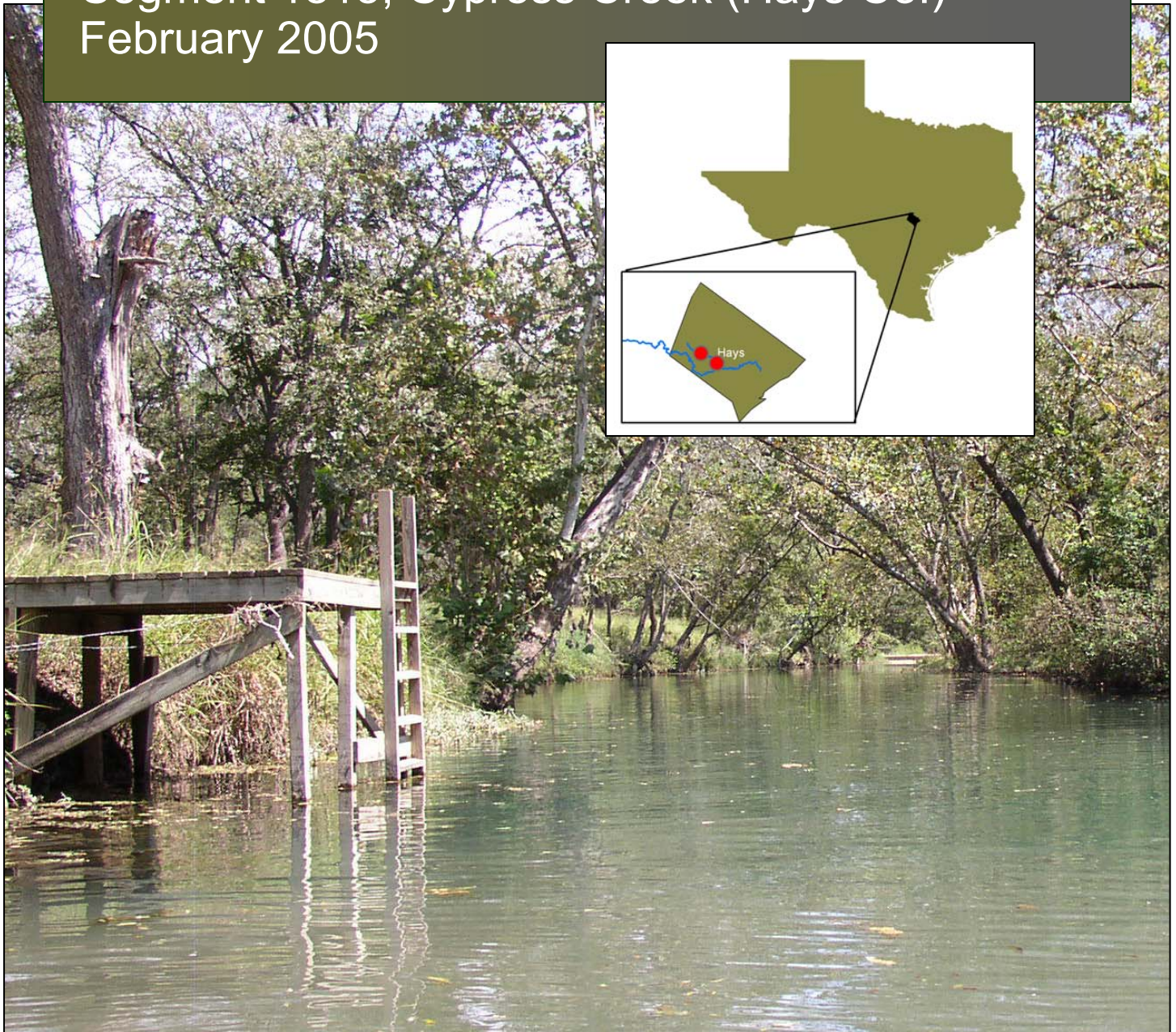
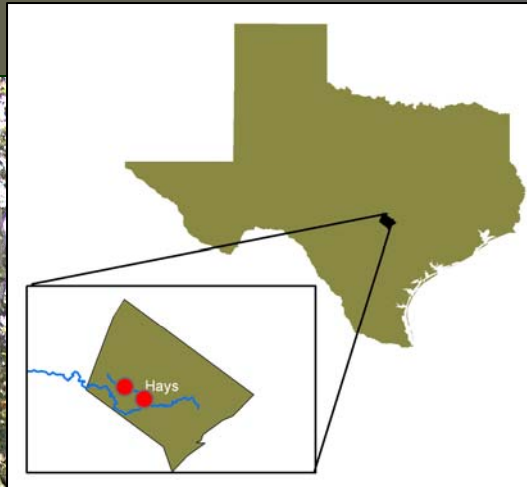


Impairment Verification Monitoring-Volume 2:
Biological and Habitat Components
Segment 1815, Cypress Creek (Hays Co.)
February 2005



Ecological Communications Corporation
Austin, TX



**Impairment Verification Monitoring-Volume 2: Biological and
Habitat Components
Segment 1815, Cypress Creek (Hays Co.)**

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Under Texas Engineering Experiment Station Project No. 32525-60880 CC
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Impairment Verification Monitoring-Volume 2: Biological and Habitat Components
Segment 1815 Cypress Creek (Hays Co.)

ABSTRACT

Ecological Communications Corporation (EComm) conducted biological data collection and analysis as part of an impairment verification monitoring project on Cypress Creek (Segment 1815). Segment 1815 appears on the State of Texas' 303(d) list as impaired for exceptional aquatic life based on low dissolved oxygen concentrations previously reported by or to the Texas Commission on Environmental Quality (TCEQ) or its predecessor agencies. Due to an insufficient amount of data to support a re-assessment, this water body remained on the draft 2002 303(d) list. The objective of EComm's data assessment was to assemble enough information on the water body to support a use attainability analysis if it was determined that the designated aquatic life use was incorrect.

A separate but related assessment was simultaneously conducted by the Texas Engineering Experiment Station (TEES) and the Conrad Blucher Institute for Surveying and Science (CBI) to facilitate the objective. The TEES/CBI effort included physical and chemical data collection and analysis in an attempt to provide a comprehensive assessment of the water quality within the stream segment. As part of the overriding TMDL project (TCEQ Contract 582-4-58897), the combined biological, physical, and chemical data collection and analytical activities will result in one of four outcomes:

1. Removal of the water body from the 303(d) list,
2. An evaluation of applicable water quality standards (aquatic life use impairments only),
3. Development of a TMDL, or
4. Additional monitoring to better characterize the impairment.

Based on data collected by the GBRA, this water body was found to be meeting the dissolved oxygen criteria for exceptional aquatic life use, and was removed from the 303(d) List of impaired waters in 2004. The additional data collected as part of this study represents further support of this action and indicates full attainment of the exceptional aquatic life use on Cypress Creek.

Impairment Verification Monitoring-Volume 2: Biological and Habitat Components
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APPENDICES

Appendix A Complete Raw Data Set Segment 1815 – Cypress Creek September 2002

1.0 INTRODUCTION

In 2000 the Texas Commission on Environmental Quality (TCEQ) initiated a study to investigate water quality impairments in 11 water bodies in Basin Groups D & E identified through the 1999 305(b) Water Quality Inventory as part of a total daily maximum load (TMDL) program. The segments are included on the 1999 State of Texas Clean Water Act 303(d) list as impaired due to



Figure 1. Station 12673

concentration levels of dissolved oxygen or bacteria or both which exceed established criteria. One of these water bodies was Cypress Creek (Segment 1815) which was included on the State's 303(d) list as impaired for its exceptional aquatic life use designation. The impairment to this portion of Cypress Creek was caused by an exceedance of the established dissolved oxygen criteria. As an initial phase for TMDL development, Segment 1815 was assessed to verify the aquatic life impairment using the latest sampling techniques. This initial assessment was performed so that resources within the program can be efficiently utilized for truly impaired waterbodies, preventing TMDL

development for a waterbody that may be delisted or subject to a water quality standards revision at a later date. Chemical, physical, and biological data were collected at two stations (sites) within the segment in an effort to determine what course of action, if any, needed to be taken to address impairments. Data collection activities would result in one of four outcomes:

- 1) Removal of the water body from the 303(d) list,
- 2) An evaluation of applicable water quality standards (aquatic life use impairments only),
- 3) Development of a TMDL, or
- 4) Additional monitoring to better characterize the impairment.

