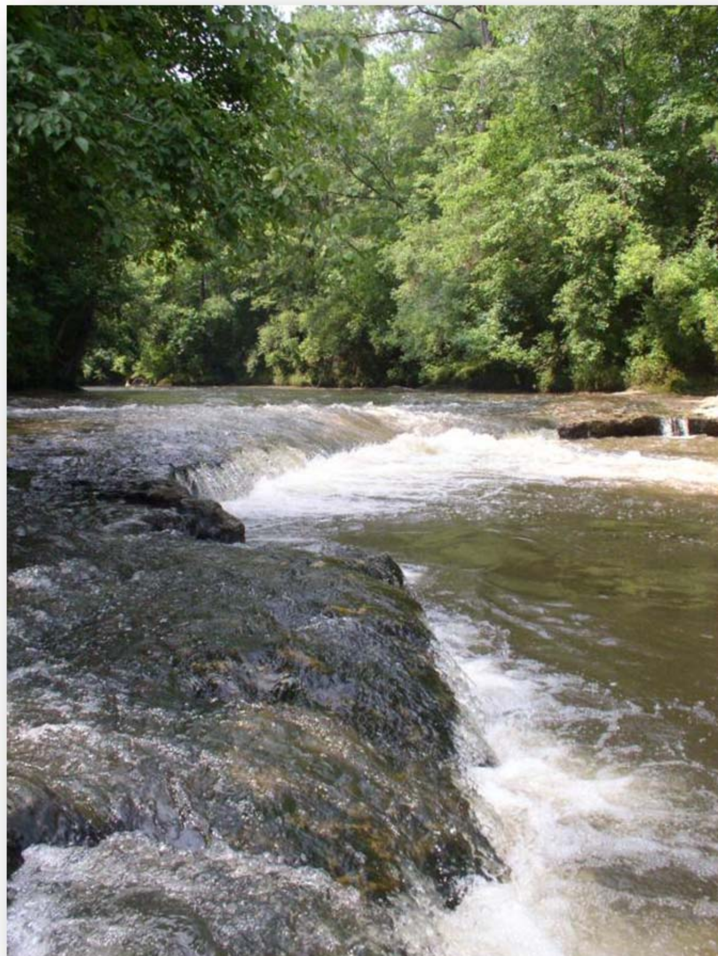
DRAFT
June, 2013

# Total Maximum Daily Load

## For pH

## Okatoma Creek (410511)
## Pascagoula Basin
## Mississippi



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Mississippi Department of
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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.

Cover image www.okatoma.com/images6/okatomacreek.jpg

**Table 1 Prefixes for fractions and multiple 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 |

**Table 2 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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# Executive Summary

Okatoma Creek (410511) in Simpson and Covington Counties at Kola from confluence with Roger Creek to Mississippi Watershed boundary 4107 near Gin Branch was assessed by 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). This water quality limited segment is located in the Pascagoula Basin in Simpson and Covington Counties. 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.) (MDEQ, 2012).

The specific causes of the low pH for these waters are not known but are believed to be a combination of point source discharge and stormwater discharge over acid 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 is information that suggests waters in this watershed exhibit low pH due to naturally acidic soil conditions. USGS pH data from the 1960s and 1970s show historically low pH values for this segment.

The wasteload allocation for the total maximum daily load (TMDL) requires that the pH in effluent from 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. with the exception of some stormwater permits that allow a range of 5.0 to 9.0 due to natural conditions. These allocations provide for the year-round protection of water quality.

