# APPENDIX HH

# FISH, UNIONID, AND CRAYFISH REPORT

# Final Report:
# Fish, Unionid, and Crayfish Community Characterization of the I-69 Tier 2 Section 5 Corridor Bloomington to Martinsville Monroe to Morgan Counties, Indiana

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## 1.0 Introduction

Fish, unionid (freshwater mussel), and crayfish surveys were conducted as one component of investigations for the I-69 Tier 2 Section 5 project corridor. The corridor extends from Bloomington, Indiana northerly to Martinsville, Indiana and centers on the existing State Route (SR 37). Eight streams are crossed by SR 37 between the southern and northern termini of the I-69 Tier 2 study corridor; all are tributaries to the White River basin (Figure 1-1).

The White River Basin supports species-rich fish and unionid (freshwater mussel) communities. One hundred and fifty-three (153) species of fish representing 25 families have been identified in the White River Basin in Indiana (Appendix A). Of those, 13 are listed by Indiana Department of Natural Resources (IDNR) as endangered or of special concern (Table 1-1). The White River Basin historically supported 72 unionid species and 59 unionid species have been reported since 1989. Eighteen (18) unionid species are listed as endangered or special concern in Indiana and seven of these are federally-listed as endangered or are federal candidate species (see Table 1-1). These include the federally-endangered *Cyprogenia stegaria*, *Epioblasma obliquata perobliqua*, *Epioblasma torulosa rangiana*, *Epioblasma torulosa torulosa*, *Pleurobema clava,* and *Pleurobema plenum* (Appendix B). *Cyprogenia stegaria*, *E. torulosa torulosa* and *P. clava* are identified for the West Fork White River (Cummings *et al.*, 1991). Of these three, the only species thought to be extant in the White River is *C. stegaria* (ESI, 2002; Thomas Simon, USFWS, pers. comm., 2004; Brant Fisher, Indiana DNR, pers. comm., 2004)

The purpose for this survey was to characterize the fish, mussel, and crayfish communities, describe stream habitat characteristics, report on any state or federally-listed species that may be present, and compare results of similar studies on these streams. Species of potential occurrence within the study area that are of particular interest to the U. S. Fish and Wildlife Service (USFWS) and the Indiana Department of Natural Resources (IDNR), include *Ammocrypta pellucida* (eastern sand darter), an undescribed subspecies of mud darter, *Etheostoma cf. asprigene* (Thomas Simon, pers. comm., 2004; Brant Fisher, Indiana DNR, pers. comm., 2004), and the fanshell (*C. stegaria*). The species were identified based on historical records for the project area.

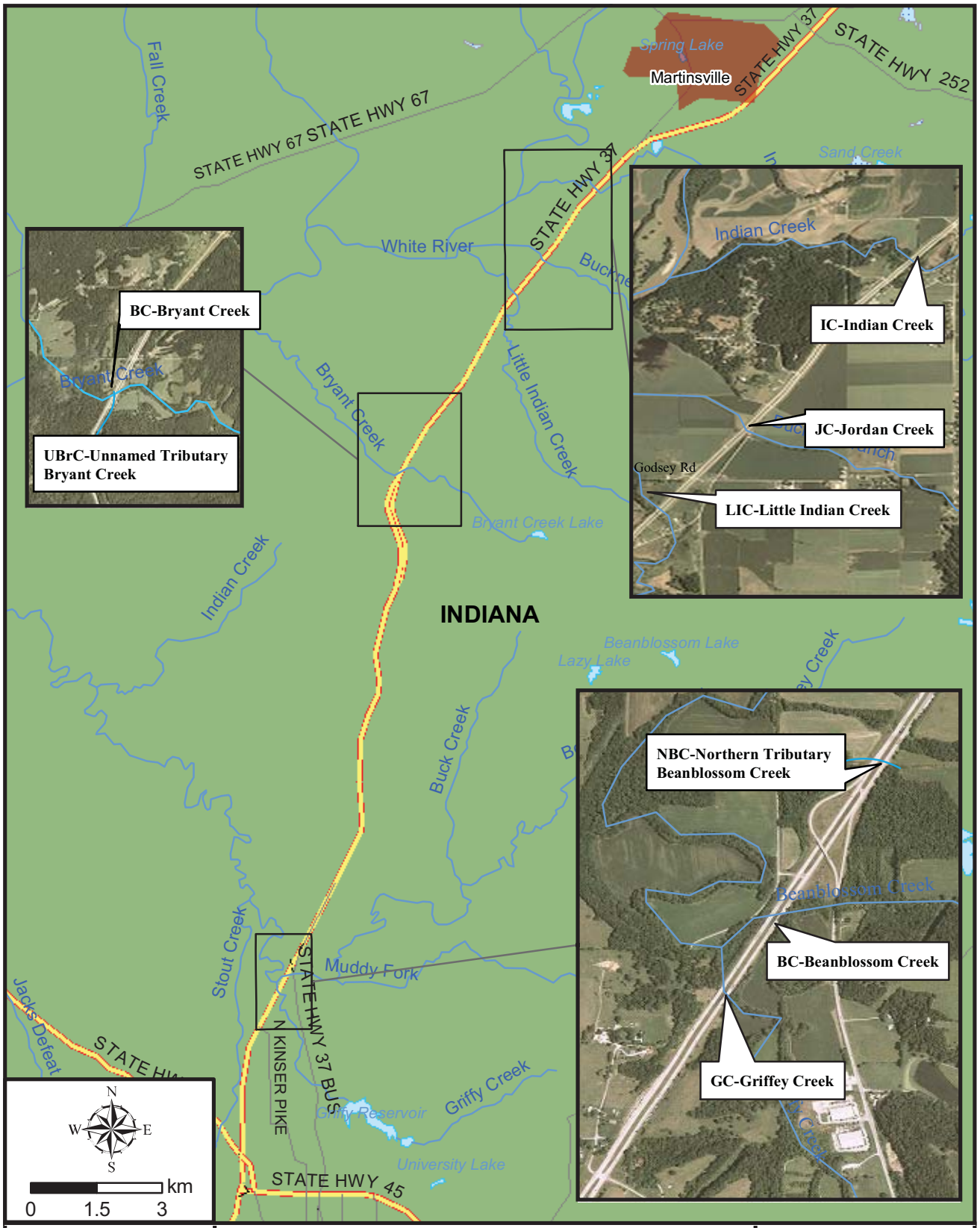


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Figure 1-1. Streams investigated for fish, unionids, habitat and crayfish within the I-69 Tier 2 Section 5 study area, 2004-2006.

ESI

Table 1-1. Federal and state listed species of the White River Basin in Indiana, 2006.

| Species[1] | | Status[2] Federal | State | White River[3] | West Fork White River[4] |
|---|---|---|---|---|---|
| **Mollusks** | | | | | |
| Unionidae | | | | | |
| *Cyprogenia stegaria* | Fanshell | FE | E | X | X |
| *Epioblasma obliquata perobliqua* | White catspaw | FE | E | X | --- |
| *Epioblasma torulosa rangiana* | Northern riffleshell | FE | E | X | X |
| *Epioblasma torulosa torulosa* | Tubercled blossom | FE | E | X | X |
| *Epioblasma triquetra* | Snuffbox | --- | E | X | --- |
| *Fusconaia subrotunda* | Longsolid | --- | E | X | X |
| *Lampsilis fasciola* | Wavyrayed lampmussel | --- | SC | X | --- |
| *Obovaria subrotunda* | Round hickorynut | --- | SC | X | X |
| *Pleurobema clava* | Clubshell | FE | E | X | X |
| *Pleurobema cordatum* | Ohio pigtoe | --- | SC | X | --- |
| *Pleurobema plenum* | Rough pigtoe | FE | E | X | --- |
| *Pleurobema rubrum* | Pyrimid pigtoe | --- | E | X | X |
| *Ptychobrnchus fasciolaris* | Kidneyshell | --- | SC | X | X |
| *Quadrula cylindrica* | Rabbitsfoot | --- | E | X | X |
| *Simpsonaias ambigua* | Salamander mussel | --- | SC | X | --- |
| *Toxolasma lividus* | Purple lilliput | --- | SC | X | --- |
| *Villosa fabalis* | Rayed bean | FC | SC | X | --- |
| *Villosa lienosa* | Little spectaclecase | --- | SC | X | --- |
| **Fishes** | | | | | |
| Acipenseridae (Sturgeons) | | | | | |
| *Acipenser fulvescens* | Lake sturgeon | --- | E | X | --- |
| Catostomidae (Suckers) | | | | | |
| *Cycleptus elongatus* | Blue sucker | --- | SC | X | --- |
| *Moxostoma carinatum* | River redhorse | --- | SC | X | --- |
| Amblyopsidae (Cavefishes) | | | | | |
| *Amblyopsis spelaea* | Northern cavefish | --- | E | X | --- |
| Fundulidae (Topminnows) | | | | | |
| *Fundulus catenatus* | Northern studfish | --- | SC | X | --- |
| Centrarchidae (Sunfish and Basses) | | | | | |
| *Lepmois symmetricus* | Bantam sunfish | --- | SC | X | --- |
| Percidae (Perches and Darters) | | | | | |
| *Ammocrytpa pellucida* | Eastern sand darter | --- | SC | X | --- |
| *Etheostoma camurum* | Bluebreast darter | --- | E | X | --- |
| *Etheostoma histrio* | Harlequin darter | --- | E | X | --- |
| *Etheostoma maculatum* | Spotted darter | --- | E | X | --- |
| *Etheostoma tippecanoe* | Tippecanoe darter | --- | E | X | --- |
| *Etheostoma variatum* | Variegate darter | --- | E | X | --- |
| *Percina evides* | Gilt darter | --- | E | X | --- |

[1] Mollusk nomenclature follows Turgeon *et al*. (1998); Fish nomenclature follows Nelson et al. (2004)
[2] Indiana DNR (2003); USFWS (2004); FE = Federally Endangered; FC = Federal Candidate; E = Endangered; SC = Special Concern
[3] Cummings *et al*. (1991); Crawford *et al*. (1996)
[4] Cummings *et al*. (1991)

## 2.0 Methods

Eight streams were identified within the project corridor based on aerial photography and topographic maps. These streams were investigated for fish, unionids, crayfish, and habitat: Griffey Creek (GC), Beanblossom Creek (BC), North tributary to Beanblossom Creek (NBC), Unnamed tributary to Bryant Creek (UBrC), Bryant Creek (BrC), Little Indian Creek (LIC), Jordan Creek (JC), and Indian Creek (IC) (see Figure 1-1). Preliminary investigation determined that Jordan Creek would not receive sampling for fish, crayfish, or unionids. Jordan Creek appears to be an intermittent stream and was dry at the time of review therefore only habitat was evaluated at this site. Fish and unionid sampling was conducted between 12 to 17, October 2004. Habitat evaluations, additional fish sampling on Bryant and North tributary to Beanblossom creeks, and crayfish sampling was conducted 29 to 30, June 2005. The unnamed tributary to Bryant Creek was conducted May 2006. A Qualitative Habitat Evaluation Index (QHEI) form was completed for all streams.

### 2.1 Fish Survey

Four of the six streams (Griffey Creek (GC), Beanblossom Creek (BC), Little Indian (LIC) and Indian Creeks (IC)) were sampled for fish using a DC-pulse tote barge electrofishing unit. Since the purpose of the survey was to characterize the fish community in terms of species composition and presence/absence of target species within the project corridor, 200m sections within the corridor were delineated in each stream. The sampling area for each stream was defined as that length of stream extending 100m downstream of the center of State Route (SR) 37 bridge to a point approximately 100m upstream of that bridge. Access to Little Indian Creek at both SR 37 and Old SR 37 bridge crossings was not possible; therefore, the stream was accessed at the Godsey Road bridge (see Figure 1-1). The stream was sampled for 200m from Godsey Road upstream to within approximately 50m of the SR 37 bridge crossing. This segment of Little Indian Creek was partially within the project corridor and similar in landuse, stream characteristics, and habitat to Little Indian Creek in the project corridor upstream of SR 37 bridge. Since the segments were similar in characteristics and in close proximity to each other, the fish communities were presumed similar.

Electrofishing began at the downstream point and continued to the upstream end. Effort expended at sites ranged from 9.6 to 21.9 electrofishing minutes. Stunned fish were collected and placed in a 19L bucket until processed. Those specimens too large for the bucket were processed immediately. Fish were identified, counted, measured for length (mm; total length for fish larger than 100mm) and weight (g). Fish smaller than 100mm were batch weighed. Those fish smaller than 100mm and/or sole representatives of a species were not weighed due to equipment limitations. Fish not readily identified in the field were preserved with 10% formalin and returned to the laboratory for identification. Laboratory specimens were not measured for length and were not weighed because of

possible preservation induced distortions (Anderson and Neumann, 1996).

Three of the streams (North Tributary to Beanblossom Creek (NBC), Bryant Creek (BrC), and unnamed tributary to Bryant Creek (UBrC)) were too small for sampling with a tote barge electrofishing unit, thus fish were sampled using a 3mm (0.125in) mesh seine (October 2004 sampling) and/or a Wisconsin battery-powered backpack electrofisher (June 2005 and May 2006 sampling). Sites were demarcated as described above. Methods ranged from kick seining in shallow, rocky, and sandy areas; dragging the seine through deeper pools; and electrofishing the entire reach (200m). Seined areas totaled approximately 50m to 70m of stream at each site. All habitats were representatively sampled. *Ammocrypta pellucida* and *E. cf. asprigene* prefer shallow sand/gravel and sluggish riffle habitats and backwater areas with organic material; therefore, efforts were concentrated in those areas. All collected fish were identified and counted as described above.

Metrics used to describe the fish community included abundance (total number of fish caught), species richness (number of species collected), catch-per-unit-effort (CPUE), evenness, and Shannon-Weiner diversity. The CPUE is the number of fish caught per unit of effort (meter or minute). Evenness represents the relative abundance of each species throughout the community in the study reach, and Shannon-Weiner diversity index measures the diversity of the study reach. Shannon Weiner diversity index collectively evaluates abundance, richness, and evenness of a site. Photodocumentation of sites is presented in Appendix C.

2.2 Unionid Survey

Because species richness is a function of the number of individuals collected, qualitative methods (freely collecting all unionids encountered) were used to characterize the unionid community at each of the six sites (Strayer and Smith, 2003). The survey area was the same as that for fish and was defined as that length of stream extending 100m downstream of the center of State Route (SR) 37 bridge to a point approximately 100m upstream of that bridge. Unsuitable habitat areas (very shallow, thick vegetation, or thick silt over substrate) were avoided. Unionids require burrowable substrate in water with sufficient flow to prevent sedimentation, but without enough flow to render the substrate unstable (Vaughn, 1997). Biologists visually and tactually searched for at least 1.5 work person hours (wph), concentrating their efforts in the highest quality habitats (clean substrates in flowing areas). All shells were collected and identified. Freshly-dead (lustrous nacre, periostracum intact, animal probably dead $\leq$1 year), weathered dead (dull, chalky nacre, periostracum heavily eroded, animal likely dead >2-3 months), and live unionids were identified, counted, measured (length in mm), and aged (external annuli count). Habitat parameters including substrate, velocity, land use, and riparian vegetation were recorded.

2.3 Crayfish Survey

Crayfish were sampled using guidance outlined in the *Standard Operating Procedures for the Collection and Study of Burrowing Crayfish in Indiana* (Simon, 2004). Crayfish were originally to be collected while sampling for fish; however, fish were sampled in October 2004, which is when some crayfish are inactive (Simon, 2004; Thomas Simon, pers. comm., 2004). Therefore, crayfish sampling was postponed until June 2005 and conducted in the same reaches as fish sampling. A Wisconsin battery backpack electrofishing unit was used to collect crayfish. Stunned crayfish were netted or hand collected and placed into a 19L bucket until preserved. In areas where crayfish densities were high (>100 individuals), only a representative sample was retained. All crayfish were preserved with 70% ethanol and 10% formalin solution. Crayfish samples were sent to the USFWS Bloomington Field Office for identification by Dr. Thomas Simon.

2.4 Habitat Evaluation

An Indiana Department of Environmental Management (IDEM) Qualitative Habitat Evaluation Index (QHEI) was calculated for each of the eight streams. The purpose of the QHEI (Ohio EPA, 1989) was to assess each of the sites ability to support biota (fish and macroinvertebrates). Instream habitat and surrounding land use were evaluated and six metrics were scored to obtain an overall QHEI score. The higher the score a site received the better the habitat with a maximum achievable score equaling 100. The six metrics evaluated were substrate, instream cover, channel morphology, riparian zone and bank erosion, pool/glide quality, riffle/run quality, and gradient.

## 3.0 Results

### 3.1 Fish Survey

A total of 1,412 fish representing 46 species and 11 families were collected from seven streams within the I-69 Tier 2 Section 5 corridor (Table 3-1). The catch per unit effort (CPUE) ranged from 2.9 to 22.9 fish/min and 0.8 to 3.6 fish/m. Habitat varied among sites. In general, Indian Creek, Little Indian Creek, Bryant Creek and unnamed tributary to Bryant Creek exhibited more habitat diversity and richness (i.e., riffle/run/pool sequences, variety of fish habitats, and moderate flow rates); a combination of conditions that are necessary to support a diverse fish community. Griffey Creek, Beanblossom Creek, and the North Tributary to Beanblossom Creek were generally more homogeneous in terms of habitat (little to no flow, mud/silt/sand substrate). None of the fish species identified by INDNR or USFWS as potentially occurring in the corridor (*A. pellucida* and *E. cf. asprigene*) or any other federal or state listed fish species were collected at any of the surveyed locations.

*Griffey Creek*

Griffey Creek was small and stream morphology differed between upstream and downstream sampling reaches near the SR 37 bridge. Water depths upstream of SR 37 averaged 0.5m and stream width averaged 4.0m. Water depths downstream averaged 1.5m deep and stream width averaged 6.0m wide. Habitat underneath the bridge and in the upstream reach was shallow and substrate consisted of sand and gravel with a few riffle/run sequences. The surveyed reach downstream of SR 37 was generally deep and habitat was homogeneous, consisting of sand and clay with steeply sloping banks. Stable substrate was virtually absent except for a few cobble/boulders just downstream of the bridge. Landuse in the area was predominantly agriculture and the riparian zone was row crop/pasture upstream of SR 37 and forested in the downstream reach.

The fish community reflected the small stream nature of the site with primarily pool species and a few riffle/run species. A total of 125 fish representing 17 species were collected from Griffey Creek (Table 3-1). The dominant species were *Lepomis humilis* (43.2%) and *Hypentelium nigricans* (12.8%). Other species present and comprising less than 10% of the total catch were *Lepomis macrochirus* (N=10), *Pimephales notatus* (N=9), *Etheostoma nigrum* (N=8), and *Cyprinella whipplei* (N=7). Eight of the 17 species were measured for length and/or weight (Table 3-2). The remaining species were either too small or returned to the laboratory for processing. The CPUE was 13.0fish/min and effort expended at this site was 9.6min. Shannon-Weiner diversity (2.90) and evenness (0.71) were moderate.

*Beanblossom Creek*

Water depth in Beanblossom Creek averaged 1m and stream width was approximately 10 to 15m.

Table 3-1. Fish species collected along the I-69 Tier 2 Section 5 corridor (1 of 2).

| | Site[1] | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GC[2] | | BC[2] | | NBC[2] | | NBC[3] | | UBrC[4] | | BrC[2] | | BrC[3] | | LIC[2] | | IC[2] | | Total | |
| **Species** | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % |
| **Clupeidae (Herrings)** | | | | | | | | | | | | | | | | | | | | |
| *Dorosoma cepedianum* | - | - | 10 | 18.2% | - | - | - | - | - | - | - | - | - | - | 8 | 4.5% | 2 | 0.4% | 20 | 1.4% |
| **Cyprinidae (Carps and Minnows)** | | | | | | | | | | | | | | | | | | | | |
| *Campostoma pullum* | - | - | - | - | - | - | - | - | 4 | 4.4% | - | - | 17 | 8.8% | 2 | 1.1% | 9 | 1.8% | 32 | 2.3% |
| *Cyprinella spiloptera* | 5 | 4.0% | 2 | 3.6% | - | - | - | - | - | - | 3 | 5.5% | - | - | - | - | 243 | 48.5% | 253 | 17.9% |
| *Cyprinella whipplei* | 7 | 5.6% | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 47 | 9.4% | 54 | 3.8% |
| *Cyprinus carpio* | - | - | 1 | 1.8% | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | 0.1% |
| *Hybognanthus nuchalis* | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 34 | 19.3% | - | - | 34 | 2.4% |
| *Luxilus chrysocephalus* | - | - | - | - | - | - | - | - | - | - | 4 | 7.3% | 1 | 0.5% | 5 | 2.8% | - | - | 10 | 0.7% |
| *Lythrurus umbratilis* | - | - | - | - | - | - | - | - | 1 | 1.1% | - | - | - | - | - | - | - | - | 1 | 0.1% |
| *Notropis atherinoides* | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | 0.2% | 1 | 0.1% |
| *Notropis blennius* | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | 0.2% | 1 | 0.1% |
| *Notropis stramineus* | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | 0.2% | 1 | 0.1% |
| *Opsopoedus emiliae* | - | - | - | - | 54 | 29.8% | - | - | - | - | - | - | - | - | - | - | - | - | 54 | 3.8% |
| *Phoxinus erythrogaster* | - | - | - | - | - | - | - | - | - | - | - | - | 15 | 7.8% | - | - | - | - | 15 | 1.1% |
| *Pimephales notatus* | 9 | 7.2% | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 23 | 4.6% | 32 | 2.3% |
| *Pimephales vigilax* | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 11 | 2.2% | 11 | 0.8% |
| *Rhynichthys atratulus* | - | - | - | - | - | - | - | - | 2 | 2.2% | - | - | 1 | 0.5% | - | - | - | - | 3 | 0.2% |
| *Semotilus atromaculatus* | - | - | - | - | - | - | - | - | 25 | 27.5% | 25 | 45.5% | 97 | 50.3% | - | - | - | - | 147 | 10.4% |
| **Catostomidae (Suckers)** | | | | | | | | | | | | | | | | | | | | |
| *Carpiodes velifer* | - | - | 2 | 3.6% | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2 | 0.1% |
| *Catostomus commersoni* | - | - | - | - | - | - | - | - | - | - | - | - | 1 | 0.5% | - | - | 1 | 0.2% | 2 | 0.1% |
| *Erimyzon oblongus* | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | 0.6% | - | - | 1 | 0.1% |
| *Hypentelium nigricans* | 16 | 12.8% | - | - | - | - | - | - | - | - | - | - | - | - | 25 | 14.2% | 23 | 4.6% | 64 | 4.5% |
| *Minytrema melanops* | 1 | 0.8% | 1 | 1.8% | - | - | - | - | - | - | - | - | - | - | 2 | 1.1% | 2 | 0.4% | 6 | 0.4% |
| *Moxostoma duquesnei* | 1 | 0.8% | - | - | - | - | - | - | - | - | - | - | - | - | 1 | 0.6% | 7 | 1.4% | 9 | 0.6% |
| *Moxostoma erythrurum* | - | - | 6 | 10.9% | - | - | - | - | - | - | - | - | - | - | 2 | 1.1% | 3 | 0.6% | 11 | 0.8% |
| **Ictaluridae (Bullhead Catfish)** | | | | | | | | | | | | | | | | | | | | |
| *Ictalurus punctatus* | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | 0.2% | 1 | 0.1% |
| *Noturus miurus* | 1 | 0.8% | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | 0.1% |

Table 3-1. Fish species collected along the I-69 Tier 2 Section 5 corridor (2 of 2).

| | Site[1] | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GC[2] | | BC[2] | | NBC[2] | | NBC[3] | | UBrC[4] | | BrC[2] | | BrC[3] | | LIC[2] | | IC[2] | | Total | |
| **Species** | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % |
| **Esocidae (Pikes)** | | | | | | | | | | | | | | | | | | | | |
| *Esox americanus* | 1 | 0.8% | 1 | 1.8% | - | - | 4 | 11.4% | - | - | - | - | - | - | - | - | - | - | 6 | 0.4% |
| **Umbridae (Mudminnows)** | | | | | | | | | | | | | | | | | | | | |
| *Umbra limi* | - | - | - | - | - | - | 6 | 17.1% | - | - | - | - | - | - | - | - | - | - | 6 | 0.4% |
| **Poeciliidae (Livebearers)** | | | | | | | | | | | | | | | | | | | | |
| *Gambusia affinis* | - | - | - | - | 122 | 67.4% | 25 | 71.4% | - | - | - | - | - | - | - | - | - | - | 147 | 10.4% |
| **Atherinidae (Silversides)** | | | | | | | | | | | | | | | | | | | | |
| *Labidesthes sicculus* | 1 | 0.8% | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | 0.1% |
| **Centrarchidae (Sunfish)** | | | | | | | | | | | | | | | | | | | | |
| *Lepomis cyanellus* | 3 | 2.4% | - | - | - | - | - | - | - | - | - | - | - | - | 2 | 1.1% | - | - | 5 | 0.4% |
| *Lepomis humilis* | 54 | 43.2% | 11 | 20.0% | - | - | - | - | - | - | - | - | 1 | 0.5% | 15 | 8.5% | 20 | 4.0% | 101 | 7.2% |
| *Lepomis macrochirus* | 10 | 8.0% | 17 | 30.9% | 5 | 2.8% | - | - | - | - | 6 | 10.9% | 12 | 6.2% | 38 | 21.6% | 1 | 0.2% | 89 | 6.3% |
| *Lepomis megalotis* | 2 | 1.6% | 1 | 1.8% | - | - | - | - | - | - | - | - | 5 | 2.6% | 2 | 1.1% | 4 | 0.8% | 14 | 1.0% |
| *Lepomis microlophus* | - | - | 1 | 1.8% | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | 0.1% |
| *Lepomis punctatus* | - | - | - | - | - | - | - | - | - | - | - | - | 2 | 1.0% | - | - | - | - | 2 | 0.1% |
| *Lepomis X* | 1 | 0.8% | - | - | - | - | - | - | - | - | - | - | - | - | 2 | 1.1% | - | - | 3 | 0.2% |
| *Micropterus salmoides* | 3 | 2.4% | 1 | 1.8% | - | - | - | - | - | - | - | - | - | - | 10 | 5.7% | 11 | 2.2% | 25 | 1.8% |
| **Percidae (Perches)** | | | | | | | | | | | | | | | | | | | | |
| *Etheostoma blennoides* | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 12 | 2.4% | 12 | 0.8% |
| *Etheostoma caeruleum* | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2 | 0.4% | 2 | 0.1% |
| *Etheostoma flabellare* | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | 0.2% | 1 | 0.1% |
| *Etheostoma nigrum* | 8 | 6.4% | - | - | - | - | - | - | - | - | 4 | 7.3% | 2 | 1.0% | 26 | 14.8% | 36 | 7.2% | 76 | 5.4% |
| *Etheostoma spectabile* | 1 | 0.8% | - | - | - | - | - | - | 59 | 64.8% | 13 | 23.6% | 39 | 20.2% | - | - | - | - | 112 | 7.9% |
| *Percina maculata* | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | 0.6% | 1 | 0.2% | 2 | 0.1% |
| *Percina sciera* | 1 | 0.8% | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 38 | 7.6% | 39 | 2.8% |
| **Sciaenidae (Drums)** | | | | | | | | | | | | | | | | | | | | |
| *Aplodinotus grunniens* | - | - | 1 | 1.8% | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | 0.1% |
| **Total** | 125 | | 55 | | 181 | | 35 | | 91 | | 55 | | 193 | | 176 | | 501 | | 1412 | |
| **No. of Species[5]** | 17 | | 13 | | 3 | | 3 | | 5 | | 6 | | 12 | | 16 | | 25 | | 46 | |
| **Shannon-Weiner Diversity[5]** | 2.90 | | 2.86 | | 1.04 | | 1.14 | | 1.31 | | 2.13 | | 2.24 | | 3.14 | | 2.88 | | - | |
| **Evenness[5]** | 0.71 | | 0.77 | | 0.66 | | 0.72 | | 0.56 | | 0.82 | | 0.63 | | 0.79 | | 0.62 | | - | |
| **Method** | Electrofish | | Electrofish | | Seine | | Electrofish | | Electrofish | | Seine | | Electrofish | | Electrofish | | Electrofish | | - | |
| **Effort (minutes shocktime or meters)** | 9.6min | | 18.7min | | 50.0m | | 11.5min | | 18.4min | | 70.0m | | 12.5min | | 11.8min | | 21.9min | | - | |
| **Catch per Unit Effort (CPUE)** | 13.0 | | 2.9 | | 3.6 | | 3.0 | | 4.9 | | 0.8 | | 15.4 | | 15.0 | | 22.9 | | - | |

[1]GC = Griffey Creek; BC = Beanblossom Creek; NBC = Northern Tributary to Beanblossom Creek; UBrC = Unnamed tributary to Bryant Creek; BrC = Bryant Creek; LIC = Little Indian Creek; IC = Indian Creek
[2]October 2004 sampling event
[3]June 2005 sampling event
[4]May 2006 sampling event
[5]Excludes hybrid sunfish

