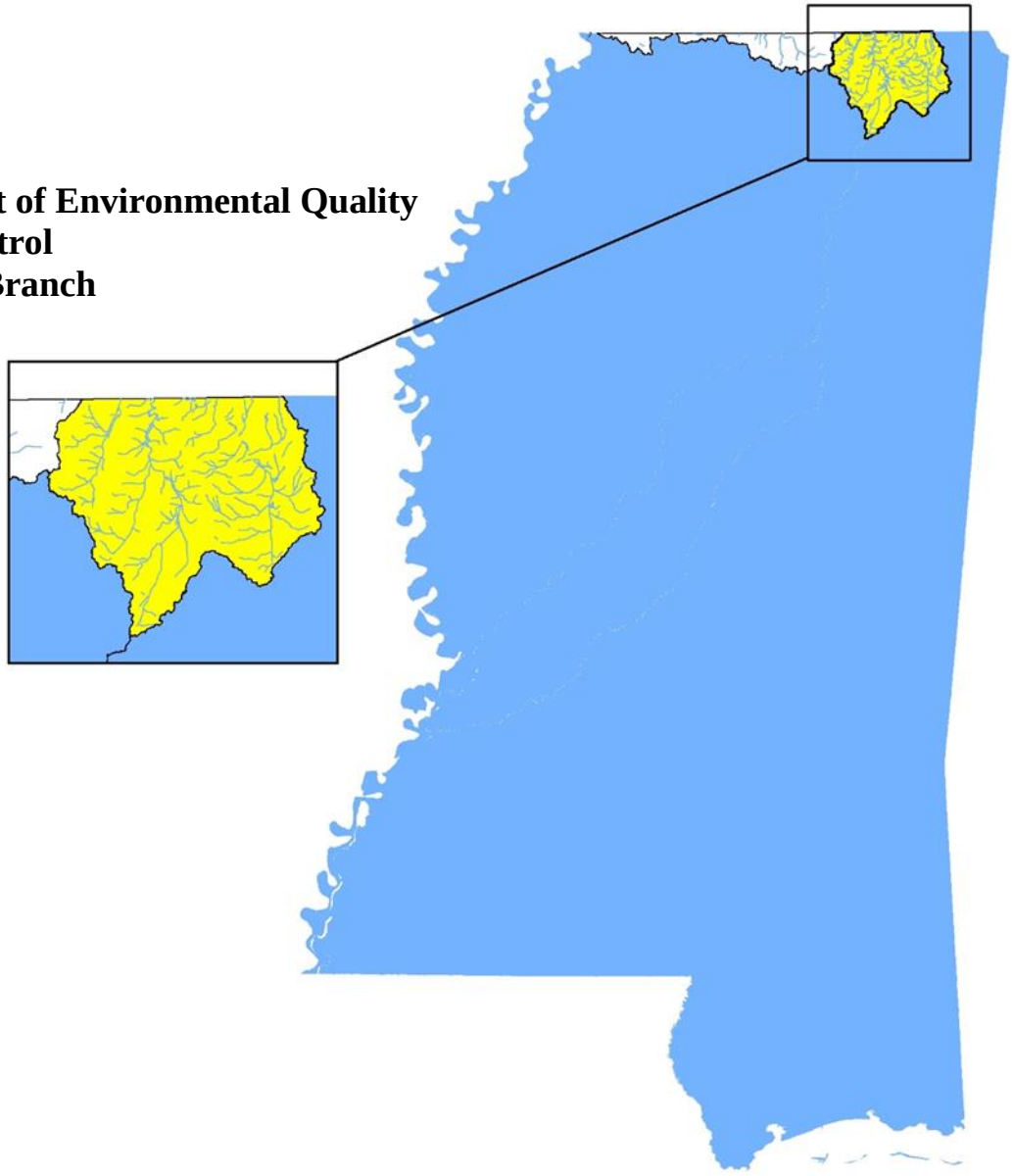
FINAL REPORT
ERRATA
APRIL 2020

Total Maximum Daily Load

For pH

Hatchie River and Tuscumbia River Canal (302411 & 301211)
North Independent Streams Basin
Mississippi

Prepared By
Mississippi Department of Environmental Quality
Office of Pollution Control
Modeling and TMDL Branch



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FOREWORD

The amount and quality of the data on which this report is based are limited. As additional information becomes available, the TMDLs may be updated. Such additional information may include water quality and quantity data, changes in pollutant loadings, or changes in landuse within the watershed. In some cases, additional water quality data may indicate that no impairment exists.

