

NORTHEAST OHIO REGIONAL SEWER DISTRICT

2014 West Creek Environmental Monitoring



Prepared by

Water Quality and Industrial Surveillance Division

Introduction

During 2007 and 2008, the Northeast Ohio Regional Sewer District (NEORSD) completed baseline assessments at sites on West Creek, a tributary to the Cuyahoga River. The baseline assessments were completed to determine the conditions of the creek prior to restoration activities that started in 2009. The goals of these restoration projects were to improve existing in-stream habitat, construct additional in-stream habitat, remove or alter existing permanent structures that are preventing fish migration, and re-stabilize eroding stream banks utilizing bioengineered technology and natural channel design techniques. In 2006, sampling was also conducted on West Creek, but only consisted of habitat and qualitative macroinvertebrate evaluations. The 2007 and 2008 sampling included electrofishing, benthic macroinvertebrate, water chemistry sampling, and habitat assessments.

In 2013, the NEORSD conducted water chemistry sampling, habitat assessments, and fish and benthic macroinvertebrate community surveys on West Creek after the completion of the stream restoration project.

In 2014, the same environmental assessment work was completed at the above aforementioned sites; however, water chemistry, habitat, macroinvertebrate and fish assessments were evaluated at an additional site located downstream of Granger Road Bridge at River Mile 0.20. Sampling was conducted by NEORSD 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 NEORSD's Project Study Plan, *2014 West Creek Environmental Monitoring* approved by Ohio EPA on April 14, 2014.

Completed construction of the stream restoration projects was at river miles (RM) 3.65, 2.10, 1.60 and 0.20. Stream restoration at RM 3.65 consisted of limestone boulder bank protection, and 194 cubic yards of boulder cascade over the stream bed and bank to stabilize the natural stream structure and gradient. Restoration work at RM 2.10 consisted of approximately 45 cubic yards of limestone boulder along the south bank for bank stabilization and 641 cubic yards of boulder and concrete grout covered over the stream bed to stabilize the stream gradient. Restoration work at RM 1.60 consisted of placing 2126 cubic yards of limestone boulder and cobble in the stream bed and bank for the construction of three cascades and pools and bank stabilization. Restoration work at RM 0.20 consisted of rehabilitation of 1000 feet of stream channel with bank stabilization and construction of new deep pools and riffle features. A revegetation of the stream bank along West Creek at this site was completed. Additionally, a backwater channel within the West Creek floodplain that captures overbank flows from the channel and Cuyahoga River was also constructed. Figure 1 is a map of the sampling locations on West Creek,

2014 West Creek Environmental Monitoring Results
February 6, 2017

and Table 1 indicates the sampling locations and includes river mile, latitude/longitude, description and the types of surveys conducted.