Table 3-2. Average, maximum, and minimum lengths and weights for fish species measured from the I-69 Tier 2 Section 5 corridor (1 of 2).

| Site[1] | Species | | N[2] | Max. Length (mm) | Min. Length (mm) | Avg. Length (mm) | N[2] | Max. Weight (g) | Min. Weight (g) | Avg. Weight (g) |
|---|---|---|---|---|---|---|---|---|---|---|
| GC | *Esox americanus* | Redfin pickerel | 1 | 165.0 | --- | --- | 1 | 34.0 | --- | --- |
| | *Hypentelium nigricans* | Northern hogsucker | 2 | 310.0 | 310.0 | **310.0** | 1 | 304.0 | --- | --- |
| | *Lepomis cyanellus* | Green sunfish | - | --- | --- | --- | 1 | 11.0 | --- | --- |
| | *Lepomis humilis* | Orangespotted sunfish | - | --- | --- | --- | 2 | 114.0 | 67.0 | **90.5** |
| | *Lepomis megalotis* | Longear sunfish | 2 | 153.0 | 148.0 | **150.5** | 2 | 93.0 | 60.0 | **76.5** |
| | *Lepomis X* | Sunfish hybrid | - | --- | --- | --- | 1 | 28.0 | --- | --- |
| | *Micropterus salmoides* | Largemouth bass | 3 | --- | --- | **62.0** | 2 | --- | --- | **2.0** |
| | *Minytrema melanops* | Spotted sucker | 1 | 298.0 | --- | --- | 1 | 268.0 | --- | --- |
| BC | *Aplodinotus grunniens* | Freshwater drum | 1 | 475.0 | --- | --- | - | --- | --- | --- |
| | *Carpiodes velifer* | Highfin carpsucker | 1 | 210.0 | --- | --- | 1 | 132.0 | --- | --- |
| | *Cyrpinus carpio* | Common carp | 1 | 450.0 | --- | --- | 1 | --- | --- | --- |
| | *Dorosoma cepedianum* | Gizzard shad | 10 | 241.0 | 165.0 | **200.6** | 9 | 110.0 | 43.0 | **71.4** |
| | *Esox americanus* | Redfin pickerel | 1 | 115.0 | --- | --- | - | --- | --- | --- |
| | *Lepomis humilis* | Orangespotted sunfish | - | --- | --- | --- | 2 | 36.0 | 15.0 | **25.5** |
| | *Lepomis megalotis* | Longear sunfish | 1 | 128.0 | --- | --- | 1 | 40.0 | --- | --- |
| | *Lepomis microlophus* | Redear sunfish | 1 | 175.0 | --- | --- | 1 | 85.0 | --- | --- |
| | *Micropterus salmoides* | Largemouth bass | 1 | 115.0 | --- | --- | 1 | 13.0 | --- | --- |
| | *Minytrema melanops* | Spotted sucker | 1 | 320.0 | --- | --- | 1 | 380.0 | --- | --- |
| | *Moxostoma erythrurum* | Golden redhorse | 6 | 362.0 | 222.0 | **302.5** | 6 | 520.0 | 123.0 | **345.7** |
| NBC[3] | *Esox americanus* | Redfin pickerel | 4 | 115.0 | 95.0 | **108.0** | - | --- | --- | --- |
| | *Gambusia affinis* | Mosquitofish | 25 | 15.0 | 15.0 | **15.0** | - | --- | --- | --- |
| UBrC[4] | *Campostoma pullum* | Central stoneroller | 8 | 105.0 | 72.0 | **94.7** | - | --- | --- | --- |
| | *Etheostoma specatbile* | Orangethroat darter | 43 | 65.0 | 30.0 | **47.3** | 43 | --- | --- | 1.3 |
| | *Rhinicthys atratulus* | Blacknose dace | 1 | 60.0 | --- | --- | - | --- | --- | --- |
| | *Semotilus atromacultus* | Creek chub | 2 | 130.0 | --- | --- | 2 | 25.0 | 23.0 | 24.0 |
| BrC[3] | *Campostoma pullum* | Central stoneroller | 17 | 86.0 | 65.0 | **72.2** | - | --- | --- | --- |
| | *Catastomas commersoni* | White sucker | 1 | 280.0 | --- | --- | - | --- | --- | --- |
| | *Etheostoma spectabile* | Orangethroat darter | 13 | 44.0 | 32.0 | **39.3** | - | --- | --- | --- |
| | *Lepomis macrochirus* | Bluegill | 13 | 96.0 | 35.0 | **63.7** | - | --- | --- | --- |
| | *Lepomis megalotis* | Longear sunfish | 5 | 120.0 | 90.0 | **105.0** | - | --- | --- | --- |
| | *Phoxinus erythrogaster* | Southern redbelly dace | 15 | 75.0 | 59.0 | **66.0** | - | --- | --- | --- |
| | *Semotilus atromaculatus* | Creek chub | 25 | 210.0 | 25.0 | **96.8** | - | --- | --- | --- |

Table 3-2. Average, maximum, and minimum lengths and weights for fish species measured from the I-69 Tier 2 Section 5 corridor (2 of 2).

| Site[1] | Species | | N[2] | Max. Length (mm) | Min. Length (mm) | Avg. Length (mm) | N[2] | Max. Weight (g) | Min. Weight (g) | Avg. Weight (g) |
|---|---|---|---|---|---|---|---|---|---|---|
| LIC | *Dorosoma cepedianum* | Gizzard shad | 8 | 230.0 | 115.0 | **164.4** | 8 | 120.0 | 10.0 | **55.1** |
| | *Erimyzon oblongus* | Creek chubsucker | 1 | 170.0 | --- | **---** | 1 | 42.0 | --- | --- |
| | *Hybognanthus nuchalis* | Mississippi silvery minnow | - | --- | --- | **---** | 34 | --- | --- | **9.9** |
| | *Hypentelium nigricans* | Northern hogsucker | 22 | 290.0 | 125.0 | **202.8** | 22 | 225.0 | 18.0 | **83.7** |
| | *Lepomis cyanellus* | Green sunfish | - | --- | --- | **---** | 2 | --- | --- | **31.0** |
| | *Lepomis humilis* | Orangespotted sunfish | - | --- | --- | **---** | 15 | --- | --- | **194.0** |
| | *Lepomis megalotis* | Longear sunfish | - | --- | --- | **---** | 1 | 42.0 | --- | --- |
| | *Lepomis X* | Sunfish hybrid | 2 | 105.0 | 65.0 | **85.0** | - | --- | --- | --- |
| | *Micropterus salmoides* | Largemouth bass | 4 | 220.0 | 30.0 | **120.0** | 2 | 122.0 | 40.0 | **81.0** |
| | *Minytrema melanops* | Spotted sucker | 2 | 155.0 | 145.0 | **150.0** | 2 | 30.0 | 26.0 | **28.0** |
| | *Moxostoma erythrurum* | Golden redhorse | 2 | 140.0 | 135.0 | **137.5** | 2 | 20.0 | 20.0 | **20.0** |
| IC | *Dorosoma cepedianum* | Gizzard shad | 2 | 240.0 | 210.0 | **225.0** | 12 | 140.0 | 98.0 | **119.0** |
| | *Hypentelium nigricans* | Northern hogsucker | 12 | 265.0 | 75.0 | **121.7** | 7 | 266.0 | 6.0 | **69.3** |
| | *Lepomis humilis* | Orangespotted sunfish | 18 | 125.0 | 50.0 | **83.5** | 10 | 90.0 | 4.0 | **22.4** |
| | *Lepomis megalotis* | Longear sunfish | 4 | 130.0 | 115.0 | **123.8** | 4 | 50.0 | 30.0 | **39.8** |
| | *Micropterus salmoides* | Largemouth bass | 8 | 180.0 | 55.0 | **79.8** | 2 | 72.0 | 62.0 | **67.0** |
| | *Minytrema melanops* | Spotted sucker | 2 | 320.0 | 150.0 | **235.0** | 1 | 275.0 | --- | --- |
| | *Moxostoma erythrurum* | Golden redhorse | 3 | 280.0 | 95.0 | **164.3** | 2 | 244.0 | 8.0 | **126.0** |

[1] GC = Griffey Creek; BC = Beanblossom Creek; LIC = Little Indian Creek; IC = Indian Creek; NBC = North tributary to Beanblossom Creek; BrC = Bryant Creek; UBrC = Unnamed Tributary to Bryant Creek

[2] N = number of individuals measured

[3] June 2005 sampling only

[4] May 2006 sampling

Instream habitat appeared inferior in relation to other streams in the study corridor. Stable substrate was represented by large woody debris. Flow was minimal and substrate was predominantly silt and mud. Landuse in the immediate area was agriculture and the riparian zone was forest. An out-of-service water treatment facility was present upstream of the SR 37 bridge. The fish community reflected the poor habitat conditions and homogeneous stream morphology present in Beanblossom Creek. A total of 55 individuals representing 13 species were collected from Beanblossom Creek, however, several of these species were representative of lake or lentic habitats (see Table 3-1). The three dominant species were *L. macrochirus* (30.9%), *L. humilis* (20.0%), and *Dorosoma cepedianum* (18.2%). Eleven (11) of the species were measured for length and/or weight (see Table 3-2). The remaining species were either too small or returned to the laboratory for processing. The CPUE was 2.9fish/min and effort expended was 18.7min. Shannon-Weiner diversity (2.86) was moderate, and evenness (0.77) was good.

*North Tributary to Beanblossom Creek*

The North Tributary to Beanblossom Creek was pooled just underneath the SR 37 bridge. A low water dam dividing the stream was present approximately 50m upstream of the bridge. The stream was visually assessed upstream of the low water dam and it appeared to be an agricultural/farm pond with no observable inflow or outflow: the pooled area appeared to be underground seepage through the dam. Fish sampling was not conducted upstream of the low water dam due to project scope, accessibility, and habitat conditions (0.5m layer of thick mud, excessive algal growth, inundated conditions). The pooled area located at the SR 37 bridge crossing was shallow (0.5m deep) and approximately 30m wide. Substrate was sand and concrete/asphalt rip-rap with submerged aquatic vegetation. The pooled area drains into a small stream approximately 0.25m deep and 2m wide flowing for approximately 150m before disappearing or flowing subterraneously. Substrate in this portion of the stream was sand and gravel and there was little observable flow. Landuse in the area was agriculture and the riparian zone was pasture and forest.

A total of 216 fish representing five species were collected in October 2004 and June 2005 from the North Tributary to Beanblossom Creek. One hundred and eighty-one (181) individuals representing three species were collected in October 2004 (see Table 3-1). The two dominant species collected were *Gambusia affinis* (67.4%) and *Opsopoedus emiliae* (29.8%). Thirty-five (35) fish representing 3 species were collected in June 2005. The dominant species were *G. affinis* (71.4%) and *Umbra limi* (17.1%). *Opsopoedus emiliae* and *L. macrochirus* were not collected during the June 2005 sampling. *Umbra limi* and *Esox americanus* were not collected during the October 2004 sampling event. Only fish collected in the June 2005 were measured for length. Fish were not measured for weight due to equipment limitations and most of the individuals collected were returned to the laboratory for processing. A variety of gear types were used to collect fish. Seining was conducted in October 2004,

and backpack electrofishing was used in June 2005. Because gear types differed between sampling events, CPUE, abundance, Shannon-Weiner diversity, and evenness were calculated separately for each event. The CPUE of the October 2004 sampling was 3.6 fish/m and approximately 50m of the 200m stream reach was seined (effort). The CPUE of the June 2005 sampling was 3.0 fish/min and effort expended was 11.5min. Shannon-Weiner diversity was low, 1.04 and 1.14, respectively. Evenness was moderate for the October 2004 sampling (0.66) and was slightly higher for the June 2005 sampling (0.72).

*Bryant Creek*

Bryant Creek was a relatively small stream, water depths ranged from 0.5 to 1m and stream widths averaged 2m to 3m. Riffle/run sequences were prevalent and substrate was sand, gravel, and cobble. Flow was moderate and substrate was moderately stable (represented by cobbles and large woody debris). Landuse in the area was agriculture and the riparian zone was predominantly forest and fallow fields throughout the surveyed reach. The fish community was typical of a small stream with primarily riffle/run and headwater species.

A total of 248 fish representing 12 species were collected from Bryant Creek. Fifty-five (55) fish representing six species were collected in October 2004 and 193 fish representing 11 species were collected in June 2005 (see Table 3-1). Species collected in 2005 not collected in October 2004 included: *Lepomis punctatus*, *Lepomis megalotis*, *L. humilus*, *Catastomus commersoni*, *Rhinichthys atratulus*, *Phoxinus erythrogaster*, and *Campostoma pullum*. Similarly, *Cyprinella spiloptera* was collected in October 2004 but not in June 2005. The two dominant species collected in October 2004 and June 2005 were *Semotilus atromaculatus* (45.5% and 50.3%, respectively) and *E. spectabile* (23.6%, and 20.2%, respectively). None of the species collected in October 2004 were measured for length or weight due to equipment limitations and most of the individuals collected were returned to the laboratory for processing. Species not retained for laboratory identification and/or verification from both the 2004 and 2005 sampling events were measured for length. Weights were not taken due to equipment limitations and most of the individuals collected were returned to the laboratory for processing. Different gear types were used to collect fish; seining was employed in October 2004, and backpack electrofishing was used in June 2005. Because gear types differed between sampling events CPUE, abundance, Shannon-Weiner diversity, and evenness were calculated separately for each event. The CPUE for the October 2004 sampling was 0.8 fish/m and approximately 70m of the 200m stream reach was seined (effort). The CPUE for the June sampling event was 15.4 fish/min for 12.5min. Shannon-Weiner diversity and evenness were 2.13 and 0.82, respectively, in October 2004 and 2.24 and 0.63, respectively, in June 2005.

*Unnamed Tributary to Bryant Creek*

The unnamed tributary to Bryant Creek was a small stream, water depths ranged from 0.1 to 0.4m and stream widths averaged 0.5m to 2m. Riffle/run sequences were prevalent and substrate was bedrock and gravel. Flow was moderate and substrate was stable. Landuse in the area was predominantly forest and wetlands throughout the surveyed reach. The stream flows through the median that separates the north and southbound lanes of existing SR 37. The fish community was similar to Bryant Creek and species composition was typical of a small stream with primarily riffle/run and headwater species.

Ninety-one (91) fish representing five species were collected from the unnamed tributary to Bryant Creek (see Table 3-1). The dominant species collected was *E. spectabile* (64.8%). Species not retained for laboratory identification and/or verification were measured for length. Weights were taken in aggregate for the *E. spectabile*, *C. pullum*, and *S. atromaculatus* (see Table 3-2). The CPUE was 4.9 fish/min and approximately 200m of stream was electrofished in 18.4min (effort). Shannon-Weiner diversity and evenness were 1.31 and 0.56, respectively (see Table 3-1).

*Little Indian Creek*

Little Indian Creek was between 0.75m and 1.5m deep and approximately 3m wide. Riffle/run sequences were present at the surveyed location though not evident at the SR 37 crossing. Substrate was sand and mud with gravel and small cobble in the riffles. Stable substrate was represented by boulders, large cobbles, and large woody debris. Landuse in the area was row-crop agriculture and the riparian zone was forest and pasture.

A total of 176 fish representing 16 species were collected from Little Indian Creek. The dominant species were *L. macrochirus* (21.6%), *Hybognanthus nuchalis* (19.3%), *E. nigrum* (14.8%), and *H. nigricans (*14.2%). Seven of the species were measured for length and weight. All other species were either sole representatives and too small or returned to the laboratory for processing. The CPUE was 15.0 fish/min and effort expended was 11.8 min. The Shannon-Weiner diversity (3.14) and evenness (0.79) were moderate to high at this site.

*Indian Creek*

Indian Creek was between 0.25m and 2.5m deep and was between 5m and 25m wide. The deepest portions of the stream were directly underneath the SR 37 bridge (created from scour). Riffle/run sequences were well developed throughout the site, and substrate was predominantly sand and small gravel. Stable substrate was represented by large woody debris. Upstream of SR 37, Indian Creek becomes very shallow (<0.5m). Additionally, a waterline/pipe crosses the stream

approximately 20m upstream from the northbound SR 37 bridge.

A total of 501 fish representing 25 species were collected (see Table 3-1). The dominant species was *Cyprinella spiloptera* (48.5%). Other dominant species present though each comprising less than 10% of the total catch included *C. whipplei*, *Percina sciera*, *E. nigrum*, *H. nigricans*, *L. humilis*, and *Etheostoma blennioides*. The CPUE was 22.9 fish/min and effort expended at this site was 21.9 min. Shannon-Weiner diversity (2.88) and evenness (0.62) were moderate at this site. Some of the species were measured for length and weight. All others were either sole representatives, too small to be measured, or returned to the laboratory for processing.

3.2 Unionid Survey

Unionids generally occur in shallow riffle/run areas where current velocity is sufficient to prevent silt accumulation but low enough to allow substrate stability (Vaughn, 1997). Two areas with seemingly suitable unionid habitat were found within the study area (Indian Creek and Little Indian Creek). Habitat for unionids was lacking in Griffey Creek, Beanblossom Creek, North Tributary to Beanblossom Creek, Bryant Creek, and unnamed tributary to Bryant Creek due to poor stream conditions (low current velocity, substrate of bedrock, clay and/or silt, and stream size). A total of ten species (live, freshdead, wathered dead) were collected. No state or federal species were observed.

Only three live unionids, *Pyganodon grandis*, *Lampsilis cardium*, and *Strophitus undulatus*, were collected in this study (Table 3-3). In addition to the live unionids, seven other species were collected as fresh or weathered dead shells. These species include *Fusconaia flava*, *Lampsilis siliquoidea, Lampsilis teres, Lasmigona costata, Leptodea fragilis, Utterbackia imbecillis,* and *Amblema plicata*. Both the live *P. grandis* and *L. cardium* were observed at the downstream end in the riffle/pool complex in Indian Creek and were not visible at the substrate surface (only found by grubbing through the substrate). Approximately 4.5wph were spent searching for unionids at this site.

A single live *S. undulatus* was observed in Little Indian Creek at the substrate surface in June 2005 during the crayfish sampling. No other live unionids were observed at Little Indian Creek in June 2005. Approximately 1.5 wph were spent searching for unionids at this site.

Shell material collected from Beanblossom Creek represented species tolerant of a wide range of habitat conditions. Approximately 2 wph were spent visually and tactually searching for unionids. Species collected as weathered dead shells were *Amblema plicata* and *L. siliquoidea*. In addition, three fresh dead shells of *L. fragilis* were collected. No live unionids were collected.

Table 3-3. Unionid species collected from the I-69 Tier 2 Section 5 corridor.

| Site* | Species | | No. | L | H | W |
|---|---|---|---|---|---|---|
| GC | None Observed | | | | | |
| BC | *Amblema plicata* | Threeridge | 1 WD | | | |
| | *Lampsilis siliquoidea* | Fatmucket | 2 WD | | | |
| | *Leptodea fragilis* | Fragile papershell | 3 FD | | | |
| NBC | *Pyganodon grandis* | Giant floater | 1 FD | | | |
| | *Utterbackia imbecillis* | Paper pondshell | 1 FD | | | |
| UBrC | None Observed | | | | | |
| BrC | None Observed | | | | | |
| LIC | *Strophitus undulatus* | Creeper | 1 L | 51.1 | 30.5 | 19.1 |
| IC | *Pyganodon grandis* | Giant Floater | 1 L | 110.0 | 59.0 | 42.2 |
| | *Fusconaia flava* | Wabash pigtoe | 1 WD | | | |
| | *Lampsilis cardium* | Plain pocketbook | 1 L | 89.1 | 74.0 | 47.6 |
| | *Lampsilis siliqouidea* | Fatmucket | 2 WD | | | |
| | *Lampsilis teres* | Yellow sandshell | 1 WD | | | |
| | *Lasmigona costata* | Fluted shell | 1 WD | | | |
| | *Leptodea fragilis* | Fragile papershell | 1 FD | | | |
| | *Utterbackia imbecillis* | Paper pondshell | 1 FD | | | |

* GC = Griffey Creek; BC = Beanblossom Creek; NBC = Northern Tributary to Beanblossom Creek; UBrC = Unnamed tributary to Bryant Creek; BrC = Bryant Creek; LIC = Little Indian Creek; IC = Indian Creek

L = live; FD = fresh dead; WD = weathered dead

Shell material collected from the Northern tributary to Beanblossom Creek consisted of two species, *P. grandis* and *U. imbecillis* (see Table 3-3). Both of these were fresh dead shells (<1 year old) and are typically found in pond or lentic conditions. Approximately 1.5 wph were spent visually and tactually searching for unionids at this site. No live unionids were observed.

### 3.3 Crayfish Sampling

Only two species of crayfish were collected from the study area, *Orconectes (Gremicambarus) virilis* (Northern crayfish) and *Cambarus (Tubericambarus) polychromatus* (Paintedhand mudbug). A total of 141 crayfish were collected and all but one individual was *O. G. virilis* (Table 3-4). Bryant Creek and North tributary to Beanblossom Creek appeared to have a high density population for over 100 individuals were collected in the sampled reaches. However, only a few were retained and preserved from each of the locations. Specimens retained were representative of the entire reach sampled, size classes exhibited, and morphological characteristics observed. No crayfish were collected or observed from unnamed tributary to Bryant Creek.

### 3.4 Habitat Evaluation

QHEI scores varied among the eight streams evaluated. Jordan Creek had the lowest score (25) and Bryant Creek had the highest (64) (Table 3-5). Generally, the riffle/run metric scored low (≤4) among all sites whereas all other metrics were variable. QHEI forms for each site are located in Appendix D.

Table 3-4. Crayfish species collected along the I-69 Tier 2 Section 5 corridor.

| Site[1] | Species | 2004 | 2005 |
|---|---|---|---|
| GC | *Orconectes (Gremicambarus) virilis* | 4 | 9 |
| BC | *Orconectes (Gremicambarus) virilis* | 2 | 12 |
| NBC | *Orconectes (Gremicambarus) virilis* | 3 | 31 |
| | *Cambarus (Tubericambarus) polychromatus* | 0 | 1 |
| BrC | *Orconectes (Gremicambarus) virilis* | 6 | 37 |
| LIC | *Orconectes (Gremicambarus) virilis* | 1 | 29 |
| IC | *Orconectes (Gremicambarus) virilis* | 2 | 4 |

[1]GC = Griffey Creek; BC = Beanblossom Creek; NBC = Northern Tributary to Beanblossom Creek; BrC = Bryant Creek; LIC = Little Indian Creek; IC = Indian Creek; No crayfish collected or observed in UBrC.

Table 3-5. QHEI individual and overall metric scores of streams evaluated along the I-69 Tier 2 Section 5 corridor.

| | Site[1] | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Metric | GC | BC | NBC | UBrC | BrC | LIC | JC | IC |
| Substrate | 1 | 0.5 | 12 | 16.5 | 17 | 11.5 | 1 | 15 |
| Instream Cover | 8 | 8 | 6 | 7 | 12 | 8 | 12 | 8 |
| Channel Morphology | 5 | 7 | 5 | 17 | 13.5 | 13 | 7 | 10 |
| Riparian Zone and Bank Erosion | 6 | 6 | 8 | 8.5 | 4.5 | 7 | 3 | 9.5 |
| Pool/Glide Quality | 8 | 8 | 2 | 5 | 9 | 9 | 0 | 9 |
| Riffle/Run Quality | 0 | 0 | 0 | 3.5 | 2 | 4 | 0 | 4 |
| Gradient | 6 | 2 | 0 | 6 | 6 | 6 | 2 | 6 |
| QHEI Score | 34 | 31.5 | 33 | 63.5 | 64 | 58.5 | 25 | 61.5 |

[1]GC = Griffey Creek; BC = Beanblossom Creek; NBC = Northern Tributary to Beanblossom Creek; UBrC = Unnamed tributary to Bryant Creek; BrC = Bryant Creek; LIC = Little Indian Creek; JC = Jordan Creek; IC = Indian Creek

**4.0 Discussion**

Fish, unionid, and crayfish communities were evaluated for seven streams in the study corridor. Overall, landuse in the study area was agriculture (row-crop or grazing) and habitat within the surveyed streams reflected landuse effects. Most of the streams had evidence of bank sloughing, narrow or poorly developed riparian zones, and instream habitat was limited. Species richness, evenness, and diversity in study streams reflected habitat characteristics and stability. Three of the streams (downstream section of Griffey Creek, Beanblossom Creek, and North Tributary to Beanblossom Creek) were low quality, appeared channelized, had excess sediment/silt, and were uniform in morphology. The upstream section of Griffey Creek and the remaining four streams (unnamed tributary to Bryant Creek, Bryant Creek, Little Indian Creek, and Indian Creek) had complex habitat with stream meanders, a diverse fish community, and/or evidence of unionids.

This study was to determine species composition and if any of the target species identified by the USFWS and INDNR occur in the project corridor. The three species potentially occurring in the study area are *Ammocrypta pellucida* (eastern sand darter), an undescribed species of mud darter *E. cf. asprigene*, and the federal and state endangered *C. stegaria* (fanshell). A statewide survey of *A. pellucida* was initiated in 2001, and results show distribution of this species to be more widespread than originally reported (IDNR, 2002). *Ammocrypta pellucida* historically occurred in the West Fork White River basin as well as the Maumee, Tippecanoe, East Fork White, Wabash, and Whitewater river basins. There have been sporadic collections of *A. pellucida* in these drainages since the 1940's (IDNR, 2002). Habitat degradation has contributed to its decline; however, new populations have been identified in the West Fork White River (Greene County, Indiana) and the East Fork White River (Bartholomew and Jennings Counties, Indiana) (IDNR, 2002).

*Ammocrypta pellucida* prefers clean, sandy runs in small creeks to large rivers (Trautman, 1981; IDNR, 2002). Clean, sandy runs were present in Griffey Creek upstream of SR 37 bridge, Bryant Creek, Little Indian Creek, and Indian Creek. Indian Creek appeared the most suitable for *A. pellucida* based on size, preferred habitat, and fish community composition. Substrate surfaces were generally clean and species similar in trophic guild (insectivores) were also present (*E. blennoides*, *Etheostoma caeruleum*, *Etheostoma flabellare*, *E. nigrum*, *Percina maculata*, and *P. sciera*). However, no *A. pellucida* were collected in this study.

In addition to *A. pellucida*, an undescribed species of *E. cf. asprigene* was targeted at the request of IDNR and the USFWS. *Etheostoma cf. asprigene* differs from *E. asprigene* in morphology and habitat. Both forms have historically been found in Indiana, but they were not recognized as separate species (Collette, 1962). The subspecies is currently being described, but additional specimens are required for further study (Thomas P. Simon, pers. comm., 2004). The preferred

habitat of *E. asprigene* is sloughs and low gradient small streams and rivers rich in organic material. The subspecies *E. cf. asprigene* prefers larger rivers at tributary mouths (Thomas P. Simon, pers. comm., 2004). Habitat for *E. asprigene* was observed in Griffey Creek downstream of SR 37, Beanblossom Creek, Northern Tributary to Beanblossom Creek, Little Indian Creek, and Indian Creek. However, no *E. asprigene* or *E. cf. asprigene* were observed in any of the surveyed streams.

The federal and state listed unionid, *C. stegaria*, prefers gravel substrate in flowing waters of medium to large rivers (Parmalee and Bogan, 1998; USFWS, 1991). This habitat was present only in Indian Creek downstream of the SR 37 bridge. *Cyprogenia stegaria* was historically abundant in the White River; however, surveys conducted in 1966-1967 yielded no live individuals (Cummins *et al.,* 1991). Fresh-dead shells were observed in 1985 in Martin County, Indiana and only weathered dead shells were collected from the White River during 1989-1991 and in 2002 (Cummins *et al.*, 1991; ESI, 2002). No evidence of *C. stegaria* was found in any of the surveyed streams.

The northern crayfish (*O. G. virilis*) was collected from six of the seven streams sampled. This species is relatively common in Indiana and occurs in low gradient warm water streams with abundant cover (Simon, 2001; Pflieger, 1996). The sites where crayfish were collected in abundance (BrC and NBC) were both abundant with cover in the form of woody debris, detritus, or submerged aquatic vegetation. The paintedhand mudbug (*G. T. polychromatus*) was also collected from the project corridor. This species is newly described and is primarily a burrowing species (Thomas Simon, pers. comm., 2005).

*Griffey Creek*

Griffey Creek had relatively homogeneous habitat downstream of the SR 37 bridge. The QHEI score (34) reflects the lack of habitat and influence of landuse in the area. The channel was uniform in depth and width, and structure was limited to some large woody debris, root wads, and undercut banks. All of these habitats are utilized and preferred by Centrarchidae (Trautman, 1981). The fish community in Griffey Creek was species rich but both evenness and diversity were low, as the site was dominated by *L. humilis*. The few representatives of Cyprinidae and Percidae collected from this site were upstream of the SR 37 bridge crossing where habitat changed significantly; the stream became shallow, substrate was gravel and sand, and a few small riffles were present. The *Cyprinella spp*. and *Etheostoma spp*. collected from this site are generally found in flowing streams with sandy gravel substrates (Trautman, 1981). The fish community is viable for multiple age classes were observed from specimens that were measured and collected. Unlike fish that can move into and out of an area, unionids are sedentary and typically occur in stable habitat. Unionids are typically not found in channelized areas with unstable substrate (Yokely, 1976; Strayer and Ralley, 1991) and no unionids were found downstream of the SR 37 bridge. The small stream nature (fluctuating flow

conditions) of Griffey Creek most likely prevents unionid colonization.