Prefixes for fractions and multiples of SI units

Fraction	Prefix	Symbol	Multiple	Prefix	Symbol
10^{-1}	deci	D	10	deka	da
10^{-2}	centi	C	10^{2}	hecto	h
10^{-3}	milli	M	10^{3}	kilo	k
10^{-6}	micro	μ	10^{6}	mega	M
10^{-9}	nano	N	10^{9}	giga	G
10^{-12}	pico	P	10^{12}	tera	T
10^{-15}	femto	F	10^{15}	peta	P
10^{-18}	atto	A	10^{18}	exa	E

Conversion Factors

To convert from	To	Multiply by	To Convert from	To	Multiply by
Acres	Sq. miles	0.00156	Days	Seconds	86400
Cubic feet	Cu. Meter	0.02832	Feet	Meters	0.3048
Cubic feet	Gallons	7.4805	Gallons	Cu feet	0.13368
Cubic feet	Liters	28.316	Hectares	Acres	2.4711
cfs	Gal/min	448.83	Miles	Meters	1609.34
cfs	MGD	0.64632	Mg/l	ppm	1
Cubic meters	Gallons	264.173	μg/l * cfs	Gm/day	2.45

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TMDL INFORMATION

Name	ID	County	Cause
Hatchie River and Tuscumbia River Canal	302411-301211	Alcorn	pH
Both rivers Hatchie River (302411), from watershed boundary 3019 to the Tennessee state line, and Tuscumbia River Canal (301211) present in basin of North Independent Streams of Mississippi.			

Water Quality Standards

Parameter	Beneficial use	Water Quality Criteria
pH	Fish and Wildlife	The applicable water quality criteria, as described in the *WPC-2 State of Mississippi's Water Quality Criteria for Intrastate, Interstate, and Coastal Waters*, requires that the pH shall be within the range of 6.0 to 9.0 standard units (s.u.)

EXECUTIVE SUMMARY

Hatchie River (302411), from watershed boundary 3019 to the Tennessee state line, and Tuscumbia River Canal (301211) were identified by the Mississippi Department of Environmental Quality (MDEQ) as not supporting designated uses for the pH standard on the State's 2012 Section 303(d) List of Impaired Water Bodies (MDEQ, 2012). These water quality limited segments are in the North Independent Streams Basin in Alcorn County near Walnut, Mississippi. The applicable water quality criteria, as described in the State of Mississippi's Water Quality Criteria for Intrastate, Interstate, and Coastal Waters, requires that the pH shall be within the range of 6.0 to 9.0 standard units (s.u.) (MDEQ, 2012).

The specific causes of the low pH for these water body are not known but are believed to be a combination of point source discharge and stormwater discharge over acidic soils. The low pH in this water must be attributed either to unknown point or nonpoint sources of low pH or to natural background conditions. There are no known national forests in the area, however, the water body is surrounded primarily by forest.

The wasteload allocation for the total maximum daily load (TMDL) requires that the pH in effluent from any permitted point sources shall be within the range of 6.0 to 9.0 s.u. The load allocation for the TMDL requires that the pH of waters originating from nonpoint sources shall be within the range of 6.0 to 9.0 s.u. These allocations provide for the year-round protection of water quality.

Introduction

Hatchie River (302411), from watershed boundary 3019 to the Tennessee state line, and Tuscumbia River Canal (301211) located in the basin of north independent streams were identified by the Mississippi Department of Environmental Quality (MDEQ) as not supporting their designated uses for the pH standard on the State's 2012 Section 303(d) List of Impaired Water Bodies (MDEQ, 2012). TMDLs are required for impaired waters on the §303(d) list as required by the Federal Clean Water Act §303(d) and the implementing regulations in accordance with 40 CFR.130. A TMDL establishes the maximum amount of a pollutant a water body can assimilate without exceeding the applicable water quality standard. The TMDL also allocates the total allowable load to individual sources or categories of sources through wasteload allocations (WLAs) for point sources, and through load allocations (LAs) for non-point sources. The WLAs and LAs in the TMDL provide a basis for states to reduce pollution from both point and non-point source activities that will lead to the attainment of water quality standards and protection of the beneficial use.