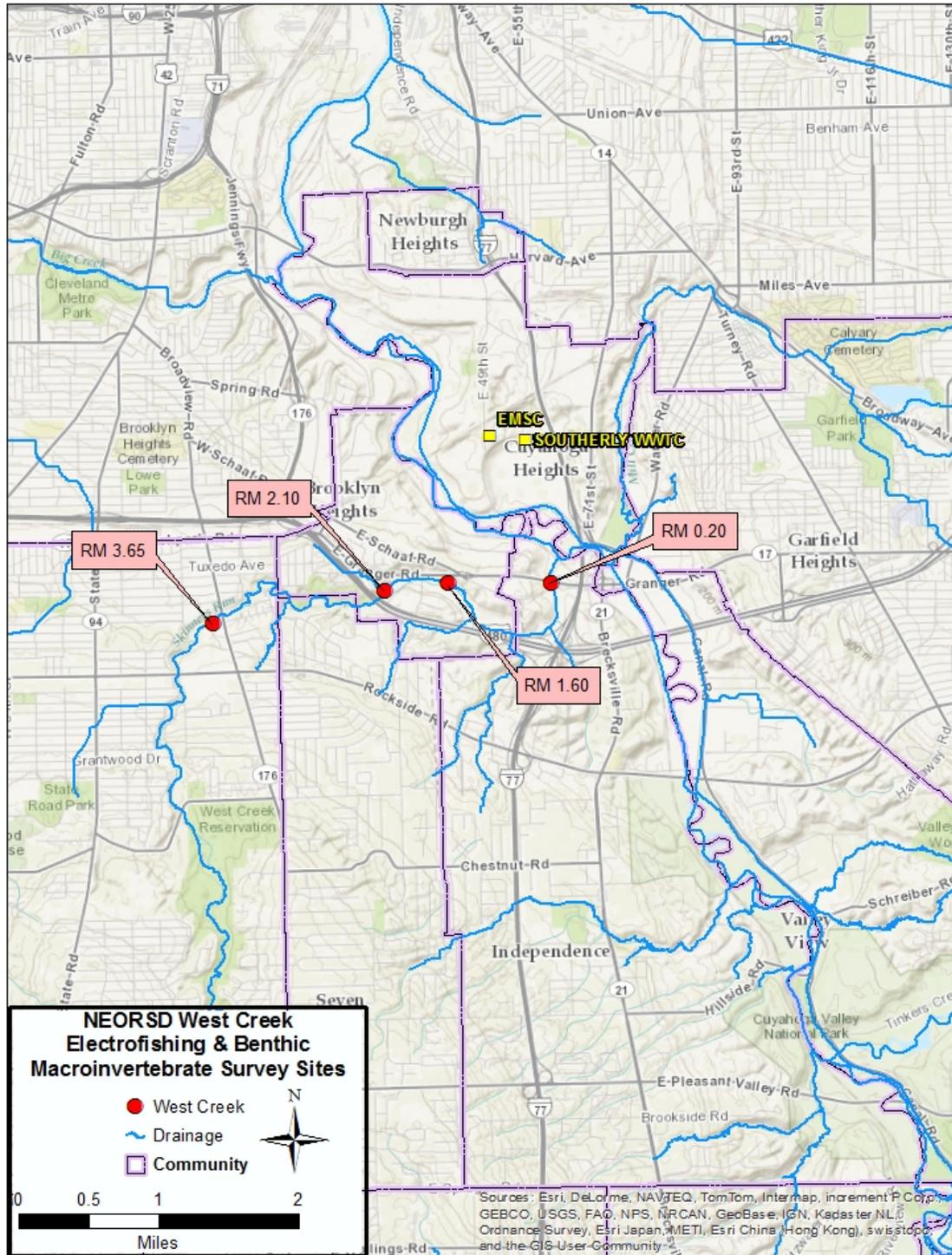


Figure 1. Sampling Locations

Table 1. Sample Locations					
Location	Latitude	Longitude	River Mile	Description	Purpose
Site #11	41.4122	-81.6754	3.65	Upstream of Broadview Road	Evaluate habitat, fish, & macroinvertebrates after completion of stream restoration work
Site #9A	41.4134	-81.7606	2.10	Downstream from I-480	Evaluate habitat, fish, & macroinvertebrates after completion of stream restoration work
Site #8	41.4144	-81.6619	1.60	Downstream from Lancaster Drive Bridge	Evaluate habitat, fish, & macroinvertebrates after completion of stream restoration work
Site #1	41.4145	-81.6447	0.20	Granger & Schaaf Road	Evaluate habitat, fish, & macroinvertebrates after completion of stream restoration work

Water Chemistry Sampling

Methods

Water chemistry and bacteriological sampling was conducted five times between July 22, 2014, and August 20, 2014, on West Creek at four sites, RMs 3.65, 1.60, 2.10, and 0.20. Techniques used for sampling and analyses followed the Ohio EPA *Surface Water Field Sampling Manual* (2013c). 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 either a YSI EXO 1 or 600XL sonde. Duplicate samples and field blanks were collected at randomly selected sites, each 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, 2013a).

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

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 West Creek 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 stream.

Water chemistry analysis sheets for each site are available upon request from the NEORSW WQIS Division.

Results and Discussion

West Creek 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, 2011).

A duplicate sample was collected on July 30, 2014, at RM 2.10 for Quality Assurance Quality Control (QA/QC) purposes. The sample showed cobalt, antimony and zinc being rejected due to a RPD greater than the acceptable level (Table 2). There are numerous reasons for why these parameters were rejected, such as a lack of precision and consistency in sample collection and/or analytical procedures, environmental

2014 West Creek Environmental Monitoring Results
February 6, 2017

heterogeneity and/or improper handling of samples. This sampling date was considered to be wet weather. The increased flow during this sampling event may have resulted in less homogenization of the creek than during dry weather, due to runoff, and therefore could have resulted in the differences observed between the two samples.

Table 2. Duplicate samples with RPDs greater than acceptable					
Date	Site	Parameter	Acceptable RPD (%)	Actual RPD (%)	Qualifier
7/30/2014	RM 2.10	cobalt	67.7	71.6	Rejected
7/30/2014	RM 2.10	antimony	81.5	103.3	Rejected
7/30/2014	RM 2.10	zinc	58.8	78.4	Rejected

Paired parameters were also evaluated and compared and showed that total solids and total dissolved solids data needed to be qualified as estimated for samples collected at RM 1.60 on August 6 (Table 3).

Table 3. Paired Parameter Analysis					
Date	Site	Parameters	Acceptable RPD (%)	Actual RPD (%)	Qualifier
8/06/2014	RM 1.60	TS (total solids) TDS (total dissolved solids)	17.1	2.5	Estimated

On July 30, 2014, one field blank was collected for QA/QC purposes. A total of five water quality parameters were estimated, rejected or downgraded to Level 2 due to potential field blank contamination based on Ohio EPA data validation protocol (Table 4). It is unclear how the field blanks became contaminated and may be due to inappropriate sample collection, handling, contaminated blank water and/or interference during analysis.

Table 4. Parameters affected by possible blank contamination		
COD	NH ₃	Zn
Cr	DRP	

2014 West Creek Environmental Monitoring Results
February 6, 2017

E. coli was the only parameter in which exceedances were measured in West Creek in 2014. The Class B Primary Contact Recreation criteria for West Creek include an *E. coli* criterion not to exceed a single sample maximum (SSM) of 523 colony counts per 100 milliliters in more than ten percent of the samples taken during any thirty-day period, and a seasonal geometric mean (SGM) criterion of 161 colony counts/100mL (Ohio EPA, 2009b).

All of the sites on West Creek were in non-attainment of the single sample maximum criterion for all 30-day periods throughout the sampling in 2014 (Table 5). They also failed to meet the seasonal geometric mean criterion. There were four wet-weather sampling events in 2014, which could have contributed to the elevated density of *E. coli* in the stream. The samples collected on July 30, 2014, August 6, 2014, August 13, 2014, and August 20, 2014, are considered wet-weather¹ sampling events because there was more than 0.25 inches of rain accumulation.

