B.6 Instream and Riparian Habitat in Support of Aquatic Life

The guidance document "Association Between Nutrients, Habitat, and the Aquatic Biota in Ohio Rivers and Streams" (Ohio EPA, 1999), discusses the importance of habitat quality and the effect of habitat disruptions on aquatic life. Passages from that document pertinent to the Big Darby Creek watershed are provided below.

> Ohio EPA uses the Qualitative Habitat Evaluation Index (QHEI; Rankin, 1989, 1995) to assess the physical habitat quality of streams and rivers. This index measures the important components of lotic (i.e., riverine) macrohabitat (i.e., large scale habitat features) that are essential to sustaining high value aquatic communities. The major categories of macrohabitat include substrate quality, instream cover (physical structure), stream channel morphology and condition, riparian quality and bank erosion, pool and run-riffle quality, and gradient. Comparisons between the QHEI and IBI has resulted in a list of critical habitat components associated with the occurrence of IBI scores corresponding with the Warmwater Habitat (WWH) or Exceptional Warmwater Habitat (EWH) biocriteria ("warmwater attributes") and a list of components that are associated with degraded communities (high and moderate influence "modified attributes"; Rankin, 1989, 1995). These modified attributes were further divided into " high" influence or "moderate" influence attributes based on the statistical strength of the relationships. By examining a combined database of least impacted reference sites and physically modified reference sites essentially free from point source associated chemical impacts, a relationship was developed between the IBI and the accrual of modified habitat attributes.

The "associations report" goes on to discuss how the accumulation of attributes representative of a modified condition decreases the likelihood that a stream will meet the criteria for the WWH aquatic life use designation. This relationship is presented in Table B.6.1.

Table B.6.1. Modified habitat attributes and predicted percent attainment.

Number of Modified Habitat Attributes	Percent of Streams That May Attain a Warmwater Habitat Aquatic Life Use
4	<50%
6	<25%
7	rare occurrence

The associations report gives the following as guidance for assessing future implementation of Best Management Practices (BMPs):

> As a "rule of thumb", goals for BMPs and habitat restoration should strive to reduce the number of modified attributes (moderate influence) to four or fewer, reduce the number of modified to warmwater attributes to less than 6, and to eliminate all high influence modified attributes. These measures are needed to have a reasonable probability of attaining the WWH biocriteria.

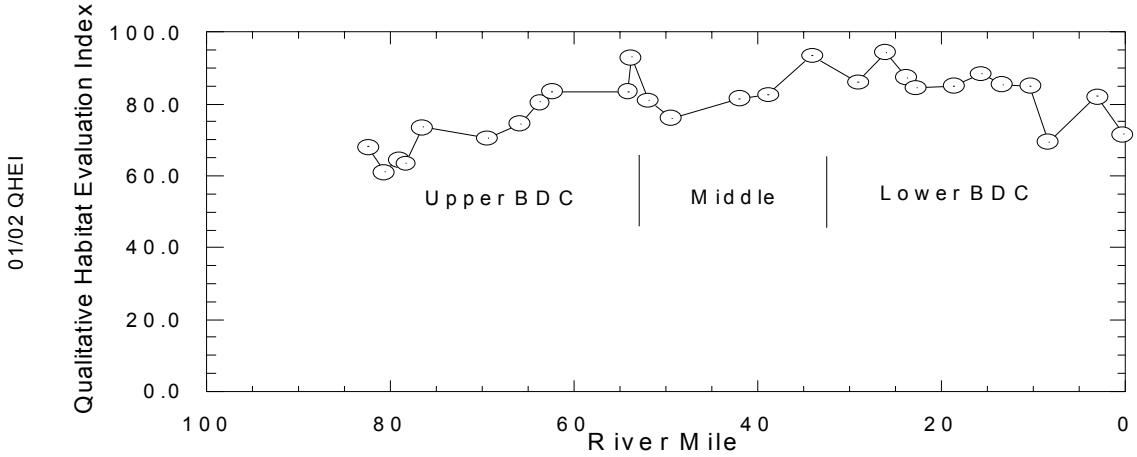
Table B.6.1 provides the breakdown of the QHEI positive and modified habitat attributes from the 2001/2002 and historical Big Darby Creek watershed survey. The results depicted here can be used to determine which BMPs should be implemented and to evaluate the likelihood of meeting the WWH use designation.

Big Darby Creek (02-200)

Determination of the aquatic biological potential and beneficial use attainability of a given stream segment requires the analysis of riparian and instream habitat characteristics, disturbance type, potential rate of recovery, and plans for maintenance of modifications (Rankin 1989). Table B.6.1 presents a matrix of Warmwater Habitat characteristics, Modified Warmwater Habitat characteristics (further broken down to characteristics that have high influence or moderate influence on altering aquatic community performance) and individual site habitat characteristics for use in helping to determine the appropriate designated aquatic life use of a stream segment.

The Qualitative Habitat Evaluation Index (QHEI) in the Big Darby Creek mainstem in 2001/2002 ranged from good (i.e., 61.0) at RM 80.8 to extraordinary (i.e., 94.5) at RM 26.1 (Table A.15 and Figure B.6.1) with a mean QHEI of 79.7 for the 27 locations evaluated, well

Figure B.6.1. Longitudinal trends in the Qualitative Habitat Evaluation Index in Big Darby Creek based on evaluations conducted in 2001/2002.



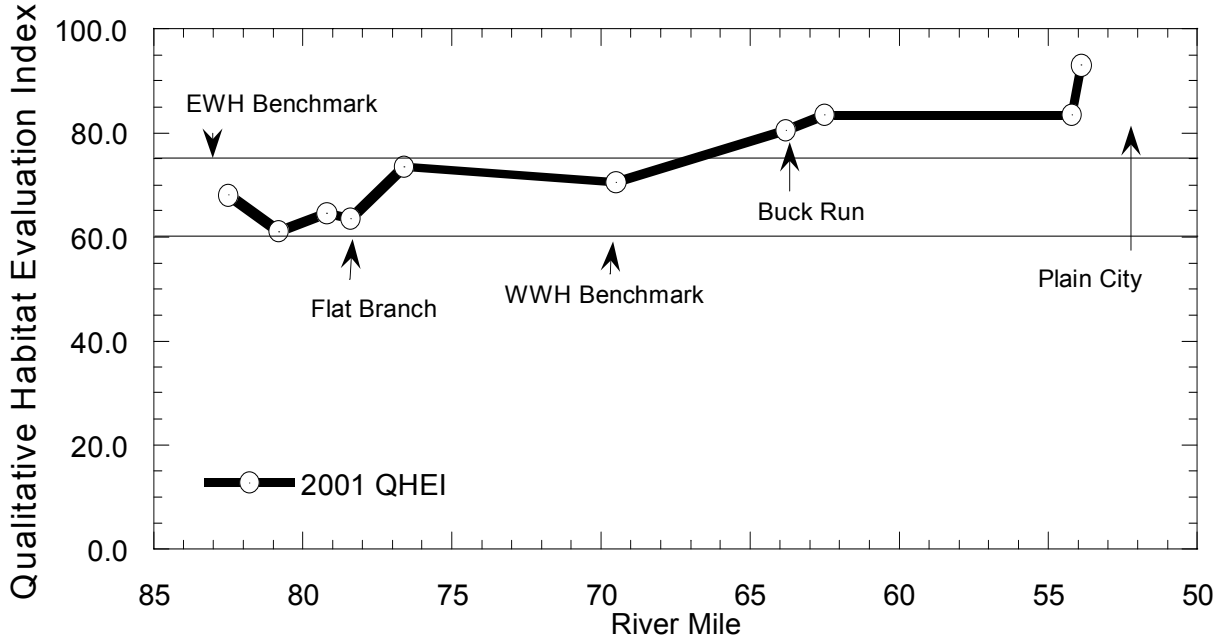
into the excellent range. Comparison of QHEI scores with the biological performance of sites in the Ohio EPA database has shown that segments with average scores higher than 60 are easily capable of achieving the Warmwater Habitat (WWH) aquatic life use designation criteria based on habitat alone (Rankin 1989). Segments equaling or exceeding a mean QHEI of 75 - 80 have been shown to be capable of achieving the Exceptional Warmwater Habitat (WWH) aquatic life use designation criteria based on habitat alone. It is important to note that this evaluation stresses the analysis of habitat characteristics of a segment and not of individual sites. Individual sites may have much poorer physical habitat due to a localized disturbance yet still support aquatic communities closely resembling those sampled at higher quality adjacent sites if other water resource parameters are adequate. The converse rarely occurs. Sites with good quality habitat located in the midst of a low quality stream segment will generally not support a community equivalent to that found in a high quality segment.

Upper Big Darby Creek (Headwaters to Plain City)

Within this segment Big Darby Creek is currently designated as WWH from its headwaters to its confluence with Flat Branch (RM 83.5 - RM 78.48). However, this segment has been recommended to be re-designated as EWH based on its improved instream biological community performance. Downstream from Flat Branch, Big Darby Creek is designated EWH to its confluence with the Scioto River (RM 78.48 - 0.0).

Evaluation of riparian and instream habitat quality at the twelve (12) sites located within this segment in 2001/2002 yielded an average QHEI of 74.95. A QHEI average value in this range demonstrates that this segment possesses the physical characteristics and thus the potential to support EWH aquatic communities. Figure B.6.2 presents the longitudinal pattern in habitat quality for this segment in 2001/2002. This plot demonstrates that habitat quality improves from its headwaters gradually with downstream position. The major re-location started in the late1980s of US Rt. 33 has exposed this segment to repeated insults to habitat quality at several locations for nearly 20 years. Construction of the new alignment within the Big Darby Creek watershed has proceeded from its eastern bounds westward. This staging of construction resulted in sediment loads and changes in hydrology first impacting Buck Run and then Flat Branch and then areas downstream from their respective confluences. More recently the relocation of the County Rd. 152 intersection and the re-alignment of the roadway in the very headwaters of Big Darby Creek resulted in several hundred feet of the stream channel being relocated and channelized. This relocation, as well as inadequate implementation of the specified erosion control BMPs resulted in high sediment loadings to the stream during and immediately after construction. Numerous citizen complaints resulted in eventual implementation of the specified BMPs and an eventual re-design and reconstruction of the stream channel following Natural Stream Design Principles orchestrated by experts from ODNR Division of Soil and Water Conservation (DSWC). Habitat quality in the headwaters has been improving as the bed load of fines has moved downstream or been side cast into the flood plain (where it hasn't been diked off from the stream). Expectations are that habitat quality will continue to improve as the sediments are flushed out or stabilized and planned restoration and protection measures enacted and thus the segment average should further increase. This segment will be closely monitored in the future. Additionally a preliminary investigation has been

Figure B.6.2. Longitudinal Trends in the Qualitative Habitat Evaluation Index in the Upper Big Darby Creek Mainstem, 2001-2002.



conducted by scientists from the Ohio State University (OSU) and funded by the U.S. Army Corps of Engineers on the suitability of the creation/restoration of riparian ecosystems at the confluence with Flat Branch and Big Darby Creek to deal with water quality problems, potentially improve biotic integrity of downstream Big Darby Creek and increase the amount of wetland habitat in this portion of the watershed (Mitsch et al., 2002).