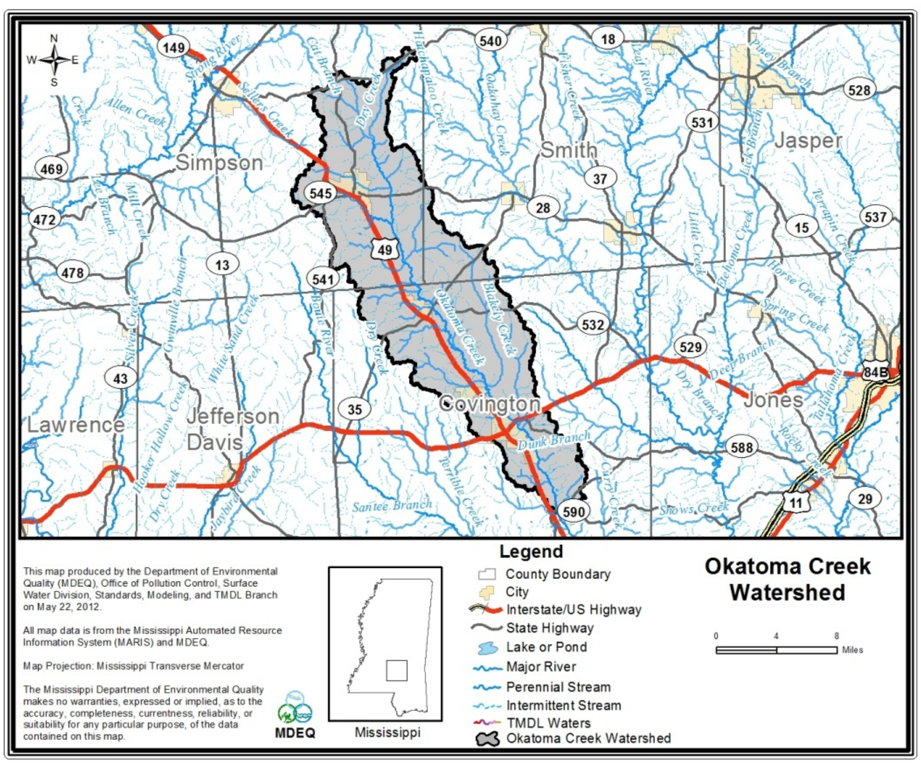


**Figure 1 Location of Okatoma Watershed**

# Introduction


**Figure 2www.okatoma.com/images6/familyfun2.jpg**

Okatoma Creek (410511) was identified by MDEQ as not supporting the designated use for the pH standard on *Mississippi'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.

# 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 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.

## Applicable Water Quality Standard

The TMDL for Okatoma Creek 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 these segments 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. except where noted in specific stormwater permits.

## Watershed Characterization

Okatoma Creek (410511) is located in Covington County adjacent to Highway 49. The first syllable *oka* is from the Choctaw word for "water", however the last two syllables are not completely identified. It may be a derivation of *tombi* which mean to radiate or shine, or it may be from *oktobbi* which means "fog". (Baca, 2007)

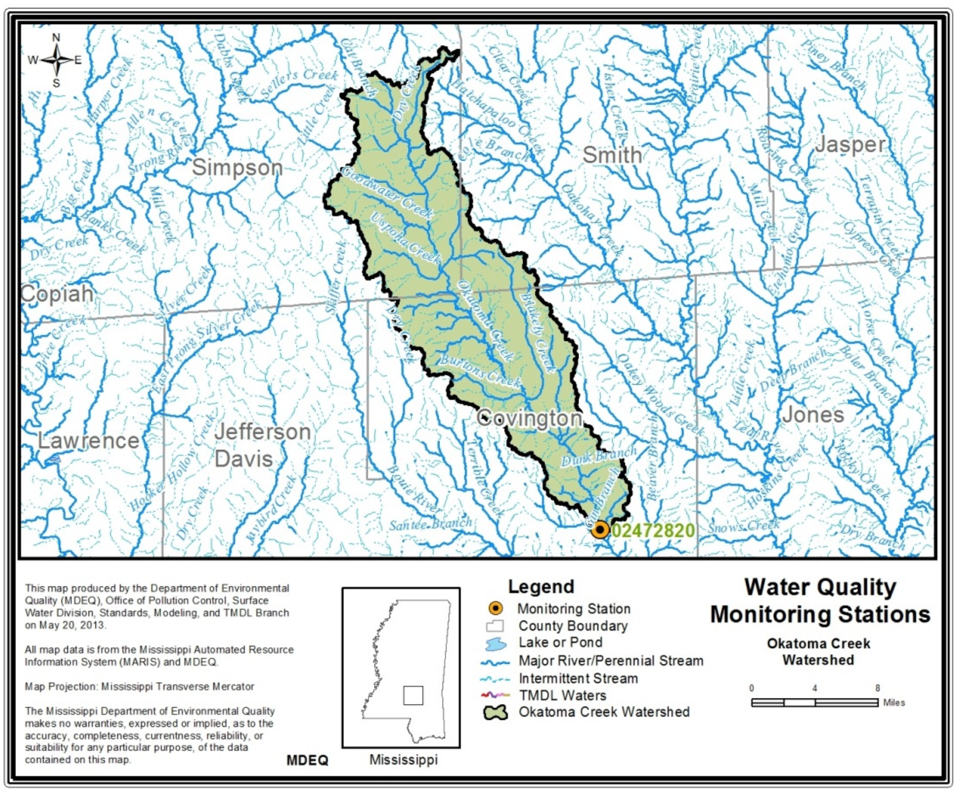


**Figure 3 Monitoring Station for Ambient Site**

There are several canoe outfitters in business in the area which provide for extensive use of the stream for contact recreation as well as camping sites. One of the major canoe starting points is at the highway bridge crossing in Seminary which is within the 410511 segment.

Landuse is predominantly forest and scrubland (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 2006 Landsat Thematic Mapper digital images.