*Beanblossom Creek*

Beanblossom Creek was similar to the downstream section of Griffey Creek. Griffey Creek is a major tributary to Beanblossom Creek, and the confluence of the two is within the project corridor. Just upstream of the surveyed reach is a small, low head dam as well as Lemon Lake. Similar to Griffey Creek, the low QHEI score (31.5) was indicative of the lack of habitat and influence of landuse in the area. Stable substrate in the study reach was represented solely by large woody debris and water was not flowing. Water depths were also uniform throughout the surveyed reach. The dominant species at this site are typical pool species and are generally tolerant of homogenous habitat such as those observed in Beanblossom Creek. Species collected from this site appeared to represent several year classes indicating viability within the community. Like Griffey Creek, the Centrarchidae family was dominant. Although CPUE and species richness were lower in Beanblossom Creek than in Griffey Creek, diversity and evenness were higher: fewer individuals of dominant species were collected. Centrarchidae (namely *L. humilis* and *L. macrochirus*) dominated. *Micropterus salmoides* was the only top predator collected and may have come from Lemon Lake.

Beanblossom Creek has reportedly supported a diverse fish community (Table 4-1). Gerking (1945) identifies 35 species from Beanblossom Creek in studies conducted in 1940-1942 and earlier (Eigenmann and Fordice, 1886). There appears to have been a change in diversity in that only 13 species were observed in 2004. Additionally, the number of darter species, has also decreased substantially. Historically, seven species are known from Beanblossom Creek and none were collected in 2004.

Although ideal habitat was lacking in Beanblossom Creek, unionid shells were present. Unionids are typically found in flowing waters of medium to large streams and rivers. They are particularly sensitive to pollution and modification of rivers (Stansbery, 1970, 1971; Fuller, 1974; Havlik and Marking, 1987), such as impoundment, channelization, dredging, instream construction. The resulting siltation and hydrological changes are often cited as the primary reasons for the decline of unionid species (i.e., Stansbery, 1970 and 1971; Stein, 1972; Yokley, 1976; Suloway *et al*., 1981; Miller *et al*., 1984; Williams *et al*., 1992; Parmalee and Hughes, 1993; Hartfield, 1993). Perhaps hosts for these species traveled upstream during high water and dropped newly-metamorphosed juveniles near the dam (Watters, 1996). The unionid species found (*A.plicata, L. siliquoidea, and L. fragilis*) typically tolerate a wide range of habitat conditions. Additionally, both *A. plicata* and *L. siliquoidea* can use a wide variety of fish hosts. The host for *L. fragilis* is limited to freshwater drum (*Aplodinotus grunniens*), which typically migrate upstream during spring high water events. A few tolerant unionids may be surviving in Beanblossom Creek, but conditions are unsuitable for a

sustained unionid community.

*North Tributary to Beanblossom Creek*

The Northern Tributary to Beanblossom Creek was primarily shallow pool with aquatic vegetation. The QHEI score (33) was low for this site, but the substrate score (12) was higher than the other low QHEI scoring streams. This can be attributed to the variety of substrates present (see Table 3-5). However, abundance and quality of substrates was lacking. Water depths were <0.5m and substrate was sand with woody debris present and submerged aquatic vegetation. Fish were abundant at this site but diversity was low; only three species were collected. There were various year classes of the fish measured during the 2005 sampling event. The non-indigenous *G. affinis*, which inhabit ponds, small pools, and marshes, and is abundant in areas with aquatic vegetation, was the dominant species. Also collected from this site was *O. emiliae*. This species was generally collected from the narrow flowing portion that drained the pooled area. *Opsopoedus emiliae* is generally found in small streams with aquatic vegetation and sandy, organic substrates (Trautman, 1981). It should be noted that this species is relatively uncommon in Indiana (Crawford *et al.,* 1996). Similar to the fish community, the unionid community was limited to species typically found in ponds and headwaters, *P. grandis* and *U. imbecillis*. However, since no live individuals and only one shell of each were collected, the site appears unsuitable for sustaining a unionid community.

*Unnamed Tributary to Bryant Creek and Bryant Creek*

Species richness in Bryant Creek and the unnamed tributary reflected the small stream nature of these sites. Smaller streams tend to have a more homogeneous fish community comprised of few top predators (piscivores), overall fewer species, and less biomass, primarily due to habitat limitations (Li and Li, 1996; Vannote *et al*. 1980; Angermeier and Schlosser, 1989). The QHEI scores (64 and 63.4) were the highest of all the streams and can be attributed to substrate, instream cover, and channel morphology (see Table 3-5). Stream morphology was typical of headwater streams and the low species richness and moderate evenness values reflected this. The fish community was dominated by small stream species such as *S. atromaculatus* and *E. spectabile* (Trautman, 1981). There were various year classes of the fish measured during the 2005 sampling event in Bryant Creek, and *S. atromaculatus* exhibited the greatest range in length. Only six species were found in Bryant Creek, and though similar methods were used to capture fish and more linear area of stream was seined, the CPUE compared to North Tributary of Beanblossom Creek was much lower (3.6 fish/m versus 0.8 fish/m). The fish community of these streams was comprised of species adapted to flowing conditions (darters and minnows). These streams appear too small to sustain a unionid community, as evidenced by the absence of any individuals.

*Little Indian Creek*

Little Indian Creek appeared to be higher quality than the aforementioned streams. The QHEI score (58.5) was moderate compared to the other streams. Little Indian Creek lacked the substrate quality and instream cover that the higher-scoring sites (Bryant and Indian creeks) received. However, Little Indian Creek scored higher for channel morphology, riparian zone, riffle/run quality and gradient than the lower QHEI scoring sites (Griffey, Beanblossom, and North Tributary to Beanblossom creeks). Habitat was more heterogeneous with developed riffle/run/pool sequences; however, it suffers from siltation and bank cutting which suggests widely fluctuating discharge. Fish species richness and abundance was similar to that observed in Griffey Creek; however, the higher quality habitat in Little Indian Creek resulted in higher fish diversity and evenness. Species varied in length and weight, exhibiting a relatively diverse fish community. Several age classes of *Dorosoma cepedianum*, *Hypentelium nigricans*, *Lepomis* hybrids, and *Micropterus salmoides* were observed indicating viable populations of these species. Both fish communities were dominated by Centrarchidae (*L. macrochirus*). The presence of hybridized sunfish (*Lepomis sp*.) may indicate some perturbation within Little Indian Creek (Barbour *et al.,* 1999; Simon and Dufor, 1997). Additionally, members of the Cyprinidae and Catostomidae families were more abundant in Little Indian Creek than Griffey Creek, possibly due to habitat heterogeneity. Little Indian Creek appears capable of sustaining a unionid community though only one unionid was observed. Perhaps siltation and fluctuating discharges prevent a unionid community from establishing in Little Indian Creek.

*Indian Creek*

Indian Creek was one of the larger, higher quality streams in the study area and the QHEI score (61.5) reflected this. The relative higher quality of the stream was also reflected in the total abundance of fish, CPUE, diversity of fish, and presence of unionids. Indian Creek supported the most species rich aquatic community of all the surveyed streams due to the variety of clean substrate types and well-developed riffle/run/pool sequences. Additionally, Indian Creek was larger and most likely more hydrologically stable. Comparable in size to Beanblossom Creek, Indian Creek had 10x more individuals and twice as many species, even though effort was similar at each site. Again, these differences can be attributed primarily to habitat heterogeneity and stability.

Indian Creek presently appears to harbor a more diverse and species rich community than previously reported by Gerking (1945). Seventeen (17) species, dominated by the Cyprinids (15), were historically reported from Indian Creek; whereas 25 were collected in 2004. Similarly, only five families (three of which were represented by one species) were reported in 1940-1942 and six were observed in 2004. The shift in community and increase in diversity may be indicative of a "recovering" stream.

Though only two live unionids were observed in the project corridor (*P. grandis* and *L. cardium*), Indian Creek may sustain a unionid community. Both unionids were burrowed beneath the substrate. Rapid decline in water temperature slows unionid metabolism decreasing movement, feeding, and respiration in water temperatures <50ºF (Waller *et al*. 1999). Burrowing is typical for unionids as water temperature declines; furthermore burrowing decreases the chance of disturbance and predation.

## 5.0 Summary

A summary of biota and habitat characteristics for the I-69 Tier 2 Section 5 project corridor is presented in Table 5-1. Forty-six species of fish representing 11 families were observed in the project corridor. No state or federally listed species were observed. Aquatic habitat appeared better at sustaining aquatic communities in the northern end of the project corridor, specifically Bryant Creek, Little Indian Creek, and Indian Creek, all in Morgan County, Indiana. All of these streams exhibited more diverse and species rich fish communities than Griffey, Beanblossom, and North Tributary to Beanblossom creeks and the unnamed tributary to Bryant Creek. Additionally, the presence of live unionids, though not in abundance, is also indicative of the habitat quality and its ability to support a diverse aquatic ecosystem. QHEI scores demonstrated similar results in that these three streams scored higher in terms of habitat quality.

Table 5-1. Summary information for fishes collected in the I-69 Tier 2 Section 5 project corridor.

| | Site | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | GC[2] | | BC[2] | | NBC[2] | | NBC[3] | |
| **Fish** | | | | | | | | |
| Total Abundance | 125 | | 55 | | 181 | | 35 | |
| Shannon-Weiner Diversity | 2.90 | | 2.86 | | 1.04 | | 1.14 | |
| Species Richness | 17 | | 13 | | 3 | | 3 | |
| Evenness | 0.71 | | 0.77 | | 0.66 | | 0.72 | |
| Catch per Unit Effort[1] | 13.0 | | 2.9 | | 3.6 | | 3.0 | |
| Dominant Family | | | | | | | | |
| | Centrarchidae | 58.4% | Centrarchidae | 56.3% | Poeciliidae | 67.4% | Poeciliidae | 71.4% |
| | Cyprinidae | 16.8% | Clupeidae | 18.2% | Cyprinidae | 29.8% | Umbridae | 17.1% |
| Dominant Species | | | | | | | | |
| | *L. humilus* | 43.2% | *L. macrochirus* | 30.9% | *G. affinis* | 67.4% | *G. affinis* | 71.4% |
| | *H. nigricans* | 12.8% | *D. cepedianum* | 18.2% | *O. emiilae* | 29.8% | *U. limi* | 17.1% |
| **Unionids** | | | | | | | | |
| Present | No | | Yes | | Yes | | --- | |
| No. Live | n/a | | FD/WD shells only | | FD shells only | | --- | |
| **Crayfish** | | | | | | | | |
| Total collected | 13 | | 14 | | 3 | | 32 | |
| No. Species | 1 | | 1 | | 1 | | 2 | |
| **Habitat** | | | | | | | | |
| QHEI Score | 34.0 | | 31.5 | | 33.0 | | 33.0 | |

| | Site | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | UBrC[4] | | BrC[2] | | BrC[3] | | LIC[2] | | IC[2] | |
| **Fish** | | | | | | | | | | |
| Total Abundance | 91 | | 55 | | 193 | | 176 | | 501 | |
| Shannon-Weiner Diversity | 1.31 | | 2.13 | | 2.24 | | 3.14 | | 2.88 | |
| Species Richness | 5 | | 6 | | 12 | | 16 | | 25 | |
| Evenness | 0.56 | | 0.82 | | 0.63 | | 0.79 | | 0.62 | |
| Catch per Unit Effort[1] | 4.9 | | 0.8 | | 15.4 | | 15.0 | | 22.9 | |
| Dominant Family | | | | | | | | | | |
| | Percidae | 64.8% | Cyprinidae | 58.3% | Cyprinidae | 67.9% | Centrarchidae | 39.1% | Cyprinidae | 67.1% |
| | | | Percidae | 30.9% | Percidae | 21.2% | Cyprinidae | 23.2% | Percidae | 18.0% |
| Dominant Species | | | | | | | | | | |
| | *E. spectabile* | 64.8% | *S. atromaculatus* | 45.5% | *S. atromaculatus* | 50.3% | *L. macrochirus* | 21.6% | *C. spiloptera* | 48.5% |
| | | | *E. spectabile* | 23.6% | *E. spectabile* | 20.2% | *H. nuchalis* | 19.3% | *C. whipplei* | 9.4% |
| **Unionids** | | | | | | | | | | |
| Present | No | | No | | --- | | Yes | | Yes | |
| No. Live | n/a | | n/a | | --- | | 1 | | 2 | |
| **Crayfish** | | | | | | | | | | |
| Total collected | 0 | | 6 | | 37 | | 30 | | 6 | |
| No. Species | --- | | 1 | | 1 | | 1 | | 1 | |
| **Habitat** | | | | | | | | | | |
| QHEI Score | 63.5 | | 64 | | 64.0 | | 58.5 | | 61.5 | |

GC = Griffey Creek; BC = Beanblossom Creek; NBC = Northern Tributary to Beanblossom Creek; UBrC= Unnamed tributary to Bryant Creek; BR = Bryant Creek; LIC = Little Indian Creek; IC = Indian Creek

[1] CPUE = no/min for GC, BC, NBC (June), UBrC, BrC (June), LIC, and IC; CPUE = no/m for NBC (Oct) and BrC (Oct).

[2] October 2004 sampling effort

[3] June 2005 sampling effort

[4] May 2006 sampling effort

**6.0 Literature Cited**

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# Appendix A. Fishes of the White River Basin, Indiana

Appendix A. Fishes of the White River Basin, Indiana (Crawford *et al*., 1996).

| Species[1] | | Status[2] Federal | State |
|---|---|---|---|
| Petromyzontidae (Lampreys) | | | |
| *Icthyomyzon castaneus* | Chestnut lamprey | --- | --- |
| *Icthyomyzon fossor* | Northern brook lamprey | --- | --- |
| *Icthyomyzon unicuspis* | Silver lamprey | --- | --- |
| *Lampetra aepyptera* | Least brook lamprey | --- | --- |
| *Lampetra appendix* | American brook lamprey | --- | --- |
| Acipenseridae (Sturgeons) | | | |
| *Acipenser fulvescens* | Lake sturgeon | --- | SE |
| *Scaphirhynchus platorynchus* | Shovelnose sturgeon | --- | --- |
| Polyodontidae (Paddlefishes) | | | |
| *Polyodon spathula* | Paddlefish | --- | --- |
| Lepisosteidae (Gars) | | | |
| *Lepisosteus oculatus* | Spotted gar | --- | --- |
| *Lepisosteus osseus* | Longnose gar | --- | --- |
| *Lepisosteus platostomus* | Shortnose gar | --- | --- |
| *Lepisosteus spathula* | Alligator gar | --- | --- |
| Ammidae (Bowfins) | | | |
| *Amia clava* | Bowfin | --- | --- |
| Hiodontidae (Mooneyes) | | | |
| *Hiodon alosoides* | Goldeye | --- | --- |
| *Hiodon tergisus* | Mooneye | --- | --- |
| Anguilidae (Freshwater eels) | | | |
| *Anguilla rostrata* | American eel | --- | --- |
| Clupeidae (Herrings) | | | |
| *Alosa chrysochloris* | Skipjack herring | --- | --- |
| *Dorosoma cepedianum* | Gizzard shad | --- | --- |
| *Dorosoma petenense* | Threadfin shad | --- | --- |
| Cyprinidae (Carps and Minnows) | | | |
| *Campostoma pullum* | Central stoneroller | --- | --- |
| *Carassius auratus* | Goldfish | --- | --- |
| *Ctenopharyngodon idella* | Grass carp | --- | --- |
| *Cyprinella lutrensis* | Red shiner | --- | --- |
| *Cyprinella spiloptera* | Spotfin shiner | --- | --- |
| *Cyprinella whipplei* | Steelcolor shiner | --- | --- |
| *Cyprinus carpio* | Common carp | --- | --- |
| *Erimystax dissimilis* | Streamliine chub | --- | --- |
| *Erimystax x-punctatus* | Gravel chub | --- | --- |
| *Hybognanthus nuchalis* | Mississippi silvery minnow | --- | --- |
| *Luxilus chrysocephalus* | Striped shiner | --- | --- |
| *Luxilus cornutus* | Common shiner | --- | --- |
| *Lythrurus ardens* | Rosefin shiner | --- | --- |
| *Lythrurus fumeus* | Ribbon shiner | --- | --- |
| *Lythrurus umbratilis* | Redfin shiner | --- | --- |
| *Macrhybopsis aestivalis* | Speckled chub | --- | --- |
| *Macrhybopsis storeriana* | Silver chub | --- | --- |
| *Nocomis biguttatus* | Hornyhead chub | --- | --- |
| *Nocomis micropogon* | River chub | --- | --- |
| *Notemigonus crysoleucas* | Golden shiner | --- | --- |
| *Notropis amblops* | Bigeye chub | --- | --- |
| *Notropis amnis* | Pallid shiner | --- | --- |
| *Notropis anogenus* | Pugnose shiner | --- | --- |
| *Notropis ariomnus* | Popeye siner | --- | --- |

| Species[1] | | Status[2] Federal | State |
|---|---|---|---|
| *Notropis blennius* | River shiner | --- | --- |
| *Notropis boops* | Bigeye shiner | --- | --- |
| *Notropis buccatus* | Silverjaw minnow | --- | --- |
| *Notropis buchanani* | Ghost shiner | --- | --- |
| *Notropis chalybaeus* | Ironcolor shiner | --- | --- |
| *Notropis heterodon* | Blackchin shiner | --- | --- |
| *Notropis heterolepis* | Blacknose shiner | --- | --- |
| *Notropis hudsonius* | Spottail shiner | --- | --- |
| *Notropis photogenis* | Silver shiner | --- | --- |
| *Notropis rubellus* | Rosyface shiner | --- | --- |
| *Notropis shumardi* | Silverband shiner | --- | --- |
| *Notropis stramineus* | Sand shiner | --- | --- |
| *Notropis texanus* | Weed shiner | --- | --- |
| *Notropis volucellus* | Mimic shiner | --- | --- |
| *Notropis wickliffi* | Channel shiner | --- | --- |
| *Opsopoedus emiliae* | Pugnose minnow | --- | --- |
| *Phenacobius mirabilis* | Suckermouth minnow | --- | --- |
| *Phoxinus erythrogaster* | Southern redbelly dace | --- | --- |
| *Pimephales notatus* | Bluntnose minnow | --- | --- |
| *Pimephales promelas* | Fathead minnow | --- | --- |
| *Pimephales vigilax* | Bullhead minnow | --- | --- |
| *Rhinichthys atratulus* | Blacknose dace | --- | --- |
| *Semotilus atromaculatus* | Creek chub | --- | --- |
| Catostomidae (Suckers) | | | |
| *Carpiodes carpio* | River carpsucker | --- | --- |
| *Carpiodes cyprinus* | Quillback | --- | --- |
| *Carpiodes velifer* | Highfin carpsucker | --- | --- |
| *Catostomus commersoni* | White sucker | --- | --- |
| *Cycleptus elongatus* | Blue sucker | --- | SC |
| *Erimyzon oblongus* | Creek chubsucker | --- | --- |
| *Hypentelium nigricans* | Northern hog sucker | --- | --- |
| *Ictiobus bubalus* | Smallmouth buffalo | --- | --- |
| *Ictiobus cyprinellus* | Bigmouth buffalo | --- | --- |
| *Ictiobus niger* | Black buffalo | --- | --- |
| *Lagochila lacera* | Harelip sucker | --- | --- |
| *Minytrema melanops* | Spotted sucker | --- | --- |
| *Moxostoma anisurum* | Silver redhorse | --- | --- |
| *Moxostoma carinatum* | River redhorse | --- | SC |
| *Moxostoma duquesnei* | Black redhorse | --- | --- |
| *Moxostoma erythrurum* | Golden redhorse | --- | --- |
| *Moxostoma macrolepidotum* | Shorthead redhorse | --- | --- |
| Ictaluridae (North American catfish) | | | |
| *Ameiurus catus* | White catfish | --- | --- |
| *Ameiurus melas* | Black bullhead | --- | --- |
| *Ameiurus natalis* | Yellow bullhead | --- | --- |
| *Ameiurus nebulosus* | Brown bullhead | --- | --- |
| *Ictalurus furcatus* | Blue catfish | --- | --- |
| *Ictalurus punctatus* | Channel catfish | --- | --- |
| *Noturus eleutherus* | Mountain madtom | --- | --- |
| *Noturus exilis* | Slender madtom | --- | --- |
| *Noturus flavus* | Stonecat | --- | --- |
| *Noturus gyrinus* | Tadpole madtom | --- | --- |
| *Noturus miurus* | Brindled madtom | --- | --- |

| Species[1] | | Status[2] Federal | State |
|---|---|---|---|
| Esocidae (Pikes) | | | |
| *Esox americanus vermiculatus* | Grass pickerel | --- | --- |
| Umbridae (Mudminnows) | | | |
| *Umbra limi* | Central mudminnow | --- | --- |
| Aphredoderidae (Pirate perches) | | | |
| *Aphredoderus sayanus* | Pirate perch | --- | --- |
| Gadidae (Cods) | | | |
| *Lota lota* | Burbot | --- | --- |
| Amblyopsidae (Cavefishes) | | | |
| *Amblyopsis spelaea* | Northern cavefish | --- | SE |
| Fundulidae (Topminnows) | | | |
| *Fundulus catenatus* | Northern studfish | --- | SC |
| *Fundulus dispar* | Starhead minnow | --- | --- |
| *Fundulus notatus* | Blackstripe topminnow | --- | --- |
| *Fundulus olivaceus* | Blackspotted topminnow | --- | --- |
| Poeciliidae (Livebearers) | | | |
| *Gambusia affinis* | Western mosquitofish | --- | --- |
| Atherinidae (Silversides) | | | |
| *Labidesthes sicculus* | Brook silverside | --- | --- |
| Gasterosteidae (Sticklebacks) | | | |
| *Culaea inconstans* | Brook stickleback | --- | --- |
| Corridae (Sculpins) | | | |
| *Cottus bairdi* | Mottled sculpin | --- | --- |
| *Cottus carolinae* | Banded sculpin | --- | --- |
| Percichthyidae (Temeperate basses) | | | |
| *Morone chrysops* | White bass | --- | --- |
| *Mornone mississippiensis* | Yellow bass | --- | --- |
| *Morone saxatilis* | Striped bass | --- | --- |
| Centrarchidae (Sunfish) | | | |
| *Ambloplites rupestris* | Rock bass | --- | --- |
| *Centrarchus macropterus* | Flier | --- | --- |
| *Lepomis cyanellus* | Green sunfish | --- | --- |
| *Lepomis gibbosus* | Pumpkinseed | --- | --- |
| *Lepomis gulosus* | Warmouth | --- | --- |
| *Lepomis humilis* | Orangespotted sunfish | --- | --- |
| *Lepomis macrochirus* | Bluegill | --- | --- |
| *Lepomis megalotis* | Longear sunfish | --- | --- |
| *Lepomis microlophus* | Redear sunfish | --- | --- |
| *Lepomis punctatus* | Spotted sunfish | --- | --- |
| *Lepmois symmetricus* | Bantam sunfish | --- | SC |
| *Micropterus dolomieu* | Smallmouth bass | --- | --- |
| *Micropterus punctulatus* | Spotted bass | --- | --- |
| *Micropterus salmoides* | Largemouth bass | --- | --- |
| *Pomoxis annularis* | White crappie | --- | --- |
| *Pomoxis nigromaculatus* | Black crappie | --- | --- |
| Percidae (Perches) | | | |
| *Ammocrypta clara* | Western sand darter | --- | --- |
| *Ammocrytpa pellucida* | Eastern sand darter | --- | SC |
| *Etheostoma asprigene* | Mud darter | --- | --- |
| *Etheostoma blennoides* | Greenside darter | --- | --- |
| *Etheostoma caeruleum* | Rainbow darter | --- | --- |
| *Etheostoma camurum* | Bluebreast darter | --- | SE |

| Species[1] | | Status[2] Federal | State |
|---|---|---|---|
| *Etheostoma fusiforme* | Swamp darter | --- | --- |
| *Etheostoma gracile* | Slough darter | --- | --- |
| *Etheostoma histrio* | Harlequin darter | --- | SE |
| *Etheostoma maculatum* | Spotted darter | --- | SE |
| *Etheostoma micrperca* | Least darter | --- | --- |
| *Etheostoma nigrum* | Johnny darter | --- | --- |
| *Etheostoma spectabile* | Orqngethroat darter | --- | --- |
| *Etheostoma tippecanoe* | Tippecanoe darter | --- | SE |
| *Etheostoma variatum* | Variegate darter | --- | SE |
| *Perca flavescens* | Yellow perch | --- | --- |
| *Percina caprodes* | Logperch | --- | --- |
| *Percina copelandi* | Channel darter | --- | --- |
| *Percina evides* | Gilt darter | --- | SE |
| *Percina maculata* | Blackside darter | --- | --- |
| *Percina phoxocephala* | Slenderhead darter | --- | --- |
| *Percina sciera* | Dusky darter | --- | --- |
| *Percina shumardi* | River darter | --- | --- |
| *Stizostedion canadense* | Sauger | --- | --- |
| *Stizostedion vitreum* | Walleye | --- | --- |
| Sciaenidae (Drums) | | | |
| *Aplodinotus grunniens* | Freshwater drum | --- | --- |

[1] Nomenclature follows Nelson *et al*., 2004

[2] Indiana DNR (2004); USFWS (2004); SE = State Endangered; SC = State Special Concern

Appendix B. Unionids of the White River Basin reported since 1989.

Appendix B. Unionids of the White River Basin reported since 1989 (Cummings *et al.*, 1991)

| Species[1] | | Status[2] Federal | State | White River | West Fork White River |
|---|---|---|---|---|---|
| Unionidae | | | | | |
| Ambleminae | | | | | |
| *Amblema plicata* | Threeridge | --- | --- | X | X |
| *Cyclonaias tuberculata* | Purple wartyback | --- | --- | X | X |
| *Elliptio crassidens* | Elephant ear | --- | --- | X | --- |
| *Elliptio dilatata* | Spike | --- | --- | X | X |
| *Fusconaia ebena* | Ebonyshell | --- | --- | X | --- |
| *Fusconaia flava* | Wabash pigtoe | --- | --- | X | X |
| *Fusconaia subrotunda* | Longsolid | --- | SE | X | X |
| *Megalonaias nervosa* | Washboard | --- | --- | X | X |
| *Pleurobema clava* | Clubshell | FE | SE | X | X |
| *Pleurobema cordatum* | Ohio pigtoe | --- | SC | X | --- |
| *Pleurobema plenum* | Rough pigtoe | FE | SE | X | --- |
| *Pleurobema rubrum* | Pyrimid pigtoe | --- | SE | X | X |
| *Pleurobema sintoxia* | Round pigtoe | --- | --- | X | X |
| *Quadrula cylindrica* | Rabbitsfoot | --- | SE | X | X |
| *Quadrula metanevra* | Monkeyface | --- | --- | X | --- |
| *Quadrula nodulata* | Wartyback | --- | --- | X | --- |
| *Quadrula pustulosa* | Pimpleback | --- | --- | X | X |
| *Quadrula quadrula* | Mapleleaf | --- | --- | X | X |
| *Tritogonia verrucosa* | Pistolgrip | --- | --- | X | X |
| Anodoninae | | | | | |
| *Alasmidonta marginata* | Elktoe | --- | --- | X | --- |
| *Alasmidonta viridis* | Slippershell mussel | --- | --- | X | --- |
| *Anodonta suborbiculata* | Flat floater | --- | --- | X | --- |
| *Anodontoides ferussacianus* | Cylindrical papershell | --- | --- | X | --- |
| *Arcidens confragosus* | Rock pocketbook | --- | --- | X | --- |
| *Lasmigona complanata* | White heelsplitter | --- | --- | X | X |
| *Lasmigona compressa* | Creek heelsplitter | --- | --- | X | |
| *Lasmogona costata* | Fluted shell | --- | --- | X | X |
| *Pyganodon grandis* | Giant floater | --- | --- | X | X |
| *Simpsonaias ambigua* | Salamander mussel | --- | SC | X | --- |
| *Stophitus undulatus* | Creeper | --- | --- | X | X |
| *Utterbackia imbecillis* | Paper pondshell | --- | --- | X | --- |
| Lampsillinae | | | | | |
| *Actinonaias ligamentina* | Mucket | --- | --- | X | X |
| *Cyprogenia stegaria* | Fanshell | FE | SE | X | X |
| *Ellipsaria lineolata* | Butterfly | --- | --- | X | --- |
| *Epioblasma o. perobliqua* | White catspaw | FE | SE | X | --- |
| *Epioblasma t. rangiana* | Northern riffleshell | FE | SE | X | X |
| *Epioblasma t. torulosa* | Tubercled blossom | FE | SE | X | X |
| *Epioblasma triquetra* | Snuffbox | --- | SE | X | --- |
| *Lampsilis cardium* | Plain pocketbook | --- | --- | X | X |
| *Lampsilis fasciola* | Wavyrayed lampmussel | --- | SC | X | |
| *Lampsilis ovata* | Pocketbook | --- | --- | X | X |
| *Lampsilis siliquoidea* | Fatmucket | --- | --- | X | X |
| *Lampsilis teres* | Yellow sandshell | --- | --- | X | X |
| *Leptodea fragilis* | Fragile papershell | --- | --- | X | X |
| *Ligumia recta* | Black sandshell | --- | --- | X | X |
| *Obliquaria reflexa* | Threehorn wartyback | --- | --- | X | X |

| Species[1] | | Status[2] Federal | State | White River | West Fork White River |
|---|---|---|---|---|---|
| *Obovaria olivaria* | Hickorynut | --- | --- | X | X |
| *Obovaria retusa* | Ring pink | --- | --- | X | X |
| *Obovaria subrotunda* | Round hickorynut | --- | SC | X | X |
| *Potamilus alatus* | Pink heelsplitter | --- | --- | X | --- |
| *Potamilus ohiensis* | Pink papershell | --- | --- | X | X |
| *Ptychobranchus fasciolaris* | Kidneyshell | --- | SC | X | X |
| *Toxolasma lividus* | Purple lilliput | --- | SC | X | --- |
| *Toxolasma parvus* | Lilliput | --- | --- | X | --- |
| *Truncilla donaciformis* | Fawnsfoot | --- | --- | X | X |
| *Truncilla truncata* | Deertoe | --- | --- | X | X |
| *Villosa fabalis* | Rayed bean | FC | SC | X | --- |
| *Villosa iris* | Rainbow | --- | --- | X | --- |
| *Villosa lienosa* | Little spectaclecase | --- | SC | X | --- |

[1] Mollusk nomenclature follows Turgeon *et al*. (1998)

[2] Indiana DNR (2004); USFWS (2004); FE = Federally Endangered; FC = Federal Candidate; SC = Special Concer
SE = State Endangered

Appendix C. Photodocumentation of sites and fish and unionids encountered in the I-69 Tier 2 Section 5 corridor, October 2004.

