



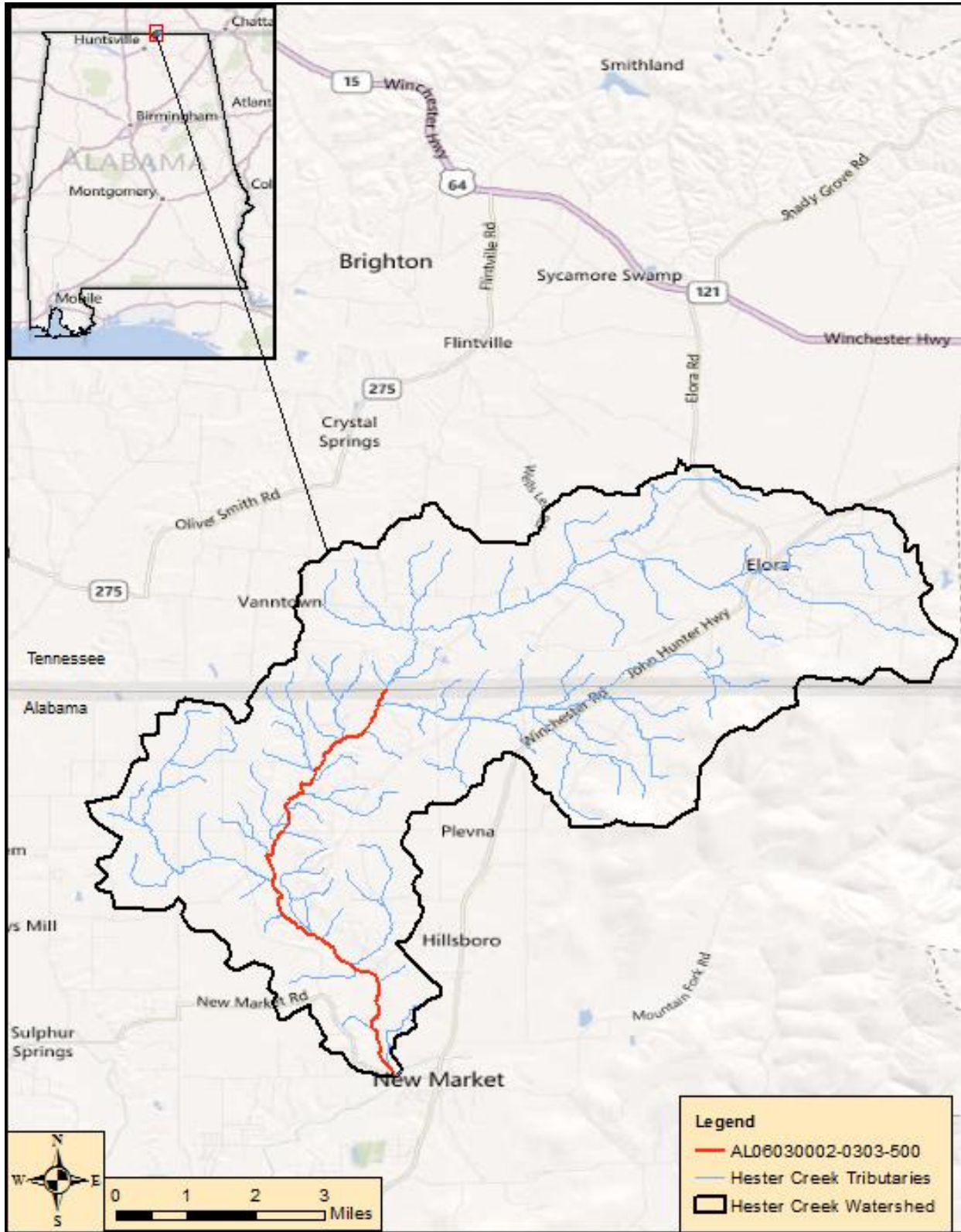
**Draft
Delisting Decision
For
Hester Creek**

Assessment Unit ID # AL06030002-0303-500

Nutrients

Alabama Department of Environmental Management
Water Quality Branch
Water Division
February 2014

Figure I: Hester Creek Watershed



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1.0 Executive Summary

Hester Creek is located in the Tennessee River Basin in the northeastern part of Alabama in Madison County. The 7.27 mile reach of Hester Creek, extending from Mountain Fork to the Alabama/Tennessee state line, was added to the State of Alabama's §303(d) list of impaired streams in 1998 for nutrients by the United States Environmental Protection Agency (USEPA). The source of the impairment is listed as pasture grazing. Hester Creek was subsequently listed on Alabama's §303(d) list of impaired streams for nutrients in 2000, 2002, 2004, 2006, 2008, 2010, and 2012.

Hester Creek has a designated use classification of Fish and Wildlife. The State of Alabama currently has no numeric criteria for nutrients in streams. However, the narrative criteria of "*Minimum Conditions Applicable to All State Waters*" applies to Hester Creek and states the following:

(a) *State waters shall be free from substances attributable to sewage, industrial wastes or other wastes that will settle to form bottom deposits which are unsightly, putrescent or interfere directly or indirectly with any classified water use.*

(b) *State waters shall be free from floating debris, oil, scum, and other floating materials attributable to sewage, industrial wastes or other wastes in amounts sufficient to be unsightly or interfere directly or indirectly with any classified water use.*

(c) *State waters shall be free from substances attributable to sewage, industrial wastes or other wastes in concentrations or combinations which are toxic or harmful to human, animal or aquatic life to the extent commensurate with the designated usage of such waters.*

Hester Creek was placed on the State of Alabama's 1998 §303(d) list of impaired streams based on fish IBI data collected by the Tennessee Valley Authority (TVA) in 1994 and 1995.

In 2009, ADEM Field Operations Division collected chemical, physical and biological data on Hester Creek at stations HESM-1, HESM-2, and HESM-3 in an effort to more fully evaluate existing conditions as related to the previous nutrient listing decision. These assessments did not indicate that Hester Creek was impaired for nutrients. Based on the 2009 sampling, nutrient concentrations and chlorophyll-*a* concentrations were relatively the same as, or well below, the ecoreference level concentrations. Between August 2, 2010 and August 5, 2010, diurnal dissolved oxygen (DO) data was collected at Hester Creek sampling stations HESM-1, HESM-2, and HESM-3. Diurnal dissolved oxygen data was also collected between August 13, 2010 and August 16, 2010 at Hester Creek stations HESM-2 and HESM-3. Dissolved Oxygen concentrations at all of these stations remained within normal levels during these sampling events ranging between 5.3 and 9.0 mg/l. Also, pH levels were normal ranging between 7 and 8 further providing evidence that Hester Creek is not impaired for nutrients. Bioassessment results indicated the macroinvertebrate community to be in "Fair" condition. The overall habitat quality was categorized as sub-optimal. A Fish IBI was also conducted on Hester Creek, and the Fish IBI for Hester Creek was rated as Fair.

