Lorain County, Ohio
226 Middle Avenue, Elyria, OH 44035

Black River Area of Concern – Willow Creek Stream Restoration and Enhancement (GL-00E01563-3)

Final Report

Funding Provided by:
United States Environmental Protection Agency
Great Lakes Restoration Initiative

3079 East Erie Ave.
Lorain, Ohio 44052
440-444-0074

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1.0 Executive Summary

In 2015, Lorain County was awarded $600,000 of Great Lakes Restoration Initiative (GLRI) funds (GL-00E01563-0) from the US Environmental Protection Agency (US EPA) Great Lakes National Program Office (GLNPO) to implement the project titled "Black River Area of Concern – Willow Creek Stream Restoration and Enhancement." In 2017, a supplemental assistance agreement (GL-00E01563-1) provided an additional $550,000 to complete the "Fortune Ditch Stream Restoration Project." Both projects under the umbrella of the $1,150,000 grant were designed to accelerate water quality improvements in the (then) Black River Area of Concern (AOC) by restoring two critical areas of upstream degradation in the Willow Creek sub-watershed.

Specific goals for the restoration portion of the Project were as follows:

Willow Creek:

1. Restore 800 feet of Willow Creek using natural channel design methods
2. Restore 0.5-1 acre of floodplain along Willow Creek
3. Restore 800 feet of riparian vegetation along Willow Creek
4. Enhance 2 acres of marginal Category 2 wetlands at the Margaret Peak Nature Preserve
5. Improve Qualitative Habitat Evaluation Index (QHEI) rating from "Poor" to "Fair" and possibly to "Good" upon maturity

Fortune Ditch:

1. Restore 600 feet of Fortune Ditch using natural channel design methods
2. Restore 600 feet of riparian vegetation along Fortune Ditch
3. Improve QHEI rating from "Poor" to "Fair" and possibly good upon maturity

The Project was originally intended to be implemented over a three-year period, but a no-cost extension (GL-00E01563-2) was granted in 2019 to lengthen the duration of the Project due to delays associated with the Federal government shutdown of 2018-2019. Another no-cost extension (GL-00E01563-3) was granted in 2020 to lengthen the duration of the Project to September 30, 2021, due to COVID-19 related delays.

Upon project completion, 800 feet of Willow Creek was restored using natural channel design methods. The riparian vegetation community was also restored along the same reach by installing native seed and woody plantings. Approximately 0.75 acres of floodplain were restored and now supports quality wetland habitat. More than 2 acres of marginal Category 2 wetlands were enhanced at the Margaret Peak Nature Preserve through the installation of native woody plantings. The QHEI score of Willow Creek increased from "Poor" (30) to "Good" (56).

Upon project completion, 875 feet of Fortune Ditch was restored using natural channel design methods. The riparian vegetation community was also restored along the same reach by installing native seed and woody plantings. The QHEI score of Fortune Ditch increased from “Poor” (35) to “Good” (60.75).

All goals and outcomes outlined in the grant agreement were met or exceeded and flexibility in the grant allowed the achievement of several other notable outcomes, which included 1.5 acres of floodplain wetland habitat that was restored through the Fortune Ditch Stream Restoration Project. Additionally, 52 acres of oak savanna and prairie habitat was established at the Margaret Peak Nature Preserve adjacent to the Fortune Ditch Stream Restoration Project. It should be noted that Lorain County was able to partner with the USFWS which helped, in addition to the grant, to facilitate the restoration. Approximately 800 feet of riparian corridor along Fortune Ditch (downstream of the Fortune Ditch Stream Restoration Project) was enhanced through the installation of native seed and tree plantings.

2.0 Introduction

In 2015, Lorain County was awarded $600,000 of Great Lakes Restoration Initiative (GLRI) funds (GL-00E01563-0) from the US Environmental Protection Agency (US EPA) Great Lakes National Program Office (GLNPO) to implement the project titled "Black River Area of Concern – Willow Creek Stream Restoration and Enhancement." In 2017, a supplemental assistance agreement (GL-00E01563-1) provided an additional $550,000 to complete the "Fortune Ditch Stream Restoration Project." Both projects under the umbrella of the $1,150,000 grant were designed to accelerate water quality improvements in the (then) Black River Area of Concern (AOC) by restoring two critical areas of upstream degradation in the Willow Creek sub-watershed.

Biological monitoring conducted by Ohio EPA indicated that the Willow Creek watershed is in non-attainment of its warmwater habitat aquatic life use designation. Excessive flooding is also prevalent in the watershed, caused primarily by stormwater runoff and stream erosion. Impairments in the Willow Creek watershed have been identified as a priority for advancing de-listing of beneficial use impairments (BUIs) in the Black River AOC. It should be noted that during initial project planning, the entire Black River watershed was designated as an AOC but boundary revisions in 2015 reduced the designation to include only the lower Black River and exclude sub-watersheds such as Willow Creek. The Willow Creek Stream Restoration Project is located within the Eaton Township Community Park. The Fortune Ditch Stream Restoration Project is located within the Margaret Peak Nature Preserve. The Project locations are shown in Figure 2-1.

