Appendix C

Texas Commission on Environmental Quality
Surface Water Quality Monitoring Program

Metrics and Scoring for Kick Samples
Rapid Bioassessment Protocol
Benthic Macroinvertebrates Worksheet

Stream Name:				
Date:		**Collectors:**		
Location:				
County:		**Ecoregion Number:**		
Type of Assessment:	UAA	ALA	ALM	RWA
Metric		**Value**		**Score**
1. Taxa Richness				
2. EPT Taxa Abundance				
3. Biotic Index (HBI)				
4. % Chironomidae				
5. % Dominant Taxon				
6. % Dominant FFG				
7. % Predators				
8. Ratio of Intolerant:Tolerant Taxa				
9. % of Total Trichoptera as Hydropsychidae				
10. # of Non-Insect Taxa				
11. % Collector-Gatherers				
12. % of Total Number as Elmidae				
Aquatic Life Use Point Score Ranges:		Exceptional: High: Intermediate: Limited:		> 36 29-36 22-28 < 22
Total Score:				
Aquatic Life Use:				

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

Ecoregions 33 & 35

Stream Name:		**Location:**		**Date:**	
Collector:			**County:**		
No. seine hauls:		**Electrofishing effort (min):**			
Metric Category	**Intermediate Totals for Metrics**		**Metric Name**	**Raw Value**	**IBI Score**
	Drainage basin size (km^2)				
Species richness and composition	Number of fish species		Number of fish species		
	Number of native Cyprinid species		Number of native Cyprinid species		
	Number of benthic invertivore species		Number of benthic invertivore species		
	Number of sunfish species		Number of sunfish species		
	Number of intolerant species		Number of intolerant species		
	Number of individuals as tolerants[a]		% of individuals as tolerant species[a]		
Trophic composition	Number of individuals as omnivores		% of individuals as omnivores		
	Number of individuals as invertivores		% of individuals as invertivores		
	Number of individuals as piscivores		% of individuals as piscivores		
Fish abundance and condition	Number of individuals (seine)		Number of individuals in sample		
	Number of individuals (electrofishing)		Number of individuals/seine haul		
	Number of individuals in sample		Number of individuals/min electrofishing		
	# of individuals as non-native species		% of individuals as non-native species		
	# of individuals with disease/anomaly		% of individuals with disease/anomaly		
			Index of biotic integrity numeric score:		
			Aquatic life use:		
This data should be incorporated with water quality, habitat, and other available biological data to assign an overall stream score.					

[a] Excluding western mosquitofish

Table 9. Index of Biotic Integrity Scoring and Evaluation Statewide Criteria

Category	Metric	Scoring 5	3	1
Species richness and composition	1. Total number of fish species	*	*	*
	2. Number of darter species	≥ 3	1-2	0
	3. Number of sunfish species (excluding bass)	≥ 2	1	0
	4. Number of sucker species	≥ 2	1	0
	5. Number of intolerant species	≥ 3	1-2	0
	6. Percentage of individuals as tolerants	< 5%	5-20%	> 20%
Trophic composition	7. Percentage of individuals as omnivores	< 20%	20-45%	> 45%
	8. Percentage of individuals as insectivores	> 80%	> 40-80%	≤ 40%
	9. Percentage of individuals as piscivores	> 5%	1-5%	< 1%
Fish abundance and condition	10. Number of individuals in sample	> 200	> 50-200	≤ 50-0
	11. Percentage of individuals as hybrids	0%	> 0-1%	> 1%
	12. Percentage of individuals with disease or other anomaly	≤ 2%	> 2-5%	> 5%

*First-second order streams: ≥ 7(5), 4-6(3), ≤ 3(1)
Third-fourth order streams: ≥ 10(5), 5-9(3), ≤ 4(1)
Fifth-sixth order streams: ≥ 16(5), 8-15(3), ≤ 7(1)
Seventh-eighth order streams: ≥ 22(5), 11-21(3), ≤ 10(1)

Total Score for Aquatic Life Use Subcategories

58 - 60	**Exceptional**
48 - 52	**High**
40 - 44	**Intermediate**
< 34	**Limited**