Middle Big Darby Creek - (Plain City to the confluence with Little Darby Creek: RM 52.1 - 34.1)

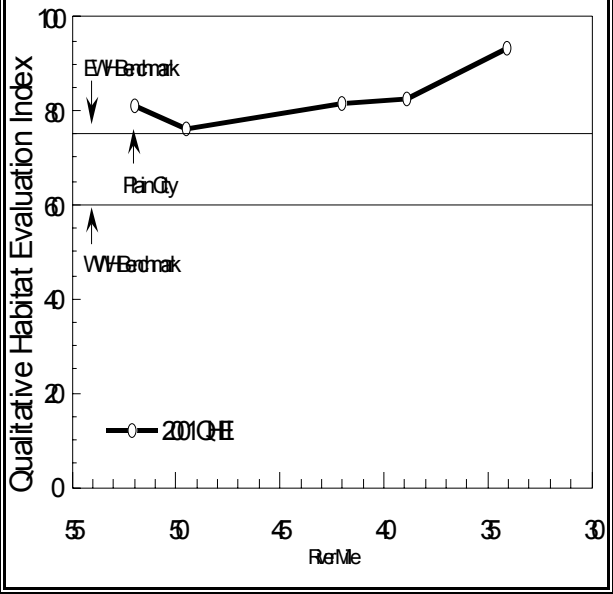
Five sites were located within this approximately 17.9 mile segment in 2001/2002. The average QHEI for the segment of 82.9 again well exceeded the values judged suitable for supporting EWH aquatic communities (Figure B.6.4). The existing aquatic life use EWH has, therefore, been judged appropriate and should be retained. Although major strides have been made towards protecting or maintaining existing habitat quality within this segment impacts have taken place in the upper reaches. Just upstream from Plain City filling of the floodway flushed considerable amounts of sediment into the stream prior to the implementation of erosion control BMPs (Figure B.6.3). Downstream from SR 161 along the east shore of Big Darby Creek paralleling Plain City Tuffco Sand and Gravel has constructed a dike close to the stream channel. This dike has cut Big Darby Creek off from its floodplain affecting the hydrology in the immediate vicinity. In contrast, further downstream, numerous efforts have protected the riparian buffer and floodplain which should go a long way towards ensuring the maintenance of existing habitat quality and perhaps results in some improvement. The Franklin County Metropark system has purchased a considerable amount of land north of I-70 to establish the

Prairie Oaks Metropark. Big Darby Creek flows through the middle of the park. The land purchased was previously used primarily for rowcrop agriculture. Additionally, a large parcel of land was used as a quarry. When the quarry eventually ceases operation a potential source of stress to this segment of Big Darby Creek will be eliminated. The quarry started out as a gravel operation which had gravel washing and its attendant problems. As gravel deposits were depleted the quarry switched to the mining of the limestone substrata. Eventually pumping of the mine pit was required as the mining proceeded below the water table. Pumping of ground water from mine pits can cause several problems, cooler waters can shift several biological processes particularly spawning, unoxygenated waters are obviously stressful, ground waters can contain high levels of a variety of dissolved minerals, increased flow can affect local hydrology, etc. Most of these stressors will be eliminated when the mining ceases operation.

The segment of Big Darby Creek between the I-70 Interstate Highway and the confluence with Little Darby Creek is a largely continuous patchwork of conservation easements, parklands and protected land with a relatively intact wooded riparian buffer. This land is currently owned, held or managed by ODNR - Scenic River Program, The Nature Conservancy, Camp Ken-Jockety Girl Scout Camp, Battelle Institute, Franklin County Metropark and others. If maintained in its current state habitat quality will remain adequate to support the exceptional community that has been documented there. Conditions may actually improve if best management practices for nonpoint sources are implemented in the watershed upstream.

Figure B.6.3. Sediment from a construction site delivered to the floodplain and subsequently to Big Darby Creek just north of Plain City, 1999.

Figure B.6.4. Longitudinal Trends in the Qualitative Habitat Evaluation Index in Middle Big Darby Creek Mainstem, 2001-2002.



Lower Big Darby Creek (confluence of Little Darby Creek to its confluence with the Scioto River RM 34.1 - 0.0)
A total of eleven locations were evaluated for riparian and instream habitat quality downstream from the confluence with Little Darby Creek in 2001 and 2002. The segment average QHEI was 83.6. Similar to the upstream segments evaluated this stretch possesses an abundance of positive habitat features more than capable of supporting EWH aquatic biological communities. It is currently designated EWH, which is appropriate and should be retained.

Significant changes in riparian and instream habitat in the lower reaches of Big Darby Creek since the last major significant sampling in the early 1990s were associated with the June 1997 flood. This major flood caused significant damage to some of the dikes in this lower reach that had separated the stream from its floodplain. Unfortunately, some of the dikes were "repaired" by dredging and bulldozing streambed sediments to re-establish the berm causing impact to local aquatic communities. Further downstream at the mouth, a better, more lasting solution was implemented. A collaborative project between the local landowner, ODNR Division of Wildlife (DOW) and DSWC, Pickaway SWCD and U.S. FWS resulted in moving the dike away from the stream channel which permitted the re-establishment of a floodway and a wooded riparian buffer. Discussions are ongoing to further extend this project upstream. As a result of this project natural stream recovery processes should result in improved habitat scores in this very lower reach. Another project that will likely go forward is the re-opening of the original eastern channel around Snake Island planned by ODNR - DOW and Ohio Department of Rehabilitation and Corrections (DRC) which will increase channel length by approximately one mile. This will effectively reduce local gradient and should reduce some of the erosion problems currently being experienced in the vicinity.

Big Darby Creek Upper Tributaries - Flat Branch to Robinson Run

Flat Branch (02-223) (RM 78.48)
Flat Branch is a small tributary located in the very headwaters of the Big Darby Creek watershed. Stream length is 4.7 miles with a watershed area of 14.46 sq. mi. Its streambed gradient is 4.5 ft/mi which falls in the low-moderate category for a stream of this size. The majority of the watershed lies in Union County. It flows roughly from the northeast to the southwest where it confluences with the Big Darby Creek mainstem at RM 78.48 just west of the Logan-Union County Line. A significant portion of the watershed lies within the Honda of America property. Flat Branch's headwaters originate just north of the Honda of America property, passes through the middle of the property and confluences with upper Big Darby Creek approximately one mile south of the Honda of America property and 300 feet upstream from County Rd 153 bridge (B&N, 2002). Contributing runoff to the 13.5 mi^2 (8,608 acres) upstream from the US Rt 33 bridge are about 3,500 acres of agricultural land (mostly rowcrop), 1,600 acres of woodlot and runoff and/or discharges from the East Liberty Automobile Plant (ELP), ELP water treatment plant, Honda R&D Americas, Inc., the Transportation Research Center (TRC), Marysville Automobile Plant (MAP), the Benton Road Water Treatment Plant

(BRWTP), the Honda Support Office (HSO) and the Credit Union. There are also a couple of ponds and wetlands adjacent to the streams.

The stream channel of Flat Branch has been extensively modified in the past yielding poor to very poor instream and riparian habitat quality (Figures B.6.5 to B.6.8). The preponderance of

Figure B.6.5. Flat Branch downstream of O'Dell Road, 2001. Note turbid condition of water.

Figure B.6.6. Flat Branch downstream from O'Dell Road, 2001, looking upstream towards the riffle. Again, note the turbidity.

Figure B.6.7. Flat Branch downstream of the upstream tributaries, looking upstream, 2001.

Figure B.6.8. Flat Branch adjacent to SR 739 downstream of tributaries, downstream view in channel.

high and moderate influence negative habitat attributes currently limit the potential for this tributary to support aquatic communities. These attributes include little to no recovery from channelization, high percentage of silt and muck substrates, no sinuosity, sparse to no cover, reduced residual pool volumes, fair to poor development, low current velocities, extensive embeddedness and the absence of defined riffles. In recognition of the impact of the reduced habitat quality of Flat Branch on resident aquatic communities and the changes in

hydrology on the Big Darby Creek mainstem a variety of activities are being studied or implemented to improve or restore stream habitat. The Ohio Chapter of The Nature Conservancy (TNC), in collaboration with the U.S. Army Corps of Engineers (USACOE) and The Ohio State University have initiated a study to determine the restoration potential of the upper headwaters of the Big Darby Creek watershed (Mitsch et al., 2002). Restoration projects discussed have included a wetland or series of wetlands created or restored in the upper watershed to improve water quality, ameliorate flood peaks, and provide habitat. Efforts have also been made on the part of Honda of America to widen the vegetated buffer and put in storm water retention ponds.

Little Darby Creek (Logan County) (02-251) (RM 78.34)

This Little Darby Creek is also located in the very headwaters of the Big Darby Creek watershed. Its confluence is just over one tenth of a mile downstream from that of Flat Branch at RM 78.34. Comparable in stream length to Flat Branch at 4.5 miles physically it differs in almost every other respect. It flows from the northwest to the southeast in Logan County and originates in the much hillier Cable moraine. This portion of the Cable moraine coincides with an area of glaciated Ohio called the boulder belt where glacial erratics from Canada are found at a concentration of 1 - 100/acre. Its streambed gradient of 26 - 32 ft/mi is in the high to very high range. The kinetic energy associated with these steep gradients typically results in scouring flows that sweep finer sediments downstream resulting in coarser streambed sediments and higher quality habitats.

Habitat evaluations conducted in 1988 and 2001 yielded QHEIs that demonstrated the potential for the headwaters to support good to very good communities (i.e. WWH to marginal EWH communities) (Figures B.6.9 and B.6.10). In 1988 a site just upstream from the mouth was judged to be excellent and received a score of 88 placing it as one of the highest scoring sites in

Figure B.6.9. Little Darby Creek (Logan Co.) at CR 277 looking upstream, 2001. Note wooded buffer and coarse stream substrates.

