BIOTIC CHARACTERIZATION OF THREE STREAM SEGMENTS
MACON COUNTY, ILLINOIS

SPRING OF 2006

PROJECT DESCRIPTION

In 2004, the Macon County Conservation District updated their Master Plan. During completion of the Master Plan, seven of the District's holdings were investigated and management/restoration strategies were developed for those properties. The proposed restoration strategies included working with wetland, prairie, savanna, and forest habitats. The strategies involve long term projects that will take many years for the full ecological benefits to develop. The purpose of this project is to collect baseline monitoring data at four stream locations (three separate streams: Sand Creek, Willow Branch, and Long Grove Branch – see Figure 1). The establishment of baseline conditions will aid in the documentation of the effects of restoration activities at the following District properties: Sand Creek Recreational Area, Grove Branch, and Willow Branch Tracts #1 and #2. The baseline monitoring included physical, chemical, and biotic parameters.

PROJECT METHODOLOGY

Locations were selected at non-random points, generally near the center of a parcel. Each stream was walked downstream for approximately 1,000 feet from the starting point; sampling was conducted moving upstream back to the starting point.

Biotic Characterization

A Qualitative Habitat Evaluation Index (QHEI) as developed by the Ohio Environmental Protection Agency was used to characterize the biotic community of each stream. The QHEI is an index of macro-habitat quality that generally corresponds to those physical factors that affect fish and other warmwater aquatic communities. The QHEI uses several metrics that describe the attributes of physical habitat present in a stream segment and is meant to be used as a predictive tool of suitability for estimating the likelihood of the presence or absence of communities within a stream. The QHEI index scores are between 0 and 100, with the highest score assigned to habitat parameters that have been shown to be correlated with streams that have high biological diversity and integrity.

Warmwater Habitat is described as those waters capable of supporting and maintaining a balanced community of warmwater aquatic organisms. Modified Warmwater Habitat is described as those waters incapable of supporting and maintaining a balanced community of warmwater aquatic organisms because of extensive and irretrievable modifications to the

physical habitat. A QHEI score of greater than 60 is consistent with streams able to meet the Warmwater Habitat (WWH) designation. A score of less than 45 is consistent with streams not able to meet the WWH designation based on some impairment; such streams are considered Modified Warmwater Habitat (MWH). Streams that score between 46 and 60 may or may not meet the WWH designation but are indicative of some form of impairment.

The correlation between QHEI scores and biological diversity has been developed to be used to categorize streams ability to meet a state's Section 305(b) Beneficial Use designations for aquatic life. The Illinois Environmental Protection Agency (IEPA) has not currently integrated the QHEI into their Beneficial Use categories as has the Ohio Environmental Protection Agency (where the QHEI was developed); therefore, the scores may be used comparatively to the Ohio EPA standards but do not provide direct relevance for Illinois standards.

The purpose of the QHEI is to produce a quick and cost-effective method to evaluate lotic systems. It is not meant to replace more intensive evaluation protocols, but instead as a screening tool to rapidly assess streams with respect to supporting or not supporting their designated aquatic life use standard.

Macroinvertebrate Sampling

Macroinvertebrates were sampled in all observable habitat types (cobble/riffles; raceways/runs, snags/woody debris; vegetated banks/undercut banks/root wads; submerged macrophytes; algal mats; fine sand/sediment; leaf packs/detritus; and deep water pools) encountered within each sampling the reach, using a 10 in. X 18 inch rectangular dip net with a 500 µm mesh size. Supplemental visual surveys of the shoreline and shallow water habitats were performed to collect any larger invertebrates such as mussels (Unionidae) and crayfish (Decopoda). Collection techniques varied depending on habitat type. Riffles/cobble were sampled using the standard stationary kick method; briefly described, the dip net is positioned in the substrate so that is maintains solid contact with stream bottom, approximately one meter upstream of the net, a square patch of the substrate is disturbed by repeated kicks or shuffles to dislodge attached species. Pools were sampled using both sweeps and jabs with sediment within the pool disturbed into suspension through agitation. After disturbance of the substrate, several sweeps above the disturbed area was performed to capture dislodged or escaping invertebrates. Microhabitats such as snags, woody debris, leaf packs, root wads, etc required the jabbing technique, or a forceful thrust into the habitat. After each habitat was sampled, all the organisms and the debris from the net was dumped into a white plastic pan and sorted.

All invertebrates were identified to the lowest possible taxonomic level using several peer reviewed taxonomic keys and a Nikon dissecting scope. Voucher specimens were collected within each habitat. A list of macroinvertebrates found at each stream site was tabulated and attached to the end of the corresponding QHEI form.

Fish Sampling

Fish inadvertently collected during the sampling of macroinvertebrates were recorded. Additionally, a 30 ft X 4ft nylon seine, with 1/16 inch mesh and a 4 ft bag was used to provide a more comprehensive look at fish species diversity within each stream. Riffles were sampled using the kick set or foot shuffle method - setting the net perpendicular to the current and disturbing the substrate three meters in front to the net. Pools were sampled by pulling the net through the pool either perpendicular or obliquely to the shoreline. Runs or raceways were sampled by pulling the net upstream and downstream parallel to the bank.

All fish species were field identified to the lowest possible taxonomic level using several peer reviewed taxonomic keys and a Nikon dissecting scope. Voucher specimens were collected within each stream. A list of fish species found within each stream site was tabulated and attached to the end of the corresponding QHEI form.

Physical and Chemical Sampling

Physical and chemical measurements were performed at each site using a variety of standard limnological methods. Depth was measured in each habitat. Flow was measured using the orange float method over a distance of 20 feet. A YSI 85 handheld field meter was used to record the temperature, dissolved oxygen and conductivity; pH was measured using an Oakton pH6 Acorn series field meter. All field measurements were included on the QHEI forms.

SUMMARY

Willow Branch

The District has two holdings along Willow Branch. The western holding (Tract 1) is bisected by Route 51 south of Macon and the eastern holding (Tract 2) is located approximately a mile northeast of the Route 51 crossing. Tract 1 and 2 are approximately 94 and 80 acres, respectively. Willow Branch flows west then south and eventually connects into the Flat Branch of the South Fork of the Sangamon River. The holdings are located near the headwaters of the stream. The historical government land office (GLO) maps of the 1800’s were reviewed and showed that the stream began roughly at the location of Tract 1. The stream currently extends for a few miles beyond Tract 2, which was listed as entirely prairie during the time of the GLO survey without a defined stream within the township section. Willow Branch is a perennial stream; however, headwaters of streams typically dry down during droughty periods. A severe drought occurred in Illinois during 2005 (it was one of the driest summers on record). The stream was briefly observed during the drought. No observable flow was present at Tract 2 and water was found only within the deeper pools. Tract 1 was reduced to a trickle, but flow was still maintained.

Tract 1 is approximately 94 acres, divided roughly in half by Route 51, and is downstream from Tract 2. The sampling site for this parcel was located on the west side of Route 51 (T14N, R2E, Sec 8). The parcel was formerly in agricultural production (row crop), but has been out of production since the District took ownership. The dominant land cover on the sampling side of Route 51 is currently open grassland (cool season grasses); however, early successional tree species are spreading from the stream edge outward. The sampling point is relatively representative of the stream with the exception of the extent of the buffer due to the removal of the parcel from agricultural production.

The stream is predominantly sand and gravel, but cobble and boulders are present. The observed embeddedness was low in the riffle-run areas and silt accumulation in the pools was fairly low. There is a high degree of sinuosity with numerous tight meanders. The stream is entrenched approximately seven feet and the tight meanders have resulted in some areas of high erosive potential along the outside bends. Pool depths were highly variable, ranging from 15 to over 36 inches. The stream survey produced a QHEI score of 85.

This reach of Willow Branch had the highest total diversity for both fish and macroinvertebrates of all sampling sites. There were 29 species of macroinvertebrates and 10 species of fish. Riffle, pool, and run habitats maintained unique sets of organisms, providing a functional balance to the stream. Riffles contained the highest number of macroinvertebrate species followed by the pools. Several species of stoneflies (Plecoptera) from three different families were more abundant than both caddisflies (Trichoptera) and mayflies (Ephemoptera) and seemed to be the dominant species within the riffle zones. Additionally, there were several other unique species that were only found in this reach, including riffle beetles (Elmidae) and darner dragonflies (Aeshnidae). Other sensitive species found within this reach were fingernail clams (Sphaeriidae), gammarid amphipods (Amphipods), and crawling water beetles (Haliplidae). Fish diversity was high within this reach compared to the other streams sampled, and contained unique species such as tadpole madtom and the blackstripe topminnow.

Tract 2 is approximately 80 acres and is located a little more than a mile upstream of Tract 1 (T14N, R2E, Sec 4). The parcel was only recently acquired by the District and this past year is the first year it will be out of agricultural production (three-quarters of the holding has been in agricultural production). Much of the stream within this holding has only a small buffer (generally less than 30 ft).

Portions of the stream are channelized further upstream of this parcel but channelization was not evidenced within the reach. One artificial modification was observed however, the former owner placed rock fill in the channel about halfway through the parcel to create a stable crossing for farm implements to reach the adjacent field. The rock fill created an approximately three foot riffle which is creating a small backwater area behind the fill (this portion of the stream was not sampled). The streambed is predominantly composed of gravel with very low embeddedness in the riffle-run areas. The pools here have higher accumulations of silts and sands than was found downstream. The stream is entrenched approximately seven feet but there is not an accessible floodplain shelf so although the stream has not been channelized, it is rather trapezoidal in shape. The stream survey produced a QHEI score of 79.5.

This reach of Willow Branch had the second highest diversity of invertebrates among the streams sampled (16 species were collected). Riffles provided the best habitat for many of the macroinvertebrates, followed by the long runs. Pools were generally very shallow and had limited cover for invertebrates. Stoneflies, caddisflies, and mayflies were all abundant within the artificial riffle zone (agricultural crossing), but were very sparse within other areas of the stream. This reach of Willow Branch was the only sampling site with more than one species of mayfly collected. Crayfish were very abundant and appear to be playing a large functional role within this reach of the stream. Fish diversity was low within this reach (5 species collected).