Segment 1815 originates four miles upstream of the most upstream unnamed county road crossing in Hays County. It flows 14 miles southeastward through Hays to the confluence of the Blanco River near downtown Wimberley, Texas. Site 12677 (Figures 3 & 4) is located in Hays County at Jacob's Well in Wimberley. Site 12673 (Figure 1) is located in Hays County, just above the Cypress confluence with the Blanco River in Wimberley. A location map of the segment is provided in Figure 2.

Impairment Verification Monitoring-Volume 2: Biological and Habitat Components
Segment 1815 Cypress Creek (Hays Co.)

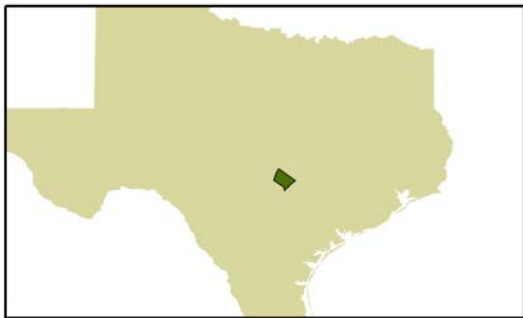
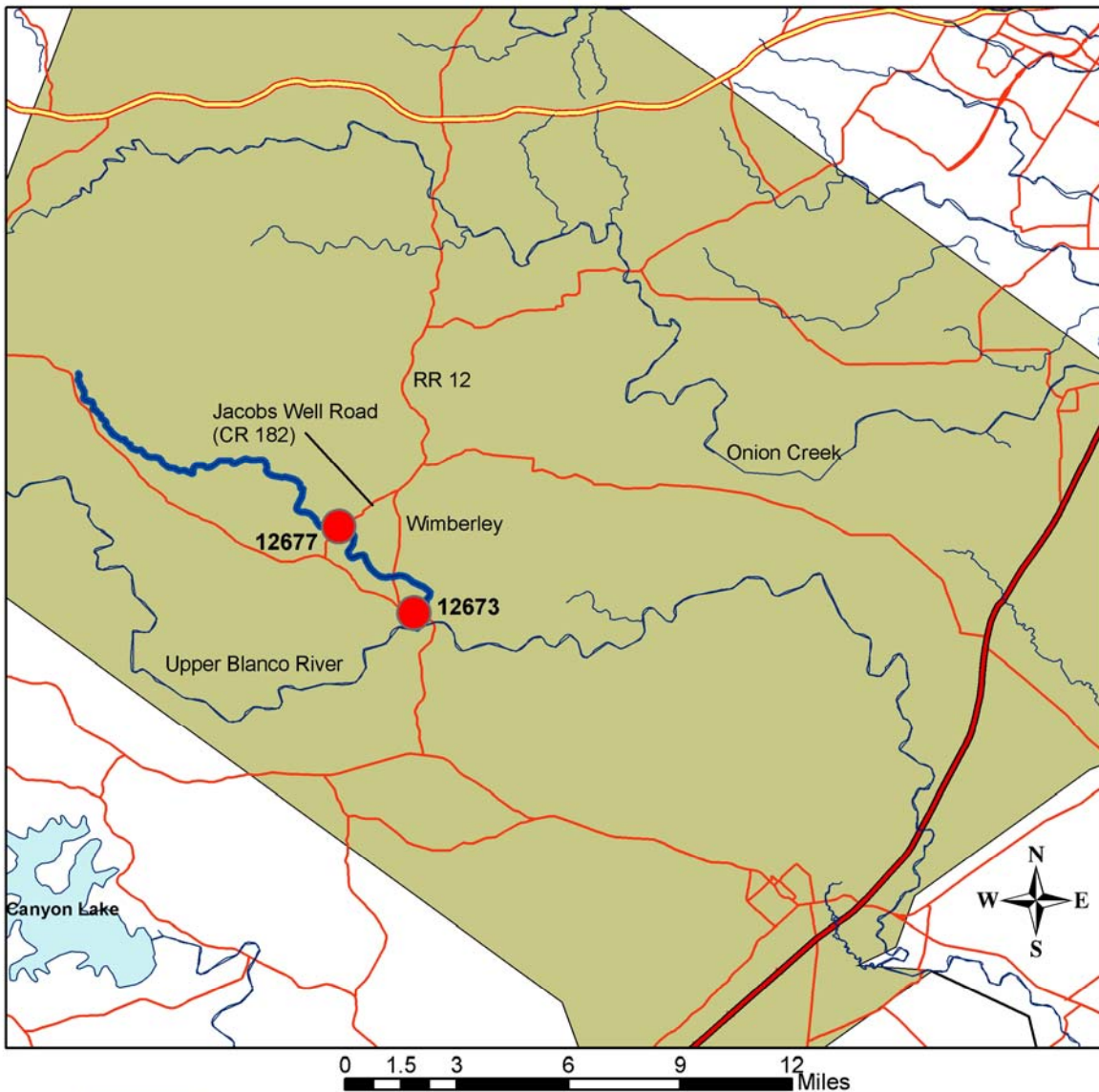


Figure 2.
Location Map for Segment 1815, Cypress Creek
Hays County, TX

2.0 BIOLOGICAL AND HABITAT METHODOLOGY

Biological data (including fish, benthic macroinvertebrates, and habitat) were collected under strict interpretation of the Biological Component and Stream Physical Habitat Component sections of the Receiving Water Assessment (RWA) Procedures Manual (Texas Natural Resource Conservation Commission [TNRCC] 1999b). As specified in the RWA manual, EComm evaluated fish sampled in accordance with statewide criteria of Indices of Biotic Integrity (IBI). Additionally, EComm generated IBI for all stations using regional criteria developed by the Texas Parks and Wildlife Department (2002). The regional criteria consider differences in landforms, soil types, vegetation, climatic conditions, and zoogeographic factors among the ecoregions and thus “provide a better representation of the integrity of fish assemblage” as compared to statewide criteria.



Figure 3. Station 12677

Also, in addition to data collection via RWA guidelines and TCEQ Surface Water Quality Monitoring (SWQM) Procedures Manual (TNRCC 1999a), EComm captured data for 14 previously uncoded biological and habitat parameters. These parameters include: the various metrics used in determining regional IBI scores; the final scores for aquatic life use values for both statewide and regional IBI criteria; the final scores for Rapid Bioassessment Protocol (RBP) for benthic macroinvertebrates; and the final scores for Habitat Quality Indices (HQIs). All 14 parameters were assigned unique STORET codes in an effort to create maximum efficiency for data management. The new STORET codes and descriptions, along with other STORET codes captured for this segment, are provided in Table 1.

Segment 1815 had not previously been designated as a segment requiring a Use Attainability Analysis (UAA). Although the main purpose of the physical/chemical component of the study was to verify the dissolved oxygen impairment, a biological sampling regime satisfying the minimum UAA data requirements was initially attempted for this segment to be used if it was determined that a UAA was the correct course of action. UAA requirements include at least three complete sampling events over two consecutive index periods (March 15 – October 15). One event is required in the early portion (before April 30) of the index period in either Year 1 or Year 2, and the other two efforts must be conducted during the Critical Period (July 1 – September 30), including one sampling event during Year 1 and the other during Year 2. Biological sampling for Segment 1815 was only conducted in September 2002. During the 2004 305(b) assessment, this segment was found to be meeting standards. As such, project resources were shifted to address issues in other segments of poorer water quality, and the data collection under a UAA sampling regime was discontinued.