Figure B.6.10. Little Darby Creek (Logan Co.) downstream CR 277, 2001. Again note coarse stream bed materials being filled with fines.

the state. However, prior to the 2001 evaluation, one of the adjacent landowners had recently removed the riparian vegetation and had pushed the gravel downstream and armored the now eroding bank to "stabilize" it. This had reduced the QHEI score to 68, which is still well within the range demonstrated capable of supporting WWH biological communities. A similar activity in the upper reaches was investigated by Ohio EPA staff in late 2002. A landowner in the vicinity of SR 287 had dredged the stream channel and stockpiled the spoil upland, effectively creating dikes along both sides of the stream and adversely impacting instream habitat. As these pictures (Figures B.6.11 to B.6.15) show, the stream bed materials have shifted from coarse gravel cobble sized material found upstream from the project segment to sand and other fines within the channelized segment. The confinement of the floodwaters within the diked channel has prevented the expulsion of the fines into the floodplain and retained them within the channel. This is being conveyed downstream to the next landowner as evidenced in Figure B.6.15. The extensiveness of this project has concerned the downstream landowners to the point that there is concern about property being flooded and needing to extend the dredging. This is illustrative of the problems associated with channelization. Rather than dealing with the core cause of the problem it deals with the symptom(s) and passes the problem along to the next group downstream forcing them to then deal with their unwanted problem.

Figure B.6.11. Coarse substrates and clear water typical of segment upstream from project area in Little Darby Creek (Logan Co.).

Figure B.6.12. Little Darby Creek (Logan Co.) view of unauthorized channelization in the headwaters.

Figure B.6.13. Little Darby Creek (Logan Co.) view of previous unauthorized channelization in headwaters. Note diking and entrenchment.

Figure B.6.14. Sand and fine substrates predominate in freshly channelized segment, Little Darby Creek (Logan Co.), 2001.

Figure B.6.15. Sand substrates in Little Darby Creek (Logan Co.) upstream of SR 287 bridge, 2001 as a result of unauthorized channelization.

Unnamed Tributary to Big Darby Creek

(02-361) (RM 74.91)

Similar to Little Darby Creek this small, unnamed tributary originates in the boulder belt of the Cable end moraine in Logan County. It flows in a general easterly direction into Union County where it confluences with Big Darby Creek at RM 74.91 just upstream from the mouth of Spain Creek. Biological sampling and the instream and riparian habitat evaluation were conducted towards the mouth where the stream flowed across ground moraine. The QHEI of 62.5 and the habitat features present demonstrate the potential for this stream to support WWH aquatic communities (Table A.15 and Figure B.6.16).

Figure B.6.16. Unnamed tributary to Big Darby Creek (RM 74.91) at Innsburg-Cratty Rd.

Spain Creek (02-222) (RM 74.3)

Spain Creek flows in an easterly direction just south of the Logan - Champaign County line and then the Union - Champaign County line. It confluences with Big Darby Creek at RM 74.3. Stream length is 7.3 miles with a drainage area of 9.1 sq. mi.(Table A.15). North Lewisburg, one of the few small municipalities in the Big Darby Creek watershed, is located approximately 1.5 miles upstream from its mouth. North Lewisburg is a bedroom community for Marysville, the Honda complex and its attendant satellite support infrastructure and is experiencing relatively rapid population growth. Gradient in most of the subwatershed is 21-22 ft/mi. (relatively high). Instream and riparian habitat over the years (1981-2001) has been fairly consistently judged as very good to excellent with QHEIs averaging 76. Extensive sampling across the state has revealed that stream segments with QHEIs that average greater than 75 and possessing no interfering water chemistry problems hold the potential to yield EWH aquatic communities. The upstream portions of Spain Creek although still of very good quality appear capable of supporting WWH aquatic communities. Additionally, significant declines have been experienced in habitat quality upstream from North Lewisburg with the QHEI dropping from 82.5 to 72.0 at Gilbert Rd.- RM 3.7. The main difference between the years was the increase in the embeddedness and the absence of silt free substrates. This can be attributed to a shift in landuse from old field with very low density rural residential to a mix of residential and oldfield. Habitat quality in the lower reaches of Spain Creek downstream from North Lewisburg have been evaluated on several occasions since 1981 and have always yielded QHEI scores in the mid to high 70s clearly capable of supporting EWH biological communities (Table B.6.1 and Figure B.6.17).

Pleasant Run (02-221) (RM 72.01)

Pleasant Run also originates in the boulder belt of the Cable end moraine and flows in a general easterly direction to meet Big Darby Creek at RM 72.01. Its drainage lies completely within Champaign County with its main channel possessing a gradient ranging from 22 ft/mi. in the Cable moraine to 14 ft./mi. where crosses the end moraine and meets Big Darby Creek. Similar to the majority of the tributaries originating from the Cable moraine upstream this tributary has instream and riparian habitat with the potential to support very good WWH to EWH communities. This stream appears to be a "gaining" stream with good ground water contribution. It was sampled during the drought of 1988 and while many other streams in the vicinity dried up completely this stream still had good flow and was distinctly cool despite the high atmospheric temperatures. Based on the more recent results, habitat quality in 1988 was probably judged downward as a result of the severe low water conditions experienced during 1988. The more recent declines documented in 2001, however, were the result of the relatively recent channel work in the downstream reaches of this stream (Figures B.6.18 and B.6.19).

Figure B.6.17. Spain Creek upstream from the Cratty Rd. Bridge, 2001.

Figure B.6.18. Pleasant Run downstream of Middleburg Rd., 2001.

Figure B.6.19. Pleasant Run upstream from Middleburg Rd. with a view of substrate composition, 2001.

Tributary to Big Darby Creek (RM 69.40)

This unnamed tributary originates on the west side of Big Darby Creek and confluences with the mainstem just upstream from the Collins Rd. bridge. This small stream possesses a preponderance of positive habitat attributes. Modified habitat attributes included fair

development, heavy silt cover and extensive embeddedness. On balance it yielded a QHEI of 62.5 and was judged suitable for supporting WWH aquatic communities. Since the first evaluation of riparian and instream habitat quality of this small stream were conducted in 2001 it was not possible to document long term trends in habitat quality.

Hay Run (02-220) (RM67.6)

Hay Run is a very small stream with a stream length of 3.6 miles and drainage area of 5.82 square miles. It confluences with Big Darby Creek just upstream from Milford Center on the west shore. Unlike many of the streams originating from the west side of the upper watershed Hay Run does not drain the Cable moraine. It drains the ground moraine along the Big Darby Creek mainstem which yields a shallower gradient of 7.35 ft/mi which would place it in the low-moderate range. Hay Run was sampled at Middleburg Road and it has been modified in the past and is in a state of recovery (Figures B.6.20 and B.6.21). Substrate quality is mixed with larger cobble and gravel moderately embedded with silt and sand. Many other habitat attributes are in the low moderate range suggesting a marginal ability to support WWH aquatic communities. Ground water influenced Hay Run yielded mean temperatures during the 2001 field season about 3.5 degrees cooler than many other streams in the vicinity. Despite the less than optimum habitat the ameliorating effect of the ground water appeared to hold adequate sway to support EWH biological communities. Since the first evaluation of riparian and instream habitat quality of this small stream were conducted in 2001 it was not possible to document long term trends in habitat quality.

Figure B.6.20. Hay Run upstream from Middleburg Rd. Note coarse substrates, clear water, and attached filamentous algae.

Figure B.6.21. Hay Run downstream from Middleburg Rd. Note algal mats - evidence of nutrient enrichment.

Prairie Run (02-359) (RM 63.84)

Prairie Run was first evaluated in 2002. Prairie Run is a very small stream that originates from the west of Big Darby Creek in ground moraine. Gradient at the one site sampled towards its mouth was 13.7 ft/mi. placing it in the moderate range. Evaluation of the instream and riparian

habitat yielded a QHEI of 23, in the very poor range. No positive WWH attributes were noted at the site. A preponderance of high influence modified habitat attributes, however, was documented. They included lack of recovery from channelization, silt/muck substrates, the absence of sinuosity, the almost total lack of cover, and little residual pool volume. Moderate influence modified habitat attributes also depressed habitat quality. The absence of riffles and extensive embeddedness were noteworthy. Some of the impact appeared to be relatively recent. Coarse substrates were discernable underneath the unconsolidated 6-8 inch thick layer of silt coating the majority of the sampling zone. The source of this silt, upstream from the zone, should be found and stabilized to reduce its contribution to Big Darby Creek.

Since the first evaluations of riparian and instream habitat quality of this small stream were conducted in 2001, it was not possible to document long term trends in habitat quality.

Buck Run (02-209) (RM 63.74)

The Buck Run subwatershed lies on the east side of the Big Darby Creek mainstem. Its channel closely parallels Big Darby Creek for most of its 6.8 mile length flowing from northeast to southwest until it merges with Big Darby Creek in the vicinity of Bridgeport. The majority of its watershed lies within the Powell end moraine. There is less geographical relief to the land surface east of Big Darby Creek and the majority of sites sampled in Buck Run over the years have local gradients of 5-7 ft/mi which places them in the range of low - moderate to moderate range for most sites. Land use in the subwatershed is a mixture of rowcrop agriculture, livestock and pasturage. Local habitat in 2001 varied widely in quality from very good to excellent at the site at the mouth to poor at several sites scattered throughout this small stream. Inspection of the site description sheets reveal that in almost every situation the lowered habitat quality has been associated with pasturage with open access to the stream. This results in trampled, false banks, increased siltation and embeddedness, reduced instream cover amounts and diversity.

Instream and riparian habitat in Buck Run has been evaluated several times since 1988 at varying locations in the watershed making it possible to tracks trends in habitat quality over time (Figures B.6.22 to B.6.26).

In 1988, as a part of a screening survey for a Non-Point Source Pollution Research Project, site description sheets were completed for eight sites from RM 12.9, downstream from Holy Cross Epps Rd. to the mouth at RM 0.1. The mean QHEI for this segment was 50.5. This mean score falls in the range of scores requiring a closer evaluation to determine the appropriateness of the existing WWH aquatic life use designation. It was noted in this survey that the relocation of US Rt. 33 had deposited considerable amounts of silt into the headwaters of this stream. The silt layer was estimated to be 18 inches thick in spots lowering the QHEI in the upper reaches of this stream. This silt probably has been and will be flushed downstream with elevated flows, temporarily impacting downstream reaches. Localized impacts from free access of livestock to the stream, channelization, removal of the riparian buffer, etc. were also noted at the sites evaluated in 1988.