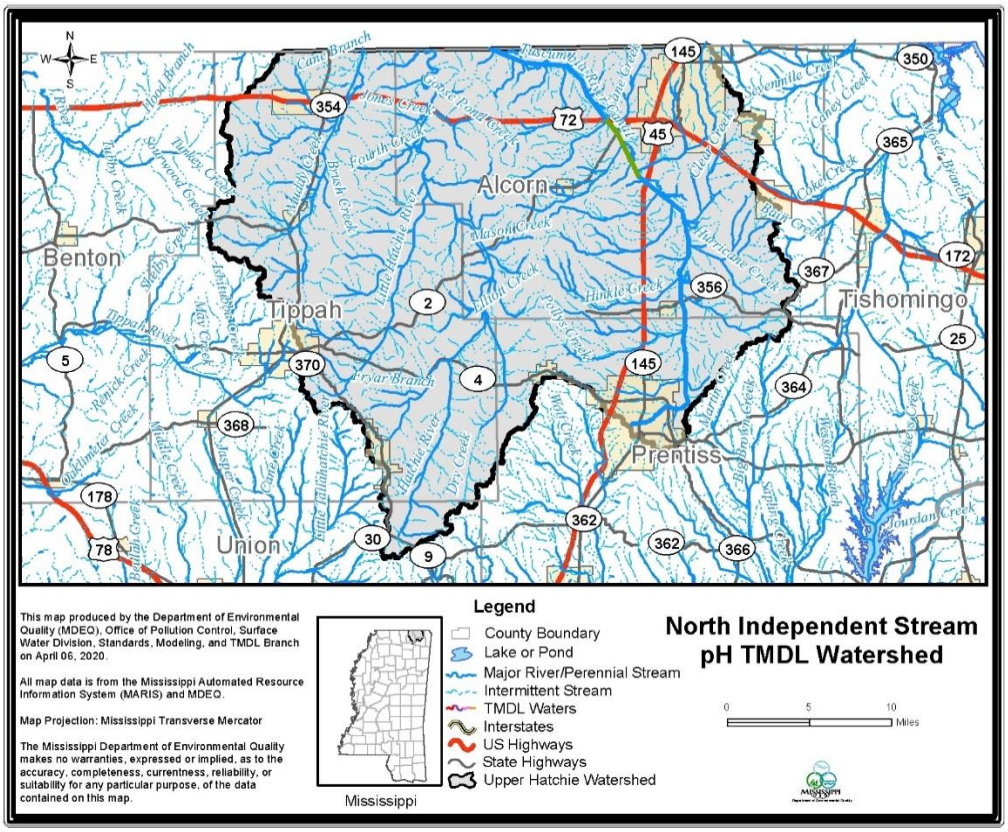

Figure 1. Location of Watersheds for Hatchie River and Tuscumbia River Canal

Watershed Characterization

Hatchie River and Tuscumbia River Canal are located in the Alcorn County between Walnut and Corinth, Mississippi. The name Hatchie may be from the Choctaw word for "river" even though this stream is in the Chickasaw Tribe area. Tuscumbia may also be from the Choctaw words for "warrior rainmaker". (Baca, 2007) The streams flow north into Tennessee (Figure 1). Landuse is predominantly forest, scrubland, and cropland (Table 1 and Figure 3). The landuse distributions presented in Table 1 and Figure 3 were derived from the State of Mississippi's Automated Resource Information System (MARIS), which is based on Landsat Thematic Mapper digital images.

Table 1. Landuse in the North Independent Streams Basin Watershed

	Water	Urban	Forest	Scrub/Barren	Pasture	Cropland	Wetland
area	4,258.42	26,917.78	167,336.55	58,705.79	51,513.54	46,315.51	30,756.32
% area	**1.1%**	**7.0%**	**43.4%**	**15.2%**	**13.4%**	**12.0%**	**8.0%**