Photograph 1. Representative view of Indian Creek at SR 37 bridge looking downstream.
Photograph 2. Representative view of Indian Creek at SR 37 bridge looking upstream.
Photograph 3. Representative view of Little Indian Creek at Godsey Road bridge looking upstream.
Photograph 4. Representative view of Little Indian Creek at Godsey Road bridge looking downstream.
Photograph 5. Representative view of Griffey Creek looking upstream from confluence with Beanblossom Creek.
Photograph 6. Representative view of Beanblossom Creek looking downstream from SR 37 bridge crossing.
Photograph 7. Representative view of North tributary to Beanblossom Creek at SR 37 bridge crossing looking upstream.
Photograph 8. Representative view of North tributary to Beanblossom Creek at SR 37 bridge crossing looking downstream.
Photograph 9. View of levee and farm pond upstream of North tributary to Beanblossom Creek (east of SR 37 bridge crossing).
Photograph 10. Representative view of Bryant Creek upstream of SR 37 bridge crossing.
Photograph 11. Representative view looking downstream of unnamed tributary to Bryant Creek.
Photograph 12. Representative view looking upstream of unnamed tributary to Bryant Creek.
Photograph 13. Representative view of sunfish species collected from I-69 Tier 2 Section 5 corridor.
Photograph 14. Representative view of unionid mollusks collected from I-69 Tier 2 Section 5 corridor.

Photograph 1. Representative view of Indian Creek at SR 37 bridge looking downstream.

Photograph 2. Representative view of Indian Creek at SR 37 bridge looking upstream.

Photograph 3. Representative view of Little Indian Creek at Godsey Road bridge looking upstream.

Photograph 4. Representative view of Little Indian Creek at Godsey Road bridge looking downstream.

Photograph 5. Representative view of Griffey Creek looking upstream from confluence with Beanblossom Creek.

Photograph 6. Representative view of Beanblossom Creek looking downstream from SR 37 bridge crossing.

Photograph 7. Representative view of North tributary to Beanblossom Creek at Sr 37 bridge crossing looking upstream.

Photograph 8. Representative view of North tributary to Beanblossom Creek at SR 37 bridge crossing looking downstream.

Photograph 9. View of levee and farm pond upstream of North tributary to Beanblossom Creek (east ofSR 37 bridge crossing).

Photograph 10. Representative view of Bryant Creek upstream of SR 37 bridge crossing.

Photograph 11. Representative view looking downstream of unnamed tributary to Bryant Creek.

Photograph 12. Representative view looking upstream of unnamed tributary to Bryant Creek.

Photograph 13. Representative view of sunfish species collected from I-69 Tier 2 Section 5 corridor.

Photograph 14. Representative view of unionid mollusks collected from I-69 Tier 2 Section 5 corridor.

Appendix D. QHEI forms for seven streams evaluated in the Tier 2 Section 5 corridor

Five QHEI scores included in the following appendix were updated based upon current scoring methodology or recent field reviews. Revised QHEI forms are attached at the end of this document. The remaining QHEI scores did not change.

# IDEM — OWQ Biological Studies QHEI (Qualitative Habitat Evaluation Index)

Sample # | bioSample # | Stream Name: Indian Creek | Location: @ SR 37 bridge

Surveyor | Sample Date: 6/30/2005 | County: MORGAN | Macro SampleType | ☐ Habitat Complete | **QHEI Score: 61.5**

## 1-Substrate (20 points maximum)

**Substrate Score: 15**

Check 1 Predominant Pool & 1 Predominant Riffle

Check all that are present — P=Pool, R=Riffle

| Predominant P | Predominant R | Present P | Present R | | Predominant P | Predominant R | Present P | Present R | |
|---|---|---|---|---|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | Bldrs/Slabs(10) | ☐ | ☐ | ☐ | ☐ | Hardpan(4) |
| ☐ | ☐ | ☐ | ☐ | Boulders(9) | ☐ | ☐ | ☐ | ☐ | Detritus(3) |
| ☐ | ☐ | ☐ | ☑ | Cobble(8) | ☐ | ☐ | ☐ | ☐ | Muck(2) |
| ☑ | ☑ | ☑ | ☑ | Gravel(7) | ☐ | ☐ | ☐ | ☐ | Silt(2) |
| ☑ | ☑ | ☑ | ☑ | Sand(6) | ☐ | ☐ | ☐ | ☐ | Sludge(1) |
| ☐ | ☐ | ☐ | ☐ | Bedrock(5) | ☐ | ☐ | ☑ | ☑ | Artificial(0) |

(13)

Substrate Quality (check only 1, or check 2 and AVERAGE)

Substrate Origin: ☐ Limestone(1) ☐ Hardpan(0) ☐ Lacustrine(0) ☑ Tills(1) ☐ Sandstone(0) ☐ Shale(-1) ☐ Wetlands(0) ☐ Rip/Rap(0) ☐ Coal fines(-2)

Silt Cover: ☐ Silt heavy(-2) ☐ Silt moderate(-1) ☑ Silt normal(0) ☐ Silt free(1)

Embeddedness: ☐ Extensive(-2) ☑ Moderate(-1) ☐ Low/Normal(0) ☐ None(1)

NOTE: ignore sludge originating from point sources; score based on natural substrates

☑ >4 substrates present(2)

Comments: 13 +1 -1 = 15

## 2-Instream Cover (20 points maximum

**Instream Cover Score: 8**

Type (check ALL that apply)

☑ Undercut banks(1) ☑ Deep pools(2) ☐ Oxbows(1)
☐ Overhanging vegetation(1) ☐ Rootwads(1) ☐ Aquatic macrophytes(1)
☑ Shallows(in slow water)(1) ☐ Boulders(1) ☑ Logs and woody debris(1)
☐ Rootmats(1)

Amount (check only 1, or 2 and AVERAGE)

☐ Extensive >75% (11)
☐ Moderate 25-75% (7)
☑ Sparse 5-25% (3)
☐ Nearly absent <5% (1)

Comments:

## 3-Channel Morphology (20) (check only one per category, OR two and AVERAGE)

**Channel Score: 10**

| Sinuosity | Development | Channelization | Stability | Modifications/Other | |
|---|---|---|---|---|---|
| ☐ High (4) | ☐ Excellent (7) | ☐ None (6) | ☐ High (3) | ☐ Snagging | ☐ Impound |
| ☐ Moderate (3) | ☐ Good (5) | ☑ Recovered (4) | ☐ Moderate (2) | ☐ Relocation | ☐ Islands |
| ☑ Low (2) | ☑ Fair (3) | ☐ Recovering (3) | ☑ Low (1) | ☐ Canopy Removal | ☐ Leveed |
| ☐ None (1) | ☐ Poor (1) | ☐ Recent or no recovery (1) | | ☐ Dredging | ☐ Bank shaping |
| | | | | ☐ One side channel modifications | |

Comments:

## 4-Riparian Zone & Bank Erosion (10 points maximum)

**Riparian Score: 9.5**

Left/Right banks looking downstream (For each category, check only one per bank, OR two per bank and AVERAGE).

Riparian width (per bank)

| L | R | |
|---|---|---|
| ☐ | ☐ | Wide >50m (4) |
| ☑ | ☑ | Moderate 10-50m (3) |
| ☑ | ☐ | Narrow 5-10m (2) |
| ☐ | ☐ | Very narrow <5m (1) |
| ☐ | ☐ | None (0) |

Erosion/Runoff-Floodplain quality (past 100 ft Riparian) (most predominant per bank)

| L | R | |
|---|---|---|
| ☑ | ☑ | Forest, Swamp (3) |
| ☑ | ☑ | Shrub or Old field (2) |
| ☐ | ☐ | Residential, Park, New field (1) |
| ☐ | ☐ | Fenced pasture (1) |
| ☐ | ☐ | Conservation Tillage (1) |
| ☐ | ☐ | Urban or Industrial (0) |
| ☐ | ☐ | Mining, Construction (0) |
| ☐ | ☐ | Open Pasture/Rowcrop (0) |

Bank Erosion (per bank)

| L | R | |
|---|---|---|
| ☐ | ☐ | None or little (3) |
| ☑ | ☑ | Moderate (2) |
| ☐ | ☐ | Heavy/Severe (1) |

Comments:

## 5a-Pool/Glide Quality (12 points maximum

**Pool/Glide Score: 9**

Max pool depth (check one)
☐ >1m (6)
☑ 0.7-1m (4)
☐ 0.4-0.7m (2)
☐ 0.2-0.4m (1)
☐ <0.2m (pool=0)

Morphology (check only one, OR check two and AVERAGE)
☑ Pool width > riffle width (2)
☐ Pool width = riffle width (1)
☐ Pool width < riffle width (0)

Pool/Run/Riffle current velocity (check all that apply)
☑ Eddies (1) ☐ Torrential (-1)
☐ Fast (1) ☐ Interstitial (-1)
☑ Moderate (1) ☐ Intermittent (-2)
☑ Slow (1) ☐ No pool (0)

Comments:

## 5b-Riffle/Run Quality (8) (check only one per category, OR two and AVERAGE)

**Riffle/Run Score: 4**

Riffle/run depth (check one)
☐ Generally>10cm, Max>50cm (4)
☑ Generally>10cm, Max<50cm(3)
☐ Generally 5-10cm (1)
☐ Generally<5cm (riffle=0)

Riffle/run substrate
☐ Stable-e.g. cobble, boulder (2)
☑ Mod. stable-e.g. pea gravel (1)
☐ Unstable-e.g. sand, gravel (0)

Riffle/run embeddedness
☐ Extensive (-1) ☐ Normal/Low (1)
☑ Moderate (0) ☐ None (2)
☐ No riffle (0)

Comments:

## 6-Gradient (10 points maximum)

**Gradient Score: 6**

Average width: 10m | Gradient: 10 (ft/mile) | Drainage Area: (square miles)

Comments:

IDEM **OWQ Biological Studies QHEI (Qualitative Habitat Evaluation Index)**

| Sample # | bioSample # | Stream Name | Location |
|---|---|---|---|
| | | Indian Crk | [illegible] SR 37 bridge |

| Surveyor | Sample Date | County | Macro SampleType | ☐ Habitat Complete | QHEI Score: 61.5 |
|---|---|---|---|---|---|
| | | | | | |

## Impacts/Miscellaneous

**Major Suspected Impacts (Check all that apply)**

- ☐ None
- ☐ Industrial
- ☐ WWTP
- ☐ Agricultural
- ☐ Livestock
- ☐ Silviculture
- ☐ Construction
- ☒ Urban Runoff
- ☐ Suburban
- ☒ Channelization
- ☐ Riparian Removal
- ☐ Flow Alteration
- ☐ CSOs
- ☐ Mining
- ☐ Landfills
- ☐ Natural

Pollution Impact Comments:

**Miscellaneous QHEI Information**

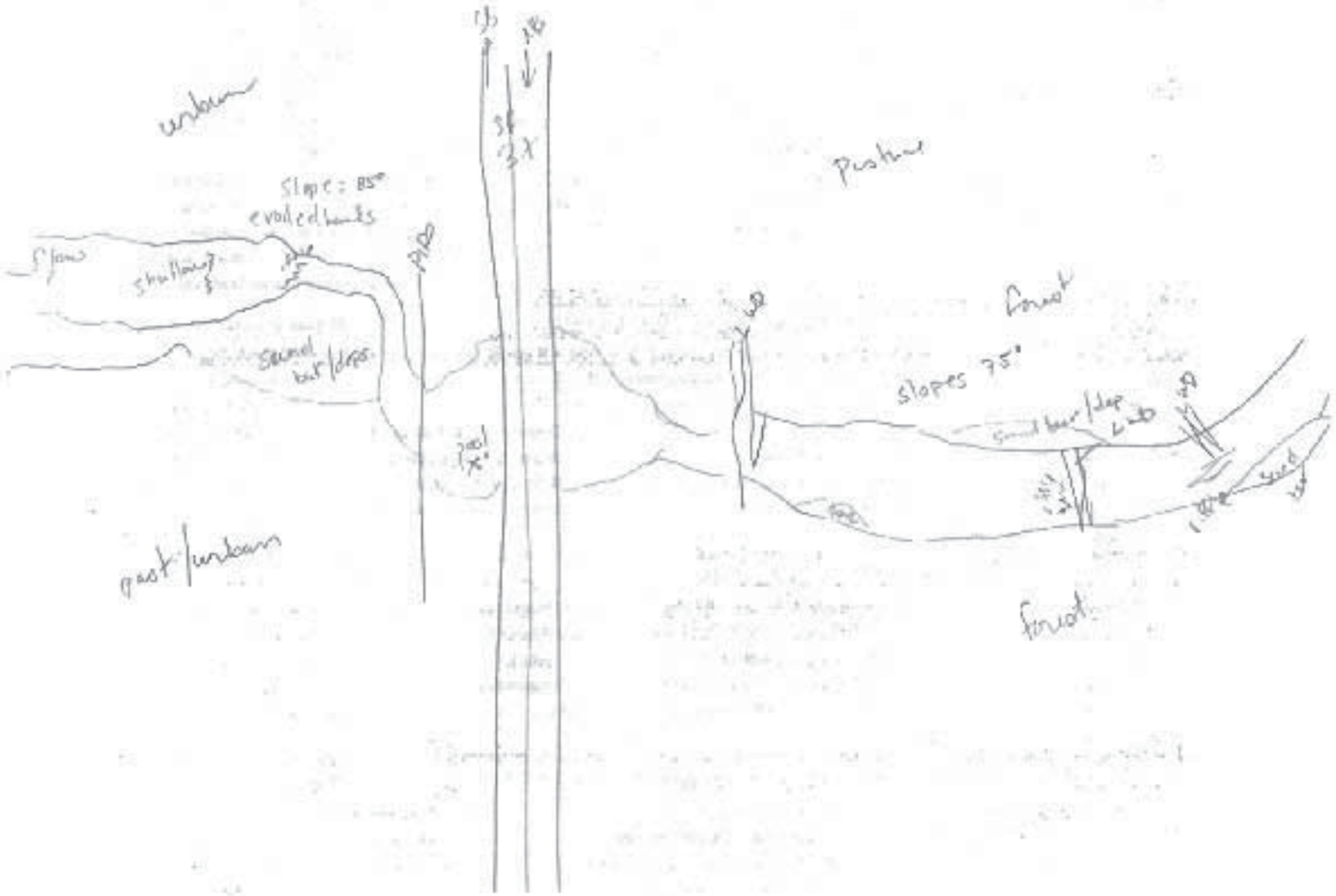
Subjective rating (1-10): 6 — % Riffle: 20 — Is reach representative of stream? Yes

Aesthetic rating (1-10): 7 — % Run: 30 — % Glide: 20

Canopy Cover (% Open): 70 — % Pool: 30

General QHEI Notes:

lots of ins. hab types



# IDEM — OWQ Biological Studies QHEI (Qualitative Habitat Evaluation Index)

| Sample # | bioSample # | Stream Name | Location |
|---|---|---|---|
| | | N. Trib to Brown blossom | downstream SR 37 |

| Surveyor | Sample Date | County | Macro SampleType | Habitat Complete | QHEI Score: 33 |
|---|---|---|---|---|---|
| | 4/30/2015 | Monroe | | ☐ | |

## 1-Substrate (20 points maximum)

Substrate Score: 12

Check 1 Predominant Pool & 1 Predominant Riffle

Check all that are present — P=Pool, R=Riffle

| Predominant P R | Present P R | Predominant P R | Present P R |
|---|---|---|---|
| ☐ ☐ Bldrs/Slabs(10) | ☐ ☐ | ☐ ☐ Hardpan(4) | ☑ ☑ |
| ☐ ☐ Boulders(9) | ☐ ☐ | ☑ ☑ Detritus(3) | ☑ ☑ |
| ☐ ☐ Cobble(8) | ☐ ☐ | ☐ ☐ Muck(2) | ☐ ☐ |
| ☐ ☐ Gravel(7) | ☑ ☑ | ☐ ☐ Silt(2) | ☐ ☐ |
| ☑ ☑ Sand(6) | ☑ ☑ | ☐ ☐ Sludge(1) | ☐ ☐ |
| ☐ ☐ Bedrock(5) | ☐ ☐ | ☐ ☐ Artificial(0) | ☐ ☐ |

Substrate Quality (check only 1, or check 2 and AVERAGE)

Substrate Origin: ☐ Limestone(1) ☐ Hardpan(0) ☐ Lacustrine(0) ☑ Tills(1) ☐ Sandstone(0) ☐ Shale(-1) ☑ Wetlands(0) ☐ Rip/Rap(0) ☐ Coal fines(-2)

Silt Cover: ☐ Silt heavy(-2) ☑ Silt moderate(-1) ☐ Silt normal(0) ☐ Silt free(1)

Embeddedness: ☐ Extensive(-2) ☐ Moderate(-1) ☑ Low/Normal(0) ☐ None(1)

NOTE: ignore sludge originating from point sources; score based on natural substrates

☑ >4 substrates present(2)

Comments: 11 +

## 2-Instream Cover (20 points maximum

Instream Cover Score: 6

Type (check ALL that apply)

☐ Undercut banks(1) ☐ Deep pools(2) ☐ Oxbows(1)
☑ Overhanging vegetation(1) ☐ Rootwads(1) ☑ Aquatic macrophytes(1)
☑ Shallows(in slow water)(1) ☐ Boulders(1) ☐ Logs and woody debris(1)
☐ Rootmats(1)

Amount (check only 1, or 2 and AVERAGE)

☐ Extensive >75% (11)
☐ Moderate 25-75% (7)
☑ Sparse 5-25% (3)
☐ Nearly absent <5% (1)

Comments:

## 3-Channel Morphology (20) (check only one per category, OR two and AVERAGE)

Channel Score: 5

| Sinuosity | Development | Channelization | Stability | Modifications/Other | |
|---|---|---|---|---|---|
| ☐ High (4) | ☐ Excellent (7) | ☐ None (6) | ☐ High (3) | ☐ Snagging | ☐ Impound |
| ☐ Moderate (3) | ☐ Good (5) | ☐ Recovered (4) | ☑ Moderate (2) | ☐ Relocation | ☐ Islands |
| ☐ Low (2) | ☐ Fair (3) | ☑ Recovering (3) | ☐ Low (1) | ☐ Canopy Removal | ☐ Leveed |
| ☑ None (1) | ☑ Poor (1) | ☐ Recent or no recovery (1) | | ☐ Dredging | ☐ Bank shaping |
| | | | | | ☐ One side channel modifications |

Comments: drains pasture

## 4-Riparian Zone & Bank Erosion (10 points maximum)

Riparian Score: 5

Left/Right banks looking downstream (For each category, check only one per bank, OR two per bank and AVERAGE).

Riparian width (per bank): ☐ ☑ Wide >50m (4) 3.5; ☑ ☐ Moderate 10-50m (3); ☐ ☐ Narrow 5-10m (2); ☐ ☐ Very narrow <5m (1); ☐ ☐ None (0)

Erosion/Runoff-Floodplain quality (past 100 ft Riparian) (most predominant per bank): ☐ ☑ Forest, Swamp (3); ☐ ☐ Shrub or Old field (2) 1.5; ☐ ☐ Residential, Park, New field (1); ☐ ☐ Fenced pasture (1); ☐ ☐ Conservation Tillage (1); ☐ ☐ Urban or Industrial (0); ☐ ☐ Mining, Construction (0); ☑ ☐ Open Pasture/Rowcrop (0)

Bank Erosion (per bank): ☑ ☑ None or little (3); ☐ ☐ Moderate (2); ☐ ☐ Heavy/Severe (1)

Comments:

## 5a-Pool/Glide Quality (12 points maximum

Pool/Glide Score: 2

Max pool depth (check one): ☐ >1m (6); ☐ 0.7-1m (4); ☐ 0.4-0.7m (2); ☑ 0.2-0.4m (1); ☐ <0.2m (pool=0)

Morphology (check only one, OR check two and AVERAGE): ☐ Pool width > riffle width (2); ☐ Pool width = riffle width (1); ☑ Pool width < riffle width (0)

Pool/Run/Riffle current velocity (check all that apply): ☐ Eddies (1); ☐ Fast (1); ☐ Moderate (1); ☑ Slow (1); ☐ Torrential (-1); ☐ Interstitial (-1); ☐ Intermittent (-2); ☐ No pool (0)

Comments:

## 5b-Riffle/Run Quality (8) (check only one per category, OR two and AVERAGE)

Riffle/Run Score: 0

Riffle/run depth (check one): ☐ Generally>10cm, Max>50cm (4); ☐ Generally>10cm, Max<50cm(3); ☐ Generally 5-10cm (1); ☑ Generally<5cm (riffle=0)

Riffle/run substrate: ☐ Stable-e.g. cobble, boulder (2); ☐ Mod. stable-e.g. pea gravel (1); ☑ Unstable-e.g. sand, gravel (0)

Riffle/run embeddedness: ☐ Extensive (-1) ☐ Normal/Low (1) ☐ Moderate (0) ☐ None (2) ☑ No riffle (0)

Comments:

## 6-Gradient (10 points maximum)

Gradient Score: 0

Average width: 2m Gradient: 0 (ft/mile) Drainage Area: (square miles)

Comments:

IDEM — OWQ Biological Studies QHEI (Qualitative Habitat Evaluation Index)

| Sample # | bioSample # | Stream Name | Location |
|---|---|---|---|
| | | N. trib to Beanblossom | SR 37 |

| Surveyor | Sample Date | County | Macro SampleType | ☐ Habitat Complete | QHEI Score: 33 |
|---|---|---|---|---|---|
| | | | | | |

## Impacts/Miscellaneous

**Major Suspected Impacts (Check all that apply)**

- ☐ None
- ☐ Industrial
- ☐ WWTP
- ☒ Agricultural
- ☒ Livestock
- ☐ Silviculture
- ☐ Construction
- ☐ Urban Runoff
- ☐ Suburban
- ☒ Channelization
- ☒ Riparian Removal
- ☐ Flow Alteration
- ☐ CSOs
- ☐ Mining
- ☐ Landfills
- ☐ Natural

Pollution Impact Comments:

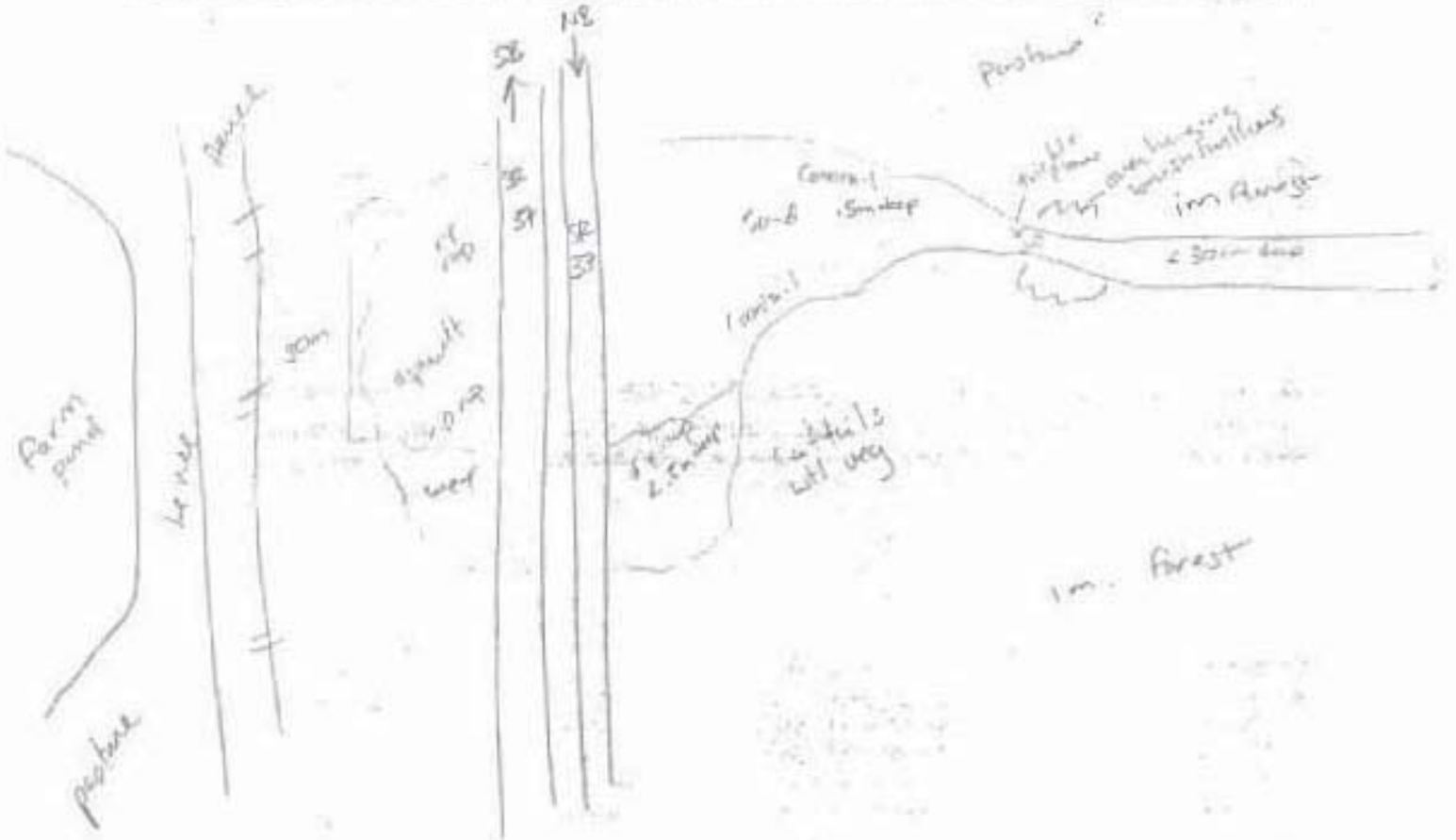
**Miscellaneous QHEI Information**

Subjective rating (1-10): 3 % Riffle: 5 Is reach representative of stream? ☐

Aesthetic rating (1-10): 2 % Run: % Glide: 45

Canopy Cover (% Open): 86 % Pool: 50

General QHEI Notes:



# IDEM — OWQ Biological Studies QHEI (Qualitative Habitat Evaluation Index)

Sample # | bioSample # | Stream Name: Beanblossom Creek | Location: SR 37 Xing

Surveyor: RW | Sample Date: 6/29/2005 | County: Monroe | Macro SampleType | [x] Habitat Complete

**QHEI Score: 36.5**

## 1-Substrate (20 points maximum)

**Substrate Score: .5**

Check 1 Predominant Pool & 1 Predominant Riffle

Check all that are present — P=Pool, R=Riffle

| Predominant (P R) | Present (P R) | Predominant (P R) | Present (P R) |
|---|---|---|---|
| [ ] [ ] Bldrs/Slabs(10) | [ ] [ ] | [ ] [ ] Hardpan(4) | [ ] [ ] |
| [ ] [ ] Boulders(9) | [ ] [ ] | [ ] [x] Detritus(3) | [x] [x] |
| [ ] [ ] Cobble(8) | [x] [ ] | [ ] [ ] Muck(2) | [ ] [ ] |
| [ ] [ ] Gravel(7) | [ ] [ ] | [x] [ ] Silt(2) | [x] [x] |
| [ ] [ ] Sand(6) | [ ] [ ] | [ ] [ ] Sludge(1) | [ ] [ ] |
| [ ] [ ] Bedrock(5) | [ ] [ ] | [ ] [ ] Artificial(0) | [ ] [ ] |

Substrate Quality (check only 1, or check 2 and AVERAGE)

Substrate Origin: [ ] Limestone(1) [ ] Hardpan(0) [ ] Lacustrine(0) [ ] Tills(1) [ ] Sandstone(0) [ ] Shale(-1) [ ] Wetlands(0) [x] Rip/Rap(0) [ ] Coal fines(-2)

Silt Cover: [x] Silt heavy(-2) [ ] Silt moderate(-1) [ ] Silt normal(0) [ ] Silt free(1)

Embeddedness: [x] Extensive(-2) [ ] Moderate(-1) [ ] Low/Normal(0) [ ] None(1)

NOTE: ignore sludge originating from point sources; score based on natural substrates

[x] >4 substrates present(2)

Comments: 2.5 + 2 - 4 = .5

## 2-Instream Cover (20 points maximum

**Instream Cover Score: 8**

Type (check ALL that apply): [ ] Undercut banks(1) [x] Deep pools(2) [ ] Oxbows(1) [ ] Overhanging vegetation(1) [ ] Rootwads(1) [ ] Aquatic macrophytes(1) [x] Shallows(in slow water)(1) [x] Boulders(1) [x] Logs and woody debris(1) [ ] Rootmats(1)

Amount (check only 1, or 2 and AVERAGE): [ ] Extensive >75% (11) [ ] Moderate 25-75% (7) [x] Sparse 5-25% (3) [ ] Nearly absent <5% (1)

Comments:

## 3-Channel Morphology (20) (check only one per category, OR two and AVERAGE)

**Channel Score: 7**

| Sinuosity | Development | Channelization | Stability | Modifications/Other | |
|---|---|---|---|---|---|
| [ ] High (4) | [ ] Excellent (7) | [ ] None (6) | [ ] High (3) | [ ] Snagging | [ ] Impound |
| [ ] Moderate (3) | [ ] Good (5) | [ ] Recovered (4) | [x] Moderate (2) | [ ] Relocation | [ ] Islands |
| [ ] Low (2) | [ ] Fair (3) | [x] Recovering (3) | [ ] Low (1) | [ ] Canopy Removal | [ ] Leveed |
| [x] None (1) | [x] Poor (1) | [ ] Recent or no recovery (1) | | [ ] Dredging | [ ] Bank shaping |
| | | | | [ ] One side channel modifications | |

Comments: appears channelized - very uniform

## 4-Riparian Zone & Bank Erosion (10 points maximum)

**Riparian Score: 6**

Left/Right banks looking downstream (For each category, check only one per bank, OR two per bank and AVERAGE).