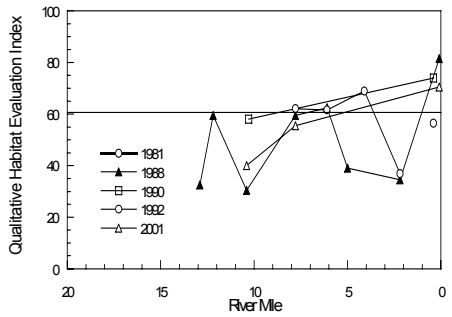
Figure B.6.22. Buck Run upstream from the Sam Reed Rd. Bridge. Note turbid waters.

Figure B.6.23. Buck Run downstream from the Sam Reed Rd. Bridge.

Figure B.6.24. Buck Run upstream from Orchard Rd., 2001.

Figure B.6.25. Confluence of Buck Run with Big Darby Creek from the Streng Rd/ bridge, 2001.

Figure B.6.26. Longitudinal and temporal patterns in the Qualitative Habitat Evaluation Index in Buck Run between 1981 and 2001.



Sampling in 1990 at two sites, RM 10.3 - Allen Center Rd. and 0.4 - the mouth, yielded a mean QHEI of 66.0. Significant improvement was noted at the upstream site. This site, when evaluated in 1988, had been recently channelized for a short distance, in conjunction with the construction of a bridge, yielding a QHEI of 30.5. Natural recovery processes resulted in an increase to 58.0 in 1990 demonstrating the rate and potential for recovery in this basin.

In 1992, biologists from ODNR Division of Natural Areas and Preserves (DNAP) sampled four sites in Buck Run as a part of a Section 319 urban storm water grant. Qualitative habitat evaluation index scores in 1992 ranged from 69.0 at RM 4.1, upstream from the US 36 bridge, to 37.0 measured at RM 2.2, upstream from Sam Reed Rd. Mean QHEI for the four sites was 57.4, comparable to the mean value measured in 1988. Three of the four sites sampled were noted to have sparse to no cover, the only high influence modified habitat attribute observed within the subbasin in 1992. In addition to the three moderate influence modified habitat attributes found at upstream sites, the downstream site also had moderate silt cover, no instream cover and moderate embeddedness. Riffle, pool, run development declined from good at the upstream sites to fair in the mid reaches and poor at the downstream site. It is apparent that this stream is subject to a variety of habitat disruptions along its length and that some of the impacts are cumulative. However, as mentioned previously, prevailing instream gradient and natural recovery processes have demonstrated the potential for recovery from habitat disruptions.

In 2001 three sites were sampled from Allen Center Rd - RM 10.4 to the mouth site - RM 0.1 with a reach mean QHEI of 55.3. The site at Allen Rd. appears to be subject to periodic disruptions in habitat quality. In 1988 a QHEI of 32.5 was recorded which is almost in the very poor range and obviously a channel modified condition. This site had by 1990 recovered to a QHEI of 58 - almost in the good range. By 2001 the QHEI had slipped to 40.0 in the middle of the poor range. A reworking of the stream channel had obviously occurred since it was last sampled. The site at SR 245 although remaining fairly stable in habitat quality is starting to show signs of declining quality with increases in the amounts of embeddedness. Similarly the site at the mouth although measured at the high end of the good range in the most recent sampling represents a significant decline from the excellent habitat found in 1988. Differences noted between the years include a shift in streambed substrate composition, moderate siltation, fair development, slower current velocities, and moderate overall embeddedness.

Although the ability of habitat quality to improve over time has been documented in Buck Run periodic disruptions are slowly lowering overall habitat quality in Buck Run. Channelization and free access of livestock to the stream appear to be sources most significantly contributing to the

accumulation of high and moderate influence modified habitat attributes in the Buck Run watershed.

Robinson Run (02-207) (RM 53.69)

Robinson Run is small, previously modified stream not under maintenance 3.2 miles in length with a drainage area of 10.9 square miles and a moderate stream bed gradient of 11.84 feet mile. The channel of Robinson Run parallels closely the southern terminus of the Powell end moraine flowing southeasterly through the relatively flatter ground moraine of Union County. It confluences with Big Darby Creek just upstream from Plain City. Stream bed substrates were predominately cobble and gravel with lesser amounts of boulder, hardpan, sand and silt at the upstream site RM 2.1 Hickory Ridge Rd and SR 736. Gravel was the predominant substrate at the downstream site RM 0.1 (Figures B.6.27 and B.6.28). The mean QHEI for the two sites evaluated was 67.0. Values in this range generally have been found suitable to support WWH communities. Habitat improved slightly towards the mouth associated with an increase in local streambed gradient. A comparison with previously sampling conducted in 1992 revealed almost identical scores to the 2001 results. Robinson Run appears to be maintaining its good habitat quality in the reach evaluated.

Figure B.6.27. Robinson Run upstream from flow site, 2001.

Figure B.6.28. Robinson Run downstream from the flow site, 2001.

Big Darby Creek Middle Tributaries

Sweeney Run (02-357) (RM 52.11)

Sweeney Run has the unique distinction of not being listed in the Gazetteer of Ohio Streams. Much of its length has been channelized in the past. In its upper reaches the channel work has been done in conjunction with agricultural drainage and in the lower reaches in association with the development of Plain City. Numerous storm water drains and debris are present in the channel within Plain City. Additionally, portions of the lower reach have had the trees removed and banks shaped within the last five years. Despite these habitat disruptions the segment at the

mouth of Sweeney Run had fair-good habitat. A QHEI of 58 was recorded at RM 0.2. Positive WWH features included coarse substrates (i.e., cobble, gravel, and gravel) moderate sinuosity and cover amounts, fast currents, and relatively deep pools (Figures B.6.29 and B.6.30). Habitat attributes that detract from the streams suitability to support aquatic communities included the channel recovering from channelization, moderate silt cover, fair development and moderate riffle and overall embeddedness. Many of the later negative attributes were probably due to the erosion resulting from the recent bank work and the residential development taking place along the stream channel on the southwest borders of Plain City. The stream possesses adequate gradient (> 31ft/mi) and enough positive attributes to recover well into the WWH range if adequate storm water and erosion control BMPs are implemented.

Figure B.6.29. Sweeney Run near its mouth in Plain City, Ohio, 2001

Figure B.6.30. Sweeney Run downstream view near mouth, 2001.

Sugar Run (02-206) (RM 50.62)

Sugar Run originates in Union County. It flows across the Powell end moraine in the southern portion of the county and then into ground moraine. It confluences with Big Darby Creek five miles from its origin just downstream from Plain City in Madison County. It has a drainage area of 19.5 square miles and an average streambed gradient of 7.8 ft/mi - in the moderate range. Sites evaluated for habitat quality at the mouth have consistently scored in the range judged suitable for supporting WWH aquatic communities (Figure B.6.36). The headwaters of this stream, however, have consistently been judged poorer and unfortunately the trend in habitat quality has been downward (Figures B.6.31 to B.6.35). Channelization and habitat destruction associated with free access livestock pasturing were the problems documented in previous sampling. The construction of the Rolling Meadows Golf Course has furthered this decline. The site located at RM 5.4, downstream from US Rt 42 has declined significantly in quality over time (Figure B.6.35). When first evaluated in1990 this segment possessed habitat suitable for support of a marginal EWH aquatic community (i.e., QHEI = 72). Steady declines in the intervening years has yielded ever worsening habitat with the most recent sampling yielding a QHEI of 38.5. Based on historical sampling and the most recent effort Modified Warmwater Habitat would be the appropriate use designation upstream from US Rt. 42 upstream and Warmwater Habitat downstream from US Rt. 42.

Figure B.6.31. Sugar Run upstream Industrial Parkway, 2001. Note golf course backing grassed banks.

Figure B.6.32. Sugar Run downstream Industrial Parkway, 2001.

Figure B.6.33. Sugar Run upstream from Taylor Rd. Note row cropping beyond grassed banks.

Figure B.6.34. Sugar Run downstream from Taylor Rd, 2001. Note residential land use.

Figure B.6.35. Sugar Run downstream US Rt. 42 bridge, 2001.

Figure B.6.36. Sugar Run upstream Cemetery Pike, 2001.

Unnamed Tributary to Sugar Run (02-358) (RM 7.39)

This very small tributary to Sugar Run originates from the east side of Sugar Run almost at its headwaters. It is totally contained within the Powell end moraine with its attendant geological characteristics. At the site where the stream was evaluated, Industrial Parkway - RM 0.1, it had been extensively modified (Figures B.6.37 and B.6.38). It possessed all of the high influence negative attributes including recent or no recovery from channelization, silt substrates, the absence of sinuosity, sparse instream cover, and shallow pool depths. Numerous moderate influence negative habitat attributes were also present including moderate silt cover, poor development, low sinuosity, high to moderate riffle and overall embeddedness and a lack of riffles. Based on the cumulative effect of these attributes and the low QHEI score of 27.0 this stream segment is judged incapable of supporting Warmwater Habitat aquatic communities. This ditch has been petitioned under the Ohio County Ditch Law and is routinely maintained by

Figure B.6.37. Unnamed tributary to Sugar Run RM 7.39 upstream Industrial Parkway, 2001.

Figure B.6.38. Unnamed tributary to Sugar Run RM 7.39 at Industrial Parkway, 2001.

the Union County Soil and Water Conservation to keep it in its current state. Based on the documented reduced instream habitat quality and that it will be legally maintained in its current state this stream was recommended to be designated Modified Warmwater Habitat.

Worthington Ditch (02-356) (RM 50.62)

This approximately six mile long stream confluences with Big Darby Creek approximately 1.1 miles downstream from Plain City, from the west. It flows almost directly due east just south of Converse - Huff Rd. Although the predominant landuse in the watershed has been agriculture, large lot residential development has taken place along Converse-Huff Rd. in the last 5-10 years. The south side of Plain City is also spreading southward towards this catchment.

Although the stream channel possesses adequate gradient (i.e., > 20 ft/mi) and, therefore, the potential energy to regrade its stream channel the current evaluation of habitat quality revealed that it had not significantly recovered from past channel work. Coarse substrates and relatively deep pools were the main positive habitat features present. Attributes detracting from habitat quality include a channel that has shown little recovery from channelization, no sinuosity and sparse cover. Moderate influence modified habitat attributes included increased silt cover, inadequate development, low number of cover types, lack of fast current, and elevated overall and riffle embeddedness. These attributes yielded a QHEI of 46.5 (Figure B.6.40). Immediately downstream from this segment (Figure B.6.39) where some woody vegetation was permitted to remain along the stream banks yielded WWH macroinvetebrate communities and an evaluation that the stream in its current form in this segment is capable of supporting WWH aquatic biological communities and should be designated WWH. Worthington Ditch would benefit by the addition of a vegetated riparian buffer to filter runoff and provide shading to

Figure B.6.39. Worthington Ditch downstream from Plain City-Georgesville Rd.

