

NORTHEAST OHIO REGIONAL SEWER DISTRICT

2013 Doan Brook Environmental Monitoring Biological, Water Quality and Habitat Survey Results



**Prepared by:
Water Quality and Industrial Surveillance
Division**

Introduction

In 2013, the Northeast Ohio Regional Sewer District (NEORS D) conducted water chemistry sampling, habitat assessments, and fish and benthic macroinvertebrate surveys on Doan Brook at river miles (RM) 0.75, 1.40, and 6.70. The data collected was evaluated to determine the extent to which the downstream biological communities may be impacted by combined sewer overflow (CSO) discharge points and other environmental impairments. Sampling was conducted by NEORS D Level 3 Qualified Data Collectors certified by Ohio Environmental Protection Agency (EPA) in Fish Community and Benthic Macroinvertebrate Biology, and Chemical Water Quality and Stream Habitat Assessments as explained in the NEORS D study plan *2013 Doan Brook Environmental Monitoring* approved by Ohio EPA on July 10, 2013.

Macroinvertebrate and water chemistry sampling at RM 0.75 is required by Ohio EPA Permit No. 3PA00002*FD. Fish and habitat assessments are not required, but were conducted to determine the overall quality of water at this location.

Figure 1 is a map of the sampling location evaluated during the study, and Table 1 indicates the sampling location with respect to river mile, latitude/longitude, description, and the types of surveys conducted. A digital photo catalog of the sampling locations is available upon request by contacting the NEORS D Water Quality and Industrial Surveillance Division.



Figure 1. Doan Brook Sample Locations

Table 1. Doan Brook Evaluated Sites						
Site Location	Latitude	Longitude	River Mile	Description	HUC 8	Purpose
Doan Brook	41.5330°	-81.6296°	0.75	Downstream of St. Clair Avenue	Ashtabula-Chagrin 04110003	Evaluate chemistry, habitat, fish, & macroinvertebrates in support of Ohio EPA Permit #3PA00002*FD and watershed assessment
Doan Brook	41.4838°	-81.5643°	6.70	Upstream of Lee Road	Ashtabula-Chagrin 04110003	Evaluate chemistry, habitat, fish, & macroinvertebrates for watershed assessment
Doan Brook, South Branch	41.4739°	-81.5593°	1.40	Upstream of Attleboro Road	Ashtabula-Chagrin 04110003	Evaluate chemistry, habitat, fish, & macroinvertebrates for watershed assessment

Water Chemistry and Bacteriological Sampling

Methods

Water chemistry and bacteriological sampling was conducted six times between June 17th, 2013 and July 23rd, 2013, on Doan Brook and select tributaries. Techniques used for sampling and analyses followed the Ohio EPA *Surface Water Field Sampling Manual* (2013). Chemical water quality samples from each site were collected with a 4-liter disposable polyethylene cubitainer with a disposable polypropylene lid, three 473-mL plastic bottles and a 125-mL plastic bottle. The first 473-mL plastic bottle was field preserved with trace nitric acid, the second was field preserved with trace sulfuric acid and the third bottle received no preservative. The sample collected in the 125-mL plastic bottle (Dissolved Reactive Phosphorus) was filtered using a 0.45- μ m PVDF syringe filter. All water quality samples were collected as grab samples. Bacteriological samples were collected in sterilized plastic bottles preserved with sodium thiosulfate. At the time of sampling, measurements for dissolved oxygen, pH, temperature, and conductivity were collected using a YSI 600XL sonde. Duplicate samples and field blanks were each collected at randomly selected sites, at a frequency not less than 5% of the total samples collected. Relative percent difference (RPD) was used to determine the degree of discrepancy between the primary and duplicate sample (Formula 1).

$$\text{Formula 1: } \text{RPD} = \left(\frac{|X-Y|}{((X+Y)/2)} \right) * 100$$

X= is the concentration of the parameter in the primary sample
Y= is the concentration of the parameter in the duplicate sample

The acceptable percent RPD is based on the ratio of the sample concentration and detection limit (Formula 2) (Ohio EPA, 2013).

$$\text{Formula 2: } \text{Acceptable \% RPD} = [(0.9465X^{-0.344}) * 100] + 5$$

X = sample/detection limit ratio

Those RPDs that are higher than acceptable may indicate potential problems with sample collection and, as a result, the data was not used for comparison to the water quality standards.

