria (≤ 4 IBI or ICI units, or ≤ 0.5 MIwb units).
- + Potential coolwater/cold water fish listed were collected during present sampling (e.g., Longnose dace, American Brook lamprey, mudminnow, blacknose dace, and white sucker - specific interpretation based on local collection - presence, distribution & habitat from OEPA data and historical distributions).
- h- Cold water fish Redside Dace present at Rms 11.1 and 9.0 in 1991 and 1995.
- I- Upper reach historical presence of cold water fish Redside Dace (1991,1995). Cold water fish are present in Smith Creek watershed (2004) (confluence to Aurora Branch @ RM 8.98) - Redside Dace and Brook Stickleback. Cold water fish native Brook Trout present in Linton Creek (confluence to Aurora Br. @ RM 5.27). Cold water fish Brook Stickleback is present in North Branch McFarland Creek (2004).
- J- Sampled by consultant in 2005.

<u>INDEX -Site Type</u>	<u>WWH</u>	<u>EWB</u>	<u>CWH^c</u>
IBI - Headwaters	40	50	No Numerical
IBI - Wading	38	50	Criteria
MIwb-Wading	7.9	9.4	Criteria
ICI	34	46	Available

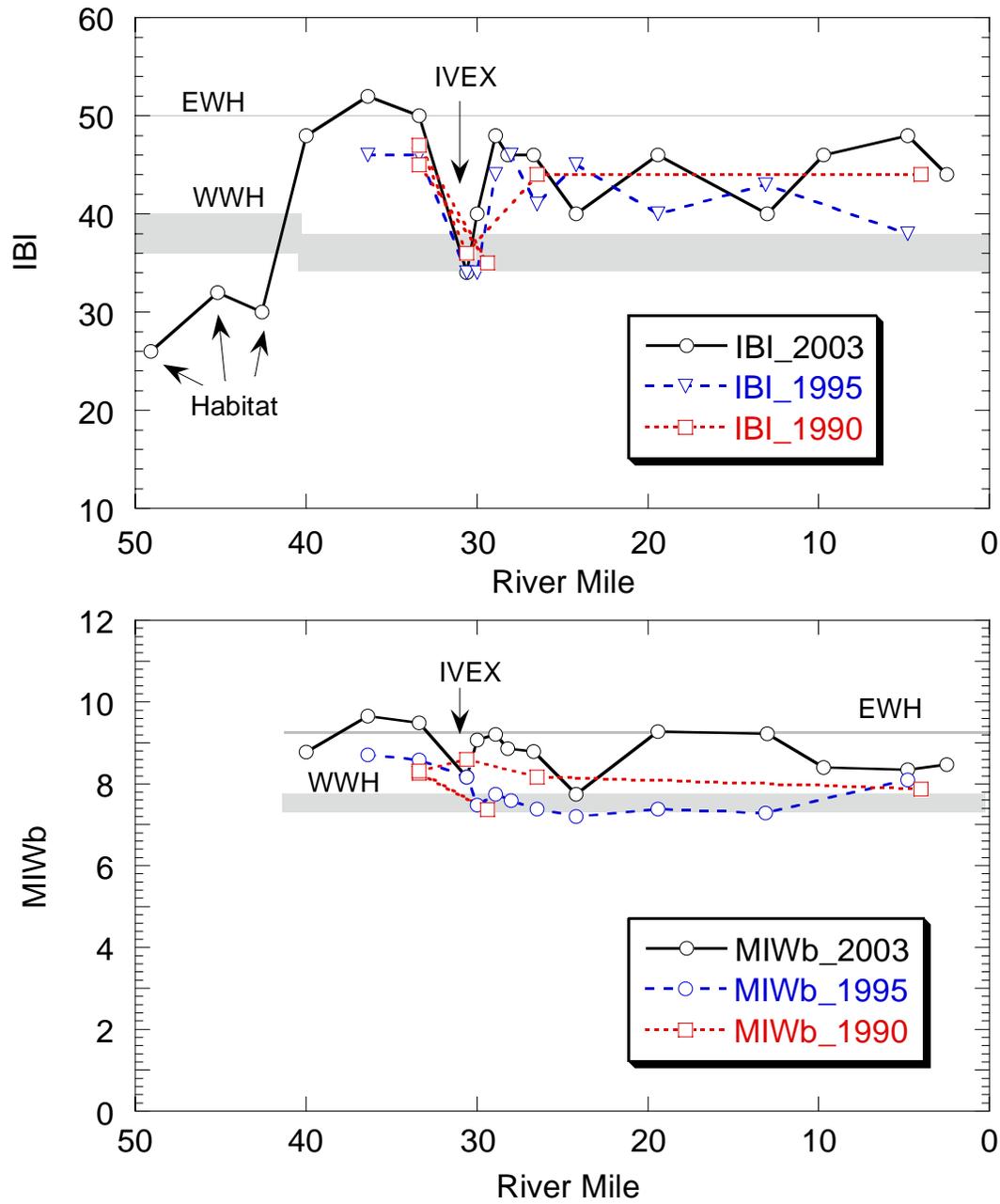


Figure 13. Index of Biotic Integrity scores (top panel) and Modified Index of Well-being scores (bottom panel) for sites sampled in the Chagrin River mainstem 1990 to 2003. The thick shaded line shows the respective minimum IBI or MIWb score acceptable for streams classified as Warmwater Habitat, and the thin shaded line shows the minimally acceptable scores for streams classified as Exceptional Warmwater Habitat.

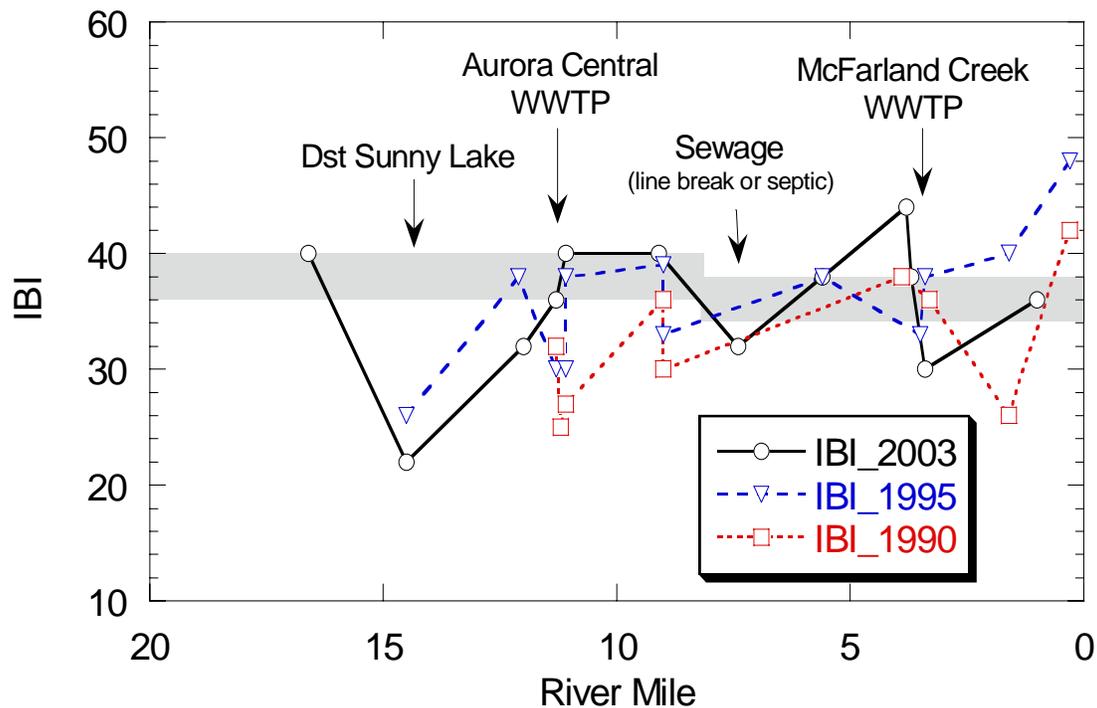


Figure 14. Index of Biotic Integrity Scores from sites sampled in the Aurora Branch, 1990 - 2003, in relation to landmarks discussed in the text. The thick shaded line shows the minimally acceptable IBI scores for streams classified as Warmwater Habitat.

to 52 (Exceptional in 2003), and the MIWb was consistently higher in this recent survey compared to the 1990 and 1995 results (Figure 13).

Aurora Branch and Tributaries

Several problems confront fish communities in the Aurora Branch and its tributaries. For the mainstem of the Aurora Branch, organic enrichment and toxicity are the primary causes (Figure 12). The sources of organic enrichment include overloading the capacity of the McFarland Creek WWTP (Figure 6), and either malfunctioning on-site sewerage (home septic systems) or sewerage infrastructure. A decreased IBI score was documented in 2003 downstream from the McFarland Creek WWTP compared to earlier surveys (Figure 14). Organic enrichment was inferred from the elevated relative abundance of pollution tolerant species and omnivores (Figure 15). The segments of the river impacted by organic enrichment include the segment downstream from the McFarland WWTP, the reach near Brewster Road (home septic and/or sewer lines), and upstream from the Aurora Central WWTP. The source of toxicity was blooms of cyanobacteria in Sunny Lake. The reach affected extends downstream from the Sunny Lake outlet to upstream from the Aurora Central

WWTP. Chronic or intermittent toxicity from Sunny Lake is suspected because of the low overall relative abundance of all fishes and the absence of pollution sensitive species downstream from the Sunny Lake Outlet. Sedimentation from new home construction affects McFarland Creek in the vicinity of Chagrin Road, and Smith Creek was impacted by recent bridge construction at Crackle Road. New development and habitat alteration near North Branch McFarland Creek could affect its cold water community quality.

Compared to past surveys (1990 and 1995), fish communities in the Aurora Branch have improved downstream from the Aurora Central WWTP, and worsened downstream from the McFarland Creek WWTP (Figure 14, Table 16).

Silver Creek

Fish samples collected from three sites within the Silver Creek drainage all met the standard for small WWH streams, though the site sampled in the South Branch only marginally met due to the influence of an upstream impoundment. Removal of an impoundment on the Silver Creek mainstem upstream from Kinsman Road, and habitat naturalization through the historically impounded reach, has apparently resulted in a significantly improved fish community (Tables 12, 13).

Dewdale Creek

Fish sampled at two locations in Dewdale Creek met (Rockhaven Road) and marginally met (Auburn Road) the WWH biocriterion for headwaters (Table 15). The stream at Auburn Road was a wetland stream, and consequently the fish community was naturally limited (when compared to higher gradient glacial till streams).

Unnamed Tributary to Chagrin River at RM 38.32

This small subcatchment has a relatively high density of residential land use, much of it comparatively new (based solely on field observations), and instream impoundments. Accordingly, the fish community was degraded, consisting almost entirely of tolerant individuals.

Lower Chagrin - East Branch Assessment Unit (Hydrologic Unit 04110003 030)

Summary

Overall, fish communities within the Hydrologic Unit comprising the lower Chagrin River met numeric water quality standards (Figure 11, Table 15). The few notable exceptions are attributable to urban land use (Ward Creek), sediment from gravel mining (East Branch), and episodic disturbance (Pepper-Luce Creek).

Chagrin River Mainstem

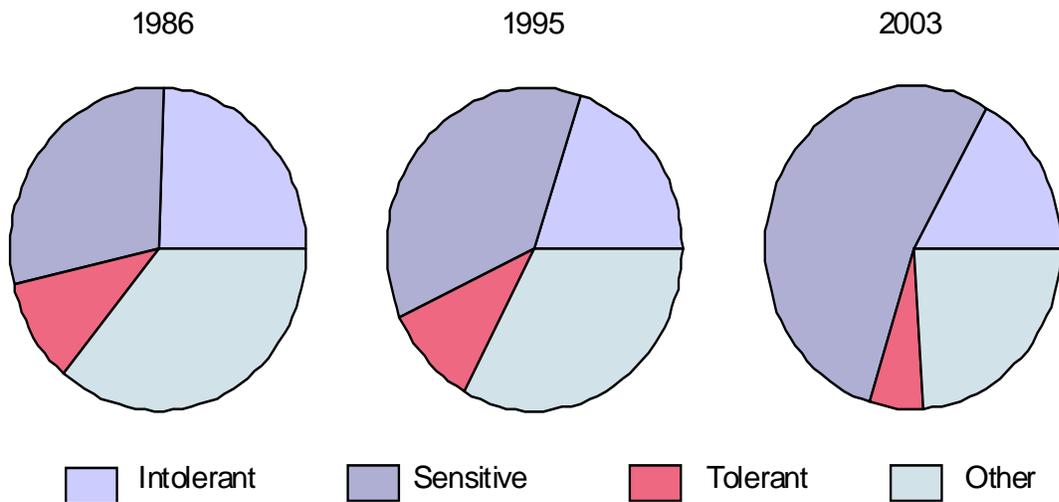


Figure 15. Percent composition by pollution tolerance ranking of fishes sampled in the Chagrin River mainstem downstream from the confluence with the Aurora Branch, 1986 - 2003.

Fish communities sampled in the Chagrin River downstream from Chagrin Falls in 2003 completely met standards at all locations sampled (Tables 12, 13), and improved compared to 1995 and 1986 owing to decreased pollution loading from Ivex in Chagrin Falls (Figure 13). Pollution tolerant species comprised a lower percentage of the total catch, and species sensitive to pollution a greater percentage in 2003 compared to 1995 and 1986 (Figure 15). Accordingly, Modified Index of Well-being (MIWb) scores improved with most scores in the Good and Very Good narrative ranges in 2003 compared to Marginally Good in 1995 (Figure 13, Table 16). A robust population of smallmouth bass exist downstream from Chagrin Falls.

East Branch Chagrin River and Tributaries

The East Branch Chagrin River is unique among Ohio streams in that it harbors a strong population of longnose dace, a coolwater/cold water fish species with a southern limit to its distribution in Northeast Ohio. Several of the tributaries to the East Branch are *bona fide* cold water streams, particularly Stebbins Gulch (tributary to the East Branch at RM 10.60) where the water temperature was 14.0 C on July 7, 2004. Most sites sampled in the East Branch and its tributaries harbor fish communities that meet numeric water quality standards for biological integrity. The one notable exception is the East Branch mainstem upstream from Mitchells Mill Road where a sediment bedload from upstream gravel mining drastically reduced the abundance of fish sampled, resulting in an MIWb score in the Poor range. The strong population of longnose dace, and the presence of numerous young-of-the-year (YOY) steelhead trout in the mainstem and tributaries indicate that the East Branch continues to maintain its cold water character. YOY steelhead were notably abundant in Pierson Creek, Stebbins Gulch and the unnamed tributary at RM 10.2.

Table 14. Aquatic Life use attainment status for stations sampled in the Chagrin River basin in **HUC 04110003 030 (Downstream Aurora Branch to mouth Chagrin River) (Lower Chagrin - East Branch Unit)**, 2003-2004. The Index of Biotic Integrity (IBI) and Modified Index of Well-being (MIwb), and Invertebrate Community Index (ICI) are scores derived, respectively, from the assemblage composition of sampled fish and macroinvertebrate communities. The Qualitative Habitat Evaluation Index (QHEI) measures the ability of the physical habitat to support a biotic community at a sampling location . All sites are located in the Erie- Ontario Lake Plain (EOLP) Ecoregion.

RIVER MILE Fish/Invert.	2003/4 IBI	2003/4 MIwb	2003/4 ICI ^a	2003/4 # CW ^c Fish / bugs	2003/4 QHEI	2003/4 Attainment Status ^b	Site Location	Causes ^d	Sources
Chagrin River (2003-04)							EOLP: WWH Use Designation (Existing) and SSH (Recommended)		
26.7	46	8.8	VG	0/0	-	FULL	Dst. Miles Rd & Aur. Br. confl.		
25.3	-	-	50	0/2	-	(FULL)	Dst. Chagrin Blvd. in park		
24.2 / 23.7	40	7.7 ^{ns}	42	0/3	73.5	FULL	Ust. SR 87 or ust. Kinsman Rd.		
19.4	46	9.3	44	0/0	87.5	FULL	Adj. Chagrin R. Rd dst. Fairmount		
13.0 / 12.8	40	9.2	38	0/0	71.0	FULL	Rodgers Rd. bridge		
9.7 / 8.3	46	8.4	VG	0/2	73.0	FULL	Eagle Rd.		
4.8 / 4.2	48	8.3	38	0/2	74.5	FULL	Todd Field		
2.5	44	7.9	VG	0/1	78.5	FULL	At Park off Reeves Rd.		
1.5 / 1.7	44	8.5	G	0/0	-	FULL	Ust. lacustuary in park near powerline crossing		
Ward Creek (2004) (Trib. To Chagrin R. @ RM 1.0)							EOLP: WWH Use Designation and SSH (Recommended)		
0.4 / 0.8	32*	--	F*	1+/0	67.5	NON	Robin Dr. off Reeves Rd.	Sedimentation, flow alteration, organic enrichment, nutrients	Urban runoff & storm sewers
East Branch Chagrin River (2004)							EOLP: CWH Use Designation (Existing)		
16.3	42	--	E	1+/6	76.0	FULL but Declining ^e	at Heath Rd.		

RIVER MILE Fish/Invert.	2003/4 IBI	2003/4 MIwb	2003/4 ICI ^a	2003/4 # CW ^c Fish / bugs	2003/4 QHEI	2003/4 Attainment Status ^b	Site Location	Causes ^d	Sources
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East Branch Chagrin River (2004) (cont.)

EOLP: CWH Use Designation (Existing)

10.3 / 10.2 42 4.5 E 1+/7 70.0 FULL but Declining^e Adj. Wisner Rd. dst. Mitchells Mills Rd.

2.4 42 8.2 VG 0+/2 76.0 NON Ust. Markell Rd.

Thermal modifications, Direct habitat alterations, Flow alteration, Sedimentation Dredge Mining, Dams, Removal of riparian vegetation, Suburban development

Quarry Creek (2004) (Trib. To E. Br. Chagrin R. @ RM 1.85) EOLP: CWH (Existing) and EWH Use Designation (Recommended)

0.1 56 -- VG^{ns} 1+/5 55.0 FULL/FULL Markell Rd.

Stoney Brook (2004) (Trib. To E. Br. Chagrin R. @ RM 3.57)

EOLP: CWH Use Designation (Existing)

0.1 40 -- VG 0+/4 65.5 PARTIAL @ Kirtland Chardon Rd. (SR 615)

Thermal modification, nutrients, flow alteration, habitat alteration Removal of wooded riparian vegetation, suburban NPS storm water runoff, suburbanization, onsite septic tanks or HSTS, package plants

Pierson Creek (2004) (Trib. To E. Br. Chagrin R. @ RM 6.73) EOLP: CWH (Existing) and EWH Use Designation (Recommended)

0.1 56 -- VG^{ns} 1+/11 66.5 FULL/FULL Sperry Rd. and Booth Rd.

Trib. to E. Br. Chagrin R. @ RM 10.13 (2004) EOLP: CWH (Existing) and EWH Use Designation (Recommended)

0.1 48^{ns} -- 54 1+/12 78.0 FULL/FULL near mouth dst. Wisner Rd.

Stebbins Gulch (2004) (Trib. To E. Br. Chagrin R. @ RM 10.60)

EOLP: CWH Use Designation (Existing)

0.2 38 -- E 1+/14 68.5 FULL Ust. Wisner Rd. & south of Mitchell Mill Rd.

RIVER MILE Fish/Invert.	2003/4 IBI	2003/4 MIwb	2003/4 ICI ^a	2003/4 # CW ^c Fish / bugs	2003/4 QHEI	2003/4 Attainment Status ^b	Site Location	Causes ^d	Sources
Trib. to E. Br. Chagrin R. @ RM 14.62 (east side trib.) (Harris Cr.) (2004)							EOLP: CWH Use Designation (Existing)		
0.1	38	--	E	0+/8	62.5	PARTIAL	Heath Rd.	Habitat Alteration	bridge construction (fish barrier), some removal of riparian vegetation
Trib. to E. Br. Chagrin R. @ RM 14.80 (west side trib.) (2004)							EOLP: CWH Use Designation (Existing)		
0.1	48	--	G	0+/6	63.5	PARTIAL	Sperry Rd.	Habitat alteration, Flow alteration, Sedimentation	Dam / bridge construction, Riparian vegetation removal, Suburban NPS stormwater runoff
Trib. to E. Br. Chagrin R. @ RM 15.35 (west side trib.) (2004)							EOLP: CWH (Existing) and EWH Use Designation (Recommended)		
0.2	46 ^{ns}	--	VG ^{ns}	0+/7	72.5	PARTIAL/ FULL	Sperry Rd.	Habitat alteration, Flow alteration, Sedimentation	Road construction (bridge fish barrier), suburban NPS stormwater
Trib. to E. Br. Chagrin R. @ RM 16.2 (2004)							EOLP: CWH (Existing) and EWH Use Designation (Recommended)		
0.2 / 0.1	50	--	E	1+/12	72.5	FULL/FULL	Wilson Mills Rd.		
Gully Brook (Trib. to Chagrin R. @ RM 5.54) (2004)							EOLP: WWH Use Designation (Existing) and SSH (Recommended)		
0.6	-	--	MG ^{ns}	- /1	-	-	River Rd.		
Caves Creek (2004) (Trib. to Chagrin R. @ RM 11.52) (2004)							EOLP: CWH Use Designation (Recommended)		
0.9	36 ^{ns}	--	E	1+/8	71.0	FULL	County Line Rd.		
Trib. to Chagrin R. @ RM 22.81 (2004) (Pepper-Luce Creek)							EOLP: WWH Use Designation (Existing)		
0.2	38	--	MG ^{ns}	0/1	66.5	FULL	Chagrin River Rd.		
Griswold Creek (2004)							EOLP: CWH Use Designation (Existing)		
4.4	46	--	G	1+/1	86.0	PARTIAL	Fairmount Rd.	Habitat alteration, Thermal modification	Suburban development, NPS stormwater runoff, Removal of riparian vegetation

RIVER MILE Fish/Invert.	2003/4 IBI	2003/4 MIwb	2003/4 ICI ^a	2003/4 # CW ^c Fish / bugs	2003/4 QHEI	2003/4 Attainment Status ^b	Site Location	Causes ^d	Sources
Griswold Creek (2004) (cont.)							EOLP: CWH Use Designation (Existing)		
0.1	40	--	VG	0+/2	67.5	NON	Falls River Rd.	Habitat alteration, Thermal modification	Streambank modification / dredging, NPS stormwater runoff, Removal of riparian vegetation

a- MIwb is not applicable to headwater streams with drainage areas ≤ 20 mi².

b- A qualitative narrative evaluation based on community composition, EPT taxa richness, and other attributes. E = Exceptional, VG = Very Good, G = Good, MG = Marginally Good, F = Fair, P = Poor, VP = Very Poor.

c- Attainment of CWH evaluated on presence and quality of cold water fish {OEPA CW list (trouts, sculpins, brook stickleback, and reidside dace) & other additional species (e.g., American Brook lamprey, Longnose dace, mudminnow, blacknose dace, and white sucker - specific interpretation based on local collection - presence, distribution, and habitat)} and ≥ 4 cold water macroinvertebrates (from OEPA current list) and narrative quality. If cold water fish from OEPA CW fish list were present, the total number of different cold water fish taxa were listed, and a footnote (+) was added if additional potential coolwater/cold water fish were present from the additional species list. Full but Declining is noted when a lack of quality or decreased quality can be determined by documented decreases in the cold water fish or macroinvertebrate assemblages over time.

d- Causes and Sources listed are considered to be a primary influence on water quality, but may not be the only issue leading to impairment. See text for discussion of additional causes that cumulatively have led to impairment.

E- This upper reach showed a documented historical decrease in the quality of the cold water fish community (no rainbow trout, American brook lamprey, and only a remnant Longnose dace population present compared to earlier data).

F- This reach sampled had a poor fish biomass quality score and high sediment load - directly related to dredging. Also there was a historical decrease in cold water fish community quality (loss of brook trout, American brook lamprey, and large decreases (60-80%) in Blacknose dace and Longnose dace). Some stretches of reach contained sandy bedload covering large substrates. Where habitat was better as indicated by QHEI, the macroinvertebrate community was present in those areas.

*- Indicates significant departure from biocriteria (> 4 IBI or ICI units, or > 0.5 MIwb units).

ns- Nonsignificant departure from biocriteria (≤ 4 IBI or ICI units, or ≤ 0.5 MIwb units).

+ Potential coolwater/cold water fish listed were collected during present sampling (e.g., Longnose dace, American Brook lamprey, mudminnow, blacknose dace, and white sucker - specific interpretation based on local collection - presence, distribution & habitat from OEPA data and historical distributions).

<u>INDEX -Site Type</u>	<u>WQH</u>	<u>EWI</u>	<u>CWH^e</u>
IBI - Headwaters	40	50	No Numerical
IBI - Wading	38	50	Criteria
MIwb-Wading	7.9	9.4	Criteria
ICI	34	46	Available

Ward Creek

Fish communities in Ward Creek were rated as Fair, and are impaired by hydrologic alteration, sedimentation and toxicity from urbanization as the Ward Creek sub-catchment drains the highest amount of impervious surfaces in the Chagrin watershed. Based on the 1994 Landsat Thematic Mapper Data, land classified as urban constitutes 24.8% of the Ward Creek drainage. Analysis of the Ohio EPA statewide database for small urban streams shows that streams having greater than ~15% of their watershed hardened have a lowered probability of their biological communities meeting numeric water quality standards, and those exceeding ~25% imperviousness are not at all likely to attain standards (Miltner et al. 2003).

Caves Creek

The fish community sampled in Caves Creek at County Line Road was within the margin of error for meeting numeric water quality standards for small WWH streams. An elevated relative abundance of tolerant fishes, notably blacknose dace, and a comparatively low number of sensitive species suggest that stormwater may be affecting the fish community. The fish community, however, has a cold water character that is very much in step with a high gradient, bedrock, Erie-Ontario Lake Plain stream, and therefore may, in a sense, be naturally limited when compared to a criterion derived largely from warmwater streams in the Eastern Cornbelt Ecoregion. Also, eight YOY steelhead were collected.

Griswold Creek

The water quality of Griswold Creek, as reflected in the fish community, appears stable compared to surveys in 1995 and 1996. The lower mile of the creek shows signs of hydrologic alteration from excessive stormwater. Unlike 1995, no septic odor was detected at the downstream sampling location.

Pepper-Luce Creek (unnamed tributary at RM 22.81)

The fish community sampled in Pepper-Luce Creek at Chagrin River Road, although marginally achieving the criterion for WWH, deteriorated remarkably compared to 1995, likely due to intermittent toxicity from the upstream wastewater discharges, or some other episodic events, as inferred by the low relative abundance of all species sampled. Chronic toxicity is ruled out because tolerant and pioneering fishes were not abnormally abundant, and organic enrichment is not suspected because the trophic structure appears intact. Increased stormwater flows as a causative agent is tentatively ruled out because the population in the census blocks comprising the watershed remained stable between the 1990 and 2000 censuses. Compared to 1995, the substrates appeared more embedded with sediment, and pulverized shale more apparent, suggesting that one or more construction events (e.g., sewerline or gasline crossing, bridge construction) may be responsible.

Table 15. Fish community attributes for sites sampled in the Chagrin River Basin 2003 and 2004 grouped by 11 digit hydrologic unit. MIWb and IBI scores not meeting water quality standards are denoted with an asterisk, and those departing from water quality standards within a margin of error are denoted by the superscript ns.

River Mile	Cumulative Species	Mean Species	Relative Number	Relative Weight	QHEI	MIWb	IBI	Narrative Evaluation
04110003 030								
<i>15-001 Chagrin River</i>								
26.7	18	17.0	1006.9	75.01	77.0	8.8	46	Good/V. Good
24.2	11	11.0	969.0	95.72	73.5	7.7	40	Good
19.4	19	19.0	1161.0	53.90	87.5	9.3	46	V. Good
13.0	19	19.0	1059.0	19.08	65.0	9.2	40	V. Good
9.7	19	18.0	486.0	25.03	73.0	8.4	46	Good/V. Good
4.8	22	22.0	1158.0	54.00	74.5	8.3	48	Good/V. Good
2.5	18	18.0	171.0	12.39	78.5	7.9	44	Good
<i>15-002 East Branch Chagrin River</i>								
16.3	12	12.0	1468.0	--	76.0	--	42	Good
10.3	14	13.0	766.5	5.95	70.0	4.5	42	Poor/Good
2.4	22	22.0	814.5	5.06	76.0	8.2	42	Good
<i>15-003 Griswold Creek</i>								
4.4	13	13.0	796.0	--	86.0	--	46	V. Good
0.1	9	9.0	280.0	--	67.5	--	40	Good
<i>15-011 Caves Creek</i>								
0.9	9	8.0	958.0	--	71.0	--	36	Marginal
<i>15-018 Chagrin Trib. 22.81</i>								
0.2	12	12.0	210.0	--	66.5	--	38	Marginal
<i>15-030 Ward Creek</i>								
0.4	16	15.0	436.0	--	67.5	--	32	Fair
<i>15-031 Quarry Creek</i>								
0.1	21	20.0	580.0	--	55.0	--	56	Exceptional
<i>15-032 Stony Brook</i>								
0.1	7	7.0	1788.0	--	65.5	--	40	Good

Table 15. Continued.

River Mile	Cumulative Species	Mean Species	Relative Number	Relative Weight	QHEI	MIWb	IBI	Narrative Evaluation
<i>15-033 Pierson Creek</i>								
0.1	11	10.0	583.6	--	66.5	--	56	Exceptional
<i>15-038 Trib to E. Branch Chagrin 10.13</i>								
0.1	14	13.0	367.0	--	78.0	--	48	V. Good
<i>15-039 Trib to E. Branch Chagrin 10.60</i>								
0.2	6	5.0	355.4	--	68.5	--	38	Marginal
<i>15-040 Trib to E. Branch Chagrin 14.62</i>								
0.1	6	6.0	555.0	--	62.5	--	38	Marginal
<i>15-041 Trib to E. Branch Chagrin 14.80</i>								
0.1	12	12.0	453.3	--	63.5	--	48	V. Good
<i>15-042 Trib to E. Branch Chagrin 15.35</i>								
0.2	13	13.0	698.6	--	72.5	--	46	V. Good
<i>15-043 Trib to E. Branch Chagrin 16.20</i>								
0.1	13	12.0	834.0	--	77.5	--	50	Exceptional
04110003 020								
<i>15-001 Chagrin River</i>								
49.1	7	6.0	80.0	--	23.0	--	26	Poor
45.2	17	17.0	1368.0	--	82.5	--	32	Fair
42.6	12	12.0	183.7	--	58.0	--	30	Fair
40.0	19	19.0	891.0	20.50	82.0	8.8	48	V. Good
36.4	20	20.0	1083.0	38.09	85.0	9.7	52	Exceptional
33.4	19	19.0	981.0	61.69	86.0	9.5	50	Exceptional
30.6	22	22.0	3081.0	19.38	72.5	8.2	34	Marginal
30.0	19	18.0	1368.8	155.55	75.5	9.1	40	V. Good/Good
28.9	19	18.0	921.0	49.80	77.5	9.2	48	V. Good
28.2	19	18.0	696.0	60.25	82.0	8.7	46	Good/V. Good

Table 15. Continued.

River Mile	Cumulative Species	Mean Species	Relative Number	Relative Weight	QHEI	MIWb	IBI	Narrative Evaluation
<i>15-005 Aurora Branch</i>								
16.3	13	13.0	560.0	--	66.5	--	40	Good
14.4	13	12.0	426.5	--	77.0	--	22	Poor
11.9	13	13.0	344.0	--	79.5	--	32	Fair
11.3	16	16.0	954.0	--	76.5	--	36	Marginal
11.1	13	13.0	490.0	--	82.0	--	40	Good
9.1	11	11.0	2436.0	--	83.0	--	40	Good
7.4	12	12.0	1186.9	25.62	74.5	8.0	32	Good/Fair
5.6	18	18.0	2361.0	26.72	74.0	7.7	38	Good
3.8	21	20.0	468.0	13.74	79.5	8.5	44	Good
3.7	20	19.0	832.5	12.96	79.5	8.3	38	Good
3.4	19	19.0	1200.0	14.08	79.5	8.4	30	Good/Fair
1.0	14	14.0	708.0	10.97	54.0	7.8	36	Marginal
<i>15-006 McFarland Creek</i>								
2.3	13	13.0	1066.0	--	78.5	--	38	Marginal
0.2	15	15.0	564.0	--	75.0	--	44	Good
<i>15-007 Silver Creek</i>								
5.1	13	13.0	807.8	--	76.0	--	46	V. Good
2.8	17	17.0	664.5	--	77.0	--	46	V. Good
<i>15-014 Smith Creek</i>								
0.1	11	11.0	1208.0	--	77.0	--	36	Marginal
<i>15-024 Dewdale Creek</i>								
4.6	12	12.0	302.0	--	70.0	--	36	Marginal
0.6	16	16.0	568.0	--	71.0	--	44	Good
<i>15-025 S. Branch Silver Creek</i>								
1.1	14	14.0	230.0	--	79.5	--	36	Marginal
<i>15-037 Trib to Chagrin 38.32</i>								
0.7	5	5.0	846.0	--	60.5	--	32	Fair

Table 15. Continued.

River Mile	Cumulative Species	Mean Species	Relative Number	Relative Weight	QHEI	MIWb	IBI	Narrative Evaluation
<i>15-044 N. Branch McFarland Creek</i>								
0.1	9	9.0	1006.0	--	70.0	--	34	Fair
<i>15-045 Trib. to Smith Creek</i>								
0.6	5	5.0	525.0	--	67.5	--	30	Fair

Ecoregion Biocriteria: Erie-Ontario Lake Plain

Site Type	IBI			MIwb		
	WWH	EWB	MWH ^c	WWH	EWB	MWH ^c
Headwaters	40	50	24	NA	NA	NA
Wading	38	50	24	7.9	9.4	5.6
Boat	40	48	24	8.7	9.6	5.7

a - MIwb is not applicable to headwater streams with drainage areas ≤ 20 mi².

ns - Nonsignificant departure from biocriteria (≤ 4 IBI units or ≤ 0.5 MIwb units).

* - Indicates significant departure from applicable biocriteria (> 4 IBI units or > 0.5 MIwb units). Underlined scores are in the Poor or Very Poor range.

Table 16. Fish community attributes for sites sampled in the Chagrin River Basin, 2004 - 1990. MIWb and IBI scores not meeting water quality standards are denoted with an asterisk, and those departing from water quality standards within a margin of error are denoted by the superscript ns.

River Mile	Cumulative Species	Mean Species	Relative Number	Relative Weight	QHEI	MIWb	IBI	Narrative Evaluation
<i>15-001 Chagrin River</i>								
2004								
2.5	18	18.0	171.0	12.39	78.5	7.9	44	Good
2003								
49.1	7	7.0	80.0	0.00	23.0	--	26	Poor
45.2	17	17.0	1368.0	0.00	82.5	--	32	Fair
42.6	12	12.0	183.7	0.00	58.0	4.5	30	Fair
40.0	19	19.0	891.0	20.50	82.0	8.8	48	Good/V.Good
36.4	20	20.0	1083.0	38.09	85.0	9.7	52	Exceptional
33.4	19	19.0	981.0	61.69	86.0	9.5	50	Exceptional
30.6	22	22.0	3081.0	19.38	72.5	8.2	34	Good/M.Good
30.0	19	19.0	1368.8	155.55	75.5	9.1	40	V.Good/Good
28.9	19	19.0	921.0	49.80	77.5	9.2	48	Very Good
28.2	19	19.0	696.0	60.25	82.0	8.9	46	Very Good
26.7	18	18.0	1006.9	75.01	0.0	8.8	46	Good/V.Good
24.2	11	11.0	969.0	95.72	73.5	7.7	40	M.Good/Good
19.4	19	19.0	1161.0	53.90	87.5	9.3	46	Very Good
13.0	19	19.0	1059.0	19.08	65.0	9.2	40	V.Good/Good
9.7	19	19.0	486.0	25.03	73.0	8.4	46	Good/V.Good
4.8	22	22.0	1158.0	54.00	74.5	8.3	48	Good/V.Good
2.5	18	18.0	684.0	73.71	78.5	8.5	44	Good/V.Good
1995								
36.4	19	16.5	1146.8	14.43	80.5	8.7	46	Good/V.Good
33.4	2	15.0	709.5	26.94	83.5	8.6	46	Good/V.Good
30.6	0	16.5	1737.8	8.17	71.5	8.2	34	Good/M.Good
30.0	22	18.0	294.0	10.96	71.5	7.5	34	M.Good
28.9	16	14.5	375.8	35.75	80.0	7.7	44	M.Good/Good
28.0	23	19.5	434.3	25.12	78.0	7.6	46	M.Good/V.Good
26.5	0	12.5	370.5	17.54	85.5	7.4	41	M.Good/Good
24.2	19	16.5	269.3	15.06	79.5	7.2	45	Fair/Good
19.4	24	16.5	354.8	8.79	80.5	7.4	40	M.Good/Good
19.4	24	16.5	354.8	8.79	74.5	7.4	40	M.Good/Good
13.1	23	17.0	655.5	8.90	71.0	7.3	43	Fair/Good
4.8	24	17.5	474.0	11.31	69.0	8.1	38	Good

Table 16. Continued.

River Mile	Cumulative Species	Mean Species	Relative Number	Relative Weight	QHEI	MIWb	IBI	Narrative Evaluation
<i>15-001 Chagrin River</i>								
1990								
33.4	0	14.5	954.0	22.61	82.0	8.3	45	Good/V.Good
29.4	20	18.5	363.0	23.79	68.0	7.4	35	M.Good
1986								
33.4	24	21.3	538.3	20.62	84.5	8.3	47	Good/V.Good
30.6	25	20.7	1526.0	24.05	72.5	8.6	36	Good/M.Good
26.5	20	18.3	542.0	25.09	85.5	8.2	44	Good
4.0	13	21.3	497.5	21.28	77.5	7.9	44	Good
1977								
40.0	13	13.0	450.0	0.00	82.0	--	42	Good
4.0	23	23.0	1055.4	0.00	77.5	--	46	V. Good
<i>15-002 East Branch Chagrin River</i>								
2004								
16.3	12	12.0	1468.0	0.00	76.0	--	42	Good
10.3	14	14.0	766.5	5.95	70.0	8.2	42	Good
2.4	22	22.0	814.5	5.06	76.0	8.2	42	Good
1993								
13.9	20	20.0	2778.8	15.07	73.5	9.6	52	Exceptional
12.4	14	14.0	1473.8	5.33	63.5	7.9	48	Good/V.Good
1990								
10.4	19	17.5	1499.1	9.97	73.0	8.6	46	Good/V.Good
6.6	21	18.5	932.3	5.25	73.5	7.8	40	Good
3.7	21	19.0	1066.9	6.37	60.5	8.3	38	Good
2.4	19	18.5	1247.6	10.98	76.5	8.5	45	Good
1987								
10.4	16	16.0	1408.2	12.99	73.0	8.7	38	Good
<i>15-003 Griswold Creek</i>								
2004								
4.4	13	13.0	796.0	0.00	86.0	--	46	V.Good
0.1	9	9.0	280.0	0.00	67.5	--	40	Good
1996								
4.4	12	12.0	918.0	0.00	86.0	--	48	V.Good
0.9	12	12.0	1018.5	0.00	63.5	--	36	M.Good
1995								
0.9	7	7.0	978.0	1.94	63.5	--	32	Fair

Table 16. Continued.

River Mile	Cumulative Species	Mean Species	Relative Number	Relative Weight	QHEI	MIWb	IBI	Narrative Evaluation
<i>15-004 Willey Creek</i>								
1995								
0.2	17	17.0	656.6	5.02	72.0	--	44	Good
<i>15-005 Aurora Branch</i>								
2004								
3.8	21	21.0	468.0	13.74	79.5	8.3	44	Good
2003								
16.3	13	13.0	560.0	0.00	66.5	--	40	Good
14.4	13	13.0	426.5	0.00	77.0	--	22	Poor
11.9	13	13.0	344.0	4.09	79.5	--	32	Fair
11.3	16	16.0	954.0	12.63	76.5	--	36	M.Good
11.1	13	13.0	490.0	4.10	82.0	--	40	Good
9.1	11	11.0	2436.0	16.16	83.0	--	40	Good
7.4	12	12.0	1186.9	25.62	74.5	7.7	32	M.Good/Fair
5.6	18	18.0	2361.0	26.72	74.0	8.5	38	Good
3.7	20	20.0	832.5	12.96	79.5	8.4	38	Good
3.4	19	19.0	1200.0	14.08	79.5	7.8	30	Good/Fair
1.0	14	14.0	708.0	10.97	54.0	7.9	36	Good/M.Good
1996								
14.4	17	17.0	419.0	12.62	74.5	--	26	Poor
11.1	16	13.0	592.5	13.22	71.5	--	30	Fair
9.0	14	11.5	775.5	8.14	81.5	--	33	Fair
1995								
12.1	12	12.0	1376.3	15.60	66.0	--	38	Good
11.3	14	11.0	724.0	7.68	73.5	--	30	Fair
11.1	18	14.5	1779.8	30.11	71.5	--	38	Good
9.0	15	13.5	1121.3	14.06	81.5	--	39	Good
5.6	14	13.0	2173.5	12.92	70.5	8.1	38	Good
3.5	16	14.5	1289.3	9.74	69.0	7.1	33	Fair
3.4	9	18.0	1188.0	13.24	75.0	7.9	38	Good
1.6	21	18.5	833.3	15.62	59.5	7.9	40	Good
0.3	3	20.5	987.0	37.81	79.5	8.8	48	Good/V.Good
1994								
11.3	12	11.5	1052.0	9.92	73.5	--	33	Fair
11.1	16	14.0	1816.0	23.13	71.5	--	36	M.Good
9.0	14	13.0	1907.0	9.37	81.5	--	39	Good

Table 16. Continued.

River Mile	Cumulative Species	Mean Species	Relative Number	Relative Weight	QHEI	MIWb	IBI	Narrative Evaluation
<i>15-005 Aurora Branch</i>								
1991								
11.3	11	10.0	2007.0	7.73	78.0	--	32	Fair
11.2	10	10.0	1191.0	31.97	63.5	--	25	Poor
11.1	13	11.0	1142.5	16.34	80.0	--	27	Poor
9.0	12	11.0	1995.1	9.21	78.0	--	36	M.Good
1990								
9.0	12	10.5	1217.7	9.85	79.5	--	30	Fair
3.9	15	14.0	1328.8	12.72	79.0	7.9	38	Good
3.3	17	16.0	872.3	8.50	69.5	6.6	36	Fair/M.Good
1.6	13	13.0	282.0	2.38	63.0	5.8	26	Poor
0.3	5	17.0	1359.3	28.98	76.0	8.3	42	Good
1986								
0.3	20	15.7	1321.0	17.34	69.0	8.0	37	Good/M.Good
<i>15-006 McFarland Creek</i>								
2004								
2.3	12	12.0	1066.0	0.00	78.5	--	36	M.Good
0.2	15	15.0	564.0	0.00	75.0	--	44	Good
1995								
0.1	13	13.0	1500.0	5.07	72.0	--	46	V.Good
<i>15-007 Silver Creek</i>								
2004								
5.1	13	13.0	807.8	0.00	75.0	--	46	V.Good
2.8	17	17.0	664.5	0.00	77.0	--	46	V.Good
2002								
2.0	20	20.0	1125.0	0.00	60.0	--	38	Good
1995								
4.0	8	8.0	172.0	2.32	69.5	--	30	Fair
1.7	19	16.0	247.6	12.62	78.0	--	41	Good
0.5	18	16.5	228.0	18.00	61.5	--	43	Good
1994								
5.1	12	12.0	474.0	0.00	75.0	--	42	Good
2.7	19	19.0	294.8	0.00	85.5	--	50	Exceptional

Table 16. Continued.

River Mile	Cumulative Species	Mean Species	Relative Number	Relative Weight	QHEI	MIWb	IBI	Narrative Evaluation
<i>15-011 Caves Creek</i>								
2004								
0.9	9	9.0	958.0	0.00	71.0	--	36	M.Good
1987								
0.9	10	10.0	1018.0	0.00	71.0	--	32	Fair
<i>15-012 Trib to Chagrin 15.42</i>								
1995								
0.4	8	8.0	602.0	2.67	75.5	--	48	V.Good
1987								
0.2	12	12.0	1611.0	0.00	75.5	--	48	V.Good
<i>15-014 Smith Creek</i>								
2004								
0.1	11	11.0	1208.0	0.00	77.0	--	36	M.Good
<i>15-017 Trib to Chagrin 12.8</i>								
1995								
0.2	2	2.0	158.0	1.04	57.5	--	20	Poor
<i>15-018 Trib to Chagrin 22.8</i>								
2004								
0.2	12	12.0	210.0	0.00	66.5	--	38	Good
1995								
0.3	16	16.0	630.0	4.35	60.5	--	50	Exceptional
<i>15-023 Sunny Lake</i>								
1996								
0.1	10	10.0	216.0	0.00	64.0	--	26	Poor
<i>15-024 Dewdale Creek</i>								
2004								
4.6	12	12.0	302.0	0.00	70.0	--	36	M.Good
0.6	16	16.0	568.0	0.00	71.0	--	44	Good

Table 16. Continued.

River Mile	Cumulative Species	Mean Species	Relative Number	Relative Weight	QHEI	MIWb	IBI	Narrative Evaluation
<i>15-025 South Branch Silver Creek</i>								
2004								
1.1	14	14.0	230.0	0.00	79.5	--	36	M.Good
<i>15-025 South Branch Silver Creek</i>								
1994								
1.1	14	14.0	339.0	0.00	53.5	--	42	Good
<i>15-030 Ward Creek</i>								
2004								
0.4	16	16.0	436.0	0.00	67.5	--	32	Fair
<i>15-031 Quarry Creek</i>								
2004								
0.1	21	21.0	580.0	0.00	55.0	--	56	Exceptional
<i>15-032 Stony Brook</i>								
2004								
0.1	7	7.0	1788.0	0.00	65.5	--	40	Good
<i>15-033 Pierson Creek</i>								
2004								
0.1	11	11.0	583.6	0.00	66.5	--	56	Exceptional
<i>15-037 Chagrin Trib. 38.32</i>								
2004								
0.7	5	5.0	846.0	0.00	60.5	--	32	Fair
<i>15-038 Trib to E. Branch Chagrin 10.13</i>								
2004								
0.1	14	14.0	367.0	0.00	78.0	--	48	V.Good
<i>15-039 Stebbins Gulch</i>								
2004								
0.2	6	6.0	355.4	0.00	68.5	--	38	Good

Table 16. Continued.

River Mile	Cumulative Species	Mean Species	Relative Number	Relative Weight	QHEI	MIWb	IBI	Narrative Evaluation
<i>15-040 Trib to E. Branch Chagrin 14.62</i>								
2004								
0.1	6	6.0	555.0	0.00	62.5	--	38	Marginal
<i>15-041 Trib to E. Branch Chagrin 14.80</i>								
2004								
0.1	12	12.0	453.3	0.00	63.5	--	48	V. Good
<i>15-042 Trib to E. Branch Chagrin 15.35</i>								
2004								
0.2	13	13.0	698.6	0.00	72.5	--	46	V. Good
<i>15-043 Trib to E. Branch Chagrin 16.20</i>								
2004								
0.1	13	12.0	834.0	0.00	72.5	--	50	Exceptional
<i>15-044 N. Br. McFarland Creek</i>								
2004								
0.1	9	9.0	1006.0	0.00	70.0	--	34	Fair
<i>15-045 Trib. to Smith Creek</i>								
2004								
0.6	5	5.0	525.0	0.00	67.5	--	30	Fair

Ecoregion Biocriteria: Erie-Ontario Lake Plain

Site Type	IBI			MIwb		
	WWH	EWL	MWH ^c	WWH	EWL	MWH ^c
Headwaters	40	50	24	NA	NA	NA
Wading	38	50	24	7.9	9.4	5.6
Boat	40	48	24	8.7	9.6	5.7

a - MIwb is not applicable to headwater streams with drainage areas ≤ 20 mi².

ns - Nonsignificant departure from biocriteria (≤ 4 IBI units or ≤ 0.5 MIwb units).

* - Indicates significant departure from applicable biocriteria (> 4 IBI units or > 0.5 MIwb units). Underlined scores are in the Poor or Very Poor range.

BIOLOGICAL QUALITY: MACROINVERTEBRATE COMMUNITY**Upper Chagrin - Aurora Branch Assessment Unit (Hydrologic 11 Unit: 04110003-020)***Upper Chagrin River Mainstem*

There were eleven mainstem sites upstream from the Aurora Branch confluence. Six sites were Very Good to Exceptional in quality. Only two sites did not meet the WWH biological criterion. Both upstream sites, RMs 49.2 and 46.5, were modified pooled habitats and wetland influenced which limited the community diversity yielding few EPT and sensitive taxa with low community tolerance values (Table 17, Figures 16, 17). The upstream site (RM 49.2) was influenced by golf course construction and possibly channelized conditions which promoted pooled reaches having little channel development. At Auburn Rd. (RM 46.5) downstream from Bass Lake, a low fair quality community was present with similar habitat issues (as above), some nutrient runoff (higher community density) and a limited community of tolerant and facultative organisms (Figures 16, 17).

Downstream at Fowlers Mill Rd. (RM 45.3) and Rockhaven Rd. (RM 42.8) increased gradient and habitat features (rubble substrates) with swifter flows supported a more diverse quality community. Ten to twelve EPT taxa and 15-22 sensitive taxa mirrored a good quality community meeting WWH expectations (Figure 16).

By RM 40 and downstream from Dewdale Creek an exceptional macroinvertebrate community was present with very good to exceptional quality exhibited to the confluence with Aurora Branch (RM 27.09) (Figure 16). There is some concern about the increases in relative density. The highest density documented was at RM 36.6 (Fairmount Rd.) with >2200 organisms/ft.² which is almost 2.5 times higher than the previous survey (Table 17). The mean relative density for *ambient* regional reference sites in the EOLP ecoregion for the Chagrin, Grand, and upper Cuyahoga River basins is 620 organisms/ft.² with a range of 274 - 720 organisms/ft.² (for the 25th to 75th percentiles). Upstream nonpoint and point source inputs include Marsh Hawk Run (Trib. to Chagrin R. @ RM 38.32) and three tributaries to the Chagrin River mainstem between RM 38 and RM 37 draining residential areas.

The only variation from marginally exceptional or exceptional scores in this reach was at St. Rt. 87 (RM 33.5) where the Invertebrate Community Index (ICI) score was 38 (Good). Excessive sand was present in the run habitats, likely from upstream inputs. This could be the sand bedload from washout from a dam removal in Silver Creek (confluence at RM 34.21). An impending dam failure initiated removal prior to the survey in 2003-2004. There has also been suburban development with nonpoint sedimentation runoff locally. The Quality Community Tolerance Value (QCTV) remained high (41.9) indicating high taxa quality, so the effect of the sediment bedload in the Chagrin River mainstem might be a minor and possibly a temporal issue (Figure 17). The QCTV is a median

Table 17. Summary of macroinvertebrate data collected from artificial substrates (quantitative sampling) & natural substrates (qualitative sampling) in the Chagrin River study area, June to October, 2003 and 2004.

Stream RM	Drain. Area (sq. mi.)	Data Codes	Qual./ Quant./ Total Taxa	EPT Ql. /Total	Sensitive Taxa Ql. /Qnt./ Tot.	Density Ql. / Qt.	CW Taxa	Ql. Tol. Taxa	Ql. Sens. Tol.	QCTV	Predominant Organisms with Tolerance Category(ies) in Parentheses	ICI	Narrative Evaluation
Chagrin River (15-001)													
49.2	1.8	X19	27/ - /27	1 / 1	2 / - / 2	Low	0	15	0.13	26.4	Beetles (MT,F), Physella (T), odonates (MT,T)	P*	Poor
46.5	10.3	-	26/ - /26	0 / 0	1 / - / 1	High	0	14	0.07	22.8	Scuds (F), sponge (F), damselflies (MT)	F*	Fair
45.3	11.1	-	34/ - /34	11 / 11	15 /- /15	H.-Mod.	3	0	>15	39.7	Hydropsychid caddisflies (F), riffle beetles (F), <i>Macronychus glabratus</i> (MI)	G	Good
42.8	13.4	-	62/ - /62	12 / 12	21/- /21	Low	1	9	2.33	39.3	Hydropsychid caddisflies (F,MI), odonates (F)	G	Good
40.0	30.0	X16	53/40/72	20 / 24	24/22/34	Low/ 1107	1	3	8.00	41.6	Hydropsychid caddisflies (F,MI), <i>Rheo.</i> and other midges (F,MI,I), blackflies (F)	50	Exceptional
36.6	36.0	X16	56/40/69	20 / 23	28/23/35	M.-Low/ 2288	0	4	7.00	41.0	Hydropsychid caddisflies (F,MI), <i>Rheo.</i> and other midges (F,MI,I), blackflies (F)	50	Exceptional
33.5	54.0	X16	49/35/65	21 / 23	23/22/33	Mod./ 333	0	4	5.75	41.9	Hydropsychid caddisflies (MI,F), <i>Rheo.</i> and other midges (F,MI,I), <i>Psephenus</i> (MI), <i>Psychomyia</i> caddisflies (I)	38	Good
30.6	56.0	X16	48/47/69	22 / 26	27/25/37	Mod.-H. /1982	1	3	9.00	41.6	<i>Rheotanytarsus</i> & other midges (MI,F,I), Hydropsychid caddisflies (MI,F), moth larvae <i>Petrophila</i> (I), <i>Psychomyia</i> (I)	50	Exceptional
30.0	57.0	X16	40/ - / 40	18 / 18	15 / - /15	High - Mod.	1	4	3.75	39.4	Hydropsychid caddisflies (MI,F), <i>Rheo.</i> and other midges (MI,F), <i>Psychomyia</i> caddisflies (I), steno. mayflies (F,MI,I)	VG	Very Good

Stream RM	Drain. Area (sq. mi.)	Data Codes	Qual./Quant./Total Taxa	EPT Ql./Total	Sensitive Taxa Ql./Qnt./Tot.	Density Ql./Qt.	CW Taxa	Ql. Tol. Taxa	Ql. Sens. Tol.	QCTV	Predominant Organisms with Tolerance Category(ies) in Parentheses	ICI	Narrative Evaluation
Chagrin River (15-001) (cont.)													
28.8 ⁺	58.0	-	42/37/57	22 / 25	24/20/31	High / 1726	2	2	12.00	43.3	<i>Rheotanytarsus</i> & other midges (F,MI,I), <i>Leucotrichia</i> (MI), Hydropsychids (MI,F), baetid mayflies (F,MI,I)	48	Exceptional
28.2	60.0	X16	44/42/65	17 / 21	23/21/33	H.-Mod. / 1407	1	6	3.83	42.3	Hydropsychid caddisflies (F,MI), <i>Rheo.</i> & other midges (F,MI,I), <i>Leucotrichia</i> caddisflies (MI)	48	Exceptional
26.7	122	X16	29/ -/ 29	15 / 15	14 / 14	H.-Mod.	0	2	7.00	42.8	Hydropsychids (F,MI), <i>Leucotrichia</i> (MI)	VG	Very Good
25.3 ⁺	129	-	52/33/64	18 / 20	27/19/34	H.-M./899	2	6	4.50	42.3	Hydropsychids (F,MI), <i>Leucotrichia</i> (MI)	50	Exceptional
23.7	139	X16	34/31/49	16 / 21	16/18/25	H.-Mod. / 1395	3	2	8.00	43.2	Hydropsychids (F,MI), <i>Leucotrichia</i> (MI), <i>Rheo.</i> & other midges (F,MI,I)	42	Very Good
19.4	161	X16	42/41/57	14 / 15	19/19/25	H.-M./ 1759	0	4	4.75	42.3	Hydropsychids (F,MI), <i>Rheotanytarsus</i> & other midges (F,MI,I)	44	Very Good
12.8	174	X16	47/36/66	12 / 13	17/20/30	M-L/334	1	8	2.13	39.5	Hydropsychids (F,MI), <i>Petrophila</i> (MI)	38	Good
8.3	187	X16	37/ -/ 37	13 / 13	17/ -/ 17	Low	2	5	3.40	40.0	Hydropsychids (F,MI), <i>Petrophila</i> (MI)	VG	Very Good
4.2	246	X16	35/35/52	10 / 14	16/17/26	M / 842	2	3	5.33	41.6	Hydropsychids (F,MI), <i>Petrophila</i> (MI)	38	Good
2.5 ⁺	248	-	59/ -/ 59	17/ 17	22/ -/ 22	H.-Mod.	1	11	2.00	39.5	Baetid mayflies (F,MI,I), <i>Rheotanytarsus</i> & other midges (F,MI), <i>Leucotrichia</i> (MI)	VG	Very Good
1.7	249	X16	27/ -/ 27	10 / 10	10/ -/ 10	Mod.-Low	0	4	2.50	40.4	Hydropsychids (F,MI), <i>Petrophila</i> (MI)	G	Good
East Branch Chagrin River (15-002)													
16.3	5.3	X19	64/ -/ 64	20 / 20	31/ -/ 31	H.-Mod.	6	6	5.17	39.7	Hydropsychids (F,MI), <i>Rheotanytarsus</i> & other midges (F,MI,I), <i>Glossosoma</i> (MI)	E	Exceptional

Stream RM	Drain. Area (sq. mi.)	Data Codes	Qual./ Quant./ Total Taxa	EPT Ql./Total	Sensitive Taxa Ql./Qnt./ Tot.	Density Ql. / Qt.	CW Taxa	Ql. Tol. Taxa	Ql. Sens. Tol.	QCTV	Predominant Organisms with Tolerance Category(ies) in Parentheses	ICI	Narrative Evaluation
East Branch Chagrin River (15-002) (cont.)													
10.2	24.2	-	49/ -/ 49	17 / 17	31/ -/ 31	Mod.-Low	7	3	8.67	42.3	Hydropsychids (F,MI), <i>Rheo.</i> midges (MI)	E	Exceptional
2.4	46.5	-	37/ -/ 37	15 / 15	17/ -/ 17	Mod.-Low	2	3	5.67	42.3	Hydropsychids (F,MI), <i>Rheo.</i> midges (MI), blackflies (F), steno. mayflies (F,MI,I)	VG	Very Good
Griswold Creek (15-003)													
4.4	3.5	X19	47/ -/ 47	9 / 9	19/ -/ 19	Mod.-H.	1	4	4.75	39.5	Hydropsychids (F,MI), <i>Rheo.</i> midges (MI,F)	G	Good
0.1	7.2	X19	37/ -/ 37	16 / 16	16/ -/ 16	Mod.	2	2	8.00	41.9	Hydropsychids (F,MI), <i>Rheo.</i> midges (MI,F)	VG	Very Good
Aurora Branch (15-005)													
16.3	3.6	X16, X19	28/ -/ 28	1 / 1	1/ - / 1	Low	0	11	0.09	28.4	Flatworms (F), midges (F,MI,T), damselflies (F,MT)	P*	Poor
14.4	7.5	X16, X19	36/ -/ 36	12 / 12	10/ -/ 10	Low	0	4	2.50	39.5	Hydropsychid caddisflies (F), <i>Rheo.</i> midges (MI)	G	Good
11.9	12.1	X16	37/32/51	8 / 9	7/14/16	Mod.-Low/ 233	2	5	1.40	38.3	Hydropsychid caddisflies (F), blackflies (F), <i>Rheotanytarsus</i> midges (MI)	42	Very Good
11.3	13.1	X16	46/32/57	8 / 10	13/15/20	Mod.-Low/ 553	1	6	2.17	39.7	Hydropsychid caddisflies (F), blackflies (F), <i>Rheotanytarsus</i> midges (MI)	42	Very Good
11.0	13.3	X6, 12,16	42/35/52	6 / 8	12/15/16	Mod.-Low / 1067	2	5	2.40	39.5	Hydropsychid caddisflies (F), blackflies (F), <i>Rheotanytarsus</i> midges (MI)	42	Very Good
9.1	16.4	X16	46/35/62	11 / 14	20/14/27	Mod.-Low / 431	1	4	5.00	40.9	Hydropsychid caddisflies (F,MI), blackflies (F), <i>Rheo.</i> and other midges (F,MI,I,MT), stonemid mayflies (F)	48	Very Good

Stream RM	Drain. Area (sq. mi.)	Data Codes	Qual./ Quant./ Total Taxa	EPT Ql./Total	Sensitive Taxa Ql./Qnt./ Tot.	Density Ql. / Qt.	CW Taxa	Ql. Tol. Taxa	Ql. Sens. Tol.	QCTV	Predominant Organisms with Tolerance Category(ies) in Parentheses	ICI	Narrative Evaluation
Aurora Branch (15-005) (cont.)													
7.3	28.0	X16	48/ -/ 48	18 / 18	25/ -/ 25	Mod.- Low	5	3	8.33	42.3	Hydropsychid caddisflies (F,MI), midges (F,MI,I)	VG	Very Good
5.5 ⁺	31.0	-	72/45/85	22 / 24	36/27/45	High- Mod./ 854	5	7	5.14	41.0	Baetid mayflies (F,MI), hydropsychid caddisflies (F,MI), <i>Rheotanytarsus</i> and other midges (F,MI,I,T)	56	Exceptional
5.1	33.0	X16	68/31/77	21 / 23	35/16/38	Mod. - Low/ 1364	5	6	5.83	41.0	Hydropsychid caddisflies (F,MI), <i>Paratanytarsus</i> & others (MT,T,MI,I)	48	Exceptional
3.7 ⁺	37.5	-	44/30/51	17 / 18	19/15/23	Mod. / 1659	2	1	19.00	42.1	<i>Rheotanytarsus</i> (MI),baetid mayflies (F,MI), <i>Isonychia</i> (MI), blackflies (F), hydropsychid caddisflies (F,MI)	50	Exceptional
3.5	49.0	X16	65/46/81	22 / 23	29/24/38	Mod./ 624	4	7	4.14	40.0	Hydropsychid caddisflies (F,MI), midges (F,MI,I,T), blackflies (F)	54	Exceptional
3.4	49.0	X16	53/34/61	17 / 18	24/19/28	High / 1474	6	7	3.43	41.2	Hydropsychid caddisflies (F,MI), <i>Rheo.</i> midges (F,MI,I,T), blackflies (F)	48	Exceptional
0.9 ⁺	57.0	-	30/ -/ 30	15 / 15	16/ -/16	Mod.	1	1	16.00	43.6	<i>Rheo.</i> midges (MI), baetids (F,MI)	VG	Very Good
0.3	58.0	X16	55/30/66	20 / 22	20/18/27	Mod.	1	5	4.00	39.7	Hydropsychid caddisflies (F,MI), midges (F,MI,I,T), blackflies (F), <i>Leucotrichia</i> (MI)	46	Exceptional
McFarland Creek (15-006)													
2.3 ⁺	9.3	X19	44/ -/ 44	18 / 18	14 / 14	High - Mod.	3	3	6.00	40.4	Hydropsychid caddisflies (F,MI), <i>Rheotanytarsus</i> & other midges (F,MI,I)	VG	Very Good
0.2 ⁺	11.1	-	45/ -/ 45	15 / 15	21 / 21	Mod. - Low	3	2	10.50	41.9	<i>Rheotanytarsus</i> & other midges (F,MI,I), Hydropsychid caddisflies (F,MI), blackflies (F), Hydroptilids (F)	VG	Very Good

Stream RM	Drain. Area (sq. mi.)	Data Codes	Qual./ Quant./ Total Taxa	EPT Ql./Total	Sensitive Taxa Ql./Qnt./ Tot.	Density Ql. / Qt.	CW Taxa	Ql. Tol. Taxa	Ql. Sens. Tol.	QCTV	Predominant Organisms with Tolerance Category(ies) in Parentheses	ICI	Narrative Evaluation
Silver Creek (15-007)													
5.1 ⁺	2.5	X19	48/ -/ 48	17 / 17	21/ -/21	H.-Mod.	4	2	10.50	42.3	Hydropsychid caddisflies (F,MI), Neophylax (I), Psychomyia (I)	E	Exceptional
0.4 ⁺	13.7	-	43/49/67	15 / 18	24/28/39	Mod./711	3	2	12.00	42.8	Hydropsychids (F,MI), <i>Rheo.</i> midges (MI)	54	Exceptional
Beaver Creek (15-008)													
2.3 ⁺	1.4	X19	74/52/89	17 / 20	23/24/33	H-Mod./ 356	12	6	3.83	38.3	Hydropsychid caddisflies (F,CW), <i>Rheotanytarsus</i> & other midges (F,MI,I)	52	Exceptional
0.6 ⁺	3.3	X19	63/51/86	13 / 17	17/16/26	High - Mod./ 1587	1	10	1.70	38.3	Hydropsychid caddisflies (F,MI), Tanytarsini (F,MI,I) & <i>Polypedilum flavum</i> midges (F,MI)	54	Exceptional
Gully Brook (Trib. to Chagrin River @ RM 5.54) (15-010)													
0.6 ⁺	5.8	X19	39/ -/ 39	5 / 5	11/ -/11	Mod. - Low	1	6	1.83	38.3	Hydropsychid caddisflies (F), baetid mayflies (F), Tanytarsini & other midges (F,MI,I,MT,T)	MG ^{ns}	Marginally Good
Caves Creek (Trib. to Chagrin River @ RM 11.52) (15-011)													
0.9	5.5	X19	44/ -/ 44	21 / 21	23/ -/23	Mod. - High	8	2	11.50	42.2	Hydropsychid caddisflies (F,MI), <i>Rheo.</i> midges (MI), <i>Chimarra</i> caddisflies (MI)	E	Exceptional
Smith Creek (15-014)													
1.1	10.1	-	53/ -/ 53	21 / 21	31/ -/31	Mod.	4	4	7.75	42.8	Hydropsychid caddisflies (F,MI), <i>Rheotanytarsus</i> midges (MI)	E	Exceptional
Trib. to Chagrin R. @ RM 22.81 (Pepper-Luce Creek) (15-018)													
0.2 ⁺	9.3	X19	30/ -/ 30	8 / 8	8/ -/8	High - Mod.	1	6	1.33	38.7	Blackflies (F), baetid mayflies (F,MI), <i>Petrophila</i> moths (I)	MG ^{ns}	Marginally Good

Stream RM	Drain. Area (sq. mi.)	Data Codes	Qual./ Quant./ Total Taxa	EPT Ql./Total	Sensitive Taxa Ql./Qnt./ Tot.	Density Ql. / Qt.	CW Taxa	Ql. Tol. Taxa	Ql. Sens. Tol.	QCTV	Predominant Organisms with Tolerance Category(ies) in Parentheses	ICI	Narrative Evaluation
Dewdale Creek (15-024)													
4.6 ⁺	3.6	X19	53/ -/ 53	7 / 7	13/ -/13	Mod.	2	10	1.30	36.8	<i>Rheotanytarsus</i> and other midges (F)	G	Good
0.7 ⁺	12.0	-	60/46/74	21 / 26	32/31/44	High - Mod./ 653	5	4	8.00	42.0	Hydropsychid caddisflies (F,MI), <i>Rheo.</i> and other midges (F), blackflies (F), riffle beetles (F,MI)	56	Exceptional
South Branch Silver Creek (15-025)													
1.1 ⁺	3.7	X19	64/ -/ 64	8 / 8	18/ -/18	Mod.- High	0	15	1.20	38.3	Hydropsychid caddisflies (F,MI), <i>Rheo.</i> and other midges (F,MI,I,MT,T,VT,)	G	Good
Ward Creek (15-030)													
0.8 ⁺	7.5	X19	25/ -/ 25	4 / 4	4/ - / 4	High	0	4	1.00	36.2	Hydropsychid caddisflies (F), <i>Rheo.</i> and other <i>Tanytarsus</i> midges (MI), <i>Baetis</i> (F)	F*	Fair
Quarry Creek (Trib. to E. Br. Chagrin R. @ RM 1.85) (15-031)													
0.1 ⁺	3.4	X19	48/ -/ 48	9 / 9	18/ - /18	Mod.	5	3	6.00	39.5	Hydropsychids (F,MI), <i>Rheo.</i> midges (MI)	VG ^{ns}	Very Good
Stoney Brook (Trib. to E. Br. Chagrin R. @ RM 3.57) (15-032)													
0.1	3.8	X19	62/ -/ 62	18 / 18	24/ -/24	High	4	6	4.00	40.0	Hydropsychids (F,MI), <i>Rheotanytarsus</i> & other midges (F,MI,I,MT,T)	VG	Very Good
Pierson Creek (Trib. to E. Br. Chagrin R. @ RM 6.73) (15-033)													
0.1	1.9	X19	42/ -/ 42	16 / 16	24/ -/24	Mod. - Low	11	1	24.00	42.8	<i>Chimarra</i> (MI), hydropsychids (F,MI), and <i>Glossosoma</i> (MI) caddisflies	VG ^{ns}	Very Good
Trib. to Chagrin R. @ RM 38.32 (Marsh Hawk Run) (15-037)													
0.3 ⁺	1.4	X19	46/ -/ 46	6 / 6	5/ - / 5	Mod.- Low	3	9	0.56	37.1	<i>Rheotanytarsus</i> & other midges (F,MI,MT,T), hydropsychids (F)	F*	Fair

Stream RM	Drain. Area (sq. mi.)	Data Codes	Qual./ Quant./ Total Taxa	EPT Ql./Total	Sensitive Taxa Ql./Qnt./ Tot.	Density Ql. / Qt.	CW Taxa	Ql. Tot. Taxa	Ql. Sens. Tot.	QCTV	Predominant Organisms with Tolerance Category(ies) in Parentheses	ICI	Narrative Evaluation
Trib. to E. Br. Chagrin R. @ RM 10.13 (15-038)													
0.1 ⁺	4.6	X6, X19	39/38/64	18 / 28	24/26/41	Mod.	12	1	24.00	43.5	Baetid mayflies (F,MI,I), <i>Rheotanytarsus</i> mayflies (F,MI)	54	Exceptional
Stebbins Gulch (Trib. to E. Br. Chagrin R. @ RM 10.60) (15-039)													
0.2 ⁺	2.0	X19	61/ -/ 61	26 / 26	37/ -/ 37	Mod.	14	2	18.50	43.3	Baetids (MI,I), Steno. mayflies (F,MI)	E	Exceptional
Trib. to E. Br. Chagrin R. @ RM 14.62 (15-040)													
0.1 ⁺	1.7	X19	63/ -/ 63	23 / 23	31/ -/ 31	Mod. - Low	8	4	7.75	41.9	<i>Rheotanytarsus</i> midges (MI), H ₂ O penny, <i>Glossosoma</i> (MI), <i>M. vicarium</i> (MI)	E	Exceptional
Trib. to E. Br. Chagrin R. @ RM 14.80 (15-041)													
0.1 ⁺	2.0	X19	44/ -/ 44	11 / 11	18/ -/ 18	H.-Mod.	6	2	9.00	40.9	Hydropsychid caddisflies (F,MI)	G	Good
Trib. to E. Br. Chagrin R. @ RM 15.35 (15-042)													
0.2 ⁺	1.5	X19	54/ -/ 54	13 / 13	24/ -/ 24	Mod.	7	6	4.00	40.4	Hydropsychid caddisflies (F,MI), baetid mayflies (F,MI), Tanytarsini and CW midge <i>P. (P.) aviceps</i> (F,MI)	VG ^{ns}	Very Good
Trib. to E. Br. Chagrin R. @ RM 16.20 (15-043)													
0.1 ⁺	4.4	X19	68/ -/ 68	21 / 21	34/ -/ 34	Mod.	12	3	11.33	40.7	Hydropsychid caddisflies (F,MI), baetid mayflies (F,MI), blackflies (F)	E	Exceptional
North Br. McFarland Creek (15-044)													
0.2 ⁺	4.0	X19	46/ -/ 46	21 / 21	34/ -/ 34	Mod.- High	6	2	10.50	42.3	<i>Rheotanytarsus</i> midges (MI), stenoemid mayflies (F,MI)	VG	Very Good

Stream RM	Drain. Area (sq. mi.)	Data Codes	Qual./Quant./Total Taxa	EPT Ql./Total	Sensitive Taxa Ql./Qnt./Tot.	Density Ql. / Qt.	CW Taxa	Ql. Tol. Taxa	Ql. Sens. Tol.	QCTV	Predominant Organisms with Tolerance Category(ies) in Parentheses	ICI	Narrative Evaluation
Trib. to Smith Creek @ RM 2.70 (15-045)													
0.6 ⁺	2.2	X19	68/ -/ 68	14 / 14	22/ -/ 22	Mod.	6	8	2.75	38.3	<i>Rheotanytarsus</i> and CW midge <i>P. (P.) aviceps</i> (F,MI), hydroptychid caddisflies (F,MI), cased caddisflies (F,MI,I)	VG ^{ns}	Very Good

RM: River Mile.

Drain. Ar.: Drainage Area

Data Codes: X6 = 4 HD's only, X12 = Suspected High Water Influence/Disturbance, X16 = Post-September Fall Sampling (> 9/30),
X19 = Drainage Area < 10 sq. miles.

Ql.: Qualitative sample collected from the natural substrates.

Sensitive Taxa: Taxa listed on the Ohio EPA Macroinvertebrate Taxa List as MI (moderately intolerant) or I (intolerant).

Qt.: Quantitative sample collected on Hester-Dendy artificial substrates, density is expressed in organisms per square foot.

Qualitative sample relative density: L=Low, M=Moderate, H=High.

CW: cold water.

Tolerance Categories: VT=Very Tolerant, T=Tolerant, MT=Moderately Tolerant, F=Facultative, MI=Moderately Intolerant, I=Intolerant.

⁺ 2004 sample

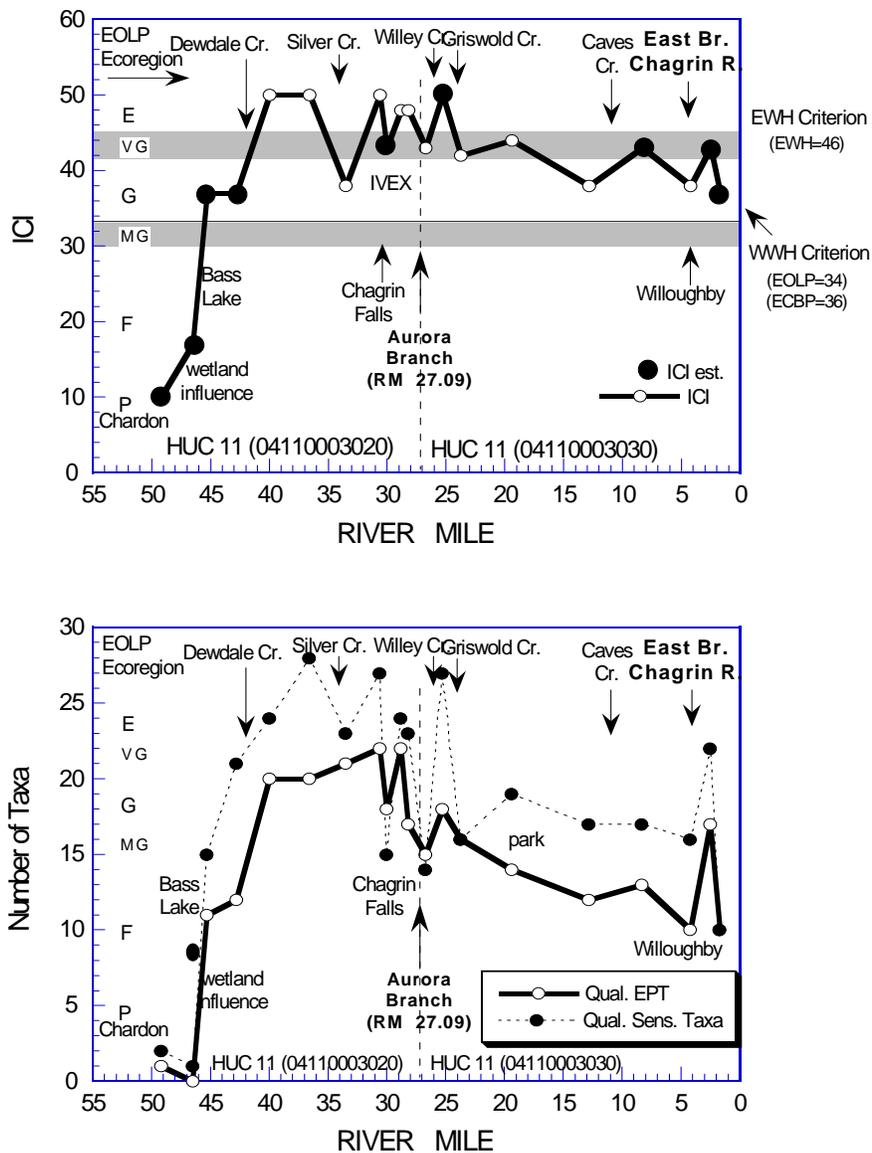


Figure 16. Longitudinal plots of the Invertebrate Community Index (ICI) scores (and estimated ICI values) and the qualitative EPT and sensitive taxa totals for the Chagrin River mainstem, 2003-04. The estimated ICI is determined as the average score for the narrative site evaluation or estimated and totalled from each metric calculation.

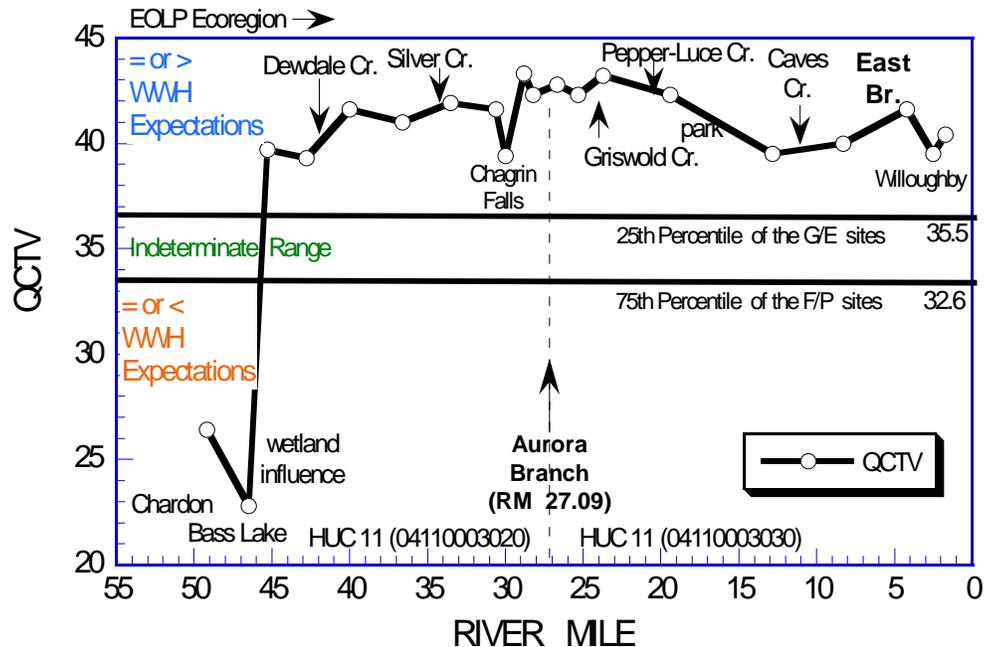


Figure 17. Longitudinal plot of Quality Community Tolerance Value (QCTV) for the Chagrin River mainstem, 2003-04. The QCTV is a weighted ICI value based on the weighted mean of all of the average ICIs at each location that each taxa was collected. For each taxa in the Ohio EPA database the average ICI score was computed and weighted by the abundance data for that taxa in that sample.

weighted ICI score for each site. For each taxa in the Ohio EPA database the average ICI score was computed and weighted by the abundance data for that taxa in that sample. The sites with taxa found in high abundance at good sites (high ICI scores) and which decrease in abundance at poor sites will have higher weighted ICI values. Each taxa will have a weighted ICI value and for any site these values are then averaged for each taxa found in the qualitative sample to derive the QCTV for a specific site.

The only other decline in macroinvertebrate quality in the upper mainstem were near St. Rt. 87 (RM 33.5) and downstream from IVEX at RM 30.0 (historical discharge abandoned in August, 2004 though still discharging at time of sampling). A large sand bedload was causing embeddedness of the larger substrates due to runoff from recent development. There was an increase in more tolerant taxa like limpet snails (*Ferrissia* sp.) and oligochaete worms in the quantitative sample. Field

observations noted also that the blackfly population were increased, as the reach looks somewhat enriched. The ICI score of 38 (Good) decreased significantly from the exceptional scores upstream and verifies decreased quality from the nonpoint source inputs from the local development. The Chagrin River mainstem water quality downstream from IVEX at RM 30.0 was still assessed as Very Good, but the reach quality decreased from an ICI of 50 upstream between the lakes (RM 30.6). Minimal decreases in EPT taxa (< 10 percent) occurred, but the number of sensitive taxa decreased by 45 percent downstream from IVEX (at RM 30.0) (Table 17, Figures 16) Some nutrient enriched conditions continued at RM 30.6 from upstream (increased algal production from instream nonpoint source runoff exacerbated by open canopy conditions in impoundment at ~ RM 30.8). Exceptional quality continued in the upper Chagrin mainstem to downstream from Chagrin Falls WWTP (RM 28.2) despite some slight but not inordinate nutrient enrichment. At Miles Rd. (RM 28.8) the relative community density was still elevated from greater numbers of filtering midges and caddisflies at 1726 organisms/ft.², but the ICI was still 48 (Exceptional) (Figure 17). At Solon Road there was similarly exceptional community quality (RM 28.2) with 33 sensitive taxa and a high QCTV value (42.3), as the ICI also scored a 48 (Table 17, Figures 16, 17).