Figure 2-1: Project Area Location Map

The Black River watershed has experienced significant ecological impacts due to widespread habitat loss, point source and non-point source contamination, and spread of invasive species. Land uses in the project area include some industry, increasing urbanization, and row-crop agriculture. The target beneficial use impairments (BUIs) for the Project were loss of fish and wildlife habitat and degradation of fish and wildlife populations. By addressing these BUIs, the Project has helped advance the delisting of the Black River AOC. The Project targeted stream, floodplain, and wetland restoration/enhancement and were implemented over a six-year period.

Specific goals for the restoration portion of the Project were as follows:

Willow Creek:

1. Restore 800 feet of Willow Creek using natural channel design methods
2. Restore 0.5-1 acre of floodplain along Willow Creek
3. Restore 800 feet of riparian vegetation along Willow Creek
4. Enhance 2 acres of marginal Category 2 wetlands at the Margaret Peak Nature Preserve
5. Improve Qualitative Habitat Evaluation Index (QHEI) rating from "Poor" to "Fair" and possibly to "Good" upon maturity

Fortune Ditch:

1. Restore 600 feet of Fortune Ditch using natural channel design methods
2. Restore 600 feet of riparian vegetation along Fortune Ditch
3. Improve QHEI rating from "Poor" to "Fair" and possibly good upon maturity

3.0 Methods

3.1 Assessment and Monitoring

3.1.1 Assessment

Various assessment methodologies were employed to accurately characterize the Project sites and inform the respective designs to achieve the goals outlined in the grant application. Data collected during this phase was also utilized to provide content necessary for the permitting process.

Fluvial geomorphologic data was collected at both sites to characterize the streams for a natural channel restoration design approach. Using the Rosgen classification system, the streams were assigned a designation and channel evolution models were reviewed to further refine stream type design targets. Regional curves of Ohio Lake Erie Watershed channels were reviewed for additional sizing considerations. Detailed modeling of existing and proposed hydrologic and hydraulic conditions using HEC-RAS software were completed to further inform the natural stream restoration design.

In addition to review of existing literature and data, soil borings were collected and logged to understand the implications of planned excavation during construction.

As a function of Section 404 of the Clean Water Act permitting requirements, additional assessment included surface water delineation, threatened and endangered species habitat assessment, and cultural and historic resources consideration.

3.2.1 Monitoring

Stream habitat improvements were documented using the Ohio EPA Qualitative Habitat Evaluation Index (QHEI). The QHEI is an accepted metric for evaluation of habitat beneficial use impairments and AOC delisting in Ohio. Both project sites were first assessed in 2014 and again in 2021 following the conclusion of the work and the maturation of the restoration sites.

3.2 Permitting

Both stream restoration projects required federal, state, and local permitting to properly move forward to the construction phase. Data collected during the assessment phase was used to support respective applications.

3.2.1 USACE Permitting

Both projects necessitated impacts to jurisdictional surface waters and were permitted under Section 404 of the Clean Water Act through the Nationwide Permit #27 for Aquatic Habitat Restoration, Enhancement, and Establishment Activities.

3.2.2 Local Floodplain Permitting

Both restoration projects required work within the 100-year floodplain. Appropriate floodplain encroachment approvals were obtained from the Local Floodplain Administrator prior to any construction within 100-year floodplain.

3.2.3 NPDES Permitting

Coverage under the National Pollutant Discharge Elimination System (NPDES) General Permit for Storm Water during Construction Activity was required in order to complete the proposed work. In order to obtain coverage under this permit, a Storm Water Pollution Prevention Plan (SWPPP) was developed for the construction site and a Notice of Intent (NOI) was submitted to Ohio EPA.

3.3 Design

A primary component of the restoration design from the initial conceptualization of the projects was the use of natural channel design methods. Designing and constructing natural systems supports ecological recovery and inherently provides benefits such as reduced erosion, flood water detention, and improvements to fish and wildlife habitat.

When determining the nature and scale of the design, strong consideration is given to the form and function of natural stream systems in the watershed to serve as reference for the design. Published regional curves of Ohio Lake Erie Watershed channels as well as other data were reviewed for additional sizing considerations.

Detailed modeling of existing and proposed hydrologic and hydraulic conditions using HEC-RAS software were completed to further inform the natural stream restoration design.

3.4 Construction

Local contractors were selected through competitively bid processes to perform the work. With both projects being near each other and sharing similar components of the design and construction, the challenges of stream restoration were comparable.

Above-freezing temperatures, excessive precipitation, poorly drained soils, and other factors led to a constant battle of managing stormwater discharging from the sites as well as stormwater ponding in the

excavation areas. Contractors employed excavation dewatering techniques and best management practices to keep the project sites workable and compliant with NPDES requirements.

Applicable to both projects, but more so to the Fortune Ditch Stream Restoration Project, the poorly drained, former cropland required the design team and contractors to address historical subsurface drainage tiles encountered during construction. This was completed by incorporating drainage into the restoration work by routing tiles to respective floodplain wetlands to passively treat subsurface flows and to supplement hydrology instead of only relying on precipitation and storm flows.