Riparian width (per bank): [ ] [ ] Wide >50m (4) [ ] [x] Moderate 10-50m (3) [ ] [ ] Narrow 5-10m (2) [ ] [ ] Very narrow <5m (1) [ ] [ ] None (0)

Erosion/Runoff-Floodplain quality (most predominant per bank): [x] [x] Forest, Swamp (3) [ ] [ ] Shrub or Old field (2) [ ] [ ] Residential, Park, New field (1) [ ] [ ] Fenced pasture (1) [ ] [ ] Conservation Tillage (1) [ ] [ ] Urban or Industrial (0) [ ] [ ] Mining, Construction (0) [ ] [x] Open Pasture/Rowcrop (0)

Bank Erosion (per bank): [ ] [ ] None or little (3) [ ] [ ] Moderate (2) [x] [ ] Heavy/Severe (1)

Comments: 3.5 + 1.5 + 0 + 1

## 5a-Pool/Glide Quality (12 points maximum

**Pool/Glide Score: 8**

Max pool depth (check one): [x] >1m (6) [ ] 0.7-1m (4) [ ] 0.4-0.7m (2) [ ] 0.2-0.4m (1) [ ] <0.2m (pool=0)

Morphology (check only one, OR check two and AVERAGE): [ ] Pool width > riffle width (2) [x] Pool width = riffle width (1) [ ] Pool width < riffle width (0)

Pool/Run/Riffle current velocity (check all that apply): [ ] Eddies (1) [ ] Fast (1) [ ] Moderate (1) [x] Slow (1) [ ] Torrential (-1) [ ] Interstitial (-1) [ ] Intermittent (-2) [ ] No pool (0)

Comments:

## 5b-Riffle/Run Quality (8) (check only one per category, OR two and AVERAGE)

**Riffle/Run Score: Ø**

Riffle/run depth (check one): [ ] Generally>10cm, Max>50cm (4) [ ] Generally>10cm, Max<50cm(3) [ ] Generally 5-10cm (1) [x] Generally<5cm (riffle=0)

Riffle/run substrate: [ ] Stable-e.g. cobble, boulder (2) [ ] Mod. stable-e.g. pea gravel (1) [x] Unstable-e.g. sand, gravel (0)

Riffle/run embeddedness: [ ] Extensive (-1) [ ] Moderate (0) [ ] Normal/Low (1) [ ] None (2) [x] No riffle (0)

Comments:

## 6-Gradient (10 points maximum)

**Gradient Score: 2**

Average width: 12 m | Gradient: 0 (ft/mile) | Drainage Area: (square miles)

Comments:

IDEM OWQ Biological Studies QHEI (Qualitative Habitat Evaluation Index)

| Sample # | bioSample # | Stream Name | Location |
|---|---|---|---|
| | | Branchossom creek | [illegible] |

| Surveyor | Sample Date | County | Macro SampleType | [x] Habitat Complete | QHEI Score: 57.5 |
|---|---|---|---|---|---|
| | | Monroe | | | |

## Impacts/Miscellaneous

**Major Suspected Impacts (Check all that apply)**

- [ ] None
- [ ] Industrial
- [ ] WWTP
- [x] Agricultural
- [ ] Livestock
- [ ] Silviculture
- [ ] Construction
- [x] Urban Runoff
- [ ] Suburban
- [x] Channelization
- [ ] Riparian Removal
- [ ] Flow Alteration
- [ ] CSOs
- [ ] Mining
- [ ] Landfills
- [ ] Natural

Pollution Impact Comments:

**Miscellaneous QHEI Information**

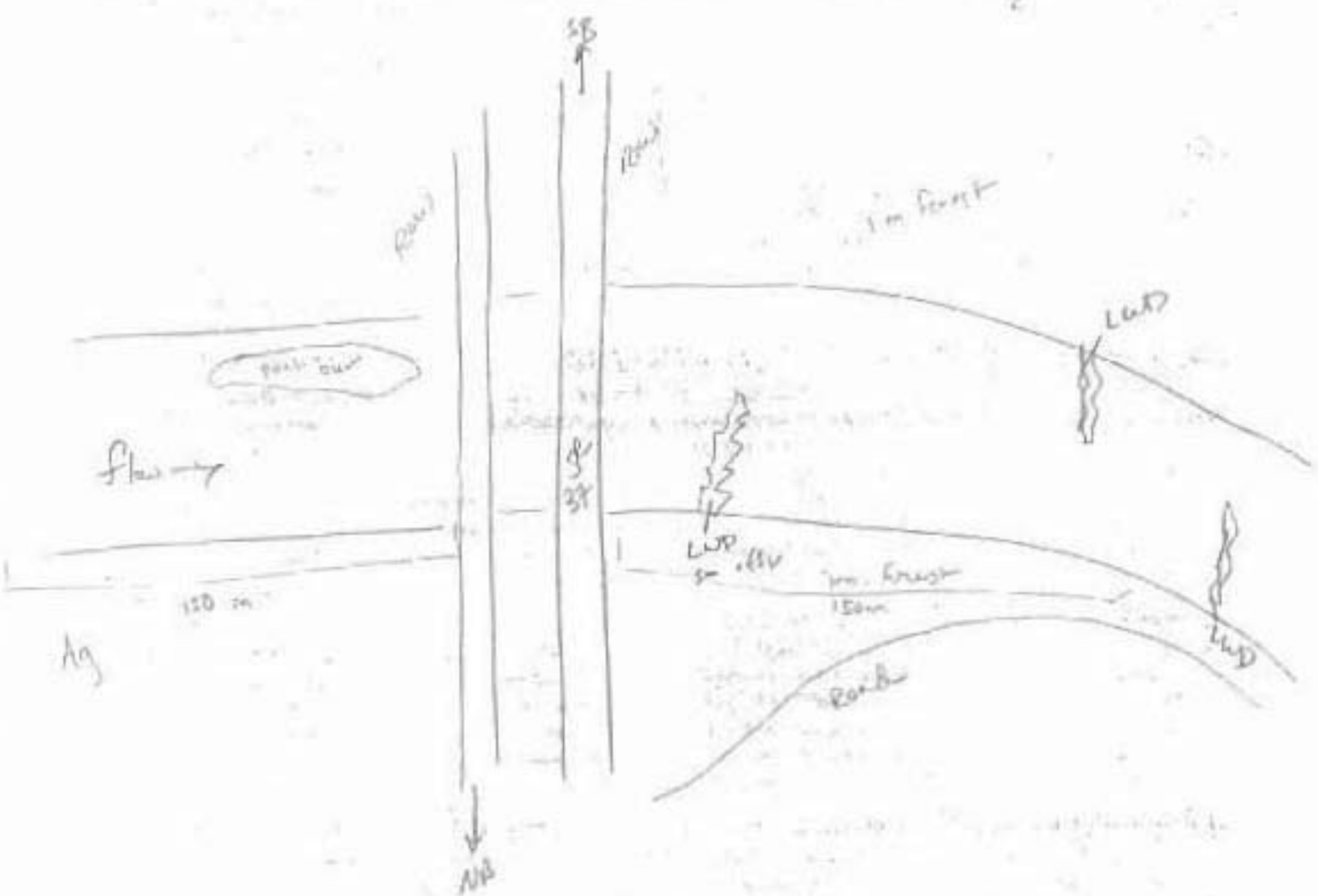
Subjective rating (1-10): 4 | % Riffle: 5 | Is reach representative of stream? yes

Aesthetic rating (1-10): 3 | % Run: 80

Canopy Cover (% Open): 20 | % Glide: 15 | % Pool:

General QHEI Notes:

very homogeneous substrate & morphology



# IDEM — OWQ Biological Studies QHEI (Qualitative Habitat Evaluation Index)

| Sample # | bioSample # | Stream Name | Location |
|---|---|---|---|
| | | Jordan Creek | SR 57 bridge |

| Surveyor | Sample Date | County | Macro SampleType | ☐ Habitat Complete | QHEI Score: 25 |
|---|---|---|---|---|---|
| | 6/30/2007 | Morgan | | | |

## 1-Substrate (20 points maximum)

Substrate Score: 1

Check 1 Predominant Pool & 1 Predominant Riffle

Check all that are present — P=Pool, R=Riffle

| Predominant P R | Present P R | Predominant P R | Present P R |
|---|---|---|---|
| ☐ ☐ Bldrs/Slabs(10) | ☐ ☐ | ☐ ☐ Hardpan(4) | ☐ ☐ |
| ☐ ☐ Boulders(9) | ☐ ☐ | ☐ ☐ Detritus(3) | ☐ ☐ |
| ☐ ☐ Cobble(8) | ☐ ☐ | ☐ ☐ Muck(2) | ☑ ☑ |
| ☐ ☐ Gravel(7) | ☐ ☐ | ☑ ☑ Silt(2) | ☐ ☐ |
| ☐ ☐ Sand(6) | ☐ ☐ | ☐ ☐ Sludge(1) | ☐ ☐ |
| ☐ ☐ Bedrock(5) | ☐ ☐ | ☐ ☐ Artificial(0) | ☐ ☐ |

Substrate Quality (check only 1, or check 2 and AVERAGE)

Substrate Origin: ☐ Limestone(1) ☐ Hardpan(0) ☐ Lacustrine(0) ☑ Tills(1) ☐ Sandstone(0) ☐ Shale(-1) ☐ Wetlands(0) ☐ Rip/Rap(0) ☐ Coal fines(-2)

Silt Cover: ☑ Silt heavy(-2) ☐ Silt moderate(-1) ☐ Silt normal(0) ☐ Silt free(1)

Embeddedness: ☑ Extensive(-2) ☐ Moderate(-1) ☐ Low/Normal(0) ☐ None(1)

NOTE: ignore sludge originating from point sources; score based on natural substrates

☐ >4 substrates present(2)

Comments: 4/4 -4 = 1

## 2-Instream Cover (20 points maximum

Instream Cover Score: 12

Type (check ALL that apply)

☐ Undercut banks(1) ☐ Deep pools(2) ☐ Oxbows(1)
☑ Overhanging vegetation(1) ☐ Rootwads(1) ☐ Aquatic macrophytes(1)
☐ Shallows(in slow water)(1) ☐ Boulders(1) ☐ Logs and woody debris(1)
☐ Rootmats(1)

Comments: DRY

Amount (check only 1, or 2 and AVERAGE)

☑ Extensive >75% (11)
☐ Moderate 25-75% (7)
☐ Sparse 5-25% (3)
☐ Nearly absent <5% (1)

## 3-Channel Morphology (20) (check only one per category, OR two and AVERAGE)

Channel Score: 7

| Sinuosity | Development | Channelization | Stability | Modifications/Other | |
|---|---|---|---|---|---|
| ☐ High (4) | ☐ Excellent (7) | ☐ None (6) | ☐ High (3) | ☐ Snagging | ☐ Impound |
| ☐ Moderate (3) | ☐ Good (5) | ☐ Recovered (4) | ☑ Moderate (2) | ☐ Relocation | ☐ Islands |
| ☐ Low (2) | ☐ Fair (3) | ☑ Recovering (3) | ☐ Low (1) | ☐ Canopy Removal | ☐ Leveed |
| ☑ None (1) | ☑ Poor (1) | ☐ Recent or no recovery (1) | | ☐ Dredging | ☐ Bank shaping |
| | | | | | ☐ One side channel modifications |

Comments: appears to have been channelized

## 4-Riparian Zone & Bank Erosion (10 points maximum)

Riparian Score: 3

Left/Right banks looking downstream. (For each category, check only one per bank, OR two per bank and AVERAGE).

| Riparian width L R (per bank) | Erosion/Runoff-Floodplain quality (past 100 ft Riparian) L R (most predominant per bank) | L R | Bank Erosion L R (per bank) |
|---|---|---|---|
| ☐ ☐ Wide >50m (4) | ☐ ☐ Forest, Swamp (3) | ☐ ☐ Conservation Tillage (1) | ☐ ☐ None or little (3) |
| ☐ ☐ Moderate 10-50m (3) | ☐ ☐ Shrub or Old field (2) | ☐ ☐ Urban or Industrial (0) | ☑ ☑ Moderate (2) |
| ☐ ☐ Narrow 5-10m (2) | ☐ ☐ Residential, Park, New field (1) | ☐ ☐ Mining, Construction (0) | ☐ ☐ Heavy/Severe (1) |
| ☑ ☐ Very narrow <5m (1) | ☐ ☐ Fenced pasture (1) | ☑ ☑ Open Pasture/Rowcrop (0) | |
| ☐ ☐ None (0) | | | |

Comments:

## 5a-Pool/Glide Quality (12 points maximum

Pool/Glide Score: 10

Max pool depth (check one)

☐ >1m (6)
☐ 0.7-1m (4)
☐ 0.4-0.7m (2)
☐ 0.2-0.4m (1)
☑ <0.2m (pool=0)

Morphology (check only one, OR check two and AVERAGE)

☐ Pool width > riffle width (2)
☑ Pool width = riffle width (1)
☐ Pool width < riffle width (0)

Pool/Run/Riffle current velocity (check all that apply)

☐ Eddies (1) ☐ Torrential (-1)
☐ Fast (1) ☐ Interstitial (-1)
☐ Moderate (1) ☑ Intermittent (-2)
☐ Slow (1) ☑ No pool (0)

Comments:

## 5b-Riffle/Run Quality (8) (check only one per category, OR two and AVERAGE)

Riffle/Run Score: 0

Riffle/run depth (check one)

☐ Generally>10cm, Max>50cm (4)
☐ Generally>10cm, Max<50cm(3)
☐ Generally 5-10cm (1)
☑ Generally<5cm (riffle=0)

Riffle/run substrate

☐ Stable-e.g. cobble, boulder (2)
☐ Mod. stable-e.g. pea gravel (1)
☑ Unstable-e.g. sand, gravel (0)

Riffle/run embeddedness

☐ Extensive (-1) ☐ Normal/Low (1)
☐ Moderate (0) ☐ None (2)
☑ No riffle (0)

Comments:

## 6-Gradient (10 points maximum)

Gradient Score: 2

Average width: 12 /m Gradient: 0 (ft/mile) Drainage Area: (square miles)

Comments:

IDEM OWQ Biological Studies: QHEI (Qualitative Habitat Evaluation Index)

| Sample # | bioSample # | Stream Name | Location |
|---|---|---|---|
| | | Broad Creek | E SR 37 bridge |

| Surveyor | Sample Date | County | Macro SampleType | Habitat Complete | QHEI Score: |
|---|---|---|---|---|---|
| | 6/30/05 | Morgan | | | 25 |

## Impacts/Miscellaneous

**Major Suspected Impacts (Check all that apply)**

- [ ] None
- [ ] Industrial
- [ ] WWTP
- [x] Agricultural
- [ ] Livestock
- [ ] Silviculture
- [ ] Construction
- [x] Urban Runoff
- [ ] Suburban
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Flow Alteration
- [ ] CSOs
- [ ] Mining
- [ ] Landfills
- [ ] Natural

Pollution Impact Comments:

**Miscellaneous QHEI Information**

Subjective rating (1-10): 2 % Riffle: – Is reach representative of stream? yes

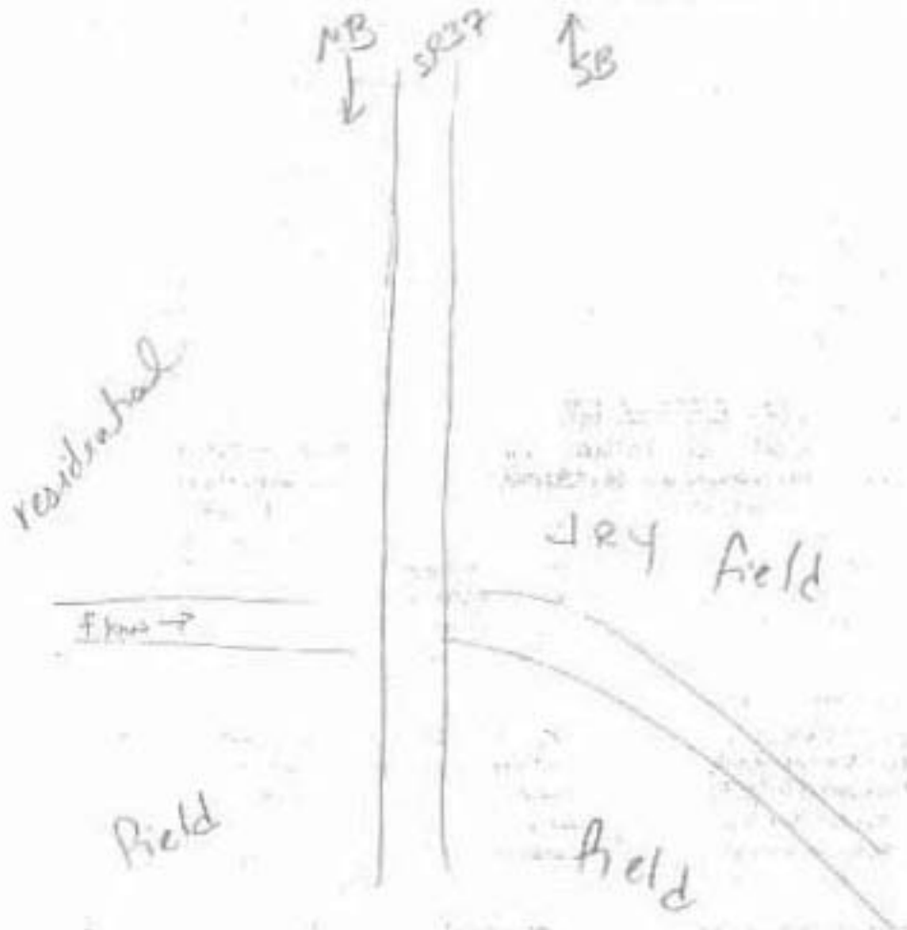
Aesthetic rating (1-10): 0 % Run: –

Canopy Cover (% Open): 100 % Glide: –

% Pool: –

General QHEI Notes:

appears more like a ditch



# IDEM — OWQ Biological Studies QHEI (Qualitative Habitat Evaluation Index)

Sample # | bioSample # | Stream Name: GRIFFEY CREEK | Location: SR 37 bridge

Surveyor: RW | Sample Date | County: Monroe | Macro SampleType | ☑ Habitat Complete

**QHEI Score: 34**

## 1-Substrate (20 points maximum)

**Substrate Score: 1**

Check 1 Predominant Pool & 1 Predominant Riffle

Check all that are present — P=Pool, R=Riffle

| Predominant P | Predominant R | Present P | Present R | | Predominant P | Predominant R | Present P | Present R | |
|---|---|---|---|---|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | Bldrs/Slabs(10) | ☐ | ☐ | ☐ | ☐ | Hardpan(4) |
| ☐ | ☐ | ☑ | ☐ | Boulders(9) | ☐ | ☐ | ☑ | ☑ | Detritus(3) |
| ☐ | ☐ | ☐ | ☑ | Cobble(8) | ☐ | ☐ | ☐ | ☑ | Muck(2) |
| ☐ | ☐ | ☐ | ☑ | Gravel(7) | ☑ | ☑ | ☐ | ☐ | Silt(2) |
| ☐ | ☐ | ☐ | ☑ | Sand(6) | ☐ | ☐ | ☐ | ☐ | Sludge(1) |
| ☐ | ☐ | ☐ | ☐ | Bedrock(5) | ☐ | ☐ | ☐ | ☐ | Artificial(0) |

Substrate Quality (check only 1, or check 2 and AVERAGE)

Substrate Origin: ☑ Limestone(1) ☐ Hardpan(0) ☐ Lacustrine(0) ☐ Tills(1) ☐ Sandstone(0) ☑ Shale(-1) ☐ Wetlands(0) ☐ Rip/Rap(0) ☐ Coal fines(-2)

Silt Cover: ☑ Silt heavy(-2) ☐ Silt moderate(-1) ☐ Silt normal(0) ☐ Silt free(1)

Embeddedness: ☑ Extensive(-2) ☐ Moderate(-1) ☐ Low/Normal(0) ☐ None(1)

NOTE: ignore sludge originating from point sources; score based on natural substrates

☑ >4 substrates present(2)

Comments: 4+2 = 6 (-5) 1

## 2-Instream Cover (20 points maximum

**Instream Cover Score: 8**

Type (check ALL that apply)

☐ Undercut banks(1) ☑ Deep pools(2) ☐ Oxbows(1)
☐ Overhanging vegetation(1) ☐ Rootwads(1) ☐ Aquatic macrophytes(1)
☑ Shallows(in slow water)(1) ☑ Boulders(1) ☑ Logs and woody debris(1)
☐ Rootmats(1)

Amount (check only 1, or 2 and AVERAGE)

☐ Extensive >75% (11)
☐ Moderate 25-75% (7)
☑ Sparse 5-25% (3)
☐ Nearly absent <5% (1)

Comments: 5+3

## 3-Channel Morphology (20) (check only one per category, OR two and AVERAGE)

**Channel Score: 5**

| Sinuosity | Development | Channelization | Stability | Modifications/Other | |
|---|---|---|---|---|---|
| ☐ High (4) | ☐ Excellent (7) | ☐ None (6) | ☐ High (3) | ☐ Snagging | ☐ Impound |
| ☐ Moderate (3) | ☐ Good (5) | ☐ Recovered (4) | ☑ Moderate (2) | ☐ Relocation | ☐ Islands |
| ☑ Low (2) | ☐ Fair (3) | ☐ Recovering (3) | ☐ Low (1) | ☐ Canopy Removal | ☐ Leveed |
| ☑ None (1) | ☑ Poor (1) | ☑ Recent or no recovery (1) | | ☐ Dredging | ☐ Bank shaping |
| | | | | ☐ One side channel modifications | |

Comments:

## 4-Riparian Zone & Bank Erosion (10 points maximum)

**Riparian Score: 6**

Left/Right banks looking downstream (For each category, check only one per bank, OR two per bank and AVERAGE).