Lower Chagrin - East Branch Assessment Unit (Hydrologic 11 Unit: 04110003-030)

Lower Chagrin River Mainstem

Overall, the lower mainstem macroinvertebrate community quality was generally very good with ICI scores ranging from 38 (Good) to 50 (Exceptional). Six sites were Very Good or Exceptional, and three indicated good community quality (Figure 16, Table 17). The best lower mainstem sites, as gauged by ICI, sensitive taxa, Sensitive/Tolerant ratio (S/T) and the Quality Community Tolerance Values (QCTV) were within the first ten miles of the Chagrin River mainstem downstream from Aurora Branch (RM 27.09) and also downstream from East Branch Chagrin River in the Chagrin Metro Parks (RMs 4.2 and 2.5) (Figures 16, 17, Table 17). The best ICI score (50) was at Chagrin Blvd. (RM 25.3) where there were 27 qualitative and 34 total sensitive taxa collected (Fig. 16, Table 17). The predominant organisms in the lower Chagrin River mainstem were primarily moderately intolerant (MI) *Ceratopsyche* and *Leucotrichia* caddisflies and MI *Petrophila* moth larvae.

Samples indicated enriched nutrient conditions existed through the lower mainstem, but areas of bedrock at higher flows would cause some scour and decrease the relative density locally (i.e., Rogers Rd. and Eagle Rd. at RMs 12.8 and 8.3, respectively). The areas of higher relative density had increased nutrient inputs and more open canopy conditions which increased primary production. These areas were downstream from Aurora Branch (RM 26.7), upstream from Kinsman Rd. (RM 23.7) (NPS Chagrin Falls runoff and Griswold Cr.) and downstream from Fairmount Rd. at RM 19.4 (dst. Pepper-Luce Creek @ RM 22.81) (Fig. 17). These macroinvertebrate community densities were not elevated enough to indicate the most extreme nutrient enriched conditions, as very good community quality was still present as noted above. Care should be taken to carefully control point

source and NPS nutrient inputs to avoid overwhelming the assimilative capacity of the system and then cause complete degradation of community quality.

Chagrin River Mainstem Trends

Trend data indicate there has been an increase in quality overall since prior surveys in the 1980s and 1990s. The reach around IVEX in the upper mainstem is greatly improved (Very Good) in quality compared to fair conditions (ICI=16) in 1995, and the ICI scores in the lower reach are generally higher than the most recent previous survey in 1995 (Fig. 18). The mean QCTV score for 2003-04 was 41.4 which is almost 3 points higher than the 1995 mean of 38.6 indicating general improvements related to improved treated wastewater quality and likely decreased nonpoint effects from stormwater in some areas (Fig. 19). The 1986 survey had two sites with slightly higher scores (48 at Fairmount Rd. (RM 20.9) and 42 at Rogers Rd. (RM 13)), but the 2003 scores were within an acceptable range of variability (four points) suggesting no significant difference. The only 2003 reach site with a lower ICI score was upstream St. Rt. 87 (RM 33.5). Conversely, there were more qual. EPT taxa, sensitive taxa (with similar total amounts), and similar QCTV values in the 2003 data compared to the 1995 data. However, it was noted that in 2003 that embedded substrates, a large sand bedload, and erosion with some enrichment occurred as a result of suburban housing development pressures in the local area. The other consideration for the higher instream sand bedload is possibly substrates washed out from Silver Creek that were deposited behind an impoundment that was recently removed. Nonpoint source stormwater and sedimentation inputs need to be controlled to protect water quality in this reach.

Relative community densities in 2003 were higher in the upstream mainstem reaches than those measured in 1995, but relative density values between surveys were similar in the middle reaches of the Chagrin River in vicinity of the Aurora Branch confluence. The highest relative density documented was at RM 36.6 (Fairmount Rd.) with >2200 organisms/ft.² which is almost 2.5 times higher than the 1995 survey results (Table 17, Figure 19). The mean relative density for *ambient* regional reference sites in the EOLP ecoregion for the Chagrin, Grand, and upper Cuyahoga River basins is 620 organisms/ft.² with a range of 274 - 720 organisms/ft.² (for the 25th to 75th percentiles). Care could be taken to control point and nonpoint source inputs upstream which include Marsh Hawk Run (Trib. to Chagrin R. @ RM 38.32) and likely tributaries to the Chagrin River mainstem between RM 38 and RM 37 draining residential areas. Lower relative density was observed during 2003 in the lower Chagrin mainstem reach than in 1995 (Figure 19).

Chagrin River tribs. from Upper Chagrin - Aurora Branch Unit (Hydrologic 11 Unit: 04110003-020)

Beaver Creek (RM 47.40) (EOLP)

Beaver Creek in the upper watershed (RM 2.3) was among those tributaries with the most cold water

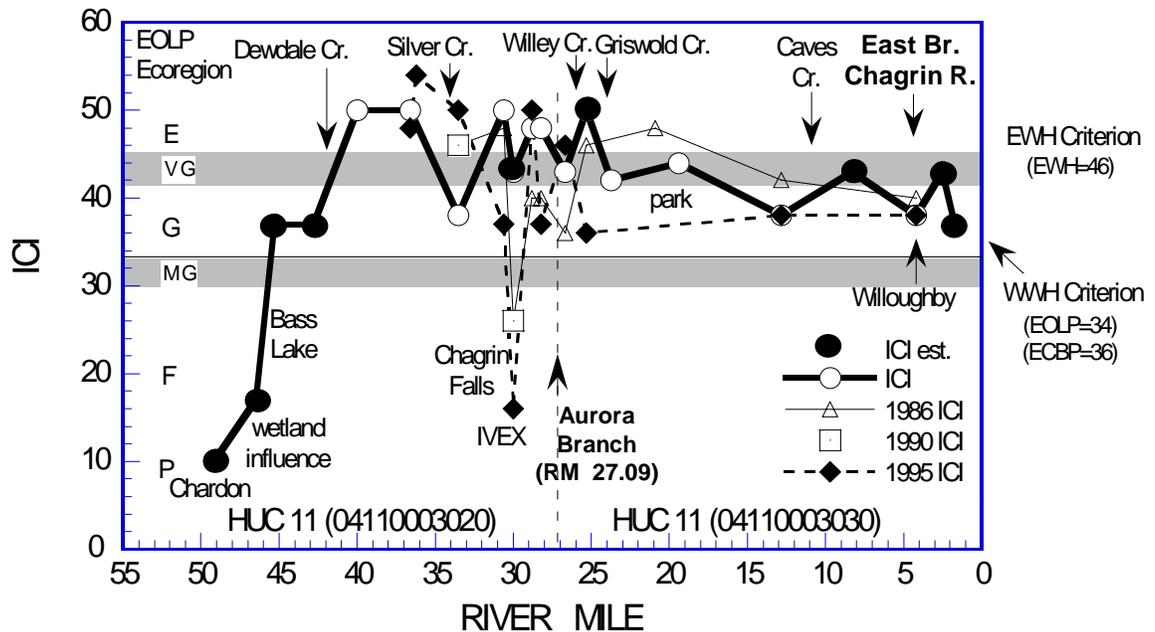


Figure 18. Longitudinal trends of the Invertebrate Community Index (ICI) scores (and estimated ICI values) for the Chagrin River mainstem, 1986-2004. The estimated ICI is determined as the average score for the narrative site evaluation or estimated and totalled from each metric calculation.

taxa (12), as it is a cold wetland stream. Both ICI scores at RMs 2.3 and at 0.6 were Exceptional (52 and 54, respectively). There were high numbers of 17 - 20 total EPT taxa and 26 - 33 total sensitive taxa at both sample sites (Table 17). The number of cold water taxa from RM 2.3 to RM 0.6 decreased from 12 to one. The lower reach (\leq RM 1.0) was recommended to be changed from CWH to WWH based on consultant data. A question that remains is whether the conversion of a wooded riparian buffer to open pasture or the Heather Hill discharge affected a cold water community in the lower mile (RM 0.5-1). An attempt to verify consultant data results by examining samples was not possible, as a complete sample was not provided. A large wetland complex upstream near Mayfield Rd. near to or through which the Beaver Creek mainstem flows might be allowing increased instream temperatures. It is recommended that Beaver Creek be resampled in the lower reach with a fish survey to verify the appropriateness of a use designation change.

Trends: 1995-2004 for Beaver Creek (EOLP)

The upper site was sampled in 1995 documenting an exceptional quality community. Similarly, high numbers of qualitative sensitive taxa and cold water taxa were collected during each survey.

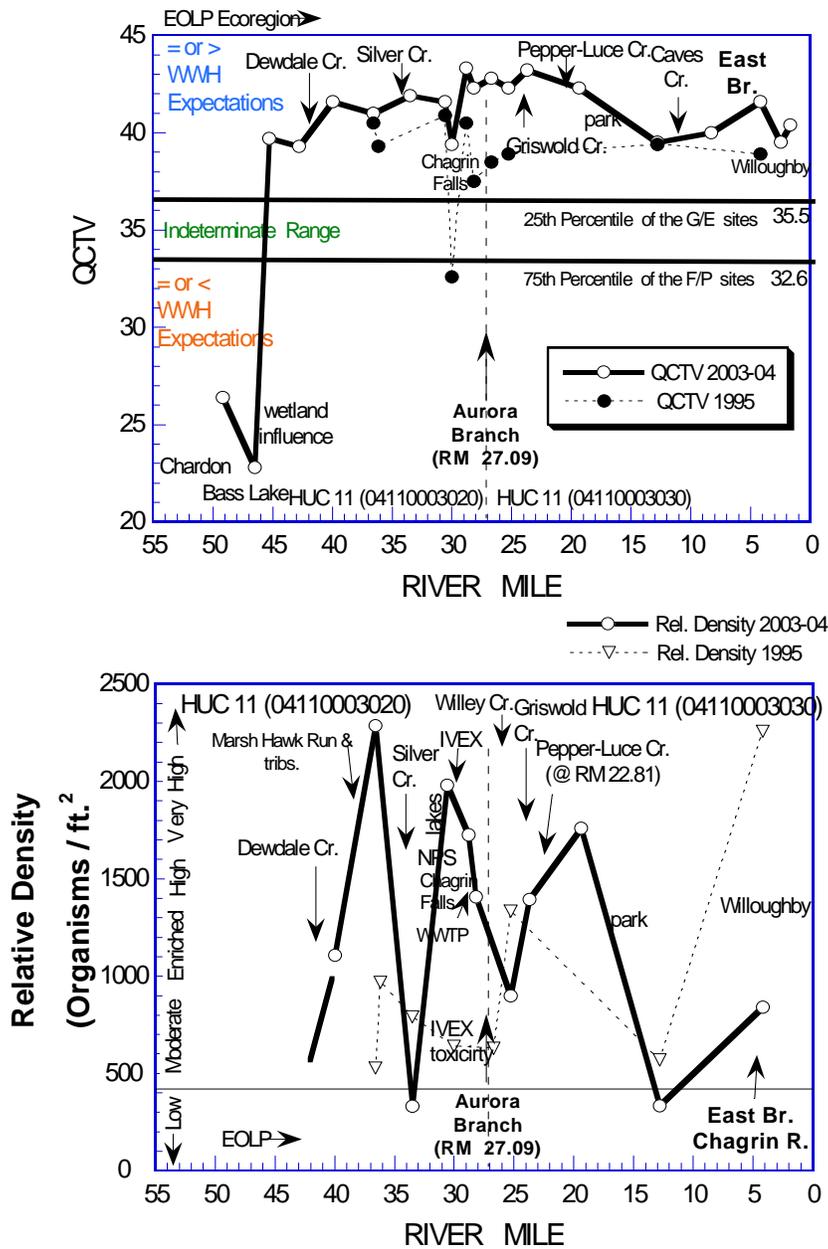


Figure 19. Longitudinal trends for QCTV and relative density for macroinvertebrates in the Chagrin River mainstem, 1995-2004.

The overall quality may have increased, as the numbers of cold water taxa, EPT taxa, and total taxa increased significantly. Effluent from the Heather Hill WWTP need to be of such quality to protect documented downstream biological performance.

Dewdale Creek (RM 42.55) (EOLP)

Dewdale Creek was sampled in 2004 and was designated CWH. The stream is spring-fed with some wetland attributes and has good instream channel development. Dewdale Creek is surrounded by a predominantly wooded riparian corridor that is mostly intact and contains varied substrates. The upper site at Auburn Rd. (RM 4.6) did have some riparian vegetation removal and was impacted by upstream septic and suburban nonpoint source stormwater runoff nutrient inputs (including NH₃) affecting instream D.O. concentrations and the thermal regime. The lower site at Rock Haven Rd. (RM 0.7) scored an ICI of 56 and five cold water taxa were collected including cold water caddisflies *Glossosoma* sp. and *Ceratopsyche slossonae*. There were also 26 total EPT taxa and 44 sensitive taxa collected documenting the exceptional community quality (Table 17). Attempts to mitigate upstream impacts are important (some habitat alteration/nonpoint source inputs - increased bacterial and ammonia inputs). Improvements would benefit rainbow trout present in Dewdale Creek and/or stocked native brook trout present in adjacent stream with connections through The Rookery wetland that could utilize the Dewdale Creek mainstem.

Trib. To Chagrin R. @ RM 38.32 (Marsh Hawk Run) (EOLP)

Marsh Hawk Run is a cooler headwater stream draining a suburban housing development. It is somewhat sluggish in portions from beaver dams which has allowed more sand and silt deposition yielding smaller substrates overall. In lotic segments there were more baetid mayflies and hydroptilid and hydroptilid caddisflies. However, there were almost double the number of tolerant taxa versus sensitive taxa collected due to impacts by upstream (development) septic and nutrient inputs (including NH₃) affecting enrichment and instream D.O. concentrations. Overall the macroinvertebrate community indicated only fair community quality and did not meet WWH expectations (Table 17).

Silver Creek (RM 34.21) (EOLP)

Silver Creek was sampled at RM 5.1 (Music St.) and near the mouth downstream from St. Rt. 306 at Hitching Post Lane (RM 0.4). The macroinvertebrate community was of exceptional quality in this cold water stream. The upper site, despite some past channel straightening had high numbers of sensitive taxa including a diverse group of predominant caddisflies: *Neophylax* sp., *Psychomyia* sp., and *Ceratopsyche morosa* group. *Ceratopsyche slossonae* was among four cold water taxa collected, and the QCTV (42.3) indicated high quality with ten times more sensitive taxa than tolerant taxa.

The lower site scored an ICI of 54 with 39 sensitive taxa and a QCTV of 42.8 (Table 17). There were four mussel species collected including the intolerant (I) fluted-shell mussel (*Lasmigona costata*). There were three cold water taxa collected near the mouth. However, due to continuing stabilization

/ recovery from bedload movement after dam removal and recent riparian restoration projects upstream, attainment status for the downstream reach was deferred.

Trends: 1995-2004 for Silver Creek (EOLP)

The exceptional scores are similar between 1995 and 2004, as all ICI scores were between 52 and 56. The number of sensitive taxa were also similar during qualitative sampling, and the 2004 QCTV scores are slightly higher (mean of 42.5 vs. 41.5 in 1995) (Fig. 20). Removal of the impoundment had permitted some recovery. More cold water taxa were collected downstream. Downstream water temperatures after the removal of the dam. Increased shading may have also helped to lower instream temperatures (Fig. 20).

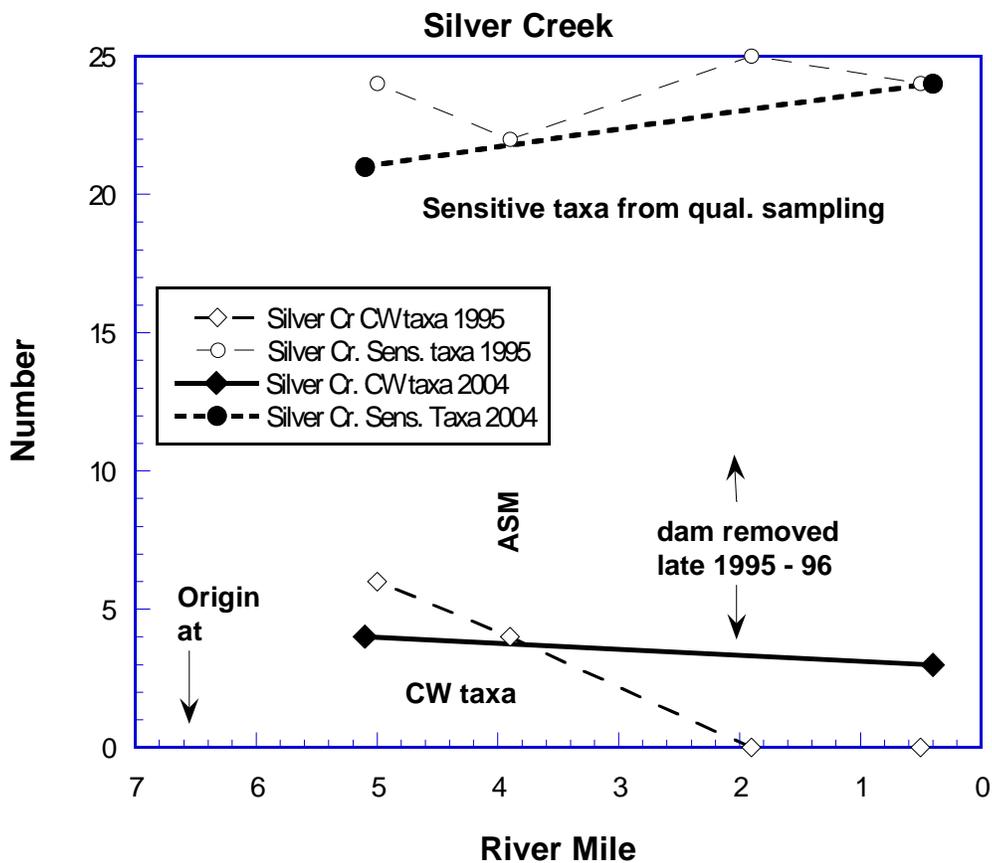


Figure 20. Trends of the number of sensitive taxa and cold water taxa in Silver Creek, 1995-2004.

South Branch Silver Creek (@ RM 2.62) (EOLP)

Upstream from the Music St. sample site (RM 1.1) there are upstream impoundments (Lake Louise and Pawpaw Lake) and nonpoint nutrient sources upstream that warmed and enriched the stream. The instream water temperature in South Branch Silver Creek at RM 1.1 was 25.7° C. and there was a moderate to high density population of filtering caddisflies and midges present in response to increased nutrient enrichment. The community quality was still assessed as Good with 18 sensitive taxa and 64 total taxa collected (Table 17).

Aurora Branch Chagrin River (@ RM 27.09) (EOLP)

Fourteen samples were collected in Aurora Branch Chagrin River with ten quantitative and four qualitative samples. The upper portion from the headwaters to RM 8.98 and from McFarland Creek downstream to the mouth is designated WWH aquatic life use, and the middle reach from Smith Creek to McFarland Creek (RM 8.98-3.73) is recommended to be CWH. Thirteen of fourteen reaches (93%) sampled met their aquatic performance expectations. Twelve of thirteen sampled reaches were Very Good to Exceptional in quality with an ICI range of 42 (VG) to 56 (E) (Fig. 21). The ICI of 56 included a high of 45 sensitive taxa and 24 total EPT taxa collected at the reference reach adjacent Geauga Lake Rd near Fields Road (RM 5.5) (Fig. 21, Table 17). Good gradient and high quality substrates with a mean QHEI of approximately 77.0 were persistent from ~RM 14 to ~RM 1.5 (to bedrock gorge reach near the mouth).

The only reach that did not meet macroinvertebrate community expectations was the upstream reach at Chamberlain Rd. (RM 16.3) despite a QHEI of 66.5. There was a thin coating of blue green algal growth or a brown slime on rocky substrates which limited macroinvertebrate diversity, as poor community quality was documented (nutrients and possible toxicity as well as some wetland inputs). Flatworms and pollution tolerant *Chironomus* midges were the predominant organisms with only one caddisfly taxon and one sensitive taxon. The sensitive / tolerant taxa ratio was 0.09, and the QCTV was a low 28.4 (Table 17).

Recovery to good performance occurred in the next reach near Pioneer Trail (RM 14.4). There were twelve EPT taxa and a good QCTV (39.5) indicating more healthy community quality (Table 17, Fig. 21). Some sedimentation and embedded conditions at and downstream from St Rt. 87 (< RM 12-9) did limit diversity somewhat, as the lowest QCTV occurred in Aurora Branch (RM 11.9) where attainment is meeting. Filtering caddisflies, midges, and blackflies were among the predominant organisms in this reach where NPS and Aurora Central discharge inputs occurred.

The recommended CWH reach from Smith Creek to McFarland Creek (RM 8.98 to RM 3.73) had five cold water taxa at all three sites, and the ICIs ranged from 48 (VG) to 56 (E). It is noteworthy that there were still four and six cold water taxa downstream from the McFarland Creek confluence and the Geauga County McFarland Creek WWTP (Table 17, Fig. 21). There were nonpoint source

silt inputs from local development that was observed from a tributary at St. Rt. 306 into Aurora Branch during sampling. Nonpoint source inputs need to be limited in this cold water reach and upstream to reduce embeddedness which will facilitate increased diversity. There is a large nonpoint source sand bedload downstream from McFarland Creek confluence.

Trends: 1986-2003 for Aurora Branch Chagrin River (EOLP)

There was a vast improvement in quality between 2003 and 1995 because of the recovery of the macroinvertebrate community from a sewage line break near Aurora (between RM 11.9-11.3) in 1995. Poor performance in 1995 at RM 11.3 (ust. From Aurora central WWTP) now yielded very good ICI scores of 42. Some nutrient enrichment remains (Fig. 22). QCTV scores were improved overall throughout the Aurora Branch from upstream to a stable middle reach (RM 5.5). The mean QCTV score in 2003 was 40.7 compared to the 1995 mean QCTV of 36.3 (Fig. 22). The 1990 and 1995 ICI scores downstream from the Geauga County McFarland Creek WWTP were better than the 2003 ICI scores. High nitrates and phosphorus inputs from the McFarland Creek WWTP inputs and Solon's nonpoint source inputs of TSS and nutrients increase relative density, though the 1,474 organisms/ft.² was similar to 1996 densities downstream from the McFarland Creek WWTP. Some improvement and maturation in the riparian corridor downstream from the McFarland Creek confluence (particularly near U.S. Rt. 422) and improved suburban tributary nonpoint source stormwater runoff controls will reduce primary production, scouring, sand bedload, and will foster the continuation of stable high quality communities in the lower reaches of Aurora Branch Chagrin River. The numbers of cold water taxa collected from RM 9.1 to the mouth in 2003 are more similar to 1991. Likely the local development near the middle and lower Aurora Branch Chagrin River mainstem and local tributary nonpoint source inputs have stabilized somewhat.

Smith Creek (RM 8.98) (EOLP)

Smith Creek was a clear, cooler, spring-fed stream with lots of larger cobble, rubble and boulders present. There was a good riparian corridor upstream from South Spring Valley Rd. (RM 1.1) protecting the banks and shading the stream, and the stream temperature was 17.4° C. in 9/04. This cold water stream contained an exceptional macroinvertebrate community with almost 60 percent of the sampled taxa were sensitive organisms (21 EPT taxa and 31 sensitive taxa) (Table 17). Among the cold water taxa collected were baetid mayfly *Baetis tricaudatus* and cold water caddisfly *Ceratopsyche slossonae*. Upstream reaches or tributaries might be considered for brook trout or trout recolonization, as habitat seems to be right.

Trib. to Smith Creek (@ RM 2.70) (EOLP)

This tributary was a cold water stream with some wetland attributes (temp. = 15.4° C. in 9/04). There were six cold water taxa and 22 sensitive taxa. Macroinvertebrate community diversity was enhanced by a good protective riparian cover upstream. The very good community quality was illustrated by the 68 total taxa collected in this 2.2 sq. mile stream.

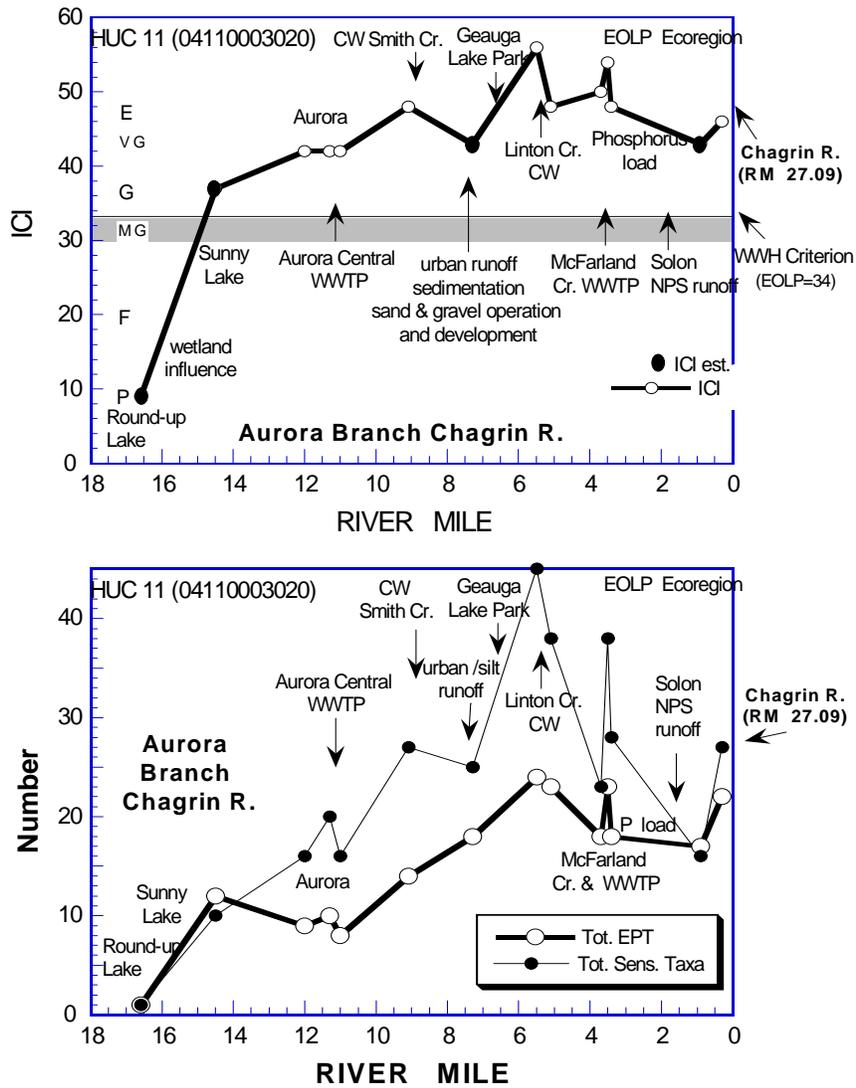


Figure 21. Longitudinal plots of the macroinvertebrate ICI and total numbers of EPT taxa and sensitive taxa in Aurora Branch Chagrin River, 2003.

McFarland Creek (Trib. to Aurora Branch @ RM 3.73) (EOLP)

The upstream McFarland Creek reach was sampled downstream from Chagrin Rd. (RM 2.3) and downstream from the North Branch McFarland Creek confluence. Among the macroinvertebrates collected were four sensitive taxa including the mayfly *Stenonema vicarium*, the cold water mayfly *Baetis tricaudatus*, and the caddisflies *Leucotrichia pictipes* and the cold water *Ceratopsyche slossonae*. Habitat was affected by silt and embedded substrates attributed to upstream development (Lake Lucerne development among others); the source is likely flashy stormwater NPS runoff. The relative macroinvertebrate density was higher than the mouth site, but there was still very good community quality. The macroinvertebrate community quality at the downstream site near the mouth was also assessed as Very Good with 21 sensitive taxa and a QCTV score of 41.9 (Table 17). Flashy stormwater runoff into McFarland Creek upstream have allowed increased embedded conditions in lower McFarland Creek. The loss of stabilizing bank vegetation at the mouth and near the US Rt. 422 highway bridge in Aurora Branch allowed erosion at the McFarland Creek confluence and sand accumulation in the channel in Aurora Branch. Controlling NPS stormwater flows into McFarland Creek would decrease bedload movement downstream, and stabilizing banks (with improved riparian buffers) at the McFarland Creek confluence would increase riffle stability and decrease bedload movement downstream into Aurora Branch. Bank stability in Aurora Branch near the U.S. Rt. 422 bridge and immediately downstream would increase streambed stability and decrease channel affects from McFarland Creek inputs. Possibly allowing channel widening under US Rt. 422 might decrease entrenchment effects. It would be important to ascertain where and how stormwater runoff from US Rt. 422 enters McFarland Creek and Aurora Branch.

Trends: 1995-2004 for McFarland Creek (EOLP)

The quality in McFarland Creek in 2004 near the mouth improved dramatically from 1995. The 1995 sampling occurred shortly after US Rt. 422 and other road construction activities and not long after the dewatering of McFarland Creek due to filling Cannon Lake. Despite continuing problems with stormwater NPS runoff and bedload movement, local development in 2004 is generally more stable and has allowed macroinvertebrate colonization to stabilize and become more diverse. The number of sensitive taxa and EPT taxa has nearly doubled, and the 2004 QCTV of 41.9 is higher compared to the value of 38.7 in 1995 (Table 17). Riparian corridor vegetative growth has helped stabilize banks upstream and maintain cooler instream temperatures. There were three cold water taxa at both McFarland Creek sample sites compared to zero cold water taxa at the mouth site in 1995. Nonpoint source stormwater volume controls would allow continued improvement in quality in McFarland Creek and downstream in Aurora Branch.

North Branch McFarland Creek (Trib. to McFarland Cr. @ RM 2.58) (EOLP)

This cold water tributary to McFarland Creek supported six cold water taxa and very good macroinvertebrate community quality. There were 21 EPT taxa and 34 sensitive taxa collected at the sampling location near the mouth (Table 17). High quality habitat with coarse gravel to boulders predominated in the riffles and runs resulting in a QHEI score of 70.0. The QCTV score of 42.3

mirrored macroinvertebrate community quality. There was a predominance of sensitive mayflies and midges. The predominance and moderate to high density of filtering midges of the genus *Rheotanytarsus* are indicative of some enrichment from NPS inputs. Filtering hydroptychid caddisflies, including the cold water species *Ceratopsyche slossonae*, were common in riffles and runs. The lower instream temperatures helped moderate the temperature in McFarland Creek, as three cold water taxa were also collected in the sampled reach downstream from the North Branch confluence. Protection of this tributary from development is important to maintain its cold water attributes and continue to ecologically benefit the McFarland Creek mainstem.

Chagrin River Tributaries within the Lower Chagrin - East Branch Unit (Hydrologic 11 Unit: 04110003-030)

Griswold Creek (Trib. to Chagrin River @ RM 23.82) (EOLP)

At Fairmount Rd. (RM 4.4) the sampled reach was downstream from a newer school / park property and large lot residential area. Upstream at RM 7.6 the Geauga County Valleyview WWTP, operating since 1997 to eliminate local home septic tank failures, did have some low D.O. measurements (4.4 mg/l - 5.7 mg/l). Despite some substrate embeddedness at RM 4.4 from local post-construction NPS sediment bedload, a good macroinvertebrate community was still present. However, some expected sensitive taxa were absent. Moderate to high relative densities of filtering macroinvertebrates, including hydroptychid caddisflies and tanytarsini midges, were predominant. There were still almost 20 sensitive taxa and 47 total taxa collected during qualitative sampling (Table 17).

Downstream near the mouth (RM 0.1) some anthropogenic channel modification was evident. As a result, some increased substrate bedload was moving downstream. Regardless, the mayfly population diversity improved dramatically compared to upstream, including the pollution sensitive *Acentrella turbida*, *Nixe* and *Leucrocuta* spp.. Moderately intolerant caddisflies were predominant, and the site totalled 16 EPT taxa. The QCTV of 41.9 was indicative of the high quality and diversity (Table 17). Community quality should improve with habitat stabilization after the completion of the stream modification. Control of stormwater flows should decrease erosive effects and downstream bedload movement; restoring and improving the riparian corridor length and width should improve habitat stability, shading and thermal control.

Trends: 1995-2004 for Griswold Creek (EOLP)

There was a slight improvement in the macroinvertebrate community at the mouth site in 2004 compared to 1995, as the EPT totals (11 to 16) and the QCTV scores increased (from 39.3 to 41.9). Still two cold water taxa were collected in both samples near the mouth, though stream modification likely affected community diversity in the 2005 survey. Higher instream dissolved oxygen concentrations downstream from the WWTP at RM 7.6 and improved canopy and riparian width upstream from the sampling site at RM 4.4 will improve overall quality even more.

Trib. To Chagrin River @ RM 22.81 (Pepper-Luce Creek) (EOLP)

Discharge inputs from Pepper Pike Creekside WWTP (RM 3.43), Pepper Pike - Pepper Hill WWTP (trib. at RM 5.59 to be abandoned 6/2006), and Moreland Hills Woodland Glen WWTP (RM 2.17) were reflected in higher relative macroinvertebrate densities and a larger percentage of more pollution intermediate (baetid mayflies and blackflies), transition, or moderately tolerant organisms. Positive signs of community quality were the predominance of pollution sensitive moth larvae (*Petrophila* sp.) and caddisflies (*Leucotrichia* sp.). Eight EPT taxa were collected including one cold water mayfly (*Baetis tricaudatus*) and three sensitive caddisflies. Sampling indicated marginally good (MG) community quality with the QCTV score (38.7) lower than many other sampled reaches (Table 17).

Trends: 1995-2004 for Trib. To Chagrin River @ RM 22.81 (Pepper-Luce Creek) (EOLP)

Samples near the mouth from both 1995 and 2004 were similar, and both were given the narrative quality assessment of Marginally Good (MG). The QCTV scores were similar - 38.4 (1995) and 38.7 (2004). There were a few more total taxa and EPT taxa collected in 2005. Fewer flatworms and isopods compared to the previous survey indicate some decreased nutrient inputs and a subtle community quality improvement. With one wastewater treatment plant already abandoned, additional improvements in macroinvertebrate community quality may occur.

Caves Creek (Trib. to Chagrin River @ RM 11.52) (EOLP)

Caves Creek was a high quality stream with an abundance of larger substrates in all habitats (mostly rubble, boulder, and bedrock). There were patches of sand and silt causing embedded substrates in some riffles, locally. A mostly intact wooded riparian corridor upstream contributed greatly to enhancing its cold water character. There were eight cold water taxa and 21 EPT taxa with pollution sensitive caddisflies predominant (Table 17). Smaller streams in this subwatershed should be sampled to document the high quality and cold water attributes.

Gully Brook (Trib. to Chagrin River @ RM 5.54) (EOLP)

A large riparian flood plain helps mitigate some of the NPS stormwater runoff and protects streambanks from high energy freeway drainage flows. Gully Brook is naturally a more meandering stream that has had some past beaver activity on it. Sand and small gravel were the main substrates in the soft, unstable, shallow riffles. Broken slate bedrock as coarse gravel constituted most of the run substrates, and substrate size increased to include some rubble in the runs and pools. Stick riffles and small flat bedrock fragments were utilized by the macroinvertebrate community. A marginally good macroinvertebrate community quality was present with eleven sensitive taxa and a QCTV score of 38.3. The macroinvertebrate community met WWH ecological expectations.

East Branch Chagrin River (Trib. to Chagrin River @ RM 4.98) (EOLP)

At Heath Rd. (RM 16.3) the East Branch Chagrin River is a quality high gradient stream that contained a small metal impoundment serving as a metal sediment control structure that is filled with

a large sand and gravel bedload. This sand/gravel trap did decrease bedload movement, but the gravel trap inhibits fish movements. Stormwater NPS inputs need controlled to slow erosive forces and bedload movements. There were six cold water taxa, including the stonefly *Sweltsa* and the caddisfly *Glossosoma* confirming its cold water attributes. Twenty EPT and 30 sensitive taxa documented the exceptional community quality (Table 17). The East Branch watershed upstream from Heath Rd. needs to be sampled to document the quality of this upper reach within an intact and naturally protected riparian corridor area.

At RM 10.2 (Wisner and Mitchells Mill Rds.), gravel bedload has buried some larger substrates in slower depositional areas, but clean substrates in the riffles and runs harbored an exceptional macroinvertebrate community. Seven cold water taxa were present, and the 26 sensitive taxa reflected by a QCTV score of 42.3 indicated exceptional community quality in this CWH stream.

Stream temperatures increased 2°C to 23.2°C at Markell Rd. (RM 2.4) compared to the upstream sample reach at RM 10.2 during macroinvertebrate sampling on 8/9/04. Chemical data indicates the average difference in temperature between those sites is 1.53° C. There were more soft sandy substrates (less riffle stability) and less diverse habitat with little definition between the runs and pools. Loss of riparian corridor and suburbanization influences (NPS stormwater inputs) have affected some cold water attributes of this lower reach. Only two cold water taxa were collected, but a rainbow trout was observed swimming through this reach when macroinvertebrate sampling was conducted. There was still a very good macroinvertebrate community present with 17 EPT taxa and 25 sensitive taxa, and the QCTV score of 42.3 was identical to upstream at RM 10.2 (Table 17).

Trends: 1986-2004 for East Branch Chagrin River (Trib. to Chagrin River @ RM 4.98) (EOLP)

Improvements have occurred in upstream reaches from earlier gravel mining inputs.

Macroinvertebrate community quality was similar both sampling years at RM 10.2. The 2004 sample had three more EPT taxa and a QCTV score only one point higher. The lower site had a higher QCTV score in 2004 (42.3 compared to 39.8 in 1986). The number of sensitive taxa were similar, but the number of tolerant species increased significantly in 2004. Riparian restoration and stormwater controls should stabilize and improve the macroinvertebrate community quality and cold water attributes in the lower reach of the East Branch Chagrin River.

Trib. to East Branch Chagrin R. @ RM 16.2 (EOLP)

This cold water stream, sampled near the mouth at Wilson Mills Rd., boasted twelve cold water taxa, including two rare and intolerant caddisfly species, *Psilotreta indecisa* and *Ceratopsyche ventura*. Predominant organisms were cold water caddisflies and mayflies. This exceptional community fully utilized the high quality habitat consisting mostly of coarse gravel and rubble with some boulders in the lotic areas along with a diverse margin habitat. The riparian corridor was mostly large trees which helped insulate instream temperatures (16.2°C in 9/2006). There were other intolerant taxa

(e.g., the stonefly *Leuctra*) among the 34 sensitive taxa and 21 EPT taxa collected. The upper subwatershed should be monitored for quality and as possible brook trout relocation sites due to its intact habitat.

Trib. to East Branch Chagrin R. @ RM 15.35 (EOLP)

This west side cold water tributary at Sperry Rd. (RM 0.2) met the recommended EWH expectations with a macroinvertebrate community assessed as Very Good. The cold water component of the macroinvertebrate community was evident with seven cold water taxa, including predominant populations of the mayfly *Baetis tricaudatus*, the caddisfly *Ceratopsyche slossonae*, and the midge *Polypedilum aviceps*. This small watershed of 1.5 mi.² supported 24 sensitive taxa and collected a QCTV of 40.4 (Table 17). Some substrate embeddedness is affecting the community, as some expected species, like the caddisflies *Chimarra* and *Glossosoma*, were missing. A more dense riparian corridor would increase shading and help reduce instream temperatures (measured at 20.0°C in 9/2006).

Trib. to East Branch Chagrin R. @ RM 14.80 (EOLP)

This west side cold water tributary at Sperry Rd. (RM 0.1) supported six cold water taxa including the intolerant caddisfly species *Ceratopsyche slossonae* among the predominant riffle organisms. The riffle and runs were more embedded than the upstream Chagrin tributary (@ RM 15.35), and, as a likely result, there seemed to be fewer taxa and numbers of mayflies. Upstream nutrient inputs from closed pastures and more open canopy conditions allowed increased primary production and moderate to high relative densities of filter-feeding caddisflies. Still, a good macroinvertebrate community was documented. The upstream reach is not densely populated (big property lots and forest intermixed), and, as the riparian corridor matures, primary cold water attributes such as clean, unembedded, rocky substrates and low stream temperatures will be better protected.

Trib. to East Branch Chagrin R. @ RM 14.62 (EOLP)

This east side cold water tributary at Heath Rd. (RM 0.1) supported an exceptional macroinvertebrate community including cold water caddisflies among the predominant organisms (e.g., *Glossosoma* sp. and *Ceratopsyche slossonae*). The diversity of 23 EPT taxa and 31 sensitive taxa, including two intolerant stonefly taxa, were attributed to the nearly intact upstream forested condition (Table 17). The shaded riparian kept water temperatures lower (~17.5°C. in 9/2006). Riffles and runs were similar upstream and downstream from the Heath Rd. bridge, but a plunge pool was downstream below step waterfalls. It should be noted that this vertical drop from the bridge structure inhibits cold water fish recolonization and salamander movement to upstream reaches from downstream sources.

Stebbins Gulch (Trib. to East Branch Chagrin R. @ RM 10.60) (EOLP)

Stebbins Gulch is a small, pristine, high-gradient cold water stream that had a survey high 37 sensitive macroinvertebrate taxa and 26 total EPT taxa collected from *qualitative* samples near the mouth (RM 0.2). The QCTV was 43.3 with the Sensitive/Tolerant ratio at 18.50 (Table 17). Cold

water mayflies and caddisflies were the predominant organisms collected. There were three stonefly taxa collected, including these cold water genera: *Amphinemura* and *Sweltsa*. Other notable cold water taxa of the fourteen collected were fishflies (*Nigronia fasciatus*), the dragonfly *Boyeria grafiana*, and the caddisfly species *Ceratopsyche ventura*, *Dolophilodes distinctus* and *Oligostomis pardulus*. The macroinvertebrate community was assessed as exceptional. This high quality cold water stream could be a possible brook trout recolonization site.

Trib. to East Branch Chagrin R. @ RM 10.13 (EOLP)

This diverse cold water stream with a drainage of 4.6 mi.² supported an exceptional macroinvertebrate community which scored an ICI of 54 (Table 17). The rocky rubble and boulders in the riffle and pools were underlain with some areas of exposed bedrock. A robust wooded riparian corridor existed throughout the subwatershed with mostly closed (shaded) canopy conditions. As a result, the excellent upstream streamside habitat kept the instream temperature low (17.8° C.). The sample collected near the mouth (RM 0.1) had the highest total EPT taxa (28) and total sensitive taxa (41) of the Chagrin survey for *quantitative* samples, including three different intolerant mayflies. There were twelve cold water taxa collected, including the stonefly *Leuctra* and the caddisflies *Glossosoma* and *Lepidostoma*. The cold water mayfly, *Baetis tricaudatus*, and filter-feeding midge, *Rheotanytarsus*, were the predominant organisms during sampling. A very high QCTV of 43.5 confirmed the exceptional quality of the macroinvertebrate community (Table 17).

Pierson Creek (Trib. to East Branch Chagrin R. @ RM 6.73) (EOLP)

Pierson Creek had superior cold water attributes and macroinvertebrates marginally met the EWH performance criteria with very good (VG) community quality. Eleven cold water taxa were collected including several unique taxa: the stonefly *Sweltsa* sp., the fishfly *Nigronia fasciatus*, and the caddisflies *Dolophilodes distinctus*, *Glossosoma* and *Rhyacophila*. Other pollution intolerant taxa collected included the stonefly *Acroneuria carolinensis* and the tanytarsini midge *Sublettea coffmani*. Upstream the East Branch park area (grass) and upland forest contained good forested riparian buffers and kept the instream water temperature lower (~13-14° C.) with an average of <25 percent open conditions. The rocky substrates ranged from predominantly fine gravel to boulders in the riffle and runs with an increased sand bedload in the pools. Slightly embedded conditions seemed to limit some sensitive taxa, as there were lower totals of sensitive taxa (24) and EPT taxa (16) compared to other comparable Chagrin tributaries (Table 17).

Stoney Brook (Trib. to East Branch Chagrin R. @ RM 3.57) (EOLP)

The sample near the mouth (RM 0.1) upstream from Kirtland Chardon Rd. met the CWH macroinvertebrate criteria with four cold water taxa collected. However, nutrient enriched conditions attributed to upstream wastewater discharges and NPS suburban runoff inputs (housing development) and more open canopy conditions caused the macroinvertebrate community to have a high relative density of facultative filtering caddisflies and *Rheotanytarsus* midges. There has been some riparian removal in the sampled reach which has allowed some erosion and bank slumpage, and an outside

bend is unstable. Abundant rocky substrates (mostly fine gravel to rubble with some boulders) did mitigate some impacts and supported a fairly diverse macroinvertebrate community. There were 18 EPT taxa and 24 sensitive taxa with a QCTV score of 40.0, and the macroinvertebrate community was evaluated as Very Good (Table 17). Better treated wastewater effluent discharged upstream, a decrease of NPS stormwater peaks and nutrient inputs, and improved woody riparian corridors would decrease open canopy conditions, instream water temperatures, improve natural assimilation, reduce erosion, and increase bank stability.

Quarry Creek (Trib. to East Branch Chagrin R. @ RM 1.85) (EOLP)

Quarry Creek was sampled near the mouth at Markell Road (RM 0.1). There was very good (VG) macroinvertebrate community quality with sixteen sensitive taxa in a reach that was predominantly bedrock with some rocky substrates ranging from boulder to sand in the riffles and runs. A deeper scoured pool had been formed in the bedrock. There were five cold water taxa collected. Facultative and intolerant organisms predominated, including the caddisflies *Cheumatopsyche* and *Ceratopsyche slossonae* and the midge *Rheotanytarsus*.

Ward Creek (Trib. to Chagrin R. @ RM 1.0) (EOLP)

Ward Creek macroinvertebrate community quality was affected by an upstream WWTP and diffuse NPS inputs. Relative organism density was high and attributed to nutrient enrichment and increased primary production. High relative densities of caddisflies, filtering midges, and facultative mayflies were predominant in the riffle / run habitats. While sampling, solids and algal mats were observed in the slower runs and margins, and much less diverse and more tolerant biota were collected laterally from the more oxygenated thalweg (center of the main flow channel). The stream color was murky grey to green. Fair macroinvertebrate community quality was documented with 25 total taxa and only four EPT and sensitive taxa collected. The QCTV score was 36.2 (Table 17). Better wastewater treatment, NPS stormwater runoff controls, and improved riparian corridor thickness and canopy cover would improve the biological community quality.

APPENDICES

Appendix 1. Water chemistry results for the Chagrin River watershed water quality survey, 2003-2004.

HUC 11/ STORET Station ID	River Mile	Date	Time	QC	Temp. (Field) (°C)	Dissolved Oxygen (mg/l)	D.O. % Saturation	pH (Field) (SU)	Conductance @ 25 °C (Field) (µmhos/cm)	BOD ₅ (mg/l)	BOD ₂₀ (mg/l)	COD (mg/l)	Alkalinity (mg/l)
04110003020 [Chagrin River (headwaters to below Aurora Branch)]													
Chagrin River (15-001)													
D01G03	49.15	9/4/2003	1302		18.83	2.65	28.5	7.03	536	<2		18	116
		9/11/2003	1107		17.91	4.32	45.6	7.42	358	<2		24	126
		10/8/2003	1306		8.80	5.21	44.9	9.84	572	<2		34	131
D01P26	46.54	9/4/2003	1246		21.09	3.59	40.4	7.48	376	2.6		21	96.7
		9/11/2003	1045		19.77	4.18	45.8	7.50	399	<2		27	95.3
		10/8/2003	1247		11.66	8.25	76.0	7.63	319	<2		24	80.9
D01G02	42.70	9/4/2003	1227		20.65	8.53	95.1	7.94	391	<2		18	102
		9/11/2003	1128		18.39	9.29	99.0	7.79	429	<2		17	118
		10/8/2003	1228	Dupl.	12.20	11.00	102.6	7.76	342	<2		21	89.8
		10/8/2003	1228	Dupl.						<2		21	89.2
D01G01	40.05	8/6/2003	1136		21.16	7.94	89.4	7.84	407	<2		11	129
		8/27/2003	1141		21.73	7.20	81.9	7.67	330	2.4		26	85.4
		9/4/2003	1210		19.41	8.00	87.1	7.79	379	<2		18	106
		9/11/2003	1025	Dupl.	17.99	8.67	91.6	7.92	417	<2		14	131
		9/11/2003	1025	Dupl.						<2		14	130
		9/23/2003	851		16.12	8.36	85.0	7.59	279	2.6		26	83
		10/8/2003	1148		10.45	10.68	95.7	7.78	347	<2		18	103
		12/10/2003	1024		2.94	11.94	88.7	7.64	329	<2		17	94.2
		4/29/2004	1217	Dupl.	13.41	11.24	107.7	8.18	368	2		13	95.6
		4/29/2004	1217	Dupl.						<2		13	95.6
		6/7/2004	1037		18.01	8.70	92.0	8.00	341	<2		22	123
		7/12/2004	1055		21.48	6.97	79.0	7.84	374	2.2		12	117
		7/22/2004	1113		21.53	7.13	80.9	7.88	348	3.3		24	99.8
		8/16/2004	954		17.06	8.89	92.2	8.09	399	<2		15	150
D01W20	36.55	9/4/2003	1142		19.23	8.64	93.7	7.91	380	<2		18	107
		9/11/2003	1011		18.15	8.51	90.3	8.02	419	<2		14	123
		10/8/2003	1131		10.46	11.21	100.5	7.80	355	<2		18	102

Appendix 1. Water chemistry results for the Chagrin River watershed water quality survey, 2003-2004.

HUC 11/ STORET Station ID	River Mile	Date	Time	QC	Temp. (Field) (°C)	Dissolved Oxygen (mg/l)	D.O. % Saturation	pH (Field) (SU)	Conductance @ 25 °C (Field) (µmhos/cm)	BOD ₅ (mg/l)	BOD ₂₀ (mg/l)	COD (mg/l)	Alkalinity (mg/l)
04110003020 [Chagrin River (headwaters to below Aurora Branch)] (cont.)													
Chagrin River (15-001) (cont.)													
D01P13	33.35	9/4/2003	1124		19.00	8.67	93.6	7.88	385	<2		15	110
		9/11/2003	957		18.14	9.10	96.5	8.03	419	<2		14	127
		10/8/2003	1112		10.03	11.25	99.8	7.87	361	<2		14	109
D01W11	30.70	9/4/2003	1058		19.31	9.35	101.5	8.12	380	<2		15	108
		9/11/2003	935		17.65	9.80	102.9	8.11	424	<2		<10	126
		10/8/2003	1044		10.05	11.80	104.8	7.91	365	<2		14	110
D01S12	29.80	9/4/2003	1043		19.22	8.56	92.8	8.00	385	2.2		21	107
		9/11/2003	920		19.42	7.57	82.4	8.14	438	2.5		14	129
		10/8/2003	1028		9.70	11.36	100.0	7.98	256	<2		18	110
D01S11	28.96	8/6/2003	952		21.27	8.46	95.5	8.05	417	<2		17	125
		8/27/2003	1327		23.16	8.23	96.3	8.14	326	2.8		22	90.1
		9/4/2003	1018	Dupl.	19.14	9.06	98.0	8.05	389	<2		25	110
		9/4/2003	1018	Dupl.						<2		18	111
		9/11/2003	907		18.94	8.77	94.6	8.17	447	<2		14	126
		9/23/2003	1211		16.51	10.80	110.7	8.23	305	2.6		23	86.1
		10/8/2003	1013		9.63	11.77	103.5	7.94	375	<2		18	109
		12/10/2003	1240		3.20	12.88	96.3	8.14	361	<2		13	90.6
		4/29/2004	1417		15.03	11.82	117.4	8.97	353	<2		<10	99.1
		7/12/2004	1204		22.72	8.36	97.0	8.31	378	2.6		<10	111
		7/22/2004	1051		22.57	8.34	96.5	8.34	411	<2		24	127
		8/16/2004	1022		17.99	8.90	94.0	8.10	418	<2		12	138
D01S10	28.30	9/4/2003	955		19.09	9.05	97.8	8.03	397	<2		18	112
		9/11/2003	851		18.83	8.53	91.7	8.09	513	<2		11	126
		10/8/2003	953		9.59	11.85	104.1	7.96	386	<2		18	109
Aurora Branch (15-005)													
D01S02	16.74	9/4/2003	1346		20.01	7.60	83.0	7.69	564	<2		20	161
		9/11/2003	1259		20.50	7.74	86.1	8.00	558	<2		<10	173
		10/8/2003	1249		13.72	8.60	83.1	7.75	377	<2		17	133

Appendix 1. Water chemistry results for the Chagrin River watershed water quality survey, 2003-2004.

HUC 11/ STORET Station ID	River Mile	Date	Time	QC	Temp. (Field) (°C)	Dissolved Oxygen (mg/l)	D.O. % Saturation	pH (Field) (SU)	Conductance @ 25 °C (Field) (µmhos/cm)	BOD ₅ (mg/l)	BOD ₂₀ (mg/l)	COD (mg/l)	Alkalinity (mg/l)
04110003020 [Chagrin River (headwaters to below Aurora Branch)] (cont.)													
Aurora Branch (15-005) (cont.)													
D01G04	14.60	9/4/2003	1400		20.75	9.97	111.0	8.16	422	3.6		27	127
		9/11/2003	1313		19.70	9.41	103.0	8.20	479	<2		17	166
		10/8/2003	1307		12.42	10.83	101.5	7.91	415	<2		21	152
D01W01	11.30	9/4/2003	1246		19.41	6.85	74.0	8.01	436	<2		27	123
		9/11/2003	1200		18.66	10.01	107.4	8.15	578	<2		14	190
		10/8/2003	1158		11.26	11.23	102.6	7.94	479	<2		17	164
D01W03	11.10	9/4/2003	1314		19.60	8.81	96.0	8.04	537	<2		24	136
		9/11/2003	1140		18.03	8.94	94.8	8.00	932	<2		11	206
		10/8/2003	1138		10.34	10.84	96.9	7.78	510	<2		17	168
D01S24	9.00	9/4/2003	1155		18.50	4.52	48.0	8.06	498	<2		20	139
		9/11/2003	1122		16.99	10.31	106.9	8.19	723	<2		11	191
		10/8/2003	1115		10.16	10.99	97.9	7.88	609	<2		17	176
D01W16	7.35	9/4/2003	1127		17.91	11.02	116.0	8.15	537	<2		17	144
		9/11/2003	1059		17.26	10.64	110.9	8.33	639	<2		11	178
		10/8/2003	1053	Dupl.	9.81	11.04	97.6	7.97	576	<2		11	174
		10/8/2003	1053	Dupl.						<2		<10	175
D01W15	5.52	9/4/2003	1105		18.19	11.03	117.0	8.15	535	<2		17	146
		9/11/2003	1022	Dupl.	16.93	9.76	101.0	8.24	633	<2		<10	172
		9/11/2003	1022	Dupl.						<2		<10	170
		10/8/2003	957		9.57	11.13	97.8	7.93	575	<2		11	174
D01P22	3.80	8/6/2003	854	Dupl.	19.33	8.13	88.3	7.75	393	2.8		21	110
		8/6/2003	854	Dupl.						2.7		17	107
		8/27/2003	1410	Dupl.	22.92	9.61	112.1	8.20	627	<2		<10	151
		8/27/2003	1410	Dupl.						<2		<10	153
		9/4/2003	1047		18.18	10.72	113.0	8.03	545	<2		11	145
		9/23/2003	954		17.05	9.11	94.5	8.12	631	2.7		20	87
		9/11/2003	1300		16.65	9.29	95.5	8.10	353	<2		11	167
		10/8/2003	1005		9.27	10.96	95.5	7.85	557	<2		11	166
		12/10/2003	954		3.17	12.13	90.7	8.01	573	<2		20	111

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HUC 11/ STORET Station ID	River Mile	Date	Time	QC	Temp. (Field) (°C)	Dissolved Oxygen (mg/l)	D.O. % Saturation	pH (Field) (SU)	Conductance @ 25 °C (Field) (µmhos/cm)	BOD ₅ (mg/l)	BOD ₂₀ (mg/l)	COD (mg/l)	Alkalinity (mg/l)
04110003020 [Chagrin River (headwaters to below Aurora Branch)] (cont.)													
Aurora Branch (15-005) (cont.)													
D01P22	3.80	4/29/2004	1509		17.01	15.31	158.6	9.27	470	<2		10	133
(cont.)		6/7/2004	943	Dupl.	16.41	9.60	98.2	8.17	592	<2		10	179
		6/7/2004	943	Dupl.						<2		10	179
		7/12/2004	1301		20.88	7.97	89.3	8.03	433	4.1		<10	122
		7/22/2004	956		20.88	7.92	88.8	8.10	609	<2		17	173
		8/9/2004	1453		20.00	10.24	112.8	8.33	589		<2	19	
		8/16/2004	939		16.17	8.57	87.3	7.69	617	<2		<10	194
D01S22	3.30	9/4/2003	1024		18.49	10.41	111.0	7.98	565	<2		15	137
		9/11/2003	929		18.03	9.20	97.4	8.10	758	<2		11	143
		10/8/2003	942		9.65	10.65	93.8	7.81	576	<2		11	156
D01P19	1.03	8/6/2003	922		19.65	7.87	86.0	7.70	415	2.9		17	104
		8/27/2003	1347		23.11	7.85	91.9	7.89	593	<2		13	125
		9/4/2003	951		18.60	9.38	100.0	8.02	561	<2		15	132
		9/23/2003	905		18.83	7.75	83.5	8.19	729	2.5		16	88.7
		9/11/2003	1229		16.86	11.09	114.6	8.14	384	<2		<10	147
		10/8/2003	905		9.72	9.88	87.1	7.78	597	<2		17	153
		12/10/2003	936		3.27	12.03	90.2	7.86	607	<2		17	110
		4/29/2004	1439		15.62	13.41	135.0	9.09	528	<2		13	128
		6/7/2004	1027		17.26	8.36	87.2	7.95	666	<2		<10	155
		7/12/2004	1225		22.08	8.76	100.4	8.22	511	3		14	120
		7/22/2004	1027		22.03	6.40	73.4	7.92	651	<2		22	158
		8/16/2004	1010		17.60	9.30	97.6	7.76	667	<2		12	170
McFarland Creek (15-006)													
D01G17	2.50	6/7/2004	857		15.08	9.64	95.9	8.07	526	<2		44	125
		7/22/2004	910		19.88	8.48	93.2	8.11	513	<2		19	128
		8/16/2004	858		15.33	9.28	92.8	7.46	529	<2		10	138
D01G16	2.30	6/7/2004	1006		17.33	9.58	100.0	8.08	518	<2		<10	126
		7/22/2004	928		21.75	7.79	88.7	8.05	472	<2		22	120
		8/16/2004	915		17.29	8.61	89.7	7.46	420	<2		20	113

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HUC 11/ STORET Station ID	River Mile	Date	Time	QC	Temp. (Field) (°C)	Dissolved Oxygen (mg/l)	D.O. % Saturation	pH (Field) (SU)	Conductance @ 25 °C (Field) (µmhos/cm)	BOD ₅ (mg/l)	BOD ₂₀ (mg/l)	COD (mg/l)	Alkalinity (mg/l)
04110003020 [Chagrin River (headwaters to below Aurora Branch)] (cont.)													
McFarland Creek (15-006) (cont.)													
D01P17	0.06	6/7/2004	909		17.00	9.12	94.5	8.04	461	<2		77	115
		7/22/2004	1011		21.58	7.90	89.8	8.04	519	<2		14	132
		8/16/2004	948		17.14	8.61	89.5	7.59	475	<2		15	131
Silver Creek (15-007)													
D01W22	5.07	6/7/2004	925	Dupl.	16.10	8.89	90.4	7.97	390	<2		11	184
		6/7/2004	925	Dupl.						<2		11	175
		7/22/2004	912		18.45	8.23	87.8	7.85	480	<2		14	174
		8/16/2004	909		14.73	9.10	89.8	7.92	462	<2		12	186
D01W23	0.54	6/7/2004	904		16.83	8.87	91.5	8.07	310	<2		13	139
		7/22/2004	935		21.39	7.73	87.4	7.97	411	<2		17	135
		8/16/2004	844		16.57	8.49	87.1	7.90	407	<2		12	146
Smith Creek (RM 8.98 Trib. Aurora Branch) (15-014)													
D01G20	0.50	6/7/2004	819		15.52	9.47	95.1	8.19	485	<2		<10	183
		7/22/2004	840		20.68	8.03	89.6	8.06	466	<2		27	168
		8/16/2004	832		15.45	9.06	90.9	7.29	479	<2		10	192
Dewdale Creek (15-024)													
D01G24	2.60	6/7/2004	959		16.71	3.75	38.6	7.36	359	<2		27	121
		7/22/2004	1138		21.51	4.06	46.0	7.51	401	<2		39	116
		8/16/2004	925		16.14	4.86	49.4	7.62	441	<2		30	144
D01G23	0.60	6/7/2004	1022		17.08	8.98	93.2	8.06	369	<2		16	154
		7/22/2004	1125		20.94	8.03	90.1	7.97	416	<2		17	140
		8/9/2004	1418		19.19	8.88	96.2	8.11	395		<2	14	
		8/16/2004	943		16.21	8.87	90.4	8.06	421	<2		12	169
Unnamed Tributary Chagrin River RM 38.4 (15-039)													
D01G31	0.45	6/7/2004	1054		17.10	8.38	87.2	7.74	1029	<2		24	168
		7/22/2004	1059		19.96	8.26	91.0	7.89	931	17		42	121
		8/16/2004	1007	Dupl.	16.00	8.08	82.2	7.78	1310	<2		15	171
		8/16/2004	1007	Dupl.						<2		17	172

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HUC 11/ STORET Station ID	River Mile	Date	Time	QC	Temp. (Field) (°C)	Dissolved Oxygen (mg/l)	D.O. % Saturation	pH (Field) (SU)	Conductance @ 25 °C (Field) (µmhos/cm)	BOD ₅ (mg/l)	BOD ₂₀ (mg/l)	COD (mg/l)	Alkalinity (mg/l)
04110003030 [Chagrin River (below Aurora Branch to Lake Erie)]													
Chagrin River (15-001)													
D01P03	26.80	6/7/2004	1119		19.25	10.25	111.2	8.40	555	<2		<10	147
D01P07	25.30	8/6/2003	1020		20.31	8.33	92.3	7.92	421	2.4		14	109
		8/27/2003	1254		23.44	8.46	99.6	8.10	413	2.4		16	89.2
		9/4/2003	910		18.89	8.64	93.0	7.99	480	<2		15	115
		9/11/2003	825		18.53	8.11	86.7	8.43	609	<2		<10	136
		9/23/2003	1148		16.74	10.52	108.3	8.17	355	2.4		20	90.4
		10/8/2003	928		9.57	11.59	101.8	8.17	485	<2		18	128
		12/10/2003	1224		3.52	12.74	96.1	8.15	562	<2		13	102
		12/10/2003	1224		3.52	12.74	96.1	8.15	562	<2		13	102
		4/29/2004	1346		14.64	14.31	141.0	9.20	455	<2		10	113
		6/7/2004	1054		18.34	10.18	108.5	8.33	577	<2		15	142
		7/12/2004	1144		22.66	7.88	91.3	8.10	449	2.6		<10	110
		7/22/2004	1108		22.69	8.17	94.8	8.18	543	<2		19	140
		8/16/2004	1038		17.67	8.70	91.4	7.85	591	<2		30	157
D01P06	23.62	9/4/2003	1303		19.96	9.96	109.6	8.25	433	<2		15	121
		9/11/2003	1253		21.01	9.16	102.9	8.43	635	<2		<10	137
		10/8/2003	1343		11.95	11.79	109.5		482	<2		14	128
D01S09	20.95	9/4/2003	1237		19.85	10.23	112.3	8.35	448	<2		15	124
		9/11/2003	1227		20.19	10.46	115.6	8.48	638	<2		<10	146
		10/8/2003	1324		11.81	11.65	107.8	8.70	515	<2		14	134
D01P04	18.08	8/6/2003	1056		21.39	8.57	97.0	8.04	577	<2		34	142
		8/27/2003	1225		23.00	8.27	96.5	8.01	442	<2		13	98.7
		9/4/2003	1211		20.30	10.03	111.1	8.25	443	<2		31	119
		9/11/2003	1206		21.26	9.55	107.9	8.47	630	<2		<10	137
		9/23/2003	1116	Dupl.	16.57	7.82	80.3	8.12	367	2.9		20	89.8
		9/23/2003	1116	Dupl.						2.7		16	89.6
		10/8/2003	1254		10.67	11.66	105.1	8.15	513	<2		14	135
		12/10/2003	1200		3.26	12.81	96.1	8.10	749	<2		13	120
		4/29/2004	1311		13.68	12.35	119.1	8.74	498	<2		<10	120

Appendix 1. Water chemistry results for the Chagrin River watershed water quality survey, 2003-2004.

HUC 11/ STORET Station ID	River Mile	Date	Time	QC	Temp. (Field) (°C)	Dissolved Oxygen (mg/l)	D.O. % Saturation	pH (Field) (SU)	Conductance @ 25 °C (Field) (µmhos/cm)	BOD ₅ (mg/l)	BOD ₂₀ (mg/l)	COD (mg/l)	Alkalinity (mg/l)
04110003030 [Chagrin River (below Aurora Branch to Lake Erie)] (cont.)													
Chagrin River (15-001) (cont.)													
D01P04	18.08	6/7/2004	1221		19.27	10.27	111.5	8.40	592	<2		<10	154
(cont.)		7/12/2004	1120		23.61	8.00	94.5	8.20	595	<2		12	149
		7/22/2004	1202		23.76	8.87	105.0	8.29	600	<2		19	142
		8/16/2004	837		19.33	10.06	109.4	8.54	587	<2		10	152
D01S08	13.04	9/4/2003	1159		20.43	10.31	114.5	8.36	444	<2		74	117
		9/11/2003	1145		20.51	4.77	53.1	8.57	657	<2		<10	142
		10/8/2003	1207		11.49	11.79	108.3	8.20	521	<2		11	131
D01G05	10.95	9/4/2003	1131		20.13	10.06	111.0	8.32	446	<2		44	115
		9/11/2003	1126		20.47	10.93	121.6	8.61	648	<2		<10	136
		10/8/2003	1146		11.04	11.63	105.7	8.18	522	<2		14	130
502400	4.95	1/29/2003	1153		0.02	13.88	95.5	7.87	1565	<2		<10	155
		3/17/2003	1109		5.55	12.92	102.7	7.84	487	<2		<10	64.3
		4/16/2003	1331		17.25	11.63	121.2	8.79	699	<2		15	117
		5/6/2003	1233		15.89	9.60	97.2	7.74	562	8.4		34	87.6
		6/9/2003	1020		17.71	8.97	94.2	7.90	653	2.7		21	115
		7/23/2003	930		19.55	8.61	93.9	7.84	305	2.5		<10	79.9
		7/31/2003	939		22.57	8.66	100.3	8.10	541	<2		26	133
		8/6/2003	1008		22.93	8.32	97.0	8.02	655	<2		14	119
		8/27/2003	1410							<2		16	130
		9/4/2003	941		19.28	8.58	93.1	8.17	448	<2		74	114
		9/11/2003	955		19.56	2.51	27.4	8.32	647	<2		11	124
		9/23/2003	1037		16.52	9.54	97.9	8.07	424	2.9		36	94.4
		10/8/2003	1122		10.32	11.85	106.0	8.21	537	<2		20	134
		12/10/2003	1132		3.13	12.81	95.7	8.12	714	<2		10	123
		4/29/2004	1345		15.51	14.43	145.0	9.00	608	<2		<10	118
		6/7/2004	912		18.35	9.77	104.2	8.41	628	<2		12	156
		7/12/2004	1308		25.15	8.94	108.7	8.31	617	<2		<10	144
		7/22/2004	919		23.70	7.11	84.2	8.20	604	<2		19	135
		8/16/2004	902		18.72	8.22	88.3	8.17	648	<2		12	139
		11/4/2004	1120		9.91	11.44	101.2	8.02	499	2.3		25	103

Appendix 1. Water chemistry results for the Chagrin River watershed water quality survey, 2003-2004.

HUC 11/ STORET Station ID	River Mile	Date	Time	QC	Temp. (Field) (°C)	Dissolved Oxygen (mg/l)	D.O. % Saturation	pH (Field) (SU)	Conductance @ 25 °C (Field) (µmhos/cm)	BOD ₅ (mg/l)	BOD ₂₀ (mg/l)	COD (mg/l)	Alkalinity (mg/l)
04110003030 [Chagrin River (below Aurora Branch to Lake Erie)] (cont.)													
Chagrin River (15-001) (cont.)													
D01G06	2.72	9/4/2003	913		19.48	8.90	97.0	8.24	458	<2		15	119
		9/11/2003	927		20.22	9.63	106.6	8.44	658	<2		<10	125
		10/8/2003	1058		10.82	11.60	104.9	8.20	549	<2		11	139
East Branch Chagrin River (15-002)													
D01S06	14.50	6/7/2004	1145		16.71	11.36	117.0	8.33	433	<2		<10	157
		7/22/2004	1029	Dupl.	19.02	8.39	90.6	7.96	440	<2		19	133
		7/22/2004	1029	Dupl.						<2		17	132
D01S20	10.28	8/16/2004	1036		14.67	9.76	96.2	8.09	524	<2		<10	184
		8/6/2003	1222		20.26	9.72	107.6	8.15	584	<2		<10	192
		8/27/2003	1103		20.63	8.54	95.2	7.99	470	<2		<10	129
		9/4/2003	1048		17.19	10.25	106.6	8.23	486	<2		<10	167
		9/11/2003	1049		16.94	10.22	105.8	8.32	614	<2		<10	182
		9/23/2003	932		15.31	9.49	94.8	8.08	380	<2		16	108
		10/8/2003	959		8.92	11.52	99.7	8.16	557	<2		<10	186
		12/10/2003	1053		3.61	12.40	93.7	8.03	411	<2		10	113
		4/29/2004	1059		11.74	11.61	107.3	8.41	466	<2		<10	153
		6/7/2004	1051		16.25	10.90	111.2	8.30	560	<2		<10	193
D01P01	2.35	7/12/2004	1022		19.96	8.36	92.0	8.02	404	<2		<10	126
		7/22/2004	1037		19.47	8.98	97.9	8.11	495	<2		14	148
		8/16/2004	1025		15.67	10.20	102.8	8.26	591	<2		<10	210
		8/6/2003	1256		22.52	9.89	114.4	8.28	578	<2		<10	172
		8/27/2003	1033		21.81	8.53	97.3	7.99	443	<2		13	106
		9/4/2003	1012	Dupl.	18.55	10.25	109.6	8.30	493	<2			158
		9/4/2003	1012	Dupl.						<2			155
		9/11/2003	1019		18.02	9.75	103.2	8.37	626	<2		<10	158
		9/23/2003	958		13.13	10.53	100.2	8.12	359	2.2		16	97.1
		10/8/2003	929		9.33	11.50	100.4	8.05	582	<2		<10	177
12/10/2003	1116		4.04	12.69	97.0	8.08	450	<2		10	121		
4/29/2004	1025		12.13	11.67	108.8	8.39	514	<2		<10	146		
6/7/2004	952		17.68	10.72	112.7	8.29	599	<2		<10	191		

Appendix 1. Water chemistry results for the Chagrin River watershed water quality survey, 2003-2004.

HUC 11/ STORET Station ID	River Mile	Date	Time	QC	Temp. (Field) (°C)	Dissolved Oxygen (mg/l)	D.O. % Saturation	pH (Field) (SU)	Conductance @ 25 °C (Field) (µmhos/cm)	BOD ₅ (mg/l)	BOD ₂₀ (mg/l)	COD (mg/l)	Alkalinity (mg/l)
04110003030 [Chagrin River (below Aurora Branch to Lake Erie)] (cont.)													
East Branch Chagrin River (15-002) (cont.)													
		7/12/2004	959		22.43	8.03	92.8	8.15	595	<2		<10	176
		7/22/2004	934		22.04	8.29	95.1	8.21	570	<2		17	154
		8/16/2004	934		17.42	10.06	105.1	8.27	612	<2		<10	187
Griswold Creek (15-003)													
D01G15	4.40	6/7/2004	841		14.86	7.40	73.3	7.86	706	<2		19	196
		7/22/2004	951		19.68	6.35	69.5	7.80	794	<2		19	191
		8/16/2004	1112		14.97	7.64	75.9	7.92	803	<2		10	211
D01P12	0.02	6/7/2004	1144		20.15	11.68	129.1	8.52	757	<2		<10	208
		7/22/2004	1127		20.47	9.38	104.3	8.20	662	<2		19	212
		8/16/2004	1054		17.44	9.20	96.2	7.99	756	<2		10	232
Unnamed Tributary to Chagrin River (RM 5.54) (15-010)													
D01G18	0.60	6/7/2004	932		17.36	8.62	90.2	7.84	1377	<2		15	171
		7/22/2004	1121		22.12	7.53	86.6	7.81	1279	<2		24	138
		8/16/2004	917		16.95	7.86	81.6	7.88	1357	<2		22	168
Caves Creek (15-011)													
D01S15	0.88	6/7/2004	1157		17.29	11.28	117.6	8.44	680	<2		<10	202
		7/22/2004	1139		20.52	9.25	103.0	8.28	708	<2		11	175
		8/16/2004	1102		16.15	10.10	102.9	8.29	729	<2		<10	217
Unnamed Tributary to Chagrin River (RM 22.81) (15-018)													
D01G21	0.20	6/7/2004	1158		18.71	10.51	113.0	8.64	1116	7		19	172
		7/22/2004	1146		21.77	9.52	108.6	8.29	850	<2		22	148
		8/16/2004	1106		16.37	8.84	90.4	7.93	539	<2		17	182
Unnamed Tributary to East Branch Chagrin River RM 3.57 (Stoney Brook) (15-032)													
D01G27	0.10	6/7/2004	1008		17.28	10.71	111.7	8.02	789	<2		<10	178
		7/22/2004	958		20.47	7.75	86.3	7.77	725	2.4		19	151
		8/16/2004	950		17.02	9.56	99.2	7.97	854	<2		<10	201

Appendix 1. Water chemistry results for the Chagrin River watershed water quality survey, 2003-2004.

HUC 11/ STORET Station ID	River Mile	Date	Time	QC	Temp. (Field) (°C)	Dissolved Oxygen (mg/l)	D.O. % Saturation	pH (Field) (SU)	Conductance @ 25 °C (Field) (µmhos/cm)	BOD ₅ (mg/l)	BOD ₂₀ (mg/l)	COD (mg/l)	Alkalinity (mg/l)
04110003030 [Chagrin River (below Aurora Branch to Lake Erie)] (cont.)													
Unnamed Tributary to East Branch Chagrin River RM 10.13 (15-038)													
D01G32	0.10	6/7/2004	1041		15.40	10.49	105.0	8.29	359	<2		<10	136
		7/22/2004	1050		14.53	10.35	101.7	8.09	455	<2		<10	151
		8/9/2004	1333		17.23	9.95	103.5	8.22	443		<2	12	
		8/16/2004	1036		13.00	10.88	103.4	8.24	448	<2		<10	171
Unnamed Tributary to East Branch Chagrin River RM 10.60 (Stebbins Gulch) (15-039)													
D01G33	0.20	6/7/2004	1103		13.98	10.75	104.4	8.28	413	<2		<10	160
		7/22/2004	1024	Dupl.	19.59	8.60	93.9	8.03	406	<2		13	134
		7/22/2004	1024	Dupl.						<2		10	133
		8/16/2004	1014		15.01	9.95	98.8	8.27	454	<2		<10	175
Unnamed Tributary East Branch Chagrin River RM 15.35 (15-042)													
D01G36	0.20	6/7/2004	1127		16.92	10.26	106.1	8.16	509	<2		11	198
		7/22/2004	1013		19.53	8.19	89.3	7.98	454	3.1		27	132
		8/16/2004	1050		15.76	9.67	97.6	8.11	570	<2		<10	214
Unnamed Tributary East Branch Chagrin River RM 16.20 (15-043)													
D01G35	0.10	6/7/2004	1150		16.70	11.12	114.5	8.41	440	<2		<10	179
		7/22/2004	1040		18.37	9.16	97.6	8.05	441	4		29	139
		8/16/2004	1030		14.72	10.60	104.7	8.26	486	<2		<10	193
Ward Creek (15-048)													
D01G39	0.80	6/7/2004	848		19.36	7.53	81.9	8.09	904	<2		15	145
		7/22/2004	856		23.91	6.89	81.9	7.66	938	<2		24	112
		8/16/2004	843	Dupl.	18.37	7.98	85.1	7.95	810	<2		15	121
		8/16/2004	843	Dupl.						<2		20	121

Appendix 1. Water chemistry results for the Chagrin River watershed water quality survey, 2003-2004.

HUC 11/ STORET Station ID	River Mile	Date	Time	QC	NH ₃ -N (mg/l)	NO ₂ -N (mg/l)	NO ₂ + NO ₃ -N (mg/l)	TKN (mg/l)	Total Phosphorus (mg/l)	Chloride (mg/l)	Spec. Cond. (µmhos/cm)	TDS (mg/l)	TSS (mg/l)	Sulfate (mg/l)
04110003020 [Chagrin River (headwaters to below Aurora Branch)]														
Chagrin River (15-001)														
D01G03	49.15	9/4/2003	1302		0.085	<0.02	<0.1	0.55	0.047	35.5	408	238	<5	24.2
		9/11/2003	1107		0.067	<0.02	<0.1	0.59	0.063	21	376	216	9	17.4
		10/8/2003	1306		<0.05	<0.02	0.11	0.74	0.041	81.1	592	352	<5	31.8
D01P26	46.54	9/4/2003	1246		0.584	0.088	0.12	1.02	0.116	50.1	393	236	11	11.9
		9/11/2003	1045		0.173	0.046	<0.1	0.95	0.072	51.6	399	220	9	13.8
		10/8/2003	1247		0.101	0.036	0.27	0.73	0.06	38.3	332	212	10	20.6
D01G02	42.70	9/4/2003	1227		0.174	0.084	0.54	0.65	0.086	49.8	410	250	5	14.6
		9/11/2003	1128		0.066	<0.02	0.58	0.48	0.063	49.5	456	260	<5	20.4
		10/8/2003	1228	Dupl.	<0.05	0.028	0.42	0.46	0.059	39.1	357	230	<5	21.4
		10/8/2003	1228	Dupl.	<0.05	0.028	0.42	0.52	0.053	39.5	358	226	5	21.4
D01G01	40.05	8/6/2003	1136		<0.05	<0.02	0.36	0.52	0.054	34.8	427	252	<5	21.6
		8/27/2003	1141		0.058	<0.02	0.32	0.6	0.087	32.3	340	206	27	24.4
		9/4/2003	1210		0.128	0.042	0.41	0.52	0.092	41.5	397	238	10	17.9
		9/11/2003	1025	Dupl.	0.052	<0.02	0.36	0.4	0.047	37.1	444	258	<5	22.2
		9/11/2003	1025	Dupl.	0.055	<0.02	0.35	0.37	0.047	37.2	444	250	<5	23.4
		9/23/2003	851		<0.05	0.024	0.25	0.64	0.105	25.7	289	178	51	18.6
		10/8/2003	1148		<0.05	0.021	0.34	0.47	0.053	33.5	361	222	5	21.8
		12/10/2003	1024		<0.05	<0.02	0.49	0.4	0.041	40	372	218	15	24.5
		4/29/2004	1217	Dupl.	<0.05	<0.02	<0.1	0.77	0.024	54	411	224	8	19.1
		4/29/2004	1217	Dupl.	<0.05	<0.02	<0.1	0.56	0.034	50.2	410	226	8	19.7
		6/7/2004	1037		<0.05	<0.02	0.43	0.33	0.057	35.8	396	230	15	22.7
		7/12/2004	1055		0.05	<0.02	0.34	0.41	0.196	35.8	394	228	24	23.8
		7/22/2004	1113		0.067	0.024	0.51	0.54	0.073	28.2	336	194	27	20.4
		8/16/2004	954		<0.05	<0.02	0.36	0.36	0.038	31.5	427	242	<5	23.8
D01W20	36.55	9/4/2003	1142		0.095	0.026	0.45	0.46	0.069	41.4	398	236	6	18.3
		9/11/2003	1011		<0.05	<0.02	0.21	0.42	0.04	42.8	446	258	<5	21
		10/8/2003	1131		<0.05	<0.02	0.37	0.43	0.057	34.9	370	228	<5	20.9

Appendix 1. Water chemistry results for the Chagrin River watershed water quality survey, 2003-2004.