Long Grove Branch

The District has one holding along Long Grove Branch. The holding is located approximately two mile southeast of the Willow Branch Tract 2 holding, just north of the Macon/Shelby County line (T14N, R2E, Sec 15). The holding is approximately 80 acres. The stream flows west and is a tributary to Willow Branch. The historical GLO maps show the stream within the section; however, it is a prairie stream at that time. The stream was briefly observed during the drought. No observable flow was present and water was found only within the deeper pools.

The Long Grove holding has approximately 30 acres of active row crop production still maintained, but the rest of the site is forested. The entire stream within the holding is enclosed with a relatively wide forest buffer. The forest has a dominant overstory canopy of Osage orange (*Maclura pomifera*) [based on this feature it is assumed the forested area was formerly in pasture]. The understory vegetation has a dense carpet of Virginia Rye (*Elymus virginiana*). The sampling point is relatively representative of the stream.

A high level of bank erosion is one of the most notable features of this stream. The stream is entrenched approximately seven feet and lacks an accessible floodplain shelf. The streambed is predominantly sand and gravel. The gravels that are present are very fine and only a few isolated cobbles were observed. There is a fairly high level of sinuosity and many of the meander bends are sharp. The undercutting of the banks has resulted in a large number of trees downed into the stream. This has, however, resulted in the creation of a considerable amount of woody debris habitat for macroinvertebrates. The stream survey produced a QHEI score of 73.

Grove Branch, with regard to fish and macroinvertebrates, was fairly limited in diversity (5 and 11 species respectively). There were, however, still sensitive species present as part of the stream macroinvertebrate community. Sensitive macroinvertebrate taxa including, stoneflies, caddisflies, and fingernail clams were collected in fair numbers within this reach, however mayflies were not present during the time of the survey. Substrate size likely limited the available micro-habitat niche space and may be restricting diversity. Pools habitats contained areas of large detrital packs along the margins, which provided excellent habitat for predatory macroinvertebrates such as predacious diving beetles (Dytisidae) and damsel flies (Zygoptera). Aquatic sow bugs (Isopoda) were very abundant and appear play a vital functional role within this system.

Sand Creek

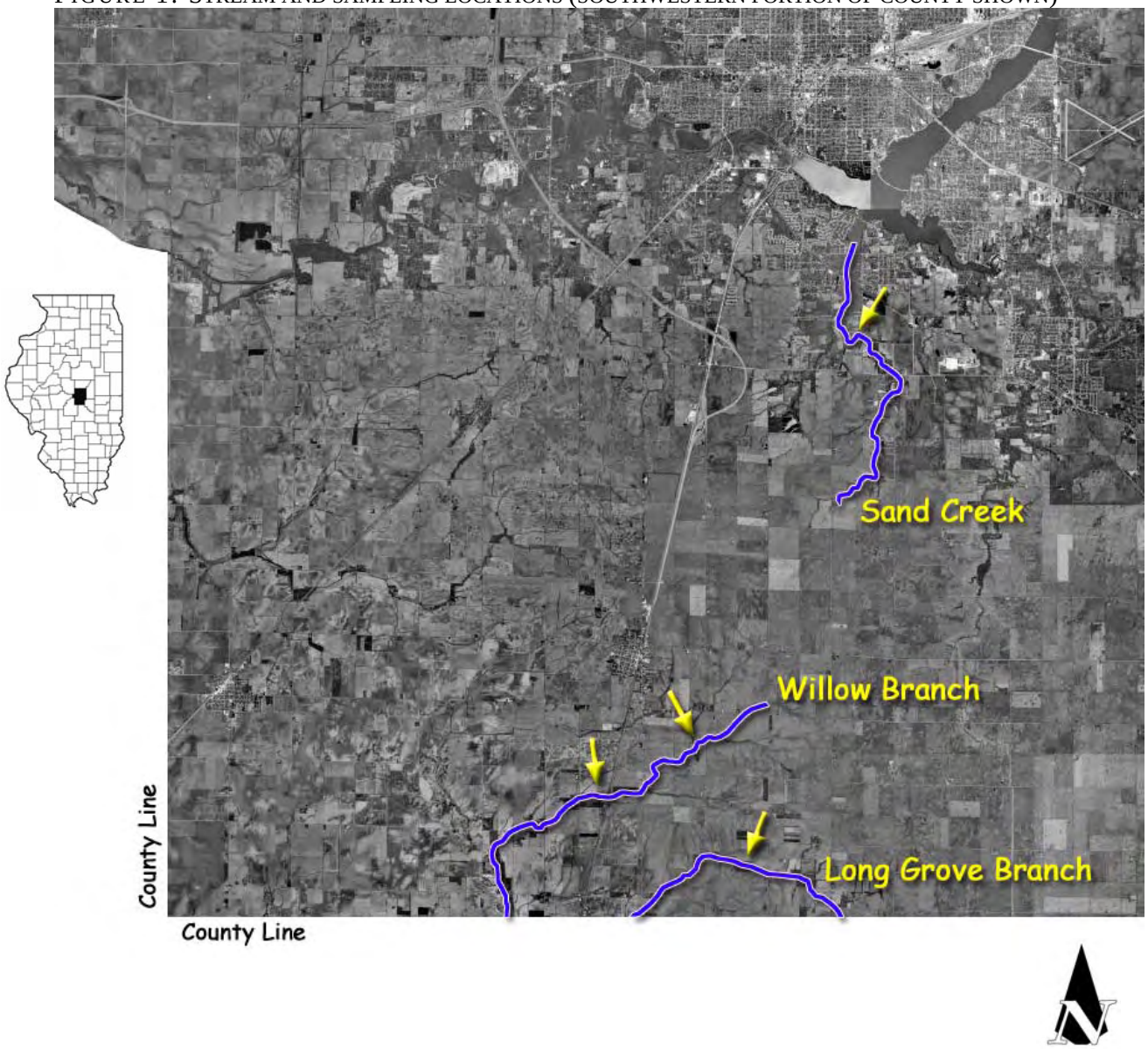
Sand Creek Recreational Area is an approximately 780 acre public park and the only district property with horse trails. The park is located just south of Lake Decatur. The park occupies parts of three separate township sections; the sampling site occurred in T15N, R2E, Sec 1. Sand Creek flows north through the park and is a direct tributary to the Sangamon River (within Lake Decatur). The park makes up a sizable portion of the streams watershed. The historical GLO maps show the park area to be a mixture of prairie and forest. The stream was briefly observed during the drought. No observable flow was present and water was found only within the deeper pools.

The park has numerous ecological areas, but the sampling site occurred in a section of mature sycamore-walnut floodplain forest. Where the stream cuts through taller bluffs, the forest quickly turns to a mature oak-hickory upland forest. None of the park is in agricultural production and the size of the park creates a large buffer for not only the main part of the creek but also several of its tributaries. The sampling point is representative of the stream.

The stream, as with the other sites, was entrenched approximately seven feet. The bank slopes are generally not steep, except on the outside bends of tight meanders, and can readily walked along. The stream is aptly named with a very high constituent of sand present. The streambed is predominantly sand-gravel with boulders and cobbles making up a lesser component. Sinuosity is high and the large amount of timber surrounding the stream results in a considerable amount of woody debris within the channel. There are numerous logs wedged into the banks and many these have created deep scour pools. The size and types of pools present are highly variable. The stream survey produced a QHEI score of 84.

Macroinvertebrate diversity was moderate to low, given the heterogeneous composition of its substrate and numerous habitat types (14 species collected). Small minnow mayflies were the most abundant macroinvertebrate within this stream, followed by stoneflies and chironomid midges. This sampling site was the only one where winter stoneflies (Taeniopterygidae) and an interesting large bodied dragonfly from the family Libellulidae were collected. Fish diversity was low within this site (4 species collected), and was reflective of lake systems. One single mud dater was collected from a snag within a large pool upstream of the Old Trace Ford, and may represent a relict population of the once extensive Sangamon River backwater habitat.

FIGURE 1: STREAM AND SAMPLING LOCATIONS (SOUTHWESTERN PORTION OF COUNTY SHOWN)



QUALITATIVE HABITAT EVALUATION INDEX

Stream: Willow Branch (downstream) Location: Willow Branch Tract 1 holding (T14N, R2E, Sec 8)
County: Macon Date: April 21, 2006
Investigator(s): Bryan Cross and Joseph Bartletti
General weather conditions (has it been raining in the past three days?) No rain in previous 3 days; however the past several weeks have produced a considerable amount of precipitation. Sunny, upper 70's

SUBSTRATE

Type*

		Pool	Riffle
☐ - ☐	Slabs [10]		
☐ - ☒	Boulder [9]	2	1
☐ - ☒	Cobble [8]		6
☒ - ☐	Gravel [7]	10	58
☒ - ☐	Sand [6]	50	20
☐ - ☐	Bedrock [5]		
☐ - ☒	Hardpan [4]		In runs
☐ - ☒	Detritus [3]	8	
☐ - ☐	Muck [2]		
☐ - ☒	Silt [2]	30	5
☐ - ☐	Artificial [0]		

Substrate Origin
Average if 2 are checked

- ☐ Limestone [1]
- ☒ Tills [1]
- ☐ Wetlands [0]
- ☐ Hardpan [0]
- ☐ Sandstone [0]
- ☐ Rip-Rap [0]
- ☐ Lacustrine [0]
- ☐ Shale [-1]
- ☐ Coal fines [-2]

Substrate Quality
Average if 2 are checked

- ☐ Silt Heavy [-2]
- ☐ Silt Moderate [-1]
- ☒ Silt Normal [0]
- ☐ Silt Free [1]

Silt Embeddedness:

- ☐ Extensive [-2]
- ☐ Moderate [-1]
- ☒ Normal [0]
- ☐ None [1]

Number of Substrate Types:

- ☒ 4 or more [2]
- ☐ 3 or less [0]

*ignore point source sludge, left box = dominant, right box = co-dominant, estimate percent composition

Score
Max 20
20

Comments:

IN-STREAM COVER

Type
(Check all that occur)