Table 5. 2014 West Creek <i>E. coli</i> Densities (most-probable number/100mL)					
Date	RM 3.65	RM 2.10	RM 1.60	RM 0.20	Precipitation within 3-days of sampling Rain Gauge at Parma, N. Royalton
7/22/14	250	303.0	91	120	0.00
7/30/14	598	7,757.5	4,080	1,966	1.03
8/06/14	3,542	3,475	3,315	2,758	1.77
8/13/14	24,720	31,940	28,020	19,710	2.70
8/20/14	7,292	11,460	10,920	18,160	1.59
Seasonal Geomean	2,489	4,956	3,275	2,975	

Exceeds single sample maximum criterion for 30-day period starting on that date

West Creek is in an urbanized area having one combined sewer overflow (CSO) entering the creek at RM 2.0, Permit No. 3PA00002 063 (Ohio EPA 1997). The Ohio EPA has stated that the major chemical constraints to West Creek seem to be linked to storm water runoff, construction and failing household waste treatment systems (Ohio EPA 2003). There are approximately 700 household waste treatment systems in the West Creek Watershed (West Creek Preservation Committee [WCPC] 2005). The Ohio Department of Health (ODH) estimates a failure rate of the on-site waste treatment systems around twenty-five percent (ODH 2007). The presence of these failing systems, along with CSO 063, may be the cause of the bacteriological exceedances that were

¹Wet-weather sampling events: 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; greater than 0.25 inches, the samples collected that day and the following two days are considered wet weather samples.

found in West Creek. All of the communities surrounding West Creek are currently in the process of either eliminating the on-site waste treatment systems or are in the planning stages of connection to a sanitary collection system (WCPC 2005). CSO 063 has also been controlled under the District's Long-Term Control Plan. These activities may help to reduce the number of exceedances in the future.

Ohio EPA's Trophic Index Criterion (TIC) is an index that looks at the measures of nutrients, benthic algae, dissolved oxygen, and the biological components and assigns points to ranges of each indicator. Of these components, only nutrients were assessed in 2014. For West Creek, the samples collected showed average concentrations of total phosphorus at 0.067mg/L, 0.070 mg/L, 0.082 mg/L, and 0.088 mg/L and dissolved inorganic nitrogen (DIN) of 0.741 mg/L, 0.784 mg/L, 0.711 mg/L and 0.644 mg/L at RMs 3.65, 2.10, 1.60 and 0.20, respectively. Based on these concentrations, all of the West Creek sites for the nutrient component of the TIC indicates that the concentrations are acceptable because they are typical of healthy streams in working landscapes.

Habitat Assessment

Methods

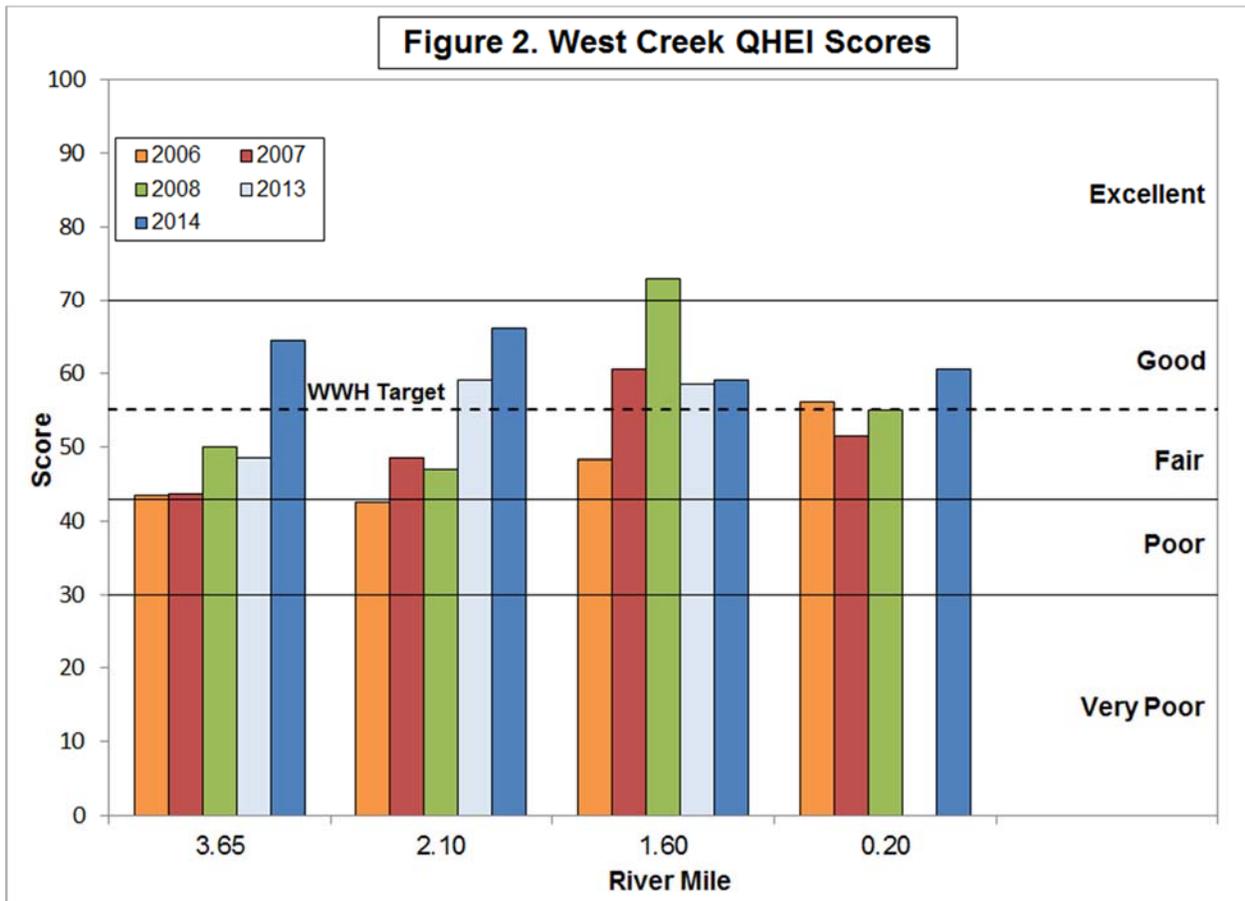
Instream habitat assessments were conducted once on West Creek in 2014 using the Qualitative Habitat Evaluation Index (QHEI). The QHEI was developed by the Ohio EPA to assess aquatic habitat conditions that may influence the presence or absence of fish species by evaluating the physical attributes of 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, 2006). 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)* (OEPA 2006). QHEI field sheets for each site are available upon request from the NEORSD WQIS Division.

