

Macroinvertebrate Sampling Required by Ohio EPA Permit Number 3PA00002*FD

December 22, 2005

1. Name of the facility:

Combined sewer overflows (CSOs) of the Northeast Ohio Regional Sewer District (NEORSD).

2. Receiving water of the discharge and subsequent stream network:

NEORSD CSOs discharge to several water bodies. This report pertains to macroinvertebrate sampling required under Ohio EPA Permit No. 3PA00002*FD. Sampling was conducted on Big Creek, Doan Brook, Euclid Creek, and Mill Creek. Doan Brook and Euclid Creek are tributary to Lake Erie. Big Creek and Mill Creek are tributary to the Cuyahoga River and ultimately to Lake Erie.

3. Description of the facility:

Several different types of CSO structures are present within the NEORSD system. The location of each NEORSD CSO is listed in Ohio EPA Permit No. 3PA00002*FD. Diagrams and any other descriptive information pertaining to each CSO are on file at the NEORSD Planning Department.

4. Characterization of the effluent from the facility:

NEORSD CSO effluent data were reported to Ohio EPA in monthly Combined Sewer Overflow Reports from November 1988 through March 1997.

5. Descriptions of all sampling sites in the study area:

Ohio EPA Permit No. 3PA00002*FD states that macroinvertebrate sampling shall be conducted at the mouths of Mill Creek, Big Creek, Doan Brook, and Euclid Creek. For practical purposes, however, sampling was not necessarily conducted at the mouths of these water bodies. This slight alteration of the sites specified in the permit was discussed with and approved by Ohio EPA in 1997. Documentation of this and other minor changes in sampling and reporting procedures are included in Appendix A.

Big Creek

Hester-Dendy artificial substrate samplers were installed downstream of all CSOs tributary to Big Creek, at NEORSD stream monitoring Site #25. This site is located approximately 150 meters downstream of Jennings Road. The creek at this location has riffles, a run, and a deep pool. The samplers were located approximately 30 meters downstream of the Treadway Creek outfall, downstream of the last riffle in the

area and upstream of a sharp bend in the creek and a deep pool. The creek is approximately three meters wide at this location with riffle depths generally greater than ten centimeters. The Hester-Dendy samplers were placed in approximately 36 centimeters of water at this location. The stream gradient at Site #25 is estimated to be approximately 18 feet per mile and the creek has a drainage area of approximately 38.6 square miles. The riparian zone in the area is very narrow, and land use is primarily urban and industrial.

Doan Brook

The Doan Brook NEORSD macroinvertebrate sampling site #16.1 is located approximately 50 meters downstream of the furthest downstream CSO discharging to Doan Brook. This site is located within Rockefeller Park, approximately 30 meters downstream of St. Clair Avenue in the channelized section of the brook. Stone walls eight to ten feet in height are present on both sides of the brook from the University Circle area to Interstate 90. Stream width at this location is approximately three meters and Hester-Dendy samplers were placed in approximately 36 centimeters of water. Land use in the area and throughout the Doan Brook watershed is predominantly residential and recreational. The stream gradient at this site was estimated at approximately 14 feet per mile and the stream has a drainage area of approximately 9.5 square miles.

Euclid Creek

The Euclid Creek macroinvertebrate sampling site is located at NEORSD stream monitoring Site #0.5, within the Wildwood Park area of the Cleveland Lakefront State Park. The stream gradient at this site is estimated to be approximately six feet per mile, creating a dry weather velocity that is lower than desired for the colonization of Hester-Dendy artificial substrate samplers. Despite this low flow, the Hester-Dendy artificial substrate samplers were set downstream of all the Euclid Creek CSOs, approximately 200 meters downstream of Lake Shore Boulevard, in a glide area, which was approximately 36 centimeters deep. The creek is approximately 20 meters wide at this location with a narrow riparian zone and a drainage area of approximately 24.2 square miles. Upstream of Lake Shore Boulevard, the creek has been channelized by the U.S. Army Corps of Engineers. Land use within the Euclid Creek watershed is primarily residential and recreational.

Mill Creek

Hester-Dendy artificial substrate samplers were installed downstream of all CSOs tributary to Mill Creek, at NEORSD stream monitoring Site #31. This site is located approximately 200 meters upstream of the confluence with the Cuyahoga River. Hester-Dendy artificial substrate samplers were installed downstream of a riffle approximately 50 feet upstream from the Canal Road Bridge. The samplers were

installed in approximately 36 centimeters of water. This site is downstream from all CSO outfalls and tributaries to Mill Creek. At this location the stream gradient is calculated to be approximately 12 feet per mile, and the creek has a drainage area of approximately 18.1 miles. Land use within the Mill Creek watershed is primarily industrial and residential.

6. Listing of name and model number of all sampling equipment used:

Hester-Dendy artificial substrate samplers per Ohio EPA specifications; 12" x 4" x 2" cinder blocks; assorted lengths of half inch diameter steel rebar; plastic tie wraps; U.S. number 35 standard sieve (500-micron openings); 1000-milliliter cylindrical plastic screw-top containers; 500-micron D-frame aquatic dip net, Turtox Design 73-440, Wildco Catalog number 425-A46; one square foot Surber sampler; serrated fine-point forceps; 50-milliliter snap-cap vials; Hedwin 4-liter Cubitainers #10M4M3; Wildco Model #190-E20 wash bucket (583-micron mesh bottom); YSI 556 MPS multi-meter (dissolved oxygen, specific conductance, pH and temperature).

7. Description of all electrofishing configurations used:

Not Applicable.

8. Types of boats used:

Not Applicable.

9. Description of exact methods for demarcation of the sampling zone:

Investigators identified the Hester-Dendy artificial substrate sampler locations by pacing off the distance from known landmarks and the sample location. The Big Creek site was located midstream, approximately ninety feet downstream of the Treadway Creek outfall; the Doan Brook site was located river left, approximately 100 feet downstream of the St. Clair Avenue Bridge; the Euclid Creek site was located river right, approximately 600 feet downstream of the Lake Shore Boulevard bridge; and the Mill Creek site was located river right, approximately 50 feet upstream of Canal Road. All sample sites were marked with a length of rebar.

10. Diagram of the course followed as each sampling zone was traversed:

Not Applicable.

11. Description of sample preservation methods:

The Hester-Dendy artificial substrate samplers were removed from the water and placed into the five-gallon Wildco wash bucket. The individual samplers were disassembled in this wash bucket. The Hester-Dendy plates were left in the wash bucket while all of the associated hardware was washed into the bucket with water from the stream being sampled and carefully examined before discarding. The remaining contents of the wash bucket, including the Hester-Dendy plates, were then placed into a 1000-milliliter cylindrical, plastic screw-top container and enough ethanol to completely submerge the sample was added to the container. Qualitative samples were obtained and placed directly into a 50-milliliter snap-cap vial containing ethanol.

12. Listing of all taxonomic keys utilized for specimen identification:

The following taxonomic literature sources were used by EA Engineering, Science and Technology to identify the benthos in the NEORSD's samples from Big Creek, Doan Brook, Mill Creek, and Euclid Creek.