HUC 11/ STORET Station ID	River Mile	Date	Time	QC	NH ₃ -N (mg/l)	NO ₂ -N (mg/l)	NO ₂ + NO ₃ -N (mg/l)	TKN (mg/l)	Total Phosphorus (mg/l)	Chloride (mg/l)	Spec. Cond. (µmhos/cm)	TDS (mg/l)	TSS (mg/l)	Sulfate (mg/l)
04110003020 [Chagrin River (headwaters to below Aurora Branch)] (cont.)														
Chagrin River (15-001) (cont.)														
D01P13	33.35	9/4/2003	1124		0.113	<0.02	0.45	0.47	0.055	39.7	403	238	6	18.2
		9/11/2003	957		<0.05	<0.02	0.25	0.39	0.032	40.7	446	250	<5	21.8
		10/8/2003	1112		<0.05	<0.02	0.36	0.44	0.051	33.5	377	230	<5	21.4
D01W11	30.70	9/4/2003	1058		0.091	<0.02	0.38	0.47	0.056	39.7	398	240	13	19
		9/11/2003	935		<0.05	<0.02	0.17	0.43	0.035	42.6	451	252	<5	22
		10/8/2003	1044		<0.05	<0.02	0.37	0.33	0.086	35.2	380	228	<5	21.9
D01S12	29.80	9/4/2003	1043		0.147	<0.02	0.36	0.52	0.053	39.1	402	242	24	19.1
		9/11/2003	920		0.088	<0.02	0.12	0.64	0.063	46.1	465	268	37	23.8
		10/8/2003	1028		<0.05	<0.02	0.37	0.53	0.059	35.1	385	231	<5	21.8
D01S11	28.96	8/6/2003	952		<0.05	<0.02	0.31	0.51	0.061	43.2	438	240	12	25.4
		8/27/2003	1327		0.063	<0.02	0.4	0.62	0.101	30.2	340	208	39	24.1
		9/4/2003	1018	Dupl.	<0.05	<0.02	0.38	0.44	0.053	40.6	408	242	26	20.5
		9/4/2003	1018	Dupl.	<0.05	<0.02	0.38	0.44	0.055	40.8	409	244	24	20.5
		9/11/2003	907		<0.05	<0.02	0.21	0.54	0.046	47.5	476	274	8	25
		9/23/2003	1211		0.054	0.026	0.31	0.62	0.101	29.1	317	206	67	19.9
		10/8/2003	1013		<0.05	<0.02	0.39	0.56	0.058	35.3	390	234	<5	22.9
		12/10/2003	1240		<0.05	<0.02	0.62	0.51	0.037	49.5	410	232	12	26.2
		4/29/2004	1417		<0.05	<0.02	<0.1	0.41	0.102	49.2	407	224	9	21
		7/12/2004	1204		<0.05	<0.02	0.41	0.35	0.053	39.5	399	222	47	24.3
		7/22/2004	1051		0.053	<0.02	0.35	0.3	0.257	40.7	432	238	24	20.9
		8/16/2004	1022		<0.05	<0.02	0.74	0.43	0.022	44.8	455	244	6	26.8
D01S10	28.30	9/4/2003	955		<0.05	<0.02	0.39	0.46	0.045	42.2	414	248	16	20.6
		9/11/2003	851		<0.05	<0.02	2.38	0.75	0.104	63.1	539	304	7	29.6
		10/8/2003	953		<0.05	<0.02	0.46	0.49	0.048	38.9	405	248	5	24.3
Aurora Branch (15-005)														
D01S02	16.74	9/4/2003	1346		0.098	0.057	0.87	0.58	0.17	44.5	585	360	<5	52.4
		9/11/2003	1259		0.09	0.102	1.76	0.33	0.272	34.7	582	344	9	57.8
		10/8/2003	1249		<0.05	<0.02	1.04	0.55	0.186	26.6	409	260	<5	29.2

Appendix 1. Water chemistry results for the Chagrin River watershed water quality survey, 2003-2004.

HUC 11/ STORET Station ID	River Mile	Date	Time	QC	NH ₃ -N (mg/l)	NO ₂ -N (mg/l)	NO ₂ + NO ₃ -N (mg/l)	TKN (mg/l)	Total Phosphorus (mg/l)	Chloride (mg/l)	Spec. Cond. (µmhos/cm)	TDS (mg/l)	TSS (mg/l)	Sulfate (mg/l)
04110003020 [Chagrin River (headwaters to below Aurora Branch)] (cont.)														
Aurora Branch (15-005) (cont.)														
D01G04	14.60	9/4/2003	1400		<0.05	<0.02	0.3	0.65	0.285	33.2	449	262	18	32.6
		9/11/2003	1313		0.069	<0.02	0.31	0.4	0.089	24.9	502	292	10	46.3
		10/8/2003	1307		<0.05	<0.02	0.38	0.53	0.072	26.9	440	272	6	33.6
D01W01	11.30	9/4/2003	1246		<0.05	<0.02	0.35	0.63	0.078	40.1	465	266	16	34.6
		9/11/2003	1200		0.058	<0.02	0.26	0.37	0.058	38.6	603	350	5	56.6
		10/8/2003	1158		<0.05	<0.02	0.28	0.47	0.054	36.8	506	302	6	38.9
D01W03	11.10	9/4/2003	1314		<0.05	<0.02	1.14	0.68	0.188	58.4	578	336	10	46.5
		9/11/2003	1140		0.066	<0.02	2.99	0.74	0.458	114	977	568	<5	97.6
		10/8/2003	1138		<0.05	<0.02	0.88	0.63	0.065	42.5	544	332	<5	44.8
D01S24	9.00	9/4/2003	1155		<0.05	<0.02	0.57	0.47	0.114	49.1	530	312	6	40.3
		9/11/2003	1122		0.068	<0.02	0.99	0.45	0.176	76.5	758	436	<5	71.6
		10/8/2003	1115		<0.05	<0.02	2.13	0.54	0.111	61.1	652	380	<5	56.7
D01W16	7.35	9/4/2003	1127		<0.05	<0.02	0.55	0.35	0.221	54	579	332	12	51.1
		9/11/2003	1059		0.07	<0.02	0.37	0.25	0.057	57.5	672	386	<5	70.3
		10/8/2003	1053	Dupl.	<0.05	<0.02	0.99	0.23	0.066	50.6	615	366	8	59.8
D01W15	5.52	10/8/2003	1053	Dupl.	<0.05	<0.02	1.02	0.32	0.065	50.4	616	358	7	60
		9/4/2003	1105		<0.05	<0.02	0.5	0.4	0.098	54.7	575	324	6	50.1
		9/11/2003	1022	Dupl.	0.081	<0.02	0.31	0.23	0.055	59.2	668	384	<5	69.3
D01P22	3.80	9/11/2003	1022	Dupl.	0.081	<0.02	0.31	0.23	0.048	59.5	668	388	<5	69.6
		10/8/2003	957		<0.05	<0.02	0.98	0.33	0.057	52.1	616	366	7	60
		8/6/2003	854	Dupl.	0.054	0.033	0.53	0.51	0.098	41.1	416	250	106	30.3
		8/6/2003	854	Dupl.	0.056	0.031	0.51	0.45	0.082	41.2	417	250	102	30.2
		8/27/2003	1410	Dupl.	<0.05	<0.02	0.63	0.34	0.031	66.8	657	390	7	63.8
		8/27/2003	1410	Dupl.	<0.05	<0.02	0.62	0.44	0.027	66.6	657	404	8	63.5
		9/4/2003	1047		0.052	<0.02	0.47	0.4	0.072	55.2	585	338	15	53.1
9/23/2003	954		<0.05	0.025	0.44	0.61	0.106	36.9	365	218	63	26.6		
9/11/2003	1300		<0.05	<0.02	0.25	0.25	0.038	60.4	664	394	10	66.8		
10/8/2003	1005		<0.05	<0.02	0.6	0.35	0.032	50.5	596	360	6	56.2		
12/10/2003	954		<0.05	<0.02	0.81	0.4	0.039	100	645	360	41	40.1		

Appendix 1. Water chemistry results for the Chagrin River watershed water quality survey, 2003-2004.

HUC 11/ STORET Station ID	River Mile	Date	Time	QC	NH ₃ -N (mg/l)	NO ₂ -N (mg/l)	NO ₂ + NO ₃ -N (mg/l)	TKN (mg/l)	Total Phosphorus (mg/l)	Chloride (mg/l)	Spec. Cond. (µmhos/cm)	TDS (mg/l)	TSS (mg/l)	Sulfate (mg/l)
04110003020 [Chagrin River (headwaters to below Aurora Branch)] (cont.)														
Aurora Branch (15-005) (cont.)														
D01P22	3.80	4/29/2004	1509		<0.05	<0.02	<0.1	0.61	0.023	61.1	543	298	10	39.6
(cont.)		6/7/2004	943	Dupl.	0.061	<0.02	0.5	0.45	0.021	53.6	607	372	7	58.8
		6/7/2004	943	Dupl.	<0.05	<0.02	0.49	0.37	0.019	54.1	607	372	7	58.1
		7/12/2004	1301		<0.05	<0.02	0.41	0.31	0.147	43.2	461	260	46	39.5
		7/22/2004	956		<0.05	<0.02	0.5	0.38	0.048	60.9	645	364	10	57.5
		8/9/2004	1453		<0.05	<0.02	0.48	0.26	0.025	55.8	628	346	5	55.5
		8/16/2004	939		<0.05	<0.02	0.7	0.28	0.021	60.8	670	382	5	59.9
D01S22	3.30	9/4/2003	1024		0.077	<0.02	1.26	0.48	0.087	71.1	614	354	17	47.7
		9/11/2003	929		0.066	0.021	3.82	0.6	0.13	108	797	456	12	58.5
		10/8/2003	942		<0.05	<0.02	1.37	0.43	0.054	62.1	615	362	<5	54.8
D01P19	1.03	8/6/2003	922		0.056	0.028	0.69	0.61	0.106	47	439	264	88	30.6
		8/27/2003	1347		0.07	0.024	0.93	0.51	0.068	79.5	621	372	24	51.5
		9/4/2003	951		0.111	<0.02	0.96	0.49	0.093	71.4	601	354	37	44.2
		9/23/2003	905		<0.05	0.028	0.57	0.6	0.106	46.8	399	238	60	28.3
		9/11/2003	1229		0.102	0.026	2.54	0.48	0.091	102	765	438	27	56.8
		10/8/2003	905		<0.05	<0.02	1.59	0.37	0.062	70.8	641	380	9	53.6
		12/10/2003	936		<0.05	<0.02	1.09	0.61	0.062	108	682	386	41	45.7
		4/29/2004	1439		<0.05	<0.02	0.4	0.69	0.06	83.5	610	328	6	39.4
		6/7/2004	1027		<0.05	<0.02	2.23	0.5	0.068	82.2	681	412	25	57
		7/12/2004	1225		<0.05	<0.02	0.66	0.34	0.26	65.8	544	304	115	42.8
		7/22/2004	1027		0.27	0.07	0.67	0.72	0.075	82.6	685	380	36	51.5
		8/16/2004	1010		<0.05	<0.02	1.85	0.43	0.086	88	719	400	10	56.2
McFarland Creek (15-006)														
D01G17	2.50	6/7/2004	857		<0.05	<0.02	0.84	0.3	0.034	69.7	541	314	<5	34.4
		7/22/2004	910		<0.05	<0.02	0.55	0.32	0.018	69.4	543	298	<5	29.6
		8/16/2004	858		<0.05	<0.02	0.56	0.24	0.021	75.8	579	322	<5	34.5
D01G16	2.30	6/7/2004	1006		0.125	<0.02	0.65	0.34	0.021	67.7	533	310	8	34.6
		7/22/2004	928		<0.05	<0.02	0.31	0.54	0.031	62.6	499	258	<5	25
		8/16/2004	915		<0.05	<0.02	0.28	0.52	0.042	57	455	254	<5	23.9

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HUC 11/ STORET Station ID	River Mile	Date	Time	QC	NH ₃ -N (mg/l)	NO ₂ -N (mg/l)	NO ₂ + NO ₃ -N (mg/l)	TKN (mg/l)	Total Phosphorus (mg/l)	Chloride (mg/l)	Spec. Cond. (µmhos/cm)	TDS (mg/l)	TSS (mg/l)	Sulfate (mg/l)
04110003020 [Chagrin River (headwaters to below Aurora Branch)] (cont.)														
McFarland Creek (15-006) (cont.)														
D01P17	0.06	6/7/2004	909		0.106	<0.02	0.71	0.43	0.033	60.5	475	286	<5	27.4
		7/22/2004	1011		<0.05	<0.02	0.25	0.4	0.017	68.8	547	314	13	32.2
		8/16/2004	948		<0.05	<0.02	0.21	0.36	0.018	62.1	514	286	<5	32.6
Silver Creek (15-007)														
D01W22	5.07	6/7/2004	925	Dupl.	<0.05	<0.02	0.43	0.33	0.023	21.1	444	278	7	26
		6/7/2004	925	Dupl.	<0.05	<0.02	0.44	0.28	0.02	22.1	443	286	7	26.9
		7/22/2004	912		<0.05	<0.02	0.4	<0.2	0.235	24.3	471	266	<5	25.4
		8/16/2004	909		<0.05	<0.02	0.38	0.44	0.015	25	479	272	5	27.2
D01W23	0.54	6/7/2004	904		<0.05	<0.02	0.36	0.3	0.02	25.8	389	246	6	23.1
		7/22/2004	935		<0.05	<0.02	0.38	0.22	0.048	29	401	228	10	24.4
		8/16/2004	844		<0.05	<0.02	0.36	0.33	0.03	29.4	412	226	<5	23.7
Smith Creek (RM 8.98 Trib. Aurora Branch) (15-014)														
D01G20	0.50	6/7/2004	819		<0.05	<0.02	0.28	0.22	0.065	30.3	498	284	6	37.8
		7/22/2004	840		<0.05	<0.02	0.15	0.39	0.027	31.6	491	288	<5	31.4
		8/16/2004	832		<0.05	<0.02	<0.1	0.22	0.111	30.2	521	308	<5	38
Dewdale Creek (15-024)														
D01G24	2.60	6/7/2004	959		0.163	0.029	0.21	0.71	0.13	39	377	222	5	9.9
		7/22/2004	1138		0.106	<0.02	0.19	0.7	0.145	40.9	378	226	<5	7.5
		8/16/2004	925		0.129	<0.02	2.01	0.93	0.308	57.8	500	284	7	13.6
D01G23	0.60	6/7/2004	1022		<0.05	<0.02	0.31	0.23	0.083	27.1	427	260	8	27.4
		7/22/2004	1125		<0.05	<0.02	0.23	0.21	0.154	26.1	408	228	5	24.3
		8/9/2004	1418		<0.05	<0.02	0.23	0.43	0.03	25.4	415	230	<5	23.4
		8/16/2004	943		<0.05	<0.02	0.39	0.32	0.014	26.5	449	244	<5	27.5
Unnamed Tributary Chagrin River RM 38.4 (15-039)														
D01G31	0.45	6/7/2004	1054		0.138	0.111	2.91	1.33	0.453	231	1220	706	5	43.8
		7/22/2004	1059		1.36	0.202	1.7	2.17	0.798	180	925	522	354	34.9
		8/16/2004	1007	Dupl.	0.07	0.036	4.34	0.89	0.302	322	1450	804	<5	52.1
		8/16/2004	1007	Dupl.	0.072	0.035	4.32	0.79	0.336	322	1450	808	<5	50.2

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HUC 11/ STORET Station ID	River Mile	Date	Time	QC	NH ₃ -N (mg/l)	NO ₂ -N (mg/l)	NO ₂ + NO ₃ -N (mg/l)	TKN (mg/l)	Total Phosphorus (mg/l)	Chloride (mg/l)	Spec. Cond. (µmhos/cm)	TDS (mg/l)	TSS (mg/l)	Sulfate (mg/l)
04110003030 [Chagrin River (below Aurora Branch to Lake Erie)]														
Chagrin River (15-001)														
D01P03	26.80	6/7/2004	1119		<0.05	<0.02	1.35	0.57	0.026	64.9	567	344	16	38.4
D01P07	25.30	8/6/2003	1020		<0.05	0.029	0.8	0.47	0.115	47.9	445	262	96	28.2
		8/27/2003	1254		0.062	0.023	0.91	0.46	0.095	51.1	431	280	39	33.2
		9/4/2003	910		<0.05	<0.02	0.71	0.5	0.074	56.9	503	292	22	34.2
		9/11/2003	825		<0.05	<0.02	1.42	0.49	0.045	83.6	647	362	9	44
		9/23/2003	1148		<0.05	0.029	0.46	0.68	0.112	40.1	369	214	116	23.9
		10/8/2003	928		<0.05	<0.02	0.95	0.41	0.062	54.5	508	290	8	34.4
		12/10/2003	1224		<0.05	<0.02	0.89	0.62	0.047	104	635	354	30	37.1
		12/10/2003	1224		<0.05	<0.02	0.89	0.62	0.047	104	635	354	30	37.1
		4/29/2004	1346		<0.05	<0.02	0.13	0.47	0.025	71.9	525	296	9	29.9
		6/7/2004	1054		<0.05	<0.02	1.46	0.47	0.037	71	593	362	9	40.1
		7/12/2004	1144		0.056	<0.02	0.72	0.38	0.067	58.8	477	266	91	34.4
		7/22/2004	1108		<0.05	<0.02	0.89	0.39	0.094	67.6	573	320	20	36.8
		8/16/2004	1038		<0.05	<0.02	1.82	0.46	0.032	79	639	358	<5	46.3
D01P06	23.62	9/4/2003	1303		<0.05	<0.02	0.73	0.39	0.076	58	523	304	32	34.3
		9/11/2003	1253		<0.05	<0.02	1.37	0.49	0.045	85	656	366	11	46.9
		10/8/2003	1343		<0.05	<0.02	0.96	0.54	0.045	53.6	507	284	6	35.4
D01S09	20.95	9/4/2003	1237		<0.05	<0.02	0.85	0.45	0.068	62.2	540	312	25	34.4
		9/11/2003	1227		<0.05	<0.02	0.92	0.44	0.034	85.1	658	372	7	48.5
		10/8/2003	1324		<0.05	<0.02	1	0.55	0.047	60.3	543	328	5	39.6
D01P04	18.08	8/6/2003	1056		<0.05	<0.02	1.08	0.47	0.08	76	612	346	48	42
		8/27/2003	1225		0.081	0.028	0.82	0.44	0.093	53.9	459	276	45	34.2
		9/4/2003	1211		<0.05	<0.02	0.54	0.43	0.066	62.9	535	304	34	36.1
		9/11/2003	1206		<0.05	<0.02	0.72	0.47	0.041	85.8	650	370	20	45.9
		9/23/2003	1116	Dupl.	0.054	0.03	0.53	0.59	0.119	44.5	383	232	118	24.2
		9/23/2003	1116	Dupl.	0.055	0.03	0.54	0.69	0.082	44.6	382	230	128	24.6
		10/8/2003	1254		<0.05	<0.02	0.85	0.49	0.035	58.4	539	318	<5	39.8
		12/10/2003	1200		<0.05	<0.02	1.01	0.71	0.069	147	844	460	14	42.8
		4/29/2004	1311		<0.05	<0.02	0.17	0.44	0.021	79.4	568	314	7	31.3

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HUC 11/ STORET Station ID	River Mile	Date	Time	QC	NH ₃ -N (mg/l)	NO ₂ -N (mg/l)	NO ₂ + NO ₃ -N (mg/l)	TKN (mg/l)	Total Phosphorus (mg/l)	Chloride (mg/l)	Spec. Cond. (µmhos/cm)	TDS (mg/l)	TSS (mg/l)	Sulfate (mg/l)
04110003030 [Chagrin River (below Aurora Branch to Lake Erie)] (cont.)														
Chagrin River (15-001) (cont.)														
D01P04	18.08	6/7/2004	1221		<0.05	<0.02	1.1	0.43	0.032	77	634	364	13	41.4
(cont.)		7/12/2004	1120		<0.05	<0.02	0.99	0.35	0.027	74.6	634	358	8	48.1
		7/22/2004	1202		<0.05	<0.02	0.68	0.44	0.04	73.5	600	342	23	40
		8/16/2004	837		<0.05	<0.02	0.38	0.57	0.022	80	627	332	<5	42.6
D01S08	13.04	9/4/2003	1159		<0.05	<0.02	0.49	0.45	0.06	65	538	310	27	36.1
		9/11/2003	1145		<0.05	<0.02	0.57	0.43	0.011	94.3	680	378	8	46.9
		10/8/2003	1207		<0.05	<0.02	0.75	0.49	0.038	63.7	548	330	<5	39.1
D01G05	10.95	9/4/2003	1131		<0.05	<0.02	0.47	0.47	0.072	63.3	539	312	23	36.7
		9/11/2003	1126		<0.05	<0.02	0.44	0.41	0.045	94.8	675	372	5	47.8
		10/8/2003	1146		<0.05	<0.02	0.72	0.47	0.048	63.3	549	324	5	40
502400	4.95	1/29/2003	1153		0.084	0.055	1.4	0.54	<0.05	344	1610	842	<5	68.5
		3/17/2003	1109		0.05	0.022	0.83	0.65	0.081	90.9	503	276	200	29.1
		4/16/2003	1331		<0.05	<0.02	<0.1	0.49	<0.05	122	746	398	<5	59.5
		5/6/2003	1233		<0.05	0.102	0.67	0.6	0.309	103	598	336	942	33.9
		6/9/2003	1020		<0.05	0.028	0.75	0.46	0.154	108	698	398	86	44.4
		7/23/2003	930		0.063	0.025	0.69	0.62	0.134	32.5	319	206	164	24.2
		7/31/2003	939		<0.05	<0.02	0.43	0.39	0.046	70.9	421	332	11	38.3
		8/6/2003	1008		<0.05	<0.02	0.75	0.46	0.063	80.8	593	336	59	41.4
		8/27/2003	1410		0.081	0.032	1.26	0.5	0.085	92.8	674	410	104	52.2
		9/4/2003	941		<0.05	<0.02	0.5	0.57	0.071	65.8	541	310	42	36
		9/11/2003	955		<0.05	<0.02	0.26	0.43	0.054	96.7	662	374	12	50.4
		9/23/2003	1037		0.066	0.04	0.77	0.54	0.164	54.6	443	278	223	32.2
		10/8/2003	1122		<0.05	<0.02	0.7	0.49	0.028	64.5	562	334	5	43.7
		12/10/2003	1132		<0.05	<0.02	0.92	0.59	0.034	136	802	450	23	46.5
		4/29/2004	1345		<0.05	<0.02	<0.1	0.51	0.03	86.2	590	326	6	33.9
		6/7/2004	912		<0.05	<0.02	0.51	0.4	0.011	88.2	676	388	9	43.4
		7/12/2004	1308		<0.05	<0.02	0.37	<0.2		87.6	666	362	15	50.7
		7/22/2004	919		<0.05	<0.02	0.37	0.42	0.024	78.8	603	340	16	42.2
		8/16/2004	902		<0.05	<0.02	0.31	0.51	0.01	102	690	389	7	46.6
		11/4/2004	1120		<0.05	<0.02	0.37	0.43	0.051	62.2	509	300	15	36.9

Appendix 1. Water chemistry results for the Chagrin River watershed water quality survey, 2003-2004.

HUC 11/ STORET Station ID	River Mile	Date	Time	QC	NH ₃ -N (mg/l)	NO ₂ -N (mg/l)	NO ₂ + NO ₃ -N (mg/l)	TKN (mg/l)	Total Phosphorus (mg/l)	Chloride (mg/l)	Spec. Cond. (µmhos/cm)	TDS (mg/l)	TSS (mg/l)	Sulfate (mg/l)
04110003030 [Chagrin River (below Aurora Branch to Lake Erie)] (cont.)														
Chagrin River (15-001) (cont.)														
D01G06	2.72	9/4/2003	913		<0.05	<0.02	0.6	0.47	0.035	60	553	322	33	44.8
		9/11/2003	927		<0.05	<0.02	0.11	0.38	0.031	92.8	665	370	<5	59.5
		10/8/2003	1058		<0.05	<0.02	0.66	0.37	0.045	60.3	573	338	<5	49.2
East Branch Chagrin River (15-002)														
D01S06	14.50	6/7/2004	1145		<0.05	<0.02	0.15	<0.2	0.019	38.2	506	306	<5	42.6
		7/22/2004	1029	Dupl.	<0.05	<0.02	0.37	0.38	0.087	32.4	434	246	25	33.1
		7/22/2004	1029	Dupl.	<0.05	<0.02	0.38	0.35	0.095	32.4	434	258	24	33.8
		8/16/2004	1036		<0.05	<0.02	0.18	<0.2	0.055	43.1	569	322	<5	47.1
D01S20	10.28	8/6/2003	1222		<0.05	<0.02	<0.1	0.24	<0.01	42	619	374	<5	62.3
		8/27/2003	1103		0.05	<0.02	0.44	0.32	0.03	34.3	488	316	23	52.8
		9/4/2003	1048		<0.05	<0.02	0.33	0.24	0.013	39	589	360	<5	58.8
		9/11/2003	1049		<0.05	<0.02	<0.1	<0.2	<0.01	43.3	638	380	<5	72.2
		9/23/2003	932		<0.05	<0.02	0.42	0.56	0.062	30.2	393	250	33	31.5
		10/8/2003	959		<0.05	<0.02	0.35	<0.2	0.018	36	587	356	<5	60.9
		12/10/2003	1053		<0.05	<0.02	0.6	0.44	0.064	50.3	465	274	46	33.4
		4/29/2004	1059		<0.05	<0.02	<0.1	0.2	0.466	40.9	510	284	<5	39.7
		6/7/2004	1051		<0.05	<0.02	<0.1	<0.2	<0.01	39.9	596	378	<5	62.3
		7/12/2004	1022		<0.05	<0.02	0.5	0.27	0.307	31.4	426	246	48	39.2
		7/22/2004	1037		<0.05	<0.02	0.36	0.23	0.028	35.8	497	294	15	43.6
		8/16/2004	1025		<0.05	<0.02	<0.1	0.22	<0.01	41.3	630	360	<5	60.5
D01P01	2.35	8/6/2003	1256		<0.05	<0.02	<0.1	0.25	<0.01	48.5	612	356	<5	65.3
		8/27/2003	1033		<0.05	0.034	0.6	0.32	0.08	37.1	455	298	39	51.2
		9/4/2003	1012	Dupl.		<0.02				44.4	595	358	8	64.9
		9/4/2003	1012	Dupl.		<0.02				43.9	595	352	7	64.4
		9/11/2003	1019		<0.05	<0.02	<0.1	<0.2	<0.01	54.2	646	380	<5	78.3
		9/23/2003	958		<0.05	0.025	0.42	0.64	0.069	32	374	216	46	31.2
		10/8/2003	929		<0.05	<0.02	0.46	0.25	<0.01	43.6	611	366	<5	64.5
		12/10/2003	1116		<0.05	<0.02	0.5	0.31	0.047	52	509	296	25	43.3
		4/29/2004	1025		<0.05	<0.02	0.22	0.41	0.018	50	540	290	<5	45.3
		6/7/2004	952		<0.05	<0.02	0.2	<0.2	0.013	51.6	642	400	<5	70.7

Appendix 1. Water chemistry results for the Chagrin River watershed water quality survey, 2003-2004.

HUC 11/ STORET Station ID	River Mile	Date	Time	QC	NH ₃ -N (mg/l)	NO ₂ -N (mg/l)	NO ₂ + NO ₃ -N (mg/l)	TKN (mg/l)	Total Phosphorus (mg/l)	Chloride (mg/l)	Spec. Cond. (µmhos/cm)	TDS (mg/l)	TSS (mg/l)	Sulfate (mg/l)
04110003030 [Chagrin River (below Aurora Branch to Lake Erie)] (cont.)														
East Branch Chagrin River (15-002) (cont.)														
D01P01	2.35	7/12/2004	959		<0.05	<0.02	0.11	<0.2	0.024	45.7	625	368	17	80.1
(cont.)		7/22/2004	934		<0.05	<0.02	0.18	0.26	0.031	46.8	562	332	36	56.7
		8/16/2004	934		<0.05	<0.02	<0.1	0.27	0.033	50.4	649	372	<5	71.2
Griswold Creek (15-003)														
D01G15	4.40	6/7/2004	841		0.149	<0.02	1.91	0.58	0.079	108	798	466	<5	35
		7/22/2004	951		<0.05	<0.02	1.25	0.55	0.127	110	803	450	11	38.8
		8/16/2004	1112		<0.05	<0.02	2.96	0.53	0.074	141	935	512	<5	46.1
D01P12	0.02	6/7/2004	1144		<0.05	<0.02	0.11	0.37	<0.01	85.5	764	458	<5	72.4
		7/22/2004	1127		<0.05	<0.02	0.18	0.25	0.02	77.4	773	438	<5	66.6
		8/16/2004	1054		<0.05	<0.02	0.63	0.24	<0.01	84.8	819	466	<5	76.8
Unnamed Tributary to Chagrin River (RM 5.54) (15-010)														
D01G18	0.60	6/7/2004	932		<0.05	<0.02	1.62	1.12	0.029	286	1490	844	9	110
		7/22/2004	1121		0.056	<0.02	0.39	0.68	0.039	254	1280	704	91	84
		8/16/2004	917		<0.05	<0.02	0.48	0.66	<0.01	307	1450	788	11	81.1
Caves Creek (15-011)														
D01S15	0.88	6/7/2004	1157		<0.05	<0.02	0.51	0.43	<0.01	75.5	734	436	<5	69.7
		7/22/2004	1139		<0.05	<0.02	0.47	0.25	0.137	81.1	713	412	11	59.9
		8/16/2004	1102		<0.05	<0.02	0.17	0.26	0.027	76.3	779	440	<5	80.4
Unnamed Tributary to Chagrin River (RM 22.81) (15-018)														
D01G21	0.20	6/7/2004	1158		<0.05	<0.02	0.61	0.9	0.069	212	1150	656	14	72.1
		7/22/2004	1146		<0.05	<0.02	1.1	0.88	0.124	182	1010	552	5	57.7
		8/16/2004	1106		<0.05	<0.02	1.91	0.81	0.143	188	1090	610	<5	64.6
Unnamed Tributary to East Branch Chagrin River RM 3.57 (Stoney Brook) (15-032)														
D01G27	0.10	6/7/2004	1008		<0.05	<0.02	0.33	0.61	<0.01	106	845	506	<5	88.7
		7/22/2004	958		<0.05	<0.02	0.25	0.36	0.073	96.2	753	454	87	75.8
		8/16/2004	950		<0.05	<0.02	0.31	0.33	<0.01	115	905	518	<5	96

Appendix 1. Water chemistry results for the Chagrin River watershed water quality survey, 2003-2004.

HUC 11/ STORET Station ID	River Mile	Date	Time	QC	NH ₃ -N (mg/l)	NO ₂ -N (mg/l)	NO ₂ + NO ₃ -N (mg/l)	TKN (mg/l)	Total Phosphorus (mg/l)	Chloride (mg/l)	Spec. Cond. (µmhos/cm)	TDS (mg/l)	TSS (mg/l)	Sulfate (mg/l)
04110003030 [Chagrin River (below Aurora Branch to Lake Erie)] (cont.)														
Unnamed Tributary to East Branch Chagrin River RM 10.13 (15-038)														
D01G32	0.10	6/7/2004	1041		<0.05	<0.02	0.29	0.41	<0.01	19.2	386	234	<5	32.8
		7/22/2004	1050		<0.05	<0.02	0.12	<0.2	0.024	19.1	457	272	<5	48.5
		8/9/2004	1333		<0.05	<0.02	0.12	<0.2	0.033	20.6	471	254	<5	48.9
		8/16/2004	1036		<0.05	<0.02	0.22	<0.2	<0.01	20.6	477	270	<5	50.8
Unnamed Tributary to East Branch Chagrin River RM 10.60 (Stebbins Gulch) (15-039)														
D01G33	0.20	6/7/2004	1103		<0.05	<0.02	0.11	0.29	<0.01	16.8	443	282	<5	49.2
		7/22/2004	1024	Dupl.	<0.05	<0.02	0.32	<0.2	0.029	24.9	406	238	58	32
		7/22/2004	1024	Dupl.	<0.05	<0.02	0.32	<0.2	0.021	23.7	405	240	61	31.6
		8/16/2004	1014		<0.05	<0.02	0.38	0.22	0.019	26.1	477	258	<5	37.3
Unnamed Tributary East Branch Chagrin River RM 15.35 (15-042)														
D01G36	0.20	6/7/2004	1127		<0.05	<0.02	0.26	0.22	0.034	52.2	595	360	<5	37.1
		7/22/2004	1013		0.053	<0.02	0.3	0.52	0.089	43	446	282	150	24.8
		8/16/2004	1050		<0.05	<0.02	0.37	0.23	0.011	47.8	619	342	<5	43.8
Unnamed Tributary East Branch Chagrin River RM 16.20 (15-043)														
D01G35	0.10	6/7/2004	1150		<0.05	<0.02	0.25	<0.2	0.059	51.7	519	322	<5	37.4
		7/22/2004	1040		<0.05	<0.02	0.28	0.32	0.148	31.1	434	272	290	30.8
		8/16/2004	1030		<0.05	<0.02	0.43	<0.2	<0.01	35.4	538	314	<5	39.5
Ward Creek (15-048)														
D01G39	0.80	6/7/2004	848		0.057	0.036	0.72	0.82	0.018	160	972	578	12	91
		7/22/2004	856		0.069	0.021	0.59	0.67	0.033	164	928	526	43	74.6
		8/16/2004	843	Dupl.	<0.05	<0.02	0.39	0.64	0.044	151	857	472	16	74.2
		8/16/2004	843	Dupl.	<0.05	<0.02	0.37	0.67	0.058	151	856	474	16	73.1

Appendix 1. Water chemistry results for the Chagrin River watershed water quality survey, 2003-2004.

HUC 11/ STORET Station ID	River Mile	Date	Time	QC	Al (µg/l)	As (µg/l)	Ba (µg/l)	Cd (µg/l)	Ca (mg/l)	Cr (µg/l)	Cu (µg/l)	Fe (µg/l)	Pb (µg/l)	Mg (µg/l)
04110003020 [Chagrin River (headwaters to below Aurora Branch)]														
Chagrin River (15-001)														
D01G03	49.15	9/4/2003	1302		<200	2.3	55	<0.2	43	<30	<10	496	<2	9
		9/11/2003	1107		<200	3.6	55	<0.2	52	<30	<10	837	<2	11
		10/8/2003	1306		<200	2	49	<0.2	48	<30	<10	470	<2	8
D01P26	46.54	9/4/2003	1246		236	5.9	41	<0.2	33	<30	<10	831	<2	6
		9/11/2003	1045		<200	4.2	41	<0.2	37	<30	<10	654	<2	7
		10/8/2003	1247		329	<2	36	<0.2	28	<30	<10	897	<2	6
D01G02	42.70	9/4/2003	1227		<200	4.2	40	<0.2	37	<30	<10	580	<2	7
		9/11/2003	1128		<200	3.2	51	<0.2	49	<30	<10	421	<2	10
		10/8/2003	1228	Dupl.	<200	<2	35	<0.2	31	<30	<10	688	<2	6
		10/8/2003	1228	Dupl.	<200	<2	34	<0.2	31	<30	<10	700	<2	6
D01G01	40.05	8/27/2003	1136		<200	3.6	47	<0.2	47	<30	<10	506	<2	11
		8/27/2003	1141		599	3.6	44	<0.2	34	<30	<10	1320	<2	7
		9/4/2003	1210		417	3.9	43	<0.2	39	<30	<10	875	<2	8
		9/11/2003	1025	Dupl.	<200	3	50	<0.2	52	<30	<10	401	<2	12
		9/11/2003	1025	Dupl.	<200	2.6	51	<0.2	52	<30	<10	410	<2	12
		9/23/2003	851		1010	3.2	39	<0.2	28	<30	<10	1900	2.5	6
		10/8/2003	1148		<200	<2	36	<0.2	35	<30	<10	659	<2	7
		12/10/2003	1024		364	<2	39	<0.2	38	<30	<10	910	<2	8
		4/29/2004	1217	Dupl.	<200	<2	37	<0.2	34	<30	<10	657	<2	7
		4/29/2004	1217	Dupl.	<200	<2	38	<0.2	35	<30	<10	651	<2	7
		6/7/2004	1037		<200	2.4	43	<0.2	40	<30	<10	1040	<2	9
		7/12/2004	1055		238	3.3	49	<0.2	40	<30	<10	963	<2	10
		7/22/2004	1113		696	3.1	49	<0.2	37	<30	<10	1670	<2	8
		8/16/2004	954		<200	<2	46	<0.2	49	<30	<10	476	<2	12
D01W20	36.55	9/4/2003	1142		279	3.6	42	<0.2	39	<30	<10	733	<2	8
		9/11/2003	1011		<200	3	46	<0.2	49	<30	<10	407	<2	11
		10/8/2003	1131		<200	<2	35	<0.2	35	<30	<10	634	<2	7

Appendix 1. Water chemistry results for the Chagrin River watershed water quality survey, 2003-2004.

HUC 11/ STORET Station ID	River Mile	Date	Time	QC	Al (µg/l)	As (µg/l)	Ba (µg/l)	Cd (µg/l)	Ca (mg/l)	Cr (µg/l)	Cu (µg/l)	Fe (µg/l)	Pb (µg/l)	Mg (µg/l)
04110003020 [Chagrin River (headwaters to below Aurora Branch)] (cont.)														
Chagrin River (15-001) (cont.)														
D01P13	33.35	9/4/2003	1124		233	3.1	43	<0.2	40	<30	<10	737	<2	8
		9/11/2003	957		<200	2.9	46	<0.2	50	<30	<10	387	<2	11
		10/8/2003	1112		<200	<2	36	<0.2	37	<30	<10	650	<2	8
D01W11	30.70	9/4/2003	1058		274	3.3	44	<0.2	41	<30	<10	736	<2	8
		9/11/2003	935		<200	2.3	47	<0.2	50	<30	<10	374	<2	11
		10/8/2003	1044		<200	<2	36	<0.2	38	<30	<10	643	<2	8
D01S12	29.80	9/4/2003	1043		570	3.3	46	<0.2	39	<30	<10	1320	<2	8
		9/11/2003	920		457	3.4	51	<0.2	49	<30	<10	1180	<2	11
		10/8/2003	1028		<200	<2	38	<0.2	38	<30	<10	787	<2	8
D01S11	28.96	8/27/2003	952		366	2.2	46	<0.2	45	<30	<10	790	<2	10
		8/27/2003	1327		820	3	44	<0.2	35	<30	<10	1700	2	8
		9/4/2003	1018	Dupl.	647	3.2	47	<0.2	42	<30	<10	1280	<2	8
		9/4/2003	1018	Dupl.	595	3.4	46	<0.2	40	<30	<10	1290	<2	8
		9/11/2003	907		<200	2.8	46	<0.2	50	<30	<10	468	<2	11
		9/23/2003	1211		1360	3.7	46	<0.2	31	<30	<10	2650	2.3	7
		10/8/2003	1013		<200	<2	36	<0.2	38	<30	<10	726	<2	8
		12/10/2003	1240		337	2.2	39	<0.2	40	<30	<10	976	<2	9
		4/29/2004	1417		<200	<2	33	<0.2	36	<30	<10	658	<2	7
		7/12/2004	1204		583	2.6	45	<0.2	39	<30	<10	1540	3.1	9
		7/22/2004	1051		376	2.5	50	<0.2	46	<30	<10	1300	<2	10
		8/16/2004	1022		<200	2.2	42	<0.2	47	<30	<10	510	<2	11
D01S10	28.30	9/4/2003	955		578	3.2	45	<0.2	42	<30	<10	1160	<2	8
		9/11/2003	851		<200	2.5	45	<0.2	52	<30	<10	413	<2	12
		10/8/2003	953		<200	<2	36	<0.2	38	<30	<10	682	<2	8
Aurora Branch (15-005)														
D01S02	16.74	9/4/2003	1346		<200	3.5	83	0.21	68	<30	<10	630	<2	14
		9/11/2003	1259		<200	3.9	114	<0.2	81	<30	<10	810	<2	18
		10/8/2003	1249		<200	4.2	57	<0.2	47	<30	<10	601	<2	10

Appendix 1. Water chemistry results for the Chagrin River watershed water quality survey, 2003-2004.

HUC 11/ STORET Station ID	River Mile	Date	Time	QC	Al (µg/l)	As (µg/l)	Ba (µg/l)	Cd (µg/l)	Ca (mg/l)	Cr (µg/l)	Cu (µg/l)	Fe (µg/l)	Pb (µg/l)	Mg (µg/l)
04110003020 [Chagrin River (headwaters to below Aurora Branch)] (cont.)														
Aurora Branch (15-005) (cont.)														
D01G04	14.60	9/4/2003	1400		305	4.4	53	<0.2	50	<30	<10	860	<2	10
		9/11/2003	1313		302	4.1	70	<0.2	70	<30	<10	705	<2	17
		10/8/2003	1307		<200	2.8	51	<0.2	52	<30	<10	583	<2	11
D01W01	11.30	9/4/2003	1246		293	4.2	45	<0.2	47	<30	<10	1010	<2	10
		9/11/2003	1200		<200	4.8	54	<0.2	74	<30	<10	555	<2	21
		10/8/2003	1158		<200	3.6	44	<0.2	54	<30	<10	713	<2	14
D01W03	11.10	9/4/2003	1314		215	4	42	<0.2	50	<30	<10	838	<2	11
		9/11/2003	1140		<200	3.4	37	<0.2	75	<30	<10	329	<2	20
		10/8/2003	1138		<200	3.2	42	<0.2	55	<30	<10	677	<2	14
D01S24	9.00	9/4/2003	1155		<200	3.3	49	<0.2	53	<30	<10	746	<2	12
		9/11/2003	1122		<200	3.3	47	<0.2	75	<30	<10	397	<2	20
		10/8/2003	1115		<200	2.4	41	<0.2	58	<30	<10	543	<2	14
D01W16	7.35	9/4/2003	1127		259	3	66	<0.2	58	<30	<10	769	<2	13
		9/11/2003	1059		<200	2.6	92	<0.2	76	<30	<10	339	<2	19
		10/8/2003	1053	Dupl.	211	2.1	71	<0.2	63	<30	<10	721	<2	15
		10/8/2003	1053	Dupl.	218	2.2	70	<0.2	63	<30	<10	734	<2	15
D01W15	5.52	9/4/2003	1105		<200	2.8	60	<0.2	57	<30	<10	665	<2	13
		9/11/2003	1022	Dupl.	<200	2.3	86	<0.2	76	<30	<10	281	<2	19
		9/11/2003	1022	Dupl.	<200	2.5	87	<0.2	75	<30	<10	267	<2	19
		10/8/2003	957		<200	2.1	65	<0.2	62	<30	<10	639	<2	15
D01P22	3.80	8/27/2003	854	Dupl.	2560	4.2	61	<0.2	43	<30	<10	3890	3.5	9
		8/27/2003	854	Dupl.	2490	3.8	58	<0.2	42	<30	<10	3940	3.2	9
		8/27/2003	1410	Dupl.	201	2.3	70	<0.2	65	<30	<10	473	<2	17
		8/27/2003	1410	Dupl.	<200	3.2	71	<0.2	65	<30	<10	457	<2	17
		9/4/2003	1047		296	3	60	<0.2	57	<30	<10	854	<2	13
		9/23/2003	954		1120	3.4	41	<0.2	32	<30	<10	2210	2.4	7
		9/11/2003	1300		<200	2.3	79	<0.2	74	<30	<10	531	<2	19
		10/8/2003	1005		<200	2	61	<0.2	61	<30	<10	576	<2	14
		12/10/2003	954		622	2.6	53	<0.2	54	<30	<10	1560	<2	12

Appendix 1. Water chemistry results for the Chagrin River watershed water quality survey, 2003-2004.

HUC 11/ STORET Station ID	River Mile	Date	Time	QC	Al (µg/l)	As (µg/l)	Ba (µg/l)	Cd (µg/l)	Ca (mg/l)	Cr (µg/l)	Cu (µg/l)	Fe (µg/l)	Pb (µg/l)	Mg (µg/l)
04110003020 [Chagrin River (headwaters to below Aurora Branch)] (cont.)														
Aurora Branch (15-005) (cont.)														
D01P22	3.80	4/29/2004	1509		<200	<2	42	<0.2	50	<30	<10	421	<2	12
(cont.)		6/7/2004	943	Dupl.	<200	2.5	59	<0.2	66	<30	<10	329	<2	15
		6/7/2004	943	Dupl.	<200	<2	58	<0.2	65	<30	<10	355	<2	15
		7/12/2004	1301		747	2.8	55	<0.2	46	<30	<10	1740	<2	11
		7/22/2004	956		<200	2.2	65	<0.2	67	<30	<10	614	<2	16
		8/9/2004	1453											
		8/16/2004	939		<200	<2	68	<0.2	70	<30	<10	322	<2	18
D01S22	3.30	9/4/2003	1024		346	2.4	58	<0.2	55	<30	<10	1010	<2	12
		9/11/2003	929		<200	2.2	67	<0.2	69	<30	<10	762	<2	17
		10/8/2003	942		<200	2	58	<0.2	58	<30	<10	552	<2	13
D01P19	1.03	8/27/2003	922		2250	4.1	57	<0.2	42	<30	<10	4310	3.5	10
		8/27/2003	1347		573	3.4	54	<0.2	53	<30	<10	1230	<2	13
		9/4/2003	951		771	3.8	59	<0.2	54	<30	<10	1770	<2	12
		9/23/2003	905		1240	3.4	41	<0.2	33	<30	<10	2630	2.6	7
		9/11/2003	1229		581	2.8	72	<0.2	69	<30	<10	1370	<2	17
		10/8/2003	905		261	<2	54	<0.2	57	<30	<10	730	<2	13
		12/10/2003	936		817	2.9	52	<0.2	54	<30	<10	1990	<2	12
		4/29/2004	1439		<200	<2	41	<0.2	49	<30	<10	488	<2	11
		6/7/2004	1027		373	2.9	57	<0.2	62	<30	<10	952	<2	14
		7/12/2004	1225		1620	3.8	60	<0.2	47	<30	<10	3770	3.3	11
		7/22/2004	1027		519	3.2	62	<0.2	62	<30	<10	1580	<2	15
		8/16/2004	1010		<200	2.3	58	<0.2	64	<30	<10	559	<2	16
McFarland Creek (15-006)														
D01G17	2.50	6/7/2004	857		<200	<2	57	<0.2	50	<30	<10	262	<2	11
		7/22/2004	910		<200	<2	64	<0.2	54	<30	<10	363	<2	11
		8/16/2004	858		<200	<2	67	<0.2	57	<30	<10	273	<2	12
D01G16	2.30	6/7/2004	1006		<200	<2	49	<0.2	47	<30	<10	407	<2	9
		7/22/2004	928		<200	<2	59	<0.2	48	<30	<10	267	<2	10
		8/16/2004	915		<200	2.3	55	<0.2	44	<30	10	279	<2	9

Appendix 1. Water chemistry results for the Chagrin River watershed water quality survey, 2003-2004.

HUC 11/ STORET Station ID	River Mile	Date	Time	QC	Al (µg/l)	As (µg/l)	Ba (µg/l)	Cd (µg/l)	Ca (mg/l)	Cr (µg/l)	Cu (µg/l)	Fe (µg/l)	Pb (µg/l)	Mg (µg/l)
04110003020 [Chagrin River (headwaters to below Aurora Branch)] (cont.)														
McFarland Creek (15-006) (cont.)														
D01P17	0.06	6/7/2004	909		<200	<2	53	<0.2	45	<30	12	290	<2	9
		7/22/2004	1011		<200	<2	58	<0.2	52	<30	<10	771	<2	11
		8/16/2004	948		<200	<2	52	<0.2	49	<30	<10	400	<2	10
Silver Creek (15-007)														
D01W22	5.07	6/7/2004	925	Dupl.	<200	<2	64	<0.2	62	<30	<10	465	<2	13
		6/7/2004	925	Dupl.	<200	<2	60	<0.2	57	<30	<10	409	<2	13
		7/22/2004	912		<200	<2	73	<0.2	64	<30	<10	414	<2	14
		8/16/2004	909		<200	2.3	74	<0.2	65	<30	<10	460	<2	14
D01W23	0.54	6/7/2004	904		<200	<2	47	<0.2	47	<30	<10	560	<2	10
		7/22/2004	935		<200	2	53	<0.2	47	<30	<10	855	<2	11
		8/16/2004	844		<200	<2	51	<0.2	50	<30	<10	634	<2	12
Smith Creek (RM 8.98 Trib. Aurora Branch) (15-014)														
D01G20	0.50	6/7/2004	819		<200	<2	67	<0.2	65	<30	<10	444	<2	15
		7/22/2004	840		<200	2	65	<0.2	62	<30	<10	436	<2	15
		8/16/2004	832		<200	2.4	74	<0.2	69	<30	<10	264	<2	17
Dewdale Creek (15-024)														
D01G24	2.60	6/7/2004	959		<200	2.5	25	<0.2	38	<30	<10	1190	<2	8
		7/22/2004	1138		<200	2.9	28	<0.2	38	<30	<10	1370	<2	8
		8/16/2004	925		<200	<2	48	<0.2	46	<30	<10	1150	<2	10
D01G23	0.60	6/7/2004	1022		<200	2.9	43	<0.2	50	<30	<10	655	<2	12
		7/22/2004	1125		<200	2.7	46	<0.2	50	<30	<10	614	<2	12
		8/9/2004	1418											
		8/16/2004	943		<200	2.9	46	<0.2	54	<30	<10	388	<2	14
Unnamed Tributary Chagrin River RM 38.4 (15-039)														
D01G31	0.45	6/7/2004	1054		<200	2.4	60	<0.2	74	<30	<10	658	<2	15
		7/22/2004	1059		6040	6.9	109	0.38	58	<30	10	13000	17.3	13
		8/16/2004	1007	Dupl.	<200	2.2	69	<0.2	80	<30	<10	442	<2	16
		8/16/2004	1007	Dupl.	<200	2.2	69	<0.2	82	<30	<10	442	<2	16

Appendix 1. Water chemistry results for the Chagrin River watershed water quality survey, 2003-2004.

HUC 11/ STORET Station ID	River Mile	Date	Time	QC	Al (µg/l)	As (µg/l)	Ba (µg/l)	Cd (µg/l)	Ca (mg/l)	Cr (µg/l)	Cu (µg/l)	Fe (µg/l)	Pb (µg/l)	Mg (µg/l)
04110003030 [Chagrin River (below Aurora Branch to Lake Erie)]														
Chagrin River (15-001)														
D01P03	26.80	6/7/2004	1119		235	3	45	<0.2	53	<30	<10	644	<2	12
D01P07	25.30	8/27/2003	1020		2340	4.1	56	<0.2	43	<30	<10	3870	3.5	10
		8/27/2003	1254		1060	3.9	48	<0.2	39	<30	<10	2130	3.6	9
		9/4/2003	910		582	2.9	49	<0.2	48	<30	<10	1200	<2	10
		9/11/2003	825		<200	2	57	<0.2	61	<30	<10	483	<2	14
		9/23/2003	1148		1730	4.3	46	<0.2	33	<30	<10	3730	3.2	7
		10/8/2003	928		<200	<2	42	<0.2	46	<30	<10	729	<2	10
		12/10/2003	1224		479	3.2	45	<0.2	48	<30	<10	1260	<2	11
		12/10/2003	1224		479	3.2	45	<0.2	48	<30	<10	1260	<2	11
		4/29/2004	1346		<200	2	36	<0.2	43	<30	<10	547	<2	9
		6/7/2004	1054		217	2.4	46	<0.2	54	<30	<10	623	<2	12
		7/12/2004	1144		1490	3.5	51	<0.2	41	<30	<10	3350	3.1	10
		7/22/2004	1108		<200	<2	52	<0.2	54	<30	<10	884	<2	12
		8/16/2004	1038		<200	2.3	47	<0.2	57	<30	<10	362	<2	14
D01P06	23.62	9/4/2003	1303		655	2.7	49	<0.2	50	<30	<10	1340	<2	10
		9/11/2003	1253		<200	2.4	54	<0.2	61	<30	<10	551	<2	14
		10/8/2003	1343		<200	<2	41	<0.2	46	<30	<10	591	<2	10
D01S09	20.95	9/4/2003	1237		477	2.8	47	<0.2	49	<30	<10	1100	<2	10
		9/11/2003	1227		<200	2.4	53	<0.2	62	<30	<10	350	<2	14
		10/8/2003	1324		<200	<2	42	<0.2	49	<30	<10	674	<2	11
D01P04	18.08	8/27/2003	1056		871	2.8	48	<0.2	55	<30	<10	1600	<2	12
		8/27/2003	1225		927	3.2	45	<0.2	41	<30	<10	1890	<2	10
		9/4/2003	1211		654	2.9	44	<0.2	49	<30	<10	1420	<2	10
		9/11/2003	1206		397	3.1	51	<0.2	60	<30	<10	868	<2	14
		9/23/2003	1116	Dupl.	2010	5.2	45	<0.2	32	<30	<10	4320	3.5	7
		9/23/2003	1116	Dupl.	1930	5	45	<0.2	32	<30	<10	4130	3.3	7
		10/8/2003	1254		<200	<2	40	<0.2	49	<30	<10	497	<2	11
		12/10/2003	1200		330	2	47	<0.2	58	<30	<10	976	<2	12
		4/29/2004	1311		<200	<2	36	<0.2	46	<30	<10	509	<2	10

Appendix 1. Water chemistry results for the Chagrin River watershed water quality survey, 2003-2004.

HUC 11/ STORET Station ID	River Mile	Date	Time	QC	Al (µg/l)	As (µg/l)	Ba (µg/l)	Cd (µg/l)	Ca (mg/l)	Cr (µg/l)	Cu (µg/l)	Fe (µg/l)	Pb (µg/l)	Mg (µg/l)
04110003030 [Chagrin River (below Aurora Branch to Lake Erie)] (cont.)														
Chagrin River (15-001) (cont.)														
D01P04	18.08	6/7/2004	1221		<200	2.1	46	<0.2	59	<30	<10	508	<2	13
(cont.)		7/12/2004	1120		<200	2.1	48	<0.2	55	<30	<10	388	<2	13
		7/22/2004	1202		452	2.1	50	<0.2	54	<30	<10	992	<2	12
		8/16/2004	837		<200	2	42	<0.2	55	<30	<10	265	<2	13
D01S08	13.04	9/4/2003	1159		571	3	45	<0.2	48	<30	<10	1280	<2	10
		9/11/2003	1145		<200	2.3	49	<0.2	60	<30	<10	296	<2	14
		10/8/2003	1207		<200	<2	39	<0.2	48	<30	<10	545	<2	10
D01G05	10.95	9/4/2003	1131		500	2.3	42	<0.2	48	<30	<10	1100	<2	10
		9/11/2003	1126		<200	2.2	47	<0.2	59	<30	<10	160	<2	14
		10/8/2003	1146		<200	<2	39	<0.2	48	<30	<10	567	<2	10
502400	4.95	1/29/2003	1153		<200	<2	53	<0.2	72	<30	<10	222	<2	17
		3/17/2003	1109		3180	4.7	49	<0.2	34	<30	<10	7470	5.1	8
		4/16/2003	1331		<200	<2	39	<0.2	54	<30	<10	241	<2	12
		5/6/2003	1233		12200	11.3	112	0.42	50	<30	26	27400	23.3	14
		6/9/2003	1020		1880	4.2	51	<0.2	52	<30	<10	3880	2.8	12
		7/23/2003	930		3770	4.6	53	<0.2	33	<30	<10	7820	5.9	7
		7/31/2003	939		<200	2.3	38	<0.2	49	<30	<10	587	<2	11
		8/27/2003	1008		1180	2.5	41	<0.2	51	<30	<10	2150	<2	11
		8/27/2003	1410		1750	4.8	54	<0.2	57	<30	<10	3690	2.8	14
		9/4/2003	941		749	2.5	44	<0.2	48	<30	<10	1640	<2	10
		9/11/2003	955		<200	2.8	45	<0.2	55	<30	<10	489	<2	14
		9/23/2003	1037		3580	7	52	<0.2	37	<30	<10	8100	5.9	9
		10/8/2003	1122		<200	<2	39	<0.2	51	<30	<10	549	<2	11
		12/10/2003	1132		326	2.1	44	<0.2	60	<30	<10	1070	<2	13
		4/29/2004	1345		<200	<2	34	<0.2	47	<30	<10	454	<2	10
		6/7/2004	912		<200	<2	42	<0.2	59	<30	<10	306	<2	13
		7/12/2004	1308		<200	2.1	47	<0.2	56	<30	<10	357	<2	14
		7/22/2004	919		<200	<2	43	<0.2	52	<30	<10	572	<2	12
		8/16/2004	902		<200	<2	45	<0.2	54	<30	<10	311	<2	14
		11/4/2004	1120		<200	2	40	<0.2	46	<30	<10	764	<2	11

Appendix 1. Water chemistry results for the Chagrin River watershed water quality survey, 2003-2004.

HUC 11/ STORET Station ID	River Mile	Date	Time	QC	Al ($\mu\text{g/l}$)	As ($\mu\text{g/l}$)	Ba ($\mu\text{g/l}$)	Cd ($\mu\text{g/l}$)	Ca (mg/l)	Cr ($\mu\text{g/l}$)	Cu ($\mu\text{g/l}$)	Fe ($\mu\text{g/l}$)	Pb ($\mu\text{g/l}$)	Mg ($\mu\text{g/l}$)
04110003030 [Chagrin River (below Aurora Branch to Lake Erie)] (cont.)														
Chagrin River (15-001) (cont.)														
D01G06	2.72	9/4/2003	913		773	2.9	44	<0.2	51	<30	<10	1490	<2	11
		9/11/2003	927		<200	<2	44	<0.2	58	<30	<10	243	<2	15
		10/8/2003	1058		<200	2	39	<0.2	53	<30	<10	526	<2	11
East Branch Chagrin River (15-002)														
D01S06	14.50	6/7/2004	1145		<200	<2	55	<0.2	65	<30	<10	53	<2	14
		7/22/2004	1029	Dupl.	308	2.9	52	<0.2	51	<30	<10	1120	<2	11
		7/22/2004	1029	Dupl.	336	2.1	52	<0.2	51	<30	<10	1160	<2	11
		8/16/2004	1036		<200	<2	61	<0.2	70	<30	<10	120	<2	15
D01S20	10.28	8/27/2003	1222		<200	<2	57	<0.2	77	<30	<10	137	<2	17
		8/27/2003	1103		570	2.1	48	<0.2	57	<30	<10	1130	<2	12
		9/4/2003	1048		<200	<2	55	<0.2	73	<30	<10	336	<2	15
		9/11/2003	1049		<200	<2	58	<0.2	84	<30	<10	108	<2	18
		9/23/2003	932		771	2.9	39	<0.2	41	<30	<10	1550	<2	9
		10/8/2003	959		<200	<2	50	<0.2	69	<30	<10	225	<2	14
		12/10/2003	1053		881	<2	43	<0.2	51	<30	<10	1870	<2	11
		4/29/2004	1059		<200	<2	42	<0.2	57	<30	<10	239	<2	12
		6/7/2004	1051		<200	<2	54	<0.2	77	<30	<10	155	<2	16
		7/12/2004	1022		928	2	52	<0.2	51	<30	<10	1740	<2	11
D01P01	2.35	7/22/2004	1037		395	<2	49	<0.2	60	<30	<10	908	<2	13
		8/16/2004	1025		<200	<2	57	<0.2	83	<30	<10	145	<2	18
		8/6/2003	1256		<200	<2	47	<0.2	72	<30	<10	82	<2	16
		8/27/2003	1033		1070	<2	46	<0.2	51	<30	<10	2050	<2	11
		9/4/2003	1012	Dupl.	248	<2	50	<0.2	70	<30	<10	459	<2	14
		9/4/2003	1012	Dupl.	234	<2	49	<0.2	70	<30	<10	438	<2	14
		9/11/2003	1019		<200	<2	52	<0.2	77	<30	<10	<50	<2	18
		9/23/2003	958		1050	2.7	36	<0.2	37	<30	<10	1960	<2	8
		10/8/2003	929		<200	<2	46	<0.2	68	<30	<10	135	<2	14
		12/10/2003	1116		423	<2	42	<0.2	56	<30	<10	990	<2	12
		4/29/2004	1025		<200	<2	40	<0.2	58	<30	<10	179	<2	13
		6/7/2004	952		<200	<2	49	<0.2	76	<30	<10	<50	<2	17

Appendix 1. Water chemistry results for the Chagrin River watershed water quality survey, 2003-2004.

HUC 11/ STORET Station ID	River Mile	Date	Time	QC	Al (µg/l)	As (µg/l)	Ba (µg/l)	Cd (µg/l)	Ca (mg/l)	Cr (µg/l)	Cu (µg/l)	Fe (µg/l)	Pb (µg/l)	Mg (µg/l)
04110003030 [Chagrin River (below Aurora Branch to Lake Erie)] (cont.)														
East Branch Chagrin River (15-002) (cont.)														
		7/12/2004	959		<200	2	53	<0.2	71	<30	<10	473	<2	17
		7/22/2004	934		680	<2	52	<0.2	65	<30	<10	1630	2.2	15
		8/16/2004	934		<200	<2	54	<0.2	77	<30	<10	86	<2	19
Griswold Creek (15-003)														
D01G15	4.40	6/7/2004	841		<200	2.2	52	<0.2	70	<30	<10	378	<2	15
		7/22/2004	951		<200	3	58	<0.2	71	<30	<10	462	<2	15
		8/16/2004	1112		<200	3	59	<0.2	78	<30	<10	165	<2	17
D01P12	0.02	6/7/2004	1144		<200	2.2	54	<0.2	80	<30	<10	112	<2	19
		7/22/2004	1127		<200	<2	59	<0.2	84	<30	<10	185	<2	19
		8/16/2004	1054		<200	<2	57	<0.2	89	<30	<10	97	<2	21
Unnamed Tributary to Chagrin River (RM 5.54) (15-010)														
D01G18	0.60	6/7/2004	932		<200	2.1	54	<0.2	93	<30	<10	666	<2	24
		7/22/2004	1121		1280	2.9	51	<0.2	69	<30	<10	3400	3.3	18
		8/16/2004	917		<200	2.5	49	<0.2	83	<30	<10	689	<2	22
Caves Creek (15-011)														
D01S15	0.88	6/7/2004	1157		<200	<2	42	<0.2	76	<30	<10	<50	<2	18
		7/22/2004	1139		250	<2	47	<0.2	73	<30	<10	569	<2	17
		8/16/2004	1102		<200	<2	48	<0.2	86	<30	<10	76	<2	21
Unnamed Tributary to Chagrin River (RM 22.81) (15-018)														
D01G21	0.20	6/7/2004	1158		<200	2	42	<0.2	69	<30	<10	196	<2	16
		7/22/2004	1146		<200	3.1	42	<0.2	63	<30	<10	273	<2	13
		8/16/2004	1106		<200	3	45	<0.2	74	<30	<10	188	<2	17
Unnamed Tributary to East Branch Chagrin River RM 3.57 (Stoney Brook) (15-032)														
D01G27	0.10	6/7/2004	1008		<200	<2	52	<0.2	85	<30	<10	120	<2	19
		7/22/2004	958		1170	2.7	61	<0.2	75	<30	<10	3110	3.7	17
		8/16/2004	950		<200	<2	54	<0.2	90	<30	<10	186	<2	20

Appendix 1. Water chemistry results for the Chagrin River watershed water quality survey, 2003-2004.

HUC 11/ STORET Station ID	River Mile	Date	Time	QC	Al (µg/l)	As (µg/l)	Ba (µg/l)	Cd (µg/l)	Ca (mg/l)	Cr (µg/l)	Cu (µg/l)	Fe (µg/l)	Pb (µg/l)	Mg (µg/l)
04110003030 [Chagrin River (below Aurora Branch to Lake Erie)] (cont.)														
Unnamed Tributary to East Branch Chagrin River RM 10.13 (15-038)														
D01G32	0.10	6/7/2004	1041		<200	<2	33	<0.2	47	<30	<10	<50	<2	11
		7/22/2004	1050		<200	<2	39	<0.2	63	<30	<10	123	<2	13
		8/9/2004	1333											
		8/16/2004	1036		<200	<2	41	<0.2	66	<30	<10	89	<2	14
Unnamed Tributary to East Branch Chagrin River RM 10.60 (Stebbins Gulch) (15-039)														
D01G33	0.20	6/7/2004	1103		<200	<2	36	<0.2	64	<30	<10	<50	<2	13
		7/22/2004	1024	Dupl.	1490	<2	46	<0.2	49	<30	<10	2540	<2	12
		7/22/2004	1024	Dupl.	1390	<2	45	<0.2	49	<30	<10	2420	<2	12
		8/16/2004	1014		<200	<2	38	<0.2	56	<30	<10	59	<2	14
Unnamed Tributary East Branch Chagrin River RM 15.35 (15-042)														
D01G36	0.20	6/7/2004	1127		<200	<2	42	<0.2	64	<30	<10	66	<2	13
		7/22/2004	1013		4150	3.6	69	<0.2	48	<30	<10	6680	6.4	11
		8/16/2004	1050		<200	<2	27	<0.2	67	<30	<10	87	<2	11
Unnamed Tributary East Branch Chagrin River RM 16.20 (15-043)														
D01G35	0.10	6/7/2004	1150		<200	<2	55	<0.2	65	<30	<10	250	<2	14
		7/22/2004	1040		5380	5.1	95	0.21	57	<30	<10	10100	9.6	13
		8/16/2004	1030		<200	<2	59	<0.2	71	<30	<10	254	<2	15
Ward Creek (15-048)														
D01G39	0.80	6/7/2004	848		233	2.3	57	<0.2	79	<30	<10	595	<2	15
		7/22/2004	856		860	2.6	58	<0.2	66	<30	<10	1930	2.4	13
		8/16/2004	843	Dupl.	368	2.1	54	<0.2	63	<30	<10	867	<2	12
		8/16/2004	843	Dupl.	403	2.3	56	<0.2	64	<30	<10	929	<2	12

Appendix 1. Water chemistry results for the Chagrin River watershed water quality survey, 2003-2004.

HUC 11/ STORET Station ID	River Mile	Date	Time	QC	Mn (µg/l)	Hg (µg/l)	Ni (µg/l)	K (mg/l)	Se (µg/l)	Sr (µg/l)	Na (µg/l)	Zn (µg/l)	Hardness (mg/l)
04110003020 [Chagrin River (headwaters to below Aurora Branch)]													
Chagrin River (15-001)													
D01G03	49.15	9/4/2003	1302		123	<0.2	<40	3	<2	21	108	<10	144
		9/11/2003	1107		256	<0.2	<40	3	<2	13	111	<10	175
		10/8/2003	1306		46	<0.2	<40	2	<2	54	155	<10	153
D01P26	46.54	9/4/2003	1246		271	<0.2	<40	2	<2	31	101	<10	107
		9/11/2003	1045		302	<0.2	<40	2	<2	33	110	<10	121
		10/8/2003	1247		85	<0.2	<40	2	<2	25	84	<10	95
D01G02	42.70	9/4/2003	1227		77	<0.2	<40	2	<2	32	108	<10	121
		9/11/2003	1128		94	<0.2	<40	2	<2	30	128	<10	164
		10/8/2003	1228	Dupl.	54	<0.2	<40	2	<2	25	88	<10	102
		10/8/2003	1228	Dupl.	54	<0.2	<40	2	<2	25	89	<10	102
D01G01	40.05	8/6/2003	1136		80	<0.2	<40	2	<2	22	132	<10	163
		8/27/2003	1141		124	<0.2	<40	3	<2	21	94	11	114
		9/4/2003	1210		85	<0.2	<40	3	<2	27	113	<10	130
		9/11/2003	1025	Dupl.	61	<0.2	<40	2	<2	24	138	<10	179
		9/11/2003	1025	Dupl.	62	<0.2	<40	2	<2	23	137	<10	179
		9/23/2003	851		104	<0.2	<40	3	<2	17	80	10	95
		10/8/2003	1148		50	<0.2	<40	2	<2	22	95	<10	116
		12/10/2003	1024		97	<0.2	<40	2	<2	23	100	<10	128
		4/29/2004	1217	Dupl.	105	<0.2	<40	2	<2	33	96	<10	114
		4/29/2004	1217	Dupl.	106	<0.2	<40	2	<2	33	96	<10	116
		6/7/2004	1037		117	<0.2	<40	2	<2	22	109	10	137
		7/12/2004	1055		157	<0.2	<40	2	<2	21	113	<10	141
		7/22/2004	1113		156	<0.2	<40	2	<2	18	100	<10	125
		8/16/2004	954		59	<0.2	<40	2	<2	19	134	<10	172
D01W20	36.55	9/4/2003	1142		55	<0.2	<40	3	<2	27	113	<10	130
		9/11/2003	1011		66	<0.2	<40	2	<2	27	134	<10	168
		10/8/2003	1131		37	<0.2	<40	2	<2	23	97	<10	116

Appendix 1. Water chemistry results for the Chagrin River watershed water quality survey, 2003-2004.

HUC 11/ STORET Station ID	River Mile	Date	Time	QC	Mn (µg/l)	Hg (µg/l)	Ni (µg/l)	K (mg/l)	Se (µg/l)	Sr (µg/l)	Na (µg/l)	Zn (µg/l)	Hardness (mg/l)
04110003020 [Chagrin River (headwaters to below Aurora Branch)] (cont.)													
Chagrin River (15-001) (cont.)													
D01P13	33.35	9/4/2003	1124		58	<0.2	<40	3	<2	26	111	<10	133
		9/11/2003	957		47	<0.2	<40	2	<2	26	126	<10	170
		10/8/2003	1112		45	<0.2	<40	2	<2	22	97	<10	125
D01W11	30.70	9/4/2003	1058		48	<0.2	<40	3	<2	26	109	<10	135
		9/11/2003	935		28	<0.2	<40	2	<2	27	128	<10	170
		10/8/2003	1044		33	<0.2	<40	2	<2	23	98	<10	128
D01S12	29.80	9/4/2003	1043		120	<0.2	<40	3	<2	27	108	<10	130
		9/11/2003	920		141	<0.2	<40	3	<2	32	126	<10	168
		10/8/2003	1028		61	<0.2	<40	2	<2	24	98	<10	128
D01S11	28.96	8/6/2003	952		67	<0.2	<40	3	<2	29	126	<10	154
		8/27/2003	1327		106	<0.2	<40	3	<2	20	92	13	120
		9/4/2003	1018	Dupl.	92	<0.2	<40	3	<2	29	111	<10	138
		9/4/2003	1018	Dupl.	90	<0.2	<40	3	<2	28	111	<10	133
		9/11/2003	907		56	<0.2	<40	3	<2	33	132	<10	170
		9/23/2003	1211		144	<0.2	<40	3	<2	18	85	16	106
		10/8/2003	1013		36	<0.2	<40	2	<2	24	99	<10	128
		12/10/2003	1240		84	<0.2	<40	3	<2	30	112	<10	137
		4/29/2004	1417		75	<0.2	<40	2	<2	30	96	<10	119
		7/12/2004	1204		115	<0.2	<40	2	<2	22	104	<10	134
		7/22/2004	1051		132	<0.2	<40	2	<2	25	124	<10	156
		8/16/2004	1022		49	<0.2	<40	2	<2	26	130	<10	163
D01S10	28.30	9/4/2003	955		79	<0.2	<40	3	<2	30	112	<10	138
		9/11/2003	851		42	<0.2	<40	3	<2	42	153	<10	179
		10/8/2003	953		34	<0.2	<40	2	<2	26	102	<10	128
Aurora Branch (15-005)													
D01S02	16.74	9/4/2003	1346		165	<0.2	<40	4	<2	25	146	<10	227
		9/11/2003	1259		186	<0.2	<40	3	<2	21	145	<10	276
		10/8/2003	1249		100	<0.2	<40	3	<2	16	92	<10	158

Appendix 1. Water chemistry results for the Chagrin River watershed water quality survey, 2003-2004.

HUC 11/ STORET Station ID	River Mile	Date	Time	QC	Mn (µg/l)	Hg (µg/l)	Ni (µg/l)	K (mg/l)	Se (µg/l)	Sr (µg/l)	Na (µg/l)	Zn (µg/l)	Hardness (mg/l)
04110003020 [Chagrin River (headwaters to below Aurora Branch)] (cont.)													
Aurora Branch (15-005) (cont.)													
D01G04	14.60	9/4/2003	1400		95	<0.2	<40	4	<2	22	126	<10	166
		9/11/2003	1313		91	<0.2	<40	3	<2	17	151	<10	245
		10/8/2003	1307		71	<0.2	<40	3	<2	17	115	<10	175
D01W01	11.30	9/4/2003	1246		89	<0.2	<40	4	<2	27	173	<10	158
		9/11/2003	1200		95	<0.2	<40	3	<2	29	290	<10	271
		10/8/2003	1158		70	<0.2	<40	3	<2	25	189	<10	192
D01W03	11.10	9/4/2003	1314		72	<0.2	<40	5	<2	41	194	<10	170
		9/11/2003	1140		58	<0.2	<40	8	<2	112	325	21	270
		10/8/2003	1138		64	<0.2	<40	4	<2	31	199	<10	195
D01S24	9.00	9/4/2003	1155		57	<0.2	<40	4	<2	33	165	<10	182
		9/11/2003	1122		57	<0.2	<40	5	<2	63	276	<10	270
		10/8/2003	1115		55	<0.2	<40	4	<2	48	205	<10	202
D01W16	7.35	9/4/2003	1127		57	<0.2	<40	4	<2	36	167	<10	198
		9/11/2003	1059		43	<0.2	<40	3	<2	43	204	<10	268
		10/8/2003	1053	Dupl.	62	<0.2	<40	3	<2	35	169	<10	219
		10/8/2003	1053	Dupl.	62	<0.2	<40	3	<2	35	168	<10	219
D01W15	5.52	9/4/2003	1105		55	<0.2	<40	3	<2	36	166	<10	196
		9/11/2003	1022	Dupl.	50	<0.2	<40	3	<2	44	205	<10	268
		9/11/2003	1022	Dupl.	49	<0.2	<40	3	<2	43	202	<10	266
		10/8/2003	957		57	<0.2	<40	3	<2	36	169	<10	216
D01P22	3.80	8/6/2003	854	Dupl.	180	<0.2	<40	5	<2	30	155	20	144
		8/6/2003	854	Dupl.	180	0.23	<40	5	<2	29	152	18	142
		8/27/2003	1410	Dupl.	44	<0.2	<40	3	<2	43	193	<10	232
		8/27/2003	1410	Dupl.	44	<0.2	<40	3	<2	43	194	<10	232
		9/4/2003	1047		61	<0.2	<40	4	<2	38	176	<10	196
		9/23/2003	954		97	<0.2	<40	4	<2	24	117	11	109
		9/11/2003	1300		63	<0.2	<40	3	<2	43	210	<10	263
		10/8/2003	1005		52	<0.2	<40	3	<2	34	175	<10	210
		12/10/2003	954		104	<0.2	<40	3	<2	60	177	10	184

Appendix 1. Water chemistry results for the Chagrin River watershed water quality survey, 2003-2004.

HUC 11/ STORET Station ID	River Mile	Date	Time	QC	Mn (µg/l)	Hg (µg/l)	Ni (µg/l)	K (mg/l)	Se (µg/l)	Sr (µg/l)	Na (µg/l)	Zn (µg/l)	Hardness (mg/l)
04110003020 [Chagrin River (headwaters to below Aurora Branch)] (cont.)													
Aurora Branch (15-005) (cont.)													
D01P22	3.80	4/29/2004	1509		59	<0.2	<40	2	<2	41	154	<10	174
(cont.)		6/7/2004	943	Dupl.	67	<0.2	<40	3	<2	34	178	<10	226
		6/7/2004	943	Dupl.	67	<0.2	<40	3	<2	34	175	<10	224
		7/12/2004	1301		115	<0.2	<40	3	<2	26	130	<10	160
		7/22/2004	956		82	<0.2	<40	3	<2	41	197	<10	233
		8/9/2004	1453										
		8/16/2004	939		61	<0.2	<40	3	<2	42	196	<10	249
D01S22	3.30	9/4/2003	1024		66	<0.2	<40	4	<2	45	174	<10	187
		9/11/2003	929		64	<0.2	<40	6	<2	73	202	12	242
		10/8/2003	942		48	<0.2	<40	4	<2	40	170	<10	198
D01P19	1.03	8/6/2003	922		177	<0.2	<40	5	<2	30	140	22	146
		8/27/2003	1347		78	<0.2	<40	4	<2	49	186	10	186
		9/4/2003	951		131	<0.2	<40	4	<2	45	178	<10	184
		9/23/2003	905		112	<0.2	<40	4	<2	29	123	10	111
		9/11/2003	1229		125	<0.2	<40	5	<2	65	201	<10	242
		10/8/2003	905		64	<0.2	<40	4	<2	46	177	<10	196
		12/10/2003	936		112	<0.2	<40	3	<2	66	209	<10	184
		4/29/2004	1439		77	<0.2	<40	3	<2	52	161	<10	168
		6/7/2004	1027		110	<0.2	<40	4	<2	51	181	11	212
		7/12/2004	1225		226	<0.2	<40	4	<2	38	154	12	163
		7/22/2004	1027		147	<0.2	<40	4	<2	54	196	<10	216
		8/16/2004	1010		86	<0.2	<40	4	<2	57	193	<10	226
McFarland Creek (15-006)													
D01G17	2.50	6/7/2004	857		45	<0.2	<40	2	<2	38	170	<10	170
		7/22/2004	910		49	<0.2	<40	3	<2	38	201	<10	180
		8/16/2004	858		42	<0.2	<40	2	<2	39	196	<10	192
D01G16	2.30	6/7/2004	1006		53	<0.2	<40	2	<2	38	140	<10	154
		7/22/2004	928		53	<0.2	<40	3	<2	37	155	<10	161
		8/16/2004	915		60	<0.2	<40	3	<2	33	138	<10	147

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HUC 11/ STORET Station ID	River Mile	Date	Time	QC	Mn (µg/l)	Hg (µg/l)	Ni (µg/l)	K (mg/l)	Se (µg/l)	Sr (µg/l)	Na (µg/l)	Zn (µg/l)	Hardness (mg/l)
04110003020 [Chagrin River (headwaters to below Aurora Branch)] (cont.)													
McFarland Creek (15-006) (cont.)													
D01P17	0.06	6/7/2004	909		57	<0.2	<40	2	<2	36	132	<10	149
		7/22/2004	1011		50	<0.2	<40	3	<2	40	171	<10	175
		8/16/2004	948		42	<0.2	<40	3	<2	35	155	<10	164
Silver Creek (15-007)													
D01W22	5.07	6/7/2004	925	Dupl.	131	<0.2	<40	<2	<2	13	107	<10	208
		6/7/2004	925	Dupl.	120	<0.2	<40	<2	<2	12	100	<10	196
		7/22/2004	912		111	<0.2	<40	<2	<2	14	112	<10	217
		8/16/2004	909		111	<0.2	<40	2	<2	14	114	<10	220
D01W23	0.54	6/7/2004	904		76	<0.2	<40	<2	<2	16	100	<10	158
		7/22/2004	935		95	<0.2	<40	2	<2	17	106	<10	163
		8/16/2004	844		59	<0.2	<40	2	<2	17	110	<10	174
Smith Creek (RM 8.98 Trib. Aurora Branch) (15-014)													
D01G20	0.50	6/7/2004	819		67	<0.2	<40	2	<2	17	135	<10	224
		7/22/2004	840		68	<0.2	<40	2	<2	18	134	<10	216
		8/16/2004	832		35	<0.2	<40	2	<2	16	139	<10	242
Dewdale Creek (15-024)													
D01G24	2.60	6/7/2004	959		387	<0.2	<40	2	<2	27	100	<10	128
		7/22/2004	1138		341	<0.2	<40	2	<2	26	104	<10	128
		8/16/2004	925		341	<0.2	<40	3	<2	42	140	<10	156
D01G23	0.60	6/7/2004	1022		105	<0.2	<40	2	<2	18	139	<10	174
		7/22/2004	1125		77	<0.2	<40	2	<2	18	145	<10	174
		8/9/2004	1418										
		8/16/2004	943		46	<0.2	<40	2	<2	17	154	<10	192
Unnamed Tributary Chagrin River RM 38.4 (15-039)													
D01G31	0.45	6/7/2004	1054		192	<0.2	<40	7	<2	144	210	31	246
		7/22/2004	1059		1010	<0.2	<40	7	<2	109	167	104	198
		8/16/2004	1007	Dupl.	97	<0.2	<40	8	<2	176	224	32	266
		8/16/2004	1007	Dupl.	99	<0.2	<40	8	<2	180	227	34	271

Appendix 1. Water chemistry results for the Chagrin River watershed water quality survey, 2003-2004.