**Table 3 Landuse in Okatoma Watershed above segment**

| | Water | Urban | Forest | Scrub/Barren | Pasture | Cropland | Wetland | |
|---|---|---|---|---|---|---|---|---|
| area | 507 | 11,393 | 56,980 | 17,469 | 29,340 | 2,501 | 11,663 | 129,853 |
| % area | 0.4% | 8.8% | 43.9% | 13.5% | 22.6% | 1.9% | 9.0% | 100.0% |

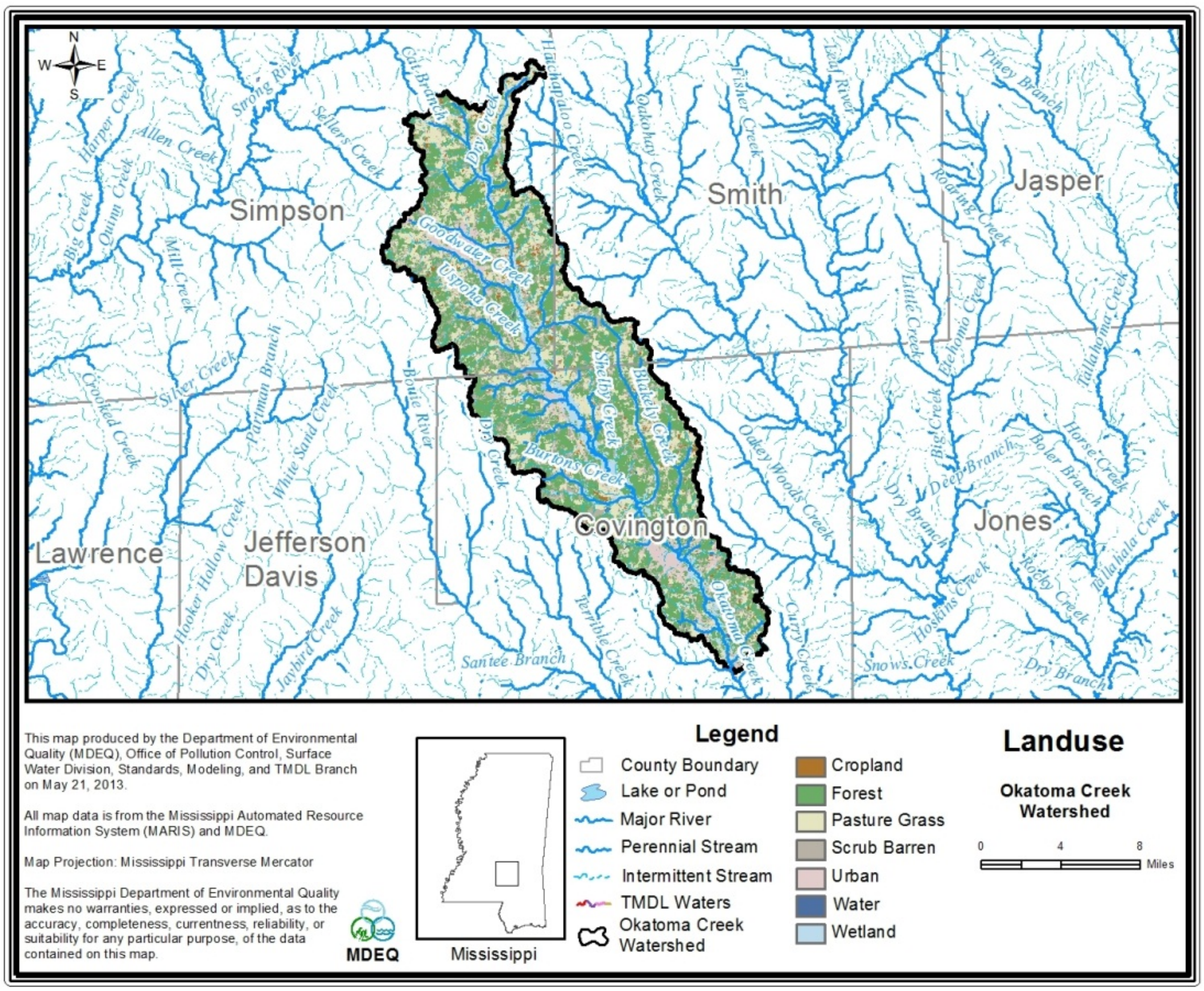


**Figure 4 Landuse Distribution Map**

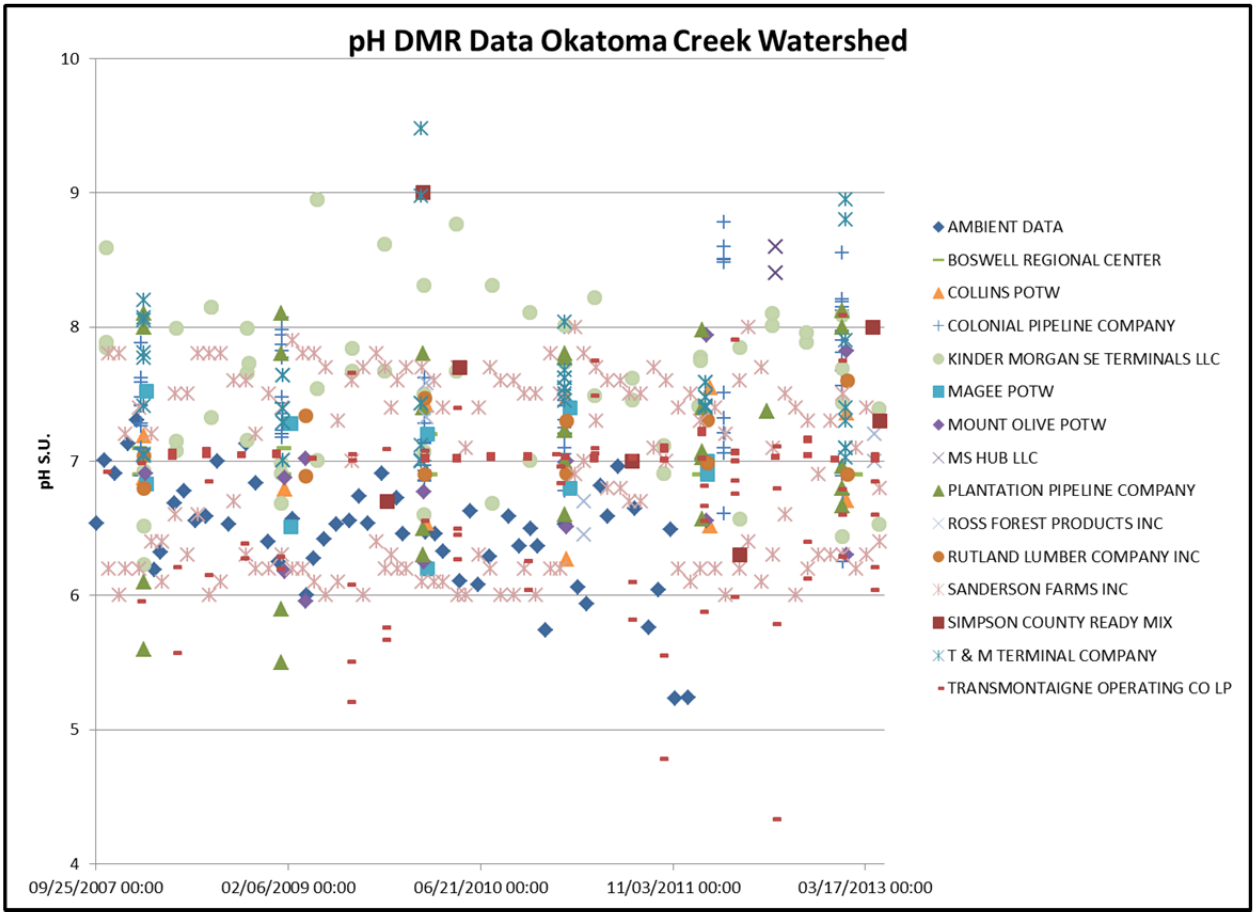


**Figure 5 DMR and Ambient pH Data 2007 - 2011**

## Source Identification

There are 24 point sources in the watershed that flow into this segment (Table 4 below). The vast majority of the discharge monitoring report (DMR) data submitted by these facilities are within the 6.0 S.U. to 9.0 S.U. range allowed in the water quality standards. These data are shown in Figure 5 above.

Two of these facilities TransMontaigne Operating Company Numbers 1 and 2 have permitted discharges that range from 5.0 S.U. to 9.0 S.U. for stormwater runoff based on naturally acidic soils. The permit rationale from TransMontaigne Operating Company LP Collins Piedmont Terminal Number 2 states the minimum pH effluent limit of 5.0 s.u. is based on previous studies conducted by the permittee during 1992 and 1997 which illustrated the natural acidic conditions of the rainwater, surface water, and the surrounding soils. During the February 1998 re-issuance of this permit, a minimum pH limit of 4.5 was established in the renewal permit. During the reissuance of the permit to the current facility owner, TransMontaigne Product Services Inc., a review of their discharge monitoring reports from the previous five years revealed that only 1 pH value was reported lower than 5.0 s.u. As a result, a minimum pH limit of 5.0 s.u. was established in the September 23, 2003 reissuance of this permit. The maximum pH effluent limit of 9.0 s.u. is WQBELs that reflects the WPC-2 requirement for the maximum in-stream pH to be less than 9.0 s.u.