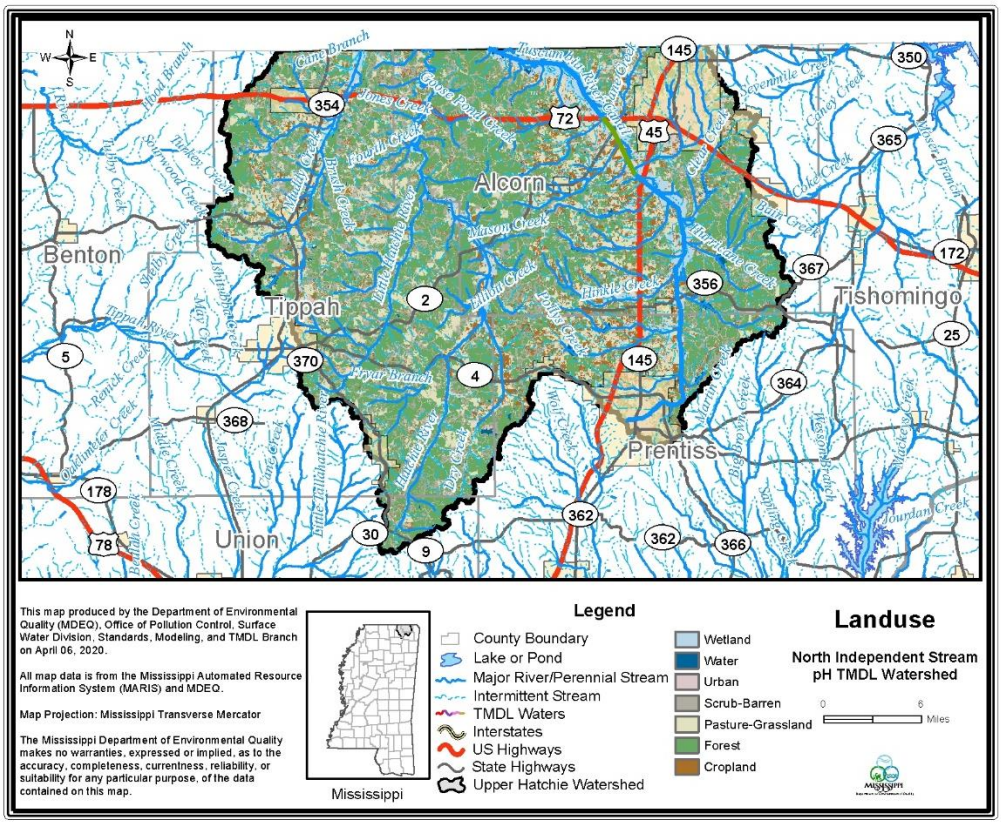

Figure 2. Landuse Distribution

Problem Definition

pH is a measure of the hydrogen ion concentration in water as well as a measure of the acidity or alkalinity. Specifically, pH is defined as the negative logarithm of the hydrogen ion concentration in terms of moles per liter.

$$pH = -\log [H+]$$

pH values can range from 0 s.u. for a very acidic solution to 14 s.u. for a very basic solution. A pH equal to 7.0 s.u. represents neutrality. One of the most significant environmental impacts of pH is the effect that it has on the solubility and thus the bioavailability of potentially toxic substances that may be present in surface waters. As the pH in a water body becomes lower (i.e., the solution becomes more acidic) many insoluble toxic substances like cyanides, sulfides, and most metals become more soluble and thus more likely to have toxic effects on fish and other aquatic life. Slight increases in pH may greatly increase the toxicity of pollutants such as ammonia. (Lee, 1998)

Due to high humidity in the southwest, large amounts of rainwater, which is naturally slightly acidic, move through the soil. If weak acids are formed from the reaction of hydrogen ions combining with carbon dioxide or other compounds, bases may be gradually leached from the soil as the water percolates through it, lowering the soil pH. Decomposition of coniferous vegetation, which produces more fulvic acids than either deciduous vegetation or grasses, is another process that lowers soil pH.

Applicable Water Quality Standard

The TMDL for the Hatchie River and Tuscumbia River will be established at a level to ensure consistency with the applicable water quality criteria and protection of its designated use (i.e., Fish and Wildlife). The State of Mississippi *Water Quality Criteria for Intrastate, Interstate, and Coastal Waters* includes numeric water quality criteria for pH of 6.0 to 9.0 s.u. for waters with these designated uses (MDEQ, 2012). Although there is information that suggests that waters in the basin exhibit low pH due to natural conditions, there is currently not enough information readily available to determine whether the low pH in this segment is attributed to natural conditions. Therefore, the applicable pH criteria for these segments are the allowable range of 6.0 to 9.0 s.u.

Source Identification

Due to high humidity in the southeast, large amounts of rainwater, which is naturally slightly acidic, move through the soil. If weak acids are formed from the reaction of hydrogen ions combining with carbon dioxide or other compounds, bases may be gradually leached from the soil as the water percolates through it, lowering the soil pH. Decomposition of coniferous vegetation, which produces more fulvic acids than either deciduous vegetation or grasses, is another process that lowers soil pH. While this mechanism is potentially important in forested parts of the basin, the watersheds currently have a relatively low percentage of coniferous cover.

There are currently no National Pollutant Discharge Elimination System (NPDES) permitted point sources that discharge to the segments that are impaired from low pH. It is also not expected that there will be any point source discharges permitted in the near future that would cause or contribute to pH violations in these watersheds.