Mercury analysis for all of the sampling events was done using EPA Method 245.1. Because the detection limit for this method is above the criteria for the Human Health Nondrinking and Protection of Wildlife OMZA, it generally cannot be determined if Chagrin River was in attainment of those criteria. Instead, this type of mercury sampling was used as a screening tool to determine whether contamination was present above those levels typically found in the brook.

Results and Discussion

A duplicate sample was collected on July 8, 2013, at RM 6.70 for QA/QC purposes. No parameters were rejected due to RPD evaluations.

Paired parameters, those in which one is a subset of the other, for all samples collected were also evaluated and compared for QA/QC purposes. These comparisons revealed that some of the data for total and dissolved solids and total and dissolved reactive phosphorous were either estimated or rejected. Because there were no exceedances associated with these parameters, qualification of these results did not significantly change the overall water chemistry assessment of Doan Brook (Table 2).

Date	Site	Parameter	Acceptable RPD (%)	Actual RPD (%)	Qualifier
6/17/2013	RM 0.75	Total Phosphorous Dissolved Reactive Phosphorus	31.3	8.8	Estimated
6/17/2013	RM 1.40	Total Phosphorous, Dissolved Reactive Phosphorus	40.6	65.2	Rejected
6/24/2013	RM 1.40	Total Solids Total Dissolved Solids	16.0	0.8	Estimated
6/17/2013	RM 6.70	Total Phosphorous Dissolved Reactive Phosphorus	38.4	51.5	Rejected
6/24/2013	RM 6.70	Total Solids Total Dissolved Solids	16.2	3.2	Estimated
7/8/2013	RM 6.70	Total Solids Total Dissolved Solids	16.8	1.4	Estimated

Over the course of the sampling, one field blank was collected at each site on June 24, 2013. Some parameters were rejected, or had to be determined using estimated values ('J'). It is unclear how the field blanks became contaminated and may be due to inappropriate sample collection, handling, or contaminated blank water. Ohio EPA's Credible Data program includes a data validation protocol for QA/QC samples. Using this protocol, some of the sample results needed to be downgraded from Level 3 to Level 2 when compared to the field blanks (Table 3).

Parameter (X, Rejected; J, Estimated Value)					
Date	River Mile	COD	Cr	NH3	NO3-NO2
06/24/2013	RM 0.75	Level 2	X		
06/24/2013	RM 1.40	Level 2	X	Level 2	J
06/24/2013	RM 6.70	J	X		

Doan Brook is designated Warmwater Habitat (WWH), agricultural water supply, industrial water supply, and Class B primary contact recreation. The Class B Primary Contact Recreational Use Criteria apply for *Escherichia coli* (*E. coli*). The water chemistry samples collected at each site were compared to the applicable Ohio Water Quality Standards for the designated uses to determine attainment (Ohio EPA, 2009a).

Water chemistry sampling at the Doan Brook sites in 2013 revealed mercury concentrations that resulted in 30-day averages that exceeded the Human Health

Nondrinking Water and Protection of Wildlife Outside Mixing Zone Averages (OMZA) for all sampling periods (Table 4). Mercury may be introduced into Doan Brook from CSO discharges and urban runoff within the watershed.

Table 4. 2013 Doan Brook Mercury Exceedances						
Site	Sample Date	Form (units)	Adjusted Concentration*	30-Day Average Concentration	OMZA Criterion Nondrinking	OMZA Criterion Wildlife
RM 0.75	06/17/2013	TR (µg/L)	0.003	0.0032	0.0031	0.0013
RM 0.75	06/24/2013	TR (µg/L)	0.003	0.0034	0.0031	0.0013
RM 0.75	07/01/2013	TR (µg/L)	0.003	0.0035	0.0031	0.0013
RM 0.75	07/08/2013	TR (µg/L)	0.003	0.0037	0.0031	0.0013
RM 0.75	07/15/2013	TR (µg/L)	0.004	0.0040	0.0031	0.0013
RM 1.40	06/24/2013	TR (µg/L)	0.011	0.014	0.0031	0.0013
RM 1.40	07/01/2013	TR (µg/L)	0.003	0.015	0.0031	0.0013
RM 1.40	07/08/2013	TR (µg/L)	0.038	0.021	0.0031	0.0013
RM 6.70	06/24/2013	TR (µg/L)	0.003	0.0045	0.0031	0.0013
RM 6.70	07/01/2013	TR (µg/L)	0.003	0.0050	0.0031	0.0013
RM 6.70	07/08/2013	TR (µg/L)	0.008	0.0060	0.0031	0.0013

