

2006-07 West Creek Biological, Water Quality and Habitat Survey Results

Introduction

During 2006 and 2007, the Northeast Ohio Regional Sewer District¹ (NEORS) conducted electrofishing, benthic macroinvertebrate and water chemistry sampling, and habitat assessments at sites on West Creek, a tributary to the Cuyahoga River (Figure 1). The purpose of the sampling was to establish baseline conditions in the creek prior to restoration activities that will start in 2009. The goals of these restoration projects are to improve existing in-stream habitat, construct additional in-stream habitat, remove or alter existing fish migration barriers, and re-stabilize eroding stream banks utilizing bioengineered technology and natural channel design techniques. In 2006, sampling consisted of habitat and qualitative macroinvertebrate evaluations. In 2007, sampling included electrofishing, benthic macroinvertebrate and water chemistry sampling, and habitat assessments. Sampling will again be performed once construction is complete to determine the effectiveness of the restoration. Figure 1 is a map of the sampling locations on West Creek, and Table 1 indicates the sampling locations with respect to river mile (RM), latitude/longitude, description and surveys conducted.

Water Chemistry Sampling

In 2007, to assess water quality conditions, water samples were collected from West Creek river miles (RM) 0.20, 1.60, 2.40, 3.65, and 7.90. Samples were collected weekly during the macroinvertebrate colonization period from June 20, 2007 to August 13, 2007, under a variety of weather and flow conditions. The techniques that were used for the water chemistry sampling and chemical analyses followed the *Manual of Ohio EPA Surveillance Methods and Quality Assurance Practices* (2006). Field analyses included the use of a Marsh-McBirney FloMate Model 2000 Portable Flow Meter, which measures flow in feet per second, and a YSI-556 MPS Multi-Parameter Water Quality Meter to measure dissolved oxygen, water temperature, specific conductivity and pH at the time of sampling. Each site was sampled on seven occasions with three of the sampling events during wet weather and four under dry weather conditions.

¹ Sampling was conducted by NEORS Level 3 Qualified Data Collectors certified by Ohio EPA in Fish Community and Benthic Macroinvertebrate Biology, Chemical Water Quality and Stream Habitat Assessments as explained in the NEORS study plan approved by Ohio EPA on July 2, 2007, *2007 West Creek Restoration Evaluation*.