There are 33-point sources in the watershed above these areas. These point sources will be included in the TMDL to ensure the discharge does not impair the waters for this pollutant.

Table 2. NPDES Permits in Watershed

MDEQ AI NUMBER	FACILITY NAME	CITY	LAT	LON	SUBPROGRAM	PERMIT NUMBER
20329	Loving Hands Daycare	Rienzi	34.857361	-88.560558	NPDES Commercial	MS0059897-001
20331	Oakview Place Apartments	Corinth	34.888353	-88.6114	NPDES Commercial	MS0059901-001
23047	Pleasant Hill Pentecostal Church	Corinth	34.904469	-88.598611	NPDES Commercial	MS0060143-001
385	Suitor Meat Company	Rienzi	34.796267	-88.573303	NPDES Minor Industrial, No Exposure Certification	MS0037214 - 001
1640	Hankins Inc	Ripley	34.724417	-88.848056	Baseline Stormwater, NPDES Minor Industrial, Wet Deck Log Spray	MSG170083-001
1646	Mississippi Polymers Inc	Corinth	34.907361	-88.528103	Baseline Stormwater, NPDES Minor Industrial, PT NCS, PT SIU	MS0000086-001
1833	B and B Concrete Company Inc, Booneville	Booneville	34.656467	-88.529867	Baseline Stormwater, NPDES Minor Industrial	MSG110034-001
13032	Booneville POTW	Booneville	34.663431	-88.537558	NPDES Major Municipal	MS0042030-001
13090	Corinth POTW	Corinth	34.907092	-88.512136	Construction Stormwater, NPDES Major Municipal	MS0021652-001
13090	Corinth POTW	Corinth	34.885278	-88.566111	Construction Stormwater, NPDES Major Municipal	MS0061328-001
13362	Rienzi POTW	Rienzi	34.768161	-88.518764	NPDES Minor Municipal	MS0033961-001
13682	Alcorn County School District, Kossuth High School	Kossuth	34.874797	-88.638447	NPDES Commercial	MS0029084-001
13733	Alcorn County Schools, Biggersville School	Corinth	34.83925	-88.559558	NPDES Commercial	MS0030589-001
52331	Corinth Gas and Water Department, Gas and Water Department Transmission Line	Corinth	34.932739	-88.540725	Hydrostatic Testing, NPDES Minor Industrial	MSG130289-001
52331	Corinth Gas and Water Department, Gas and Water Department Transmission Line	Corinth	34.923247	-88.520044	Hydrostatic Testing, NPDES Minor Industrial	MSG130289-010
52331	Corinth Gas and Water Department, Gas and Water Department Transmission Line	Corinth	34.91745	-88.51515	Hydrostatic Testing, NPDES Minor Industrial	MSG130289-011

52331	Corinth Gas and Water Department, Gas and Water Department Transmission Line	Corinth	34.909356	-88.512108	Hydrostatic Testing, NPDES Minor Industrial	MSG130289-012
52331	Corinth Gas and Water Department, Gas and Water Department Transmission Line	Corinth	34.910411	-88.493358	Hydrostatic Testing, NPDES Minor Industrial	MSG130289-013
52331	Corinth Gas and Water Department, Gas and Water Department Transmission Line	Corinth	34.897019	-88.471703	Hydrostatic Testing, NPDES Minor Industrial	MSG130289-014
52331	Corinth Gas and Water Department, Gas and Water Department Transmission Line	Corinth	34.891475	-88.4637	Hydrostatic Testing, NPDES Minor Industrial	MSG130289-015
52331	Corinth Gas and Water Department, Gas and Water Department Transmission Line	Corinth	34.879803	-88.442681	Hydrostatic Testing, NPDES Minor Industrial	MSG130289-016
52331	Corinth Gas and Water Department, Gas and Water Department Transmission Line	Corinth	34.932633	-88.537567	Hydrostatic Testing, NPDES Minor Industrial	MSG130289-002
52331	Corinth Gas and Water Department, Gas and Water Department Transmission Line	Corinth	34.932358	-88.534286	Hydrostatic Testing, NPDES Minor Industrial	MSG130289-003
52331	Corinth Gas and Water Department, Gas and Water Department Transmission Line	Corinth	34.930894	-88.532092	Hydrostatic Testing, NPDES Minor Industrial	MSG130289-004
52331	Corinth Gas and Water Department, Gas and Water Department Transmission Line	Corinth	34.929542	-88.529711	Hydrostatic Testing, NPDES Minor Industrial	MSG130289-005
52331	Corinth Gas and Water Department, Gas and Water Department Transmission Line	Corinth	34.929089	-88.527742	Hydrostatic Testing, NPDES Minor Industrial	MSG130289-006
52331	Corinth Gas and Water Department, Gas and Water Department Transmission Line	Corinth	34.929781	-88.526672	Hydrostatic Testing, NPDES Minor Industrial	MSG130289-007
52331	Corinth Gas and Water Department, Gas and Water Department Transmission Line	Corinth	34.925872	-88.523064	Hydrostatic Testing, NPDES Minor Industrial	MSG130289-008
52331	Corinth Gas and Water Department, Gas and Water Department Transmission Line	Corinth	34.923928	-88.520194	Hydrostatic Testing, NPDES Minor Industrial	MSG130289-009
57739	Southern Concrete Products Inc, Mobile Plant Number Two	Corinth	34.908611	-88.515	Baseline Stormwater, NPDES Minor Industrial	MSG110301-001
18639	B and B Concrete Company Inc, Corinth South Fulton Drive	Corinth	34.9103	-88.521689	Baseline Stormwater, NPDES Minor Industrial	MSG110223-001
14979	Jumpertown, Town of, WWTF	Jumpertown	34.698669	-88.709731	NPDES Minor Municipal	MS0057096-001
15031	B and B Concrete Company Inc	Corinth	34.910678	-88.526947	Baseline Stormwater, NPDES Minor Industrial	MSG110166-001