*For concentrations below the MDL, ½ the MDL used as the concentration

The Class B Primary Contact Recreation criteria for Doan Brook include an *E. coli* criterion not to exceed a single sample maximum (SSM) of 523 colony-forming units per 100 milliliters (CFU/100mL) in more than ten percent of the samples taken during any thirty-day period, and a seasonal geometric mean (SGM) criterion of 161 CFU/100mL (Ohio EPA, 2009b) (Table 5). Doan Brook exceeded both the Class B Primary Contact Recreation SGM criteria at the sites¹, while the SSM was exceeded at RM 1.40 and RM 0.75.

On June 16, 2013, there was a wet weather event totaling 0.11 inches with sampling that took place on June 17th. This sample exceeded the criteria for mercury and *E. coli*. On July 8, 2013, there was a wet weather event with a total of 1.16 inches of rain. On this day, there were elevated *E. coli* densities at RM 0.75 and 1.40. In addition, mercury at RM 1.40 was the highest it had been during our sampling events (0.038 µg/L). CSO-218 overflowed on that day, at a rate of 0.01 MGD (million gallons per day). This NPDES permit point is located just south of Superior Avenue on Doan Brook, which is upstream of RM 0.75. Although it is not the only CSO on Doan Brook, it is the only one

¹ Wet-weather sampling events are considered greater than 0.10 inches of rain but less than 0.25 inches. Samples collected that day and the following day are considered wet-weather samples. For wet-weather sampling events with greater than 0.25 inches of rain, the samples collected that day and the following two days are considered wet-weather samples.

with a flow meter installed. Wet weather events also occurred on July 22 and July 23 of 2013. Mercury did not exceed the criterion; however, *E.coli* densities at RM 0.75 were 7800 CFU/100mL, the highest of the samples collected during the sampling period.

Table 5. 2013 Doan Brook <i>E. coli</i> Exceedances (colony-forming units/100mL)				
	Sample Date	Result (CFU/100mL)	30-Day Average Density (CFU/100mL)	Single Sample Maximum % Days > 523 CFU/100mL
RM 0.75	6/17/2013	616	474.80	40.0
	6/24/2013	292	1911.60	40.0
	7/1/2013	318	2316.50	50.0
	7/8/2013	EC 748	2982.67	66.7
	7/15/2013	400	4100.00	50.0
	7/23/2013	7800	---	---
	Seasonal Geomean			714.89
RM 1.40	6/17/2013	365	427.40	40.0
	6/24/2013	800	443.00	50.0
	7/1/2013	155	324.00	33.3
	7/8/2013	EC 687	408.50	50.0
	7/15/2013	130	---	---
	Seasonal Geomean			324.40
RM 6.70	6/17/2013	195	208.50	208.50
	6/24/2013	390	211.88	211.88
	7/1/2013	105	152.50	152.50
	7/8/2013	242.5	176.25	176.25
	7/15/2013	110	---	---
	Seasonal Geomean			181.80
EC=Estimated Count --- The 30-Day Average Density and the Single Sample Maximum % Days require more than one sample to be taken after the corresponding sample date in order to have an average.				

Ohio EPA's Trophic Index Criterion assigns designations for quality of surface waters based on many factors including nutrients, periphyton, dissolved oxygen, and biological assemblages. This criterion was published in 2011 as a draft, and in March 2013, some aspects of the paper were published in a document called, "Trophic Index Criterion- Rationale and Scoring" (Ohio EPA, Division of Surface Water). The scoring

places the streams into one of three categories: impaired, threatened, or acceptable. NEORS D does not assess periphyton; however, nutrients were assessed. The scoring is based on levels of Total Phosphorus and Dissolved Inorganic Nitrogen (DIN).