**Table 4 NPDES Permitted Sources**

| Agency Interest | Name | City | County | Permit | Description |
|---|---|---|---|---|---|
| 13926 | Boswell Regional Center | Sanatorium | Simpson | MS0038849 | Outfall 001 (Domestic Wastewater Discharge) |
| 1159 | Chevron Products Company, Collins Terminal | Collins | Covington | MS0039934 | Outfall 001 (Process Tank Water Flow) |
| 13084 | Collins POTW | Collins | Covington | MS0023761 | Outfall 001 (Domestic/ Municipal Wastewater) |
| 1817 | Colonial Pipeline Company, Collins Complex | Collins | Covington | MS0030392 | Outfall 001 (Storm Water Discharge From Retention Pond No. 1). |
| 58517 | Colonial Pipeline Company, Collins Injection | Collins | Covington | MSG130368-001 | Outfall 001 (Hydrostatic Testing Discharge) |
| 5042 | Colonial Pipeline Company, Kola Station | Collins | Covington | MSG130368-001 | Outfall 001 (Hydrostatic Testing Discharge) |
| 4664 | D and L Veneers Inc | Collins | Covington | MSG170047-001 | Outfall 001 (Overflow from Recycle Storage Pond) |
| 1057 | Kinder Morgan Southeast Terminals LLC, Collins Terminal | Collins | Covington | MS0044628-001 | Outfall 001 (Stormwater, Laboratory Cleanup Water, Washdown Water, Monitor Well Test Water and Aquifer Characteristics Test Water) |
| 13242 | Magee POTW | Magee | Simpson | MS0024911 | Outfall 001 (Treated Domestic Wastewater Discharge) |
| 1358 | Motiva Enterprises LLC, Collins Terminal | Collins | Covington | MS0002968-002 | Outfall 002 (Stormwater) |
| 13291 | Mount Olive POTW | Mount Olive | Covington | MS0020699 | Outfall 001 (Domestic/ Municipal Wastewater) |
| 37951 | MS HUB LLC, MS HUB Natural Gas Handling Facility | Jaynesville | Simpson | MSG130226-004 | Outfall 004 (Hydrostatic Testing Discharge) |
| 14296 | Pantry Inc, The, Store Number 3397 dba Big K | Magee | Simpson | MS0052779 | Outfall 001 (Treated Car Wash Effluent) |
| 2876 | Pine Belt Ready Mix Concrete Inc | Collins | Covington | MSG110054-001 | Outfall-001 (Process Wastewater from Ready Mix Plant) |
| 4363 | Plantation Pipeline Company, Collins Terminal | Collins | Covington | MS0046264-002 | Outfall 002 (Stormwater Runoff from the East Catchment Basin) |
| 2060 | Rutland Lumber Company Inc | Collins | Covington | MSG170015-001 | Outfall 001 (Overflow from Recycle Storage Pond) |
| 1094 | Sanderson Farms Inc, Collins Processing Facility | Collins | Covington | MS0002089 | Outfall 001 (Process and Sanitary Wastewaters, Boiler Blowdown Water, Condenser Non-Contact Cooling Water, Ice Water, |

| | | | | | |
|---|---|---|---|---|---|
| | | | | | and Stormwater Run-off). |
| 8446 | Simpson County Ready Mix Concrete, Plant Number 6 | Magee | Simpson | MSG110177-001 | Outfall - 001 (Process Wastewater from Ready Mix Plant) |
| 23696 | Suds N Shine Inc, Number 3 | Magee | Simpson | MS0060381 | Outfall 001 (Treated car wash waste water) |
| 8243 | Sullivan Ready Mix | Magee | Simpson | MSG110298-001 | Outfall 001 (Process Wastewater from Ready Mix Plant) |
| 3690 | T and M Terminal Company | Collins | Covington | MS0047627 | Outfall 001 (Stormwater Discharged From Pond No. 1) |
| 1699 | TransMontaigne Operating Company LP, Collins Piedmont Terminal Number 1 | Collins | Covington | MS0045454 | Hydrostatic Test Discharge, Outfall 001 |
| 1725 | TransMontaigne Operating Company LP, Collins Piedmont Terminal Number 2 | Collins | Covington | MS0045381 | Outfall 001 (Stormwater Runoff from Tank Diked Area, Pump Pad Area and Construction Stormwater). |
| 1393 | TransMontaigne Operating Company LP, Collins Southeast Terminal | Collins | Covington | MS0021245 | Hydrostatic Test Discharge, Outfall 002 |

# Data

MDEQ collected ambient monthly water quality samples from Okatoma Creek. The ambient pH data are shown in Figure 6 below. The chart also has the stage measured in the stream. The pH values appear to be seasonal through 2010. The values in 2011 do not follow the same format.

Figure 7 shows the data for 2011. There appears to be a correlation to stormwater runoff and lower pH values. This would support the theory of acidic soils contributing to the pH values found in the ambient program.

The higher pH values 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.

Further Figure 8 shows the DMR pH data for 2011 which also have more lower values during the fall. There is not sufficient information available to determine the cause for the lower pH values in the fall of 2011. The 2012 ambient data set failed MDEQs quality control process and is not available.

Figure 9 shows the USGS pH data from 1965 through 1975. The pH values were much lower during this time period.