QHEI scores were determined for the four restoration sites, RMs 0.20, 1.60, 2.10, and 3.65 in 2014. These results, along with past scores QHEI are provided in Table 6 and depicted graphically in Figure 2.

2014 West Creek Environmental Monitoring Results
 February 6, 2017

Table 6. West Creek QHEI Scores					
Location	2006	2007	2008	2013	2014
RM 3.65	43.50 <i>(Fair)</i>	43.75 <i>(Fair)</i>	50.00 <i>(Fair)</i>	48.50 <i>(Fair)</i>	*64.50 <i>(Good)</i>
RM 2.10	42.50 <i>(Fair)</i>	48.50 <i>(Fair)</i>	47.00 <i>(Fair)</i>	59.00 <i>(Good)</i>	66.00 <i>(Good)</i>
RM 1.60	48.25 <i>(Fair)</i>	60.50 <i>(Fair)</i>	73.00 <i>(Excellent)</i>	58.50 <i>(Good)</i>	59.00 <i>(Good)</i>
RM 0.20	56.00 <i>(Good)</i>	51.50 <i>(Fair)</i>	n/a	n/a	60.50 <i>(Good)</i>

*Site started approx. 500-ft. upstream of Broadview Rd. bridge and included a pool >3-ft. deep



The QHEI score at RM 3.65 was calculated at 64.50 with a narrative rating of “*Good*”. The 2014 zone corresponded with the electrofishing sampling site, which started approximately 500-feet upstream of Broadview Road. Predominantly bedrock/slabs substrate was evident throughout the creek. The site included the two step pools from the restoration project and a pool greater than 3-feet deep. Instream cover consisted of boulders and shallows, and deep pools. Moderate amounts of instream cover were evident throughout the creek. Prior to 2014, QHEI scores at this site were relatively the same, obtaining a “*Fair*” narrative rating every year that it was evaluated.

The QHEI score at RM 2.10 was calculated at 66.00 with a narrative rating of “*Good*”. This site begins where the creek exits the culvert under Interstate 480. The predominant substrate type in this section was bedrock and boulder/slab. The habitat of this straight channel was primarily a run/glide with sparse to moderate amounts of marginal quality instream cover types consisting of boulders, logs, deep pools and shallows. Some areas of riffle/pool complexes had fairly good development and both banks exhibited moderate erosion. Commercial development borders the riparian zone on river right. The riparian habitat along river left bank varies in width and land use and is primarily forest land. In 2014, this headwater site met the QHEI warmwater habitat score above 55 (“*Good*”).

The QHEI score at RM 1.60 was calculated at 59.00 with a narrative rating of “*Good*”. This site is located downstream of Lancaster Drive. Boulder and cobble were the predominant substrate types with gravel and sand also prevalent along the stream bottom. Sparse amounts of instream cover with the presence of shallows, deep pools, and boulders were evident in 2014. The bank on river right, which abuts a commercial development, was steep with areas of moderate tree removal. Tree removal was also evident on the river left bank which borders Granger Road, but offers a wider riparian habitat width of better flood plain quality. From 2008 to 2014, QHEI scores have been rated “*Good*” to “*Excellent*” at this site.

The QHEI score at RM 0.20 was calculated at 60.50 with a narrative rating of “*Good*”. This site begins at the Granger Road Bridge and continues downstream. The predominant substrate type in this section was cobble/gravel. The habitat of this straight channel was primarily a run with sparse to moderate amounts of marginal quality instream cover types consisting of boulders, shallows and backwaters. Some areas of riffle/pool complexes had fairly good development and both banks exhibited no erosion. Commercial industrial development borders the riparian zone on river right and left. In 2014, this headwater site met the QHEI warmwater habitat score above 55 (“*Good*”).

