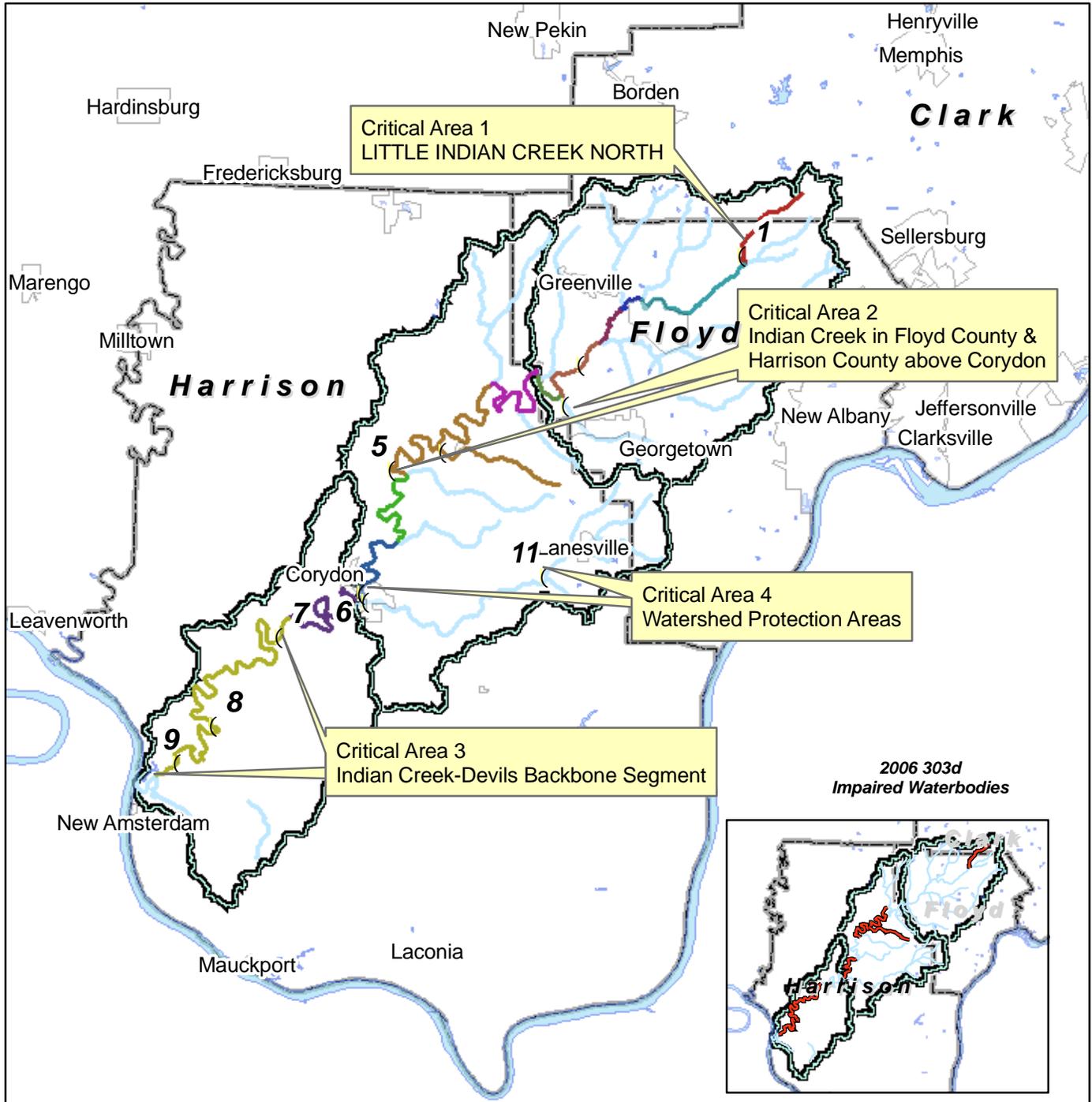


Indian Creek Watershed -- Critical Areas



2008 303d Impaired Stream

- | | |
|---------------------|------------------------|
| Segment: INN0482_00 | Segment: INN0491_01 |
| Segment: INN0483_00 | Segment: INN0494_00 |
| Segment: INN0484_02 | Segment: INN0495_T1050 |
| Segment: INN0485_01 | Segment: INN0496_T1051 |
| Segment: INN0488_00 | Segment: INN04A1_00 |
| Segment: INN048A_01 | Segment: INN04A3_00 |