Of the three sites assessed, Doan Brook RM 0.75 and 6.70 were both considered “Threatened”. For Doan Brook RM 0.75, the samples collected showed an average of 0.180 mg/l Total Phosphorus and an average of 0.681 mg/l DIN. This narrative rating is described as “Concentrations observed with high-intensity landuse and WWTP loadings” (Ohio EPA). Doan Brook RM 6.70 showed an average of 0.154 mg/l Total Phosphorus and an average of 0.570 mg/l DIN. This is also narrative rating of “Threatened” on the nutrient component and above the target loading. However, Doan Brook RM 1.40 was analyzed and results showed an average of 0.097 mg/l Total Phosphorus and an average of 0.328 mg/l DIN. This is a narrative rating of “Acceptable” and is described as, “Concentrations typical of healthy streams in working landscapes”. The high nutrient loading at RMs 0.75 and 6.70 are likely a factor contributing to the low scoring biological criteria assessments which follow in this report.

Table 6. Ohio EPA Trophic Index Criterion Scoring for the Nutrient Component					
Total Phosphorus (mg/l)	Dissolved Inorganic Nitrogen (mg/l)				
	≤0.44	0.44-1.10	1.10-3.60	3.60-6.70	≥6.70
≤0.04	6	3	3	1	0
0.04-0.08	3	3	3	1	0
0.08-0.13	3	3	1	1	0
0.13-0.40	1	1	1	0	0
≥0.40	0	0	0	0	0

Habitat Assessment

Methods

Instream habitat assessments were conducted on Doan Brook in 2013 using the Qualitative Habitat Evaluation Index (QHEI). The QHEI was developed by the Ohio EPA to assess aquatic habitat conditions that may influence the presence or absence of fish species by evaluating the physical attributes of a stream. The index is based on six metrics: stream substrate, instream cover, channel morphology, riparian zone and bank condition, pool and riffle quality, and stream gradient. The QHEI has a maximum score of 100, and a score of 55 or more suggests that sufficient habitat exists to support a fish community that attains the warmwater habitat criterion (Ohio EPA, 2003). A more detailed description of the QHEI can be found in Ohio EPA’s *Methods for Assessing Habitat in Flowing Waters: Using the Qualitative Habitat Evaluation Index (QHEI)* (2006). QHEI field sheets for each site are available upon request from the NEORS D WQIS Division.

Results and Discussion

The stream segment at RM 0.75 obtained a QHEI score of 61.0, a narrative rating of *Good* (Table 7), exceeding the warmwater habitat target of 55 and the potential to support a healthy fish. Sand and gravel were the predominant substrate types. Moderate instream cover consisting of shallows, deep pools, boulders, and woody debris were present. This portion of the stream is channelized with low sinuosity, which detracts from the overall score.

At RM 6.70, the site obtained a QHEI score of 67.0 (*Good*), exceeding the warmwater habitat target (Table 7). Cobble and gravel were the predominant substrate types. High sinuosity, a lack of channelization, deep pools, and riffles were beneficial to the overall score.

The South Branch of Doan Brook at RM 1.40 obtained a score of 60.0 (*Good*). This site is predominantly sand and gravel. It had moderate instream cover including woody debris, shallows, and undercut banks. No functional riffle was identified in this section of stream; this led to a lower overall score.

River Mile	Date	QHEI Score	Narrative Rating	Stream Flow (ft ³ /s)*
0.75	9/24/2013	61.0	<i>Good</i>	4.3
1.40	9/24/2013	60.0	<i>Good</i>	4.3
6.70	9/24/2013	67.0	<i>Good</i>	4.3

*Provisional flow data obtained from USGS 04208700 Euclid Creek flow gauge in Cleveland, Ohio

Electrofishing

Methods

One quantitative electrofishing pass was conducted at RMs 0.75, 6.70, and 1.40 in 2013. Sampling was conducted using backpack electrofishing techniques and consisted of shocking all habitat types within a sampling zone while moving from downstream to upstream. The sampling zone was 0.15 kilometers individually for all sites. The methods that were used followed Ohio EPA protocol methods as detailed in *Biological Criteria for the Protection of Aquatic Life, Volumes II* (1987a) and *III* (1987b). Fish collected during the surveys were identified and examined for the presence of anomalies including DELTs (deformities, eroded fins, lesions, and tumors). All fish were then released to the

waters from which they were collected, except for vouchers and those that could not be easily identified in the field.