HUC 11/ STORET Station ID	River Mile	Date	Time	QC	Mn (µg/l)	Hg (µg/l)	Ni (µg/l)	K (mg/l)	Se (µg/l)	Sr (µg/l)	Na (µg/l)	Zn (µg/l)	Hardness (mg/l)
04110003030 [Chagrin River (below Aurora Branch to Lake Erie)]													
Chagrin River (15-001)													
D01P03	26.80	6/7/2004	1119		67	<0.2	<40	3	<2	40	148	19	182
D01P07	25.30	8/6/2003	1020		166	<0.2	<40	5	<2	32	140	21	148
		8/27/2003	1254		96	<0.2	<40	4	<2	32	122	17	134
		9/4/2003	910		74	<0.2	<40	4	<2	40	146	<10	161
		9/11/2003	825		51	<0.2	<40	4	<2	52	183	<10	210
		9/23/2003	1148		160	<0.2	<40	4	<2	25	107	15	111
		10/8/2003	928		38	<0.2	<40	3	<2	35	135	<10	156
		12/10/2003	1224		83	<0.2	<40	3	<2	61	169	<10	165
		12/10/2003	1224		83	<0.2	<40	3	<2	61	169	<10	165
		4/29/2004	1346		64	<0.2	<40	2	<2	46	135	<10	144
		6/7/2004	1054		62	<0.2	<40	3	<2	44	156	13	184
		7/12/2004	1144		134	<0.2	<40	3	<2	33	134	11	144
		7/22/2004	1108		72	<0.2	<40	3	<2	43	167	<10	184
		8/16/2004	1038		39	<0.2	<40	4	<2	49	180	<10	200
D01P06	23.62	9/4/2003	1303		84	<0.2	<40	4	<2	41	149	<10	166
		9/11/2003	1253		58	<0.2	<40	4	<2	53	180	<10	210
		10/8/2003	1343		34	<0.2	<40	3	<2	35	134	<10	156
D01S09	20.95	9/4/2003	1237		67	<0.2	<40	4	<2	43	153	<10	164
		9/11/2003	1227		37	<0.2	<40	4	<2	53	188	<10	212
		10/8/2003	1324		34	<0.2	<40	3	<2	38	143	<10	168
D01P04	18.08	8/6/2003	1056		70	<0.2	<40	4	<2	50	181	<10	187
		8/27/2003	1225		75	<0.2	<40	4	<2	33	125	11	144
		9/4/2003	1211		88	<0.2	<40	4	<2	43	152	<10	164
		9/11/2003	1206		88	<0.2	<40	4	<2	53	182	<10	207
		9/23/2003	1116	Dupl.	170	<0.2	<40	4	<2	28	108	20	109
		9/23/2003	1116	Dupl.	167	<0.2	<40	4	<2	28	108	19	109
		10/8/2003	1254		31	<0.2	<40	3	<2	38	144	<10	168
		12/10/2003	1200		68	<0.2	<40	3	<2	91	199	<10	194
		4/29/2004	1311		53	<0.2	<40	2	<2	51	142	<10	156

Appendix 1. Water chemistry results for the Chagrin River watershed water quality survey, 2003-2004.

HUC 11/ STORET Station ID	River Mile	Date	Time	QC	Mn (µg/l)	Hg (µg/l)	Ni (µg/l)	K (mg/l)	Se (µg/l)	Sr (µg/l)	Na (µg/l)	Zn (µg/l)	Hardness (mg/l)
04110003030 [Chagrin River (below Aurora Branch to Lake Erie)] (cont.)													
Chagrin River (15-001) (cont.)													
D01P04	18.08	6/7/2004	1221		58	<0.2	<40	3	<2	48	168	<10	201
(cont.)		7/12/2004	1120		50	<0.2	<40	3	<2	44	164	<10	191
		7/22/2004	1202		105	<0.2	<40	4	<2	45	169	<10	184
		8/16/2004	837		37	<0.2	<40	3	<2	48	182	<10	191
D01S08	13.04	9/4/2003	1159		76	<0.2	<40	4	<2	44	153	<10	161
		9/11/2003	1145		42	<0.2	<40	4	<2	57	187	<10	207
		10/8/2003	1207		36	<0.2	<40	3	<2	40	144	<10	161
D01G05	10.95	9/4/2003	1131		63	<0.2	<40	4	<2	44	153	<10	161
		9/11/2003	1126		32	<0.2	<40	4	<2	57	184	<10	205
		10/8/2003	1146		33	<0.2	<40	3	<2	40	144	<10	161
502400	4.95	1/29/2003	1153		58		<40	3	<2	236	246	<10	250
		3/17/2003	1109		196		<40	3	<2	57	115	32	118
		4/16/2003	1331		34		<40	3	<2	68	169	<10	184
		5/6/2003	1233		792		<40	5	<2	64	157	172	182
		6/9/2003	1020		124		<40	4	<2	67	175	20	179
		7/23/2003	930		199		<40	4	<2	22	100	44	111
		7/31/2003	939		35		<40	3	<2	43	154	<10	168
		8/6/2003	1008		77	<0.2	<40	4	<2	52	167	<10	173
		8/27/2003	1410		134	<0.2	<40	5	<2	58	192	17	200
		9/4/2003	941		76	<0.2	<40	4	<2	45	154	<10	161
		9/11/2003	955		58	<0.2	<40	4	<2	59	184	<10	195
		9/23/2003	1037		246	<0.2	<40	4	<2	35	133	31	129
		10/8/2003	1122		32	<0.2	<40	3	<2	41	152	<10	173
		12/10/2003	1132		67	<0.2	<40	3	<2	84	189	<10	203
		4/29/2004	1345		41	<0.2	<40	2	<2	56	144	<10	158
		6/7/2004	912		43	<0.2	<40	3	<2	55	177	<10	201
		7/12/2004	1308		59	<0.2	<40	3	<2	53	178	<10	197
		7/22/2004	919		62	<0.2	<40	3	<2	49	168	<10	179
		8/16/2004	902		38	<0.2	<40	4	<2	60	190	<10	192
		11/4/2004	1120		41		<40	5	<2	38	140	10	160

Appendix 1. Water chemistry results for the Chagrin River watershed water quality survey, 2003-2004.

HUC 11/ STORET Station ID	River Mile	Date	Time	QC	Mn (µg/l)	Hg (µg/l)	Ni (µg/l)	K (mg/l)	Se (µg/l)	Sr (µg/l)	Na (µg/l)	Zn (µg/l)	Hardness (mg/l)
04110003030 [Chagrin River (below Aurora Branch to Lake Erie)] (cont.)													
Chagrin River (15-001) (cont.)													
D01G06	2.72	9/4/2003	913		63	<0.2	<40	4	<2	45	154	<10	173
		9/11/2003	927		35	<0.2	<40	4	<2	55	182	<10	206
		10/8/2003	1058		29	<0.2	<40	3	<2	39	148	<10	178
East Branch Chagrin River (15-002)													
D01S06	14.50	6/7/2004	1145		26	<0.2	<40	2	<2	23	138	<10	220
		7/22/2004	1029	Dupl.	72	<0.2	<40	3	<2	20	112	<10	173
		7/22/2004	1029	Dupl.	72	<0.2	<40	3	<2	20	110	<10	173
		8/16/2004	1036		36	<0.2	<40	2	<2	23	151	<10	236
D01S20	10.28	8/6/2003	1222		31	<0.2	<40	3	<2	25	187	<10	262
		8/27/2003	1103		41	<0.2	<40	3	<2	22	140	<10	192
		9/4/2003	1048		28	<0.2	<40	3	<2	28	173	<10	244
		9/11/2003	1049		20	<0.2	<40	2	<2	26	200	<10	284
		9/23/2003	932		44	<0.2	<40	3	<2	20	103	<10	139
		10/8/2003	959		32	<0.2	<40	2	<2	24	160	<10	230
		12/10/2003	1053		52	<0.2	<40	2	<2	29	118	10	173
		4/29/2004	1059		33	<0.2	<40	2	<2	26	134	<10	192
		6/7/2004	1051		33	<0.2	<40	2	<2	24	177	<10	258
		7/12/2004	1022		71	<0.2	<40	3	<2	18	120	<10	173
		7/22/2004	1037		49	<0.2	<40	3	<2	22	142	<10	203
		8/16/2004	1025		20	<0.2	<40	2	<2	24	200	<10	281
D01P01	2.35	8/6/2003	1256		17	<0.2	<40	3	<2	31	176	<10	246
		8/27/2003	1033		62	<0.2	<40	4	<2	23	123	12	173
		9/4/2003	1012	Dupl.	24	<0.2	<40	3	<2	32	164	<10	232
		9/4/2003	1012	Dupl.	23	<0.2	<40	3	<2	32	164	<10	232
		9/11/2003	1019		15	<0.2	<40	3	<2	32	192	<10	266
		9/23/2003	958		60	<0.2	<40	3	<2	21	93	12	125
		10/8/2003	929		23	<0.2	<40	2	<2	28	156	<10	227
		12/10/2003	1116		33	<0.2	<40	2	<2	30	131	<10	189
		4/29/2004	1025		20	<0.2	<40	2	<2	32	134	<10	198
		6/7/2004	952		18	<0.2	<40	2	<2	32	175	<10	260

Appendix 1. Water chemistry results for the Chagrin River watershed water quality survey, 2003-2004.

HUC 11/ STORET Station ID	River Mile	Date	Time	QC	Mn (µg/l)	Hg (µg/l)	Ni (µg/l)	K (mg/l)	Se (µg/l)	Sr (µg/l)	Na (µg/l)	Zn (µg/l)	Hardness (mg/l)
04110003030 [Chagrin River (below Aurora Branch to Lake Erie)] (cont.)													
East Branch Chagrin River (15-002) (cont.)													
		7/12/2004	959		33	<0.2	<40	2	<2	26	179	<10	247
		7/22/2004	934		58	<0.2	<40	3	<2	28	160	<10	224
		8/16/2004	934		12	<0.2	<40	2	<2	29	190	<10	270
Griswold Creek (15-003)													
D01G15	4.40	6/7/2004	841		63	<0.2	<40	4	<2	70	228	<10	236
		7/22/2004	951		63	<0.2	<40	4	<2	69	237	<10	239
		8/16/2004	1112		33	<0.2	<40	5	<2	86	268	<10	265
D01P12	0.02	6/7/2004	1144		29	<0.2	<40	3	<2	52	183	<10	278
		7/22/2004	1127		36	<0.2	<40	3	<2	48	195	<10	288
		8/16/2004	1054		27	<0.2	<40	3	<2	50	202	<10	309
Unnamed Tributary to Chagrin River (RM 5.54) (15-010)													
D01G18	0.60	6/7/2004	932		135	<0.2	<40	5	<2	165	316	<10	331
		7/22/2004	1121		184	<0.2	<40	6	<2	151	265	15	246
		8/16/2004	917		126	<0.2	<40	5	<2	162	304	<10	298
Caves Creek (15-011)													
D01S15	0.88	6/7/2004	1157		<10	<0.2	<40	3	<2	43	188	<10	264
		7/22/2004	1139		26	<0.2	<40	4	<2	49	188	<10	252
		8/16/2004	1102		<10	<0.2	<40	3	<2	42	217	<10	301
Unnamed Tributary to Chagrin River (RM 22.81) (15-018)													
D01G21	0.20	6/7/2004	1158		79	<0.2	<40	5	<2	139	286	<10	238
		7/22/2004	1146		38	<0.2	<40	5	<2	118	263	<10	211
		8/16/2004	1106		26	<0.2	<40	6	<2	122	312	15	255
Unnamed Tributary to East Branch Chagrin River RM 3.57 (Stoney Brook) (15-032)													
D01G27	0.10	6/7/2004	1008		75	<0.2	<40	4	<2	60	218	<10	290
		7/22/2004	958		271	<0.2	<40	5	<2	52	194	14	257
		8/16/2004	950		71	<0.2	<40	4	<2	59	229	<10	307

Appendix 1. Water chemistry results for the Chagrin River watershed water quality survey, 2003-2004.

HUC 11/ STORET Station ID	River Mile	Date	Time	QC	Mn (µg/l)	Hg (µg/l)	Ni (µg/l)	K (mg/l)	Se (µg/l)	Sr (µg/l)	Na (µg/l)	Zn (µg/l)	Hardness (mg/l)
04110003030 [Chagrin River (below Aurora Branch to Lake Erie)] (cont.)													
Unnamed Tributary to East Branch Chagrin River RM 10.13 (15-038)													
D01G32	0.10	6/7/2004	1041		<10	<0.2	<40	2	<2	14	116	<10	163
		7/22/2004	1050		33	<0.2	<40	2	<2	12	119	<10	211
		8/9/2004	1333										
		8/16/2004	1036		33	<0.2	<40	2	<2	11	120	<10	222
Unnamed Tributary to East Branch Chagrin River RM 10.60 (Stebbins Gulch) (15-039)													
D01G33	0.20	6/7/2004	1103		34	<0.2	<40	2	<2	11	115	<10	213
		7/22/2004	1024	Dupl.	63	<0.2	<40	3	<2	17	130	<10	172
		7/22/2004	1024	Dupl.	62	<0.2	<40	3	<2	17	130	<10	172
		8/16/2004	1014		<10	<0.2	<40	2	<2	19	155	<10	197
Unnamed Tributary East Branch Chagrin River RM 15.35 (15-042)													
D01G36	0.20	6/7/2004	1127		37	<0.2	<40	2	<2	33	153	<10	220
		7/22/2004	1013		333	<0.2	<40	4	<2	27	125	30	196
		8/16/2004	1050		17	<0.2	<40	2	<2	33	162	<10	239
Unnamed Tributary East Branch Chagrin River RM 16.20 (15-043)													
D01G35	0.10	6/7/2004	1150		34	<0.2	<40	<2	<2	22	134	<10	213
		7/22/2004	1040		451	<0.2	<40	3	<2	18	120	47	165
		8/16/2004	1030		33	<0.2	<40	2	<2	19	148	<10	212
Ward Creek (15-048)													
D01G39	0.80	6/7/2004	848		96	<0.2	<40	4	<2	97	260	<10	259
		7/22/2004	856		131	<0.2	<40	4	<2	96	243	14	218
		8/16/2004	843	Dupl.	101	<0.2	<40	4	<2	84	235	<10	207
		8/16/2004	843	Dupl.	103	<0.2	<40	4	<2	86	241	<10	209

Appendix 2.

Chagrin River Watershed Recreational Uses

Water quality criteria for determining whether rivers and streams are suitable for recreational uses are established in the Ohio Water Quality Standards (Table 7-13 in OAC 3745-1-07) based upon the presence or absence of bacteria indicators in the water column. Indicator organisms used for these determinations are fecal coliform bacteria and *Escherichia coli*.

Fecal coliform bacteria are microscopic organisms that are present in large numbers in the feces and intestinal tracts of humans and other warm-blooded animals. *E. coli* typically comprises approximately 97 percent of the organisms found in the fecal coliform bacteria of human feces (Dufour, 1977). There is currently no simple way to differentiate between human and animal sources of coliform bacteria in surface waters, although methodologies for this type of analysis are becoming more practicable. These microorganisms can enter water bodies where there is a direct discharge of human and animal wastes, or may enter water bodies along with runoff from soils where these wastes have been deposited.

Pathogenic (disease causing) organisms are typically present in the environment in such small amounts that it is impractical monitor them directly. Although some strains of *E. coli* can be toxic, causing serious illness, fecal coliform bacteria, including *E. coli*, by themselves are usually not pathogenic (disease causing). Fecal coliform bacteria and *E. coli* are instead used as indicators of the potential presence of pathogenic organisms that enter the environment through the same pathways. When fecal coliform bacteria or *E. coli* are present in high numbers in a water sample, it invariably means that the water has received fecal matter from one source or another. Swimming or other recreational-based contact with water having a high fecal coliform or *E. coli* count may result in ear, nose, and throat infections, as well as stomach upsets, skin rashes, and diarrhea. Young children, the elderly, and those with depressed immune systems are most susceptible to infection.

Designations of recreational uses for water bodies in the Chagrin River watershed are listed in OAC Rule 3745-1-22. All water bodies with designated recreational uses in the Chagrin River watershed are designated for Primary Contact Recreation (PCR), which "...are waters that, during the recreation season, are suitable for full-body contact recreation such as ... swimming, canoeing, and SCUBA diving with minimal threat to public health as a result of water quality" [OAC 3745-1-07 (B)(4)(b)]. There are no known designated bathing areas within the areas assessed for the Chagrin River watershed in 2003 and 2004. Applicable water quality criteria for the PCR use for the Chagrin River study area are listed in Table 1. Bacteriological results from environmental samples are typically reported as colony forming units (cfu)/100 ml water.

For purposes of assessing bacteriological data collected from the Chagrin River Assessment Units (AU's), fecal coliform and *E. coli* results from ambient samples collected during the years 1998 through 2004 were pooled in order to calculate

Table 1.	Primary Contact Recreational Use Water Quality Criteria applicable to the Chagrin River Study Area (Table 7-13 of OAC 3745-1-07). At least one of the two bacteriological standards (fecal coliform or <i>E. coli</i>) must be met. These criteria apply outside of the mixing zone.
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Primary Contact

Fecal coliform - geometric mean fecal coliform content (either MPN or MF), based upon not less than five samples within a thirty-day period, shall not exceed 1,000 per 100 ml and fecal coliform content (either MPN or MF) shall not exceed 2,0000 per 100 ml in more than ten percent of the samples taken during any thirty-day period.

E. coli - geometric mean *E. coli* content (either MPN or MF), based upon not less than five samples within a thirty-day period, shall not exceed 126 per 100 ml and *E. coli* content (either MPN or MF) shall not exceed 298 per 100 ml in more than ten percent of the samples taken during any thirty-day period.

geometric means and to determine the 90th percentile. The Chagrin River has a watershed area of 267 mi². Therefore, none of the mainstem segments of the river are assessed as Large River Assessment Units (streams with watershed areas > 500 mi²) under the Ohio EPA integrated assessment protocols (Ohio EPA, 2005). Instead, data from Chagrin River mainstem sites are pooled with data from tributaries within the same sub-watershed assessment units.

Only data collected during the recreational season (May 1 through October 15) are used for the analysis. The results of the analyses are compared to the PCR use water quality criteria to determine the degree of attainment. The water quality criteria states that if either of the two indicators (fecal coliform or *E. coli*) is in attainment of its criterion then the water body is in attainment of the recreational use criteria. Given the current numerical standards for fecal coliform or *E. coli*, in almost all instances fecal coliform results are determinate in assessing attainment. Therefore, data analysis presented in this report is limited to the use of fecal coliform results although analyses were also conducted for *E. coli* in the majority of the samples (results provided in the appendices to this report).

For purposes of water quality evaluation, the Ohio EPA utilizes assessment units (AU's) based upon the 11-digit watershed Hydrologic Unit Code (HUC) boundaries established by the Natural Resources Conservation Service (NRCS, www.oh.nrcs.usda.gov) (Ohio EPA, 2002). For purposes of reporting the attainment status for a particular Assessment Unit, the following protocol is followed:

1. Where sufficient data is available for direct comparison to the water quality criteria (5 samples collected within a thirty-day period), compliance with the criteria determines the attainment status. Violations of either the geometric mean or 10 percent criteria represents NON-Attainment and values below the criteria indicate FULL Attainment.
2. Where sufficient data is not available for direct comparison to the water quality

criteria, pooled data for a period of record is compared to the water quality criteria as follows:

- A) NON-Attainment is assigned when both the geometric mean and the 90th percentile for the data exceed the applicable water quality criteria.
- B) PARTIAL Attainment is assigned when the geometric mean for the pooled data is less than the water quality criteria but the 90th percentile exceeds the water quality criteria.
- C) FULL Attainment is assigned when both the geometric mean and the 90th percentile for the pooled data are below the applicable water quality criteria.

HUC 11 Assessment Units

Ambient fecal coliform data from 59 sampling locations within the upper Chagrin (headwaters to below Aurora Branch - 04110003020) and lower Chagrin River (below Aurora Branch to Lake Erie - 04110003030) Assessment Units (AU's) was analyzed to determine the degree of attainment with the recreational use criteria. There were 36 sampling locations on 9 different streams within the upper Chagrin River AU, while 23 sampling locations were distributed over 12 streams within the lower Chagrin River AU (Figure 1). Comparison of the results with the applicable water quality criteria found that both AU's were in PARTIAL attainment for recreational use (Table 2). Pooled results for each sampling station are depicted in Figures 2 and 3.

Table 2. Summary statistics for fecal coliform data from HUC 11 Assessment Units in the Chagrin River study area, 1998-2004.

HUC11 Watershed	HUC14 Watershed	Number of Samples	Geometric Mean	90th Percentile	Minimum	Maximum	Percent >1000	Percent >2000	Percent >5000	Attainment Status
04110003020 Chagrin River (headwaters to below Aurora Branch)										
	Chagrin R. headwaters except Silver Creek (010)	67	377	3,500	1	26,000	23.9%	13.4%	7.5%	
	Silver Creek (020)	6	279	655	150	940	0.0%	0.0%	0.0%	
	Aurora Br. above McFarland Cr. (030)	26	501	3,020	40	120,000	11.5%	11.5%	11.5%	
	Aurora Br. below McFarland Cr. (040)	20	320	4,820	50	17,000	15.0%	15.0%	5.0%	
	04110003020 Total	119	385	3,920	1	120,000	18.5%	12.6%	7.6%	PARTIAL
04110003030 Chagrin River (below Aurora Branch to Lake Erie)										
	Chagrin R. above E. Branch (010)	42	498	4,430	30	22,000	21.4%	16.7%	9.5%	
	East Branch (020)	36	485	<u>5,100</u>	8	15,000	33.3%	27.8%	11.1%	
	Chagrin R. below E. Branch (030)	45	395	3,960	20	18,000	22.2%	17.8%	8.9%	
	04110003030 Total	123	454	4,480	8	22,000	25.2%	20.3%	9.8%	PARTIAL
Key to data qualifiers: Bold type indicates values exceeding the Primary Contact Recreation criteria.										
Bold Underlined type indicates values exceeding the Secondary Contact Recreation criteria.										

04110003020 Chagrin River (headwaters to below Aurora Branch)

Pooled data analysis for fecal coliform bacteria in the upper Chagrin watershed, including the Aurora Branch found that the geometric mean for the data pooled from all 36 of the sites sampled by the Ohio EPA from 1999 through 2004 was below the PCR water quality criterion (Table 2, Figure 2). Analysis of data from individual sites found that the geometric mean was exceeded at 8 locations in the upper Chagrin AU. The 90th percentile of the pooled data (all sites) exceeded the 10 percent water quality criterion (Table 2, Figure 3), indicating that this AU is in PARTIAL attainment of the recreational use water quality criteria. The 90th percentile criterion was exceeded at 6 of the 8 sites where the geometric mean was found to be exceeded. These results are indicative of a water quality problem occurring under high flow or runoff events, likely caused by non-point sources of pollution rather than from failures at point source dischargers.

Problem areas identified in the upper Chagrin AU included:

1. The upper portion of Dewdale Creek (RM 2.60, STORET ID D01G24): this sampling site is located downstream of Kiwanis Lake, an area with a high density of older housing not served by sewers. Failing on-site home sewage systems are a likely source for the observed problems.
2. Unnamed tributary to the Chagrin River at river mile 38.4 (aka Marsh Hawk Run): this stream drains unsewered suburban housing areas located to the south of the Chesterland area and also is the receiving stream for the Geauga Co. Opalacka WWTP. Non-point pollution resulting from small farm livestock management may also be an issue in this stream.
3. Chagrin River mainstem at Sperry Rd. (RM 40.05, STORET ID D01G01): this location was used as a sentinel site for the survey, and both the geometric mean and the 90th percentile of the fecal coliform data exceeded the PCR criteria. Several homes located upstream of this site are located in very close proximity to the river bank. This reach of the Chagrin River is characterized by shallow depth to bedrock, with exposed bedrock in the stream channel throughout this area. Failing septic systems are the likely cause for the observed data.
4. Chagrin River mainstem in the Chagrin Falls area: although much of this area is served by central sewers, it is the most densely developed area within the upper Chagrin AU, and is intermixed with unsewered areas. Urban runoff effects and failing on-site sewage systems, combined with potential wildlife contributions from the park located upstream of the waterfall in Chagrin Falls potentially all contribute to the observed problems.
5. The lower Aurora Branch: the geometric mean and 90th percentile criteria were exceeded at both sentinel sites positioned on the Aurora Branch, both upstream and downstream of McFarland Creek and the Geauga Co. McFarland Creek WWTP. Depths to bedrock, especially near the stream corridor, are very shallow throughout these reaches of the stream, increasing the likelihood of on-site system failure and transport to the stream from the numerous homes located in close proximity to the stream in the areas north of Aurora (Portage County) and in Bainbridge Township (Gauga County). Urban runoff from the more heavily

developed suburban areas of Solon and Bainbridge as well as runoff from small-scale livestock management, such as small horse farms may also be contributing to this situation.

It should be noted that although the site near the mouth of Beaver Creek (Sherman Rd., STORET ID D01G09) is flagged in Figure 2 as exceeding the PCR geometric mean criterion, only one sample was collected at this site. Use of a single sample to determine attainment of the water quality criteria is not possible. However, this site is located just downstream of an agricultural area where cattle have unrestricted access to the stream, so it is very likely that the value reported is representative of conditions at this location. Similarly, the Silver Creek sub-watershed (14 digit HUC 04110003020020) had not results exceeding the water quality criteria. However, only 6 samples were collected from this area during the survey, and the results may not be representative of all flow conditions occurring during a typical recreation season.

In general, the upper reaches of the Aurora Branch demonstrated the highest degree of attainment of the recreational use criteria in the entire Chagrin River watershed. It should be noted that all of the sentinel sites data exceeded the geometric mean and 90th percentile PCR criteria in the upper Chagrin AU. These sites were sampled more frequently and under more varying flow conditions than the other site utilized in the survey. These results indicate that results from the other sites used in the survey should be analyzed with some caution and that problems relating to meeting the PCR water quality criteria may be more widespread than indicated by the present data set.

04110003030 Chagrin River (below Aurora Branch to Lake Erie)

Analysis of the pooled data for the lower Chagrin AU (Table 2) found that this portion of the chagrin watershed is also in PARTIAL attainment of its designated Recreational Use. The geometric mean of the pooled results was below the PCR criterion, while the 90th percentile exceeded the criterion. As with the upper Chagrin AU, causes of the PARTIAL attainment generally appear to be related to non-point sources rather than permitted wastewater discharges.

Problem areas noted in the lower Chagrin AU included the following:

1. The sites throughout the East Branch sub-watershed were the most elevated for the 90th percentile of any of the streams monitored during the survey. However, only the sentinel site located at Markell Rd. (STORET ID D01P01) was found to have exceeded the geometric mean PCR criterion. The results indicate that storm event runoff (non-point) is driving this problem. Likely sources of the problems observed in the East Branch sub-watershed are failing on-site systems and large number of small-scale equestrian facilities located in this area. Many areas within this watershed have very shallow depth to bedrock or proximity to deeply incised ravines, thereby increasing the likelihood of rapid transport of pollutants to shallow groundwater or nearby streams during spate events. Stream flows often are very low during the summertime period and base flows do not provide significant dilution to pollutant loads. A very cautious approach to the

placement of new housing, innovative management of existing on-site home sewage systems, and manure management programs designed to protect the stream network will all be necessary if the recreational use criteria are to be met in the East Branch watershed.

2. Stoney Brook. Although the geometric mean for fecal coliform bacteria was met in this stream, historical problems relating to unsewered areas and the numerous small wastewater treatment plants discharging to Stoneybrook in the Kirtland area are well known. It is likely that bacteria loads to the East Branch from Stoneybrook are a primary source of the elevated fecal coliform counts observed at the downstream sentinel sampling site located on the East Branch at Markell Rd. (RM 2.35, STORET ID D01P01). Plans are currently being developed to provide central sewerage for the Kirtland area which will result in the abandonment of several small wastewater treatment plants and sewer service for several unsewered areas within the Village. Completion of this project will have a positive effect upon attainment with respect to recreational uses.
3. The unnamed tributary to the Chagrin at RM 5.5 (aka Gully Brook) had exceedances for both the geometric mean and 90th percentile criteria. The upper portion of this small watershed is heavily developed, and other portions are impacted by road runoff from the I-90 corridor and mixed residential use.

A positive note regarding the bacteria data collected during the survey was apparent. Bacteriological water quality appears to have improved significantly in Griswold Creek as the result of the construction of the Valley View WWTP servicing the Chesterland area. This plant went on line in May of 1999 and alleviated significant water quality problems noted in Griswold Creek resulting from failing on-site sewage treatment systems. Although the data set was small (n=6), only one sample collected from the sites located on Griswold Creek was found to be above 1,000 cfu/100 ml for fecal coliform during the survey, indicating a significant improvement in water quality.

As observed in the upper Chagrin AU, fecal coliform counts at the sentinel sites were more likely to exceed the geometric mean and 90th percentile criteria for the PCR use. In the lower Chagrin AU, the only sentinel sites where the geometric mean criteria were not exceeded were the Chagrin River at Daniels Park (RM 4.95, STORET ID 502400) and the East Branch at Mitchells Mill Rd. (RM 10.28, STORET ID D01S20). These results indicate that the true nature of the coliform bacteria (and potentially pathogen) pollution problem may be more widespread than would be initially surmised by a review of the data presented in Figures 2 and 3. It is likely that larger data sets at all of the sampling locations, including more data collection during high flow situations, would indicate a greater degree of non-attainment of the recreational use criteria throughout the watershed. Efforts will be needed on a watershed-wide scale to reduce the loading of indicator bacteria in order to assure attainment of the designated recreational uses in the Chagrin River basin.

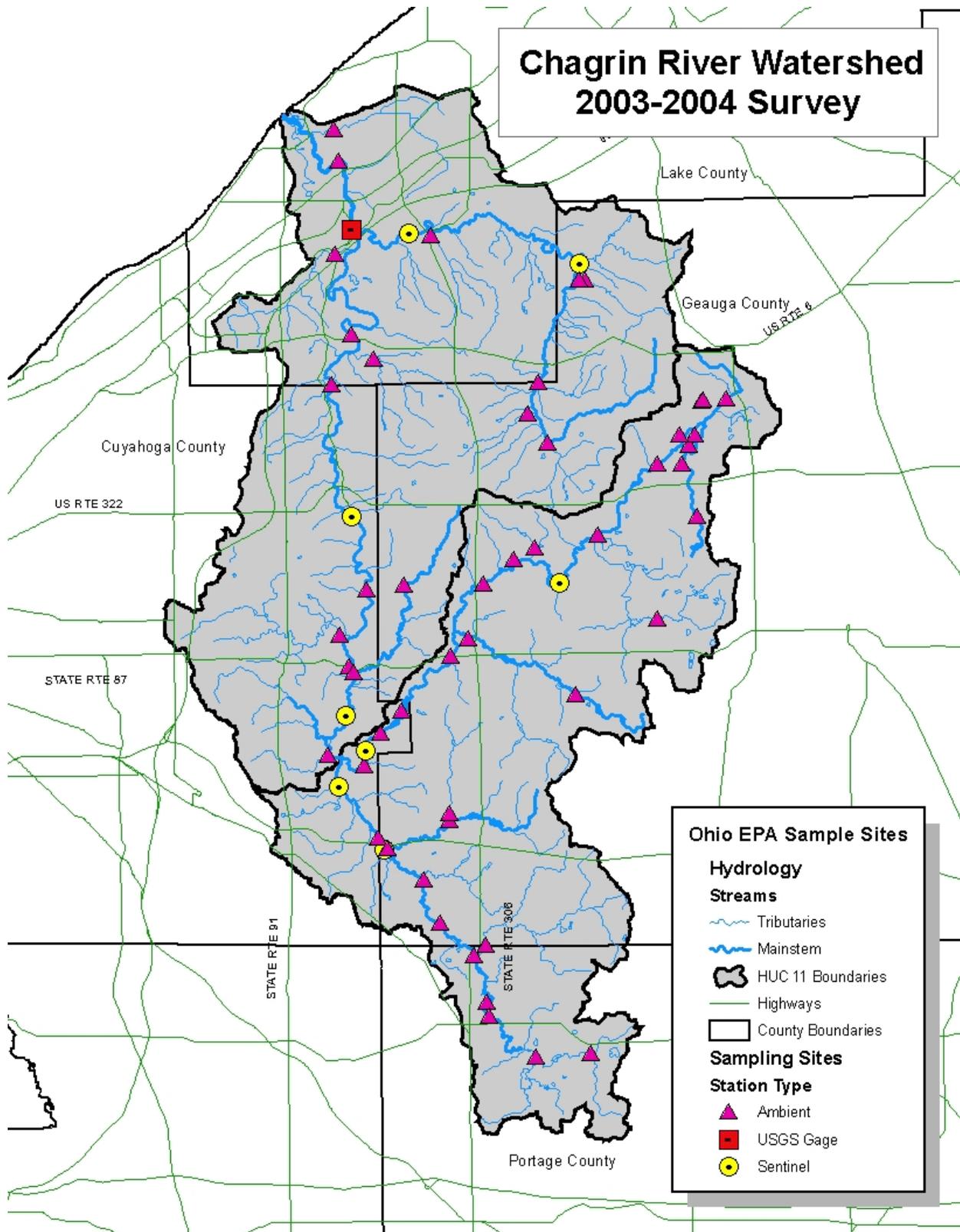


Figure 1. Bacteriological sampling locations for the Chagrin River watershed.

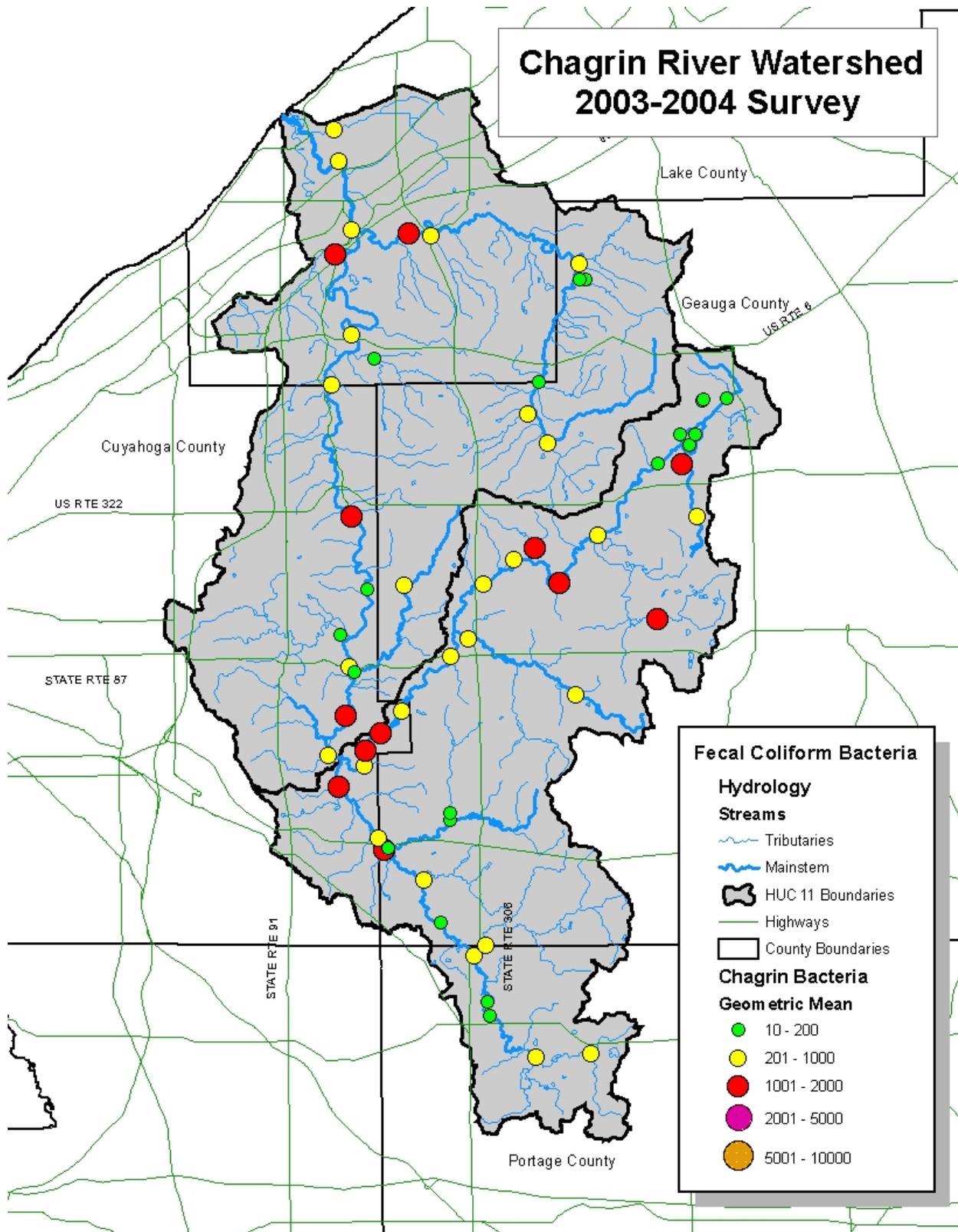


Figure 2. Geometric means for fecal coliform bacteria at sites within the Chagrin River watershed.

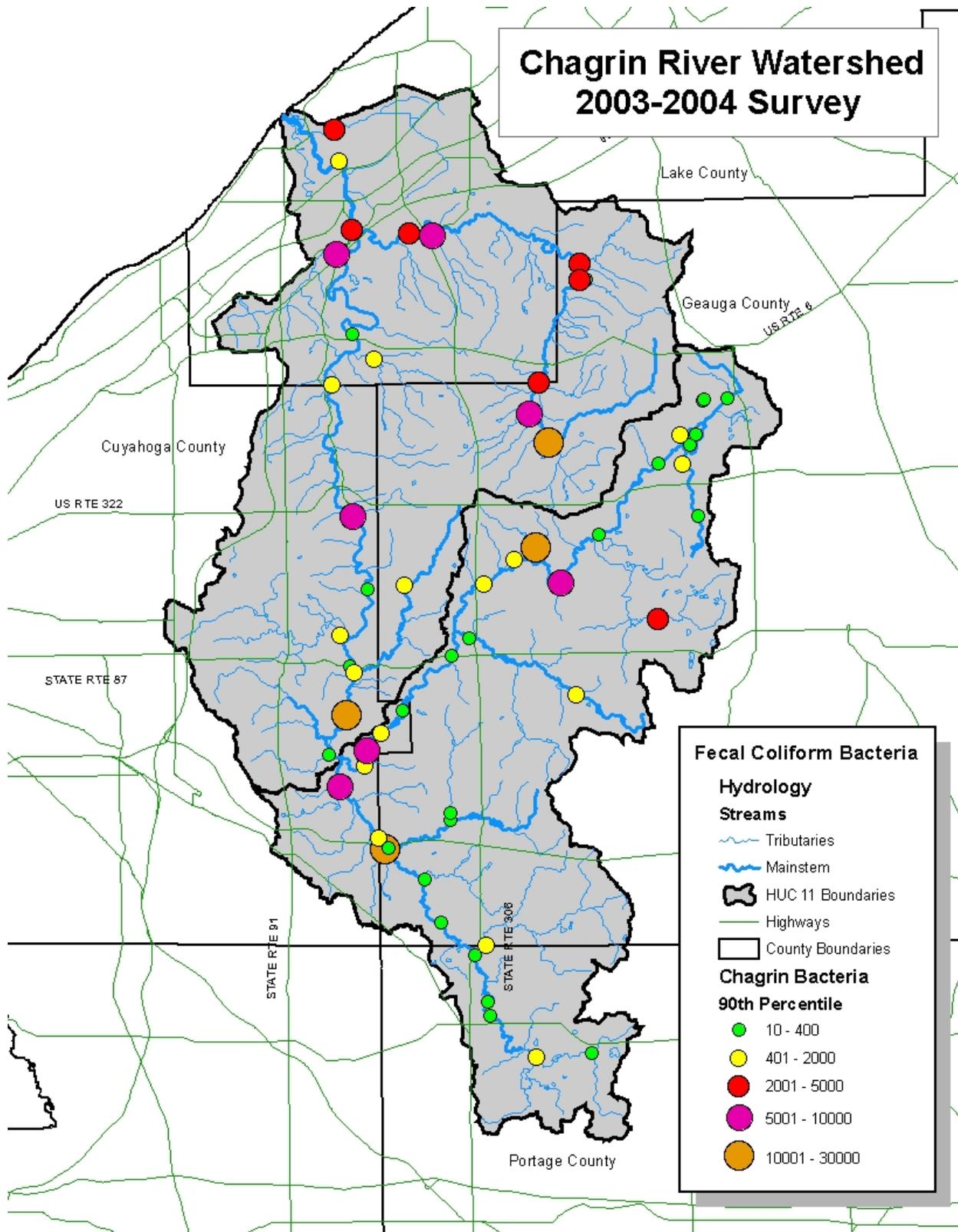


Figure 3. Fecal coliform 90th percentile results for sites within the Chagrin River watershed.

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Appendix 2a. Summary fecal coliform data for sites within the Chagrin River watershed, 1999-2000. All values expressed as cfu/100ml unless otherwise noted.

HUC11	Stream/ River	STORET ID	Location	River Mile	Number of Samples	Geometric Mean ¹	90th Percentile ¹	Percent >1000	Percent >2000	Percent >5000	Min	Max
HUC14	Code	ID	Location	Mile	Number	Mean ¹	Percentile ¹	>1000	>2000	>5000	Min	Max
04110003020	Chagrin R. (headwaters to below Aurora Branch)											
	<i>04110003020010 Chagrin River headwaters to above Aurora Branch [except Silver Cr.]</i>											
	Chagrin River 15-001											
	D01S10		Dst. Chagrin Falls WWTP	28.30	2	482	775	0.0%	0.0%	0.0%	280	830
	D01S11		Miles Rd. (ust. Aurora Br.)	28.96	8	1,588	7,370	50.0%	50.0%	25.0%	290	8,000
	D01S12		Ust. Main St.	29.80	2	1,428	1,650	100.0%	0.0%	0.0%	1,200	1,700
	D01W11		Dst. Old Ivex Dam Site	30.70	2	235	239	0.0%	0.0%	0.0%	230	240
	D01P13		State Rt. 87 (upper crossing)	33.35	2	201	292	0.0%	0.0%	0.0%	130	310
	D01W20		Fairmont Blvd. (upper crossing)	36.55	2	297	459	0.0%	0.0%	0.0%	180	490
	D01G01		Sperry Rd.	40.05	9	1,195	7,760	44.4%	33.3%	22.2%	140	8,800
	D01G02		Rockhaven Rd.	42.70	2	267	327	0.0%	0.0%	0.0%	210	340
	D01P26		Auburn Rd.	46.54	3	58	92	0.0%	0.0%	0.0%	33	100
	BL-L1		Bass Lake Station L-1	47.58	1	10	10	0.0%	0.0%	0.0%	10	10
	BL-L2		Bass Lake Station L-2	47.80	2	10	18	0.0%	0.0%	0.0%	1	20
	D01G03		Woodiebrook Rd.	49.15	3	155	314	0.0%	0.0%	0.0%	80	360
	Beaver Creek 15-008											
	D01G09		Sherman Rd.	0.55	1	1,800	1,800	100.0%	0.0%	0.0%	1,800	1,800
	D01G10		Bean Rd.	2.31	1	230	230	0.0%	0.0%	0.0%	230	230
	Unnamed Trib. Bass Lake (Chagrin RM 47.63) (aka Spring Brook) 15-015											
	D01W32		Old Inter-Urban Culvert	0.10	13	175	424	7.7%	0.0%	0.0%	48	1,200
	Unnamed Trib. Chagrin R. RM 48.3 (aka Woodiebrook) 15-016											
	WB-1		West Trib. @ Woodiebrook Rd.		4	76	388	0.0%	0.0%	0.0%	28	520
	WB-2		East Trib dst. Woodiebrook Rd		1	180	180	0.0%	0.0%	0.0%	180	180
	Dewdale Creek 15-024											
	D01G23		Rockhaven Rd.	0.60	3	502	1,048	33.3%	0.0%	0.0%	240	1,200
	D01G24		Auburn Rd.	2.60	3	1,270	2,828	33.3%	33.3%	0.0%	660	3,300
	Unnamed Trib. Chagrin River (RM 38.4) 15-039											
	D01G31		Marsh Hawk Run Rd.	0.45	3	1,277	21,120	66.7%	33.3%	33.3%	50	26,000

Appendix 2a. Summary fecal coliform data for sites within the Chagrin River watershed, 1999-2000. All values expressed as cfu/100ml unless otherwise noted.

HUC11	Stream/ River	STORET ID	Location	River Mile	Number of Samples	Geometric Mean ¹	90th Percentile ¹	Percent >1000	Percent >2000	Percent >5000	Min	Max
<i>04110003020020 Silver Creek</i>												
Silver Creek 15-007												
	D01W23		Hitching Post Lane	0.54	3	215	332	0.0%	0.0%	0.0%	150	370
	D01W22		Music St.	5.07	3	362	800	0.0%	0.0%	0.0%	210	940
<i>04110003020030 Aurora Branch headwaters to above McFarland Cr.</i>												
Aurora Branch Chagrin River 15-005												
	D01P22		Bainbridge Rd.	3.80	9	1,902	28,560	33.3%	33.3%	33.3%	210	120,000
	D01W15		Geauga Lake Rd.	5.52	2	255	259	0.0%	0.0%	0.0%	250	260
	D01W16		Brewster Rd.	7.35	2	175	263	0.0%	0.0%	0.0%	110	280
	D01S24		SR 306	9.00	2	201	292	0.0%	0.0%	0.0%	130	310
	D01W03		Dst. Aurora Central WWTP	11.10	2	161	193	0.0%	0.0%	0.0%	130	200
	D01W01		Ust. Aurora Central WWTP	11.30	2	94	202	0.0%	0.0%	0.0%	40	220
	D01G04		Pioneer Trail (lower crossing)	14.60	2	572	795	0.0%	0.0%	0.0%	390	840
	D01S02		Chamberlain Rd.	16.74	2	330	338	0.0%	0.0%	0.0%	320	340
Smith Creek 15-014												
	D01G20		YMCA Camp	0.50	3	416	594	0.0%	0.0%	0.0%	300	650
<i>04110003020040 Aurora Branch above McFarland Cr. to Chagrin R.</i>												
Aurora Branch 15-005												
	D01P19		Solon Rd.	1.03	9	1,003	7,400	33.3%	33.3%	11.1%	50	17,000
	D01S22		Dst McFarland Cr. WWTP	3.30	2	485	497	0.0%	0.0%	0.0%	470	500
McFarland Creek 15-006												
	D01P17		Creek @ Chagrin River Rd.	0.06	3	99	179	0.0%	0.0%	0.0%	50	200
	D01G16		Dst. Chagrin Rd.	2.30	3	94	120	0.0%	0.0%	0.0%	57	120
	D01G17		Chagrin Rd.	2.50	3	87	124	0.0%	0.0%	0.0%	50	130

Appendix 2a. Summary fecal coliform data for sites within the Chagrin River watershed, 1999-2000. All values expressed as cfu/100ml unless otherwise noted.

HUC11	Stream/ River	STORET Code	Location	River Mile	Number of Samples	Geometric Mean ¹	90th Percentile ¹	Percent >1000	Percent >2000	Percent >5000	Min	Max
04110003030	Chagrin River (below Aurora Branch to Lake Erie)											
	<i>04110003030010 Chagrin River below Aurora Branch to above E. Br.</i>											
	Chagrin River 15-001											
	D01G05		Pleasant Valley Rd.	10.95	2	283	380	0.0%	0.0%	0.0%	200	400
	D01S08		Rogers Rd.	13.04	2	300	468	0.0%	0.0%	0.0%	180	500
	D01P04		Old Mill Rd.	18.08	9	1,199	5,840	33.3%	22.2%	11.1%	40	11,200
	D01S09		Fairmont Blvd. (lower crossing)	20.95	2	104	247	0.0%	0.0%	0.0%	40	270
	D01P06		SR 87 (lower crossing)	23.62	2	217	398	0.0%	0.0%	0.0%	110	430
	D01P07		Chagrin Blvd.	25.30	9	1,098	10,640	44.4%	44.4%	22.2%	160	22,000
	D01P03		Miles Rd. (Dst. Aurora Br.)	26.80	1	300	300	0.0%	0.0%	0.0%	300	300
	Griswold Creek 15-003											
	D01P12		Falls River Rd.	0.02	3	176	492	0.0%	0.0%	0.0%	30	530
	D01G15		Fairmont Blvd.	4.40	3	478	1,266	33.3%	0.0%	0.0%	220	1,500
	Unnamed Trib. Chagrin River (RM 5.5) 15-010											
	D01G18		River Rd. (SR 174)	0.60	3	1,102	5,384	33.3%	33.3%	33.3%	390	6,600
	Caves Creek 15-011											
	D01S15		Worrel Rd.	0.88	3	162	682	0.0%	0.0%	0.0%	40	820
	Unnamed Trib. Chagrin River (RM 22.81) 15-018											
	D01G21		Chagrin River Rd.	0.20	3	164	512	0.0%	0.0%	0.0%	60	610
	<i>04110003030020 East Branch Chagrin River</i>											
	East Branch Chagrin River 15-002											
	D01P01		Markell Rd.	2.35	9	1,238	4,540	44.4%	22.2%	11.1%	88	5,900
	D01S20		Mitchells Mill Rd.	10.28	9	593	3,500	33.3%	33.3%	0.0%	48	4,300
	D01S06		Heath Rd.	14.50	3	166	2,018	33.3%	33.3%	0.0%	20	2,500
	Stoney Brook 15-032											
	D01G27		Kirtland-Chardon Rd.	0.10	3	763	9,688	33.3%	33.3%	33.3%	84	12,000
	Unnamed Trib. East Branch (RM 10.13) 15-038											
	D01G32		Wisner Rd.	0.10	3	56	229	0.0%	0.0%	0.0%	10	270

Appendix 2a. Summary fecal coliform data for sites within the Chagrin River watershed, 1999-2000. All values expressed as cfu/100ml unless otherwise noted.

HUC11	Stream/ River	STORET ID	Location	River Mile	Number of Samples	Geometric Mean ¹	90th Percentile ¹	Percent >1000	Percent >2000	Percent >5000	Min	Max
<i>04110003030020 East Branch Chagrin River (cont.)</i>												
Unnamed Trib. East Branch (RM 10.60) (Stebbens Gulch) 15-039												
	D01G33		Mitchells Mill Rd.	0.20	3	114	2,890	33.3%	33.3%	0.0%	8	3,600
Unnamed Trib. East Branch (RM 15.35) 15-042												
	D01G36		Sperry Rd	0.20	3	624	<u>6,626</u>	33.3%	33.3%	33.3%	90	8,200
Unnamed Trib. East Branch (RM 16.20) 15-043												
	D01G35		Wilson Mills Rd.	0.10	3	857	<u>12,056</u>	33.3%	33.3%	33.3%	150	15,000
<i>04110003030030 Chagrin River below E. Branch to Lake Erie</i>												
Chagrin River 15-001												
	D01G06		Park off Reeves Rd.	2.72	2	559	584	0.0%	0.0%	0.0%	530	590
	502400		Daniels Park (SR 84)	4.95	40	363	3,480	22.5%	17.5%	10.0%	20	18,000
Ward Creek 15-048												
	D01G39		Robin Rd. Pump Sta.	0.80	3	972	3,630	33.3%	33.3%	0.0%	380	4,400

1. **Bold type** indicates that the value exceeds the Primary Contact Recreation criterion. **Bold underlined** type indicates that the value exceeds the Secondary Contact Recreation criterion.

Appendix 3. Fecal coliform and E. coli bacteria results for the Chagrin River watershed, 1999-2004.

HUC11	Stream/ River	STORET ID	LOCATION	River Mile	Date	Fecal Coliform (cfu/100 ml)	E. coli (cfu/100ml)
HUC14	Code						
04110003020 Chagrin R. (headwaters to below Aurora Branch)							
<i>04110003020010 Chagrin River headwaters to above Aurora Branch [except Silver Cr.]</i>							
Chagrin River (15-001)							
	D01S10		Dst. Chagrin Falls WWTP	28.30	9/4/2003	830	420
				28.30	9/11/2003	280	290
			Miles Rd.				
	D01S11		(ust. Aurora Br.)	28.96	8/27/03	3,100	>2,400
				28.96	8/27/2003	8,000	4,700
				28.96	9/4/2003	1,000	740
				28.96	9/11/2003	290	290
				28.96	9/23/2003	7,100	8,600
				28.96	7/12/2004	4,400	7,300
				28.96	7/22/2004	500	260
				28.96	8/16/2004	360	370
	D01S12		Ust. Main St.	29.80	9/4/2003	1,700	920
				29.80	9/11/2003	1,200	660
	D01W11		Dst. Old Ivex Dam Site	30.70	9/4/2003	230	100
				30.70	9/11/2003	240	230
			State Rt. 87		9/4/2003		
	D01P13		(upper crossing)	33.35		130	260
				33.35	9/11/2003	310	200
			Fairmont Blvd.		9/4/2003		
	D01W20		(upper crossing)	36.55		180	130
				36.55	9/11/2003	490	310
	D01G01		Sperry Rd.	40.05	8/27/2003	180	
				40.05	8/27/2003	8,800	6,200
				40.05	9/4/2003	280	130
				40.05	9/11/2003	100	160
				40.05	9/11/2003	100	160
				40.05	9/23/2003	7,500	5,800
				40.05	6/7/2004	200	180
				40.05	7/12/2004	3,800	2,400
				40.05	7/22/2004	1,400	1,300
				40.05	8/16/2004	140	93
	D01G02		Rockhaven Rd.	42.70	9/4/2003	340	170
				42.70	9/11/2003	210	220
	D01P26		Auburn Rd.	46.54	7/18/2002	<100	<100
				46.54	9/4/2003	33	62
				46.54	9/11/2003	60	30
	BL-L1 ^a		Bass Lake Station L-1	47.58	6/20/2002	<10	2
	BL-L2 ^a		Bass Lake Station L-2	47.80	6/20/2002	<10	1
				47.80	6/20/2002	<10	1
				47.80	8/29/2002	<1	1

Appendix 3. Fecal coliform and E. coli bacteria results for the Chagrin River watershed, 1999-2004.

HUC11	Stream/ River	STORET ID	LOCATION	River Mile	Date	Fecal Coliform (cfu/100 ml)	E. coli (cfu/100ml)
HUC14	Code	ID	LOCATION				
<i>04110003020010 (cont.)</i>							
Chagrin River (15-001) (cont.)							
	D01G03		Woodiebrook Rd.	49.15	9/23/2002	360	250
				49.15	9/4/2003	130	41
				49.15	9/11/2003	80	44
Beaver Creek (15-008)							
	D01G09		Sherman Rd.	0.55	7/18/2002	1,800	1,200
	D01G10		Bean Rd.	2.31	7/18/2002	230	150
				2.31	7/18/2002	230	150
Unnamed Trib. (Chagrin RM 47.65) Bass Lake (15-015) (aka Spring Brook)							
	D01W32		Old Inter-Urban Culvert	0.10	5/10/1999	100	
				0.10	6/2/1999	48	
				0.10	7/7/1999	110	
				0.10	8/9/1999	64	
				0.10	9/27/1999	430	190
				0.10	10/12/1999	220	96
				0.10	5/24/2000	290	220
				0.10	6/14/2000	400	460
				0.10	7/24/2000	120	110
				0.10	8/8/2000	1,200	2,400
				0.10	8/22/2000	230	290
				0.10	7/18/2002	64	56
				0.10	9/23/2002	190	200
Unnamed Trib. Chagrin R. RM 48.3 (15-016) (aka Woodiebrook)							
	WB-1 ^a		West Trib. @ Woodiebrook Rd.		7/24/2000	28	21
					8/8/2000	80	100
					8/22/2000	28	
					7/18/2002	520	610
	WB-2 ^a		East Trib dst. Woodiebrook Rd		7/18/2002	180	85
Dewdale Creek (15-024)							
	D01G23		Rockhaven Rd.	0.60	6/7/2004	440	250
				0.60	7/22/2004	1,200	1,100
				0.60	8/16/2004	240	280
	D01G24		Auburn Rd.	2.60	6/7/2004	3,300	2,000
				2.60	7/22/2004	940	770
				2.60	8/16/2004	660	870
Unnamed Trib. Chagrin River RM 38.4 (15-039) (aka Marsh Hawk Run)							
	D01G31		Marsh Hawk Run Rd.	0.45	6/7/2004	1,600	1,300
				0.45	7/22/2004	26,000	>2,400
				0.45	8/16/2004	50	43

Appendix 3. Fecal coliform and E. coli bacteria results for the Chagrin River watershed, 1999-2004.

HUC11	Stream/ River	STORET ID	LOCATION	River Mile	Date	Fecal Coliform (cfu/100 ml)	E. coli (cfu/100ml)
HUC14	Code	ID	LOCATION				
<i>04110003020020 Silver Creek</i>							
Silver Creek (15-007)							
	D01W23		Hitching Post Lane	0.54	6/7/2004	180	100
				0.54	7/22/2004	150	210
				0.54	8/16/2004	370	440
	D01W22		Music St.	5.07	6/7/2004	940	820
				5.07	7/22/2004	210	190
				5.07	8/16/2004	240	300
<i>04110003020030 Aurora Branch headwaters to above McFarland Cr.</i>							
Aurora Branch Chagrin River (15-005)							
	D01P22		Bainbridge Rd.	3.80	8/27/2003	120,000	
				3.80	8/27/2003	380	200
				3.80	9/4/2003	290	310
				3.80	9/11/2003	210	200
				3.80	9/23/2003	5,700	5,200
				3.80	6/7/2004	170	130
				3.80	6/7/2004	190	170
				3.80	7/12/2004	5,200	>2,400
				3.80	7/22/2004	350	290
				3.80	8/16/2004	350	330
	D01W15		Geauga Lake Rd.	5.52	9/4/2003	260	310
				5.52	9/11/2003	250	230
	D01W16		Brewster Rd.	7.35	9/4/2003	280	270
				7.35	9/11/2003	110	160
	D01S24		SR 306	9.00	9/4/2003	310	120
				9.00	9/11/2003	130	160
	D01W03		Dst. Aurora Central WWTP	11.10	9/4/2003	200	97
				11.10	9/11/2003	130	140
	D01W01		Ust. Aurora Central WWTP	11.30	9/4/2003	220	140
				11.30	9/11/2003	40	66
	D01G04		Pioneer Trail (lower crossing)	14.60	9/4/2003	390	200
				14.60	9/11/2003	840	920
	D01S02		Chamberlain Rd.	16.74	9/4/2003	340	380
				16.74	9/11/2003	320	430
Smith Creek (15-014)							
	D01G20		YMCA Camp	0.50	6/7/2004	370	340
				0.50	7/22/2004	300	370
				0.50	8/16/2004	650	920

Appendix 3. Fecal coliform and E. coli bacteria results for the Chagrin River watershed, 1999-2004.

HUC11	Stream/ River	STORET ID	LOCATION	River Mile	Date	Fecal Coliform (cfu/100 ml)	E. coli (cfu/100ml)
HUC14	Code	ID	LOCATION	Mile	Date	(cfu/100 ml)	(cfu/100ml)
<i>04110003020040 Aurora Branch above McFarland Cr. to Chagrin R.</i>							
Aurora Branch Chagrin River (15-005)							
	D01P19		Solon Rd.	1.03	8/27/2003	17,000	
				1.03	8/27/2003	1,000	1,100
				1.03	9/4/2003	600	740
				1.03	9/11/2003	400	310
				1.03	9/23/2003	4,800	3,700
				1.03	6/7/2004	280	370
				1.03	7/12/2004	5,000	>2,400
				1.03	7/22/2004	750	580
				1.03	8/16/2004	50	340
	D01S22		Dst McFarland Cr. WWTP	3.30	9/4/2003	470	80
				3.30	9/11/2003	500	410
McFarland Creek (15-006)							
	D01P17		Creek @ Chagrin River Rd.	0.06	6/7/2004	200	190
				0.06	7/22/2004	96	110
				0.06	8/16/2004	50	71
	D01G16		Dst. Chagrin Rd.	2.30	6/7/2004	120	83
				2.30	7/22/2004	120	160
				2.30	8/16/2004	57	160
	D01G17		Chagrin Rd.	2.50	6/7/2004	50	47
				2.50	7/22/2004	130	120
				2.50	8/16/2004	100	180
04110003030 Chagrin River (below Aurora Branch to Lake Erie)							
<i>04110003030010 Chagrin River below Aurora Branch to above E. Br.</i>							
Chagrin River (15-001)							
	D01G05		Pleasant Valley Rd.	10.95	9/4/2003	400	400
				10.95	9/11/2003	200	370
	D01S08		Rogers Rd.	13.04	9/4/2003	500	360
				13.04	9/11/2003	180	490
	D01P04		Old Mill Rd.	18.08	8/27/2003	2,000	
				18.08	8/27/2003	4,500	4,200
				18.08	9/4/2003	430	320
				18.08	9/11/2003	150	180
				18.08	9/23/2003	5,600	3,900
				18.08	9/23/2003	5,600	3,900
				18.08	4/29/2004	52	40
				18.08	6/7/2004	100	140
				18.08	7/12/2004	440	460
				18.08	7/22/2004	160	210
				18.08	8/16/2004	40	75

Appendix 3. Fecal coliform and E. coli bacteria results for the Chagrin River watershed, 1999-2004.

HUC11	Stream/ River	STORET ID	LOCATION	River Mile	Date	Fecal Coliform (cfu/100 ml)	E. coli (cfu/100ml)
HUC14	Code	ID	LOCATION	Mile	Date	(cfu/100 ml)	(cfu/100ml)
<i>04110003030010 Chagrin River below Aurora Branch to above E. Br. (cont.)</i>							
Chagrin River (15-001) (cont.)							
	D01S09		Fairmont Blvd. (lower crossing)	20.95	9/4/2003	270	300
				20.95	9/11/2003	40	98
	D01P06		SR 87 (lower crossing)	23.62	9/4/2003	430	300
				23.62	9/11/2003	110	140
	D01P07		Chagrin Blvd.	25.30	8/27/2003	22,000	
				25.30	8/27/2003	7,800	4,600
				25.30	9/4/2003	480	350
				25.30	9/11/2003	200	170
				25.30	9/23/2003	3,300	5,800
				25.30	6/7/2004	200	240
				25.30	7/12/2004	3,800	7,300
				25.30	7/22/2004	350	240
				25.30	8/16/2004	160	120
	D01P03		Miles Rd. (Dst. Aurora Br.)	26.80	6/7/2004	300	220
Griswold Creek (15-003)							
	D01P12		Falls River Rd.	0.02	6/7/2004	340	140
				0.02	7/22/2004	530	370
				0.02	8/16/2004	30	31
	D01G15		Fairmont Blvd.	4.40	6/7/2004	330	330
				4.40	7/22/2004	1,500	2,000
				4.40	8/16/2004	220	250
Unnamed Trib. Chagrin River RM 5.5 (15-010)							
	D01G18		River Rd. (SR 174)	0.60	6/7/2004	390	550
				0.60	7/22/2004	6,600	>2,400
				0.60	8/16/2004	520	370
Caves Creek 15-011							
	D01S15		Worrel Rd.	0.88	6/7/2004	40	24
				0.88	7/22/2004	820	1,200
				0.88	8/16/2004	130	190
Unnamed Trib. Chagrin River RM 22.81 (15-018)							
	D01G21		Chagrin River Rd.	0.20	6/7/2004	120	86
				0.20	7/22/2004	610	820
				0.20	8/16/2004	60	59

Appendix 3. Fecal coliform and E. coli bacteria results for the Chagrin River watershed, 1999-2004.

HUC11	Stream/ River	STORET ID	LOCATION	River Mile	Date	Fecal Coliform (cfu/100 ml)	E. coli (cfu/100ml)
<i>04110003030020 East Branch Chagrin River</i>							
East Branch Chagrin River (15-002)							
	D01P01		Markell Rd.	2.35	8/27/2003	280	210
				2.35	8/27/2003	1,500	920
				2.35	9/4/2003	370	220
				2.35	9/4/2003	370	220
				2.35	9/11/2003	260	510
				2.35	9/23/2003	4,200	5,000
				2.35	6/7/2004	150	86
				2.35	7/12/2004	1,400	1,000
				2.35	7/22/2004	5,900	>2,400
				2.35	8/16/2004	88	70
	D01S20		Mitchells Mill Rd.	10.28	8/27/2003	460	290
				10.28	8/27/2003	4,300	5,600
				10.28	9/4/2003	300	300
				10.28	9/11/2003	520	550
				10.28	9/23/2003	3,300	3,500
				10.28	6/7/2004	84	60
				10.28	7/12/2004	2,400	2,400
				10.28	7/22/2004	920	>2,400
				10.28	8/16/2004	48	39
	D01S06		Heath Rd.	14.50	6/7/2004	20	12
				14.50	7/22/2004	2,500	1,200
				14.50	8/16/2004	92	83
Stoney Brook (15-032)							
	D01G27		Kirtland-Chardon Rd.	0.10	6/7/2004	440	390
				0.10	7/22/2004	12,000	>2,400
				0.10	8/16/2004	84	82
Unnamed Trib. East Branch (RM 10.13) (15-038)							
	D01G32		Wisner Rd.	0.10	6/7/2004	64	72
				0.10	7/22/2004	270	100
				0.10	8/16/2004	10	10
Unnamed Trib. East Branch RM 10.60 (15-039) (aka Stebbens Gulch)							
	D01G33		Mitchells Mill Rd.	0.20	6/7/2004	8	4
				0.20	7/22/2004	3,600	>2,400
				0.20	8/16/2004	52	33
Unnamed Trib. East Branch RM 15.35 (15-042)							
	D01G36		Sperry Rd	0.20	6/7/2004	90	75
				0.20	7/22/2004	8,200	>2,400
				0.20	8/16/2004	330	390

Appendix 3. Fecal coliform and E. coli bacteria results for the Chagrin River watershed, 1999-2004.

HUC11	Stream/ River	STORET ID	LOCATION	River Mile	Date	Fecal Coliform (cfu/100 ml)	E. coli (cfu/100ml)
			<i>04110003030020 East Branch Chagrin River (cont.)</i>				
			Unnamed Trib. East Branch RM 16.20 (15-043)				
		D01G35	Wilson Mills Rd.	0.10	6/7/2004	150	150
				0.10	7/22/2004	15,000	>2,400
				0.10	8/16/2004	280	350
			<i>04110003030030 Chagrin River below E. Branch to Lake Erie</i>				
			Chagrin River 15-001				
		D01G06	Park off Reeves Rd.	2.72	9/4/2003	530	460
				2.72	9/11/2003	590	610
		502400	Daniels Park (SR 84)	4.95	5/10/1999	20	
				4.95	6/2/1999	210	
				4.95	7/7/1999	14,000	
				4.95	8/9/1999	210	
				4.95	9/27/1999	330	110
				4.95	10/12/1999	100	40
				4.95	5/24/2000	1,600	1,200
				4.95	6/14/2000	370	170
				4.95	7/24/2000	160	30
				4.95	8/8/2000	3,200	1,700
				4.95	8/22/2000	110	31
				4.95	5/30/2001	260	
				4.95	6/5/2001	200	
				4.95	7/12/2001	100	10
				4.95	8/1/2001	130	35
				4.95	9/10/2001	160	88
				4.95	10/1/2001	260	51
				4.95	5/22/2002	23	34
				4.95	6/3/2002	150	89
				4.95	7/2/2002	100	5
				4.95	8/5/2002	90	110
				4.95	9/23/2002	400	220
				4.95	10/9/2002	70	58
				4.95	5/6/2003	7,400	
				4.95	6/9/2003	2,700	
				4.95	7/23/2003	3,300	2,500
				4.95	7/31/2003	200	140
				4.95	8/27/2003	1,900	
				4.95	8/27/2003	18,000	11,000
				4.95	9/4/2003	400	410
				4.95	9/11/2003	630	600
				4.95	9/23/2003	5,100	4,600
				4.95	6/7/2004	120	86

Appendix 3. Fecal coliform and E. coli bacteria results for the Chagrin River watershed, 1999-2004.

HUC11	Stream/ River	STORET ID	LOCATION	River Mile	Date	Fecal Coliform (cfu/100 ml)	E. coli (cfu/100ml)
HUC14	Code						
<i>04110003030030 Chagrin River below E. Branch to Lake Erie (cont.)</i>							
Chagrin River 15-001 (cont.)							
	502400		Daniels Park (SR 84) (cont.)	4.95	7/12/2004	530	610
				4.95	7/22/2004	380	290
				4.95	8/16/2004	120	75
				4.95	5/14/1998	85	
				4.95	8/3/1998	340	
				4.95	9/16/1998	600	
				4.95	10/7/1998	250	
Ward Creek 15-048							
	D01G39		Robin Rd. Pump Sta.	0.80	6/7/2004	550	440
				0.80	7/22/2004	4,400	>2,400
				0.80	8/16/2004	380	240

a. No STORET station code yet established for this location. Temporary identification number assigned.

Appendix 4.

Sediment Quality

Sediment samples were collected at three ecoregional reference sites within the Chagrin River watershed in 2004. All of the sediment sampling locations are within the upper Chagrin AU (04110003020): the Chagrin River at RM 36.55 (Fairmount Rd., upper crossing - D01W20), the Chagrin River at RM 33.35 (SR 87, upper crossing - D01P13), and the Aurora Branch Chagrin River at RM 5.52 (Geauga Lake Rd. - D01W15). Sediment at all three sites consisted primarily of sand (85-86% in the Chagrin River samples and 100% in the Aurora Branch sample) with some silts present in the Chagrin River samples (12.6-12.7%). Total organic carbon content of all of the samples was less than 1 percent. Stream substrate was predominantly bedrock, boulder and cobble at all three sampling sites, with sediment depositional areas dominated by larger gravel materials. In summary, sediment quality appeared to be representative of least-impacted reference sites, and no evidence of sediment contamination was found at the sites sampled.

Chemical analyses of the sediments for heavy metals found that none of the metals detected were above either the sediment reference values used in the Ohio Voluntary Action Program (Ohio EPA, 2003), or probable effect levels used to gage potential impacts on aquatic life due to exposure to sediments (Ingersoll, et. al, 2000). In addition, all of the concentrations of metals in the three samples collected were had concentrations deemed to be "not elevated" for the Erie Ontario Lake Plain Ecoregion (Mishne, 1996). Results for inorganic analyses of the sediment samples are found in Appendix Table Y.

The sediment samples collected from the Chagrin River watershed were also analyzed for 64 volatile organic compounds, 86 semi-volatile organic compounds, 19 priority pollutant pesticides, and 7 isomers of PCB's. None of these compounds were detected in any of the three samples collected.

Lit. cited:

Ohio EPA (2003). Ecological Risk Assessment Guidance. Ohio EPA, Division of Emergency and Remedial Response. Columbus, Ohio, 143 pp.

Christopher G Ingersoll, D. D. MacDonald, N. Wang, J. L. Crane, L. J. Field, P. S. Haverland, N. E. Kemble, R. A. Lindskoog, C. Severn, and D. E. Smorong (2000). Prediction of sediment toxicity using consensus-based freshwater sediment quality guidelines. United States Geological Survey final report for the U.S. Environmental Protection Agency Great Lakes National Program Office. EPA 905/R-00/007, U.S.EPA Great Lakes Program Office, Chicago, IL. 33 pp.

Mishne, D. (1996). Inter-Office Communication regarding analysis of sediment data in the Ohio EPA data base dated 12/2/1996. Ohio EPA Division of Surface Water, Columbus, Ohio.

Table 4-1. Results of analyses for inorganic constituents in sediment at ecoregional reference sites within the Chagrin River watershed, 2004.

Parameter (Reporting Units)	Chagrin River @ Fairmont Rd. (upper Crossing - RM 36.55) D01W20	Chagrin River @ SR 87 (upper crossing - RM 33.35) D01P13	Aurora Branch @ Geauga Lake Rd. (RM 5.52) D01W15
Percent Solids (%)	69.6	72.5	83.3
Total Organic Carbon (%)	0.9	0.9	0.5
Aluminum (mg/kg)	10,400	7,400	3,330
Arsenic (mg/kg)	7.12	4.70	2.89
Barium (mg/kg)	68.7	46.7	21.7
Cadmium (mg/kg)	0.170	0.115	<0.091
Calcium (mg/kg)	3,790	2,030	2,310
Chromium (mg/kg)	<17	<14	<14
Copper (mg/l)	6.7	4.9	<4.5
Iron (mg/kg)	12,200	8,650	4,950
Lead (mg/l)	<22	<19	<18
Magnesium (mg/kg)	2,390	1,630	934
Manganese (mg/kg)	301	228	150
Mercury (mg/kg)	<0.030	0.028	<0.020
Nickel (mg/kg)	<22	<19	<18
Potassium (mg/kg)	2,870	2,070	<906
Selenium (mg/kg)	<1.10	<0.95	<0.91
Sodium (mg/kg)	<2,760	<2,380	<2260
Strontium (mg/kg)	17	<14	<14
Zinc (mg/kg)	60.6	42.1	17.9

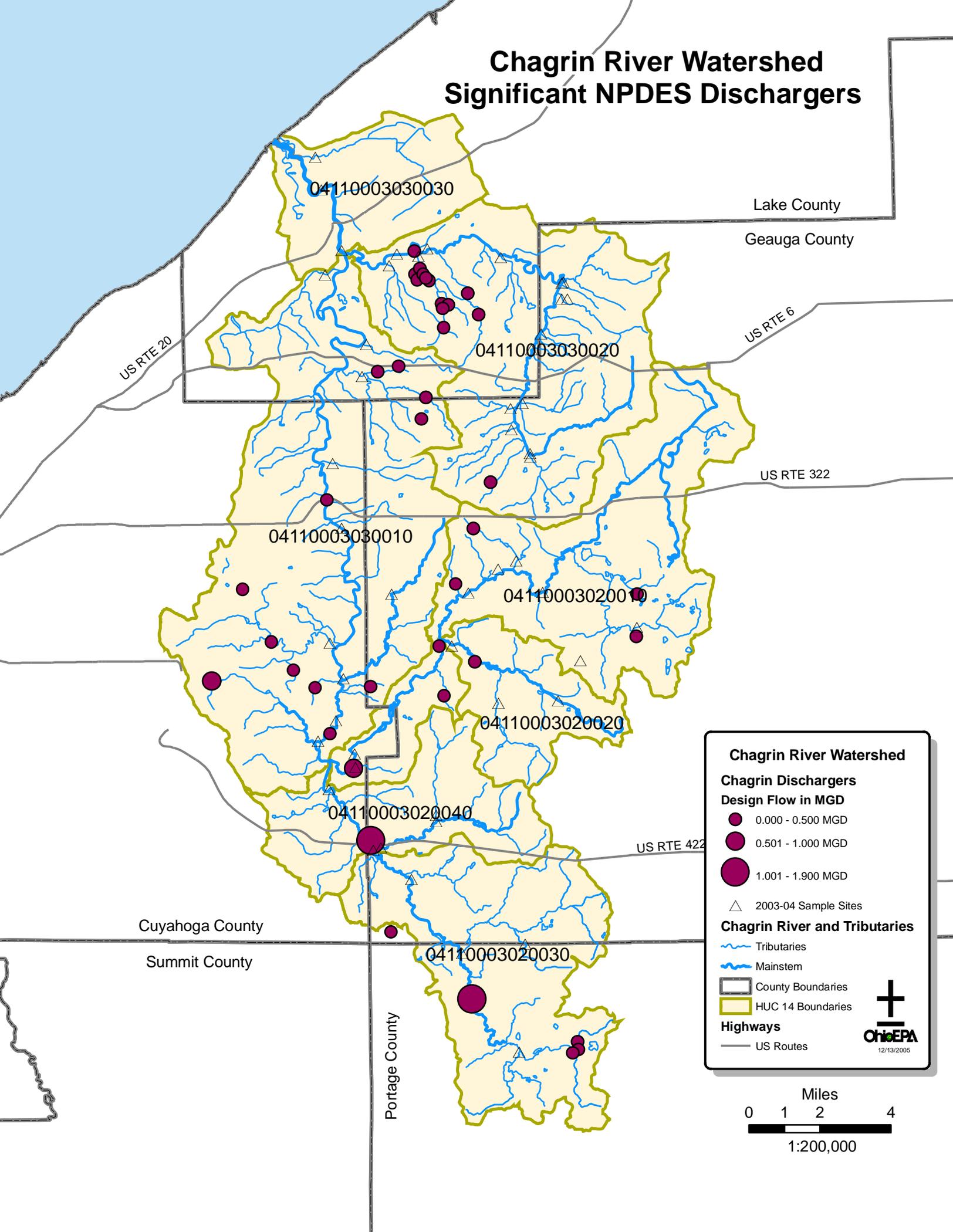
Appendix 5

5a. Chagrin River Watershed Significant NPDES Dischargers Map

5b. Upper Chagrin River - Aurora Branch WAU NPDES Discharger Schematic

5c. Lower Chagrin River - East Branch WAU NPDES Discharger Schematic

Chagrin River Watershed Significant NPDES Dischargers



Chagrin River Watershed

Chagrin Dischargers

Design Flow in MGD

- 0.000 - 0.500 MGD
- 0.501 - 1.000 MGD
- 1.001 - 1.900 MGD

△ 2003-04 Sample Sites

Chagrin River and Tributaries

- Tributaries
- Mainstem

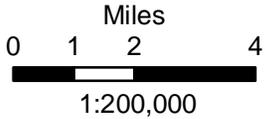
□ County Boundaries

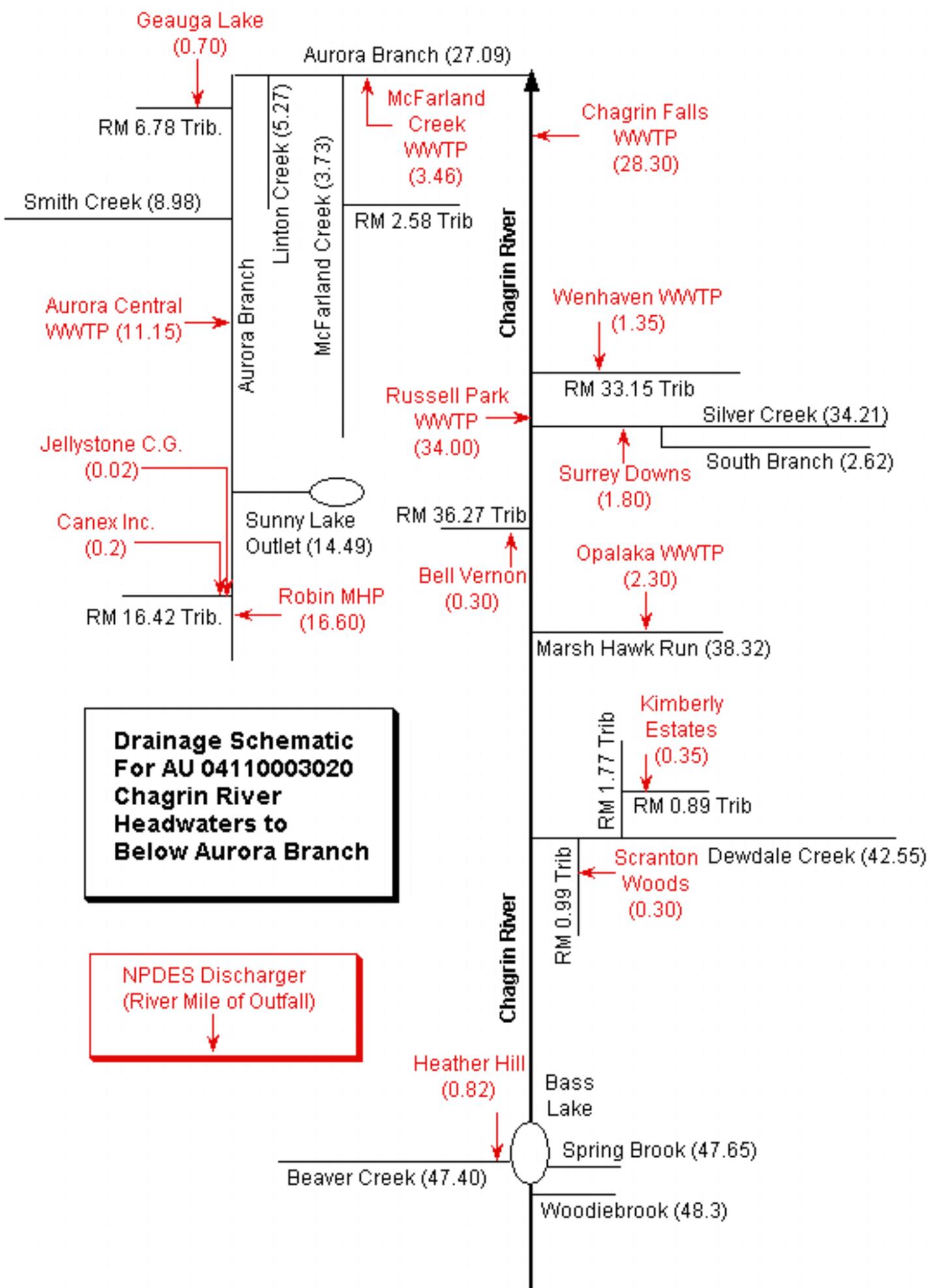
▭ HUC 14 Boundaries

Highways

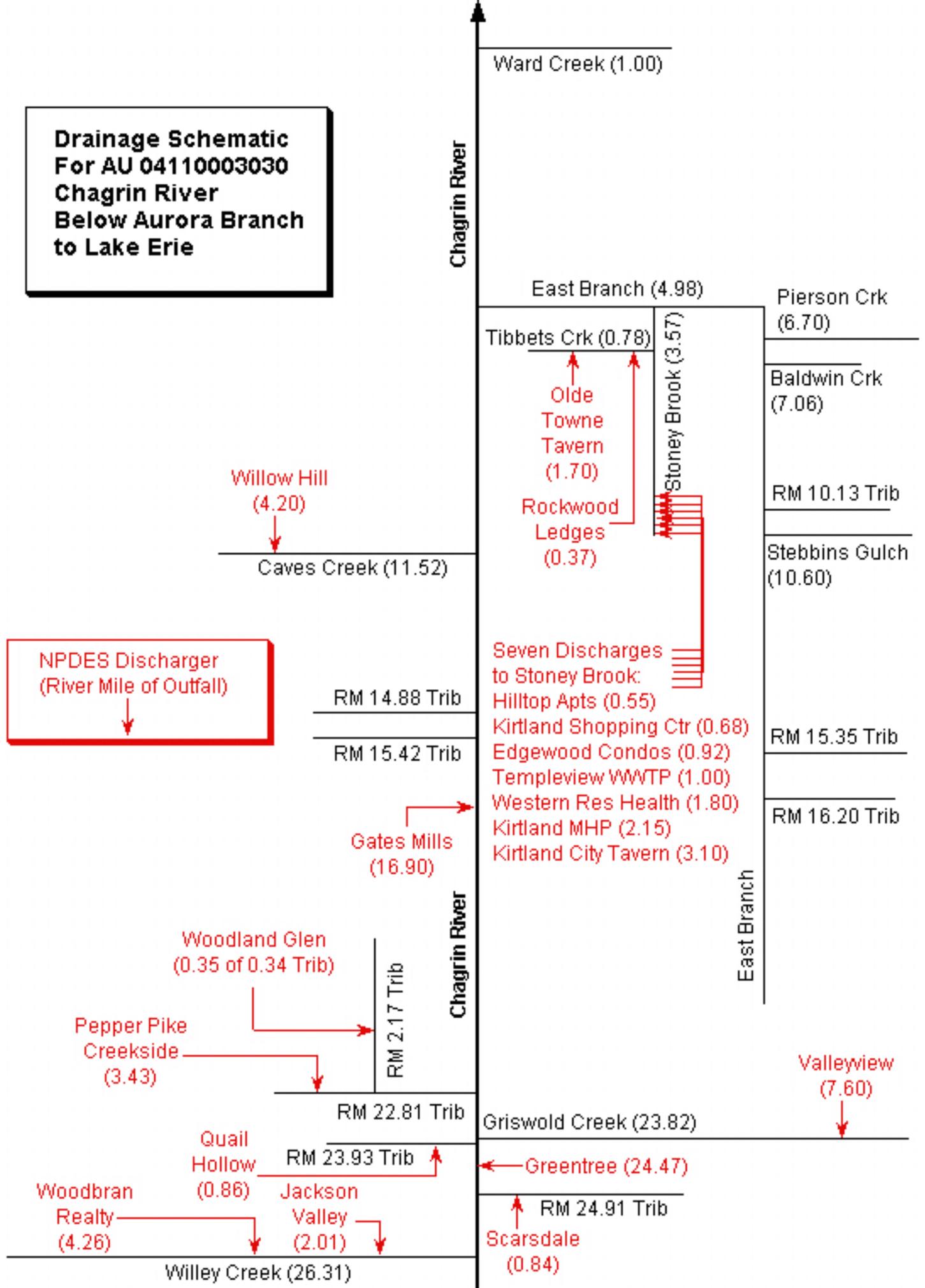
- US Routes

Ohio EPA
12/13/2005





**Drainage Schematic
For AU 04110003030
Chagrin River
Below Aurora Branch
to Lake Erie**



Samp No 2002 355 **Species** 5 RAINBOW TROUT **Lab Name** OEPA
Riv Code 15-001 **Samp Type** SOFC **% Lipid** 7.23 **Lab No** 52419
Riv Mile 0.20 **Samp Date** 10/22/2002 **Sampler** ODNR **Appr Date** 06/25/2003
Site Name Chagrin R. at mouth

Chm ID	CAS No	Chemical Name	Result	Det Lim	Unit	Qualif	Method
3	7440-38-2	Arsenic	<0.040	0.040	mg/kg		FSHC
6	7440-43-9	Cadmium	<0.0040	0.0040	mg/kg		FSHC
12	7439-92-1	Lead	<0.040	0.040	mg/kg		FSHC
15	7439-97-6	Mercury	0.121		mg/kg		FSHC
18	7782-49-2	Selenium	0.304		mg/kg		FSHC

Samp No	2002 355	Species	5 RAINBOW TROUT		Lab Name	OEPA	
Riv Code	15-001	Samp Type	SOFC	% Lipid	7.23	Lab No	52927
Riv Mile	0.20	Samp Date	10/22/2002	Sampler	ODNR	Anls Date	06/11/2003
Site Name	Chagrin R. at mouth						

Chm ID	CAS No	Chemical Name	Result	Det Lim	Unit	Qualif	Method
1	309-00-2	Aldrin	<10.0	10.0	ug/kg		OEPA
3	319-84-6	a-BHC	<10.0	10.0	ug/kg		OEPA
4	319-85-7	b-BHC	<10.0	10.0	ug/kg		OEPA
5	319-86-8	d-BHC	<10.0	10.0	ug/kg		OEPA
6	58-89-9	y-BHC	<10.0	10.0	ug/kg		OEPA
8	72-54-8	4,4'-DDD	16.6	10.0	ug/kg		OEPA
9	72-55-9	4,4'-DDE	33.8	10.0	ug/kg		OEPA
10	50-29-3	4,4'-DDT	<10.0	10.0	ug/kg		OEPA
12	60-57-1	Dieldrin	<10.0	10.0	ug/kg		OEPA
13	959-98-8	Endosulfan I	<10.0	10.0	ug/kg		OEPA
14	33213-65-9	Endosulfan II	<10.0	10.0	ug/kg		OEPA
15	1031-07-8	Endosulfan Sulfate	<10.0	10.0	ug/kg		OEPA
16	72-20-8	Endrin	<10.0	10.0	ug/kg		OEPA
18	76-44-8	Heptachlor	<10.0	10.0	ug/kg		OEPA
19	1024-57-3	Heptachlor Epoxide	<10.0	10.0	ug/kg		OEPA
21	72-43-5	Methoxychlor	<10.0	10.0	ug/kg		OEPA
22	2385-85-5	Mirex	<10.0	10.0	ug/kg		OEPA
20	118-74-1	Hexachlorobenzene	<10.0	10.0	ug/kg		OEPA
34	5103-71-9	Alpha-Chlordane	<10.0	10.0	ug/kg		OEPA
35	5103-74-2	Trans-Gamma-Chlordane	<10.0	10.0	ug/kg		OEPA
36	27304-13-8	Oxychlordane	<10.0	10.0	ug/kg		OEPA
37	5103-73-1	Cis-Nonachlor	<10.0	10.0	ug/kg		OEPA
38	39765-80-5	Trans-Nonachlor	<10.0	10.0	ug/kg		OEPA
23	12674-11-2	PCB-1016	<49.8	49.8	ug/kg		OEPA
24	11104-28-2	PCB-1221	<49.8	49.8	ug/kg		OEPA
25	11141-16-5	PCB-1232	<49.8	49.8	ug/kg		OEPA
26	53469-21-9	PCB-1242	<49.8	49.8	ug/kg		OEPA
27	12672-29-6	PCB-1248	<49.8	49.8	ug/kg		OEPA
28	11097-69-1	PCB-1254	220	49.8	ug/kg		OEPA
29	11096-82-5	PCB-1260	204	49.8	ug/kg		OEPA

Samp No 2002 357 **Species** 5 RAINBOW TROUT **Lab Name** OEPA
Riv Code 15-001 **Samp Type** SOFC **% Lipid** 6.61 **Lab No** 52420
Riv Mile 0.20 **Samp Date** 10/22/2002 **Sampler** ODNR **Appr Date** 06/25/2003
Site Name Chagrin R. at mouth
Comments UJ = Compound not detected. The associated value is an estimate.