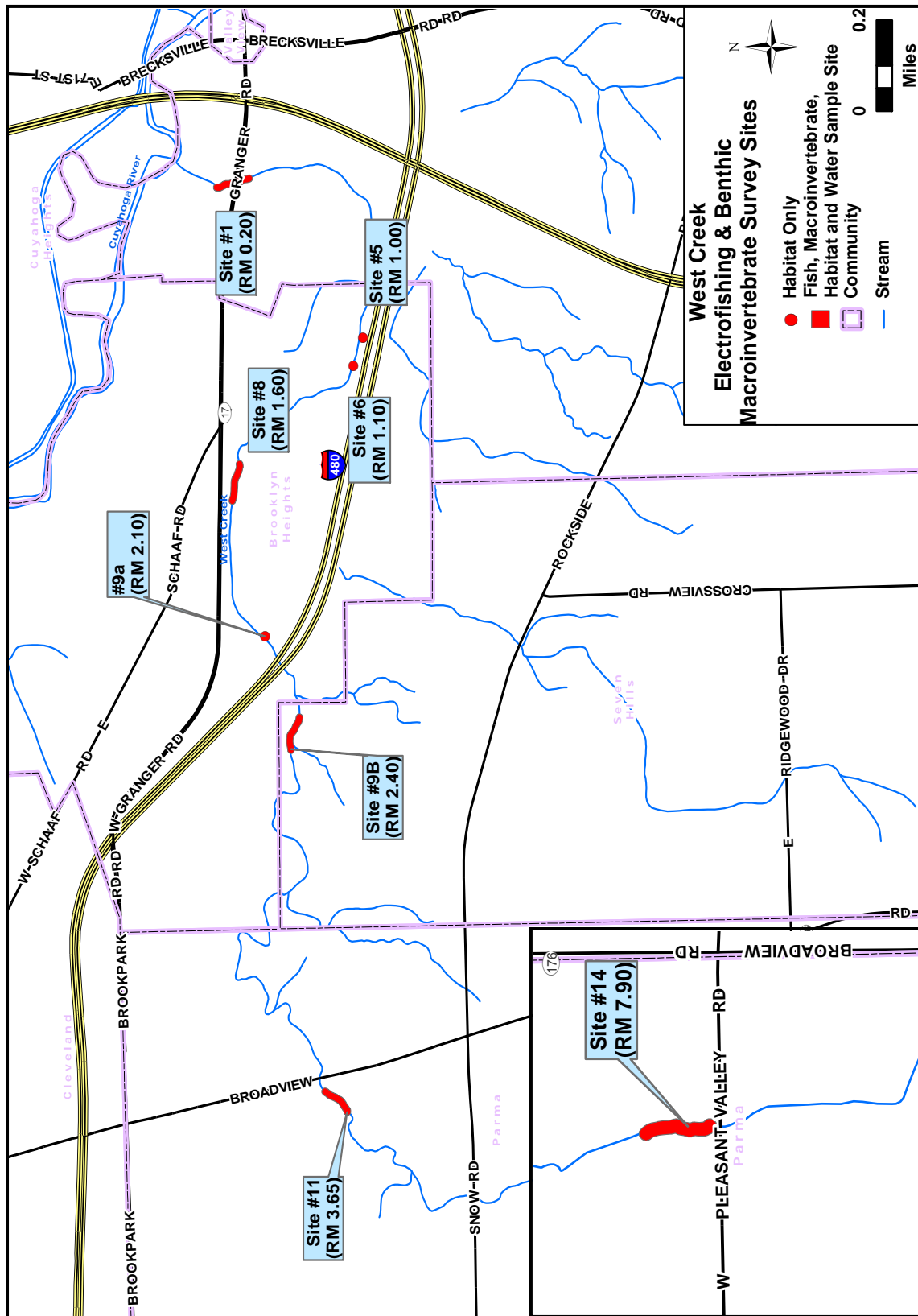


Figure 1. NEORSD West Creek Biological, Habitat and Water Chemistry Sites

2006-2007 West Creek Biological, Water Quality and Habitat Survey Results
November 12, 2008

Table 1. 2007 West Creek Locations						
Location	Latitude	Longitude	River Mile	Description	Quadrangle	Purpose
Site #14	41.3630°N	81.6894°W	7.90	Downstream from West Pleasant Valley Road	Broadview Heights	Evaluate habitat, fish, & macroinvertebrate prior to restoration
Site #11	41.4122°N	81.6754°W	3.65	Upstream of Broadview Road	Cleveland South	Evaluate habitat, fish, & macroinvertebrate prior to restoration and removal of fish barrier
Site #9B	41.4120°N	81.6747°W	2.40	Brooklyn Heights Park, upstream from I-480	Cleveland South	Evaluate habitat, fish, & macroinvertebrate prior to restoration and removal of fish barrier
Site #9A	41.4134°N	81.7606°W	2.10	Downstream from I-480	Cleveland South	Evaluate habitat changes prior to restoration and removal of fish barrier
Site #8	41.4144°N	81.6619°W	1.60	Downstream from Lancaster Drive Bridge	Cleveland South	Evaluate habitat, fish, & macroinvertebrate changes prior to restoration and removal of fish barrier
Site #6	41.4097°N	81.6570°W	1.10	ODOT Concrete Flume	Cleveland South	Evaluate habitat changes prior to restoration and removal of fish barrier
Site #5	41.4093°N	81.6556°W	1.00	Adjacent to Mercomp Landfill	Cleveland South	Evaluate habitat changes prior to restoration
Site #1	41.4152°N	81.6479°W	0.20	Between Granger & Schaaf Roads	Cleveland South	Evaluate habitat, fish, & macroinvertebrate changes prior to restoration

