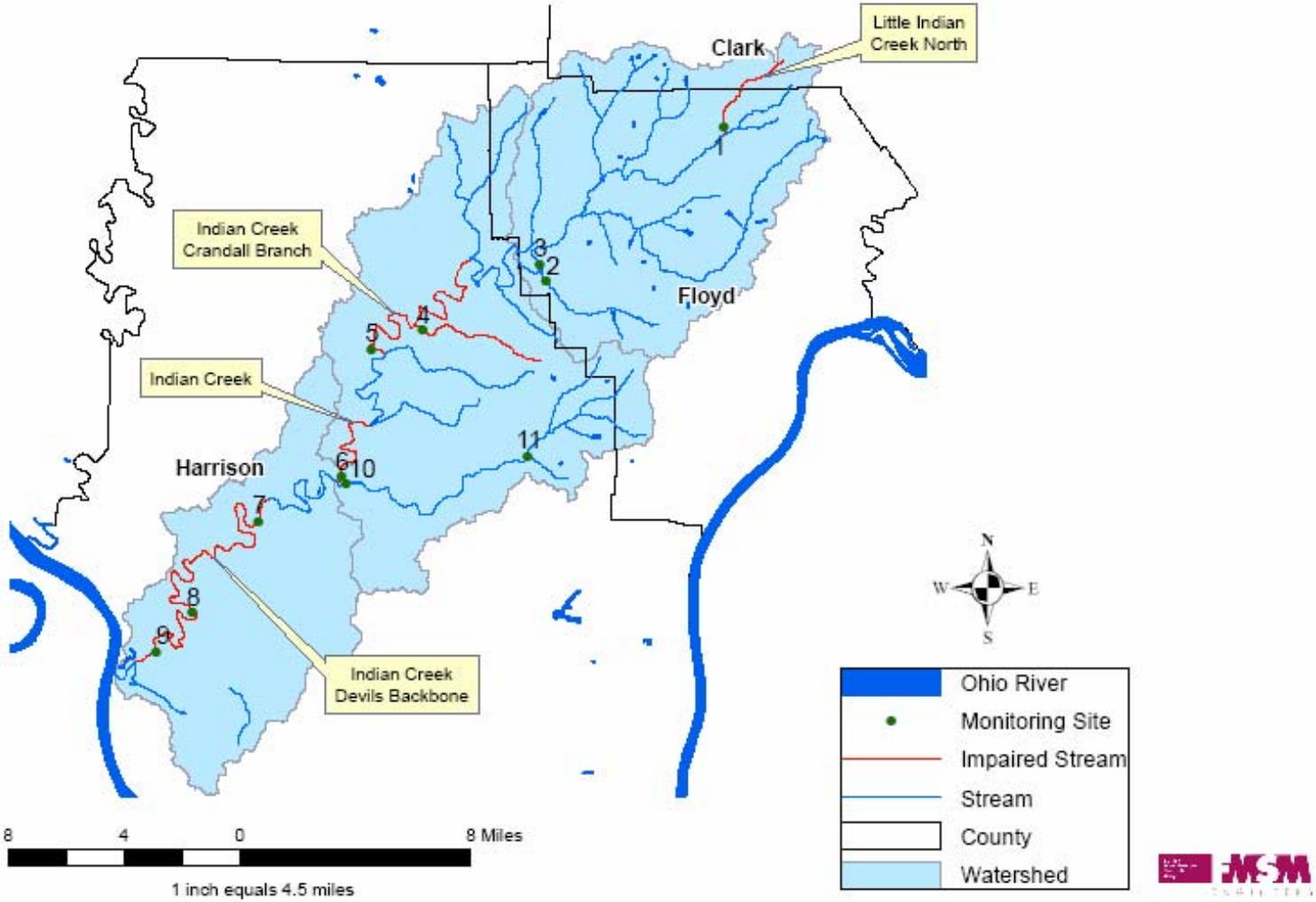
Appendix A

Indian Creek Sampling Sites

Indian Creek Watershed Monitoring Sites



Appendix B

Water Quality Criteria and Other Comparison Values

Parameter (Units)	Warm Water Aquatic Habitat Acute Criterion	Warm Water Aquatic Habitat Chronic Criterion	Domestic Water Supply Source	Other Comparison Value	Notes
Dissolved Oxygen (DO) (mg/L)	≥ 4.0 instantaneous	≥5.0 daily avg.	NA	>12 mg	**Comparison Value:** From IDEM, 2006 Integrated Report, Appendix C.
% DO Saturation	NA	NA	NA	<60% or >120%	% DO Saturation less than 60% or greater than 120% generally indicates eutrophication
pH (pH units)	≥ 6.0 and ≤ 9.0	NA	NA		
Temperature (°C)	See Table Below				
Specific Conductance (µS/cm @ 25 °C)	1,200	NA	NA		
Turbidity (NTU)	NA	NA	NA	5 – 25 NTU	**Comparison Value:** 5 NTU was recommended by AWWA, 1990 for recreation and 25 NTU was recommended by Harvey, 1989 for aquatic life
Total Solids (TS) (mg/L)	NA	NA	NA	261 mg/L	**Comparison Value:** Median of 99 results from the Indian Creek Watershed (4/7/99 to 2/8/06). Data collected by IDEM.
E. coli (CFU/100 ml)	**April 1 – Oct 31:** Geomean ≤ 125 / 100 ml and no single sample can exceed 576 / 100 ml		NA	NA	Geometric mean (geomean) based on a minimum of 5 samples in 30 days.
Total Kjeldahl Nitrogen (TKN) (mg/L)				0.26 – 0.50 mg/L	**Comparison Value:** < 0.25 mg/L was recommended by NHDES as ideal, with 0.26 – 0.50 mg/L recognized as an average value.
Nitrate-Nitrogen (NO3-N) (mg/L)	10	NA	NA	5 mg/L	**Comparison Value:** Concentrations greater than 5 mg/L trigger additional monitoring in finished drinking water.

Parameter (Units)	Warm Water Aquatic Habitat Acute Criterion	Warm Water Aquatic Habitat Chronic Criterion	Domestic Water Supply Source	Other Comparison Value	Notes
Ammonia-Nitrogen (NH4-N)					Un-ionized ammonia concentration is calculated using the equation below and compared to criteria tables in 327 IAC 2-1-6
Total Phosphorus (TP) (mg/L)	NA	NA	NA	0.3 mg/L	**Comparison Value:** From IDEM, 2006 Integrated Report, Appendix C.

Table 6-4

	Ohio River Main Stem °F(°C)	Other Indiana Streams °F(°C)
January	50 (10.0)	50 (10.0)
February	50 (10.0)	50 (10.0)
March	60 (15.6)	60 (15.6)
April	70 (21.1)	70 (21.1)
May	80 (26.7)	80 (26.7)
June	87 (30.6)	90 (32.2)
July	89 (31.7)	90 (32.2)
August	89 (31.7)	90 (32.2)
September	87 (30.7)	90 (32.2)
October	78 (25.6)	78 (25.5)
November	70 (21.1)	70 (21.1)
December	57 (14.0)	57 (14.0)

***To calculate total ammonia, divide the number in the table by the value determined by: $1/(10^{pK_a-pH}+1)$.

Where: pK_a = $0.09018 + (2729.92/(T + 273.2))$

pH = pH of water

T = °C

DO at 100% saturation based on temperature is shown on the table below. % DO saturation is also affected by barometric pressure. More detailed tables that include this effect have been published by USGS, 1998.