Chm ID	CAS No	Chemical Name	Result	Det Lim	Unit	Qualif	Method
3	7440-38-2	Arsenic	<0.038	0.038	mg/kg	UJ	FSHC
6	7440-43-9	Cadmium	<0.0038	0.0038	mg/kg		FSHC
12	7439-92-1	Lead	<0.038	0.038	mg/kg		FSHC
15	7439-97-6	Mercury	0.127		mg/kg		FSHC
18	7782-49-2	Selenium	0.277		mg/kg		FSHC

Samp No 2002 357 **Species** 5 RAINBOW TROUT **Lab Name** OEPA
Riv Code 15-001 **Samp Type** SOFC **% Lipid** 6.61 **Lab No** 52428
Riv Mile 0.20 **Samp Date** 10/22/2002 **Sampler** ODNR **Anls Date** 06/11/2003
Site Name Chagrin R. at mouth

Chm ID	CAS No	Chemical Name	Result	Det Lim	Unit	Qualif	Method
1	309-00-2	Aldrin	<10.0	10.0	ug/kg		OEPA
3	319-84-6	a-BHC	<10.0	10.0	ug/kg		OEPA
4	319-85-7	b-BHC	<10.0	10.0	ug/kg		OEPA
5	319-86-8	d-BHC	<10.0	10.0	ug/kg		OEPA
6	58-89-9	y-BHC	<10.0	10.0	ug/kg		OEPA
8	72-54-8	4,4'-DDD	16.0	10.0	ug/kg		OEPA
9	72-55-9	4,4'-DDE	28.4	10.0	ug/kg		OEPA
10	50-29-3	4,4'-DDT	<10.0	10.0	ug/kg		OEPA
12	60-57-1	Dieldrin	<10.0	10.0	ug/kg		OEPA
13	959-98-8	Endosulfan I	<10.0	10.0	ug/kg		OEPA
14	33213-65-9	Endosulfan II	<10.0	10.0	ug/kg		OEPA
15	1031-07-8	Endosulfan Sulfate	<10.0	10.0	ug/kg		OEPA
16	72-20-8	Endrin	<10.0	10.0	ug/kg		OEPA
18	76-44-8	Heptachlor	<10.0	10.0	ug/kg		OEPA
19	1024-57-3	Heptachlor Epoxide	<10.0	10.0	ug/kg		OEPA
21	72-43-5	Methoxychlor	<10.0	10.0	ug/kg		OEPA
22	2385-85-5	Mirex	<10.0	10.0	ug/kg		OEPA
20	118-74-1	Hexachlorobenzene	<10.0	10.0	ug/kg		OEPA
34	5103-71-9	Alpha-Chlordane	<10.0	10.0	ug/kg		OEPA
35	5103-74-2	Trans-Gamma-Chlordane	<10.0	10.0	ug/kg		OEPA
36	27304-13-8	Oxychlordane	<10.0	10.0	ug/kg		OEPA
37	5103-73-1	Cis-Nonachlor	<10.0	10.0	ug/kg		OEPA
38	39765-80-5	Trans-Nonachlor	<10.0	10.0	ug/kg		OEPA
23	12674-11-2	PCB-1016	<49.8	49.8	ug/kg		OEPA
24	11104-28-2	PCB-1221	<49.8	49.8	ug/kg		OEPA
25	11141-16-5	PCB-1232	<49.8	49.8	ug/kg		OEPA
26	53469-21-9	PCB-1242	<49.8	49.8	ug/kg		OEPA
27	12672-29-6	PCB-1248	<49.8	49.8	ug/kg		OEPA
28	11097-69-1	PCB-1254	183	49.8	ug/kg		OEPA
29	11096-82-5	PCB-1260	179	49.8	ug/kg		OEPA

Appendix 7

Chagrin River Watershed Sample Site Fish Taxa Lists

Chagrin River Summary Totals of Fish Species Collected

Species List

River Code: 15-001 River Mile: 49.10 Time Fished: 2120 sec Dist Fished: 0.15 km	Stream: Chagrin River Location: upst. Woodiebrook Rd. Drainage: 1.9 sq mi Basin: Chagrin River	Sample Date: 2003 Date Range: 10/06/2003 No of Passes: 1 Sampler Type: E
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Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
White Sucker	W	O	S	T	3	6.00	15.00			
Common Carp	G	O	M	T	7	14.00	35.00			
Golden Shiner	N	I	M	T	1	2.00	5.00			
Brown Bullhead		I	C	T	4	8.00	20.00			
Green Sunfish	S	I	C	T	1	2.00	5.00			
Bluegill Sunfish	S	I	C	P	3	6.00	15.00			
Yellow Perch			M		1	2.00	5.00			
<i>Mile Total</i>					20	40.00				
<i>Number of Species</i>					7					
<i>Number of Hybrids</i>					0					

Species List

River Code: 15-001 River Mile: 45.20 Time Fished: 2655 sec Dist Fished: 0.15 km	Stream: Chagrin River Location: Fowlers Mill Rd. Drainage: 11.2 sq mi Basin: Chagrin River	Sample Date: 2003 Date Range: 10/06/2003 No of Passes: 1 Sampler Type: D
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Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Redfin Pickerel		P	M	P	6	12.00	1.75			
Northern Hog Sucker	R	I	S	M	2	4.00	0.58			
White Sucker	W	O	S	T	12	24.00	3.51			
Creek Chub	N	G	N	T	66	132.00	19.30			
Common Shiner	N	I	S		84	168.00	24.56			
Silverjaw Minnow	N	I	M		1	2.00	0.29			
Bluntnose Minnow	N	O	C	T	121	242.00	35.38			
Central Stoneroller	N	H	N		23	46.00	6.73			
Yellow Bullhead		I	C	T	1	2.00	0.29			
Rock Bass	S	C	C		2	4.00	0.58			
Largemouth Bass	F	C	C		1	2.00	0.29			
Green Sunfish	S	I	C	T	4	8.00	1.17			
Yellow Perch			M		2	4.00	0.58			
Johnny Darter	D	I	C		13	26.00	3.80			
Greenside Darter	D	I	S	M	1	2.00	0.29			
Rainbow Darter	D	I	S	M	1	2.00	0.29			
Fantail Darter	D	I	C		2	4.00	0.58			
<i>Mile Total</i>					342	684.00				
<i>Number of Species</i>					17					
<i>Number of Hybrids</i>					0					

Species List

River Code: 15-001	Stream: Chagrin River	Sample Date: 2003
River Mile: 42.60	Location: upst. Rock Haven Rd.	Date Range: 10/06/2003
Time Fished: 2250 sec	Drainage:	
Dist Fished: 0.17 km	Basin: Chagrin River	No of Passes: 1
		Sampler Type: D

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Redfin Pickerel		P	M	P	3	5.29	5.77			
White Sucker	W	O	S	T	13	22.94	25.00			
Creek Chub	N	G	N	T	3	5.29	5.77			
Common Shiner	N	I	S		5	8.82	9.62			
Silverjaw Minnow	N	I	M		1	1.77	1.92			
Bluntnose Minnow	N	O	C	T	3	5.29	5.77			
Yellow Bullhead		I	C	T	3	5.29	5.77			
Rock Bass	S	C	C		12	21.18	23.08			
Green Sunfish	S	I	C	T	3	5.29	5.77			
Bluegill Sunfish	S	I	C	P	3	5.29	5.77			
Pumpkinseed Sunfish	S	I	C	P	2	3.53	3.85			
Yellow Perch			M		1	1.77	1.92			
<i>Mile Total</i>					52	91.77				
<i>Number of Species</i>					12					
<i>Number of Hybrids</i>					0					

River Code: 15-001	Stream: Chagrin River	Sample Date: 2003
River Mile: 40.00	Location: Sperry Rd.	Date Range: 09/03/2003
Time Fished:	Drainage: 30.0 sq mi	
Dist Fished: 0.20 km	Basin: Chagrin River	No of Passes: 1
		Sampler Type: D

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Redfin Pickerel		P	M P	2	3.00	0.67	0.04	0.37	12.50
Northern Hog Sucker	R	I	S M	41	61.50	13.80	4.13	40.26	67.07
White Sucker	W	O	S T	2	3.00	0.67	0.29	2.78	95.00
River Chub	N	I	N I	2	3.00	0.67	0.06	0.59	20.00
Creek Chub	N	G	N T	55	82.50	18.52	1.80	17.57	21.82
Common Shiner	N	I	S	41	61.50	13.80	0.81	7.93	13.21
Silverjaw Minnow	N	I	M	1	1.50	0.34	0.01	0.08	5.00
Bluntnose Minnow	N	O	C T	10	15.00	3.37	0.05	0.44	3.00
Central Stoneroller	N	H	N	66	99.00	22.22	1.12	10.89	11.27
Rock Bass	S	C	C	16	24.00	5.39	0.86	8.34	35.63
Smallmouth Bass	F	C	C M	6	9.00	2.02	0.77	7.54	85.83
Largemouth Bass	F	C	C	2	3.00	0.67	0.02	0.22	7.50
Green Sunfish	S	I	C T	2	3.00	0.67	0.04	0.37	12.50
Bluegill Sunfish	S	I	C P	3	4.50	1.01	0.05	0.44	10.00
Pumpkinseed Sunfish	S	I	C P	3	4.50	1.01	0.06	0.59	13.33
Green Sf X Bluegill Sf				1	1.50	0.34	0.03	0.29	20.00
Johnny Darter	D	I	C	3	4.50	1.01	0.01	0.05	1.00
Greenside Darter	D	I	S M	22	33.00	7.41	0.09	0.84	2.62
Rainbow Darter	D	I	S M	15	22.50	5.05	0.03	0.29	1.33
Fantail Darter	D	I	C	4	6.00	1.35	0.02	0.15	2.50
<i>Mile Total</i>				297	445.50		10.25		
<i>Number of Species</i>				19					
<i>Number of Hybrids</i>				1					

River Code: 15-001	Stream: Chagrin River	Sample Date: 2003
River Mile: 36.40	Location:	Date Range: 09/03/2003
Time Fished:	Drainage: 36.0 sq mi	
Dist Fished: 0.20 km	Basin: Chagrin River	No of Passes: 1
		Sampler Type: D

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Redfin Pickerel		P	M	P	3	4.50	0.83	0.14	0.72	30.67
Northern Hog Sucker	R	I	S	M	42	63.00	11.63	6.30	33.09	100.00
White Sucker	W	O	S	T	16	24.00	4.43	3.68	19.33	153.33
River Chub	N	I	N	I	41	61.50	11.36	1.71	8.97	27.78
Creek Chub	N	G	N	T	8	12.00	2.22	0.34	1.80	28.50
Common Shiner	N	I	S		24	36.00	6.65	0.56	2.92	15.44
Silverjaw Minnow	N	I	M		2	3.00	0.55	0.01	0.07	4.50
Bluntnose Minnow	N	O	C	T	10	15.00	2.77	0.07	0.39	4.90
Central Stoneroller	N	H	N		30	45.00	8.31	0.56	2.91	12.33
Yellow Bullhead		I	C	T	5	7.50	1.39	0.32	1.65	42.00
Rock Bass	S	C	C		61	91.50	16.90	3.20	16.82	35.00
Smallmouth Bass	F	C	C	M	16	24.00	4.43	1.52	7.96	63.13
Largemouth Bass	F	C	C		3	4.50	0.83	0.03	0.16	6.67
Green Sunfish	S	I	C	T	14	21.00	3.88	0.20	1.07	9.64
Bluegill Sunfish	S	I	C	P	1	1.50	0.28	0.02	0.12	15.00
Pumpkinseed Sunfish	S	I	C	P	3	4.50	0.83	0.09	0.45	19.00
Green Sf X Bluegill Sf					1	1.50	0.28	0.02	0.09	12.00
Johnny Darter	D	I	C		6	9.00	1.66	0.01	0.05	1.00
Greenside Darter	D	I	S	M	28	42.00	7.76	0.17	0.88	4.00
Rainbow Darter	D	I	S	M	32	48.00	8.86	0.08	0.43	1.69
Fantail Darter	D	I	C		15	22.50	4.16	0.03	0.14	1.13
<i>Mile Total</i>					361	541.50		19.04		
<i>Number of Species</i>					20					
<i>Number of Hybrids</i>					1					

River Code: 15-001	Stream: Chagrin River	Sample Date: 2003
River Mile: 33.40	Location: St. Rt. 87	Date Range: 09/04/2003
Time Fished:	Drainage: 54.0 sq mi	
Dist Fished: 0.20 km	Basin: Chagrin River	No of Passes: 1
		Sampler Type: D

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight	
Redfin Pickerel		P	M	P	1	1.50	0.31	0.02	0.06	11.00
Northern Hog Sucker	R	I	S	M	49	73.50	14.98	5.76	18.67	78.33
White Sucker	W	O	S	T	34	51.00	10.40	10.53	34.14	206.45
River Chub	N	I	N	I	23	34.50	7.03	1.07	3.48	31.11
Striped Shiner	N	I	S		5	7.50	1.53	0.11	0.37	15.00
Common Shiner	N	I	S		41	61.50	12.54	0.82	2.64	13.25
Spotfin Shiner	N	I	M		1	1.50	0.31	0.01	0.03	5.00
Bluntnose Minnow	N	O	C	T	2	3.00	0.61	0.02	0.05	5.00
Central Stoneroller	N	H	N		14	21.00	4.28	0.50	1.63	23.93
Yellow Bullhead		I	C	T	10	15.00	3.06	1.28	4.14	85.10
Rock Bass	S	C	C		44	66.00	13.46	3.66	11.86	55.41
Smallmouth Bass	F	C	C	M	30	45.00	9.17	6.64	21.54	147.63
Largemouth Bass	F	C	C		2	3.00	0.61	0.02	0.05	5.00
Green Sunfish	S	I	C	T	3	4.50	0.92	0.05	0.16	10.67
Bluegill Sunfish	S	I	C	P	10	15.00	3.06	0.14	0.45	9.20
Pumpkinseed Sunfish	S	I	C	P	4	6.00	1.22	0.09	0.28	14.25
Greenside Darter	D	I	S	M	16	24.00	4.89	0.06	0.19	2.50
Rainbow Darter	D	I	S	M	26	39.00	7.95	0.07	0.22	1.74
Fantail Darter	D	I	C		12	18.00	3.67	0.02	0.07	1.25
<i>Mile Total</i>				327	490.50			30.84		
<i>Number of Species</i>				19						
<i>Number of Hybrids</i>				0						

River Code: 15-001	Stream: Chagrin River	Sample Date: 2003
River Mile: 30.60	Location:	Date Range: 09/04/2003
Time Fished:	Drainage: 56.0 sq mi	
Dist Fished: 0.20 km	Basin: Chagrin River	No of Passes: 1
		Sampler Type: D

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Northern Hog Sucker	R	I	S	M	4	6.00	0.39	0.25	2.56	41.25
White Sucker	W	O	S	T	16	24.00	1.56	0.13	1.36	5.50
River Chub	N	I	N	I	44	66.00	4.28	0.93	9.60	14.08
Creek Chub	N	G	N	T	14	21.00	1.36	0.24	2.48	11.43
Striped Shiner	N	I	S		7	10.50	0.68	0.05	0.55	5.00
Common Shiner	N	I	S		35	52.50	3.41	0.32	3.25	6.00
Spotfin Shiner	N	I	M		1	1.50	0.10	0.00	0.03	2.00
Sand Shiner	N	I	M	M	6	9.00	0.58	0.02	0.19	2.00
Silverjaw Minnow	N	I	M		12	18.00	1.17	0.05	0.46	2.50
Bluntnose Minnow	N	O	C	T	565	847.50	55.01	0.49	5.06	0.58
Central Stoneroller	N	H	N		257	385.50	25.02	5.40	55.71	14.00
Yellow Bullhead		I	C	T	6	9.00	0.58	0.48	4.95	53.33
Rock Bass	S	C	C		13	19.50	1.27	0.41	4.27	21.23
Smallmouth Bass	F	C	C	M	9	13.50	0.88	0.80	8.21	58.89
Largemouth Bass	F	C	C		3	4.50	0.29	0.02	0.15	3.33
Green Sunfish	S	I	C	T	2	3.00	0.19	0.02	0.19	6.00
Bluegill Sunfish	S	I	C	P	1	1.50	0.10	0.01	0.14	9.00
Pumpkinseed Sunfish	S	I	C	P	1	1.50	0.10	0.01	0.08	5.00
Johnny Darter	D	I	C		9	13.50	0.88	0.01	0.14	1.00
Greenside Darter	D	I	S	M	5	7.50	0.49	0.02	0.18	2.25
Rainbow Darter	D	I	S	M	16	24.00	1.56	0.04	0.43	1.75
Fantail Darter	D	I	C		1	1.50	0.10	0.00	0.03	2.00
<i>Mile Total</i>					1,027	1,540.50		9.69		
<i>Number of Species</i>					22					
<i>Number of Hybrids</i>					0					

River Code: 15-001	Stream: Chagrin River	Sample Date: 2003
River Mile: 30.00	Location:	Date Range: 09/04/2003
Time Fished:	Drainage: 57.0 sq mi	
Dist Fished: 0.16 km	Basin: Chagrin River	No of Passes: 1
		Sampler Type: D

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Northern Hog Sucker	R	I	S	M	36	67.50	9.86	15.38	19.77	227.78
Common Carp	G	O	M	T	8	15.00	2.19	48.86	62.82	3,257.14
River Chub	N	I	N	I	14	26.25	3.84	0.10	0.13	3.93
Creek Chub	N	G	N	T	6	11.25	1.64	0.02	0.02	1.33
Striped Shiner	N	I	S		56	105.00	15.34	0.53	0.68	5.00
Common Shiner	N	I	S		1	1.88	0.27	0.03	0.04	15.00
Bluntnose Minnow	N	O	C	T	68	127.50	18.63	0.26	0.34	2.06
Central Stoneroller	N	H	N		12	22.50	3.29	0.07	0.08	2.92
Channel Catfish	F		C		1	1.88	0.27	1.88	2.41	1,000.00
Yellow Bullhead		I	C	T	32	60.00	8.77	4.69	6.03	78.13
Black Crappie	S	I	C		3	5.63	0.82	0.55	0.70	97.33
Rock Bass	S	C	C		12	22.50	3.29	1.17	1.50	51.83
Smallmouth Bass	F	C	C	M	12	22.50	3.29	1.31	1.68	58.00
Green Sunfish	S	I	C	T	6	11.25	1.64	0.20	0.25	17.50
Bluegill Sunfish	S	I	C	P	15	28.13	4.11	0.48	0.61	17.00
Pumpkinseed Sunfish	S	I	C	P	57	106.88	15.62	2.11	2.71	19.74
Green Sf X Bluegill Sf					1	1.88	0.27	0.06	0.08	32.00
Greenside Darter	D	I	S	M	7	13.13	1.92	0.06	0.08	4.60
Rainbow Darter	D	I	S	M	11	20.63	3.01	0.04	0.05	1.82
Fantail Darter	D	I	C		7	13.13	1.92	0.02	0.02	1.43
<i>Mile Total</i>					365	684.38		77.77		
<i>Number of Species</i>					19					
<i>Number of Hybrids</i>					1					

Species List

River Code: 15-001	Stream: Chagrin River	Sample Date: 2003
River Mile: 28.90	Location:	Date Range: 09/04/2003
Time Fished:	Drainage: 58.0 sq mi	
Dist Fished: 0.20 km	Basin: Chagrin River	No of Passes: 1
		Sampler Type: D

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Northern Hog Sucker	R	I	S	M	101	151.50	32.90	12.51	50.24	82.56
White Sucker	W	O	S	T	3	4.50	0.98	1.13	4.52	250.00
Common Carp	G	O	M	T	3	4.50	0.98	2.78	11.18	618.33
River Chub	N	I	N	I	21	31.50	6.84	0.81	3.26	25.79
Striped Shiner	N	I	S		7	10.50	2.28	0.15	0.58	13.80
Common Shiner	N	I	S		29	43.50	9.45	0.64	2.58	14.76
Spotfin Shiner	N	I	M		1	1.50	0.33	0.01	0.04	6.00
Bluntnose Minnow	N	O	C	T	14	21.00	4.56	0.06	0.24	2.86
Central Stoneroller	N	H	N		12	18.00	3.91	0.11	0.43	6.00
Yellow Bullhead		I	C	T	2	3.00	0.65	0.13	0.52	43.00
Stonecat Madtom		I	C	I	16	24.00	5.21	0.70	2.80	29.00
Rock Bass	S	C	C		12	18.00	3.91	1.13	4.53	62.67
Smallmouth Bass	F	C	C	M	48	72.00	15.64	4.06	16.32	56.44
Green Sunfish	S	I	C	T	5	7.50	1.63	0.08	0.31	10.20
Bluegill Sunfish	S	I	C	P	4	6.00	1.30	0.08	0.30	12.50
Pumpkinseed Sunfish	S	I	C	P	13	19.50	4.23	0.41	1.63	20.77
Green Sf X Bluegill Sf					1	1.50	0.33	0.03	0.10	17.00
Greenside Darter	D	I	S	M	10	15.00	3.26	0.09	0.34	5.67
Rainbow Darter	D	I	S	M	4	6.00	1.30	0.02	0.08	3.33
Fantail Darter	D	I	C		1	1.50	0.33	0.00	0.01	2.00
<i>Mile Total</i>					307	460.50		24.90		
<i>Number of Species</i>					19					
<i>Number of Hybrids</i>					1					

River Code: 15-001	Stream: Chagrin River	Sample Date: 2003
River Mile: 28.20	Location: upst Aurora Br., adj. Solon Rd	Date Range: 09/04/2003
Time Fished:	Drainage: 60.0 sq mi	
Dist Fished: 0.20 km	Basin: Chagrin River	No of Passes: 1
		Sampler Type: D

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Northern Hog Sucker	R	I	S	M	58	87.00	25.00	9.02	29.95	103.70
White Sucker	W	O	S	T	8	12.00	3.45	2.23	7.40	185.71
Common Carp	G	O	M	T	9	13.50	3.88	14.36	47.68	1,063.89
River Chub	N	I	N	I	11	16.50	4.74	0.51	1.70	31.00
Striped Shiner	N	I	S		37	55.50	15.95	1.17	3.88	21.08
Common Shiner	N	I	S		6	9.00	2.59	0.11	0.35	11.67
Spotfin Shiner	N	I	M		2	3.00	0.86	0.01	0.03	3.00
Sand Shiner	N	I	M	M	9	13.50	3.88	0.03	0.11	2.44
Bluntnose Minnow	N	O	C	T	5	7.50	2.16	0.02	0.07	2.75
Central Stoneroller	N	H	N		12	18.00	5.17	0.16	0.54	9.08
Yellow Bullhead		I	C	T	1	1.50	0.43	0.11	0.36	71.00
Stonecat Madtom		I	C	I	1	1.50	0.43	0.07	0.23	46.00
Rock Bass	S	C	C		15	22.50	6.47	1.23	4.10	54.86
Smallmouth Bass	F	C	C	M	12	18.00	5.17	0.68	2.27	38.00
Green Sunfish	S	I	C	T	4	6.00	1.72	0.03	0.10	5.00
Bluegill Sunfish	S	I	C	P	4	6.00	1.72	0.11	0.37	18.50
Pumpkinseed Sunfish	S	I	C	P	11	16.50	4.74	0.17	0.55	10.00
Greenside Darter	D	I	S	M	11	16.50	4.74	0.06	0.20	3.64
Rainbow Darter	D	I	S	M	16	24.00	6.90	0.04	0.13	1.57
<i>Mile Total</i>					232	348.00		30.12		
<i>Number of Species</i>					19					
<i>Number of Hybrids</i>					0					

River Code: 15-001	Stream: Chagrin River	Sample Date: 2003
River Mile: 26.70	Location: Solon Rd.	Date Range: 09/11/2003
Time Fished:	Drainage: 122.0 sq mi	
Dist Fished: 0.18 km	Basin: Chagrin River	No of Passes: 1
		Sampler Type: D

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Northern Hog Sucker	R	I	S	M	160	266.67	52.98	21.01	56.03	78.79
White Sucker	W	O	S	T	11	18.33	3.64	2.88	7.68	157.09
Common Carp	G	O	M	T	2	3.33	0.66	3.09	8.25	927.50
River Chub	N	I	N	I	14	23.33	4.64	1.08	2.87	46.07
Striped Shiner	N	I	S		12	20.00	3.97	0.27	0.72	13.50
Spotfin Shiner	N	I	M		8	13.33	2.65	0.05	0.14	3.88
Central Stoneroller	N	H	N		2	3.33	0.66	0.14	0.37	41.00
Yellow Bullhead		I	C	T	14	23.33	4.64	1.74	4.64	74.50
Stonecat Madtom		I	C	I	7	11.67	2.32	0.38	1.01	32.29
White Crappie	S	I	C		3	5.00	0.99	0.41	1.10	82.67
Black Crappie	S	I	C		3	5.00	0.99	0.21	0.57	42.33
Rock Bass	S	C	C		9	15.00	2.98	0.57	1.53	38.11
Smallmouth Bass	F	C	C	M	41	68.33	13.58	5.36	14.30	78.44
Green Sunfish	S	I	C	T	5	8.33	1.66	0.08	0.21	9.60
Bluegill Sunfish	S	I	C	P	5	8.33	1.66	0.11	0.30	13.60
Pumpkinseed Sunfish	S	I	C	P	1	1.67	0.33	0.03	0.09	20.00
Hybrid X Sunfish					1	1.67	0.33	0.04	0.10	23.00
Greenside Darter	D	I	S	M	3	5.00	0.99	0.04	0.11	8.00
Rainbow Darter	D	I	S	M	1	1.67	0.33	0.00	0.01	2.00
<i>Mile Total</i>					302	503.33		37.50		
<i>Number of Species</i>					18					
<i>Number of Hybrids</i>					1					

Species List

River Code: 15-001 River Mile: 24.20 Time Fished: Dist Fished: 0.20 km	Stream: Chagrin River Location: 0.5 miles upst. Kinsman Rd. Drainage: 131.0 sq mi Basin: Chagrin River	Sample Date: 2003 Date Range: 09/17/2003 No of Passes: 1 Sampler Type: D
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Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Northern Hog Sucker	R	I	S	M	188	282.00	58.20	39.48	82.49	140.00
River Chub	N	I	N	I	62	93.00	19.20	3.04	6.35	32.69
Striped Shiner	N	I	S		2	3.00	0.62	0.09	0.19	31.00
Common Shiner	N	I	S		2	3.00	0.62	0.04	0.09	14.00
Spotfin Shiner	N	I	M		8	12.00	2.48	0.07	0.14	5.38
Central Stoneroller	N	H	N		1	1.50	0.31	0.06	0.13	40.00
Stonecat Madtom		I	C	I	19	28.50	5.88	0.76	1.59	26.65
Smallmouth Bass	F	C	C	M	23	34.50	7.12	4.13	8.62	119.57
Bluegill Sunfish	S	I	C	P	1	1.50	0.31	0.03	0.06	18.00
Greenside Darter	D	I	S	M	14	21.00	4.33	0.15	0.32	7.31
Rainbow Darter	D	I	S	M	3	4.50	0.93	0.01	0.03	3.00
<i>Mile Total</i>					323	484.50		47.86		
<i>Number of Species</i>					11					
<i>Number of Hybrids</i>					0					

River Code: 15-001	Stream: Chagrin River	Sample Date: 2003
River Mile: 19.40	Location: near Berkshire Rd./River Rd.	Date Range: 09/17/2003
Time Fished:	Drainage: 161.0 sq mi	
Dist Fished: 0.20 km	Basin: Chagrin River	No of Passes: 1
		Sampler Type: D

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Northern Hog Sucker	R	I	S	M	134	201.00	34.63	14.22	52.77	70.74
White Sucker	W	O	S	T	3	4.50	0.78	1.65	6.12	366.67
River Chub	N	I	N	I	47	70.50	12.14	1.13	4.18	15.96
Rosyface Shiner	N	I	S	I	4	6.00	1.03	0.02	0.06	2.50
Striped Shiner	N	I	S		22	33.00	5.68	0.63	2.32	18.95
Common Shiner	N	I	S		33	49.50	8.53	1.32	4.88	26.56
Spotfin Shiner	N	I	M		1	1.50	0.26	0.01	0.04	8.00
Sand Shiner	N	I	M	M	40	60.00	10.34	0.10	0.35	1.58
Silverjaw Minnow	N	I	M		8	12.00	2.07	0.02	0.08	1.86
Bluntnose Minnow	N	O	C	T	6	9.00	1.55	0.02	0.06	1.67
Central Stoneroller	N	H	N		18	27.00	4.65	0.57	2.11	21.06
Yellow Bullhead		I	C	T	4	6.00	1.03	0.39	1.45	65.25
Stonecat Madtom		I	C	I	2	3.00	0.52	0.08	0.29	25.50
Rock Bass	S	C	C		8	12.00	2.07	0.94	3.48	78.13
Smallmouth Bass	F	C	C	M	23	34.50	5.94	5.67	21.05	164.43
Bluegill Sunfish	S	I	C	P	4	6.00	1.03	0.06	0.21	9.25
Pumpkinseed Sunfish	S	I	C	P	1	1.50	0.26	0.06	0.22	40.00
Greenside Darter	D	I	S	M	17	25.50	4.39	0.07	0.27	2.81
Rainbow Darter	D	I	S	M	12	18.00	3.10	0.02	0.07	1.00
<i>Mile Total</i>					387	580.50		26.95		
<i>Number of Species</i>					19					
<i>Number of Hybrids</i>					0					

River Code: 15-001	Stream: Chagrin River	Sample Date: 2003
River Mile: 13.00	Location: Rogers Rd.	Date Range: 09/12/2003
Time Fished:	Drainage: 174.0 sq mi	
Dist Fished: 0.20 km	Basin: Chagrin River	No of Passes: 1
		Sampler Type: D

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Black Redhorse	R	I	S I	10	15.00	2.83	2.10	22.02	140.00
Golden Redhorse	R	I	S M	6	9.00	1.70	2.40	25.17	266.67
Northern Hog Sucker	R	I	S M	13	19.50	3.68	0.87	9.17	44.83
White Sucker	W	O	S T	1	1.50	0.28	0.18	1.92	122.00
River Chub	N	I	N I	93	139.50	26.35	1.60	16.81	11.49
Bigeye Chub	N	I	S I	2	3.00	0.57	0.02	0.19	6.00
Rosyface Shiner	N	I	S I	50	75.00	14.16	0.16	1.67	2.12
Striped Shiner	N	I	S	41	61.50	11.61	0.96	10.03	15.54
Spotfin Shiner	N	I	M	8	12.00	2.27	0.02	0.24	1.88
Sand Shiner	N	I	M M	67	100.50	18.98	0.16	1.64	1.56
Silverjaw Minnow	N	I	M	31	46.50	8.78	0.08	0.82	1.67
Bluntnose Minnow	N	O	C T	7	10.50	1.98	0.03	0.27	2.43
Central Stoneroller	N	H	N	6	9.00	1.70	0.33	3.44	36.40
Yellow Bullhead		I	C T	2	3.00	0.57	0.14	1.50	47.50
Stonecat Madtom		I	C I	9	13.50	2.55	0.33	3.46	24.44
Rock Bass	S	C	C	1	1.50	0.28	0.02	0.22	14.00
Smallmouth Bass	F	C	C M	2	3.00	0.57	0.12	1.22	38.50
Greenside Darter	D	I	S M	1	1.50	0.28	0.01	0.05	3.00
Rainbow Darter	D	I	S M	3	4.50	0.85	0.02	0.19	4.00
<i>Mile Total</i>				353	529.50		9.54		
<i>Number of Species</i>				19					
<i>Number of Hybrids</i>				0					

River Code: 15-001	Stream: Chagrin River	Sample Date: 2003
River Mile: 9.70	Location: Dodd Rd.	Date Range: 08/29/2003
Time Fished:	Drainage: 186.0 sq mi	
Dist Fished: 0.20 km	Basin: Chagrin River	No of Passes: 1
		Sampler Type: D

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Black Redhorse	R	I	S I	1	1.50	0.62	0.43	3.42	285.00
Golden Redhorse	R	I	S M	6	9.00	3.70	1.01	8.10	112.50
Northern Hog Sucker	R	I	S M	65	97.50	40.12	5.67	45.33	58.14
White Sucker	W	O	S T	3	4.50	1.85	0.20	1.56	43.33
Common Carp	G	O	M T	1	1.50	0.62	1.05	8.40	700.00
River Chub	N	I	N I	12	18.00	7.41	0.52	4.19	29.09
Silver Shiner	N	I	S I	1	1.50	0.62	0.00	0.02	1.00
Striped Shiner	N	I	S	31	46.50	19.14	0.89	7.14	19.19
Spotfin Shiner	N	I	M	2	3.00	1.23	0.01	0.11	4.50
Bluntnose Minnow	N	O	C T	1	1.50	0.62	0.01	0.04	3.00
Yellow Bullhead		I	C T	8	12.00	4.94	1.36	10.86	113.13
Rock Bass	S	C	C	4	6.00	2.47	0.31	2.47	51.50
Smallmouth Bass	F	C	C M	8	12.00	4.94	0.65	5.16	53.75
Green Sunfish	S	I	C T	7	10.50	4.32	0.14	1.14	13.57
Bluegill Sunfish	S	I	C P	4	6.00	2.47	0.15	1.18	24.50
Pumpkinseed Sunfish	S	I	C P	3	4.50	1.85	0.07	0.54	15.00
Green Sf X Bluegill Sf				1	1.50	0.62	0.04	0.30	25.00
Yellow Perch			M	2	3.00	1.23	0.01	0.06	2.50
Blackside Darter	D	I	S	1	1.50	0.62	0.00	0.02	2.00
Johnny Darter	D	I	C	1	1.50	0.62	0.00	0.02	1.00
<i>Mile Total</i>				162	243.00		12.51		
<i>Number of Species</i>				19					
<i>Number of Hybrids</i>				1					

Species List

River Code: 15-001	Stream: Chagrin River	Sample Date: 2003
River Mile: 4.80	Location: dst. East Branch	Date Range: 08/29/2003
Time Fished:	Drainage: 246.0 sq mi	
Dist Fished: 0.20 km	Basin: Chagrin River	No of Passes: 1
		Sampler Type: D

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Black Redhorse	R	I	S I	4	6.00	1.04	0.74	2.74	123.25
Golden Redhorse	R	I	S M	10	15.00	2.59	1.80	6.67	120.00
Northern Hog Sucker	R	I	S M	178	267.00	46.11	21.17	78.39	79.27
White Sucker	W	O	S T	1	1.50	0.26	0.08	0.31	55.00
River Chub	N	I	N I	22	33.00	5.70	0.50	1.86	15.23
Creek Chub	N	G	N T	1	1.50	0.26	0.00	0.01	2.00
Rosyface Shiner	N	I	S I	6	9.00	1.55	0.02	0.06	1.67
Striped Shiner	N	I	S	64	96.00	16.58	1.75	6.49	18.25
Spotfin Shiner	N	I	M	26	39.00	6.74	0.12	0.43	2.96
Sand Shiner	N	I	M M	32	48.00	8.29	0.07	0.27	1.55
Silverjaw Minnow	N	I	M	1	1.50	0.26	0.00	0.01	2.00
Bluntnose Minnow	N	O	C T	8	12.00	2.07	0.05	0.20	4.50
Central Stoneroller	N	H	N	8	12.00	2.07	0.17	0.64	14.38
Yellow Bullhead		I	C T	1	1.50	0.26	0.07	0.25	45.00
Stonecat Madtom		I	C I	4	6.00	1.04	0.05	0.19	8.33
Rock Bass	S	C	C	4	6.00	1.04	0.09	0.33	14.75
Smallmouth Bass	F	C	C M	5	7.50	1.30	0.21	0.77	27.60
Bluegill Sunfish	S	I	C P	2	3.00	0.52	0.05	0.20	18.00
Logperch	D	I	S M	1	1.50	0.26	0.03	0.10	17.00
Greenside Darter	D	I	S M	3	4.50	0.78	0.02	0.06	3.33
Rainbow Darter	D	I	S M	4	6.00	1.04	0.01	0.03	1.50
Fantail Darter	D	I	C	1	1.50	0.26	0.00	0.01	2.00
<i>Mile Total</i>				386	579.00		27.00		
<i>Number of Species</i>				22					
<i>Number of Hybrids</i>				0					

Species List

River Code: 15-001	Stream: Chagrin River	Sample Date: 2004
River Mile: 2.50	Location: at park, off Reeves Rd.	Date Range: 08/05/2004
Time Fished:	Drainage: 248.0 sq mi	
Dist Fished: 0.20 km	Basin: Chagrin River	No of Passes: 1
		Sampler Type: D

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Black Redhorse	R	I	S	I	2	3.00	1.75	0.87	7.02	290.00
Golden Redhorse	R	I	S	M	2	3.00	1.75	0.56	4.48	185.00
Northern Hog Sucker	R	I	S	M	25	37.50	21.93	7.05	56.91	188.00
Emerald Shiner	N	I	M		2	3.00	1.75	0.01	0.10	4.00
Striped Shiner	N	I	S		13	19.50	11.40	0.28	2.24	14.23
Spotfin Shiner	N	I	M		9	13.50	7.89	0.06	0.48	4.44
Sand Shiner	N	I	M	M	14	21.00	12.28	0.05	0.36	2.14
Central Stoneroller	N	H	N		1	1.50	0.88	0.03	0.22	18.00
Yellow Bullhead		I	C	T	5	7.50	4.39	0.61	4.91	81.00
Stonecat Madtom		I	C	I	14	21.00	12.28	0.33	2.63	15.50
Rock Bass	S	C	C		9	13.50	7.89	0.51	4.12	37.78
Smallmouth Bass	F	C	C	M	5	7.50	4.39	0.50	4.04	66.60
Bluegill Sunfish	S	I	C	P	1	1.50	0.88	0.02	0.19	15.00
Logperch	D	I	S	M	1	1.50	0.88	0.02	0.19	15.00
Greenside Darter	D	I	S	M	1	1.50	0.88	0.01	0.06	5.00
Rainbow Darter	D	I	S	M	1	1.50	0.88	0.01	0.04	3.00
Freshwater Drum			M	P	2	3.00	1.75	0.92	7.39	305.00
Round Goby					7	10.50	6.14	0.58	4.67	55.00
<i>Mile Total</i>					114	171.00		12.39		
<i>Number of Species</i>					18					
<i>Number of Hybrids</i>					0					

River Code: 15-001	Stream: Chagrin River	Sample Date: 2003
River Mile: 1.50	Location:	Date Range: 09/12/2003
Time Fished:	Drainage: 249.0 sq mi	
Dist Fished: 0.20 km	Basin: Chagrin River	No of Passes: 1
		Sampler Type: D

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Golden Redhorse	R	I	S	M	5	7.50	2.19	2.59	7.02	345.00
Northern Hog Sucker	R	I	S	M	95	142.50	41.67	23.87	64.78	167.52
White Sucker	W	O	S	T	1	1.50	0.44	0.16	0.43	105.00
Common Carp	G	O	M	T	3	4.50	1.32	4.28	11.61	950.67
Goldfish	G	O	M	T	1	1.50	0.44	0.15	0.41	100.00
River Chub	N	I	N	I	8	12.00	3.51	0.61	1.65	50.75
Silver Shiner	N	I	S	I	2	3.00	0.88	0.01	0.01	1.50
Rosyface Shiner	N	I	S	I	5	7.50	2.19	0.01	0.02	1.20
Striped Shiner	N	I	S		59	88.50	25.88	1.66	4.51	18.79
Spotfin Shiner	N	I	M		14	21.00	6.14	0.07	0.18	3.07
Central Stoneroller	N	H	N		3	4.50	1.32	0.09	0.24	19.33
Yellow Bullhead		I	C	T	4	6.00	1.75	0.39	1.06	64.75
Stonecat Madtom		I	C	I	1	1.50	0.44	0.04	0.10	25.00
Rock Bass	S	C	C		10	15.00	4.39	0.63	1.71	42.00
Smallmouth Bass	F	C	C	M	9	13.50	3.95	2.06	5.60	152.78
Rainbow Darter	D	I	S	M	1	1.50	0.44	0.00	0.01	1.00
Freshwater Drum			M	P	1	1.50	0.44	0.11	0.28	70.00
Round Goby					6	9.00	2.63	0.14	0.39	15.83
<i>Mile Total</i>					228	342.00		36.85		
<i>Number of Species</i>					18					
<i>Number of Hybrids</i>					0					

Species List

River Code: 15-002 River Mile: 16.30 Time Fished: Dist Fished: 0.15 km	Stream: East Branch Chagrin River Location: upst. Heath Rd. Drainage: 5.3 sq mi Basin: Chagrin River	Sample Date: 2004 Date Range: 07/08/2004 No of Passes: 1 Sampler Type: E
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Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
White Sucker	W	O	S	T	27	54.00	3.68			
Western Blacknose Dace	N	G	S	T	434	868.00	59.13			
Longnose Dace	N	I	S	R	1	2.00	0.14			
Creek Chub	N	G	N	T	40	80.00	5.45			
Redside Dace	N	I	S	I	13	26.00	1.77			
Common Shiner	N	I	S		29	58.00	3.95			
Fathead Minnow	N	O	C	T	1	2.00	0.14			
Central Stoneroller	N	H	N		108	216.00	14.71			
Largemouth Bass	F	C	C		3	6.00	0.41			
Bluegill Sunfish	S	I	C	P	5	10.00	0.68			
Johnny Darter	D	I	C		33	66.00	4.50			
Rainbow Darter	D	I	S	M	40	80.00	5.45			
<i>Mile Total</i>					734	1,468.00				
<i>Number of Species</i>					12					
<i>Number of Hybrids</i>					0					

Species List

River Code: 15-002	Stream: East Branch Chagrin River	Sample Date: 2004
River Mile: 10.20	Location: upst. Mitchell Mill Rd.	Date Range: 07/08/2004
Time Fished:	Drainage: 24.2 sq mi	
Dist Fished: 0.20 km	Basin: Chagrin River	No of Passes: 1
		Sampler Type: D

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Rainbow Trout	E		N		7	10.50	1.37	0.11	1.76	10.00
Northern Hog Sucker	R	I	S	M	36	54.00	7.05	1.95	32.77	36.11
White Sucker	W	O	S	T	2	3.00	0.39	0.15	2.52	50.00
River Chub	N	I	N	I	102	153.00	19.96	0.97	16.22	6.31
Western Blacknose Dace	N	G	S	T	15	22.50	2.94	0.05	0.86	2.29
Longnose Dace	N	I	S	R	36	54.00	7.05	0.15	2.54	2.79
Creek Chub	N	G	N	T	23	34.50	4.50	0.84	14.08	24.29
Striped Shiner	N	I	S		6	9.00	1.17	0.07	1.14	7.50
Common Shiner	N	I	S		43	64.50	8.41	0.28	4.71	4.34
Bluntnose Minnow	N	O	C	T	31	46.50	6.07	0.16	2.66	3.39
Central Stoneroller	N	H	N		99	148.50	19.37	1.00	16.82	6.74
Johnny Darter	D	I	C		22	33.00	4.31	0.02	0.35	0.63
Rainbow Darter	D	I	S	M	82	123.00	16.05	0.20	3.31	1.61
Fantail Darter	D	I	C		7	10.50	1.37	0.02	0.29	1.57
<i>Mile Total</i>					511	766.50		5.95		
<i>Number of Species</i>					14					
<i>Number of Hybrids</i>					0					

Species List

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River Code: 15-002	Stream: East Branch Chagrin River	Sample Date: 2004
River Mile: 2.40	Location: Markell Rd.	Date Range: 07/16/2004
Time Fished:	Drainage: 46.5 sq mi	
Dist Fished: 0.20 km	Basin: Chagrin River	No of Passes: 1
		Sampler Type: D

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Northern Hog Sucker	R	I	S	M	21	31.50	3.87	2.05	40.55	65.00
White Sucker	W	O	S	T	2	3.00	0.37	0.01	0.10	1.50
River Chub	N	I	N	I	84	126.00	15.47	0.75	14.81	5.93
Bigeye Chub	N	I	S	I	9	13.50	1.66	0.04	0.69	2.63
Western Blacknose Dace	N	G	S	T	5	7.50	0.92	0.02	0.42	2.80
Longnose Dace	N	I	S	R	11	16.50	2.03	0.06	1.15	3.50
Creek Chub	N	G	N	T	39	58.50	7.18	0.69	13.62	11.76
Rosyface Shiner	N	I	S	I	7	10.50	1.29	0.02	0.30	1.43
Striped Shiner	N	I	S		10	15.00	1.84	0.05	1.03	3.44
Common Shiner	N	I	S		66	99.00	12.15	0.40	7.88	4.02
Sand Shiner	N	I	M	M	7	10.50	1.29	0.02	0.30	1.43
Silverjaw Minnow	N	I	M		2	3.00	0.37	0.01	0.10	1.50
Bluntnose Minnow	N	O	C	T	132	198.00	24.31	0.41	8.14	2.08
Central Stoneroller	N	H	N		30	45.00	5.52	0.19	3.82	4.29
Common Sh X Rosyface Sh		I			1	1.50	0.18	0.02	0.30	10.00
Yellow Bullhead		I	C	T	2	3.00	0.37	0.05	0.95	16.00
Stonecat Madtom		I	C	I	3	4.50	0.55	0.02	0.46	5.00
Green Sunfish	S	I	C	T	2	3.00	0.37	0.01	0.24	4.00
Bluegill Sunfish	S	I	C	P	23	34.50	4.24	0.08	1.48	2.17
Pumpkinseed Sunfish	S	I	C	P	5	7.50	0.92	0.02	0.34	2.20
Green Sf X Hybrid					1	1.50	0.18	0.00	0.06	2.00
Johnny Darter	D	I	C		20	30.00	3.68	0.04	0.71	1.19
Rainbow Darter	D	I	S	M	58	87.00	10.68	0.13	2.51	1.46
Fantail Darter	D	I	C		3	4.50	0.55	0.01	0.14	1.50
<i>Mile Total</i>					543	814.50		5.05		
<i>Number of Species</i>					22					
<i>Number of Hybrids</i>					2					

Species List

River Code: 15-003	Stream: Griswold Creek	Sample Date: 2004
River Mile: 4.40	Location: Fairmount Rd.	Date Range: 07/28/2004
Time Fished:	Drainage: 3.5 sq mi	
Dist Fished: 0.15 km	Basin: Chagrin River	No of Passes: 1
		Sampler Type: E

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
White Sucker	W	O	S	T	57	114.00	14.32			
Western Blacknose Dace	N	G	S	T	41	82.00	10.30			
Creek Chub	N	G	N	T	99	198.00	24.87			
Redside Dace	N	I	S	I	4	8.00	1.01			
Striped Shiner	N	I	S		2	4.00	0.50			
Common Shiner	N	I	S		8	16.00	2.01			
Fathead Minnow	N	O	C	T	1	2.00	0.25			
Bluntnose Minnow	N	O	C	T	13	26.00	3.27			
Central Stoneroller	N	H	N		118	236.00	29.65			
Largemouth Bass	F	C	C		1	2.00	0.25			
Bluegill Sunfish	S	I	C	P	9	18.00	2.26			
Green Sf X Hybrid					1	2.00	0.25			
Johnny Darter	D	I	C		12	24.00	3.02			
Rainbow Darter	D	I	S	M	32	64.00	8.04			
<i>Mile Total</i>					398	796.00				
<i>Number of Species</i>					13					
<i>Number of Hybrids</i>					1					

Species List

River Code: 15-003 River Mile: 0.10 Time Fished: Dist Fished: 0.15 km	Stream: Griswold Creek Location: at mouth Drainage: 7.2 sq mi Basin: Chagrin River	Sample Date: 2004 Date Range: 07/28/2004 No of Passes: 1 Sampler Type: E
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Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Northern Hog Sucker	R	I	S	M	2	4.00	1.43			
White Sucker	W	O	S	T	7	14.00	5.00			
Western Blacknose Dace	N	G	S	T	7	14.00	5.00			
Creek Chub	N	G	N	T	29	58.00	20.71			
Sand Shiner	N	I	M	M	1	2.00	0.71			
Central Stoneroller	N	H	N		46	92.00	32.86			
Largemouth Bass	F	C	C		1	2.00	0.71			
Bluegill Sunfish	S	I	C	P	1	2.00	0.71			
Rainbow Darter	D	I	S	M	46	92.00	32.86			
<i>Mile Total</i>					140	280.00				
<i>Number of Species</i>					9					
<i>Number of Hybrids</i>					0					

Species List

River Code: 15-005	Stream: Aurora Branch	Sample Date: 2003
River Mile: 16.60	Location: Chamberlain Rd.	Date Range: 09/30/2003
Time Fished: 2400 sec	Drainage: 3.6 sq mi	
Dist Fished: 0.12 km	Basin: Chagrin River	No of Passes: 1
		Sampler Type: E

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Central Mudminnow		I	C	T	1	2.50	0.45			
Redfin Pickerel		P	M	P	2	5.00	0.89			
White Sucker	W	O	S	T	28	70.00	12.50			
Western Blacknose Dace	N	G	S	T	4	10.00	1.79			
Creek Chub	N	G	N	T	59	147.50	26.34			
Bluntnose Minnow	N	O	C	T	3	7.50	1.34			
Central Stoneroller	N	H	N		21	52.50	9.38			
Largemouth Bass	F	C	C		5	12.50	2.23			
Green Sunfish	S	I	C	T	1	2.50	0.45			
Bluegill Sunfish	S	I	C	P	1	2.50	0.45			
Johnny Darter	D	I	C		92	230.00	41.07			
Rainbow Darter	D	I	S	M	6	15.00	2.68			
Fantail Darter	D	I	C		1	2.50	0.45			
<i>Mile Total</i>					224	560.00				
<i>Number of Species</i>					13					
<i>Number of Hybrids</i>					0					

Species List

River Code: 15-005 River Mile: 14.50 Time Fished: 3013 sec Dist Fished: 0.14 km	Stream: Aurora Branch Location: dst. Pioneer Trail Drainage: 7.5 sq mi Basin: Chagrin River	Sample Date: 2003 Date Range: 09/30/2003 No of Passes: 1 Sampler Type: E
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Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Redfin Pickerel		P	M	P	1	2.14	0.50			
White Sucker	W	O	S	T	36	77.14	18.09			
Common Carp	G	O	M	T	22	47.14	11.06			
Creek Chub	N	G	N	T	74	158.57	37.19			
Common Shiner	N	I	S		12	25.71	6.03			
Bluntnose Minnow	N	O	C	T	17	36.43	8.54			
Yellow Bullhead		I	C	T	6	12.86	3.02			
White Crappie	S	I	C		1	2.14	0.50			
Green Sunfish	S	I	C	T	1	2.14	0.50			
Bluegill Sunfish	S	I	C	P	5	10.71	2.51			
Pumpkinseed Sunfish	S	I	C	P	3	6.43	1.51			
Bluegill X Pumpkinseed					2	4.29	1.01			
Johnny Darter	D	I	C		12	25.71	6.03			
Rainbow Darter	D	I	S	M	7	15.00	3.52			
<i>Mile Total</i>					199	426.43				
<i>Number of Species</i>					13					
<i>Number of Hybrids</i>					1					

Species List

River Code: 15-005 River Mile: 12.00 Time Fished: Dist Fished: 0.15 km	Stream: Aurora Branch Location: dst. St. Rt. 82 Drainage: 12.1 sq mi Basin: Chagrin River	Sample Date: 2003 Date Range: 09/10/2003 No of Passes: 1 Sampler Type: E
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Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
White Sucker	W	O	S	T	4	8.00	2.33	0.36	8.92	45.50
Western Blacknose Dace	N	G	S	T	23	46.00	13.37	0.25	6.05	5.37
Creek Chub	N	G	N	T	32	64.00	18.60	0.57	13.94	8.90
Striped Shiner	N	I	S		15	30.00	8.72	0.32	7.84	10.67
Common Shiner	N	I	S		10	20.00	5.81	0.24	5.98	12.20
Bluntnose Minnow	N	O	C	T	11	22.00	6.40	0.09	2.28	4.22
Central Stoneroller	N	H	N		16	32.00	9.30	0.68	16.75	21.38
Yellow Bullhead		I	C	T	4	8.00	2.33	0.52	12.64	64.50
Largemouth Bass	F	C	C		2	4.00	1.16	0.02	0.39	4.00
Green Sunfish	S	I	C	T	14	28.00	8.14	0.34	8.33	12.14
Bluegill Sunfish	S	I	C	P	29	58.00	16.86	0.40	9.67	6.82
Pumpkinseed Sunfish	S	I	C	P	1	2.00	0.58	0.02	0.59	12.00
Hybrid X Sunfish					10	20.00	5.81	0.27	6.54	13.33
Johnny Darter	D	I	C		1	2.00	0.58	0.00	0.10	2.00
<i>Mile Total</i>					172	344.00		4.08		
<i>Number of Species</i>					13					
<i>Number of Hybrids</i>					1					

Species List

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River Code: 15-005	Stream: Aurora Branch	Sample Date: 2003
River Mile: 11.30	Location: upst. Aurora WWTP	Date Range: 09/10/2003
Time Fished:	Drainage: 13.1 sq mi	
Dist Fished: 0.15 km	Basin: Chagrin River	No of Passes: 1
		Sampler Type: E

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Northern Hog Sucker	R	I	S	M	5	10.00	1.05	0.33	2.61	33.00
White Sucker	W	O	S	T	29	58.00	6.08	3.19	25.25	55.00
Western Blacknose Dace	N	G	S	T	116	232.00	24.32	0.88	6.95	3.78
Creek Chub	N	G	N	T	150	300.00	31.45	4.95	39.21	16.51
Striped Shiner	N	I	S		1	2.00	0.21	0.02	0.13	8.00
Common Shiner	N	I	S		55	110.00	11.53	1.07	8.47	9.73
Fathead Minnow	N	O	C	T	2	4.00	0.42	0.01	0.08	2.50
Bluntnose Minnow	N	O	C	T	13	26.00	2.73	0.12	0.94	4.58
Central Stoneroller	N	H	N		45	90.00	9.43	1.26	9.97	14.00
Yellow Bullhead		I	C	T	3	6.00	0.63	0.28	2.22	46.67
Largemouth Bass	F	C	C		4	8.00	0.84	0.04	0.32	5.00
Green Sunfish	S	I	C	T	8	16.00	1.68	0.16	1.27	10.00
Bluegill Sunfish	S	I	C	P	4	8.00	0.84	0.06	0.47	7.50
Pumpkinseed Sunfish	S	I	C	P	1	2.00	0.21	0.03	0.24	15.00
Hybrid X Sunfish					4	8.00	0.84	0.10	0.80	12.67
Johnny Darter	D	I	C		23	46.00	4.82	0.07	0.55	1.52
Rainbow Darter	D	I	S	M	14	28.00	2.94	0.07	0.51	2.33
<i>Mile Total</i>					477	954.00		12.63		
<i>Number of Species</i>					16					
<i>Number of Hybrids</i>					1					

Species List

River Code: 15-005	Stream: Aurora Branch	Sample Date: 2003
River Mile: 11.10	Location: dst. Aurora WWTP	Date Range: 09/11/2003
Time Fished:	Drainage: 13.3 sq mi	
Dist Fished: 0.15 km	Basin: Chagrin River	No of Passes: 1
		Sampler Type: E

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Northern Hog Sucker	R	I	S	M	6	12.00	2.45	0.52	12.58	43.00
White Sucker	W	O	S	T	5	10.00	2.04	0.95	23.16	95.00
Western Blacknose Dace	N	G	S	T	34	68.00	13.88	0.24	5.92	3.58
Creek Chub	N	G	N	T	24	48.00	9.80	0.84	20.48	17.50
Striped Shiner	N	I	S		23	46.00	9.39	0.42	10.19	9.09
Common Shiner	N	I	S		12	24.00	4.90	0.20	4.78	8.17
Bluntnose Minnow	N	O	C	T	5	10.00	2.04	0.03	0.73	3.00
Central Stoneroller	N	H	N		23	46.00	9.39	0.48	11.80	10.52
Largemouth Bass	F	C	C		1	2.00	0.41	0.01	0.24	5.00
Bluegill Sunfish	S	I	C	P	6	12.00	2.45	0.04	0.88	3.00
Pumpkinseed Sunfish	S	I	C	P	1	2.00	0.41	0.01	0.34	7.00
Johnny Darter	D	I	C		22	44.00	8.98	0.07	1.73	1.61
Rainbow Darter	D	I	S	M	83	166.00	33.88	0.29	7.17	1.77
<i>Mile Total</i>					245	490.00		4.10		
<i>Number of Species</i>					13					
<i>Number of Hybrids</i>					0					

Species List

River Code: 15-005	Stream: Aurora Branch	Sample Date: 2003
River Mile: 9.10	Location: upst. St. Rt. 306	Date Range: 09/10/2003
Time Fished:	Drainage: 16.4 sq mi	
Dist Fished: 0.15 km	Basin: Chagrin River	No of Passes: 1
		Sampler Type: E

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Northern Hog Sucker	R	I	S	M	11	22.00	0.90	0.71	4.37	32.09
White Sucker	W	O	S	T	7	14.00	0.57	0.24	1.47	17.00
Western Blacknose Dace	N	G	S	T	370	740.00	30.38	1.99	12.30	2.69
Creek Chub	N	G	N	T	80	160.00	6.57	2.18	13.50	13.64
Striped Shiner	N	I	S		3	6.00	0.25	0.06	0.37	10.00
Common Shiner	N	I	S		21	42.00	1.72	0.54	3.33	12.81
Fathead Minnow	N	O	C	T	3	6.00	0.25	0.02	0.12	3.33
Bluntnose Minnow	N	O	C	T	103	206.00	8.46	0.63	3.87	3.04
Central Stoneroller	N	H	N		338	676.00	27.75	9.14	56.54	13.51
Johnny Darter	D	I	C		76	152.00	6.24	0.18	1.11	1.19
Rainbow Darter	D	I	S	M	206	412.00	16.91	0.49	3.00	1.18
<i>Mile Total</i>					1,218	2,436.00		16.16		
<i>Number of Species</i>					11					
<i>Number of Hybrids</i>					0					

Species List

River Code: 15-005	Stream: Aurora Branch	Sample Date: 2003
River Mile: 7.40	Location: Brewster Rd.	Date Range: 09/11/2003
Time Fished:	Drainage: 28.0 sq mi	
Dist Fished: 0.18 km	Basin: Chagrin River	No of Passes: 1
		Sampler Type: E

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Northern Hog Sucker	R	I	S	M	30	50.00	4.21	2.93	11.42	58.52
White Sucker	W	O	S	T	78	130.00	10.96	13.95	54.45	107.28
Western Blacknose Dace	N	G	S	T	128	213.33	17.98	0.68	2.67	3.20
Creek Chub	N	G	N	T	27	45.00	3.79	0.77	3.02	17.20
Striped Shiner	N	I	S		40	66.67	5.62	0.86	3.36	12.89
Bluntnose Minnow	N	O	C	T	78	130.00	10.96	0.36	1.40	2.76
Central Stoneroller	N	H	N		240	400.00	33.71	5.48	21.41	13.71
Yellow Bullhead		I	C	T	2	3.33	0.28	0.37	1.44	111.00
Largemouth Bass	F	C	C		1	1.67	0.14	0.01	0.02	3.00
Green Sunfish	S	I	C	T	1	1.67	0.14	0.02	0.08	12.00
Johnny Darter	D	I	C		61	101.67	8.57	0.12	0.45	1.14
Rainbow Darter	D	I	S	M	26	43.33	3.65	0.07	0.28	1.67
<i>Mile Total</i>					712	1,186.67		25.62		
<i>Number of Species</i>					12					
<i>Number of Hybrids</i>					0					

Species List

River Code: 15-005	Stream: Aurora Branch	Sample Date: 2003
River Mile: 5.60	Location: Geauga Lake Rd.	Date Range: 09/05/2003
Time Fished:	Drainage: 31.0 sq mi	
Dist Fished: 0.20 km	Basin: Chagrin River	No of Passes: 1
		Sampler Type: D

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Northern Hog Sucker	R	I	S	M	50	75.00	3.18	2.23	8.36	29.79
White Sucker	W	O	S	T	43	64.50	2.73	2.75	10.30	42.68
River Chub	N	I	N	I	7	10.50	0.44	0.30	1.12	28.57
Western Blacknose Dace	N	G	S	T	230	345.00	14.61	1.50	5.61	4.35
Creek Chub	N	G	N	T	37	55.50	2.35	0.70	2.61	12.57
Rosyface Shiner	N	I	S	I	1	1.50	0.06	0.00	0.01	2.00
Striped Shiner	N	I	S		83	124.50	5.27	0.83	3.09	6.63
Common Shiner	N	I	S		83	124.50	5.27	0.83	3.09	6.63
Fathead Minnow	N	O	C	T	1	1.50	0.06	0.00	0.01	2.00
Bluntnose Minnow	N	O	C	T	122	183.00	7.75	0.69	2.60	3.79
Central Stoneroller	N	H	N		787	1,180.50	50.00	16.19	60.60	13.72
Yellow Bullhead		I	C	T	4	6.00	0.25	0.20	0.73	32.50
Largemouth Bass	F	C	C		3	4.50	0.19	0.02	0.07	4.00
Green Sunfish	S	I	C	T	5	7.50	0.32	0.07	0.27	9.50
Bluegill Sunfish	S	I	C	P	6	9.00	0.38	0.04	0.16	4.80
Pumpkinseed Sunfish	S	I	C	P	1	1.50	0.06	0.01	0.04	8.00
Johnny Darter	D	I	C		60	90.00	3.81	0.17	0.65	1.92
Rainbow Darter	D	I	S	M	51	76.50	3.24	0.18	0.67	2.35
<i>Mile Total</i>					1,574	2,361.00		26.72		
<i>Number of Species</i>					18					
<i>Number of Hybrids</i>					0					

River Code: 15-005	Stream: Aurora Branch	Sample Date: 2004
River Mile: 3.80	Location: Bainbridge Rd.	Date Range: 07/29/2004
Time Fished:	Drainage: 37.5 sq mi	
Dist Fished: 0.20 km	Basin: Chagrin River	No of Passes: 1
		Sampler Type: D

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Amer Brook Lamprey		F	N R	5	7.50	1.60	0.11	0.76	14.00
Northern Hog Sucker	R	I	S M	45	67.50	14.42	5.60	40.76	82.95
White Sucker	W	O	S T	19	28.50	6.09	3.00	21.84	105.26
Common Carp	G	O	M T	2	3.00	0.64	1.65	12.01	550.00
Western Blacknose Dace	N	G	S T	3	4.50	0.96	0.01	0.09	2.67
Creek Chub	N	G	N T	12	18.00	3.85	0.49	3.55	27.08
Rosyface Shiner	N	I	S I	1	1.50	0.32	0.00	0.02	2.00
Striped Shiner	N	I	S	19	28.50	6.09	0.41	2.98	14.33
Common Shiner	N	I	S	33	49.50	10.58	0.52	3.77	10.47
Sand Shiner	N	I	M M	3	4.50	0.96	0.01	0.10	3.00
Bluntnose Minnow	N	O	C T	4	6.00	1.28	0.02	0.11	2.50
Central Stoneroller	N	H	N	24	36.00	7.69	0.72	5.24	20.00
Yellow Bullhead		I	C T	1	1.50	0.32	0.18	1.31	120.00
White Crappie	S	I	C	2	3.00	0.64	0.17	1.20	55.00
Black Crappie	S	I	C	2	3.00	0.64	0.11	0.82	37.50
Smallmouth Bass	F	C	C M	1	1.50	0.32	0.35	2.57	235.00
Largemouth Bass	F	C	C	2	3.00	0.64	0.01	0.04	2.00
Green Sunfish	S	I	C T	35	52.50	11.22	0.09	0.68	1.77
Bluegill Sunfish	S	I	C P	9	13.50	2.88	0.09	0.65	6.56
Green Sf X Hybrid				1	1.50	0.32	0.01	0.08	7.00
Johnny Darter	D	I	C	17	25.50	5.45	0.03	0.25	1.33
Rainbow Darter	D	I	S M	72	108.00	23.08	0.16	1.18	1.50
<i>Mile Total</i>				312	468.00		13.74		
<i>Number of Species</i>				21					
<i>Number of Hybrids</i>				1					

River Code: 15-005	Stream: Aurora Branch	Sample Date: 2003
River Mile: 3.70	Location: Bainbridge Rd.	Date Range: 09/11/2003
Time Fished:	Drainage: 37.5 sq mi	
Dist Fished: 0.20 km	Basin: Chagrin River	No of Passes: 1
		Sampler Type: D

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Northern Hog Sucker	R	I	S	M	72	108.00	12.97	5.92	45.70	54.84
White Sucker	W	O	S	T	20	30.00	3.60	1.45	11.19	48.33
Common Carp	G	O	M	T	3	4.50	0.54	0.73	5.62	161.67
River Chub	N	I	N	I	1	1.50	0.18	0.19	1.45	125.00
Creek Chub	N	G	N	T	41	61.50	7.39	0.74	5.68	11.97
Striped Shiner	N	I	S		59	88.50	10.63	0.82	6.29	9.21
Sand Shiner	N	I	M	M	1	1.50	0.18	0.00	0.02	2.00
Bluntnose Minnow	N	O	C	T	83	124.50	14.95	0.50	3.89	4.05
Central Stoneroller	N	H	N		113	169.50	20.36	1.72	13.26	10.14
Yellow Bullhead		I	C	T	1	1.50	0.18	0.07	0.52	45.00
Black Crappie	S	I	C		2	3.00	0.36	0.11	0.81	35.00
Rock Bass	S	C	C		1	1.50	0.18	0.10	0.73	63.00
Smallmouth Bass	F	C	C	M	1	1.50	0.18	0.05	0.41	35.00
Largemouth Bass	F	C	C		2	3.00	0.36	0.03	0.23	10.00
Green Sunfish	S	I	C	T	13	19.50	2.34	0.20	1.53	10.15
Bluegill Sunfish	S	I	C	P	7	10.50	1.26	0.06	0.49	6.00
Pumpkinseed Sunfish	S	I	C	P	1	1.50	0.18	0.01	0.06	5.00
Blackside Darter	D	I	S		1	1.50	0.18	0.01	0.09	8.00
Johnny Darter	D	I	C		59	88.50	10.63	0.12	0.89	1.30
Rainbow Darter	D	I	S	M	74	111.00	13.33	0.15	1.17	1.36
<i>Mile Total</i>					555	832.50		12.96		
<i>Number of Species</i>					20					
<i>Number of Hybrids</i>					0					

River Code: 15-005	Stream: Aurora Branch	Sample Date: 2003
River Mile: 3.40	Location: dst. McFarland Creek WWTP	Date Range: 09/11/2003
Time Fished:	Drainage: 49.0 sq mi	
Dist Fished: 0.20 km	Basin: Chagrin River	No of Passes: 1
		Sampler Type: D

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Amer Brook Lamprey		F	N	R	4	6.00	0.50	0.06	0.45	10.50
Northern Hog Sucker	R	I	S	M	1	1.50	0.13	0.48	3.41	320.00
White Sucker	W	O	S	T	41	61.50	5.13	4.80	34.09	78.05
River Chub	N	I	N	I	1	1.50	0.13	0.00	0.02	2.00
Western Blacknose Dace	N	G	S	T	5	7.50	0.63	0.05	0.32	6.00
Creek Chub	N	G	N	T	57	85.50	7.13	1.53	10.84	17.86
Rosyface Shiner	N	I	S	I	1	1.50	0.13	0.00	0.02	2.00
Striped Shiner	N	I	S		164	246.00	20.50	2.40	17.02	9.74
Common Shiner	N	I	S		3	4.50	0.38	0.04	0.29	9.00
Sand Shiner	N	I	M	M	6	9.00	0.75	0.02	0.13	2.00
Bluntnose Minnow	N	O	C	T	297	445.50	37.13	1.28	9.11	2.88
Central Stoneroller	N	H	N		144	216.00	18.00	2.37	16.82	10.97
Yellow Bullhead		I	C	T	10	15.00	1.25	0.39	2.79	26.20
Rock Bass	S	C	C		3	4.50	0.38	0.31	2.17	67.67
Green Sunfish	S	I	C	T	11	16.50	1.38	0.16	1.15	9.82
Bluegill Sunfish	S	I	C	P	1	1.50	0.13	0.01	0.04	4.00
Pumpkinseed Sunfish	S	I	C	P	1	1.50	0.13	0.06	0.45	42.00
Johnny Darter	D	I	C		19	28.50	2.38	0.04	0.31	1.50
Rainbow Darter	D	I	S	M	31	46.50	3.88	0.08	0.59	1.77
<i>Mile Total</i>					800	1,200.00		14.08		
<i>Number of Species</i>					19					
<i>Number of Hybrids</i>					0					

River Code: 15-005	Stream: Aurora Branch	Sample Date: 2003
River Mile: 1.00	Location: Solon Rd.	Date Range: 09/05/2003
Time Fished:	Drainage: 57.0 sq mi	
Dist Fished: 0.20 km	Basin: Chagrin River	No of Passes: 1
		Sampler Type: E

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Northern Hog Sucker	R	I	S	M	39	58.50	8.26	3.09	28.18	52.86
White Sucker	W	O	S	T	8	12.00	1.69	0.57	5.20	47.50
River Chub	N	I	N	I	78	117.00	16.53	1.15	10.44	9.79
Western Blacknose Dace	N	G	S	T	8	12.00	1.69	0.02	0.15	1.43
Creek Chub	N	G	N	T	5	7.50	1.06	0.08	0.68	10.00
Striped Shiner	N	I	S		35	52.50	7.42	0.53	4.78	10.00
Common Shiner	N	I	S		79	118.50	16.74	1.38	12.58	11.65
Sand Shiner	N	I	M	M	4	6.00	0.85	0.01	0.11	2.00
Fathead Minnow	N	O	C	T	1	1.50	0.21	0.00	0.03	2.00
Bluntnose Minnow	N	O	C	T	11	16.50	2.33	0.06	0.57	3.82
Central Stoneroller	N	H	N		195	292.50	41.31	3.66	33.32	12.50
Yellow Bullhead		I	C	T	2	3.00	0.42	0.19	1.71	62.50
Stonecat Madtom		I	C	I	2	3.00	0.42	0.23	2.11	77.00
Rainbow Darter	D	I	S	M	5	7.50	1.06	0.02	0.14	2.00
<i>Mile Total</i>					472	708.00		10.97		
<i>Number of Species</i>					14					
<i>Number of Hybrids</i>					0					

Species List

River Code: 15-006	Stream: McFarland Creek	Sample Date: 2004
River Mile: 2.30	Location: dst. north trib., dst. Chagrin Rd.	Date Range: 06/30/2004
Time Fished:	Drainage: 9.3 sq mi	
Dist Fished: 0.15 km	Basin: Chagrin River	No of Passes: 1
		Sampler Type: E

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Northern Hog Sucker	R	I	S	M	8	16.00	1.50			
White Sucker	W	O	S	T	21	42.00	3.94			
Western Blacknose Dace	N	G	S	T	72	144.00	13.51			
Creek Chub	N	G	N	T	62	124.00	11.63			
Striped Shiner	N	I	S		3	6.00	0.56			
Common Shiner	N	I	S		68	136.00	12.76			
Bluntnose Minnow	N	O	C	T	48	96.00	9.01			
Central Stoneroller	N	H	N		217	434.00	40.71			
Yellow Bullhead		I	C	T	2	4.00	0.38			
Largemouth Bass	F	C	C		5	10.00	0.94			
Bluegill Sunfish	S	I	C	P	4	8.00	0.75			
Johnny Darter	D	I	C		12	24.00	2.25			
Rainbow Darter	D	I	S	M	11	22.00	2.06			
<i>Mile Total</i>					533	1,066.00				
<i>Number of Species</i>					13					
<i>Number of Hybrids</i>					0					

River Code: 15-006	Stream: McFarland Creek	Sample Date: 2004
River Mile: 0.20	Location: Chagrin River Rd.	Date Range: 07/01/2004
Time Fished:	Drainage: 11.1 sq mi	
Dist Fished: 0.15 km	Basin: Chagrin River	No of Passes: 1
		Sampler Type: E