Fish Community Assessment

Methods

One quantitative electrofishing pass was conducted at each West Creek site in 2014. Sampling was conducted using the longline electrofishing technique and consisted of shocking all habitat types within a sampling zone while moving from downstream to upstream. The sampling zones were 0.15 kilometers. 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 were compiled and utilized to evaluate fish community health through the application of the Ohio EPA Index of Biotic Integrity (IBI). The IBI incorporates 12 community metrics representing structural and functional attributes (Table 12). 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 7.

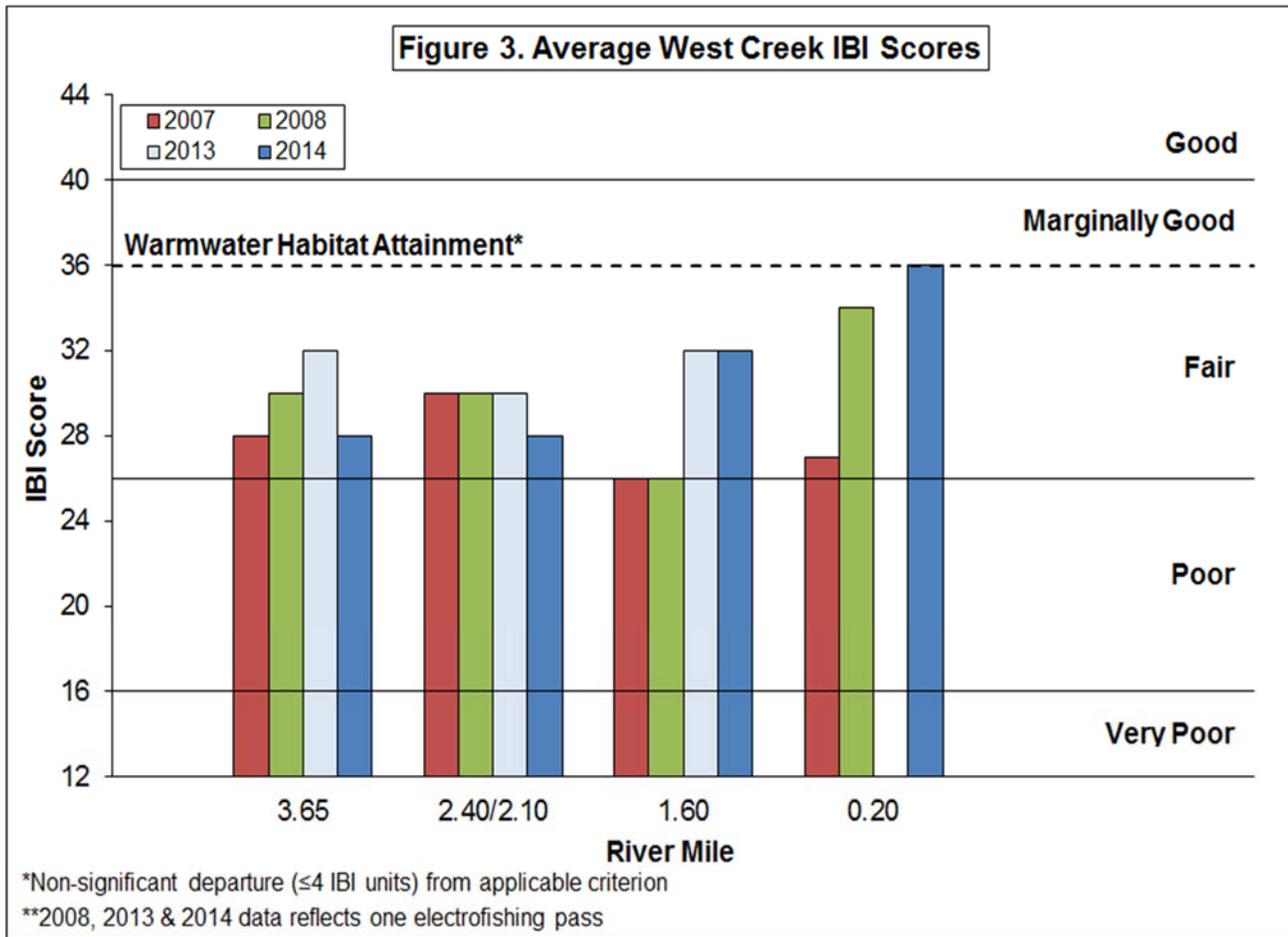
Table 7. IBI Metrics (Headwater)
Total number of Native Species
Number of Darters & Sculpins
Number of Headwater Species
Number of Minnow Species
Number of Sensitive Species
Percent Tolerant Species
Percent Pioneering Species
Percent Omnivores
Percent Insectivores
Number of Simple Lithophils
Percent DELT Anomalies
Number of Fish

Results and Discussion

Table 8 shows the IBI scores that were calculated for each site. None of the sites met the IBI Warmwater Habitat (WWH) criterion for headwater sites with the exception of RM 0.20 downstream of Granger Road (Table 8, Figure 3). River Mile 0.20 scored a 36, falling in the non-significant departure (≤ 4 IBI units) of the applicable criterion of 40. The site downstream of I-480 (RM 2.10) was electrofished for the first time in 2013 after habitat construction restoration work was completed. In the second round of electrofishing, in 2014, the fish community remained relatively the same, maintaining a *Fair* narrative rating.