Wet weather sampling events for the purpose of this study were defined as follows:

- greater than 0.10 inches of rain, and samples collected that day and the following day were considered wet weather samples
- greater than 0.25 inches, and samples collected that day and the following two days were considered wet weather samples

Each sample collected was analyzed for up to 35 chemical parameters. Field measurements for dissolved oxygen, water temperature, specific conductance, pH, and flow velocity were obtained at the time of sampling. A total of 35 samples were collected with no excursions from the applicable Ohio Water Quality Standards. Raw data sheets for this sampling are available upon request.

Habitat Assessment

In 2006, Qualitative Habitat Evaluation Index (QHEI) scores were determined for eleven proposed restoration sites. In 2007, after specific restoration activities were determined, QHEI's were performed at RMs 0.20, 1.00, 1.10, 1.60, 2.10, 2.40, 3.65, and 7.90. The QHEI, developed by Ohio EPA, is used to assess the aquatic habitat conditions at each sample location by providing an evaluation of the physical components of a stream. The index is based on six metrics: stream substrate, instream cover, stream channel morphology, riparian and bank condition, pool and riffle quality and stream gradient. These metrics describe the physical attributes of a stream and may be important in explaining why fish species are present or absent. 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)*, June 2006. The QHEI results for both 2006 and 2007 are provided in Table 2. QHEI field sheets for each site are available upon request.

Table 2. West Creek QHEI Scores			
Site Location	RM	2006	2007
Downstream from West Pleasant Valley Road	7.90	61.75 (G)	55.00 (G)
Upstream of Broadview Road	3.65	43.50 (F)	43.75 (F)
Brooklyn Heights Park, upstream from I-480	2.40	51.25 (F)	48.00 (F)
Downstream from I-480	2.10	42.50 (F)	48.50 (F)
Downstream from Lancaster Drive Bridge	1.60	48.25 (F)	60.50 (G)
ODOT Concrete Flume	1.10	38.75 (P)	42.25 (P)
Adjacent to Mercomp Landfill	1.00	61.00 (G)	63.25 (G)
Adjacent to I-480 and Independence Concrete Recycling	0.56	51.00 (F)	---
Adjacent to Independence Concrete Recycling	0.40	60.25 (G)	---
Upstream of Schaaf Road	0.25	51.25 (F)	---
Between Granger & Schaaf Roads	0.20	56.00 (G)	51.50 (F)
(G)- Good (F)- Fair (P)- Poor			

RM 0.20

This site obtained QHEI scores in the *Good* and *Fair* range (56.00 and 51.50) in 2006 and 2007, respectively. This straightened section of channel begins under the Schaaf Road bridge and extends beyond the Granger Road bridge. Sparse amounts of instream cover of marginal quality were noted at this site. Little erosion was noted along both banks which were at steep angles. The land use in the area is primarily urban and industrial and the riparian habitat width is very narrow to none.

RM 0.25

In 2006, this site obtained a QHEI score of 51.25 (*Fair*). This site located upstream of Schaaf Road exhibited a poorly defined in-stream habitat. The riffle and run habitats were absent from this section of the creek, which was predominately a glide. Gravel and sand were the main substrate types, and the sinuosity was low showing no recovery from the channel having been straightened. The riparian habitat width was very narrow to none with an urban and construction type of land use in the surrounding area.

RM 0.40

In 2006, this site obtained a QHEI score of 60.25 (*Good*). This section of creek had moderately stable yet steep banks and the main substrate types were gravel and sand. Although in very small amounts or of marginal quality, the instream cover consisted of undercut banks, shallows, overhanging vegetation, rootmats, deep pools, boulders and woody debris. The surrounding land use is bordered by Independence Concrete Recycling to the northwest and Interstate 480 to the southeast. The riparian habitat width was very narrow to none.