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Northern Hog Sucker	R	I	S	M	4	8.00	1.42			
White Sucker	W	O	S	T	5	10.00	1.77			
Western Blacknose Dace	N	G	S	T	29	58.00	10.28			
Creek Chub	N	G	N	T	38	76.00	13.48			
Striped Shiner	N	I	S		7	14.00	2.48			
Common Shiner	N	I	S		28	56.00	9.93			
Sand Shiner	N	I	M	M	2	4.00	0.71			
Bluntnose Minnow	N	O	C	T	19	38.00	6.74			
Central Stoneroller	N	H	N		79	158.00	28.01			
Yellow Bullhead		I	C	T	5	10.00	1.77			
Largemouth Bass	F	C	C		1	2.00	0.35			
Green Sunfish	S	I	C	T	4	8.00	1.42			
Bluegill Sunfish	S	I	C	P	2	4.00	0.71			
Johnny Darter	D	I	C		4	8.00	1.42			
Rainbow Darter	D	I	S	M	55	110.00	19.50			
<i>Mile Total</i>					282	564.00				
<i>Number of Species</i>					15					
<i>Number of Hybrids</i>					0					

Species List

River Code: 15-007	Stream: Silver Creek	Sample Date: 2004
River Mile: 5.10	Location: Music St.	Date Range: 07/01/2004
Time Fished:	Drainage: 2.5 sq mi	
Dist Fished: 0.13 km	Basin: Chagrin River	No of Passes: 1
		Sampler Type: E

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Amer Brook Lamprey		F	N	R	1	2.31	0.29			
Central Mudminnow		I	C	T	1	2.31	0.29			
White Sucker	W	O	S	T	16	36.92	4.57			
Western Blacknose Dace	N	G	S	T	20	46.15	5.71			
Creek Chub	N	G	N	T	152	350.77	43.43			
Fathead Minnow	N	O	C	T	1	2.31	0.29			
Bluntnose Minnow	N	O	C	T	3	6.92	0.86			
Central Stoneroller	N	H	N		1	2.31	0.29			
Yellow Bullhead		I	C	T	4	9.23	1.14			
Bluegill Sunfish	S	I	C	P	4	9.23	1.14			
Pumpkinseed Sunfish	S	I	C	P	7	16.15	2.00			
Johnny Darter	D	I	C		55	126.92	15.71			
Rainbow Darter	D	I	S	M	85	196.15	24.29			
<i>Mile Total</i>					350	807.69				
<i>Number of Species</i>					13					
<i>Number of Hybrids</i>					0					

Species List

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River Code: 15-007	Stream: Silver Creek	Sample Date: 2004
River Mile: 0.80	Location: upst. St. Rt. 306	Date Range: 07/02/2004
Time Fished:	Drainage:	
Dist Fished: 0.20 km	Basin: Chagrin River	No of Passes: 1
		Sampler Type: D

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Northern Hog Sucker	R	I	S	M	20	30.00	4.51			
White Sucker	W	O	S	T	20	30.00	4.51			
River Chub	N	I	N	I	3	4.50	0.68			
Creek Chub	N	G	N	T	64	96.00	14.45			
Striped Shiner	N	I	S		3	4.50	0.68			
Common Shiner	N	I	S		22	33.00	4.97			
Silverjaw Minnow	N	I	M		12	18.00	2.71			
Bluntnose Minnow	N	O	C	T	73	109.50	16.48			
Central Stoneroller	N	H	N		110	165.00	24.83			
White Bass	F	P	M		10	15.00	2.26			
Rock Bass	S	C	C		6	9.00	1.35			
Smallmouth Bass	F	C	C	M	1	1.50	0.23			
Green Sunfish	S	I	C	T	9	13.50	2.03			
Johnny Darter	D	I	C		4	6.00	0.90			
Greenside Darter	D	I	S	M	20	30.00	4.51			
Rainbow Darter	D	I	S	M	45	67.50	10.16			
Fantail Darter	D	I	C		21	31.50	4.74			
<i>Mile Total</i>					443	664.50				
<i>Number of Species</i>					17					
<i>Number of Hybrids</i>					0					

River Code: 15-011	Stream: Caves Creek	Sample Date: 2004
River Mile: 0.90	Location: County Line Rd.	Date Range: 07/28/2004
Time Fished:	Drainage: 5.5 sq mi	
Dist Fished: 0.15 km	Basin: Chagrin River	No of Passes: 1
		Sampler Type: E

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Rainbow Trout	E		N		8	16.00	1.67			
Northern Hog Sucker	R	I	S	M	4	8.00	0.84			
White Sucker	W	O	S	T	4	8.00	0.84			
Western Blacknose Dace	N	G	S	T	174	348.00	36.33			
Creek Chub	N	G	N	T	68	136.00	14.20			
Central Stoneroller	N	H	N		142	284.00	29.65			
Bluegill Sunfish	S	I	C	P	3	6.00	0.63			
Johnny Darter	D	I	C		1	2.00	0.21			
Rainbow Darter	D	I	S	M	75	150.00	15.66			
	<i>Mile Total</i>				479	958.00				
	<i>Number of Species</i>				9					
	<i>Number of Hybrids</i>				0					

Species List

River Code: 15-014 River Mile: 1.10 Time Fished: Dist Fished: 0.15 km	Stream: Smith Creek Location: South Spring Valley Rd. Drainage: Basin: Chagrin River	Sample Date: 2004 Date Range: 07/01/2004 No of Passes: 1 Sampler Type: E
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Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
White Sucker	W	O	S	T	2	4.00	0.33			
Western Blacknose Dace	N	G	S	T	56	112.00	9.27			
Creek Chub	N	G	N	T	89	178.00	14.74			
Redside Dace	N	I	S	I	4	8.00	0.66			
Striped Shiner	N	I	S		4	8.00	0.66			
Common Shiner	N	I	S		50	100.00	8.28			
Fathead Minnow	N	O	C	T	2	4.00	0.33			
Bluntnose Minnow	N	O	C	T	132	264.00	21.85			
Central Stoneroller	N	H	N		101	202.00	16.72			
Johnny Darter	D	I	C		132	264.00	21.85			
Rainbow Darter	D	I	S	M	32	64.00	5.30			
<i>Mile Total</i>					604	1,208.00				
<i>Number of Species</i>					11					
<i>Number of Hybrids</i>					0					

Species List

River Code: 15-018	Stream: Trib. to Chagrin R. (RM 22.81)	Sample Date: 2004
River Mile: 0.20	Location: Chagrin River Rd.	Date Range: 07/29/2004
Time Fished:	Drainage: 9.3 sq mi	
Dist Fished: 0.15 km	Basin: Chagrin River	No of Passes: 1
		Sampler Type: E

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
White Sucker	W	O	S	T	11	22.00	10.48			
River Chub	N	I	N	I	10	20.00	9.52			
Common Shiner	N	I	S		1	2.00	0.95			
Sand Shiner	N	I	M	M	2	4.00	1.90			
Bluntnose Minnow	N	O	C	T	6	12.00	5.71			
Central Stoneroller	N	H	N		24	48.00	22.86			
Yellow Bullhead		I	C	T	2	4.00	1.90			
Stonecat Madtom		I	C	I	1	2.00	0.95			
Smallmouth Bass	F	C	C	M	2	4.00	1.90			
Green Sunfish	S	I	C	T	2	4.00	1.90			
Bluegill Sunfish	S	I	C	P	2	4.00	1.90			
Rainbow Darter	D	I	S	M	42	84.00	40.00			
<i>Mile Total</i>					105	210.00				
<i>Number of Species</i>					12					
<i>Number of Hybrids</i>					0					

River Code: 15-024	Stream: Dewdale Creek	Sample Date: 2004
River Mile: 2.60	Location: Auburn Rd.	Date Range: 07/02/2004
Time Fished:	Drainage: 3.6 sq mi	
Dist Fished: 0.15 km	Basin: Chagrin River	No of Passes: 1
		Sampler Type: E

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Redfin Pickerel		P	M	P	24	48.00	15.89			
White Sucker	W	O	S	T	3	6.00	1.99			
Western Blacknose Dace	N	G	S	T	1	2.00	0.66			
Creek Chub	N	G	N	T	23	46.00	15.23			
Bluntnose Minnow	N	O	C	T	2	4.00	1.32			
Yellow Bullhead		I	C	T	6	12.00	3.97			
Largemouth Bass	F	C	C		1	2.00	0.66			
Green Sunfish	S	I	C	T	18	36.00	11.92			
Bluegill Sunfish	S	I	C	P	47	94.00	31.13			
Pumpkinseed Sunfish	S	I	C	P	5	10.00	3.31			
Yellow Perch			M		4	8.00	2.65			
Johnny Darter	D	I	C		17	34.00	11.26			
<i>Mile Total</i>					151	302.00				
<i>Number of Species</i>					12					
<i>Number of Hybrids</i>					0					

Species List

River Code: 15-024	Stream: Dewdale Creek	Sample Date: 2004
River Mile: 0.60	Location: Rock Haven Rd.	Date Range: 07/07/2004
Time Fished:	Drainage: 12.0 sq mi	
Dist Fished: 0.15 km	Basin: Chagrin River	No of Passes: 1
		Sampler Type: E

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Redfin Pickerel		P	M	P	5	10.00	1.76			
Northern Hog Sucker	R	I	S	M	6	12.00	2.11			
White Sucker	W	O	S	T	9	18.00	3.17			
Creek Chub	N	G	N	T	45	90.00	15.85			
Striped Shiner	N	I	S		7	14.00	2.46			
Common Shiner	N	I	S		2	4.00	0.70			
Bluntnose Minnow	N	O	C	T	2	4.00	0.70			
Central Stoneroller	N	H	N		32	64.00	11.27			
Yellow Bullhead		I	C	T	3	6.00	1.06			
Rock Bass	S	C	C		8	16.00	2.82			
Green Sunfish	S	I	C	T	2	4.00	0.70			
Bluegill Sunfish	S	I	C	P	1	2.00	0.35			
Green Sf X Hybrid					2	4.00	0.70			
Yellow Perch			M		1	2.00	0.35			
Johnny Darter	D	I	C		51	102.00	17.96			
Greenside Darter	D	I	S	M	19	38.00	6.69			
Rainbow Darter	D	I	S	M	89	178.00	31.34			
<i>Mile Total</i>					284	568.00				
<i>Number of Species</i>					16					
<i>Number of Hybrids</i>					1					

Species List

River Code: 15-025	Stream: South Branch Silver Creek	Sample Date: 2004
River Mile: 1.10	Location: Music St.	Date Range: 07/01/2004
Time Fished:	Drainage: 3.7 sq mi	
Dist Fished: 0.15 km	Basin: Chagrin River	No of Passes: 1
		Sampler Type: E

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
White Sucker	W	O	S	T	25	50.00	21.74			
Creek Chub	N	G	N	T	1	2.00	0.87			
Common Shiner	N	I	S		4	8.00	3.48			
Bluntnose Minnow	N	O	C	T	9	18.00	7.83			
Yellow Bullhead		I	C	T	19	38.00	16.52			
Brown Bullhead		I	C	T	2	4.00	1.74			
White Crappie	S	I	C		2	4.00	1.74			
Black Crappie	S	I	C		1	2.00	0.87			
Largemouth Bass	F	C	C		14	28.00	12.17			
Green Sunfish	S	I	C	T	3	6.00	2.61			
Bluegill Sunfish	S	I	C	P	30	60.00	26.09			
Pumpkinseed Sunfish	S	I	C	P	2	4.00	1.74			
Bluegill X Pumpkinseed					1	2.00	0.87			
Yellow Perch			M		1	2.00	0.87			
Rainbow Darter	D	I	S	M	1	2.00	0.87			
<i>Mile Total</i>					115	230.00				
<i>Number of Species</i>					14					
<i>Number of Hybrids</i>					1					

Species List

River Code: 15-030	Stream: Ward Creek	Sample Date: 2004
River Mile: 0.40	Location: Robin Drive	Date Range: 07/29/2004
Time Fished:	Drainage: 7.6 sq mi	
Dist Fished: 0.15 km	Basin: Chagrin River	No of Passes: 1
		Sampler Type: E

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Rainbow Trout	E		N	1	2.00	0.46			
White Sucker	W	O	S T	39	78.00	17.89			
Golden Shiner	N	I	M T	1	2.00	0.46			
Western Blacknose Dace	N	G	S T	4	8.00	1.83			
Creek Chub	N	G	N T	94	188.00	43.12			
Striped Shiner	N	I	S	5	10.00	2.29			
Common Shiner	N	I	S	4	8.00	1.83			
Fathead Minnow	N	O	C T	10	20.00	4.59			
Bluntnose Minnow	N	O	C T	3	6.00	1.38			
Central Stoneroller	N	H	N	6	12.00	2.75			
Yellow Bullhead		I	C T	7	14.00	3.21			
Largemouth Bass	F	C	C	2	4.00	0.92			
Green Sunfish	S	I	C T	2	4.00	0.92			
Bluegill Sunfish	S	I	C P	32	64.00	14.68			
Pumpkinseed Sunfish	S	I	C P	1	2.00	0.46			
Johnny Darter	D	I	C	7	14.00	3.21			
<i>Mile Total</i>				218	436.00				
<i>Number of Species</i>				16					
<i>Number of Hybrids</i>				0					

River Code: 15-031	Stream: Quarry Creek	Sample Date: 2004
River Mile: 0.10	Location: Markell Rd.	Date Range: 07/14/2004
Time Fished:	Drainage: 3.4 sq mi	
Dist Fished: 0.15 km	Basin: Chagrin River	No of Passes: 1
		Sampler Type: E

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Rainbow Trout	E		N	10	20.00	3.45			
Golden Shiner	N	I	M T	3	6.00	1.03			
River Chub	N	I	N I	1	2.00	0.34			
Western Blacknose Dace	N	G	S T	49	98.00	16.90			
Longnose Dace	N	I	S R	4	8.00	1.38			
Creek Chub	N	G	N T	37	74.00	12.76			
Striped Shiner	N	I	S	7	14.00	2.41			
Common Shiner	N	I	S	31	62.00	10.69			
Sand Shiner	N	I	M M	41	82.00	14.14			
Silverjaw Minnow	N	I	M	19	38.00	6.55			
Fathead Minnow	N	O	C T	5	10.00	1.72			
Bluntnose Minnow	N	O	C T	9	18.00	3.10			
Central Stoneroller	N	H	N	16	32.00	5.52			
Black Bullhead		I	C P	1	2.00	0.34			
Stonecat Madtom		I	C I	2	4.00	0.69			
Largemouth Bass	F	C	C	1	2.00	0.34			
Green Sunfish	S	I	C T	4	8.00	1.38			
Bluegill Sunfish	S	I	C P	21	42.00	7.24			
Johnny Darter	D	I	C	11	22.00	3.79			
Rainbow Darter	D	I	S M	10	20.00	3.45			
Fantail Darter	D	I	C	8	16.00	2.76			
<i>Mile Total</i>				290	580.00				
<i>Number of Species</i>				21					
<i>Number of Hybrids</i>				0					

Species List

River Code: 15-032 River Mile: 0.10 Time Fished: Dist Fished: 0.15 km	Stream: Stony Brook Location: at mouth, upst. St. Rt. 615 Drainage: 3.8 sq mi Basin: Chagrin River	Sample Date: 2004 Date Range: 07/09/2004 No of Passes: 1 Sampler Type: E
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Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Western Blacknose Dace	N	G	S	T	195	390.00	21.81			
Creek Chub	N	G	N	T	107	214.00	11.97			
Common Shiner	N	I	S		2	4.00	0.22			
Bluntnose Minnow	N	O	C	T	2	4.00	0.22			
Central Stoneroller	N	H	N		417	834.00	46.64			
Johnny Darter	D	I	C		22	44.00	2.46			
Rainbow Darter	D	I	S	M	149	298.00	16.67			
<i>Mile Total</i>					894	1,788.00				
<i>Number of Species</i>					7					
<i>Number of Hybrids</i>					0					

Species List

River Code: 15-033	Stream: Pierson Creek	Sample Date: 2004
River Mile: 0.10	Location: Booth Rd.	Date Range: 07/08/2004
Time Fished:	Drainage: 1.9 sq mi	
Dist Fished: 0.11 km	Basin: Chagrin River	No of Passes: 1
		Sampler Type: E

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Rainbow Trout	E		N	18	49.09	8.41			
River Chub	N	I	N I	1	2.73	0.47			
Western Blacknose Dace	N	G	S T	103	280.91	48.13			
Longnose Dace	N	I	S R	13	35.46	6.07			
Creek Chub	N	G	N T	9	24.55	4.21			
Common Shiner	N	I	S	1	2.73	0.47			
Central Stoneroller	N	H	N	13	35.46	6.07			
Green Sunfish	S	I	C T	1	2.73	0.47			
Pumpkinseed Sunfish	S	I	C P	1	2.73	0.47			
Rainbow Darter	D	I	S M	45	122.73	21.03			
Fantail Darter	D	I	C	9	24.55	4.21			
<i>Mile Total</i>				214	583.64				
<i>Number of Species</i>				11					
<i>Number of Hybrids</i>				0					

Species List

River Code: 15-037	Stream: Trib. to Chagrin R. (RM 38.32)	Sample Date: 2004
River Mile: 0.70	Location: Winchester Rd.	Date Range: 07/07/2004
Time Fished:	Drainage: 1.4 sq mi	
Dist Fished: 0.10 km	Basin: Chagrin River	No of Passes: 1
		Sampler Type: E

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Western Blacknose Dace	N	G	S	T	157	471.00	55.67			
Creek Chub	N	G	N	T	59	177.00	20.92			
Central Stoneroller	N	H	N		64	192.00	22.70			
Green Sunfish	S	I	C	T	1	3.00	0.35			
Bluegill Sunfish	S	I	C	P	1	3.00	0.35			
<i>Mile Total</i>					282	846.00				
<i>Number of Species</i>					5					
<i>Number of Hybrids</i>					0					

Species List

River Code: 15-038 River Mile: 0.10 Time Fished: Dist Fished: 0.13 km	Stream: Trib. to E. Br. Chagrin R. (RM 10.13) Location: upst. Wisner Rd. Drainage: 4.6 sq mi Basin: Chagrin River	Sample Date: 2004 Date Range: 07/08/2004 No of Passes: 1 Sampler Type: E
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Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Rainbow Trout	E		N		10	23.08	6.29			
Northern Hog Sucker	R	I	S	M	3	6.92	1.89			
White Sucker	W	O	S	T	4	9.23	2.52			
Western Blacknose Dace	N	G	S	T	20	46.15	12.58			
Longnose Dace	N	I	S	R	14	32.31	8.81			
Creek Chub	N	G	N	T	44	101.54	27.67			
Common Shiner	N	I	S		8	18.46	5.03			
Bluntnose Minnow	N	O	C	T	3	6.92	1.89			
Central Stoneroller	N	H	N		29	66.92	18.24			
Bluegill Sunfish	S	I	C	P	9	20.77	5.66			
Pumpkinseed Sunfish	S	I	C	P	1	2.31	0.63			
Johnny Darter	D	I	C		2	4.62	1.26			
Rainbow Darter	D	I	S	M	6	13.85	3.77			
Fantail Darter	D	I	C		6	13.85	3.77			
<i>Mile Total</i>					159	366.92				
<i>Number of Species</i>					14					
<i>Number of Hybrids</i>					0					

Species List

River Code: 15-039 River Mile: 0.20 Time Fished: Dist Fished: 0.13 km	Stream: Trib. to E. Br. Chagrin R. (RM 10.60) Location: Wisner Rd., at dead end road Drainage: 2.0 sq mi Basin: Chagrin River	Sample Date: 2004 Date Range: 07/08/2004 No of Passes: 1 Sampler Type: E
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Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Rainbow Trout	E		N		16	36.92	10.39			
Western Blacknose Dace	N	G	S	T	86	198.46	55.84			
Creek Chub	N	G	N	T	20	46.15	12.99			
Central Stoneroller	N	H	N		4	9.23	2.60			
Rainbow Darter	D	I	S	M	16	36.92	10.39			
Fantail Darter	D	I	C		12	27.69	7.79			
<i>Mile Total</i>					154	355.39				
<i>Number of Species</i>					6					
<i>Number of Hybrids</i>					0					

Species List

River Code: 15-040 River Mile: 0.10 Time Fished: Dist Fished: 0.12 km	Stream: Trib. to E. Br. Chagrin R. (RM 14.62) Location: Heath Rd. Drainage: 1.7 sq mi Basin: Chagrin River	Sample Date: 2004 Date Range: 07/15/2004 No of Passes: 1 Sampler Type: E
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Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Western Blacknose Dace	N	G	S	T	73	182.50	32.88			
Creek Chub	N	G	N	T	87	217.50	39.19			
Central Stoneroller	N	H	N		10	25.00	4.50			
Johnny Darter	D	I	C		7	17.50	3.15			
Rainbow Darter	D	I	S	M	5	12.50	2.25			
Fantail Darter	D	I	C		40	100.00	18.02			
<i>Mile Total</i>					222	555.00				
<i>Number of Species</i>					6					
<i>Number of Hybrids</i>					0					

River Code: 15-041	Stream: Trib. to E. Br. Chagrin R. (RM 14.80)	Sample Date: 2004
River Mile: 0.10	Location: Sperry Rd.	Date Range: 07/08/2004
Time Fished:	Drainage: 2.0 sq mi	
Dist Fished: 0.09 km	Basin: Chagrin River	No of Passes: 1
		Sampler Type: E

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Northern Hog Sucker	R	I	S	M	3	10.00	2.21			
White Sucker	W	O	S	T	2	6.67	1.47			
Western Blacknose Dace	N	G	S	T	58	193.33	42.65			
Creek Chub	N	G	N	T	25	83.33	18.38			
South. Redbelly Dace	N	H	S		2	6.67	1.47			
Bluntnose Minnow	N	O	C	T	8	26.67	5.88			
Central Stoneroller	N	H	N		13	43.33	9.56			
Green Sunfish	S	I	C	T	1	3.33	0.74			
Bluegill Sunfish	S	I	C	P	6	20.00	4.41			
Johnny Darter	D	I	C		5	16.67	3.68			
Rainbow Darter	D	I	S	M	8	26.67	5.88			
Fantail Darter	D	I	C		5	16.67	3.68			
<i>Mile Total</i>					136	453.33				
<i>Number of Species</i>					12					
<i>Number of Hybrids</i>					0					

Species List

River Code: 15-042	Stream: Trib. to E. Br. Chagrin R. (RM 15.35)	Sample Date: 2004
River Mile: 0.20	Location: Sperry Rd.	Date Range: 07/07/2004
Time Fished:	Drainage: 1.5 sq mi	
Dist Fished: 0.14 km	Basin: Chagrin River	No of Passes: 1
		Sampler Type: E

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
White Sucker	W	O	S	T	3	6.43	0.92			
Golden Shiner	N	I	M	T	1	2.14	0.31			
Western Blacknose Dace	N	G	S	T	161	345.00	49.39			
Creek Chub	N	G	N	T	85	182.14	26.07			
Striped Shiner	N	I	S		5	10.71	1.53			
Common Shiner	N	I	S		1	2.14	0.31			
Central Stoneroller	N	H	N		41	87.86	12.58			
Yellow Bullhead		I	C	T	1	2.14	0.31			
Largemouth Bass	F	C	C		2	4.29	0.61			
Bluegill Sunfish	S	I	C	P	17	36.43	5.21			
Johnny Darter	D	I	C		3	6.43	0.92			
Rainbow Darter	D	I	S	M	3	6.43	0.92			
Fantail Darter	D	I	C		3	6.43	0.92			
<i>Mile Total</i>					326	698.57				
<i>Number of Species</i>					13					
<i>Number of Hybrids</i>					0					

Species List

River Code: 15-043 River Mile: 0.10 Time Fished: Dist Fished: 0.15 km	Stream: Trib. to E. Br. Chagrin R. (RM 16.20) Location: Wilson Mills Rd. Drainage: 4.4 sq mi Basin: Chagrin River	Sample Date: 2004 Date Range: 07/07/2004 No of Passes: 1 Sampler Type: E
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Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Amer Brook Lamprey		F	N	R	3	6.00	0.72			
Rainbow Trout	E		N		2	4.00	0.48			
Northern Hog Sucker	R	I	S	M	6	12.00	1.44			
Golden Shiner	N	I	M	T	1	2.00	0.24			
Western Blacknose Dace	N	G	S	T	180	360.00	43.17			
Longnose Dace	N	I	S	R	15	30.00	3.60			
Creek Chub	N	G	N	T	61	122.00	14.63			
Striped Shiner	N	I	S		1	2.00	0.24			
Common Shiner	N	I	S		4	8.00	0.96			
Central Stoneroller	N	H	N		34	68.00	8.15			
Johnny Darter	D	I	C		27	54.00	6.47			
Rainbow Darter	D	I	S	M	71	142.00	17.03			
Fantail Darter	D	I	C		12	24.00	2.88			
<i>Mile Total</i>					417	834.00				
<i>Number of Species</i>					13					
<i>Number of Hybrids</i>					0					

Species List

River Code: 15-044	Stream: North Branch McFarland Creek	Sample Date: 2004
River Mile: 0.10	Location: Chagrin Rd.	Date Range: 06/30/2004
Time Fished:	Drainage: 4.0 sq mi	
Dist Fished: 0.15 km	Basin: Chagrin River	No of Passes: 1
		Sampler Type: E

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
White Sucker	W	O	S	T	17	34.00	3.38			
Western Blacknose Dace	N	G	S	T	244	488.00	48.51			
Creek Chub	N	G	N	T	92	184.00	18.29			
Striped Shiner	N	I	S		1	2.00	0.20			
Bluntnose Minnow	N	O	C	T	31	62.00	6.16			
Central Stoneroller	N	H	N		73	146.00	14.51			
Johnny Darter	D	I	C		41	82.00	8.15			
Rainbow Darter	D	I	S	M	2	4.00	0.40			
Brook Stickleback		I	C		2	4.00	0.40			
<i>Mile Total</i>					503	1,006.00				
<i>Number of Species</i>					9					
<i>Number of Hybrids</i>					0					

Species List

River Code: 15-045	Stream: Trib. to Smith Creek (RM 2.70)	Sample Date: 2004
River Mile: 0.60	Location: Crackel Rd.	Date Range: 07/01/2004
Time Fished:	Drainage: 2.2 sq mi	
Dist Fished: 0.10 km	Basin: Chagrin River	No of Passes: 1
		Sampler Type: E

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Western Blacknose Dace	N	G	S	T	79	237.00	45.14			
Creek Chub	N	G	N	T	52	156.00	29.71			
Bluegill Sunfish	S	I	C	P	1	3.00	0.57			
Johnny Darter	D	I	C		41	123.00	23.43			
Brook Stickleback		I	C		2	6.00	1.14			
<i>Mile Total</i>					175	525.00				
<i>Number of Species</i>					5					
<i>Number of Hybrids</i>					0					

Dist Fished: 9.50 km No of Streams: 24 No of Passes: 58								Grand Total of All Streams Date Range: 08/29/2003 Thru: 08/05/2004		
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Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Amer Brook Lamprey		F	N R	13	0.38	0.05	0.01	0.03	12.44
Rainbow Trout	E		N	72	2.79	0.40	0.00	0.02	10.00
Central Mudminnow		I	C T	2	0.08	0.01			
Redfin Pickerel		P	M P	47	1.58	0.23	0.01	0.03	21.33
Black Redhorse	R	I	S I	17	0.44	0.06	0.15	0.73	162.24
Golden Redhorse	R	I	S M	29	0.75	0.11	0.31	1.48	192.07
Northern Hog Sucker	R	I	S M	1,563	41.80	5.99	7.87	37.59	91.53
White Sucker	W	O	S T	721	22.69	3.25	2.02	9.65	96.50
Common Carp	G	O	M T	60	1.91	0.27	2.84	13.59	1,434.81
Goldfish	G	O	M T	1	0.03	0.00	0.01	0.03	100.00
Golden Shiner	N	I	M T	7	0.24	0.03			
River Chub	N	I	N I	702	18.40	2.64	0.63	3.01	16.40
Bigeye Chub	N	I	S I	11	0.28	0.04	0.00	0.01	3.24
Western Blacknose Dace	N	G	S T	3,184	115.19	16.51	0.21	1.01	3.40
Longnose Dace	N	I	S R	94	3.07	0.44	0.01	0.04	2.96
Creek Chub	N	G	N T	2,295	81.29	11.65	0.62	2.97	15.88
South. Redbelly Dace	N	H	S	2	0.11	0.02			
Redside Dace	N	I	S I	21	0.72	0.10			
Emerald Shiner	N	I	M	2	0.05	0.01	0.00	0.00	4.00
Silver Shiner	N	I	S I	3	0.08	0.01	0.00	0.00	1.33
Rosyface Shiner	N	I	S I	75	1.94	0.28	0.01	0.04	1.97
Striped Shiner	N	I	S	859	23.46	3.36	0.57	2.71	12.18
Common Shiner	N	I	S	981	29.24	4.19	0.37	1.79	10.37
Spotfin Shiner	N	I	M	81	2.12	0.30	0.02	0.08	3.52
Sand Shiner	N	I	M M	235	6.47	0.93	0.02	0.09	1.70
Silverjaw Minnow	N	I	M	90	2.50	0.36	0.01	0.03	2.03
Fathead Minnow	N	O	C T	27	0.92	0.13	0.00	0.01	2.71
Bluntnose Minnow	N	O	C T	2,093	59.94	8.59	0.20	0.96	2.15
Central Stoneroller	N	H	N	4,238	130.20	18.67	1.93	9.23	13.01
Common Sh X Rosyface Sh		I		1	0.03	0.00	0.00	0.00	10.00
Channel Catfish	F		C	1	0.03	0.00	0.07	0.33	1,000.00
Yellow Bullhead		I	C T	182	5.56	0.80	0.52	2.46	68.17
Brown Bullhead		I	C T	6	0.21	0.03			
Black Bullhead		I	C P	1	0.03	0.00			
Stonecat Madtom		I	C I	81	2.14	0.31	0.11	0.53	25.10
White Bass	F	P	M	10	0.26	0.04			
White Crappie	S	I	C	8	0.24	0.03	0.02	0.10	71.60
Black Crappie	S	I	C	11	0.32	0.05	0.04	0.17	56.40
Rock Bass	S	C	C	250	6.71	0.96	0.56	2.68	44.54
Smallmouth Bass	F	C	C M	254	6.78	0.97	1.29	6.17	90.50
Largemouth Bass	F	C	C	62	2.03	0.29	0.01	0.04	5.08
Green Sunfish	S	I	C T	194	5.73	0.82	0.07	0.33	8.34
Bluegill Sunfish	S	I	C P	347	11.50	1.65	0.08	0.37	8.76
Pumpkinseed Sunfish	S	I	C P	130	4.00	0.57	0.12	0.57	17.31
Bluegill X Pumpkinseed				3	0.11	0.02			
Green Sf X Bluegill Sf				5	0.14	0.02	0.01	0.03	21.20
Green Sf X Hybrid				5	0.16	0.02	0.00	0.00	4.50

Species List

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Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Hybrid X Sunfish				15	0.51	0.07	0.02	0.07	13.80
Yellow Perch			M	12	0.39	0.06	0.00	0.00	2.50
Blackside Darter	D	I	S	2	0.05	0.01	0.00	0.00	5.00
Logperch	D	I	S M	2	0.05	0.01	0.00	0.01	16.00
Johnny Darter	D	I	C	1,003	34.35	4.93	0.03	0.16	1.33
Greenside Darter	D	I	S M	178	4.83	0.69	0.03	0.15	3.93
Rainbow Darter	D	I	S M	1,729	56.13	8.05	0.08	0.39	1.56
Fantail Darter	D	I	C	170	5.97	0.86	0.00	0.02	1.44
Freshwater Drum			M P	3	0.08	0.01	0.04	0.18	226.67
Round Goby				13	0.34	0.05	0.03	0.13	36.92
Brook Stickleback		I	C	4	0.17	0.02			
<i>Grand Total</i>				22,207	697.54		20.94		
<i>Number of Species</i>				53					
<i>Number of Hybrids</i>				5					

Appendix 8

Chagrin River Watershed Sample Site Macroinvertebrate Taxa Lists

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Collection Date: 08/11/2004 River Code: 15-001 RM: 28.80 Site: Chagrin River

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01801	<i>Turbellaria</i>	98 +	80420	<i>Cricotopus (C.) bicinctus</i>	56
03600	<i>Oligochaeta</i>	80	81650	<i>Parametriocnemus sp</i>	56
05800	<i>Caecidotea sp</i>	+	82141	<i>Thienemanniella xena</i>	152
08250	<i>Orconectes (Procericambarus) rusticus</i>	+	82220	<i>Tvetenia discoloripes group</i>	56 +
08601	<i>Hydrachnidia</i>	8	82710	<i>Chironomus (C.) sp</i>	56
11014	<i>Acentrella turbida</i>	+	83040	<i>Dicrotendipes neomodestus</i>	56
11115	<i>Baetis tricaudatus</i>	+	84450	<i>Polypedilum (Uresipedilum) flavum</i>	1684 +
11120	<i>Baetis flavistriga</i>	77 +	84460	<i>Polypedilum (P.) fallax group</i>	56
11130	<i>Baetis intercalaris</i>	160 +	85615	<i>Rheotanytarsus pellucidus</i>	168
12200	<i>Isonychia sp</i>	45 +	85625	<i>Rheotanytarsus sp</i>	3762 +
12924	<i>Heptagenia flavescens</i>	+	86401	<i>Atherix lantha</i>	2 +
13400	<i>Stenacron sp</i>	+	95100	<i>Physella sp</i>	+
13521	<i>Stenonema femoratum</i>	+	96900	<i>Ferrissia sp</i>	34 +
13561	<i>Maccaffertium pulchellum</i>	154 +			
13570	<i>Maccaffertium terminatum</i>	5	No. Quantitative Taxa: 37		Total Taxa: 57
16324	<i>Serratella deficiens</i>	34	No. Qualitative Taxa: 42		ICI: 48
17200	<i>Caenis sp</i>	3	Number of Organisms: 8630		Qual EPT: 22
21200	<i>Calopteryx sp</i>	+			
23909	<i>Boyeria vinosa</i>	+			
34300	<i>Neoperla clymene complex</i>	+			
34410	<i>Paragnetina media</i>	2 +			
47600	<i>Sialis sp</i>	+			
48410	<i>Corydalus cornutus</i>	2 +			
50315	<i>Chimarra obscura</i>	3 +			
51400	<i>Nyctiophylax sp</i>	+			
51600	<i>Polycentropus sp</i>	+			
52200	<i>Cheumatopsyche sp</i>	701 +			
52430	<i>Ceratopsyche morosa group</i>	258 +			
52450	<i>Ceratopsyche sparna</i>	215 +			
52530	<i>Hydropsyche depravata group</i>	205 +			
52540	<i>Hydropsyche dicantha</i>	84 +			
54000	<i>Leucotrichia pictipes</i>	+			
57900	<i>Pycnopsyche sp</i>	+			
58505	<i>Helicopsyche borealis</i>	+			
59970	<i>Petrophila sp</i>	+			
68075	<i>Psephenus herricki</i>	+			
68601	<i>Ancyronyx variegata</i>	16			
68901	<i>Macronychus glabratus</i>	9 +			
69400	<i>Stenelmis sp</i>	77 +			
74100	<i>Simulium sp</i>	+			
77500	<i>Conchapelopia sp</i>	168 +			
78450	<i>Nilotanypus fimbriatus</i>	32 +			
80351	<i>Corynoneura n.sp I</i>	8			
80370	<i>Corynoneura lobata</i>	48			

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Collection Date: 08/11/2004 River Code: 15-001 RM: 25.30 Site: Chagrin River Chagrin Blvd.

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01801	<i>Turbellaria</i>	1 +	78450	<i>Nilotanypus fimbriatus</i>	28
03045	<i>Fredericella indica</i>	+	80310	<i>Cardiocladius obscurus</i>	+
03600	<i>Oligochaeta</i>	+	80351	<i>Corynoneura n.sp 1</i>	12
05800	<i>Caecidotea sp</i>	1 +	80370	<i>Corynoneura lobata</i>	4
06700	<i>Crangonyx sp</i>	+	82141	<i>Thienemanniella xena</i>	4
08250	<i>Orconectes (Procericambarus) rusticus</i>	+	82200	<i>Tvetenia bavarica group</i>	24
08601	<i>Hydrachnidia</i>	9	82220	<i>Tvetenia discoloripes group</i>	71 +
11014	<i>Acentrella turbida</i>	+	82820	<i>Cryptochironomus sp</i>	+
11115	<i>Baetis tricaudatus</i>	5 +	83820	<i>Microtendipes "caelum" (sensu Simpson & Bode, 1980)</i>	47
11120	<i>Baetis flavistriga</i>	202 +	84450	<i>Polypedilum (Uresipedilum) flavum</i>	777 +
11130	<i>Baetis intercalaris</i>	274 +	84470	<i>Polypedilum (P.) illinoense</i>	+
12200	<i>Isonychia sp</i>	6 +	84480	<i>Polypedilum (P.) laetum group</i>	+
12924	<i>Heptagenia flavescens</i>	+	84540	<i>Polypedilum (Tripodura) scalaenum group</i>	118
13100	<i>Nixe sp</i>	+	84612	<i>Saetheria tylus</i>	+
13400	<i>Stenacron sp</i>	16 +	85625	<i>Rheotanytarsus sp</i>	1036 +
13521	<i>Stenonema femoratum</i>	+	86401	<i>Atherix lantha</i>	+
13561	<i>Maccaffertium pulchellum</i>	199 +	87540	<i>Hemerodromia sp</i>	4
13570	<i>Maccaffertium terminatum</i>	8	93200	<i>Hydrobiidae</i>	+
17200	<i>Caenis sp</i>	+	96900	<i>Ferrissia sp</i>	+
21200	<i>Calopteryx sp</i>	+	98600	<i>Sphaerium sp</i>	+
21300	<i>Hetaerina sp</i>	+			
22300	<i>Argia sp</i>	+			
23909	<i>Boyeria vinosa</i>	+	No. Quantitative Taxa: 33		Total Taxa: 64
25510	<i>Stylogomphus albistylus</i>	+	No. Qualitative Taxa: 52		ICI: 50
48410	<i>Corydalus cornutus</i>	+	Number of Organisms: 4494		Qual EPT: 18
48610	<i>Nigronia fasciatus</i>	2			
50906	<i>Psychomyia flavida</i>	+			
51600	<i>Polycentropus sp</i>	+			
52200	<i>Cheumatopsyche sp</i>	705 +			
52430	<i>Ceratopsyche morosa group</i>	556 +			
52450	<i>Ceratopsyche sparna</i>	54 +			
52530	<i>Hydropsyche depravata group</i>	107			
52540	<i>Hydropsyche dicantha</i>	62 +			
54000	<i>Leucotrichia pictipes</i>	+			
59970	<i>Petrophila sp</i>	+			
68075	<i>Psephenus herricki</i>	1 +			
68601	<i>Ancyronyx variegata</i>	5 +			
68901	<i>Macronychus glabratus</i>	2 +			
69200	<i>Optioservus sp</i>	+			
69400	<i>Stenelmis sp</i>	103 +			
70600	<i>Antocha sp</i>	26 +			
74100	<i>Simulium sp</i>	25 +			
77800	<i>Helopelopia sp</i>	+			
78401	<i>Natarsia species A (sensu Roback, 1978)</i>	+			

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Collection Date: 08/11/2004 River Code: 15-001 RM: 2.50 Site: Chagrin River at park, off Reeves Rd.

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01801	<i>Turbellaria</i>	+	82220	<i>Tvetenia discoloripes group</i>	+
03040	<i>Fredericella sp</i>	+	82730	<i>Chironomus (C.) decorus group</i>	+
03360	<i>Plumatella sp</i>	+	82820	<i>Cryptochironomus sp</i>	+
03600	<i>Oligochaeta</i>	+	83820	<i>Microtendipes "caelum" (sensu Simpson & Bode, 1980)</i>	+
05800	<i>Caecidotea sp</i>	+	84300	<i>Phaenopsectra obediens group</i>	+
06700	<i>Crangonyx sp</i>	+	84450	<i>Polypedilum (Uresipedilum) flavum</i>	+
08601	<i>Hydrachnidia</i>	+	84460	<i>Polypedilum (P.) fallax group</i>	+
11014	<i>Acentrella turbida</i>	+	84470	<i>Polypedilum (P.) illinoense</i>	+
11115	<i>Baetis tricaudatus</i>	+	85201	<i>Cladotanytarsus species group A</i>	+
11120	<i>Baetis flavistriga</i>	+	85615	<i>Rheotanytarsus pellucidus</i>	+
11130	<i>Baetis intercalaris</i>	+	85625	<i>Rheotanytarsus sp</i>	+
11251	<i>Centroptilum sp (w/ hindwing pads)</i>	+	85821	<i>Tanytarsus glabrescens group sp 7</i>	+
13000	<i>Leucrocota sp</i>	+	89700	<i>Limnophora sp</i>	+
13400	<i>Stenacron sp</i>	+	95100	<i>Physella sp</i>	+
13521	<i>Stenonema femoratum</i>	+	96900	<i>Ferrissia sp</i>	+
13561	<i>Maccaffertium pulchellum</i>	+	98600	<i>Sphaerium sp</i>	+
13570	<i>Maccaffertium terminatum</i>	+			
22001	<i>Coenagrionidae</i>	+			
22300	<i>Argia sp</i>	+	No. Quantitative Taxa: 0	Total Taxa: 59	
24900	<i>Gomphus sp</i>	+	No. Qualitative Taxa: 59	ICI:	
48410	<i>Corydalus cornutus</i>	+	Number of Organisms: 0	Qual EPT: 17	
52200	<i>Cheumatopsyche sp</i>	+			
52430	<i>Ceratopsyche morosa group</i>	+			
52450	<i>Ceratopsyche sparna</i>	+			
52540	<i>Hydropsyche dicantha</i>	+			
53800	<i>Hydroptila sp</i>	+			
54000	<i>Leucotrichia pictipes</i>	+			
59140	<i>Ceraclea maculata</i>	+			
59970	<i>Petrophila sp</i>	+			
60900	<i>Peltodytes sp</i>	+			
63900	<i>Laccophilus sp</i>	+			
65800	<i>Berosus sp</i>	+			
68075	<i>Psephenus herricki</i>	+			
69400	<i>Stenelmis sp</i>	+			
74100	<i>Simulium sp</i>	+			
77120	<i>Ablabesmyia mallochi</i>	+			
77750	<i>Hayesomyia senata or Thienemannimyia norena</i>	+			
78402	<i>Natarsia baltimoreus</i>	+			
80310	<i>Cardiocladius obscurus</i>	+			
80420	<i>Cricotopus (C.) bicinctus</i>	+			
80430	<i>Cricotopus (C.) tremulus group</i>	+			
80440	<i>Cricotopus (C.) trifascia</i>	+			
81231	<i>Nanocladius (N.) crassicornus or N. (N.) "rectinervis"</i>	+			

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/04/2003 River Code: 15-001 RM: 49.20 Site: Chagrin River upst. Woodiebrook Rd.

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01801	<i>Turbellaria</i>	+			
03600	<i>Oligochaeta</i>	+			
04660	<i>Helobdella sp</i>	+			
04935	<i>Erpobdella punctata punctata</i>	+			
13590	<i>Maccaffertium vicarium</i>	+			
22001	<i>Coenagrionidae</i>	+			
23618	<i>Aeshna umbrosa</i>	+			
28500	<i>Libellula sp</i>	+			
42700	<i>Belostoma sp</i>	+			
60800	<i>Halipus sp</i>	+			
60900	<i>Peltodytes sp</i>	+			
63300	<i>Hydroporus sp</i>	+			
67800	<i>Tropisternus sp</i>	+			
69400	<i>Stenelmis sp</i>	+			
72600	<i>Aedes sp</i>	+			
72700	<i>Anopheles sp</i>	+			
72900	<i>Culex sp</i>	+			
77125	<i>Ablabesmyia monilis</i>	+			
80410	<i>Cricotopus (C.) sp</i>	+			
83002	<i>Dicrotendipes modestus</i>	+			
84210	<i>Paratendipes albimanus or P. duplicatus</i>	+			
84315	<i>Phaenopsectra flavipes</i>	+			
84470	<i>Polypedilum (P.) illinoense</i>	+			
95100	<i>Physella sp</i>	+			
95900	<i>Gyraulus sp</i>	+			
96264	<i>Planorbella (Pierosoma) pilsbryi</i>	+			
98600	<i>Sphaerium sp</i>	+			

No. Quantitative Taxa: 0	Total Taxa: 27
No. Qualitative Taxa: 27	ICI:
Number of Organisms: 0	Qual EPT: 1

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/04/2003 River Code: 15-001 RM: 46.50 Site: Chagrin River

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
00401	<i>Spongillidae</i>	+			
01801	<i>Turbellaria</i>	+			
03337	<i>Hyalinella punctata</i>	+			
03600	<i>Oligochaeta</i>	+			
04666	<i>Helobdella triserialis</i>	+			
06201	<i>Hyalella azteca</i>	+			
22001	<i>Coenagrionidae</i>	+			
28705	<i>Pachydiplax longipennis</i>	+			
43300	<i>Ranatra sp</i>	+			
45900	<i>Notonecta sp</i>	+			
60800	<i>Haliplus sp</i>	+			
60900	<i>Peltodytes sp</i>	+			
63400	<i>Hydrovatus sp</i>	+			
67700	<i>Paracymus sp</i>	+			
67800	<i>Tropisternus sp</i>	+			
68702	<i>Dubiraphia bivittata</i>	+			
74501	<i>Ceratopogonidae</i>	+			
77140	<i>Ablabesmyia peleensis</i>	+			
83002	<i>Dicrotendipes modestus</i>	+			
83051	<i>Dicrotendipes simpsoni</i>	+			
83158	<i>Endochironomus nigricans</i>	+			
83300	<i>Glyptotendipes (G.) sp</i>	+			
84010	<i>Parachironomus "abortivus" (sensu Simpson & Bode, 1980)</i>	+			
84470	<i>Polypedilum (P.) illinoense</i>	+			
94603	<i>Pseudosuccinea columella</i>	+			
95100	<i>Physella sp</i>	+			

No. Quantitative Taxa: 0 Total Taxa: 26
 No. Qualitative Taxa: 26 ICI:
 Number of Organisms: 0 Qual EPT: 0

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/04/2003 River Code: 15-001 RM: 45.30 Site: Chagrin River

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01801	<i>Turbellaria</i>	+			
08250	<i>Orconectes (Procericambarus) rusticus</i>	+			
11120	<i>Baetis flavistriga</i>	+			
11430	<i>Dipheter hageni</i>	+			
12200	<i>Isonychia sp</i>	+			
12501	<i>Heptageniidae</i>	+			
21200	<i>Calopteryx sp</i>	+			
23909	<i>Boyeria vinosa</i>	+			
34130	<i>Acroneuria frisoni</i>	+			
34700	<i>Agnatina capitata complex</i>	+			
47600	<i>Sialis sp</i>	+			
50301	<i>Chimarra aterrima</i>	+			
52200	<i>Cheumatopsyche sp</i>	+			
52530	<i>Hydropsyche depravata group</i>	+			
57400	<i>Neophylax sp</i>	+			
57900	<i>Pycnopsyche sp</i>	+			
66500	<i>Enochrus sp</i>	+			
68075	<i>Psephenus herricki</i>	+			
68901	<i>Macronychus glabratus</i>	+			
69400	<i>Stenelmis sp</i>	+			
71100	<i>Hexatoma sp</i>	+			
74100	<i>Simulium sp</i>	+			
77500	<i>Conchapelopia sp</i>	+			
77800	<i>Helopelopia sp</i>	+			
81650	<i>Parametriocnemus sp</i>	+			
81825	<i>Rheocricotopus (Psilocricotopus) robacki</i>	+			
82820	<i>Cryptochironomus sp</i>	+			
84440	<i>Polypedilum (Uresipedilum) aviceps</i>	+			
84450	<i>Polypedilum (Uresipedilum) flavum</i>	+			
84700	<i>Stenochironomus sp</i>	+			
85400	<i>Micropsectra sp</i>	+			
85625	<i>Rheotanytarsus sp</i>	+			
93900	<i>Elimia sp</i>	+			
98600	<i>Sphaerium sp</i>	+			

No. Quantitative Taxa: 0 Total Taxa: 34
 No. Qualitative Taxa: 34 ICI:
 Number of Organisms: 0 Qual EPT: 11

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/04/2003 River Code: 15-001 RM: 42.80 Site: Chagrin River

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
00653	<i>Eunapius fragilis</i>	+	81650	<i>Parametriocnemus sp</i>	+
01801	<i>Turbellaria</i>	+	82820	<i>Cryptochironomus sp</i>	+
03600	<i>Oligochaeta</i>	+	83840	<i>Microtendipes pedellus group</i>	+
04637	<i>Batracobdella phalera</i>	+	84315	<i>Phaenopsectra flavipes</i>	+
04685	<i>Placobdella ornata</i>	+	84450	<i>Polypedilum (Uresipedilum) flavum</i>	+
05800	<i>Caecidotea sp</i>	+	84460	<i>Polypedilum (P.) fallax group</i>	+
06201	<i>Hyaella azteca</i>	+	84750	<i>Stictochironomus sp</i>	+
06700	<i>Crangonyx sp</i>	+	85500	<i>Paratanytarsus sp</i>	+
08250	<i>Orconectes (Procericambarus) rusticus</i>	+	85625	<i>Rheotanytarsus sp</i>	+
11120	<i>Baetis flavistriga</i>	+	85800	<i>Tanytarsus sp</i>	+
11670	<i>Procloeon viridoculare</i>	+	86100	<i>Chrysops sp</i>	+
13400	<i>Stenacron sp</i>	+	89716	<i>Limnophora discreta</i>	+
13561	<i>Maccaffertium pulchellum</i>	+	93200	<i>Hydrobiidae</i>	+
21200	<i>Calopteryx sp</i>	+	93900	<i>Elimia sp</i>	+
22001	<i>Coenagrionidae</i>	+	95100	<i>Physella sp</i>	+
23600	<i>Aeshna sp</i>	+	96002	<i>Helisoma anceps anceps</i>	+
23909	<i>Boyeria vinosa</i>	+	98600	<i>Sphaerium sp</i>	+
24900	<i>Gomphus sp</i>	+	99160	<i>Anodontoides ferussacianus</i>	+
43300	<i>Ranatra sp</i>	+			
45400	<i>Trichocorixa sp</i>	+	No. Quantitative Taxa: 0		Total Taxa: 62
48620	<i>Nigronia serricornis</i>	+	No. Qualitative Taxa: 62		ICI:
50301	<i>Chimarra aterrima</i>	+	Number of Organisms: 0		Qual EPT: 12
51400	<i>Nyctiophylax sp</i>	+			
51600	<i>Polycentropus sp</i>	+			
52200	<i>Cheumatopsyche sp</i>	+			
52430	<i>Ceratopsyche morosa group</i>	+			
52530	<i>Hydropsyche depravata group</i>	+			
57900	<i>Pycnopsyche sp</i>	+			
59310	<i>Mystacides sepulchralis</i>	+			
59970	<i>Petrophila sp</i>	+			
60900	<i>Peltodytes sp</i>	+			
68025	<i>Ectopria sp</i>	+			
68075	<i>Psephenus herricki</i>	+			
68708	<i>Dubiraphia vittata group</i>	+			
68901	<i>Macronychus glabratus</i>	+			
69400	<i>Stenelmis sp</i>	+			
71100	<i>Hexatoma sp</i>	+			
71900	<i>Tipula sp</i>	+			
71910	<i>Tipula abdominalis</i>	+			
74100	<i>Simulium sp</i>	+			
77120	<i>Ablabesmyia mallochi</i>	+			
77800	<i>Helopelopia sp</i>	+			
78450	<i>Nilotanypus fimbriatus</i>	+			
81280	<i>Nanocladius (Plecopteracoluthus) downesi</i>	+			

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Collection Date: 10/03/2003 River Code: 15-001 RM: 40.00 Site: Chagrin River Sperry Rd.

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01320	<i>Hydra sp</i>	144	77800	<i>Helopelopia sp</i>	218 +
03360	<i>Plumatella sp</i>	+	78350	<i>Meropelopia sp</i>	55
03600	<i>Oligochaeta</i>	184 +	80370	<i>Corynoneura lobata</i>	16
08250	<i>Orconectes (Procericambarus) rusticus</i>	+	80410	<i>Cricotopus (C.) sp</i>	55
11020	<i>Acerpenna pygmaea</i>	16	80430	<i>Cricotopus (C.) tremulus group</i>	55 +
11120	<i>Baetis flavistriga</i>	3 +	81229	<i>Nanocladius (N.) crassicornus</i>	164
11250	<i>Centroptilum sp (w/o hindwing pads)</i>	+	81270	<i>Nanocladius (N.) spiniplenus</i>	109
11650	<i>Procloeon sp (w/ hindwing pads)</i>	+	81280	<i>Nanocladius (Plecopteracoluthus) downesi</i>	2 +
11651	<i>Procloeon sp (w/o hindwing pads)</i>	+	81465	<i>Orthocladius (O.) carlatus</i>	+
12200	<i>Isonychia sp</i>	95 +	81631	<i>Parakiefferiella n.sp 1</i>	109 +
13400	<i>Stenacron sp</i>	+	81825	<i>Rheocricotopus (Psilocricotopus) robacki</i>	55
13521	<i>Stenonema femoratum</i>	+	82101	<i>Thienemanniella taurocapita</i>	64 +
13561	<i>Maccaffertium pulchellum</i>	96 +	82141	<i>Thienemanniella xena</i>	16
13590	<i>Maccaffertium vicarium</i>	4	82200	<i>Tvetenia bavarica group</i>	109 +
14900	<i>Leptophlebia sp</i>	+	83840	<i>Microtendipes pedellus group</i>	164 +
17200	<i>Caenis sp</i>	+	84450	<i>Polypedilum (Uresipedilum) flavum</i>	164
21200	<i>Calopteryx sp</i>	+	84540	<i>Polypedilum (Tripodura) scalaenum group</i>	+
22001	<i>Coenagrionidae</i>	+	84750	<i>Stictochironomus sp</i>	+
25510	<i>Stylogomphus albistylus</i>	+	85615	<i>Rheotanytarsus pellucidus</i>	273 +
34130	<i>Acroneuria frisoni</i>	1 +	85625	<i>Rheotanytarsus sp</i>	2567
34410	<i>Paragnetina media</i>	6 +	85800	<i>Tanytarsus sp</i>	+
45400	<i>Trichocorixa sp</i>	+	86100	<i>Chrysops sp</i>	+
48620	<i>Nigronia serricornis</i>	+	86401	<i>Atherix lantha</i>	+
50301	<i>Chimarra aterrima</i>	1 +	87400	<i>Stratiomys sp</i>	+
50315	<i>Chimarra obscura</i>	+	87540	<i>Hemerodromia sp</i>	200
50804	<i>Lype diversa</i>	24	96900	<i>Ferrissia sp</i>	8 +
50906	<i>Psychomyia flavida</i>	+	98200	<i>Pisidium sp</i>	+
51600	<i>Polycentropus sp</i>	+	98600	<i>Sphaerium sp</i>	+
52200	<i>Cheumatopsyche sp</i>	268 +			
52430	<i>Ceratopsyche morosa group</i>	81 +	No. Quantitative Taxa: 40		Total Taxa: 72
52530	<i>Hydropsyche depravata group</i>	13	No. Qualitative Taxa: 53		ICI: 50
55300	<i>Ptilostomis sp</i>	+	Number of Organisms: 5533		Qual EPT: 20
57900	<i>Pycnopsyche sp</i>	+			
67100	<i>Hydrobius sp</i>	+			
68075	<i>Psephenus herricki</i>	8 +			
68708	<i>Dubiraphia vittata group</i>	8			
68901	<i>Macronychus glabratus</i>	17			
69200	<i>Optioservus sp</i>	2			
69400	<i>Stenelmis sp</i>	19 +			
71910	<i>Tipula abdominalis</i>	1			
72900	<i>Culex sp</i>	+			
74100	<i>Simulium sp</i>	139 +			
74501	<i>Ceratopogonidae</i>	+			
77120	<i>Ablabesmyia mallochi</i>	+			

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Collection Date: 10/03/2003 River Code: 15-001 RM: 36.60 Site: Chagrin River

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01320	<i>Hydra sp</i>	80	70600	<i>Antocha sp</i>	8 +
03360	<i>Plumatella sp</i>	1	71100	<i>Hexatoma sp</i>	+
03600	<i>Oligochaeta</i>	64 +	71910	<i>Tipula abdominalis</i>	9 +
04664	<i>Helobdella stagnalis</i>	+	74100	<i>Simulium sp</i>	140 +
04685	<i>Placobdella ornata</i>	+	77800	<i>Helopelopia sp</i>	61 +
06700	<i>Crangonyx sp</i>	+	79100	<i>Thienemannimyia group</i>	61
08250	<i>Orconectes (Procericambarus) rusticus</i>	+	80351	<i>Corynoneura n.sp 1</i>	32
08601	<i>Hydrachnidia</i>	16 +	80370	<i>Corynoneura lobata</i>	32
11120	<i>Baetis flavistriga</i>	7 +	80410	<i>Cricotopus (C.) sp</i>	+
12200	<i>Isonychia sp</i>	214 +	81270	<i>Nanocladius (N.) spiniplenus</i>	+
13400	<i>Stenacron sp</i>	1 +	81280	<i>Nanocladius (Plecopteracoluthus) downesi</i>	+
13521	<i>Stenonema femoratum</i>	+	82101	<i>Thienemanniella taurocapita</i>	+
13561	<i>Maccaffertium pulchellum</i>	92 +	82141	<i>Thienemanniella xena</i>	32
13590	<i>Maccaffertium vicarium</i>	1 +	83300	<i>Glyptotendipes (G.) sp</i>	+
14950	<i>Leptophlebia sp or Paraleptophlebia sp</i>	1 +	83840	<i>Microtendipes pedellus group</i>	122 +
16324	<i>Serratella deficiens</i>	16	84300	<i>Phaenopsectra obediens group</i>	+
17200	<i>Caenis sp</i>	17 +	84302	<i>Phaenopsectra punctipes</i>	+
21200	<i>Calopteryx sp</i>	+	85500	<i>Paratanytarsus sp</i>	61
23909	<i>Boyeria vinosa</i>	+	85625	<i>Rheotanytarsus sp</i>	9327 +
24900	<i>Gomphus sp</i>	+	85752	<i>Sublettea coffmani</i>	+
34130	<i>Acroneuria frisoni</i>	3 +	86100	<i>Chrysops sp</i>	+
34410	<i>Paragnetina media</i>	70 +	86401	<i>Atherix lantha</i>	2 +
45400	<i>Trichocorixa sp</i>	+	87540	<i>Hemerodromia sp</i>	96 +
47600	<i>Sialis sp</i>	+	96900	<i>Ferrissia sp</i>	40 +
50315	<i>Chimarra obscura</i>	8 +	98600	<i>Sphaerium sp</i>	+
50804	<i>Lype diversa</i>	40			
50906	<i>Psychomyia flavida</i>	+	No. Quantitative Taxa: 40		Total Taxa: 69
51600	<i>Polycentropus sp</i>	+	No. Qualitative Taxa: 56		ICI: 50
52200	<i>Cheumatopsyche sp</i>	357 +	Number of Organisms: 11442		Qual EPT: 20
52430	<i>Ceratopsyche morosa group</i>	281 +			
52450	<i>Ceratopsyche sparna</i>	24 +			
52530	<i>Hydropsyche depravata group</i>	+			
57400	<i>Neophylax sp</i>	+			
57900	<i>Pycnopsyche sp</i>	16			
58505	<i>Helicopsyche borealis</i>	1 +			
59720	<i>Triaenodes ignitus</i>	+			
59970	<i>Petrophila sp</i>	+			
68025	<i>Ectopria sp</i>	+			
68075	<i>Psephenus herricki</i>	8 +			
68601	<i>Ancyronyx variegata</i>	1			
68708	<i>Dubiraphia vittata group</i>	1			
68901	<i>Macronychus glabratus</i>	88			
69200	<i>Optioservus sp</i>	+			
69400	<i>Stenelmis sp</i>	11 +			

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Collection Date: 10/02/2003 River Code: 15-001 RM: 33.50 Site: Chagrin River upst. St. Rt. 87

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
03600	<i>Oligochaeta</i>	145	71900	<i>Tipula sp</i>	+
05800	<i>Caecidotea sp</i>	1 +	71910	<i>Tipula abdominalis</i>	3
08250	<i>Orconectes (Procericambarus) rusticus</i>	+	74100	<i>Simulium sp</i>	37 +
08601	<i>Hydrachnidia</i>	+	77500	<i>Conchapelopia sp</i>	3
11014	<i>Acentrella turbida</i>	+	77750	<i>Hayesomyia senata or Thienemannimyia norena</i>	6
11120	<i>Baetis flavistriga</i>	+	80351	<i>Corynoneura n.sp I</i>	32
11250	<i>Centroptilum sp (w/o hindwing pads)</i>	+	80370	<i>Corynoneura lobata</i>	+
11651	<i>Procloeon sp (w/o hindwing pads)</i>	+	81270	<i>Nanocladius (N.) spiniplenus</i>	3
12200	<i>Isonychia sp</i>	73 +	82101	<i>Thienemanniella taurocapita</i>	64
13400	<i>Stenacron sp</i>	+	82220	<i>Tvetenia discoloripes group</i>	3
13521	<i>Stenonema femoratum</i>	3 +	83040	<i>Dicrotendipes neomodestus</i>	3
13561	<i>Maccaffertium pulchellum</i>	42 +	83840	<i>Microtendipes pedellus group</i>	+
13590	<i>Maccaffertium vicarium</i>	6 +	83900	<i>Nilothauma sp</i>	3
14950	<i>Leptophlebia sp or Paraleptophlebia sp</i>	49 +	84302	<i>Phaenopsectra punctipes</i>	+
21200	<i>Calopteryx sp</i>	+	84450	<i>Polypedilum (Uresipedilum) flavum</i>	6 +
22001	<i>Coenagrionidae</i>	+	85625	<i>Rheotanytarsus sp</i>	404 +
22300	<i>Argia sp</i>	+	86100	<i>Chrysops sp</i>	+
23909	<i>Boyeria vinosa</i>	+	87540	<i>Hemerodromia sp</i>	65
24900	<i>Gomphus sp</i>	+	95100	<i>Physella sp</i>	+
34130	<i>Acroneuria frisoni</i>	+	96900	<i>Ferrissia sp</i>	196 +
34410	<i>Paragnetina media</i>	8 +	99160	<i>Anodontoides ferussacianus</i>	+
47600	<i>Sialis sp</i>	+			
48620	<i>Nigronia serricornis</i>	+			
50315	<i>Chimarra obscura</i>	1	No. Quantitative Taxa: 35		Total Taxa: 65
50906	<i>Psychomyia flavida</i>	+	No. Qualitative Taxa: 49		ICI: 38
51300	<i>Neureclipsis sp</i>	66	Number of Organisms: 1664		Qual EPT: 21
52200	<i>Cheumatopsyche sp</i>	162 +			
52430	<i>Ceratopsyche morosa group</i>	105 +			
52450	<i>Ceratopsyche sparna</i>	23 +			
52530	<i>Hydropsyche depravata group</i>	21 +			
53501	<i>Hydroptilidae</i>	+			
54000	<i>Leucotrichia pictipes</i>	+			
57900	<i>Pycnopsyche sp</i>	2 +			
58505	<i>Helicopsyche borealis</i>	+			
59970	<i>Petrophila sp</i>	+			
60900	<i>Peltodytes sp</i>	+			
68075	<i>Psephenus herricki</i>	1 +			
68601	<i>Ancyronyx variegata</i>	4			
68708	<i>Dubiraphia vittata group</i>	3			
68901	<i>Macronychus glabratus</i>	37			
69200	<i>Optioservus sp</i>	18 +			
69400	<i>Stenelmis sp</i>	+			
70600	<i>Antocha sp</i>	66 +			
71100	<i>Hexatoma sp</i>	+			

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Collection Date: 10/02/2003 River Code: 15-001 RM: 30.60 Site: Chagrin River

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01801	<i>Turbellaria</i>	+	69400	<i>Stenelmis sp</i>	60
03360	<i>Plumatella sp</i>	1	70600	<i>Antocha sp</i>	1 +
03600	<i>Oligochaeta</i>	256 +	71100	<i>Hexatoma sp</i>	+
05800	<i>Caecidotea sp</i>	+	71900	<i>Tipula sp</i>	+
08250	<i>Orconectes (Procericambarus) rusticus</i>	+	74100	<i>Simulium sp</i>	9 +
08601	<i>Hydrachnidia</i>	56	77750	<i>Hayesomyia senata or Thienemannimyia norena</i>	52
11014	<i>Acentrella turbida</i>	+	77800	<i>Helopelopia sp</i>	52 +
11120	<i>Baetis flavistriga</i>	15 +	78400	<i>Natarsia sp</i>	+
11130	<i>Baetis intercalaris</i>	10	80351	<i>Corynoneura n.sp 1</i>	32
12200	<i>Isonychia sp</i>	48 +	81060	<i>Lopescladius sp</i>	+
12924	<i>Heptagenia flavescens</i>	+	81650	<i>Parametriocnemus sp</i>	104
13400	<i>Stenacron sp</i>	+	82220	<i>Tvetenia discoloripes group</i>	52 +
13521	<i>Stenonema femoratum</i>	+	83040	<i>Dicrotendipes neomodestus</i>	52
13561	<i>Maccaffertium pulchellum</i>	273 +	83840	<i>Microtendipes pedellus group</i>	52
13590	<i>Maccaffertium vicarium</i>	2 +	84450	<i>Polypedilum (Uresipedilum) flavum</i>	520 +
14950	<i>Leptophlebia sp or Paraleptophlebia sp</i>	+	84460	<i>Polypedilum (P.) fallax group</i>	52
16200	<i>Eurylophella sp</i>	40	84540	<i>Polypedilum (Tripodura) scalaenum group</i>	52
17200	<i>Caenis sp</i>	27 +	85263	<i>Cladotanytarsus vanderwulpi group Type 3</i>	+
18100	<i>Anthopotamus sp</i>	+	85615	<i>Rheotanytarsus pellucidus</i>	52
21200	<i>Calopteryx sp</i>	1 +	85625	<i>Rheotanytarsus sp</i>	5879 +
22300	<i>Argia sp</i>	2	85800	<i>Tanytarsus sp</i>	104
23909	<i>Boyeria vinosa</i>	+	86401	<i>Atherix lantha</i>	2 +
25010	<i>Hagenius brevistylus</i>	+	87540	<i>Hemerodromia sp</i>	672
34410	<i>Paragnetina media</i>	5 +	96900	<i>Ferrissia sp</i>	128 +
47600	<i>Sialis sp</i>	+	98600	<i>Sphaerium sp</i>	2 +
48620	<i>Nigronia serricornis</i>	2 +			
50315	<i>Chimarra obscura</i>	9 +			
50319	<i>Chimarra socia</i>	1	No. Quantitative Taxa: 47		Total Taxa: 69
50906	<i>Psychomyia flavida</i>	1 +	No. Qualitative Taxa: 48		ICI: 50
51600	<i>Polycentropus sp</i>	+	Number of Organisms: 9908		Qual EPT: 22
52200	<i>Cheumatopsyche sp</i>	600 +			
52430	<i>Ceratopsyche morosa group</i>	449 +			
52450	<i>Ceratopsyche sparna</i>	71 +			
52530	<i>Hydropsyche depravata group</i>	+			
52540	<i>Hydropsyche dicantha</i>	28 +			
54000	<i>Leucotrichia pictipes</i>	+			
58505	<i>Helicopsyche borealis</i>	3 +			
59510	<i>Oecetis avara</i>	8			
59970	<i>Petrophila sp</i>	+			
68075	<i>Psephenus herricki</i>	+			
68601	<i>Ancyronyx variegata</i>	8			
68700	<i>Dubiraphia sp</i>	8			
68901	<i>Macronychus glabratus</i>	30			
69200	<i>Optioservus sp</i>	25 +			

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Collection Date: 10/02/2003 River Code: 15-001 RM: 30.00 Site: Chagrin River

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
00653	<i>Eunapius fragilis</i>	+			
01801	<i>Turbellaria</i>	+			
03600	<i>Oligochaeta</i>	+			
05800	<i>Caecidotea sp</i>	+			
08250	<i>Orconectes (Procericambarus) rusticus</i>	+			
11014	<i>Acentrella turbida</i>	+			
11120	<i>Baetis flavistriga</i>	+			
12200	<i>Isonychia sp</i>	+			
13400	<i>Stenacron sp</i>	+			
13521	<i>Stenonema femoratum</i>	+			
13561	<i>Maccaffertium pulchellum</i>	+			
13590	<i>Maccaffertium vicarium</i>	+			
17200	<i>Caenis sp</i>	+			
18100	<i>Anthopotamus sp</i>	+			
22300	<i>Argia sp</i>	+			
25510	<i>Stylogomphus albistylus</i>	+			
34410	<i>Paragnetina media</i>	+			
45400	<i>Trichocorixa sp</i>	+			
47600	<i>Sialis sp</i>	+			
48620	<i>Nigronia serricornis</i>	+			
50906	<i>Psychomyia flavida</i>	+			
51001	<i>Polycentropodidae</i>	+			
52200	<i>Cheumatopsyche sp</i>	+			
52430	<i>Ceratopsyche morosa group</i>	+			
52450	<i>Ceratopsyche sparna</i>	+			
52540	<i>Hydropsyche dicantha</i>	+			
54000	<i>Leucotrichia pictipes</i>	+			
58505	<i>Helicopsyche borealis</i>	+			
60800	<i>Haliphus sp</i>	+			
63300	<i>Hydroporus sp</i>	+			
68075	<i>Psephenus herricki</i>	+			
69400	<i>Stenelmis sp</i>	+			
74100	<i>Simulium sp</i>	+			
77800	<i>Helopelopia sp</i>	+			
78350	<i>Meropelopia sp</i>	+			
81280	<i>Nanocladius (Plecopteracoluthus) downesi</i>	+			
84450	<i>Polypedilum (Uresipedilum) flavum</i>	+			
95100	<i>Physella sp</i>	+			
96900	<i>Ferrissia sp</i>	+			
98600	<i>Sphaerium sp</i>	+			

No. Quantitative Taxa: 0 Total Taxa: 40

No. Qualitative Taxa: 40 ICI:

Number of Organisms: 0 Qual EPT: 18

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Collection Date: 10/02/2003 River Code: 15-001 RM: 28.20 Site: Chagrin River upst Aurora Br., adj. Solon Rd

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
00653	<i>Eunapius fragilis</i>	+	70600	<i>Antocha sp</i>	25
01801	<i>Turbellaria</i>	76 +	74100	<i>Simulium sp</i>	60 +
01900	<i>Nemertea</i>	8	77500	<i>Conchapelopia sp</i>	+
03040	<i>Fredericella sp</i>	+	77750	<i>Hayesomyia senata or Thienemannimyia norena</i>	51
03600	<i>Oligochaeta</i>	104 +	77800	<i>Helopelopia sp</i>	152
04664	<i>Helobdella stagnalis</i>	+	80351	<i>Corynoneura n.sp 1</i>	16
04960	<i>Mooreobdella sp</i>	+	80370	<i>Corynoneura lobata</i>	32
05800	<i>Caecidotea sp</i>	2 +	80700	<i>Eukiefferiella sp</i>	51
06700	<i>Crangonyx sp</i>	+	81650	<i>Parametriocnemus sp</i>	+
08250	<i>Orconectes (Procericambarus) rusticus</i>	+	82101	<i>Thienemanniella taurocapita</i>	+
08601	<i>Hydrachnidia</i>	24	82141	<i>Thienemanniella xena</i>	16
11120	<i>Baetis flavistriga</i>	31 +	82220	<i>Tvetenia discoloripes group</i>	304 +
11130	<i>Baetis intercalaris</i>	1	83040	<i>Dicrotendipes neomodestus</i>	51
12200	<i>Isonychia sp</i>	18 +	83840	<i>Microtendipes pedellus group</i>	101
13400	<i>Stenacron sp</i>	+	84450	<i>Polypedilum (Uresipedilum) flavum</i>	1013 +
13561	<i>Maccaffertium pulchellum</i>	446 +	84888	<i>Xenochironomus xenolabis</i>	+
14950	<i>Leptophlebia sp or Paraleptophlebia sp</i>	+	85625	<i>Rheotanytarsus sp</i>	2179
21200	<i>Calopteryx sp</i>	+	85800	<i>Tanytarsus sp</i>	51 +
22001	<i>Coenagrionidae</i>	+	86401	<i>Atherix lantha</i>	1 +
22300	<i>Argia sp</i>	+	87540	<i>Hemerodromia sp</i>	88
34130	<i>Acroneuria frisoni</i>	+	96900	<i>Ferrissia sp</i>	+
34410	<i>Paragnetina media</i>	1 +			
48410	<i>Corydalus cornutus</i>	+	No. Quantitative Taxa: 42		Total Taxa: 65
48620	<i>Nigronia serricornis</i>	8	No. Qualitative Taxa: 44		ICI: 48
50315	<i>Chimarra obscura</i>	81 +	Number of Organisms: 7033		Qual EPT: 17
50906	<i>Psychomyia flavida</i>	+			
51400	<i>Nyctiophylax sp</i>	+			
52200	<i>Cheumatopsyche sp</i>	1211 +			
52430	<i>Ceratopsyche morosa group</i>	382 +			
52450	<i>Ceratopsyche sparna</i>	87 +			
52530	<i>Hydropsyche depravata group</i>	45 +			
52540	<i>Hydropsyche dicantha</i>	169 +			
53800	<i>Hydroptila sp</i>	17 +			
54000	<i>Leucotrichia pictipes</i>	+			
57900	<i>Pycnopsyche sp</i>	1			
58505	<i>Helicopsyche borealis</i>	1			
59510	<i>Oecetis avara</i>	8			
59970	<i>Petrophila sp</i>	+			
68075	<i>Psephenus herricki</i>	16 +			
68601	<i>Ancyronyx variegata</i>	8			
68700	<i>Dubiraphia sp</i>	9			
68901	<i>Macronychus glabratus</i>	17			
69210	<i>Optioservus ampliatus</i>	+			
69400	<i>Stenelmis sp</i>	71 +			

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Collection Date: 10/02/2003 River Code: 15-001 RM: 26.70 Site: Chagrin River Solon Rd.

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
00653	<i>Eunapius fragilis</i>	+			
01801	<i>Turbellaria</i>	+			
04901	<i>Erpobdellidae</i>	+			
08250	<i>Orconectes (Procericambarus) rusticus</i>	+			
11014	<i>Acentrella turbida</i>	+			
11120	<i>Baetis flavistriga</i>	+			
12200	<i>Isonychia sp</i>	+			
13400	<i>Stenacron sp</i>	+			
13521	<i>Stenonema femoratum</i>	+			
13561	<i>Maccaffertium pulchellum</i>	+			
22300	<i>Argia sp</i>	+			
50315	<i>Chimarra obscura</i>	+			
50906	<i>Psychomyia flavida</i>	+			
52200	<i>Cheumatopsyche sp</i>	+			
52430	<i>Ceratopsyche morosa group</i>	+			
52450	<i>Ceratopsyche sparna</i>	+			
52530	<i>Hydropsyche depravata group</i>	+			
52540	<i>Hydropsyche dicantha</i>	+			
54000	<i>Leucotrichia pictipes</i>	+			
58505	<i>Helicopsyche borealis</i>	+			
59970	<i>Petrophila sp</i>	+			
68075	<i>Psephenus herricki</i>	+			
69400	<i>Stenelmis sp</i>	+			
70600	<i>Antocha sp</i>	+			
74100	<i>Simulium sp</i>	+			
80420	<i>Cricotopus (C.) bicinctus</i>	+			
84450	<i>Polypedilum (Uresipedilum) flavum</i>	+			
85500	<i>Paratanytarsus sp</i>	+			
85625	<i>Rheotanytarsus sp</i>	+			

No. Quantitative Taxa: 0	Total Taxa: 29
No. Qualitative Taxa: 29	ICI:
Number of Organisms: 0	Qual EPT: 15

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Collection Date: 10/03/2003 River Code: 15-001 RM: 23.70 Site: Chagrin River Kinsman Rd. (St. Rt. 87)

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01801	<i>Turbellaria</i>	11 +	85615	<i>Rheotanytarsus pellucidus</i>	61 +
03045	<i>Fredericella indica</i>	11	85625	<i>Rheotanytarsus sp</i>	242 +
03451	<i>Urnatella gracilis</i>	2	87540	<i>Hemerodromia sp</i>	2
03600	<i>Oligochaeta</i>	+	89700	<i>Limnophora sp</i>	+
06700	<i>Crangonyx sp</i>	+	96900	<i>Ferrissia sp</i>	11 +
08601	<i>Hydrachnidia</i>	162			
11115	<i>Baetis tricaudatus</i>	8	No. Quantitative Taxa: 31		Total Taxa: 49
11120	<i>Baetis flavistriga</i>	24 +	No. Qualitative Taxa: 34		ICI: 42
11130	<i>Baetis intercalaris</i>	16	Number of Organisms: 6975		Qual EPT: 16
12200	<i>Isonychia sp</i>	1			
13400	<i>Stenacron sp</i>	+			
13521	<i>Stenonema femoratum</i>	+			
13561	<i>Maccaffertium pulchellum</i>	44 +			
13590	<i>Maccaffertium vicarium</i>	+			
16700	<i>Tricorythodes sp</i>	1			
17200	<i>Caenis sp</i>	+			
21200	<i>Calopteryx sp</i>	+			
22300	<i>Argia sp</i>	+			
48620	<i>Nigronia serratocornis</i>	+			
50315	<i>Chimarra obscura</i>	+			
50906	<i>Psychomyia flavida</i>	+			
51400	<i>Nyctiophylax sp</i>	+			
52200	<i>Cheumatopsyche sp</i>	1305 +			
52430	<i>Ceratopsyche morosa group</i>	1025 +			
52440	<i>Ceratopsyche slossonae</i>	+			
52450	<i>Ceratopsyche sparna</i>	459 +			
52460	<i>Ceratopsyche ventura</i>	3			
52530	<i>Hydropsyche depravata group</i>	65 +			
52540	<i>Hydropsyche dicantha</i>	672 +			
54000	<i>Leucotrichia pictipes</i>	+			
59970	<i>Petrophila sp</i>	+			
68075	<i>Psephenus herricki</i>	13 +			
68601	<i>Ancyronyx variegata</i>	20			
68901	<i>Macronychus glabratus</i>	24			
69200	<i>Optioservus sp</i>	1			
69400	<i>Stenelmis sp</i>	33			
70600	<i>Antocha sp</i>	21 +			
74100	<i>Simulium sp</i>	196 +			
77500	<i>Conchapelopia sp</i>	30			
77750	<i>Hayesomyia senata or Thienemannimyia norena</i>	+			
77800	<i>Helopelopia sp</i>	+			
80351	<i>Corynoneura n.sp 1</i>	27			
82220	<i>Tvetenia discoloripes group</i>	576 +			
84450	<i>Polypedilum (Uresipedilum) flavum</i>	1909 +			

Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Collection Date: 10/03/2003 River Code: 15-001 RM: 19.40 Site: Chagrin River near Berkshire Rd./River Rd.

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
00653	<i>Eunapius fragilis</i>	+		"rectinervis"	
01801	<i>Turbellaria</i>	107 +	82220	<i>Tvetenia discoloripes group</i>	71 +
03040	<i>Fredericella sp</i>	1 +	82820	<i>Cryptochironomus sp</i>	71
03600	<i>Oligochaeta</i>	89	83040	<i>Dicrotendipes neomodestus</i>	214
04960	<i>Mooreobdella sp</i>	+	83840	<i>Microtendipes pedellus group</i>	71
05800	<i>Caecidotea sp</i>	+	84450	<i>Polypedilum (Uresipedilum) flavum</i>	1217 +
06700	<i>Crangonyx sp</i>	1 +	84520	<i>Polypedilum (Tripodura) halterale group</i>	71 +
08250	<i>Orconectes (Procericambarus) rusticus</i>	+	84540	<i>Polypedilum (Tripodura) scalaenum group</i>	71
08601	<i>Hydrachnidia</i>	32	85615	<i>Rheotanytarsus pellucidus</i>	71
11120	<i>Baetis flavistriga</i>	39 +	85625	<i>Rheotanytarsus sp</i>	3936 +
11670	<i>Procloeon viridoculare</i>	+	85800	<i>Tanytarsus sp</i>	429
13400	<i>Stenacron sp</i>	33 +	87540	<i>Hemerodromia sp</i>	40
13561	<i>Maccaffertium pulchellum</i>	196 +	96900	<i>Ferrissia sp</i>	32 +
13590	<i>Maccaffertium vicarium</i>	1 +	98600	<i>Sphaerium sp</i>	2 +
21200	<i>Calopteryx sp</i>	4 +			
21300	<i>Hetaerina sp</i>	32	No. Quantitative Taxa: 41		Total Taxa: 57
22001	<i>Coenagrionidae</i>	+	No. Qualitative Taxa: 42		ICI: 44
22300	<i>Argia sp</i>	9 +	Number of Organisms: 8796		Qual EPT: 14
23909	<i>Boyeria vinosa</i>	+			
34120	<i>Acroneuria carolinensis</i>	1 +			
47600	<i>Sialis sp</i>	+			
48410	<i>Corydalus cornutus</i>	+			
50315	<i>Chimarra obscura</i>	1 +			
51400	<i>Nyctiophylax sp</i>	+			
52200	<i>Cheumatopsyche sp</i>	515 +			
52430	<i>Ceratopsyche morosa group</i>	521 +			
52450	<i>Ceratopsyche sparna</i>	1			
52530	<i>Hydropsyche depravata group</i>	+			
52540	<i>Hydropsyche dicantha</i>	62 +			
54000	<i>Leucotrichia pictipes</i>	+			
58505	<i>Helicopsyche borealis</i>	+			
59970	<i>Petrophila sp</i>	1 +			
68075	<i>Psephenus herricki</i>	1 +			
68601	<i>Ancyronyx variegata</i>	3			
68901	<i>Macronychus glabratus</i>	36 +			
69400	<i>Stenelmis sp</i>	7 +			
70600	<i>Antocha sp</i>	124 +			
74100	<i>Simulium sp</i>	+			
74501	<i>Ceratopogonidae</i>	+			
77500	<i>Conchapelopia sp</i>	286 +			
77750	<i>Hayesomyia senata or Thienemannimyia norena</i>	143			
78450	<i>Nilotanypus fimbriatus</i>	+			
80370	<i>Corynoneura lobata</i>	40			
81231	<i>Nanocladius (N.) crassicornus or N. (N.)</i>	214			

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Collection Date: 10/07/2003 River Code: 15-001 RM: 12.80 Site: Chagrin River dst. Rogers Rd.