- Stream
- Indian Creek WS Project Monitoring Site
- City
- Draft 2008 303d Impaired Lakes (none present in WS)
- Waterbody
- HUC11 Watershed Boundary

0 0.5 1 2 3 4 5 Miles

The information on this map has been compiled by Startec staff from a variety of sources and is subject to change without notice. Startec makes no representations or warranties, expressed or implied, as to accuracy, completeness, timeliness, or rights to the use of such information.
 SOURCE: Indiana Department of Environmental Management (IDEM) M:2006UF2006001 HARRISON COGIS_MXD\ICW_critical-area_050408

Indian Creek Watershed Plan
Appendix 3.2. Critical Areas Issues and Strategies

Critical Area 1. Little Indian Creek North

Critical Area 1: Little Indian Creek North

Item	Description
Monitoring Site	001
Location	Indian Creek North at Banet Road, IDEM Site OBS080-0001
Site Selection Rationale	303(d) Segment – Aquatic Life Impairment
Biological Monitoring Result	Not sampled due to severe drought conditions. Habitat assessment result was Fair (score 46) and indicated bank erosion and poor riparian zone.
Interpretation	Data gap
Cause of Impairment	
Load Reduction Required	
Pollution Source(s)	
Strategies - High Priority	
Strategies - Medium Priority	Sample this location during normal flow conditions; both IDEM data were collected during low flow and it was not possible to collect benthic data during this project Use data collected under normal flow conditions to re-assess this stream.
Strategies - Low Priority	Bank stabilization and riparian vegetation would be beneficial.



Monitoring Site 001: These photographs were taken on September 20, 2007 during the biological sampling event. Due to lack of water, this site was not sampled. The very small drainage area may contribute to biological impairment since this site is easily affected by both droughts and floods.

Indian Creek Watershed Plan
Appendix 3.2. Critical Areas Issues and Strategies

Critical Area 2: Indian Creek in Floyd County and Harrison County above Corydon

This critical area includes the Indian Creek mainstem, Georgetown Creek and Crandall Branch. Information to support the critical area assessment was derived from monitoring data collected at Sites 002, 003, 004 and 005.

Critical Area 2: Georgetown Creek

Item	Description
Monitoring Site	002
Location	Georgetown Creek below Georgetown at Malinee Ott Road
Site Selection Rationale	Unassessed reach below Georgetown
Bacteria Result (CFU/100 ml)	Geomean: 194; Maximum: 300 Estimated Existing Load: 6.7 E+12 CFU/year
Interpretation	Recreational Use Impaired
Cause of Impairment	Elevated e. coli
Load Reduction Estimates	Estimated Load Reduction: 2.4 E+12 CFU/year 35.5%
Pollution Source(s)	Cattle in creek (field observation, see photos below). Possible pasture sources and septic systems (BIT result)
Strategies - High Priority	Cattle exclusion/ alternate water supply, stream buffer / streambank stabilization
Strategies - Medium Priority	Evaluate septic systems as a possible pollution source in Georgetown Creek; address through maintenance, repair, and replacement as needed.
Strategies - Low Priority	



Indian Creek Watershed Plan

Appendix 3.2. Critical Areas Issues and Strategies

Monitoring Site 2. Georgetown Creek below Georgetown at Malinee Ott Road. These field photos document cattle access to the creek, which could be addressed by cattle exclusion fencing and alternate water supplies. The photos also show poor riparian buffer. This site was not included in the benthic macroinvertebrate sampling, but clearly riparian buffer and bank stabilization would be beneficial here.