Impairment Verification Monitoring-Volume 2: Biological and Habitat Components
Segment 1815 Cypress Creek (Hays Co.)

Table 1. STORET Codes
(New STORET codes captured are temporarily assigned to the "00800" series (in italics))

STORET Code*	Description	STORET Code	Description
89832	Number of lateral transects	90008	EPT index
89847	Average bank slope	98009	Total number of sucker species
89846	Average bank erosion potential	98010	Total number of intolerant species
89845	Percent of substrate that is gravel or larger	98016	Percent individuals as tolerants (fish)
<i>800</i>	<i>Channel flow status</i>	98017	Percent individuals as omnivores
89844	Dominant substrate	98021	Percent individuals as insectivores
89843	Total number of riffles	98022	Percent individuals as piscivores
89842	Number of poorly defined stream bends	98023	Total number of individuals in fish sample
89841	Number of moderately defined stream bends	98024	Percent individuals as hybrid
89840	Number of well defined stream bends	98030	Percent with disease
<i>812</i>	<i>Statewide IBI</i>	98003	Number of fish species
<i>833</i>	<i>Habitat Quality Index</i>	89905	Number of minutes debris was sampled
84161	Stream order	89851	Percent grass
84159	Percent instream cover	89854	Percentage tree canopy
<i>813</i>	<i>Number of Cyprinidae species</i>	89859	Drainage area
<i>814</i>	<i>Number of benthic invertebrates</i>	89860	Length of reach
72052	Streambed slope	89861	Average stream width
<i>816</i>	<i>Percent that are tolerant species, excluding G.affinis</i>	89862	Average stream depth
<i>817</i>	<i>Number of individuals per seine haul</i>	89864	Maximum pool width
<i>818</i>	<i>Number of individuals per minute electroshocking</i>	89865	Maximum pool depth
<i>819</i>	<i>Percentage of individuals as non-native</i>	89866	Average width of riparian vegetation
<i>820</i>	<i>Regional IBI</i>	90010	Dominant functional feeding group percentage
<i>832</i>	<i>Total RBP score</i>	89899	Biological rpt unit
89853	Percent other as riparian vegetation	90009	Number of functional feeding groups
89839	Total number of stream bends	89906	Number of individuals in RBA sample
98008	Total number of sunfish species	89941	Seine length
90025	Percentage benthic gatherers	89943	Electrofishing method
90030	Percentage benthic filterers	89944	Electrofishing duration
90035	Percentage benthic shredders	89946	Average mesh size
90036	Percentage benthic predators	89948	Number of seine hauls
<i>834</i>	<i>Percentage benthic scrapers</i>	89950	Benthic sampling code
90042	Percentage benthic inverts individuals in dominant taxon	89961	Texas ecoregion
90050	Ratio of intolerant to tolerant taxa	89976	Area seined
90052	Number of non-insects	90007	Hilsenhoff biotic index
90054	Percentage of Elmidae	89849	Percent trees
92266	Percentage of Trichoptera that are Hydropsychidae	89867	Aesthetics
92491	Percent Chironomidae	<i>835</i>	<i>Benthic invertebrate taxa richness</i>
89850	Percent as shrubs	<i>836</i>	<i>Number instream cover types</i>
98004	Total number of darter species	89904	Minutes spent kicknetting

* STORET Codes beginning with 8 have yet to be formally established



Figure 4. Salamander collected at Station 12677

Benthic Macroinvertebrate Collections

Collection of benthic macroinvertebrates (Figure 4) in the field was conducted using a 12-inch D-frame kicknet in riffle areas traveling a zigzag pattern across the bed in five-minute intervals. Intervals were repeated until the minimum sample size of 100 specimens was approached, met, or exceeded. All individuals collected within the net were transferred and stored in 70% ethanol for lab analysis and identification. The collection of all individuals within a sample assured that no biases were present for larger, more active, or otherwise more obvious species captured in the net. Most individuals were identified to genus, or as

otherwise suggested by the RWA manual. Collections from sites were analyzed using the 12 metrics defined in the Rapid Bioassessment Protocol in Appendix B of the RWA manual. These metrics include parameters such as species diversity and composition, trophic structure, and species tolerance to adverse environmental conditions.

Nekton Collections

Collection of fish in the field was conducted using both electrofishing and seine methods to ensure a representative sample was collected at each site. Electrofishing was conducted using Smith-Root LR-24 backpack electrofishing gear powered by either 7 amp-hour or 12 amp-hour 24 volt deep-cycle batteries. Each sampling team consisted of three field personnel, including a field director and two technicians. One team member served as the backpack operator while the other two flanked the operator with dip nets. Collected fish were temporarily placed in a five gallon plastic bucket partially filled with water for later identification. Sampling teams moved in an upstream direction, focusing pulses on snags, along vegetated banks, within large boulders or gravel-based riffles, and any other location most likely to contain fish. Active sampling (instances when current was applied to the water) was conducted for a minimum of 900 seconds. Field teams used best judgment to gauge if enough active sampling had been conducted to collect an accurate representation of present species; therefore, the minimum sampling time was exceeded at some sites. Maximum active sampling time for any site was approximately 1,000 seconds. Upon completion of electrofishing, fish were immediately identified, recorded, and returned to the water in order to minimize mortality. Any fish that could not be identified in the field was preserved in either formalin solution or ethanol. If more than one fish exhibiting the same characteristics could not be field identified, then only one representative specimen was preserved for later lab identification. Additionally, one individual from each field-identified species was retained as a voucher specimen.



Figure 5. Station 12677

Impairment Verification Monitoring-Volume 2: Biological and Habitat Components
Segment 1815 Cypress Creek (Hays Co.)

Electrofishing collections were complemented by seining at all sites where seining was possible. A straight seine measuring 30' x 4' with 1/8" mesh was used. Six seine hauls, each approximately 10 meters long, were taken during each sampling event. Only successful seine hauls were counted. Those that encountered obstacles that could have resulted in the escape of fish (heavy snags or rocks that prevented, or otherwise significantly impaired the lead line from traveling across the bottom substrate) were not included. After each successful haul, collected specimens were identified, recorded, and immediately returned to the stream in an effort to minimize mortality. Species which could not be field-identified were handled in the manner described in the electrofishing section.

Collections were analyzed using metrics defined by TNRCC 1999 to generate Statewide IBI. Regional IBI were also calculated using the TPWD 2002 criteria. Both calculations use metrics that capture parameters such as species diversity and composition, community trophic structure, and fish abundance and condition.

Habitat Assessment

Various habitat data were collected at each site, including primary attributes (instream channel measurements), secondary attributes (stream morphology), and tertiary attributes (riparian environment) of each site. Data were used to generate a Habitat Quality Index (HQI), which serves the same function as the RBP for macroinvertebrates and IBIs for fish.

Descriptions of the various data collected are provided in Table 1.

Several subjective habitat parameters were evaluated as required by the RWA manual (TNRCC 1999). These include bank erosion potential, aesthetics, dominant types of riparian vegetation, and to a lesser degree, percent instream cover and percent gravel or larger. For the purpose of this project, EComm attempted to standardize such measurements by using the same crews for each segment during as many sampling events as possible. Because this was not always possible, and because individuals within a crew may have different duties for any given sampling event, a training session was conducted prior to fieldwork to help ensure that all crew members were given identical background and similar interpretation of the subjective measurements.