Figure B.6.40. Worthington Ditch upstream from Plain City-Georgesville Rd.

the stream channel. This evaluation is the first time that Worthington Ditch has been monitored and, therefore, a trends assessment cannot be conducted.

Ballenger-Jones Ditch (02-355) (RM 49.68)

This approximately six mile long tributary originates on the west side of Big Darby Creek about two miles south of Plain City. It flows almost directly east and confluences with Big Darby Creek at the intersection of Amity Pike Rd and Plain City - Georgesville Rd. and just upstream from Amity. The streams flows through ground moraine its entire length. Land use although primarily row crop agriculture has significant number of large lot residences as well as horse stables. The Jonathan Alder High School campus is also situated in this small subwatershed. The qualitative habitat evaluation was conducted just upstream from Plain City - Georgesville Rd. Adjacent landuse was large lot residential with mowed banks and little in the way of riparian vegetation (Figure B.6.41). However, there was a predominance of positive warmwater habitat attributes present including little evidence of channelization, coarser streambed substrates, a good variety of substrates, high sinuosity, moderate amounts of instream cover, a variety of current types and deep pools. A few negative attributes were also present including heavy to moderate silt cover, and moderate embeddedness in the riffles and the zone overall. Nonpoint sources of pollution are the likely contributors to these negative attributes and if controlled would likely yield higher quality instream habitat. Overall the QHEI score of 69 strongly suggests that this stream should be capable of supporting Warmwater Habitat Aquatic communities particularly in its lower reaches (Figure B.6.42). This evaluation is the first time that Ballenger-Jones Ditch has been monitored and, therefore, a trends assessment cannot be conducted.

Figure B.6.41. Ballenger-Jones Ditch upstream from SR 142, 2001.

Figure B.6.42. Ballenger-Jones Ditch downstream from SR 142, 2001.

Yutzy Ditch (02-364) (RM 47.1)
This small tributary which originates on the west side of Big Darby Creek and confluences just upstream from the Scioto - Darby Rd. in Franklin County (Figure B.6.43). A considerable portion of this stream has been channel modified particularly in the upstream reaches. A large portion of the stream has estate and large lot residential landuse along its length. This is backed by rowcrop agriculture. The Canaan Middle School is located in the middle reaches of the watershed. Although Yutzy Ditch has been observed flowing throughout the year over the course of several years it had become desiccated at the selected site towards the end of the 2001 field sampling season when it was planned to be sampled.

Figure B.6.43. Yutzy Ditch at Plain City-Georgesville Rd. looking upstream.

Fitzgerald Ditch (02-272) (RM 44.96)
Another tributary originating from the western side of Big Darby Creek confluences with Big Darby Creek 0.5 mile upstream from the Lucas Rd/Beach Rd. Suspension Bridge. Much of the upper reaches of Fitzgerald Ditch have been channel modified. Lower reaches (~RM 1.5 downstream) have been modified to a much lesser degree. The instream habitat evaluation conducted downstream from St Rt 142 yielded a QHEI of 56.4 (Figures B.6.44 and B.6.45). Moderate influence negative habitat attributes were the main factors resulting in the slightly less than optimal habitat. These attributes were: recovering from channel modification, moderate silt cover, fair development, lowered sinuosity, no fast current, and moderate riffle and overall embeddedness.

An evaluation of habitat quality had been conducted further up in the watershed in response to a fish kill in 1994. A custom applicator of farm chemicals had released a large volume of ammonia into Fitzgerald Ditch upstream from US Rt. 42. The stream segment evaluated just downstream from US Rt. 42 had been channelized with a straight, trapezoidal channel and only grass as vegetation along the stream bank. The only positive habitat feature were the coarse streambed constituents (i.e., boulder, cobble and gravel substrates).

Negative habitat features included no recovery from channelization, sparse cover, shallow depths, moderate silt cover and embeddedness, and moderate to extensive run embeddedness and the lack of functional riffles. Some of these attributes may have been exacerbated by the small dams that were being used to temporarily hold back the ammonia laden water from upstream. This segment has been documented to be in the area under county ditch maintenance by the Madison County Engineer's Office. This portion of the stream has been judged not suitable for supporting WWH aquatic communities and has been recommended to be designated as MWH.

Figure B.6.44. Fitzgerald Ditch upstream from Plain City - Georgesville Rd.

Figure B.6.45. Fitzgerald Ditch downstream from Plain City - Georgesville Road.

Little Darby Creek and Tributaries

Little Darby Creek is the largest tributary to Big Darby Creek with a drainage area of about 176 square miles and a stream channel length of 38 miles. The average stream bed gradient over its course is 5.9 ft/mi. However, along its length Little Darby Creek flows through a variety of different landscape features that yield a wide range of stream bed gradients and consequent instream habitat characteristics (Figure B.6.60). Habitat quality varies from amongst the best in the state (e.g., QHEI = 99 at RM 4.1) to good (e.g., QHEI = 63.5 at RM 0.7) towards the mouth and within the area that is still recovering from the removal of a run-of-the-river dam (Figure B.6.58). The average QHEI for the eleven sites evaluated in 2001 was 80.5. This demonstrates that habitat quality overall is suitable for sustaining EWH biological communities and that the existing EWH is appropriate and should be retained (Figures B.6.46 to B.6.59 and Figure B.6.1). Despite the overall high quality, documented problems have also been noted. As many of the photos that follow show, high quality habitat is

Figure B.6.46. Little Darby Creek RM 41.2 downstream from Allison Rd. Note wooded riparian buffer and good stream development.

Figure B.6.47. Little Darby Creek RM 39.6 downstream of SR 29.

Figure B.6.48. Little Darby Creek RM 39.6 downstream SR 29.

Figure B.6.49. Little Darby Creek RM 34.7 downstream Irwin Rd.

Figure B.6.50. Little Darby Creek RM 34.7 downstream Irwin Rd. Note condition of stream banks.

Figure B.6.51. Little Darby Creek RM 34.7 downstream from Irwin Rd.

Figure B.6.52. Little Darby Creek RM 33.0 upstream from Bates Rd. Note wooded riparian buffer.

Figure B.6.53. Little Darby Creek RM 33.0 downstream from Bates Rd. Note false banks and absence of any bank vegetation.

Figure B.6.54. Little Darby Creek RM 29.5 at Axe Handle Rd.

Figure B.6.55. Little Darby Creek RM 29.5 at Axe Handle Rd.

Figure B.6.56. Little Darby Creek RM 15.3 upstream US 42.

Figure B.6.57. Little Darby Creek RM 15.3 upstream US 42. Note fast riffle.

Figure B.6.58. Little Darby Creek near mouth, just upstream Alkire Rd.

Figure B.6.59. Longitudinal trends in the Qualitative Habitat Evaluation Index in Little Darby Creek, 2001.

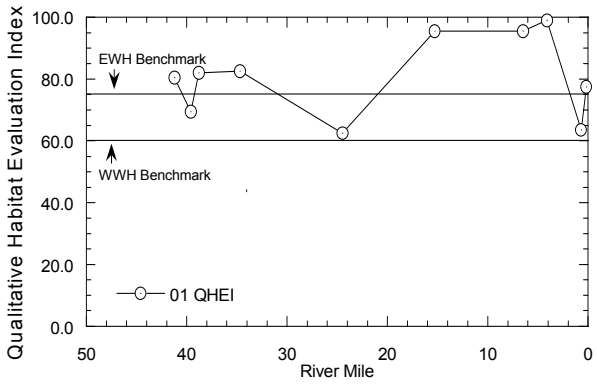
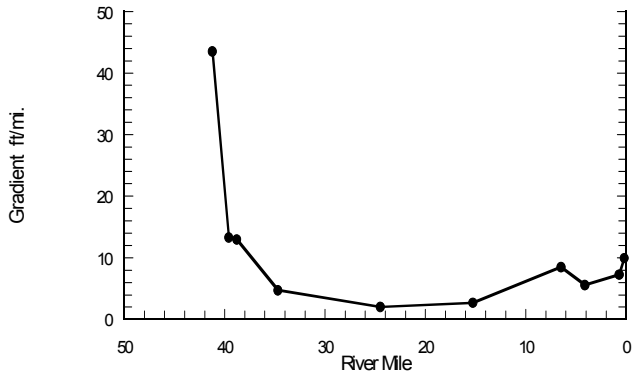


Figure B.6.60. Gradient (ft/mi)of sites sampled in the Little Darby Creek mainstem during 2001.



frequently interspersed with areas where most if not all of the riparian vegetation has been stripped off and bank erosion is contributing fines to the stream channel (e.g., Figure B.6.53). The Little Darby Creek mainstem originates in the boulder belt of the Cable moraine in Champaign County, then flows through the southwestern corner of Union County into Madison County which contains the majority of the watershed. The Champaign County portion of the watershed is characterized by its steep gradient, coarse substrates, good to excellent development, fast currents, and low embeddedness. Upon leaving the Cable moraine Little Darby Creek flows through ground moraine for the majority of its length. Gradient there drops from >43 ft/mi to about 13ft/mi in the vicinity of Mechanicsburg, which is a gradient range with sufficient potential energy to transport sediment and rework the stream channel after modification to re-establish normal stream development (i.e., riffle, pool, run complexes). Glacial maps of Ohio reveal that the stream course of Little Darby Creek with the ground moraine portion of its course is lined with significant deposits of alluvium and glacial outwash (Figure A.2). These deposits are responsible for the relatively coarse substrates and the ground water input to the stream. Mid reaches of the stream (from about RM 30 to RM 15) possess fairly low gradients on the order of 2-3 ft/mi. Gradients in this range have classified as low (Ohio EPA, 1989) and possess less potential energy and thus have less ability to expel and transport sediments and re-establish natural channel features after disruption. These are the areas that need more help if disrupted and more protection if currently undisturbed.