The electrofishing results for each pass were compiled and utilized to evaluate fish community health through the application of an Ohio EPA index, the Index of Biotic Integrity (IBI). The IBI incorporates 12 community metrics representing structural and functional attributes. The structural attributes are based upon fish community aspects such as fish numbers and diversity. Functional attributes are based upon fish community aspects such as feeding strategies, environmental tolerances, and disease symptoms. These metrics are individually scored by comparing the data collected at the survey site with values expected at reference sites located in a similar geographical region. The maximum possible IBI score is 60 and the minimum possible score is 12. The summation of the 12 individual metrics scores provides a single-value IBI score, which corresponds to a narrative rating of *Exceptional*, *Good*, *Marginally Good*, *Fair*, *Poor* or *Very Poor*. The 12 metrics utilized for headwater sites are listed in Table 8. Lists of the species, numbers, pollution tolerances and incidence of DELT anomalies for fish collected during the electrofishing passes at each site are available upon request from the NEORSD WQIS Division.

Table 8. IBI Metrics (Headwater)
Total Number of Native Species
Number of Darters & Sculpins
Number of Headwater Species
Number of Minnow Species
Number of Sensitive Species
Percent Tolerant Species
Percent Pioneering Species
Percent Omnivores
Percent Insectivores
Number of Simple Lithophils
Percent DELT Anomalies
Number of Fish

Results and Discussion

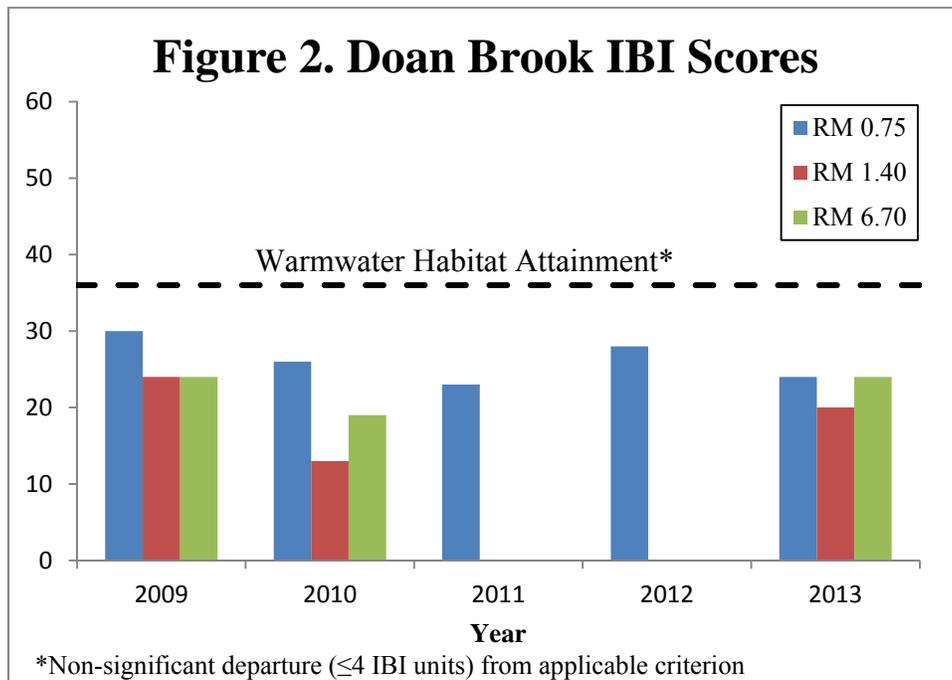
In 2013, Doan Brook RM 0.75 obtained an IBI score of 24 (*Poor*) compared to the 2012 score of 28 (*Fair*) and failed to meet the WWH IBI criterion of 40 (Table 9 and Figure 2). Of the fish collected, 96% (compared to 88% in 2012) were considered moderately to highly pollution tolerant. The sample consisted mainly of pumpkinseed sunfish, brown and yellow bullheads, and northern fathead minnows. The number of

DELT anomalies present on fish collected in 2013 was 15%, which was higher than in 2012, but consistent with years prior. Degraded water quality indicated by mercury and *E. coli* exceedances at RM 0.75 may have contributed to the abundance of pollution-tolerant fish species and lack of pollution-intolerant species. A QHEI score of 61.0 (*Good*) indicates that necessary instream habitat is present to support a robust fish community; however, Doan Brook is subject to flash flooding during rain events which may prevent fish communities from establishing permanent populations.