3.0 RESULTS

Aquatic life use determinations were based upon scores for each of the three ecosystem components (fish, benthic macroinvertebrates, and habitat) analyzed for Segment 1815. The fish component resulted in Statewide and Regional IBI scores, the macroinvertebrate component resulted in a RBP score, and the habitat resulted in a HQI score. The scores from each of these calculations in turn relates to a given Aquatic Life Use designation: limited, intermediate, high, or exceptional (Table 2). The Aquatic Life Use designation is used to assess existing uses according to the health of the sampled biological communities as compared to established water quality standards. It should be noted that the calculated scores of the Statewide IBI may fall in between two range subcategories (see ranges in Table 2). In these cases, subcategories were

Impairment Verification Monitoring-Volume 2: Biological and Habitat Components
Segment 1815 Cypress Creek (Hays Co.)

assigned as an intermediary between the two subcategories. For example, if a site received a Statewide IBI score of 38, it would fall between the “Limited” and “Intermediate” subcategories, and would be considered to have a “Limited-Intermediate” Aquatic Life Use subcategory.

Table 2. Ranges and Subcategories for each component

Subcategory	Statewide IBI	Regional IBI (Region 30)	RBP	HQI
Limited	<34	<30	<22	<14
Intermediate	40-44	30-41	22-28	14-19
High	48-52	42-51	29-36	20-25
Exceptional	58-60	>51	>36	26-31

Results of the biological and habitat analyses for the two sites over the one sampling event are provided in Table 3. Raw data are provided in Appendix A.

Table 3. Results of Biological and Habitat Sampling for Segment 1815, Cypress Creek

Event 1				
Station (ecoregion)	Statewide IBI	Regional IBI	RBP	HQI
12673 (30)	48 - High	40 - Intermediate	34 - High	18 - Intermediate
12677 (30)	48 - High	54 - Exceptional	30 - High	20 - High

For each component, an average score was calculated using scores from every sampling event. Scores for sampling events for each component that scored within the subcategory “Exceptional” agreed with the designated aquatic life use value for the segment. A subcategory of “Limited”, “Limited-Intermediate”, “Intermediate”, “Intermediate-High”, “High”, or “Exceptional-High” was considered substandard, as it reflects a poorer level of water quality than that for which the segment is designated. Statewide IBI scores averaged 48 (High) across both sites for the single sampling event. This result was in poor agreement with the designated aquatic life use, which was determined as “Exceptional” (0% overall). Regional IBI scores averaged 46 for the two sites within ecoregion 30 (High) and represented a higher agreement with the standard (50%; 50% below standard). RBP scores averaged approximately 32 (High), while HQI averaged 19 (Intermediate).

4.0 DISCUSSION

Average scores of all components generally were lower than the exceptional aquatic life use designation for Segment 1815. The general trend in Statewide IBI scores is to underestimate the aquatic life use when compared to other assessment methods (TPWD 2002). Therefore, the lower Statewide IBI scores generated from data collected for this study are most likely not indicative of lower aquatic life use. The low scores for Regional IBI may be a function of low sample size during metric development for this region, and may not reflect poor water quality (TPWD 2002).

Impairment Verification Monitoring-Volume 2: Biological and Habitat Components
Segment 1815 Cypress Creek (Hays Co.)

Segment 1815 did show some spatial variation in aquatic life use scores between the two sites. EComm is currently investigating the causes for this, but it is hypothesized that several factors may contribute, including the effect that inconsistencies in stream attributes between the two sites may have had on sampling effectiveness.

5.0 CONCLUSION

Based on the Regional IBI, RBP, and HQI scores, it is inconclusive that the biological and habitat data support the conclusion that existing aquatic life uses are meeting the established standards. Additional sampling events would be necessary to come to any conclusions about the existing aquatic life use. However, according to results of the physical/chemical component of this study, the dissolved oxygen concentrations in Segment 1815 are above criteria.

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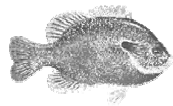
APPENDIX A
COMPLETE RAW DATA SET
SEGMENT 1815-CYPRESS CREEK
SEPTEMBER 2002



Ecological Communications Corporation
Austin, TX

BIOTIC ASSESSMENT – FISH

Species Lists and Preliminary Data Manipulation



FISH COLLECTED

Stream	Date	ID	Species	N=	Type	Method	Tolerance	Trophic Gp
Cypress	9/23/02	12677	Bluegill	4	SF	E	T	IF
			Bluegill	3	SF	S	T	IF
			Bullhead Minnow	6		E	-	IF
			Bullhead Minnow	3		S	-	IF
			Gambusia affinis	157		S	T	IF
			Green Sunfish	6	SF	E	T	P
			Green Throated Darter	14	D	E	I	IF
			Green Throated Darter	27	D	S	I	IF
			Largemouth Bass	3		E	-	P
			Largemouth Bass	23		S	-	P
			Longear Sunfish	2	SF	E	-	IF
			Orange Spotted Sunfish	6	SF	E	-	IF
			Orangethroat Darter	16	D	E	-	IF
			Orangethroat Darter	33	D	S	-	IF
			Redbreast Sunfish	1	SF	E	-	IF
			Spotted Sunfish	10	SF	E	-	IF
			Spotted Sunfish	1	SF	S	-	IF
			Stoneroller	51		E	-	H
			Texas Shiner	11		E	-	IF
			Texas Shiner	129		S	-	IF
			Yellow Bullhead	1		E	-	O
			Total	507				

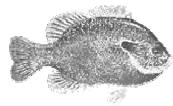
** Abnormalities:
Orangethroat darter
with growth on throat

KEY:
SF Sunfish
D Darter
SU Sucker
E Electroshock
S Seine
V Visually Observed
I Intolerant
T Tolerant
- Intermediate
O Omnivore
IF Invertivore
P Piscivore
H Herbivore

Stream	Date	ID	Species	N=	Type	Method	Tolerance	Trophic Gp
Cypress	9/23/02	12673	Blue Catfish	1		S	-	P
			Bluegill	19	SF	S	T	IF
			Bluegill	14	SF	E	T	IF
			Darter (unknown)	1	D	S		
			Green Sunfish	4	SF	E	T	P
			Largemouth Bass	1		S	-	P
			Longear Sunfish	3	SF	S	-	IF
			Longear Sunfish	36	SF	E	-	IF
			Orange-spotted Sunfish	2	SF	S	-	IF
			Orange-spotted Sunfish	15	SF	E	-	IF
			Redbreast Sunfish	4	SF	S	-	IF
			Redbreast Sunfish	8	SF	E	-	IF
			Rio Grande Cichlid	1		S	-	IF
			Rio Grande Cichlid	1		E	-	IF
			Smallmouth Bass	1		E	I	P
			Spotted Bass	1		E	-	P
			Spotted Sunfish	11	SF	S	-	IF
			Spotted Sunfish	40	SF	E	-	IF
			Stoneroller	13		S	-	H
			Stoneroller	7		E	-	H
			Texas Shiner	57		S	-	IF
			Yellow Bullhead	1		E	-	O
			Total	241				

BIOTIC ASSESSMENT – FISH

Indices of Biotic Integrity – Statewide Criteria



**Quantitative Biological Scoring for Evaluating Aquatic Life Use Subcategories Based on Fish
Statewide Criteria**

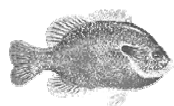
Stream: Cypress		Date: 9/23/02	Location: 12677	County: Hays
Category	Metric	Value	Score	
Species Richness and Composition	1. Total number of fish species	14	5	
	2. Number of darter species	2	3	
	3. Number of sunfish species (exc. bass)	6	5	
	4. Number of sucker speices	0	1	
	5. Number of intolerant species	1	3	
	6. Percentage of individuals as tolerants	34	1	
Trophic Composition	7. Percentage of individuals as omnivores	0.01	5	
	8. Percentage of individuals as insectivores	83	5	
	9. Percentage of individuals as piscivores	6	5	
Fish Abundance and Condition	10. Number of individuals in sample	507	5	
	11. Percentage of individuals as hybrids	0	5	
	12. Percentage of individuals with disease/anomalies	0.01	5	
Aquatic Life Use: HIGH		Total Points:	48	