4.0 Significant Events and Experiences

4.1 Floodplain Wetland Restoration at Fortune Ditch

The Fortune Ditch Stream Restoration Project did not include proposed floodplain restoration in the grant application. However, the design and construction budgets were ultimately able to accommodate the additional work that yielded the creation of 1.5 acres of floodplain wetland habitat. This important facet of the construction reconnected Fortune Ditch to its floodplain and increased the habitat heterogeneity across the Margaret Peak Nature Preserve.

4.2 Oak Savanna Installation at the Margaret Peak Nature Preserve

Favorable bids on the Willow Creek Stream Restoration Project and the Fortune Ditch Stream Restoration Project coupled with grant flexibility led to the conversion of 52 acres of former farmland into oak savanna and prairie habitat at the Margaret Peak Nature Preserve. Lorain County was able to utilize remaining grant funds purchase native seed and trees. Leaning on partnerships with the United States Fish and Wildlife Service (USFWS), and various local volunteers, Lorain County was able to install 52 acres of native seed and plant 400 native trees.

4.3 Delays

The most notable significant events associated with the grant were delays caused by actions outside of the control of the project team. The federal government shutdown of 2018-2019 proved problematic with regards to the partnership with USFWS mentioned in Section 4.2. The USFWS' major role in facilitating seed and tree acquisition and installation was halted immediately and the uncertainty associated with the duration of the shutdown led to the request, and approval, of a no-cost extension of the grant period. The second major delay was related to the extreme uncertainty surrounding the early stages of the COVID-19 pandemic. Various stay-at-home orders and office closures challenged the project team's ability to maintain the original schedule.

5.0 Results and Discussion

5.1 Goals

Specific goals for the restoration portion of the Project were as follows:

Willow Creek:

1. Restore 800 feet of Willow Creek using natural channel design methods
2. Restore 0.5-1 acre of floodplain along Willow Creek
3. Restore 800 feet of riparian vegetation along Willow Creek
4. Enhance 2 acres of marginal Category 2 wetlands at the Margaret Peak Nature Preserve
5. Improve Qualitative Habitat Evaluation Index (QHEI) rating from "Poor" to "Fair" and possibly to "Good" upon maturity

Fortune Ditch:

1. Restore 600 feet of Fortune Ditch using natural channel design methods
2. Restore 600 feet of riparian vegetation along Fortune Ditch
3. Improve QHEI rating from "Poor" to "Fair" and possibly good upon maturity

5.1 Outputs

Specific outputs for the restoration portion of the Projects were as follows:

Willow Creek:

1. Restored 800 feet of Willow Creek using natural channel design methods
2. Restored 0.75 acres of floodplain along Willow Creek
3. Restored 800 feet of riparian vegetation along Willow Creek
4. Enhanced 2 acres of marginal Category 2 wetlands at the Margaret Peak Nature Preserve
5. Improved Qualitative Habitat Evaluation Index (QHEI) rating from "Poor" (30) to "Good" (56).

Fortune Ditch:

1. Restored 875 feet of Fortune Ditch using natural channel design methods
2. Restored 1.5 acres of floodplain along Fortune Ditch
3. Restored 875 feet of riparian vegetation along Fortune Ditch
4. Enhanced 800 feet of riparian buffer along Fortune Ditch downstream of the restoration work by installing native seed and trees
5. Improved QHEI rating from "Poor" (35) to "Good" (60.75).
6. Converted 52 acres of historical cropland to oak savanna and prairie habitat.

5.3 Discussion

All numerical outputs were met or exceeded. Favorable bids coupled with flexibility in the grant led to the achievement of additional restoration acreage within the Margaret Peak Nature Preserve. The work performed at both Willow Creek in the Eaton Township Community Park and Fortune Ditch in the Margaret Peak Nature Preserve has provided many benefits for fish and wildlife. See attached photographic log (Appendix A) showing pre- and post-construction conditions.

The native vegetation community at Willow Creek has flourished, especially the live staking of willow and dogwood species. The live stakes have surpassed growth expectations and are effectively stabilizing the streambank while providing shade over the channel. This is in stark contrast to the pre-construction conditions of an incised channel devoid of functional stream and riparian habitat. What was once an under-utilized public park with mowed grass and little other vegetation is now a relative ecological hotspot nestled between a busy state route and a residential housing community.

Fortune Ditch and the landscape at the Margaret Peak Nature Preserve has been transformed radically from pre-construction conditions. What was once a deeply incised channel with agricultural land acting as the floodplain is now a heterogenous system that is supporting a myriad of wildlife. The constructed floodplains adjacent to the stream receive enough hydrology to support wetland habitat, as evidenced by the diversity of obligate wetland vegetation, muskrat colonies, and bird species such as the spotted sandpiper. Existing wetlands on the property were enhanced by installing native live stakes and shrubs. The 52 acres of former cropland adjacent to the stream restoration work now supports oak savanna and prairie habitat that is popular with the bird watching community. According to https://birding-in-ohio.com/lorain-county/margaret-peak-nature-preserve/, short-eared owls were documented in 2020 for the first time on the property as well as the state-listed northern harrier, both of which tend to utilize grassland habitat.