- Bednarik, A.F. and W.P. McCafferty. 1979. Biosystematic revision of the genus Stenonema (Ephemeroptera: Heptageniidae). Canadian Bulletins of Fisheries and Aquatic Sciences 201:1-73.
- Bode, R.W. 1983. Larvae of North American Eukiefferiella and Tvetenia (Diptera: Chironomidae). New York State Museum Bulletin 452:1-40.
- Bolton, M.J. 1998. Guide to the identification of larval Chironomidae (Diptera) in the temperate eastern Nearctic north of Florida. Ohio EPA, Division of Surface Water, Ecological Assessment Section, Columbus, Ohio.
- Brown, H.P. 1976. Aquatic dryopoid beetles (Coleoptera) of the United States. Water Pollution Control Series 18050 ELDO4/72. 2nd edition. U.S. Environmental Protection Agency, Cincinnati, OH.
- Burch, J.B. 1982. Freshwater snails (Mollusca: Gastropoda) of North America. EPA-600/3-82-026. U.S. Environmental Protection Agency, Environmental Monitoring and Support Laboratory, Cincinnati, OH.
- Epler, J.H. 1987. Revision of the Nearctic Dicrotendipes Kieffer, 1913 (Diptera: Chironomidae). Evolutionary Monographs No. 9:1-102.
- _____. 1995. Identification manual for the larval Chironomidae (Diptera) of Florida. Florida DEP, Division of Water Facilities, Tallahassee, FL.

- _____. 2001. Identification manual for the larval Chironomidae (Diptera) of North and South Carolina. North Carolina DENR, Division of Water Quality, Raleigh, NC.
- Grodhaus, G. 1987. Endochironomus Kieffer, Tribelos Townes, Synendotendipes new genus, and Endotribelos new genus (Diptera: Chironomidae) of the Nearctic region. Journal of the Kansas Entomological Society 60(2):167-247.
- Jezerinac, R.F., G.W. Stocker, and D.C. Tarter. 1995. The crayfishes (Decapoda: Cambaridae) of West Virginia. Bulletin of the Ohio Biological Survey 10(1):1-193.
- Klemm, D.J. 1985. Guide to the freshwater Annelida (Polychaeta, nauid, and tubificid Oligochaeta, and Hirudinea) of North America. Kendall/Hunt Publishing Co., Dubuque, IA.
- Larson, D.J., Y. Alarie, and R.E. Roughley. 2000. Predaceous Diving Beetles (Coleoptera: Dytiscidae) of the Nearctic Region: with emphasis on the fauna of Canada and Alaska. NRC Research Press, Ottawa, Canada.
- Maschwitz, D.E. 1976. Revision of the Nearctic species of the subgenus Polypedilum (Chironomidae: Diptera). Doctoral Dissertation, University of Minnesota.
- McCafferty, W.P. and R.D. Waltz. 1990. Revisionary synopsis of the Baetidae (Ephemeroptera) of North and Middle America. Transactions of the American Entomological Society 116(4):769-799.
- Merritt, R.W. and K.W. Cummins, eds. 1996. An introduction to the aquatic insects of North America. 3rd edition. Kendall/Hunt Publishing Co., Dubuque, IA.
- Morihara, D.K. and W.P. McCafferty. 1979. The Baetis larvae of North America (Ephemeroptera: Baetidae). Transactions of the American Entomological Society 105:139-221.
- Needham, J.G. and M.J. Westfall, Jr. 1955. A manual of the dragonflies of North America (Anisoptera) including the Greater Antilles and the provinces of the Mexican border. University of California Press, Berkeley, California.
- Pennak, R.W. 1989. Fresh-water invertebrates of the United States. 2nd edition. John Wiley & Sons, New York, NY.
- Roback, S.S. 1985. The immature chironomids of the eastern United States VI. Pentaneurini-genus Ablabesmyia. Proceedings of The Academy of Natural Sciences of Philadelphia 137(2):153-212.

Saether, O.A. 1977. Taxonomic studies on Chironomidae: Nanocladius, Pseudochironomus, and the Harnischia complex. Bulletin of the Fisheries Research Board of Canada 196:1-143.

Simpson, K.W. and R.W. Bode. 1980. Common larvae of the Chironomidae (Diptera) from New York State streams and rivers with particular reference to the fauna of artificial substrates. New York State Museum Bulletin 439:1-105.

Wiederholm, T., ed. 1983. Chironomidae of the Holarctic region. Keys and diagnoses. Part 1. Larvae. Entomologica Scandinavica Supplement 19:1-457.

Wiggins, G.B. 1996. Larvae of the North American caddisfly genera (Trichoptera). 2nd edition. University of Toronto Press, Toronto, Canada.

13. Location of the reference collection and other sources used to verify identifications:

A reference collection was not necessary for identification of these specimens. However, if a reference collection had been needed to verify any specimens, EA Engineering, Science and Technology maintains a sizable macroinvertebrate voucher collection with over 1800 specimens representing over 700 taxa. If this taxonomic library proved to be insufficient, every reasonable attempt would be made to have the specimen(s) identified or verified by a noted authority.

14. Exact methods used to construct Hester-Dendy samplers or source of purchase:

Hester-Dendy artificial substrate samplers were constructed by ARC Industries, Inc., using eight, three-inch squares of one-eighth inch thick hardboard, twelve one-inch diameter round, one-eighth inch thick plastic washers (spacers), a one-quarter inch eyebolt, and a one-quarter inch nut. A one-quarter inch diameter hole was drilled through the center of each hardboard square. The plates and spacers were arranged on the eyebolt to provide three single spaces, three double spaces, and one triple space. ARC Industries, Inc. is located at 2879 Johnstown Road in Columbus, Ohio.

15. Methods for anchoring Hester-Dendy samplers:

There are two methods used by NEORSD staff to anchor Hester-Dendy samplers. First, five Hester-Dendy artificial substrate samplers are clustered together with plastic tie-wraps. Another plastic tie-wrap is used to secure the cluster of samplers to the top end of the 12" x 4" side of a 12" x 4" x 2" cinder block or to the top end of the 12" x 2" side. If the cluster of Hester-Dendy samplers is attached to the 12" x 4" side of the block, a plastic tie-wrap is passed through the hole in the other end of the concrete block and around a length of steel rebar that has been driven into the

substrate, as shown in Figure A. If the cluster of Hester-Dendy samplers is attached to the 12" x 2" side of the concrete block, a length of steel rebar is driven into the substrate through the hole in the concrete block, as shown in Figure B. The latter method is used at sampling sites that are prone to heavy silt deposition to aid in preventing the Hester-Dendy samplers from being buried in the silt.