- ☒ Undercut banks [1]
- ☒ Overhanging Vegetation [1]
- ☐ Shallows (in slow water) [1]
- ☒ Rootmats [1]
- ☒ Rootwads [1]
- ☒ Pools >28" [2]
- ☐ Oxbows, backwaters [1]
- ☒ Aquatic Macrophytes [1]
- ☒ Logs or Woody Debris [1]
- ☒ Boulders [1]

Amount
Average if 2 are checked

- ☐ Extensive (>75%) [11]
- ☒ Moderate (25-75%) [7]
- ☐ Sparse (5-25%) [3]
- ☐ Nearly Absent (<5%) [1]

Score
Max 20
16

Comments:

CHANNEL MORPHOLOGY

Average if 2 are checked

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]	☐ No Recovery [1]	

Additional Information
No Score

Modifications

- ☐ Snagging
- ☐ Relocation
- ☐ Canopy Removal
- ☐ Dredging
- ☐ Impounded
- ☐ Island(s)
- ☐ Levied
- ☐ Bank Shaping

Score
Max 20
17

Comments:

QUALITATIVE HABITAT EVALUATION INDEX

RIPARIAN ZONE AND BANK EROSION

≪ L/R relative to looking DOWNSTREAM ≪

Riparian Width

L - R (Per Bank)
- ☒ - ☒ Wide (>50m) [4]
- ☐ - ☐ Moderate (10-50m) [3]
- ☐ - ☐ Narrow (5-10m) [2]
- ☐ - ☐ Very Narrow (<5m) [1]
- ☐ - ☐ None [0]

Floodplain Quality

L - R (Per Bank)
- ☐ - ☐ Forest, Swamp [3]
- ☒ - ☒ Shrub/Old Field [2]
- ☐ - ☐ Residential/Park [1]
- ☐ - ☐ Fenced Pasture [1]
- ☐ - ☐ Conservation Tillage [1]
- ☐ - ☐ Open Pasture/Row Crop [0]
- ☐ - ☐ Urban/Industrial [0]
- ☐ - ☐ Mining/Construction [0]

Bank Erosion

L - R (Per Bank)
- ☐ - ☐ None/Little [3]
- ☒ - ☒ Moderate [2]
- ☐ - ☐ Heavy/Severe [1]

Score
Max 10

8

Comments: _____

POOL / GLIDE QUALITY

Maximum Depth

(Check only 1)
- ☒ > 36” [6]
- ☐ 28-36” [4]
- ☐ 16-28” [2]
- ☐ 8-16” [1]
- ☐ < 8” [0]

Morphology

(Average if 2 are checked)
- ☒ Pool width > Riffle width [2]
- ☐ Pool width = Riffle width [1]
- ☐ Pool width < Riffle width [0]

Current Velocity

(riffle – pool: Check all that apply)
- ☐ - ☐ Eddies [1]
- ☐ - ☐ Very Fast [1]
- ☒ - ☐ Fast [1]
- ☐ - ☒ Moderate [1]
- ☐ - ☒ Slow [1]
- ☐ - ☐ Torrential [-1]
- ☐ - ☐ Interstitial [-1]
- ☐ - ☐ Intermittent [-2]

Score
Max 12

11

Comments: _____

RIFFLE / RUN QUALITY

Riffle Depth
- ☒ > 4” [2]
- ☐ 2-4” [1]
- ☐ < 2” [0]

Run Depth
- ☐ > 20” [2]
- ☒ < 20” [1]

Riffle/Run Substrate
- ☐ Stable (cobble/boulder) [2]
- ☒ Moderate (gravel) [1]
- ☐ Unstable (sand) [0]

Riffle/Run Embeddedness
- ☐ None [2]
- ☒ Low [1]
- ☐ Moderate [0]
- ☐ Extensive [-1]

Score
Max 8

5

Comments: _____

STREAM GRADIENT

See gradient table below for scoring

Gradient (ft/mi): 10-15

Drainage area (sq. mi.): _____

Score
Max 10

8

Comments: estimated from USGS 7.5 min topographic map

Gradient (feet/mile)

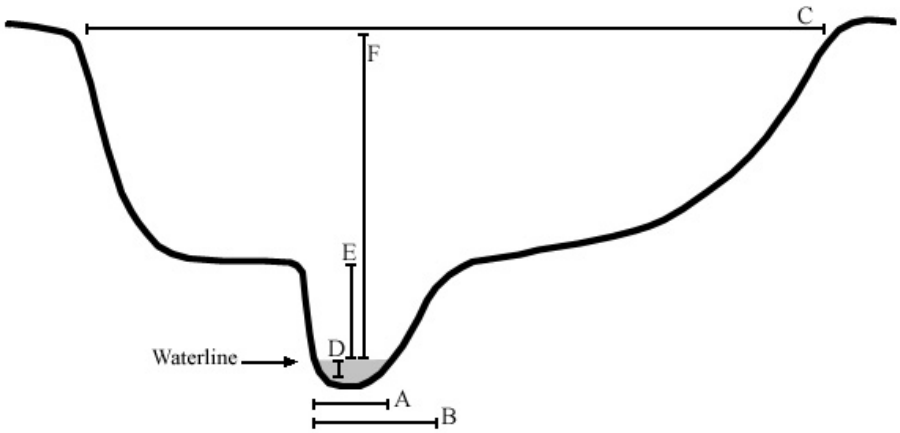
Stream width	Drainage Area (square miles)	Very Low	Low	Moderate Low	Moderate	Moderate High	High	Very High
<5’	<9	0-1 = 2	1-5 = 4	5-10 = 6	10-15 = 8	15-20 = 10	20-30 = 10	30-40 = 8
5-9’	9-42	0-1 = 2	1-3 = 4	3-6 = 6	6-12 = 10	12-18 = 10	18-30 = 8	30-40 = 6
9-14’	42-104	0-1 = 2	1-2.5 = 4	3-5 = 6	5-8 = 8	8-12 = 10	12-20 = 8	20-30 = 6
14-31’	104-623	0-1 = 4	1-2 = 6	2-4 = 8	4-6 = 10	6-10 = 10	**10-15 = 8**	15-25 = 6
>31’	>623		0-5 = 6	0.5-1 = 8	1-3 = 10	3-4 = 10	4-9 = 10	>9 = 8

QUALITATIVE HABITAT EVALUATION INDEX

STREAM SEGMENT DESCRIPTION

	Riffle	Run/Glide	Pool	
(A) Average width FLOW	6’	10’	18’	
(B) Average width MAIN CHANNEL	18’	20’	22’	
(C) Average width FLOODPLAIN	62’	*Same for all*		
(D) Average depth FLOW	10”	12”	15”*	*high variability
(E) Average depth MAIN CHANNEL	4’	*Same for all*		
(F) Average depth FLOODPLAIN (entrenchment)	7’	*Same for all*		

% Pool	60
% Riffle	30
% Glide	- - -
% Run	10



Is sampling reach representative of stream? ☒ Yes ☐ No

Please provide a brief description of the general aesthetic and physical condition of the stream.
Be sure to name any suspected sources of impacts to the stream (i.e. agricultural practices, urban runoff, industrial facilities, etc.)

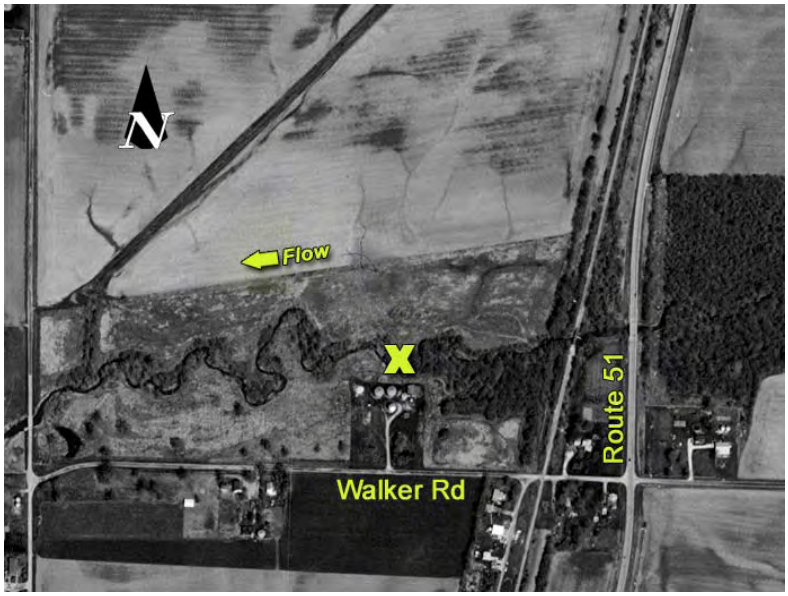
The stream is predominately an east-west flowing stream and has a road (township or other) crossing it at about half mile intervals. The stream is perennial but reduces to a trickle during dry periods - as was observed during the drought of 2005. The stream is representative although the riparian buffer is larger than throughout the rest of the watershed.

QHEI SCORE

	Calculated	*Maximum*
Substrate	20	20
In-stream Cover	16	20
Channel Morphology	17	20
Riparian Zone and Bank Erosion	8	10
Pool / Glide Quality	11	12
Riffle / Run Quality	5	8
Stream Gradient	8	10
TOTAL	**85**	**100**

Water Quality Parameters
Temperature: 15.9˚ C
Specific Conductance: 325 µS
Dissolved Oxygen: 9.2 (91% saturation)
pH: 8.1

PHOTOGRAPHS / SKETCHES OF STREAM SEGMENT



The downstream sampling section of Willow Branch is located west of Route 51 north of Walker Road. This township section was formerly, based off the 1800's government land office maps, where Willow Branch began. The holding is divided by Route 51; with approximately 50 and 44 acres on the east and west side respectively. The X marks the general location where sampling began (sampling movement was downstream).

The arrow marks the general location where sampling began. The grain bins visible in the 1998 aerial photograph have been removed (the remaining barn shown here was demolished this past spring).

Riparian Area

Portions of property starting to form closed canopy

Vegetation dominated by grassy understory

Portions remain relatively treeless

The parcel where sampling occurred is owned by the Conservation District and has been removed from agricultural production so the stream within this area has a relatively large buffer. The vegetation is dominated by early successional tree species and species common to agricultural land (mulberry, hedge, and honey locust). The understory vegetation was predominately pasture grasses and other 'weedy' species associated with agricultural lands.

