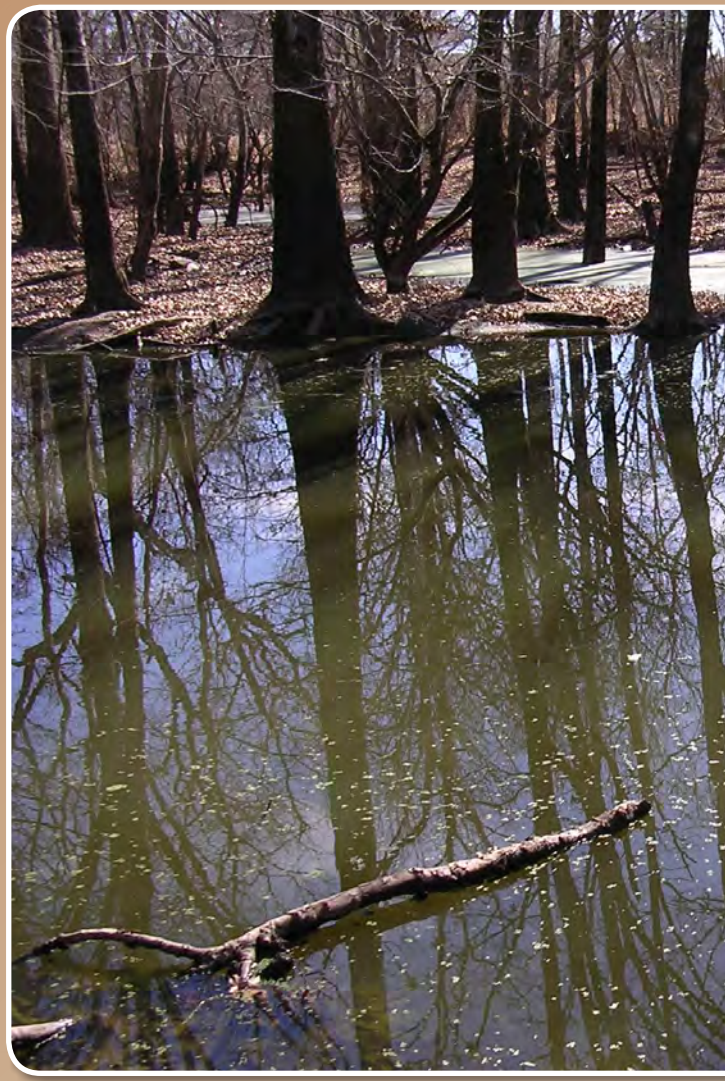
UPPER NECHES BASIN SUMMARY REPORT 2010



ANRA

Angelina & Neches River Authority

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Executive Summary

Activities and Accomplishments

The Clean Rivers Program (CRP) utilizes a watershed management approach to identify and evaluate water quality issues, establish priorities for corrective action, and outline strategies to implement those actions. CRP funds are shared equally among the LNVA and ANRA to monitor water bodies in the Neches River Basin. During FY 2010, there were thirty monitoring stations that ANRA submits data for within ANRA's jurisdiction. These stations were monitored once every quarter (three month period intervals). Four of these stations were collected by City of Tyler; the remaining twenty-six stations were monitored by ANRA personnel. During this same time frame, TCEQ collected water quality data at thirty-nine routine stations. All CRP monitoring activities can be found online at the Coordinated Monitoring Schedule website (cms.lcra.org).

Significant Findings

Bacteria, used as indicator of support for contact recreation, can be considered problematic on some water bodies in the Upper Neches Basin, including, but not limited to, unclassified waters of segment 0604, 0605A, 0606, 0610A, parts of 0611, 0612, and parts of 0615. The majority of the water segments placed on the 303(d) list of impaired water bodies within ANRA's jurisdiction are due to elevated *E. coli* bacterial levels.

Dissolved oxygen criterion levels are established to support and maintain aquatic life. Several water bodies have been and are currently impaired for nonsupport of the designated aquatic life use due to depressed dissolved oxygen levels. On the 2008 303(d) list of impaired water bodies, several segments including 0604A, 0604M, 0605A, 0606, and areas within 0615 have been listed for depressed dissolved oxygen levels.

Many water bodies within the basin have pH issues. The alkalinity for the Neches River basin is generally low, having a naturally occurring low buffering capacity. However, areas of high pH are found within the basin, including Lake Palestine (segment 0605). This segment was listed on the 303(d) list of impaired water bodies for high pH. Lake Palestine is believed to have issues with pH contributed by nutrient enrichment and photosynthesis. Segment 0606, Neches River above Lake Palestine, was listed on the 303(d) list of impaired water bodies for a low pH, caused by natural sulfur deposits and groundwater influx. The source or cause of exceedances of criteria and the nutrient concerns for screening levels varied from segment to segment.

Toxic substances in water including lead, aluminum, and zinc have also been found in East Texas waters including the East Fork Angelina River and the Neches River below and above Lake Palestine.

Mercury in edible fish tissue is a major concern in East Texas reservoirs. The Angelina River, Sam Rayburn Reservoir, and Lake Ratcliff are just a few examples within the Neches River basin that have mercury in edible fish tissue. A fish consumption advisory for water included in the basin was issued on March 8, 2010 by the Texas Department of State Health Services. The fish advisory warning was issued for mercury in edible fish tissue along the Neches River and all contiguous waters from State Highway 7 bridge west of Lufkin downstream to the U.S. Highway 96 bridge near Evadale. The species affected in regards to the health advisory in the Neches River are flathead catfish, freshwater drum, gar, largemouth bass, spotted bass, and white bass. The consumption advisory includes that adults should limit consumption of the species affected to no more than two, eight ounce meals per month. Children under twelve years of age should limit consumption of the affected species to no more than two, four ounce meals per month. Women who are nursing or pregnant should not consume any species affected according to the health advisory. Mercury exists in various forms and people can become exposed to it in different ways. The highest concentrations of methylmercury can be found in larger fish due to mercury being a substance which bioaccumulates. Additional information may be obtained at the Department of State Health Services website (www.dshs.state.tx.us/news/releases/20100308.shtm).

Recommendations

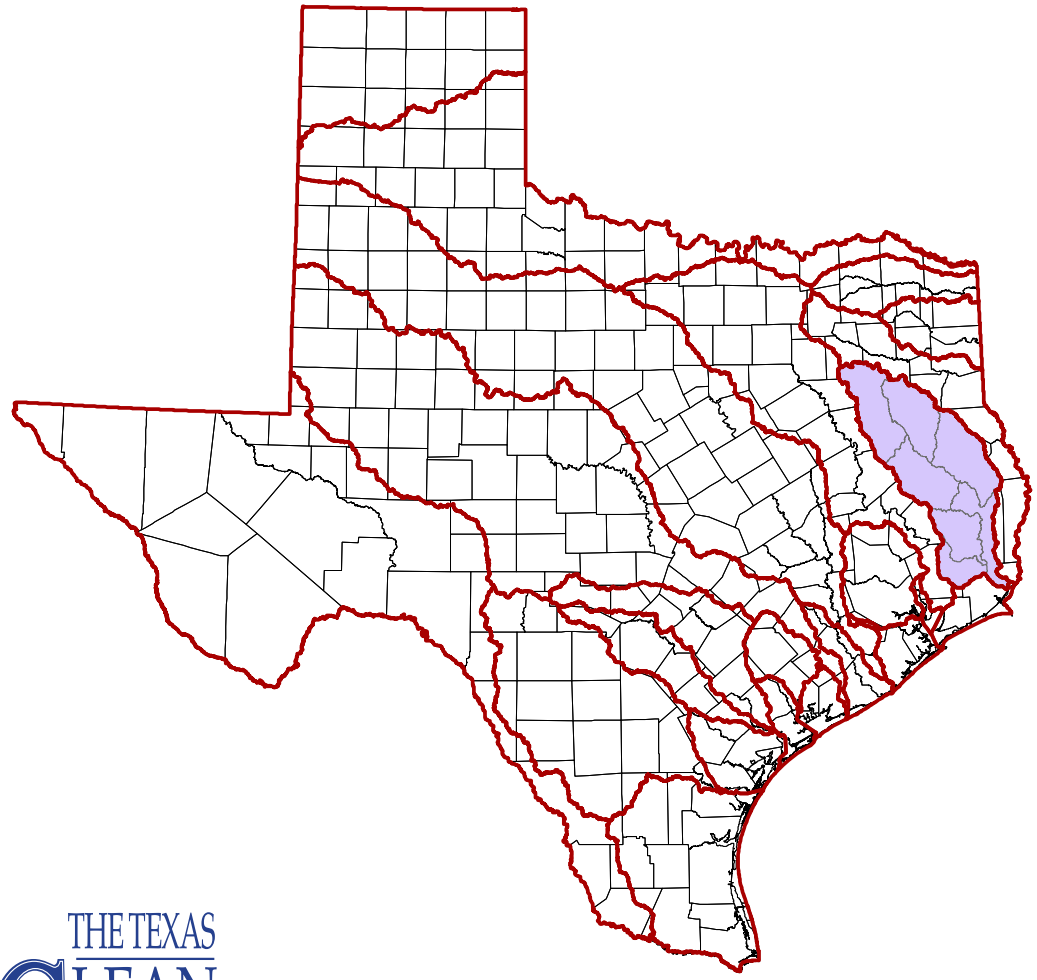
Continued monitoring efforts within the basin are an important issue to stakeholders. In addition to monitoring activities funded by the Clean Rivers Program, ANRA is looking to expand its surface water quality monitoring program by developing partnerships with other entities in the state and the basin. Starting in FY 2010, ANRA is joining the Texas Water Resource Institute (TWRI), Texas AgriLife Research, Castilaw Environmental Services, Stephen F Austin State University, and Pineywoods Resource Conservation & Development in a project to assess the water quality in Attoyac Bayou and develop a Watershed Protection Plan. This project is being funded through a grant from the Texas State Soil and Water Conservation Board (TSSWCB). By participating in grant-based projects such as this one, ANRA will be able to expand the services it provides to the stakeholders in the basin and address issues in water quality that have been previously identified. One of the primary goals of the current water quality monitoring program at ANRA is to identify and foster collaborative relationships with other entities to pool resources and talents in addressing these types of water quality issues.

Introduction

About The Basin Summary Report

The Basin Summary Report, assembled every five years, provides a comprehensive review of water quality data and water quality related issues for the Upper Neches River Basin. The report serves to develop a greater understanding of water quality within the basin, which can be used to aid regulatory agencies in decision making. The report consists of a comprehensive review including descriptions of water quality conditions and issues, trend analysis of water quality by station and parameter, discussion of watershed characteristics, and potential influences on water quality. Furthermore, recommendations of management strategies for correcting identified water quality impairments are also included in the report. The report details activities performed by the Angelina & Neches River Authority (ANRA) under the Texas Clean Rivers Program (CRP).

The 2010 Basin Summary Report was prepared by the Angelina & Neches River Authority in cooperation with the Texas Commission on Environmental Quality (TCEQ) under the authorization of the Texas Clean Rivers Act.



ANRA
Angelina & Neches River Authority

TCEQ

The Texas Clean Rivers Program

Introduction

About The Angelina & Neches River Authority

The Angelina & Neches River Authority, originally named the Sabine & Neches Conservation District, was created in 1935 by the Texas legislature as a conservation and reclamation district. The legislature divided the territory of the Sabine & Neches Conservation District into the Sabine River Authority and the Neches River Conservation District in 1949. It was not until 1971 that the Neches River Conservation District was activated and began operating as a water resource agency. In 1977, Senate Bill 125 changed the name of the Neches River Conservation District to the Angelina & Neches River Authority.

ANRA's office is located in Lufkin, Texas. ANRA's territorial jurisdiction consists of 8,500 square miles that lie wholly or in part of the following counties: Van Zandt, Smith, Henderson, Newton, Cherokee, Anderson, Rusk, Houston, Nacogdoches, San Augustine, Shelby, Angelina, Trinity, Sabine, Polk, Jasper, and Orange.

The Angelina & Neches River Authority (ANRA) has the responsibility for monitoring, protecting, and enhancing water resources in the Neches River Basin.

ANRA's functions in the basin include:

- water quality monitoring
- drinking water and wastewater analysis
- on-site sewage facility permitting
- water and wastewater utilities
- water resources development
- regional wastewater/composting facilities
- other regional planning efforts

ANRA Main Office, located in downtown Lufkin

CRP and Basin Goals & Objectives

Senate Bill 818, known as the Texas Clean Rivers Act, was enacted in 1991 by the Texas legislature in response to heightened concerns that water resource issues were not being pursued in an integrated, systematic fashion as intended under the Clean Water Act (CWA). The Texas Clean Rivers Act requires that each Texas River Basin conduct ongoing water quality assessments, integrating water quality issues using a watershed management approach.The Clean Rivers Program (CRP) implements the Clean Rivers Act through water quality monitoring, assessment, and public outreach. Currently, monitoring in the state of Texas includes over 1800 sites and regional water quality assessments within the 23 major river and coastal basins and their sub-watersheds. The CRP legislation mandates that each governing entity submit quality-assured data collected in each river basin to the TCEQ. A regional Quality Assurance Project Plan (QAPP) has been developed between the ANRA and the TCEQ to accomplish the activities mandated by the legislation.

The mission of the CRP is to maintain and improve the quality of water within each river basin in Texas through an ongoing partnership involving the Texas Commission on Environmental Quality, river authorities, other agencies, regional entities, local governments, industry, and citizens. The program's watershed management approach will identify and evaluate water quality issues, establish priorities for corrective action, work to implement those actions, and adapt to changing priorities. CRP has a long-term plan with six objectives as specified in the accompanying table.

CRP's long-term plan is implemented through the biennial Clean Rivers Program Guidance developed by TCEQ project management staff with input from the partner agencies. The Guidance document describes seven key tasks to be performed by partner agencies. These tasks are listed in the table to the right.

Clean Rivers Program Long-Term Plan

Objective	*Goal*
1	Provide Quality-Assured Data to the Commission for Use in Water Quality Decision-Making
2	Identify and Evaluate Water Quality Issues
3	Promote Cooperative Watershed Planning
4	Inform and Engage Stakeholders
5	Maintain Efficient Use of Public Funds
6	Adapt Program to Emerging Water Quality Issues

Clean Rivers Program Tasks

Task	*Responsibility*
1	Project Administration
2	Quality Assurance
3	Water Quality Monitoring
4	Data Management
5	Data Analysis and Reporting
6	Stakeholder Participation and Public Outreach
7	Special Projects

Coordination and Cooperation with Other Entities in the Basin

The Clean Rivers program enables stakeholders, citizens, and state entities to meet periodically to review and discuss water quality related issues. ANRA works with TCEQ regional offices in Tyler (Region 5) and Beaumont (Region 10) to coordinate monitoring activities. ANRA also coordinates activities with other agencies, such as Texas Parks and Wildlife Department (TPWD), the United States Geological Survey (USGS), and the Texas State Soil and Water Conservation Board (TSSWCB), and other River Authorities. Every year the Coordinated Monitoring Meeting allows entities in the basin to meet and coordinate sampling schedules to make sure that adequate coverage is maintained with minimal duplication of effort.

The Neches Basin is divided between the Angelina & Neches River Authority in Lufkin and the Lower Neches Valley Authority (LNVA) in Beaumont. ANRA monitors the upper and middle portions of the Neches Basin, with LNVA monitoring the lower portion. The City of Tyler also aids in monitoring four stations for ANRA's CRP on a quarterly basis. The TCEQ also monitors within the Neches Basin, with the regional offices in Tyler and Beaumont conducting monitoring activities.

ANRA's Clean Rivers Program assists and supports the activities of the Texas Stream Team volunteer monitoring program. ANRA supplies replacement reagents for test kits, as well as providing training in sampling, testing, and quality assurance procedures for volunteer monitors in the basin. Currently a group of volunteers, The Greater Lake Palestine Area Council, monitors at four locations around Lake Palestine. This group has collected data consistently since 2000. For more information about Texas Stream Team and volunteer monitoring throughout the state, please visit their website at txstreamteam.rivers.txstate.edu.

CRP monitoring by City of Tyler staff

ANRA assisting in Pine Island Bayou UAA

Descriptive Overview of the Neches Basin

The Upper Neches River Basin originates in southwest Van Zandt County and flows easterly through the Piney Woods of East Texas to the confluence of the Angelina and Neches Rivers at B.A. Steinhagen Lake. The Neches River continues to meander prior to emptying into the Sabine Lake estuary. The tidal portion of the river has undergone dredging, widening, and straightening to accommodate seagoing vessels. The Northeastern one third of the basin is drained by the Angelina River, while the remaining two thirds of the 10,011 square mile area are drained by the Neches River, Pine Island Bayou, and Village Creek.

The Neches River Basin has been divided into sixteen classified segments, including nine stream segments encompassing 710.1 stream miles and six reservoirs yielding 163,515 acres. ANRA performs monitoring in the upper and middle regions of the Neches Basin, with the Lower Neches Valley Authority (LNVA) being responsible for monitoring in the lower region. In the Upper Neches River Basin, there are nine classified river segments consisting of two major reservoirs and eight water supply lakes. The principle tributaries in the basin are Mud Creek, Striker Creek, East Fork Angelina River, Piney Creek, Attoyac Bayou, and Ayish Bayou.

The two major river basins are the Angelina and Neches Rivers, which comprise an estimated 1.2 billion gallons of water discharge annually into the Gulf of Mexico. Two major reservoirs, Sam Rayburn Reservoir and Lake Palestine, are also included in the Upper Neches River Basin. Ten minor reservoirs are included in the Upper Neches River Basin, including Lake Tyler, Lake Tyler East, Lake Naconiche, Lake Jacksonville, Lake Athens, Striker Lake, Lake Nacogdoches, Kurth Lake, Lake Pinkston, and Lake Ratcliff.

Rainfall patterns vary across the basin. In the northern half of the basin, average annual precipitation is 43 inches. Annual precipitation increases as the location is closer to the Gulf of Mexico, where the climate is subtropical to temperate.

Annual Precipitation in the Upper Neches Basin

Area of Basin	*Average Annual Precipitation (in inches)*
Upper Neches Sub-Basin	
Lake Athens area	40 - 42
Lake Jacksonville	42 - 44
Middle Neches Sub-Basin	
Most of the middle and upper portion	42 - 44
Junction of middle and lower sub-basin	46 - 48
Lower Neches Sub-Basin	48 - 58
Upper Angelina Sub-Basin	
Upper portion	42 - 44
Lower area towards Lake Nacogdoches	44 - 46
Lower Angelina Sub-Basin	
Junction of middle and lower sub-basin	46 - 48
Pinkston Reservoir and middle area	48 - 50
Sam Rayburn towards lower area	50 - 52
Lowermost portion of sub-basin	52 - 54

The Upper Neches River Basin is supported by two major aquifers (the Carrizo-Wilcox and Gulf Coast Aquifers). The basin is also supported by minor aquifers including Sparta, Yegua Jackson, and Queen City Aquifers.

The watersheds are primarily located within the South Central Plains Ecoregion, with the northwest portion of the jurisdiction located within the East Central Texas Plains Ecoregion. This northwestern tip is within the East Central Texas Plains Ecoregion and is dominated by oak woods and prairie. The South Central Plains Ecoregion is locally termed "piney woods." This region is comprised mostly of irregular plains that were once blanketed by oak-hickory-pine forests. Presently, the area is predominantly loblolly and shortleaf pine. Lumber, pulpwood production, creosoting, silviculture, oil and gas activities, agriculture, and poultry are major economic activities.

Sam Rayburn Reservoir at Shirley Creek

Soil Properties in the Upper Neches Basin

The soil properties for each of the five watersheds of the Upper Neches Basin were summarized using soil surveys and general soil maps for individual counties.

Segment 0604 (Neches River Below Lake Palestine)
The soil is generally loamy with sandy and clayey portions that are nearly level to gently sloping. The natural drainage ranges from moderately well to somewhat poorly drained soils. The permeability ranges from very slow to moderate. This watershed segment is dominated by strongly acidic to moderately acidic soils.