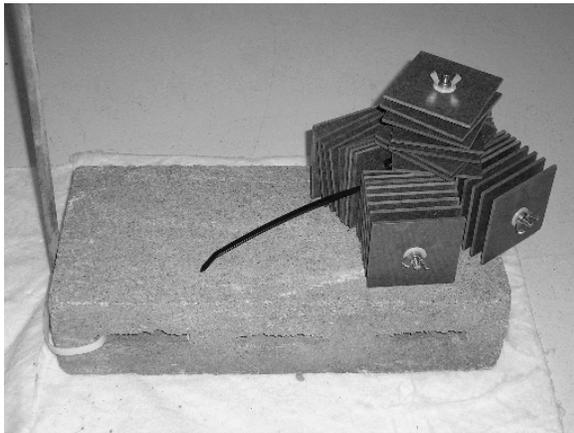


Figure A

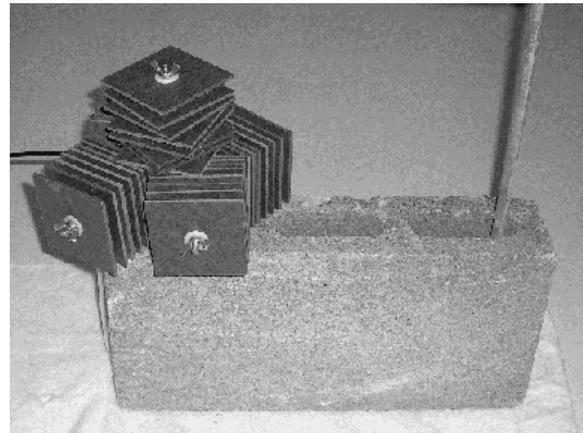


Figure B

16. Descriptions of the methods used to identify dipterans of the family Chironomidae:

Chironomidae larvae were cleared in warm 10% potassium hydroxide and mounted in CMC-10 prior to identification. Generally, 100 chironomids from any single sample are mounted for identification. Species-level identifications generally follow those suggested by Ohio EPA.

17. Copies of all raw data sheets:

Raw data sheets are located in the Appendices at the end of  report as follows:

- | | |
|------------|---------------------------------|
| Appendix B | Chemical Sample Analysis Sheets |
| Appendix C | Macroinvertebrate Data Sheets |

18. Description of the methods used to calculate the QHEI, the IBI, the MIwb, and the ICI for each site:

The QHEI, IBI and the MIwb were not required by Ohio EPA Permit No. 3PA00002*FD.

The Invertebrate Community Index (ICI) was used as the principal measure of overall macroinvertebrate community condition. Developed by the Ohio EPA, the ICI is a modification of the Index of Biotic Integrity for fish (Ohio EPA 1987). The ICI consists of ten individually scored structural community metrics:

1. Total number of taxa
2. Total number of mayfly taxa
3. Total number of caddisfly taxa
4. Total number of dipteran taxa
5. Percent mayflies
6. Percent caddisflies
7. Percent Tanytarsini midges
8. Percent other dipterans and non-insects
9. Percent tolerant organisms
10. Total number of qualitative EPT taxa

Scoring criteria for all ten metrics is dependent upon drainage area. The scoring of an individual sample is based on the relevant attributes of that sample compared to equivalent data from 232 reference sites throughout Ohio. Metric scores range from six points for values comparable to exceptional community structure to zero points for values that deviate strongly from the expected range of values based on scoring criteria established by Ohio EPA (1989a). The sum of the individual metric scores resulted in the ICI score for that particular location.

Calculation of the ICI was conducted using a computer program written for the software SAS® by EA in 1994. This program is continuously tested and updated to ensure its accuracy.

19. Description of qualitative macroinvertebrate sampling techniques:

Qualitative macroinvertebrate sampling was conducted using a 500-micron D-frame aquatic dip net and curved, serrated fine-point forceps. The net was placed in the water with the open end facing upstream. The substrate of all available habitat types (i.e., riffles, runs, deep pools, margins, undercut banks, etc.) was disturbed using kicks with the foot or by hand. Large objects, such as logs, boulders, and slabs, were first handpicked for large invertebrates using forceps and were then washed off into the dip net. Kick sampling and hand picking were conducted until all available habitat types were sampled. The contents of the net were placed into a white enamel pan and sorted for 35 to 45 minutes, until no new or different organisms were found. The organisms were preserved with ethanol in sealed containers for future identification.

A Surber sample was utilized when Hester-Dendy samplers were lost or buried. A quadrat (one square foot) was attached to the frame of the collecting net in such a way that it could be placed on the substrate. The substrate within the quadrat was disturbed and current washed the benthic organisms into the net. The contents retained within the Surber sample were preserved with ethanol in sealed containers for future identification.

20. Complete description of any statistical analysis performed on the data:

The only statistical comparison used was the relative abundance (or percent composition) of individual taxa per site and sample type. Relative abundance was calculated for both sample types as:

$$\text{Relative Abundance} = \frac{\# \text{ Individuals of a Taxa}}{\text{Total \# of Individuals in a Sample}}$$

21. Dates and Times of Sampling:

Hester-Dendy artificial substrate samplers were installed at all four sites twice during the sampling season. Two macroinvertebrate samplings were conducted at each site in 2005 to evaluate seasonality as a variable. The following table lists the streams, date installed and date removed.

FIRST SAMPLING PERIOD		
STREAM	DATE	
	INSTALLED	REMOVED
EUCLID CREEK	JUNE 15, 2005	JULY 28, 2005
DOAN BROOK		
BIG CREEK		
MILL CREEK	JUNE 15, 2005	JULY 28, 2005 (SURBER SAMPLE)

SECOND SAMPLING PERIOD		
STREAM	DATE	
	INSTALLED	REMOVED
EUCLID CREEK	AUGUST 3, 2005	SEPTEMBER 15, 2005
DOAN BROOK		SEPTEMBER 15, 2005 (SURBER SAMPLE)
BIG CREEK		
MILL CREEK	AUGUST 24, 2005	OCTOBER 5, 2005 (SURBER SAMPLE)

22. Results of the stream surveys, in terms of species presence, absence, and relative numbers for each study site.

A list of taxa collected at each site is included in Appendix C.

23. Discussion of historic data pertaining to the locality of the study sites or that stream segment:

ICI SCORES				
DATE	BIG CREEK	DOAN BROOK	EUCLID CREEK	MILL CREEK
1995	22	--	--	18
1996	20	--	--	--
1997	8	4	8	--
1998	--	16	4	--
1999	16	40	22	32
2000	12	30	10	28
2001	22	8	4	12
July 2002	34*	30	24	28
September 2002	26	33	26	32
August 2003	10*	0*	10*	0
September 2003	16*	22	23	18
July 2004	20*	16	10	16
September 2004	10	12	18	16

* ICI score obtained using Surber sampler.