Critical Area 2: Indian Creek above Georgetown Creek

Item	Description
Monitoring Site	003
Location	Indian Creek above Georgetown Creek, IDEM Site OBS080-0005
Site Selection Rationale	Floyd County drainage, near County boundary, developing
Bacteria Result (CFU/100 ml)	Geomean: 147; Maximum: 430 Estimated Existing Load: 3.5 E+13 CFU/year
Interpretation	Recreational Use Impaired
Cause of Impairment	Elevated e. coli
Load Reduction Required	Estimated Load Reduction: 5.4 E+12 CFU/ year 15.1%
Pollution Source(s)	Septic systems (BIT Result for subwatersheds 1-10 indicates that the area draining to Site 3 had the highest potential for septic contribution in Indiana Creek Watershed due to poor soil conditions for septic systems and higher population density. Non-compliance at Woods of Lafayette WWTP– See Table below.
Strategies - High Priority	WWTP Compliance at Woods of Lafayette, historical compliance issues at Jacobi's Car Wash seem to be addressed; maintain compliance at WWTPs above Site 003.
Strategies - Medium Priority	Evaluate septic systems as a potential source of bacterial pollution using methods such as dye and smoke testing, fecal coliform / fecal strep ratios, optical brighteners.
Strategies - Low Priority	

Wastewater Treatment Facilities above Monitoring Site 3

Facility	Map Reference ID Number (1)	NPDES #	Monitoring Location	Total # of Violations (03/2002 - 02/2007)	# of E. coli Violations (03/2002 - 02/2007)	Most Recent E. Coli Violation (03/2002-02/2007)
Galena Elem & Floyd Central HS	2	IN0031178	Effluent Outfall	6	1	5/31/2006
Wymberly Sanitary Works, Inc	5	IN0043923	Effluent Outfall	1	0	N/A
Highlander Point Shopping Cent	7	IN0050032	Effluent Outfall	0	0	N/A
Chimneywood Sewage Works, Inc.	8	IN0050181	Effluent Outfall	16	0	N/A
Galena WWTP	9	IN0052019	Effluent Outfall	22	0	N/A
Country View Subdivision	10	IN0052159	Effluent Outfall	1	0	N/A
Woods Of Lafayette's WWTP	11	IN0054101	Effluent Outfall	46	12	6/30/2006
Huber Family Restaurant	12	IN0055794	Effluent Outfall	37	0	N/A
Floyd Knobs Elementary School	14	IN0058572	Effluent Outfall	15	0	N/A
Jacobi's Car	15	IN0059382	Effluent	32	11	10/31/2002

Indian Creek Watershed Plan
Appendix 3.2. Critical Areas Issues and Strategies

Facility	Map Reference ID Number (1)	NPDES #	Monitoring Location	Total # of Violations (03/2002 - 02/2007)	# of E. coli Violations (03/2002 - 02/2007)	Most Recent E. Coli Violation (03/2002-02/2007)
Wash & Store			Outfall			
Cleancar Auto Wash Corp.	16	IN0059803	Effluent Outfall	42	0	N/A