DO (mg/L) at 100% Saturation

$$DO\ (percent\ saturation) = \frac{measured\ DO\ (mg/L)}{DO\ (mg/L\ at\ 100\ percent\ saturation)} \times 100$$

Temperature (°C)	DO (mg/l)	Temperature (°C)	DO (mg/l)
0	14.60	23	8.56
1	14.19	24	8.40
2	13.81	25	8.24
3	13.44	26	8.09
4	13.09	27	7.95
5	12.75	28	7.81
6	12.43	29	7.67
7	12.12	30	7.54
8	11.83	31	7.41
9	11.55	32	7.28
10	11.27	33	7.16
11	11.01	34	7.16
12	10.76	35	6.93
13	10.52	36	6.82
14	10.29	37	6.71
15	10.07	38	6.61
16	9.85	39	6.51
17	9.65	40	6.41
18	9.45	41	6.41
19	9.26	42	6.22
20	9.07	43	6.13
21	8.90	44	6.04
22	8.72	45	5.95

Appendix C

Microbac Laboratories, Inc., KTL Division, Standard Operating Procedures and Registration

E. coli MF (using modified mTEC agar)

PREPARED BY: Alison Schleck
APPROVED BY: Dee Cutrera
SUPERCEDES:
REFERENCES: EPA 1603
APPLICATION: Ambient Water and Wastewater
CONC. RANGE: N/A

1. PRELIMINARY COMMENTS

This method is approved for LT2 testing. Method 1603 describes a membrane filter (MF) procedure for the detection and enumeration of Escherichia coli in ambient waters and disinfected wastewater. This method is a single-step modification of EPA method 1103.1.

2. PRESERVATION & HOLDING TIMES

Samples should be held at <10°C. Sample analysis is preferably begun within 2 hours of collection. The maximum transport time to the laboratory is 6 hours, and samples should be processed within 2 hours of receipt at the lab.

3. INTERFERENCES

4. SAFETY CONSIDERATIONS

All samples should be handled as if they contain pathogens.

5. CLEANING CONSIDERATIONS

Disinfect work area before and after handling each sample.

6. APPARATUS AND EQUIPMENT

6.1 Autoclave
6.2 Water bath capable of maintaining 44.5 ± 0.2°C
6.3 Water bath for tempering agar
6.4 Vacuum source
6.5 Filter flask
6.6 Forceps
6.7 Sterile filtration apparatus
6.8 Magnifying lens or stereoscope
6.9 Thermometer, checked against a NIST certified thermometer, graduated to 0.1 °C.

7. REAGENTS AND SUPPLIES

7.1 Sterile phosphate buffered rinse water with MgCl
7.2 mTEC agar, modified (laboratory or commercially prepared)
  7.2.1 Prepare according to directions on container. Adjust volumes to amount of media needed
  7.2.2 Sterilize by autoclaving
  7.2.3 pH should be 7.3 ± 0.2
  7.2.4 Pour 4-6ml of tempered agar into petri dishes
  7.2.5 Allow to solidify and dry completely. Refrigerate for up to two weeks.
7.3 Sterile disposable plastic petri dishes (50x11mm)
7.4 Sterile borosilicate pipettes (1.00 & 10.0ml)
7.5 Membrane filters, sterile, gridded, 47mm, with 0.45 micron pore size
7.6 Ethanol for flame-sterilizing equipment

8. STANDARDS

8.1 Positive control culture: *Escherichia coli*, ATCC traceable
8.2 Negative control culture: *Enterobacter aerogenes*, ATCC traceable

9. SAMPLE PREPARATION

10. INSTRUMENT CALIBRATION

Refer to SOP Balances Operation and Calibration Program, SOP Thermometers Operation and Calibration Program, SOP Autoclave Market Forge Operation and SOP Thermo pH Meter Operation for specific instrument calibration indications.

11. PROCEDURE

11.1 Place bottom portion of filtration unit on vacuum flask.
11.2 Using sterile forceps, place membrane filter on bottom portion of filtration unit.
11.3 Carefully place top portion of filtration unit on top of filter (do not wrinkle filter) and attach clamp.
11.4 Shake the sample at least 25 times to distribute the bacteria uniformly.
11.5 Measure the desired volume into the funnel and filter under low vacuum. Select sample volumes that will yield counts between 20 and 80 *E.coli* per membrane. A minimum of three dilutions is recommended to ensure that a countable plate is obtained. For volumes of 20ml or less, add 20-30ml sterile buffered rinse water to the filter prior to adding sample aliquot. When sample is completely filtered rinse filter with (2) 20-30ml aliquots of sterile phosphate buffered rinse water with MgCl.
11.6 Turn off the vacuum and remove the top portion of the filtration apparatus.
11.7 Using sterile forceps, transfer filter to petri dish with modified mTEC agar, ensuring that no bubbles are trapped.
11.8 To rejuvenate stressed or injured cells, invert, and incubate for 2 ± 0.5 hours @ 35 ± 0.5°C.
11.9 After a 2 ± 0.5 hour incubation at 35 ± 0.5°C, transfer the plates to a Whirl-Pak® bag, seal and submerge in a 44.5 ± 0.2°C water bath for 22 ± 2 hours.
11.10 Remove plates from the water bath, and count and record the number of red or magenta colonies with the aid of a magnifying lens or stereoscope.
11.11 If required, verify a portion of typical and atypical colonies using Enterotube II, a commercially available multi-test identification system.

12. CALCULATIONS

Colonies per 100ml = C*100/S

Where: C = Colonies Counted
S = Sample Volume (ml)

13. QUALITY ASSURANCE

13.1 Analyst must be trained per DW and LT2 requirements and SOP Training
13.2 Check each batch of media for performance with positive and negative control organisms.
13.3 Each lot of membrane filters is checked for sterility by placing one filter in a non-selective broth and checking for growth (turbidity) after 24 hours incubation at 35±0.5°C.
13.4 Once per month repeat counts will be performed on at least one positive sample and compared with the counts of other analysts. Replicate counts for the same analyst should agree within 5% and those between analysts agree within 10%.
13.5 Each batch of Buffered Rinse water is checked for sterility by adding 50 ml of buffer water to 50 ml TSB 2X and checking for growth (turbidity) after 48 hours incubation at 35 ± 0.5°C.
13.6 All media and supplies shall be checked for sterility and documented in the Sterility Log and/or the Micro Working Reagents Log. Results and date read must be included with the data.
13.7 Each lot of pipets or autoclave batch of pipet tips is checked for sterility by placing one tip in TSB 1X or by repeatedly pipetting TSB through the pipet and checking for growth (turbidity) after 48 hours incubation at 35 ± 0.5°C.
13.8 The filter apparatus is checked for sterility for each filtration series by an initial blank, performing a blank after every 10 samples, and performing a final blank. If a control indicates contamination, the data shall be rejected and a new sample requested.
13.9 Each analyst on record will perform a set of PE or Blind studies every six months.

13.10 An IPR (Initial precision and recovery) study should be conducted by the laboratory prior to running client samples.