Riparian width (per bank)

| L | R | |
|---|---|---|
| ☐ | ☐ | Wide >50m (4) |
| ☑ | ☑ | Moderate 10-50m (3) |
| ☐ | ☐ | Narrow 5-10m (2) |
| ☐ | ☐ | Very narrow <5m (1) |
| ☐ | ☐ | None (0) |

Erosion/Runoff-Floodplain quality (past 100 ft Riparian) (most predominant per bank)

| L | R | |
|---|---|---|
| ☐ | ☐ | Forest, Swamp (3) |
| ☑ | ☑ | Shrub or Old field (2) |
| ☐ | ☐ | Residential, Park, New field (1) |
| ☐ | ☐ | Fenced pasture (1) |
| ☐ | ☐ | Conservation Tillage (1) |
| ☐ | ☐ | Urban or Industrial (0) |
| ☐ | ☐ | Mining, Construction (0) |
| ☑ | ☑ | Open Pasture/Rowcrop (0) |

Bank Erosion (per bank)

| L | R | |
|---|---|---|
| ☐ | ☐ | None or little (3) |
| ☐ | ☐ | Moderate (2) |
| ☑ | ☑ | Heavy/Severe (1) |

Comments:

## 5a-Pool/Glide Quality (12 points maximum

**Pool/Glide Score: 8**

Max pool depth (check one)

☑ >1m (6)
☐ 0.7-1m (4)
☐ 0.4-0.7m (2)
☐ 0.2-0.4m (1)
☐ <0.2m (pool=0)

Morphology (check only one, OR check two and AVERAGE)

☐ Pool width > riffle width (2)
☑ Pool width = riffle width (1)
☐ Pool width < riffle width (0)

Pool/Run/Riffle current velocity (check all that apply)

☐ Eddies (1) ☐ Torrential (-1)
☐ Fast (1) ☐ Interstitial (-1)
☐ Moderate (1) ☐ Intermittent (-2)
☑ Slow (1) ☐ No pool (0)

Comments:

## 5b-Riffle/Run Quality (8) (check only one per category, OR two and AVERAGE)

**Riffle/Run Score: 8**

Riffle/run depth (check one)

☐ Generally>10cm, Max>50cm (4)
☐ Generally>10cm, Max<50cm(3)
☑ Generally 5-10cm (1)
☐ Generally<5cm (riffle=0)

Riffle/run substrate

☐ Stable-e.g. cobble, boulder (2)
☐ Mod. stable-e.g. pea gravel (1)
☑ Unstable-e.g. sand, gravel (0)

Riffle/run embeddedness

☑ Extensive (-1) ☐ Normal/Low (1)
☐ Moderate (0) ☐ None (2)
☑ No riffle (0)

Comments:

## 6-Gradient (10 points maximum)

**Gradient Score: 6**

Average width: 4m | Gradient: 10 (ft/mile) | Drainage Area: (square miles)

Comments:

IDEM OWQ Biological Studies QHEI (Qualitative Habitat Evaluation Index)

| Sample # | bioSample # | Stream Name | Location |
|---|---|---|---|
| | | GRIFFEY CREEK | @ SR 37 |

| Surveyor | Sample Date | County | Macro SampleType | % Habitat Complete | QHEI Score: |
|---|---|---|---|---|---|
| | | | | | 34 |

## Impacts/Miscellaneous

**Major Suspected Impacts (Check all that apply)**

- [ ] None
- [ ] Industrial
- [ ] WWTP
- [x] Agricultural
- [ ] Livestock
- [ ] Silviculture
- [ ] Construction
- [x] Urban Runoff
- [ ] Suburban
- [x] Channelization
- [x] Riparian Removal
- [ ] Flow Alteration
- [ ] CSOs
- [ ] Mining
- [ ] Landfills
- [ ] Natural

Pollution Impact Comments:

**Miscellaneous QHEI Information**

Subjective rating (1-10): 5 | % Riffle: 0 | Is reach representative of stream? yes

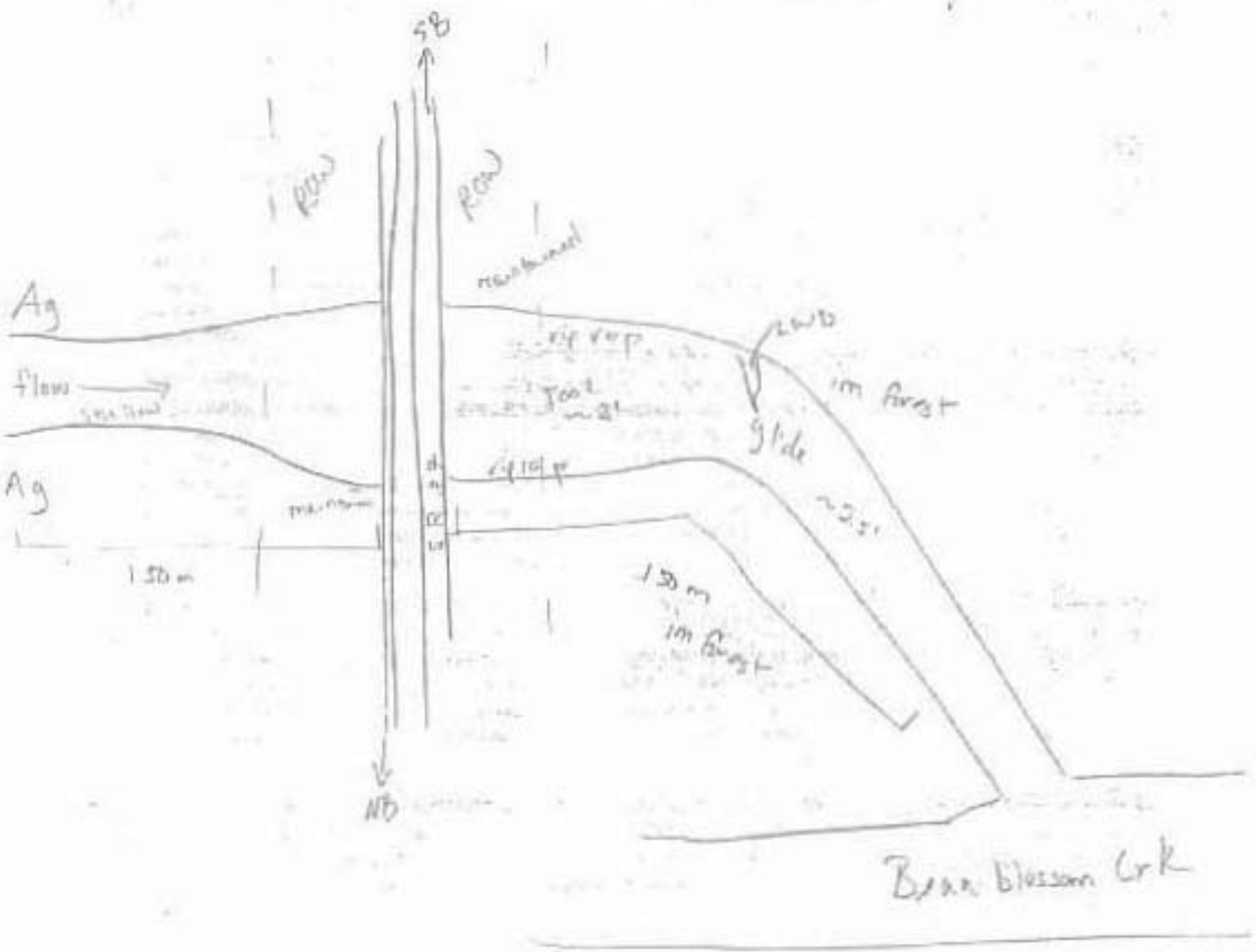
Aesthetic rating (1-10): 3 | % Run: 80

% Glide: 10

Canopy Cover (% Open): 30 | % Pool: 10

General QHEI Notes:

Substrate very loose, shifty



IDEM — OWQ Biological Studies QHEI (Qualitative Habitat Evaluation Index)

| Sample # | bioSample # | Stream Name | Location |
|---|---|---|---|
| | | Bryant Creek | @ SR-37 bridge |

| Surveyor | Sample Date | County | Macro Sample Type | Habitat Complete | QHEI Score: |
|---|---|---|---|---|---|
| | 6/29/05 | Monroe | | | 64 |

## 1-Substrate (20 points maximum)

Substrate Score: 17

Check 1 Predominant Pool & 1 Predominant Riffle

Check all that are present — P=Pool, R=Riffle

| Predominant P | Predominant R | Present P | Present R | | Predominant P | Predominant R | Present P | Present R | |
|---|---|---|---|---|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | Bldrs/Slabs(10) | ☐ | ☐ | ☐ | ☐ | Hardpan(4) |
| ☐ | ☐ | ☐ | ☐ | Boulders(9) | ☐ | ☐ | ☐ | ☐ | Detritus(3) |
| ☐ | ☐ | ☐ | ☐ | Cobble(8) | ☐ | ☐ | ☐ | ☐ | Muck(2) |
| ☑ | ☑ | ☑ | ☑ | Gravel(7) | ☐ | ☐ | ☐ | ☐ | Silt(2) |
| ☐ | ☐ | ☐ | ☐ | Sand(6) | ☐ | ☐ | ☐ | ☐ | Sludge(1) |
| ☐ | ☐ | ☐ | ☐ | Bedrock(5) | ☐ | ☐ | ☐ | ☐ | Artificial(0) |

Substrate Quality (check only 1, or check 2 and AVERAGE)

Substrate Origin: ☐ Limestone(1) ☐ Hardpan(0) ☐ Lacustrine(0) ☑ Tills(1) ☐ Sandstone(0) ☐ Shale(-1) ☐ Wetlands(0) ☐ Rip/Rap(0) ☐ Coal fines(-2)

Silt Cover: ☐ Silt heavy(-2) ☐ Silt moderate(-1) ☑ Silt normal(0) ☐ Silt free(1)

Embeddedness: ☐ Extensive(-2) ☐ Moderate(-1) ☑ Low/Normal(0) ☐ None(1)

NOTE: Ignore sludge originating from point sources; score based on natural substrates

☑ >4 substrates present(2)

Comments:

## 2-Instream Cover (20 points maximum

Instream Cover Score: 12

Type (check ALL that apply)

☐ Undercut banks(1) ☐ Deep pools(2) ☐ Oxbows(1)
☑ Overhanging vegetation(1) ☐ Rootwads(1) ☐ Aquatic macrophytes(1)
☑ Shallows(in slow water)(1) ☐ Boulders(1) ☑ Logs and woody debris(1)
☐ Rootmats(1)

Amount (check only 1, or 2 and AVERAGE)

☐ Extensive >75% (11)
☑ Moderate 25-75% (7)
☐ Sparse 5-25% (3)
☐ Nearly absent <5% (1)

Comments: 18

## 3-Channel Morphology (20) (check only one per category, OR two and AVERAGE)

Channel Score: 13.5

| Sinuosity | Development | Channelization | Stability | Modifications/Other | |
|---|---|---|---|---|---|
| ☐ High (4) | ☐ Excellent (7) | ☑ None (6) | ☐ High (3) | ☐ Snagging | ☐ Impound |
| ☑ Moderate (3) | ☐ Good (5) | ☐ Recovered (4) | ☑ Moderate (2) | ☐ Relocation | ☐ Islands |
| ☐ Low (2) | ☑ Fair (3) | ☐ Recovering (3) | ☑ Low (1) 1.5 | ☐ Canopy Removal | ☐ Leveed |
| ☐ None (1) | ☐ Poor (1) | ☐ Recent or no recovery (1) | | ☐ Dredging | ☐ Bank shaping |

Comments: dam top end / middle end of site

☐ One side channel modifications

## 4-Riparian Zone & Bank Erosion (10 points maximum)

Riparian Score: 7.5

Left/Right banks looking downstream (For each category, check only one per bank, OR two per bank and AVERAGE).

Riparian width (per bank)

☐ ☐ Wide >50m (4)
☐ ☐ Moderate 10-50m (3)
☑ ☑ Narrow 5-10m (2)
☐ ☐ Very narrow <5m (1)
☐ ☐ None (0)

Erosion/Runoff-Floodplain quality (past 100 ft Riparian) (most predominant per bank)

☑ ☑ Forest, Swamp (3)
☐ ☐ Shrub or Old field (2)
☐ ☐ Residential, Park, New field (1)
☐ ☐ Fenced pasture (1) 1.5
☐ ☐ Conservation Tillage (1)
☐ ☐ Urban or Industrial (0)
☐ ☐ Mining, Construction (0)
☑ ☑ Open Pasture/Rowcrop (0)

Bank Erosion (per bank)

☐ ☐ None or little (3)
☐ ☐ Moderate (2)
☑ ☑ Heavy/Severe (1)

Comments:

## 5a-Pool/Glide Quality (12 points maximum

Pool/Glide Score: 9

Max pool depth (check one)

☑ >1m (6)
☐ 0.7-1m (4)
☐ 0.4-0.7m (2)
☐ 0.2-0.4m (1)
☐ <0.2m (pool=0)

Morphology (check only one, OR check two and AVERAGE)

☑ Pool width > riffle width (2)
☐ Pool width = riffle width (1)
☐ Pool width < riffle width (0)

Pool/Run/Riffle current velocity (check all that apply)

☐ Eddies (1) ☐ Torrential (-1)
☐ Fast (1) ☑ Interstitial (-1)
☑ Moderate (1) ☐ Intermittent (-2)
☑ Slow (1) ☐ No pool (0)

Comments:

## 5b-Riffle/Run Quality (8) (check only one per category, OR two and AVERAGE)

Riffle/Run Score: 2

Riffle/run depth (check one)

☐ Generally>10cm, Max>50cm (4)
☐ Generally>10cm, Max<50cm(3)
☑ Generally 5-10cm (1) .5
☑ Generally<5cm (riffle=0)

Riffle/run substrate

☐ Stable-e.g. cobble, boulder (2)
☑ Mod. stable-e.g. pea gravel (1) .5
☑ Unstable-e.g. sand, gravel (0)

Riffle/run embeddedness

☐ Extensive (-1) ☑ Normal/Low (1)
☐ Moderate (0) ☐ None (2)
☐ No riffle (0)

Comments:

## 6-Gradient (10 points maximum)

Gradient Score: 6

Average width: 3 Gradient: 10 (ft/mile) Drainage Area: (square miles)

Comments:

IDEM OWQ Biological Studies QHEI (Qualitative Habitat Evaluation Index)

| Sample # | bioSample # | Stream Name | Location |
|---|---|---|---|
| | | BRYANT CREEK | [illegible] SR37 |

| Surveyor | Sample Date | County | Macro SampleType | ☐ Habitat Complete | QHEI Score: 64 |
|---|---|---|---|---|---|
| | 6/29/2007 | MORGAN | | | |

## Impacts/Miscellaneous

**Major Suspected Impacts (Check all that apply)**

- ☐ None
- ☐ Industrial
- ☐ WWTP
- ☐ Agricultural
- ☐ Livestock
- ☐ Silviculture
- ☐ Construction
- ☐ Urban Runoff
- ☐ Suburban
- ☐ Channelization
- ☐ Riparian Removal
- ☐ Flow Alteration
- ☐ CSOs
- ☐ Mining
- ☐ Landfills
- ☐ Natural

Pollution Impact Comments:

**Miscellaneous QHEI Information**

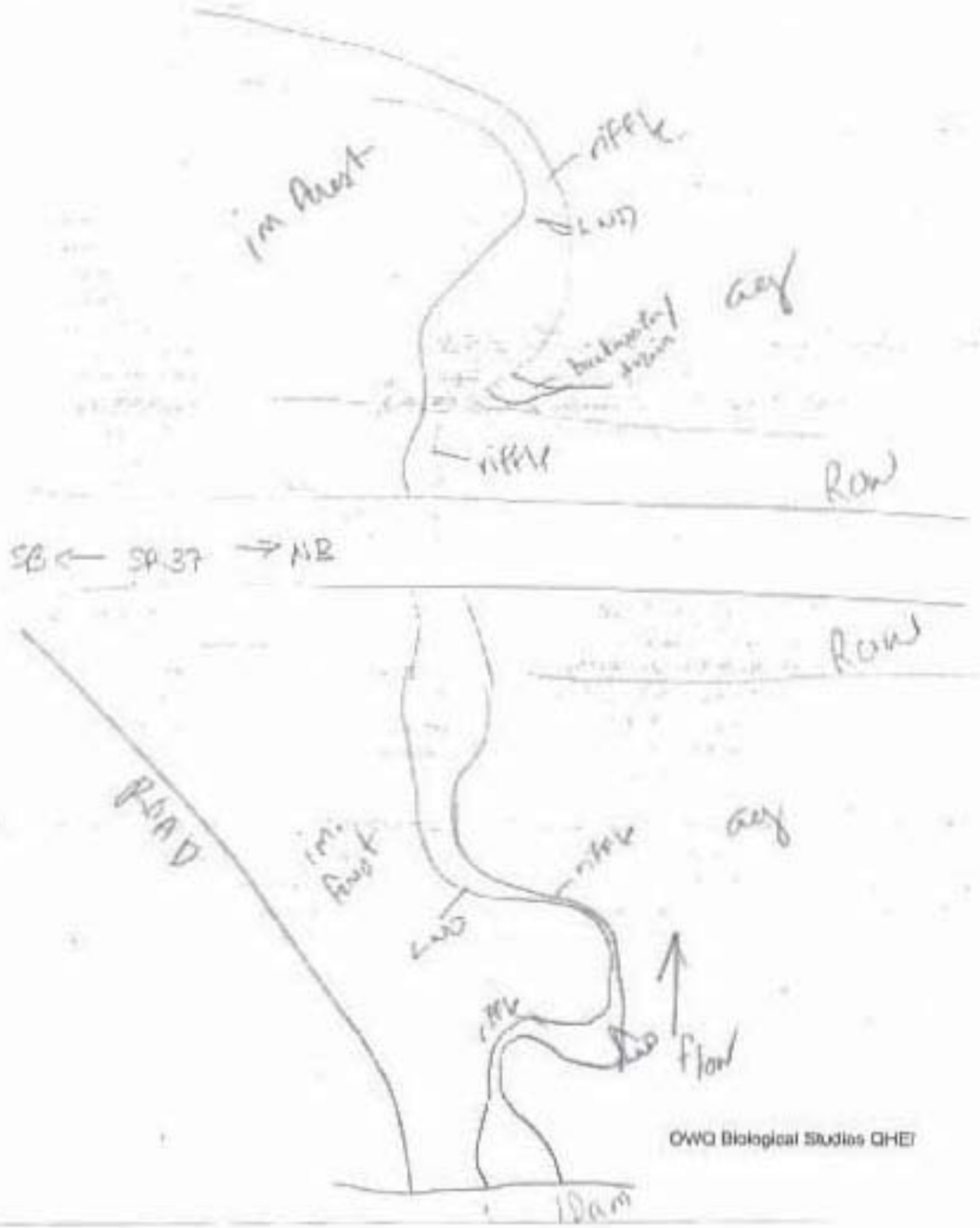
Subjective rating (1-10): 8 | % Riffle: 30 | Is reach representative of stream? yes

Aesthetic rating (1-10): 8 | % Run: 30

% Glide: 10

Canopy Cover (% Open): 70 | % Pool: 20

General QHEI Notes:




OWQ Biological Studies QHEI

IDEM — OWQ Biological Studies QHEI (Qualitative Habitat Evaluation Index)

Sample # | bioSample # | Stream Name: Little Indian Crk | Location: SR37 bridge

Surveyor | Sample Date: 10/20/05 | County: Morgan | Macro SampleType | ☐ Habitat Complete | QHEI Score: 53.5

## 1-Substrate (20 points maximum)

Substrate Score: 11.5

Check 1 Predominant Pool & 1 Predominant Riffle

Check all that are present — P=Pool, R=Riffle

| Predominant P | Predominant R | Present P | Present R | Predominant P | Predominant R | Present P | Present R |
|---|---|---|---|---|---|---|---|
| | | | | | Hardpan(4) | | |
| | Bldrs/Slabs(10) | | | | Detritus(3) | | ✓ |
| | Boulders(9) | | | | Muck(2) | | |
| | Cobble(8) | ✓ | ✓ | ✓ | Silt(2) | | ✓ |
| | Gravel(7) | ✓ | ✓ | | Sludge(1) | | |
| ✓ | Sand(6) | ✓ | ✓ | | Artificial(0) | | |
| | Bedrock(5) | | | | | | |

6.5 + 4 = 10.5

Substrate Quality (check only 1, or check 2 and AVERAGE)

Substrate Origin: ☐ Limestone(1) ☐ Hardpan(0) ☐ Lacustrine(0) ✓ Tills(1) ☐ Sandstone(0) ☐ Shale(-1) ☐ Wetlands(0) ☐ Rip/Rap(0) ☐ Coal fines(-2)

Silt Cover: ☐ Silt heavy(-2) ✓ Silt moderate(-1) ☐ Silt normal(0) ☐ Silt free(1)

Embeddedness: ☐ Extensive(-2) ✓ Moderate(-1) ☐ Low/Normal(0) ☐ None(1)

NOTE: ignore sludge originating from point sources; score based on natural substrates

✓ 4 substrates present(2)

Comments: 10.5 + 2 = 12.5 + 13.5 - 2 = 11.5

## 2-Instream Cover (20 points maximum

Instream Cover Score: 8

Type (check ALL that apply): ☐ Undercut banks(1) ✓ Deep pools(2) ☐ Oxbows(1) ✓ Overhanging vegetation(1) ☐ Rootwads(1) ☐ Aquatic macrophytes(1) ✓ Shallows(in slow water)(1) ☐ Boulders(1) ✓ Logs and woody debris(1) ☐ Rootmats(1)

Amount (check only 1, or 2 and AVERAGE): ☐ Extensive >75% (11) ☐ Moderate 25-75% (7) ✓ Sparse 5-25% (3) ☐ Nearly absent <5% (1)

Comments:

## 3-Channel Morphology (20) (check only one per category, OR two and AVERAGE)

Channel Score: 13

| Sinuosity | Development | Channelization | Stability | Modifications/Other | |
|---|---|---|---|---|---|
| ☐ High (4) | ☐ Excellent (7) | ✓ None (6) | ☐ High (3) | ☐ Snagging | ☐ Impound |
| ☐ Moderate (3) | ☐ Good (5) | ☐ Recovered (4) | ✓ Moderate (2) | ☐ Relocation | ☐ Islands |
| ✓ Low (2) | ✓ Fair (3) | ☐ Recovering (3) | ☐ Low (1) | ☐ Canopy Removal | ☐ Leveed |
| ☐ None (1) | ☐ Poor (1) | ☐ Recent or no recovery (1) | | ☐ Dredging | ☐ Bank shaping |
| | | | | ☐ One side channel modifications | |

Comments:

## 4-Riparian Zone & Bank Erosion (10 points maximum)

Riparian Score: 7

Left/Right banks looking downstream (For each category, check only one per bank, OR two per bank and AVERAGE).

Riparian width (per bank): ✓ ✓ Wide >50m (4) (4) ☐ ☐ Moderate 10-50m (3) ☐ ☐ Narrow 5-10m (2) ☐ ☐ Very narrow <5m (1) ☐ ☐ None (0)

Erosion/Runoff-Floodplain quality (past 100 ft Riparian) (most predominant per bank): ☐ ☐ Forest, Swamp (3) ✓ ✓ Shrub or Old field (2) ☐ ☐ Residential, Park, New field (1) (1) ☐ ☐ Fenced pasture (1)

L R: ☐ ☐ Conservation Tillage (1) ☐ ☐ Urban or Industrial (0) ☐ ☐ Mining, Construction (0) ✓ ✓ Open Pasture/Rowcrop (0)

Bank Erosion (per bank): ☐ ☐ None or little (3) ✓ ✓ Moderate (2) (2) ☐ ☐ Heavy/Severe (1)

Comments:

## 5a-Pool/Glide Quality (12 points maximum

Pool/Glide Score: 9

Max pool depth (check one): ☐ >1m (6) ✓ 0.7-1m (4) ☐ 0.4-0.7m (2) ☐ 0.2-0.4m (1) ☐ <0.2m (pool=0)

Morphology (check only one, OR check two and AVERAGE): ✓ Pool width > riffle width (2) ☐ Pool width = riffle width (1) ☐ Pool width < riffle width (0)

Pool/Run/Riffle current velocity (check all that apply): ✓ Eddies (1) ☐ Fast (1) ✓ Moderate (1) ✓ Slow (1) ☐ Torrential (-1) ☐ Interstitial (-1) ☐ Intermittent (-2) ☐ No pool (0)

Comments:

## 5b-Riffle/Run Quality (8) (check only one per category, OR two and AVERAGE)

Riffle/Run Score: 4

Riffle/run depth (check one): ☐ Generally>10cm, Max>50cm (4) ✓ Generally>10cm, Max<50cm(3) ☐ Generally 5-10cm (1) ☐ Generally<5cm (riffle=0)

Riffle/run substrate: ☐ Stable-e.g. cobble, boulder (2) ✓ Mod. stable-e.g. pea gravel (1) ☐ Unstable-e.g. sand, gravel (0)

Riffle/run embeddedness: ☐ Extensive (-1) ✓ Moderate (0) ☐ Normal/Low (1) ☐ None (2) ☐ No riffle (0)

Comments:

## 6-Gradient (10 points maximum)

Gradient Score: 6

Average width: 4 | Gradient: 5 (ft/mile) | Drainage Area: (square miles)

Comments:

IDEM OWQ Biological Studies QHEI (Qualitative Habitat Evaluation Index)

| Sample # | bioSample # | Stream Name | Location |
|---|---|---|---|
| | | Little Indian Creek | @ SR 37 |

| Surveyor | Sample Date | County | Macro SampleType | Habitat Complete | QHEI Score: |
|---|---|---|---|---|---|
| | 6/30/2005 | MORGAN | | ☐ | 58.5 |

## Impacts/Miscellaneous

**Major Suspected Impacts (Check all that apply)**

- ☐ None
- ☐ Industrial
- ☐ WWTP
- ☑ Agricultural
- ☐ Livestock
- ☐ Silviculture
- ☐ Construction
- ☑ Urban Runoff
- ☐ Suburban
- ☐ Channelization
- ☐ Riparian Removal
- ☐ Flow Alteration
- ☐ CSOs
- ☐ Mining
- ☐ Landfills
- ☐ Natural

Pollution Impact Comments:

**Miscellaneous QHEI Information**

Subjective rating (1-10): 6 | % Riffle: 30 | Is reach representative of stream? yes

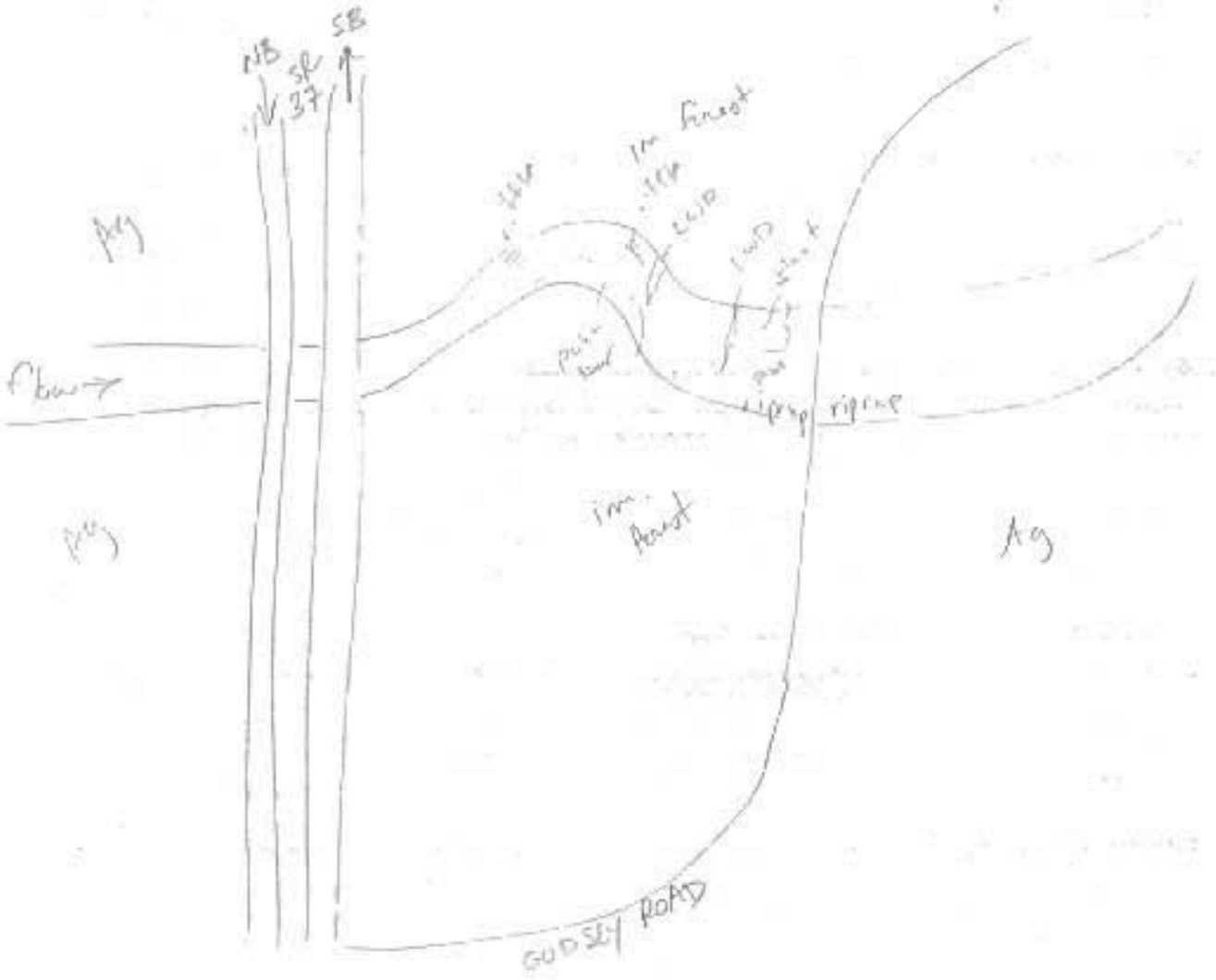
Aesthetic rating (1-10): 5 | % Run: 15

% Glide: 15

Canopy Cover (% Open): 30 | % Pool: 30

General QHEI Notes:

one culvert found - 5 mile. small, trash @ bridge



# OWQ Biological Studies QHEI (Qualitative Habitat Evaluation Index)

| Sample # | bioSample # | Stream Name | Location |
|---|---|---|---|
| (253e) | | | UT to Bryant Creek |

| Surveyor | Sample Date | County | Macro SampleType | Habitat Complete | QHEI Score: |
|---|---|---|---|---|---|
| RW | 5/8/06 | Monroe | | ☒ | 68.5 |

## 1-Substrate (20 points maximum)

Substrate Score: 16.5

Check 1 Predominant Pool & 1 Predominant Riffle

Check all that are present — P=Pool, R=Riffle

| Predominant P | Predominant R | | Present P | Present R | Predominant P | Predominant R | | Present P | Present R |
|---|---|---|---|---|---|---|---|---|---|
| ☒ | ☒ | Bldrs/Slabs(10) | ☒ | ☒ | ☐ | ☐ | Hardpan(4) | ☐ | ☐ |
| ☐ | ☐ | Boulders(9) | ☒ | ☒ | ☐ | ☐ | Detritus(3) | ☒ | ☒ |
| ☐ | ☐ | Cobble(8) | ☒ | ☒ | ☐ | ☐ | Muck(2) | ☐ | ☐ |
| ☐ | ☒ | Gravel(7) | ☒ | ☒ | ☐ | ☐ | Silt(2) | ☒ | ☐ |
| ☐ | ☐ | Sand(6) | ☒ | ☒ | ☐ | ☐ | Sludge(1) | ☐ | ☐ |
| ☒ | ☒ | Bedrock(5) | ☒ | ☒ | ☐ | ☐ | Artificial(0) | ☐ | ☐ |

Substrate Quality (check only 1, or check 2 and AVERAGE)

Substrate Origin: ☒ Limestone(1) ☐ Hardpan(0) ☐ Lacustrine(0) ☐ Tills(1) ☐ Sandstone(0) ☐ Shale(-1) ☒ Wetlands(0) ☐ Rip/Rap(0) ☐ Coal fines(-2)

Silt Cover: ☐ Silt heavy(-2) ☐ Silt moderate(-1) ☐ Silt normal(0) ☒ Silt free(1)

Embeddedness: ☐ Extensive(-2) ☐ Moderate(-1) ☒ Low/Normal(0) ☐ None(1)

NOTE: ignore sludge originating from point sources; score based on natural substrates

☒ >4 substrates present(2)

Comments: 6+5+4+.5+1 16.5

## 2-Instream Cover (20 points maximum

Instream Cover Score: 7

Type (check ALL that apply): ☐ Undercut banks(1) ☐ Deep pools(2) ☐ Oxbows(1) ☒ Overhanging vegetation(1) ☐ Rootwads(1) ☐ Aquatic macrophytes(1) ☒ Shallows(in slow water)(1) ☒ Boulders(1) ☒ Logs and woody debris(1) ☐ Rootmats(1)

Amount (check only 1, or 2 and AVERAGE): ☐ Extensive >75% (11) ☐ Moderate 25-75% (7) ☒ Sparse 5-25% (3) ☐ Nearly absent <5% (1)

