

NORTHEAST OHIO REGIONAL SEWER DISTRICT

2019 Rocky River East Branch Environmental Monitoring Biological, Water Quality and Habitat Survey Results



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

Introduction

In 2019, the Northeast Ohio Regional Sewer District (NEORS) conducted water chemistry sampling, habitat assessments, and fish and benthic macroinvertebrate community surveys on Rocky River East Branch and Baldwin Creek, one of its tributaries. Rocky River East Branch and Baldwin Creek flow through the communities of North Olmsted, Olmsted Township, Brook Park, Berea, Middleburg Heights, Strongsville and Cleveland before emptying into Lake Erie. Sampling was conducted by NEORS Level 3 Qualified Data Collectors certified by the Ohio Environmental Protection Agency (Ohio EPA) in Fish Community and Benthic Macroinvertebrate Biology, Chemical Water Quality and Stream Habitat Assessments as explained in the NEORS study plan *2019 Rocky River Environmental Monitoring* approved by Ohio EPA on May 15, 2019.

The study's objective was to assess the attainment status of the stream segments at Rocky River East Branch river miles (RM) 0.15, 6.25, 9.00, 17.50 and Baldwin Creek RM 0.20. Table 1 lists the sampling sites with respect to RM, latitude/longitude, description, and types of surveys conducted. Figure 1 is a map of the sampling locations located on the Rocky River East Branch and Baldwin Creek.

Table 1. 2019 Rocky River East Branch and Baldwin Creek Sampling Sites

Water Body	Latitude	Longitude	River Mile	Location Information	USGS HUC 8 Number Name	Purpose
Rocky River, East Branch	41.2814	-81.7425	17.50	Upstream of Ridge road	041100010201 Headwaters East Branch Rocky River	Evaluate water chemistry, habitat, fish & macroinvertebrate community for general watershed monitoring
Rocky River, East Branch	41.3278	-81.8335	9.00	Upstream of Bonnie Park	041100010202 Baldwin Creek East Branch Rocky River	Evaluate water chemistry, habitat, fish & macroinvertebrate community for general watershed monitoring
Rocky River, East Branch	41.3528	-81.8476	6.25	Downstream of Valley Parkway	041100010202 Baldwin Creek East Branch Rocky River	Evaluate water chemistry, habitat, fish & macroinvertebrate community for general watershed monitoring
Rocky River, East Branch	41.4060	-81.8846	0.15	Upstream of Metro Park Valley Parkway	041100010202 Baldwin Creek East Branch Rocky River	Evaluate water chemistry, habitat, fish & macroinvertebrate community for general watershed monitoring
Baldwin Creek	41.3632	-81.8542	0.20	Upstream of Quarry Lane	041100010202 Baldwin Creek East Branch Rocky River	Evaluate water chemistry, habitat, fish & macroinvertebrate community for general watershed monitoring