14. MAJOR SOURCES OF UNCERTAINTY

14.1. Holding temperature and time
14.2. Interference from other species
14.3. Interference from colloidal or suspended particulate material
14.4. Homogeneity of sample

Help

Logout

LT2 *E. coli* Lab Registration

Thank you for registering your organization as a participating *E. coli* lab for the LT2 Data Collection System. Below is a summary of the information you submitted to the system. Please click the edit link at the bottom of the screen to edit the information, or click the continue link to complete the registration process.

The LT2 Data Collection System has record of the following information for your *E. coli* lab:

Lab ID	KY00074
Lab Name	Microbac Laboratories, Inc. Kentucky Testing Division
Lab Type	*E. coli*, Membrane Filtration
Primary User Name	Delores Cutrera
Mailing Address	3323 Gilmore Industrial Blvd.
City	Louisville
State	KY
Zip Code	40213
Phone Number	5029626400
Fax Number	(502) 962-6411
E-mail	dcutrera@microbac.com

Please send the certification information to LT2ESWTR and Stage 2 DBPR by fax: (937) 586-6557, or by mail: to LT2ESWTR and Stage 2 DBPR ATTN: E. coli LT2 Data Collection and Tracking System Laboratory Registration, P.O. Box 98, Dayton, OH 45401. After certification is verified, the system administrator is notified to activate your laboratory in the system.

Edit Information Continue with Registration

Revised: June 2006
LT2 Technical Support: stage2mdbp@epa.gov

Indian Creek Watershed Plan
Water Quality Monitoring Data Summary

Station ID	Location	Characteristic Name	Units	Number of Samples	Minimum	Average	Maximum
002	**Indian Creek above Georgetown Creek @ Hamby Rd**						
		Dissolved oxygen (DO)	mg/L	6	4.6	7.42	15
		E. Coli	CFU / 100 ml	5	110	194.00	300
		Nitrogen - nitrate+nitrite	mg/L	5	0.1	0.80	3.2
		Orthophosphate	mg/L	6	0.03	0.04	0.1
		pH	su	6	7.32	7.70	8.57
		Phosphorus, total	mg/L	6	0.03	0.04	0.05
		Solids, total	mg/L	6	281	379.33	475
		Specific conductance	us/cm	6	367	563.67	666
		Stream Flow	ft/sec	9	0	0.37	0.99
		Temperature, water	C	6	14.1	20.82	26
		Total Ammonia	mg/L	6	0.1	0.10	0.1
		Total Dissolved Solids	mg/L	4	263	297.50	338
		Total Kjeldahl Nitrogen	mg/L	6	0.3	0.63	1.5
		Turbidity	NTU	6	4.2	10.33	22.9
003	**Indian Creek above Georgetown Creek, IDEM Site OBS080-0005**						
		Dissolved oxygen (DO)	mg/L	7	5.74	6.98	8.78
		E. Coli	CFU / 100 ml	5	12	147.20	430
		Nitrogen - nitrate+nitrite	mg/L	6	0.1	0.37	1.7
		Orthophosphate	mg/L	7	0.03	0.03	0.06
		pH	su	7	7.19	7.41	7.69
		Phosphorus, total	mg/L	7	0.03	0.04	0.08
		Solids, total	mg/L	7	217	235.86	264
		Specific conductance	us/cm	7	304	347.61	400
		Stream Flow	ft/sec	11	0	0.21	1.99
		Temperature, water	C	7	13.5	20.33	27.24
		Total Ammonia	mg/L	7	0.1	0.10	0.1
		Total Dissolved Solids	mg/L	5	147	182.00	201
		Total Kjeldahl Nitrogen	mg/L	7	0.2	0.47	1
		Turbidity	NTU	7	6.14	10.58	14.3

Indian Creek Watershed Plan
Water Quality Monitoring Data Summary

Station ID	Location	Characteristic Name	Units	Number of Samples	Minimum	Average	Maximum
004	**Crandall Branch above SR335 Bridge**						
		Dissolved oxygen (DO)	mg/L	7	6.41	8.14	10.4
		E. Coli	CFU / 100 ml	5	196	779.20	2200
		Nitrogen - nitrate+nitrite	mg/L	6	0.2	0.93	3.6
		Orthophosphate	mg/L	7	0.03	0.03	0.04
		pH	su	7	7.26	7.56	7.97
		Phosphorus, total	mg/L	7	0.03	0.04	0.05
		Solids, total	mg/L	7	265	331.86	376
		Specific conductance	us/cm	7	426	515.27	673.9
		Stream Flow	ft/sec	11	0	0.12	1.06
		Temperature, water	C	7	13.9	20.09	25
		Total Ammonia	mg/L	7	0.1	0.10	0.1
		Total Dissolved Solids	mg/L	5	207	245.40	260
		Total Kjeldahl Nitrogen	mg/L	7	0.3	0.46	0.6
		Turbidity	NTU	7	2.16	4.54	7.11
005	**Indian Creek above SR355 Bridge, IDEM Site OBS090-0004**						
		Dissolved oxygen (DO)	mg/L	6	4.5	6.30	8.66
		E. Coli	CFU / 100 ml	5	84	268.80	410
		Nitrogen - nitrate+nitrite	mg/L	5	0.1	0.48	1.9
		Orthophosphate	mg/L	6	0.03	0.04	0.09
		pH	su	6	7.3	7.48	7.66
		Phosphorus, total	mg/L	6	0.03	0.05	0.13
		Solids, total	mg/L	6	225	255.00	274
		Specific conductance	us/cm	6	310	375.43	448
		Stream Flow	ft/sec	10	0	0.59	4.85
		Temperature, water	C	6	13.9	20.37	25.2
		Total Ammonia	mg/L	6	0.1	0.10	0.1
		Total Dissolved Solids	mg/L	4	171	200.00	215
		Total Kjeldahl Nitrogen	mg/L	6	0.3	0.63	1.3
		Turbidity	NTU	6	3.79	11.18	29

Indian Creek Watershed Plan
Water Quality Monitoring Data Summary

Station ID	Location	Characteristic Name	Units	Number of Samples	Minimum	Average	Maximum
006	**Indian Creek above Little Indian Creek at Water Street**						
		Dissolved oxygen (DO)	mg/L	7	7.58	10.17	14.2
		E. Coli	CFU / 100 ml	8	19	94.63	200
		Nitrogen - nitrate+nitrite	mg/L	7	0.1	0.64	1.9
		Orthophosphate	mg/L	8	0.03	0.05	0.1
		pH	su	7	7.62	8.01	8.53
		Phosphorus, total	mg/L	8	0.03	0.06	0.16
		Solids, total	mg/L	8	244	264.13	288
		Specific conductance	us/cm	6	305	362.43	444
		Stream Flow	ft/sec	10	0.12	2.41	18.78
		Temperature, water	C	7	14.2	21.24	29.8
		Total Ammonia	mg/L	8	0.1	0.10	0.1
		Total Dissolved Solids	mg/L	5	152	182.00	223
		Total Kjeldahl Nitrogen	mg/L	8	0.2	0.68	1.2
		Turbidity	NTU	7	1.13	15.58	46.6
007	**Indian Creek at Mathis Road bridge**						
		Dissolved oxygen (DO)	mg/L	6	5.6	7.27	9.04
		E. Coli	CFU / 100 ml	5	10	19.40	32
		Nitrogen - nitrate+nitrite	mg/L	6	0.1	0.55	2.6
		Orthophosphate	mg/L	7	0.03	0.04	0.1
		pH	su	6	7.43	7.82	8.39
		Phosphorus, total	mg/L	7	0.03	0.05	0.18
		Solids, total	mg/L	7	162	200.43	287
		Specific conductance	us/cm	6	222.8	293.97	340
		Stream Flow	ft/sec	10	0	1.10	6.6
		Temperature, water	C	6	14.4	20.07	28.2
		Total Ammonia	mg/L	7	0.1	0.10	0.1
		Total Dissolved Solids	mg/L	4	156	160.75	168
		Total Kjeldahl Nitrogen	mg/L	7	0.3	0.57	1.1
		Turbidity	NTU	6	2.01	10.69	45