It is clear that the restoration work was successful in achieving and exceeding the goals outlined in the grant agreement and that the additional work completed under the grant has been as equally transformative to the landscape. Not only have the projects resulted in ecological gains but have provided opportunities to educate the public through visible signage, social media postings, and website updates.

6.0 Recommendations

Both restoration projects completed under the grant were not particularly complex or overly difficult to construct. The desired results were achieved with the funding available but several recommendations to other practitioners on future projects are provided that may prevent schedule delays and reduce the challenges faced on any project, regardless of scope or scale.

Seasonal activity restrictions such as fish spawning or tree clearing periods must be accounted for early on as they often impact the construction schedule. In the cases of both projects, waivers were granted which allowed in-stream work during the spawning period. The project team implemented best management practices to minimize impacts and demonstrated that the potential for temporary disruption to the fish community would be negligible compared to the net increase in aquatic function following construction.

Both projects required tree removal and clearing to achieve the design completed by the engineering team. This required consideration of threatened and endangered species as a function of the federal funding and Section 404 permit. Early coordination with the applicable agencies was performed to gain concurrence that seasonal removal of trees would not impact threatened and/or endangered bat species. This early coordination was built into the permitting and construction schedule and prevented delays. The proactive coordination helped to expedite permit review and prevented excessive back-and-forth between the project team and the permitting agencies.

Projects require adequate oversight to ensure that it is built as designed and specified. The selected contractor for the Willow Creek Stream Restoration Project, while qualified, did not have strong experience in stream and wetland restoration construction. Having construction oversight personnel onsite regularly helped the construction contractor navigate the challenges associated with working in difficult conditions described in Section 3.4. This was critical to ensure the contractor remained compliant with applicable permits. Oversight proved to be especially critical during the seeding and planting phases of both Willow Creek and Fortune Ditch. Personnel were able to ensure only native species were utilized on the projects and helped the planting subcontractors determine the most appropriate areas to plant certain species.

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Appendix A – Photographic Log

Project Number 012-022

PHOTOGRAPHIC LOG

Photo No. 1	**Date:** 2015
Direction Photo Taken: N/A	
Description: Aerial view of pre-construction conditions at Willow Creek.	

Photo No. 2	**Date:** 8/5/2020
Direction Photo Taken: N/A	
Description: Aerial view of post-construction conditions at Willow Creek in the Eaton Township Community Park.	

PHOTOGRAPHIC LOG

Photo No. 3	**Date:** 12/17/2015
Direction Photo Taken: Southwest	
Description: Downstream view of pre-construction conditions at Willow Creek.	

Photo No. 4	**Date:** 7/18/2019
Direction Photo Taken: East	
Description: Upstream view of post-construction conditions at Willow Creek.	

PHOTOGRAPHIC LOG

Photo No. 5	**Date:** 12/17/2015
Direction Photo Taken: West	
Description: View of pre-construction conditions of manicured turfgrass acting as a floodplain to Willow Creek.	

Photo No. 6	**Date:** 7/18/2019
Direction Photo Taken: West	
Description: Post-construction view of floodplain wetland and restored riparian buffer along Willow Creek.	

PHOTOGRAPHIC LOG

Photo No. 7	**Date:** 10/24/2018
Direction Photo Taken: Upstream	
Description: One of two restored riffles in Willow Creek.	

Photo No. 8	**Date:** 7/18/2019
Direction Photo Taken: Northeast	
Description: Upstream view of aquatic macrophytes serving as habitat in Willow Creek.	

PHOTOGRAPHIC LOG

Photo No. 9	**Date:** 2017
Direction Photo Taken: South	
Description: Aerial view of pre-construction conditions at Fortune Ditch.	

Photo No. 10	**Date:** 8/5/2020
Direction Photo Taken: South	
Description: Aerial view of post-construction conditions at Fortune Ditch as well as oak savanna and grassland restoration within the Margaret Peak Nature Preserve.	

PHOTOGRAPHIC LOG

Photo No. 11	**Date:** 12/20/2017
Direction Photo Taken: East	
Description: Upstream view of pre-construction conditions at Fortune Ditch.	

Photo No. 12	**Date:** 8/19/2019
Direction Photo Taken: East	
Description: Upstream view of post-construction conditions at Fortune Ditch.	

PHOTOGRAPHIC LOG

Photo No. 13	**Date:** 1/30/2018
Direction Photo Taken: East	
Description: Pre-construction conditions of soybean field acting as a floodplain to Fortune Ditch.	

Photo No. 14	**Date:** 6/16/2021
Direction Photo Taken: East	
Description: Post-construction view of floodplain wetlands and restored riparian buffer along Fortune Ditch.	

PHOTOGRAPHIC LOG

Photo No. 15	**Date:** 8/14/2019
Direction Photo Taken: N/A	
Description: View of robust dogwood shrub planting and multiple obligate wetland species within the constructed floodplain wetlands.	

Photo No. 16	**Date:** 11/11/2021
Direction Photo Taken: N/A	
Description: One of several substantial muskrat lodges observed within the constructed floodplain wetlands.	