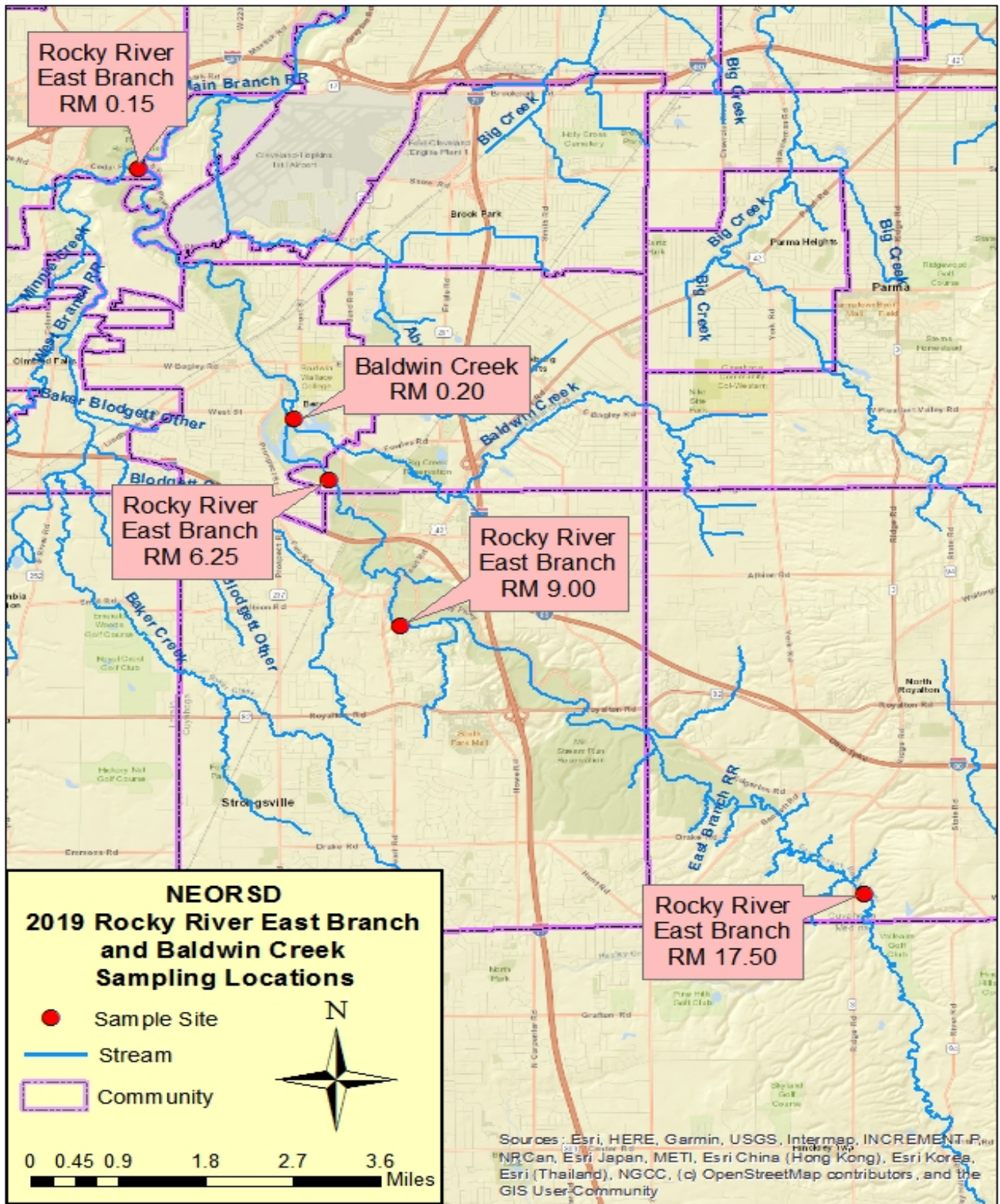


Figure 1. 2019 Sampling Locations on Rocky River East Branch and Baldwin Creek

Water Chemistry & Bacteriological Sampling

Methods

Water chemistry and bacteriological sampling was conducted five times between June 19, 2019 and July 17, 2019. Techniques used for sampling and analyses followed the Ohio EPA *Surface Water Field Sampling Manual for water quality parameters and flows* (2018b). 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 one 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 an YSI 600XL sonde or YSI EXO1 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).

Formula 1:

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

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, 2018b).

Formula 2: 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.

Results and Discussion

Over the course of the sampling, field blanks were collected for QA/QC purposes on June 26, 2019 and July 10, 2019, and the results were used to compare to all the samples collected on those days. One water quality parameter was rejected due to potential field blank contamination. It is unclear how the field blank became contaminated and may be due to inappropriate sample collection, handling, and/or contaminated blank water. Table 2 lists the water quality parameter that was rejected based on Ohio EPA data validation protocol.

Table 2. Potential Field Blank Contamination
 COD (Chemical Oxygen Demand)

Duplicate samples were collected on July 2, 2019, at RM 17.50 and on July 10, 2019 at RM 6.25 for QA/QC purposes. The duplicate sample collected at RM 17.50 revealed three parameters that were rejected due to an RPD that was greater than or equal to the acceptable RPD (Table 3). Possible reasons for why the parameters were rejected include the collector mishandling the sample, environmental heterogeneity, inconsistent sampling methods and/or analytical errors.

Table 3. Unacceptable Duplicate RPDs						
River/Creek	River Mile	Date	Parameter	Acceptable RPD (%)	Actual RPD (%)	Qualifier
Rocky	17.50	7/2/2019	Ca (Calcium)	14.3	14.3	Rejected
Rocky	17.50	7/2/2019	TS (Total Solids)	16.9	26.7	Rejected
Rocky	17.50	7/2/2019	TSS (Total Suspended Solids)	26.3	115.0	Rejected

Paired parameters for all samples collected were also evaluated and compared for QA/QC purposes using the same RPD formula. One paired parameter was qualified because the sub-parent was greater than the parent one (Table 4). The reason for the TDS being higher is unknown.

Table 4. Paired Data Parameter Analysis						
River/Creek	River Mile	Date	Parameters	Acceptable RPD (%)	Actual RPD (%)	Qualifier
Baldwin RM 0.20	17.50	6/19/2019	TS/TDS	15.6	0.3	Estimate

Rocky River and Baldwin Creek are designated as Primary Contact Recreation. The criteria for this designation are based on a statistical threshold value (STV); the *E. coli* count cannot be over 410 colony counts per 100 milliliters in more than ten percent of the samples taken over a 90-day period. A criterion for the 90-day geometric mean requires that the *E. coli* cannot be greater than 126 colony counts per 100 mL. For the 2019 data, Table 5 shows the *E. coli* results and exceedances of the STV and 90-day geomean. In 2019, both criteria were exceeded at every site. For most of the samples collected, the *E. coli* densities were elevated. High *E. coli* densities can be the result of illicit discharges, septic systems, improper connections, storm sewer runoff, and wild/domesticated animal waste.