Streambed

Typical view of in-stream vegetation

Typical view of pool

Typical riffle substrate

Typical run substrate – low embeddedness

The streambed is predominately sand and gravel; however, cobble and boulders are present. The land was formerly in agricultural production and it is possible / likely that many of the boulders observed were tossed in by the former landowners. Silt was mostly restricted to the pools and embeddedness was low in the riffle-run areas. Vegetation within the stream was limited, predominately a single species of grass (was not identifiable but appeared to be a type of fescue).

Morphology and Bank Stability

The stream has a high degree of sinuosity (top left and right) and a good development of riffle-run-pool complexes. The stream is incised approximately seven feet and the banks are actively eroding. Large sections of the outside bends have potential for mass wasting (above right). There is an abundant amount of woody debris (above left) which is contributing to both pool and habitat variability. Although the stream is incised and the banks are eroding, there are large sections of till exposed (left) which is contributing substrate to the stream.

Table 1: Collected Macroinvertebrates, Willow Branch (Downstream)

Class	Order	Suborder	Family	Genus	(Stage)	Common Name
Gastropoda	Gastropoda	Phaorbidae	Physidae	- - -	Adult	Snails
Insecta	Coleoptera	Adephaga	Dytiscidae	*Agabus*	Adult	Predaceous Diving Beetle
Insecta	Coleoptera	Adephaga	Dytiscidae	- - -	Larva	Predaceous Diving Beetle
Insecta	Coleoptera	Adephaga	Haliplidae	*Peltodytes*	Adult	Crawling Water Beetles
Insecta	Coleoptera	Polyphaga	Elmidae	- - -	Adult	Riffle Beetles
Insecta	Diptera	Netmatocera	Chironomidae	- - -	Larva	Non-biting Midges
Insecta	Diptera	Netmatocera	Chironomidae	- - -	Larva	Non-biting Midges
Insecta	Diptera	Netmatocera	Chironomidae	- - -	Larva	Non-biting Midges
Insecta	Diptera	Netmatocera	Simulidae	- - -	Larva	Black flies, Buffalo Gnats
Insecta	Diptera	Netmatocera	Tipulidae	- - -	Larva	Craneflies
Insecta	Ephemoptera	- - -	Baetidae	- - -	Larva	Small Minnow Mayflies
Insecta	Hemiptera	Gerromorpha	Gerridae	- - -	Juvenile	Water Striders
Insecta	Hemiptera	Nepomorpha	Corrixidae	- - -	Juvenile	Water Boatmen
Insecta	Hemiptera	Nepomorpha	Gelastocoridae	*Gelastocoris*	Adult	Toad Bugs
Insecta	Hemiptera	Nepomorpha	Nepidae	*Ranatra*	Adult	Water Scorpion
Insecta	Odonata	Anisoptera	Aeshnidae	*Aeshna*	Naiad	Darner Dragonflies
Insecta	Odonata	Anisoptera	Libellulidae	*Perithemis*	Naiad	Percher-Skimmer Dragonflies
Insecta	Odonata	Zygoptera	Coenagrionidae	*Enallagma*	Naiad	Narrow-winged Damselflies
Insecta	Plecoptera	Systellognatha	Chloroperlidae	- - -	Larva	Green Stoneflies
Insecta	Plecoptera	Systellognatha	Pelodidae	*Isoperla*	Larva	Patterned Stoneflies
Insecta	Plecoptera	Systellognatha	Perlidae	*Neoperla*	Larva	Common Stoneflies
Insecta	Tricoptera	Annulipalpia	Polycentropidae	*Neureclipsis*	Larva	Tube-Making / Trumpet-Net Caddisflies
Malacostraca	Amphipoda	Gammaridea	- - -	- - -	Adult	Gammarid Amphipods
Malacostraca	Decopoda	Pleocyemata	Cambaridae	*Procambarus*	Adult	Crayfish
Oligochaeta	- - -	- - -	- - -	- - -	Adult	Aquatic Worms
Pelecypoda	Unionoida	- - -	Corbiculidae	*Corbicula*	Adult	Asian Clam (sp. *fluminea*)
Pelecypoda	Unionoida	- - -	Sphaeriidae	- - -	Adult	Fingernail Clams
Pelecypoda	Unionoida	- - -	Unionidae	*Anodonta*	Adult	Giant Floater (sp. *grandis*)
Pelecypoda	Unionoida	- - -	Unionidae	*Uniomerus*	Adult	Pondhorn (sp. *tetralasmus*)

Table 2: Collected Fish, Willow Branch (Downstream)

Class	Order	Family	Scientific Name	Common Name
Osteichthyes	Cypriniformes	Cyprinidae	*Cyprinella lutrensis*	Red Shiner
Osteichthyes	Cypriniformes	Cyprinidae	*Lythrurus umbratilis*	Redfin Shiner
Osteichthyes	Cypriniformes	Cyprinidae	*Notemigonus crysoleucas*	Golden Shiner
Osteichthyes	Cypriniformes	Cyprinidae	*Notropis sp.*	Minnow
Osteichthyes	Cypriniformes	Cyprinidae	*Pimephales notatus*	Bluntnose Minnow
Osteichthyes	Cyprinodonitiformes	Fundulidae	*Fundulus notatus*	Blackstripe Topminnow
Osteichthyes	Perciformes	Centrarchidae	*Lepomis cyanellus*	Green Sunfish
Osteichthyes	Perciformes	Centrarchidae	*Lepomis macrochirus*	Bluegill
Osteichthyes	Perciformes	Percidae	*Etheostoma nigrum*	Johnny Darter
Osteichthyes	Siluriformes	Ictaluridae	*Noturus gyrinus*	Tadpole Madtom

QUALITATIVE HABITAT EVALUATION INDEX

Stream: Willow Branch (upstream hold) Location: Willow Branch Tract 2 holding (T14N, R2E, Sec 4)
County: Macon Date: April 21, 2006
Investigator(s): Bryan Cross and Joseph Bartletti
General weather conditions (has it been raining in the past three days?) No rain in previous 3 days; however the past several weeks have produced a considerable amount of precipitation. Sunny, upper 70's

SUBSTRATE

Type*	Pool	Riffle
☐ - ☐ Slabs [10]		
☐ - ☐ Boulder [9]		
☐ - ☒ Cobble [8]		10
☒ - ☐ Gravel [7]	15	70
☒ - ☐ Sand [6]	70	20
☐ - ☐ Bedrock [5]		
☐ - ☒ Hardpan [4]		In runs
☐ - ☒ Detritus [3]	5	
☐ - ☐ Muck [2]		
☐ - ☒ Silt [2]	10	
☐ - ☐ Artificial [0]		

Substrate Origin
Average if 2 are checked
- ☐ Limestone [1]
- ☒ Tills [1]
- ☐ Wetlands [0]
- ☐ Hardpan [0]
- ☐ Sandstone [0]
- ☐ Rip-Rap [0]
- ☐ Lacustrine [0]
- ☐ Shale [-1]
- ☐ Coal fines [-2]

Substrate Quality
Average if 2 are checked
- ☐ Silt Heavy [-2]
- ☐ Silt Moderate [-1]
- ☒ Silt Normal [0]
- ☐ Silt Free [1]

Silt Embeddedness:
- ☐ Extensive [-2]
- ☐ Moderate [-1]
- ☒ Normal [0]
- ☐ None [1]

Number of Substrate Types:
- ☒ 4 or more [2]
- ☐ 3 or less [0]

*ignore point source sludge, left box = dominant, right box = co-dominant, estimate percent composition

Score
Max 20
20

Comments: Did not include artificial substrate – material from ag crossing did not migrate

IN-STREAM COVER

Type
(Check all that occur)
- ☒ Undercut banks [1]
- ☐ Overhanging Vegetation [1]
- ☐ Shallows (in slow water) [1]
- ☒ Rootmats [1]
- ☒ Rootwads [1]
- ☒ Pools >28" [2]
- ☐ Oxbows, backwaters [1]
- ☐ Aquatic Macrophytes [1]
- ☒ Logs or Woody Debris [1]
- ☐ Boulders [1]

Amount
Average if 2 are checked
- ☐ Extensive (>75%) [11]
- ☒ Moderate (25-75%) [7]
- ☐ Sparse (5-25%) [3]
- ☐ Nearly Absent (<5%) [1]

Score
Max 20
13

Comments:

CHANNEL MORPHOLOGY

Average if 2 are checked

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]	☐ No Recovery [1]	

Additional Information
No Score

Modifications
- ☐ Snagging
- ☐ Relocation
- ☐ Canopy Removal
- ☐ Dredging
- ☐ Impounded
- ☐ Island(s)
- ☐ Levied
- ☐ Bank Shaping

Score
Max 20
15.5

Comments: Abundance of large gravel

QUALITATIVE HABITAT EVALUATION INDEX

RIPARIAN ZONE AND BANK EROSION

≪ L/R relative to looking DOWNSTREAM ≪

Riparian Width

L - R (Per Bank)
- ☐ - ☐ Wide (>50m) [4]
- ☒ - ☒ Moderate (10-50m) [3]
- ☐ - ☐ Narrow (5-10m) [2]
- ☐ - ☐ Very Narrow (<5m) [1]
- ☐ - ☐ None [0]

Floodplain Quality

L - R (Per Bank)
- ☒ - ☒ Forest, Swamp [3]
- ☐ - ☐ Shrub/Old Field [2]
- ☐ - ☐ Residential/Park [1]
- ☐ - ☐ Fenced Pasture [1]
- ☐ - ☐ Conservation Tillage [1]
- ☐ - ☐ Open Pasture/Row Crop [0]
- ☐ - ☐ Urban/Industrial [0]
- ☐ - ☐ Mining/Construction [0]

Bank Erosion

L - R (Per Bank)
- ☐ - ☐ None/Little [3]
- ☒ - ☒ Moderate [2]
- ☐ - ☐ Heavy/Severe [1]

Score
Max 10

8

Comments: _____

POOL / GLIDE QUALITY

Maximum Depth

(Check only 1)
- ☐ > 36” [6]
- ☒ 28-36” [4]
- ☐ 16-28” [2]
- ☐ 8-16” [1]
- ☐ < 8” [0]