Based on the assessment of all available water quality data obtained for Hester Creek, inclusive of physical, chemical, and biological data, ADEM concludes that no water quality impairment

from nutrients exists. Accordingly, ADEM will not proceed in developing a nutrient TMDL for this stream due to “more recent or accurate data” which, in doing so, provides sufficient justification for delisting a waterbody in conformance with Title 40 of the Code of Federal Regulations (CFR), Part 130.7(b)(6)(iv). The following sections of this report provide analysis of data and information related to ADEM’s delisting of Hester Creek for nutrients.

2.0 Basis for §303(d) Listing

Section 303(d) of the Clean Water Act (CWA), as amended by the Water Quality Act of 1987 and EPA’s Water Quality Planning and Management Regulations [(Title 40 of the Code of Federal Regulations (CFR), Part 130)] require states to identify waterbodies which are not meeting water quality criteria applicable to their designated use classifications. The identified waters are prioritized based on severity of pollution with respect to designated use classifications. Total maximum daily loads (TMDLs) for all pollutants causing violation of applicable water quality criteria are established for each identified water. Such loads are established at levels necessary to implement the applicable water quality criteria with seasonal variations and margins of safety. The TMDL process establishes the allowable loading of pollutants, or other quantifiable parameters for a waterbody, based on the relationship between pollution sources and in-stream water quality conditions, so that states can establish water-quality based controls to reduce pollution from both point and non-point sources and restore and maintain the quality of their water resources (USEPA, 1991).

Hester Creek was originally listed by the USEPA in 1998 and added to Alabama’s 1998 §303(d) list as being impaired for nutrients as a result of fish IBI data collected by TVA in 1994 and 1995. Hester Creek is a part of the Tennessee River Basin located in Northeast Alabama within Madison County and has a use classification of Fish and Wildlife (F&W).

3.0 Technical Basis for Delisting Decision

3.1 Water Quality Target Identification

The listing of Hester Creek as being impaired for nutrients was authorized under ADEM’s Water Quality Standards Program, which employs both numeric and narrative criteria to ensure adequate protection of designated uses for surface waters of the State. Numeric criteria typically have quantifiable endpoints for a given parameter, such as pH, dissolved oxygen, or a toxic pollutant, whereas narrative criteria are qualitative statements that establish a set of desired conditions for all State waters. These narrative criteria are more commonly referred to as “free from” criteria that enable states a regulatory avenue to address pollutants or problems that may be causing or contributing to a use impairment that otherwise cannot be evaluated against any numeric criteria. Typical pollutants that fall under this category are nutrients and siltation. Historically, in the absence of established numeric nutrient criteria, ADEM and/or EPA would use available data and information coupled with best professional judgment to determine overall use support for a given waterbody. Narrative criteria continue to serve as a regulatory basis for determining use support and making listing/delisting decisions of waters in regards to Alabama’s

303(d) List. ADEM's Narrative Criteria, as shown in ADEM's Administrative Code, Rule 335-6-10-.06, are as follows:

335-6-10-.06 **Minimum Conditions Applicable to All State Waters.** *The following minimum conditions are applicable to all State waters, at all places and at all times, regardless of their uses:*

(a) State waters shall be free from substances attributable to sewage, industrial wastes or other wastes that settle to form bottom deposits which are unsightly, putrescent or interfere directly or indirectly with any classified water use.

(b) State waters shall be free from floating debris, oil, scum, and other floating materials attributable to sewage, industrial wastes or other wastes in amounts sufficient to be unsightly or which interfere directly or indirectly with any classified water use.

(c) State waters shall be free from substances attributable to sewage, industrial wastes or other wastes in concentrations or combinations, which are toxic or harmful to human, animal or aquatic life to the extent commensurate with the designated usage of such waters.

ADEM is continuing its efforts to develop comprehensive numeric nutrient criteria for all surface waters throughout Alabama, including rivers/streams, lakes/reservoirs, wetlands, and coastal/estuarine waters. However, until numeric nutrient criteria or some form of quantitative interpretations of ADEM's narrative criteria are developed, the Department will continue to use all available data and information coupled with best professional judgment to make informed decisions regarding overall use support and when establishing numeric targets for TMDLs.

3.2 Methodology for Evaluating Nutrient Impacts

In determining appropriate or acceptable levels of nutrients necessary to support Hester Creek's designated use, ADEM elected to use a "reference condition" approach. This approach is based on the use of ambient water quality data from candidate reference streams located in characteristically similar types of watersheds known as ecoregions. ADEM considers the "reference condition" approach for determining appropriate nutrient levels to be reasonable, consistent with USEPA guidance, protective of designated uses, and scientifically defensible in assessing and evaluating nutrient influences or impacts.

Reference streams, also referred to as "reference reaches" or "ecoregional reference sites," are defined as relatively homogeneous areas of similar climate, land form, soil, natural vegetation, hydrology, and other ecologically relevant variables (USEPA, 2000b) which have remained comparatively undisturbed or minimally impacted by human activity over an extended period of time in relation to other waters of the State. While not necessarily pristine or completely undisturbed by humans, reference streams do represent desirable chemical, physical and biological conditions for a given ecoregion that can be used for evaluation purposes. The reference streams selected for a particular analysis depends primarily on the available number of reference streams and associated data within a particular ecoregion. Therefore, the total number

of reference sites selected and the aerial scale (i.e. Ecoregion Level III, Level IV) used to represent a reference condition will often vary on a case-by-case basis.

In developing and establishing reference conditions from best available data, frequency distributions are recommended by the *Nutrient Criteria Technical Guidance Manual for Rivers and Streams* (USEPA, 2000b) as the preferred method for setting nutrient criteria. ADEM selected to use the 90th percentile of the data distributions from the selected reference sites to be used to establish goals for Total Phosphorus (TP) and Total Nitrogen (TN) on an ecoregional basis. Median values were used to represent existing conditions of TP and TN within the impaired waterbody. The 90th percentile of the data distribution was considered an appropriate target, since it falls within an acceptable range of “least-impacted” conditions (i.e. upper quartile). If the TP and TN concentrations of the subject impaired stream are relatively the same or below reference condition levels, then the stream was considered not to be impaired for nutrients. If TP and TN concentrations within the impaired stream are shown to be above reference conditions, then other water quality data and information are used in the evaluation. The additional data and information that can be used includes, but is certainly not limited to, chlorophyll a (Chl-a) data, diurnal dissolved oxygen readings, algal biomass measurements (periphyton or suspended algae), habitat assessments, and macroinvertebrate and fish community indices.