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Table 5. 2019 Rocky River and Baldwin Creek <i>E. coli</i> Densities (most-probable number/100mL)					
Date	RM 0.15	RM 6.25	RM 9.0	RM 17.5	Baldwin 0.20
6/19/2019	634	213	470	139	1,440
6/26/2019	1,266	720	794	458	1,712
7/02/2019	219	388	1,130	286	256
7/10/2019	559	225	449	464	668
7/17/2019*	20,140	18,180	19,180	8,880	51,720
290-day G	2	2	2,613		1,852
<div style="display: flex; justify-content: space-between; align-items: flex-start;"> <div style="width: 15%; border: 1px solid black; background-color: #cccccc; padding: 2px;">Exceeds statistical threshold value</div> <div style="width: 15%; border: 1px solid black; background-color: #0070c0; padding: 2px;">Exceeds geometric mean criterion for 90-day period</div> </div> <p>*Wet-Weather Event: 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.</p>					

Mercury analysis for the sampling events was completed using EPA Method 245.1. The detection limit for this method is above the criteria for the Human Health Nondrinking and Protection of Wildlife Outside Mixing Zone Averages (OMZA), so it generally cannot be determined if the sites were in attainment of those criteria. Instead, this type of mercury sampling was used as a screening tool to determine whether contamination was present above the detection limit. Based on the sampling that was completed, mercury was not present at levels above those normally found in the watershed (USEPA, 2004).

In 2015, the Ohio EPA Nutrients Technical Advisory Group released a proposed Stream Nutrient Assessment Procedure (SNAP) designed to determine the degree of impairment in a stream due to nutrient enrichment. SNAP assigns designations for quality of surface waters based on factors including dissolved oxygen (DO) swings, benthic chlorophyll *a*, total phosphorous, and dissolved inorganic nitrogen (Ohio EPA, 2015a). NEORSR did not assess DO swings or benthic chlorophyll *a* in 2018; however, nutrients were assessed.

Nutrients were assessed for the Rocky River East Branch and Baldwin Creek monitoring sites. Table 6 shows the results for dissolved inorganic nitrogen, total phosphorus, and dissolved reactive phosphorus. The concentrations of total phosphorus and dissolved inorganic nitrogen were computed using Table 2 of the SNAP Analysis. Rocky River East Branch RMs 17.50, 9.00, 6.25, 0.15 and Baldwin RM 0.20 sites exhibited relatively low levels of total phosphorus and dissolved inorganic nitrogen. This is typical of working landscapes and poses little or no risk to beneficial uses if allied responses are within normal ranges (Ohio EPA, 2015a).

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Table 6. 2019 Nutrient Results for Rocky River and Baldwin Creek used for SNAP Analysis				
River Mile	Sample Date	Total Phosphorus (mg/L)	DRP (mg/L)	Dissolved Inorganic Nitrogen (mg/L)
17.50	6/19/2019	0.097	0.037	1.187
	6/26/2019	0.101	0.032	1.085
	7/2/2019	0.076	0.025	1.941
	7/10/2019	0.124	0.061	2.893
	7/17/2019	0.166	0.033	1.746
	GeoMean	0.109	0.036	1.660
9.00	6/19/2019	0.093	0.033	1.383
	6/26/2019	0.097	0.031	1.042
	7/2/2019	0.111	0.049	4.247
	7/10/2019	0.106	0.054	4.472
	7/17/2019	0.334	0.035	1.839
	GeoMean	0.129	0.039	2.190
6.25	6/19/2019	0.096	0.032	1.525
	6/26/2019	0.115	0.028	0.981
	7/2/2019	0.068	0.027	3.150
	7/10/2019	0.069	0.027	3.029
	7/17/2019	0.363	0.026	1.348
	GeoMean	0.113	0.028	1.807
0.15	6/19/2019	0.108	0.04	0.762
	6/26/2019	0.117	0.025	0.755
	7/2/2019	0.045	0.006	2.834
	7/10/2019	0.045	0.006	2.264
	7/17/2019	0.27	0.024	2.303
	GeoMean	0.093	0.015	1.534
Baldwin 0.20	6/19/2019	0.125	0.041	3.140
	6/26/2019	0.136	0.052	2.514
	7/2/2019	0.134	0.046	1.637
	7/10/2019	0.141	0.055	4.291
	7/17/2019	0.263	0.047	1.214
	GeoMean	0.153	0.048	2.321

Habitat Assessment

Methods

Instream habitat assessments were conducted once at each site on Rocky River East Branch and Baldwin Creek in 2019 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 60 or more in streams >20 square miles or 55 for streams ≤20 square miles suggests that sufficient habitat exists to support a fish community that meets the warmwater habitat criterion (Ohio EPA, 2005). 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 Ohio EPA's target score for the QHEI is 60 (or 55 for headwater sites), which means that the body of water's habitat should be able to support a community of warmwater fish species. Fish are an excellent indicator of water quality; the presence and abundance of tolerant and non-tolerant species can help to determine the health of a stream. Table 7 lists the specific QHEI attributes for each site and the resulting score and narrative rating. The attributes of each site are discussed in further detail below. All the sites met the target score except for Rocky River East Branch RM 9.00.