Indian Creek Watershed Plan
Water Quality Monitoring Data Summary

Station ID	Location	Characteristic Name	Units	Number of Samples	Minimum	Average	Maximum
008	**Indian Creek above Rocky Hollow Road Bridge, IDEM Site OBS100-0001**						
		Dissolved oxygen (DO)	mg/L	6	0.08	5.73	7.73
		E. Coli	CFU / 100 ml	6	4	40.17	177
		Nitrogen - nitrate+nitrite	mg/L	5	0.1	0.62	2.5
		Orthophosphate	mg/L	6	0.03	0.06	0.14
		pH	su	6	7.27	7.88	8.24
		Phosphorus, total	mg/L	6	0.06	0.11	0.22
		Solids, total	mg/L	6	199	226.67	299
		Specific conductance	us/cm	6	190	288.32	330
		Stream Flow	ft/sec	10	0	0.21	2.01
		Temperature, water	C	6	13	19.82	27
		Total Ammonia	mg/L	6	0.1	0.10	0.1
		Total Dissolved Solids	mg/L	4	145	151.50	156
		Total Kjeldahl Nitrogen	mg/L	6	0.4	0.90	1.2
		Turbidity	NTU	6	10.1	23.52	63.1
009	**Indian Creek above Lickford Road Bridge, IDEM Site OBS100-0006**	Dissolved oxygen (DO)	mg/L	6	3.09	4.91	8.9
		E. Coli	CFU / 100 ml	5	4	44.20	132
		Nitrogen - nitrate+nitrite	mg/L	5	0.1	0.60	2.5
		Orthophosphate	mg/L	6	0.03	0.05	0.15
		pH	su	6	6.91	7.40	7.58
		Phosphorus, total	mg/L	6	0.03	0.08	0.24
		Solids, total	mg/L	6	279	310.17	341
		Specific conductance	us/cm	5	331	452.36	520
		Stream Flow	ft/sec	10	-0.72	0.15	1.91
		Temperature, water	C	6	14.9	21.01	26.98
		Total Ammonia	mg/L	6	0.1	0.10	0.1
		Total Dissolved Solids	mg/L	4	166	230.50	260
		Total Kjeldahl Nitrogen	mg/L	6	0.2	0.57	1.2
		Turbidity	NTU	6	5.62	17.51	68.9

Indian Creek Watershed Plan
Water Quality Monitoring Data Summary

Station ID	Location	Characteristic Name	Units	Number of Samples	Minimum	Average	Maximum
010	**Little Indian Creek above Water Street Bridge**						
		Dissolved oxygen (DO)	mg/L	6	7.74	9.87	11.1
		E. Coli	CFU / 100 ml	5	100	119.20	140
		Nitrogen - nitrate+nitrite	mg/L	5	0.1	1.22	5.1
		Orthophosphate	mg/L	6	0.03	0.06	0.16
		pH	su	6	7.61	7.89	8.08
		Phosphorus, total	mg/L	6	0.03	0.07	0.21
		Solids, total	mg/L	6	201	267.67	319
		Specific conductance	us/cm	6	267	397.17	510
		Stream Flow	ft/sec	10	0.1	3.37	28.3
		Temperature, water	C	6	13.8	22.47	29.3
		Total Ammonia	mg/L	6	0.1	0.10	0.1
		Total Dissolved Solids	mg/L	4	176	233.00	268
		Total Kjeldahl Nitrogen	mg/L	6	0.5	0.70	1.1
		Turbidity	NTU	5	1.3	6.04	20.9
011	**Little Indian Creek below Lanesville at State Road 62**						
		Dissolved oxygen (DO)	mg/L	6	4.9	10.63	16.2
		E. Coli	CFU / 100 ml	6	20	136.67	420
		Nitrogen - nitrate+nitrite	mg/L	5	0.1	1.60	5.9
		Orthophosphate	mg/L	6	0.1	0.66	2.15
		pH	su	6	7.52	8.24	8.88
		Phosphorus, total	mg/L	6	0.12	0.74	2.88
		Solids, total	mg/L	6	285	391.00	453
		Specific conductance	us/cm	6	406	572.83	720
		Stream Flow	ft/sec	10	0.02	2.23	18.4
		Temperature, water	C	6	14.2	21.80	26.2
		Total Ammonia	mg/L	6	0.1	0.22	0.8
		Total Dissolved Solids	mg/L	4	230	322.25	362
		Total Kjeldahl Nitrogen	mg/L	6	0.6	0.92	1.4
		Turbidity	NTU	6	1.9	17.17	80.2

Indian Creek Watershed Plan
Water Quality Monitoring Data Summary

Station ID	Location	Characteristic Name	Units	Number of Samples	Minimum	Average	Maximum
Blank							
		E. Coli	CFU / 100 ml	1	1	1.00	1
		Nitrogen - nitrate+nitrite	mg/L	1	0.1	0.10	0.1
		Phosphorus, total	mg/L	1	0.03	0.03	0.03
		Total Ammonia	mg/L	1	0.1	0.10	0.1
		Total Kjeldahl Nitrogen	mg/L	1	0.1	0.10	0.1

Indian Creek Watershed
Benthic Macroinvertebrate Data
Station List

Station ID	Station Name	Sample Date	Parameters	Notes
001	Indian Creek North at Banet Road, IDEM Site OBS080-0001	09/20/07	QHEI	Drought, insufficient water to sample benthic
002	Georgetown Creek below Georgetown at Malinee Ott Road	09/20/07	QHEI	
003	Indian Creek above Georgetown Creek, IDEM Site OBS080-0005	09/20/07	QHEI	
004	Crandall Branch above SR335 Bridge	09/20/07	QHEI	
005	Indian Creek above SR355 Bridge, IDEM Site OBS090-0004	09/20/07	QHEI	
006	Indian Creek above Little Indian Creek at Water Street, Corydon	09/20/07	Benthic, QHEI	Duplicate Sample
007	Indian Creek at Mathis Road Bridge	09/20/07	Benthic, QHEI	
008	Indian Creek above Rocky Hollow Road Bridge, IDEM Site OBS100-0001	09/20/07	Benthic, QHEI	
009	Indian Creek above Lickford Road Bridge, IDEM Site OBS100-0006	09/20/07	QHEI	
010	Little Indian Creek above Water Street Bridge	09/20/07	Benthic, QHEI	
011	Little Indian Creek below Lanesville at State Road 62	09/20/07	QHEI	