Big Creek

NEORSD has conducted quantitative macroinvertebrate sampling near the mouth of Big Creek since 1995. Although there were difficulties with the Hester-Dendy samplers being lost or buried in 1995 and high flows that prevented their timely removal in 1996, the site received an ICI score of 22 in 1995 and of 20 in 1996. In 1997, the site received a “poor” score of eight. It is important to note that, during the 1997 sampling period, a large construction project was taking place approximately one quarter of a mile upstream of the sampling location. This construction site had extensive erosion and runoff, which entered Big Creek through nearby storm sewers. By 1999, the ICI score had improved to 16. In 2000, the ICI score decreased to 12, but it should be noted that the creek again experienced heavy sediment loadings attributable to a nearby construction project. By 2001, the score had improved to 22, which may reflect the benthic community’s recovery from the previous high sediment load. In 2002, Hester-Dendy samplers were installed

twice, once in July and once in September. During the July 2002 sampling period, the Hester-Dendy samplers were either lost or buried, so a Surber sample was obtained and an ICI score of 34 was calculated. In September 2002, the site obtained an ICI score of 26. In 2003, Hester-Dendy samplers were also installed twice, one six-week period ending in August and one six-week period ending in September. It is hypothesized that heavy rains during the first sampling period led to the samplers being buried or washed away, and in general, led to the lower scores, at all sites, in 2003. In 2004, the Hester-Dendy samplers were installed twice. For the first period, the Hester-Dendy was not recovered, however a Surber sample score of 20 was calculated. The second 2004 period of Hester-Dendy sampling received a score of 10.

Doan Brook

NEORSD has conducted quantitative sampling near the mouth of Doan Brook since 1997. The ICI score calculated in 1997 was four. The ICI score at this location improved to 16 by 1998. The 1999 ICI score of 40 demonstrated improvement from the previous years. Flow velocities had increased and some upstream discharges were remediated. In 2000, the ICI score near the mouth of Doan Brook was 30. In 2001, the scores had decreased to eight, but, by 2002, the ICI score had improved. In 2002, Hester-Dendy samplers were installed twice, and they were removed in July and September. The scores had improved to 30 and 22, respectively. In 2003, the average score for the two periods that were sampled decreased to 11. The scores from the two 2004 sample periods improved to an average of 14.

Euclid Creek

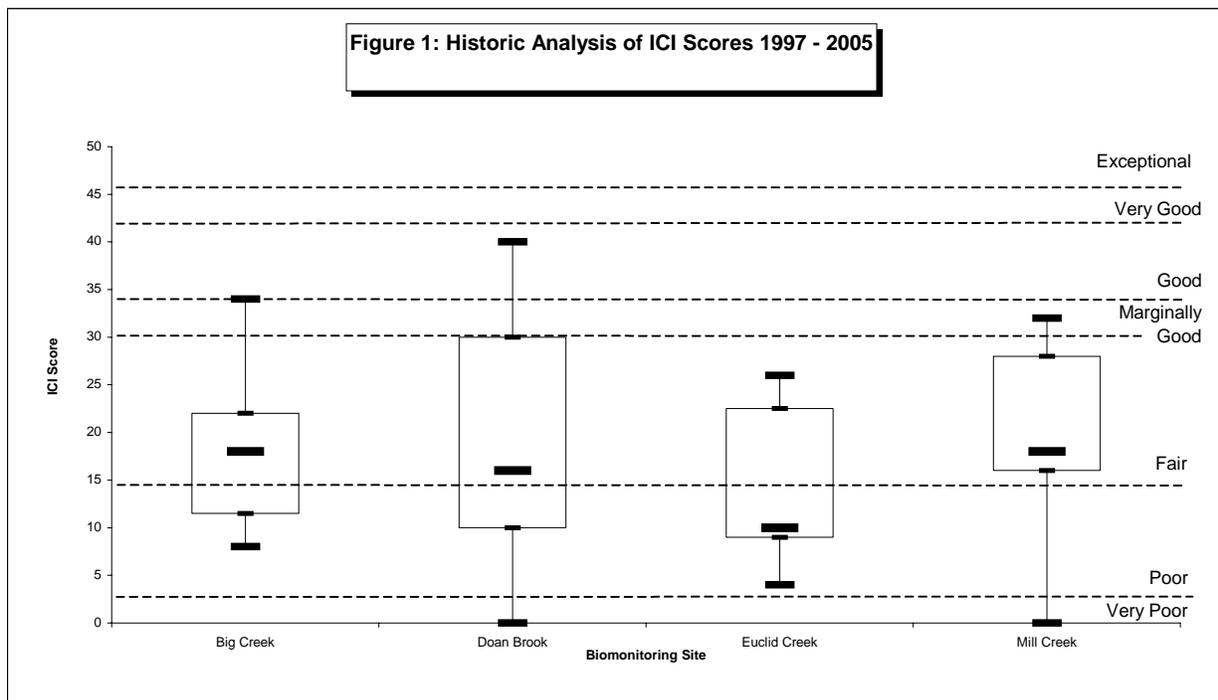
NEORSD conducted quantitative macroinvertebrate sampling near the mouth of Euclid Creek as early as 1991, when a score of 18 was obtained. In 1997, the site was relocated approximately 450 feet downstream of the previous location. At the new location (closer to the mouth), ICI scores of eight and four were obtained in 1997 and 1998, respectively. Low flow observed at the site may have contributed to the poor habitat conditions and low ICI scores. By 1999, the ICI score near the mouth of Euclid Creek had improved to 22. However, in 2000 the score decreased to 10. In 2001, the score had further decreased to four. By 2002, the Euclid Creek ICI scores had shown an improvement. The Hester-Dendy samplers were installed twice in 2002 and removed in July and September with scores of 24 and 26, respectively. In 2003, the Hester-Dendy samplers were also installed twice. The first sampler was lost or buried and a Surber sample was obtained. This sample received a score of 10. The second sampling period received a score of 23. The score from the first sampling in 2004 received a score of 10. The second Hester-Dendy sampling of 2004 improved to a score of 18.

Mill Creek

NEORSD conducted quantitative macroinvertebrate sampling on Mill Creek, upstream of Canal Road in 1995 and obtained an ICI score of 18. In 1999, an ICI score of 32 at Mill

Creek indicated marked improvement since 1995. The ICI score decreased to 28 in 2000. It should be noted that a break in an interceptor sewer had occurred in the spring of 2000 allowing untreated sewage to enter Mill Creek. In 2001, the ICI score had further decreased to 12, suggesting a possible lag time between the break in the interceptor sewer and the effects on the biota of the creek. By 2002, the ICI scores near the mouth of Mill Creek had improved. The Hester-Dendy samplers were installed twice in 2002 and 2003, with average scores of 30 and 9, respectively. In 2004, the average score increased to 16.