Rocky River East Branch RM 17.50 received a QHEI score of 62.00, resulting in a *Good* narrative rating. River right is forest and river left are residential riparian zones. The predominant type of substrate is sand; with three best types of substrate present in the pool and two in the riffle. The riffle depth was 5-10 centimeters and the depth of the run was less than 50 centimeters. The channel sinuosity was moderately high, and moderately stable. The pools were of good quality, while the riffles were poor, exhibiting a lack of depth, instability and low to moderate embeddedness. Riffles are important in a stream because they supply oxygen and habitat to support aquatic life. Instream cover received a low score in this section of stream due to the following characteristics; a low number and/or poor quality of undercut banks, pools, root mats and woody debris along with moderate bank erosion.

Rocky River East Branch RM 9.00 received a QHEI score of 48.00, which resulted in a *Fair* narrative rating. River right is forest and exhibited little to no erosion and river left is residential and exhibited moderate bank erosion. A dam is located downstream of this site. The predominant types of substrate were sand and silt. Bedrock and gravel were also present in a limited amount. No riffle was present at this site, but the depth of the pool was greater than 1 meter. The channel sinuosity is very low, has poor development and the stability is low. The instream cover had pools that were greater than 70 centimeters and sparse amounts of root wads and woody debris.

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Rocky River East Branch RM 6.25 received a QHEI score of 78.00 resulting in an *Excellent* narrative rating. This area is within the Cleveland Metroparks and is forested on river right and left. The predominant type of substrate is bedrock. This site had all the best type substrates such as slabs, boulders, cobble, gravel, sand and bedrock. Silt was present in the pool, which has the potential to be a detriment to biological communities during high flows as it can block the gills of fish and macroinvertebrates. This silt can also degrade the interstitial spaces that these organisms rely on for breeding and to avoid predation. The riffle was greater than 10 centimeters and the run depth was greater than 50 centimeters. The channel sinuosity is moderate, and the development of the channel is good and stable. This site has characteristics of a very good pool. There was sparse to moderate instream cover that includes overhanging vegetation, root mats, root wads, and boulders. This site had little bank erosion which is beneficial for aquatic invertebrates because this improves the margin's habitat.

Rocky River East Branch RM 0.15 received a score of 63.75, which resulted in a *Good* narrative rating. This area is in the Cleveland Metroparks and is forested on river right and left. The predominant types of substrate were cobble and bedrock. This site had a large amount of best type substrate. The pool and riffle included 5 best type substrates. Silt was present in the pool. The riffle was greater than 10 centimeters and the run was less than 50 centimeters. The channel morphology sinuosity was low with good development. There was sparse instream cover that included shallows, root mats, boulders and backwater. This site had little erosion.

Baldwin Creek RM 0.20 received a high score of 72.50, resulting in an *Excellent* narrative rating. This area is in the Cleveland Metroparks and is located between two sections of quarry rock walls. The predominant types of substrate at this site are boulders and slabs. Boulders and slabs are beneficial to a creek because they promote stability and provide excellent habitat. There were 6 best types of substrate present in the pool and in the riffle, and the site was composed of mainly riffle with small pools. The riffle was greater than 10 centimeters and the run depth was greater than 50 centimeters. The channel morphology sinuosity was low, highly stable, and exhibited good/fair development. There was moderate instream cover that included shallows, root mats, and boulders. There was little bank erosion.

Table 7. 2019 Qualitative Habitat Evaluation Index scores and physical attributes