**Quantitative Biological Scoring for Evaluating Aquatic Life Use Subcategories Based on Fish
Statewide Criteria**

Stream: Cypress		Date: 9/23/02	Location: 12673	County: Hays
Category	Metric	Value	Score	
Species Richness and Composition	1. Total number of fish species	15	5	
	2. Number of darter species	1	3	
	3. Number of sunfish species (exc. bass)	6	5	
	4. Number of sucker speices	0	1	
	5. Number of intolerant species	1	3	
	6. Percentage of individuals as tolerants	15	3	
Trophic Composition	7. Percentage of individuals as omnivores	0.01	5	
	8. Percentage of individuals as insectivores	88	5	
	9. Percentage of individuals as piscivores	3	3	
Fish Abundance and Condition	10. Number of individuals in sample	241	5	
	11. Percentage of individuals as hybrids	0	5	
	12. Percentage of individuals with disease/anomalies	0	5	
Aquatic Life Use: HIGH		Total Points:	48	

BIOTIC ASSESSMENT – FISH

Indices of Biotic Integrity – Regional Criteria



Quantitative Biological Scoring for Evaluating Aquatic Life Use Subcategories Based on Fish Regional Criteria

Stream:Cypress		Date:09/23/02	Location: 12677(Region 30)	County: Hays
Metric		Value	Score	
1. Total number of fish species		14	5	
2. Number of native cyprinid species		3	3	
3. Number of benthic invertivore species		2	5	
4. Number of sunfish species		6	5	
5. Number of intolerant species		1	3	
6. Percentage of individuals as tolerants (exc. <i>G. affinis</i>)		2.6	5	
7. Percentage of individuals as omnivores		0.01	5	
8. Percentage of individuals as insectivores		83	5	
9. Percentage of individuals as piscivores		6	3	
10. Number of individuals in sample		507		
a. number of ind/seine haul		62.7	5	
b. number of ind/min electrofishing		8.7	5	5*
11. Percentage of ind. as non-native species		0.2	5	
12. Percentage of individuals with disease/anomalies		0.2	5	
Aquatic Life Use: EXCEPTIONAL			Total Points:	54

*Average of 10a and 10b

Drainage area upstream of Station 12677 = 80 sq. km.

Quantitative Biological Scoring for Evaluating Aquatic Life Use Subcategories Based on Fish Regional Criteria

Stream:Cypress		Date:09/23/02	Location: 12673 (Region30)	County: Hays
Metric	Value	Score		
1. Total number of fish species	15	5		
2. Number of native cyprinid species	2	1		
3. Number of benthic invertivore species	0	1		
4. Number of sunfish species	6	5		
5. Number of intolerant species	1	3		
6. Percentage of individuals as tolerants (exc. G. affinis)	15.35	5		
7. Percentage of individuals as omnivores	0.01	5		
8. Percentage of individuals as insectivores	88	5		
9. Percentage of individuals as piscivores	3	1		
10. Number of individuals in sample	241	-		
a. number of ind/seine haul	18.83	1		
b. number of ind/min electrofishing	8.53	5		
11. Percentage of ind. as non-native species	5.39	1		
12. Percentage of individuals with disease/anomalies	0	5		
Aquatic Life Use: INTERMEDIATE	Total Points:	40		

3*

*Average of 10a and 10b

Drainage area upstream of Station 12673 = 99 sq. km.

BIOTIC ASSESSMENT – BENTHIC MACROINVERTEBRATES

Species Lists and Preliminary Data Manipulation



Benthic Macroinvertebrates - Kick Sample (Qualitative)

Stream	Date	ID	Taxa	N=	Func.Gp.	Tolerance	HBI
Cypress	9/23/02	12677	Odonata-Coenagrionidae- <i>Argia</i>	7	P	6	0.35
Func.Gp	%		Odonata-Aeshnidae- <i>Basiaeschna</i>	1	P	2	0.0166667
P	28.36022		Ephemeroptera-Leptophlebiidae- <i>Farrodes</i>	1	CG/SCR	2	0.0166667
SCR	61.29032		Ephemeroptera-Heptageniidae- <i>Stenonema</i>	1	SCR/CG	4	0.0333333
CG	8.602151		Hemiptera-Naucoridae- <i>Ambryus</i>	1	P	-	-
FC	1.747312		Hemiptera-Naucoridae- <i>Cryphocricos</i>	1	P	-	-
SHR	0		Hemiptera-Veliidae- <i>Rhagovelia</i>	2	P	-	-
	100		Trichoptera-Polycentropidae- <i>Polycentropus</i>	3	FC/P	3	0.075
			Coleoptera-Psephenidae- <i>Psephenus</i>	52	SCR	4	1.7333333
			Diptera-Chironomidae	2	P/CG/FC	6	0.1
			Trichladia (<i>Dugesia</i>)	21	P	7.5	1.3125
			Gastropoda (Limnophila)-Pleuroceridae- <i>Elimia</i>	23	SCR	2.5	0.4791667
			Amphipoda-Hyalloidea- <i>Hyalloidea</i> (CG-8)	8	CG	8	0.5333333
			Decapoda-Cambaridae	1	CG	5	0.0416667
Total				124	120		4.6916667
Intolerant/Tolerant				2.16			

P-Predator
 SCR-Scraper
 CG-Collector/Gatherer
 FC-Filtering Collector
 SHR-Shredder

HBI-Hilsenhoff Biotic Index=
 sum(nt/N)
 n=#individuals of a particular taxa
 t=tolerance value of that taxa
 N=total # of organisms in sample

Stream	Date	ID	Taxa	N=	Func.Gp.	Tolerance	HBI
Cypress	9/23/02	12673	Odonata-Coenagrionidae- <i>Argia</i>	3	P	6	0.3103448
			Odonata-Libellulidae- <i>Brechmorhoga</i>	1	P	6	0.1034483
			Odonata-Gomphidae- <i>Erpetogomphus</i>	1	P	1	0.0172414
Func.Gp	%		Ephemeroptera-Tricorythidae- <i>Tricorythodes</i>	1	CG	5	0.0862069
P	22.38095		Ephemeroptera-Leptophlebiidae- <i>Thraulodes</i>	1	CG/SCR	2	0.0344828
SCR	10.71429		Ephemeroptera-Leptophlebiidae- <i>Neocorerpes</i>	2	CG/SCR	2	0.0689655
CG	20.2381		Ephemeroptera-Heptageniidae- <i>Stenonema</i>	2	SCR/CG	4	0.137931
FC	42.38095		Ephemeroptera-Baetidae- <i>Baetis</i>	10	SCR/CG	4	0.6896552
SHR	4.285714		Hemiptera-Veliidae- <i>Rhagovelia</i>	9	P	-	-
	100		Trichoptera-Hydropsychidae- <i>Cheumatopsyche</i>	1	FC	6	0.1034483
			Trichoptera-Philopotamidae- <i>Chimarra</i>	22	FC	3	1.137931
			Coleoptera-Lutrochidae (Limnichidae)- <i>Lutrochus</i> (L)	2	CG	-	-
			Coleoptera-Staphylinidae- <i>Bledius</i> (A)	1	P	-	-
			Diptera-Chironomidae	2	P/CG/FC	6	0.2068966
			Diptera-Simuliidae- <i>Simulium</i>	1	FC	4	0.0689655
			Diptera-Stratiomyidae- <i>Odontomyia</i>	1	-	-	-
			Diptera-Atherceridae- <i>Suragina</i>	5	-	-	-
			Gastropoda (Limnophila)-Planorbidae- <i>Biomphalaria</i>	1	-	-	-
			Bivalvia (Heterodonta)-Corbiculidae- <i>Corbicula</i>	5	FC	3	0.2586207
			Amphipoda-Hyalloidea- <i>Hyalloidea</i> (CG-8)	6	CG/SHR	8	0.8275862
Total				70	58		4.0517241
Intolerant/Tolerant				3.46			