Clover Run (02-218) (RM 39.8) (EWH)

This small tributary originates in the very headwaters of Little Darby Creek and confluences with it immediately south of Mechanicsburg. It comes off of the boulder belt of the Cable Moraine and drains some of the hilliest portions of the entire Big Darby Creek watershed. The local gradient of 47.62 places it in the very high category. Overall riparian and instream habitat was good and judged suitable for supporting WWH aquatic biological communities (Figure B.6.61). Moderate siltation and embeddedness and little to moderate erosion were the main negative habitat influences noted. The first evaluation of instream and riparian habitat took place in 2001 so an analysis of trends in Clover Run was not possible.

Figure B.6.61. Clover Run at Maplegrove Cemetery.

Lake Run (02-216) (RM 36.9) (EWH/EWH Deferred)

This small tributary originates just north of Mechanicsburg. It flows through the Cable end moraine and has a couple of glacial kettle lakes situated on it or draining to it. Local gradient of 16.39 ft/mi is in the moderately high range. Very few negative habitat attributes were present at the site evaluated and resulted from historical channelization and recent construction activities which had delivered sediment to the stream channel. These negative attributes include moderate overall embeddedness and low-moderate riffle embeddedness (Table B.6.1). The stream is close to being recovered from channelization. It currently yielded a QHEI of 71 in the very good range (Figure B.6.62). That coupled with the moderately high gradient should swiftly flush out the contributed sediments if adequate erosion control practices are in place. This stream should quickly recover from this temporal impact and, therefore, the existing EWH use is being retained pending future monitoring.

Figure B.6.62. Lake Run upstream from State Route 4.

Jumping Run (02-217) (RM 3.9)

Jumping Run is a 2.8 square mile tributary to Lake Run. Although silt and muck substrates contributed to the moderate embeddedness detected this stream it was still judged to be suitable for the WWH aquatic life use (Table A.15 and Figure B.6.63). The first evaluation of instream and riparian habitat took place in 2001 so an analysis of trends in Jumping Run was not possible.

Figure B.6.63. Jumping Run at SR 559.

Treacle Creek (02-213) (RM 31.3)

Treacle Creek is 14.2 miles long with a drainage area of 37.1 sq/mi and a local gradient in the moderate- high ranges in its headwaters and mid reaches and drops into the low-moderate range towards the mouth where it transitions from ground moraine to end moraine. Several sites have been evaluated since 1992. With the exception of the site at Winget Rd. all segments evaluated have received QHEI scores in the sixties yielding a segment average of 65.3 (Figure B.6.65). The site at Winget Rd. has been channelized historically and maintained more recently. In all

years evaluated an extensive pasture lined both sides of the stream (Figure B.6.64). Livestock were given free access to the stream and had severely trampled both banks yielding thick deposits of silt which blanketed essentially the whole site and in some places resulted in unconsolidated layers as thick as 24 inches.

Figure B.6.64. Treacle Creek upstream from the covered bridge.

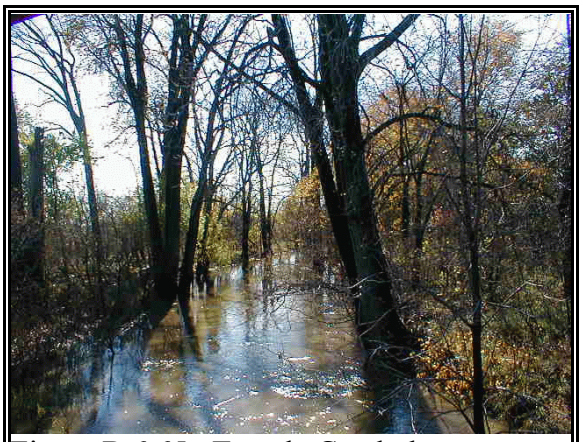


Figure B.6.65. Treacle Creek downstream from the covered bridge.

Sampling conducted in 1992, 1993 and 2001 has yielded fairly consistent results at the sites evaluated with QHEI values averaging greater than 60 upstream from RM 5.0 (Figure B.6.66). The site upstream from Eagle Rd. which has yielded QHEIs averaging around 30 would benefit by fencing the cattle from the stream and providing a single point of access for watering. Allowing re-vegetation would stabilize the stream bank and filter sediments coming off the pastured land which would also benefit Little Darby Creek downstream from the confluence with Treacle Creek. Ground water contribution to the stream channel and proximity to higher quality stream segments has ameliorated the impact of the negative attributes in Treacle Creek and permitted either full or partially support of EWH communities at all sites except the most downstream site.

Howard Run (02-215) (RM 5.4) (EWH)

Howard Run is 3.2 miles long with a drainage area of 2.72 sq. mi. and a overall gradient of 23.1 ft/mi placing it in the high range. Locally the gradient at the site sampled was considerably less at 13.27 ft/mi. falling in the moderate range. The site had a mix of positive and negative habitat attributes yielding a QHEI of 55.5 (Figure B.6.67). Only one high influence, modified habitat attribute was noted - low sinuosity. However, the site was recovering from historical channelization and given the steep overall gradient of the stream there is sufficient energy for this site to revert to the high quality present in the rest of the stream.

Figure B.6.66. Longitudinal and temporal patterns in the Qualitative Habitat Evaluation Index for sites sampled in Treacle Creek during 1992, 1993 and 2001.

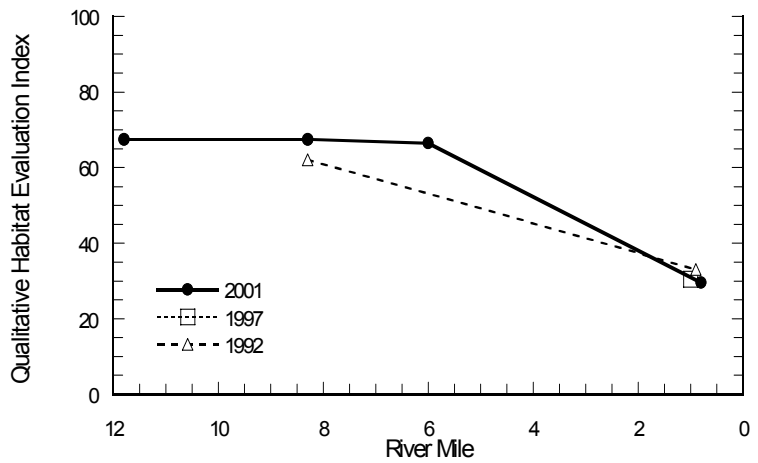


Figure B.6.67. Howard Run at McMahill Rd.

Proctor Run (02-214) (RM 3.69) (EWH)
Proctor Run is six miles long with a local gradient of 21.4 ft/mi and drains a watershed of 10.4 sq/mi. Proctor Run originates in Champaign County in the boulder belt of the Cable Moraine. It then flows almost directly east downslope through the rest of the Cable moraine and into ground moraine and Union County. Three sites were evaluated in Proctor Run yielding QHEI scores ranging from 65 to 73. Positive warmwater habitat attributes predominated at all three sites (Figure B.6.68). No high influence modified habitat attributes were found although moderate amounts of silt and embeddedness somewhat lowered habitat quality.

A single site, RM 1.7 - upstream from Mc Mahill Rd., had been evaluated previously in 1992 as well as in 2001. Although slight differences were noted between the years overall habitat quality was judged very similar and of very good quality.

Barron Creek (02-212) (RM 24.4) (EWH)
Barron Creek is 4.8 miles long, has a gradient of 8.3 ft/mi. and drains a watershed of 6.3 sq/mi. It is listed in the Gazetteer of Ohio Streams as intermittent. Despite this notation discernable flow was present during the summer of 2001, one of the driest periods on record in central Ohio. Habitat at the site sampled has been impacted by channelization yielding low to no sinuosity, fair to poor development, silt substrates in spots, slower currents and moderate overall and riffle embeddedness (Figures B.6.69 and B.6.70). The QHEI was 44.5, in the poor range. The presence of a spring in the sampling zone prevented worse instream biological performance.

The sampling conducted in 2001 was the first evaluation of instream and riparian habitat on Barron Creek so an analysis of longterm trends in Barron Creek was not possible.

Wamp Ditch (02-363) (RM 23.0) (Undesignated/WWH Recommended)
Wamp Ditch originates on the east side of Little Darby Creek entering about one mile upstream from the Morris Rd. bridge. Local gradient is 12.5 ft/mi, in the moderate range. Habitat quality is poor (QHEI = 44.5) with four high influence modified habitat attributes including recent or no recovery from channelization, no sinuosity, sparse cover and little residual pool volume. A number of moderate influence modified habitat attributes drive habitat quality further down including fair to poor development and moderate overall embeddedness (Figure B.6.71).

Figure B.6.68. Proctor Run RM 3.69 upstream of bridge.

Figure B.6.69. Barron Creek RM 24.4 south of Rosedale-Plain City Rd.

Figure B.6.70. Barron Creek RM 24.4 south of Rosedale-Plain City Rd.

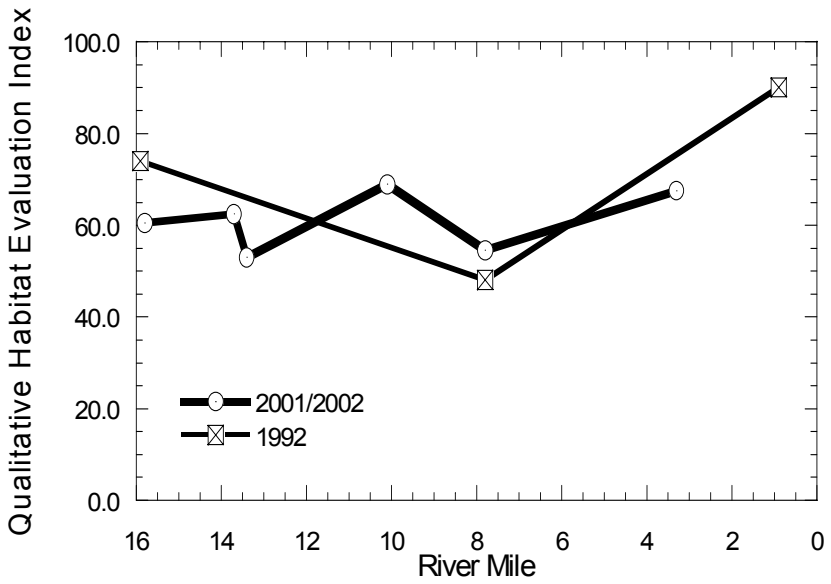
Figure B.6.71. Wamp Ditch upstream from Vogelburg Road.