				MWH Attributes																													
				WWH Attributes										High Influence				Moderate Influence															
Stream	River Mile	QHEI Score	Narrative Rating	No Channelization or Recovered Boulder/Cobble/Gravel Substrates	Silt Free Substrates	Good/Excellent Development	Moderate/High Sinuosity	Extensive/Moderate Cover	Fast Current/Eddies	Low-Normal Overall Embeddedness	Max. Depth >40 cm	Low-Normal Riffle Embeddedness	Total WWH Attributes	Channelized or no Recovery	Silt/Muck Substrates	No Sinuosity	Sparse/No Cover	Max Depth < 40 cm (WD, HW sites)	Total High Influence Attributes	Recovering Channel	Heavy/Moderate Silt Cover	Hardpan Substrate Origin	Fair/Poor Development	Low Sinuosity	Only 1-2 Cover Types	Intermittent & Poor Pools	No Fast Current	High/Mod. Overall Embeddedness	High/Mod. Riffle Embeddedness	No Riffle	Total Moderate Influence Attributes	(MWH-H.I.+1) / (WWH+1) Ratio	(MWH M.I.+1) / (WWH+1) Ratio
East Branch	17.50	62.00	Good	X		X	X			X	X	X	6	X			X		2		X	X				X		X			4	0	1
Rocky River	9.00	48.00	Fair	X						X	X		3	X	X	X		3		X	X	X				X				X	5	1	2
	6.25	78.00	Excellent	X	X	X	X	X	X	X	X	X	9	X					1											0	0	0	
	0.15	63.75	Good	X	X	X			X	X	X	X	7	X		X			2		X						X	X		4	0	1	
Baldwin Ck.	0.20	72.50	Excellent	X	X	X	X	X	X	X	X	X	8	X					1				X	X						2	0	0	

Fish Community Biology Assessment

Methods

Two quantitative electrofishing passes were conducted for each site in 2019. A list of the dates when the surveys were completed, along with flow as measured at the United States Geological Survey gage station #04201484 in Strongsville, Ohio (Rocky River East Branch) and gage station # 04201495 in Strongsville, Ohio (Baldwin Creek) is given in Table 8. Sampling at all sites was conducted using longline electrofishing techniques and consisted of shocking all habitat types within a sampling zone while moving from downstream to upstream. The sampling zone at all sites was 0.20 kilometers in length, with the exception of Baldwin Creek at 0.15 kilometers in length. 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, weighed 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.

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Table 8. 2019 Rocky River East and Baldwin Creek Electrofishing Surveys		
Site	Date	Daily Mean Flow (CFS) or Stream Discharge (ft ³ /s) [#]
17.50	9/12/2019	12.6
	10/11/2019	8.55
9.00	8/1/2019	35.9
	9/27/2019	8.79
6.25	8/1/2019	38.2
	9/27/2019	8.78
0.15	7/29/2019	19.5
	9/26/2019	9.28
Baldwin 0.20	6/27/2019	3.60*
	9/13/2019	3.75*

[#] Approved flow data obtained from USGS #4201484 flow gauge in Strongsville, Ohio (RREB) and USGS # 04201495 flow gage in Strongsville, Ohio (Baldwin).
(*) Denotes Provisional data not yet approved, estimates from graph were used from USGS # 04201495.

The electrofishing results for each pass were compiled and utilized to evaluate fish community health through the application of two Ohio EPA indices, the Index of Biotic Integrity (IBI) and the Modified Index of Well-Being (MIwb). 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 wading, and headwater sites are listed in Table 9. The IBI scores and their associated narrative ratings are shown in Table 10. A summary of the 2019 monitoring for each site and their representative scores are listed in Table 11.

Table 9. IBI Metrics	
Wading sites	Headwater sites (≤20 sq. miles)
Number of indigenous fish species	Number of indigenous fish species
Number of darter species	Number of darter species
Number of sunfish species	Number of headwater species
Number of sucker species	Number of minnow species
Number of intolerant species	Number of sensitive species
Percent tolerant species	Percent tolerant species

Table 9. IBI Metrics	
Wading sites	Headwater sites (≤20 sq. miles)
Percent omnivore species	Percent omnivore species
Percent insectivore species	Percent insectivore species
Percent of top carnivore species	Percent pioneering species
Number of individuals (minus tolerant sp.)	Number of individuals (minus tolerant sp.)
Percent of simple lithophilic spawners	Number of simple lithophilic species
Percent DELT anomalies	Percent DELT anomalies

Table 10. Fish Community Biology Scores in the EOLP Ecoregion							
Ohio EPA Narrative	Very Poor	Poor	Fair	Marginally Good	Good	Very Good	Exceptional
IBI Score - Headwater	12-17	18-27	28-35	36-39	40-45	46-49	50-60
IBI Score - Wading	12-17	18-27	28-33	34-37	38-45	46-49	50-60
MIwb Score (Wading only)	0-4.4	4.5-5.8	5.9-7.3	7.4-7.8	7.9-8.8	8.9-9.3	≥9.4
Ohio EPA Narrative	Non-Attainment			NSD	Attainment		
NSD – Non-Significant Departure of WWH attainment							

The second fish index utilized by Ohio EPA is the Modified Index of Well-being (MIwb). The MIwb, Formula 3 below, incorporates four fish community measures: numbers of individuals, biomass, and the Shannon Diversity Index (H) (Formula 4 below) based on numbers and weight of fish. The MIwb is a result of a mathematical calculation based upon the formula.