Segment 0605 (Lake Palestine)
The soil is generally loamy with small portions of sandy areas. The slope of this segment ranges from gently sloping to moderately steep. This watershed segment is dominated by well to moderately drained soils, with moderate to moderately slow permeability. This segment contains slightly to moderately acidic soils.

Segment 0606 (Neches Above Lake Palestine)
The soil is characterized by mostly loamy and sandy soils that are gently sloping to moderately steep. This segment's natural drainage is characterized mainly by well and moderately well drained soils. The permeability is moderately slow to moderate. This segment contains moderately to slightly acidic soils.

Segment 0610 (Sam Rayburn Reservoir)
This soil is characterized by loamy and sandy soils with some clayey areas that are nearly level to gently sloping. The soils are moderately well drained. This segment contains mostly moderate and very slowly permeable soils that are dominated by neutral and strongly acidic regions.

Segments 0611 (Angelina Above Sam Rayburn) and 0613 (Lake Tyler)
These soils are dominated by loamy and sandy soils with portions of clay soils that are gently sloping to moderately steep. This segment is characterized by well and moderately well drained soils that display moderate permeability. These soils range from moderate to strongly acidic.

Segment 0612 (Attoyac Bayou)
This segment is characterized by loamy soils with sandy and clayey portions that are gently sloping to moderately steep. These soils are well to moderately well drained, with moderately slow permeability. This segment displays moderate to strongly acidic soils.

Soil at Sam Rayburn Reservoir, near Shirley Creek

Ecosystem of East Texas

East Texas is home to four National Forests, including the Sabine, Angelina, Davy Crockett and Sam Houston, Big Thicket National Preserve, and Trinity River National Wildlife Refuge (NWR). The East Texas Ecosystem includes forested, scrub-shrub, emergent, aquatic bed, and wetlands. Wetland and deep water areas like reservoirs may provide habitat for a large number of migratory waterfowl, wading birds, and resident species of amphibians, reptiles, birds, and mammals. The reservoirs included within the East Texas pineywoods provide outdoor recreational activities such as camping, and hiking. In addition, they provide significant sport fisheries and commercial operations within the area. Both bottomland and upland woodlands, savannah, and grasslands provide breeding and migratory habitat for neotropical migrants. This ecosystem is the major bald eagle nesting and wintering area of Texas and contains all of the state's extant habitat for red-cockaded woodpeckers. Currently, 9 endangered species, 2 threatened species, 1 proposed species, 3 candidate species, and 43 species of concern are known to occur within the boundaries of the East Texas Ecosystem.

Major threats to the East Texas Ecosystem are continual loss and fragmentation of habitat from urban sprawl, forest land conversion to improved pasture, mineral extraction, dam and highway construction, pipeline and transmission line installation, soil and water contamination, short-rotation management of commercial forests, and introduction of exotic species.

More information can be found on the U.S. Fish & Wildlife website at the following addresses:

www.fws.gov/endangered/bulletin/96/julnews.html

www.fws.gov/southwest/clearlakees/RarePlantsEastTexas.htm

www.fws.gov/southwest/es/EndangeredSpecies/lists/ListSpecies.cfm

Carlson's Trophic State Index

Major Texas reservoirs have been evaluated and ranked by the TCEQ using Carlson's Trophic State Index (TSI). It was developed to compare among reservoirs Secchi disk depths, chlorophyll-*a* concentrations, and total phosphorus concentrations. These three variables are highly correlated and are considered estimators of algal biomass. The TSI is determined from three computational equations used with SWQM data. Thus, TSI calculations can classify reservoirs or lakes into the following trophic states:

Carlson's Trophic State Index (TSI)

Trophic State	*Water Quality Characteristics*
Oligotrophic	Clear waters with extreme clarity, low nutrient concentrations, little organic matter or sediment, and minimal biological activity
Mesotrophic	Waters with moderate nutrient concentrations and, therefore, more biological productivity. Waters may be lightly clouded by organic matter, sediment, suspended solids or algae
Eutrophic	Waters extremely rich in nutrient concentrations, with high biological productivity. Waters clouded by organic matter, sediment, suspended solids, and algae. Some species may be eliminated
Hypereutrophic	Very murky, highly productive waters due to excessive nutrient loading. Many clearwater species cannot survive.

Segment 0610 Sam Rayburn Reservoir was classified as mesotrophic.

Segment 0614 Lake Jacksonville was classified as eutrophic.

Segment 0613 Lake Tyler and Lake Tyler East are both listed as eutrophic.

Segment 0615 Lake Palestine is classified as eutrophic.

Secchi Depth measurement at Lake Ratcliff

Summary of the Neches Basin Water Quality Characteristics

In determination of whether designated uses are supported, water quality parameters were examined and compared to water quality criteria and screening levels. The Texas Surface Water Quality Standards (TSWQS) and the TCEQ's Guidance for Assessing Texas Surface and Finished Drinking Water Quality Data were two guidance documents used in ANRA's assessment. The 2008 Water Quality Inventory and 303(d) List of impaired water bodies was used, as the 2010 assessment is still in draft form as of the publication date of this report.

In general, historical and current water quality data of the Neches River basin included elevated bacteria levels, depressed dissolved oxygen, mercury in edible fish tissue, and several acute and chronic toxics. Data analysis displayed nonsupport and several concerns for screening levels in regards to nutrients. However, there are several segments, tributaries, and reservoirs within the basin that are fully supporting the criteria established for designated uses.

Collection of water samples at Sam Rayburn Reservoir

Public Involvement

ANRA Operations

The Angelina & Neches River Authority promotes public involvement in the Upper Neches Basin through numerous operations and departments. In addition to monitoring water quality through the Clean Rivers Program, ANRA operates and maintains numerous public drinking water and municipal wastewater facilities, maintains the on-site septic system program for Sam Rayburn Reservoir, and operates an Environmental Laboratory offering services to the public. Additionally, ANRA produces and sells biosolids compost through our Neches Compost Facility.

ANRA Environmental Laboratory

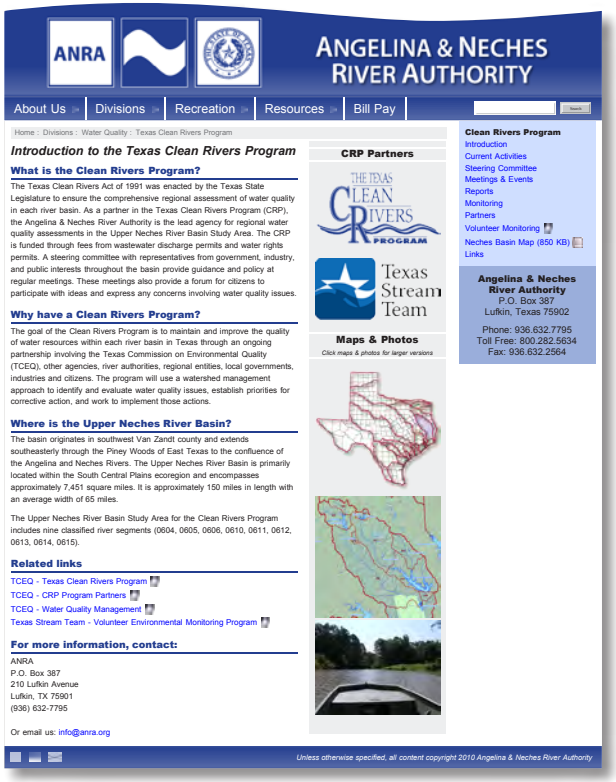
ANRA has an in-house water quality laboratory that provides services to numerous municipalities, water supply corporations, industries, and the general public, as well as conducting analyses of ambient surface water to support Clean Rivers Program monitoring activities. The ANRA Environmental Laboratory is certified by the National Environmental Laboratory Accreditation Program to perform chemical and microbiological analysis of both potable and non-potable waters.

Public Information

ANRA provides the public with information concerning water quality issues on our website (www.anra.org), which is updated frequently. The ANRA website provides public access to information on the Clean Rivers Program, current and historical Basin Summary and Basin Highlights reports, meeting agendas and minutes, maps, and water quality data. Numerous pamphlets, brochures, and other educational and informational literature on such topics as water quality, conservation, and on-site septic facilities are available to the public at ANRA's offices. ANRA supports the TPWD invasive species awareness campaign "Hello Giant Salvinia, Goodbye Texas Lakes" by making informational pamplets available to the public.

ANRA's Neches Compost Facility near Jacksonville

ANRA Laboratory sample receiving area



ANRA's website, redesigned in June 2010

ANRA's Holmwood Utilities in Jasper

Analysis of Total Suspended Solids (TSS)

Public Involvement

Basin Steering Committee

The steering committee's role is advisory in nature and involves assistance with the review of local issues and creation of priorities for the Upper Neches river basin. Committee members assist with the review and development of work plans, reports, basin monitoring plans, allocation of resources, and basin action plans. CRP steering committee meetings are held annually each Spring. The committee is made up from a diverse group of stakeholders, including:

- Private citizens
- Fee-payers (identified in Texas Water Code TWC 26.0135(h))
- Political subdivisions (including local, regional, and state officials)
- Texas State Soil and Water Conservation Board
- Other appropriate state agencies including: Texas Parks and Wildlife Department, Texas Water Development Board, Texas General Land Office, Texas Department of Health, Texas Department of Agriculture, Texas Railroad Commission and Texas Department of Transportation.
- Other entities interested in water quality matters including: Texas Commission on Environmental Quality regional staff, business and industry, agriculture, environmental and other public interest groups.

One of the objectives of the CRP Long-Term Plan is to engage and inform stakeholders. The Steering Committee process gives stakeholders an opportunity to contribute their ideas and concerns through steering committee meetings, public meetings, and other forums. The process also allows for the communication of issues related to water quality so that priorities may be set which consider local, regional, state, and federal needs. The Steering Committee aids in increasing opportunities for citizens to identify pressing issues and concerns, contribute ideas to the CRP process, and functions to expand the public's role in water quality management issues.

Shawna Simpson from the TCEQ presents on the water quality assessment process at the 2010 Basin Steering Committee Meeting

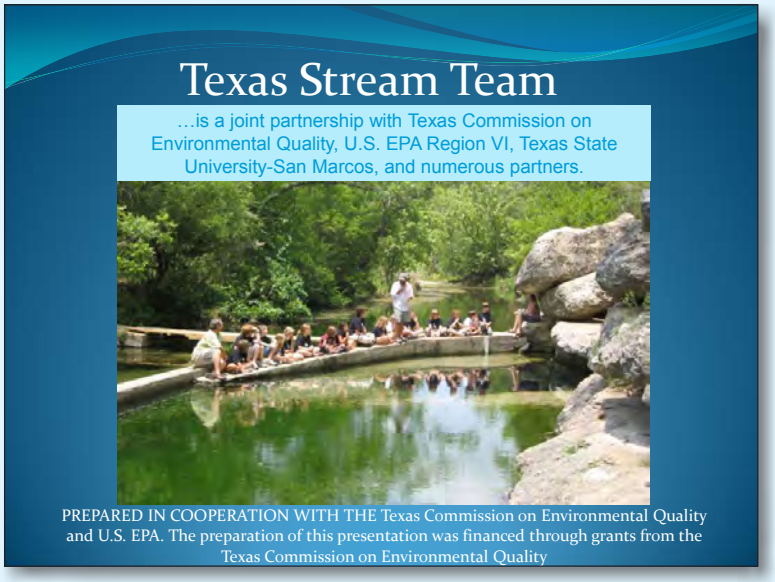
Presentations from the 2010 Basin Steering Committee Meeting are available online at www.anra.org

Public Involvement

Texas Stream Team

ANRA serves as the Texas Stream Team (formerly known as Texas Watch) regional partner for the Upper Neches Basin and provides training, monitoring kits, and replacement reagents to the volunteer monitors in the basin. ANRA supports a number of water quality monitors in the basin. The largest and most active group is comprised of members of the Greater Lake Palestine Council (GLPC). GLPC consists of a group of representatives from each Property Owner's Association surrounding Lake Palestine. The GLPC is concerned about protecting water quality in Lake Palestine and making other improvements in the area.

For more information on Texas Stream Team, please visit their website at txstreamteam.rivers.txstate.edu.



A presentation by Josh Oyer of Texas Stream Team from the 2010 Basin Steering Committee Meeting is available online at www.anra.org

For anyone interested in becoming a volunteer monitor, please contact:

Josh Oyer
Statewide Volunteer Coordinator
Texas Stream Team
River Systems Institute
Texas State University – San Marcos
Phone : 512-245-7591
E-mail : oyer@txstate.edu

Training event for Texas Stream Team, conducted February 23, 2007 by ANRA Clean Rivers Program staff

Selected Water Quality Projects In The Upper Neches Basin

Attoyac Bayou Watershed Protection Plan

This project is being conducted under a CWA Section 319(h) Nonpoint Source Management Program grant. Section 319 addresses the need for greater federal leadership to assist state and local nonpoint source efforts. Under Section 319, recipients of grant money receive funding that supports a wide variety of activities. These activities can include technical assistance, financial assistance, education, training, technology transfer, demonstration projects, and monitoring to assess the success of specific nonpoint source implementation projects.

Currently, a 319(h) Nonpoint source grant was awarded for the development of a watershed protection plan for Attoyac Bayou. On a federal level, the US Environmental Protection Agency (EPA) provides project oversight and funding. Within a state level, the Texas State Soil and Water Conservation Board (TSSWCB) provides project oversight. The Texas Water Resources Institute (TWRI) at Texas A&M is responsible for general project oversight, coordination administration, reporting and development of data quality objectives (DQOs) and a Quality Assurance Project Plan (QAPP). ANRA is responsible for conducting water quality analyses, maintaining a water quality database, and transmitting project data in a format such that it is ready for submission to the TCEQ. This project will extend approximately 28 months in duration and begins in Spring 2010. GIS inventory, public participation, a targeted water quality monitoring approach, load duration curves, bacteria source tracking, and analysis of historic data will be some activities performed under this project. Other project participants include Stephen F. Austin State University, Texas AgriLife, Castilaw Environmental Services, and Pineywoods Resource Conservation and Development.

More information on this project, including stakeholder participation, can be found online at attoyac.tamu.edu.

Attoyac Bayou at SH 21

Recreational Use Attainability Analysis

A Recreational Use Attainability Analysis (RUAA) began on 6/25/2009 for the following segments due to bacteria:

0604A	Cedar Creek
0604B	Hurricane Creek
0604C	Jack Creek
0604M	Biloxi Creek
0610A	Ayish Bayou
0611	Angelina River above Sam Rayburn Reservoir
0611A	East Fork Angelina River
0611B	La Nana Bayou
0615	Papermill Creek

UAAs are assessments of the physical, chemical, biological, and economic factors affecting a water body. UAAs are used to identify and assign attainable uses and criteria for a water body. These RUAAs have a target end date of 8/31/2012.

Swim Beach Monitoring on Sam Rayburn Reservoir

Beginning each Memorial Day and extending through the Fourth of July holiday, ANRA monitors the *E. coli* levels at several designated swim areas in Sam Rayburn Reservoir. Bacteria samples are collected at 1 ft and 2 ft depths, along with data for pH, water and air temperature, and the number of swimmers present. Monitoring is done at Ebenezer Park, Mill Creek Park, San Augustine Park, and Hanks Creek Park. All monitoring activities are performed under contract for the US Army Corps of Engineers Sam Rayburn Project Office.

Selected Water Quality Projects In The Upper Neches Basin

Lake Palestine Diurnal Survey

Some areas of Lake Palestine have been identified as concerns for ammonia, nitrate+nitrite nitrogen and high pH. Data collected in 2001 to 2003 also identified cases of depressed dissolved oxygen. Multiprobe instruments were deployed monthly for two years at each location and D.O. and pH measurements were collected hourly for a total of 24 individual measurements per month.'

The upper portion of Lake Palestine is shallow and has heavy concentrations of aquatic vegetation. The middle part of the lake has fewer aquatic vegetation problems, but it has higher phytoplankton concentration. The City of Tyler operates a raw water intake in this area. Since the plant came online in 2004, there have been seasonal taste and odor issues.

The project start date was 10/6/05, and ended on 2/1/08.

Lake Palestine Continuous Water Quality Monitoring (CWQM) Project

Seasonal dissolved oxygen stratification and increased pH and nutrient concentrations have been identified in the upper and middle portions of Lake Palestine. Raw water from Lake Palestine, located approximately ten (10) miles southwest of Tyler, is pumped to the Lake Palestine Water Treatment Plant where it is treated, filtered, and disinfected before distribution. Historically, the City of Tyler Public Water Supply (CoT PWS) staff has received complaints about the taste and odor of the public water. Seasonal taste and odor problems are typically caused by algal blooms resulting from increased nutrient concentrations, internal nutrient recycling due to temperature and DO stratification, and decreased water movement. The CoT PWS water intake structure contains three pumps, each at a different depth. Based on the degree of stratification, raw water may be collected at an appropriate depth. Water quality data (temperature, pH, specific conductivity, and DO) was collected at various depths. The extent of DO stratification may be considered to manage the timing and volume of water withdrawn from Lake Palestine. Additionally, pH data may be used to address the pH impairments in the mid-lake area.

The project began on 2/20/08 and ended on 10/7/09.

Fish Kill at Lake Palestine (5/25/05) due to depressed dissolved oxygen

Aquatic vegetation at Lake Palestine (5/25/05)

Selected Water Quality Projects In The Upper Neches Basin

Tier 1 Statewide Fish Tissue Monitoring Program

Tier 1 human health risk screening studies conducted on (up to 90) reservoirs and (20) classified stream segments. The primary purpose was to identify frequently fished sites where commonly consumed fish may be chemically contaminated, posing a risk to human health. Most of the water bodies had not been previously sampled and were selected to maximize statewide coverage. Segments 0604, 0605, 0610, and 0611 were included in the project.

The project start date was 11/1/03, with the project ending 8/1/07

Tier 2 Mercury in East Texas Water Bodies Project

The Texas Department of State Health Services (DSHS) will conduct human health risk assessments on (12) East Texas water bodies where elevated concentrations of mercury in fish tissue have been identified by screening studies. These assessments may result in the issuance of fish advisories. Segments 0604 and 0611 are included in this project. A fish consumption advisory for the Neches River was issued on 3/18/10 by DSHS.

Project start date was 12/1/04, and is currently ongoing .

Implementation Support Project in the Sam Rayburn and Toledo Bend Reservoir Watersheds

This project provided financial assistance to landowners for development/implementation of Water Quality Managemet Plans (WQMPs). It also worked to foster coordinated technical assistance activities in Sam Rayburn Reservoir and Toledo Bend Reservoir watersheds between the TSSWCB, Soil and Water Conservation Districts, the Natural Resource Conservation Service (NRCS), and other interested individuals. Another project goal was to compile information on the location/types of Best Management Practices (BMPs) for WQMPs implemented.

The project start date was 7/1/03 and the project ended on 8/31/07.

Texas Forest Service BMP Monitoring Program (1991-2005)

The Best Management Practices (BMP) Implementation Monitoring Program was started in 1991 by the Texas Forest Service in order to measure the degree of implementation with BMP guidelines by the forestry community and to evaluate the effectiveness of BMPs. Randomly chosen, "normal silvicultural" operations were evaluated for the presence of BMPs and whether or not they are functioning properly. Operations selected for evaluation included both public and private lands, and this cooperative, non-regulatory program was completely voluntary.

Since 1991, the Texas Forest Service has completed six BMP implementation reports. The last report from 2005 indicates a total of 156 sites were evaluated and are believed to be a representative sample of the forestry activities that occurred in East Texas. These sites were monitored between 5/7/03 and 7/1/05. The overall BMP implementation on the sites monitored was 91.7%. In general, implementation was highest on sites under public ownership. The national and state forestland sites had an overall implementation of 98.3%, industry sites had a 95.7% rating, commercial landowners scored 96.0% and family forest owners scored 88.9%. In the Neches River Basin, there were 62 forestry operations monitored. The combined results of these evaluations showed a 92.8% implementation rate.