Indian Creek Watershed
Benthic Macroinvertebrate Data
Species List

Order	Genus	Species	Tol Val.	FFG	HABIT	Site 6 Quantitative	Site 6 Qualitative	Site 6 Duplicate Quantitative	Site 6 Duplicate Qualitative	Site 7 Qualitative	Site 8 Qualitative	Site 10 Quantitative	Site 10 Qualitative
Epheneroptera	*Acerpenna*	*pygmaenus*	3.88	CG		21		4		3		4	
	Baetis	*intercalaris*	4.99	CG		17		7		3		1	
	Callibaetis	*sp.*	9.84	CG			4			5			
	Caenis	*lattapennis*	7.4	CG		5		3		5		22	
	Caenis	*sp.*	7.4	CG							1		
	Choropterpes	*basalis*	2.3	SC	Clinger			1		1			
	Ephemera	*sp.*	1.1	CG				1	1				
	Isonychia	*sp.*	3.45	CF						1			
	Maccaffertium	*sp.*	4.1	SC	Clinger	2							
	Procloeon	*sp.*	5	CG						1			
	Stenacron	*sp.*	4	CG	Clinger					8		14	
	Stenonema	*femoratum*	7.18	SC	Clinger					6	16	3	
	Tricorythodes	*sp.*	5.06	CG		1						1	
Plecoptera	*Acroneuria*	*frisoni*	4	PR	Clinger							1	
	Acroneuria	*sp.*	1.4	PR	Clinger					1			
Tricoptera	*Cheumatopsyche*	*sp.*	6.22	CF	Clinger	2				29			
	Helicopsyche	*borealis*	5	SC	Clinger	8		2					
	Hydroptila	*sp.*	6.22	PH	Clinger			1					
	Hydropsyche	*venularis*	4	CF	Clinger	1		1					
	Neophylax	*sp.*	2.2	SC	Clinger							1	
	Triaenodes	*sp.*	4.46	PR							6		
Odonata	*Argia*	*fumipennis*	8.2	PR			2		2	1			
	Argia	*moesta*	8.2	PR		1		3		1		7	3
	Argia	*sedula*	8.46	PR					1	1			1
	Argia	*tibalis*	8.17	PR				1					2
	Argia	*sp.*	8.2	PR		1	1		1				
	Enallagma	*sp.*	8.91	PR			25			10	19		2
	Hetaerina	*sp.*	5.61	PR						7		1	
	Basiaeschna	*janata*	7.35	PR			1			2			1
	Boyeria	*vinosa*	5.89	PR							1		
	Epitheca	*priceps*	5.6	PR			2						
	Somatochlora	*sp.*	9.15	PR			3		5	1	1		
Coleoptera	*Ancyronyx*	*variegata*	6.49	SC	Clinger					1			
	Berosus	*sp.* (larvae)	8.43	PH		1	1						
	Dubiraphia	*vittata*	4.05	SC	Clinger			1		8	2	1	
	Helichus	*lithophilis*	4.6	SC	Clinger					7			
	Lutrochus	*laticeps*	5	SC	Clinger	2		5		1		2	2
	Macronychus	*glabratus*	4.58	CG	Clinger						5		
	Optioservus	*trivittatus*	2.36	SC	Clinger					1			
	Optioservus	*sp.* (larvae)	2.36	SC	Clinger			2					
	Peltodytes	*duodecipunctatus*	8.7	PH			2						
	Peltodytes	*sexmaculatus*	8.7	PH			1						
	Psephenus	*herricki*	2.35	SC	Clinger	2		12		19	13	10	6
	Stenelmis	*crenata*	5.1	SC	Clinger	1		2			1	8	1
	Stenelmis	*sexlineata*	5.1	SC	Clinger			1		29		12	
	Stenelmis	*sp.* (larvae)	5.1	SC	Clinger	5		22		4		143	1
	Tropisternus	*collaris striolatus*	9.7	CG							1		
	Tropisternus	*sp.*	9.7	CG						4			1
Hemiptera	*Belostoma*	*sp.*	9.8	PR									1
	Notonecta	*irrorata*	9	PR							1		
	Mesovelia	*sp.*	9.8	PR						1			
	Microvelia	*sp.*	9	PR						3			
Lepidoptera	*Parapoynx*	*sp.*	3	SH	Clinger							1	
	Petrophila	*sp.*	1.8	SH	Clinger	1							

Indian Creek Watershed
Benthic Macroinvertebrate Data
Species List

Order	Genus	Species	Tol Val.	FFG	HABIT	Site 6 Quantitative	Site 6 Qualitative	Site 6 Duplicate Quantitative	Site 6 Duplicate Qualitative	Site 7 Qualitative	Site 8 Qualitative	Site 10 Quantitative	Site 10 Qualitative
Diptera	*Anopheles*	*sp.*	8.58	CF							2		
	Chironominae		7	CG						1			
	Chironomus	*sp.*	9.63	CG									1
	Cryptochironomus	*sp.*	6.4	PR		7		1				2	
	Dicrotendipes	*sp.*	8.1	CG		3		1		1			
	Nanocladius	*sp.*	7.07	CG				1					
	Polypedilum	*sp.*	6.8	SH		11		1		1			
	Sphaeromias	*sp.*	6.9	PR									1
	Tanytarsus	*sp.*	6.7	CF	Clinger			3					
	Thienemannella	*sp.*	5.86	CG						1			
	Thienemannimyia	*gp.sp.*	5.9	PR		11		3					
	Zavrelia	*sp.*	5.3	CG		3		2					
Turbellaria	Unident. Flat worm		5	CG						16			
Oligochaeta	Lumbricudae		5	CG								4	
Hirudinea	*Helobdella*	*triserialis*	9.2	PC								1	
	Mooreobdella	*melanostoma*	7.8	CG						1		1	3
Gastropoda	*Campeloma*	*sp.*	5	SC					1				
	Elimia	*semicarinata*	2.5	SC		153	17	28	11	21	8	265	6
	Ferrissia	*rivularis*	6.55	SC						1			
	Physella	*sp.*	8.84	SC			2	1		2			
Pelecypoda	*Corbicula*	*fluminea*	6.12	CF		1	8	9	6	3		9	1
	Pisidium	*sp.*	6.48	CF								3	
	Sphaerium	*striatinum*	7.6	CF			4		5			1	1
Amphipoda	*Hyalella*	*azteca*	7.75	CG			5		1	5			
Isopoda	*Lirceus*	*sp.*	7.85	CG						1			
Decapoda	*Orconectes*	*juvinilis*	5.99	CG			4			5	8	4	4
		Total # Individuals				260(132)		116(113)		223	85	522(164)	
		Taxa Richness (TR)				35(31)		34(28)		42	15	34(30)	
		EPT				9		8		11	3	8	
		mHBI				4.8353		4.6168				5.0216	
		m%EPT				22		17				9	
		% Clingers				9		46				38	
		% Chir+Olig				13		10				1	
		MBI				**38.2**	**Poor**	**44.1**	**Fair**			**43.2**	**Fair**

Indian Creek Watershed
Benthic Macroinvertebrate Data
Qualitative Habitat Evaluation Index (QHEI)