Formula 3:
$$MIwb = 0.5 \ln N + 0.5 \ln B + \bar{H}(No.) + \bar{H}(Wt.)$$

N = Relative numbers of all species excluding species designated as highly tolerant, hybrids, or exotics

B = Relative weights of all species excluding species designated as highly tolerant, hybrids, or exotics

$\bar{H}(No.)$ = Shannon Diversity Index based on numbers

$\bar{H}(Wt.)$ = Shannon Diversity Index based on weight

Formula 4:
$$\bar{H} = - \sum \left[\left(\frac{n_i}{N} \right) \log_e \left(\frac{n_i}{N} \right) \right]$$

n_i = Relative numbers or weight of species

N = Total number or weight of the sample

A MIwb score ≥ 7.9 (*Good*) is in attainment of the WWH biocriterion for wading sites in the EOLP ecoregion. A MIwb score of 7.4 (*Marginally Good*) is also in attainment, as it is considered non-significant departure (≤ 0.5 MIwb units) from the criterion. The IBI criterion for wading is 38 or greater. The non-significant departure (NSD) for the IBI is ≤ 4 units from the criterion.

Results and Discussion

Rocky River East Branch RM 17.50 was in attainment of the IBI WWH criterion for 2019. Two electrofishing passes were conducted which resulted in the site receiving an average IBI score of 39 (*Good*). The site received an average MIwb score of 9.15 (*Very Good*). This site exhibited a good diversity of fish species. The species that are intolerant to pollution sampled at this site were the river chub (*Nocomis micropogon*). The presence of these, along with the following species: golden redhorse (*Moxostoma erythrurum*), northern hog sucker (*Hypentelium nigricans*), sand shiner (*Notropis stramineus*), rainbow darter (*Etheostoma caeruleum*), and the greenside darter (*Etheostoma blenniodes*) indicate good water quality with low occurrence of common stressors. One invasive species was found at this site, the round goby (*Neogobius melanostomus*). Invasive species can be a problem for native fish because they will have to compete for limited habitat and resources. The high metric scores were a result of the number of native species (5), number of darter species (5), proportion of simple lithophils (5), and number of individuals (5). The rest of the metrics received a score of 1 or 3.

Rocky River East Branch RM 9.00 was in NSD of the IBI WWH criterion for 2019. Two electrofishing passes were conducted which resulted in the site receiving an average IBI score of 37 (*Marginally Good*). This site met the MIwb criterion, with an average score of 7.4 (*Marginally Good*). The moderately intolerant species sampled at this site included the golden redhorse and northern hog sucker. Higher metric scores came from number of sunfish species (5), proportion of Omnivores (5), proportion of insectivores (5), proportion of top carnivores (5) and proportion with DELTS (5). There were low metric scores for number of darter species (1), number of intolerant species (1), number of tolerant species (1), and proportion of simple lithophils (1). The same invasive species that was found at RM 17.50 was also found at this site, the round goby.

Rocky River East Branch RM 6.25 was in non-attainment of the IBI WWH criterion for 2019. Two electrofishing passes were conducted and resulted in the site receiving an average IBI score of 31 (*Fair*). The site received an average MIwb score of 8.7 (*Good*). The species sampled at this site ranged from highly tolerant, to highly intolerant of pollution. Highly tolerant species that were found are as follows: common white sucker (*Catostomus commersonii*), blacknose dace (*Rhinichthys atratulus*), bluntnose minnow (*Pimephales notatus*) and green sunfish (*Lepomis cyanellus*). The high metric scores at this site were from number of native species (5), number of sunfish species (5), proportion with DELTS (5) and number of individuals (5).

Rocky River East Branch RM 0.15 was in NSD of the IBI WWH criterion during 2019. Two electrofishing passes were conducted which resulted in the site receiving an average IBI score of 34 (*Marginally Good*). The site received an average MIwb score of 7.6 (*Good*). This had moderately intolerant, intolerant and highly intolerant species of fish. There were 3 moderately intolerant species, northern hog sucker, sand shiner, and greenside darter. The high

metric scores at this site were from number proportion of tolerant species (5), proportion of omnivores (5), proportion of insectivores (5) and proportion with DELTS (5). The invasive species round goby was also found at this site.

Baldwin Creek RM 0.20 was in attainment of the IBI WWH criterion during 2019. Two electrofishing passes were conducted which resulted in the site receiving an average IBI score of 48 (*Very Good*). The MIwb does not apply to headwater sites; therefore, no calculation is warranted. Observed at this site were species of all pollution tolerances. The mimic shiner (*Notropis volucellus*), a common intolerant species was found at this site. The following are moderately intolerant species that were found in both passes: northern hog sucker, sand shiner, greenside darter and rainbow darter. This site had high metric scores of 5 in most of the categories, while the number of headwater species received a low metric score of 1. The rest of the metrics received a score of 3. A low variation in the IBI score was observed in the two electrofishing passes conducted at this site.