Morphology

(Average if 2 are checked)
- ☒ Pool width > Riffle width [2]
- ☐ Pool width = Riffle width [1]
- ☐ Pool width < Riffle width [0]

Current Velocity

(riffle – pool: Check all that apply)
- ☐ - ☐ Eddies [1]
- ☐ - ☐ Very Fast [1]
- ☒ - ☐ Fast [1]
- ☒ - ☒ Moderate [1]
- ☐ - ☐ Slow [1]
- ☐ - ☐ Torrential [-1]
- ☐ - ☐ Interstitial [-1]
- ☐ - ☐ Intermittent [-2]

Score
Max 12

8

Comments: Velocity 20ft in 8sec in runs

RIFFLE / RUN QUALITY

Riffle Depth
- ☒ > 4” [2]
- ☐ 2-4” [1]
- ☐ < 2” [0]

Run Depth
- ☐ > 20” [2]
- ☒ < 20” [1]

Riffle/Run Substrate
- ☐ Stable (cobble/boulder) [2]
- ☒ Moderate (gravel) [1]
- ☐ Unstable (sand) [0]

Riffle/Run Embeddednes
- ☐ None [2]
- ☒ Low [1]
- ☐ Moderate [0]
- ☐ Extensive [-1]

Score
Max 8

5

Comments: _____

STREAM GRADIENT

See gradient table below for scoring

Gradient (ft/mi): 6-10

Drainage area (sq. mi.): _____

Score
Max 10

10

Comments: Estimated from USGS 7.5 min topographic map

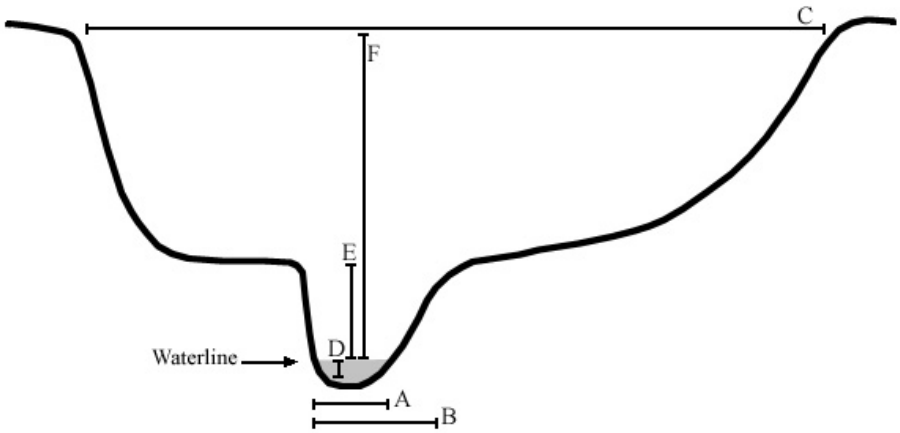
Gradient (feet/mile)

Stream width	Drainage Area (square miles)	Very Low	Low	Moderate Low	Moderate	Moderate High	High	Very High
<5’	<9	0-1 = 2	1-5 = 4	5-10 = 6	10-15 = 8	15-20 = 10	20-30 = 10	30-40 = 8
5-9’	9-42	0-1 = 2	1-3 = 4	3-6 = 6	6-12 = 10	12-18 = 10	18-30 = 8	30-40 = 6
9-14’	42-104	0-1 = 2	1-2.5 = 4	3-5 = 6	5-8 = 8	8-12 = 10	12-20 = 8	20-30 = 6
14-31’	104-623	0-1 = 4	1-2 = 6	2-4 = 8	4-6 = 10	**6-10 = 10**	10-15 = 8	15-25 = 6
>31’	>623		0-5 = 6	0.5-1 = 8	1-3 = 10	3-4 = 10	4-9 = 10	>9 = 8

STREAM SEGMENT DESCRIPTION

	Riffle	Run/Glide	Pool
(A) Average width FLOW	14’	19’	21’
(B) Average width MAIN CHANNEL	23’	21’	27’
(C) Average width FLOODPLAIN	30’	*Same for all*	
(D) Average depth FLOW	6.5”	7”	3’
(E) Average depth MAIN CHANNEL	40”	*Same for all (see below)*	
(F) Average depth FLOODPLAIN (entrenchment)	8’	*Same for all*	

% Pool	20
% Riffle	40
% Glide	- - -
% Run	40



Is sampling reach representative of stream? ☒ Yes* ☐ No

Please provide a brief description of the general aesthetic and physical condition of the stream.
Be sure to name any suspected sources of impacts to the stream (i.e. agricultural practices, urban runoff, industrial facilities, etc.)

The main channel is entrenched and cut off from the floodplain except in 100 year type events. The normal high water mark from 2 year events is at ~3 ft so this depth is substituted for the depth of main channel.

*agricultural crossing created ~3 ft riffle which is acting as a weir and created an upstream ponding effect. Sampling occurred downstream of the crossing and reach is considered representative.

QHEI SCORE

	Calculated	*Maximum*
Substrate	20	20
In-stream Cover	13	20
Channel Morphology	15.5	20
Riparian Zone and Bank Erosion	8	10
Pool / Glide Quality	8	12
Riffle / Run Quality	5	8
Stream Gradient	10	10
TOTAL	**79.5**	**100**

Water Quality Parameters
Temperature: 16˚ C
Specific Conductance: 262 µS
Dissolved Oxygen: 8.5 (88% saturation)
pH: 8.1

PHOTOGRAPHS / SKETCHES OF STREAM SEGMENT

The upstream sampling section of Willow Branch is located a little more than a mile northeast of the Route 51 bridge. This township section was formerly, based off the 1800's government land office maps, entirely in prairie with no stream present. The holding is an 80 acre tract. The X marks the location where sampling began; this was an agricultural crossing of the stream. The former owner placed rock down to create a stable crossing of the stream and inadvertently created an approximately 3 foot weir which is backing some water upstream of the crossing.

Below: The arrow marks the site of the agricultural crossing and the start of the sampling.

The Conservation District has taken the agricultural lands out of production this year

Riparian Area

The parcel where sampling occurred is owned by the Conservation District and has been removed from agricultural production starting this year. In the future, the stream will have a large buffer through this area, although the field is tiled and outlets into the stream. Looking downstream, much of the left side of the stream has a forested buffer wider than 100 ft; the right side has a buffer less than 25 ft over most of it

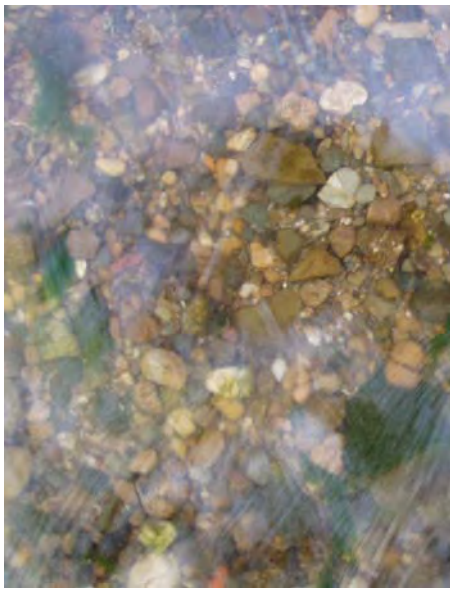
The areas where the agricultural field immediately abuts the stream have a buffer less than 25 feet

A farm lane cuts through the forested section to allow access to the adjacent field via the stream crossing

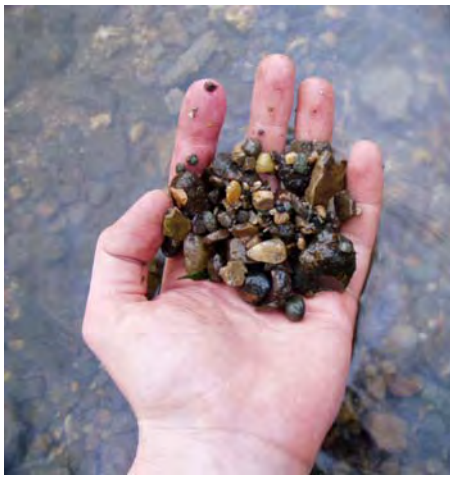
The forested areas are irregular in shape and are composed mostly of early successional species

Streambed

Gravel bars prevalent along system


Embeddedness low in riffle-run

Typical pool substrate


Typical riffle substrate

The streambed is predominately sand and gravel; however cobble is present (boulders are artificially placed). The stream is incised and access to the floodplain is limited.

Looking downstream from top of artificial crossing

Morphology and Bank Stability

Channel sinuosity is on the low side of moderate. Access to the floodplain is limited due to the incision and the channel is rather trapezoidal in shape (two photos below left). There is very little streambank vegetation present, limited to small pockets (photo below). Rootwads and rootmats provide a fair amount of macroinvertebrate habitat (photos above left and above). The stream does dry down during droughty summer periods; however, the deeper pools do retain water leaving isolated aquatic communities. Although overall the erosive potential of the banks is quite high, the banks appear to eroding but not mass wasting.