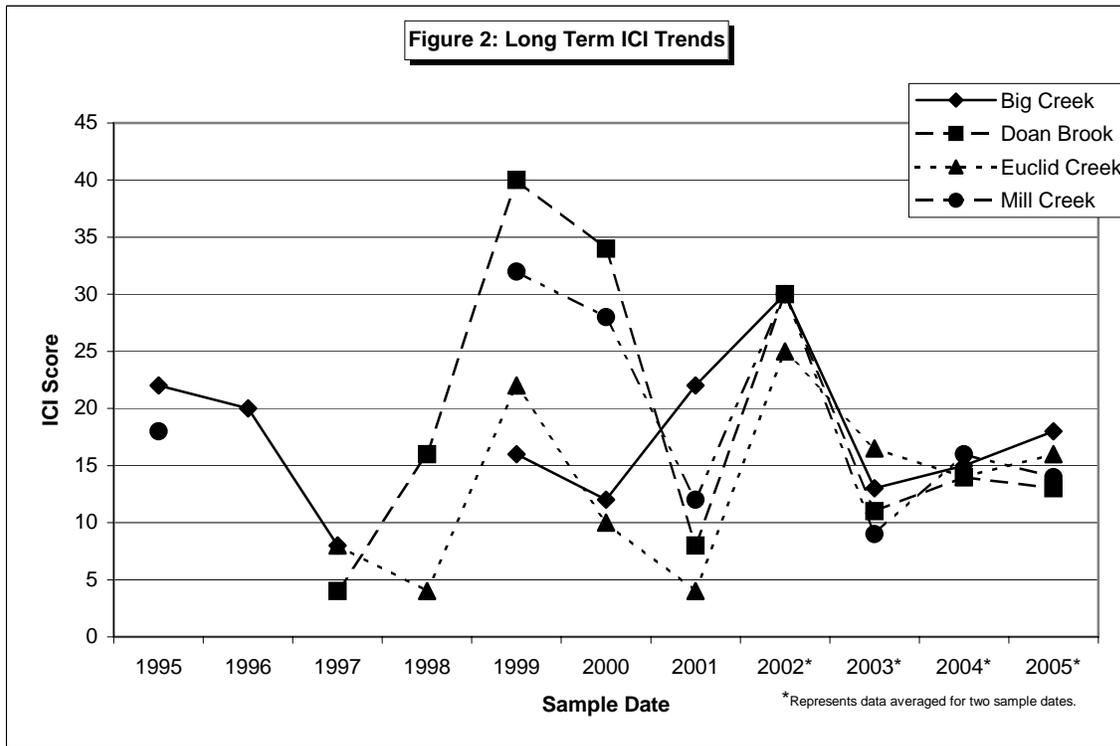
All Sites



The box and whisker plot in Figure 1 provides a comprehensive view of ICI scores from 1997 through 2005 for each body of water. This reveals that Doan Brook has experienced the greatest amount of variability in ICI scores since 1997, with fifty percent of the ICI scores (i.e., the interquartile range) falling between 10 and 30. The amount of variability in the individual ICI scores for Big Creek, Euclid Creek and Mill Creek, since 1997 is similar. The interquartile ranges as well as the maximum and minimum scores indicate that there has been a great deal of variability at each site over the past eight years.

Analyses of the long-term ICI scores, as shown in Figure 2, reveal considerable fluctuation from year to year for each creek. Figure 2 also suggests that the fluctuation in ICI scores may not be dependent on site-specific changes in water quality, as the scores for each site appear to increase and decrease somewhat in unison. The fluctuation of ICI

scores may be at least partially dependent on an external factor that has a similar effect on each watershed.



24. The calculated index scores used for comparison with the biological water quality criteria:

SAMPLE LOCATION	JULY 2005 SCORE	NARRATIVE RATING	SEPTEMBER 2005 SCORE	NARRATIVE RATING	AVERAGE 2005 SCORES	NARRATIVE RATING
BIG CREEK	16	FAIR	20*	FAIR	18	FAIR
DOAN BROOK	10*	POOR	16	FAIR	13	FAIR
EUCLID CREEK	22	FAIR	10	POOR	16	FAIR
MILL CREEK	28	FAIR	4* ¹	POOR	16	FAIR

* Score calculated using Surber sample

¹ Indicates that the sample was collected on October 5, 2005

25. Raw data submitted in computer format:

The raw data are contained on the enclosed on a compact disk.

26. The biological criteria used for comparison with the stream sampling data, and the rationale behind the selection of the criteria:

The stream segments which are required to be sampled for macroinvertebrates per Ohio EPA Permit No. 3PA00002*FD have all been designated Warmwater Habitat for aquatic life use by the Ohio EPA. According to Table 7-15 (Biological Criteria for Warmwater, Exceptional Warmwater and Modified Warmwater Habitats) in OAC 3745-1-07, the ICI criterion for sites that have been designated Warmwater Habitat within the Erie/Ontario Lake Plain ecoregion is 34. The table, however, also indicates that the criteria do not apply to Lake Erie river mouths.

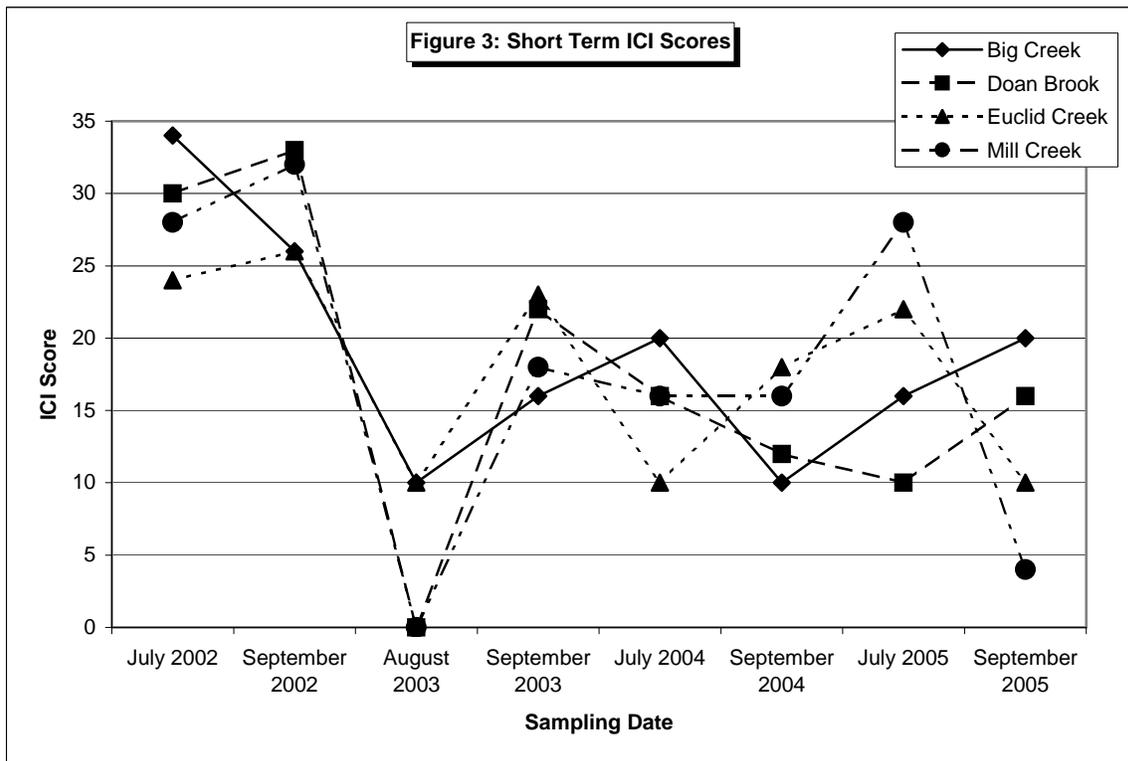
27. The calculated QHEI values:

Not required by Ohio EPA Permit No. 3PA00002*FD.