Note: Map ID # refers to Figure 2.10 Indian Creek NPDES Facility Compliance

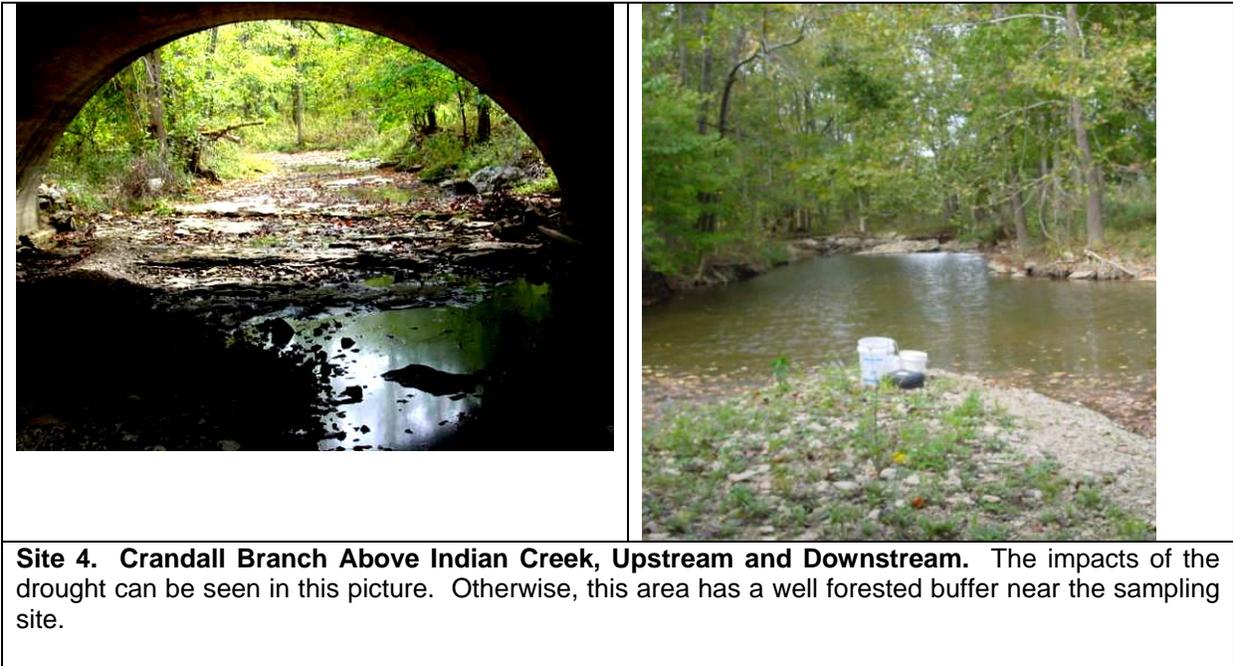


Site 003 Upstream and Downstream. This site has a well-forested buffer and little evidence of disturbance near the sampling site.

Critical Area 2: Crandall Branch above SR335 Bridge

Item	Description
Monitoring Site	004
Location	Crandall Branch above SR335 Bridge
Site Selection Rationale	303(d) Segment – Recreation (may be an artifact of mapping?)
Bacteria Result	Geomean: 779; Maximum: 2,200 Estimated existing load: 3.3 E+13 CFU/year
Interpretation	Recreational Use Impaired
Cause of Impairment	Elevated e. coli
Load Reduction Estimate	Estimated Load Reduction: 2.8 E+13 CFU/year 84.5%
Pollution Source(s)	BIT result for Watershed 13 indicated crop, pasture and cattle as potential sources. BIT result ranked septic systems as relatively low impact in this watershed compared to other Indian Creek subwatersheds, discharges into the well developed karst system from septic systems and/or agricultural sources could contribute to impairments as could bacterial regrowth. Currently, no WWTPs discharge into Crandall Branch.
Strategies - High Priority	
Strategies - Medium Priority	Perform visual and habitat assessments to evaluate agricultural sources of bacteria in this subwatershed.
Strategies - Low Priority	Evaluate septic systems as a potential source of bacterial pollution using methods such as dye and smoke testing, fecal coliform / fecal strep ratios, optical brighteners.

Indian Creek Watershed Plan
Appendix 3.2. Critical Areas Issues and Strategies



Site 4. Crandall Branch Above Indian Creek, Upstream and Downstream. The impacts of the drought can be seen in this picture. Otherwise, this area has a well forested buffer near the sampling site.