RM 0.56

In 2006, this site obtained a QHEI score of 51.00 (*Fair*). This site is bordered by Independence Concrete Recycling to the northwest and Interstate 480 to the southeast. The instream cover types were limited to shallows, rootmats, and logs or woody debris. This site exhibited only a fair development of the riffle/pool complexes. The riffle areas were shallow and the riffle substrate only moderately stable. Although this section of channel was straightened, deposits of gravel and sand have created small meanders resulting in some sinuosity.

RM 1.00

This site obtained QHEI scores in the *Good* range (61.00 and 63.26) in 2006 and 2007, respectively. This straightened section of stream is bordered by a landfill along the north bank and Interstate 480 along the south bank. Cobble and gravel were the main substrate types. The instream habitat cover consisted of undercut banks, shallows, rootmats, deep pools, boulders and logs or woody debris. This section of creek had only a few, shallow pool areas. The riparian habitat width was very narrow to none.

RM 1.10

This site obtained QHEI scores in the *Poor* range (38.75 and 42.25) in 2006 and 2007, respectively. Although this site contains more than four types of substrate, the predominant type was artificial since a concrete flume is located within this section of stream. This site is bordered by a landfill along the north bank and Interstate 480 along the south bank. The flume precludes development of riffle/pool complexes. Sparse amounts of instream cover of marginal quality were noted at this site.

RM 1.60

This site obtained QHEI scores in the *Fair* and *Good* range (48.25 and 60.50) in 2006 and 2007, respectively. This straightened section of channel is located downstream of Lancaster Drive. Sparse amounts of instream cover and poorly defined pool areas were noted at this site. The south bank, which abuts a commercial development, was steep with areas of severe erosion. The north bank borders Granger Road, but offers a wider riparian habitat width of better flood plain quality.

RM 2.10

This site obtained QHEI scores in the *Fair* range (42.50 and 48.50) in 2006 and 2007, respectively. This site begins where the creek exits the culvert under Interstate 480. The predominant substrate type in this section was bedrock. The habitat was primarily a shallow run/glide with sparse amounts of marginal quality instream cover types. The riffle/pool complexes were poorly developed and both banks exhibited moderate to severe erosion. Commercial development borders the southeast banks eliminating the riparian habitat. The riparian habitat along the northwest bank varies in width and land use.

RM 2.40

This site obtained QHEI scores in the *Fair* range (51.25 and 48.00) in 2006 and 2007, respectively. This section of creek has a 'very high' gradient (63.6 feet per mile) with a predominant bedrock substrate. This site exhibited poorly developed riffle/pool complexes as evidenced by the shifting bedload. The instream cover types were limited to shallows, boulders, and logs or woody debris. Moderate to severe erosion was noted along both banks. This site is located within the City of Brooklyn Heights Park which provides a wide riparian width consisting of a forest, residential/park flood plain quality.

RM 3.65

This site obtained QHEI scores in the *Fair* range (43.50 and 43.75) in 2006 and 2007, respectively. This site, located upstream of Broadview Road, has a 'very high' gradient (48.4 feet per mile) with a predominant bedrock substrate. Only sparse amounts of marginal quality instream cover were observed in this section of creek. This site lacked well-defined pools and riffles and was predominately a shallow run habitat. Although the bedrock substrate provides a stable channel, its predominance limits the

development of a good riffle habitat. The surrounding land use in the area is primarily residential and urban.

RM 7.90

This site obtained QHEI scores in the *Good* range (61.75 and 55.00) in 2006 and 2007, respectively. Located downstream of West Pleasant Valley Road, this site exhibited moderate amounts of instream habitat cover. Gravel, sand and bedrock were the main substrate types. This section of the creek had a slow current velocity and was predominately a pool and glide habitat. The surrounding land use consists of residential and forest habitat.