Comments:

## 3-Channel Morphology (20) (check only one per category, OR two and AVERAGE)

Channel Score: 17

| Sinuosity | Development | Channelization | Stability | Modifications/Other | |
|---|---|---|---|---|---|
| ☒ High (4) | ☐ Excellent (7) | ☒ None (6) | ☐ High (3) | ☐ Snagging | ☐ Impound |
| ☐ Moderate (3) | ☒ Good (5) | ☐ Recovered (4) | ☒ Moderate (2) | ☐ Relocation | ☐ Islands |
| ☐ Low (2) | ☐ Fair (3) | ☐ Recovering (3) | ☐ Low (1) | ☐ Canopy Removal | ☐ Leveed |
| ☐ None (1) | ☐ Poor (1) | ☐ Recent or no recovery (1) | | ☐ Dredging | ☐ Bank shaping |
| | | | | ☒ One side channel modifications | |

Comments: 5+3+

## 4-Riparian Zone & Bank Erosion (10 points maximum)

Riparian Score: 8.5

Left/Right banks looking downstream (For each category, check only one per bank, OR two per bank and AVERAGE).

| Riparian width L | R | (per bank) | Erosion/Runoff-Floodplain quality (past 100 ft Riparian) L | R | (most predominant per bank) | L | R | Bank Erosion L | R | (per bank) |
|---|---|---|---|---|---|---|---|---|---|---|
| ☒ | ☐ | Wide >50m (4) 3.5 | ☒ | ☒ | Forest, Swamp (3) | ☐ | ☐ | ☐ | ☐ | None or little (3) |
| ☐ | ☒ | Moderate 10-50m (3) | ☐ | ☐ | Shrub or Old field (2) 3 | ☐ | ☐ | ☒ | ☒ | Moderate (2) |
| ☐ | ☐ | Narrow 5-10m (2) | ☐ | ☐ | Residential, Park, New field (1) | ☐ | ☐ | ☐ | ☐ | Heavy/Severe (1) |
| ☐ | ☐ | Very narrow <5m (1) | ☐ | ☐ | Fenced pasture (1) | ☐ | ☐ | | | |
| ☐ | ☐ | None (0) | | | | ☐ | ☐ | | | |

Comments:

## 5a-Pool/Glide Quality (12 points maximum

Pool/Glide Score: 5

Max pool depth (check one): ☐ >1m (6) ☐ 0.7-1m (4) ☒ 0.4-0.7m (2) ☒ 0.2-0.4m (1) ☐ <0.2m (pool=0)

Morphology (check only one, OR check two and AVERAGE): ☒ Pool width > riffle width (2) ☐ Pool width = riffle width (1) ☐ Pool width < riffle width (0)

Pool/Run/Riffle current velocity (check all that apply): ☐ Eddies (1) ☒ Fast (1) ☒ Moderate (1) ☒ Slow (1) ☐ Torrential (-1) ☒ Interstitial (-1) ☒ Intermittent (-2) ☐ No pool (0)

maybe 1 or 10 w

Comments:

## 5b-Riffle/Run Quality (8) (check only one per category, OR two and AVERAGE)

Riffle/Run Score: 3.5

Riffle/run depth (check one): ☐ Generally>10cm, Max>50cm (4) ☒ Generally>10cm, Max<50cm(3) 2 ☒ Generally 5-10cm (1) ☐ Generally<5cm (riffle=0)

Riffle/run substrate: ☒ Stable-e.g. cobble, boulder (2) ☒ Mod. stable-e.g. pea gravel (1) 1.5 ☐ Unstable-e.g. sand, gravel (0)

Riffle/run embeddedness: ☐ Extensive (-1) ☒ Moderate (0) ☐ Normal/Low (1) ☐ None (2) ☐ No riffle (0)

Comments:

## 6-Gradient (10 points maximum)

Gradient Score: 6

Average width: WW = 25 BW = 16.5 Gradient: 1.5? (ft/mile) Drainage Area: 7 (square miles)

Comments:

IDEM OWQ Biological Studies QHEI (Qualitative Habitat Evaluation Index)

| Sample # | bioSample # | Stream Name | Location |
|---|---|---|---|
| | | | |

| Surveyor | Sample Date | County | Macro SampleType | ☐ Habitat Complete | QHEI Score: |
|---|---|---|---|---|---|
| | | | | | |

## Impacts/Miscellaneous

**Major Suspected Impacts (Check all that apply)**

- ☐ None
- ☐ Industrial
- ☐ WWTP
- ☐ Agricultural
- ☐ Livestock
- ☐ Silviculture
- ☐ Construction
- ☒ Urban Runoff
- ☐ Suburban
- ☐ Channelization
- ☒ Riparian Removal
- ☐ Flow Alteration
- ☐ CSOs
- ☐ Mining
- ☐ Landfills
- ☐ Natural

**Pollution Impact Comments:**

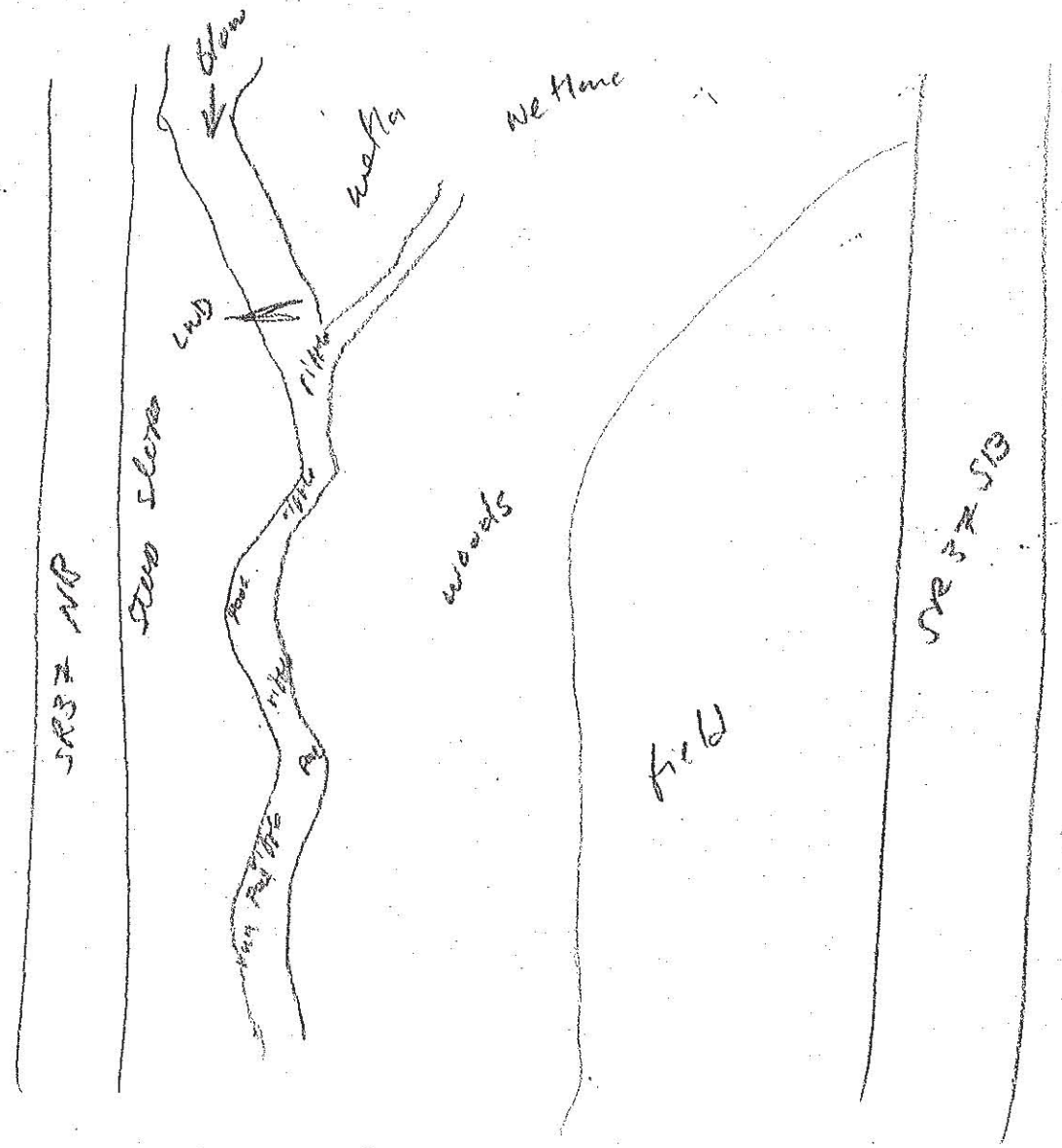
**Miscellaneous QHEI Information**

Subjective rating (1-10): 8 % Riffle: 40 Is reach representative of stream? yes

Aesthetic rating (1-10): 9 % Run: 20

Canopy Cover (% Open): 20 % Pool: 40 % Glide: 10

**General QHEI Notes:**



# UPDATED QHEI FORMS

Sec5-S65 b, c, d

# IDEM OWQ Biological Studies QHEI (Qualitative Habitat Evaluation Index)

| Sample # | bioSample # | Stream Name | Location |
|---|---|---|---|
| | | GRIFFEY CREEK | SR-37 bridge & below |

| Surveyor | Sample Date | County | Macro SampleType | Habitat Complete | QHEI Score: |
|---|---|---|---|---|---|
| RW | | Monroe | | ☑ | 37 |

Modified Warmwater Habitat

## 1-Substrate (20 points maximum)

Substrate Score: 1

Check 1 Predominant Pool & 1 Predominant Riffle

Check all that are present — P=Pool, R=Riffle

| Predominant P | Predominant R | Present P | Present R | | Predominant P | Predominant R | Present P | Present R | |
|---|---|---|---|---|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | Bldrs/Slabs(10) | ☐ | ☐ | ☐ | ☐ | Hardpan(4) |
| ☐ | ☐ | ☑ | ☐ | Boulders(9) | ☐ | ☐ | ☑ | ☐ | Detritus(3) |
| ☐ | ☐ | ☐ | ☑ | Cobble(8) | ☐ | ☐ | ☑ | ☑ | Muck(2) |
| ☐ | ☐ | ☐ | ☑ | Gravel(7) | ☑ | ☑ | ☐ | ☐ | Silt(2) |
| ☐ | ☐ | ☐ | ☑ | Sand(6) | ☐ | ☐ | ☐ | ☐ | Sludge(1) |
| ☐ | ☐ | ☐ | ☐ | Bedrock(5) | ☐ | ☐ | ☐ | ☐ | Artificial(0) |

Substrate Quality (check only 1, or check 2 and AVERAGE)

Substrate Origin: ☐ Limestone(1) ☐ Hardpan(0) ☐ Lacustrine(0) ☐ Tills(1) ☐ Sandstone(0) ☐ Shale(-1) ☐ Wetlands(0) ☐ Rip/Rap(0) ☐ Coal fines(-2)

Silt Cover: ☑ Silt heavy(-2) ☐ Silt moderate(-1) ☐ Silt normal(0) ☐ Silt free(1)

Embeddedness: ☑ Extensive(-2) ☐ Moderate(-1) ☐ Low/Normal(0) ☐ None(1)

NOTE: ignore sludge originating from point sources; score based on natural substrates

☑ >4 substrates present(2)

Comments: 4+2 = 6 (-5) 1

## 2-Instream Cover (20 points maximum

Instream Cover Score: 8

Type (check ALL that apply)

☐ Undercut banks(1) ☑ Deep pools(2) ☐ Oxbows(1)
☐ Overhanging vegetation(1) ☐ Rootwads(1) ☐ Aquatic macrophytes(1)
☑ Shallows(in slow water)(1) ☑ Boulders(1) ☑ Logs and woody debris(1)
☐ Rootmats(1)

Amount (check only 1, or 2 and AVERAGE)

☐ Extensive >75% (11)
☐ Moderate 25-75% (7)
☑ Sparse 5-25% (3)
☐ Nearly absent <5% (1)

Comments: 5+3

## 3-Channel Morphology (20) (check only one per category, OR two and AVERAGE)

Channel Score: 5

| Sinuosity | Development | Channelization | Stability | Modifications/Other | |
|---|---|---|---|---|---|
| ☐ High (4) | ☐ Excellent (7) | ☐ None (6) | ☐ High (3) | ☐ Snagging | ☐ Impound |
| ☐ Moderate (3) | ☐ Good (5) | ☐ Recovered (4) | ☑ Moderate (2) | ☐ Relocation | ☐ Islands |
| ☐ Low (2) | ☐ Fair (3) | ☐ Recovering (3) | ☐ Low (1) | ☐ Canopy Removal | ☐ Leveed |
| ☑ None (1) | ☑ Poor (1) | ☑ Recent or no recovery (1) | | ☐ Dredging | ☐ Bank shaping |
| | | | | ☐ One side channel modifications | |

Comments:

## 4-Riparian Zone & Bank Erosion (10 points maximum)

Riparian Score: 5

Left/Right banks looking downstream (For each category, check only one per bank, OR two per bank and AVERAGE).

Riparian width (per bank): ☐☐ Wide >50m (4); ☑☑ Moderate 10-50m (3); ☐☐ Narrow 5-10m (2); ☐☐ Very narrow <5m (1); ☐☐ None (0)

Erosion/Runoff-Floodplain quality (past 100 ft Riparian) (most predominant per bank): ☐☐ Forest, Swamp (3); ☑☑ Shrub or Old field (2); ☐☐ Residential, Park, New field (1); ☐☐ Fenced pasture (1); ☐☐ Conservation Tillage (1); ☐☐ Urban or Industrial (0); ☐☐ Mining, Construction (0); ☑☑ Open Pasture/Rowcrop (0)

Bank Erosion (per bank): ☐☐ None or little (3); ☐☐ Moderate (2); ☑☑ Heavy/Severe (1)

Comments:

## 5a-Pool/Glide Quality (12 points maximum

Pool/Glide Score: 8

Max pool depth (check one): ☑ >1m (6); ☐ 0.7-1m (4); ☐ 0.4-0.7m (2); ☐ 0.2-0.4m (1); ☐ <0.2m (pool=0)

Morphology (check only one, OR check two and AVERAGE): ☐ Pool width > riffle width (2); ☑ Pool width = riffle width (1); ☐ Pool width < riffle width (0)

Pool/Run/Riffle current velocity (check all that apply): ☐ Eddies (1); ☐ Fast (1); ☐ Moderate (1); ☑ Slow (1); ☐ Torrential (-1); ☐ Interstitial (-1); ☐ Intermittent (-2); ☐ No pool (0)

Comments:

## 5b-Riffle/Run Quality (8) (check only one per category, OR two and AVERAGE)

Riffle/Run Score: 6

Riffle/run depth (check one): ☐ Generally>10cm, Max>50cm (4); ☐ Generally>10cm, Max<50cm(3); ☑ Generally 5-10cm (1); ☐ Generally<5cm (riffle=0)

Riffle/run substrate: ☐ Stable-e.g. cobble, boulder (2); ☐ Mod. stable-e.g. pea gravel (1); ☑ Unstable-e.g. sand, gravel (0)

Riffle/run embeddedness: ☑ Extensive (-1); ☐ Moderate (0); ☐ Normal/Low (1); ☐ None (2); ☐ No riffle (0)

Comments:

## 6-Gradient (10 points maximum)

Gradient Score: 10

Average width: 16 m  Gradient: 10 (ft/mile)  Drainage Area: 14.1 (square miles)

Comments:

OHWM 52' x 13' (15.85)

IDEM OWQ Biological Studies QHEI (Qualitative Habitat Evaluation Index)

| Sample # | bioSample # | Stream Name | Location |
|---|---|---|---|
| 365b,c,d | | GRIFFEY CREEK | @ SR 37 |

| Surveyor | Sample Date | County | Macro SampleType | ☒ Habitat Complete | QHEI Score: 37 |
|---|---|---|---|---|---|
| | | | | | |

## Impacts/Miscellaneous

**Major Suspected Impacts (Check all that apply)**

- ☐ None
- ☐ Industrial
- ☐ WWTP
- ☑ Agricultural
- ☐ Livestock
- ☐ Silviculture
- ☐ Construction
- ☑ Urban Runoff
- ☐ Suburban
- ☑ Channelization
- ☑ Riparian Removal
- ☐ Flow Alteration
- ☐ CSOs
- ☐ Mining
- ☐ Landfills
- ☐ Natural

Pollution Impact Comments:

**Miscellaneous QHEI Information**

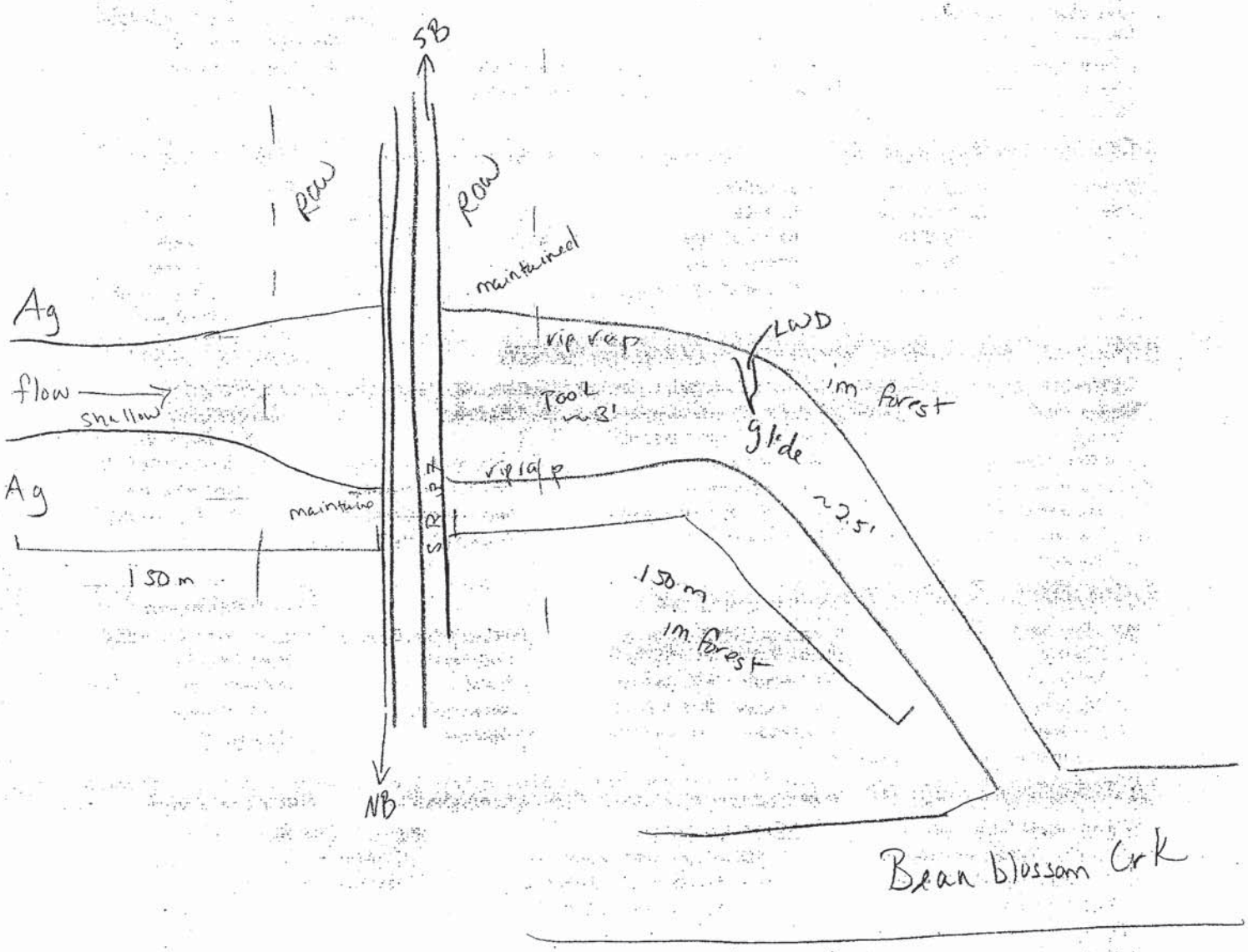
Subjective rating (1-10): 5 | % Riffle: 0 | Is reach representative of stream? Yes

Aesthetic rating (1-10): 3 | % Run: 80

Canopy Cover (% Open): 30 | % Glide: 10 | % Pool: 10

General QHEI Notes:

Substrate very loose, shifty



See 5-S81c,d,e

# IDEM — OWQ Biological Studies QHEI (Qualitative Habitat Evaluation Index)

Sample # | bioSample # | Stream Name: Beanblossom Creek | Location: SR 37 Xing

Surveyor: RW | Sample Date: 6/29/2005 | County: Monroe | Macro SampleType | ☑ Habitat Complete

**QHEI Score: 34.75**

## 1-Substrate (20 points maximum)

**Substrate Score: 3**

Check 1 Predominant Pool & 1 Predominant Riffle

Check all that are present — P=Pool, R=Riffle

| Predominant (P R) | Present (P R) | Predominant (P R) | Present (P R) |
|---|---|---|---|
| ☐☐ Bldrs/Slabs(10) | ☐☐ | ☐☐ Hardpan(4) | ☐☐ |
| ☐☐ Boulders(9) | ☐☐ | ☑☑ Detritus(3) | ☑☑ |
| ☐☐ Cobble(8) | ☑☐ | ☐☐ Muck(2) | ☐☐ |
| ☐☐ Gravel(7) | ☐☐ | ☑☐ Silt(2) | ☑☑ |
| ☐☐ Sand(6) | ☐☐ | ☐☐ Sludge(1) | ☐☐ |
| ☐☐ Bedrock(5) | ☐☐ | ☐☐ Artificial(0) | ☐☐ |

Substrate Quality (check only 1, or check 2 and AVERAGE)

Substrate Origin: ☐ Limestone(1) ☐ Hardpan(0) ☐ Lacustrine(0) ☐ Tills(1) ☐ Sandstone(0) ☐ Shale(-1) ☐ Wetlands(0) ☑ Rip/Rap(0) ☐ Coal fines(-2)

Silt Cover: ☑ Silt heavy(-2) ☐ Silt moderate(-1) ☐ Silt normal(0) ☐ Silt free(1)

Embeddedness: ☑ Extensive(-2) ☐ Moderate(-1) ☐ Low/Normal(0) ☐ None(1)

NOTE: ignore sludge originating from point sources; score based on natural substrates

☑ >4 substrates present(2)

Comments: 0.5+2=3

## 2-Instream Cover (20 points maximum

**Instream Cover Score: 8**

Type (check ALL that apply): ☐ Undercut banks(1) ☑ Deep pools(2) ☐ Oxbows(1) ☐ Overhanging vegetation(1) ☐ Rootwads(1) ☐ Aquatic macrophytes(1) ☑ Shallows(in slow water)(1) ☑ Boulders(1) ☑ Logs and woody debris(1) ☐ Rootmats(1)

Amount (check only 1, or 2 and AVERAGE): ☐ Extensive >75% (11) ☐ Moderate 25-75% (7) ☑ Sparse 5-25% (3) ☐ Nearly absent <5% (1)

Comments:

## 3-Channel Morphology (20) (check only one per category, OR two and AVERAGE)

**Channel Score: 7**

| Sinuosity | Development | Channelization | Stability | Modifications/Other | |
|---|---|---|---|---|---|
| ☐ High (4) | ☐ Excellent (7) | ☐ None (6) | ☐ High (3) | ☐ Snagging | ☐ Impound |
| ☐ Moderate (3) | ☐ Good (5) | ☐ Recovered (4) | ☑ Moderate (2) | ☐ Relocation | ☐ Islands |
| ☐ Low (2) | ☐ Fair (3) | ☑ Recovering (3) | ☐ Low (1) | ☐ Canopy Removal | ☐ Leveed |
| ☑ None (1) | ☑ Poor (1) | ☐ Recent or no recovery (1) | | ☐ Dredging | ☐ Bank shaping |
| | | | | ☐ One side channel modifications | |

Comments: appears channelized - very uniform

## 4-Riparian Zone & Bank Erosion (10 points maximum)

**Riparian Score: 6.75**

Left/Right banks looking downstream (For each category, check only one per bank, OR two per bank and AVERAGE).

| Riparian width (L R per bank) | Erosion/Runoff-Floodplain quality (past 100 ft Riparian) (L R most predominant per bank) | | Bank Erosion (L R per bank) |
|---|---|---|---|
| ☑☐ Wide >50m (4) | ☑☑ Forest, Swamp (3) | ☐☐ Conservation Tillage (1) | ☐☐ None or little (3) |
| ☐☑ Moderate 10-50m (3) | ☐☐ Shrub or Old field (2) | ☐☐ Urban or Industrial (0) | ☐☐ Moderate (2) |
| ☐☐ Narrow 5-10m (2) | ☐☐ Residential, Park, New field (1) | ☐☐ Mining, Construction (0) | ☑☐ Heavy/Severe (1) |
| ☐☐ Very narrow <5m (1) | ☐☐ Fenced pasture (1) 1.5 | ☐☑ Open Pasture/Rowcrop (0) | |
| ☐☐ None (0) | | | |

Comments:

## 5a-Pool/Glide Quality (12 points maximum

**Pool/Glide Score: 8**

| Max pool depth (check one) | Morphology (check only one, OR check two and AVERAGE) | Pool/Run/Riffle current velocity (check all that apply) | |
|---|---|---|---|
| ☑ >1m (6) | | ☐ Eddies (1) | ☐ Torrential (-1) |
| ☐ 0.7-1m (4) | ☐ Pool width > riffle width (2) | ☐ Fast (1) | ☐ Interstitial (-1) |
| ☐ 0.4-0.7m (2) | ☑ Pool width = riffle width (1) | ☐ Moderate (1) | ☐ Intermittent (-2) |
| ☐ 0.2-0.4m (1) | ☐ Pool width < riffle width (0) | ☑ Slow (1) | ☐ No pool (0) |
| ☐ <0.2m (pool=0) | | | |

Comments:

## 5b-Riffle/Run Quality (8) (check only one per category, OR two and AVERAGE)

**Riffle/Run Score: Ø**

| Riffle/run depth (check one) | Riffle/run substrate | Riffle/run embeddedness | |
|---|---|---|---|
| ☐ Generally>10cm, Max>50cm (4) | ☐ Stable-e.g. cobble, boulder (2) | ☐ Extensive (-1) | ☐ Normal/Low (1) |
| ☐ Generally>10cm, Max<50cm(3) | ☐ Mod. stable-e.g. pea gravel (1) | ☐ Moderate (0) | ☐ None (2) |
| ☐ Generally 5-10cm (1) | ☑ Unstable-e.g. sand, gravel (0) | | ☑ No riffle (0) |
| ☑ Generally<5cm (riffle=0) | | | |

Comments:

## 6-Gradient (10 points maximum)

**Gradient Score: 2**

Average width: 12 m | Gradient: 0 (ft/mile) | Drainage Area: 12.4 (square miles)

Comments:

OHWM 52' x 18'

IDEM OWQ Biological Studies QHEI (Qualitative Habitat Evaluation Index)

| Sample # | bioSample # | Stream Name | Location |
|---|---|---|---|
| 38lcde | | beanblossom creek | @ SR37 |

| Surveyor | Sample Date | County | Macro SampleType | Habitat Complete | QHEI Score: |
|---|---|---|---|---|---|
| | | Monroe | | ☑ | 34.75 |

## Impacts/Miscellaneous

**Major Suspected Impacts (Check all that apply)**

- ☐ None
- ☐ Industrial
- ☐ WWTP
- ☑ Agricultural
- ☐ Livestock
- ☐ Silviculture
- ☐ Construction
- ☑ Urban Runoff
- ☐ Suburban
- ☑ Channelization
- ☐ Riparian Removal
- ☐ Flow Alteration
- ☐ CSOs
- ☐ Mining
- ☐ Landfills
- ☐ Natural

Pollution Impact Comments:

**Miscellaneous QHEI Information**

Subjective rating (1-10): 4 | % Riffle: 5 | Is reach representative of stream? yes