Data

The pH data from these two segments is shown in the chart below (figure 3). The Hatchie River data are blue and the Tuscumbia River Canal data are magenta. The low values appear to be seasonal in both streams which lead to the assumption that this criterion exceedances is caused by a natural condition. The higher readings are in the fall each year. The lower values are late spring and summer values. This could possibly be due to leaf litter and die off in the fall altering the pH in the streams.

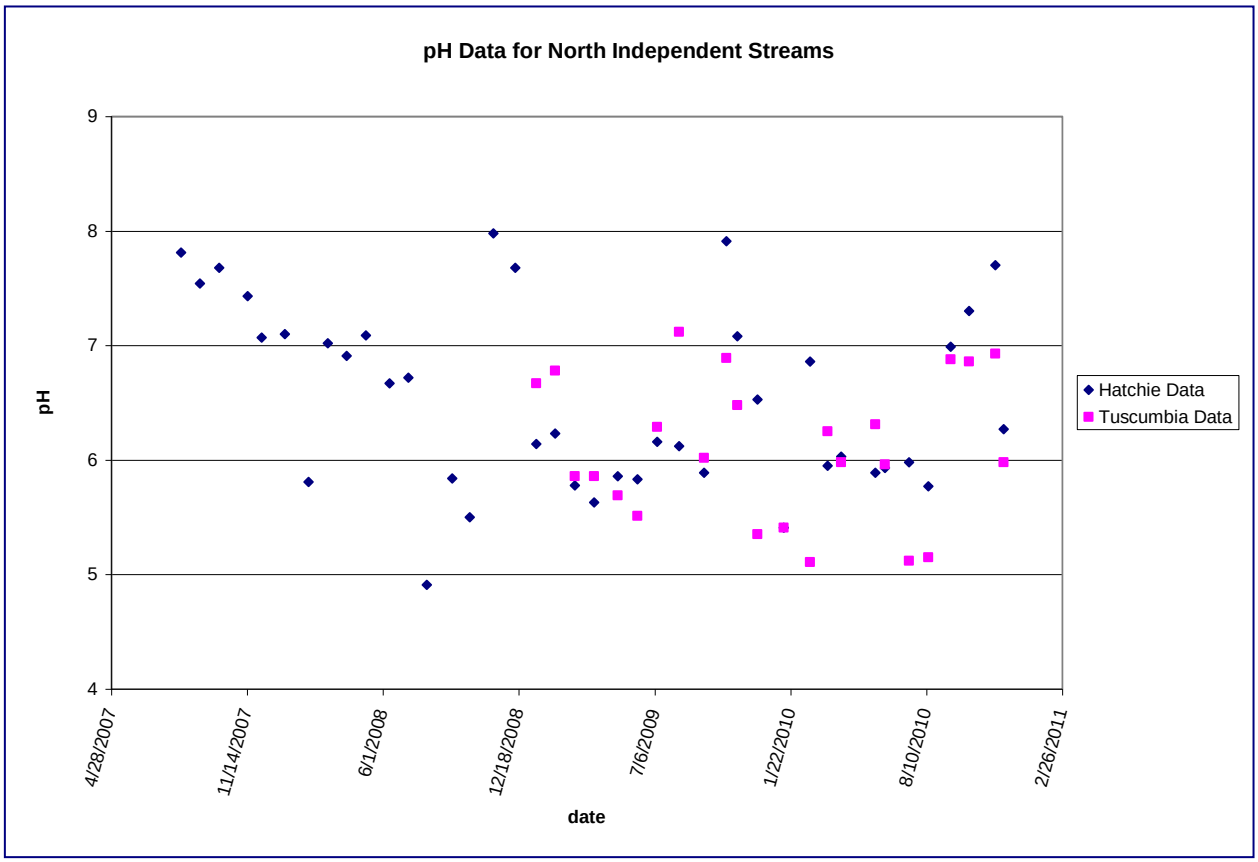

Figure 3. pH Data Values in the Watershed

Source Identification

At this time, there is insufficient information to determine the exact nature of the pollutant sources causing low pH in the watersheds. There are currently no point sources that are permitted to discharge to these segments; however there are point sources in the watersheds that drain to these segments. The low pH in this water is attributed