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Habitat Assessment Worksheet – Part I of III

Worksheet #	**Part I - Stream Physical Characteristics Worksheet**		**Page 1 of __**
Observers:	Date:	Time:	
Weather conditions:			
Stream:	Stream segment no.		
Location of site:	Length of reach:		
Observed stream uses:			
Stream type (circle one): **perennial** or **intermittent w/ perennial pools**			
Stream bends:	No. well defined	No. moderately defined	No. poorly defined
Aesthetics (circle one): **(1) wilderness** **(2) natural** **(3) common** **(4) offensive**			
Channel obstructions or modifications:	No. of riffles		
Channel flow status (circle one): **high** **moderate** **low** **no flow**			

Riparian vegetation (%):	**Left Bank**	**Right Bank**	**Notes**
Trees			
Shrubs			
Grasses or forbs			
Cultivated fields			
Other			

Site map:

Location of transect	Stream width (m)	Left bank slope (°)	Left bank erosion potential (%)	Stream Depths (m) at Points Across Transect Thalweg Depth:	Right bank slope (°)	Right bank erosion potential (%)	Tree canopy (%)	
							Total	
	Habitat type (circle one) **Riffle** **Run** **Glide** **Pool**	Dominant substrate type		Dominant types riparian vegetation: Left bank: Right bank:		% Gravel or larger	CL	
							CR	
Macrophytes (circle one) **Abundant** **Common** **Rare** **Absent**	Algae (circle one) **Abundant** **Common** **Rare** **Absent**	Width of natural buffer		Instream cover types:		% Instream cover	LB	
		LB:	RB:				RB	

Location of transect	Stream width (m)	Left bank slope (°)	Left bank erosion potential (%)	Stream depths (m) at points across transect Thalweg depth:	Right bank slope (°)	Right bank erosion potential (%)	Tree canopy (%)	
							Total	
	Habitat type (Circle One) **Riffle** **Run** **Glide** **Pool**	Dominant substrate type		Dominant types riparian vegetation: Left bank: Right bank:		% Gravel or larger	CL	
							CR	
Macrophytes (circle one) **Abundant** **Common** **Rare** **Absent**	Algae (circle one) **Abundant** **Common** **Rare** **Absent**	Width of natural buffer		Instream cover types:		% Instream cover	LB	
		LB:	RB:				RB	

Location of transect	Stream width (m)	Left bank slope (°)	Left bank erosion potential (%)	Stream depths (m) at points across transect Thalweg depth:	Right bank slope (°)	Right bank erosion potential (%)	Tree canopy (%)	
							Total	
	Habitat type (circle one) **Riffle** **Run** **Glide** **Pool**	Dominant substrate type		Dominant types riparian vegetation: Left bank: Right bank:		% Gravel or larger	CL	
							CR	
Macrophytes (circle one) **Abundant** **Common** **Rare** **Absent**	Algae (circle one) **Abundant** **Common** **Rare** **Absent**	Width of natural buffer		Instream cover types:		% Instream cover	LB	
		LB:	RB:				RB	

Worksheet #

Part I - Stream Physical Characteristics Worksheet (continued)

Location of transect	Stream width (m)	Left bank slope (°)	Left bank erosion potential (%)	Stream Depths (m) at Points Across Transect Thalweg Depth:												Right bank slope (°)	Right bank erosion potential (%)	Tree canopy (%)	
																		Total	
	Habitat type (circle one) **Riffle Run** **Glide Pool**		Dominant substrate type				Dominant types riparian vegetation: Left bank: Right bank:										% Gravel or larger	CL CR	
Macrophytes (circle one) **Abundant Common** **Rare Absent**	Algae (circle one) **Abundant Common** **Rare Absent**		Width of natural buffer LB:	RB:	Instream cover types:												% Instream cover	LB RB	