The major deficiencies noted during the evaluations were a failure to restore and stabilize stream crossings on temporary roads, and failure to remove logging debris from streams. Major improvements from the previous rounds were a decrease in the number of significant risks to water quality, a higher overall BMP implementation on permanent and temporary roads, and an increase in BMP implementation on family forest lands

Additional information about the program including the 2005 BMP implementation report is available on the Texas Forest Service website at texasforestservice.tamu.edu/forest/water/default.asp

24-Hour Dissolved Oxygen and Biological Assessments

This project addressed the problem of segments/AUs that indicate impairment. In particular, due to there being sufficient uncertainty in regards to attainment, additional data will be collected which can be used to reassess and re-assign these Category 5b/5c segments to more definitive listing categories. TCEQ also has waters on a TMDL Category 5b list. These are waters where a current criterion and/or use is not being attained, but where TCEQ staff have determined that the designated use or criterion should be reviewed before a TMDL is scheduled. For a classified segment this calls for a Use Attainability Analysis (UAA), and for an unclassified water where a specific use has not been established, an Aquatic Life Assessment (ALA) is needed. This problem of addressing UAA and ALA needs was also addressed by this project for one or more Segments/AUs. The segments assessed in the Upper Neches Basin were 0604M Biloxi Creek and 0605A Kickapoo Creek.

Metals in Water in the Neches River Basin

SWQM Special Study for Metals (2007 - 2010)

To address metals within the Neches River Basin, fulfill Clean Rivers Program deliverables, and provide data for the 2010-2012 Integrated Reports and 305(b) assessment purposes, routine metals sampling began in 2007. A Quality Assurance Plan (QAP) between TCEQ Surface Water Quality Monitoring team, Clean Rivers Program, and river authorities was filed in 2007 for the Neches River basin. ANRA, LNVA, and TCEQ regional offices collect metals samples in the Neches Basin. The QAP has been recently extended through August 2010 to provide adequate data. The TCEQ Houston Laboratory provides all clean metals kits to ANRA and conducts the metals analyses.

The routine metals sampling study was enacted to address total and dissolved metals in surface waters. Total hardness concentrations are also analyzed due to certain metals toxicity being based upon the hardness of surface waters. Hardness-dependant toxicity includes metals such as cadmium, chromium, copper, nickel, lead, silver, and zinc. The EPA has established chronic and acute concentration levels for metals in water for aquatic organisms as well as humans. Acute toxicity involves a single concentration that will result in an unacceptable effect (lethality). Chronic toxicity is caused by prolonged, lengthy exposure that does not result in death, but decreased quality of life, such as reproductive problems, growth impairments, and other physiological effects.

Dissolved and total metals in water which are analyzed include the following: aluminum, arsenic, cadmium, calcium, chromium, copper, lead, nickel, zinc, iron, magnesium, manganese, selenium, silver, potassium, and sodium. Selenium and total hardness (calcium carbonate) are also analyzed.

Collection sites for metals in water analyses are listed below:

Segment	Station ID
0604A	10478 - Cedar Creek at FM 2497
0604B	13529 - Hurricane Creek at FM 324
0604C	10492 - Jack Creek at FM 2497
0604D	16081 - Piney Creek at FM 1987
0604M	16097 - Biloxi Creek at FM 1818
0604N	16098 - Buck Creek at FM 1818
0605A	10517 - Kickapoo Creek at FM 314
0610A	15361 - Ayish Bayou at SH 103
0611C	10532 - Mud Creek at US 84

Albion Metals Study (2002-2005)

ANRA implemented a 18-month intensive survey in June 2002 to gather data on dissolved metals in water. ANRA conducted quarterly metals in water sampling at fifteen high priority stations over a two-year period. An ultra-clean sample collection and laboratory analysis developed by Albion Environmental in College Station, TX, was used to determine trace quantities of metals in water at the part per billion (ppb) to parts per trillion (ppt) level.

Mud Creek

Hurricane Creek

Cedar Creek

Water Quality Terminology

This review of water quality terminology is designed to provide a description of technical terms used in the report. While this review can be used as a glossary, it is intended to provide more than just definitions, as it includes background information on not only technical terms, but also legislation, water quality standards, monitoring, and the evaluation of water bodies.

The Federal Clean Water Act (CWA)

The forefront of the first law to address water pollution in the United States was the Federal Water Pollution Control Act of 1948. After heightened concern for water pollution, this act was reorganized, revised, and expanded in 1972. After amendments were added, the law became known as the Federal Clean Water Act (CWA) in 1977. The CWA encompassed the origin of permitted discharges, water quality standards, and holding liable parties responsible. The goal of the CWA is "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters" (33 U.S.C §1251(a)).

According to the Environmental Protection Agency (EPA), the 1977 amendments to the Clean Water Act:

- Established the basic structure for regulating pollutant discharges into the waters of the United States.
- Gave EPA the authority to implement pollution control programs such as setting wastewater standards for industry.
- Maintained existing requirements to set water quality standards for all contaminants in surface waters.
- Made it unlawful for any person to discharge any pollutant from a point source into navigable waters, unless a permit was obtained under its provisions.
- Funded the construction of sewage treatment plants under the construction grants program.
- Recognized the need for planning to address the critical problems posed by nonpoint source pollution.

The CWA established the basic structure for regulations of discharges, pollutant loadings in waters, and regulating water quality standards for surface waters.

Texas Surface Water Quality Standards (TSWQS)

Water quality standards are the basis for assessing the status of a water body. A water quality standard includes an assigned usage and specific criteria required to maintain its use. Texas Surface Water Quality Standards (TSWQS) are state rules adopted by the Texas Commission on Environmental Quality (TCEQ) that are designed to establish numerical and narrative goals for water quality throughout the state. TSWQS also provide a basis on which the TCEQ regulatory programs can establish reasonable methods to implement and attain the state's goals for water quality.

Criteria

Section 304(a)(1) of the CWA requires development of criteria for water quality that accurately reflects the latest scientific knowledge. Criteria are based solely on data and scientific judgments on pollutant concentrations and environmental or human health effects. Section 304(a) also provides guidance to states and tribes in adopting water quality standards. Criteria are developed for the protection of aquatic life as well as for human health (EPA; 1999). Criteria are numerical numbers representing a specific use for the water body. For example, for aquatic life use, the dissolved oxygen grab minimum criteria may be 3.0 mg/L. Criteria are defined in the *Texas Surface Water Quality Standards (TSWQS)*.

Impairments

Impairments occur when water quality conditions do not meet assigned water quality standards and/or criteria.

Texas Water Quality Inventory 305 (b) and 303 (d) List

Water quality standards and criteria may be applied to segments or multiple water bodies. Every two years, on even-numbered years, states must assess the quality of their water and submit a report to the EPA detailing the extent to which each water body in the state meets water quality standards. In fulfillment of the CWA requirements, the TCEQ publishes the assessment report which is entitled the Texas Water Quality Inventory 305 (b) and 303 (d) list. Once a water body is placed on the 303 (d) list of impaired waters, further investigation occurs. A list of priority rankings is created and a Total Maximum Daily Load (TMDL) may be initiated.

Total Maximum Daily Load

A TMDL is a calculation of the total maximum load of pollutant(s) a body of water can receive and still maintain its assigned uses and standards.

Water Quality Terminology

Categories

After assessment, water bodies are placed into one of five categories which indicate the water quality status of the water body. The categories are as follows:

Categories of Water Bodies on the 303 (d) List

Category	*Description*
1	Attaining all water quality standards and no use is threatened.
2	Attaining some water quality standards and no use is threatened; and insufficient data and information are available to determine if the remaining uses are attained or threatened.
3	Insufficient data and information are available to determine if any water quality standard is attained.
4	Water quality standard is not supported or is threatened for one or more designated uses but does not require the development of a TMDL.
4a	TMDL has been completed and approved by EPA.
4b	Other pollution control requirements are reasonably expected to result in the attainment of the water quality standard in the near future.
4c	Nonsupport of the water quality standard is not caused by a pollutant.
5	The water body does not meet applicable water quality standards or is threatened for one or more designated uses by one or more pollutants.
5a	A TMDL is underway, scheduled, or will be scheduled.
5b	A review of the water quality standards for the water body will be conducted before a TMDL is scheduled.
5c	Additional data and information will be collected before a TMDL is scheduled.

Segments

A segment is a water body or portion of a water body that is individually defined and classified in the TSWQS. A segment is intended to have relatively homogeneous chemical, physical, and hydrological characteristics. A segment provides a basic unit for assigning site-specific standards and for applying water quality management programs of the TCEQ. Classified segments may include streams, rivers, bays, estuaries, wetlands, lakes, or reservoirs. Unclassified segments are those waters for which no classification has been assigned and which have not been identified. Unclassified water bodies will have an alphabetical letter associated with their stream segment number.

Designated Uses

As defined in the *Texas Surface Water Quality Standards (TSWQS),* a body of water can be assigned designated uses including aquatic life use, contact recreation, public water supply, and general use. Other uses, such as oyster waters, do not apply in the Upper Neches Basin. For a designated use, there are criteria which usually consist of a numerical value.

Aquatic life use has criteria for dissolved oxygen, fish and macrobenthic community index, and acute and chronic substances.

General use includes criteria for chloride, sulfate, total dissolved solids (TDS), pH, and temperature. General use nutrients like ammonia, nitrates, ortho- and total phosphorus, and chlorophyll-*a* are used to screen concerns for supported use of the waters.

Public water supply use includes criteria for chlorides, sulfates, and TDS in drinking water.

Contact recreational use is assessed using criteria for bacteria indicators such as *E. coli* (freshwater) or *Enterococcus* (tidally influenced waters or marine waters).

Pollution

Under the Texas Administrative Code, pollution is defined as, "the alteration of the physical, thermal, chemical, or biological quality of, or the contamination of, any water in the state that renders the water harmful, detrimental, or injurious to humans, animal life, vegetation, or property or to public health, safety, or welfare, or impairs the usefulness or the public enjoyment of the water for any lawful or reasonable purpose."

Point Source Pollution: Any source of pollution that is subject to regulation and is permitted is defined as a "point source." An example of a point source is a wastewater treatment plant discharge.

Non-Point Source (NPS) Pollution: Any source that is not subject to regulation or permitted. Non-point source pollution generally results from land runoff, precipitation, atmospheric deposition, drainage, seepage, or hydrologic modification.

Surface Water Quality Monitoring (SWQM) Program

TCEQ's Surface Water Quality Monitoring (SWQM) program evaluates the physical, chemical, and biological characteristics of aquatic systems as a basis for effective policy. Water quality is monitored in relation to human health concerns, ecological condition, and designated uses. SWQM data is utilized to provide a basis for effective policies that promote the protection, restoration, and wise use of surface water in Texas.

Surface water samples collected for assessment purposes are done so following the procedures outlined in TCEQ's *Surface Water Quality Monitoring Procedures Volume 1: Physical and Chemical Monitoring Methods* (TCEQ Publication RG-415). The guidelines outlined in the SWQM procedures manual document the quality assurance procedures that must be used to demonstrate that the data collected by monitoring personnel across the state are of a known and comparable quality.

Water Quality Terminology

SWQMIS

TCEQ's Surface Water Quality Monitoring Information System (SWQMIS) database is used to enter, manage, track, and report on water quality-related data. Data collected for the Texas Clean Rivers Program is uploaded into SWQMIS.

Quality Assurance Project Plan (QAPP)

The CRP Quality Assurance Project Plan (QAPP) describes ANRA's quality assurance policy, management structure, and procedures which will be used to implement the quality assurance requirements necessary to verify and validate surface water quality data collected for the Clean Rivers Program and SWQM. This document is reviewed and approved by TCEQ to help ensure that data generated by ANRA are scientifically valid and legally defensible. This process ensures that data collected under the approved QAPP and submitted to SWQMIS have been collected and managed in such as way as to guarantee its reliability. It is crucial that only valid, quality-assured data be used in water quality assessments or other regulatory purposes.

ANRA's current and previous QAPP documents are available for viewing and/or download on ANRA's website (www.anra.org).

Coordinated Monitoring Schedule (CMS)

The Coordinated Monitoring Schedule (CMS) is the combined schedule for all surface water quality monitoring within Texas. Monitoring agencies within the basin coordinate sampling schedules to reduce duplication of effort and better utilize resources. Coordinated Monitoring Meetings are held annually with all monitoring agencies within each basin. The CMS lists monitoring stations, collecting and submitting entities, monitoring type, parameters, and monitoring frequency.

The Coordinated Monitoring Schedule is available online at cms.lcra.org.

Monitoring Categories

Monitoring is divided into the following categories:

Routine Monitoring is a general-type monitoring to collect physical, chemical, biological, and hydrological data at classified and unclassified water bodies, including water bodies that do not support the water quality standards. Routine monitoring typically lasts for at least 5 years, with 4 seasonal monitoring events which include field measurements, conventional chemical parameter samples, bacterial measurements, and flow measurements. Routine monitoring may also include aquatic-life monitoring, toxics (metals or organics) in water, and ecoregion monitoring.

Special-Study Monitoring is a monitoring and assessment plan implemented to answer a specific question. Special study monitoring, which typically lasts 2 years, can be used to better characterize nonattainment of water quality standards, assess impacts of point and nonpoint source discharges, or to address stakeholder concerns. Examples of special studies include TMDL project-support monitoring, 24-hr Dissolved Oxygen studies, and toxics (metals or organics) in sediment or fish tissue, among others.

Permit-Support Monitoring is conducted to directly support the TCEQ wastewater discharge permitting process, and is typically used in the development or modification of effluent permit limits by determining the appropriate aquatic life use. Examples of permit-support monitoring include use-attainability analyses (UAAs), receiving-water assessments (RWAs), and wasteload evaluations (WLEs).

Systematic Monitoring is similar to routine monitoring, but with a duration of less than 5 years.

Biased season, flow, and event monitoring may also be included.

Water Quality Parameters

ANRA monitoring personnel collect both Field and Conventional parameters at monitoring stations.

Field measurements are collected on-site by direct monitoring in the water body. Field data collected by multiprobe instruments include such parameters as water temperature, pH, dissolved oxygen, and specific conductance. Other field measurements include flow and Secchi-disk transparency.

Conventional parameters are also evaluated as part of the monitoring plan. During routine monitoring events, water samples are collected for laboratory analysis of conventional parameters. Conventional parameters include nutrients, minerals, and particulates. For routine monitoring stations, ANRA collects and analyzes samples for the following conventional parameters:

- Ammonia-Nitrogen
- Nitrate+Nitrite-Nitrogen
- Orthophosphorus
- Total Phosphorus
- Chlorophyll-*a*
- Chloride
- Sulfate
- Total Suspended Solids
- Total Dissolved Solids
- *E. coli*

For the conventional parameters, all analyses, with the exception of Chlorphyll-*a,* are conducted in-house at ANRA's Environmental Laboratory. Samples for Chlorophyll-*a* are analyzed by the Lower Colorado River Authority (LCRA) Environmental Laboratory Services (ELS).

The following sections summarize the various field and conventional parameters monitored, as well as potential impacts and possible sources.

Water Quality Parameters - Field Measurements

pH

Potential Impacts
pH is a measure of whether water is acidic or basic. Most aquatic organisms are adapted to live within a specific pH range. pH can also affect the toxicity of many substances, which generally increase in solubility as pH decreases. The ability of water to resist changes in pH (its buffering capacity) is essential to aquatic life.

Possible Sources/Causes
pH can be affected by industrial and wastewater discharges, runoff, and accidental spills. Natural variation in seasons may also affect pH.

Dissolved Oxygen (DO)

Potential Impacts
DO is a measure of the amount of dissolved oxygen that is available in the water. DO is vital for aquatic organisms to live. Where DO is too low, aquatic organisms may have insufficient oxygen to live.

Possible Sources/Causes
DO is temperature-dependent, with water being able to hold more dissolved oxygen at lower temperatures due to the solubility of gases increasing as the temperature decreases. The amount of oxygen present usually decreases with depth, rising temperatures, and with the oxidation of organic matter and pollutants. Bacteria and algal blooms may cause DO to decrease as decomposition of organic matter consumes oxygen in the water, resulting in hypoxic (low oxygen) areas.

Specific Conductance/Conductivity

Potential Impacts
Specific Conductance is the measure of the water's capacity to carry an electrical current and is indicative of the amounts of dissolved solids present in a water body.

Possible Sources/Causes
Dissolved salt-forming substances such as sulfate, chloride, and sodium increase the conductivity of the water.

Temperature

Potential Impacts
Water temperature affects the oxygen content of the water (dissolved oxygen). Temperature also has an impact on cold-blooded animals.

Possible Sources/Causes
Water temperature may be affected by alterations to the riparian zone, changes in ambient temperature, and discharges.

Flow

Potential Impacts
Flow is a measurement of the velocity of the water, measured in cubic feet per second (CFS). Flow combined with other parameters can be a good indicator of water quality.

Possible Sources/Causes
Flow can be affected by both natural and man-made sources.

Water Quality Parameters - Conventional Parameters

Ammonia-Nitrogen

Potential Impacts
Ammonia, which is produced from the breakdown of nitrogen-containing compounds, is found naturally in waters. In excess, algal blooms may occur. Elevated ammonia levels are indicative of organic pollution. These elevated levels can cause stress on aquatic organisms, as well as damage to tissue and gills.

Possible Sources/Causes
Ammonia enters into a body of water via excretion of nitrogenous wastes, decomposition of plants and animals, and runoff. Ammonia is an ingredient in many fertilizers. It is also present in sewage, wastewater discharges, and storm water runoff.

Chloride

Potential Impacts
Chloride is one of the major inorganic ions in water and wastewater. It is an essential element for maintaining normal physiological functions in all organisms. Elevated chloride concentrations can adversely affect survival, growth, and/or reproduction of aquatic organisms.

Possible Sources/Causes
An elevated chloride concentration can be indicative of natural or man-made pollution. Natural sources of chloride include the weathering and leaching of sedimentary rocks, soils, and salt deposits. Other possible sources include oil exploration and storage, sewage and industrial discharges, and landfill runoff.

Chlorophyll-*a*

Potential Impacts
Chlorophyll-*a* is an indicator of algal biomass in a water body. Increased concentrations indicate potential eutrophication or nutrient loading. Diurnal shifts in DO and pH resulting from increased photosynthesis and respiration can cause stress to aquatic organisms.

Possible Sources/Causes
Chlorophyll-a is a photosynthetic pigment that plays a vital role in photosynthesis. It is found in most plants, cyanobacteria, and algae. When chlorophyll-*a* levels are consistently high or variable, this may be indicative of algal blooms.

Escherichia coli (E. coli)

Potential Impacts
E. coli is an indicator of fecal contamination. Fecal contamination is a health concern to the general public, and its presence indicates a risk for contact recreation. The presence of *E. coli* in the water indicates that pathogenic organisms may be present.

Possible Sources/Causes
E. coli is abundant in the gastro-intestinal tract of warm-blooded animals. Elevated bacterial levels are indicative of a potential pollution problem. Reasons for the presence of fecal coliforms such as *E. coli* include failing septic systems, animal wastes, and inadequately treated sewage.

Nitrate + Nitrite-Nitrogen

Potential Impacts
Elevated levels of nitrite and nitrate can produce nitrite toxicity in fish ("brown blood disease") and methemoglobinemia ("blue baby syndrome") in infants by reducing the oxygen-carrying capacity of blood. In surface water, high levels of nitrates can lead to excessive growth of aquatic plants. High levels of nitrates are also indicative of human-caused pollution.

Possible Sources/Causes
As part of the nitrogen cycle, nitrogenous compounds are converted from ammonia to nitrite and then to nitrate by bacterial and chemical processes. Potential sources include effluent discharges from wastewater treatment plants, fertilizers, and agricultural runoff.

Total Phosphorus and Dissolved Orthophosphorus

Potential Impacts
Phosphorus is essential to the growth of organisms, and is considered a growth-limiting nutrient. Elevated levels in water may stimulate the growth of photosynthetic aquatic macro- and microorganisms. Elevated phosphorus levels contribute to eutrophication and may cause algal blooms.