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01801	<i>Turbellaria</i>	8 +	78450	<i>Nilotanypus fimbriatus</i>	6
03045	<i>Fredericella indica</i>	+	80360	<i>Corynoneura "celeripes" (sensu Simpson & Bode, 1980)</i>	2
03360	<i>Plumatella sp</i>	+	80370	<i>Corynoneura lobata</i>	6
03451	<i>Urnatella gracilis</i>	2	81231	<i>Nanocladius (N.) crassicornus or N. (N.) "rectinervis"</i>	8
03600	<i>Oligochaeta</i>	31 +	82101	<i>Thienemanniella taurocapita</i>	2
04935	<i>Erpobdella punctata punctata</i>	+	82200	<i>Tvetenia bavarica group</i>	8
06700	<i>Crangonyx sp</i>	+	82220	<i>Tvetenia discoloripes group</i>	67
08601	<i>Hydrachnidia</i>	10	82730	<i>Chironomus (C.) decorus group</i>	+
11120	<i>Baetis flavistriga</i>	+	83040	<i>Dicrotendipes neomodestus</i>	8 +
11130	<i>Baetis intercalaris</i>	+	83300	<i>Glyptotendipes (G.) sp</i>	8
13100	<i>Nixe sp</i>	+	83820	<i>Microtendipes "caelum" (sensu Simpson & Bode, 1980)</i>	42
13400	<i>Stenacron sp</i>	3 +	83840	<i>Microtendipes pedellus group</i>	8
13521	<i>Stenonema femoratum</i>	+	84300	<i>Phaenopsectra obediens group</i>	+
13561	<i>Maccaffertium pulchellum</i>	2	84315	<i>Phaenopsectra flavipes</i>	+
22001	<i>Coenagrionidae</i>	+	84450	<i>Polypedilum (Uresipedilum) flavum</i>	499 +
22300	<i>Argia sp</i>	+	84540	<i>Polypedilum (Tripodura) scalaenum group</i>	34
23909	<i>Boyeria vinosa</i>	+	85615	<i>Rheotanytarsus pellucidus</i>	+
27500	<i>Somatochlora sp</i>	+	85625	<i>Rheotanytarsus sp</i>	25 +
45300	<i>Sigara sp</i>	+	85840	<i>Tanytarsus sepp</i>	17
45400	<i>Trichocorixa sp</i>	+	95100	<i>Physella sp</i>	+
48410	<i>Corydalus cornutus</i>	1 +	96900	<i>Ferrissia sp</i>	+
48610	<i>Nigronia fasciatus</i>	+	97601	<i>Corbicula fluminea</i>	+
51600	<i>Polycentropus sp</i>	+			
52200	<i>Cheumatopsyche sp</i>	290 +			
52430	<i>Ceratopsyche morosa group</i>	441 +			
52450	<i>Ceratopsyche sparna</i>	33 +			
52530	<i>Hydropsyche depravata group</i>	1 +	No. Quantitative Taxa: 36	Total Taxa: 66	
52540	<i>Hydropsyche dicantha</i>	19 +	No. Qualitative Taxa: 47	ICI: 38	
54000	<i>Leucotrichia pictipes</i>	+	Number of Organisms: 1669	Qual EPT: 12	
59970	<i>Petrophila sp</i>	3 +			
65800	<i>Berosus sp</i>	+			
68025	<i>Ectopria sp</i>	+			
68075	<i>Psephenus herricki</i>	3 +			
68601	<i>Ancyronyx variegata</i>	7			
68901	<i>Macronychus glabratus</i>	11			
69400	<i>Stenelmis sp</i>	25 +			
70600	<i>Antocha sp</i>	4			
71100	<i>Hexatoma sp</i>	+			
71910	<i>Tipula abdominalis</i>	+			
74100	<i>Simulium sp</i>	10 +			
74501	<i>Ceratopogonidae</i>	+			
77120	<i>Ablabesmyia mallochi</i>	+			
77500	<i>Conchapelopia sp</i>	17			
77750	<i>Hayesomyia senata or Thienemannimyia norena</i>	8 +			

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Collection Date: 10/07/2003 River Code: 15-001 RM: 8.30 Site: Chagrin River

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
03360	<i>Plumatella sp</i>	+			
03600	<i>Oligochaeta</i>	+			
05800	<i>Caecidotea sp</i>	+			
06700	<i>Crangonyx sp</i>	+			
11014	<i>Acentrella turbida</i>	+			
11115	<i>Baetis tricaudatus</i>	+			
11120	<i>Baetis flavistriga</i>	+			
11130	<i>Baetis intercalaris</i>	+			
13561	<i>Maccaffertium pulchellum</i>	+			
13590	<i>Maccaffertium vicarium</i>	+			
21200	<i>Calopteryx sp</i>	+			
26120	<i>Cordulegaster maculata</i>	+			
34100	<i>Acroneuria sp</i>	+			
42700	<i>Belostoma sp</i>	+			
44501	<i>Corixidae</i>	+			
48410	<i>Corydalus cornutus</i>	+			
52200	<i>Cheumatopsyche sp</i>	+			
52430	<i>Ceratopsyche morosa group</i>	+			
52440	<i>Ceratopsyche slossonae</i>	+			
52450	<i>Ceratopsyche sparna</i>	+			
54000	<i>Leucotrichia pictipes</i>	+			
58505	<i>Helicopsyche borealis</i>	+			
59970	<i>Petrophila sp</i>	+			
60900	<i>Peltodytes sp</i>	+			
68075	<i>Psephenus herricki</i>	+			
69400	<i>Stenelmis sp</i>	+			
71900	<i>Tipula sp</i>	+			
71910	<i>Tipula abdominalis</i>	+			
74100	<i>Simulium sp</i>	+			
77500	<i>Conchapelopia sp</i>	+			
80740	<i>Eukiefferiella claripennis group</i>	+			
83670	<i>Lipiniella sp</i>	+			
83820	<i>Microtendipes "caelum" (sensu Simpson & Bode, 1980)</i>	+			
83840	<i>Microtendipes pedellus group</i>	+			
84450	<i>Polypedilum (Uresipedilum) flavum</i>	+			
89700	<i>Limnophora sp</i>	+			
96900	<i>Ferrissia sp</i>	+			

No. Quantitative Taxa: 0 Total Taxa: 37
 No. Qualitative Taxa: 37 ICI:
 Number of Organisms: 0 Qual EPT: 13

Ohio EPA/DSW Ecological Assessment Section
 Macroinvertebrate Collection

Collection Date: 10/07/2003 River Code: 15-001 RM: 4.20 Site: Chagrin River Daniels Park

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01801	<i>Turbellaria</i>	+	82220	<i>Tvetenia discoloripes group</i>	21 +
03045	<i>Fredericella indica</i>	3	83040	<i>Dicrotendipes neomodestus</i>	21
03451	<i>Urnatella gracilis</i>	5	84450	<i>Polypedilum (Uresipedilum) flavum</i>	1027 +
03600	<i>Oligochaeta</i>	69 +	85625	<i>Rheotanytarsus sp</i>	493 +
08250	<i>Orconectes (Procericambarus) rusticus</i>	+	85821	<i>Tanytarsus glabrescens group sp 7</i>	21
08601	<i>Hydrachnidia</i>	16	85840	<i>Tanytarsus sepp</i>	+
11014	<i>Acentrella turbida</i>	1 +	87540	<i>Hemerodromia sp</i>	20
11115	<i>Baetis tricaudatus</i>	+	95100	<i>Physella sp</i>	+
11120	<i>Baetis flavistriga</i>	9	96900	<i>Ferrissia sp</i>	8 +
11130	<i>Baetis intercalaris</i>	23			
12200	<i>Isonychia sp</i>	5	No. Quantitative Taxa: 35		Total Taxa: 52
13400	<i>Stenacron sp</i>	1 +	No. Qualitative Taxa: 35		ICI: 38
13521	<i>Stenonema femoratum</i>	+	Number of Organisms: 4209		Qual EPT: 10
13561	<i>Maccaffertium pulchellum</i>	59 +			
17200	<i>Caenis sp</i>	+			
21200	<i>Calopteryx sp</i>	+			
22001	<i>Coenagrionidae</i>	+			
22300	<i>Argia sp</i>	1 +			
23909	<i>Boyeria vinosa</i>	+			
25300	<i>Ophiogomphus sp</i>	+			
25510	<i>Stylogomphus albistylus</i>	+			
48410	<i>Corydalus cornutus</i>	2 +			
52200	<i>Cheumatopsyche sp</i>	914 +			
52430	<i>Ceratopsyche morosa group</i>	996 +			
52450	<i>Ceratopsyche sparna</i>	86 +			
52540	<i>Hydropsyche dicantha</i>	20			
54000	<i>Leucotrichia pictipes</i>	+			
59970	<i>Petrophila sp</i>	1 +			
60300	<i>Dineutus sp</i>	+			
68075	<i>Psephenus herricki</i>	10 +			
68901	<i>Macronychus glabratus</i>	44			
69400	<i>Stenelmis sp</i>	1 +			
70600	<i>Antocha sp</i>	20			
71900	<i>Tipula sp</i>	+			
74100	<i>Simulium sp</i>	24 +			
77500	<i>Conchapelopia sp</i>	41			
77750	<i>Hayesomyia senata or Thienemannimyia norena</i>	103			
77800	<i>Helopelopia sp</i>	+			
80310	<i>Cardiocladius obscurus</i>	+			
80420	<i>Cricotopus (C.) bicinctus</i>	41			
81231	<i>Nanocladius (N.) crassicornus or N. (N.) "rectinervis"</i>	41			
81650	<i>Parametriocnemus sp</i>	21 +			
82200	<i>Tvetenia bavarica group</i>	41			

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Collection Date: 10/08/2003 River Code: 15-001 RM: 1.70 Site: Chagrin River

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01801	<i>Turbellaria</i>	+			
03600	<i>Oligochaeta</i>	+			
06700	<i>Crangonyx sp</i>	+			
06810	<i>Gammarus fasciatus</i>	+			
08250	<i>Orconectes (Procericambarus) rusticus</i>	+			
13400	<i>Stenacron sp</i>	+			
13521	<i>Stenonema femoratum</i>	+			
13561	<i>Maccaffertium pulchellum</i>	+			
17200	<i>Caenis sp</i>	+			
21200	<i>Calopteryx sp</i>	+			
22300	<i>Argia sp</i>	+			
23909	<i>Boyeria vinosa</i>	+			
48620	<i>Nigronia serricornis</i>	+			
51400	<i>Nyctiophylax sp</i>	+			
52200	<i>Cheumatopsyche sp</i>	+			
52430	<i>Ceratopsyche morosa group</i>	+			
52450	<i>Ceratopsyche sparna</i>	+			
52540	<i>Hydropsyche dicantha</i>	+			
54000	<i>Leucotrichia pictipes</i>	+			
59970	<i>Petrophila sp</i>	+			
63900	<i>Laccophilus sp</i>	+			
68075	<i>Psephenus herricki</i>	+			
69400	<i>Stenelmis sp</i>	+			
71910	<i>Tipula abdominalis</i>	+			
84450	<i>Polypedilum (Uresipedilum) flavum</i>	+			
85625	<i>Rheotanytarsus sp</i>	+			
95100	<i>Physella sp</i>	+			

No. Quantitative Taxa: 0	Total Taxa: 27
No. Qualitative Taxa: 27	ICI:
Number of Organisms: 0	Qual EPT: 10

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/14/2004 River Code: 15-002 RM: 16.30 Site: East Branch Chagrin River upst. Heath Rd.

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01801	<i>Turbellaria</i>	+	80410	<i>Cricotopus (C.) sp</i>	+
05800	<i>Caecidotea sp</i>	+	80420	<i>Cricotopus (C.) bicinctus</i>	+
06700	<i>Crangonyx sp</i>	+	80430	<i>Cricotopus (C.) tremulus group</i>	+
08240	<i>Orconectes (Crockerinus) propinquus</i>	+	81650	<i>Parametriocnemus sp</i>	+
11014	<i>Acentrella turbida</i>	+	82200	<i>Tvetenia bavarica group</i>	+
11115	<i>Baetis tricaudatus</i>	+	82220	<i>Tvetenia discoloripes group</i>	+
11120	<i>Baetis flavistriga</i>	+	82730	<i>Chironomus (C.) decorus group</i>	+
12200	<i>Isonychia sp</i>	+	83840	<i>Microtendipes pedellus group</i>	+
13400	<i>Stenacron sp</i>	+	84210	<i>Paratendipes albimanus or P. duplicatus</i>	+
13521	<i>Stenonema femoratum</i>	+	84300	<i>Phaenopsectra obediens group</i>	+
13590	<i>Maccaffertium vicarium</i>	+	84440	<i>Polypedilum (Uresipedilum) aviceps</i>	+
21200	<i>Calopteryx sp</i>	+	84450	<i>Polypedilum (Uresipedilum) flavum</i>	+
22300	<i>Argia sp</i>	+	85261	<i>Cladotanytarsus vanderwulpi group Type 1</i>	+
23909	<i>Boyeria vinosa</i>	+	85625	<i>Rheotanytarsus sp</i>	+
34700	<i>Agnatina capitata complex</i>	+	85800	<i>Tanytarsus sp</i>	+
36500	<i>Sweltsa sp</i>	+	86200	<i>Tabanus sp</i>	+
47600	<i>Sialis sp</i>	+	86401	<i>Atherix lantha</i>	+
48620	<i>Nigronia serricornis</i>	+	87540	<i>Hemerodromia sp</i>	+
50301	<i>Chimarra aterrima</i>	+	95100	<i>Physella sp</i>	+
51600	<i>Polycentropus sp</i>	+	96900	<i>Ferrissia sp</i>	+
52200	<i>Cheumatopsyche sp</i>	+			
52430	<i>Ceratopsyche morosa group</i>	+	No. Quantitative Taxa: 0		Total Taxa: 64
52450	<i>Ceratopsyche sparna</i>	+	No. Qualitative Taxa: 64		ICI:
52530	<i>Hydropsyche depravata group</i>	+	Number of Organisms: 0		Qual EPT: 20
53300	<i>Glossosoma sp</i>	+			
53501	<i>Hydroptilidae</i>	+			
57400	<i>Neophylax sp</i>	+			
58505	<i>Helicopsyche borealis</i>	+			
59720	<i>Triaenodes ignitus</i>	+			
61400	<i>Agabus sp</i>	+			
67100	<i>Hydrobius sp</i>	+			
68025	<i>Ectopria sp</i>	+			
68075	<i>Psephenus herricki</i>	+			
68700	<i>Dubiraphia sp</i>	+			
68901	<i>Macronychus glabratus</i>	+			
69400	<i>Stenelmis sp</i>	+			
70501	<i>Tipulidae</i>	+			
70700	<i>Dicranota sp</i>	+			
71900	<i>Tipula sp</i>	+			
71910	<i>Tipula abdominalis</i>	+			
74100	<i>Simulium sp</i>	+			
77800	<i>Helopelopia sp</i>	+			
80310	<i>Cardiocladius obscurus</i>	+			
80351	<i>Corynoneura n.sp 1</i>	+			

Ohio EPA/DW/ Ecological Assessment Section
 Macroinvertebrate Collection

Collection Date: 08/09/2004 River Code: 15-002 RM: 10.20 Site: East Branch Chagrin River upst. Mitchell Mill

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
03360	<i>Plumatella sp</i>	+	84480	<i>Polypedilum (P.) laetum group</i>	+
03600	<i>Oligochaeta</i>	+	84540	<i>Polypedilum (Tripodura) scalaenum group</i>	+
06700	<i>Crangonyx sp</i>	+	85625	<i>Rheotanytarsus sp</i>	+
08240	<i>Orconectes (Crockerinus) propinquus</i>	+	85821	<i>Tanytarsus glabrescens group sp 7</i>	+
11115	<i>Baetis tricaudatus</i>	+	86401	<i>Atherix lantha</i>	+
11120	<i>Baetis flavistriga</i>	+	95100	<i>Physella sp</i>	+
11130	<i>Baetis intercalaris</i>	+			
12200	<i>Isonychia sp</i>	+	No. Quantitative Taxa: 0		Total Taxa: 49
13400	<i>Stenacron sp</i>	+	No. Qualitative Taxa: 49		ICI:
13521	<i>Stenonema femoratum</i>	+	Number of Organisms: 0		Qual EPT: 17
13561	<i>Maccaffertium pulchellum</i>	+			
16700	<i>Tricorythodes sp</i>	+			
17200	<i>Caenis sp</i>	+			
21200	<i>Calopteryx sp</i>	+			
23905	<i>Boyeria grafiana</i>	+			
23909	<i>Boyeria vinosa</i>	+			
25210	<i>Lanthus parvulus</i>	+			
33100	<i>Leuctra sp</i>	+			
47600	<i>Sialis sp</i>	+			
48620	<i>Nigronia serricornis</i>	+			
52200	<i>Cheumatopsyche sp</i>	+			
52430	<i>Ceratopsyche morosa group</i>	+			
52440	<i>Ceratopsyche slossonae</i>	+			
52450	<i>Ceratopsyche sparna</i>	+			
52530	<i>Hydropsyche depravata group</i>	+			
52540	<i>Hydropsyche dicantha</i>	+			
57900	<i>Pycnopsyche sp</i>	+			
68075	<i>Psephenus herricki</i>	+			
69200	<i>Optioservus sp</i>	+			
69400	<i>Stenelmis sp</i>	+			
71910	<i>Tipula abdominalis</i>	+			
74100	<i>Simulium sp</i>	+			
77500	<i>Conchapelopia sp</i>	+			
77750	<i>Hayesomyia senata or Thienemannimyia norena</i>	+			
80310	<i>Cardiocladius obscurus</i>	+			
81650	<i>Parametriocnemus sp</i>	+			
82220	<i>Tvetenia discoloripes group</i>	+			
82880	<i>Cryptotendipes sp</i>	+			
83820	<i>Microtendipes "caelum" (sensu Simpson & Bode, 1980)</i>	+			
83840	<i>Microtendipes pedellus group</i>	+			
84300	<i>Phaenopsectra obediens group</i>	+			
84440	<i>Polypedilum (Uresipedilum) aviceps</i>	+			
84450	<i>Polypedilum (Uresipedilum) flavum</i>	+			

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Collection Date: 08/09/2004 River Code: 15-002 RM: 2.40

Site: East Branch Chagrin River Markell Rd.

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
03600	<i>Oligochaeta</i>	+			
08250	<i>Orconectes (Procericambarus) rusticus</i>	+			
11014	<i>Acentrella turbida</i>	+			
11115	<i>Baetis tricaudatus</i>	+			
11130	<i>Baetis intercalaris</i>	+			
12200	<i>Isonychia sp</i>	+			
13000	<i>Leucrocuta sp</i>	+			
13400	<i>Stenacron sp</i>	+			
13521	<i>Stenonema femoratum</i>	+			
13561	<i>Maccaffertium pulchellum</i>	+			
13590	<i>Maccaffertium vicarium</i>	+			
17200	<i>Caenis sp</i>	+			
22300	<i>Argia sp</i>	+			
48410	<i>Corydalus cornutus</i>	+			
48620	<i>Nigronia serricornis</i>	+			
52200	<i>Cheumatopsyche sp</i>	+			
52430	<i>Ceratopsyche morosa group</i>	+			
52450	<i>Ceratopsyche sparna</i>	+			
52540	<i>Hydropsyche dicantha</i>	+			
54160	<i>Ochrotrichia sp</i>	+			
68075	<i>Psephenus herricki</i>	+			
69400	<i>Stenelmis sp</i>	+			
74100	<i>Simulium sp</i>	+			
77500	<i>Conchapelopia sp</i>	+			
78401	<i>Natarsia species A (sensu Roback, 1978)</i>	+			
78450	<i>Nilotanypus fimbriatus</i>	+			
80351	<i>Corynoneura n.sp 1</i>	+			
80410	<i>Cricotopus (C.) sp</i>	+			
80430	<i>Cricotopus (C.) tremulus group</i>	+			
82820	<i>Cryptochironomus sp</i>	+			
84430	<i>Polypedilum (P.) albicorne</i>	+			
84450	<i>Polypedilum (Uresipedilum) flavum</i>	+			
84540	<i>Polypedilum (Tripodura) scalaenum group</i>	+			
84750	<i>Stictochironomus sp</i>	+			
85625	<i>Rheotanytarsus sp</i>	+			
86401	<i>Atherix lantha</i>	+			
95100	<i>Physella sp</i>	+			

No. Quantitative Taxa: 0 Total Taxa: 37

No. Qualitative Taxa: 37 ICI:

Number of Organisms: 0 Qual EPT: 15

Ohio EPA/DSW Ecological Assessment Section
 Macroinvertebrate Collection

Collection Date: 09/13/2004 River Code: 15-003 RM: 4.40 Site: Griswold Creek Fairmount Rd.

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
00401	<i>Spongillidae</i>	+	85821	<i>Tanytarsus glabrescens group sp 7</i>	+
01801	<i>Turbellaria</i>	+	95100	<i>Physella sp</i>	+
03600	<i>Oligochaeta</i>	+	96900	<i>Ferrissia sp</i>	+
05800	<i>Caecidotea sp</i>	+			
07860	<i>Cambarus (Puncticambarus) robustus</i>	+	No. Quantitative Taxa: 0		Total Taxa: 47
08240	<i>Orconectes (Crockerinus) propinquus</i>	+	No. Qualitative Taxa: 47		ICI:
11120	<i>Baetis flavistriga</i>	+	Number of Organisms: 0		Qual EPT: 9
13521	<i>Stenonema femoratum</i>	+			
21200	<i>Calopteryx sp</i>	+			
22300	<i>Argia sp</i>	+			
23909	<i>Boyeria vinosa</i>	+			
25510	<i>Stylogomphus albistylus</i>	+			
51400	<i>Nyctiophylax sp</i>	+			
51600	<i>Polycentropus sp</i>	+			
52200	<i>Cheumatopsyche sp</i>	+			
52430	<i>Ceratopsyche morosa group</i>	+			
52530	<i>Hydropsyche depravata group</i>	+			
53800	<i>Hydroptila sp</i>	+			
57400	<i>Neophylax sp</i>	+			
68025	<i>Ectopria sp</i>	+			
68075	<i>Psephenus herricki</i>	+			
68901	<i>Macronychus glabratus</i>	+			
69200	<i>Optioservus sp</i>	+			
69400	<i>Stenelmis sp</i>	+			
70600	<i>Antocha sp</i>	+			
71910	<i>Tipula abdominalis</i>	+			
74100	<i>Simulium sp</i>	+			
77500	<i>Conchapelopia sp</i>	+			
77750	<i>Hayesomyia senata or Thienemannimyia norena</i>	+			
80204	<i>Brillia flavifrons group</i>	+			
80410	<i>Cricotopus (C.) sp</i>	+			
81650	<i>Parametriocnemus sp</i>	+			
82141	<i>Thienemanniella xena</i>	+			
82200	<i>Tvetenia bavarica group</i>	+			
82820	<i>Cryptochironomus sp</i>	+			
83040	<i>Dicrotendipes neomodestus</i>	+			
83840	<i>Microtendipes pedellus group</i>	+			
84210	<i>Paratendipes albimanus or P. duplicatus</i>	+			
84450	<i>Polypedilum (Uresipedilum) flavum</i>	+			
84470	<i>Polypedilum (P.) illinoense</i>	+			
84750	<i>Stictochironomus sp</i>	+			
85261	<i>Cladotanytarsus vanderwulpi group Type 1</i>	+			
85500	<i>Paratanytarsus sp</i>	+			
85625	<i>Rheotanytarsus sp</i>	+			

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/13/2004 River Code: 15-003 RM: 0.10 Site: Griswold Creek at mouth

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01801	<i>Turbellaria</i>	+			
06700	<i>Crangonyx sp</i>	+			
11014	<i>Acentrella turbida</i>	+			
11115	<i>Baetis tricaudatus</i>	+			
11120	<i>Baetis flavistriga</i>	+			
11130	<i>Baetis intercalaris</i>	+			
12200	<i>Isonychia sp</i>	+			
13000	<i>Leucrocuta sp</i>	+			
13100	<i>Nixe sp</i>	+			
13500	<i>Maccaffertium sp</i>	+			
13521	<i>Stenonema femoratum</i>	+			
21200	<i>Calopteryx sp</i>	+			
23909	<i>Boyeria vinosa</i>	+			
51600	<i>Polycentropus sp</i>	+			
52200	<i>Cheumatopsyche sp</i>	+			
52430	<i>Ceratopsyche morosa group</i>	+			
52450	<i>Ceratopsyche sparna</i>	+			
52530	<i>Hydropsyche depravata group</i>	+			
53800	<i>Hydroptila sp</i>	+			
54000	<i>Leucotrichia pictipes</i>	+			
68075	<i>Psephenus herricki</i>	+			
69400	<i>Stenelmis sp</i>	+			
70600	<i>Antocha sp</i>	+			
71900	<i>Tipula sp</i>	+			
71910	<i>Tipula abdominalis</i>	+			
74100	<i>Simulium sp</i>	+			
77500	<i>Conchapelopia sp</i>	+			
81650	<i>Parametriocnemus sp</i>	+			
82141	<i>Thienemanniella xena</i>	+			
82220	<i>Tvetenia discoloripes group</i>	+			
84450	<i>Polypedilum (Uresipedilum) flavum</i>	+			
85615	<i>Rheotanytarsus pellucidus</i>	+			
85625	<i>Rheotanytarsus sp</i>	+			
86100	<i>Chrysops sp</i>	+			
87540	<i>Hemerodromia sp</i>	+			
89704	<i>Limnophora aequifrons</i>	+			
95100	<i>Physella sp</i>	+			

No. Quantitative Taxa: 0 Total Taxa: 37

No. Qualitative Taxa: 37 ICI:

Number of Organisms: 0 Qual EPT: 16

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Collection Date: 08/10/2004 River Code: 15-005 RM: 5.50 Site: Aurora Branch Geauga Lake Rd.

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
00653	<i>Eunapius fragilis</i>	+	71100	<i>Hexatoma sp</i>	+
03360	<i>Plumatella sp</i>	+	71800	<i>Pseudolimnophila sp</i>	+
03600	<i>Oligochaeta</i>	48 +	71910	<i>Tipula abdominalis</i>	+
05800	<i>Caecidotea sp</i>	8 +	72700	<i>Anopheles sp</i>	+
06201	<i>Hyaella azteca</i>	+	74100	<i>Simulium sp</i>	21 +
06700	<i>Crangonyx sp</i>	+	74501	<i>Ceratopogonidae</i>	+
08250	<i>Orconectes (Procericambarus) rusticus</i>	+	77120	<i>Ablabesmyia mallochi</i>	+
11115	<i>Baetis tricaudatus</i>	+	77500	<i>Conchapelopia sp</i>	63 +
11120	<i>Baetis flavistriga</i>	38 +	77750	<i>Hayesomyia senata or Thienemannimyia norena</i>	+
11130	<i>Baetis intercalaris</i>	173 +			
12200	<i>Isonychia sp</i>	115 +	78450	<i>Nilotanypus fimbriatus</i>	72 +
13000	<i>Leucrocuta sp</i>	+	80310	<i>Cardiocladius obscurus</i>	+
13400	<i>Stenacron sp</i>	1 +	80351	<i>Corynoneura n.sp 1</i>	8
13521	<i>Stenonema femoratum</i>	+	80370	<i>Corynoneura lobata</i>	40 +
13550	<i>Maccaffertium mexicanum integrum</i>	8	80410	<i>Cricotopus (C.) sp</i>	+
13561	<i>Maccaffertium pulchellum</i>	64 +	81650	<i>Parametriocnemus sp</i>	148
13570	<i>Maccaffertium terminatum</i>	3	82101	<i>Thienemanniella taurocapita</i>	8
13590	<i>Maccaffertium vicarium</i>	2 +	82200	<i>Tvetenia bavarica group</i>	21 +
21200	<i>Calopteryx sp</i>	+	82220	<i>Tvetenia discoloripes group</i>	21 +
23909	<i>Boyeria vinosa</i>	+	82730	<i>Chironomus (C.) decorus group</i>	+
34410	<i>Paragnetina media</i>	19 +	83040	<i>Dicrotendipes neomodestus</i>	21
34700	<i>Agnetina capitata complex</i>	+	83820	<i>Microtendipes "caelum" (sensu Simpson & Bode, 1980)</i>	127
48620	<i>Nigronia serricornis</i>	7 +	83840	<i>Microtendipes pedellus group</i>	21 +
51600	<i>Polycentropus sp</i>	+	84210	<i>Paratendipes albimanus or P. duplicatus</i>	21
52200	<i>Cheumatopsyche sp</i>	388 +	84300	<i>Phaenopsectra obediens group</i>	21
52430	<i>Ceratopsyche morosa group</i>	249 +	84440	<i>Polypedilum (Uresipedilum) aviceps</i>	21
52440	<i>Ceratopsyche slossonae</i>	452 +	84450	<i>Polypedilum (Uresipedilum) flavum</i>	465 +
52450	<i>Ceratopsyche sparna</i>	58 +	84460	<i>Polypedilum (P.) fallax group</i>	21
52530	<i>Hydropsyche depravata group</i>	175 +	84470	<i>Polypedilum (P.) illinoense</i>	+
53300	<i>Glossosoma sp</i>	+	84480	<i>Polypedilum (P.) laetum group</i>	+
54000	<i>Leucotrichia pictipes</i>	+	84540	<i>Polypedilum (Tripodura) scalaenum group</i>	21 +
57400	<i>Neophylax sp</i>	+	84750	<i>Stictochironomus sp</i>	+
57900	<i>Pycnopsyche sp</i>	+	85261	<i>Cladotanytarsus vanderwulpi group Type 1</i>	63
58505	<i>Helicopsyche borealis</i>	+	85500	<i>Paratanytarsus sp</i>	21
59970	<i>Petrophila sp</i>	+	85625	<i>Rheotanytarsus sp</i>	1121 +
61400	<i>Agabus sp</i>	+	85800	<i>Tanytarsus sp</i>	+
68075	<i>Psephenus herricki</i>	10 +	86401	<i>Atherix lantha</i>	5 +
68130	<i>Helichus sp</i>	+	87400	<i>Stratiomys sp</i>	+
68201	<i>Scirtidae</i>	+	87520	<i>Clinocera (Hydrodromia) sp</i>	8 +
68708	<i>Dubiraphia vittata group</i>	+	87540	<i>Hemerodromia sp</i>	18 +
68901	<i>Macronychus glabratus</i>	15 +	96264	<i>Planorbella (Pierosoma) pilsbryi</i>	+
69200	<i>Optioservus sp</i>	8 +	96900	<i>Ferrissia sp</i>	+
69400	<i>Stenelmis sp</i>	50 +			
70600	<i>Antocha sp</i>	+			

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Collection Date: 08/10/2004 River Code: 15-005 RM: 5.50 Site: Aurora Branch Geauga Lake Rd.

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
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No. Quantitative Taxa: 45	Total Taxa: 85
No. Qualitative Taxa: 72	ICI: 56
Number of Organisms: 4268	Qual EPT: 22

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Collection Date: 08/10/2004 River Code: 15-005 RM: 3.70 Site: Aurora Branch Bainbridge Rd.

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01801	<i>Turbellaria</i>	5 +	84460	<i>Polypedilum (P.) fallax group</i>	+
03600	<i>Oligochaeta</i>	34	84750	<i>Stictochironomus sp</i>	+
05800	<i>Caecidotea sp</i>	1 +	85230	<i>Cladotanytarsus mancus group</i>	+
06201	<i>Hyalella azteca</i>	+	85615	<i>Rheotanytarsus pellucidus</i>	+
08260	<i>Orconectes (Crokerinus) sanbornii sanbornii</i>	+	85625	<i>Rheotanytarsus sp</i>	5599 +
11115	<i>Baetis tricaudatus</i>	+	85821	<i>Tanytarsus glabrescens group sp 7</i>	50
11120	<i>Baetis flavistriga</i>	299 +	96900	<i>Ferrissia sp</i>	64
11130	<i>Baetis intercalaris</i>	700 +			
12200	<i>Isonychia sp</i>	121 +	No. Quantitative Taxa: 30		Total Taxa: 51
13000	<i>Leucrocuta sp</i>	3 +	No. Qualitative Taxa: 44		ICI: 50
13400	<i>Stenacron sp</i>	3 +	Number of Organisms: 8295		Qual EPT: 17
13521	<i>Stenonema femoratum</i>	4 +			
13561	<i>Maccaffertium pulchellum</i>	74 +			
13590	<i>Maccaffertium vicarium</i>	2 +			
21200	<i>Calopteryx sp</i>	+			
22300	<i>Argia sp</i>	+			
23909	<i>Boyeria vinosa</i>	+			
24900	<i>Gomphus sp</i>	+			
34410	<i>Paragnetina media</i>	7			
48410	<i>Corydalus cornutus</i>	+			
48620	<i>Nigronia serricornis</i>	1 +			
52200	<i>Cheumatopsyche sp</i>	350 +			
52430	<i>Ceratopsyche morosa group</i>	115 +			
52440	<i>Ceratopsyche slossonae</i>	13 +			
52450	<i>Ceratopsyche sparna</i>	3 +			
53800	<i>Hydroptila sp</i>	+			
57400	<i>Neophylax sp</i>	+			
57900	<i>Pycnopsyche sp</i>	+			
58505	<i>Helicopsyche borealis</i>	+			
68075	<i>Psephenus herricki</i>	1 +			
68130	<i>Helichus sp</i>	+			
68707	<i>Dubiraphia quadrinotata</i>	+			
68708	<i>Dubiraphia vittata group</i>	+			
68901	<i>Macronychus glabratus</i>	4 +			
69400	<i>Stenelmis sp</i>	11 +			
70600	<i>Antocha sp</i>	+			
74100	<i>Simulium sp</i>	8 +			
77500	<i>Conchapelopia sp</i>	248 +			
78450	<i>Nilotanytus fimbriatus</i>	24			
80370	<i>Corynoneura lobata</i>	16			
80430	<i>Cricotopus (C.) tremulus group</i>	+			
82141	<i>Thienemanniella xena</i>	40			
82220	<i>Tvetenia discoloripes group</i>	99 +			
84450	<i>Polypedilum (Uresipedilum) flavum</i>	396 +			

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Collection Date: 08/10/2004 River Code: 15-005 RM: 0.90 Site: Aurora Branch Solon Rd

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01801	<i>Turbellaria</i>	+			
03040	<i>Fredericella sp</i>	+			
05800	<i>Caecidotea sp</i>	+			
11115	<i>Baetis tricaudatus</i>	+			
11120	<i>Baetis flavistriga</i>	+			
11130	<i>Baetis intercalaris</i>	+			
12200	<i>Isonychia sp</i>	+			
13000	<i>Leucrocuta sp</i>	+			
13400	<i>Stenacron sp</i>	+			
13521	<i>Stenonema femoratum</i>	+			
13561	<i>Maccaffertium pulchellum</i>	+			
13590	<i>Maccaffertium vicarium</i>	+			
34410	<i>Paragnetina media</i>	+			
52200	<i>Cheumatopsyche sp</i>	+			
52430	<i>Ceratopsyche morosa group</i>	+			
52450	<i>Ceratopsyche sparna</i>	+			
52530	<i>Hydropsyche depravata group</i>	+			
52540	<i>Hydropsyche dicantha</i>	+			
59970	<i>Petrophila sp</i>	+			
68075	<i>Psephenus herricki</i>	+			
69400	<i>Stenelmis sp</i>	+			
70600	<i>Antocha sp</i>	+			
74100	<i>Simulium sp</i>	+			
77750	<i>Hayesomyia senata or Thienemannimyia norena</i>	+			
78450	<i>Nilotanytus fimbriatus</i>	+			
82220	<i>Tvetenia discoloripes group</i>	+			
84450	<i>Polypedilum (Uresipedilum) flavum</i>	+			
84540	<i>Polypedilum (Tripodura) scalaenum group</i>	+			
84750	<i>Stictochironomus sp</i>	+			
85625	<i>Rheotanytarsus sp</i>	+			

No. Quantitative Taxa: 0 Total Taxa: 30
 No. Qualitative Taxa: 30 ICI:
 Number of Organisms: 0 Qual EPT: 15

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Collection Date: 10/01/2003 River Code: 15-005 RM: 16.30 Site: Aurora Branch Chamberlain Rd.

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01801	<i>Turbellaria</i>	+			
03600	<i>Oligochaeta</i>	+			
04935	<i>Erpobdella punctata punctata</i>	+			
06700	<i>Crangonyx sp</i>	+			
08250	<i>Orconectes (Procericambarus) rusticus</i>	+			
21200	<i>Calopteryx sp</i>	+			
22001	<i>Coenagrionidae</i>	+			
22300	<i>Argia sp</i>	+			
23600	<i>Aeshna sp</i>	+			
23909	<i>Boyeria vinosa</i>	+			
27307	<i>Epiptera (Epicordulia) princeps</i>	+			
28955	<i>Plathemis lydia</i>	+			
42700	<i>Belostoma sp</i>	+			
55300	<i>Ptilostomis sp</i>	+			
60900	<i>Peltodytes sp</i>	+			
67800	<i>Tropisternus sp</i>	+			
71900	<i>Tipula sp</i>	+			
74100	<i>Simulium sp</i>	+			
74501	<i>Ceratopogonidae</i>	+			
77500	<i>Conchapelopia sp</i>	+			
82300	<i>Xylotopus par</i>	+			
82730	<i>Chironomus (C.) decorus group</i>	+			
83040	<i>Dicrotendipes neomodestus</i>	+			
83840	<i>Microtendipes pedellus group</i>	+			
84460	<i>Polypedilum (P.) fallax group</i>	+			
84700	<i>Stenochironomus sp</i>	+			
95100	<i>Physella sp</i>	+			
96264	<i>Planorbella (Pierosoma) pilsbryi</i>	+			

No. Quantitative Taxa: 0	Total Taxa: 28
No. Qualitative Taxa: 28	ICI:
Number of Organisms: 0	Qual EPT: 1

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Collection Date: 10/01/2003 River Code: 15-005 RM: 14.40 Site: Aurora Branch dst. Pioneer Trail

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01801	<i>Turbellaria</i>	+			
03600	<i>Oligochaeta</i>	+			
06201	<i>Hyalella azteca</i>	+			
06700	<i>Crangonyx sp</i>	+			
08250	<i>Orconectes (Procericambarus) rusticus</i>	+			
11120	<i>Baetis flavistriga</i>	+			
11130	<i>Baetis intercalaris</i>	+			
13400	<i>Stenacron sp</i>	+			
13521	<i>Stenonema femoratum</i>	+			
13561	<i>Maccaffertium pulchellum</i>	+			
15000	<i>Paraleptophlebia sp</i>	+			
17200	<i>Caenis sp</i>	+			
21200	<i>Calopteryx sp</i>	+			
22001	<i>Coenagrionidae</i>	+			
25510	<i>Stylogomphus albistylus</i>	+			
34130	<i>Acroneuria frisoni</i>	+			
42700	<i>Belostoma sp</i>	+			
45100	<i>Palmacorixa sp</i>	+			
45300	<i>Sigara sp</i>	+			
47600	<i>Sialis sp</i>	+			
52200	<i>Cheumatopsyche sp</i>	+			
52530	<i>Hydropsyche depravata group</i>	+			
55300	<i>Ptilostomis sp</i>	+			
58505	<i>Helicopsyche borealis</i>	+			
68025	<i>Ectopria sp</i>	+			
69400	<i>Stenelmis sp</i>	+			
71100	<i>Hexatoma sp</i>	+			
71910	<i>Tipula abdominalis</i>	+			
74100	<i>Simulium sp</i>	+			
83300	<i>Glyptotendipes (G.) sp</i>	+			
83840	<i>Microtendipes pedellus group</i>	+			
84540	<i>Polypedilum (Tripodura) scalaenum group</i>	+			
84700	<i>Stenochironomus sp</i>	+			
84750	<i>Stictochironomus sp</i>	+			
85615	<i>Rheotanytarsus pellucidus</i>	+			
86100	<i>Chrysops sp</i>	+			

No. Quantitative Taxa: 0 Total Taxa: 36
 No. Qualitative Taxa: 36 ICI:
 Number of Organisms: 0 Qual EPT: 12

Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Collection Date: 10/01/2003 River Code: 15-005 RM: 11.90 Site: Aurora Branch dst. St. Rt. 82

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01801	<i>Turbellaria</i>	+	84540	<i>Polypedilum (Tripodura) scalaenum group</i>	+
03600	<i>Oligochaeta</i>	24 +	85500	<i>Paratanytarsus sp</i>	13
06700	<i>Crangonyx sp</i>	+	85625	<i>Rheotanytarsus sp</i>	114 +
08250	<i>Orconectes (Procericambarus) rusticus</i>	+	85821	<i>Tanytarsus glabrescens group sp 7</i>	13
08601	<i>Hydrachnidia</i>	4 +	85840	<i>Tanytarsus sepp</i>	7 +
11120	<i>Baetis flavistriga</i>	22 +	87540	<i>Hemerodromia sp</i>	20
13400	<i>Stenacron sp</i>	44 +	95100	<i>Physella sp</i>	+
13521	<i>Stenonema femoratum</i>	11 +			
14900	<i>Leptophlebia sp</i>	+	No. Quantitative Taxa: 32		Total Taxa: 51
21200	<i>Calopteryx sp</i>	+	No. Qualitative Taxa: 37		ICI: 42
22001	<i>Coenagrionidae</i>	+	Number of Organisms: 1163		Qual EPT: 8
47600	<i>Sialis sp</i>	+			
48620	<i>Nigronia serricornis</i>	+			
50804	<i>Lype diversa</i>	1			
51600	<i>Polycentropus sp</i>	+			
52200	<i>Cheumatopsyche sp</i>	248 +			
52530	<i>Hydropsyche depravata group</i>	3 +			
53501	<i>Hydroptilidae</i>	+			
66500	<i>Enochrus sp</i>	+			
68708	<i>Dubiraphia vittata group</i>	+			
68901	<i>Macronychus glabratus</i>	14 +			
69400	<i>Stenelmis sp</i>	6 +			
71900	<i>Tipula sp</i>	+			
71910	<i>Tipula abdominalis</i>	4 +			
74100	<i>Simulium sp</i>	270 +			
77750	<i>Hayesomyia senata or Thienemannimyia norena</i>	13			
77800	<i>Helopelopia sp</i>	13 +			
78350	<i>Meropelopia sp</i>	7			
78500	<i>Paramerina fragilis</i>	+			
80351	<i>Corynoneura n.sp 1</i>	44			
80370	<i>Corynoneura lobata</i>	10			
80410	<i>Cricotopus (C.) sp</i>	+			
80420	<i>Cricotopus (C.) bicinctus</i>	7 +			
80430	<i>Cricotopus (C.) tremulus group</i>	+			
81465	<i>Orthocladius (O.) carlatus</i>	13			
81631	<i>Parakiefferiella n.sp 1</i>	13 +			
81650	<i>Parametriocnemus sp</i>	20			
81825	<i>Rheocricotopus (Psilocricotopus) robacki</i>	27			
82101	<i>Thienemanniella taurocapita</i>	16			
82141	<i>Thienemanniella xena</i>	16			
82200	<i>Tvetenia bavarica group</i>	33			
82820	<i>Cryptochironomus sp</i>	+			
83840	<i>Microtendipes pedellus group</i>	33 +			
84450	<i>Polypedilum (Uresipedilum) flavum</i>	80 +			

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Collection Date: 10/01/2003 River Code: 15-005 RM: 11.30 Site: Aurora Branch upst. Aurora WWTP

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01801	<i>Turbellaria</i>	1 +	84540	<i>Polypedilum (Tripodura) scalaenum group</i>	10 +
03600	<i>Oligochaeta</i>	8 +	84700	<i>Stenochironomus sp</i>	+
06700	<i>Crangonyx sp</i>	1 +	84750	<i>Stictochironomus sp</i>	+
08250	<i>Orconectes (Procericambarus) rusticus</i>	+	85261	<i>Cladotanytarsus vanderwulpi group Type 1</i>	+
11120	<i>Baetis flavistriga</i>	35 +	85500	<i>Paratanytarsus sp</i>	10
11130	<i>Baetis intercalaris</i>	1	85615	<i>Rheotanytarsus pellucidus</i>	10
12200	<i>Isonychia sp</i>	10 +	85625	<i>Rheotanytarsus sp</i>	821 +
13000	<i>Leucrocuta sp</i>	17	85800	<i>Tanytarsus sp</i>	+
13400	<i>Stenacron sp</i>	63 +	85840	<i>Tanytarsus sepp</i>	10
13521	<i>Stenonema femoratum</i>	27 +	87400	<i>Stratiomys sp</i>	+
17200	<i>Caenis sp</i>	+	87540	<i>Hemerodromia sp</i>	48
21200	<i>Calopteryx sp</i>	+	95100	<i>Physella sp</i>	+
23909	<i>Boyeria vinosa</i>	+	96900	<i>Ferrissia sp</i>	+
42700	<i>Belostoma sp</i>	+			
43300	<i>Ranatra sp</i>	+	No. Quantitative Taxa: 32		Total Taxa: 57
44501	<i>Corixidae</i>	+	No. Qualitative Taxa: 46		ICI: 42
48200	<i>Chauliodes sp</i>	+	Number of Organisms: 2766		Qual EPT: 8
48620	<i>Nigronia serricornis</i>	1 +			
52200	<i>Cheumatopsyche sp</i>	872 +			
52530	<i>Hydropsyche depravata group</i>	+			
56001	<i>Limnephilidae</i>	+			
68075	<i>Psephenus herricki</i>	1 +			
68130	<i>Helichus sp</i>	+			
68901	<i>Macronychus glabratus</i>	+			
69400	<i>Stenelmis sp</i>	20 +			
71100	<i>Hexatoma sp</i>	+			
71900	<i>Tipula sp</i>	+			
71910	<i>Tipula abdominalis</i>	2 +			
74100	<i>Simulium sp</i>	386 +			
77800	<i>Helopelopia sp</i>	129 +			
80351	<i>Corynoneura n.sp 1</i>	80			
80370	<i>Corynoneura lobata</i>	52 +			
81650	<i>Parametriocnemus sp</i>	10 +			
81825	<i>Rheocricotopus (Psilocricotopus) robacki</i>	10			
82101	<i>Thienemanniella taurocapita</i>	20			
82141	<i>Thienemanniella xena</i>	12 +			
82200	<i>Tvetenia bavarica group</i>	10 +			
82710	<i>Chironomus (C.) sp</i>	+			
82820	<i>Cryptochironomus sp</i>	+			
83300	<i>Glyptotendipes (G.) sp</i>	+			
83820	<i>Microtendipes "caelum" (sensu Simpson & Bode, 1980)</i>	10			
83840	<i>Microtendipes pedellus group</i>	69 +			
84450	<i>Polypedilum (Uresipedilum) flavum</i>	10			
84460	<i>Polypedilum (P.) fallax group</i>	+			

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Collection Date: 10/01/2003 River Code: 15-005 RM: 11.00 Site: Aurora Branch dst. Aurora Central WWTP

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01320	<i>Hydra sp</i>	8	84750	<i>Stictochironomus sp</i>	+
01801	<i>Turbellaria</i>	17 +	84790	<i>Tribelos fuscicorne</i>	+
03600	<i>Oligochaeta</i>	40 +	85625	<i>Rheotanytarsus sp</i>	1145 +
05800	<i>Caecidotea sp</i>	+	85800	<i>Tanytarsus sp</i>	18 +
06201	<i>Hyaella azteca</i>	+	85821	<i>Tanytarsus glabrescens group sp 7</i>	18 +
06700	<i>Crangonyx sp</i>	+	85840	<i>Tanytarsus sepp</i>	36
08250	<i>Orconectes (Procericambarus) rusticus</i>	+	87540	<i>Hemerodromia sp</i>	40 +
11120	<i>Baetis flavistriga</i>	30 +	96900	<i>Ferrissia sp</i>	+
12200	<i>Isonychia sp</i>	1 +			
13400	<i>Stenacron sp</i>	2 +	No. Quantitative Taxa: 35		Total Taxa: 52
13521	<i>Stenonema femoratum</i>	5 +	No. Qualitative Taxa: 42		ICI: 42
17200	<i>Caenis sp</i>	8	Number of Organisms: 4267		Qual EPT: 6
21200	<i>Calopteryx sp</i>	+			
22001	<i>Coenagrionidae</i>	+			
22300	<i>Argia sp</i>	+			
23905	<i>Boyeria grafiana</i>	1			
23909	<i>Boyeria vinosa</i>	+			
34700	<i>Agnatina capitata complex</i>	1			
48620	<i>Nigronia serricornis</i>	1 +			
52200	<i>Cheumatopsyche sp</i>	990 +			
52530	<i>Hydropsyche depravata group</i>	12 +			
68075	<i>Psephenus herricki</i>	2 +			
68201	<i>Scirtidae</i>	+			
68901	<i>Macronychus glabratus</i>	16			
69400	<i>Stenelmis sp</i>	41 +			
71900	<i>Tipula sp</i>	+			
71910	<i>Tipula abdominalis</i>	5 +			
74100	<i>Simulium sp</i>	1192 +			
77750	<i>Hayesomyia senata or Thienemannimyia norena</i>	18			
77800	<i>Helopelopia sp</i>	164 +			
80351	<i>Corynoneura n.sp I</i>	96 +			
80370	<i>Corynoneura lobata</i>	8 +			
80410	<i>Cricotopus (C.) sp</i>	18			
80420	<i>Cricotopus (C.) bicinctus</i>	+			
80430	<i>Cricotopus (C.) tremulus group</i>	18 +			
81631	<i>Parakiefferiella n.sp I</i>	+			
81650	<i>Parametriocnemus sp</i>	+			
82101	<i>Thienemanniella taurocapita</i>	8 +			
82200	<i>Tvetenia bavarica group</i>	18 +			
83840	<i>Microtendipes pedellus group</i>	109 +			
84300	<i>Phaenopsectra obediens group</i>	+			
84450	<i>Polypedilum (Uresipedilum) flavum</i>	145 +			
84460	<i>Polypedilum (P.) fallax group</i>	18			
84540	<i>Polypedilum (Tripodura) scalaenum group</i>	18			

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Collection Date: 10/01/2003 River Code: 15-005 RM: 9.10 Site: Aurora Branch upst. St. Rt. 306

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01801	<i>Turbellaria</i>	+	81690	<i>Paratrichocladius sp</i>	+
03451	<i>Urnatella gracilis</i>	1	82101	<i>Thienemanniella taurocapita</i>	8 +
03600	<i>Oligochaeta</i>	9 +	82200	<i>Tvetenia bavarica group</i>	67
06201	<i>Hyalella azteca</i>	+	83040	<i>Dicrotendipes neomodestus</i>	17
06700	<i>Crangonyx sp</i>	+	83840	<i>Microtendipes pedellus group</i>	83 +
08250	<i>Orconectes (Procericambarus) rusticus</i>	+	84450	<i>Polypedilum (Uresipedilum) flavum</i>	117 +
08601	<i>Hydrachnidia</i>	8	84460	<i>Polypedilum (P.) fallax group</i>	33
11120	<i>Baetis flavistriga</i>	8 +	84540	<i>Polypedilum (Tripodura) scalaenum group</i>	17
11430	<i>Dipheter hageni</i>	8	84750	<i>Stictochironomus sp</i>	17 +
12200	<i>Isonychia sp</i>	11 +	85615	<i>Rheotanytarsus pellucidus</i>	67
13400	<i>Stenacron sp</i>	+	85625	<i>Rheotanytarsus sp</i>	1034 +
13521	<i>Stenonema femoratum</i>	1 +	85800	<i>Tanytarsus sp</i>	+
17200	<i>Caenis sp</i>	+	85840	<i>Tanytarsus sepp</i>	17
21200	<i>Calopteryx sp</i>	+	86401	<i>Atherix lantha</i>	+
23909	<i>Boyeria vinosa</i>	+	87540	<i>Hemerodromia sp</i>	8
28500	<i>Libellula sp</i>	+	89700	<i>Limnophora sp</i>	+
50804	<i>Lype diversa</i>	16	96900	<i>Ferrissia sp</i>	8 +
51400	<i>Nyctiophylax sp</i>	+	98600	<i>Sphaerium sp</i>	+
52200	<i>Cheumatopsyche sp</i>	382 +			
52440	<i>Ceratopsyche slossonae</i>	1 +	No. Quantitative Taxa: 35		Total Taxa: 62
52450	<i>Ceratopsyche sparna</i>	44 +	No. Qualitative Taxa: 46		ICI: 48
52530	<i>Hydropsyche depravata group</i>	1 +	Number of Organisms: 2157		Qual EPT: 11
52540	<i>Hydropsyche dicantha</i>	+			
57900	<i>Pycnopsyche sp</i>	1			
59970	<i>Petrophila sp</i>	+			
68025	<i>Ectopria sp</i>	+			
68075	<i>Psephenus herricki</i>	+			
68707	<i>Dubiraphia quadrinotata</i>	+			
68708	<i>Dubiraphia vittata group</i>	16 +			
68901	<i>Macronychus glabratus</i>	2			
69200	<i>Optioservus sp</i>	+			
69400	<i>Stenelmis sp</i>	5 +			
70600	<i>Antocha sp</i>	8 +			
71100	<i>Hexatoma sp</i>	+			
71910	<i>Tipula abdominalis</i>	+			
74100	<i>Simulium sp</i>	24 +			
77500	<i>Conchapelopia sp</i>	67 +			
77750	<i>Hayesomyia senata or Thienemannimyia norena</i>	17			
77800	<i>Helopelopia sp</i>	+			
79085	<i>Telopelopia okoboji</i>	17			
80310	<i>Cardiocladius obscurus</i>	+			
80370	<i>Corynoneura lobata</i>	+			
80420	<i>Cricotopus (C.) bicinctus</i>	+			
80430	<i>Cricotopus (C.) tremulus group</i>	17			

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Collection Date: 10/02/2003 River Code: 15-005 RM: 7.30 Site: Aurora Branch

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01801	<i>Turbellaria</i>	+	86100	<i>Chrysops sp</i>	+
03600	<i>Oligochaeta</i>	+	86401	<i>Atherix lantha</i>	+
08250	<i>Orconectes (Procericambarus) rusticus</i>	+	95100	<i>Physella sp</i>	+
11115	<i>Baetis tricaudatus</i>	+	96900	<i>Ferrissia sp</i>	+
11120	<i>Baetis flavistriga</i>	+			
12200	<i>Isonychia sp</i>	+	No. Quantitative Taxa: 0		Total Taxa: 48
13400	<i>Stenacron sp</i>	+	No. Qualitative Taxa: 48		ICI:
13521	<i>Stenonema femoratum</i>	+	Number of Organisms: 0		Qual EPT: 18
13561	<i>Maccaffertium pulchellum</i>	+			
13590	<i>Maccaffertium vicarium</i>	+			
14950	<i>Leptophlebia sp or Paraleptophlebia sp</i>	+			
17200	<i>Caenis sp</i>	+			
21200	<i>Calopteryx sp</i>	+			
22001	<i>Coenagrionidae</i>	+			
23905	<i>Boyeria grafiana</i>	+			
23909	<i>Boyeria vinosa</i>	+			
34410	<i>Paragnetina media</i>	+			
34700	<i>Aagnetina capitata complex</i>	+			
42700	<i>Belostoma sp</i>	+			
48620	<i>Nigronia serricornis</i>	+			
50804	<i>Lype diversa</i>	+			
51600	<i>Polycentropus sp</i>	+			
52200	<i>Cheumatopsyche sp</i>	+			
52430	<i>Ceratopsyche morosa group</i>	+			
52440	<i>Ceratopsyche slossonae</i>	+			
52450	<i>Ceratopsyche sparna</i>	+			
52530	<i>Hydropsyche depravata group</i>	+			
59970	<i>Petrophila sp</i>	+			
63300	<i>Hydroporus sp</i>	+			
68025	<i>Ectopria sp</i>	+			
68075	<i>Psephenus herricki</i>	+			
69400	<i>Stenelmis sp</i>	+			
70600	<i>Antocha sp</i>	+			
71100	<i>Hexatoma sp</i>	+			
71900	<i>Tipula sp</i>	+			
74100	<i>Simulium sp</i>	+			
77800	<i>Helopelopia sp</i>	+			
80430	<i>Cricotopus (C.) tremulus group</i>	+			
80750	<i>Eukiefferiella devonica group</i>	+			
81650	<i>Parametriocnemus sp</i>	+			
82220	<i>Tvetenia discoloripes group</i>	+			
83840	<i>Microtendipes pedellus group</i>	+			
85615	<i>Rheotanytarsus pellucidus</i>	+			
85625	<i>Rheotanytarsus sp</i>	+			

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Collection Date: 10/02/2003 River Code: 15-005 RM: 5.10 Site: Aurora Branch adj. Fields Rd.

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01801	<i>Turbellaria</i>	8	70600	<i>Antocha sp</i>	52 +
01900	<i>Nemertea</i>	16	71100	<i>Hexatoma sp</i>	+
03040	<i>Fredericella sp</i>	+	71910	<i>Tipula abdominalis</i>	+
03360	<i>Plumatella sp</i>	+	74100	<i>Simulium sp</i>	35 +
03600	<i>Oligochaeta</i>	4 +	77500	<i>Conchapelopia sp</i>	+
05800	<i>Caecidotea sp</i>	+	77750	<i>Hayesomyia senata or Thienemannimyia norena</i>	+
06700	<i>Crangonyx sp</i>	+	77800	<i>Helopelopia sp</i>	+
08250	<i>Orconectes (Procericambarus) rusticus</i>	+	78450	<i>Nilotanypus fimbriatus</i>	+
11014	<i>Acentrella turbida</i>	+	79300	<i>Trissopelopia ogemawi</i>	+
11115	<i>Baetis tricaudatus</i>	1 +	80310	<i>Cardiocladius obscurus</i>	+
11120	<i>Baetis flavistriga</i>	10 +	80351	<i>Corynoneura n.sp 1</i>	51
11130	<i>Baetis intercalaris</i>	2	80370	<i>Corynoneura lobata</i>	+
12200	<i>Isonychia sp</i>	160 +	80430	<i>Cricotopus (C.) tremulus group</i>	+
13000	<i>Leucrocuta sp</i>	16	81650	<i>Parametriocnemus sp</i>	+
13400	<i>Stenacron sp</i>	+	82141	<i>Thienemanniella xena</i>	32
13521	<i>Stenonema femoratum</i>	+	82200	<i>Tvetenia bavarica group</i>	53
13561	<i>Maccaffertium pulchellum</i>	86 +	82730	<i>Chironomus (C.) decorus group</i>	+
13590	<i>Maccaffertium vicarium</i>	15 +	83040	<i>Dicrotendipes neomodestus</i>	53
17200	<i>Caenis sp</i>	+	83300	<i>Glyptotendipes (G.) sp</i>	+
21200	<i>Calopteryx sp</i>	+	84450	<i>Polypedilum (Uresipedilum) flavum</i>	107 +
23905	<i>Boyeria grafiana</i>	+	84460	<i>Polypedilum (P.) fallax group</i>	+
23909	<i>Boyeria vinosa</i>	+	84540	<i>Polypedilum (Tripodura) scalaenum group</i>	+
34410	<i>Paragnetina media</i>	1 +	84700	<i>Stenochironomus sp</i>	+
42700	<i>Belostoma sp</i>	+	84750	<i>Stictochironomus sp</i>	+
48620	<i>Nigronia serricornis</i>	+	85261	<i>Cladotanytarsus vanderwulpi group Type 1</i>	+
50804	<i>Lype diversa</i>	+	85500	<i>Paratanytarsus sp</i>	5011 +
50906	<i>Psychomyia flavida</i>	+	85615	<i>Rheotanytarsus pellucidus</i>	211 +
51600	<i>Polycentropus sp</i>	+	85625	<i>Rheotanytarsus sp</i>	+
52200	<i>Cheumatopsyche sp</i>	450 +	85840	<i>Tanytarsus sepp</i>	+
52430	<i>Ceratopsyche morosa group</i>	175 +	86401	<i>Atherix lantha</i>	+
52440	<i>Ceratopsyche slossonae</i>	144 +	87540	<i>Hemerodromia sp</i>	10
52450	<i>Ceratopsyche sparna</i>	64 +	96900	<i>Ferrissia sp</i>	8 +
52530	<i>Hydropsyche depravata group</i>	9 +	98600	<i>Sphaerium sp</i>	+
54000	<i>Leucotrichia pictipes</i>	+			
57900	<i>Pycnopsyche sp</i>	+			
58505	<i>Helicopsyche borealis</i>	1 +	No. Quantitative Taxa: 31		Total Taxa: 77
59970	<i>Petrophila sp</i>	+	No. Qualitative Taxa: 68		ICI: 48
63900	<i>Laccophilus sp</i>	+	Number of Organisms: 6822		Qual EPT: 21
68025	<i>Ectopria sp</i>	8 +			
68075	<i>Psephenus herricki</i>	+			
68708	<i>Dubiraphia vittata group</i>	+			
68901	<i>Macronychus glabratus</i>	25 +			
69210	<i>Optioservus ampliatus</i>	+			
69400	<i>Stenelmis sp</i>	4 +			

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Collection Date: 10/02/2003 River Code: 15-005 RM: 3.50 Site: Aurora Branch upst. McFarland Creek WWTP

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01801	<i>Turbellaria</i>	+	71100	<i>Hexatoma sp</i>	+
01900	<i>Nemertea</i>	8	71910	<i>Tipula abdominalis</i>	+
03040	<i>Fredericella sp</i>	+	74100	<i>Simulium sp</i>	539 +
03600	<i>Oligochaeta</i>	9 +	77500	<i>Conchapelopia sp</i>	40 +
05800	<i>Caecidotea sp</i>	4 +	77750	<i>Hayesomyia senata or Thienemannimyia norena</i>	27
06700	<i>Crangonyx sp</i>	1 +			
08250	<i>Orconectes (Procericambarus) rusticus</i>	+	77800	<i>Helopelopia sp</i>	+
11014	<i>Acentrella turbida</i>	5 +	80310	<i>Cardiocladius obscurus</i>	27 +
11115	<i>Baetis tricaudatus</i>	2	80351	<i>Corynoneura n.sp 1</i>	48
11120	<i>Baetis flavistriga</i>	56 +	80370	<i>Corynoneura lobata</i>	16
11130	<i>Baetis intercalaris</i>	2 +	80420	<i>Cricotopus (C.) bicinctus</i>	27
12200	<i>Isonychia sp</i>	85 +	80430	<i>Cricotopus (C.) tremulus group</i>	92 +
13400	<i>Stenacron sp</i>	18 +	81250	<i>Nanocladius (N.) minimus</i>	12
13521	<i>Stenonema femoratum</i>	2 +	81460	<i>Orthocladius (O.) sp</i>	+
13561	<i>Maccaffertium pulchellum</i>	10 +	81631	<i>Parakiefferiella n.sp 1</i>	12
13590	<i>Maccaffertium vicarium</i>	5 +	81650	<i>Parametriocnemus sp</i>	52 +
17200	<i>Caenis sp</i>	+	82101	<i>Thienemanniella taurocapita</i>	19
21200	<i>Calopteryx sp</i>	+	82141	<i>Thienemanniella xena</i>	43
22001	<i>Coenagrionidae</i>	+	82200	<i>Tvetenia bavarica group</i>	27
22300	<i>Argia sp</i>	+	82220	<i>Tvetenia discoloripes group</i>	+
23905	<i>Boyeria grafiana</i>	+	82820	<i>Cryptochironomus sp</i>	+
23909	<i>Boyeria vinosa</i>	+	83040	<i>Dicrotendipes neomodestus</i>	+
34410	<i>Paragnetina media</i>	+	83840	<i>Microtendipes pedellus group</i>	27 +
45300	<i>Sigara sp</i>	+	84300	<i>Phaenopsectra obediens group</i>	+
50315	<i>Chimarra obscura</i>	+	84450	<i>Polypedilum (Uresipedilum) flavum</i>	107 +
50906	<i>Psychomyia flavida</i>	+	84470	<i>Polypedilum (P.) illinoense</i>	+
51600	<i>Polycentropus sp</i>	+	84540	<i>Polypedilum (Tripodura) scalaenum group</i>	+
52200	<i>Cheumatopsyche sp</i>	434 +	84750	<i>Stictochironomus sp</i>	+
52430	<i>Ceratopsyche morosa group</i>	100 +	85261	<i>Cladotanytarsus vanderwulpi group Type 1</i>	+
52440	<i>Ceratopsyche slossonae</i>	14 +	85500	<i>Paratanytarsus sp</i>	+
52450	<i>Ceratopsyche sparna</i>	80 +	85615	<i>Rheotanytarsus pellucidus</i>	27 +
52530	<i>Hydropsyche depravata group</i>	7 +	85625	<i>Rheotanytarsus sp</i>	953 +
53800	<i>Hydroptila sp</i>	8 +	85800	<i>Tanytarsus sp</i>	+
54000	<i>Leucotrichia pictipes</i>	+	85840	<i>Tanytarsus sepp</i>	27
58505	<i>Helicopsyche borealis</i>	8 +	86100	<i>Chrysops sp</i>	+
59720	<i>Triaenodes ignitus</i>	+	86401	<i>Atherix lantha</i>	+
63900	<i>Laccophilus sp</i>	+	87540	<i>Hemerodromia sp</i>	24
65800	<i>Berosus sp</i>	+	96900	<i>Ferrissia sp</i>	+
68075	<i>Psephenus herricki</i>	1 +			
68601	<i>Ancyronyx variegata</i>	4	No. Quantitative Taxa: 46		Total Taxa: 81
68901	<i>Macronychus glabratus</i>	10	No. Qualitative Taxa: 65		ICI: 54
69210	<i>Optioservus ampliatus</i>	34	Number of Organisms: 3119		Qual EPT: 22
69400	<i>Stenelmis sp</i>	23 +			
70600	<i>Antocha sp</i>	43 +			

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Collection Date: 10/02/2003 River Code: 15-005 RM: 3.40 Site: Aurora Branch dst. McFarland Creek WWTP

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01320	<i>Hydra sp</i>	32	80420	<i>Cricotopus (C.) bicinctus</i>	+
01801	<i>Turbellaria</i>	37 +	80430	<i>Cricotopus (C.) tremulus group</i>	+
03600	<i>Oligochaeta</i>	65 +	80750	<i>Eukiefferiella devonica group</i>	27 +
05800	<i>Caecidotea sp</i>	+	81650	<i>Parametriocnemus sp</i>	+
06700	<i>Crangonyx sp</i>	+	82101	<i>Thienemanniella taurocapita</i>	+
08250	<i>Orconectes (Procericambarus) rusticus</i>	+	82141	<i>Thienemanniella xena</i>	16
08601	<i>Hydrachnidia</i>	16 +	82200	<i>Tvetenia bavarica group</i>	27
11014	<i>Acentrella turbida</i>	+	82220	<i>Tvetenia discoloripes group</i>	27 +
11115	<i>Baetis tricaudatus</i>	+	82770	<i>Chironomus (C.) riparius group</i>	+
11120	<i>Baetis flavistriga</i>	33 +	83040	<i>Dicrotendipes neomodestus</i>	27
12200	<i>Isonychia sp</i>	127 +	84450	<i>Polypedilum (Uresipedilum) flavum</i>	751 +
13400	<i>Stenacron sp</i>	32 +	84750	<i>Stictochironomus sp</i>	+
13521	<i>Stenonema femoratum</i>	+	84800	<i>Tribelos jucundum</i>	+
13561	<i>Maccaffertium pulchellum</i>	51 +	85615	<i>Rheotanytarsus pellucidus</i>	94 +
17200	<i>Caenis sp</i>	1	85625	<i>Rheotanytarsus sp</i>	3475 +
21200	<i>Calopteryx sp</i>	+	86401	<i>Atherix lantha</i>	1 +
22300	<i>Argia sp</i>	+	87515	<i>Clinocera (C.) sp</i>	16
23909	<i>Boyeria vinosa</i>	+			
27500	<i>Somatochlora sp</i>	+	No. Quantitative Taxa: 34		Total Taxa: 61
34410	<i>Paragnetina media</i>	18 +	No. Qualitative Taxa: 53		ICI: 48
48620	<i>Nigronia serricornis</i>	+	Number of Organisms: 7400		Qual EPT: 17
50315	<i>Chimarra obscura</i>	4 +			
52200	<i>Cheumatopsyche sp</i>	1678 +			
52430	<i>Ceratopsyche morosa group</i>	146 +			
52440	<i>Ceratopsyche slossonae</i>	9 +			
52450	<i>Ceratopsyche sparna</i>	159 +			
52530	<i>Hydropsyche depravata group</i>	11 +			
52540	<i>Hydropsyche dicantha</i>	4 +			
53501	<i>Hydroptilidae</i>	+			
54000	<i>Leucotrichia pictipes</i>	+			
63900	<i>Laccophilus sp</i>	+			
68075	<i>Psephenus herricki</i>	9 +			
68130	<i>Helichus sp</i>	+			
68901	<i>Macronychus glabratus</i>	34			
69200	<i>Optioservus sp</i>	+			
69400	<i>Stenelmis sp</i>	+			
70600	<i>Antocha sp</i>	17 +			
71900	<i>Tipula sp</i>	+			
71910	<i>Tipula abdominalis</i>	+			
74100	<i>Simulium sp</i>	263 +			
77500	<i>Conchapelopia sp</i>	134 +			
79400	<i>Zavreliomyia sp</i>	27 +			
80310	<i>Cardiocladius obscurus</i>	+			
80351	<i>Corynoneura n.sp 1</i>	32			

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Collection Date: 10/03/2003 River Code: 15-005 RM: 0.30 Site: Aurora Branch Chagrin River Rd.

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
00653	<i>Eunapius fragilis</i>	+	77500	<i>Conchapelopia sp</i>	+
01801	<i>Turbellaria</i>	14 +	77800	<i>Helopelopia sp</i>	60 +
03040	<i>Fredericella sp</i>	1 +	80310	<i>Cardiocladius obscurus</i>	+
03360	<i>Plumatella sp</i>	+	80351	<i>Corynoneura n.sp I</i>	48
03600	<i>Oligochaeta</i>	48	80370	<i>Corynoneura lobata</i>	80
05800	<i>Caecidotea sp</i>	+	81270	<i>Nanocladius (N.) spiniplenus</i>	119
06700	<i>Crangonyx sp</i>	+	82141	<i>Thienemanniella xena</i>	16
08250	<i>Orconectes (Procericambarus) rusticus</i>	+	82200	<i>Tvetenia bavarica group</i>	179
11014	<i>Acentrella turbida</i>	+	82220	<i>Tvetenia discoloripes group</i>	60 +
11115	<i>Baetis tricaudatus</i>	1 +	82710	<i>Chironomus (C.) sp</i>	+
11120	<i>Baetis flavistriga</i>	27 +	83040	<i>Dicrotendipes neomodestus</i>	+
11130	<i>Baetis intercalaris</i>	2	84300	<i>Phaenopsectra obediens group</i>	+
12200	<i>Isonychia sp</i>	3 +	84450	<i>Polypedilum (Uresipedilum) flavum</i>	1728 +
13400	<i>Stenacron sp</i>	+	84700	<i>Stenochironomus sp</i>	+
13521	<i>Stenonema femoratum</i>	+	84750	<i>Stictochironomus sp</i>	+
13561	<i>Maccaffertium pulchellum</i>	236 +	85500	<i>Paratanytarsus sp</i>	+
13590	<i>Maccaffertium vicarium</i>	+	85625	<i>Rheotanytarsus sp</i>	4707 +
17200	<i>Caenis sp</i>	+	85800	<i>Tanytarsus sp</i>	60
21200	<i>Calopteryx sp</i>	+	87540	<i>Hemerodromia sp</i>	64
22001	<i>Coenagrionidae</i>	+	96900	<i>Ferrissia sp</i>	+
22300	<i>Argia sp</i>	+	98200	<i>Pisidium sp</i>	+
23909	<i>Boyeria vinosa</i>	+	98600	<i>Sphaerium sp</i>	+
34410	<i>Paragnetina media</i>	1			
42700	<i>Belostoma sp</i>	+	No. Quantitative Taxa: 30		Total Taxa: 66
50804	<i>Lype diversa</i>	32 +	No. Qualitative Taxa: 55		ICI: 46
50906	<i>Psychomyia flavida</i>	+	Number of Organisms: 10809		Qual EPT: 20
51400	<i>Nyctiophylax sp</i>	+			
51600	<i>Polycentropus sp</i>	+			
52200	<i>Cheumatopsyche sp</i>	1106 +			
52430	<i>Ceratopsyche morosa group</i>	1431 +			
52450	<i>Ceratopsyche sparna</i>	167 +			
52530	<i>Hydropsyche depravata group</i>	31 +			
52540	<i>Hydropsyche dicantha</i>	332 +			
53501	<i>Hydroptilidae</i>	+			
54000	<i>Leucotrichia pictipes</i>	+			
59970	<i>Petrophila sp</i>	+			
63300	<i>Hydroporus sp</i>	+			
63900	<i>Laccophilus sp</i>	+			
68075	<i>Psephenus herricki</i>	+			
68901	<i>Macronychus glabratus</i>	16			
69400	<i>Stenelmis sp</i>	1 +			
70600	<i>Antocha sp</i>	96 +			
71900	<i>Tipula sp</i>	+			
74100	<i>Simulium sp</i>	143 +			

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/02/2004 River Code: 15-006 RM: 2.30 Site: McFarland Creek dst. north trib., dst. Chagrin

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
00653	<i>Eunapius fragilis</i>	+	86401	<i>Atherix lantha</i>	+
01801	<i>Turbellaria</i>	+			
05800	<i>Caecidotea sp</i>	+	No. Quantitative Taxa: 0		Total Taxa: 44
06700	<i>Crangonyx sp</i>	+	No. Qualitative Taxa: 44		ICI:
08250	<i>Orconectes (Procericambarus) rusticus</i>	+	Number of Organisms: 0		Qual EPT: 14
11115	<i>Baetis tricaudatus</i>	+			
11120	<i>Baetis flavistriga</i>	+			
11130	<i>Baetis intercalaris</i>	+			
13400	<i>Stenacron sp</i>	+			
13521	<i>Stenonema femoratum</i>	+			
13590	<i>Maccaffertium vicarium</i>	+			
21200	<i>Calopteryx sp</i>	+			
22001	<i>Coenagrionidae</i>	+			
23909	<i>Boyeria vinosa</i>	+			
42700	<i>Belostoma sp</i>	+			
47600	<i>Sialis sp</i>	+			
50315	<i>Chimarra obscura</i>	+			
52200	<i>Cheumatopsyche sp</i>	+			
52440	<i>Ceratopsyche slossonae</i>	+			
52450	<i>Ceratopsyche sparna</i>	+			
52530	<i>Hydropsyche depravata group</i>	+			
54000	<i>Leucotrichia pictipes</i>	+			
57400	<i>Neophylax sp</i>	+			
57900	<i>Pycnopsyche sp</i>	+			
68075	<i>Psephenus herricki</i>	+			
68601	<i>Ancyronyx variegata</i>	+			
68901	<i>Macronychus glabratus</i>	+			
69200	<i>Optioservus sp</i>	+			
69400	<i>Stenelmis sp</i>	+			
74100	<i>Simulium sp</i>	+			
77120	<i>Ablabesmyia mallochi</i>	+			
77750	<i>Hayesomyia senata or Thienemannimyia norena</i>	+			
77800	<i>Helopelopia sp</i>	+			
78450	<i>Nilotanypus fimbriatus</i>	+			
81231	<i>Nanocladius (N.) crassicornus or N. (N.) "rectinervis"</i>	+			
81650	<i>Parametriocnemus sp</i>	+			
82101	<i>Thienemanniella taurocapita</i>	+			
82141	<i>Thienemanniella xena</i>	+			
84315	<i>Phaenopsectra flavipes</i>	+			
84420	<i>Polypedilum (P.) n.sp 1</i>	+			
84450	<i>Polypedilum (Uresipedilum) flavum</i>	+			
85500	<i>Paratanytarsus sp</i>	+			
85625	<i>Rheotanytarsus sp</i>	+			

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Collection Date: 08/10/2004 River Code: 15-006 RM: 0.20 Site: McFarland Creek Chagrin River Rd.

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01801	<i>Turbellaria</i>	+	96900	<i>Ferrissia sp</i>	+
06700	<i>Crangonyx sp</i>	+			
08250	<i>Orconectes (Procericambarus) rusticus</i>	+	No. Quantitative Taxa: 0		Total Taxa: 45
11120	<i>Baetis flavistriga</i>	+	No. Qualitative Taxa: 45		ICI:
11130	<i>Baetis intercalaris</i>	+	Number of Organisms: 0		Qual EPT: 15
12200	<i>Isonychia sp</i>	+			
13400	<i>Stenacron sp</i>	+			
13521	<i>Stenonema femoratum</i>	+			
13561	<i>Maccaffertium pulchellum</i>	+			
13590	<i>Maccaffertium vicarium</i>	+			
22300	<i>Argia sp</i>	+			
23600	<i>Aeshna sp</i>	+			
23909	<i>Boyeria vinosa</i>	+			
43570	<i>Neoplea sp</i>	+			
50315	<i>Chimarra obscura</i>	+			
52200	<i>Cheumatopsyche sp</i>	+			
52430	<i>Ceratopsyche morosa group</i>	+			
52440	<i>Ceratopsyche slossonae</i>	+			
52450	<i>Ceratopsyche sparna</i>	+			
53800	<i>Hydroptila sp</i>	+			
54000	<i>Leucotrichia pictipes</i>	+			
57900	<i>Pycnopsyche sp</i>	+			
68075	<i>Psephenus herricki</i>	+			
68601	<i>Ancyronyx variegata</i>	+			
68708	<i>Dubiraphia vittata group</i>	+			
68901	<i>Macronychus glabratus</i>	+			
69200	<i>Optioservus sp</i>	+			
69400	<i>Stenelmis sp</i>	+			
70600	<i>Antocha sp</i>	+			
71910	<i>Tipula abdominalis</i>	+			
74100	<i>Simulium sp</i>	+			
77500	<i>Conchapelopia sp</i>	+			
78450	<i>Nilotanytus fimbriatus</i>	+			
79400	<i>Zavreliomyia sp</i>	+			
80310	<i>Cardiocladius obscurus</i>	+			
80420	<i>Cricotopus (C.) bicinctus</i>	+			
80430	<i>Cricotopus (C.) tremulus group</i>	+			
82820	<i>Cryptochironomus sp</i>	+			
83040	<i>Dicrotendipes neomodestus</i>	+			
83840	<i>Microtendipes pedellus group</i>	+			
84440	<i>Polypedilum (Uresipedilum) aviceps</i>	+			
84450	<i>Polypedilum (Uresipedilum) flavum</i>	+			
85625	<i>Rheotanytarsus sp</i>	+			
86401	<i>Atherix lantha</i>	+			

Ohio EPA/DW Ecological Assessment Section
Macroinvertebrate Collection

Collection Date: 09/02/2004 River Code: 15-007 RM: 5.10 Site: Silver Creek Music St.