Table 1: Collected Macroinvertebrates, Willow Branch (Upstream)

Class	Order	Suborder	Family	Genus	(Stage)	Common Name
Gastropoda	Gastropoda	Phaorbidae	Physidae	- - -	Adult	Snails
Insecta	Coleoptera	Adephaga	Dytiscidae	*Agabus*	Adult	Predaceous Diving Beetle
Insecta	Coleoptera	Adephaga	Dytiscidae	- - -	Adult	Predaceous Diving Beetle
Insecta	Coleoptera	Adephaga	Dytiscidae	- - -	Adult	Predaceous Diving Beetle
Insecta	Coleoptera	Adephaga	Dytiscidae	- - -	Larva	Predaceous Diving Beetle
Insecta	Diptera	Netmatocera	Chironomidae	- - -	Larva	Non-biting Midges
Insecta	Diptera	Netmatocera	Chironomidae	- - -	Larva	Non-biting Midges
Insecta	Ephemoptera	- - -	Baetidae	- - -	Larva	Small Minnow Mayflies
Insecta	Ephemoptera	- - -	Heptageniidae	- - -	Larva	Flathead Mayflies
Insecta	Odonata	Anisoptera	Libellulidae	*Perithemis*	Naiad	Percher-Skimmer Dragonflies
Insecta	Plecoptera	Systellognatha	Chloroperlidae	- - -	Larva	Green Stoneflies
Insecta	Plecoptera	Systellognatha	Perlidae	*Neoperla*	Larva	Common Stoneflies
Insecta	Tricoptera	Annulipalpia	Polycentropidae	*Neureclipsis*	Larva	Tube-Making / Trumpet-Net Caddisflies
Malacostraca	Amphipoda	Gammaridea	- - -	- - -	Adult	Gammarid Amphipods
Malacostraca	Decopoda	Pleocyemata	Cambaridae	*Cambarus*	Adult	Crayfish
Malacostraca	Isopoda	Asellota	Asellidae	- - -	Juvenile	Aquatic Sow Bugs

Table 2: Collected Fish, Willow Branch (Upstream)

Class	Order	Family	Scientific Name	Common Name
Osteichthyes	Cypriniformes	Cyprinidae	*Notemigonus crysoleucas*	Golden Shiner
Osteichthyes	Cypriniformes	Cyprinidae	*Notropis sp.*	Minnow
Osteichthyes	Cypriniformes	Cyprinidae	*Pimephales notatus*	Bluntnose Minnow
Osteichthyes	Perciformes	Centrarchidae	*Lepomis cyanellus*	Green Sunfish
Osteichthyes	Perciformes	Percidae	*Etheostoma nigrum*	Johnny Darter

QUALITATIVE HABITAT EVALUATION INDEX

Stream: Long Grove Branch Location: Grove Branch holding (T14N, R2E, Sec 15)
County: Macon Date: April 22, 2006
Investigator(s): Bryan Cross and Joseph Bartletti
General weather conditions (has it been raining in the past three days?) No rain in previous 3 days; however the past several weeks have produced a considerable amount of precipitation. Sunny, lower 70's

SUBSTRATE

Type*

		Pool	Riffle
☐ - ☐	Slabs [10]		
☐ - ☐	Boulder [9]		
☐ - ☐	Cobble [8]		
☒ - ☐	Gravel [7]	10	45
☐ - ☒	Sand [6]	20	40
☐ - ☐	Bedrock [5]		
☐ - ☒	Hardpan [4]		In runs
☐ - ☒	Detritus [3]	10	
☐ - ☐	Muck [2]		
☒ - ☐	Silt [2]	60	15
☐ - ☐	Artificial [0]		

Substrate Origin
Average if 2 are checked

- ☐ Limestone [1]
- ☒ Tills [1]
- ☐ Wetlands [0]
- ☐ Hardpan [0]
- ☐ Sandstone [0]
- ☐ Rip-Rap [0]
- ☐ Lacustrine [0]
- ☐ Shale [-1]
- ☐ Coal fines [-2]

Substrate Quality
Average if 2 are checked

- ☒ Silt Heavy [-2]
- ☐ Silt Moderate [-1]
- ☐ Silt Normal [0]
- ☐ Silt Free [1]

Silt Embeddedness:

- ☒ Extensive [-2]
- ☐ Moderate [-1]
- ☐ Normal [0]
- ☐ None [1]

Number of Substrate Types:
- ☒ 4 or more [2]
- ☐ 3 or less [0]

*ignore point source sludge, left box = dominant, right box = co-dominant, estimate percent composition

Score
Max 20
20

Comments:

IN-STREAM COVER

Type
(Check all that occur)

- ☐ Undercut banks [1]
- ☒ Overhanging Vegetation [1]
- ☐ Shallows (in slow water) [1]
- ☐ Rootmats [1]
- ☒ Rootwads [1]
- ☒ Pools >28" [2]
- ☐ Oxbows, backwaters [1]
- ☐ Aquatic Macrophytes [1]
- ☒ Logs or Woody Debris [1]
- ☐ Boulders [1]

Amount
Average if 2 are checked

- ☐ Extensive (>75%) [11]
- ☐ Moderate (25-75%) [7]
- ☒ Sparse (5-25%) [3]
- ☐ Nearly Absent (<5%) [1]

Score
Max 20
8

Comments: Banks are fairly unstable which results in sparse cover

CHANNEL MORPHOLOGY

Average if 2 are checked

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]	☐ No Recovery [1]	

Additional Information
No Score

Modifications

- ☐ Snagging
- ☐ Relocation
- ☐ Canopy Removal
- ☐ Dredging
- ☐ Impounded
- ☐ Island(s)
- ☐ Levied
- ☐ Bank Shaping

Score
Max 20
14

Comments: No cobble or boulders present

QUALITATIVE HABITAT EVALUATION INDEX

RIPARIAN ZONE AND BANK EROSION

≪ L/R relative to looking DOWNSTREAM ≪

Riparian Width

L - R (Per Bank)
- ☒ - ☒ Wide (>50m) [4]
- ☐ - ☐ Moderate (10-50m) [3]
- ☐ - ☐ Narrow (5-10m) [2]
- ☐ - ☐ Very Narrow (<5m) [1]
- ☐ - ☐ None [0]

Floodplain Quality

L - R (Per Bank)
- ☒ - ☒ Forest, Swamp [3]
- ☐ - ☐ Shrub/Old Field [2]
- ☐ - ☐ Residential/Park [1]
- ☐ - ☐ Fenced Pasture [1]
- ☐ - ☐ Conservation Tillage [1]
- ☐ - ☐ Open Pasture/Row Crop [0]
- ☐ - ☐ Urban/Industrial [0]
- ☐ - ☐ Mining/Construction [0]

Bank Erosion

L - R (Per Bank)
- ☐ - ☐ None/Little [3]
- ☐ - ☐ Moderate [2]
- ☒ - ☒ Heavy/Severe [1]

Score
Max 10

8

Comments: _____

POOL / GLIDE QUALITY

Maximum Depth

(Check only 1)
- ☐ > 36” [6]
- ☒ 28-36” [4]
- ☐ 16-28” [2]
- ☐ 8-16” [1]
- ☐ < 8” [0]

Morphology

(Average if 2 are checked)
- ☒ Pool width > Riffle width [2]
- ☐ Pool width = Riffle width [1]
- ☐ Pool width < Riffle width [0]

Current Velocity

(riffle – pool: Check all that apply)
- ☐ - ☐ Eddies [1]
- ☐ - ☐ Very Fast [1]
- ☒ - ☐ Fast [1]
- ☒ - ☐ Moderate [1]
- ☐ - ☒ Slow [1]
- ☐ - ☐ Torrential [-1]
- ☐ - ☐ Interstitial [-1]
- ☐ - ☐ Intermittent [-2]

Score
Max 12

9

Comments: _____

RIFFLE / RUN QUALITY

Riffle Depth
- ☒ > 4” [2]
- ☐ 2-4” [1]
- ☐ < 2” [0]

Run Depth
- ☐ > 20” [2]
- ☒ < 20” [1]

Riffle/Run Substrate
- ☐ Stable (cobble/boulder) [2]
- ☒ Moderate (gravel) [1]
- ☐ Unstable (sand) [0]

Riffle/Run Embeddednes
- ☐ None [2]
- ☐ Low [1]
- ☒ Moderate [0]
- ☐ Extensive [-1]

Score
Max 8

4

Comments: Velocity 20ft in 13sec in runs

STREAM GRADIENT

See gradient table below for scoring

Gradient (ft/mi): 6-10

Drainage area (sq. mi.): _____

Score
Max 10

10

Comments: Estimated from USGS 7.5 min topographic map

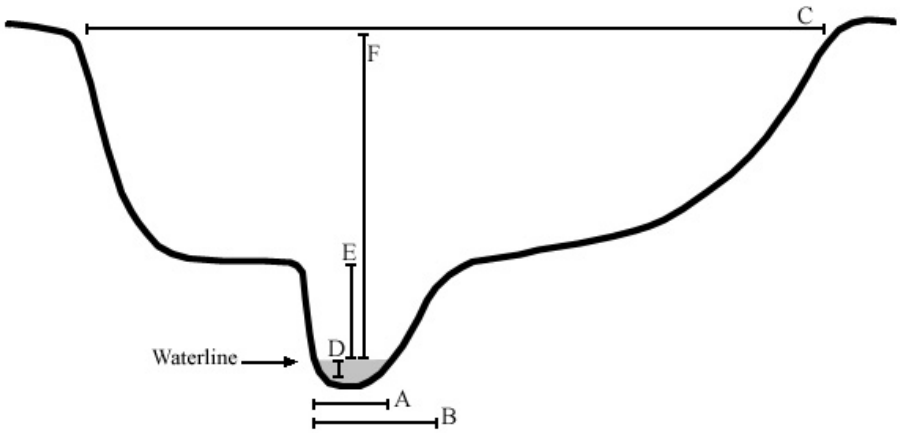
Stream width	Drainage Area (square miles)	Gradient (feet/mile) Very Low	Low	Moderate Low	Moderate	Moderate High	High	Very High
<5’	<9	0-1 = 2	1-5 = 4	5-10 = 6	10-15 = 8	15-20 = 10	20-30 = 10	30-40 = 8
5-9’	9-42	0-1 = 2	1-3 = 4	3-6 = 6	6-12 = 10	12-18 = 10	18-30 = 8	30-40 = 6
9-14’	42-104	0-1 = 2	1-2.5 = 4	3-5 = 6	5-8 = 8	8-12 = 10	12-20 = 8	20-30 = 6
14-31’	104-623	0-1 = 4	1-2 = 6	2-4 = 8	4-6 = 10	**6-10 = 10**	10-15 = 8	15-25 = 6
>31’	>623		0-5 = 6	0.5-1 = 8	1-3 = 10	3-4 = 10	4-9 = 10	>9 = 8

QUALITATIVE HABITAT EVALUATION INDEX

STREAM SEGMENT DESCRIPTION

	Riffle	Run/Glide	Pool
(A) Average width FLOW	11’	11’	25’
(B) Average width MAIN CHANNEL	26’	27’	36’
(C) Average width FLOODPLAIN	39’	*Same for all*	
(D) Average depth FLOW	5”	10”	17”
(E) Average depth MAIN CHANNEL	48”	*Same for all (see below)*	
(F) Average depth FLOODPLAIN (entrenchment)	7’	*Same for all*	

% Pool	50
% Riffle	10
% Glide	- - -
% Run	40



Is sampling reach representative of stream? ☒ Yes ☐ No

Please provide a brief description of the general aesthetic and physical condition of the stream.
Be sure to name any suspected sources of impacts to the stream (i.e. agricultural practices, urban runoff, industrial facilities, etc.)