3.3 Assessment of Ecoregion Reference Data

Based upon EPA recommended procedures outlined in the *Nutrient Criteria Technical Guidance Manual: Rivers and Streams* (USEPA, 2000b), data from selected reference sites have been compiled and analyzed for the entire State of Alabama. Through much peer review every effort was made to use the highest quality least-impacted reference reach data to accurately define background conditions. The reference reaches and their associated watersheds were established by ADEM using various methods to characterize their condition and determine if they were good candidates. Such methods include, but are not limited to, watershed surveys, landuse coverage, inventorying point and nonpoint sources, conducting field reconnaissance, and ultimately collecting chemical, physical and biological data to ensure their condition and verify the streams are of high quality and fully meet designated uses. The current list of values is included in a table referred to as “Alabama's 2010 Ecoregional Reference Guidelines.” This table of relevant ecoreference data can be found in Appendix 6.2, Table 6-9.

The Hester Creek watershed lies within two Level IV ecoregions (68c & 71g) as depicted in Figure 3-1 on the next page and has a drainage area of approximately 39.57 square miles. Due to the fact that the watershed covers two Level IV ecoregions, a weighted average will be calculated for each nutrient parameter (TP, TN, & Chl-a). ADEM does not currently have reference guideline values for these two Level IV ecoregions, therefore the Level III ecoregion reference values were used for the weighted average calculations. These calculations are shown in Table 3-2, Table 3-3, and Table 3-4.

Figure 3-1. Level IV Ecoregions within the Hester Creek Watershed

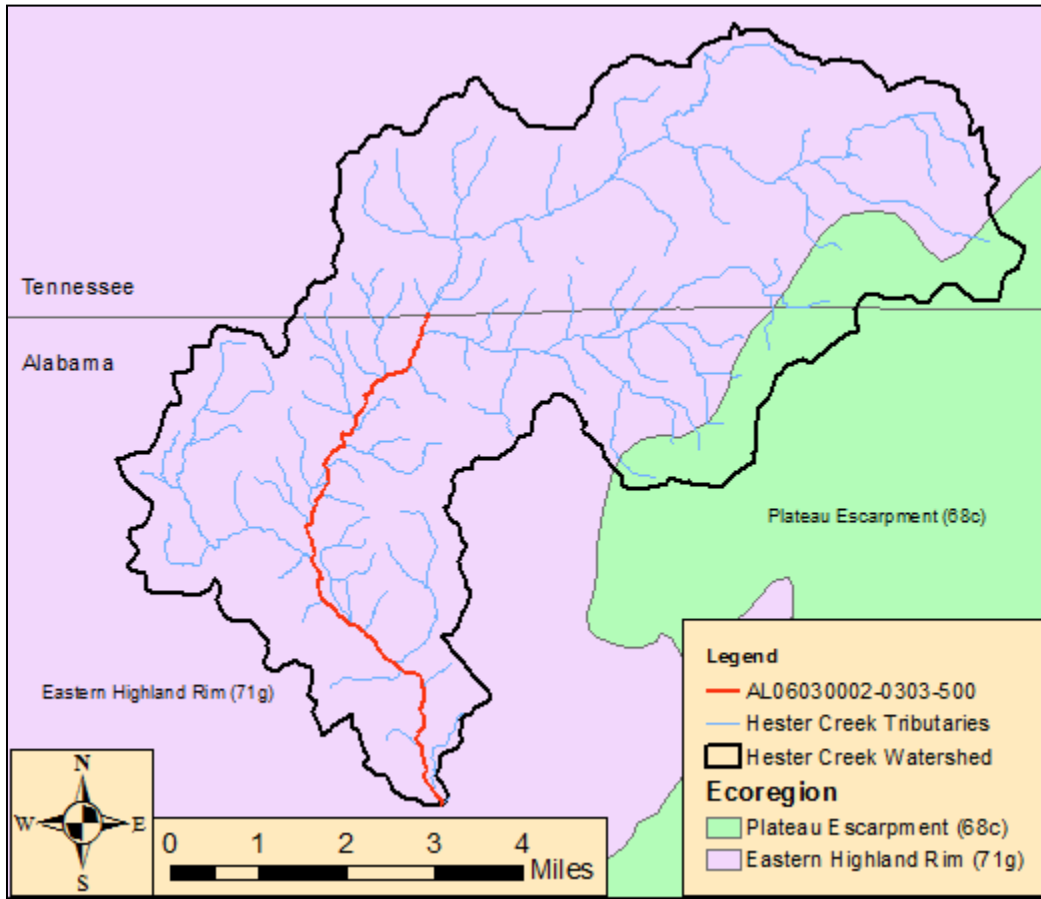


Table 3-1. Hester Creek Watershed Ecoregions

Ecoregion Name	Ecoregion	% of Watershed	Area (square miles)
Eastern Highland Rim	71g	89%	35.35
Plateau Escarpment	68c	11%	4.22
	Total	100%	39.57

Table 3-2. Summary of Weighted Average TP Values for Hester Creek Watershed

Ecoregion Name	Ecoregion	% of Watershed	90 th Percentile TP (mg/l)	Weighted Average (mg/l)
Eastern Highland Rim	71g	89%	0.0497	0.0442
Plateau Escarpment	68c	11%	0.0500	.0055
			Total weighted average	0.0497

Table 3-3. Summary of Weighted Average TN Values for Hester Creek Watershed

Ecoregion Name	Ecoregion	% of Watershed	90 th Percentile TN (mg/L)	Weighted Average (mg/l)
Eastern Highland Rim	71g	89%	1.5700	1.3973
Plateau Escarpment	68c	11%	1.4169	0.1559
			Total weighted average	1.5532

Table 3-4. Summary of Weighted Average Chl-a Values for Hester Creek Watershed

Ecoregion Name	Ecoregion	% of Watershed	90 th Percentile Chl-a (µg/L)	Weighted Average (mg/l)
Eastern Highland Rim	71g	89%	4.255	3.787
Plateau Escarpment	68c	11%	2.670	0.294
			Total weighted average	4.081