BIOTIC ASSESSMENT – BENTHIC MACROINVERTEBRATES

Rapid Bioassessment Protocol



Stream: Cypress Date: 9/23/02 Location: 12677		County: Hays	
Metric	Value	Score	
1. Taxa Richness	14	2	
2. EPT Taxa Abundance	3	1	
3. Biotic Index (HBI)	4.69	2	
4. % Chironomidae	1.612903226	4	
5. % Dominant Taxon	41.93548387	1	
6. % Dominant FFG	28.36016129	4	
7. % Predators	28.36016129	2	
8. Ratio of Intolerant:Tolerant Taxa	2.16	2	
9. % of Total Trichoptera as Hydropsychidae	0	4	
10. # of Non-insect Taxa	4	3	
11. % Collector-Gatherers	8.602153226	4	
12. % of Total Number as Elmidae	0	1	
Aquatic Life Use: HIGH	Total Score:	30	

Stream: Cypress Date: 9/23/02 Location: 12673		County: Hays	
Metric	Value	Score	
1. Taxa Richness	20	3	
2. EPT Taxa Abundance	7	3	
3. Biotic Index (HBI)	4.05	3	
4. % Chironomidae	2.857142857	4	
5. % Dominant Taxon	31.42857143	2	
6. % Dominant FFG	42.38095714	3	
7. % Predators	22.38095286	3	
8. Ratio of Intolerant:Tolerant Taxa	3.46	3	
9. % of Total Trichoptera as Hydropsychidae	4.347826087	4	
10. # of Non-insect Taxa	3	2	
11. % Collector-Gatherers	20.23809571	3	
12. % of Total Number as Elmidae	0	1	
Aquatic Life Use: HIGH	Total Score:	34	

HABITAT ASSESSMENT

Part I – Stream Physical Characteristics Worksheet



Table B-12. Part 1. Stream Physical Characteristics Worksheet

Part I - Stream Physical Characteristics Worksheet

Observers: _____ Date: ___ Time: ___ Weather conditions: _____

Stream: _____ Location of site: _____ Length of stream reach: _____

Stream Segment No.: ___ Observed Stream Uses: _____ Aesthetics (circle one): (1) wilderness (2) natural (3) common (4) offensive

Stream Type (Circle One): perennial or intermittent w/ perennial pools Stream Bends: No. Well Defined; No. Moderately Defined; No. Poorly Defined

Channel Obstructions/Modifications: _____ No. of Riffles: ___ Channel Flow Status (circle one): high moderate low no flow

Riparian Vegetation (%):

Left Bank: Trees_ Shrubs_ Grasses, Forbs_ Cult. Fields_ Other_

Right Bank: Trees_ Shrubs_ Grasses, Forbs_ Cult. Fields_ Other_

Location of Transect	Stream Width (m)	Left Bank Slope (°)	Left Bank Erosion Potential (%)	Stream Depths (m) at Points Across Transect										Right Bank Slope (°)	Right Bank Erosion Potential (%)	Tree Canopy (%)	
				Thalweg Depth:													
	Habitat Type (Circle One) Riffle Run Glide Pool		Dominant Substrate Type			Dominant Types Riparian Vegetation: Left Bank: Right Bank:						% Gravel or Larger					
	Algae or Macrophytes (Circle One) Abundant Common Rare Absent		Width of Natural Buffer Vegetation (m) LB: RB:			Instream Cover Types:						% Instream Cover					

Location of Transect	Stream Width (m)	Left Bank Slope (°)	Left Bank Erosion Potential (%)	Stream Depths (m) at Points Across Transect										Right Bank Slope (°)	Right Bank Erosion Potential (%)	Tree Canopy (%)	
				Thalweg Depth:													
	Habitat Type (Circle One) Riffle Run Glide Pool		Dominant Substrate Type			Dominant Types Riparian Vegetation: Left Bank: Right Bank:						% Gravel or Larger					
	Algae or Macrophytes (Circle One) Abundant Common Rare Absent		Width of Natural Buffer Vegetation (m) LB: RB:			Instream Cover Types:						% Instream Cover					

Location of Transect	Stream Width (m)	Left Bank Slope (°)	Left Bank Erosion Potential (%)	Stream Depths (m) at Points Across Transect										Right Bank Slope (°)	Right Bank Erosion Potential (%)	Tree Canopy (%)
				Thalweg Depth:												
	Habitat Type (Circle One) Riffle Run Glide Pool		Dominant Substrate Type				Dominant Types Riparian Vegetation: Left Bank: Right Bank:						% Gravel or Larger			
	Algae or Macrophytes (Circle One) Abundant Common Rare Absent		Width of Natural Buffer Vegetation (m) LB: RB:				Instream Cover Types:						% Instream Cover			

Location of Transect	Stream Width (m)	Left Bank Slope (°)	Left Bank Erosion Potential (%)	Stream Depths (m) at Points Across Transect										Right Bank Slope (°)	Right Bank Erosion Potential (%)	Tree Canopy (%)
				Thalweg Depth:												
	Habitat Type (Circle One) Riffle Run Glide Pool		Dominant Substrate Type				Dominant Types Riparian Vegetation: Left Bank: Right Bank:						% Gravel or Larger			
	Algae or Macrophytes (Circle One) Abundant Common Rare Absent		Width of Natural Buffer Vegetation (m) LB: RB:				Instream Cover Types:						% Instream Cover			

Location of Transect	Stream Width (m)	Left Bank Slope (°)	Left Bank Erosion Potential (%)	Stream Depths (m) at Points Across Transect										Right Bank Slope (°)	Right Bank Erosion Potential (%)	Tree Canopy (%)
				Thalweg Depth:												
	Habitat Type (Circle One) Riffle Run Glide Pool		Dominant Substrate Type				Dominant Types Riparian Vegetation: Left Bank: Right Bank:						% Gravel or Larger			
	Algae or Macrophytes (Circle One) Abundant Common Rare Absent		Width of Natural Buffer Vegetation (m) LB: RB:				Instream Cover Types:						% Instream Cover			

Location of Transect	Stream Width (m)	Left Bank Slope (°)	Left Bank Erosion Potential (%)	Stream Depths (m) at Points Across Transect										Right Bank Slope (°)	Right Bank Erosion Potential (%)	Tree Canopy (%)
				Thalweg Depth:												
	Habitat Type (Circle One) Riffle Run Glide Pool		Dominant Substrate Type				Dominant Types Riparian Vegetation: Left Bank: Right Bank:						% Gravel or Larger			
	Algae or Macrophytes (Circle One) Abundant Common Rare Absent		Width of Natural Buffer Vegetation (m) LB: RB:				Instream Cover Types:						% Instream Cover			

Part II 11/14

Table B-12. Part 1. Stream Physical Characteristics Worksheet

Part I - Stream Physical Characteristics Worksheet

SW, PG, SE Date: 9/23/02 16:00

Observers: _____ Time: _____ Weather conditions: Phly cloudy 85°

Stream: Agassiz Location of site: 10m from left bank Length of stream reach: 320m

Stream Segment No.: _____ Observed Stream Uses: Lee Aesthetics (circle one): (1) wilderness (2) natural (3) common (4) offensive

Stream Type (Circle One): perennial or intermittent w/ perennial pools Stream Bands: No. Well Defined: _____ No. Moderately Defined: _____ No. Poorly Defined: _____

Channel Obstructions/Modifications: Debris No. of Riffles: 2 Channel Flow Status (circle one): high/moderate low no flow