Possible Sources/Causes
Phosphorus is commonly known as a man-made pollutant. It is present in industrial and domestic wastewater discharges, as well as agricultural and storm water runoff. It is a an ingredient in soaps and detergents, and is used extensively in the treatment of boiler waters. Phosphates are also used by some water supplies during treatment.

Total Dissolved Solids (TDS)

Potential Impacts
TDS, reported in mg/L, is a measure of the total dissolved particles in water. Typically, it is comprised of chlorides, sulfates, and other salt-forming anions. TDS is an important measure of drinking water quality.

Possible Sources/Causes
TDS can occur naturally from dissolution of carbonate and salt deposits in rocks and soils. Other sources include agricultural and storm water runoff, effluent discharges from industrial and domestic wastewater treatment plants, and oil exploration.

Total Suspended Solids (TSS)

Potential Impacts
TSS, reported in mg/L, is a measure of the total suspended particles in water. High levels of TSS increase the turbidity of the water, reducing light penetration which subsequently decreases oxygen production by plants.

Possible Sources/Causes
Elevated TSS can result from multiple point and non-point sources. Soil erosion and runoff are two primary sources.

Sulfate

Potential Impacts
Sulfate is essential for plant growth, and low levels (under 0.5 mg/L) can be detrimental to algal growth. Excessive levels of sulfate can form strong acids and change the pH of the water. Excessively high levels may be toxic to cattle and other animals. Sulfate can also affect drinking water.

Possible Sources/Causes
Sulfate occurs in almost all natural waters due to an abundance of elemental and organic sulfur in the environment. It usually enters into water bodies by water passing over rock or soil containing minerals like gypsum, as well as runoff from agricultural lands, industrial discharges, and sewage treatment plant discharges. Sulfate can also enter water bodies from atmospheric deposition from such sources as burning fossil fuels.

Data Review Methodology

Trend Analysis

In order to review and evaluate water quality trends for this report, data from the period of September 1999 to August 2009 was queried and exported from TCEQ's Surface Water Quality Monitoring Information System (SWQMIS). The public interface for SWQMIS can be found at the following web address:

www8.tceq.state.tx.us/SwqmisWeb/public/index.faces

Once the data from the selected range was exported from SWQMIS, the raw data files (in the form of pipe-delimited text files), were used to create a relational database in Microsoft Access. Over 148,000 individual records are contained within this database. Queries were written that allowed for records to be selected by Station ID and Parameter. As this data was queried, it was exported to Microsoft Excel spreadsheets for statistical analysis and graphing.

In Excel, the following parameters were graphed, with results plotted against time:

- pH
- Dissolved Oxygen (DO)
- Conductance
- Flow
- *E. coli*
- Total Suspended Solids (TSS)
- Total Dissolved Solids (TDS)
- Ammonia-Nitrogen
- Nitrate+NItrite-Nitrogen
- Orthophosphorus
- Total Phosphorus
- Chloride
- Sulfate
- Chlorophyll-*a*

For most parameters, only one parameter code was assessed. For other parameters such as Nitrate+Nitrite and Orthophosphorus where different (but comparable) parameter codes exist, the data from multiple parameter codes was combined. For Dissolved Oxygen, data from 24-hr monitoring was not available for all monitoring stations. Therefore, data for single grab monitoring was used to assess Dissolved Oxygen trends.

Assessed Parameters and Parameter Codes

Parameter	*Parameter Code(s)*
pH	00400
Dissolved Oxygen	00300
Conductance	00094
Flow	00061 74069
E. coli	31699 31648
Total Suspended Solids	00530
Total Dissolved Solids	70300
Ammonia-Nitrogen	00610
Nitrate+Nitrite-Nitrogen	00630 00631
Orthophosphorus	00671 70507
Total Phosphorus	00665
Chloride	00940
Sulfate	00945
Chlorophyll-*a*	32211 70953

The count, minimum, maximum, median (50th percentile), mean, and standard deviation were also determined. In the case of *E. coli*, the geometric mean was calculated. The number of values exceeding criteria were counted, and the percentage of values exceeding criteria was determined. Since the 2010 Integrated Report is still in draft form, the 2008 303(d) List was used for listings of impaired water bodies. The Draft 2010 Guidance for Assessing and Reporting Surface Water Quality in Texas was the guidance document used for this report.

If enough data was present for each parameter (>19 samples in the evaluation period, with continuous monitoring), a linear regression against time was performed. Trends were considered to be significant with a *t-stat* = or > |2| and a *p-value* < 0.1. In the case of non-detects (values reported as less than the method reporting limit), those values were left as-is, ignoring the less than sign. If a trend was evident due to changes in reporting limits (as was commonly observed with Chlorophyll-*a*), all non-detect measurements were changed to match the lowest non-detect measurement to make the data consistent, and the trends were again evaluated. Significant trends were graphed and are presented in this report.

To determine if water bodies met the established criteria for their designated uses, the data was compared to the uses and criteria specified in 30 TAC §307.10(1), as well as the screening levels for nutrient parameters listed in the Draft 2010 Texas Guidance for Assessing and Reporting Surface Water Quality in Texas. A concern for water quality was identified if the screening level was exceeded >20% of the time using the binomial method, based on the number of exceedances for a given sample size.

Water Quality Standards

Site-Specific Uses and Criteria for Classified Segments

Modified from the table listed in 30 TAC §307.10(1)

Neches River Basin		Uses			Criteria						
Segment #	***Segment Name***	**Recreation**	**Aquatic Life**	**Domestic Water Supply**	**Chloride (mg/L)**	**Sulfate (mg/L)**	**TDS (mg/L)**	**Dissolved Oxygen (mg/L)**	**pH Range (SU)**	***E. coli* #/100 mL**	**Temperature (F)**
0604	Neches River Below Lake Palestine	Contact Recreation	High	Public Supply	50	50	200	5.0	6.0 - 8.5	126	91
0605	Lake Palestine	Contact Recreation	High	Public Supply	50	50	200	5.0	6.0 - 8.5	126	90
0606	Neches River Above Lake Palestine	Contact Recreation	Intermediate	Public Supply	100	50	300	4.0	6.0 - 8.5	126	95
0609	Angelina River Below Sam Rayburn Reservoir	Contact Recreation	High	Public Supply	70	50	250	5.0	6.0 - 8.5	126	90
0610	Sam Rayburn Reservoir	Contact Recreation	High	Public Supply	100	100	400	5.0	6.0 - 8.5	126	93
0611	Angelina River Above Sam Rayburn Reservoir	Contact Recreation	High	Public Supply	125	50	250	5.0	6.0 - 8.5	126	90
0612	Attoyac Bayou	Contact Recreation	High	Public Supply	75	50	200	5.0	6.0 - 8.5	126	90
0613	Lake Tyler/Lake Tyler East	Contact Recreation	High	Public Supply	50	50	200	5.0	6.5 - 9.0	126	93
0614	Lake Jacksonville	Contact Recreation	High	Public Supply	50	75	750	5.0	6.5 - 9.0	126	93
0615	Angelina River/Sam Rayburn Reservoir	Contact Recreation	Intermediate	Public Supply	150	100	500	4.0	6.5 - 9.0	126	93

Screening Levels for Nutrient Parameters

Modified from Table 3.10 in the Draft 2010 Guidance for Assessing and Reporting Surface Water Quality in Texas

Screening Levels for Nutrient Parameters		
Water Body Type	***Nutrients***	***Screening Level***
Freshwater Stream	Ammonia-Nitrogen Nitrate-Nitrogen Orthophosphorus Total Phosphorus Chlorophyll-*a*	0.33 mg/L 1.95 mg/L 0.37 mg/L 0.69 mg/L 14.1 ug/L
Reservoir	Ammonia-Nitrogen Nitrate-Nitrogen Orthophosphorus Total Phosphorus Chlorophyll-*a*	0.11 mg/L 0.37 mg/L 0.05 mg/L 0.20 mg/L 26.7 ug/L

Sub-Basin Summaries

For the purpose of this report, data will be divided and presented based upon sub-basins (as defined by their 8-digit hydrologic unit code (HUC)).

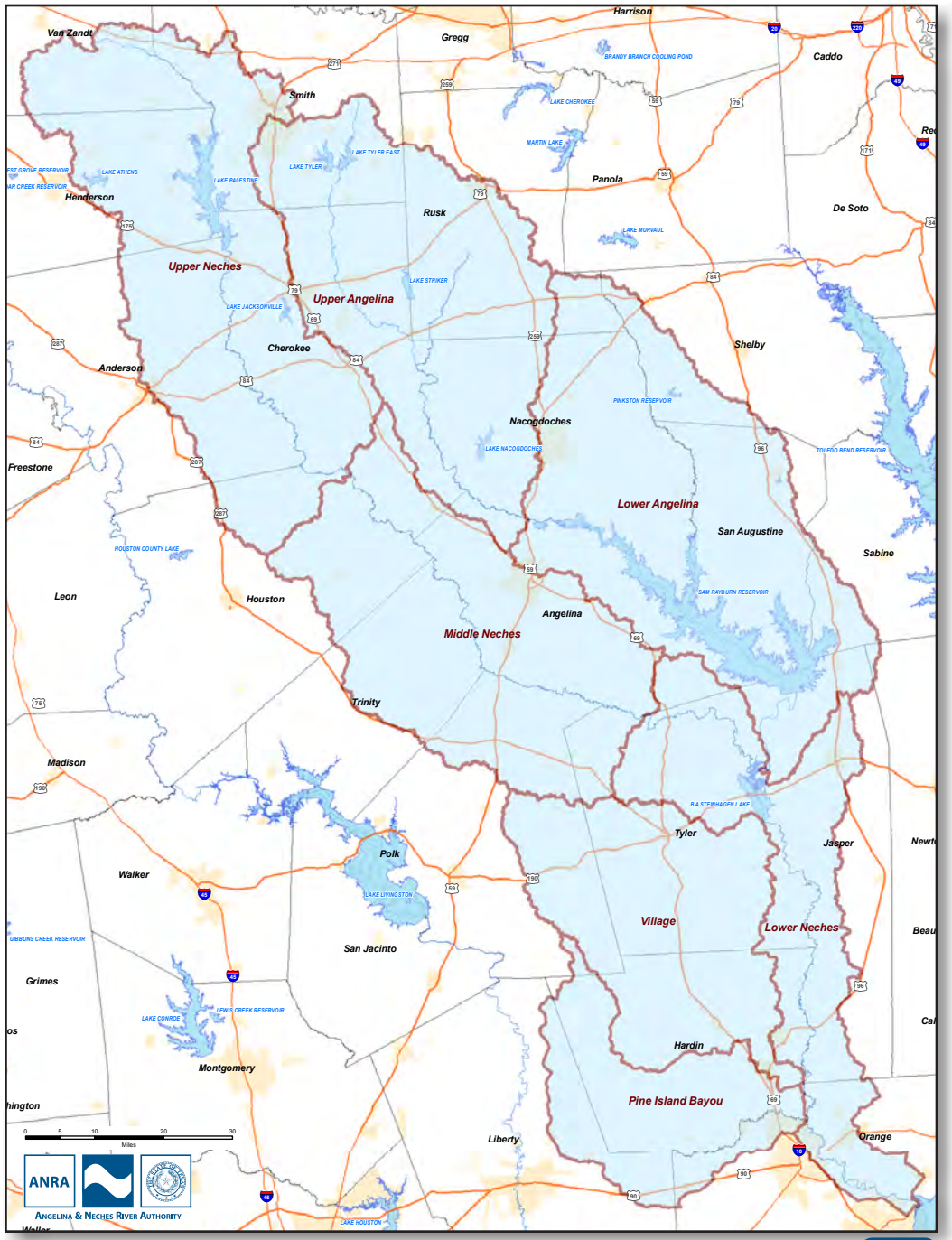
The Sub-Basin Summaries provide detailed information about the water quality in each watershed in the basin. The sub-basins in the Upper Neches Basin include:

- Upper Angelina
- Lower Angelina
- Upper Neches
- Middle Neches
- Lower Neches

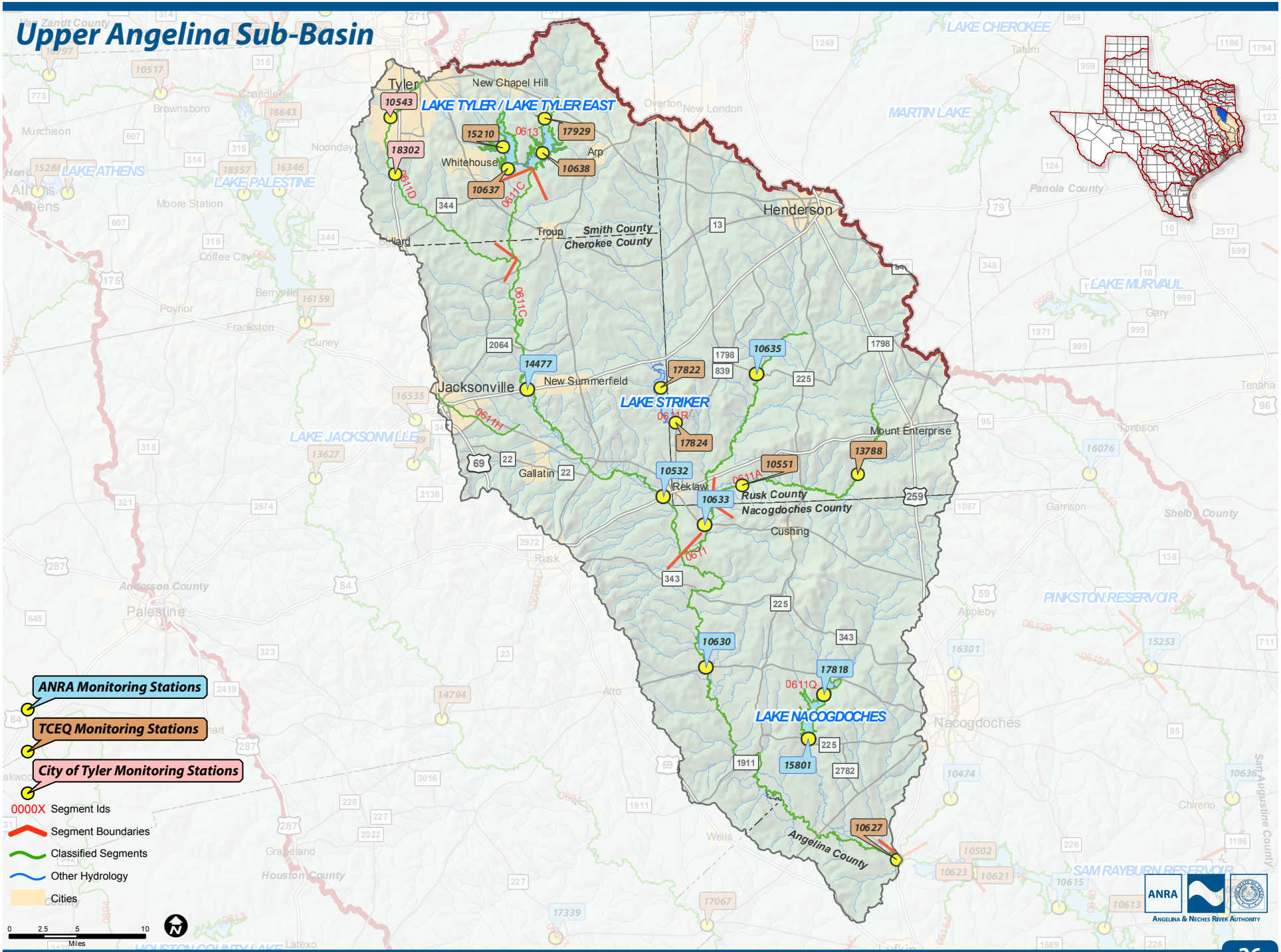
Each Sub-Basin Summary includes a narrative and descriptors of the sub-basin's geographic area, population centers, stream segments, and discharge permits. A map of each sub-basin is included with each summary. Each sub-basin summary includes a discussion of individual segments within the sub-basin, information from TCEQ's 2008 Water Quality Inventory and 303(d) List, and a trend analysis of water quality parameters. Maps of each segment displaying the monitoring stations monitored by ANRA and other agencies in the Basin are included. In the review of water quality, parameters which show significant trends, concerns for screening levels, and/or exceedances of standards are graphed.

As ANRA has only one monitoring station in the Lower Neches sub-basin, this station has been combined with the Middle Neches sub-basin for discussion purposes.

For more information on the other sub-basins comprising the Neches Basin, such as Lower Neches, Village, and Pine Island Bayou sub-basins, please refer to the Basin Summary Report developed by the Lower Neches Valley Authority.



Upper Angelina Sub-Basin



Profile of the Upper Angelina Sub-Basin

Population

The Upper Angelina Sub-Basin includes all or a portion of Angelina, Cherokee, Nacogdoches, Rusk, and Smith Counties. The Cities of Arp, Whitehouse, New Chapel Hill, Tyler, Jacksonville, New Summerfield, Gallatin, Henderson, Mount Enterprise, Reklaw, Cushing, and Troup are included in the sub-basin. There is an estimated 408,070 people residing within the watershed.

Land Characteristics and Use

This South-Central Plains Ecoregion includes floodplains, low terraces, southern tertiary uplands, and tertiary uplands. The upper north-western portion of the sub-basin includes the City of Tyler, which has developed open space and a high-intensity population. Included within the northern part of the Upper Angelina Sub-Basin is mixed, deciduous, and evergreen forest, woody wetlands, hay/pasture land, and shrub. Between Henderson and New Summerfield, there are several areas of cultivated cropland.

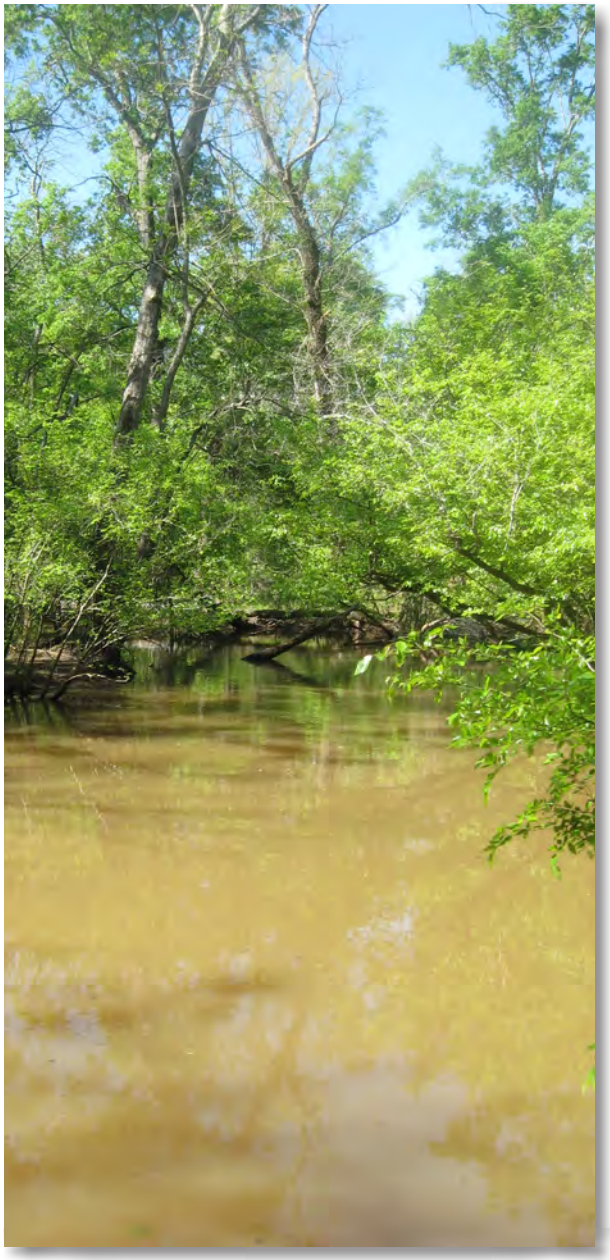
The lower southeastern portion of the sub-basin includes Lake Nacogdoches. This region is dominated by willow oak, water oak, blackgum forest, and pine hardwood. The vegetation surrounding the lower area of this sub-basin includes hay/pasture, woody wetlands, shrub, mixed, evergreen, deciduous, and young forest. There are several developed low intensity areas around Mount Enterprise, Reklaw, and Gallatin.