PHOTOGRAPHIC LOG

Photo No. 17	**Date:** 11/11/2021
Direction Photo Taken: Southwest	
Description: View of oak savanna and grassland restoration adjacent to Fortune Ditch at the Margaret Peak Nature Preserve.	

Photo No. 18	**Date:** 10/12/2019
Direction Photo Taken: Northeast	
Description: One of 400 trees planted by volunteers to support oak savanna restoration at the Margaret Peak Nature Preserve.	

Interpretive signage installed at Willow Creek in the Eaton Township Community Park.

Interpretive signage installed at Fortune Ditch in the Margaret Peak Nature Preserve.

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Appendix B – Qualitative Habitat Evaluation Index Forms

Project Number 012-022

Ohio EPA Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: 56

Stream & Location: Willow Creek - Eaton Twp. Community Park **RM:** 6.1 **Date:** 11/11/21

Scorers Full Name & Affiliation: Chip Wendt Coldwater Consulting Lorain County

River Code: 20-010-001 **STORET #** B01W21 **Lat./Long.:** (NAD 83 - decimal °) 41.3135 / 82.0083 Office verified location ☐

1] SUBSTRATE
Check ONLY Two substrate TYPE BOXES; estimate % or note every type present

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
☐ BLDR /SLABS [10]			☐ HARDPAN [4]		
☐ BOULDER [9]	5		☐ DETRITUS [3]		
☐ COBBLE [8]	5	10	☐ MUCK [2]		
☐ GRAVEL [7]	5	15	☒ SILT [2]	40	10
☐ SAND [6]	10		☐ ARTIFICIAL [0]		
☐ BEDROCK [5]					

(Score natural substrates; ignore sludge from point-sources)

NUMBER OF BEST TYPES: ☒ 4 or more [2] ☐ 3 or less [0]

Check ONE (Or 2 & average)

ORIGIN	SILT / EMBEDDEDNESS	QUALITY
☒ LIMESTONE [1]		☐ HEAVY [-2]
☒ TILLS [1]		☒ MODERATE [-1]
☐ WETLANDS [0]		☐ NORMAL [0]
☐ HARDPAN [0]		☐ FREE [1]
☐ SANDSTONE [0]		☒ EXTENSIVE [-2]
☐ RIP/RAP [0]		☐ MODERATE [-1]
☐ LACUSTURINE [0]		☐ NORMAL [0]
☐ SHALE [-1]		☐ NONE [1]
☐ COAL FINES [-2]		

Substrate 4 *Maximum 20*

Comments

IMPORTED LIMESTONE FOR RESTORATION

2] INSTREAM COVER
Indicate presence 0 to 3: **0**-Absent; **1**-Very small amounts or if more common of marginal quality; **2**-Moderate amounts, but not of highest quality or in small amounts of highest quality; **3**-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

0 UNDERCUT BANKS [1]	0	POOLS > 70cm [2]	0	OXBOWS, BACKWATERS [1]	
3 OVERHANGING VEGETATION [1]	1	ROOTWADS [1]	3	AQUATIC MACROPHYTES [1]	
3 SHALLOWS (IN SLOW WATER) [1]	1	BOULDERS [1]	2	LOGS OR WOODY DEBRIS [1]	
3 ROOTMATS [1]					

AMOUNT Check ONE (Or 2 & average)

☒ EXTENSIVE >75% [11] ☐ MODERATE 25-75% [7] ☐ SPARSE 5-<25% [3] ☐ NEARLY ABSENT <5% [1]

Comments

Cover *Maximum 20* 18

3] CHANNEL MORPHOLOGY
Check ONE in each category (Or 2 & average)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☐ HIGH [4]	☐ EXCELLENT [7]	☐ NONE [6]	☒ HIGH [3]
☐ MODERATE [3]	☒ GOOD [5]	☒ RECOVERED [4]	☒ MODERATE [2]
☒ LOW [2]	☒ FAIR [3]	☒ RECOVERING [3]	☐ LOW [1]
☐ NONE [1]	☐ POOR [1]	☐ RECENT OR NO RECOVERY [1]	

Comments

Channel *Maximum 20* 12

4] BANK EROSION AND RIPARIAN ZONE
Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

EROSION (L R)	RIPARIAN WIDTH (L R)	FLOOD PLAIN QUALITY (L R)	(L R)
☒ ☒ NONE / LITTLE [3]	☐ ☐ WIDE > 50m [4]	☐ ☐ FOREST, SWAMP [3]	☐ ☐ CONSERVATION TILLAGE [1]
☐ ☐ MODERATE [2]	☐ ☒ MODERATE 10-50m [3]	☐ ☐ SHRUB OR OLD FIELD [2]	☐ ☐ URBAN OR INDUSTRIAL [0]
☐ ☐ HEAVY / SEVERE [1]	☐ ☐ NARROW 5-10m [2]	☒ ☒ RESIDENTIAL, PARK, NEW FIELD [1]	☐ ☐ MINING / CONSTRUCTION [0]
	☒ ☐ VERY NARROW < 5m [1]	☐ ☐ FENCED PASTURE [1]	
	☐ ☐ NONE [0]	☐ ☐ OPEN PASTURE, ROWCROP [0]	