Riparian Vegetation (%):
Left Bank: Trees 5 Shrubs 2 Grasses, Forbs 20 Cult. Fields 2 Other 15
Right Bank: Trees 20 Shrubs 4 Grasses, Forbs 20 Cult. Fields 2 Other 15

Location of Transect	Stream Width (m)	Left Bank Slope (°)	Left Bank Erosion Potential (%)	Dominant Substrate Type	Width of Natural Buffer (m) LR: 0 RB: 5m	Stream Depths (m) at Points Across Transect										Right Bank Slope (°)	Right Bank Erosion Potential (%)	Tree Canopy (%)	
						Timber Depth:	.04 0 0 .02 .04 .19 .19 .09 .07 .13 .14												
#5 40m above confluence with Blue River	24.0	90	5	Bedrock		.19										40	25	5	
Habitat Type (Circle One): Grass Run Grass Pool	Algae or Macrophytes (Circle One): Abundant Common Rare Absent		Dominant Types Riparian Vegetation: Left Bank: <u>agassiz, sycamore, pecan</u> Right Bank: <u>grass</u>		Instream Cover Types: <u>barberry veg, roots, gravel</u>												% Gravel or Larger		
																25		15	

Location of Transect	Stream Width (m)	Left Bank Slope (°)	Left Bank Erosion Potential (%)	Dominant Substrate Type	Width of Natural Buffer (m) LR: 0 RB: 10	Stream Depths (m) at Points Across Transect										Right Bank Slope (°)	Right Bank Erosion Potential (%)	Tree Canopy (%)	
						Timber Depth:	.48												
#4 115 m above confluence with Blue River	21m	60°	30	Bedrock		.48										20	35	12	
Habitat Type (Circle One): Riffle Run Grass Pool	Algae or Macrophytes (Circle One): Abundant Common Rare Absent		Dominant Types Riparian Vegetation: Left Bank: <u>agassiz, sycamore, pecan</u> Right Bank: <u>cedar, pecan</u>		Instream Cover Types: <u>both overhanging veg, cobble gravel</u>												% Gravel or Larger		
																40		20	

WARS

10001

52/0

Location of Transect		Stream Width (m)		Left Bank Slope (%)	Left Bank Erosion Potential (%)	Stream Depths (m) at Points Across Transect										Right Bank Slope (%)	Right Bank Erosion Potential (%)	Tree Canopy (%)
#3		20.5		18	40	Tranweg Depth: .27 .19 .27 .22 .22 .19 .19 .12 .26 .10 .08										155	12	15
Habitat Type (Circle One) Riffle Run Grille Pool Pools		Algae or Macrophytes (Circle One) Abundant Rare Absent		Dominant Substrate Type Bedrock		Width of Natural Buffer (m) LB: 0 RB: 15		Instream Cover Types: Undercut bank, roots		Dominant Types Riparian Vegetation: Left Bank: <i>Cyperus sp.</i> Right Bank: <i>Cyperus sp.</i>		% Gravel or Larger 0		% Instream Cover 2				

Location of Transect		Stream Width (m)		Left Bank Slope (%)	Left Bank Erosion Potential (%)	Stream Depths (m) at Points Across Transect										Right Bank Slope (%)	Right Bank Erosion Potential (%)	Tree Canopy (%)
#2		8m		30	20	Tranweg Depth: .21 .02 .0 .03 .20 .19 .12 .11 .17 .21 .0 .05										10	15	15
Habitat Type (Circle One) Riffle Run Grille Pool		Algae or Macrophytes (Circle One) Abundant Rare Absent		Dominant Substrate Type Bedrock		Width of Natural Buffer (m) LB: 0 RB: 5		Instream Cover Types: rocks, cobbles, overhanging		Dominant Types Riparian Vegetation: Left Bank: <i>Cyperus sp.</i> Right Bank: <i>Cyperus sp.</i>		% Gravel or Larger 10		% Instream Cover 20				

Location of Transect		Stream Width (m)		Left Bank Slope (%)	Left Bank Erosion Potential (%)	Stream Depths (m) at Points Across Transect										Right Bank Slope (%)	Right Bank Erosion Potential (%)	Tree Canopy (%)
#1		19.0		55	70	Tranweg Depth: 1.16 .33 .53 .33 .39 .46 .57 .91 1.14 .76 .58 .12										90	0	8
5m upstream of dam		Habitat Type (Circle One) Riffle Run Grille Pool		Dominant Substrate Type Bedrock		Width of Natural Buffer (m) LB: 0 RB: 0		Instream Cover Types: Gravel on riparian		Dominant Types Riparian Vegetation: Left Bank: <i>Salix sp.</i> Right Bank: <i>Cyperus sp.</i>		% Gravel or Larger 50		% Instream Cover 25				

Location of Transect		Stream Width (m)		Left Bank Slope (%)	Left Bank Erosion Potential (%)	Stream Depths (m) at Points Across Transect										Right Bank Slope (%)	Right Bank Erosion Potential (%)	Tree Canopy (%)
						Tranweg Depth:												
Habitat Type (Circle One) Riffle Run Grille Pool		Algae or Macrophytes (Circle One) Abundant Rare Absent		Dominant Substrate Type		Width of Natural Buffer (m) LB: RB:		Instream Cover Types:		Dominant Types Riparian Vegetation: Left Bank: Right Bank:		% Gravel or Larger		% Instream Cover				

HABITAT ASSESSMENT

Part II – Summary of Physical Characteristics of Water Body



Part II - Summary of Physical Characteristics of Water Body

Stream name	Cypress 12677
Date of assessment	9/23/2002
Stream bed slope over evaluated reach	0.0051
Approximate drainage area above transect furthest downstream	80km ²
Stream order	3
Length of stream evaluated	300m
Number of lateral transects made	5
Average stream width	14.38m
Average stream depth	0.91m
Instantaneous flow	13.72 ft ³ /sec
Indicate flow measurement method	Current Meter
Channel flow status	High
Maximum pool width	14m
Maximum pool depth	2.48m
Total number of stream bends	1
Number of well defined bends	0
Number of moderately defined bends	0
Number of poorly defined bends	1
Total number of riffles	1
Dominant substrate type	Gravel
Average percent of substrate gravel sized or larger	85%
Average percent instream cover	60%
Number of stream cover types	8
Average percent stream bank erosion potential	65.50%
Average stream bank slope	84°
Average width of vegetative buffer	10m
Average riparian vegetation percent composition by:	
Trees	16%
Shrubs	1%
Grasses/Forbes	72%
Cultivated Fields	-
Other	11%
Average percent tree canopy coverage	73%
Overall aesthetic appraisal of stream	Natural

Part II - Summary of Physical Characteristics of Water Body

Stream name	Cypress 12673
Date of assessment	9/23/2002
Stream bed slope over evaluated reach	0.0081
Approximate drainage area above transect furthest downstream	99km ²
Stream order	3
Length of stream evaluated	300m
Number of lateral transects made	5
Average stream width	18.5m
Average stream depth	0.25m
Instantaneous flow	17.09 ft ³ /sec
Indicate flow measurement method	Current Meter
Channel flow status	High
Maximum pool width	19m
Maximum pool depth	>1m
Total number of stream bends	1
Number of well defined bends	0
Number of moderately defined bends	1
Number of poorly defined bends	0
Total number of riffles	8
Dominant substrate type	Bedrock
Average percent of substrate gravel sized or larger	23%
Average percent instream cover	18%
Number of stream cover types	6
Average percent stream bank erosion potential	18%
Average stream bank slope	56°
Average width of vegetative buffer	0m
Average riparian vegetation percent composition by:	
Trees	12.50%
Shrubs	2%
Grasses/Forbes	55%
Cultivated Fields	
Other	30.50%
Average percent tree canopy coverage	62%
Overall aesthetic appraisal of stream	Common