Table 11. 2019 Rocky River and Baldwin Creek IBI & MIwb Results				
Site	Type	Date	IBI	MIwb
RM 17.50	Wading	9/12/19	40	9.0
		10/11/19	38	9.3
RM 9.00	Wading	8/1/19	38	7.7
		9/27/19	36*	7.2
RM 6.25	Wading	8/1/19	32	8.7
		9/27/19	30	8.7
RM 0.15	Wading	7/29/19	36*	7.9
		9/26/19	32	7.3
Baldwin 0.20	Headwater	6/27/19	48	N/A**
		9/13/19	48	N/A**
IBI criteria wading ≥ 38 ; MIwb criteria wading ≥ 7.9				
Bold = meets biocriterion, ** MIwb does not apply to Headwater Sites.				
<i>Italics</i> *=Non-significant departure [IBI wading ≥ 34 , boat ≥ 36 ; MIwb wading ≥ 7.4]				

Macroinvertebrate Community Biology Assessment

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 all locations listed in Table 1. The recommended period for HDs to be installed is six weeks.

The macroinvertebrate samples were sent to EA Engineering of Deerfield, IL 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 NEORSD WQIS Division.

The macroinvertebrate sampling methods followed Ohio EPA protocols as detailed in *Biological Criteria for the Protection of Aquatic Life, Volumes II* (1987a) and *III* (1987b). The overall aquatic macroinvertebrate community in the stream was evaluated using Ohio EPA’s Invertebrate Community Index (ICI). The ICI consists of ten community metrics (Table 12), each with four scoring categories. Metrics 1-9 are based on the quantitative sample, while metric 10 is based on the qualitative EPT taxa collected. The sum of the individual metric scores is used to calculate the overall ICI score. This scoring evaluates the macroinvertebrate community against Ohio EPA’s reference sites for each specific eco-region. The WWH ICI criterion in the EOLP ecoregion is 34 (Table 13). A site is within non-significant departure if the score falls within 4 ICI units of the criterion.

Table 12. 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

Table 13. Invertebrate Community Index (ICI) Range for EOLP Ecoregion								
Ohio EPA Narrative	Very Poor	Poor	Low Fair	Fair	Marginally Good	Good	Very Good	Exceptional
ICI Score	0-6	8-12	14-20	22-28	30-32	34-40	42-44	46-60
Ohio EPA Status	Non-Attainment				NSD	Attainment		
NSD – Non-Significant Departure of WWH attainment								

Results and Discussion

Rocky River East Branch RM 17.50 was in attainment of the ICI WWH criterion for 2019 with an ICI score of 46 (*Excellent*). This site exhibited 9 EPT taxa out of a total of 29 taxa in the qualitative sample. Mayflies, caddisflies and Tanytarsini tribe represented 70.77% of the quantitative sample overall. Of that figure, mayflies and the Tanytarsini tribe were the most dominant in composition. Only 3.6% of the quantitative sample consisted of tolerant species, while 29.17% consisted of other Diptera and non-insects. The number of EPT taxa and very low percentage of tolerant taxa is reflected in the high score.

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Rocky River East Branch RM 9.00 was in significant departure/non-attainment for 2019 with an ICI score of 18 (*Low-Fair*). This site exhibited 2 EPT taxa out of a total of 20 taxa in the qualitative sample. Mayflies, caddisflies and Tanytarsini tribe represented 21.9% of the quantitative sample overall. Of that figure, mayflies made up only 4% of the composition, caddisflies were absent and the remaining 96% was of the Tanytarsini tribe. In contrast, 37.88% of the quantitative sample consisted of tolerant species, while 58.81% consisted of other Diptera and non-insects. The high numbers of tolerant taxa and other Diptera and non-insects is reflected in the low score.

Rocky River East Branch RM 6.25 was found to be in NSD attainment of the ICI WWH criterion for 2019 with an ICI score of 30 (*Marginally Good*). This site exhibited 6 EPT taxa out of a total of 30 taxa in the qualitative sample. Mayflies, caddisflies and Tanytarsini tribe represented 40.76 % of the quantitative sample overall, with mayfly and caddisfly taxa being dominant in that composition. In contrast, 37.88% of the quantitative sample consisted of tolerant species, while 58.81% consisted of other Diptera and non-insects. This site's score reflects a mixed community of taxa that can sustain a WWH community.

Rocky River East Branch RM 0.15 was in attainment of the ICI WWH criterion for 2019 with an ICI score of 36 (*Good*). This site exhibited 10 EPT taxa out of a total of 38 taxa in the qualitative sample. Mayflies, caddisflies and Tanytarsini tribe represented 48.85% of the quantitative sample overall, with mayfly and caddisfly taxa being dominant in that composition. Only 0.61% of the quantitative sample consisted of tolerant species, while 51.15% consisted of other Diptera and non-insects. A high percentage composition of EPT taxa and very low percentage of tolerant taxa is reflected in the score of 36.