Critical Area 2: Indian Creek above SR355 Bridge

Item	Description
Monitoring Site	005
Location	Indian Creek above SR355 Bridge, IDEM Site OBS090-0004
Site Selection Rationale	303(d) Segment – Recreation
Bacteria Result	GeoMean: 268.8; Maximum: 410 Estimated Existing Load: 1.1 E+14 CFU/year
Interpretation	Recreational Use Impaired
Cause of Impairment	Elevated e. coli
Load Reduction Estimate	Load Reduction Estimate: 5.7 E+13 CFU/year 53.4%
Pollution Source(s)	BIT results indicate crop, pasture and cattle as potential sources of bacteria in Watershed 15; Septic systems were ranked lower than other Indian Creek subwatersheds in the BIT analysis; WWTP Compliance, discharges into the well developed karst system from septic systems and/or agricultural sources could contribute to impairments; bacterial regrowth?
Strategies - High Priority	Improve WWTP Compliance at Lanesville Welcome Center
Strategies - Medium Priority	Encourage agricultural BMPs such as cattle exclusion/ alternative water supplies, manure management plans
Strategies - Low Priority	If septic system failures are reported, investigate with dye and smoke testing and repair or replace as needed

**Indian Creek Watershed Plan
Appendix 3.2. Critical Areas Issues and Strategies**

Wastewater Treatment Facilities above Monitoring Site 5

Facility	Map Reference ID Number (1)	NPDES #	Monitoring Location	Total # of Violations (03/2002 - 02/2007)	# of E. coli Violations (03/2002 - 02/2007)	Most Recent E. Coli Violation (03/2002-02/2007)
Dairy Dip Car Wash	3	IN0038385	Effluent Outfall	1	0	N/A
Lanesville Welcome Center I-64	6	IN0045942	Effluent Outfall	81	8	5/31/2006

Note: Map ID # refers to Figure 2.10 Indian Creek NPDES Facility Compliance



Site 5 Indian Creek above SR355 Bridge Looking Upstream and Downstream. This site has a relatively well vegetated riparian area, but there is evidence of some areas needing tree plantings. This area is highly influenced by karst and water was very still during the drought. This hot, dry condition promotes regrowth of bacteria.

Indian Creek Watershed Plan
Appendix 3.2. Critical Areas Issues and Strategies

Critical Area 3: Indian Creek Devils Backbone Segment

This critical area includes the Indian Creek mainstem from the Mathis Road Bridge to the Ohio River Confluence. Information to support the critical area assessment was derived from monitoring data collected at Sites 007, 008 and 009.

Critical Area 3: Indian Creek Devils Backbone Segment

Item	Description
Monitoring Site	007, 008
Location	Indian Creek at Mathis Road Bridge and Indian Creek above Rocky Hollow Road Bridge (IDEM Site OBS100-0001)
Site Selection Rationale	303(d) Segment – Aquatic Life impairment due to low dissolved oxygen
Dissolved Oxygen Result (mg/l)	Minimum: 5.6 mg/l Average: 7.3 mg/l
Interpretation	Aquatic Life Use Met
Cause of Impairment	NA
Load Reduction Required	NA
Pollution Source(s)	NA
Strategies - High Priority	
Strategies - Medium Priority	Our data showed DO criteria were met. Encourage IDEM to resample this location and delist as appropriate.
Strategies - Low Priority	



Site 007: Indian Creek at Mathis Road Bridge



Site 008: Indian Creek above Rocky Hollow Road Bridge (IDEM Site OBS100-0001)

These monitoring sites are located in an agricultural / undeveloped part of the watershed. This area is heavily influenced by karst and other than the mainstem Indian Creek, there is relatively little surface water in this area. The photographs show a well developed and stable riparian buffer in this area. The sediment load from upstream sources in these high flow photographs is clearly visible.