Station ID	Station Name	Stream Size	1-Substrate	2-Instream Cover	3-Channel Morphology	4-Bank Erosion and Riparian Zone	5a-Pool/Glide Quality	5b-Riffle/Run Quality	6-Stream Gradient	Total QHEI Score	Habitat Quality Result
001	Indian Creek North at Banet Road, IDEM Site OBS080-0001	Headwater	12	12	14	4	0	0	4	46	Fair
002	Georgetown Creek below Georgetown at Malinee Ott Road	Headwater	13	6	10	4.5	2	0	4	39.5	Poor
003	Indian Creek above Georgetown Creek, IDEM Site OBS080-0005	Larger Steam	13	13	14	9	8	0	4	61	Good
004	Crandall Branch above SR335 Bridge	Headwater	13	14	15	9.5	2	4	4	61.5	Good
005	Indian Creek above SR355 Bridge, IDEM Site OBS090-0004	Larger Steam	16	13	11					40	Not Assessed
006	Indian Creek above Little Indian Creek at Water Street, Corydon	Larger Steam	5	6	11	7	5	4	4	42	Poor
007	Indian Creek at Mathis Road Bridge	Larger Steam	14	13	15	9	2	5	4	62	Good
008	Indian Creek above Rocky Hollow Road Bridge, IDEM Site OBS100-0001	Larger Steam	15	11	11	8.5	2	4	4	55.5	Fair
009	Indian Creek above Lickford Road Bridge, IDEM Site OBS100-0006	Larger Steam	14	13	17	9.5	6	0	4	63.5	Good
010	Little Indian Creek above Water Street Bridge	Larger Steam	12	3	9	5	3	0	4	36	Poor
011	Little Indian Creek below Lanesville at State Road 62	Headwater	12	13	14	9	1	5	4	58	Good
	Maximum Score		**20**	**20**	**20**	**10**	**12**	**8**	**10**	**100**	

Notes

Stream Size: Headwaters Stream - less than or equal to 20 square miles

QHEI Scoring

Narrative Ranges	Headwaters	Large Streams
Excellent	70-100	75-100
Good	55-69	60-74
Fair	43-54	45-59
Poor	30-42	30-44
Very Poor	0-30	0-30

Site 5 Incomplete data

Appendix 3.1 Funding Sources

1. Indiana Department of Environmental Management Grants and Loans

1.1. Section 205(j) Grants

These grants are for water quality management planning, and can be used to determine the nature, extent and causes of point and nonpoint source pollution problems as well as develop plans to resolve these problems.

- **Who's Eligible:** Municipal governments, county governments, regional planning commissions, and other public organizations. For-profit entities, nonprofit organizations, private associations, universities, and individuals are not eligible to receive this assistance.
- **Matching Contribution Required:** No match is required.
- **Who to Call:** Doug Campbell, NPS/TMDL Section, (317) 233-8491.
- **More Information:** http://www.IN.gov/idem/resources/grants_loans/205j/

1.2. Section 319(h) Grants

These grants are for projects that reduce documented nonpoint source water quality impairments.

Funds may be used to conduct assessments, develop and implement watershed and surface water monitoring plans, provide technical assistance, demonstrate new technology and provide education and outreach.

- **Who's Eligible:** Nonprofit organizations, universities, and federal, state, and local governmental units.
- **Matching Contribution Required:** 40% of the total project cost, federal funds cannot be used.
- **Who to Call:** Laura Bieberich, NPS/TMDL Section, (317) 233-1863.
- **More Information:** http://www.IN.gov/idem/resources/grants_loans/319h/

1.3. Household Hazardous Waste Grants

These grants are designed to help start or expand household hazardous waste (HHW) recycling programs involving the collection, recycling, or disposal of HHW, and conditionally exempt small quantity generator waste (CESQGW).

Funds may be used to support educational and outreach programs that inform the public of substitutes for typical household hazardous products, product reuse and exchange programs that help reduce HHW, and the establishment of permanent facilities for the proper handling, collection, storage, recycling or disposal of HHW and CESQGW.

- **Who's Eligible:** Solid waste management districts, counties, municipalities and townships. Joint applications between two or more units of government are encouraged.
- **Matching Contribution Required:** 50% of the total project cost. See web site for further information.
- **Who to Call:** Office of Pollution Prevention and Technical Assistance (OPPTA), at (800) 988-7901
- **More Information:** http://www.in.gov/recycle/funding/hhwg.html

1.4. Waste Tire Recycling Grants

These grants are designed to help start or expand waste tire recycling programs in Indiana, and target new and innovative projects that reuse or recycle waste tires.

Funds may be used for IDEM approved civil engineering field projects that utilize waste tire material, research and development efforts that explore the use of waste tire material in high value-added products, projects that involve the beneficial reuse of waste tires in the construction of sports and other recreational fields, and trial and implementation efforts aimed at converting waste tires into fuel alternatives or supplements for energy generation applications.

- **Who's Eligible:** Indiana businesses, units of local government, schools and nonprofit organizations with 501(c) status.
- **Matching Contribution Required:** 50% of the total project cost. See web site for further information.
- **Who to Call:** Office of Pollution Prevention and Technical Assistance (OPPTA), at (800) 988-7901
- **More Information:** http://www.in.gov/recycle/funding/wtf.html

1.5. Recycling Grants

Each of these grants is intended to create sustainable projects with no state funding for ongoing program costs.

- **Who's Eligible:** Solid waste management districts, counties, municipalities, townships, schools, and nonprofit organizations with 501(c) status.
- **Matching Contribution Required:** 50% of the total project cost. See web site for further information.
- **Who to Call:** Office of Pollution Prevention and Technical Assistance (OPPTA), at (800) 988-7901
- **More Information:** http://www.in.gov/recycle/funding/

1.6. Indiana Brownfields Program

The Indiana Finance Authority administers the following grant and loan incentives with environmental technical support from IDEM staff:

- Stipulated Site Assessment Grants
- Stipulated Remediation Grants
- Petroleum Remediation Grants

- Federal Matching Grants
- Brownfields Low-Interest Loans
- Voluntary Remediation Tax Credits

Brownfields are abandoned, idled or underused properties where environmental contamination, either real or potential, hampers expansion and redevelopment.

In addition to site assessment and cleanup grants, which help pay for environmental investigation and remediation costs at identified brownfield sites, low-interest loans are also available under this program.

These loans are designed to help cover costs associated with brownfield remediation and redevelopment. Some of the eligible activities include soil and ground water cleanup, demolition, asbestos and lead based paint abatement, as well as further investigation.

- **Who's Eligible:** Political subdivisions.
- **Rates:** Call for current interest rates and additional information.
- **Who to Call:** Financial Resources Coordinator, Indiana Brownfields Program, (317) 234-1688

More Information: http://www.in.gov/ifa/brownfields/

1.7. Wastewater (WWSRF) and Drinking Water (DWSRF)

SRF loans are designed to fund projects that improve drinking water and wastewater infrastructure in order to maintain water quality or provide other public health benefits.

Funds are available for improvements to wastewater plants, sewer line extension projects, corrections to sewage overflow problems, water storage facilities, and water line extension projects. Funds are also available for the costs associated with non-point source water pollution abatement projects such as wetland restoration/protection, erosion control measures, stormwater best management practices, and wellhead and source water protection measures.

Contact SRF staff to see if your project is eligible for a Small System Technical Assistance Fund (SSTAF) grant.

- **Who's Eligible:** Political subdivision including incorporated cities, towns, counties, regional sewer/water districts, conservancy districts and water authorities. Private and not-for-profit facilities are eligible only for drinking water SRF loans.
- **Rates:** Below market rates are adjusted quarterly and are based on median household income (2000 census data) and current user rates. Call for current interest rates and additional information.
- **Who to Call:** Drinking Water SRF Administrator, (317) 232-8663 or the Wastewater SRF Administrator, (317) 232-4396
- **More Information:** http://www.in.gov/ifa/srf/

1.8. Boating Infrastructure Grant Program (BIG P)

This program is intended to provide funding (on a reimbursement basis) for the construction of facilities that will enhance boating for non-trailerable, (26 feet or over in length) transient recreational boats. "Transient" is defined as passing through or by a place, and staying 10 days or less.