Baldwin Creek RM 0.20 was in significant departure/non-attainment for 2019 with an ICI score of 24 (*Fair*). This site exhibited 5 EPT taxa out of a total of 28 taxa in the qualitative sample. Mayflies, caddisflies and Tanytarsini tribe represented only 15.48 % of the quantitative sample overall. Of that figure caddisflies and the Tanytarsini tribe were the most dominant in composition. 27.55% of the quantitative sample consisted of tolerant species, while 83.34% consisted of other Diptera and non-insects. The low percentage of EPT taxa and high percentage of other Diptera and non-insects is reflected in the low score.

Table 14. 2019 Rocky River East Branch and Baldwin Creek Macroinvertebrate Results							
Location	RM	ICI Score	Density per (ft ²) (Qt.)	Total Taxa	EPT Taxa (Ql.)	% Tolerant (Qt.)	Narrative Rating/ WWH Status
Rocky River East Br.	17.50	46	4998	46	9	3.16	Exceptional, Attainment
	9.00	18*	767	41	2	35.85	Low-Fair, Non-Attainment
	6.25	30*	6880	46	6	37.88	Marginally Good, NSD
	0.15	36	13369	46	10	0.61	Good, Attainment
Baldwin Creek	0.20	24*	6182	38	5	27.55	Fair, Non-Attainment
* Significant departure from biocriterion (score >4 ICI units) Bold indicates attainment of WWH Criterion (34)							

Conclusion

The Rocky River East Branch was in partial attainment overall. Of the four locations sampled, two were in full attainment of the WWH criteria (RM 0.15 and RM 17.50). The remaining sites were in partial attainment (RM 6.25 and RM 9.00). All sampling locations had *E. coli* water quality exceedances throughout the six-week sampling period. One day of sampling was conducted during wet weather for each site on the same day which resulted in *E. coli* densities being 40 times greater than during dry weather sampling. Possible sources are illicit discharges, septic systems, improper connections, storm sewer runoff, and wild/domesticated animal waste. Most of the Rocky River East Branch sampling locations exhibited enough habitat to support healthy fish and macroinvertebrate populations with one exception. RREB RM 9.00 QHEI and ICI scores were calculated at 48.00 (*Fair*) and 18 (*Low-Fair*), respectively, which may have been the result of the site's absence of a riffle. RREB RM 6.25 IBI score was calculated at 31 with a narrative rating of *Fair*. Possible reasons for the low IBI score could be due to the substrate being predominantly bedrock with very sparse amounts of boulders, cobble, gravel and sand. This habitat composition does not provide the necessary interstitial spaces and protection that fish use to feed, survive and reproduce.

Baldwin Creek RM 0.20 was in partial attainment. The IBI and QHEI scores were calculated at 48.00 (*Very Good*) and 72.50 (*Excellent*), respectively. The ICI score was calculated at 24 (*Fair*), which is in significant-departure of attainment. Seasonal fluctuations in flow may be responsible for this low score, as sufficient habitat exists to support a WWH community.

Table 15. 2019 Rocky River East Branch and Baldwin Creek Biomonitoring Results						
River Mile	IBI score	MIwb score	ICI score	QHEI score	Attainment Status	Water Quality Exceedance (s)
Rocky River East Branch (WWH Existing)						
17.50	39 (<i>Good</i>)	9.15 (<i>Very Good</i>)	46 (<i>Excellent</i>)	62.00 (<i>Good</i>)	Full	<i>E. coli</i>
9.00	37* (<i>Marg. Good</i>)	7.4* (<i>Marg. Good</i>)	18 (<i>Low-Fair</i>)	48.00 (<i>Fair</i>)	Partial	<i>E. coli</i>
6.25	31 (<i>Fair</i>)	8.7 (<i>Good</i>)	30* (<i>Marg. Good</i>)	78.00 (<i>Excellent</i>)	Partial	<i>E. coli</i>
0.15	34* (<i>Marg. Good</i>)	7.6* (<i>Marg. Good</i>)	36 (<i>Good</i>)	63.75 (<i>Good</i>)	Full	<i>E. coli</i>
Baldwin Creek (WWH Existing)						
0.20	48	N/A	24 (<i>Fair</i>)	72.50 (<i>Excellent</i>)	Partial	<i>E. coli</i>

Table 15. 2019 Rocky River East Branch and Baldwin Creek Biomonitoring Results						
River Mile	IBI score	MIwb score	ICI score	QHEI score	Attainment Status	Water Quality Exceedance (s)
	<i>(Very Good)</i>					
Significant departure in BOLD (> 4ICI; > 4IBI; > 0.5 MIwb units) Underlined scores are in the <i>Poor</i> or <i>Very Poor</i> narrative range *Non-Significant Departure from biocriterion ($\leq 4\text{IBI}$; $\leq 0.5\text{ MIwb units}$)						

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