28. Discussion of the study results in terms of impact from the facility in question and other facilities that may have been studied:

Since 2002, NEORS D staff has installed Hester-Dendy samplers for two six-week periods, in an effort to account for seasonal variability. The individual scores for 2005, as well as a calculated average for each site, are provided in the table in line item 24. While average ICI scores for 2005 were consistent with average scores since 2003, there was a large amount of variation present between the two sampling periods. Figure 3 indicates the amount of variation present between each of the two sampling periods from 2002 to 2005. There is clearly a greater degree of variation between the 2005 sampling scores compared to the scores in 2002 and 2004.

The differences in 2005 scores compared to 2002 and 2004 may be attributed to multiple storm events that occurred during the two six-week periods. Totals of 4.13 and 7.72 inches of rainfall were measured by the National Weather service at Cleveland-Hopkins International Airport during the first and second sampling periods, respectively. During the first sampling period, forty percent (1.66 inches) of the total rainfall occurred on two consecutive days immediately prior to the removal of Hester-Dendy samplers.



While collecting water quality samples at all permitted stream sites on August 24, 2005, WQIS Investigators discovered that the Hester-Dendy sampler on Mill Creek was buried in sediment. Four days before water sample collections, a storm event produced 3.55 inches of rain, which appears to be the cause for the burial. WQIS Investigators reinstalled the Hester-Dendy sampler on August 24, 2005. The sampler was again buried after the re-installation, resulting in the need to collect a Surber sample (October 5, 2005). A total of 7.11 inches of rain was measured during the third installation period, which may have resulted in the burial.

In general, the lower ICI scores may have been the result of multiple storm events throughout the two sampling periods. Elevated stream flows generated by these storm events have the potential to change the morphology of the streambed. Hester-Dendy samplers subjected to elevated stream flows may become buried, washed away or scoured of macroinvertebrates, resulting in insufficient colonization by macroinvertebrates.

There were no documented dry-weather overflows to Mill Creek, Doan Brook, Big Creek or Euclid Creek during the two sampling periods.

Water quality monitoring data revealed three excursions from maximum chemical-specific criteria for warmwater habitat aquatic life use on July 21, 2005 during the

first sampling period. Two excursions occurred on Big Creek, and one occurred on Mill Creek. The copper and zinc excursions on Big Creek were the result of single values of 34 µg/L and 117 µg/L, respectively, compared to applicable criteria of 13 µg/L and 111 µg/L, respectively. The copper excursion on Mill Creek was result of a single value of 20 µg/L compared to the applicable criterion of 16 µg/L.

Water quality monitoring data revealed one excursion from a maximum chemical-specific criterion for warmwater habitat aquatic life use during the second sampling period on Doan Brook. The copper excursion was the result of a single value of 21 µg/L measured for September 15, 2005 compared to the applicable criterion of 20 µg/L.

The water quality criteria excursions may be attributable to storm events that occurred during and before the sample collections. On July 21 and September 14, 2005, the National Weather Service recorded rainfall of 0.76 inches and 0.11 inches, respectively.

The 30-day average chemical-specific criteria for warmwater habitat aquatic life use were not exceeded by average concentrations in samples collected during the two sampling periods.

29. Other relevant information:

All information believed to be relevant has been included.

Appendix A

Correspondence Concerning Minor Changes in Sampling and Reporting Procedures



Northeast Ohio Regional Sewer District

Environmental & Maintenance Services Center • 4747 E. 49th St. • Cuyahoga Heights, OH 44125-1011
(216) 641-6000 • FAX: (216) 641-8118

May 8, 1997

Ms. Sandy Cappotto
Ohio Environmental Protection Agency
Northeast District Office
2110 East Aurora Road
Twinsburg, OH 44087

Dear Ms. Cappotto:

I am writing to confirm our telephone conversation of April 28, 1997 concerning the Northeast Ohio Regional Sewer District's (NEORS) CSO NPDES Permit No. 3PA00002*FD, effective April 1, 1997.

Part II, Item I of the permit states in part, "The macroinvertebrate sampling required at F.1(d) and G.2 shall be established and conducted in accordance with procedures outlined in 'Reporting and Testing Guidance for Biomonitoring Required by the Ohio Environmental Protection Agency' (October 1991, or latest revision; Division of Surface Water)...." The October 1991 version of "Reporting and Testing Guidance..." is the latest revision.

Section 1, Part B of "Reporting and Testing Guidance..." requires the submission of a Standard Operating Procedure (SOP) which details the techniques used to conduct tests required by NPDES permits. NEORS will not be required, for the purposes of macroinvertebrate sampling required by NPDES Permit No. 3PA00002*FD, to submit an SOP.

Section 4, Part F of "Reporting and Testing Guidance..." requires the submission of a study plan prior to the initiation of an instream biomonitoring program. NEORS will not be required, for the purposes of macroinvertebrate sampling required by NPDES Permit No. 3PA00002*FD, to submit a study plan.

Section 4, Part G of "Reporting and Testing Guidance..." requires chemical analysis of ambient waters in conjunction with an instream biological survey. Part G states,

"Protecting Your Clean Water Investment"

Northeast Ohio Regional Sewer District
Macroinvertebrate Sampling Required by Ohio EPA Permit Number 3PA00002*FD
Appendix A – December 22, 2005

Ms. Sandy Cappotto
Ohio Environmental Protection Agency
May 8, 1997
Page 2

“Parameters analyzed at each site should be relevant to the NPDES permit monitoring requirements and any interactive impacts, including nonpoint sources, that occur in the study area.” Ohio EPA will not specify which chemical parameters must be analyzed. NEORS D staff may exercise its discretion in the selection of appropriate chemical parameters.

If I have misinterpreted or misstated our telephone conversation of April 28, 1997, please contact me at the letterhead address or by telephone at (216) 641-6000.

Sincerely,



Frank Foley, Supervisor
Water Quality and Industrial Surveillance

cc J. Weber
R. Connelly
F. Greenland
K. Linn
W. Mack

Northeast Ohio Regional Sewer District
Macroinvertebrate Sampling Required by Ohio EPA Permit Number 3PA00002*FD
Appendix A – December 22, 2005



State of Ohio Environmental Protection Agency

Northeast District Office

2110 E. Aurora Road
Piquetsburg, Ohio 44087-1969
(216) 425-9171
FAX (216) 487-0769

George V. Voinovich
Governor

June 9, 1997

NEORS
CSO Permit
3PA00002 (OH0043991)

Mr. Frank Greenland
NEO Regional Sewer District
3826 Euclid Ave.
Cleveland, OH 44115

Dear Mr. Greenland:

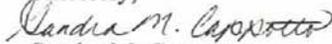
This letter is to document conversations between Frank Foley, NEORS and Steve Tuckerman of this office concerning the macroinvertebrate sampling requirement per Part II., I., of the NEORS CSO permit. The permit as written has conflicting information concerning the dates of deployment of the Hester Dendy artificial substrates (HDs). The dates specified in the permit are in error and all macroinvertebrate sampling should be performed in accordance with "Biological Criteria for the Protection of Aquatic Life: Volume III" which lists June 15 through September 30 as the proper sampling times.