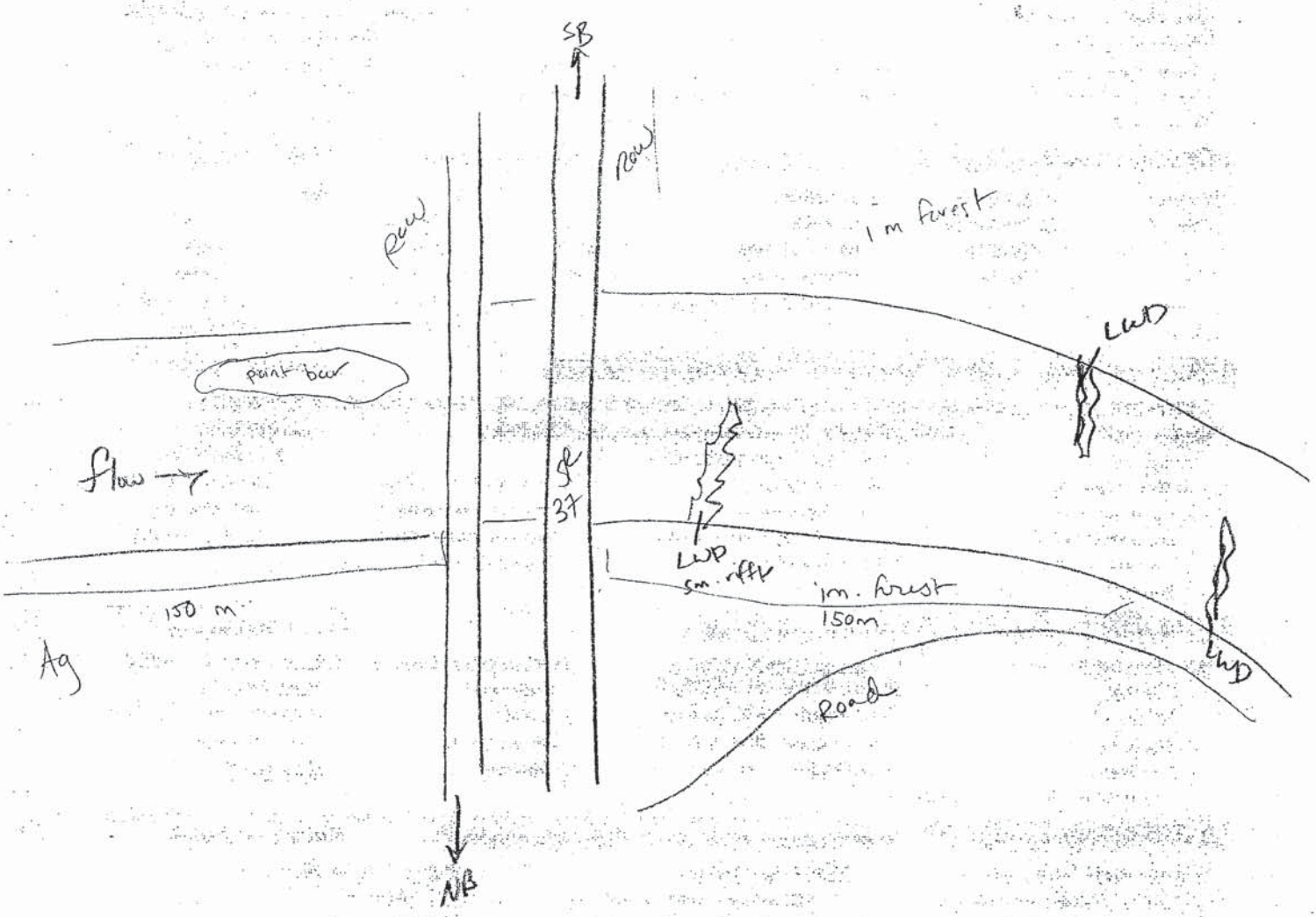
Aesthetic rating (1-10): 3 | % Run: 80

% Glide: 15

Canopy Cover (% Open): 20 | % Pool:

General QHEI Notes:

Very homogeneous substrate + morphology



# OWQ Biological Studies QHEI (Qualitative Habitat Evaluation Index)

| Sample # | bioSample # | Stream Name | Location |
|---|---|---|---|
| s253e | | UT Bryant Creek | West SR 37 |

| Surveyor | Sample Date | County | Macro Sample Type | ☒ Habitat Complete | QHEI Score: |
|---|---|---|---|---|---|
| KSS/DEW | 4/26/12 | Monroe | | | 55.5 |

**1] *SUBSTRATE*** Check ONLY Two predominant substrate TYPE BOXES; estimate % and check every type present

**BEST TYPES**

| PREDOMINANT P | PREDOMINANT R | | PRESENT P | PRESENT R | TOTAL % |
|---|---|---|---|---|---|
| ☐ | ☐ | BLDR/SLABS [10] | ☐ | ☐ | |
| ☐ | ☐ | BOULDER [9] | ☐ | ☐ | |
| ☐ | ☐ | COBBLE [8] | ☐ | ☐ | |
| ☐ | ☒ | GRAVEL [7] | ☐ | ☐ | 65 |
| ☒ | ☐ | SAND [6] | ☐ | ☐ | 20 |
| ☐ | ☐ | BEDROCK [5] | ☐ | ☐ | |

**OTHER TYPES**

| PREDOMINANT P | PREDOMINANT R | | PRESENT P | PRESENT R | TOTAL % |
|---|---|---|---|---|---|
| ☐ | ☐ | HARDPAN [4] | ☐ | ☐ | |
| ☐ | ☐ | DETRITUS [3] | ☒ | ☒ | 5 |
| ☐ | ☐ | MUCK [2] | ☐ | ☐ | |
| ☐ | ☐ | SILT [2] | ☒ | ☐ | 10 |
| ☐ | ☐ | ARTIFICIAL [0] | ☐ | ☐ | |

(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]
- ☐ LACUSTRINE [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** 14 (Maximum 20)

Comments 13 + 1

**2] *INSTREAM COVER*** Indicate presence 0 to 3 and estimate percent: **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 root wad in deep/fast water, or deep, well-defined, functional pools.)

| % | Amount | | % | Amount | | % | Amount | |
|---|---|---|---|---|---|---|---|---|
| | 0 | UNDERCUT BANKS [1] | | 0 | POOLS > 70cm [2] | | 0 | OXBOWS, BACKWATERS [1] |
| 5 | 1 | OVERHANGING VEGETATION [1] | 15 | 2 | ROOTWADS [1] | | 0 | AQUATIC MACROPHYTES [1] |
| 20 | 2 | SHALLOWS (IN SLOW WATER) [1] | | 0 | BOULDERS [1] | 10 | 1 | 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]

**Cover** 9 (Maximum 20)

Comments

**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]

**Channel** 13 (Maximum 20)

Comments 4 + 4 + 4 + 1

**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)
- ☐ ☐ NONE/LITTLE [3]
- ☐ ☐ MODERATE [2]
- ☒ ☒ HEAVY/SEVERE [1]

**RIPARIAN WIDTH** (L R)
- ☒ ☐ WIDE > 50m [4]
- ☐ ☐ MODERATE 10-50m [3]
- ☐ ☒ NARROW 5-10m [2]
- ☐ ☐ VERY NARROW [1]
- ☐ ☐ NONE [0]

**FLOOD PLAIN QUALITY** (L R)
- ☒ ☐ FOREST, SWAMP [3]
- ☐ ☐ SHRUB OR OLD FIELD [2]
- ☐ ☐ RESIDENTIAL, PARK, NEW FIELD [1]
- ☐ ☐ FENCED PASTURE [1]
- ☐ ☐ OPEN PASTURE, ROWCROP [0]

(L R)
- ☐ ☐ CONSERVATION TILLAGE [1]
- ☐ ☒ URBAN OR INDUSTRIAL [0]
- ☐ ☐ MINING / CONSTRUCTION [0]

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

**Riparian** 5.5 (Maximum 10)

Comments 1 + 3 + 1.5

**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 (Circle one and comment on back)
- ☐ Primary Contact
- ☐ Secondary Contact

**Pool/Current** 5 (Maximum 12)

Comments .66m 2 + 1 + 1 + 1

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species:

☐ 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** Check ONE (Or 2 & average)
- ☐ 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]

**Riffle/Run** 3 (Maximum 8)

Comments 1 + 1 + 1

**6] *GRADIENT*** (8.4 ft/mi)
- ☐ VERY LOW - LOW [2–4]
- ☒ MODERATE [6 - 10]
- ☐ HIGH - VERY HIGH [10 - 6]

***DRAINAGE AREA*** (0.70 mi²)

%POOL: 20 %GLIDE: ____ %RUN: 65 %RIFFLE: 15

**Gradient** 6 (Maximum 10)

IDEM 07/06/10

OHW = 15' x 1.7'
(4.57m)

S253e

IDEM

# OWQ Biological Studies QHEI (Qualitative Habitat Evaluation Index)

COMMENT

**A-CANOPY**
- ☐ > 85% - Open
- ☒ 55% - < 85%
- ☐ 30% - < 55%
- ☐ 10% - < 30%
- ☐ < 10% - Closed

**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: | ☐ > 100 ft$^2$ | ☐ > 3 ft |

**D-MAINTENANCE**
- ☐ Public ☐ Private
- ☐ Active ☐ Historic
- Succession: ☐ Young ☐ Old
- ☐ Spray ☐ Islands ☐ Scoured
- Snag: ☐ Removed ☐ Modified
- Leveed: ☐ One sided ☐ Both banks
- ☐ Relocated ☐ Cutoffs
- Bedload: ☐ Moving ☐ Stable
- ☐ Armoured ☐ Slumps
- ☐ Impounded ☐ Desiccated
- ☐ Flood control ☐ Drainage

**E-ISSUES**
- ☐ WWTP ☐ CSO ☐ NPDES
- ☐ Industry ☐ Urban
- ☐ Hardened ☐ Dirt & Grime
- ☐ Contaminated ☐ Landfill
- BMPs: ☐ Construction ☐ Sediment
- ☐ Logging ☐ Irrigation ☐ Cooling
- Erosion: ☐ Bank ☐ Surface
- ☐ False bank ☐ Manure ☐ Lagoon
- ☐ Wash $H_2O$ ☐ Tile ☐ $H_2O$ Table
- Mine: ☐ Acid ☐ Quarry
- Flow: ☐ Natural ☐ Stagnant
- ☐ Wetland ☐ Park ☐ Golf
- ☐ Lawn ☐ Home
- ☐ Atmospheric deposition

Looking ~~upstream~~ down (> 10m, 3 readings; < 10m, 1 reading in middle); Round to the nearest whole percent

| | Left | Middle | Right | Total Average |
|---|---|---|---|---|
| % open | 40 % | 60 % | 80 % | 60 % |

**Stream Drawing:**

# OWQ Biological Studies QHEI (Qualitative Habitat Evaluation Index)

IDEM

| Sample # | bioSample # | Stream Name | Location |
|---|---|---|---|
| 5345d, e | | Little Indian Creek | |

| Surveyor | Sample Date | County | Macro Sample Type | ☒ Habitat Complete | QHEI Score: 52.5 |
|---|---|---|---|---|---|
| KSI/DGW | 4/25/12 | Morgan | | | |

**1] *SUBSTRATE*** Check ONLY Two predominant substrate TYPE BOXES; estimate % and check every type present

| BEST TYPES (PREDOMINANT P R) | PRESENT (P R) | TOTAL % | OTHER TYPES (PREDOMINANT P R) | PRESENT (P R) | TOTAL % |
|---|---|---|---|---|---|
| ☐☐ BLDR/SLABS [10] | ☐☐ | | ☒☐ HARDPAN [4] | ☐☐ | 15 |
| ☐☐ BOULDER [9] | ☐☐ | | ☐☐ DETRITUS [3] | ☒☐ | 5 |
| ☐☐ COBBLE [8] | ☐☐ | | ☐☐ MUCK [2] | ☐☐ | |
| ☐☐ GRAVEL [7] | ☐☐ | | ☐☐ SILT [2] | ☒☐ | 10 |
| ☒☐ SAND [6] | ☐☐ | 70 | ☐☐ 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]
- ☐ LACUSTRINE [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: 9 (Maximum 20)

Comments

**2] *INSTREAM COVER*** Indicate presence 0 to 3 and estimate percent: **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 root wad in deep/fast water, or deep, well-defined, functional pools.)

| % | Amount | | % | Amount | | % | Amount | |
|---|---|---|---|---|---|---|---|---|
| | | UNDERCUT BANKS [1] | 40 | 2 | POOLS > 70cm [2] | | | OXBOWS, BACKWATERS [1] |
| 5 | 1 | OVERHANGING VEGETATION [1] | | | ROOTWADS [1] | | | AQUATIC MACROPHYTES [1] |
| | | SHALLOWS (IN SLOW WATER) [1] | | | BOULDERS [1] | 30 | 2 | LOGS OR WOODY DEBRIS [1] |
| | | ROOTMATS [1] | | | | | | |

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

Cover: 11 (Maximum 20)

Comments

**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]

Channel: 9 (Maximum 20)

Comments

**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)
- ☒☐ NONE/LITTLE [3]
- ☐☒ MODERATE [2]
- ☐☐ HEAVY/SEVERE [1]

2.5 + 1 + 1

**RIPARIAN WIDTH** (L R)
- ☐☐ WIDE > 50m [4]
- ☐☐ MODERATE 10-50m [3]
- ☐☐ NARROW 5-10m [2]
- ☒☒ VERY NARROW [1]
- ☐☐ NONE [0]

**FLOOD PLAIN QUALITY** (L R)
- ☐☐ FOREST, SWAMP [3]
- ☐☐ SHRUB OR OLD FIELD [2]
- ☐☐ RESIDENTIAL, PARK, NEW FIELD [1]
- ☐☐ FENCED PASTURE [1]
- ☐☐ OPEN PASTURE, ROWCROP [0]
- ☒☒ CONSERVATION TILLAGE [1]
- ☐☐ URBAN OR INDUSTRIAL [0]
- ☐☐ MINING / CONSTRUCTION [0]

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

Riparian: 4.5 (Maximum 10)

Comments

**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 (Circle one and comment on back)
- ☐ Primary Contact
- ☐ Secondary Contact

Pool/Current: 9 (Maximum 12)

Comments

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species:

☒ NO RIFFLE [metric = 0]

Check ONE (Or 2 & average)

**RIFFLE DEPTH**
- ☐ BEST AREAS > 10cm [2]
- ☐ BEST AREAS 5 - 10cm [1]
- ☐ BEST AREAS < 5 cm [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]

Riffle/Run: 0 (Maximum 8)

Comments

**6] *GRADIENT*** ( 5 ft/mi)
- ☐ VERY LOW - LOW [2–4]
- ☒ MODERATE [6 - 10]
- ☐ HIGH - VERY HIGH [10 - 6]

***DRAINAGE AREA*** (10.75 mi²)

%POOL: 30 %GLIDE: ___ %RUN: 70 %RIFFLE: ___

Gradient: 10 (Maximum 10)

IDEM 07/06/10

OHW = 58' x 12'
(17.7m)

S345d,e

IDEM

# OWQ Biological Studies QHEI (Qualitative Habitat Evaluation Index)

COMMENT

**A-CANOPY**
- ☒ > 85% - Open
- ☐ 55% - < 85%
- ☐ 30% - < 55%
- ☐ 10% - < 30%
- ☐ < 10% - Closed

**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: | ☐ > 100 ft² | ☐ > 3 ft |

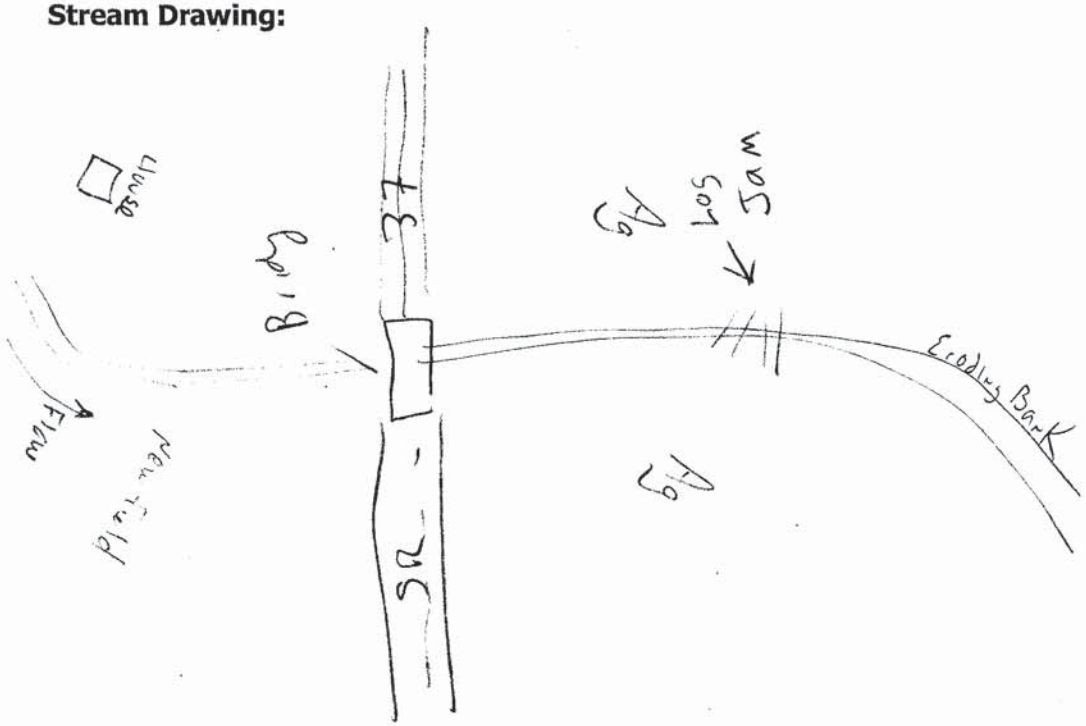
**D-MAINTENANCE**
- ☐ Public ☐ Private
- ☐ Active ☐ Historic
- Succession: ☐ Young ☐ Old
- ☐ Spray ☐ Islands ☐ Scoured
- Snag: ☐ Removed ☐ Modified
- Leveed: ☐ One sided ☐ Both banks
- ☐ Relocated ☐ Cutoffs
- Bedload: ☐ Moving ☐ Stable
- ☐ Armoured ☐ Slumps
- ☐ Impounded ☐ Desiccated
- ☐ Flood control ☐ Drainage

**E-ISSUES**
- ☐ WWTP ☐ CSO ☐ NPDES
- ☐ Industry ☐ Urban
- ☐ Hardened ☐ Dirt & Grime
- ☐ Contaminated ☐ Landfill
- BMPs: ☐ Construction ☐ Sediment
- ☐ Logging ☐ Irrigation ☐ Cooling
- Erosion: ☑ Bank ☐ Surface
- ☐ False bank ☐ Manure ☐ Lagoon
- ☐ Wash $H_2O$ ☐ Tile ☐ $H_2O$ Table
- Mine: ☐ Acid ☐ Quarry
- Flow: ☐ Natural ☐ Stagnant
- ☐ Wetland ☐ Park ☐ Golf
- ☐ Lawn ☐ Home
- ☐ Atmospheric deposition

Looking ~~upstream~~ down (> 10m, 3 readings; < 10m, 1 reading in middle); Round to the nearest whole percent

| | Left | Middle | Right | Total Average |
|---|---|---|---|---|
| % open | 95 % | 100 % | 90 % | 95 % |

**Stream Drawing:**




IDEM 07/06/10

Sec 5-5350b, c, d

# IDEM OWQ Biological Studies QHEI (Qualitative Habitat Evaluation Index)

| Sample # | bioSample # | Stream Name | Location |
|---|---|---|---|
| | | Jordan Creek | SR 37 bridge |

| Surveyor | Sample Date | County | Macro SampleType | Habitat Complete | QHEI Score: 24 |
|---|---|---|---|---|---|
| | 6/30/2005 | Morgan | | | |

Limited Resource Water

## 1-Substrate (20 points maximum)

Substrate Score: 1

Check 1 Predominant Pool & 1 Predominant Riffle

Check all that are present — P=Pool, R=Riffle

| Predominant P | Predominant R | Present P | Present R | | Predominant P | Predominant R | Present P | Present R | |
|---|---|---|---|---|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | Bldrs/Slabs(10) | ☐ | ☐ | ☐ | ☐ | Hardpan(4) |
| ☐ | ☐ | ☐ | ☐ | Boulders(9) | ☐ | ☐ | ☐ | ☐ | Detritus(3) |
| ☐ | ☐ | ☐ | ☐ | Cobble(8) | ☐ | ☐ | ☐ | ☐ | Muck(2) |
| ☐ | ☐ | ☐ | ☐ | Gravel(7) | ☑ | ☑ | ☐ | ☐ | Silt(2) |
| ☐ | ☐ | ☐ | ☐ | Sand(6) | ☐ | ☐ | ☐ | ☐ | Sludge(1) |
| ☐ | ☐ | ☐ | ☐ | Bedrock(5) | ☐ | ☐ | ☐ | ☐ | Artificial(0) |

Substrate Quality (check only 1, or check 2 and AVERAGE)

Substrate Origin: ☐ Limestone(1) ☐ Hardpan(0) ☐ Lacustrine(0) ☑ Tills(1) ☐ Sandstone(0) ☐ Shale(-1) ☐ Wetlands(0) ☐ Rip/Rap(0) ☐ Coal fines(-2)

Silt Cover: ☑ Silt heavy(-2) ☐ Silt moderate(-1) ☐ Silt normal(0) ☐ Silt free(1)

Embeddedness: ☑ Extensive(-2) ☐ Moderate(-1) ☐ Low/Normal(0) ☐ None(1)

NOTE: ignore sludge originating from point sources; score based on natural substrates

☐ >4 substrates present(2)

Comments: 4+1 -4 = 1

## 2-Instream Cover (20 points maximum

Instream Cover Score: 12

Type (check ALL that apply)

☐ Undercut banks(1) ☐ Deep pools(2) ☐ Oxbows(1)
☑ Overhanging vegetation(1) ☐ Rootwads(1) ☐ Aquatic macrophytes(1)
☐ Shallows(in slow water)(1) ☐ Boulders(1) ☐ Logs and woody debris(1)
☐ Rootmats(1)

Amount (check only 1, or 2 and AVERAGE)

☑ Extensive >75% (11)
☐ Moderate 25-75% (7)
☐ Sparse 5-25% (3)
☐ Nearly absent <5% (1)

Comments: ~~A~~DRY

## 3-Channel Morphology (20) (check only one per category, OR two and AVERAGE)

Channel Score: 7

| Sinuosity | Development | Channelization | Stability | Modifications/Other | |
|---|---|---|---|---|---|
| ☐ High (4) | ☐ Excellent (7) | ☐ None (6) | ☐ High (3) | ☐ Snagging | ☐ Impound |
| ☐ Moderate (3) | ☐ Good (5) | ☐ Recovered (4) | ☑ Moderate (2) | ☐ Relocation | ☐ Islands |
| ☐ Low (2) | ☐ Fair (3) | ☑ Recovering (3) | ☐ Low (1) | ☐ Canopy Removal | ☐ Leveed |
| ☑ None (1) | ☑ Poor (1) | ☐ Recent or no recovery (1) | | ☐ Dredging | ☐ Bank shaping |
| | | | | ☐ One side channel modifications | |

Comments: appears to have been channelized?

## 4-Riparian Zone & Bank Erosion (10 points maximum)

Riparian Score: 3

Left/Right banks looking downstream (For each category, check only one per bank, OR two per bank and AVERAGE).

Riparian width (per bank)
☐ ☐ Wide >50m (4)
☐ ☐ Moderate 10-50m (3)
☑ ☑ Narrow 5-10m (2)
☑ ☑ Very narrow <5m (1)
☐ ☐ None (0)

Erosion/Runoff-Floodplain quality (past 100 ft Riparian) (most predominant per bank)
☐ ☐ Forest, Swamp (3)
☐ ☐ Shrub or Old field (2)
☐ ☐ Residential, Park, New field (1)
☐ ☐ Fenced pasture (1)
☐ ☐ Conservation Tillage (1)
☐ ☐ Urban or Industrial (0)
☐ ☐ Mining, Construction (0)
☑ ☑ Open Pasture/Rowcrop (0)

Bank Erosion (per bank)
☐ ☐ None or little (3)
☑ ☑ Moderate (2)
☐ ☐ Heavy/Severe (1)

Comments:

## 5a-Pool/Glide Quality (12 points maximum

Pool/Glide Score: -1

Max pool depth (check one)
☐ >1m (6)
☐ 0.7-1m (4)
☐ 0.4-0.7m (2)
☐ 0.2-0.4m (1)
☑ <0.2m (pool=0)

Morphology (check only one, OR check two and AVERAGE)
☐ Pool width > riffle width (2)
☑ Pool width = riffle width (1)
☐ Pool width < riffle width (0)

Pool/Run/Riffle current velocity (check all that apply)
☐ Eddies (1) ☐ Torrential (-1)
☐ Fast (1) ☐ Interstitial (-1)
☐ Moderate (1) ☑ Intermittent (-2)
☐ Slow (1) ☑ No pool (0)

Comments:

## 5b-Riffle/Run Quality (8) (check only one per category, OR two and AVERAGE)

Riffle/Run Score: Ø

Riffle/run depth (check one)
☐ Generally>10cm, Max>50cm (4)
☐ Generally>10cm, Max<50cm(3)
☐ Generally 5-10cm (1)
☑ Generally<5cm (riffle=0)

Riffle/run substrate
☐ Stable-e.g. cobble, boulder (2)
☐ Mod. stable-e.g. pea gravel (1)
☑ Unstable-e.g. sand, gravel (0)

Riffle/run embeddedness
☐ Extensive (-1) ☐ Normal/Low (1)
☐ Moderate (0) ☐ None (2)
☑ No riffle (0)

Comments:

## 6-Gradient (10 points maximum)

Gradient Score: 2

Average width: 1.5m Gradient: 0 (ft/mile) Drainage Area: 2.72 (square miles)

Comments:

DHWM 5' x 1'

IDEM OWQ Biological Studies QHEI (Qualitative Habitat Evaluation Index)

| Sample # | bioSample # | Stream Name | Location |
|---|---|---|---|
| s3506,c,d | | JORDAN Creek | @ SR 37 bridge |

| Surveyor | Sample Date | County | Macro SampleType | Habitat Complete | QHEI Score: |
|---|---|---|---|---|---|
| | 6/30/05 | MORGAN | | [ ] | 24 |

## Impacts/Miscellaneous

**Major Suspected Impacts (Check all that apply)**

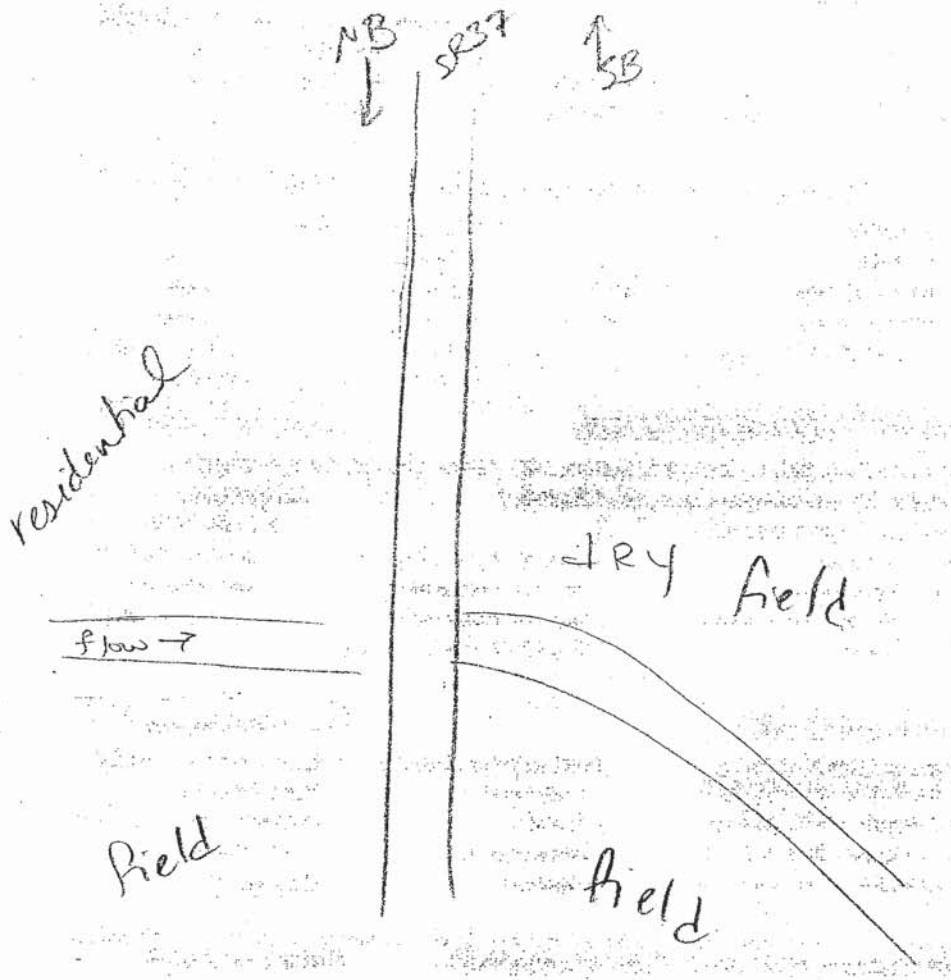
- [ ] None
- [ ] Industrial
- [ ] WWTP
- [x] Agricultural
- [ ] Livestock
- [ ] Silviculture
- [ ] Construction
- [x] Urban Runoff
- [ ] Suburban
- [ ] Channelization
- [ ] Riparian Removal
- [ ] Flow Alteration
- [ ] CSOs
- [ ] Mining
- [ ] Landfills
- [ ] Natural

Pollution Impact Comments:

**Miscellaneous QHEI Information**

Subjective rating (1-10): 2 % Riffle: –
Aesthetic rating (1-10): Ø % Run: –
Canopy Cover (% Open): 100 % Glide: –
% Pool: –

Is reach representative of stream? yes

General QHEI Notes:

appears more like a ditch