to unknown nonpoint sources of pollution, natural background conditions, or some combination of the two. Alcorn County soil survey maps indicated that the floodplain soils associated with these watersheds are classified as strongly acidic. This could be another factor to explain the lower pH values shown in the data.

Instantaneous pH measurements were made between 2007 and 2010 (Figure 3). As shown in this figure, all of water quality standards excursions were attributed to low pH. As summarized in Table 3 below, 38.5% of the pH measurements did not meet water quality standards. These mainly occur in spring and summer each year.

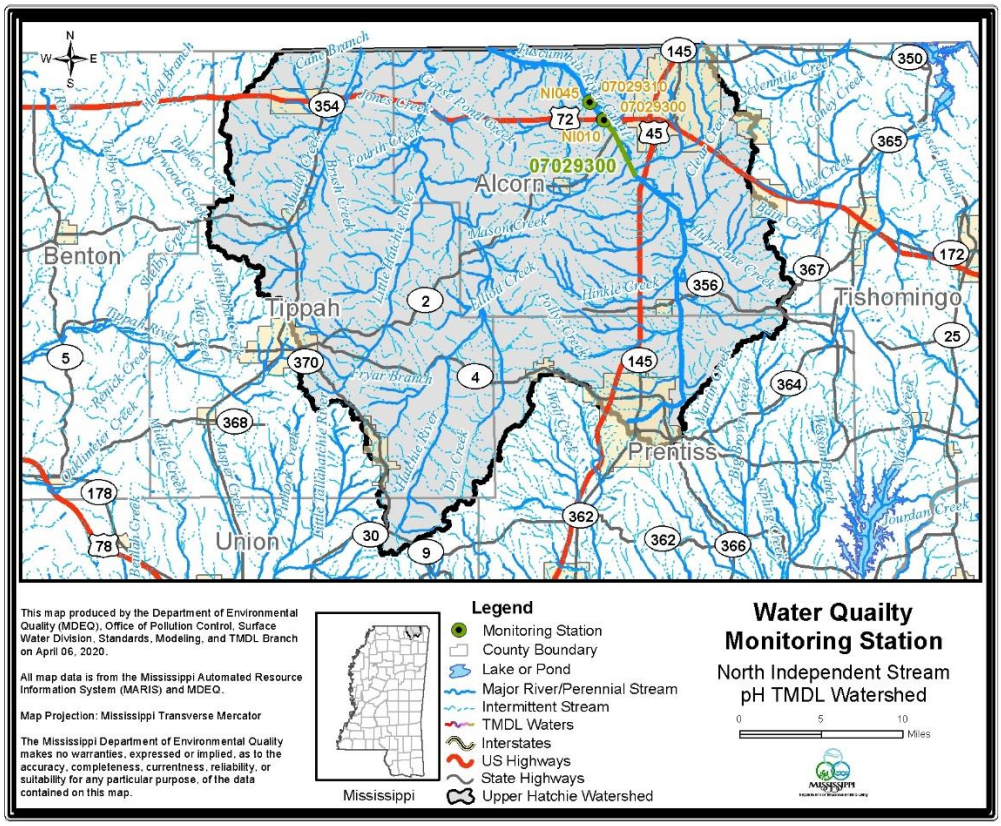

Figure 4. Water Quality Monitoring Station

Table 3. pH measured in Hatchie River and Tuscumbia River Canal

Data Window	Number of Samples	Number of samples not meeting water quality standards (low pH)	Percentage of data not meeting water quality standards
2007 - 2010	65	25	38.5%