Spring Fork (02-211) (RM 17.46) (EWH)
Spring Fork is one of the larger Little Darby Creek tributaries at 12 miles long and a drainage area of 37.9 sq/mi. Local gradient averages out at 7.2 ft/mi. Although the majority of the stream flows through ground moraine the headwaters originate in the boulder belt of the Cable Moraine with its attendant habitat features. Habitat quality in Spring Fork has been evaluated at several locations between 1992 and 2002 (Figures B.6.72 and B.6.73). In 1992 habitat quality in the headwaters and at the mouth were very high in quality particularly the mouth site which scored amongst the top tier of sites in the entire state. The mid reaches represented by the site at RM 7.8 , upstream Rosedale - Milford Center Rd. had impacted habitat quality. Historically channelized with strong evidence of use in the near past as pasturage (e.g., well trodden paths, false bank formation, elimination of understory) yielded habitat in the fair range. This same site a decade later has shown modest improvement into the upper end of the fair range. This appears to have been accomplished largely by the flushing of fine sediments from the system over the intervening years. Embeddedness has declined, coarser substrates have been exposed, pools deepened, etc. In contrast the site at RM 15.8, upstream from Wren Rd. has shown significant declines due a shift in landuse practice which has resulted in smothering of the coarser substrates, reduced sinuosity, reduced current velocity and increased embeddedness.

The mean QHEI for all of the locations evaluated in 2001 and 2002 was 61.6, solidly in the good range. Many of the sites were in the process of recovering from the effects of channelization which had resulted in fair stream development, moderate silt cover and moderate amounts of overall and riffle embeddedness.

Bales Ditch (02-362) (RM 3.64) (Undesignated/WWH Recommended)
Bales Ditch, a small tributary to Spring Fork, originates in ground moraine and flows in a general easterly direction confluencing with Spring Fork close to Plumwood, Ohio. The local gradient at the site sampled was 17.86 ft/mi placing it in the moderate high range. Habitat quality was judged very good (QHEI = 70). A moderately wide to wide riparian buffer coupled with an undisturbed stream channel, moderately high gradient and glacial till yielded a diverse and moderately stable stream channel. The habitat was judged to be easily capable of supporting a WWH aquatic biological community.

Figure B.6.72. Longitudinal trends in the Qualitative Habitat Evaluation Index in Spring Fork, 1992 and 2001/2002.



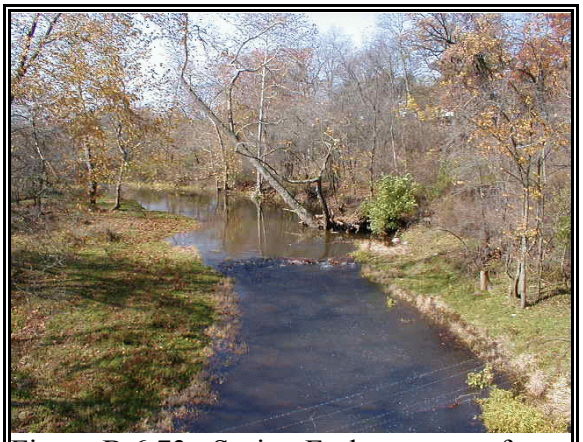


Figure B.6.73. Spring Fork upstream from Lafayette-Plain City Road, 2001.

Hellbranch Run and Tributaries

Hellbranch Run (02-204) (RM 26.1) (WWH)

Hellbranch Run is one of the few significant tributaries to Big Darby Creek east of the mainstem. It originates in and is solely contained within Franklin County. The eastern half of the watershed is rapidly being encroached upon by growth in Hilliard. The course that the stream channel follows is almost directly south and it enters Big Darby Creek a few miles south of Darbydale. Watershed length is 12.8 miles, watershed area is 37.7 square miles with an average gradient of 11.2 ft/mi. The mean QHEI recorded for the six sites sampled in the mainstem of Hellbranch Run in 2001 was 67.92. As mentioned previously, comparison of QHEI scores with biological performance of sites in the Ohio EPA database has shown that segments with average scores higher than 60 are capable of achieving the Warmwater Habitat (WWH) aquatic life use designation criteria based on habitat alone. Obviously, the mainstem of Hellbranch Run is capable of physically supporting the existing warmwater habitat aquatic life use designation. Localized habitat disruptions, however, considerably lower the mean score. These include: the segment at Alton Rd which has been dredged, deepened and straightened historically and which has declined in quality since last evaluated in 1992. Similarly, Kunz Rd. which possessed very good habitat in 1992 (QHEI = 74.5) has declined significantly in habitat quality in the intervening years with a QHEI of 51.0 recorded in 2002. Aggregating the sites in the lower four miles yields a considerably higher average QHEI of 83.8 demonstrating the potential of lower Hellbranch Run to support a very high quality aquatic community given adequate water and sediment quality. Evidence of this potential was demonstrated in the 2001 results. Two of the three sites in this segment would marginally meet the EWH criteria. Only the site downstream from the Timberlake WWTP partially met EWH criteria (Figure B.6.74). Initiatives to address habitat problems in the two source water tributaries to Hellbranch Run and at their confluences, as well as efforts to improve wastewater treatment at the existing small WWTPs to Hellbranch Run, should address further habitat and water quality shortfalls and should permit improvements in instream biological performance.

Figure B.6.74. Hellbranch Run downstream from the Timberlake (Cordell Regional) WWTP, 2001.

Hamilton Ditch (02-259) (RM 11.9) (MWH to Feder Rd., WWH Feder Rd. (RM 2.1) to mouth)

Hamilton Ditch, the western headwater source tributary for Hellbranch Run, was first evaluated for habitat and water resource quality in 1992. Landuse in this small subwatershed was predominately agricultural at that time. However, it was noted that large portions of the stream

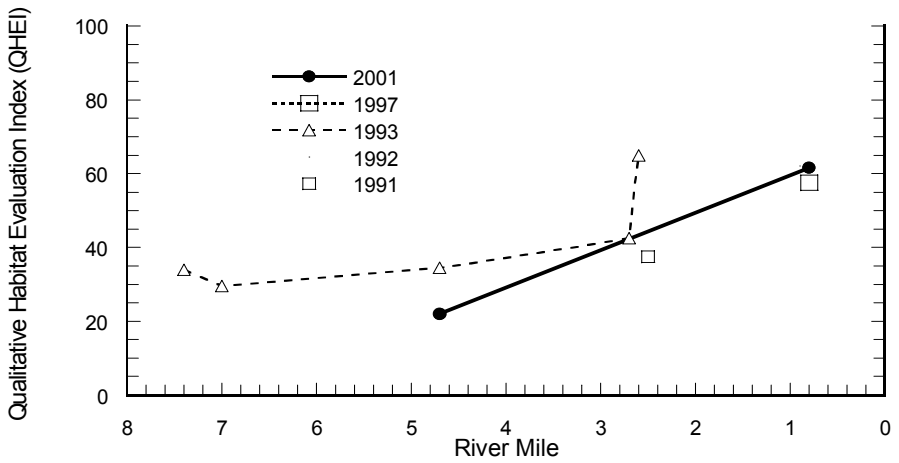
course had been channelized and when coupled with upstream and adjacent land uses yielded a preponderance of high and moderate influence modified habitat attributes at the one site evaluated, RM 1.3 upstream from the Conrail Railroad tracks adjacent to Cole Rd. These negative attributes included channelization with no recovery, low sinuosity, sparse to no cover, heavy to moderate silt cover, fair to poor development, low to no sinuosity, high to moderate stream embeddedness and extensive to moderate riffle embeddedness. Thick and unconsolidated layers of sand in backwater areas revealed a recent and ongoing problem with erosion contributing significant amounts of sediment to the stream. These instream habitat problems yielded a QHEI of 40.0. However, since Hamilton Ditch was an undesignated stream at the time and under pressure from suburban development, the quality of instream and riparian habitat was assessed at four additional locations in 1993 to determine the appropriate aquatic life use designation. Habitat quality was poorer further upstream at RM 3.4, upstream from Walker Rd., scoring only 34.0. This was in direct response to the modified nature of the stream. In contrast, the site upstream from Feder Rd. (RM 2.1) with a significant increase in local gradient yielded a QHEI of 74.5. The local gradient appeared to be capable of flushing contributed fine sediments at rates of delivery at that time. Some sand was noted being deposited in backwaters of pools and silt behind the small dam present in the zone. It was felt that any significant increase over those rates of delivery would result in smothering of habitat features and lessened biological potential. Scores at the mouth of Hamilton Ditch although slightly less than 60 had an equivalent number of WWH and modified habitat attributes. In the aggregate the segment from Feder Rd. downstream had more positive habitat features than modified habitat features largely as a result of the increased gradient. As a result this portion of the stream was recommended to be designated as Warmwater Habitat. Upstream from Feder Rd. due to the pervasive and negative nature of the prevailing instream conditions was recommended to be designated Modified Warmwater Habitat.

Two sites sampled in 2004, RM 3.4, Walker Rd. and RM 0.5, US Rt. 40, replicated sites evaluated during 1993 (Figures B.6.75 and B.6.76). Significant declines were recorded at both sites in 2001 from this previous sampling (Figure B.6.77). The upstream site already judged poor (i.e., QHEI = 34.0) in 1993 declined into the very poor range (i.e., QHEI = 21.0).

Figure B.6.75. Hamilton Ditch at Walker Rd. RM 3.4 upstream view.

Figure B.6.76. Hamilton Ditch upstream from US Rt. 40, 2001.

Figure B.6.77. Longitudinal and temporal trends in the Qualitative Habitat Evaluation Index in Clover Groff Ditch, 1991, 1992, 1993, 1997, and 2001.



Clover Groff Ditch (02-245) (RM 11.19)

Clover Groff Ditch, the other and eastern headwater source tributary for Hellbranch Run was also sampled at one location in 1992, RM 0.9, upstream from Broad St. In contrast to Hamilton Ditch, a preponderance of warmwater habitat attributes at this site yielded a QHEI of 62.5. Additional sampling was conducted in 1993 to assist in assigning an aquatic life use designation and to get a better handle on the effects associated with the residential construction taking place within this small subwatershed. Similar to Hamilton Ditch the upper portion of the watershed has been significantly modified with the three sites upstream from Feder Rd. yielding an average QHEI of only 32.7.