Table 8. Index of Biotic Integrity (IBI) Scores					
Site	Year	2007	2008	2013	2014
	RM	Average	Pass 1	Pass 1	Pass 1
US Broadview Road	3.65	31	30	32	28
Brooklyn Heights Park *(downstream of I-480)	2.40, *(2.10)	32	30	*(30)	*(28)
Downstream of Lancaster Drive	1.60	26	26	32	28
Downstream of Granger Rd.	0.20	27	34	-	36

A score of 28 (*Fair*) was calculated at RM 3.65 in 2014 compared to 32 (*Fair*) in 2013. Once again, the predominant fish collected were blacknose dace, central stoneroller minnows and creek chub. These fish accounted for 98% of the total catch. IBI metric scores of 5 were obtained for low proportion of DELTs, low proportion of pioneering species and low proportion of omnivores present. Improvements in the fish index scores should be evident in future years once fish get acclimated to the habitat renovation work completed at all sites on West Creek. A concrete flume at RM 1.10 is currently acting as a fish migration barrier to the site.



At RM 2.10, an IBI score of 28 (*Fair*) was calculated in 2014. The score calculated in 2013 was 30 (*Fair*). Ninety-eight percent of the total catch was predominantly blacknose dace, creek chubs and central stoneroller minnows. In 2014, IBI metric scores of 5 were obtained for low proportion of DELTs (0%), low proportion of pioneering species (28.9%) and low proportion of omnivores (1.8%) present. The bedrock substrate, fair straight channel development, sparse in stream cover, and downstream migration barriers are limiting factors to a more diverse fish community.

A score of 32 (*Fair*) was calculated at RM 1.60 in 2014, the same score as in 2013. The predominant fish collected in 2014 were blacknose dace, creek chubs and central stoneroller minnows. These three species accounted for 98% of the total catch. IBI metric scores of 5 were obtained for low proportion of DELTs (0%), low proportion of pioneering species (3.8%), low proportion of omnivores (2.1%), low proportion of tolerant species (23.3%), and a large number of individuals collected (4455). Following the restoration work at the site, there was more in-stream cover consisting of undercut banks, overhanging vegetation, rootmats, rootwads, aquatic macrophytes and logs and woody debris present. Fish index scores went from “*Poor*” (26) in 2008 to “*Fair*” (32)

in 2014. The boulder cobble substrate with the addition of the step pools may have contributed to the increase in the fish index score.

A score of 36 (*Good*) was calculated at RM 0.20 in 2014, falling in the non-significant departure (≤ 4 IBI units) of the applicable criterion score of 40. This was the first time that this site has been in non-significant departure of the criterion since NEORSD began sampling there in 2008. The predominant fish collected in 2014 were central stoneroller minnows and these fish comprised 77% of the total fish collected. IBI metric scores of 5 were obtained for low proportion of DELTs (0%), low proportion of pioneering species (8.8%), low proportion of omnivores (5.8%), low proportion of tolerant species (17.7%) and large number of individuals collected (1476). Improvements in site habitat because of the restoration project may have contributed to the increase in the IBI score there.

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 RMs 3.65, 2.41, 2.10, 1.60 and 0.20. 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 WQIS.

The overall aquatic macroinvertebrate community in the stream was evaluated using Ohio EPA's Invertebrate Community Index (ICI) (OEPA 1987a, Ohio EPA undated). The ICI consists of ten community metrics (Table 9), 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.