3.4 Data Availability and Analysis

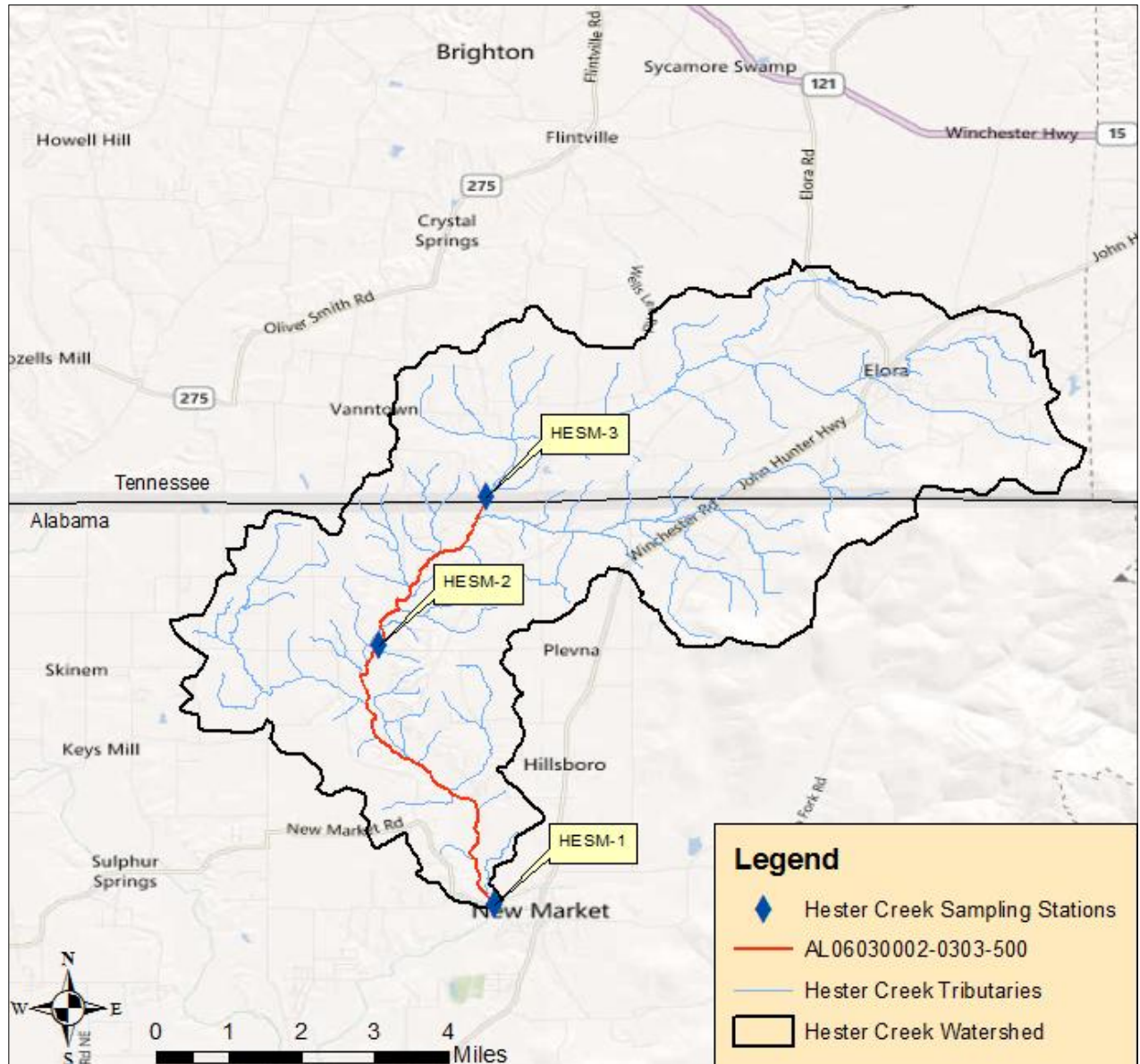
Hester Creek was placed on the State of Alabama’s 1998 §303(d) list of impaired streams based on fish IBI data collected by the TVA in 1994 and 1995.

In 2009, ADEM Field Operations Division collected chemical, physical and biological data on Hester Creek at stations HESM-1, HESM-2, and HESM-3 in an effort to more fully evaluate existing conditions as related to the previous nutrient listing decision. These assessments did not indicate that Hester Creek was impaired for nutrients. Nutrient concentrations and chlorophyll-*a* concentrations were relatively the same as, or well below, ecoreference levels.

Table 3-5. Location Descriptions of ADEM Sampling Stations

Station ID	Stream	Station Description	Lat Dec	Lon Dec	County	Ecoregion/ Subregion
HESM-1	Hester Creek	Hester Creek at unnamed Madison County Rd	34.9108	-86.4375	Madison, AL	71g
HESM-2	Hester Creek	Hester Creek at Buddy Williamson Road	34.9622	-86.4603	Madison, AL	71g
HESM-3	Hester Creek	Hester Creek at Hester Creek Road approximately 0.1 miles North of State line	34.9919	-86.4391	Lincoln, TN	71g

Figure 3-2. Map of Sampling Location for Hester Creek



In addition, between August 2, 2010 and August 5, 2010, diurnal dissolved oxygen (DO) data was collected at Hester Creek sampling stations HESM-1, HESM-2, and HESM-3. Diurnal dissolved oxygen data was also collected between August 13, 2010 and August 16, 2010 at Hester Creek stations HESM-2 and HESM-3. Dissolved oxygen concentrations at these stations remained within normal levels during these sampling events ranging between 5.3 and 9.0 mg/l. pH levels also remained within normal levels further providing evidence that Hester Creek is not impaired for nutrients.

Bioassessment results indicated the macroinvertebrate community to be in “Fair” condition. The overall habitat quality was categorized as “sub-optimal”. Fish IBI data was also collected and was rated as “Fair”.

Based on the instream TP and TN values, chlorophyll-*a* values, dissolved oxygen concentrations, and biological assessments, ADEM does not consider Hester Creek to be impaired as a result of nutrient over-enrichment. The available data that was utilized to support this delisting decision can be found in Appendix 6.2.

4.0 Conclusions

Based on the assessment of all available water quality data obtained for Hester Creek, inclusive of physical, chemical, and biological data, ADEM concludes that no water quality impairment from nutrients exists. Accordingly, ADEM will not proceed in developing a nutrient TMDL for this stream due to “more recent or accurate data” which, in doing so, provides sufficient justification for delisting a waterbody in conformance with Title 40 of the Code of Federal Regulations (CFR), Part 130.7(b)(6)(iv).

5.0 Public Participation

As part of the public participation process, this Delisting Decision (DD) will be placed on public notice and made available for review and comment. The public notice will be prepared and published in the major daily newspapers in Montgomery, Huntsville, Birmingham, and Mobile, as well as submitted to persons who have requested to be on ADEM’s postal and electronic mailing distributions. In addition, the public notice and subject DD will be made available on ADEM’s Website: www.adem.state.al.us. The public can also request paper or electronic copies of the DD by contacting Mr. Chris Johnson at 334-271-7827 or cljohnson@adem.state.al.us. The public will be given an opportunity to review the DD and submit comments to the Department in writing. At the end of the public review period, all written comments received during the public notice period will become part of the administrative record. ADEM will consider all comments received by the public prior to finalization of this DD and subsequent submission to EPA Region 4 for final review and approval.