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01801	<i>Turbellaria</i>	+	85625	<i>Rheotanytarsus sp</i>	+
08240	<i>Orconectes (Crockerinus) propinquus</i>	+	96264	<i>Planorbella (Pierosoma) pilsbryi</i>	+
11120	<i>Baetis flavistriga</i>	+	96900	<i>Ferrissia sp</i>	+
11130	<i>Baetis intercalaris</i>	+	98200	<i>Pisidium sp</i>	+
13400	<i>Stenacron sp</i>	+			
13521	<i>Stenonema femoratum</i>	+	No. Quantitative Taxa: 0		Total Taxa: 48
13540	<i>Maccaffertium mediopunctatum</i>	+	No. Qualitative Taxa: 48		ICI:
13590	<i>Maccaffertium vicarium</i>	+	Number of Organisms: 0		Qual EPT: 17
21200	<i>Calopteryx sp</i>	+			
23909	<i>Boyeria vinosa</i>	+			
24900	<i>Gomphus sp</i>	+			
26120	<i>Cordulegaster maculata</i>	+			
34700	<i>Agnatina capitata complex</i>	+			
43300	<i>Ranatra sp</i>	+			
50301	<i>Chimarra aterrima</i>	+			
50906	<i>Psychomyia flavida</i>	+			
52200	<i>Cheumatopsyche sp</i>	+			
52430	<i>Ceratopsyche morosa group</i>	+			
52440	<i>Ceratopsyche slossonae</i>	+			
52530	<i>Hydropsyche depravata group</i>	+			
53800	<i>Hydroptila sp</i>	+			
57400	<i>Neophylax sp</i>	+			
57900	<i>Pycnopsyche sp</i>	+			
58505	<i>Helicopsyche borealis</i>	+			
60400	<i>Gyrinus sp</i>	+			
67700	<i>Paracymus sp</i>	+			
68075	<i>Psephenus herricki</i>	+			
68707	<i>Dubiraphia quadrinotata</i>	+			
68901	<i>Macronychus glabratus</i>	+			
69250	<i>Optioservus ovalis</i>	+			
69400	<i>Stenelmis sp</i>	+			
71100	<i>Hexatoma sp</i>	+			
71900	<i>Tipula sp</i>	+			
71910	<i>Tipula abdominalis</i>	+			
74100	<i>Simulium sp</i>	+			
78350	<i>Meropelopia sp</i>	+			
80204	<i>Brillia flavifrons group</i>	+			
80420	<i>Cricotopus (C.) bicinctus</i>	+			
81650	<i>Parametriocnemus sp</i>	+			
81690	<i>Paratrichocladius sp</i>	+			
83820	<i>Microtendipes "caelum" (sensu Simpson & Bode, 1980)</i>	+			
84210	<i>Paratendipes albimanus or P. duplicatus</i>	+			
84300	<i>Phaenopsectra obediens group</i>	+			
84440	<i>Polypedilum (Uresipedilum) aviceps</i>	+			

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Collection Date: 08/10/2004 River Code: 15-007 RM: 0.40 Site: Silver Creek Hitching Post Lane

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
03600	<i>Oligochaeta</i>	49	82200	<i>Tvetenia bavarica group</i>	+
08250	<i>Orconectes (Procericambarus) rusticus</i>	+	82220	<i>Tvetenia discoloripes group</i>	28
08601	<i>Hydrachnidia</i>	8	83840	<i>Microtendipes pedellus group</i>	55
11120	<i>Baetis flavistriga</i>	32 +	84440	<i>Polypedilum (Uresipedilum) aviceps</i>	138
11130	<i>Baetis intercalaris</i>	66 +	84450	<i>Polypedilum (Uresipedilum) flavum</i>	277 +
12200	<i>Isonychia sp</i>	106 +	84460	<i>Polypedilum (P.) fallax group</i>	55
13400	<i>Stenacron sp</i>	1 +	84480	<i>Polypedilum (P.) laetum group</i>	28
13521	<i>Stenonema femoratum</i>	+	84540	<i>Polypedilum (Tripodura) scalaenum group</i>	277 +
13561	<i>Maccaffertium pulchellum</i>	19 +	85261	<i>Cladotanytarsus vanderwulpi group Type 1</i>	28
13590	<i>Maccaffertium vicarium</i>	5 +	85263	<i>Cladotanytarsus vanderwulpi group Type 3</i>	28
15000	<i>Paraleptophlebia sp</i>	5	85615	<i>Rheotanytarsus pellucidus</i>	111 +
17200	<i>Caenis sp</i>	1	85625	<i>Rheotanytarsus sp</i>	1190 +
21300	<i>Hetaerina sp</i>	1	85800	<i>Tanytarsus sp</i>	83
23909	<i>Boyeria vinosa</i>	+	85802	<i>Tanytarsus curticornis</i>	28
33100	<i>Leuctra sp</i>	5 +	85821	<i>Tanytarsus glabrescens group sp 7</i>	138 +
48620	<i>Nigronia serricornis</i>	4 +	86401	<i>Atherix lantha</i>	+
50315	<i>Chimarra obscura</i>	2	87520	<i>Clinocera (Hydrodromia) sp</i>	8
52200	<i>Cheumatopsyche sp</i>	180 +	87540	<i>Hemerodromia sp</i>	8
52430	<i>Ceratopsyche morosa group</i>	148 +	96900	<i>Ferrissia sp</i>	9 +
52450	<i>Ceratopsyche sparna</i>	55 +	99100	<i>Pyganodon grandis</i>	+
52530	<i>Hydropsyche depravata group</i>	4 +	99180	<i>Strophitus undulatus undulatus</i>	+
57400	<i>Neophylax sp</i>	+	99280	<i>Lasmigona costata</i>	+
57900	<i>Pycnopsyche sp</i>	+	99860	<i>Lampsilis radiata luteola</i>	+
59400	<i>Nectopsyche sp</i>	+			
60300	<i>Dineutus sp</i>	1	No. Quantitative Taxa: 49		Total Taxa: 67
68075	<i>Psephenus herricki</i>	+	No. Qualitative Taxa: 43		ICI: 54
68130	<i>Helichus sp</i>	+	Number of Organisms: 3553		Qual EPT: 15
68601	<i>Ancyronyx variegata</i>	1 +			
68708	<i>Dubiraphia vittata group</i>	2 +			
68901	<i>Macronychus glabratus</i>	25 +			
69210	<i>Optioservus ampliatus</i>	+			
69400	<i>Stenelmis sp</i>	13 +			
71100	<i>Hexatoma sp</i>	1			
74100	<i>Simulium sp</i>	9			
77500	<i>Conchapelopia sp</i>	28 +			
77750	<i>Hayesomyia senata or Thienemannimyia norena</i>	28			
78400	<i>Natarsia sp</i>	+			
78450	<i>Nilotanypus fimbriatus</i>	40			
80370	<i>Corynoneura lobata</i>	24			
80420	<i>Cricotopus (C.) bicinctus</i>	+			
80430	<i>Cricotopus (C.) tremulus group</i>	+			
81650	<i>Parametriocnemus sp</i>	55 +			
81825	<i>Rheocricotopus (Psilocricotopus) robacki</i>	138 +			
82101	<i>Thienemanniella taurocapita</i>	8			

Ohio EPA/DSW Ecological Assessment Section
 Macroinvertebrate Collection

Collection Date: 08/18/2004 River Code: 15-008 RM: 2.30 Site: Beaver Creek dst. Bean Rd.

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01320	<i>Hydra sp</i>	4	77750	<i>Hayesomyia senata or Thienemannimyia norena</i>	80 +
01900	<i>Nemertea</i>	8			
03600	<i>Oligochaeta</i>	53 +	77800	<i>Helopelopia sp</i>	+
04653	<i>Glossiphonia complanata</i>	4 +	78300	<i>Macropelopia sp</i>	+
04685	<i>Placobdella ornata</i>	+	78350	<i>Meropelopia sp</i>	32 +
06201	<i>Hyalella azteca</i>	4 +	78450	<i>Nilotanytus fimbriatus</i>	4
06700	<i>Crangonyx sp</i>	1	78650	<i>Procladius sp</i>	+
08240	<i>Orconectes (Crockerinus) propinquus</i>	1 +	79300	<i>Trissopelopia ogemawi</i>	+
11018	<i>Acerpenna macdunnoughi</i>	8	79400	<i>Zavreliomyia sp</i>	16 +
11250	<i>Centroptilum sp (w/o hindwing pads)</i>	+	80204	<i>Brillia flavifrons group</i>	+
13400	<i>Stenacron sp</i>	12 +	80370	<i>Corynoneura lobata</i>	36 +
13561	<i>Maccaffertium pulchellum</i>	1 +	80420	<i>Cricotopus (C.) bicinctus</i>	16 +
13590	<i>Maccaffertium vicarium</i>	15 +	80430	<i>Cricotopus (C.) tremulus group</i>	+
15064	<i>Paraleptophlebia praepedita</i>	58 +	80850	<i>Heterotrissocladius marcidus</i>	16
18801	<i>Litobranca recurvata</i>	+	81650	<i>Parametriocnemus sp</i>	32
21200	<i>Calopteryx sp</i>	3 +	81690	<i>Paratrichocladius sp</i>	+
21300	<i>Hetaerina sp</i>	8	82141	<i>Thienemanniella xena</i>	4 +
23600	<i>Aeshna sp</i>	+	82300	<i>Xylotopus par</i>	+
23909	<i>Boyeria vinosa</i>	+	82820	<i>Cryptochironomus sp</i>	+
30000	<i>Plecoptera</i>	+	83820	<i>Microtendipes "caelum" (sensu Simpson & Bode, 1980)</i>	+
45300	<i>Sigara sp</i>	+	83840	<i>Microtendipes pedellus group</i>	191 +
47600	<i>Sialis sp</i>	18 +	84210	<i>Paratendipes albimanus or P. duplicatus</i>	64
48620	<i>Nigronia serricornis</i>	1 +	84440	<i>Polypedilum (Uresipedilum) aviceps</i>	48 +
50804	<i>Lype diversa</i>	21 +	84450	<i>Polypedilum (Uresipedilum) flavum</i>	32 +
51400	<i>Nyctiophylax sp</i>	1 +	84460	<i>Polypedilum (P.) fallax group</i>	32 +
51500	<i>Phylocentropus sp</i>	+	84480	<i>Polypedilum (P.) laetum group</i>	+
51600	<i>Polycentropus sp</i>	8	84540	<i>Polypedilum (Tripodura) scalaenum group</i>	+
52200	<i>Cheumatopsyche sp</i>	28 +	84750	<i>Stictochironomus sp</i>	+
52315	<i>Diplectrona modesta</i>	+	84800	<i>Tribelos jucundum</i>	+
53100	<i>Rhyacophila sp</i>	+	85500	<i>Paratanytarsus sp</i>	175 +
55107	<i>Oligostomis pardalis</i>	+	85501	<i>Paratanytarsus n.sp 1</i>	16 +
55300	<i>Ptilostomis sp</i>	+	85615	<i>Rheotanytarsus pellucidus</i>	64 +
57900	<i>Pycnopsyche sp</i>	+	85625	<i>Rheotanytarsus sp</i>	223 +
58001	<i>Lepidostomatidae</i>	1 +	85720	<i>Stempellinella n.sp nr. flavidula</i>	8
59310	<i>Mystacides sepulchralis</i>	1	85800	<i>Tanytarsus sp</i>	48
60900	<i>Peltodytes sp</i>	+	85801	<i>Tanytarsus Type 1</i>	16
63300	<i>Hydroporus sp</i>	+	85802	<i>Tanytarsus curticornis</i>	80 +
63600	<i>Hygrotus sp</i>	+	85821	<i>Tanytarsus glabrescens group sp 7</i>	48 +
68130	<i>Helichus sp</i>	+	85840	<i>Tanytarsus sepp</i>	128 +
68708	<i>Dubiraphia vittata group</i>	24 +	87540	<i>Hemerodromia sp</i>	9 +
69200	<i>Optioservus sp</i>	+	94400	<i>Fossaria sp</i>	+
69400	<i>Stenelmis sp</i>	+	95100	<i>Physella sp</i>	+
74100	<i>Simulium sp</i>	+	95907	<i>Gyraulus (Torquis) parvus</i>	+
77500	<i>Conchapelopia sp</i>	16 +	96900	<i>Ferrissia sp</i>	1

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Collection Date: 08/18/2004 River Code: 15-008 RM: 2.30 Site: Beaver Creek dst. Bean Rd.

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
98200	<i>Pisidium sp</i>	63 +			
98600	<i>Sphaerium sp</i>	1 +			

No. Quantitative Taxa: 52 Total Taxa: 89

No. Qualitative Taxa: 74 ICI: **52**

Number of Organisms: 1782 Qual EPT: 17

Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Collection Date: 08/12/2004 River Code: 15-008 RM: 0.60 Site: Beaver Creek dst. Sherman Rd.

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01320	<i>Hydra sp</i>	32 +	68075	<i>Psephenus herricki</i>	+
01801	<i>Turbellaria</i>	729 +	68201	<i>Scirtidae</i>	+
03040	<i>Fredericella sp</i>	+	68601	<i>Ancyronyx variegata</i>	+
03600	<i>Oligochaeta</i>	32	68700	<i>Dubiraphia sp</i>	13
04653	<i>Glossiphonia complanata</i>	+	68702	<i>Dubiraphia bivittata</i>	+
04666	<i>Helobdella triserialis</i>	4	68708	<i>Dubiraphia vittata group</i>	+
04935	<i>Erpobdella punctata punctata</i>	2 +	68901	<i>Macronychus glabratus</i>	41 +
06201	<i>Hyalella azteca</i>	9 +	69400	<i>Stenelmis sp</i>	84 +
08240	<i>Orconectes (Crokerinus) propinquus</i>	1 +	74501	<i>Ceratopogonidae</i>	+
08601	<i>Hydrachnidia</i>	16	77150	<i>Ablabesmyia simpsoni</i>	+
11120	<i>Baetis flavistriga</i>	75 +	77500	<i>Conchapelopia sp</i>	152 +
11130	<i>Baetis intercalaris</i>	127 +	77750	<i>Hayesomyia senata or Thienemannimyia norena</i>	51
12200	<i>Isonychia sp</i>	1 +	77800	<i>Helopelopia sp</i>	+
13400	<i>Stenacron sp</i>	58 +	78655	<i>Procladius (Holotanypus) sp</i>	+
13521	<i>Stenonema femoratum</i>	1 +	80370	<i>Corynoneura lobata</i>	16
13590	<i>Maccaffertium vicarium</i>	1	80410	<i>Cricotopus (C.) sp</i>	51 +
17200	<i>Caenis sp</i>	43	80420	<i>Cricotopus (C.) bicinctus</i>	101 +
21200	<i>Calopteryx sp</i>	+	80430	<i>Cricotopus (C.) tremulus group</i>	51
21300	<i>Hetaerina sp</i>	1	81231	<i>Nanocladius (N.) crassicornus or N. (N.) "rectinervis"</i>	51
22001	<i>Coenagrionidae</i>	2 +	81650	<i>Parametriocnemus sp</i>	51
22300	<i>Argia sp</i>	1	82121	<i>Thienemanniella lobapodema</i>	32
23909	<i>Boyeria vinosa</i>	+	82141	<i>Thienemanniella xena</i>	32
42700	<i>Belostoma sp</i>	+	82820	<i>Cryptochironomus sp</i>	+
45000	<i>Hesperocorixa sp</i>	+	83820	<i>Microtendipes "caelum" (sensu Simpson & Bode, 1980)</i>	+
45100	<i>Palmacorixa sp</i>	+	84210	<i>Paratendipes albimanus or P. duplicatus</i>	51 +
45900	<i>Notonecta sp</i>	+	84420	<i>Polypedilum (P.) n.sp I</i>	+
47600	<i>Sialis sp</i>	+	84450	<i>Polypedilum (Uresipedilum) flavum</i>	1010 +
52200	<i>Cheumatopsyche sp</i>	635 +	84470	<i>Polypedilum (P.) illinoense</i>	+
52430	<i>Ceratopsyche morosa group</i>	1	84540	<i>Polypedilum (Tripodura) scalaenum group</i>	51 +
52530	<i>Hydropsyche depravata group</i>	291 +	84750	<i>Stictochironomus sp</i>	+
53800	<i>Hydroptila sp</i>	93 +	85500	<i>Paratanytarsus sp</i>	606 +
57400	<i>Neophylax sp</i>	+	85615	<i>Rheotanytarsus pellucidus</i>	152
57900	<i>Pycnopsyche sp</i>	+	85625	<i>Rheotanytarsus sp</i>	1819 +
58505	<i>Helicopsyche borealis</i>	2 +	85720	<i>Stempellinella n.sp nr. flavidula</i>	16 +
59555	<i>Oecetis inconspicua complex sp F (sensu Floyd, 1995)</i>	+	85800	<i>Tanytarsus sp</i>	505
59580	<i>Oecetis persimilis</i>	33	85802	<i>Tanytarsus curticornis</i>	455
59720	<i>Trienodes ignitus</i>	+	85821	<i>Tanytarsus glabrescens group sp 7</i>	303 +
60300	<i>Dineutus sp</i>	1	85840	<i>Tanytarsus sepp</i>	+
60900	<i>Peltodytes sp</i>	+	87540	<i>Hemerodromia sp</i>	30 +
63300	<i>Hydroporus sp</i>	+	95100	<i>Physella sp</i>	+
65800	<i>Berosus sp</i>	+	96900	<i>Ferrissia sp</i>	16
67700	<i>Paracymus sp</i>	+	98200	<i>Pisidium sp</i>	6
67800	<i>Tropisternus sp</i>	+			
68025	<i>Ectopria sp</i>	+			

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Collection Date: 08/12/2004 River Code: 15-008 RM: 0.60 Site: Beaver Creek dst. Sherman Rd.

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
98600	<i>Sphaerium sp</i>	+			

No. Quantitative Taxa: 51 Total Taxa: 86
No. Qualitative Taxa: 63 ICI: **54**
Number of Organisms: 7937 Qual EPT: 13

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/16/2004 River Code: 15-010 RM: 0.60 Site: Trib. to Chagrin R. (RM 5.54)

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01801	<i>Turbellaria</i>	+			
03600	<i>Oligochaeta</i>	+			
05800	<i>Caecidotea sp</i>	+			
05900	<i>Lirceus sp</i>	+			
06700	<i>Crangonyx sp</i>	+			
08240	<i>Orconectes (Crockerinus) propinquus</i>	+			
11130	<i>Baetis intercalaris</i>	+			
13521	<i>Stenonema femoratum</i>	+			
21200	<i>Calopteryx sp</i>	+			
22001	<i>Coenagrionidae</i>	+			
23909	<i>Boyeria vinosa</i>	+			
51400	<i>Nyctiophylax sp</i>	+			
52200	<i>Cheumatopsyche sp</i>	+			
52530	<i>Hydropsyche depravata group</i>	+			
68075	<i>Psephenus herricki</i>	+			
68601	<i>Ancyronyx variegata</i>	+			
72700	<i>Anopheles sp</i>	+			
74100	<i>Simulium sp</i>	+			
77120	<i>Ablabesmyia mallochii</i>	+			
77800	<i>Helopelopia sp</i>	+			
80420	<i>Cricotopus (C.) bicinctus</i>	+			
80430	<i>Cricotopus (C.) tremulus group</i>	+			
81650	<i>Parametriocnemus sp</i>	+			
82141	<i>Thienemanniella xena</i>	+			
83040	<i>Dicrotendipes neomodestus</i>	+			
83820	<i>Microtendipes "caelum" (sensu Simpson & Bode, 1980)</i>	+			
84450	<i>Polypedilum (Uresipedilum) flavum</i>	+			
84470	<i>Polypedilum (P.) illinoense</i>	+			
84540	<i>Polypedilum (Tripodura) scalaenum group</i>	+			
84601	<i>Saetheria species 1 (sensu Jackson, 1977)</i>	+			
84612	<i>Saetheria tylus</i>	+			
84750	<i>Stictochironomus sp</i>	+			
85261	<i>Cladotanytarsus vanderwulpi group Type 1</i>	+			
85500	<i>Paratanytarsus sp</i>	+			
85625	<i>Rheotanytarsus sp</i>	+			
85800	<i>Tanytarsus sp</i>	+			
85821	<i>Tanytarsus glabrescens group sp 7</i>	+			
96900	<i>Ferrissia sp</i>	+			
98600	<i>Sphaerium sp</i>	+			

No. Quantitative Taxa: 0 Total Taxa: 39
 No. Qualitative Taxa: 39 ICI:
 Number of Organisms: 0 Qual EPT: 5

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/16/2004 River Code: 15-011 RM: 0.90 Site: Caves Creek County Line Rd.

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01801	<i>Turbellaria</i>	+			
05800	<i>Caecidotea sp</i>	+	No. Quantitative Taxa: 0		Total Taxa: 44
06700	<i>Crangonyx sp</i>	+	No. Qualitative Taxa: 44		ICI:
07701	<i>Cambaridae</i>	+	Number of Organisms: 0		Qual EPT: 21
11014	<i>Acentrella turbida</i>	+			
11115	<i>Baetis tricaudatus</i>	+			
11120	<i>Baetis flavistriga</i>	+			
11130	<i>Baetis intercalaris</i>	+			
13521	<i>Stenonema femoratum</i>	+			
13590	<i>Maccaffertium vicarium</i>	+			
21200	<i>Calopteryx sp</i>	+			
23909	<i>Boyeria vinosa</i>	+			
30000	<i>Plecoptera</i>	+			
33001	<i>Leuctridae</i>	+			
50301	<i>Chimarra aterrima</i>	+			
51400	<i>Nyctiophylax sp</i>	+			
51600	<i>Polycentropus sp</i>	+			
52200	<i>Cheumatopsyche sp</i>	+			
52315	<i>Diplectrona modesta</i>	+			
52440	<i>Ceratopsyche slossonae</i>	+			
52450	<i>Ceratopsyche sparna</i>	+			
52530	<i>Hydropsyche depravata group</i>	+			
53300	<i>Glossosoma sp</i>	+			
53501	<i>Hydroptilidae</i>	+			
54000	<i>Leucotrichia pictipes</i>	+			
58505	<i>Helicopsyche borealis</i>	+			
59300	<i>Mystacides sp</i>	+			
68025	<i>Ectopria sp</i>	+			
68075	<i>Psephenus herricki</i>	+			
69400	<i>Stenelmis sp</i>	+			
70600	<i>Antocha sp</i>	+			
71100	<i>Hexatoma sp</i>	+			
71900	<i>Tipula sp</i>	+			
71910	<i>Tipula abdominalis</i>	+			
74100	<i>Simulium sp</i>	+			
77001	<i>Tanypodinae</i>	+			
79720	<i>Diamesa sp</i>	+			
81650	<i>Parametriocnemus sp</i>	+			
83820	<i>Microtendipes "caelum" (sensu Simpson & Bode, 1980)</i>	+			
84440	<i>Polypedilum (Uresipedilum) aviceps</i>	+			
85625	<i>Rheotanytarsus sp</i>	+			
86401	<i>Atherix lantha</i>	+			
87515	<i>Clinocera (C.) sp</i>	+			
87540	<i>Hemerodromia sp</i>	+			

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/03/2004 River Code: 15-014 RM: 1.10 Site: Smith Creek South Spring Valley Rd.

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
00653	<i>Eunapius fragilis</i>	+	82200	<i>Tvetenia bavarica group</i>	+
01801	<i>Turbellaria</i>	+	83820	<i>Microtendipes "caelum" (sensu Simpson & Bode, 1980)</i>	+
03360	<i>Plumatella sp</i>	+	83840	<i>Microtendipes pedellus group</i>	+
03600	<i>Oligochaeta</i>	+	84440	<i>Polypedilum (Uresipedilum) aviceps</i>	+
05800	<i>Caecidotea sp</i>	+	85625	<i>Rheotanytarsus sp</i>	+
08601	<i>Hydrachnidia</i>	+	85821	<i>Tanytarsus glabrescens group sp 7</i>	+
11014	<i>Acentrella turbida</i>	+	86401	<i>Atherix lantha</i>	+
11115	<i>Baetis tricaudatus</i>	+	95100	<i>Physella sp</i>	+
11120	<i>Baetis flavistriga</i>	+	96900	<i>Ferrissia sp</i>	+
11130	<i>Baetis intercalaris</i>	+			
11430	<i>Dipheter hageni</i>	+			
12200	<i>Isonychia sp</i>	+	No. Quantitative Taxa: 0		Total Taxa: 53
13400	<i>Stenacron sp</i>	+	No. Qualitative Taxa: 53		ICI:
13521	<i>Stenonema femoratum</i>	+	Number of Organisms: 0		Qual EPT: 21
13590	<i>Maccaffertium vicarium</i>	+			
21200	<i>Calopteryx sp</i>	+			
23909	<i>Boyeria vinosa</i>	+			
34700	<i>Agnatina capitata complex</i>	+			
50301	<i>Chimarra aterrima</i>	+			
51600	<i>Polycentropus sp</i>	+			
52200	<i>Cheumatopsyche sp</i>	+			
52430	<i>Ceratopsyche morosa group</i>	+			
52440	<i>Ceratopsyche slossonae</i>	+			
52450	<i>Ceratopsyche sparna</i>	+			
52530	<i>Hydropsyche depravata group</i>	+			
54000	<i>Leucotrichia pictipes</i>	+			
54160	<i>Ochrotrichia sp</i>	+			
57400	<i>Neophylax sp</i>	+			
57900	<i>Pycnopsyche sp</i>	+			
68075	<i>Psephenus herricki</i>	+			
69200	<i>Optioservus sp</i>	+			
69400	<i>Stenelmis sp</i>	+			
71100	<i>Hexatoma sp</i>	+			
71910	<i>Tipula abdominalis</i>	+			
74100	<i>Simulium sp</i>	+			
77500	<i>Conchapelopia sp</i>	+			
78401	<i>Natarsia species A (sensu Roback, 1978)</i>	+			
80370	<i>Corynoneura lobata</i>	+			
80410	<i>Cricotopus (C.) sp</i>	+			
80430	<i>Cricotopus (C.) tremulus group</i>	+			
81650	<i>Parametriocnemus sp</i>	+			
81690	<i>Paratrichocladus sp</i>	+			
81825	<i>Rheocricotopus (Psilocricotopus) robacki</i>	+			
82101	<i>Thienemanniella taurocapita</i>	+			

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/03/2004 River Code: 15-018 RM: 0.20 Site: Trib. to Chagrin R. (RM 22.81) Chagrin River

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
00653	<i>Eunapius fragilis</i>	+			
01801	<i>Turbellaria</i>	+			
01900	<i>Nemertea</i>	+			
03040	<i>Fredericella sp</i>	+			
03360	<i>Plumatella sp</i>	+			
03600	<i>Oligochaeta</i>	+			
05800	<i>Caecidotea sp</i>	+			
06700	<i>Crangonyx sp</i>	+			
08250	<i>Orconectes (Procericambarus) rusticus</i>	+			
11115	<i>Baetis tricaudatus</i>	+			
11120	<i>Baetis flavistriga</i>	+			
13521	<i>Stenonema femoratum</i>	+			
21200	<i>Calopteryx sp</i>	+			
22001	<i>Coenagrionidae</i>	+			
22300	<i>Argia sp</i>	+			
52200	<i>Cheumatopsyche sp</i>	+			
52430	<i>Ceratopsyche morosa group</i>	+			
52450	<i>Ceratopsyche sparna</i>	+			
52530	<i>Hydropsyche depravata group</i>	+			
52540	<i>Hydropsyche dicantha</i>	+			
59970	<i>Petrophila sp</i>	+			
69400	<i>Stenelmis sp</i>	+			
74100	<i>Simulium sp</i>	+			
80310	<i>Cardiocladius obscurus</i>	+			
85500	<i>Paratanytarsus sp</i>	+			
85625	<i>Rheotanytarsus sp</i>	+			
95100	<i>Physella sp</i>	+			
96120	<i>Menetus (Micromenetus) dilatatus</i>	+			
98200	<i>Pisidium sp</i>	+			
98600	<i>Sphaerium sp</i>	+			

No. Quantitative Taxa: 0 Total Taxa: 30
 No. Qualitative Taxa: 30 ICI:
 Number of Organisms: 0 Qual EPT: 8

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/02/2004 River Code: 15-024 RM: 4.60 Site: Dewdale Creek Auburn Rd.

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
03600	<i>Oligochaeta</i>	+	85625	<i>Rheotanytarsus sp</i>	+
04664	<i>Helobdella stagnalis</i>	+	85821	<i>Tanytarsus glabrescens group sp 7</i>	+
04686	<i>Placobdella papillifera</i>	+	85840	<i>Tanytarsus sepp</i>	+
04687	<i>Placobdella parasitica</i>	+	86100	<i>Chrysops sp</i>	+
06201	<i>Hyaella azteca</i>	+	92516	<i>Campeloma decisum</i>	+
06700	<i>Crangonyx sp</i>	+	96264	<i>Planorbella (Pierosoma) pilsbryi</i>	+
08250	<i>Orconectes (Procericambarus) rusticus</i>	+	96900	<i>Ferrissia sp</i>	+
11120	<i>Baetis flavistriga</i>	+	98200	<i>Pisidium sp</i>	+
13521	<i>Stenonema femoratum</i>	+	98600	<i>Sphaerium sp</i>	+
21200	<i>Calopteryx sp</i>	+			
22001	<i>Coenagrionidae</i>	+	No. Quantitative Taxa: 0		Total Taxa: 53
28955	<i>Plathemis lydia</i>	+	No. Qualitative Taxa: 53		ICI:
43300	<i>Ranatra sp</i>	+	Number of Organisms: 0		Qual EPT: 7
43570	<i>Neoplea sp</i>	+			
45300	<i>Sigara sp</i>	+			
47600	<i>Sialis sp</i>	+			
52200	<i>Cheumatopsyche sp</i>	+			
52530	<i>Hydropsyche depravata group</i>	+			
57400	<i>Neophylax sp</i>	+			
57900	<i>Pycnopsyche sp</i>	+			
58505	<i>Helicopsyche borealis</i>	+			
67100	<i>Hydrobius sp</i>	+			
68025	<i>Ectopria sp</i>	+			
68700	<i>Dubiraphia sp</i>	+			
69400	<i>Stenelmis sp</i>	+			
71900	<i>Tipula sp</i>	+			
71910	<i>Tipula abdominalis</i>	+			
74100	<i>Simulium sp</i>	+			
77355	<i>Clinotanypus pinguis</i>	+			
77500	<i>Conchapelopia sp</i>	+			
80351	<i>Corynoneura n.sp 1</i>	+			
80410	<i>Cricotopus (C.) sp</i>	+			
81631	<i>Parakiefferiella n.sp 1</i>	+			
81650	<i>Parametriocnemus sp</i>	+			
82141	<i>Thienemanniella xena</i>	+			
83040	<i>Dicrotendipes neomodestus</i>	+			
83051	<i>Dicrotendipes simpsoni</i>	+			
83840	<i>Microtendipes pedellus group</i>	+			
84450	<i>Polypedilum (Uresipedilum) flavum</i>	+			
84470	<i>Polypedilum (P.) illinoense</i>	+			
84750	<i>Stictochironomus sp</i>	+			
85500	<i>Paratanytarsus sp</i>	+			
85501	<i>Paratanytarsus n.sp 1</i>	+			
85615	<i>Rheotanytarsus pellucidus</i>	+			

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Collection Date: 08/09/2004 River Code: 15-024 RM: 0.70 Site: Dewdale Creek upst. Rock Haven Rd.

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01801	<i>Turbellaria</i>	+	74100	<i>Simulium sp</i>	18 +
03600	<i>Oligochaeta</i>	16 +	77120	<i>Ablabesmyia mallochi</i>	+
06700	<i>Crangonyx sp</i>	+	77500	<i>Conchapelopia sp</i>	77 +
08250	<i>Orconectes (Procericambarus) rusticus</i>	+	77750	<i>Hayesomyia senata or Thienemannimyia norena</i>	+
08601	<i>Hydrachnidia</i>	+			
11120	<i>Baetis flavistriga</i>	25 +	78450	<i>Nilotanypus fimbriatus</i>	1
11130	<i>Baetis intercalaris</i>	169 +	81650	<i>Parametriocnemus sp</i>	+
11430	<i>Dipheter hageni</i>	26	81825	<i>Rheocricotopus (Psilocricotopus) robacki</i>	21
12200	<i>Isonychia sp</i>	139 +	82101	<i>Thienemanniella taurocapita</i>	21 +
13000	<i>Leucrocuta sp</i>	8 +	82141	<i>Thienemanniella xena</i>	21
13400	<i>Stenacron sp</i>	2 +	82200	<i>Tvetenia bavarica group</i>	40
13521	<i>Stenonema femoratum</i>	2 +	82220	<i>Tvetenia discoloripes group</i>	+
13540	<i>Maccaffertium mediopunctatum</i>	2 +	83300	<i>Glyptotendipes (G.) sp</i>	+
13561	<i>Maccaffertium pulchellum</i>	1	83840	<i>Microtendipes pedellus group</i>	+
13590	<i>Maccaffertium vicarium</i>	9	84210	<i>Paratendipes albimanus or P. duplicatus</i>	+
15000	<i>Paraleptophlebia sp</i>	32	84450	<i>Polypedilum (Uresipedilum) flavum</i>	21 +
17200	<i>Caenis sp</i>	+	84480	<i>Polypedilum (P.) laetum group</i>	+
21200	<i>Calopteryx sp</i>	+	84750	<i>Stictochironomus sp</i>	+
23909	<i>Boyeria vinosa</i>	+	85615	<i>Rheotanytarsus pellucidus</i>	81
24900	<i>Gomphus sp</i>	+	85625	<i>Rheotanytarsus sp</i>	1581 +
34130	<i>Acroneuria frisoni</i>	3 +	85800	<i>Tanytarsus sp</i>	21 +
34700	<i>Agneta capitata complex</i>	2 +	85802	<i>Tanytarsus curticornis</i>	21 +
48620	<i>Nigronia serricornis</i>	2	85821	<i>Tanytarsus glabrescens group sp 7</i>	21 +
50315	<i>Chimarra obscura</i>	1	85840	<i>Tanytarsus sepp</i>	21
50804	<i>Lype diversa</i>	15 +	86401	<i>Atherix lantha</i>	1
51600	<i>Polycentropus sp</i>	+	87510	<i>Chelifera sp</i>	16 +
52200	<i>Cheumatopsyche sp</i>	328 +	87515	<i>Clinocera (C.) sp</i>	16 +
52430	<i>Ceratopsyche morosa group</i>	74 +	87540	<i>Hemerodromia sp</i>	117 +
52440	<i>Ceratopsyche slossonae</i>	10 +	95100	<i>Physella sp</i>	+
52530	<i>Hydropsyche depravata group</i>	9 +	96900	<i>Ferrissia sp</i>	51 +
53300	<i>Glossosoma sp</i>	+	98600	<i>Sphaerium sp</i>	+
57400	<i>Neophylax sp</i>	+	99100	<i>Pyganodon grandis</i>	+
57900	<i>Pycnopsyche sp</i>	2 +	99160	<i>Anodontoides ferussacianus</i>	+
58505	<i>Helicopsyche borealis</i>	+	99180	<i>Strophitus undulatus undulatus</i>	+
59310	<i>Mystacides sepulchralis</i>	+			
68025	<i>Ectopria sp</i>	+	No. Quantitative Taxa: 46		Total Taxa: 77
68075	<i>Psephenus herricki</i>	3 +	No. Qualitative Taxa: 63		ICI: 56
68130	<i>Helichus sp</i>	+	Number of Organisms: 3263		Qual EPT: 21
68601	<i>Ancyronyx variegata</i>	1			
68708	<i>Dubiraphia vittata group</i>	+			
68901	<i>Macronychus glabratus</i>	17 +			
69210	<i>Optioservus ampliatus</i>	1 +			
69400	<i>Stenelmis sp</i>	197 +			
71100	<i>Hexatoma sp</i>	+			

Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Collection Date: 09/02/2004 River Code: 15-025 RM: 1.10 Site: South Branch Silver Creek Music St.

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
00401	<i>Spongillidae</i>	+	82220	<i>Tvetenia discoloripes group</i>	+
01801	<i>Turbellaria</i>	+	83051	<i>Dicrotendipes simpsoni</i>	+
03360	<i>Plumatella sp</i>	+	83300	<i>Glyptotendipes (G.) sp</i>	+
03600	<i>Oligochaeta</i>	+	83820	<i>Microtendipes "caelum" (sensu Simpson & Bode, 1980)</i>	+
04664	<i>Helobdella stagnalis</i>	+	83840	<i>Microtendipes pedellus group</i>	+
05800	<i>Caecidotea sp</i>	+	84050	<i>Parachironomus "hirtalatus" (sensu Simpson & Bode, 1980)</i>	+
06201	<i>Hyaella azteca</i>	+	84210	<i>Paratendipes albimanus or P. duplicatus</i>	+
08250	<i>Orconectes (Procericambarus) rusticus</i>	+	84300	<i>Phaenopsectra obediens group</i>	+
11120	<i>Baetis flavistriga</i>	+	84450	<i>Polypedilum (Uresipedilum) flavum</i>	+
11130	<i>Baetis intercalaris</i>	+	84540	<i>Polypedilum (Tripodura) scalaenum group</i>	+
13400	<i>Stenacron sp</i>	+	84700	<i>Stenochironomus sp</i>	+
21200	<i>Calopteryx sp</i>	+	84750	<i>Stictochironomus sp</i>	+
22001	<i>Coenagrionidae</i>	+	84800	<i>Tribelos jucundum</i>	+
22300	<i>Argia sp</i>	+	84888	<i>Xenochironomus xenolabis</i>	+
23909	<i>Boyeria vinosa</i>	+	85615	<i>Rheotanytarsus pellucidus</i>	+
24620	<i>Arigomphus villosipes</i>	+	85625	<i>Rheotanytarsus sp</i>	+
25510	<i>Stylogomphus albistylus</i>	+	92615	<i>Cipangopaludina japonica</i>	+
43570	<i>Neoplea sp</i>	+	95100	<i>Physella sp</i>	+
48620	<i>Nigronia serricornis</i>	+	96264	<i>Planorbella (Pierosoma) pilsbryi</i>	+
52200	<i>Cheumatopsyche sp</i>	+	98600	<i>Sphaerium sp</i>	+
52530	<i>Hydropsyche depravata group</i>	+			
53800	<i>Hydroptila sp</i>	+	No. Quantitative Taxa: 0		Total Taxa: 64
57900	<i>Pycnopsyche sp</i>	+	No. Qualitative Taxa: 64		ICI:
59300	<i>Mystacides sp</i>	+	Number of Organisms: 0		Qual EPT: 8
60900	<i>Peltodytes sp</i>	+			
65800	<i>Berosus sp</i>	+			
67100	<i>Hydrobius sp</i>	+			
68601	<i>Ancyronyx variegata</i>	+			
68901	<i>Macronychus glabratus</i>	+			
69400	<i>Stenelmis sp</i>	+			
74100	<i>Simulium sp</i>	+			
77355	<i>Clinotanypus pinguis</i>	+			
77800	<i>Helopelopia sp</i>	+			
78200	<i>Larsia sp</i>	+			
78450	<i>Nilotanypus fimbriatus</i>	+			
80351	<i>Corynoneura n.sp 1</i>	+			
80420	<i>Cricotopus (C.) bicinctus</i>	+			
80430	<i>Cricotopus (C.) tremulus group</i>	+			
81231	<i>Nanocladius (N.) crassicornus or N. (N.) "rectinervis"</i>	+			
81240	<i>Nanocladius (N.) distinctus</i>	+			
81690	<i>Paratrichocladius sp</i>	+			
82101	<i>Thienemanniella taurocapita</i>	+			
82121	<i>Thienemanniella lobapodema</i>	+			
82141	<i>Thienemanniella xena</i>	+			

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/16/2004 River Code: 15-030 RM: 0.80 Site: Ward Creek

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01801	<i>Turbellaria</i>	+			
03600	<i>Oligochaeta</i>	+			
06810	<i>Gammarus fasciatus</i>	+			
08250	<i>Orconectes (Procericambarus) rusticus</i>	+			
11120	<i>Baetis flavistriga</i>	+			
21200	<i>Calopteryx sp</i>	+			
22001	<i>Coenagrionidae</i>	+			
22300	<i>Argia sp</i>	+			
23909	<i>Boyeria vinosa</i>	+			
52200	<i>Cheumatopsyche sp</i>	+			
52530	<i>Hydropsyche depravata group</i>	+			
53501	<i>Hydroptilidae</i>	+			
60900	<i>Peltodytes sp</i>	+			
69400	<i>Stenelmis sp</i>	+			
70600	<i>Antocha sp</i>	+			
74100	<i>Simulium sp</i>	+			
77500	<i>Conchapelopia sp</i>	+			
84450	<i>Polypedilum (Uresipedilum) flavum</i>	+			
84470	<i>Polypedilum (P.) illinoense</i>	+			
85625	<i>Rheotanytarsus sp</i>	+			
85821	<i>Tanytarsus glabrescens group sp 7</i>	+			
85840	<i>Tanytarsus sepp</i>	+			
87540	<i>Hemerodromia sp</i>	+			
96900	<i>Ferrissia sp</i>	+			
98600	<i>Sphaerium sp</i>	+			

No. Quantitative Taxa: 0	Total Taxa: 25
No. Qualitative Taxa: 25	ICI:
Number of Organisms: 0	Qual EPT: 4

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/15/2004 River Code: 15-031 RM: 0.10 Site: Quarry Creek Markell Rd.

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
03040	<i>Fredericella sp</i>	+	86401	<i>Atherix lantha</i>	+
03600	<i>Oligochaeta</i>	+	87540	<i>Hemerodromia sp</i>	+
08250	<i>Orconectes (Procericambarus) rusticus</i>	+	95100	<i>Physella sp</i>	+
11115	<i>Baetis tricaudatus</i>	+	96900	<i>Ferrissia sp</i>	+
11120	<i>Baetis flavistriga</i>	+			
13590	<i>Maccaffertium vicarium</i>	+	No. Quantitative Taxa: 0		Total Taxa: 48
21200	<i>Calopteryx sp</i>	+	No. Qualitative Taxa: 48		ICI:
23909	<i>Boyeria vinosa</i>	+	Number of Organisms: 0		Qual EPT: 9
47600	<i>Sialis sp</i>	+			
48620	<i>Nigronia serricornis</i>	+			
51001	<i>Polycentropodidae</i>	+			
52200	<i>Cheumatopsyche sp</i>	+			
52315	<i>Diplectrone modesta</i>	+			
52440	<i>Ceratopsyche slossonae</i>	+			
52450	<i>Ceratopsyche sparna</i>	+			
52530	<i>Hydropsyche depravata group</i>	+			
60300	<i>Dineutus sp</i>	+			
68075	<i>Psephenus herricki</i>	+			
71900	<i>Tipula sp</i>	+			
71910	<i>Tipula abdominalis</i>	+			
74100	<i>Simulium sp</i>	+			
77500	<i>Conchapelopia sp</i>	+			
77800	<i>Helopelopia sp</i>	+			
78350	<i>Meropelopia sp</i>	+			
80204	<i>Brillia flavifrons group</i>	+			
80410	<i>Cricotopus (C.) sp</i>	+			
81270	<i>Nanocladius (N.) spinipenus</i>	+			
81825	<i>Rheocricotopus (Psilocricotopus) robacki</i>	+			
82141	<i>Thienemanniella xena</i>	+			
82200	<i>Tvetenia bavarica group</i>	+			
82820	<i>Cryptochironomus sp</i>	+			
83840	<i>Microtendipes pedellus group</i>	+			
84300	<i>Phaenopsectra obediens group</i>	+			
84440	<i>Polypedilum (Uresipedilum) aviceps</i>	+			
84450	<i>Polypedilum (Uresipedilum) flavum</i>	+			
84460	<i>Polypedilum (P.) fallax group</i>	+			
84470	<i>Polypedilum (P.) illinoense</i>	+			
84540	<i>Polypedilum (Tripodura) scalaenum group</i>	+			
85261	<i>Cladotanytarsus vanderwulpi group Type 1</i>	+			
85500	<i>Paratanytarsus sp</i>	+			
85615	<i>Rheotanytarsus pellucidus</i>	+			
85625	<i>Rheotanytarsus sp</i>	+			
85821	<i>Tanytarsus glabrescens group sp 7</i>	+			
85840	<i>Tanytarsus sepp</i>	+			

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/15/2004 River Code: 15-032 RM: 0.10 Site: Stony Brook at mouth, upst. St. Rt. 615

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01801	<i>Turbellaria</i>	+	80750	<i>Eukiefferiella devonica group</i>	+
03360	<i>Plumatella sp</i>	+	81650	<i>Parametriocnemus sp</i>	+
03600	<i>Oligochaeta</i>	+	81690	<i>Paratrichocladius sp</i>	+
06700	<i>Crangonyx sp</i>	+	82101	<i>Thienemanniella taurocapita</i>	+
08280	<i>Orconectes (Gremicambarus) virilis</i>	+	82141	<i>Thienemanniella xena</i>	+
11014	<i>Acentrella turbida</i>	+	82730	<i>Chironomus (C.) decorus group</i>	+
11120	<i>Baetis flavistriga</i>	+	82820	<i>Cryptochironomus sp</i>	+
11130	<i>Baetis intercalaris</i>	+	84300	<i>Phaenopsectra obediens group</i>	+
12200	<i>Isonychia sp</i>	+	84302	<i>Phaenopsectra punctipes</i>	+
13400	<i>Stenacron sp</i>	+	84440	<i>Polypedilum (Uresipedilum) aviceps</i>	+
13521	<i>Stenonema femoratum</i>	+	84450	<i>Polypedilum (Uresipedilum) flavum</i>	+
21200	<i>Calopteryx sp</i>	+	85615	<i>Rheotanytarsus pellucidus</i>	+
22300	<i>Argia sp</i>	+	85625	<i>Rheotanytarsus sp</i>	+
23600	<i>Aeshna sp</i>	+	85821	<i>Tanytarsus glabrescens group sp 7</i>	+
24900	<i>Gomphus sp</i>	+	86401	<i>Atherix lantha</i>	+
25510	<i>Stylogomphus albistylus</i>	+	87540	<i>Hemerodromia sp</i>	+
42700	<i>Belostoma sp</i>	+	95100	<i>Physella sp</i>	+
45300	<i>Sigara sp</i>	+	96900	<i>Ferrissia sp</i>	+
47600	<i>Sialis sp</i>	+			
50301	<i>Chimarra aterrima</i>	+	No. Quantitative Taxa: 0		Total Taxa: 62
51400	<i>Nyctiophylax sp</i>	+	No. Qualitative Taxa: 62		ICI:
51600	<i>Polycentropus sp</i>	+	Number of Organisms: 0		Qual EPT: 18
52200	<i>Cheumatopsyche sp</i>	+			
52430	<i>Ceratopsyche morosa group</i>	+			
52440	<i>Ceratopsyche slossonae</i>	+			
52450	<i>Ceratopsyche sparna</i>	+			
52530	<i>Hydropsyche depravata group</i>	+			
52540	<i>Hydropsyche dicantha</i>	+			
53800	<i>Hydroptila sp</i>	+			
54000	<i>Leucotrichia pictipes</i>	+			
58505	<i>Helicopsyche borealis</i>	+			
60900	<i>Peltodytes sp</i>	+			
63300	<i>Hydroporus sp</i>	+			
67100	<i>Hydrobius sp</i>	+			
67700	<i>Paracymus sp</i>	+			
68075	<i>Psephenus herricki</i>	+			
69400	<i>Stenelmis sp</i>	+			
70600	<i>Antocha sp</i>	+			
71910	<i>Tipula abdominalis</i>	+			
74100	<i>Simulium sp</i>	+			
74501	<i>Ceratopogonidae</i>	+			
80420	<i>Cricotopus (C.) bicinctus</i>	+			
80430	<i>Cricotopus (C.) tremulus group</i>	+			
80440	<i>Cricotopus (C.) trifascia</i>	+			

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/15/2004 River Code: 15-033 RM: 0.10 Site: Pierson Creek Booth Rd.

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
07860	<i>Cambarus (Puncticambarus) robustus</i>	+			
11115	<i>Baetis tricaudatus</i>	+			
13400	<i>Stenacron sp</i>	+			
13590	<i>Maccaffertium vicarium</i>	+			
14950	<i>Leptophlebia sp or Paraleptophlebia sp</i>	+			
21200	<i>Calopteryx sp</i>	+			
23909	<i>Boyeria vinosa</i>	+			
25510	<i>Stylogomphus albistylus</i>	+			
26100	<i>Cordulegaster sp</i>	+			
34120	<i>Acroneuria carolinensis</i>	+			
36500	<i>Sweltsa sp</i>	+			
48610	<i>Nigronia fasciatus</i>	+			
48620	<i>Nigronia serricornis</i>	+			
50301	<i>Chimarra aterrima</i>	+			
50410	<i>Dolophilodes distinctus</i>	+			
51600	<i>Polycentropus sp</i>	+			
52200	<i>Cheumatopsyche sp</i>	+			
52315	<i>Diplectrona modesta</i>	+			
52440	<i>Ceratopsyche slossonae</i>	+			
52450	<i>Ceratopsyche sparna</i>	+			
52530	<i>Hydropsyche depravata group</i>	+			
53100	<i>Rhyacophila sp</i>	+			
53300	<i>Glossosoma sp</i>	+			
68075	<i>Psephenus herricki</i>	+			
69200	<i>Optioservus sp</i>	+			
71900	<i>Tipula sp</i>	+			
71910	<i>Tipula abdominalis</i>	+			
74100	<i>Simulium sp</i>	+			
74501	<i>Ceratopogonidae</i>	+			
77500	<i>Conchapelopia sp</i>	+			
81650	<i>Parametriocnemus sp</i>	+			
82200	<i>Tvetenia bavarica group</i>	+			
84210	<i>Paratendipes albimanus or P. duplicatus</i>	+			
84440	<i>Polypedilum (Uresipedilum) aviceps</i>	+			
85615	<i>Rheotanytarsus pellucidus</i>	+			
85752	<i>Sublettea coffmani</i>	+			
85800	<i>Tanytarsus sp</i>	+			
86100	<i>Chrysops sp</i>	+			
87515	<i>Clinocera (C.) sp</i>	+			
87540	<i>Hemerodromia sp</i>	+			
94400	<i>Fossaria sp</i>	+			
95100	<i>Physella sp</i>	+			
			No. Quantitative Taxa: 0		Total Taxa: 42
			No. Qualitative Taxa: 42		ICI:
			Number of Organisms: 0		Qual EPT: 16

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/14/2004 River Code: 15-037 RM: 0.30 Site: Trib. to Chagrin R. (RM 38.32)

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01801	<i>Turbellaria</i>	+	86200	<i>Tabanus sp</i>	+
03040	<i>Fredericella sp</i>	+	96264	<i>Planorbella (Pierosoma) pilsbryi</i>	+
03600	<i>Oligochaeta</i>	+			
04687	<i>Placobdella parasitica</i>	+	No. Quantitative Taxa: 0		Total Taxa: 46
08250	<i>Orconectes (Procericambarus) rusticus</i>	+	No. Qualitative Taxa: 46		ICI:
08601	<i>Hydrachnidia</i>	+	Number of Organisms: 0		Qual EPT: 6
11120	<i>Baetis flavistriga</i>	+			
11130	<i>Baetis intercalaris</i>	+			
13521	<i>Stenonema femoratum</i>	+			
21200	<i>Calopteryx sp</i>	+			
22001	<i>Coenagrionidae</i>	+			
22300	<i>Argia sp</i>	+			
23909	<i>Boyeria vinosa</i>	+			
26100	<i>Cordulegaster sp</i>	+			
42700	<i>Belostoma sp</i>	+			
44501	<i>Corixidae</i>	+			
52200	<i>Cheumatopsyche sp</i>	+			
52530	<i>Hydropsyche depravata group</i>	+			
53800	<i>Hydroptila sp</i>	+			
60800	<i>Haliphus sp</i>	+			
60900	<i>Peltodytes sp</i>	+			
66500	<i>Enochrus sp</i>	+			
67800	<i>Tropisternus sp</i>	+			
69400	<i>Stenelmis sp</i>	+			
71700	<i>Pilaria sp</i>	+			
71900	<i>Tipula sp</i>	+			
74100	<i>Simulium sp</i>	+			
78350	<i>Meropelopia sp</i>	+			
80420	<i>Cricotopus (C.) bicinctus</i>	+			
80430	<i>Cricotopus (C.) tremulus group</i>	+			
82141	<i>Thienemanniella xena</i>	+			
82730	<i>Chironomus (C.) decorus group</i>	+			
82820	<i>Cryptochironomus sp</i>	+			
83003	<i>Dicrotendipes fumidus</i>	+			
83040	<i>Dicrotendipes neomodestus</i>	+			
84440	<i>Polypedilum (Uresipedilum) aviceps</i>	+			
84450	<i>Polypedilum (Uresipedilum) flavum</i>	+			
84460	<i>Polypedilum (P.) fallax group</i>	+			
84470	<i>Polypedilum (P.) illinoense</i>	+			
85400	<i>Micropsectra sp</i>	+			
85500	<i>Paratanytarsus sp</i>	+			
85625	<i>Rheotanytarsus sp</i>	+			
85800	<i>Tanytarsus sp</i>	+			
85821	<i>Tanytarsus glabrescens group sp 7</i>	+			

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Collection Date: 08/09/2004 River Code: 15-038 RM: 0.10 Site: Trib. to E. Br. Chagrin R. (RM 10.13) upst.

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
03600	<i>Oligochaeta</i>	18	77500	<i>Conchapelopia sp</i>	65 +
07860	<i>Cambarus (Puncticambarus) robustus</i>	+	77800	<i>Helopelopia sp</i>	+
11014	<i>Acentrella turbida</i>	18	80370	<i>Corynoneura lobata</i>	32
11115	<i>Baetis tricaudatus</i>	2 +	81650	<i>Parametriocnemus sp</i>	325
11120	<i>Baetis flavistriga</i>	93	82101	<i>Thienemanniella taurocapita</i>	+
11130	<i>Baetis intercalaris</i>	1	82141	<i>Thienemanniella xena</i>	32 +
11175	<i>Plauditus virilis</i>	+	82200	<i>Tvetenia bavarica group</i>	65
11430	<i>Dipheter hageni</i>	5	83840	<i>Microtendipes pedellus group</i>	65
12200	<i>Isonychia sp</i>	9	83900	<i>Nilothauma sp</i>	+
12800	<i>Epeorus sp</i>	+	84430	<i>Polypedilum (P.) albicorne</i>	130
13000	<i>Leucrocuta sp</i>	+	84440	<i>Polypedilum (Uresipedilum) aviceps</i>	32 +
13400	<i>Stenacron sp</i>	16	84450	<i>Polypedilum (Uresipedilum) flavum</i>	162
13521	<i>Stenonema femoratum</i>	+	85615	<i>Rheotanytarsus pellucidus</i>	325 +
13561	<i>Maccaffertium pulchellum</i>	73 +	85625	<i>Rheotanytarsus sp</i>	2663 +
13590	<i>Maccaffertium vicarium</i>	183 +	85752	<i>Sublettea coffmani</i>	65
15000	<i>Paraleptophlebia sp</i>	1 +	85800	<i>Tanytarsus sp</i>	65
21200	<i>Calopteryx sp</i>	+	85802	<i>Tanytarsus curticornis</i>	32
22001	<i>Coenagrionidae</i>	+	87515	<i>Clinocera (C.) sp</i>	50
23909	<i>Boyeria vinosa</i>	+	87540	<i>Hemerodromia sp</i>	42
33100	<i>Leuctra sp</i>	2 +	96900	<i>Ferrissia sp</i>	+
34120	<i>Acroneuria carolinensis</i>	5 +	98200	<i>Pisidium sp</i>	1
47600	<i>Sialis sp</i>	+			
48610	<i>Nigronia fasciatus</i>	1	No. Quantitative Taxa: 38		Total Taxa: 64
48620	<i>Nigronia serricornis</i>	+	No. Qualitative Taxa: 39		ICI: 54
50301	<i>Chimarra aterrima</i>	+	Number of Organisms: 4693		Qual EPT: 18
50315	<i>Chimarra obscura</i>				
50804	<i>Lype diversa</i>	1			
51600	<i>Polycentropus sp</i>	+			
52200	<i>Cheumatopsyche sp</i>	21 +			
52315	<i>Diplectrona modesta</i>	1			
52430	<i>Ceratopsyche morosa group</i>	+			
52440	<i>Ceratopsyche slossonae</i>	57 +			
52530	<i>Hydropsyche depravata group</i>	17			
53300	<i>Glossosoma sp</i>	+			
57900	<i>Pycnopsyche sp</i>	+			
58020	<i>Lepidostoma sp</i>	+			
63300	<i>Hydroporus sp</i>	+			
68025	<i>Ectopria sp</i>	16			
68075	<i>Psephenus herricki</i>	+			
68130	<i>Helichus sp</i>	+			
68707	<i>Dubiraphia quadrinotata</i>	+			
68708	<i>Dubiraphia vittata group</i>	+			
69210	<i>Optioservus ampliatus</i>	2			
69225	<i>Optioservus fastiditus</i>	+			

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/15/2004 River Code: 15-039 RM: 0.20 Site: Trib. to E. Br. Chagrin R. (RM 10.60) Wisner

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01801	<i>Turbellaria</i>	+	77500	<i>Conchapelopia sp</i>	+
03600	<i>Oligochaeta</i>	+	79210	<i>Thienemannimyia norena</i>	+
07860	<i>Cambarus (Puncticambarus) robustus</i>	+	79400	<i>Zavreliomyia sp</i>	+
11014	<i>Acentrella turbida</i>	+	80470	<i>Cricotopus (C.) or Orthocladius (O.) sp</i>	+
11115	<i>Baetis tricaudatus</i>	+	81650	<i>Parametricnemus sp</i>	+
11120	<i>Baetis flavistriga</i>	+	81690	<i>Paratrichocladius sp</i>	+
11250	<i>Centroptilum sp (w/o hindwing pads)</i>	+	82200	<i>Tvetenia bavarica group</i>	+
11650	<i>Procloeon sp (w/ hindwing pads)</i>	+	83820	<i>Microtendipes "caelum" (sensu Simpson & Bode, 1980)</i>	+
12200	<i>Isonychia sp</i>	+	83840	<i>Microtendipes pedellus group</i>	+
13000	<i>Leucrocuta sp</i>	+	84440	<i>Polypedilum (Uresipedilum) aviceps</i>	+
13521	<i>Stenonema femoratum</i>	+	85261	<i>Cladotanytarsus vanderwulpi group Type 1</i>	+
13590	<i>Maccaffertium vicarium</i>	+	85500	<i>Paratanytarsus sp</i>	+
21200	<i>Calopteryx sp</i>	+	85615	<i>Rheotanytarsus pellucidus</i>	+
23905	<i>Boyeria grafiana</i>	+	85752	<i>Sublettea coffmani</i>	+
25210	<i>Lanthus parvulus</i>	+	85821	<i>Tanytarsus glabrescens group sp 7</i>	+
25510	<i>Stylogomphus albistylus</i>	+	89704	<i>Limnophora aequifrons</i>	+
32200	<i>Amphinemura sp</i>	+	95100	<i>Physella sp</i>	+
34120	<i>Acroneuria carolinensis</i>	+			
36500	<i>Sweltsa sp</i>	+			
45300	<i>Sigara sp</i>	+	No. Quantitative Taxa: 0		Total Taxa: 61
47600	<i>Sialis sp</i>	+	No. Qualitative Taxa: 61		ICI:
48610	<i>Nigronia fasciatus</i>	+	Number of Organisms: 0		Qual EPT: 26
50410	<i>Dolophilodes distinctus</i>	+			
51400	<i>Nyctiophylax sp</i>	+			
51600	<i>Polycentropus sp</i>	+			
52200	<i>Cheumatopsyche sp</i>	+			
52315	<i>Diplectrone modesta</i>	+			
52430	<i>Ceratopsyche morosa group</i>	+			
52440	<i>Ceratopsyche slossonae</i>	+			
52450	<i>Ceratopsyche sparna</i>	+			
52460	<i>Ceratopsyche ventura</i>	+			
53501	<i>Hydroptilidae</i>	+			
54160	<i>Ochrotrichia sp</i>	+			
55107	<i>Oligostomis pardalis</i>	+			
55300	<i>Ptilostomis sp</i>	+			
57900	<i>Pycnopsyche sp</i>	+			
60400	<i>Gyrinus sp</i>	+			
67700	<i>Paracymus sp</i>	+			
68075	<i>Psephenus herricki</i>	+			
69210	<i>Optioservus ampliatus</i>	+			
71100	<i>Hexatoma sp</i>	+			
71910	<i>Tipula abdominalis</i>	+			
74100	<i>Simulium sp</i>	+			
74501	<i>Ceratopogonidae</i>	+			

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/15/2004 River Code: 15-040 RM: 0.10 Site: Trib. to E. Br. Chagrin R. (RM 14.62) Heath Rd.

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
03600	<i>Oligochaeta</i>	+	77800	<i>Helopelopia sp</i>	+
08240	<i>Orconectes (Crockerinus) propinquus</i>	+	79760	<i>Pagastia sp</i>	+
11115	<i>Baetis tricaudatus</i>	+	80204	<i>Brillia flavifrons group</i>	+
11120	<i>Baetis flavistriga</i>	+	80370	<i>Corynoneura lobata</i>	+
11250	<i>Centroptilum sp (w/o hindwing pads)</i>	+	81650	<i>Parametrioctenemus sp</i>	+
12200	<i>Isonychia sp</i>	+	82141	<i>Thienemanniella xena</i>	+
13400	<i>Stenacron sp</i>	+	82200	<i>Tvetenia bavarica group</i>	+
13521	<i>Stenonema femoratum</i>	+	83840	<i>Microtendipes pedellus group</i>	+
13561	<i>Maccaffertium pulchellum</i>	+	84300	<i>Phaenopsectra obediens group</i>	+
13590	<i>Maccaffertium vicarium</i>	+	84440	<i>Polypedilum (Uresipedilum) aviceps</i>	+
14950	<i>Leptophlebia sp or Paraleptophlebia sp</i>	+	84450	<i>Polypedilum (Uresipedilum) flavum</i>	+
18600	<i>Ephemera sp</i>	+	84470	<i>Polypedilum (P.) illinoense</i>	+
21200	<i>Calopteryx sp</i>	+	84800	<i>Tribelos jucundum</i>	+
22300	<i>Argia sp</i>	+	85615	<i>Rheotanytarsus pellucidus</i>	+
25510	<i>Stylogomphus albistylus</i>	+	85625	<i>Rheotanytarsus sp</i>	+
26100	<i>Cordulegaster sp</i>	+	87515	<i>Clinocera (C.) sp</i>	+
33001	<i>Leuctridae</i>	+	87540	<i>Hemerodromia sp</i>	+
34120	<i>Acroneuria carolinensis</i>	+	95100	<i>Physella sp</i>	+
34700	<i>Agnatina capitata complex</i>	+	96900	<i>Ferrissia sp</i>	+
47600	<i>Sialis sp</i>	+			
48620	<i>Nigronia serricornis</i>	+	No. Quantitative Taxa: 0		Total Taxa: 63
50301	<i>Chimarra aterrima</i>	+	No. Qualitative Taxa: 63		ICI:
51600	<i>Polycentropus sp</i>	+	Number of Organisms: 0		Qual EPT: 23
52200	<i>Cheumatopsyche sp</i>	+			
52315	<i>Diplectrona modesta</i>	+			
52440	<i>Ceratopsyche slossonae</i>	+			
52530	<i>Hydropsyche depravata group</i>	+			
53100	<i>Rhyacophila sp</i>	+			
53300	<i>Glossosoma sp</i>	+			
53501	<i>Hydroptilidae</i>	+			
57900	<i>Pycnopsyche sp</i>	+			
61400	<i>Agabus sp</i>	+			
68025	<i>Ectopria sp</i>	+			
68075	<i>Psephenus herricki</i>	+			
68130	<i>Helichus sp</i>	+			
69225	<i>Optioservus fastiditus</i>	+			
69400	<i>Stenelmis sp</i>	+			
70600	<i>Antocha sp</i>	+			
71100	<i>Hexatoma sp</i>	+			
71900	<i>Tipula sp</i>	+			
71910	<i>Tipula abdominalis</i>	+			
74100	<i>Simulium sp</i>	+			
74501	<i>Ceratopogonidae</i>	+			
77500	<i>Conchapelopia sp</i>	+			

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/14/2004 River Code: 15-041 RM: 0.10 Site: Trib. to E. Br. Chagrin R. (RM 14.80) Sperry

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01801	<i>Turbellaria</i>	+			
08240	<i>Orconectes (Crockerinus) propinquus</i>	+	No. Quantitative Taxa: 0		Total Taxa: 44
11115	<i>Baetis tricaudatus</i>	+	No. Qualitative Taxa: 44		ICI:
11120	<i>Baetis flavistriga</i>	+	Number of Organisms: 0		Qual EPT: 11
13400	<i>Stenacron sp</i>	+			
13521	<i>Stenonema femoratum</i>	+			
13590	<i>Maccaffertium vicarium</i>	+			
21200	<i>Calopteryx sp</i>	+			
22300	<i>Argia sp</i>	+			
23905	<i>Boyeria grafiana</i>	+			
23909	<i>Boyeria vinosa</i>	+			
26120	<i>Cordulegaster maculata</i>	+			
47600	<i>Sialis sp</i>	+			
48620	<i>Nigronia serricornis</i>	+			
50301	<i>Chimarra aterrima</i>	+			
52200	<i>Cheumatopsyche sp</i>	+			
52440	<i>Ceratopsyche slossonae</i>	+			
52530	<i>Hydropsyche depravata group</i>	+			
53800	<i>Hydroptila sp</i>	+			
57900	<i>Pycnopsyche sp</i>	+			
63300	<i>Hydroporus sp</i>	+			
67800	<i>Tropisternus sp</i>	+			
68025	<i>Ectopria sp</i>	+			
68075	<i>Psephenus herricki</i>	+			
68130	<i>Helichus sp</i>	+			
69400	<i>Stenelmis sp</i>	+			
70600	<i>Antocha sp</i>	+			
71910	<i>Tipula abdominalis</i>	+			
74100	<i>Simulium sp</i>	+			
77500	<i>Conchapelopia sp</i>	+			
77800	<i>Helopelopia sp</i>	+			
79400	<i>Zavreliomyia sp</i>	+			
81650	<i>Parametriocnemus sp</i>	+			
81690	<i>Paratrichocladius sp</i>	+			
82100	<i>Thienemanniella sp</i>	+			
82200	<i>Tvetenia bavarica group</i>	+			
83840	<i>Microtendipes pedellus group</i>	+			
84210	<i>Paratendipes albimanus or P. duplicatus</i>	+			
84300	<i>Phaenopsectra obediens group</i>	+			
84440	<i>Polypedilum (Uresipedilum) aviceps</i>	+			
84450	<i>Polypedilum (Uresipedilum) flavum</i>	+			
84470	<i>Polypedilum (P.) illinoense</i>	+			
85500	<i>Paratanytarsus sp</i>	+			
85625	<i>Rheotanytarsus sp</i>	+			

Ohio EPA/DSW Ecological Assessment Section
 Macroinvertebrate Collection

Collection Date: 09/14/2004 River Code: 15-042 RM: 0.20 Site: Trib. to E. Br. Chagrin R. (RM 15.35) Sperry

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
03600	<i>Oligochaeta</i>	+	84440	<i>Polypedilum (Uresipedilum) aviceps</i>	+
05800	<i>Caecidotea sp</i>	+	84450	<i>Polypedilum (Uresipedilum) flavum</i>	+
06700	<i>Crangonyx sp</i>	+	84470	<i>Polypedilum (P.) illinoense</i>	+
08240	<i>Orconectes (Crockerinus) propinquus</i>	+	84750	<i>Stictochironomus sp</i>	+
11115	<i>Baetis tricaudatus</i>	+	85500	<i>Paratanytarsus sp</i>	+
11120	<i>Baetis flavistriga</i>	+	85615	<i>Rheotanytarsus pellucidus</i>	+
13521	<i>Stenonema femoratum</i>	+	85625	<i>Rheotanytarsus sp</i>	+
13590	<i>Maccaffertium vicarium</i>	+	85840	<i>Tanytarsus sepp</i>	+
21200	<i>Calopteryx sp</i>	+	87515	<i>Clinocera (C.) sp</i>	+
23600	<i>Aeshna sp</i>	+	87540	<i>Hemerodromia sp</i>	+
23909	<i>Boyeria vinosa</i>	+	95100	<i>Physella sp</i>	+
35560	<i>Isoperla similis</i>	+			
47600	<i>Sialis sp</i>	+	No. Quantitative Taxa: 0		Total Taxa: 54
51400	<i>Nyctiophylax sp</i>	+	No. Qualitative Taxa: 54		ICI:
51600	<i>Polycentropus sp</i>	+	Number of Organisms: 0		Qual EPT: 13
52200	<i>Cheumatopsyche sp</i>	+			
52315	<i>Diplectrone modesta</i>	+			
52440	<i>Ceratopsyche slossonae</i>	+			
52530	<i>Hydropsyche depravata group</i>	+			
53501	<i>Hydroptilidae</i>	+			
57400	<i>Neophylax sp</i>	+			
63300	<i>Hydroporus sp</i>	+			
68025	<i>Ectopria sp</i>	+			
68075	<i>Psephenus herricki</i>	+			
68901	<i>Macronychus glabratus</i>	+			
69200	<i>Optioservus sp</i>	+			
69400	<i>Stenelmis sp</i>	+			
70600	<i>Antocha sp</i>	+			
70700	<i>Dicranota sp</i>	+			
71900	<i>Tipula sp</i>	+			
71910	<i>Tipula abdominalis</i>	+			
74100	<i>Simulium sp</i>	+			
77500	<i>Conchapelopia sp</i>	+			
77750	<i>Hayesomyia senata or Thienemannimyia norena</i>	+			
80204	<i>Brillia flavifrons group</i>	+			
80370	<i>Corynoneura lobata</i>	+			
80430	<i>Cricotopus (C.) tremulus group</i>	+			
81650	<i>Parametriocnemus sp</i>	+			
82200	<i>Tvetenia bavarica group</i>	+			
82730	<i>Chironomus (C.) decorus group</i>	+			
83820	<i>Microtendipes "caelum" (sensu Simpson & Bode, 1980)</i>	+			
84210	<i>Paratendipes albimanus or P. duplicatus</i>	+			
84300	<i>Phaenopsectra obediens group</i>	+			

Ohio EPA/DSW Ecological Assessment Section
 Macroinvertebrate Collection

Collection Date: 09/14/2004 River Code: 15-043 RM: 0.10 Site: Trib. to E. Br. Chagrin R. (RM 16.20) Wilson

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
08240	<i>Orconectes (Crockerinus) propinquus</i>	+	80470	<i>Cricotopus (C.) or Orthocladius (O.) sp</i>	+
11115	<i>Baetis tricaudatus</i>	+	81530	<i>Orthocladius (Symposiocladius) lignicola</i>	+
11120	<i>Baetis flavistriga</i>	+	81650	<i>Parametriocnemus sp</i>	+
13521	<i>Stenonema femoratum</i>	+	82101	<i>Thienemanniella taurocapita</i>	+
13590	<i>Maccaffertium vicarium</i>	+	82200	<i>Tvetenia bavarica group</i>	+
15000	<i>Paraleptophlebia sp</i>	+	82730	<i>Chironomus (C.) decorus group</i>	+
21200	<i>Calopteryx sp</i>	+	83840	<i>Microtendipes pedellus group</i>	+
23905	<i>Boyeria grafiana</i>	+	84300	<i>Phaenopsectra obediens group</i>	+
23909	<i>Boyeria vinosa</i>	+	84440	<i>Polypedilum (Uresipedilum) aviceps</i>	+
25300	<i>Ophiogomphus sp</i>	+	84450	<i>Polypedilum (Uresipedilum) flavum</i>	+
25510	<i>Stylogomphus albistylus</i>	+	84470	<i>Polypedilum (P.) illinoense</i>	+
33100	<i>Leuctra sp</i>	+	84800	<i>Tribelos jucundum</i>	+
34700	<i>Aagnetina capitata complex</i>	+	85500	<i>Paratanytarsus sp</i>	+
47600	<i>Sialis sp</i>	+	85615	<i>Rheotanytarsus pellucidus</i>	+
48620	<i>Nigronia serricornis</i>	+	85625	<i>Rheotanytarsus sp</i>	+
50301	<i>Chimarra aterrima</i>	+	85800	<i>Tanytarsus sp</i>	+
51400	<i>Nyctiophylax sp</i>	+	85802	<i>Tanytarsus curticornis</i>	+
51600	<i>Polycentropus sp</i>	+	85821	<i>Tanytarsus glabrescens group sp 7</i>	+
52200	<i>Cheumatopsyche sp</i>	+	86401	<i>Atherix lantha</i>	+
52315	<i>Diplectrona modesta</i>	+	87515	<i>Clinocera (C.) sp</i>	+
52430	<i>Ceratopsyche morosa group</i>	+	87540	<i>Hemerodromia sp</i>	+
52440	<i>Ceratopsyche slossonae</i>	+	89704	<i>Limnophora aequifrons</i>	+
52450	<i>Ceratopsyche sparna</i>	+	95100	<i>Physella sp</i>	+
52460	<i>Ceratopsyche ventura</i>	+	96900	<i>Ferrissia sp</i>	+
52530	<i>Hydropsyche depravata group</i>	+			
53300	<i>Glossosoma sp</i>	+	No. Quantitative Taxa: 0		Total Taxa: 68
53800	<i>Hydroptila sp</i>	+	No. Qualitative Taxa: 68		ICI:
55107	<i>Oligostomis pardalis</i>	+	Number of Organisms: 0		Qual EPT: 21
58320	<i>Psilotreta indecisa</i>	+			
67000	<i>Helophorus sp</i>	+			
68901	<i>Macronychus glabratus</i>	+			
69400	<i>Stenelmis sp</i>	+			
70600	<i>Antocha sp</i>	+			
71100	<i>Hexatoma sp</i>	+			
71900	<i>Tipula sp</i>	+			
71910	<i>Tipula abdominalis</i>	+			
74100	<i>Simulium sp</i>	+			
77120	<i>Ablabesmyia mallochi</i>	+			
77500	<i>Conchapelopia sp</i>	+			
77750	<i>Hayesomyia senata or Thienemannimyia norena</i>	+			
77800	<i>Helopelopia sp</i>	+			
80204	<i>Brillia flavifrons group</i>	+			
80350	<i>Corynoneura sp</i>	+			
80410	<i>Cricotopus (C.) sp</i>	+			

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/02/2004 River Code: 15-044 RM: 0.20 Site: North Branch McFarland Creek

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01801	<i>Turbellaria</i>	+	96900	<i>Ferrissia sp</i>	+
05800	<i>Caecidotea sp</i>	+	98600	<i>Sphaerium sp</i>	+
06700	<i>Crangonyx sp</i>	+			
08240	<i>Orconectes (Crockerinus) propinquus</i>	+	No. Quantitative Taxa: 0		Total Taxa: 46
11120	<i>Baetis flavistriga</i>	+	No. Qualitative Taxa: 46		ICI:
12200	<i>Isonychia sp</i>	+	Number of Organisms: 0		Qual EPT: 14
13400	<i>Stenacron sp</i>	+			
13521	<i>Stenonema femoratum</i>	+			
13590	<i>Maccaffertium vicarium</i>	+			
21200	<i>Calopteryx sp</i>	+			
23905	<i>Boyeria grafiana</i>	+			
23909	<i>Boyeria vinosa</i>	+			
25210	<i>Lanthus parvulus</i>	+			
25510	<i>Stylogomphus albistylus</i>	+			
26100	<i>Cordulegaster sp</i>	+			
48620	<i>Nigronia serricornis</i>	+			
51400	<i>Nyctiophylax sp</i>	+			
52200	<i>Cheumatopsyche sp</i>	+			
52315	<i>Diplectrona modesta</i>	+			
52430	<i>Ceratopsyche morosa group</i>	+			
52440	<i>Ceratopsyche slossonae</i>	+			
52530	<i>Hydropsyche depravata group</i>	+			
52540	<i>Hydropsyche dicantha</i>	+			
56001	<i>Limnephilidae</i>	+			
57400	<i>Neophylax sp</i>	+			
67700	<i>Paracymus sp</i>	+			
68075	<i>Psephenus herricki</i>	+			
68708	<i>Dubiraphia vittata group</i>	+			
68901	<i>Macronychus glabratus</i>	+			
69400	<i>Stenelmis sp</i>	+			
70600	<i>Antocha sp</i>	+			
74100	<i>Simulium sp</i>	+			
77500	<i>Conchapelopia sp</i>	+			
80430	<i>Cricotopus (C.) tremulus group</i>	+			
81633	<i>Parakiefferiella n.sp 5</i>	+			
81650	<i>Parametriocnemus sp</i>	+			
81690	<i>Paratrichocladius sp</i>	+			
84210	<i>Paratendipes albimanus or P. duplicatus</i>	+			
84300	<i>Phaenopsectra obediens group</i>	+			
84440	<i>Polypedilum (Uresipedilum) aviceps</i>	+			
84450	<i>Polypedilum (Uresipedilum) flavum</i>	+			
85625	<i>Rheotanytarsus sp</i>	+			
85840	<i>Tanytarsus sepp</i>	+			
86401	<i>Atherix lantha</i>	+			

Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Collection Date: 09/03/2004 River Code: 15-045 RM: 0.60 Site: Trib. to Smith Creek (RM 2.70) Crackel Rd.

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
00653	<i>Eunapius fragilis</i>	+	81650	<i>Parametriocnemus sp</i>	+
01801	<i>Turbellaria</i>	+	82121	<i>Thienemanniella lobapodema</i>	+
03600	<i>Oligochaeta</i>	+	82141	<i>Thienemanniella xena</i>	+
04935	<i>Erpobdella punctata punctata</i>	+	82200	<i>Tvetenia bavarica group</i>	+
06700	<i>Crangonyx sp</i>	+	83040	<i>Dicrotendipes neomodestus</i>	+
08250	<i>Orconectes (Procericambarus) rusticus</i>	+	83840	<i>Microtendipes pedellus group</i>	+
11120	<i>Baetis flavistriga</i>	+	84210	<i>Paratendipes albimanus or P. duplicatus</i>	+
13400	<i>Stenacron sp</i>	+	84430	<i>Polypedilum (P.) albicorne</i>	+
13521	<i>Stenonema femoratum</i>	+	84440	<i>Polypedilum (Uresipedilum) aviceps</i>	+
21200	<i>Calopteryx sp</i>	+	84450	<i>Polypedilum (Uresipedilum) flavum</i>	+
23600	<i>Aeshna sp</i>	+	84460	<i>Polypedilum (P.) fallax group</i>	+
23909	<i>Boyeria vinosa</i>	+	84700	<i>Stenochironomus sp</i>	+
47600	<i>Sialis sp</i>	+	84750	<i>Stictochironomus sp</i>	+
48620	<i>Nigronia serricornis</i>	+	84800	<i>Tribelos jucundum</i>	+
51400	<i>Nyctiophylax sp</i>	+	85500	<i>Paratanytarsus sp</i>	+
52200	<i>Cheumatopsyche sp</i>	+	85615	<i>Rheotanytarsus pellucidus</i>	+
52440	<i>Ceratopsyche slossonae</i>	+	85625	<i>Rheotanytarsus sp</i>	+
52530	<i>Hydropsyche depravata group</i>	+	85821	<i>Tanytarsus glabrescens group sp 7</i>	+
53800	<i>Hydroptila sp</i>	+	94400	<i>Fossaria sp</i>	+
55300	<i>Ptilostomis sp</i>	+	95100	<i>Physella sp</i>	+
57400	<i>Neophylax sp</i>	+	96002	<i>Helisoma anceps anceps</i>	+
57900	<i>Pycnopsyche sp</i>	+	96264	<i>Planorbella (Pierosoma) pilsbryi</i>	+
58505	<i>Helicopsyche borealis</i>	+	96900	<i>Ferrissia sp</i>	+
59300	<i>Mystacides sp</i>	+	98200	<i>Pisidium sp</i>	+
59400	<i>Nectopsyche sp</i>	+			
63300	<i>Hydroporus sp</i>	+	No. Quantitative Taxa: 0		Total Taxa: 68
67100	<i>Hydrobius sp</i>	+	No. Qualitative Taxa: 68		ICI:
67700	<i>Paracymus sp</i>	+	Number of Organisms: 0		Qual EPT: 14
68025	<i>Ectopria sp</i>	+			
68707	<i>Dubiraphia quadrinotata</i>	+			
68708	<i>Dubiraphia vittata group</i>	+			
69225	<i>Optioservus fastiditus</i>	+			
69400	<i>Stenelmis sp</i>	+			
70600	<i>Antocha sp</i>	+			
70700	<i>Dicranota sp</i>	+			
71900	<i>Tipula sp</i>	+			
74100	<i>Simulium sp</i>	+			
77500	<i>Conchapelopia sp</i>	+			
77750	<i>Hayesomyia senata or Thienemannimyia norena</i>	+			
77800	<i>Helopelopia sp</i>	+			
78350	<i>Meropelopia sp</i>	+			
78401	<i>Natarsia species A (sensu Roback, 1978)</i>	+			
80370	<i>Corynoneura lobata</i>	+			
80420	<i>Cricotopus (C.) bicinctus</i>	+			