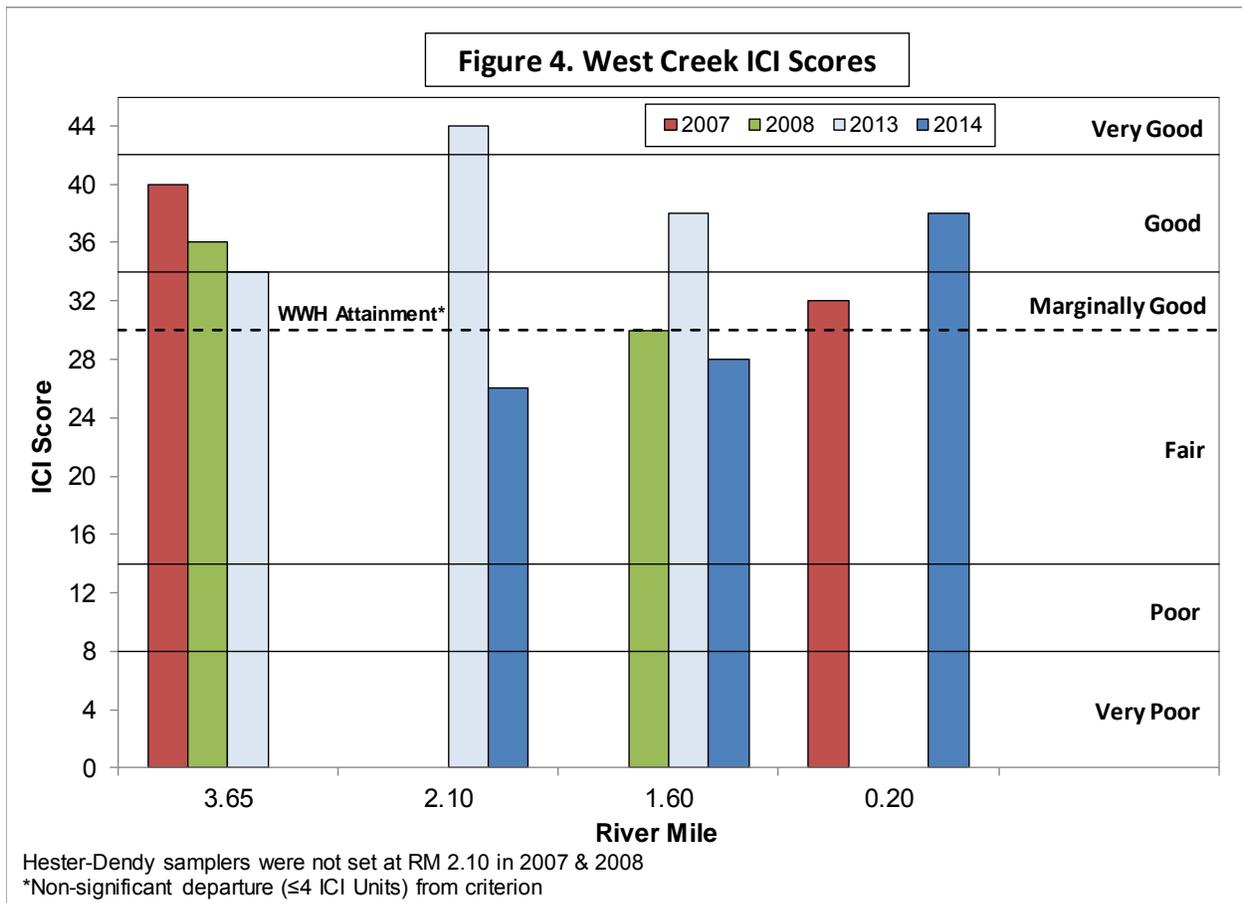
Table 9. ICI Metrics
Total Number of Taxa
Total Number of Mayfly Taxa
Total Number of Caddisfly Taxa
Total Number of Dipteran Taxa
Percent Mayflies
Percent Caddisflies
Percent Tanytarsini Midges
Percent Other Dipterans and Non-Insects
Percent Tolerant Organisms
Total Number of Qualitative EPT Taxa

Results and Discussion

In 2014, one quantitative sample site (RM 0.20) was in attainment of the WWH ICI criterion of 34. For the other sites, there was a general decrease in scores compared to the previous year, when all the sites that were assessed were in attainment. The results from 2014 and past years are summarized in Table 10 and shown in Figure 4.

Table 10. Invertebrate Community Index (ICI) Scores				
Year	2007	2008	2013	2014
Site	ICI Score	ICI Score	ICI Score	ICI Score
Upstream of Broadview Rd. (RM 3.65)	40	36	34	-
Downstream of I-480 (RM 2.10)	-	-	44	26
Downstream of Lancaster Dr. (RM 1.60)	-	30	38	28
Downstream of Granger Road (RM 0.20)	-	32	-	38

* WWH for the ICI Criterion is ≥ 34 units: Non-significant departure from attainment is ≤ 4 units



In 2014, no HD sampler was retrieved at RM 3.65. Prior year ICI scores in 2008 and 2013 were 36 and 34, respectively. A total of 22 taxa were collected at this site during qualitative sampling. Predominant organisms collected during the qualitative sampling, with a low density and diversity, were Baetid mayflies and chironomids. As a result, a qualitative rating of *Poor* was assigned to this site.

An ICI score of 26 was calculated at RM 2.10, failing to meet the ICI biocriterion in 2014. Twenty-four taxa were collected and the dominant group was Oligochaeta. This group accounted for thirty-one percent of the taxa collected at this site. Hester-Dendy samplers were not set in 2007 and 2008, and therefore, no ICI scores are available for those years; however, an ICI score of 44 was obtained in 2013. The ICI score decreased considerably from 2013 with a score of 26. The low score in 2014 was due to a decrease in the number of taxa, percent mayflies, percent tanytarsini midges, and percent tolerant organisms.

An ICI score of 28 was calculated at RM 1.60 with a narrative rating of *Fair*, also failing to meet the biocriteria of 34. In 2014, twenty-three taxa were collected with the

dominant taxa collected being Oligochaeta and *Cricotopus(C.) tremulus group*. These two taxa accounted for fifty-one percent of the total organisms collected. In 2013, thirty-five taxa were collected with the dominant taxa collected being Oligochaeta and the moderately intolerant *Ceratopsyche morose*. These two taxa accounted for thirty percent of the total organisms collected. The ICI score was *Very Good* in 2013 because of the number and percent of caddisfly taxa and the number of Dipteran taxa that were collected at this site. The ICI score decreased considerably from 2013 with a score of 28. The decrease in score was due to the HD sampler being set in non-ideal habitat conditions. In 2014, the HD sampler was moved further downstream in a pool area surrounded by pool/glide habitat conditions compared to it being set in 2013 in a run/pool area surrounded by faster moving riffle/run habitat where a greater diversity and density of organisms can be collected.

An ICI score of 38 (*Good*) was calculated at RM 0.20 in 2014 and this site was in attainment of the ICI criterion of 34. Twenty-six taxa were collected and the dominant group was *Cricotopus (C.) tremulus group*. This group accounted for twenty-nine percent of the taxa collected at this site. The ICI score received in 2014 was higher than the score of 32 from the assessment that was conducted back in 2008.