6.0 Appendices

6.1 References

ADEM Administrative Code, 2008. Water Quality Program, Chapter 335-6-10, Water Quality Criteria, and Chapter 335-6-11 Use Classifications for Interstate and Intrastate Waters.

Alabama's §303(d) Monitoring Program. 2009. ADEM.

Alabama Department of Environmental Management, 1998, 2000, 2002, 2004, 2006, 2008 & 2010 §303(d) Lists. ADEM.

ALAWADR Database (Water Quality Data). ADEM.

United States Environmental Protection Agency. 1991. Guidance for Water Quality-Based Decisions: The TMDL Process, Office of Water, EPA 440/4-91-001.

United States Environmental Protection Agency, 1999. Decision Document Concerning EPA's Addition of Waters and Pollutants to Alabama's §303(d) List.

United States Environmental Protection Agency. 2000a. Ambient Water Quality Criteria Recommendations: Information Supporting the Development of State and Tribal Nutrient Criteria. Rivers and Streams in Ecoregion XI. Office of Water. EPA 822-B-00-020.

United States Environmental Protection Agency. 2000b. Nutrient Criteria Technical Guidance Manual: River and Streams. Office of Water. EPA 822-B-00-002.

6.2 Water Quality Data and Calculations

Table 6-1. HESM-1 Nutrient/Chl-a Data

Station ID	Visit Date	TN (mg/L)	Total P (mg/L)	Total P dc	Chl a (µg/L)
HESM-1	3/23/2009				1.34
HESM-1	4/13/2009				1
HESM-1	5/12/2009	2.122	0.046		0.53
HESM-1	6/10/2009	0.981	0.024		2.67
HESM-1	7/7/2009	1.355	0.038		1.07
HESM-1	8/12/2009	0.599	0.031		0.89
HESM-1	9/9/2009	2.48	0.419		1.34
HESM-1	10/19/2009	1.826	0.028		0.76

Table 6-2. HESM-2 Nutrient/Chl-a Data

Station ID	Visit Date	TN (mg/L)	Total P (mg/L)	Total P dc	Chl a (µg/L)
HESM-2	3/23/2009				1.34
HESM-2	4/13/2009				1.6
HESM-2	5/12/2009	2.547	0.046		5.34
HESM-2	6/10/2009	1.489	0.035		1.34
HESM-2	7/7/2009	2.812	0.06		1.07
HESM-2	8/12/2009	1.641	0.043		1.6
HESM-2	9/9/2009	1.074	0.029		0.82
HESM-2	10/19/2009	2.114	0.029		0.59

Table 6-3. HESM-3 Nutrient/Chl-a Data

Station ID	Visit Date	TN (mg/L)	Total P (mg/L)	Total P dc	Chl a (µg/L)
HESM-3	3/23/2009				1.34
HESM-3	4/13/2009				1
HESM-3	5/12/2009	2.816	0.049		0.53
HESM-3	6/10/2009	1.358	0.029		1.53
HESM-3	7/7/2009	2.072	0.057		1.07
HESM-3	8/12/2009	1.034	0.032		0.53
HESM-3	9/9/2009	1.23	0.024		1.07
HESM-3	10/19/2009	1.983	0.032		0.53

Table 6-4. Hester Creek Nutrient Data Summary

Hester Creek Nutrient Data Summary			
	TN (mg/L)		TP (mg/L)
HESM-1 Median:	1.59		0.0345
HESM-2 Median:	1.88		0.0390
HESM-3 Median:	1.67		0.0320
Eco Ref. 90th %:	1.55		0.0497

Table 6-5. Hester Creek Chlorophyll-*a* Data Summary

Hester Creek Chl-<i>a</i> Data Summary	
	Chl-<i>a</i> (µg/L)
HESM-1 Median:	1.035
HESM-2 Median:	1.340
HESM-3 Median:	1.035
Eco Ref. 90th %:	4.081