The average annual precipitation is 42 - 44 inches in the upper portion of the sub-basin, with an increase to 44 - 46 inches as you move towards the lower portion of the sub-basin. This area is supported by the Carrizo-Wilcox aquifer.

There are approximately 8,046 farms included within the counties in this sub-basin. From 2002 to 2007, there has been a forty-six percent increase in the number of farms within this area. Angelina County solely has accounted for 19% increase in farms. Nacogdoches County has a total of 46,328 heads of cattle, approximately 2,000 horses and ponies, and 19,371,881 broilers and other meat-type chickens. Cherokee County has 62,691 heads of cattle, 2,716 horses and ponies, and 1,657,888 broilers and other meat-type chickens. Angelina County has 22,293 heads of cattle, 2,385 horses and ponies, and 1,285,540 broilers and other meat-type chickens. Within Smith County, there are approximately 3,000 goats, 5,600 horses and ponies, and 55,302 heads of cattle and calves. Rusk County has approximately 49,000 heads of cattle and calves, and 1,537,072 broilers and other meat-type chickens. Undoubtedly, the poultry industry and cattle ranching areas have an influence on nutrient loading within the sub-basin.

Segments included in the Upper Angelina Sub-Basin

Segment ID	*Segment Name*	*Length or Acreage*
0611	Angelina River Above Sam Rayburn Reservoir	104 miles
0611A	East Fork Angelina River (unclassified water body)	30 miles
0611C	Mud Creek (unclassified water body)	45 miles
0611D	West Mud Creek (unclassified water body)	23 miles
0611H	Ragsdale Creek (unclassified water body)	6 miles
0611Q	Lake Nacogdoches (unclassified water body)	2,210 acres
0611R	Lake Striker (unclassified water body)	1,863 acres
0613	Lake Tyler/Tyler East	4,880 acres



Station 14477 Mud Creek at US 79 (Segment 0611C)

Profile of the Upper Angelina Sub-Basin

Permitted Discharges

A total of twenty-four permitted discharges are within the Upper Angelina sub-basin..

Permitted Discharges in the Upper Angelina Sub-Basin

Segment ID	*Permit Number*	*Outfall Number*	*NPDES Number*	*Permittee*	*County*	*TCEQ Region*	*Map Location*
0611	04414-000	001	124842	Nacogdoches Power LLC	Nacogdoches	10 - Beaumont	Page 30
0611	10187-001	001	052779	City of Henderson	Rusk	05 - Tyler	Page 30
0611A	04414-000	002	124842	Nacogdoches Power LLC	Nacogdoches	10 - Beaumont	Pages 30 & 37
0611A	04414-000	003	124842	Nacogdoches Power LLC	Nacogdoches	10 - Beaumont	Pages 30 & 37
0611A	10437-001	001	053937	City of Cushing	Nacogdoches	10 - Beaumont	Pages 30 & 37
0611A	14283-001	001	122173	City of Mount Enterprise	Rusk	05 - Tyler	Pages 30 & 37
0611C	02973-000	001	104175	Unimin Corp	Cherokee	05 - Tyler	Pages 30 & 38
0611C	02973-000	002	104175	Unimin Corp	Cherokee	05 - Tyler	Pages 30 & 38
0611C	02973-000	004	104175	Unimin Corp	Cherokee	05 - Tyler	Pages 30 & 38
0611C	02973-000	005	104175	Unimin Corp	Cherokee	05 - Tyler	Pages 30 & 38
0611C	02973-000	006	104175	Unimin Corp	Cherokee	05 - Tyler	Pages 30 & 38
0611C	02973-000	007	104175	Unimin Corp	Cherokee	05 - Tyler	Pages 30 & 38
0611C	10304-001	001	033529	City of Troup	Cherokee	05 - Tyler	Pages 30 & 38
0611C	10511-001	001	054194	City of Arp	Smith	05 - Tyler	Pages 30 & 38
0611C	10653-002	001	047988	City of Tyler	Smith	05 - Tyler	Pages 30 & 38
0611C	10693-001	001	024392	City of Jacksonville	Cherokee	05 - Tyler	Pages 30 & 38
0611C	10693-003	001	100587	City of Jacksonville	Cherokee	05 - Tyler	Pages 30 & 38
0611C	11222-001	001	072770	City of Whitehouse	Smith	05 - Tyler	Pages 30 & 38
0611C	13000-001	001	101010	Tall Timbers Utility Co Inc	Smith	05 - Tyler	Pages 30 & 38
0611C	13168-001	001	098795	Woodmark Utilities Inc	Smith	05 - Tyler	Pages 30 & 38
0611C	13585-001	001	107875	City of New Summerfield	Cherokee	05 - Tyler	Pages 30 & 38
0611R	00946-000	001	001066	Luminant Generation Co LLC	Cherokee	05 - Tyler	Pages 30 & 52
0611R	12376-001	001	087360	City of New London	Rusk	05 - Tyler	Pages 30 & 52
0611R	14292-001	001	124371	Carlisle ISD	Rusk	05 - Tyler	Pages 30 & 52

Texas Surface Water Quality Standards (2008) Criteria

Numeric and Screening Level Criteria for Specified Uses for the Upper Angelina Sub-Basin

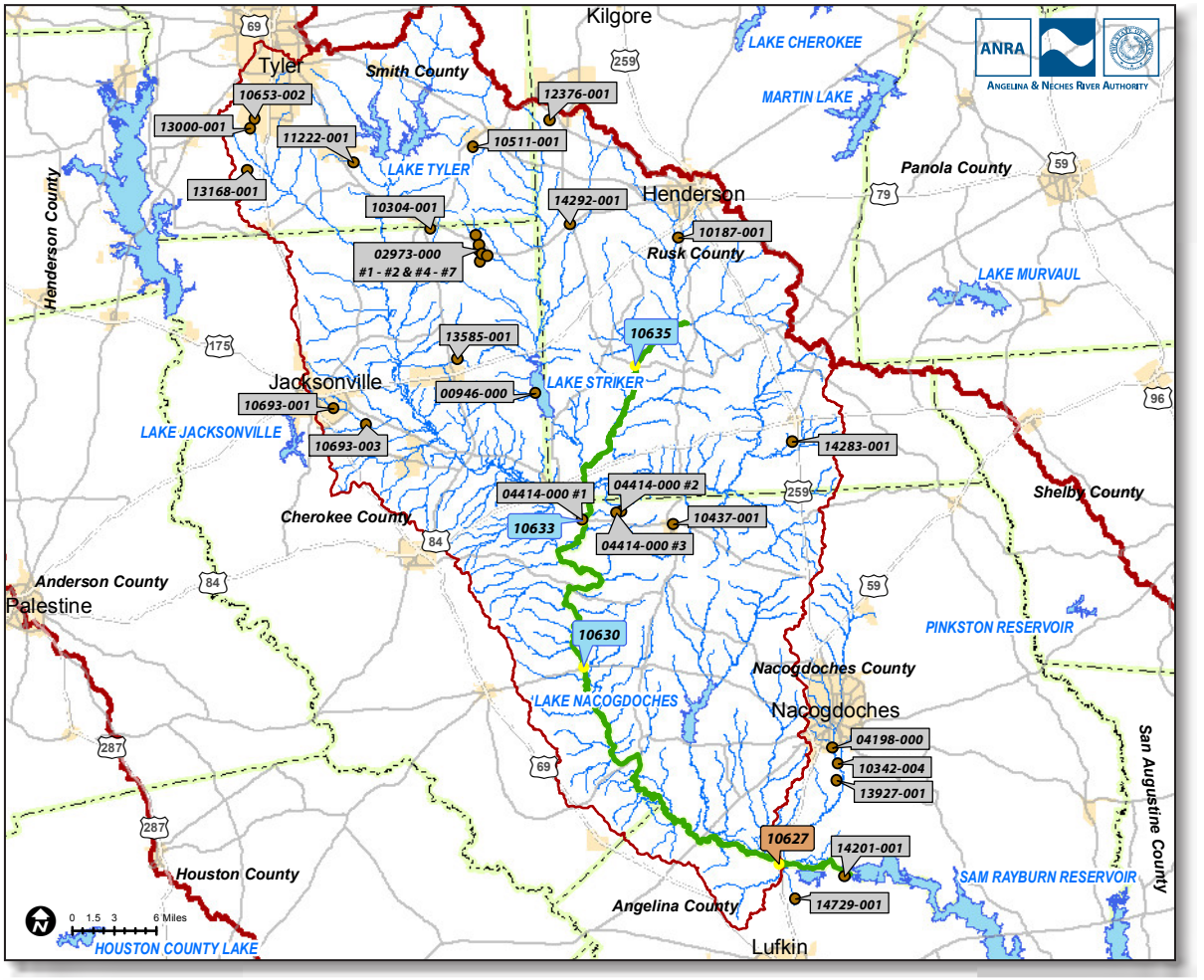
Segment ID	*Assigned Use*	*Screening Levels for Specified Use*
611	General Use	Ammonia: 0.33 mg/L, Chlorophyll-a: 14.10 ug/L, Nitrate-Nitrite: 1.95 mg/L, Orthophosphorus: 0.37 mg/L, Total Phosphorus: 0.69 mg/L
	Public Water Supply Use	Chloride: 125 mg/L, Sulfates: 50 mg/L, TDS: 250 mg/L, pH: 6-8.5
	Recreational Use	*E. coli* geomean: 126 MPN/ 100 mL, *E. coli* single sample: 394 MPN/ 100 mL
	Aquatic Life Use	DO screening level: 5.0 mg/L, DO grab minimum: 3 mg/L, DO 24-hour average: 5.0 mg/L, DO 24-hr minimum: 3.0 mg/L
0611A	General Use	Ammonia: 0.33 mg/L, Chlorophyll-a: 14.10 mg/L, Nitrate-Nitrite: 1.95 mg/L, Orthophosphorus: 0.37 mg/L, Total Phosphorus: 0.69 mg/L
	Recreation Use	*E. coli* geomean: 126 MPN/ 100 mL, *E. coli* single sample: 394 MPN/ 100mL
	Aquatic Life Use	DO screening level: 5.0 mg/L, DO grab minimum: 3.0 mg/L
0611C	General Use	Ammonia: 0.33 mg/L, Chlorophyll-a: 14.10 mg/L, Nitrate-Nitrite: 1.95 mg/L, Orthophosphorus: 0.37 mg/L, Total Phosphorus: 0.69 mg/L
	Recreation Use	*E. coli* geomean: 126 MPN/100 mL, *E. coli* single sample: 394 MPN/ 100 mL
	Aquatic Life Use	DO screening level: 5.0 mg/L, DO grab minimum: 3.0 mg/L
0611D	General Use	Ammonia: 0.33 mg/L, Chlorophyll-a: 14.1 ug/L, Nitrate-Nitrite: 1.95 mg/L, Orthophosphorus-0.37 mg/L, Total Phosphorus: 0.69 mg/L
	Recreation Use	*E. coli* geomean: 126 MPN/ 100 mL, *E. coli* single sample: 394 MPN/ 100 mL
	Aquatic Life Use	DO screening level: 3.0 mg/L, DO grab minimum: 2.0 mg/L
0611H	Recreation Use	*E. coli* geomean: 126 MPN/ 100 mL, *E. coli* single sample: 394 MPN/ 100 mL
	Aquatic Life Use	DO screening level: 4.0 mg/L, DO grab minimum: 3.0 mg/L
0611Q	General Use	Ammonia: 0.11 mg/L, Chlorophyll-a: 26.70 ug/L, Nitrate-Nitrite: 0.37 mg/L, Orthophosphorus: 0.05 mg/L, Total Phosphorus: 0.20 mg/L
	Public Water Supply Use	Chloride: 125 mg/L, Sulfates: 50 mg/L, TDS: 250 mg/L, pH: 6-8.5
	Recreation Use	*E. coli* geomean: 126 MPN/ 100 mL, *E. coli* single sample: 394 MPN/ 100 mL
	Aquatic Life Use	DO screening level: 5.0 mg/L, DO grab minimum: 3.0 mg/L
0611R	General Use	Ammonia: 0.11 mg/L, Nitrate-Nitrite: 0.37 mg/L, Orthophosphorus- 0.05 mg/L, Total Phophorus- 0.20 mg/L
	Recreation Use	*E. coli* geomean: 126 MPN/ 100 mL, *E. coli* single sample: 394 MPN/ 100 mL
	Aquatic Life Use	DO screening level: 5.0 mg/L, DO grab minimum: 3.0 mg/L
613	General Use	Ammonia- 0.11 mg/L, Chlorophyll-a: 26.70 ug/L, Nitrate-Nitrite: 0.37 mg/L, Orthophosphorus: 0.05 mg/L, Total Phophorus: 0.20 mg/L
	Public Water Supply Use	Chloride: 50 mg/L, Sulfate: 50 mg/L, TDS: 200 mg/L, pH 6.5- 9.0
	Recreation Use	*E. coli* geomean: 126 MPN/ 100 mL, *E. coli* single sample: 394 MPN/100 mL
	Aquatic Life Use	DO screening level: 5.0 mg/L, DO grab minimum: 3.0 mg/L

Segment 0611 - Angelina River Above Sam Rayburn Reservoir

Segment Profile

This freshwater stream encompasses a length of 104 miles and extends from the Upper Angelina sub-basin to the Lower Angelina sub-basin. Segment 0611 originates from the aqueduct crossing 0.6 miles upstream of the confluence of the Paper Mill Creek in Angelina/Nacogdoches County to the confluence of Barnhardt Creek and Mill Creek at FM 225 in Rusk County. The designated uses for this segment include contact recreation, high aquatic life use, fish consumption use, public water supply use, and general use. This segment has two areas that are currently listed on the 303(d) list due to bacteria. The listings were placed on the 303(d) list in the year 2000 and are currently categorized as 5a (2008), indicating a total maximum daily load (TMDL) is underway or scheduled.

Angelina River above Sam Rayburn



Monitoring Stations on Segment 0611

Station ID	Station Name	Collecting Agency	Frequency	Parameters
10627	Angelina River Bridge on US 59 North of Lufkin	TCEQ	Quarterly	Field, Conventionals, Bacteria, Flow
10630	Angelina River at SH 21 East of Alto	ANRA	Quarterly	Field, Conventionals, Bacteria, Flow
10633	Angelina River at SH 204 West of Cushing	ANRA	Quarterly	Field, Conventionals, Bacteria, Flow
10635	Angelina River at FM 1798 West of Laneville	ANRA	Quarterly	Field, Conventionals, Bacteria, Flow

STATION 10627
Angelina River Bridge on US 59
North of Lufkin

Water Quality Parameters

pH values ranged from 6.2 - 8.4 S.U., with a median value of 7.2 and a mean of 7.22 S.U. (n = 39).

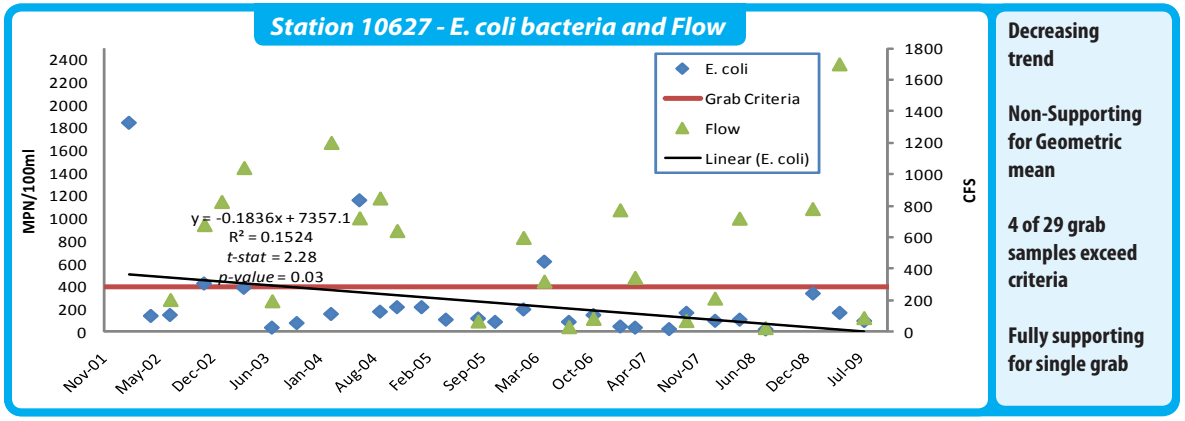
Dissolved Oxygen (DO) values ranged from 4.6 - 11.1 mg/L, with a median of 6.95 and a mean of 7.44 (n = 38). Seasonal variation was observed, with the highest values occurring during the winter months when the colder water is able to contain more dissolved oxygen.

E. coli* bacteria** ranged from 24 to 1842 MPN/100 mL, with a geometric mean of 148.4 MPN/100 mL, which exceeds the recreational use geometric mean criteria of 126 MPN/100 mL. This station is listed as not supporting based upon the bacteria geometric mean. The single grab criteria of 394 MPN/100 mL was exceeded on 4 of 29 samples (14%). A decreasing trend is observed with this data set **(t-stat* **=** 2.28**,** *p-value* **=** 0.03**).**

Total Suspended Solids (TSS) values range from 5 - 54 mg/L, with a a mean of 25.4 mg/L (n = 37). No significant trend was observed with the data.

Total Dissolved Solids (TDS) values ranged from 93 - 256 mg/L, with a mean of 144.8 mg/L (n = 35). No significant trend was observed with the data.

Ammonia-Nitrogen values were typically quite low, with the majority of values being reported as <0.5 mg/L as N (n = 37). The highest value reported (0.14 mg/L as N) is below the screening criteria of 0.33 mg/L as N.



Nitrate+Nitrite-Nitrogen values were reported in the range of <0.04 to 0.76 mg/L as N, with a median value of 0.19 and a mean of 0.24 mg/L as N (n = 37). A decreasing trend was observed with the data set (*t-stat* = 3.14, *p-value* = 0.003). All values reported are below the screening level of 1.95 mg/L as N.

Orthophosphorus values ranged from <0.04 to 0.13 mg/L as P. The majority of samples (30 out of 35, or 85.7%) were reported as less than the method reporting limit.

Total Phosphorus values, like the values for orthophosphorus, were typically low, ranging from 0.06 to 0.18 mg/L as P, with a mean of 0.12 mg/L as P (n = 37). While low, the results showed more variability than the orthophosphorus.

Chlorophyll-*a* results for this sampling station were typically below the method reporting limit. The highest reported value was 12.6 ug/L (n = 36).

Additional Water Quality Parameters

Sulfate had one exceedance (2.7%) during the evaluation period. **Chloride** and **Sulfate** are both fully supporting of criteria at this station.

STATION 10630
Angelina River at SH 21
East of Alto

Water Quality Parameters

pH values at this site typically range from 6.2 to 7.6 S.U., although there was one value of 5.6 that is below the general use criteria range of 6 - 8.5 S.U. The median pH was 6.8, with a mean of 6.78 S.U. (n = 38). Analysis indicates an increasing trend (*t-stat* = 2.44, *p-value* = 0.01).

Dissolved Oxygen (DO) values ranged from 4.8 to 10.8 mg/L, with a median of 7.25 and a mean of 7.52 mg/L (n = 38). Seasonal variation is noticeable, with higher DO values being reported during cooler months. During the evaluation period, only one value (4.8 mg/L, collected on 8/31/2006) was below the aquatic life use DO screening level of 5.0 mg/L.

***E. coli* bacteria** was reported over a range of 12 to 2400 MPN/100 mL (n = 29). The recreation use single grab criteria of 394 MPN/100 mL was exceeded four times. However, the geometric mean of 88.2 was below the criteria of 126 MPN/100 mL.

Total Suspended Solids (TSS) values ranged from 4 to 64 mg/L, with a mean of 19.9 mg/L (n = 38). The highest value reported, 64 mg/L, was associated with a higher than normal flow measurement (2650 cfs).