Concern was also expressed about the possible loss of HDs due to natural stream conditions or vandalism. The Ohio EPA recognizes that such situations may occur. All reasonable efforts must be made to collect samples from HDs. If loss of substrates should occur, the District would send a written explanation of why the HDs could not be collected. In any case, qualitative kick net sampling should be performed and the results reported.

The site locations mentioned in the permit are intended as a general location of the sampling area. Final selection of the HD location may be made at the discretion of the NEORS field staff.

If you have any questions please contact this office at (216) 963-1124 or Steve Tuckerman (216) 963-1105.

Sincerely,


Sandra M. Cappotto
Environmental Scientist
Division of Surface Water

SMC:bp

cc: Frank Foley, NEORS

file:misc:neorsd:mac

RECEIVED
WATER QUALITY & INDUSTRIAL
SURVEILLANCE

JUN 11 1997
NORTHEAST OHIO REGIONAL
SEWER DISTRICT

Appendix C
Macroinvertebrate Data Sheets

2005 ICI Scores

	Big Creek Site #25		Doan Brook Site #16.1		Euclid Creek Site #0.5		Mill Creek Site #31	
	July 2005	Sept 2005	July 2005	Sept 2005	July 2005	Sept 2005	July 2005	Oct 2005
Drainage Area	38.0	38.0	10.0	10.0	23.0	23.0	18.1	18.1
ICI Score	16	20	10	16	22	10	28	4
Total Number of Organisms	39	73	9	20	262	72	423	25
Number of Taxa	8	13	3	10	23	21	22	6
Taxa Score	0	2	0	0	2	2	2	0
Number of Mayflies	0	1	1	0	0	0	0	1
Mayfly Score	0	0	0	0	0	0	0	0
Number of Caddisflies	2	2	0	1	5	0	5	0
Caddisfly Score	4	4	0	4	6	0	6	0
Number of Dipterans	2	7	0	8	13	14	11	1
Dipteran Score	0	2	0	2	2	4	2	0
Percent Mayflies	0	39.7	55.6	0	0	0	0	4
% Mayfly Score	0	6	6	0	0	0	0	2
Percent Caddisflies	33.3	4.1	0	5	4.2	0	57.2	0
% Caddisfly Score	6	2	0	6	4	0	6	0
Percent Tanytarsini	0	1.4	0	10	15.3	6.9	0.2	0
% Tanytarsini Score	0	2	0	4	4	2	2	0
Percent Other Dipterans	64.1	54.8	44.4	85	79.4	73.6	38.5	84
% Other Dipterans Score	0	2	4	0	0	0	4	0
Percent Tolerant	2.6	35.6	33.3	35	11.5	16.7	1.2	68
% Tolerant Score	6	0	0	0	4	2	6	0
Qualitative EPT	1	3	1	3	3	2	1	5
EPT Score	0	0	0	0	0	0	0	2
Surber Sample Taken		X	X					X

Northeast Ohio Regional Sewer District
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TAXA COMPOSITION, NUMBER, AND PERCENT OF ORGANISMS COLLECTED IN EACH SURBER, HESTER-DENDY, AND QUALITATIVE SAMPLE AT LOCATION BIG CREEK (BC25), JULY AND SEPTEMBER 2005.

TAXA	JULY				SEPTEMBER			
	HESTER		QUAL		SURBER		QUAL	
	#	%	#	%	#	%	#	%
Turbellaria	--	--	--	--	1	1.37	--	--
Plumatella	1	2.56	--	--	--	--	--	--
Oligochaeta	--	--	4	19.05	2	2.74	1	2.38
Erpobdella punctata punctata	4	10.26	2	9.52	--	--	--	--
Mooreobdella microstoma	14	35.90	3	14.29	1	1.37	1	2.38
Caecidotea	--	--	1	4.76	--	--	4	9.52
Crangonyx	--	--	--	--	--	--	1	2.38
Baetis flavistriga	--	--	--	--	29	39.73	5	11.90
Calopteryx	--	--	--	--	--	--	2	4.76
Enallagma	--	--	1	4.76	--	--	6	14.29
Boyeria vinosa	--	--	--	--	--	--	1	2.38
Aeshna	--	--	--	--	--	--	1	2.38
Archilestes grandis	--	--	1	4.76	--	--	--	--
Libellula	--	--	--	--	--	--	1	2.38
Cheumatopsyche	4	10.26	1	4.76	--	--	2	4.76
Hydropsyche depravata grp.	9	23.08	--	--	1	1.37	3	7.14
Hydroptila	--	--	--	--	2	2.74	--	--
Laccophilus maculosus	--	--	1	4.76	--	--	--	--
Berosus	1	2.56	--	--	--	--	--	--
Thienemannimyia grp.	5	12.82	6	28.57	1	1.37	--	--
Cricotopus tremulus grp.	--	--	--	--	9	12.33	1	2.38
Cricotopus bicinctus grp.	--	--	--	--	15	20.55	9	21.43
Orthocladus	--	--	--	--	1	1.37	1	2.38
Chironomus	--	--	--	--	--	--	2	4.76
Dicrotendipes neomodestus	--	--	--	--	1	1.37	--	--
Polypedilum illinoense	1	2.56	--	--	9	12.33	--	--
Tanytarsus guerlus grp.	--	--	--	--	1	1.37	--	--
Pericoma	--	--	--	--	--	--	1	2.38
Tipula	--	--	1	4.76	--	--	--	--
TOTAL	39	100.00	21	100.00	73	100.00	42	100.00
TOTAL TAXA	8		10		13		17	

Northeast Ohio Regional Sewer District
 Macroinvertebrate Sampling Required by Ohio EPA Permit Number 3PA0000*FD
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TAXA COMPOSITION, NUMBER, AND PERCENT OF ORGANISMS COLLECTED IN EACH SURBER, HESTER-DENDY, AND QUALITATIVE SAMPLE AT LOCATION DOAN BROOK (DB16.1), JULY AND SEPTEMBER 2005.