In addition to the site-specific factors discussed previously, one additional impact that could have influenced the macroinvertebrate community at the upstream three sites, more than improvements to habitat, was the amount of rainfall during the HD colonization period. In 2014, over eight inches of rain fell during the period in which the HDs were installed in West Creek. This was more than twice the amount of rain that fell during the colonization period in 2013. Heavy rain can result in scouring of the macroinvertebrates in the stream, preventing them from fully establishing a healthy community. West Creek at RM 0.20 has better access to the adjacent floodplain and, thus, may have been less impacted by this.

Conclusions

Results from the bacteriological sampling, qualitative habitat evaluations, fish and macroinvertebrate assessments show West Creek may have some limiting factors and environmental stressors resulting in low fish and macroinvertebrate index scores at the three upstream sites that were assessed. Bacteriological samples collected at all sites showed water quality exceedances for *E. coli* most of the time. The overall attainment status of West Creek is summarized in Table 11; the general water quality of West Creek at the upstream sites is *Fair*. The lack of a diverse fish community at these sites may be the result of poor/fair natural substrate quality consisting of bedrock. Additionally, permanent instream structures are impeding upstream fish migration within the creek and

from the Cuyahoga River. Therefore, the habitat improvements that have been completed at these sites may not be fully realized until the downstream fish barriers are removed. This, in conjunction with elimination of onsite residential waste treatment systems within the watershed and CSO 063 would likely result in improvements in the fish community. The macroinvertebrate community would also likely benefit from a reduction in sanitary sewage going to the stream.

Although the site at RM 0.20 also exceeded the *E. coli* criteria, it was in full attainment for fish and macroinvertebrate scores by meeting the ICI WWH criterion score of 34 and being in non-significant departure of the criterion for the IBI. This was the first year that the site at RM 0.20 was in attainment and, at least in terms of the fish community, may be partly due to the habitat restoration project there.

Future bacteriological, chemical and biological monitoring will take place at these sites again in 2015 and at any additional sites where habitat restoration work has been completed to document further changes in the conditions in West Creek.

Table 11. 2014 West Creek Survey Results					
River Mile	Aquatic Life Use Attainment Status	IBI Score (Narrative Rating)	ICI Score (Narrative Rating)	QHEI Score (Narrative Rating)	Water Quality Exceedances
3.65	Non	28 (Fair)	Poor	64.5 (Good)	<i>E. coli</i>
2.10	Non	28 (Fair)	26 (Fair)	66.0 (Good)	<i>E. coli</i>
1.60	Non	28 (Fair)	28 (Fair)	59.0 (Good)	<i>E. coli</i>
0.20	Full	36 (Good)	38 (Good)	60.5 (Good)	<i>E. coli</i>
WWH biocriterion attainment: IBI Score of 40; ICI Score of 34 Non-significant departure: ≤4 IBI units; ≤4 ICI units *Narrative rating based on best professional judgment					

Acknowledgements

Field activities and/or report review completed by the following, except where otherwise noted:

Donna Friedman
Seth Hothem
Ron Maichle
John Rhoades
Eric Soehnlén

Kelsey Amidon
Mario Meany
Jill Knittle
Tom Zablony, Author

WQIS Co-ops: Julia Klepach, Sean Giblin, and Kyle Connelly

Analytical Services Division – Completed analysis for all water chemistry sampling

Reference List

- DeShon, J.E. (1995). Development and Application of the Invertebrate Community Index (ICI). In: Davis and Simon, editors. Biological assessment and criteria, tools for water resource planning and decision making. Boca Raton, FL: Lewis Publishers; 1995. p 217-43.
- Ohio Department of Health. (2007). website:
<http://www.odh.ohio.gov/ASSETS/22E1223A9A9A4E5AB044E91B0A7AF61C/InfraFS.pdf>. Lasted Accessed on June 11, 2009. Columbus, Ohio.
- Ohio Environmental Protection Agency. (2011). *State of Ohio Water Quality Standards Ohio Administrative Code Chapter 3745-1* (Revision: Adopted July 9, 2009; Effective October 9, 2009). Columbus, OH: Division of Surface Water, Standards and Technical Support Section.
- Ohio Environmental Protection Agency. (1987). Biological criteria for the protection of aquatic life: Volume III. Standardized biological field sampling and laboratory methods for assessing fish and macroinvertebrate communities. Division of Water Quality Monitoring and Assessment. Columbus, Ohio. Last updated: August 2008.
- Ohio Environmental Protection Agency. (2013a). 2013 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. Columbus, OH: Division of Surface Water, Ecological Assessment Section.
- Ohio Environmental Protection Agency. (2013b). 2013 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. Columbus, OH: Division of Surface Water, Ecological Assessment Section.

2014 West Creek Environmental Monitoring Results
February 6, 2017

Ohio Environmental Protection Agency. (2013c). *Surface Water Field Sampling Manual for water column chemistry, bacteria and flows*. Columbus, Ohio: Division of Surface Water.

Ohio Environmental Protection Agency. (1997). NEORSD Ohio EPA NPDES Permit No. 3PA00002*ED. Ohio Environmental Protection Agency. Columbus, Ohio. February 24, 1997

West Creek Preservation Committee. (July 2005 revised December 2008). Website accessed at: <http://www.westcreek.org/Final%20WSAP%2012-15-08.pdf> Last Accessed on June 11, 2009. Parma, Ohio.