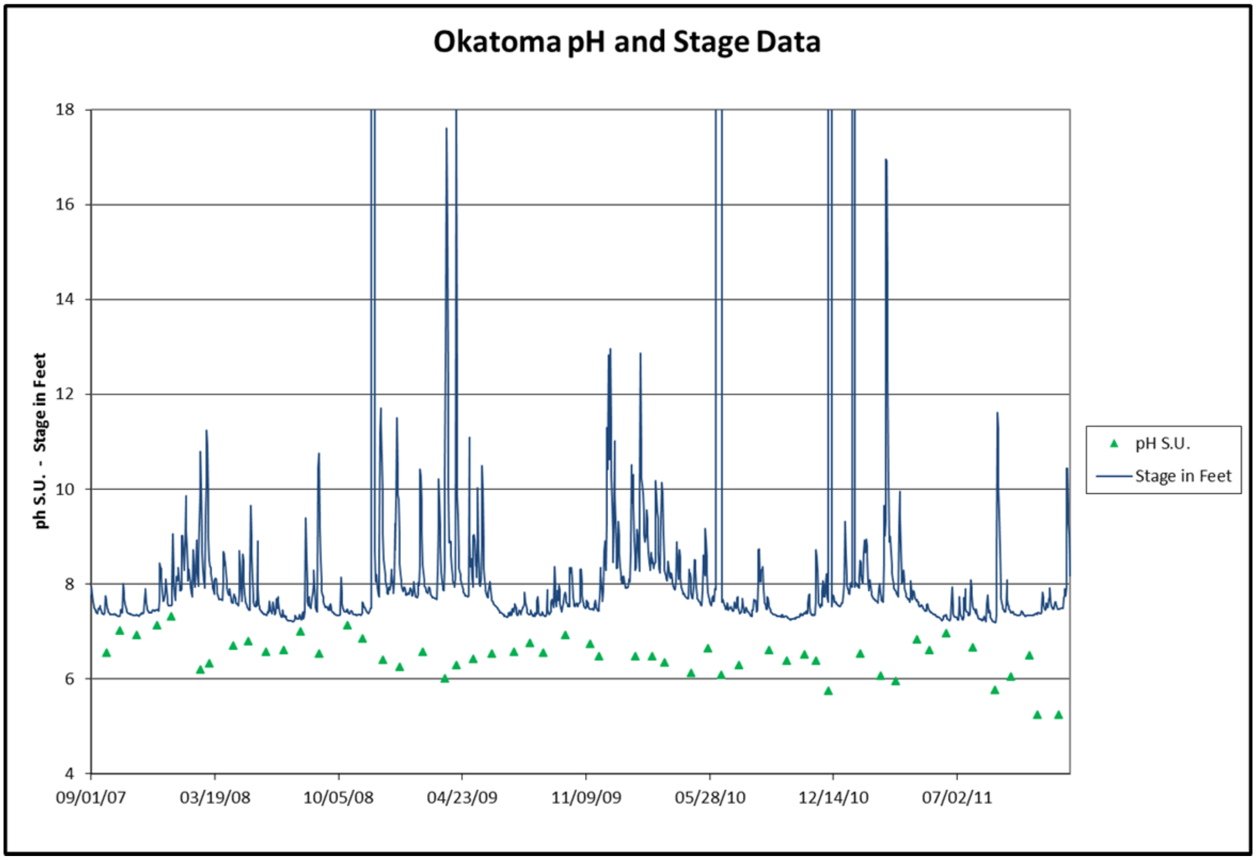


**Figure 6 pH Ambient Data and Okatoma Stage Data**

Ambient pH measurements were taken between 2007 and 2010 (Figure 6). As shown in this figure, all of water quality standards excursions were attributed to low pH. As summarized in Table 5 below, 9.6% of the pH measurements did not meet water quality standards. These mainly occur in winter and spring.

**Table 5 Assessment Table for pH**

| Data Window | Number of Samples | Number of samples not meeting water quality standards (low pH) | Percentage of data not meeting water quality standards |
|---|---|---|---|
| 2007 - 2011 | 52 | 5 | 9.6% |