Low gradient coupled with extensive channelization and the recent contribution of agricultural and construction derived sediment have resulted in the poor conditions measured there. The stream is somewhat different in character from Feder Rd. downstream. Gradient increases, especially at the mouth where the stream channel has not been modified, the stream switches from a predominance of high and moderate influence modified habitat attributes to a preponderance of positive WWH attributes. However, observations made during sampling suggest that habitat quality in this tributary is declining. Although the extensiveness of siltation was estimated to be less than in Hamilton Ditch sand entering the stream from upstream and adjacent land uses were starting to cause embeddedness and loss of channel volume. Additionally, in new residential areas of the watershed the riparian buffer is being removed, which is resulting in increased stream bank erosion. Clover Groff Ditch was designated as Modified Warm Water Habitat from its headwaters to upstream from Feder Rd. and Warmwater Habitat from this point downstream to its mouth based on the evaluations conducted in 1992 and 1993.

Sampling in 2001was conducted at RM 4.7 - upstream from Roberts Rd. and upstream from US Rt. 40 - RM 0.5. Habitat quality at RM 4.7, upstream from Roberts Rd. while judged as having poor habitat quality in 1997 had significantly worsened in 2001 yielding very poor quality habitat (i.e., from a QHEI of 34.5 to a QHEI of 22). Differences between the years include the loss of pool depth, the shift in assessment that the channel was recovering from channelization to no recovery, maximum depth less than 40 cm., no fast currents and extensive embeddedness. Inadequate erosion control and storm water BMPs in the upper reaches of Clover Groff Ditch have deposited large amounts of silts in the stream channel filling in the pools and smothering the coarse streambed materials (Figure B.6.78).

Figure B.6.78. Clover Groff Ditch RM 4.7 upstream from Roberts Rd. Large storm sewer from residential subdevelopment.

Lower Big Darby Creek Tributaries

Smith Ditch (02-353) (RM 31.69) (Undesignated/EWH Recommended)

Smith Ditch, originates in Madison County just north of the village of Lily Chapel. It flows in a southeasterly direction to the Madison - Franklin County line near Wrightsville where is takes on a more direct easterly course flowing through the Battelle- Darby Metropark before joining with Big Darby Creek less than 2.5 miles downstream from the confluence with Little Darby Creek.

Figure B.6.79. Smith Ditch RM 0.2 at Biggert Rd. looking downstream.

Gradient in this small direct tributary is very steep ranging between 35-40 ft/mi, in the very high range. Habitat quality was judged to be very good to excellent as a result of its coarse substrates, highly sinuous course, wooded canopy and well developed channel features (Figure B.6.79). Confirmation of its ability to support an EWH aquatic biological community was secured during sampling in 2001. EWH criteria were fully met at the upstream site and partially met at the downstream site where fish did not perform to expectations.

The sampling conducted in 2001 was the first evaluation of instream and riparian habitat on Smith Ditch so an analysis of longterm trends in habitat quality was not possible.

Unnamed tributary to Smith Ditch (02-354) (RM0.06) (Undesignated/WWH Recommended)

This very small tributary enters Smith Ditch almost at its mouth. Gradient is even steeper than found in sites sampled in Smith Ditch (76.92 ft/mi). Gradients this steep are not optimum for supporting normal aquatic life. Other habitat attributes, however, were very good with coarse substrates and a good representation of cover types with deep pools and aquatic macrophytes the only missing elements. The stream channel was moderately to highly sinuous and possessed a wide forested buffer for a good percentage of the sampling zone. In all the stream was judged capable of supporting very good aquatic biological communities.

The sampling conducted in 2001 was the first evaluation of instream and riparian habitat in the Unnamed Tributary to Smith Ditch so an analysis of long term trends in habitat quality was not possible.

Gay Run (02-298) (RM 26.48) (Undesignated/WWH Recommended)
Gay Run enters Big Darby Creek from the west approximately halfway in between Darbydale and Harrisburg. Gay Run at its mouth is a losing stream, losing surface water flow to the thick layer of glacial till found along the lower valley of Big Darby Creek. As a consequence, the lower site was found to be dry when sampling was attempted in 2001. In contrast, the upstream site had perennial flow with springs observed within the sampling zone (Figure B.6.80). It was evaluated and sampled in 1997 and 2001 and yielded QHEIs in the mid sixties on both occasions. Gay Run clearly has habitat adequate to support WWH biological communities. The presence of perennial pools, ground water flow contribution in its upper reaches and the proximity to the high quality repopulation resource of the mainstem of Big Darby Creek are more than adequate to supersede the occasional intermittency found at the mouth and support the assignment of the WWH designation.

Figure B.6.80. Gay Run at Boyd Rd. looking downstream.

Springwater Run (02-203) (RM 24.0) (WWH)
This small tributary happens to drain a very narrow end moraine from the late Wisconsinan glaciation which occurs as hummocky ridges that are higher than the adjacent terrain. Local gradient was 50 ft/mi which exceeds the very high range and although capable of flushing fines downstream would not be optimal for supporting aquatic life. This small tributary flows through the center of Harrisburg and was obviously channelized in the past and was observed to be recovering from that impact. The QHEI for the stream segment downstream from Main St. was 50, in the fair range. Although coarse substrates in the form of boulders, cobble and gravel were present the moderate amount of sand also present contributed to the moderate overall and riffle embeddedness noted for this site. While not possessing optimum habitat for supporting aquatic life this site did possess an adequate number of WWH attributes which when associated with the ameliorative effects of the ground water augmenting the stream base flow permitted the maintenance of a WWH aquatic community in this stream.

The sampling conducted in 2001 was the first evaluation of instream and riparian habitat on Springwater Run so an analysis of longterm trends in habitat quality was not possible.

Unnamed Tributary to Big Darby Creek (02-352) (RM23.57) (Undesignated/WWH Recommended)
This small tributary flows from the west and confluences with Big Darby Creek just south of the SR 762 bridge opposite of the small village of Orient. Stream gradient of this very small stream was the highest in the study area at 111.1 ft/mi. Streams with this high of gradient

characteristically have a flashy hydrograph. Although water fills the stream channel after rainfall or snowmelt in many cases during normal to low flow conditions the channel will dry up to isolated pools or if receiving groundwater to interstitial flow. This was indeed the case during the sampling accomplished in 2001. The stream had interstitial flow. Despite the very low flow there were preponderance of WWH attributes that would have been greater under higher perennial flow. This site received a QHEI of 61.5.

Unnamed tributary to Big Darby Creek (02-270) (RM 20.2) (Undesignated/WWH Recommended)

This small tributary enters Big Darby Creek from the west at RM 20.2 and to a segment that supports some of the rarest species encountered in the Big Darby mainstem. Habitat at RM 0.8 upstream from Harrisburg - Darbyville Rd. has been evaluated in 1994 and during the 2001 survey (Figure B.6.81). Though largely similar between the years and yielding an evaluation of excellent a slight decline was noted in 2001 (i.e., from a QHEI 0f 80.5 to 77.5). This was mainly due to an increase in the amount of embeddedness noted. There has been an increase in large lot residential development in the subwatershed that is probably responsible for this shift. Although this small stream is being recommended to be designated WWH based on the current instream biological performance this stream has the potential to support an EWH community when water quality conditions at the Clark's Lake Subdivision are rectified. The only WWH attribute missing from this stream was silt free substrates, which also contributed to some of the negative attributes noted. Ground water was also a strong influence on the biological composition of this stream. One fish species, the central mottled sculpin, an obligate coolwater species, comprised a large percentage of the resident fauna.

Figure B.6.81. Unnamed tributary to Big Darby Creek at RM 20.2 upstream Harrisburg-Darbyville Rd.

Unnamed tributary to Big Darby Creek (02-366) (RM 18.41) (Undesignated/WWH Recommended)

Unlike many of the streams discussed just upstream, this creek empties into Big Darby Creek from the east, downstream from the Scioto-Darby Creek Rd. bridge. A small reservoir is situated at its headwaters with the balance of the watershed agriculture. Local gradient was greater than 27 ft/mi, which places it in the high range. Positive WWH attributes included normal overall and riffle embeddedness. High influence modified habitat attributes included no sinuosity, sparse cover and shallow maximum depths. The QHEI score for this site was 52.5.

The sampling conducted in 2001 was the first evaluation of instream and riparian habitat on this stream so an analysis of long term trends in habitat quality was not possible.

Greenbrier Creek (02-2020) (RM 16.75) (WWH)

Greenbrier Creek's headwaters originate in the ground moraine of Pickaway County near the small unsewered village of Derby. It flows in a general southeasterly direction towards the Big Darby Creek mainstem. In its lower reaches within the Big Darby Creek beltway it encounters alluvium and alluvium terraces deposited in present and former floodplains and low-level outwash terraces which are composed of sand and gravel. Gradient in the ground moraine area was very high at approximately 35 ft/mi and flattened out to about 18 ft/mi in the alluvium/outwash areas. QHEI scores ranged from 57.0 at Scioto-Darby Rd. to 74.5 at Harrisburg - Darbyville Rd. The segment average QHEI was 65.75 well within the range judged suitable for supporting WWH communities.

The sampling conducted in 2001 was the first evaluation of instream and riparian habitat on Greenbrier Creek so an analysis of longterm trends in habitat quality was not possible.

Georges Creek (02-201) (RM 14.4) (WWH)

Georges Creek enters Big Darby Creek from the west about 1.4 miles upstream from the small village of Darbyville. The stream channel for most of its course flows through a steep valley coming off the edge of Late Wisconsinan ground moraine. Local stream gradient was >58 ft/mi. which is steeper than the very high range. Due to the velocity of flows encountered at this steepness of gradient particularly at flood stage it is felt to be more than is optimal for the support of aquatic life. Other habitat attributes, however, were positive. These included: no channelization, coarse substrates including boulder, cobble and gravel, moderate sinuosity, moderate cover amounts, slightly greater than normal embeddedness, and deep pools. This yielded a QHEI of 61.0 with the stream judged capable of supporting WWH aquatic communities which was verified by the concurrent biological sampling conducted.

The sampling conducted in 2001 was the first evaluation of instream and riparian habitat on Georges Creek so an analysis of longterm trends in habitat quality was not possible.

Lizard Run (02-273) (RM 12.93) (Undesignated/LRW Recommended)

This small tributary which also flows from the west and discharges to Big Darby Creek at the village of Darbyville was found to be dry when attempted to be sampled mid-field season 2001. Subsequent trips to sample or evaluate Lizard Run have yielded similar results Lizard Run is a true ephemeral stream. This is largely a function of the glacial geology that underlies the stream channel and results in Lizard Run becoming a losing stream with little or no flow except after rain events or snow melt periods. As a consequence of the natural ephemeral nature of this stream and the limitations imposed by this stressor this stream is recommended to be designated as a Limited Resource Water.

The sampling conducted in 2001 was the first evaluation of instream and riparian habitat on Lizard Run so an analysis of longterm trends in habitat quality was not possible.