TAXA	JULY				SEPTEMBER			
	SURBER		QUAL		HESTER		QUAL	
	#	%	#	%	#	%	#	%
Turbellaria	--	--	--	--	--	--	1	1.82
Nemertea	--	--	--	--	--	--	1	1.82
Oligochaeta	3	33.33	--	--	--	--	4	7.27
Erpobdella punctata punctata	--	--	--	--	2	10.00	2	3.64
Mooreobdella microstoma	1	11.11	2	20.00	--	--	2	3.64
Caecidotea	--	--	--	--	--	--	1	1.82
Hydracarina	--	--	1	10.00	--	--	--	--
Baetis flavistriga	5	55.56	4	40.00	--	--	7	12.73
Cheumatopsyche	--	--	--	--	1	5.00	1	1.82
Hydropsyche depravata grp.	--	--	--	--	--	--	13	23.64
Thienemannimyia grp.	--	--	--	--	3	15.00	7	12.73
Cricotopus bicinctus grp.	--	--	1	10.00	--	--	3	5.45
Cricotopus sylvestris grp.	--	--	--	--	1	5.00	--	--
Nanocladius	--	--	--	--	2	10.00	--	--
Chironomus	--	--	--	--	--	--	2	3.64
Cryptochironomus	--	--	1	10.00	--	--	--	--
Polypedilum flavum	--	--	--	--	1	5.00	2	3.64
Polypedilum illinoense	--	--	--	--	6	30.00	--	--
Polypedilum scalaenum grp.	--	--	1	10.00	1	5.00	4	7.27
Paratanytarsus	--	--	--	--	2	10.00	--	--
Simulium	--	--	--	--	--	--	3	5.45
Tipula	--	--	--	--	--	--	1	1.82
Hemerodromia	--	--	--	--	1	5.00	--	--
Bithynia tentaculata	--	--	--	--	--	--	1	1.82
TOTAL	9	100.00	10	100.00	20	100.00	55	100.00
TOTAL TAXA	3		6		10		17	

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SAMPLE TAXA COMPOSITION, NUMBER, AND PERCENT OF ORGANISMS COLLECTED IN EACH HESTER-DENDY AND QUALITATIVE
 AT LOCATION EUCLID CREEK (EC0.5), JULY AND SEPTEMBER 2005.

TAXA	JULY				SEPTEMBER			
	HESTER		QUAL		HESTER		QUAL	
	#	%	#	%	#	%	#	%
Turbellaria	--	--	4	12.12	--	--	2	5.56
Oligochaeta	18	6.87	5	15.15	1	1.39	7	19.44
Erpobdella punctata punctata	1	0.38	--	--	2	2.78	--	--
Mooreobdella microstoma	8	3.05	--	--	--	--	--	--
Caecidotea	13	4.96	--	--	14	19.44	--	--
Crangonyx	--	--	--	--	4	5.56	--	--
Orconectes	--	--	--	--	1	1.39	--	--
Baetis flavistriga	--	--	4	12.12	--	--	4	11.11
Enallagma	--	--	--	--	2	2.78	--	--
Polycentropus	1	0.38	--	--	--	--	--	--
Cheumatopsyche	3	1.15	7	21.21	--	--	5	13.89
Hydropsyche depravata grp.	--	--	2	6.06	--	--	--	--
Hydropsyche orris	3	1.15	--	--	--	--	--	--
Hydropsyche simulans	2	0.76	--	--	--	--	--	--
Potamyia flava	2	0.76	--	--	--	--	--	--
Stenelmis	3	1.15	5	15.15	12	16.67	5	13.89
Ablabesmyia mallochii	8	3.05	1	3.03	2	2.78	--	--
Thienemannimyia grp.	40	15.27	--	--	2	2.78	2	5.56
Cricotopus bicinctus grp.	2	0.76	--	--	--	--	1	2.78
Chironomus	--	--	--	--	6	8.33	5	13.89
Dicrotendipes neomodestus	52	19.85	--	--	4	5.56	--	--
Dicrotendipes fumidus	24	9.16	2	6.06	2	2.78	--	--
Paratendipes	8	3.05	--	--	5	6.94	3	8.33
Phaenopsectra punctipes	4	1.53	--	--	1	1.39	--	--
Polypedilum fallax grp.	--	--	--	--	1	1.39	--	--
Polypedilum flavum	4	1.53	--	--	--	--	--	--
Polypedilum illinoense	10	3.82	--	--	4	5.56	1	2.78
Polypedilum scalaenum grp.	10	3.82	--	--	2	2.78	--	--
Tribelos	--	--	--	--	--	--	1	2.78
Tribelos jucundum	6	2.29	--	--	1	1.39	--	--
Paratanytarsus	16	6.11	--	--	3	4.17	--	--
Tanytarsus glabrescens grp.	24	9.16	--	--	2	2.78	--	--
Pericoma	--	--	--	--	1	1.39	--	--
Simulium	--	--	3	9.09	--	--	--	--
TOTAL	262	100.00	33	100.00	72	100.00	36	100.00
TOTAL TAXA	23		9		21		11	

Northeast Ohio Regional Sewer District
 Macroinvertebrate Sampling Required by Ohio EPA Permit Number 3PA0000*FD
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TAXA COMPOSITION, NUMBER, AND PERCENT OF ORGANISMS COLLECTED IN EACH SURBER, HESTER-DENDY, AND QUALITATIVE
 SAMPLE AT LOCATION MILL CREEK (MC31), JULY AND OCTOBER 2005.

TAXA	JULY				OCTOBER			
	HESTER		QUAL		SURBER		QUAL	
	#	%	#	%	#	%	#	%
Turbellaria	--	--	2	16.67	--	--	--	--
Plumatella	--	--	1	8.33	--	--	--	--
Oligochaeta	1	0.24	--	--	16	64.00	--	--
Erpobdella punctata punctata	17	4.02	1	8.33	2	8.00	3	21.43
Mooreobdella microstoma	1	0.24	--	--	2	8.00	--	--
Caecidotea	14	3.31	--	--	--	--	--	--
Gammarus	1	0.24	--	--	--	--	--	--
Crangonyx	--	--	1	8.33	--	--	--	--
Collembola	--	--	--	--	--	--	1	7.14
Baetis intercalaris	--	--	--	--	--	--	2	14.29
Baetis flavistriga	--	--	--	--	1	4.00	2	14.29
Hetaerina	17	4.02	1	8.33	--	--	--	--
Cheumatopsyche	146	34.52	4	33.33	--	--	3	21.43
Hydropsyche depravata grp.	10	2.36	--	--	--	--	--	--
Hydropsyche dicantha	9	2.13	--	--	--	--	1	7.14
Ceratopsyche morosa	54	12.77	--	--	--	--	2	14.29
Ceratopsyche sparna	23	5.44	--	--	--	--	--	--
Stenelmis	--	--	--	--	3	12.00	--	--
Thienemannimyia grp.	100	23.64	--	--	--	--	--	--
Chironomus	1	0.24	--	--	--	--	--	--
Cryptochironomus	1	0.24	--	--	--	--	--	--
Dicrotendipes neomodestus	1	0.24	--	--	--	--	--	--
Phaenopsectra punctipes	1	0.24	--	--	--	--	--	--
Polypedilum fallax grp.	1	0.24	--	--	--	--	--	--
Polypedilum illinoense	2	0.47	1	8.33	1	4.00	--	--
Polypedilum scalaenum grp.	20	4.73	1	8.33	--	--	--	--
Paratanytarsus	1	0.24	--	--	--	--	--	--
Tipula	1	0.24	--	--	--	--	--	--
Hemerodromia	1	0.24	--	--	--	--	--	--
TOTAL	423	100.00	12	100.00	25	100.00	14	100.00
TOTAL TAXA	22		8		6		7	