Electrofishing

Methods

Electrofishing passes were conducted two times at each site in 2007. Sampling was conducted using longline electrofishing techniques and consisted of shocking all habitat types within a sampling zone, which was 0.15 kilometers in length, while moving from downstream to upstream. The methods that were used followed Ohio Environmental Protection Agency protocol methods described in *Biological Criteria for the Protection of Aquatic Life, Volume III: Standardized Biological Field Sampling and Laboratory Methods for Assessing Fish and Macroinvertebrate Communities* (Updated September 30, 1989 and November 8, 2006). Fish were identified to species level, counted, and examined for the presence of external anomalies including deformities, erosions, lesions, and tumors (DELTS). The results from this sampling were used to calculate Index of Biotic Integrity (IBI) scores for each site.

Results and Discussion

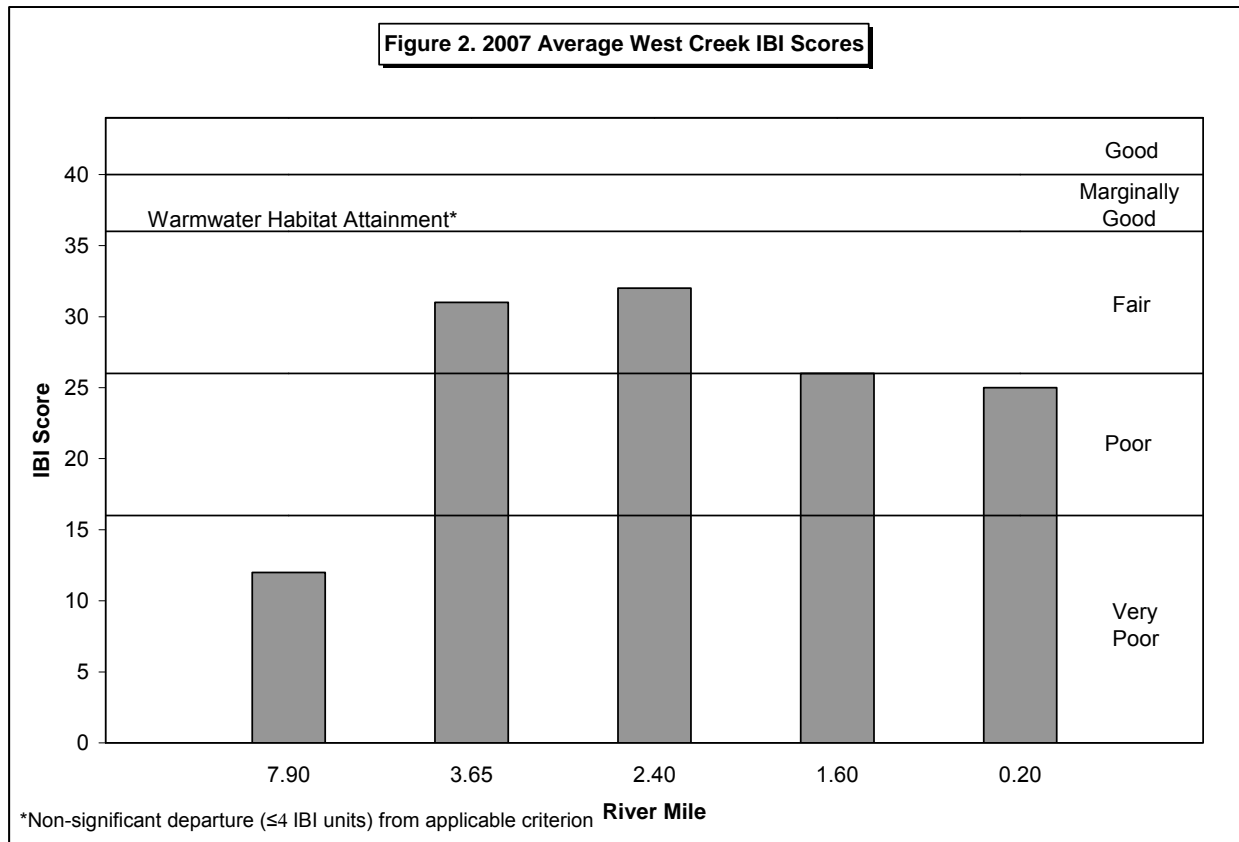
A list of the species, numbers, weights, pollution tolerances and incidence of DELT anomalies for fish collected during the electrofishing passes at each site is available upon request.