Funding could be used for such projects as slips for transient boaters, mooring buoys, navigational aids to direct safe entry to facilities, and initial dredging to provide transient vessels with safe channel depths. These funds are subject to certain limitations and requirements. Call for additional information.

Boating facilities constructed under this program must be open to the public, designed to last for at least 20 years, continue to be used for their original stated grant purpose, and be maintained throughout their useful life.

- **Who's eligible:** All public marinas in Indiana which are situated along the shorelines of Lake Michigan and the Ohio River.
- **Matching Contribution Required:** 25% of the project cost, federal funds cannot be used.
- **Who to Call:** Office of Pollution Prevention & Technical Assistance, (317) 232-8172
- **More Information:** http://www.in.gov/idem/resources/grants_loans/bigp/index.html

1.9. Clean Vessel Act Grant Program

The primary goal of the Clean Vessel Act (CVA) is to reduce overboard sewage discharge from recreational boats. Boat sewage dumped into our waters may affect aquatic plants, fish, and other animals. The nutrients, microorganisms, and chemicals contained in human waste discharged from boats have a negative impact on coastal and inland waters, particularly in sheltered or shallow areas not naturally flushed by tide or current.

This program provides funding (on a reimbursement basis) for the construction, renovation, operation and maintenance of pump-out stations for holding tanks and dump stations for portable toilets. These funds are subject to certain limitations and requirements. Call for additional information.

- **Who's eligible:** All public marinas in Indiana which support recreational boats which are 26 feet and over in length and have portable or permanent on-board toilets.
- **Matching Contribution Required:** 25% of the project cost, federal funds cannot be used.
- **Who to Call:** Office of Pollution Prevention & Technical Assistance, (317) 232-8172
- **More Information:** http://www.in.gov/idem/resources/grants_loans/cva/index.html

Clean Vessel Act Public Notices:

- East Chicago Marina located at 3301 Aldis Avenue, East Chicago, Indiana 46312
- Rivercrest Marina located at 1200 W. 2nd Street, Madison, Indiana 47250
- Turtle Creek Harbor located at 206 6th Street, Florence, Indiana 47020

2. Indiana Department of Natural Resources Grants

2.1. Best Management Practices (BMP) Cost-Share Program

Logging operations in the State of Indiana are eligible to apply for cost-share dollars that will help defray the expense of BMP installations on harvest sites, depending on the location and timing of the harvest.

2.2. Community Forestry Grant Programs

Trees make our communities better places to live and work. Cities, towns and non-profit organizations can receive funding to enhance urban trees and forests. The Indiana DNR, Division of Forestry offers four grant programs that help improve, protect, maintain and increase the number of trees in Indiana communities. This federal and state funding is provided on an annual basis by the Indiana Department of Natural Resources and the U.S.D.A.

2.3. Develop a Shooting Range

The Indiana Shooting Range grant program provides assistance with the development of rifle, handgun, shotgun, and archery facilities. The main objective of this program is to provide the citizens of Indiana with additional and safer places to fire their guns, and train hunter education students.

2.4. Development of a New Park or Recreation Area

The Land and Water Conservation Fund grant program is to assist eligible governmental units in the provision of new park areas. Participation in outdoor recreation activities is expanding so rapidly that park agencies often face a real financial burden in attempting to provide enough facilities to keep up with the demand.

2.5. Fire Fighting Assistance for Rural Community Fire Departments

There are a number of programs aimed at assisting rural fire departments with needs ranging from equipment to training. Fire departments may serve either incorporated communities or unincorporated rural areas.

2.6. Forest Management Cost Share Programs

Many landowners may not be reaping their full benefits or providing adequate long term protection of forestlands. Cost share assistance is available to provide maximum watershed protection and erosion control, encourage abundant, healthy populations of wildlife, and maximum yields on timber harvests.

2.7. Historic Preservation and Archaeology

Each year the Division of Historic Preservation and Archaeology receives over $500,000 in federal funding under the Historic Preservation Fund (HPS) Program, which helps promote the U.S. Department of the Interior, National Park Service. The HPF Program helps promote

historic preservation and Archaeology in Indiana by providing assistance to projects that will aid the State in meeting its goals for cultural resource management.

2.8. Hoosier Riverwatch

Hoosier Riverwatch has awarded grants to volunteer groups since 1996. These grant recipients form the foundation of the Hoosier Riverwatch volunteer stream monitoring network. Each grant provides up to $500 of water monitoring equipment. In return, grant recipients agree to monitor their selected stream or river segments at least four times per year for two years.

2.9. Lake and River Enhancement

The Lake and River Enhancement Program (LARE) was developed to ensure the continued viability of public-access lakes and streams. The program's goal is to utilize a watershed approach to reduce non-point source sediment and nutrient pollution of Indiana's and adjacent states' surface waters to a level that meets or surpasses state water quality standards. To accomplish this goal, grants are available for technical and financial assistance for qualifying projects.

2.10. Recreational Trails Program (RTP)

The Recreational Trails Program is a matching assistance program that provides funding for the acquisition and/or development of multi-use recreational trail projects. Both motorized and non-motorized projects may qualify for assistance. The assistance program is sponsored by the U.S. Department of Transportation’s Federal Highway Administration (FHWA). ..

http://www.in.gov/dnr/assistance/grantresources.html

3. Indiana Office of Federal Grants & Procurement

Message from the Governor

I created the Office of Federal Grants and Procurement (OFGP) by Executive Order on my first day in office in order to increase significantly the amount of federal dollars coming to our state. Indiana ranks at or near the bottom among states in terms of our success in bringing federal funds back from Washington, and now the state is determined to move quickly to improve our performance and our ranking.

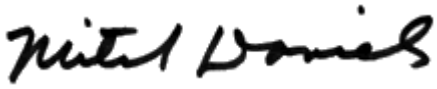
The OFGP will serve as a valuable resource in helping agencies of state government identify and win competitive federal grants, provide them with training and technical assistance to improve their grant skills, and measure and track federal grant funding to the state. In order to leverage resources and increase Indiana's capacity to pursue and secure federal grants, the Office will also provide grant assistance and support to Hoosier universities, non-for-profits, and the business community.

To ensure that Indiana receives its fair share of federal funding in the future, the OFGP will work closely with the State's Washington D.C. Office and our strong Congressional Delegation to advocate for fair adjustments in federal grant formulas, and to develop strong relationships with key federal agencies that are best able to provide direct grant assistance to the state.

In addition to coordinating federal grant activity, the OFGP is dedicated to keeping Indiana businesses informed of opportunities to sell their products and services to the federal government. The Office will work closely with the business community to find ways for the federal government to "Buy Indiana" whenever possible.

Hoosier taxpayers deserve to know that we are making every effort to ensure that a fair portion of the monies they send to Washington each year come back to Indiana to help us meet the challenges we face in building infrastructure, training workers for new job opportunities, and caring for the sick and disabled. The OFGP will be the central focus of this Administration's efforts to obtain federal support wherever possible to support our goal of improving the lives Hoosier citizens and communities as we "Aim Higher" for Indiana's future.