The main channel is entrenched and cut off from the floodplain except in 100 year type events. The normal high water mark from 2 year events is at ~4 ft so this depth is substituted for the depth of the main channel.

QHEI SCORE

	Calculated	*Maximum*
Substrate	20	20
In-stream Cover	8	20
Channel Morphology	14	20
Riparian Zone and Bank Erosion	8	10
Pool / Glide Quality	9	12
Riffle / Run Quality	4	8
Stream Gradient	10	10
TOTAL	**73**	**100**

Water Quality Parameters
Temperature: 12.4˚ C
Specific Conductance: 2.5 µS
Dissolved Oxygen: 9.58 (89.7% saturation)
pH: 8.1

PHOTOGRAPHS / SKETCHES OF STREAM SEGMENT

The sampling section of Grove Branch is located north of the Macon/Shelby line near Hilvety Airport. This township section was formerly, based off the 1800's government land office maps, a prairie stream. The holding is an 80 acre tract that has ~30 acres in row crop production and the rest is forested. The X marks the general location where sampling began (sampling movement was downstream).

Aerial oblique photographs were not available for this site

Riparian Area

The entire stream within the District's holding has a wide forested buffer. The overstory canopy is dominated by hedge with a lush /dense understory of Virginia rye and sedge. Bluebells were in bloom at the time of the survey and there were very large patches present. The site appears to have been in use as a pasture prior to the District's ownership and species diversity is fairly low but well vegetated.

Riffle substrate

Streambed

Gravel, sand, and silt were the predominant substrate of the streambed. Embeddedness could be considered moderate in the riffles; however, a very thick layer of silt was present in the depositional areas of the stream and the primary substrate of the pools was silt. Detrital packs were abundant and the amount of woody material in the stream is high. There was no in-stream vegetation but the inside banks and gravel bars had non-woody vegetation present.

Run substrate

The stream has an abundance of woody material in channel

Pool substrate

The riffles are fairly confined and long runs between the pools are typical

Morphology and Bank Stability

The three photos on the left are typical outside bends; they represent a high potential for mass wasting. The amount of logs within the channel is a direct result of bank instability (see below) as the banks are undercut. The channel has a very high degree sinuosity with sharp bends. The point bars located at the bends (see above) are generally enlarged from deposition. Rootwads are abundant from fallen trees but rootmats are generally not present. The stream is entrenched approximately seven feet. Riffles are fairly condensed and long runs and pools are the dominant features within the stream.

Table 1: Collected Macroinvertebrates, Grove Branch

Class	Order	Suborder	Family	Genus	(Stage)	Common Name
Insecta	Coleoptera	Adephaga	Dytiscidae	- - -	Larva	Predaceous Diving Beetle
Insecta	Coleoptera	Adephaga	Dytiscidae	- - -	Juvenile	Predaceous Diving Beetle
Insecta	Diptera	Netmatocera	Tipulidae	- - -	Larva	Craneflies
Insecta	Diptera	Netmatocera	Chironomidae	- - -	Larva	Non-biting Midges
Insecta	Hemiptera	Gerromorpha	Veliidae	*Microvelia*	Adult	Broad Shouldered Water Striders
Insecta	Odonata	Zygoptera	Coenagrionidae	*Enallagma*	Naiad	Narrow-winged Damselflies
Insecta	Plecoptera	Setipalpia	Chloroperlidae	- - -	Larva	Green Stoneflies
Insecta	Tricoptera	Annulipalpia	Polycentropidae	*Neureclipsis*	Larva	Tube-Making / Trumpet-Net Caddisflies
Malacostraca	Isopoda	Asellota	Asellidae	*Asellus*	Adult	Aquatic Sow Bugs
Oligochaeta	- - -	- - -	- - -	- - -	Adult	Aquatic Worms
Pelecypoda	Unionoida		Sphaeriidae	- - -	Adult	Fingernail Clams

Table 2: Collected Fish, Grove Branch

Class	Order	Family	Scientific Name	Common Name
Osteichthyes	Cypriniformes	Cyprinidae	*Notemigonus crysoleucas*	Golden Shiner
Osteichthyes	Cypriniformes	Cyprinidae	*Pimephales notatus*	Bluntnose Minnow
Osteichthyes	Cypriniformes	Cyprinidae	*Semotilus atromaculatus*	Creek Chub
Osteichthyes	Perciformes	Centrarchidae	*Lepomis cyanellus*	Green Sunfish
Osteichthyes	Perciformes	Centrarchidae	*Lepomis macrochirus*	Bluegill

QUALITATIVE HABITAT EVALUATION INDEX

Stream: Sand Creek Location: Sand Creek Park (sampled at willow ford – T15N, R2E, Sec 1)
County: Macon Date: April 22, 2006
Investigator(s): Bryan Cross and Joseph Bartletti
General weather conditions (has it been raining in the past three days?) No rain in previous 3 days; however the past several weeks have produced a considerable amount of precipitation. Sunny, lower 70's

SUBSTRATE

Type*

		Pool	Riffle
☐ - ☐	Slabs [10]		
☐ - ☒	Boulder [9]		1
☐ - ☒	Cobble [8]	5	15
☒ - ☐	Gravel [7]	35	50
☐ - ☒	Sand [6]	30	34
☐ - ☐	Bedrock [5]		
☐ - ☒	Hardpan [4]		In runs
☐ - ☒	Detritus [3]	10	
☐ - ☐	Muck [2]		
☐ - ☒	Silt [2]	20	
☐ - ☐	Artificial [0]		

Substrate Origin
Average if 2 are checked

- ☐ Limestone [1]
- ☒ Tills [1]
- ☐ Wetlands [0]
- ☐ Hardpan [0]
- ☐ Sandstone [0]
- ☐ Rip-Rap [0]
- ☐ Lacustrine [0]
- ☐ Shale [-1]
- ☐ Coal fines [-2]

Substrate Quality
Average if 2 are checked

- ☐ Silt Heavy [-2]
- ☐ Silt Moderate [-1]
- ☒ Silt Normal [0]
- ☐ Silt Free [1]

Silt Embeddedness:

- ☐ Extensive [-2]
- ☐ Moderate [-1]
- ☒ Normal [0]
- ☐ None [1]

Number of Substrate Types:
- ☒ 4 or more [2]
- ☐ 3 or less [0]

*ignore point source sludge, left box = dominant, right box = co-dominant, estimate percent composition

Score
Max 20
20

Comments:

IN-STREAM COVER

Type
(Check all that occur)

- ☒ Undercut banks [1]
- ☐ Overhanging Vegetation [1]
- ☐ Shallows (in slow water) [1]
- ☐ Rootmats [1]
- ☒ Rootwads [1]
- ☒ Pools >28" [2]
- ☐ Oxbows, backwaters [1]
- ☒ Aquatic Macrophytes [1]
- ☒ Logs or Woody Debris [1]
- ☒ Boulders [1]

Amount
Average if 2 are checked

- ☐ Extensive (>75%) [11]
- ☒ Moderate (25-75%) [7]
- ☐ Sparse (5-25%) [3]
- ☐ Nearly Absent (<5%) [1]

Score
Max 20
14

Comments:

CHANNEL MORPHOLOGY

Average if 2 are checked

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]	☐ No Recovery [1]	

Additional Information
No Score

Modifications

- ☐ Snagging
- ☐ Relocation
- ☐ Canopy Removal
- ☐ Dredging
- ☐ Impounded
- ☐ Island(s)
- ☐ Levied
- ☐ Bank Shaping

Score
Max 20
17

Comments: Gravel and sand major substrate component, results in moderate stability

QUALITATIVE HABITAT EVALUATION INDEX

RIPARIAN ZONE AND BANK EROSION

≪ L/R relative to looking DOWNSTREAM ≪

Riparian Width

L - R (Per Bank)
- ☒ - ☒ Wide (>50m) [4]
- ☐ - ☐ Moderate (10-50m) [3]
- ☐ - ☐ Narrow (5-10m) [2]
- ☐ - ☐ Very Narrow (<5m) [1]
- ☐ - ☐ None [0]

Floodplain Quality

L - R (Per Bank)
- ☒ - ☒ Forest, Swamp [3]
- ☐ - ☐ Shrub/Old Field [2]
- ☐ - ☐ Residential/Park [1]
- ☐ - ☐ Fenced Pasture [1]
- ☐ - ☐ Conservation Tillage [1]
- ☐ - ☐ Open Pasture/Row Crop [0]
- ☐ - ☐ Urban/Industrial [0]
- ☐ - ☐ Mining/Construction [0]

Bank Erosion

L - R (Per Bank)
- ☐ - ☐ None/Little [3]
- ☒ - ☒ Moderate [2]
- ☐ - ☐ Heavy/Severe [1]

Score
Max 10

9

Comments: Stream within forested park

POOL / GLIDE QUALITY

Maximum Depth

(Check only 1)
- ☒ > 36” [6]
- ☐ 28-36” [4]
- ☐ 16-28” [2]
- ☐ 8-16” [1]
- ☐ < 8” [0]

Morphology

(Average if 2 are checked)
- ☒ Pool width > Riffle width [2]
- ☐ Pool width = Riffle width [1]
- ☐ Pool width < Riffle width [0]

Current Velocity

(riffle – pool: Check all that apply)
- ☐ - ☐ Eddies [1]
- ☐ - ☐ Very Fast [1]
- ☒ - ☐ Fast [1]
- ☒ - ☒ Moderate [1]
- ☐ - ☒ Slow [1]
- ☐ - ☐ Torrential [-1]
- ☐ - ☐ Interstitial [-1]
- ☐ - ☐ Intermittent [-2]