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian *Maximum 10* 6

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH Check ONE (ONLY!)
- ☐ > 1m [6]
- ☐ 0.7-<1m [4]
- ☒ 0.4-<0.7m [2]
- ☐ 0.2-<0.4m [1]
- ☐ < 0.2m [0]

CHANNEL WIDTH Check ONE (Or 2 & average)
- ☐ POOL WIDTH > RIFFLE WIDTH [2]
- ☒ POOL WIDTH = RIFFLE WIDTH [1]
- ☐ POOL WIDTH < RIFFLE WIDTH [0]

CURRENT VELOCITY Check ALL that apply
- ☐ TORRENTIAL [-1]
- ☐ VERY FAST [1]
- ☐ FAST [1]
- ☒ MODERATE [1]
- ☒ SLOW [1]
- ☐ INTERSTITIAL [-1]
- ☐ INTERMITTENT [-2]
- ☐ EDDIES [1]

Indicate for reach - pools and riffles.

Recreation Potential
Primary Contact
Secondary Contact
(circle one and comment on back)

Comments

Pool / Current *Maximum 12* 5

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH	RUN DEPTH	RIFFLE / RUN SUBSTRATE	RIFFLE / RUN EMBEDDEDNESS
☒ BEST AREAS > 10cm [2]	☐ MAXIMUM > 50cm [2]	☒ STABLE (e.g., Cobble, Boulder) [2]	☐ NONE [2]
☐ BEST AREAS 5-10cm [1]	☒ MAXIMUM < 50cm [1]	☒ MOD. STABLE (e.g., Large Gravel) [1]	☒ LOW [1]
☐ BEST AREAS < 5cm [metric=0]		☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]	☒ MODERATE [0]
			☐ EXTENSIVE [-1]

Comments

Riffle / Run *Maximum 8* 5

6] GRADIENT
(7.1 ft/mi) ☐ VERY LOW - LOW [2-4] ☒ MODERATE [6-10] ☐ HIGH - VERY HIGH [10-6]

DRAINAGE AREA (3.3 mi²)

%POOL: 60 %GLIDE: 10 %RUN: 10 %RIFFLE: 20

Gradient *Maximum 10* 6

A] SAMPLED REACH

Check ALL that apply

Comment RE: Reach consistency/ Is reach typical of steam?, *Recreation/* Observed - Inferred, *Other/* Sampling observations, Concerns, Access directions, etc.

METHOD

- ☐ BOAT
- ☒ WADE
- ☐ L. LINE
- ☐ OTHER

STAGE

1st -sample pass-	2nd
☐ HIGH	☐
☐ UP	☐
☒ NORMAL	☐
☐ LOW	☐
☐ DRY	☐

DISTANCE

- ☐ 0.5 Km
- ☒ 0.2 Km
- ☐ 0.15 Km
- ☐ 0.12 Km
- ☐ OTHER

_____ meters

CLARITY

1st --sample pass--	2nd
☒ < 20 cm	☐
☐ 20-<40 cm	☐
☐ 40-70 cm	☐
☐ > 70 cm/ CTB	☐
☐ SECCHI DEPTH	☐

CANOPY

- ☒ > 85%- OPEN
- ☐ 55%-<85%
- ☐ 30%-<55%
- ☐ 10%-<30%
- ☐ <10%- CLOSED

1st pass _____ cm

2nd _____ cm

B] AESTHETICS

- ☐ NUISANCE ALGAE
- ☐ INVASIVE MACROPHYTES
- ☐ EXCESS TURBIDITY
- ☐ DISCOLORATION
- ☐ FOAM / SCUM
- ☐ OIL SHEEN
- ☐ TRASH / LITTER
- ☐ NUISANCE ODOR
- ☐ SLUDGE DEPOSITS
- ☐ CSOs/SSOs/OUTFALLS

C] RECREATION

AREA DEPTH

POOL: ☐ >100ft² ☐ >3ft

D] MAINTENANCE

Circle some & *COMMENT*

PUBLIC / PRIVATE / BOTH / NA
ACTIVE / HISTORIC / BOTH / NA
YOUNG-SUCCESSION-OLD
SPRAY / SNAG / REMOVED
MODIFIED / DIPPED OUT / NA
LEVEED / ONE SIDED
RELOCATED / CUTOFFS
MOVING-BEDLOAD-STABLE
ARMOURED / SLUMPS
ISLANDS / SCOURED
IMPOUNDED / DESICCATED
FLOOD CONTROL / DRAINAGE

E] ISSUES

WWTP / CSO / NPDES / INDUSTRY
HARDENED / URBAN / DIRT&GRIME
CONTAMINATED / LANDFILL
BMPs-CONSTRUCTION-SEDIMENT
LOGGING / IRRIGATION / COOLING
BANK / EROSION / SURFACE
FALSE BANK / MANURE / LAGOON
WASH H_20 / TILE / H_20 TABLE
ACID / MINE / QUARRY / FLOW
NATURAL / WETLAND / STAGNANT
PARK / GOLF / LAWN / HOME
ATMOSPHERE / DATA PAUCITY