Location of transect	Stream width (m)	Left bank slope (°)	Left bank erosion potential (%)	Stream depths (m) at points across transect Thalweg depth:												Right bank slope (°)	Right bank erosion potential (%)	Tree canopy (%)	
																		Total	
	Habitat type (Circle One) **Riffle Run** **Glide Pool**		Dominant substrate type				Dominant types riparian vegetation: Left bank: Right bank:										% Gravel or larger	CL CR	
Macrophytes (circle one) **Abundant Common** **Rare Absent**	Algae (circle one) **Abundant Common** **Rare Absent**		Width of natural buffer LB:	RB:	Instream cover types:												% Instream cover	LB RB	

Location of transect	Stream width (m)	Left bank slope (°)	Left bank erosion potential (%)	Stream depths (m) at points across transect Thalweg depth:												Right bank slope (°)	Right bank erosion potential (%)	Tree canopy (%)	
																		Total	
	Habitat type (circle one) **Riffle Run** **Glide Pool**		Dominant substrate type				Dominant types riparian vegetation: Left bank: Right bank:										% Gravel or larger	CL CR	
Macrophytes (circle one) **Abundant Common** **Rare Absent**	Algae (circle one) **Abundant Common** **Rare Absent**		Width of natural buffer LB:	RB:	Instream cover types:												% Instream cover	LB RB	

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Habitat Assessment Worksheet – Part II of III

Part II - Summary of Physical Characteristics of Water Body

Using information from all of the transects and measurements in Part I and other sources, report the following general characteristics or averages for the entire reach:

Stream Name		**Date**	

Physical Characteristics	**Value**
Stream bed slope over evaluated reach (from USGS map; elevation change in meters/reach length in meters)	
Approximate drainage area above the transect furthest downstream (from USGS or county highway map in km^2)	
Stream order	
Length of stream evaluated (in meters or kilometers)	
Number of lateral transects made	
Average stream width (in meters)	
Average stream depth (in meters)	
Instantaneous stream flow (in ft^3/sec)	
Indicate flow measurement method	
Channel flow status (high, moderate, low, or no flow)	
Maximum pool width (in meters)	
Maximum pool depth (in meters)	
Total number of stream bends	
Number of well defined bends	
Number of moderately defined bends	
Number of poorly defined bends	
Total number of riffles	
Dominant substrate type	
Average percent of substrate gravel sized or larger	
Average percent instream cover	
Number of stream cover types	
Average percent stream bank erosion potential	
Average stream bank slope (in degrees)	
Average width of natural buffer vegetation (in meters)	
Average riparian vegetation percent composition by: (total to equal 100%)	
Trees	
Shrubs	
Grasses and Forbes	
Cultivated fields	
Other	
Average percent tree canopy coverage	
Overall aesthetic appraisal of the stream	

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Habitat Assessment Worksheet – Part III of III

Part III - Habitat Quality Index

Habitat Parameter	Scoring Category			
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 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	3	2	1
Bottom Substrate Stability	**Stable** >50% gravel or larger substrate; 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 a mix of sizes	**Unstable** <10% gravel or larger substrate; substrate is uniform sand, silt, clay or bedrock
Score_____	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	3	2	1
Dimensions of Largest Pool	**Large** Pool covers more than 50% of the channel width; maximum depth is >1 meter	**Moderate** Pool covers approximately 50% or slightly less of 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_____	4	3	2	1
Channel Flow Status	**High** Water reaches the base of both 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	2	1	0

Part III - Habitat Quality Index (continued)

Habitat Parameter	Scoring Category			
Bank Stability	**Stable** Little evidence (<10%) of erosion or 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 or 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_____	3	2	1	0
Channel Sinuosity	**High** ≥ 2 well-defined bends with deep outside areas (cut banks) and shallow inside areas (point bars) 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_____	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_____	3	2	1	0
Aesthetics of Reach	**Wilderness** Outstanding natural beauty; usually wooded or unpastured area; water clarity is usually exceptional	**Natural Area** Trees and/or native vegetation are 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_____	3	2	1	0

Total Score_____

HABITAT QUALITY INDEX

26 - 31 **Exceptional**
20 - 25 **High**
14 - 19 **Intermediate**
≤ 13 **Limited**