Table 3 shows the IBI scores that were calculated for each site. None of the scores met the Warmwater Habitat (WWH) criterion for headwater sites (Figure 2). Of the sites sampled, the most upstream one, located downstream of West Pleasant Valley Road at RM 7.90, did the poorest. For both passes, it received a score of 12, the lowest that is possible. This score was the result of the extremely low number of fish that were collected there, an average of 12 fish for both passes. In addition, all of the fish that were collected except for one, a white crappie, were pollution tolerant. Although the QHEI score at this site ranged between *Good* and *Fair* in 2006 and 2007, respectively, this section of the creek had a slow current velocity and was predominately a pool and glide habitat. This may have influenced the fish community at this location.

The sites at RM 1.60, RM 2.40, and RM 3.65 had similar fish populations. The predominant fish at these sites were the western blacknose dace and the central stoneroller minnow. One of the limiting factors to a healthy fish community at all three of these sites was the lack of high quality instream cover. The two upstream sites also had a predominantly shale substrate that may have also contributed to the IBI scores in the *Fair* range received at these sites.

The most downstream site, located at RM 0.2, appeared to be influenced by fish migrating from the Cuyahoga River. Over the two sampling passes, there were many more species collected here than at any of the upstream sites. This site scored significantly higher during the second pass and was close to being within non-significant departure for the WWH criterion for that pass. The average score for this site was in the *Poor* range.

Site	RM	Pass 1	Pass 2	Average
DS West Pleasant Valley Road	7.90	12	12	12
US Broadview Road	3.65	30	32	31
Brooklyn Heights Park	2.40	32	32	32
DS Lancaster Drive	1.60	26	26	26
DS Schaaf Road	0.20	16	34	25