F] MEASUREMENTS

- $\bar{x}$ width
- $\bar{x}$ depth
- max. depth
- $\bar{x}$ bankfull width
- bankfull $\bar{x}$ depth
- W/D ratio
- bankfull max. depth
- floodprone x^2 width
- entrench. ratio

Legacy Tree:

Stream Drawing:

Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: 60.75

Stream & Location: FORTUNE DITCH - MP NATURE PRESERVE **RM:** 1.5 **Date:** 11/11/21

Scorers Full Name & Affiliation: CHIP WENDT COLDWATER CONSULTING; LORAIN COUNTY

River Code: 20-001-001 **STORET #:** NONE **Lat./Long.:** (NAD 83 - decimal °) 41.3455 / 82.0324 Office verified location ☐

1] SUBSTRATE

Check *ONLY* Two substrate *TYPE BOXES*; estimate % or note every type present

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
☐ BLDR /SLABS [10]			☐ HARDPAN [4]		
☐ BOULDER [9]		5	☐ DETRITUS [3]		
☐ COBBLE [8]	5	10	☐ MUCK [2]		
☐ GRAVEL [7]	15	15	☒ SILT [2]	35	
☒ SAND [6]	15		☐ ARTIFICIAL [0]		
☐ BEDROCK [5]			(Score natural substrates; ignore sludge from point-sources)		

NUMBER OF BEST TYPES: ☒ 4 or more [2] ☐ 3 or less [0]

Check ONE (*Or 2 & average*)

ORIGIN
- ☒ LIMESTONE [1]
- ☐ TILLS [1]
- ☐ WETLANDS [0]
- ☐ HARDPAN [0]
- ☒ SANDSTONE [0]
- ☐ RIP/RAP [0]
- ☐ LACUSTURINE [0]
- ☐ SHALE [-1]
- ☐ COAL FINES [-2]

QUALITY

SILT
- ☐ HEAVY [-2]
- ☒ MODERATE [-1]
- ☐ NORMAL [0]
- ☐ FREE [1]

EMBEDDEDNESS
- ☐ EXTENSIVE [-2]
- ☒ MODERATE [-1]
- ☐ NORMAL [0]
- ☐ NONE [1]

Substrate 8.5 *Maximum 20*

Comments

IMPORTED LIMESTONE + SANDSTONE FOR RESTORATION

2] INSTREAM COVER

Indicate presence 0 to 3: **0**-Absent; **1**-Very small amounts or if more common of marginal quality; **2**-Moderate amounts, but not of highest quality or in small amounts of highest quality; **3**-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

0 UNDERCUT BANKS [1]	0 POOLS > 70cm [2]	0 OXBOWS, BACKWATERS [1]	
2 OVERHANGING VEGETATION [1]	0 ROOTWADS [1]	3 AQUATIC MACROPHYTES [1]	
3 SHALLOWS (IN SLOW WATER) [1]	1 BOULDERS [1]	2 LOGS OR WOODY DEBRIS [1]	
0 ROOTMATS [1]			

AMOUNT Check ONE (*Or 2 & average*)
- ☐ EXTENSIVE >75% [11]
- ☒ MODERATE 25-75% [7]
- ☐ SPARSE 5-<25% [3]
- ☐ NEARLY ABSENT <5% [1]

Comments

Cover Maximum 20 12

3] CHANNEL MORPHOLOGY

Check ONE in each category (*Or 2 & average*)

SINUOSITY
- ☒ HIGH [4]
- ☐ MODERATE [3]
- ☐ LOW [2]
- ☐ NONE [1]

DEVELOPMENT
- ☐ EXCELLENT [7]
- ☒ GOOD [5]
- ☐ FAIR [3]
- ☐ POOR [1]

CHANNELIZATION
- ☒ NONE [6]
- ☐ RECOVERED [4]
- ☐ RECOVERING [3]
- ☐ RECENT OR NO RECOVERY [1]

STABILITY
- ☒ HIGH [3]
- ☐ MODERATE [2]
- ☐ LOW [1]

Comments

Channel Maximum 20 6

4] BANK EROSION AND RIPARIAN ZONE

Check **ONE** in each category for *EACH BANK* (*Or 2 per bank & average*)

River right looking downstream

EROSION L	EROSION R	RIPARIAN WIDTH L	RIPARIAN WIDTH R	FLOOD PLAIN QUALITY L	FLOOD PLAIN QUALITY R
☒ NONE / LITTLE [3]	☒ NONE / LITTLE [3]	☒ WIDE > 50m [4]	☐ WIDE > 50m [4]	☒ FOREST, SWAMP [3]	☐ FOREST, SWAMP [3]
☐ MODERATE [2]	☐ MODERATE [2]	☐ MODERATE 10-50m [3]	☒ MODERATE 10-50m [3]	☒ SHRUB OR OLD FIELD [2]	☐ SHRUB OR OLD FIELD [2]
☐ HEAVY / SEVERE [1]	☐ HEAVY / SEVERE [1]	☐ NARROW 5-10m [2]	☐ NARROW 5-10m [2]	☐ RESIDENTIAL, PARK, NEW FIELD [1]	☒ RESIDENTIAL, PARK, NEW FIELD [1]
		☐ VERY NARROW < 5m [1]	☐ VERY NARROW < 5m [1]	☐ FENCED PASTURE [1]	☐ FENCED PASTURE [1]
		☐ NONE [0]	☐ NONE [0]	☐ OPEN PASTURE, ROWCROP [0]	☐ OPEN PASTURE, ROWCROP [0]