Indian Creek Watershed Plan
Appendix 3.2. Critical Areas Issues and Strategies

Critical Area 3: Indian Creek Devils Backbone Segment

Item	Description
Monitoring Site	009
Location	Indian Creek above Lickford Road Bridge, IDEM Site OBS100-0006
Site Selection Rationale	303(d) Segment – Aquatic Life impairment due to low dissolved oxygen
Dissolved Oxygen Result (mg/l)	Minimum: 3.1 mg/l Average: 4.9mg/l
Interpretation	Aquatic Life Use Not Met
Cause of Impairment	Our data indicate that this area may be affected by Ohio River backwater and very reduced flows due to karst. If the DO violation is confirmed as being caused by natural conditions, pursue delisting and avoid TMDL development
Load Reduction Required	NA
Pollution Source(s)	NA
Strategies - High Priority	
Strategies - Medium Priority	Encourage IDEM to resample this location and delist as appropriate.
Strategies - Low Priority	



Site 009 under base flow conditions.



Site 009 under elevated flow conditions.

During four (4) sample events, flows were 0 feet/ second and during three (3) sample events, flows were reversed and ranged from -0.5 ft/s to -0.72 ft/s. These very low and reverse flows indicate the important influence of the Ohio River and it's backwater in this area.

This monitoring site is located in an agricultural / undeveloped part of the watershed. This area is heavily influenced by karst and other than the mainstem Indian Creek, there is relatively little surface water in this area. The photographs show a well developed and stable riparian buffer in this area. The sediment load from upstream sources in the elevated flow condition photograph is clearly visible.

Critical Area 4: Watershed Protection Areas

This critical area includes the Indian Creek mainstem near Corydon and Little Indian Creek. The watershed in this area has relatively good water quality, thus watershed protection was identified as an important strategy here. Information to support the critical area assessment was derived from monitoring data collected at Sites 006, 010 and 011.

Indian Creek Watershed Plan
Appendix 3.2. Critical Areas Issues and Strategies

Critical Area 4: Watershed Protection Areas

Item	Description
Monitoring Site	006
Location	Indian Creek above Little Indian Creek at Water Street
Site Selection Rationale	Downstream end of HUC, 303(d) Segment – Recreation, above WWTP, receives Corydon runoff
Bacteria Result (CFU/100ml)	Geomean: 93.3; Maximum: 180
Interpretation	Recreational use met
Cause of Impairment	NA
Load Reduction Required	NA
Pollution Source(s)	NA
Strategies - High Priority	
Strategies - Medium Priority	Maintain compliance at Corydon WWTP.
Strategies - Low Priority	Consider riparian habitat improvements.



Site 006 – Looking upstream

Site 006- Looking downstream

While recreational criteria for bacteria were met, this location has poor habitat. Sedimentation is occurring and elevated nutrients may be contributing to algal proliferation seen in the downstream photograph.

**Indian Creek Watershed Plan
Appendix 3.2. Critical Areas Issues and Strategies**

Critical Area 4: Watershed Protection Areas

Item	Description
Monitoring Site	010 and 011
Location	Little Indian Creek
Site Selection Rationale	Major tributary, classified as “unassessed” by IDEM
Bacteria Result (CFU/100 ml)	Site 010: Geomean: 119.2; Maximum: 140 Site 011: Geomean: 118; Maximum: 226
Interpretation	Recreational use met
Cause of Impairment	NA
Load Reduction Required	NA
Pollution Source(s)	NA
Strategies - High Priority	
Strategies - Medium Priority	Maintain compliance at Corydon WWTPs (Corydon, Tyson).
Strategies - Low Priority	Continue to monitor and assess nutrients below Lanesville. Consider flood protection and riparian habitat improvements near the confluence with Indian Creek (Site 010).



Site 010 – Low flow condition



Site 010- Elevated flow condition

The poor quality habitat is documented in the low flow condition photograph and potential for flooding is seen in the elevated flow photograph.



Site 11 – Biological sampling under low flow conditions



Site 11 – nearby sinkhole

Indian Creek Watershed Plan
Appendix 3.2. Critical Areas Issues and Strategies

Site 11 on Little Indian Creek near Lanesville had good quality habitat that should be maintained. The influence of karst and its ability to transport water through underground channels is depicted in the sinkhole photograph.