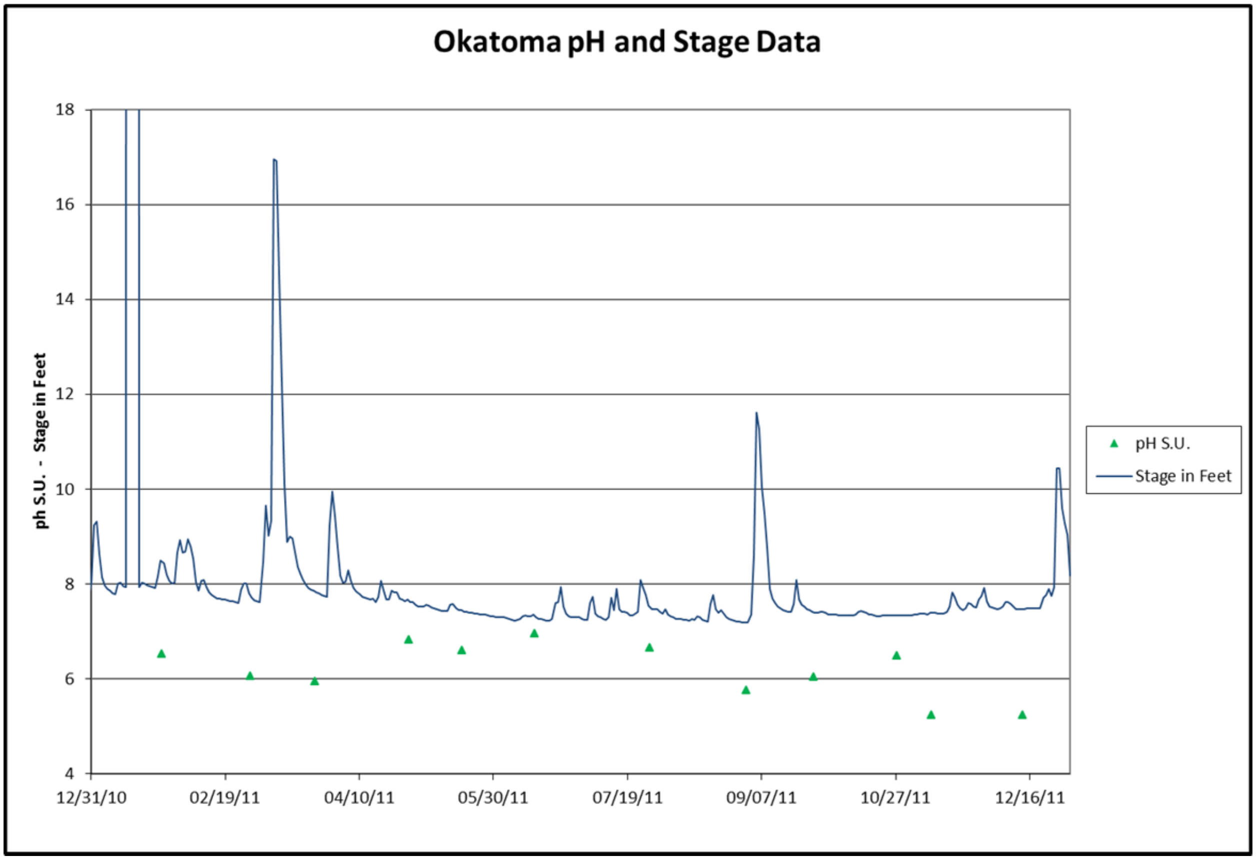


**Figure 7 pH Ambient Data and Okatoma Stage Data - 2011**

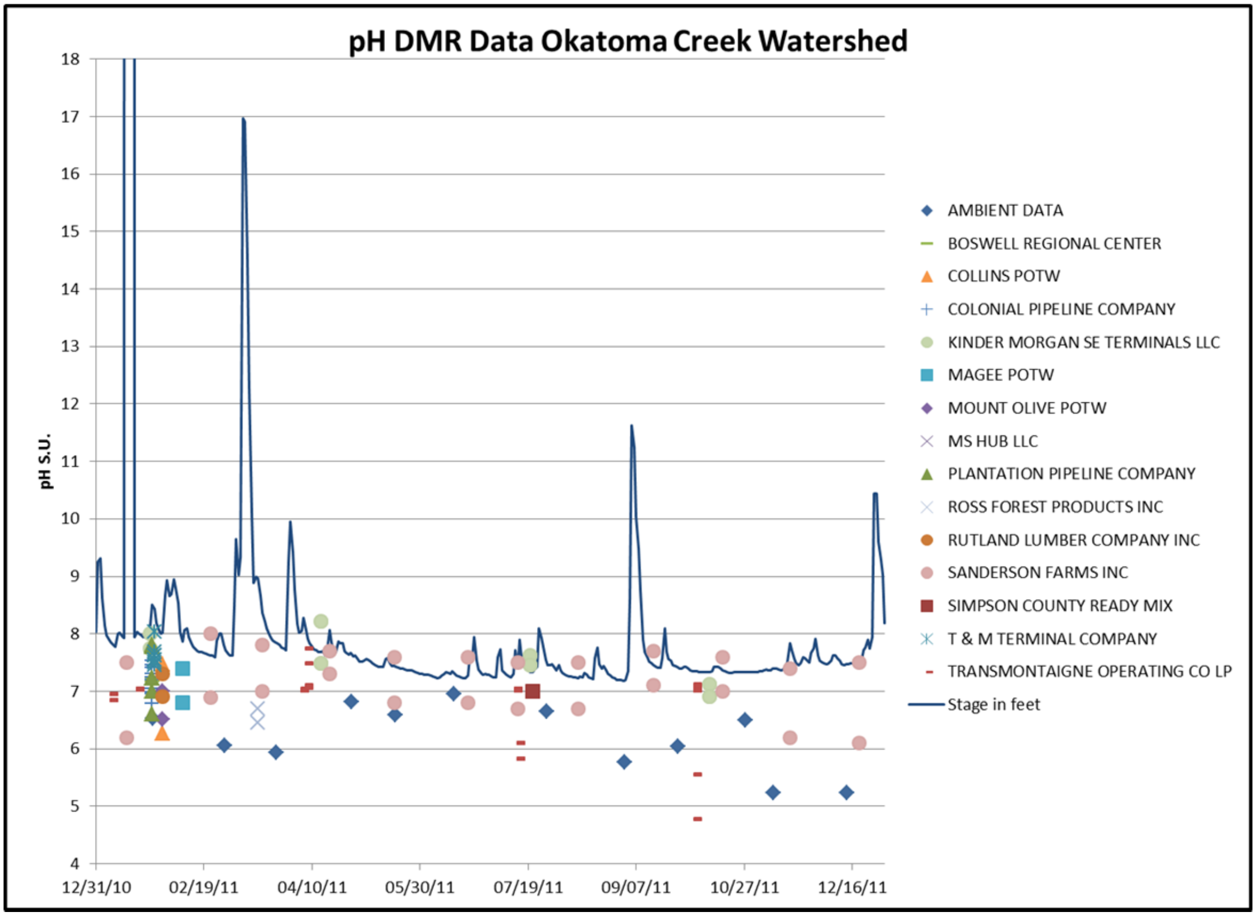


**Figure 8 DMR and Ambient Data and Stage Data - 2011**

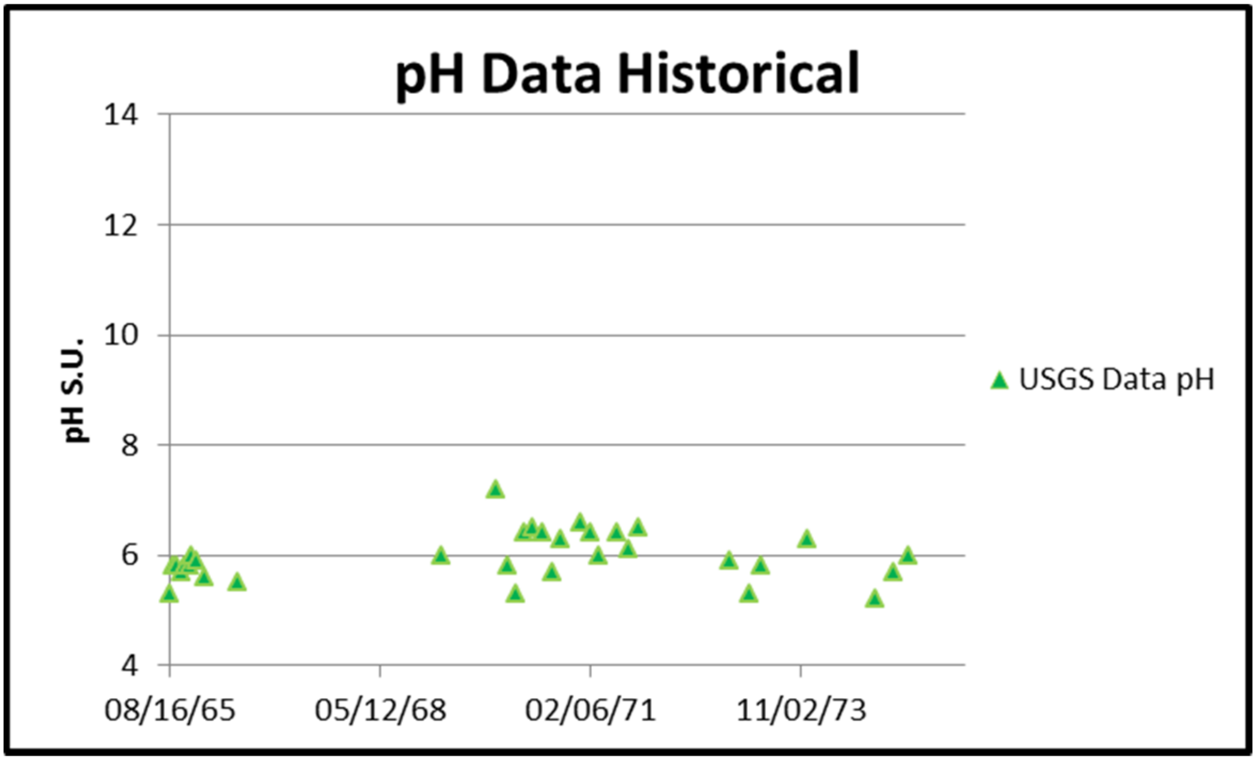


**Figure 9 USGS pH Data from 1965 - 1975**

## 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 24 point sources that discharge to this watershed. For future dischargers to this watershed or to tributaries in the watershed, effluent pH levels should 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. except as previously granted in NPDES permits. This is a standard NPDES permit requirement.

## Load Allocation

The nonpoint sources causing or contributing to pH violations are unknown. 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 water body. 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. As long as 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. In this case, MDEQ on two occasions granted NPDES permit limits lower than the water quality standards based on studying monitoring data results that showed natural conditions in the watershed are below the statewide standard. This TMDL recommends further monitoring from the point sources in their DMRs 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 Okatoma Creek.

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.

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