Total Dissolved Solids (TDS) ranged from 73 to 374 mg/L, with a mean of 152.8 mg/L (n = 39). Only 2 out of 39 results (5.1%) exceeded the criteria of 250 mg/L. A decreasing trend was observed.

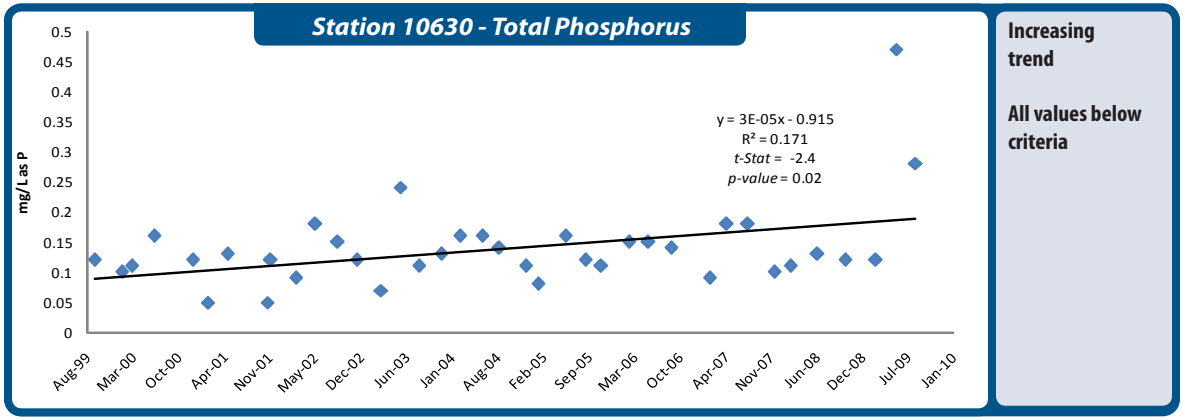
Ammonia-Nitrogen values were typically low, with the majority of values being reported as <0.5 mg/L as N (n = 39). The highest value reported during the evaluation period (0.24 mg/L as N, collected on 6/24/2000), is below the screening level of 0.33 mg/L as N.

Nitrate+Nitrite-Nitrogen values ranged from <0.04 to 1.09 mg/L as N, with a median of 0.22 and a mean of 0.29 mg/L as N (n = 39). On the day of the highest value (1.09 mg/L as N, collected on 8/28/2002), results of additional parameters collected include an *E. coli* result of 52 MPN/100 mL, a flow of 64 cfs, and a DO of 6 mg/L.

Orthophosphorus values at this station were typically low, with 75.7% (28 out of 37) results being below the method reporting limit. Results ranged from <0.04 to 0.13 mg/L as P (n = 37).

Total Phosphorus values ranged from <0.5 to 0.47 mg/L as P, with a mean of 0.14 mg/L as P (n = 37). An increasing trend is observed, although this trend is being influenced by two recent values which are higher than typically observed. All values were below criteria.

Chlorophyll-*a* results were typically reported below the reporting limit throughout the duration of the evaluation period (n = 39). Only 2 values exceeded 10 ug/L, with the highest reported value of 18.7 ug/L occurring on 10/21/2001. Although no flow or DO data is associated with that sampling event, a higher than normal Ammonia-N value (0.13 mg/L as N) and the lowest TSS value of the evaluation period (4 mg/L) were reported for that sample.



STATION 10633
Angelina River at SH 204
West of Cushing

Water Quality Parameters

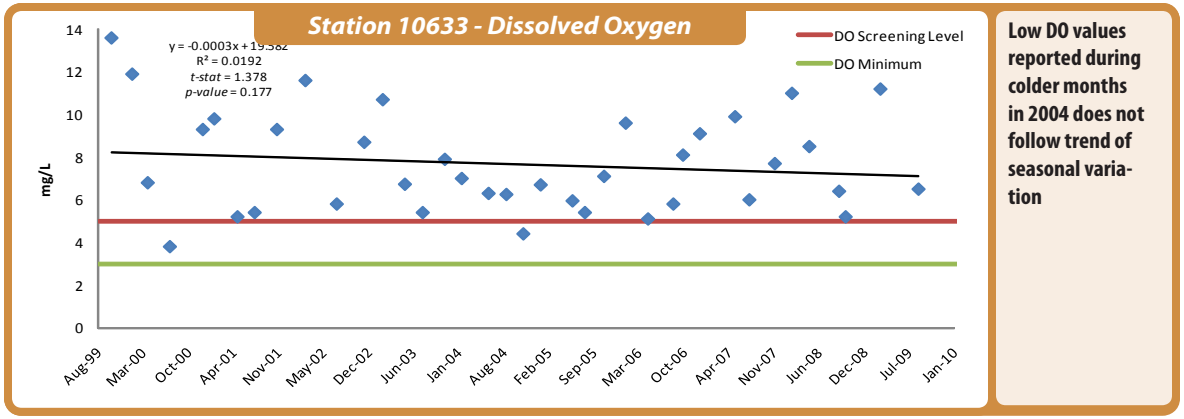
pH values during the evaluation period ranged from a minimum of 6.2 to a maximum of 8.4 S.U., with a median and mean of 7.1 S.U. (n = 36). Trend analysis did not show any significant change over time.

Dissolved Oxygen (DO) values ranged from 3.8 to 13.6 mg/L, with a median of 6.9 and a mean of 7.66 mg/L (n = 38). When graphed, the results displayed the expected seasonal dissolved oxygen fluctuation for the most part. However, this pattern was interrupted in 2004, as low DO measurements were reported in the Fall/Winter seasons. A DO of 4.4 mg/L was reported on 10/26/2004, which is unexpected for that time of the year.

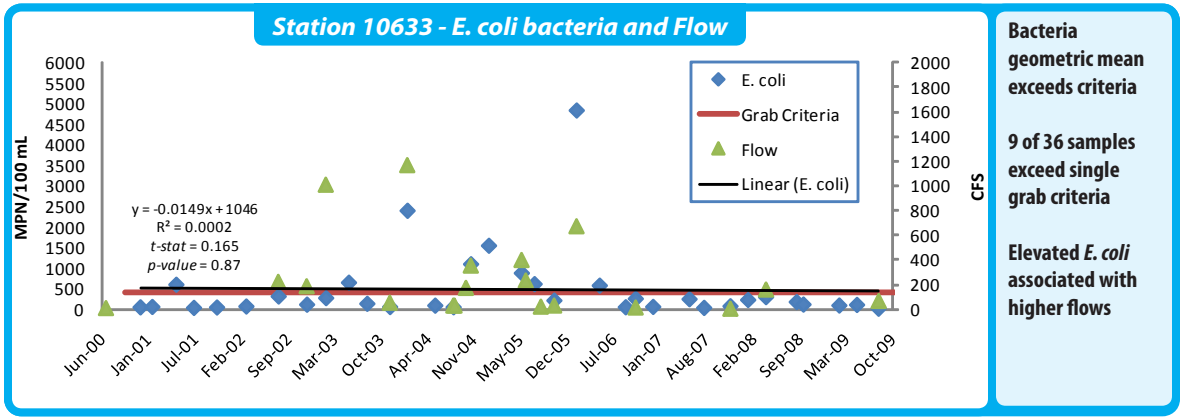
***E. coli* bacteria** contamination is an issue at this monitoring station. Reported values during the evaluation period ranged from a low of 18 MPN/100 mL to a high of >4800 MPN/100 mL (n = 36). During this time frame, there was one other greater than value reported (>2400 MPN/100 mL.) The geometric mean for the data set was 184, while the contact recreation limit is 126 MPN/100 mL. The single sample limit of 394 MPN/100 mL was exceeded for 9 of the 36 samples (25%). Elevated *E. coli* results appear to be correlated with higher stream flows.

Total Suspended Solids (TSS) values ranged from 1.33 to 56 mg/L, with a median of 7 and a mean of 11.6 mg/L (n = 39).

Total Dissolved Solids (TDS) ranged from 56 to 280 mg/L, with a mean of 121 mg/L. Only 1 of 39 results exceeded 250 mg/L.



Low DO values reported during colder months in 2004 does not follow trend of seasonal variation



Bacteria geometric mean exceeds criteria

9 of 36 samples exceed single grab criteria

Elevated *E. coli* associated with higher flows

Water Quality Parameters (continued)

Ammonia-Nitrogen results ranged from <0.01 to 1.1 mg/L as N. When graphed, the data suggests an upward trend, but statistically, it is not significant. Elevated ammonia values were reported during the period of November 2003 to July 2007, as 15 of 16 values (93.7%) during that time frame exceeded the general use screening level of 0.33 mg/L as N. For the entire evaluation period, there were exceedances for 15 of 39 results (38.5%). Ammonia is a concern for screening level at this station.

Nitrate+Nitrite-Nitrogen values ranged from <0.04 to 1.85 mg/L as N, with a median of 0.25 and a mean of 0.48 mg/L as N (n = 39). A statistically significant downward trend over time is observed. No values exceeded criteria.

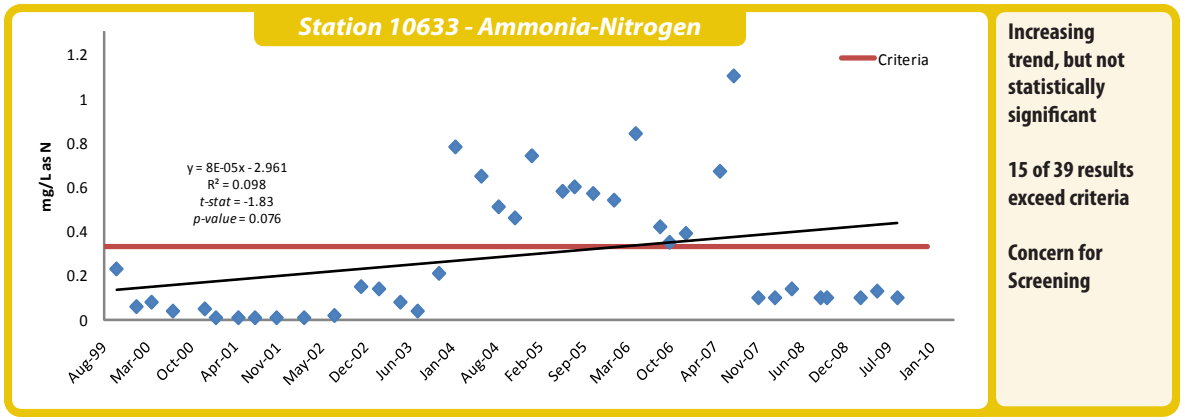
Orthophosphorus values ranged from 0.02 to 0.95 mg/L as P, with a mean of 0.12 mg/L as P. Of 39 analyses during the evaluation period, only 2 results exceeded the 0.37 mg/L as P screening criteria for general use. The most recent of the two exceedances occurred in 2001.

Total Phosphorus values ranged from <0.06 to 1.6 mg/L as P, with a mean of 0.32 mg/L as P (n = 39). There were 4 values (10.3%) which exceeded the general use criteria of 0.69 mg/L as P. The data indicates a statistically significant downward trend over time.

Chlorophyll-*a* results were low, with values ranging from a minimum of <2 ug/L to a maximum of 9 ug/L (n = 23).

Additional Water Quality Parameters

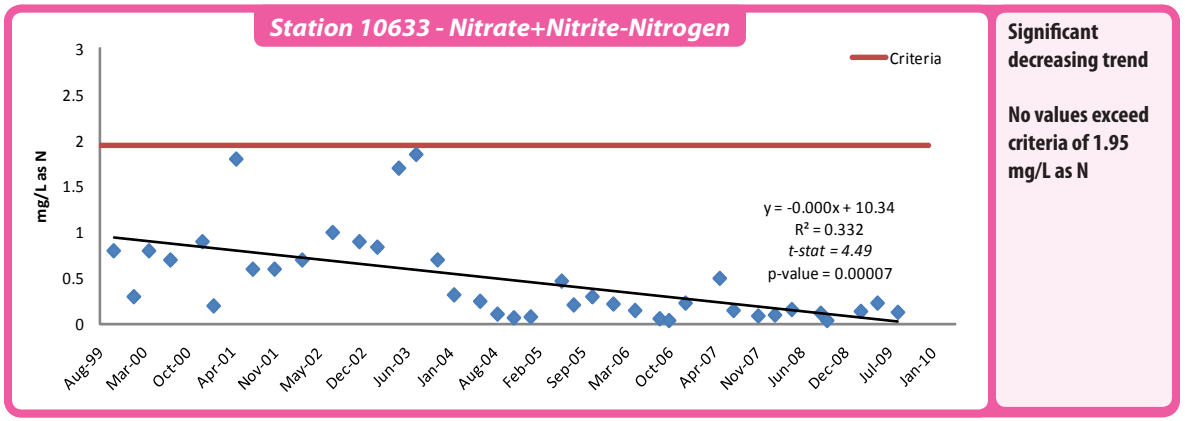
Sulfate displayed a significant decreasing trend over time. No data exceeded criteria for this parameter.



Increasing trend, but not statistically significant

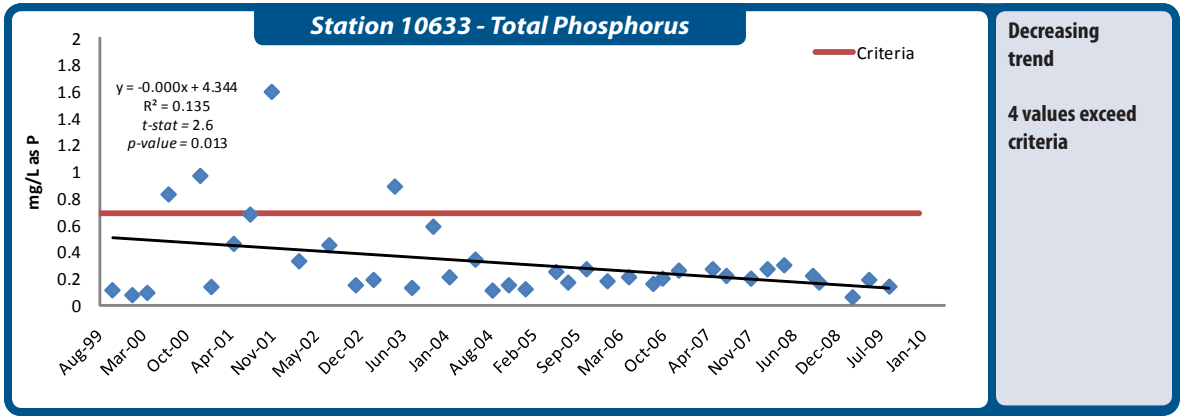
15 of 39 results exceed criteria

Concern for Screening



Significant decreasing trend

No values exceed criteria of 1.95 mg/L as N



Decreasing trend

4 values exceed criteria

STATION 10635
Angelina River at FM 1798
West of Laneville

Water Quality Parameters

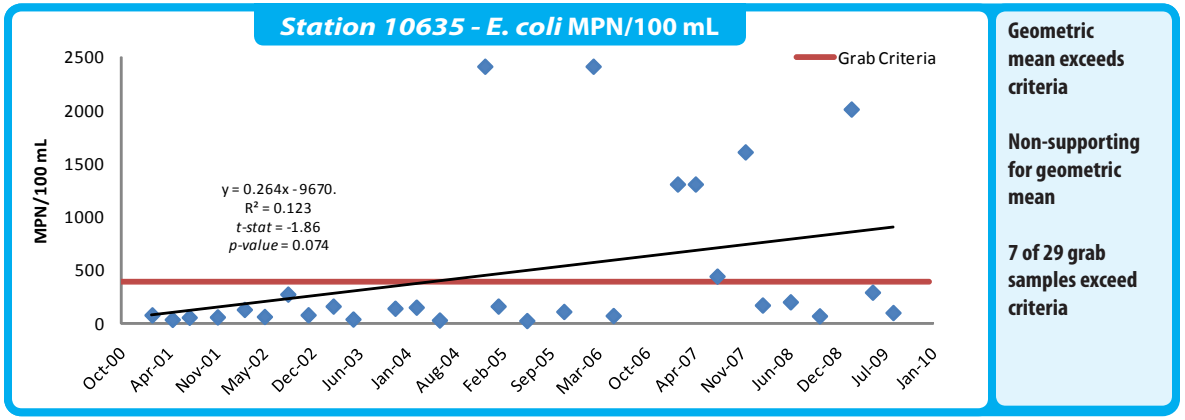
pH values ranged from 5.6 to 7.5 S.U., with a median of 6.9 and a mean of 6.86 S.U. (n = 33). One value was outside the pH 6 - 8.5 criteria. No statistically significant trend was observed.

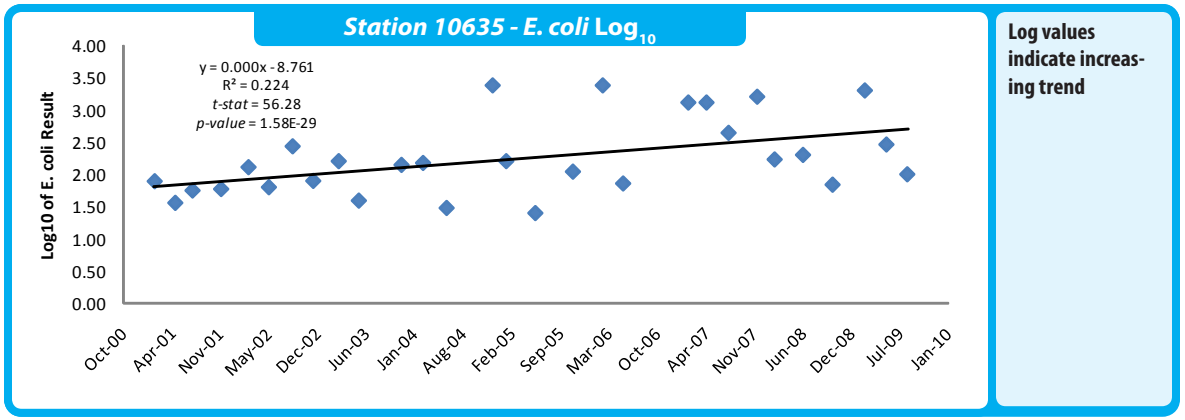
Dissolved Oxygen (DO) values ranged from 5.6 to 11.3 mg/L, with a median of 7.95 and a mean of 8.15 mg/L (n = 32). Seasonal variability was observed, with higher values being reported in the Fall/Winter months.

***E. coli* bacteria** at this station ranged from 25 to >2400 MPN/100 mL, with 2 of 29 records reported as a greater-than value. The geometric mean was 178 MPN/100 mL. Seven of 29 records exceeded the 394 MPN/100 mL single sample screening level for Contact Recreation. An increasing trend is observed when the results are graphed, but the trend is not considered statistically significant (*t-stat* = -1.86, *p-value* = 0.074). However, the log-transformed data shows a significant increasing trend (*t-stat* = 56.3, *p-value* = 1.58 X10^{-29}). Flow at this site is very low, ranging from 9.9 to 50.4 cfs).

Total Suspended Solids (TSS) values ranged from 2.7 to 71 mg/L, with a mean of 22 mg/L (n = 32). No significant trend was observed with the data set.

Total Dissolved Solids (TDS) ranged from 97 to 175 mg/L, with a mean of 129 mg/L (n = 32). No results exceeded the criteria. A statistically significant increasing trend (*t-stat* = -3.09, *p-value* = 0.004) is present. The same significant increasing trend is also present with the specific conductance.





Water Quality Parameters (continued)

Ammonia-Nitrogen concentrations were typically very low, ranging from <0.05 to 0.12 mg/L as N. For 21 of 30 results (70%), the reported value was less than the method reporting limit for this parameter.

Nitrate+Nitrite-Nitrogen results showed more variability than Ammonia-Nitrogen. While results were typically below 0.8 mg/L as N, values ranged from a minimum of 0.1 to a maximum of 2.66 mg/L as N, with a mean value of 0.48 mg/L as N (n = 31). One result during the evaluation period exceeded the 1.95 mg/L as N screening level for general use.