Macroinvertebrate Sampling

Methods

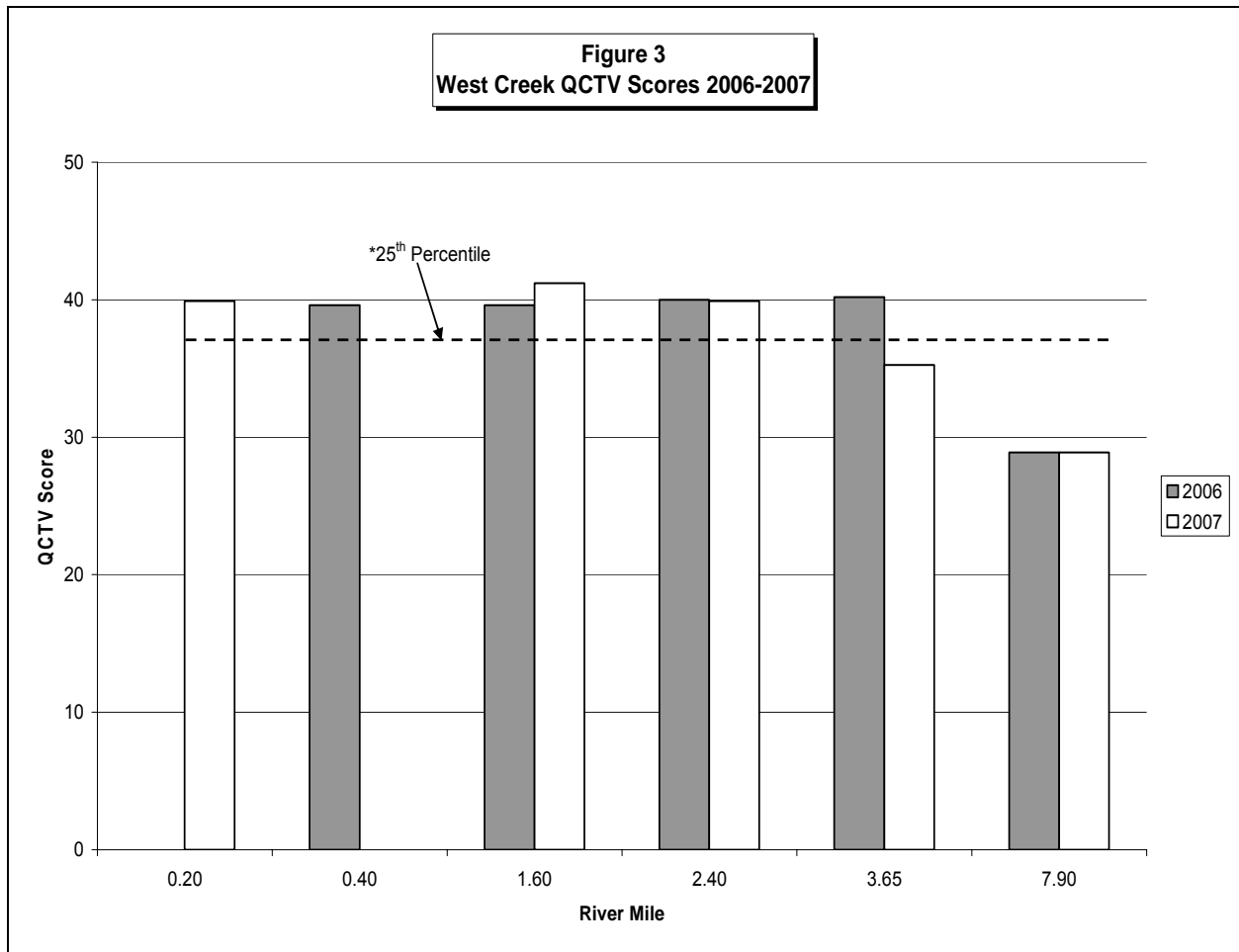
In 2006 and 2007, the macroinvertebrate communities were assessed at RM 0.20 (2007 only), RM 0.40 (2006 only), RM 1.60, RM 2.40, RM 3.65 and RM 7.90. In 2006, the sites were qualitatively sampled using a D-frame dip net, while in 2007, each site was quantitatively sampled using a modified Hester-Dendy multi-plate artificial substrate sampler (HD) and qualitatively sampled using a D-frame dip net. Ohio EPA Volunteer Monitoring Program Macroinvertebrate Field Sheets were completed at each site in 2007 and are available upon request. It should be noted that the formalin solution used to preserve the quantitative samples at sites RM 0.20 and RM 1.60 for 2007 was found to be defective in that the affected samples had signs of being under-preserved (septic odor and off-gassing when the container was opened). This resulted in the decomposition of the majority of the macroinvertebrates collected, with the remaining organisms not being a true representation of the original sample collected. The quantitative results, therefore, were not analyzed for sites RM 0.20 or RM 1.60. The cause of the under-preservation has been attributed to using a 5-gallon carboy of 10% formalin solution, previously opened in 2006, whereby the integrity of the container may have been compromised.

This would have facilitated evaporation/degradation of the formalin, resulting in a weakened strength of solution. As a result, to prevent under-preservation in the future, all macroinvertebrate samples will be preserved using a 100% formalin solution (37% formaldehyde) from a container appropriately sized to be completely used during one field season. The solution in the sample container will then be diluted to the approximate 10% formalin solution using water from the sample site.