Sincerely,



http://www.in.gov/ofgp/

4. Federal Emergency Management Agency (FEMA) Grants

4.1. Buffer Zone Protection Program (BZPP)

Total Funding Available in FY 2008: $48.5 million

Purpose: BZPP provides grants to build security and risk-management capabilities at the State and local level in order to secure pre-designated Tier I and Tier II critical infrastructure sites, including chemical facilities, financial institutions, nuclear and electric power plants, dams, stadiums, and other high-risk/high-consequence facilities.

Eligible Applicants: Specific BZPP sites within 45 States have been selected based on their level of risk and criticality. Each State with a BZPP site is eligible to submit applications for its local communities to participate in and receive funding under the program. Therefore, BZPP funding allocated to any given State or territory is a function of the number, type, and character of the pre-identified sites within that State or territory.

http://www.fema.gov/government/grant/bzpp/index.shtm

4.2. FY 2008 Emergency Management Performance Grant

The principal priority for the FY 2008 EMPG funds is to sustain and enhance catastrophic planning capabilities, to include addressing the findings of the FEMA gap analysis program

and similar capability assessment efforts, and assisting state and local jurisdictions to address national and regional catastrophic planning needs. State and local jurisdictions should also continue to focus on addressing state-specific planning issues identified through the 2006 Nationwide Plan Review. In FY 2008, specific planning focus areas of evacuation planning, logistics and resource management, continuity of operations (COOP) / continuity of government (COG) planning, and recovery planning have been identified as national planning focus areas.

Total Funding Awarded in FY 2008: $291,450,000

http://www.fema.gov/emergency/empg/empg.shtm

4.3. Hazard Mitigation Grant Program

The Hazard Mitigation Grant Program (HMGP) provides grants to States and local governments to implement long-term hazard mitigation measures after a major disaster declaration. The purpose of the HMGP is to reduce the loss of life and property due to natural disasters and to enable mitigation measures to be implemented during the immediate recovery from a disaster. The HMGP is authorized under Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act.

4.4. Flood Mitigation Assistance (FMA)

Provides funding to assist States and communities in implementing measures to reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insurable under the NFIP.

4.5. Pre-Disaster Mitigation Grant Program (PDM)

Provides funds to states, territories, Indian tribal governments, communities, and universities for hazard mitigation planning and the implementation of mitigation projects prior to a disaster event.

4.6. Repetitive Flood Claims (RFC)

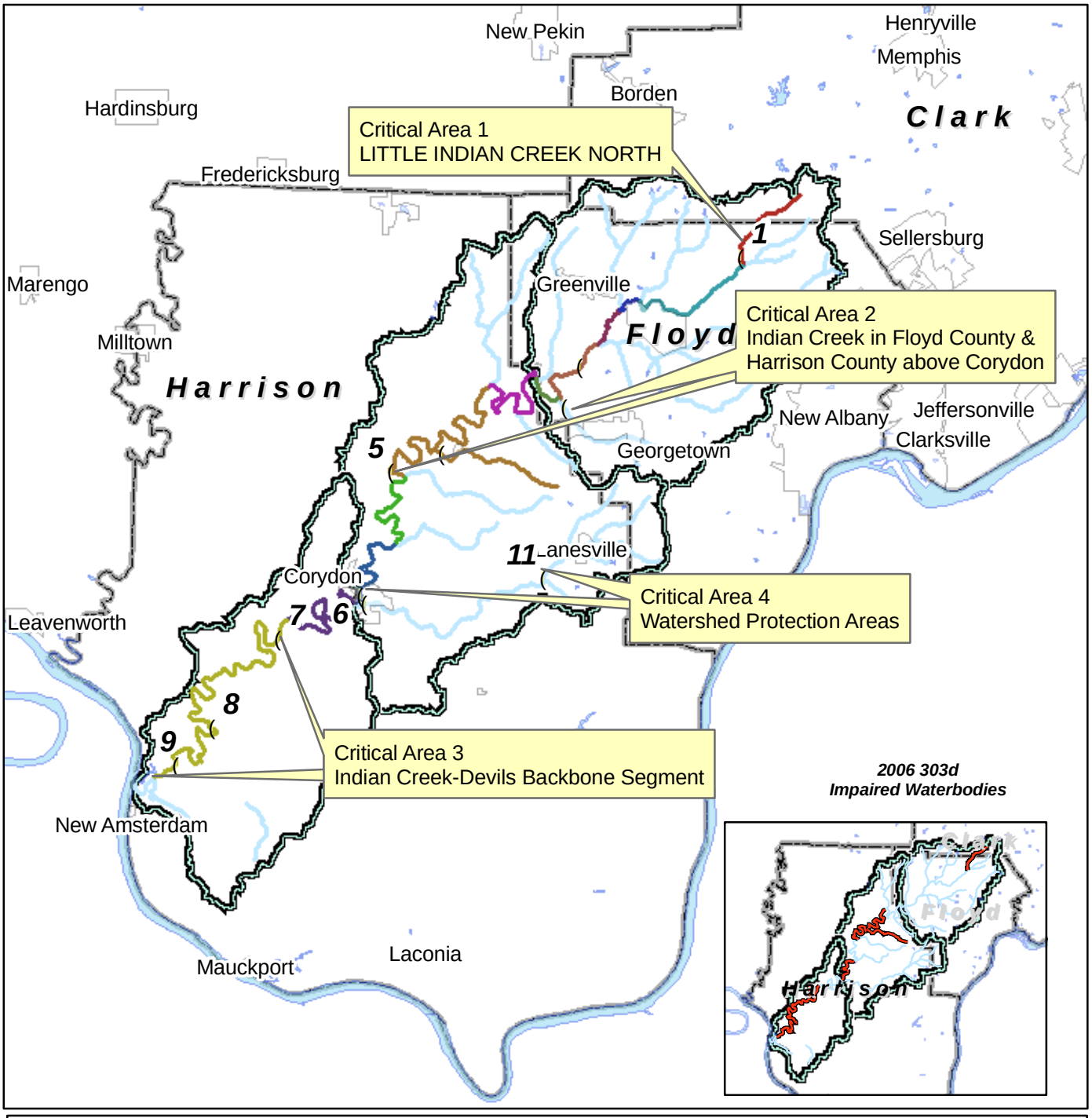
Provides funding to States and communities to reduce or eliminate the long-term risk of flood damage to structures insured under the NFIP that have had one or more claims for flood damages, and that can not meet the requirements of the Flood Mitigation Assistance (FMA) program for either cost share or capacity to manage the activities.

4.7. Severe Repetitive Loss (SRL)

Provides funding to reduce or eliminate the long-term risk of flood damage to severe repetitive loss (SRL) structures insured under the National Flood Insurance Program (NFIP).

http://www.fema.gov/government/grant/hmgp/index.shtm

Indian Creek Watershed -- Critical Areas



2008 303d Impaired Stream

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

SOURCE: Indiana Department of Environmental Managment (IDEM)
M:\2006\IF2006001 HARRISON CO\GIS_MXD\ICW_critical-area_050408

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.

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	

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 Layfayette WWTP– See Table below.
Strategies - High Priority	WWTP Compliance at Woods of Layfayette, 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**

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 as 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.

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

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.

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.

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.

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.

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

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.