Score
Max 12

11

Comments: Velocity 20ft in 12sec in runs

RIFFLE / RUN QUALITY

Riffle Depth
- ☒ > 4” [2]
- ☐ 2-4” [1]
- ☐ < 2” [0]

Run Depth
- ☐ > 20” [2]
- ☒ < 20” [1]

Riffle/Run Substrate
- ☐ Stable (cobble/boulder) [2]
- ☒ Moderate (gravel) [1]
- ☐ Unstable (sand) [0]

Riffle/Run Embeddednes
- ☐ None [2]
- ☒ Low [1]
- ☐ Moderate [0]
- ☐ Extensive [-1]

Score
Max 8

5

Comments:

STREAM GRADIENT

See gradient table below for scoring

Gradient (ft/mi): 10-15

Drainage area (sq. mi.):

Score
Max 10

8

Comments: Estimated from USGS 7.5 min topographic map

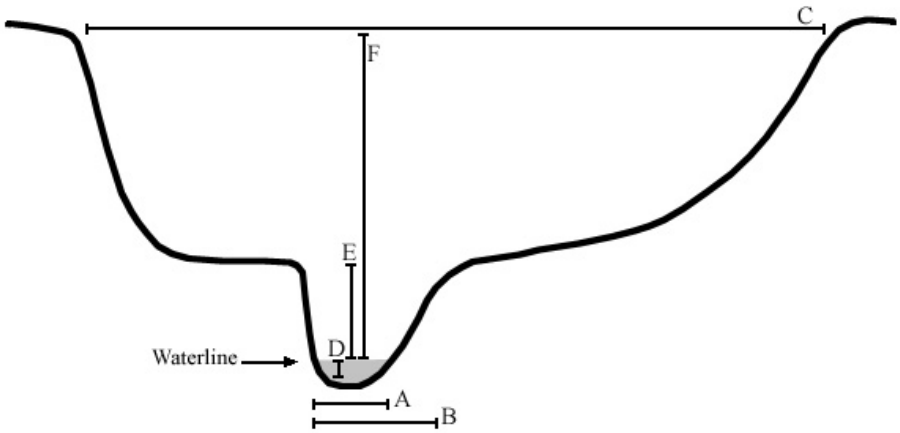
Stream width	Drainage Area (square miles)	Gradient (feet/mile) Very Low	Low	Moderate Low	Moderate	Moderate High	High	Very High
<5’	<9	0-1 = 2	1-5 = 4	5-10 = 6	10-15 = 8	15-20 = 10	20-30 = 10	30-40 = 8
5-9’	9-42	0-1 = 2	1-3 = 4	3-6 = 6	6-12 = 10	12-18 = 10	18-30 = 8	30-40 = 6
9-14’	42-104	0-1 = 2	1-2.5 = 4	3-5 = 6	5-8 = 8	8-12 = 10	12-20 = 8	20-30 = 6
14-31’	104-623	0-1 = 4	1-2 = 6	2-4 = 8	4-6 = 10	6-10 = 10	**10-15 = 8**	15-25 = 6
>31’	>623		0-5 = 6	0.5-1 = 8	1-3 = 10	3-4 = 10	4-9 = 10	>9 = 8

QUALITATIVE HABITAT EVALUATION INDEX

STREAM SEGMENT DESCRIPTION

	Riffle	Run/Glide	Pool
(A) Average width FLOW	8’	13’	21’
(B) Average width MAIN CHANNEL	23’	27’	27’
(C) Average width FLOODPLAIN	33’	*Same for all*	
(D) Average depth FLOW	5”	7”	31”
(E) Average depth MAIN CHANNEL	36”	*Same for all (see below)*	
(F) Average depth FLOODPLAIN (entrenchment)	7.5’	*Same for all*	

% Pool	40
% Riffle	30
% Glide	- - -
% Run	30



Is sampling reach representative of stream? ☒ Yes ☐ No

Please provide a brief description of the general aesthetic and physical condition of the stream.
Be sure to name any suspected sources of impacts to the stream (i.e. agricultural practices, urban runoff, industrial facilities, etc.)

The main channel is entrenched and cut off from the floodplain except in 100 year type events. The normal high water mark from 2 year events is at ~3 ft so this depth is substituted for the depth of main channel.

QHEI SCORE

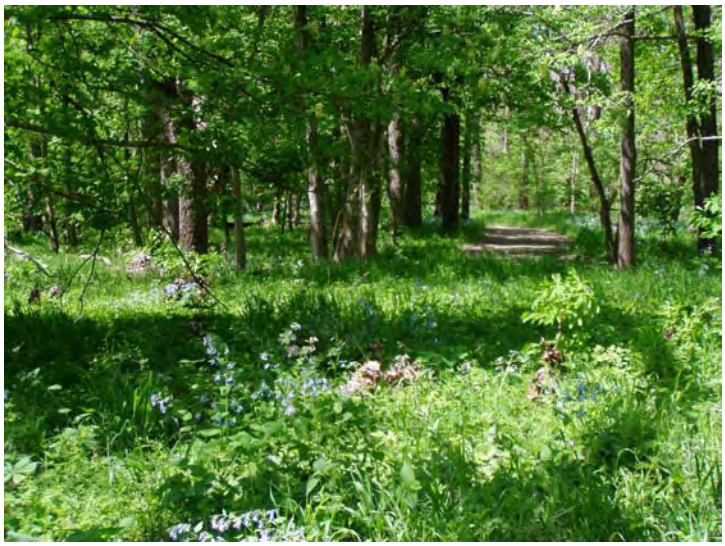
	Calculated	*Maximum*
Substrate	20	20
In-stream Cover	14	20
Channel Morphology	17	20
Riparian Zone and Bank Erosion	9	10
Pool / Glide Quality	11	12
Riffle / Run Quality	5	8
Stream Gradient	8	10
TOTAL	**84**	**100**

Water Quality Parameters
Temperature: 14.9˚ C
Specific Conductance: 537 µS
Dissolved Oxygen: 8.47 (84% saturation)
pH: 8.17

PHOTOGRAPHS / SKETCHES OF STREAM SEGMENT

The sampling section of Sand Creek is located northeast of the intersection of South Franklin Street Road and East Elwin Road. This township section was formerly, based off the 1800's government land office maps, a mixture of forest and prairie. The holding is approximately 780 acres. The X marks the general location where sampling began (sampling movement was downstream).

The arrow marks the general location where sampling began.


The stream has a well developed floodplain forest adjacent to it

Riparian Area

Sand Creek Recreational Area is nearly 800 acres and comprises a substantial drainage area of Sand Creek. The land in the park has been out of agricultural production since the 70's. The topography of the park area made much of the land adjacent to the stream un-farmable so the stream has had a well developed forested buffer prior to the Districts ownership. The flat floodplain forest areas are dominated by sycamore, walnut, cottonwood, and maple. The steep upland slopes adjoining the stream are oak-hickory dominated. Generally, the understory is well vegetated with species indicative of rich woods.

The stream is forested along both banks throughout the park

Wooded ravines border the stream throughout much of the park

Riffle substrate

Streambed

The stream is aptly named, and is sand-gravel dominated Boulders and cobbles are present, but are a much smaller component. The pools are not silt laden and have a predominantly sand bottom. The rich woods surrounding the stream provide ample woody debris and have created numerous log-jams. Embeddedness is low. There were no aquatic macrophytes observed growing in the stream bed; although extended algal mats were found clinging to cobble along reach. The log jams created habitat both by providing substrate in the stream and creating large scour pools.

Run substrate

Log jams are present along the length of the stream

Pool substrate

Algal mats are attached to cobble within the stream

Stream has braided areas along length of stream

Morphology and Bank Stability

The stream is entrenched approximately seven feet and both banks are actively eroding. The stream has a well developed riffle-pool system and is apparently passing much of the bed-load as the pools are not silt dominant.

Wide gravel bars are present throughout

The stream is quite meandrous and has undercut both inside and outside banks in areas

Tight meander bends have steeply cut outside banks

Table 1: Collected Macroinvertebrates, Sand Creek

Class	Order	Suborder	Family	Genus	(Stage)	Common Name
Hirudinea	- - -	- - -	- - -	- - -	Adult	Leech
Insecta	Coleoptera	Adephaga	Dytiscidae	- - -	Larva	Predaceous Diving Beetle
Insecta	Coleoptera	Adephaga	Haliplidae	*Peltodytes*	Adult	Crawling Water Beetles
Insecta	Diptera	Netmatocera	Chironomidae	- - -	Larva	Non-biting Midges
Insecta	Diptera	Netmatocera	Simulidae	- - -	Larva	Black flies, Buffalo Gnats
Insecta	Ephemoptera	- - -	Baetidae	- - -	Larva	Small Minnow Mayflies
Insecta	Hemiptera	Gerromorpha	Gerridae	*Aquarius*	Adult	Water Striders
Insecta	Odonata	Anisoptera	Libellulidae	- - -	Naiad	Percher-Skimmer Dragonflies
Insecta	Odonata	Zygoptera	Coenagrionidae	- - -	Naiad*	Narrow-winged Damselflies
Insecta	Plecoptera	Euholognatha	Taeniopterygidae	- - -	Larva	Winter Stoneflies
Insecta	Plecoptera	Systellognatha	Perlidae	*Acroneuria*	Larva	Common Stoneflies
Insecta	Tricoptera	Annulipalpia	Polycentropidae	*Neureclipsis*	Larva	Tube-Making / Trumpet-Net Caddisflies
Malacostraca	Decopoda	Pleocyemata	Cambaridae	*Cambarus*	Adult	Crayfish
Malacostraca	Isopoda	Asellota	Asellidae	*Asellus*	Adult	Aquatic Sow Bugs

Table 2: Collected Fish, Sand Creek

Class	Order	Family	Scientific Name	Common Name
Osteichthyes	Clupeiformes	Clupeidae	Dorosoma cepedianum	Gizzard Shad
Osteichthyes	Perciformes	Centrarchidae	Lepomis cyanellus	Green Sunfish
Osteichthyes	Perciformes	Centrarchidae	Lepomis macrochirus	Bluegill
Osteichthyes	Perciformes	Percidae	Etheostoma asprigene	Mud Darter