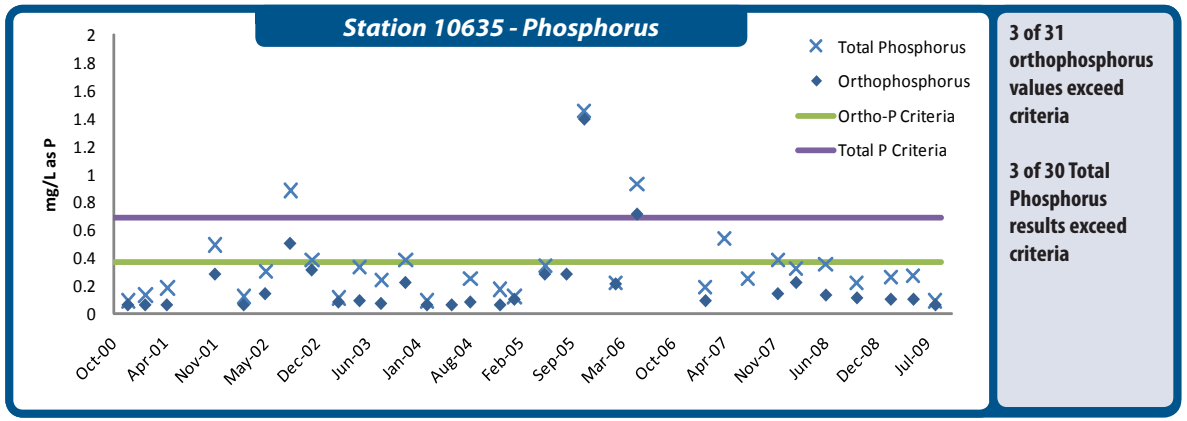
Orthophosphorus ranged from <0.06 to 1.39 mg/L as P, with a mean of 0.20 mg/L as P. During the evaluation period, 3 of 31 samples (9.7%) exceeded the general use screening level of 0.37 mg/L as P for dissolved orthophosphorus.

Total Phosphorus concentrations ranged from 0.09 to 1.45 mg/L as P, with a mean of 0.34 mg/L as P (n = 30). Three results during the evaluation period exceeded the 0.69 mg/L as P screening level for general use.

Chlorophyll-*a* values were all below 10 ug/L (n = 31).

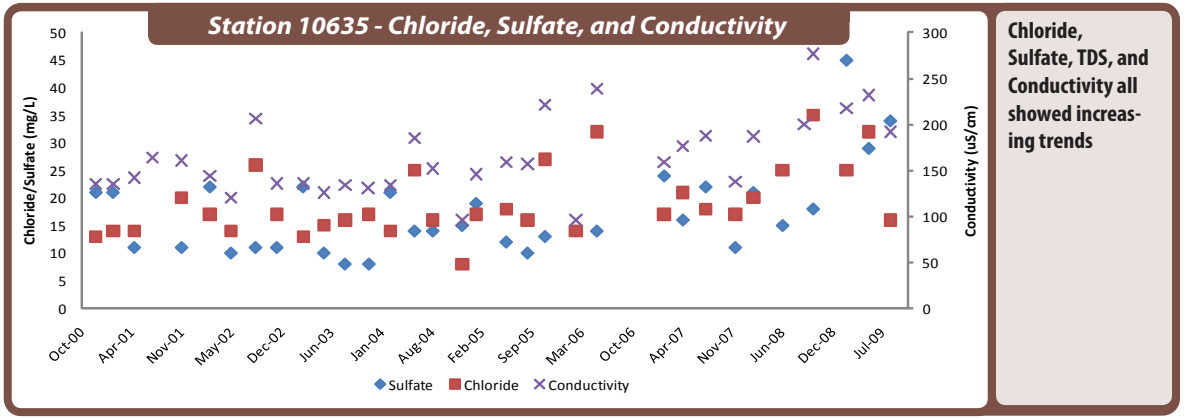
Additional Water Quality Parameters

Results for both **Chloride** and **Sulfate** indicated a statistically significant increasing trend, although no results exceeded the criteria. This same trend is also reflected in both **Total Dissolved Solids** and **Specific Conductance**.



3 of 31 orthophosphorus values exceed criteria

3 of 30 Total Phosphorus results exceed criteria

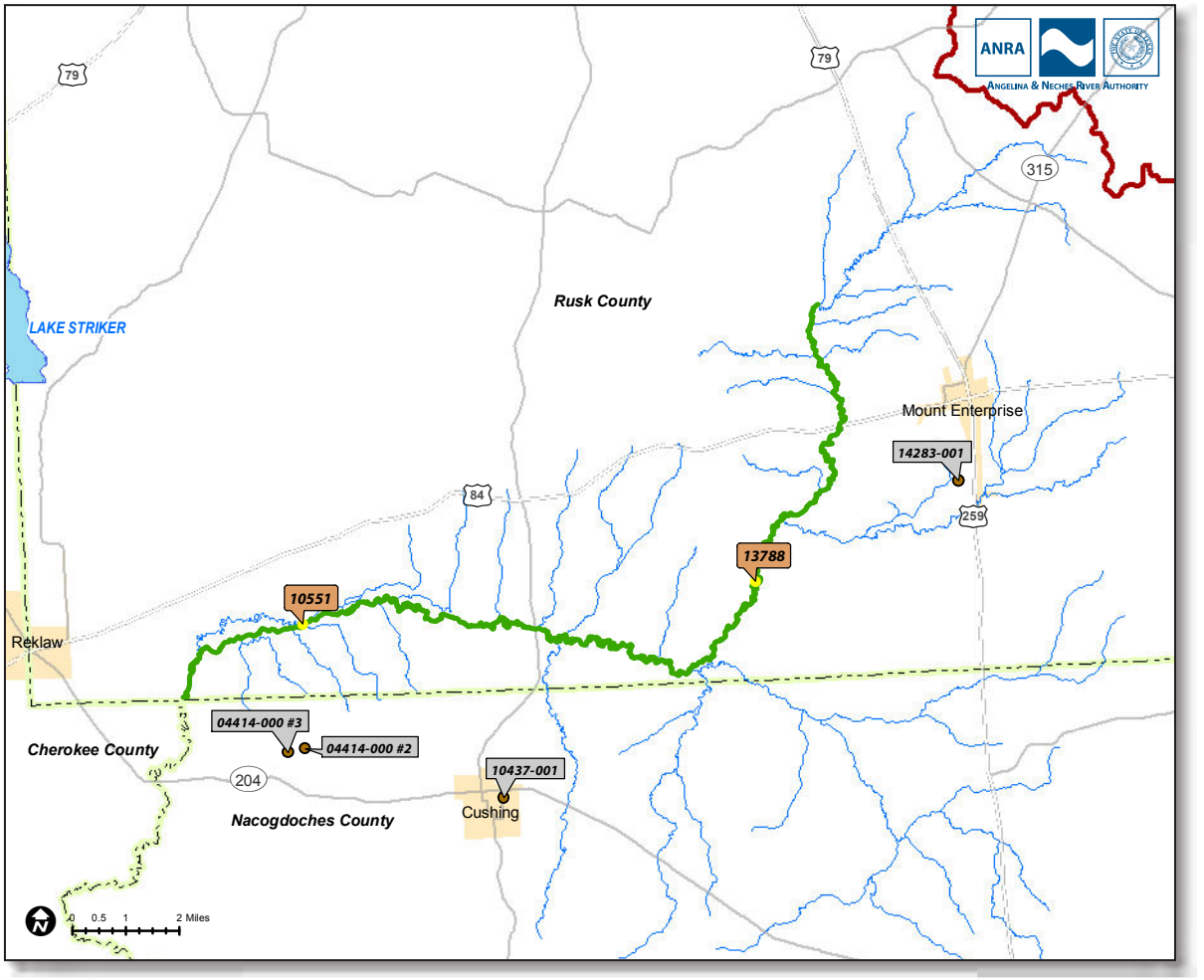


Chloride, Sulfate, TDS, and Conductivity all showed increasing trends

Segment 0611A - East Fork Angelina River (unclassified water body)

Segment Profile

Segment 0611A extends from the confluence of the Angelina River at the Rusk/Nacogdoches County line to the upstream perennial portion of the stream west of Mount Enterprise in Rusk County. This unclassified water body extends 30.4 miles in length. The segment is designated for aquatic life, general, and recreation use. Several areas within this segment have been identified on the 303(d) list. At the confluence with Grassy Lake, this area was initially listed on the 303(d) list in the year 2002 for bacteria and is currently under a 5a category status. The same location was listed in 2000 for lead in water and is currently under a 5c status. In addition, Grassy Lake area to county road near Happy Valley, county road near Happy Valley to Wooten Creek, and Wooten Creek to headwaters have been placed on the 303(d) list in the year 2000 for lead in water. These areas are currently under a 5c category, indicating that additional information is needed to identify sources and causes.



Monitoring Stations on Segment 0611A

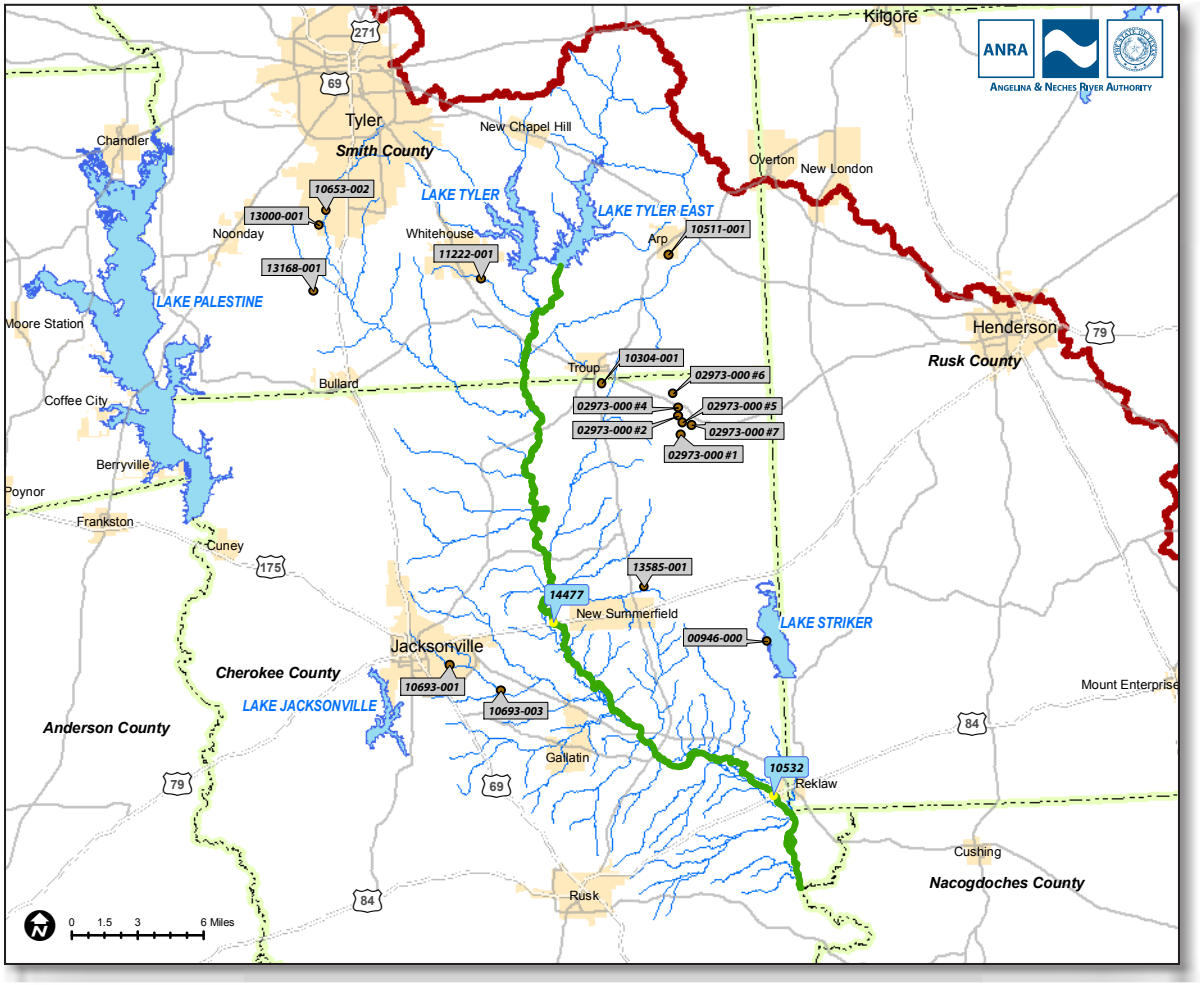
Station ID	Station Name	Collecting Agency	Frequency	Parameters
13788	CR 3218 SW Of Mount Enterprise	TCEQ	Flow & Metals 5x - Others Quarterly	Field, Conventionals, Bacteria, Flow, Metals(water)
10551	Angelina River at SH 21 East of Alto	TCEQ	Flow & Metals 5x - Others Quarterly	Field, Conventionals, Bacteria, Flow, Metals(water)

Segment 0611C - Mud Creek (unclassified water body)

Segment Profile

Segment 0611C is a 45-mile length freshwater stream extending from the confluence of the Angelina River east of Rusk in Cherokee County to the upstream perennial portion of the stream west of Troup in Smith County. It is designated for aquatic life, general, and recreational use.

Contact Recreation at Mud Creek at US 79



Monitoring Stations on Segment 0611C				
Station ID	***Station Name***	***Collecting Agency***	***Frequency***	***Parameters***
10532	Mud Creek at US 84	ANRA	Metals 3x - Others Quarterly	Field, Conventionals, Bacteria, Flow, Metals(water)
14477	Mud Creek at US 79	ANRA	Quarterly	Field, Conventionals, Bacteria, Flow

STATION 10532
Mud Creek at US 84
Southwest of Reklaw

Water Quality Parameters

pH values ranged from 6.2 to 7.9 S.U., with a mean of 7.16 S.U. (n = 37). There were no exceedances.

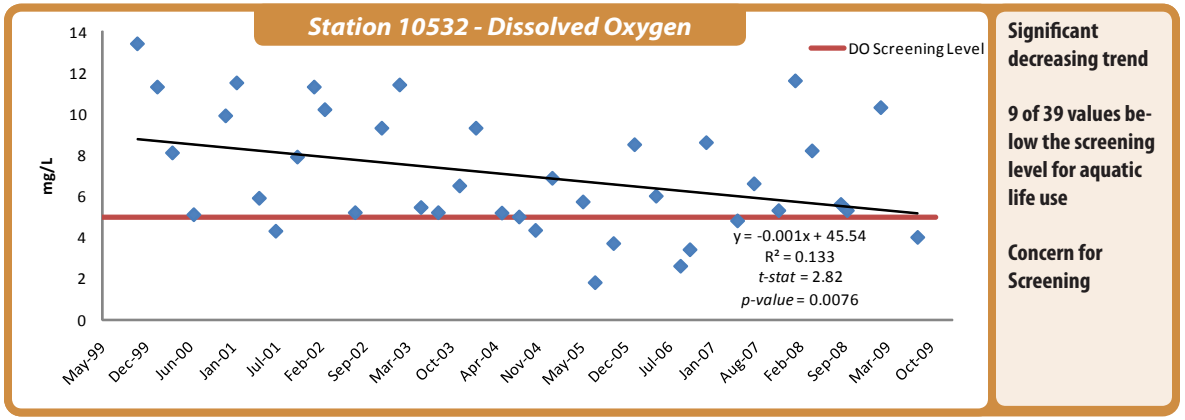
Dissolved Oxygen (DO) values ranged from a minimum of 1.8 mg/L to a maximum of 13.4 mg/L, with a mean of 7.04 mg/L (n = 39). The dissolved oxygen values at this site demonstrated a statistically significant downward trend. Several low dissolved oxygen readings were observed, with 9 of 39 (23%) values below the 5.0 mg/L DO grab screening level for aquatic life use.

***E. coli* bacteria** was reported over a range of 11 to >2400 MPN/100 mL, with a geometric mean of 181 MPN/100 mL (n = 60). *E. coli* results exceeded the single grab criteria for contact recreation use of 394 MPN/100 mL for 10 of 60 samples (17%).

Total Suspended Solids (TSS) values ranged from a minimum of 1.67 to a maximum of 32.5 mg/L. The median was 7.9, with a mean of 9.7 mg/L (n = 40).

Total Dissolved Solids (TDS) values ranged from 82 to 320 mg/L, with a mean of 169 mg/L (n = 40).

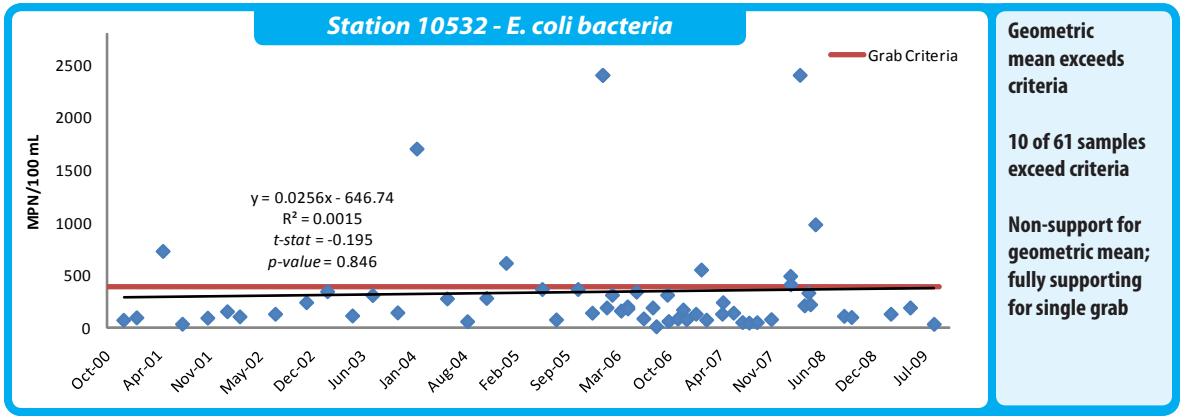
Ammonia-Nitrogen values ranged from <0.01 to 1.11 mg/L as N, with a median of 0.15 and a mean of 0.299 mg/L as N (n = 40). There were 15 of 40 results (37.5%) that exceeded the general use criteria of 0.33 mg/L as N.



Significant decreasing trend

9 of 39 values below the screening level for aquatic life use

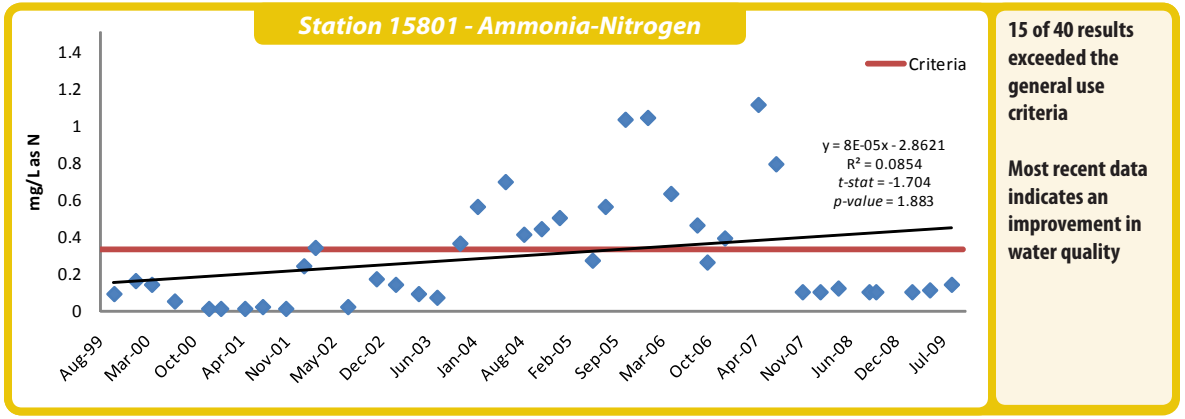
Concern for Screening



Geometric mean exceeds criteria

10 of 61 samples exceed criteria

Non-support for geometric mean; fully supporting for single grab



15 of 40 results exceeded the general use criteria

Most recent data indicates an improvement in water quality

Water Quality Parameters (continued)

Nitrate+Nitrite-Nitrogen values ranged from <0.04 to 3.8 mg/L as N, with a mean of 0.94 mg/L as N, and 6 of 40 results (15%) exceeding the general use criteria of 1.95 mg/L as N. A statistically significant decreasing trend is observed.