HABITAT ASSESSMENT

Part III – Habitat Quality Indices



Part III - Habitat Quality Index

Habitat Parameter	Scoring Category			Location: 12677	Date: 9/23/02
Available Instream Cover	Abundant >50% of substrate favorable for colonization and fish cover; good mix of several stable (not new fall or transient) cover types such as snags, cobble, undercut banks, macrophytes	Common 30-50% of substrate supports a stable habitat; adequate habitat for maintenance of populations; may be limited in the number of different habitat types	Rare 10-29.9% of substrate supports stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed	Absent <10% of substrate supports stable habitat; lack of habitat is obvious; substrate unstable or lacking	
Score: 4	4	3	2	1	
Bottom Substrate Stability	Stable >50% gravel or larger substrate, i.e., gravel, cobble, boulders; dominant substrate type is gravel or larger	Moderately Stable 30-50% gravel or larger substrate; dominant substrate type is mix of gravel with some finer sediments	Moderately Unstable 10-29.9% gravel or larger substrate; dominant substrate type is finer than gravel, but may still be in mix of sizes	Unstable <10% gravel or larger substrate; substrate is uniform sand, silt, clay, or bedrock	
Score: 4	4	3	2	1	
Number of Riffles To be counted, riffles must extend >50% the width of the channel and be at least as long as the channel width	Abundant ≥5 riffles	Common 2-4 riffles	Rare 1 riffle	Absent No riffles	
Score: 2	4	3	2	1	
Dimensions of Largest Pool	Large Pool covers more than 50% of the channel width; maximum depth is > 1m	Moderate Pool covers approximately 50% or slightly less than the channel width; maximum depth is 0.5-1 meter	Small Pool covers approximately 25% of the channel width; maximum depth is <0.5 meter	Absent No existing pools; only shallow auxiliary pockets	
Score: 3	3	2	1	0	
Channel Flow Status	High Water reaches the base of both the lower banks; <5% of channel substrate is exposed	Moderate Water fills <75% of the channel; or <25% of channel substrate is exposed	Low Water fills 25-75% of the available channel and/or riffle substrates are mostly exposed	No Flow Very little water in the channel and mostly present in standing pools; or stream is dry	
Score: 3	3	2	1	0	
Bank Stability	Stable Little evidence (<10%) of erosion bank failure; bank angles average <30°	Moderately Stable Some evidence (10-29.9%) of erosion or bank failure; small areas of erosion mostly healed over; bank angles average 30-39.9°	Moderately Unstable Evidence of erosion bank failure is common (30-50%); high potential of erosion during flooding; bank angles average 40-60°	Unstable Large and frequent evidence (>50%) of erosion or bank failure; raw areas frequent along steep banks; bank angles average >60°	
Score: 0	3	2	1	0	
Channel Sinuosity	High ≥2 well-defined bends with deep outside areas (cut banks) and shallow inside areas (point bars) are present	Moderate 1 well-defined bend OR ≥3 moderately-defined bends present	Low <3 moderately-defined bends OR only poorly-defined bends present	None Straight channel; may be channelized	
Score: 1	3	2	1	0	
Riparian Buffer Vegetation	Extensive Width of natural buffer is >20 meters	Wide Width of natural buffer is 10.1-20 meters	Moderate Width of natural buffer is 5-10 meters	Narrow Width of natural buffer is <5 meters	
Score: 1	3	2	1	0	
Aesthetics of Reach	Wilderness Outstanding natural beauty; usually wooded or ungrazed area; water clarity is usually exceptional	Natural Area Tree and/or native vegetation common; some development evident (from fields, pastures, dwellings); water clarity may be slightly turbid	Common Setting Not offensive; area is developed, but uncluttered such as in an urban park; water clarity may be turbid or discolored	Offensive Stream does not enhance the aesthetics of the area; cluttered; highly developed; may be a dumping area; water clarity is usually turbid or discolored	
Score: 2	3	2	1	0	
Total Score: 20	HIGH				

Part III - Habitat Quality Index

Habitat Parameter	Scoring Category		Location: 12673	Date: 9/23/02
Available Instream Cover	Abundant >50% of substrate favorable for colonization and fish cover; good mix of several stable (not new fall or transient) cover types such as snags, cobble, undercut banks, macrophytes	Common 30-50% of substrate supports a stable habitat; adequate habitat for maintenance of populations; may be limited in the number of different habitat types	Rare 10-29.9% of substrate supports stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed	Absent <10% of substrate supports stable habitat; lack of habitat is obvious; substrate unstable or lacking
Score: 2	4	3	2	1
Bottom Substrate Stability	Stable >50% gravel or larger substrate, i.e., gravel, cobble, boulders; dominant substrate type is gravel or larger	Moderately Stable 30-50% gravel or larger substrate; dominant substrate type is mix of gravel with some finer sediments	Moderately Unstable 10-29.9% gravel or larger substrate; dominant substrate type is finer than gravel, but may still be in mix of sizes	Unstable <10% gravel or larger substrate; substrate is uniform sand, silt, clay, or bedrock
Score: 2	4	3	2	1
Number of Riffles To be counted, riffles must extend >50% the width of the channel and be at least as long as the channel width	Abundant ≥5 riffles	Common 2-4 riffles	Rare 1 riffle	Absent No riffles
Score: 4	4	3	2	1
Dimensions of Largest Pool	Large Pool covers more than 50% of the channel width; maximum depth is > 1m	Moderate Pool covers approximately 50% or slightly less than the channel width; maximum depth is 0.5-1 meter	Small Pool covers approximately 25% of the channel width; maximum depth is <0.5 meter	Absent No existing pools; only shallow auxiliary pockets
Score: 3	3	2	1	0
Channel Flow Status	High Water reaches the base of both the lower banks; <5% of channel substrate is exposed	Moderate Water fills <75% of the channel; or <25% of channel substrate is exposed	Low Water fills 25-75% of the available channel and/or riffle substrates are mostly exposed	No Flow Very little water in the channel and mostly present in standing pools; or stream is dry
Score: 3	3	2	1	0
Bank Stability	Stable Little evidence (<10%) of erosion bank failure; bank angles average <30°	Moderately Stable Some evidence (10-29.9%) of erosion or bank failure; small areas of erosion mostly healed over; bank angles average 30-39.9°	Moderately Unstable Evidence of erosion bank failure is common (30-50%); high potential of erosion during flooding; bank angles average 40-60°	Unstable Large and frequent evidence (>50%) of erosion or bank failure; raw areas frequent along steep banks; bank angles average >60°
Score: 1	3	2	1	0
Channel Sinuosity	High ≥2 well-defined bends with deep outside areas (cut banks) and shallow inside areas (point bars) are present	Moderate 1 well-defined bend OR ≥3 moderately-defined bends present	Low <3 moderately-defined bends OR only poorly-defined bends present	None Straight channel; may be channelized
Score: 1	3	2	1	0
Riparian Buffer Vegetation	Extensive Width of natural buffer is >20 meters	Wide Width of natural buffer is 10.1-20 meters	Moderate Width of natural buffer is 5-10 meters	Narrow Width of natural buffer is <5 meters
Score: 0	3	2	1	0
Aesthetics of Reach	Wilderness Outstanding natural beauty; usually wooded or unpastured area; water clarity is usually exceptional	Natural Area Tree and/or native vegetation common; some development evident (from fields, pastures, dwellings); water clarity may be slightly turbid	Common Setting Not offensive; area is developed, but uncluttered such as in an urban park; water clarity may be turbid or discolored	Offensive Stream does not enhance the aesthetics of the area; cluttered; highly developed; may be a dumping area; water clarity is usually turbid or discolored
Score: 1	3	2	1	0
Total Score: 18	INTERMEDIATE			