Qualitative samples were evaluated using the Qualitative Community Tolerance Value (QCTV) and quantitative samples were evaluated with the Invertebrate Community Index (ICI). The QCTV is the median tolerance value of all macroinvertebrates found at the site that have a tolerance value (Ohio EPA, 2002). While this evaluation is not sufficient for determining attainment status, a general guide developed by the Ohio EPA, comparing QCTVs to Invertebrate Community Index scores, may be used to suggest whether or not a site designated as Warmwater Habitat (WWH) in the Erie/Ontario Lake Plains ecoregion meets the biological use attainment (QCTV Ecoregional Scoring Criteria, Ohio EPA, 1998). The ICI, as developed by the Ohio EPA, is used to evaluate the overall aquatic macroinvertebrate community in streams. The ICI consists of ten functional and structural community metrics, each with four scoring categories. Metrics 1-9 are based on the quantitative sample, while Metric 10, number of Ephemeroptera/Plecoptera/Trichoptera (EPT) taxa, is based on the qualitative sample.

Results and Discussion

In 2006, the macroinvertebrate communities collected qualitatively were evaluated at West Creek sites RM 0.40, RM 1.60, RM 2.40, RM 3.65 and RM 7.90 using the QCTV. In 2007, West Creek sites RM 0.20, RM 1.60, RM 2.40, RM 3.65 and RM 7.90 were sampled qualitatively and quantitative samples at RM 3.65 and 7.90 were also evaluated. As stated previously, the quantitative samples collected from sites RM 0.20 and RM 1.60 were found to be under-preserved and therefore, were not processed or evaluated. A list of taxa collected in 2006 and 2007 are available upon request. Figure 3 shows the QCTV scores for 2006 and 2007.



All sites, except for RM 7.90 and RM 3.65 (2007), scored above the 25th percentile QCTV score of 37.15 for the Erie/Ontario Lake Plains ecoregion. A QCTV score greater than 37.15, a number determined by the QCTV score at sites with ICI scores of *Good* to *Exceptional*, indicated that the site is most likely achieving the WWH biocriterion for macroinvertebrates (Ohio EPA, November 1998). Lower QCTV scores at RM 7.90, the most upstream location, were most likely due to the slow current velocity, a low-quality riffle and lack of suitable habitat for macroinvertebrate colonization. Of the scores that were greater than the 25th percentile, the range in the number of taxa present was a high of 21 and a low of 8, indicating variability in the number of taxa needed to exceed the 25th percentile.

The ICI score in 2007 at site RM 3.65 was 42, *Very Good*. An ICI score of 42 is in attainment of the WWH biocriterion of 34 for the Erie/Ontario Lake Plains ecoregion. RM 3.65 had a total of 29 taxa, 7 EPT taxa, 10 intolerant taxa and 3 tolerant taxa. RM

7.90 had an ICI score of 22, *Fair*, in 2007. This site did not meet attainment of the WWH criterion. RM 7.90 had a total of 18 taxa, 1 EPT taxon, 1 intolerant taxon and 5 tolerant taxa.

Conclusions

The macroinvertebrate and fish communities in West Creek indicated differing responses to the conditions at most of the locations that were assessed. For macroinvertebrates, each site sampled except for RM 7.90 indicated attainment of the WWH criterion for macroinvertebrates in the Erie/Ontario Lake Plains ecoregion. For fish, however, none of the sampled sites were in attainment of the applicable criterion. These responses do not appear to be related to water quality conditions, as there were no excursions of water quality standards in the samples that were collected. Instead, the lack of a healthy fish community at all of the sites and macroinvertebrate community at RM 7.90 appears to be a result of specific habitat limitations. Restoration projects on West Creek that are scheduled to begin in 2009 will attempt to correct some of the habitat problems. Future monitoring once restoration is complete will help determine any changes in the fish and macroinvertebrate communities as a result of these projects.