L	R	
☐	☐	CONSERVATION TILLAGE [1]
☐	☐	URBAN OR INDUSTRIAL [0]
☐	☐	MINING / CONSTRUCTION [0]

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian Maximum 10 8.25

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH Check **ONE** (*ONLY!*)
- ☐ > 1m [6]
- ☐ 0.7-<1m [4]
- ☐ 0.4-<0.7m [2]
- ☒ 0.2-<0.4m [1]
- ☐ < 0.2m [0]

CHANNEL WIDTH Check ONE (*Or 2 & average*)
- ☒ POOL WIDTH > RIFFLE WIDTH [2]
- ☐ POOL WIDTH = RIFFLE WIDTH [1]
- ☐ POOL WIDTH < RIFFLE WIDTH [0]

CURRENT VELOCITY Check ALL that apply
- ☐ TORRENTIAL [-1]
- ☐ VERY FAST [1]
- ☐ FAST [1]
- ☒ MODERATE [1]
- ☒ SLOW [1]
- ☐ INTERSTITIAL [-1]
- ☐ INTERMITTENT [-2]
- ☐ EDDIES [1]

Indicate for reach - pools and riffles.

Recreation Potential
Primary Contact
Secondary Contact
(circle one and comment on back)

Comments

Pool / Current Maximum 12 5

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (*Or 2 & average*). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH
- ☒ BEST AREAS > 10cm [2]
- ☐ BEST AREAS 5-10cm [1]
- ☐ BEST AREAS < 5cm [metric=0]

RUN DEPTH
- ☐ MAXIMUM > 50cm [2]
- ☒ MAXIMUM < 50cm [1]

RIFFLE / RUN SUBSTRATE
- ☒ STABLE (e.g., Cobble, Boulder) [2]
- ☒ MOD. STABLE (e.g., Large Gravel) [1]
- ☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]

RIFFLE / RUN EMBEDDEDNESS
- ☐ NONE [2]
- ☒ LOW [1]
- ☒ MODERATE [0]
- ☐ EXTENSIVE [-1]

Comments

Riffle / Run Maximum 8 5

6] GRADIENT

(1.98 ft/mi) ☒ VERY LOW - LOW [2-4] ☐ MODERATE [6-10] ☐ HIGH - VERY HIGH [10-6]

DRAINAGE AREA (7.32 mi²)

%POOL: 40 %GLIDE: 15 %RUN: 15 %RIFFLE: 30

Gradient Maximum 10 4

A] SAMPLED REACH

Check ALL that apply

Comment RE: Reach consistency/ Is reach typical of steam?, *Recreation/* Observed - Inferred, *Other/* Sampling observations, Concerns, Access directions, etc.

METHOD

- ☐ BOAT
- ☒ WADE
- ☐ L. LINE
- ☐ OTHER

STAGE

1st -sample pass-	2nd
☐ HIGH	☐
☐ UP	☐
☒ NORMAL	☐
☐ LOW	☐
☐ DRY	☐

DISTANCE

- ☐ 0.5 Km
- ☒ 0.2 Km
- ☐ 0.15 Km
- ☐ 0.12 Km
- ☐ OTHER

_____ meters

CLARITY

1st --sample pass--	2nd
☐ < 20 cm	☐
☒ 20-<40 cm	☐
☐ 40-70 cm	☐
☐ > 70 cm/ CTB	☐
☐ SECCHI DEPTH	☐

CANOPY

- ☒ > 85%- OPEN
- ☐ 55%-<85%
- ☐ 30%-<55%
- ☐ 10%-<30%
- ☐ <10%- CLOSED

pass 1st _____ cm

pass 2nd _____ cm

B] AESTHETICS

- ☐ NUISANCE ALGAE
- ☐ INVASIVE MACROPHYTES
- ☐ EXCESS TURBIDITY
- ☐ DISCOLORATION
- ☐ FOAM / SCUM
- ☐ OIL SHEEN
- ☐ TRASH / LITTER
- ☐ NUISANCE ODOR
- ☐ SLUDGE DEPOSITS
- ☐ CSOs/SSOs/OUTFALLS

C] RECREATION

AREA DEPTH

POOL: ☐ >100ft² ☐ >3ft

D] MAINTENANCE

Circle some & *COMMENT*

PUBLIC / PRIVATE / BOTH / NA
ACTIVE / HISTORIC / BOTH / NA
YOUNG-SUCCESSION-OLD
SPRAY / SNAG / REMOVED
MODIFIED / DIPPED OUT / NA
LEVEED / ONE SIDED
RELOCATED / CUTOFFS
MOVING-BEDLOAD-STABLE
ARMOURED / SLUMPS
ISLANDS / SCOURED
IMPOUNDED / DESICCATED
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Legacy Tree:

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