Total Maximum Daily Load (TMDL)

A TMDL establishes the total pollutant load a water body can receive and still achieve water quality standards. The components of a TMDL include a WLA for point sources, a LA for non-point sources, and a margin of safety (MOS) to account for uncertainty. 40 CFR.130.2(i) provides flexibility concerning how TMDLs are expressed and suggests that they may be expressed in terms of mass per time, toxicity, or other appropriate measure. For this TMDL as well as other pH TMDLs that have been established by MDEQ, it has been determined that the appropriate measure for the allocation should be in terms of pH standard units.

Wasteload Allocation

There are currently no point sources that discharge to these segments. For future dischargers to this watershed or to tributaries in the watershed, effluent pH levels shall be no less than 6.0 s.u. and no greater than 9.0 s.u. and shall not cause the pH to rapidly change more than 1 unit s.u. This is a standard NPDES permit requirement.

Load Allocation

The nonpoint sources causing or contributing to pH violations are unknown, but probable causes may be attributed to stormwater runoff from fertilized soils for cropland, failed septic tanks, noncompliant point sources, and inactive natural gas pipelines. The potential nonpoint sources include, but are not limited to, low pH in stormwater runoff, groundwater infiltration, and acid rain deposition. The load allocation for this TMDL suggests that the pH of waters originating from any nonpoint sources in the watershed shall be no less than 6.0 s.u. and no greater than 9.0 s.u. if possible, based on the natural conditions found in the watershed.

Margin of Safety

The margin of safety in TMDLs is used to account for the lack of knowledge concerning the relationship between the pollutant loads and the resulting quality of the receiving waterbody. The allocations used in this TMDL ensure that loads from any point source(s) and loads originating from any non-point source activities must individually meet the pH target of 6.0 to 9.0 s.u. before entering the stream. If pH from both point and non-point source activities are consistent with the allocations in this TMDL, water quality standards will be met.

Seasonal Variation

The allocation proposed for this TMDL provides for year-round protection (i.e., protection during all seasons and environmental conditions) of the pH criteria. Based on the available data and information, critical conditions for this TMDL could not be determined. However, considering that this TMDL is protective during all seasons and environmental conditions, it will inherently be protective during critical conditions whenever they occur.

Recommendations

The wasteload allocation for this TMDL is considered and used by MDEQ through its NPDES permitting process. This TMDL recommends further monitoring from the point sources in their DMRs. The TMDL also recommends further ambient monitoring within the stream. As well as further ambient monitoring within the stream. Subsequent NPDES permit applicants should further study the data to

determine the natural condition of this segment and possibly promote a site specific criterion for pH for this segment of Hatchie River and Tuscumbia River.

Achieving the load allocation will require a better understanding of the causes and sources of the low pH. Future monitoring and data collection should provide insight regarding the potential causes of the low pH in this watershed. If low pH is determined in the future to be attributed to natural conditions, the load allocation presented in this TMDL could not be reasonably expected to be achieved. If such a determination were to be made, revision of the TMDL and/or the development of a site-specific water quality standard for these segments may be appropriate.

Next Steps

MDEQ has adopted the Basin Approach to Water Quality Management, a plan that divides Mississippi's major drainage basins into five groups. During each yearlong cycle, MDEQ resources for water quality monitoring will be focused on one of the basin groups. During the next monitoring phase in the North Independent Streams Basin, these watersheds may receive additional monitoring to identify any changes or improvements in water quality.

Public Participation

This TMDL will be published for a 30-day public notice. During this time, the public will be notified by publication in the newspaper. The public will be given an opportunity to review the TMDL and submit comments. MDEQ also distributes all TMDLs at the beginning of the public notice to those members of the public who have requested to be included on a TMDL mailing list. Anyone wishing to become a member of the TMDL mailing list should contact Shawn Clark at sclark@mdeq.ms.gov.

All comments should be directed to Shawn Clark at sclark@mdeq.ms.gov or Shawn Clark, MDEQ, PO Box 2261, Jackson, MS 39225. All comments received during the public notice period and at any public hearings become a part of the record of this TMDL and will be considered in the submission of this TMDL to EPA Region 4 for final approval.

References

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