Figure 6-1. HESM-1 2010 Continuous 72 Hour Monitoring Data

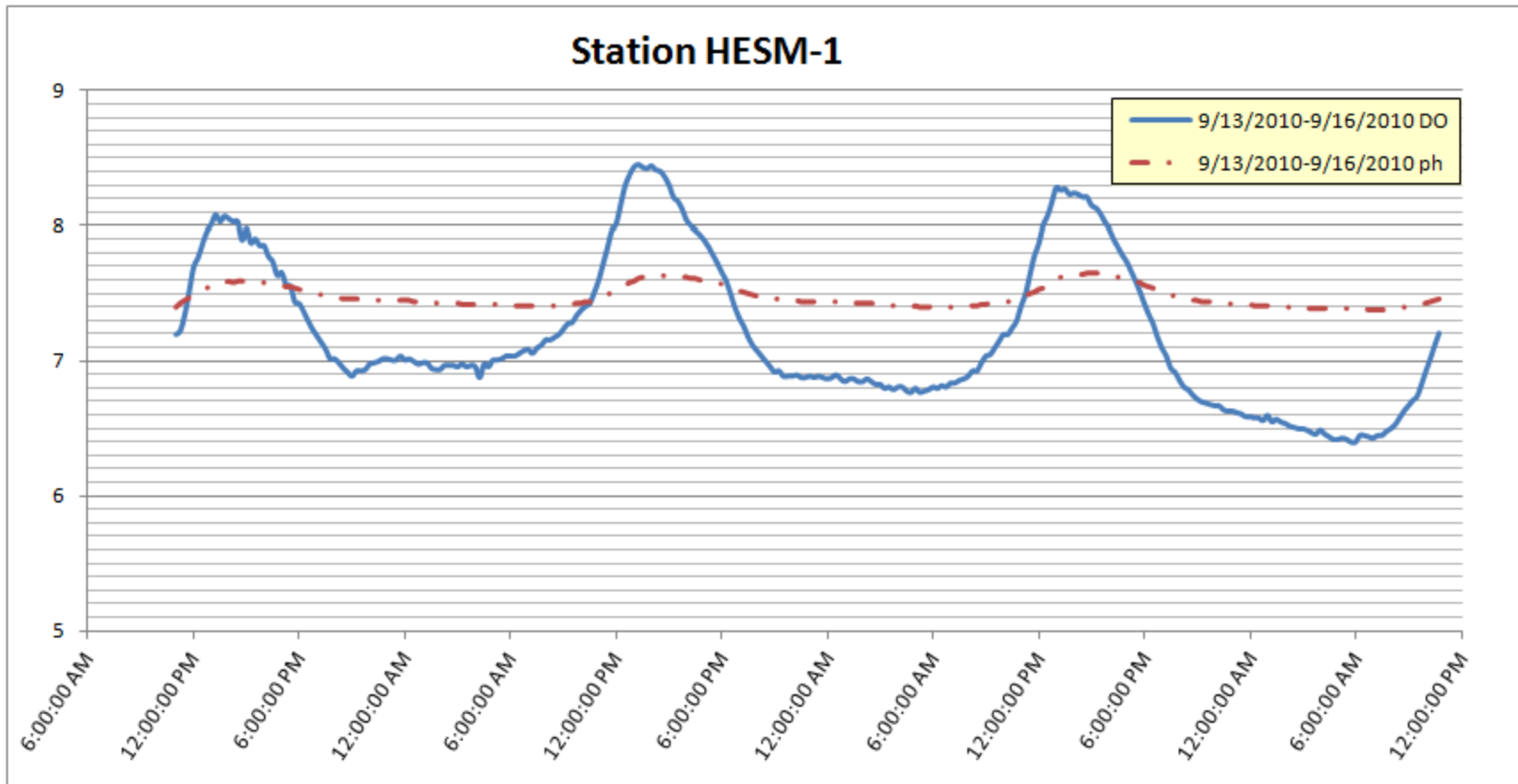


Figure 6-2. HESM-2 2010 Continuous 72 Hour Monitoring Data

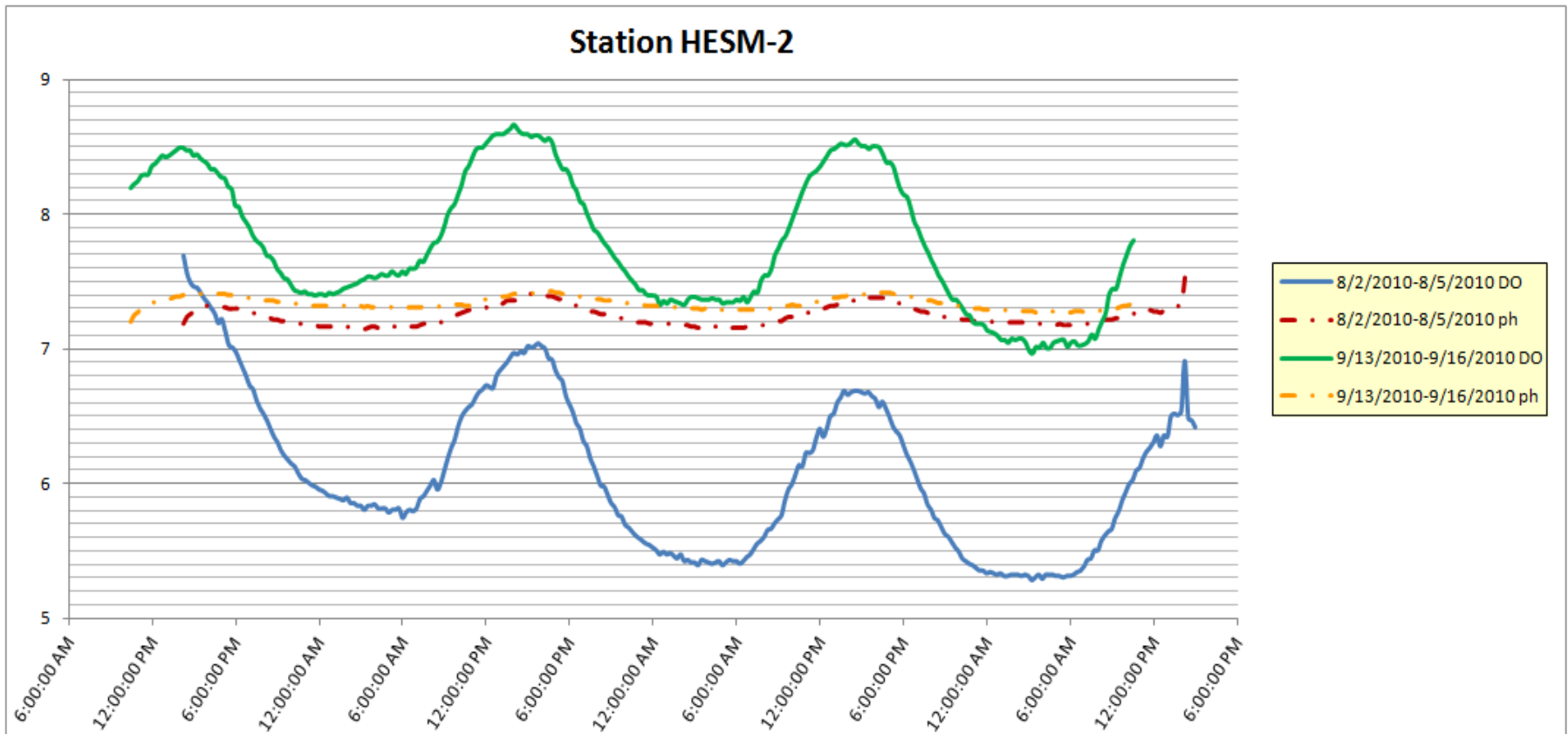


Figure 6-3. HESM-3 2010 Continuous 72 Hour Monitoring Data

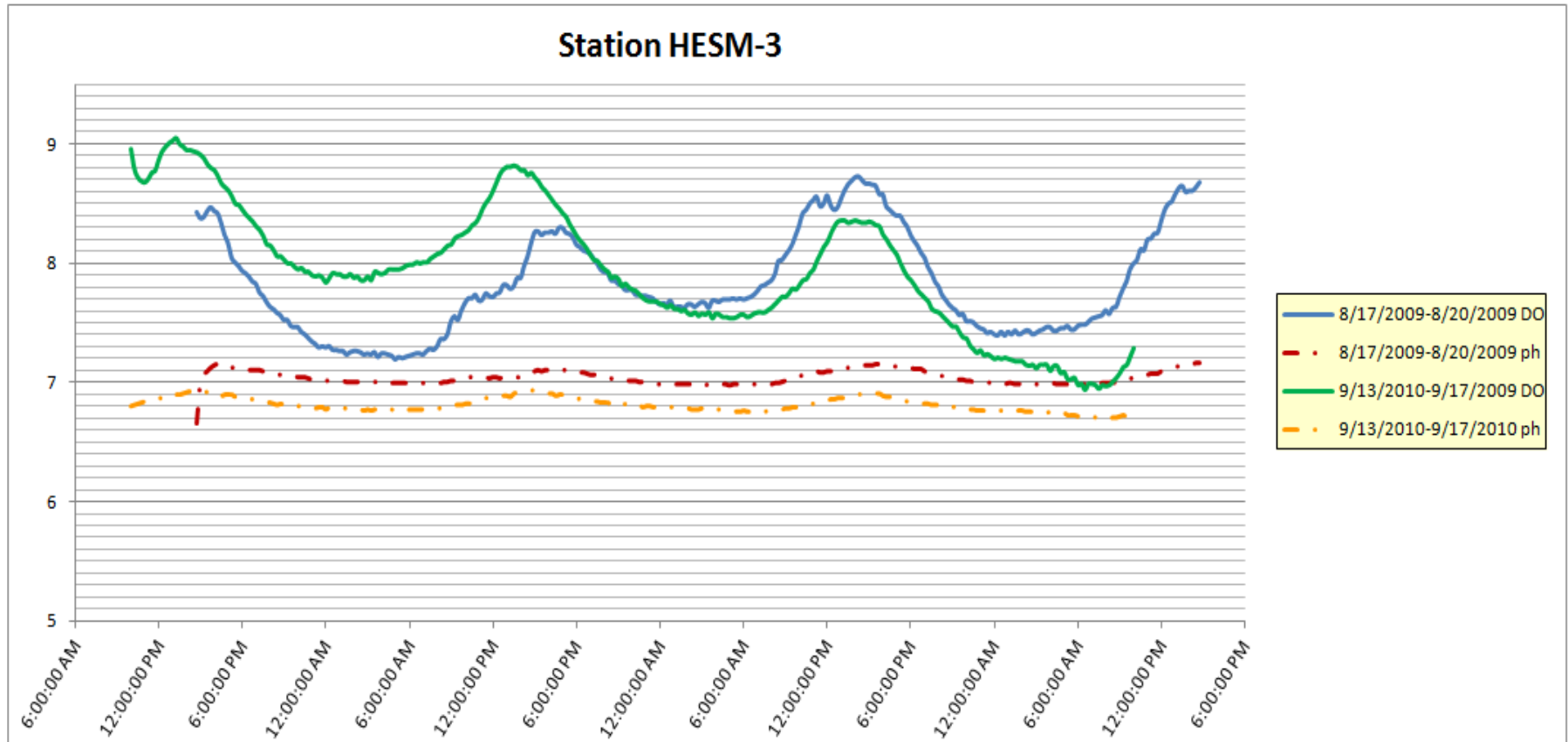


Table 6-6. Macroinvertebrate Assessment at HESM-1

Macroinvertebrate Assessment		
	Results	Scores
Taxa richness and diversity measures		(0-100)
# EPT taxa	12	35
Shannon Diversity	2.94	11
Taxonomic composition measures		
% EPT minus Baetidae and Hydropsychidae	25	55
% Non-insect taxa	12	52
Functional feeding group		
% Predator Individuals	2	0
Community tolerance		
% Tolerant taxa	33	45
WMB-I Assessment Score	---	33
WMB-I Assessment Rating		Fair (29-43)

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Table 6-7. Habitat Assessment at HESM-1

Table 3. Results of the habitat assessment conducted on Hester Ck at HESM-1, 06/11/2009		
Habitat Assessment	%Maximum Score	Rating
Instream Habitat Quality	77	Optimal >70
Sediment Deposition	73	Optimal >70
Sinuosity	73	Sub-optimal (65-84)
Bank and Vegetative Stability	69	Sub-optimal (60-74)
Riparian Buffer	53	Marginal (50-69)
Habitat Assessment Score	166	
% Maximum Score	69	Sub-optimal (59-70)

Table 6-8. Fish Community Assessment at HESM-1

Fish Community Assessment		
	Result	Score
Taxa richness measures		
Total native species	22	3
# shiner species	3	3
# sucker species	1	1
# darter + madtom species	6	3
Taxonomic composition measures		
% Lepomis	8.32	5
Functional composition measures		
% omnivores	41.78	1
% invertivores	6.96	5
% top carnivores	1.55	3
% simple lithophilic spawners	38.30	3
Tolerance measures		
# intolerant species	1	3
Population measures		
Catch per effort	517	1
IBI Assessment Score		31
IBI Assessment Rating		Fair

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Table 6-9. Alabama's 2010 Ecoregional Reference Guidelines