The IBI score at RM 1.40 was 20 (*Poor*). This site had one species, green sunfish, and had a DELT anomaly percentage of 4.9. This was a higher percentage than in 2010 when the last assessments were completed. A total of 82 specimens were collected from the site in 2013; this was compared to 2010, when 147 and 297 fish were present on the two passes. There were exceedances for both mercury and *E. coli* at this site.

At RM 6.70, the IBI score was a 24 with a narrative rating of *Poor*. The site had three species including creek chubs, green sunfish, and western blacknose dace. This was one more species than the last assessment that was conducted in 2010. The average number of fish collected over two passes in 2010 was 335 fish. In 2013, 77 fish were collected. All of these are pollution-tolerant species. There were no DELT anomalies on the 77 fish collected.

Table 9. Average Doan Brook IBI Scores		
River Mile	Year	IBI Score
0.75	2013	24 (<i>Poor</i>)
	2012	28 (<i>Fair</i>)
	2011	23 (<i>Poor</i>)
	2010	26 (<i>Poor</i>)
	2009	30 (<i>Fair</i>)
1.40	2008	22 (<i>Poor</i>)
	2013	20 (<i>Poor</i>)
	2010	23 (<i>Poor</i>)
	2009	24 (<i>Poor</i>)
6.70	2008	22 (<i>Poor</i>)
	2013	24 (<i>Poor</i>)
	2010	19 (<i>Poor</i>)
	2009	24 (<i>Poor</i>)
	2008	21 (<i>Poor</i>)



Macroinvertebrate Sampling

Methods

Macroinvertebrates were sampled quantitatively using modified Hester-Dendy (HD) samplers in conjunction with a qualitative assessment of Ephemeroptera (mayfly), Plecoptera (stonefly) and Trichoptera (caddisfly), also referred to as EPT taxa, inhabiting available habitats at the time of HD retrieval. Sampling was conducted at both of the locations listed in Table 1. Methods for sampling followed the Ohio EPA's Biological Criteria for the Protection of Aquatic Life, Volume III (1987b). The recommended period for HDs to be installed is six weeks.

The macroinvertebrate samples were sent to Third Rock Consulting of Lexington, Kentucky, for identification and enumeration. Specimens were identified to the lowest practical taxonomic level as defined by the Ohio EPA (1987b). Lists of the species collected during the quantitative and qualitative sampling at each site are available upon request from the WQIS Division.

The overall aquatic macroinvertebrate community in the stream was evaluated using Ohio EPA's Invertebrate Community Index (ICI) (OEPA 1987a). The ICI consists of ten community metrics (Table 10), each with four scoring categories. Metrics 1-9 are based on the quantitative sample, while Metric 10 is based on the qualitative EPT taxa.

The total of the individual metric scores result in the overall score. This scoring evaluates the community against Ohio EPA’s reference sites for each specific eco-region.

Table 10. ICI Metrics
Total number of taxa
Number of mayfly taxa
Number of caddisfly taxa
Number of dipteran taxa
Percent mayflies
Percent caddisflies
Percent Tanytarsini midges
Percent other diptera and non-insects
Percent tolerant organisms (as defined)
Number of qualitative EPT taxa