Alabama's 2010 Ecoregional Reference Guidelines																			
Parameters	Basis of comparison	Result to compare	Level 4	Level 4	Level 3	Level 4	Level 4	Level 4	Level 4	Level 4	Level 4	Level 4	Level 4	Level 3	Level 4	Level 4	Level 3	Level 4	Level 3
			45a	45d	45	65af	65f	65g	65i	65j	65q	67f	67h	67	68d	68e	68	71f	71
Physical																			
Temperature (°C)	90th %ile	Median	24.656	25	25	27	24.6	27	25	24	27	24	26	25.7	25	23.48	24	22.12	22.586
Turbidity (NTU)	90th %ile	INDIVIDUAL	21.7	6.823	15	49.56	9.7	13.05	26.21	10.73	42.3	6.622	10.787	8.824	9.667	9.025	10.1	3.693	11.1
Total Dissolved Solids (mg/L)	90th %ile	Median	67.9	85.4	80	162.8	53.4	97.4	63.3	167.6	103.4	165	79.4	151.2	118	84.8	97.2	79.6	150.5
Total Suspended Solids (mg/L)	90th %ile	Median	16	12	15	45	13.2	16.3	27.5	26.9	104.6	11.3	12.7	12.4	27	10	14	9.6	8.9
Specific Conductance (µmhos)	Median	Median	40.1	37	39.05	129.7	20.4	53.4	25.8	70	72.5	207	34.35	86	49.5	37	39.15	96	109
Hardness (mg/L)	Median	Median	10.65	11.1	11	56	14	14.2	6.52	82.1	34.6	94.05	8.56	42.3	16.2	10	12.15	47.2	56
Alkalinity (mg/L)	90th %ile	Median	21.8	23.5	23.01	84.41	11.8	21.85	21.05	130.64	36.36	121.73	16.54	117.716	21	44.2	42.2	57.432	109.4
Stream Flow (cfs)																			
Chemical																			
Dissolved Oxygen (mg/L)	10th %ile	Median	7.665	7.6	7.6	5.1	6.94	4.484	6.632	7.64	6.8	7.44	7	7	5.609	7.51	6.79	8.113	7.61
pH (su)	10th %ile	Median	6.5	6.787	6.64	6.758	4.436	5.69	5.82	6.31	6.6	6.938	6.69	6.768	6.482	6.522	6.5	7.162	7.345
pH (su)	90th %ile	Median	7.68	7.679	7.7	8.052	6.55	6.815	7.18	8.1	7.74	8.234	8	8.278	7.352	7.852	7.84	8.35	8.34
Ammonia Nitrogen (mg/L)	90th %ile	Median	0.0078	0.0105	0.0105	0.04802	0.046	0.0203	0.0905	0.0932	0.074	0.0228	0.031	0.0346	0.119	0.0945	0.1007	0.023	0.023
Nitrate+Nitrite Nitrogen (mg/L)	90th %ile	Median	0.1241	0.0718	0.0974	0.286	0.3258	0.2432	0.2784	0.3436	0.0634	0.261	0.0888	0.2403	1.202	0.456	0.6191	0.6895	1.42
Total Kjeldahl Nitrogen (mg/L)	90th %ile	Median	0.40482	0.2598	0.28448	0.887	0.4176	0.583	0.6782	0.4858	0.6346	0.431	0.5107	0.5826	1.46	0.6595	0.733	0.624	0.466
Total Nitrogen (mg/L)	90th %ile	Median	0.53114	0.3224	0.40016	1.1634	0.6396	0.773	0.8512	0.8064	0.69205	0.6836	0.69365	0.7109	2.269	0.9185	1.41685	1.295	1.57
Dissolved Reactive Phosphorus (mg/L)	90th %ile	Median	0.0214	0.027	0.0243	0.0618	0.0264	0.0236	0.023	0.0167	0.0193	0.0174	0.0162	0.017	0.0109	0.019	0.0182	0.017	0.0155
Total Phosphorus (mg/L)	90th %ile	Median	0.0663	0.0537	0.0599	0.201	0.04	0.0698	0.0682	0.0577	0.064	0.0514	0.0429	0.0566	0.0491	0.0501	0.05	0.1059	0.0497
CBOD-5 (mg/L)	90th %ile	Median	2.57	2.37	2.4	3.2	1.96	2.65	2	2.53	2.3	1.78	2.58	2.3	1.86	1.9	1.9	1.1	1.1
Chlorides (mg/L)	90th %ile	Median	4.778	4.029	4.495	12.032	6.692	6.066	4.2852	5.247	5.95	4.266	3.61	3.89	9.118	1.051	6.37	2.4112	2.622
Total Metals																			
Aluminum (mg/L)	90th %ile	Median	0.2437	0.1558	0.1954	1.181	0.4886	0.2732	0.801	0.4045	1.561	0.2104	0.356	0.4114	0.155	0.285	0.3055	0.1954	0.127
Iron (mg/L)	90th %ile	Median	1.094	0.5648	0.8722	2.362	1.352	3.976	3.548	0.839	2.13	0.893	0.733	0.9803	0.6855	1.047	1.046	0.4085	0.4294
Manganese (mg/L)	90th %ile	Median	0.0554	0.0647	0.057	0.215	0.0436	0.7372	0.8094	0.081	0.113	0.067	0.052	0.0628	0.184	0.0563	0.1553	0.025	0.025
Dissolved Metals																			
Aluminum (mg/L)	90th %ile	Median	0.05485	0.0545	0.0545	0.1365	0.2242	0.0545	0.1	0.11	0.193	0.1	0.1	0.1	0.1	0.1	0.1	0.03	0.03
Antimony (µg/L)	90th %ile	Median	1	1	1	1	3.75	1	5	5	3.75	5	1	5		14	14	5	5
Arsenic (µg/L)	90th %ile	Median	5	5	5	5	5	5	5	5	5	3.2	5	5		5	5	12.1	12
Cadmium (mg/L)	90th %ile	Median	0.0435	0.0435	0.0435	0.0435	0.0394	0.0435	0.0435	0.0435	0.0435	0.0435	0.0435	0.0435	0.0435	0.0448	0.04415	0.0075	0.0075
Chromium (mg/L)	90th %ile	Median	0.0395	0.0395	0.0395	0.0395	0.0321	0.0395	0.0395	0.0395	0.0395	0.0395	0.0395	0.0395	0.0395	0.0416	0.04055	0.025	0.025
Copper (mg/L)	90th %ile	Median	0.043	0.043	0.043	0.043	0.0349	0.043	0.043	0.043	0.075	0.043	0.043	0.043	0.043	0.0298	0.043	0.043	0.1
Iron (mg/L)	90th %ile	Median	0.292	0.2248	0.256	0.503	0.6132	0.8042	0.5392	0.2445	1.255	0.1218	0.1885	0.2428	0.1552	0.588	0.588	0.025	0.0579
Lead (µg/L)	90th %ile	Median	1	1	1	1	2.5	1	5	5	2.5	5	1	5	1	5	5	5	5
Manganese (mg/L)	90th %ile	Median	0.02665	0.0235	0.0253	0.1224	0.0328	0.7886	0.8218	0.025	0.1084	0.025	0.0235	0.025		0.05	0.05	0.025	0.025
Mercury (µg/L)	90th %ile	Median	0.15	0.15	0.15	0.15	0.25	0.15	0.25	0.2	0.25	0.2	0.2	0.2	0.18	0.2	0.2	0.15	0.15
Nickel (mg/L)	90th %ile	Median	0.114	0.114	0.114	0.114	0.0936	0.114	0.05	0.114	0.114	0.0884	0.114	0.114		0.114	0.114	0.025	0.025
Selenium (µg/L)	90th %ile	Median	5	5	5	5	5	5	25	23	5	23	5	5		50	50	15	25
Silver (mg/L)	90th %ile	Median	0.058	0.058	0.058	0.058	0.0467	0.058	0.05	0.058	0.058	0.0548	0.058	0.058		0.058	0.058	0.025	0.025
Thallium (µg/L)	90th %ile	Median	0.5	0.5	0.5	0.5	4.5	0.5	5	5	4.5	5	0.5	5		18.5	18.5	5	5
Zinc (mg/L)	90th %ile	Median	0.0345	0.0345	0.0345	0.0345	0.0294	0.0345	0.0345	0.0345	0.0345	0.0345	0.0345	0.0345	0.0345	0.0267	0.0438	0.0345	0.03
Biological																			
Chlorophyll a (µg/L)	90th %ile	Median	5.019	2.14	2.67	5.181	1.755	1.282	4.732	3.31	3.949	2.562	2.086	2.322	1.392	2.458	2.67	3.044	4.255
Fecal Coliform (col/100 mL)	90th %ile	Median	332	116	201.2	1564	400	234	620	582	1025	1416	152.2	197	829	252	320	200	435