Results and Discussion

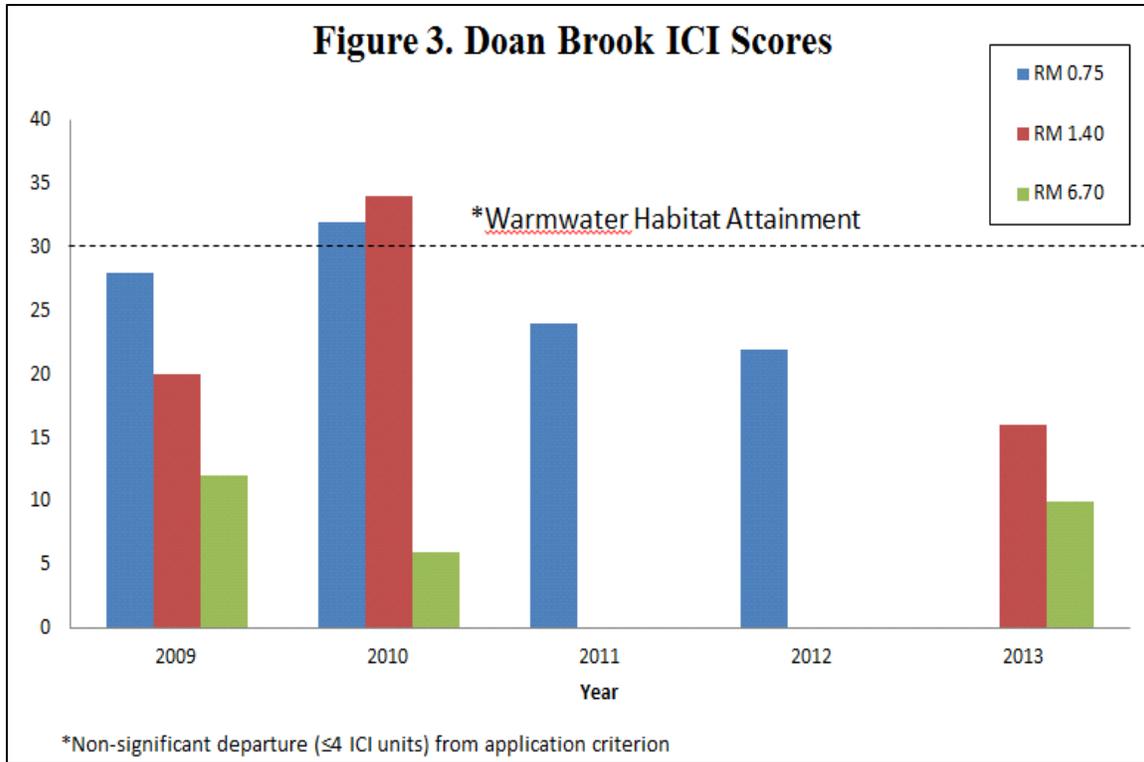
The Hester-Dendy for Doan Brook RM 0.75 obtained an ICI score of 22 and a narrative rating of *Fair* (Table 11) in 2012. However, in 2013, the Hester-Dendy was buried and therefore, was not sent in for analysis. One EPT taxa was counted in the qualitative sample as well as 10 tolerant taxa and zero intolerant taxa. The narrative rating of *Poor* was assigned to this site using best professional judgment. Just upstream of RM 0.75, from East 105 Street and Martin Luther King Jr. Boulevard to Wade Avenue, there is heavy construction being done on the hillside by the artificial ponds. This construction is labeled the “Stream Enhancement Project” of which NEORSD is the project manager with collaboration from the Doan Brook Watershed Partnership. It began in the early spring of 2013 and continued during the time when the Hester-Dendy was in place as well as during the qualitative assessment. To divert the water from the construction site in order to work on the stream bed, water was pumped through a pipe over a distance and emptied into the river bed just upstream on RM 0.75; this could have affected the colonization of some of the macroinvertebrates. In addition, storm water runoff from the eroded soils at construction sites increases the levels of phosphorous and suspended solids in stream systems which can lead to a decrease in water quality.

Table 11.
 2009-2013 Averaged Invertebrate Community Index Scores

River Mile	2009	Narrative Rating	2010	Narrative Rating	2011	Narrative Rating	2012	Narrative Rating	2013	Narrative Rating
0.75	28	<i>Fair</i>	32	<i>Good</i>	24	<i>Fair</i>	22	<i>Fair</i>	N/A	<i>Poor</i>
1.40	20	<i>Fair</i>	34	<i>Good</i>	N/A		N/A		16	<i>Fair</i>
6.70	12	<i>Poor</i>	6	<i>Very Poor</i>	N/A		N/A		10	<i>Poor</i>

The other sites which were monitored in 2013 were Doan Brook RM 1.40 and 6.70. Both of these sites are upstream of the current stream enhancement project. The ICI score calculated at Doan Brook RM 1.40 was 16 with a narrative rating of *Fair*. This is lower than in years prior. This site was not monitored in 2011 and 2012 and therefore did not have ICI scores for those years, but in 2009 and 2010, the ICI scores were 20 and 34, respectively. There were no qualitative EPT taxa noted at this site for 2013.

The ICI score calculated at Doan Brook RM 6.70 was 10 with a narrative rating of *Poor*. In 2009 and 2010, the ICI score was 12 and 6 for the site, respectively. There were no qualitative EPT taxa collected in 2013. Doan Brook RM 6.70 is downstream of Horseshoe Lake in Shaker Heights. Samples collected by NEORSD in the late 1990's just upstream of Horseshoe Lake have shown elevated solids and nutrients (Gooch, 2001). There are no CSOs upstream of RM 6.70; however, there are 19 outfalls with illicit discharge along the north branch of Doan Brook which may be contributing to the high phosphorous, *E. coli*, and total solids levels. All of these outfalls have been sampled within the 2010-2013, and some of the discharges when analyzed had elevated *E. coli* levels and appear to be intermittent in nature.



Conclusions

Bacteriological sampling showed elevated *E. coli* densities at all Doan Brook sites, an indication of generally poor water quality conditions. As a result, a relatively high percentage of pollution-tolerant fish and macroinvertebrate species were present in the stream. Wet weather flows originating from CSOs and possibly upstream golf courses and recreational lakes may be contributing to the elevated levels of *E. coli* and other pollutants. However, the main branch especially has a high number of illicit discharges upstream of Horseshoe Lake where *E. coli* levels have been historically high. This is an issue which NEORS is currently working on throughout the service area, but it is one that will take time due to the large quantity of outfalls that have been analyzed as being elevated. Nutrient loadings above the acceptable level, as those measured at RM 0.75 and 6.70, may be preventing Doan Brook from supporting a more diverse macroinvertebrate community. It would be beneficial to collect and analyze a few samples upstream and downstream of Horseshoe Lake in order to determine if it is contributing nutrients to the stream or if the illicit discharges are the main source within the area around RM 6.70. An overview of the scores for the 2013 assessment is shown in Table 12.

The macroinvertebrate community in Doan Brook RM 1.40 received an ICI *Fair* rating and RM 6.70 received a *Poor* rating in 2013. The recorded rating for RM 1.40 was much

lower than its last analysis in 2010, while RM 6.70 went from a score of 6 in 2010 to 10 in 2013. An ICI score was not determined for RM 0.75.

The fish community also appeared to be impacted from degraded water quality. From 2009 through 2013, five electrofishing passes were completed at the Doan Brook site at RM 0.75. Of the five passes completed, three had narrative ratings of *Poor* for the IBI fish community scores. A *Fair* narrative rating was obtained in 2009 and again in 2012. Seven out of the eleven species of fish collected at RM 0.75 in 2013 were highly pollution-tolerant. The other two sites that were assessed also had a poor fish community present. Stream habitat in Doan Brook met Ohio EPA’s target for warmwater habitat; however, water quality did not. Therefore, water quality may need to improve before the biotic communities can do likewise.

Table 12. 2013 Doan Brook Survey Results

River Mile	IBI Score/ Narrative Rating	ICI Score/ Narrative Rating	QHEI Score/ Narrative Rating	Aquatic Life Use Attainment Status	Water Quality Exceedances
0.75	24/ <i>Poor</i>	--/ <i>Poor</i> *	61.0/ <i>Good</i>	NON	<i>E. coli</i> , Mercury
1.40	20/ <i>Poor</i>	16/ <i>Fair</i>	60.0/ <i>Good</i>	NON	<i>E. coli</i> , Mercury
6.70	24/ <i>Poor</i>	10/ <i>Poor</i>	67.0/ <i>Good</i>	NON	<i>E. coli</i> , Mercury

WWH biocriterion attainment: IBI score of 36; ICI score of 30
 Nonsignificant departure: ≤4 IBI units; ≤4 ICI units
 --HD not collected; qualitative assessment only
 *Narrative rating based on best professional judgment and habitat evaluation

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Analytical Services Division – Completed analysis for all water chemistry sampling

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