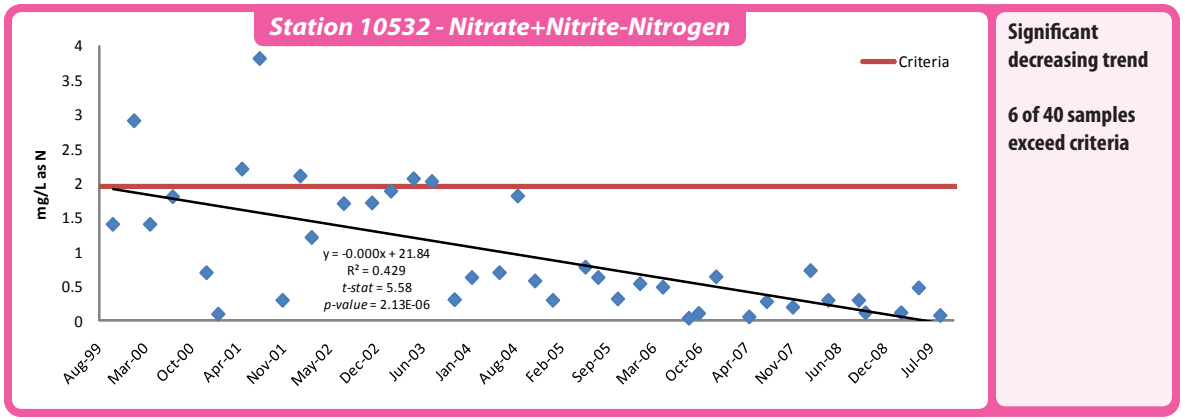
Orthophosphorus values were reported in the range of 0.036 to 0.825 mg/L as P, with a mean of 0.108 mg/L as P (n = 39). There was one exceedance (2.5%) of the general use criteria. A statistically significant decreasing trend was observed.

Total Phosphorus values ranged from <0.06 to 1.5 mg/L as P, with a mean of 0.31 mg/L as P (n = 40). There were 5 exceedances (12.5%) of the general use criteria. As with orthophosphorus, a statistically significant decreasing trend was observed (*t-stat* = 3.84, *p-value* = 0.0004).

Chlorophyll-*a* values ranged from a minimum of <2 ug/L to a maximum of 22.1 ug/L. Of the 23 values reported during the evaluation period, 16 (69.9%) were reported as less than the method limit of quantitation.

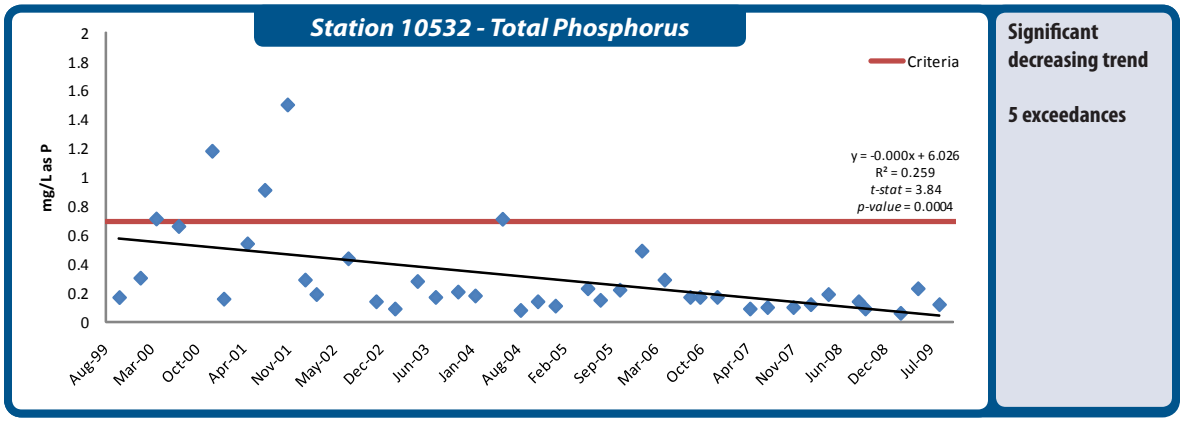
Additional Water Quality Parameters

Sulfate values show a decreasing trend over time (*t-stat* = 3.50, *p-value* = 0.001), with a range of 10.7 to 87 mg/L. The median was 39.2, and the mean was 41.2 mg/L. The general use criteria of 50 mg/L was exceeded 8 times (20%) during the evaluation period. There were no exceedances for **Chloride**.



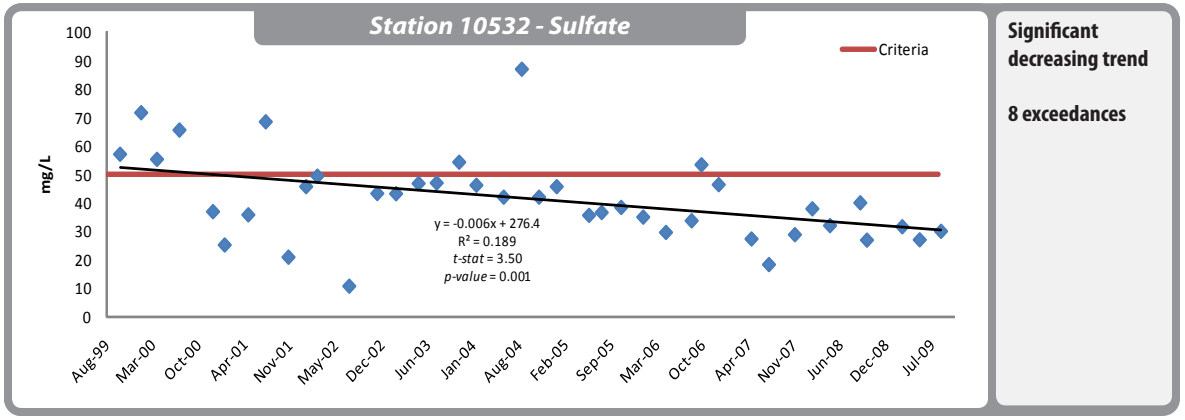
Significant decreasing trend

6 of 40 samples exceed criteria



Significant decreasing trend

5 exceedances



Significant decreasing trend

8 exceedances

STATION 14477
Mud Creek at US 79
Between Jacksonville and New Summerfield

Water Quality Parameters

pH values ranged from a minimum of 6.5 to a maximum of 7.9 S.U., with a mean of 7.19 S.U. (n = 33).

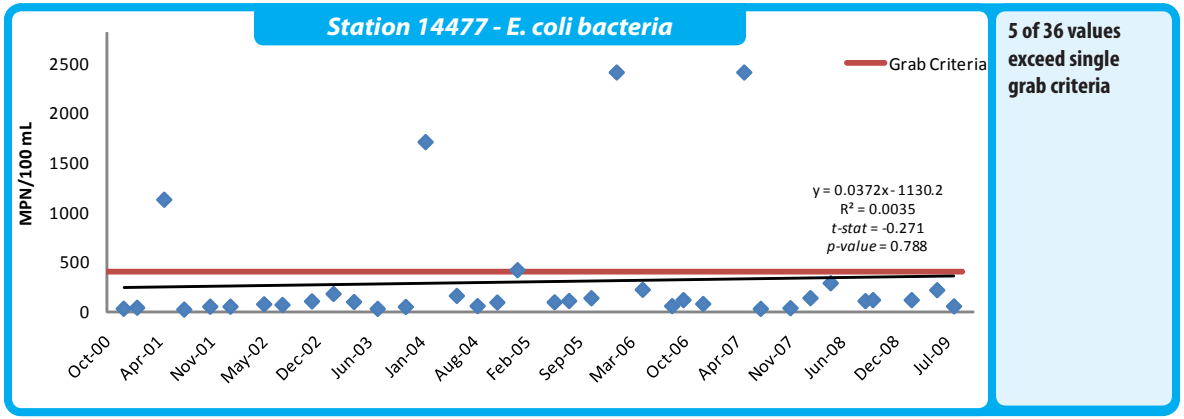
Dissolved Oxygen (DO) values ranged from 4.54 to 13.2 mg/L, with a mean of 7.62 mg/L. Of the 36 reported values, only 2 results (5.5%) fall below the 5.0 mg/L screening level for aquatic life use.

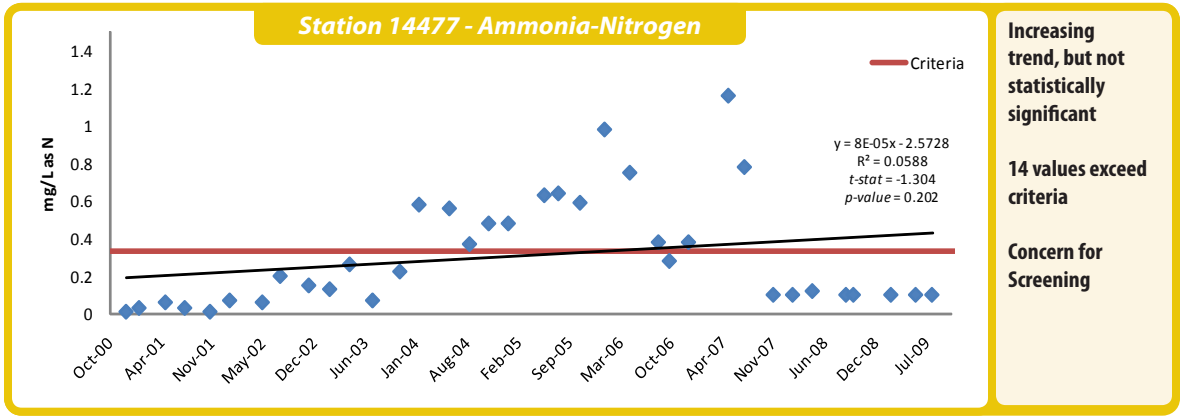
***E. coli* bacteria** results at this sampling station ranged from a minimum of 14 MPN/100 mL to >2400 MPN/100 mL. The geometric mean of the data set was 106.7 MPN/100 mL. The single grab criteria for contact recreation use of 394 MPN/100 mL was exceeded for 5 of 36 samples (13.5%).

Total Suspended Solids (TSS) values ranged from 1.33 to 77 mg/L, with a median of 6.8 and a mean of 13.5 mg/L (n = 36).

Total Dissolved Solids (TDS) values ranged from a minimum of 106 mg/L to a maximum of 294.7 mg/L, with a median of 162 and a mean of 167.5 mg/L (n = 36).

Ammonia-Nitrogen values were reported in a range of <0.01 to 1.16 mg/L as N. The median value was 0.175, with a mean of 0.33 mg/L as N (n = 36). An increasing trend is observed, but it is not statistically significant. There were 14 values (38.9%) exceeding the criteria. Several elevated values were reported during the period of 2004 through 2007, but since that time frame, values are typically <0.1 mg/L as N.





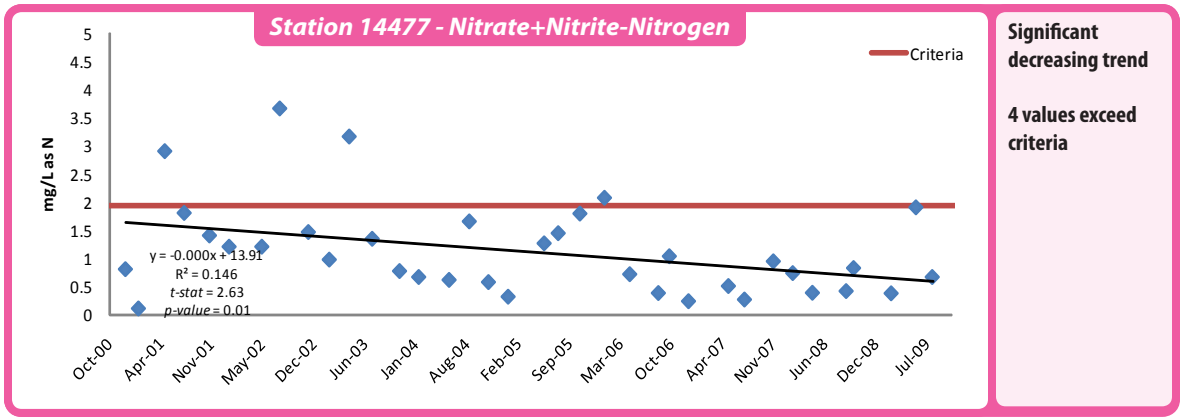
Water Quality Parameters (continued)

Nitrate+Nitrite-Nitrogen values at this site ranged from 0.1 mg/L as N to 3.66 mg/L as N, with a median of 0.88 and a mean of 1.12 mg/L as N (n = 36). The general use criteria was exceeded 4 times (11%). A statistically significant decreasing trend is observed.

Orthophosphorus values were reported in the range of <0.04 to 1.48 mg/L as P, with a median of 0.08 and a mean of 0.133 mg/L as P (n = 36).

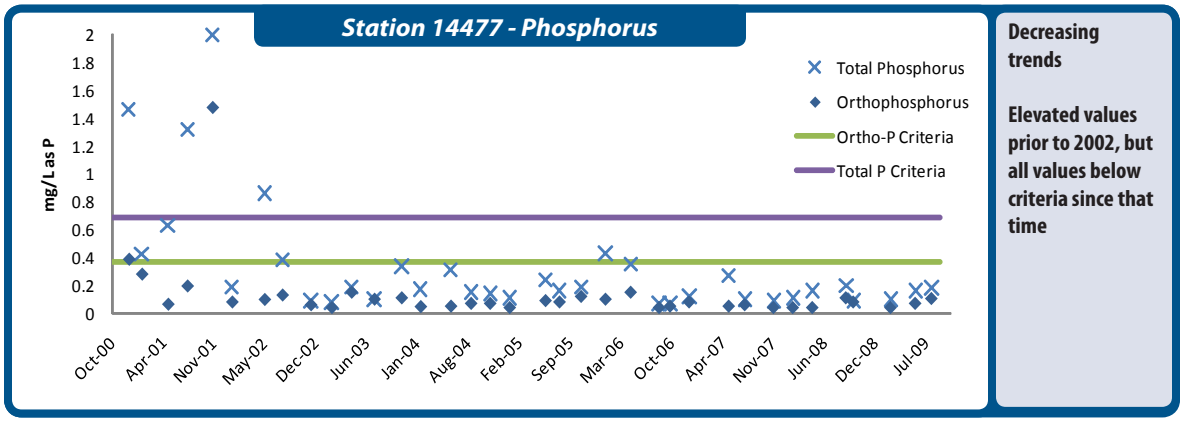
Total Phosphorus values showed a statistically significant downward trend (*t-stat* = 4.047, *p-value* = 0.00028). Results ranged from 0.07 to 2 mg/L as P, with a median of 0.175 and a mean of 0.33 mg/L as P (n = 36). Several high values were recorded in 2001 and 2002, but since that time, results have typically been low.

Chlorophyll-*a* values were very low, with all results at <5 ug/L (n = 23).



Significant decreasing trend

4 values exceed criteria



Decreasing trends

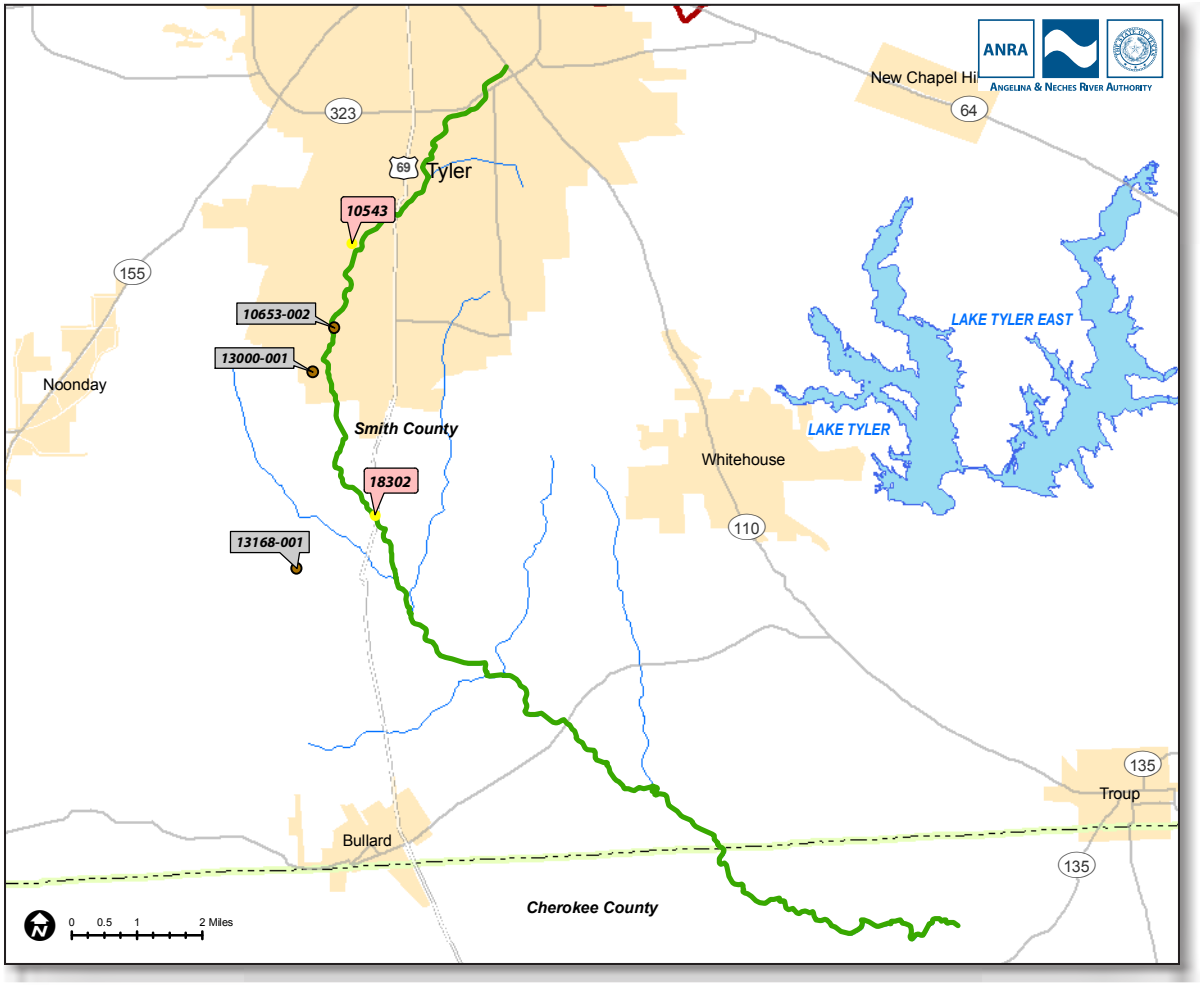
Elevated values prior to 2002, but all values below criteria since that time

Segment 0611D - West Mud Creek (unclassified water body)

Segment Profile

This segment is twenty-three miles in length from the confluence of Mud Creek southwest of Troup in Cherokee County to the upstream perennial portion of the stream south of Tyler in Smith County. The designated uses are aquatic life, general, and recreation use.

West Mud Creek



Monitoring Stations on Segment 0611D				
Station ID	***Station Name***	***Collecting Agency***	***Frequency***	***Parameters***
10543	West Mud Creek Above Southside Sewage Treatment Plant (SSTP)	City of Tyler	Quarterly	Field, Conventionals, Bacteria, Flow
18302	West Mud Creek at US 69	City of Tyler	Quarterly	Field, Conventionals, Bacteria, Flow

STATION 10543
West Mud Creek Above SSTP
Above Tyler Southside Sewer Treatment Plant

Water Quality Parameters

pH values show a statistically significant decreasing trend, although no value fell outside of the criteria. The minimum value was 6.5, with a maximum of 7.9, and the mean was 7.12 S.U. (n = 23).

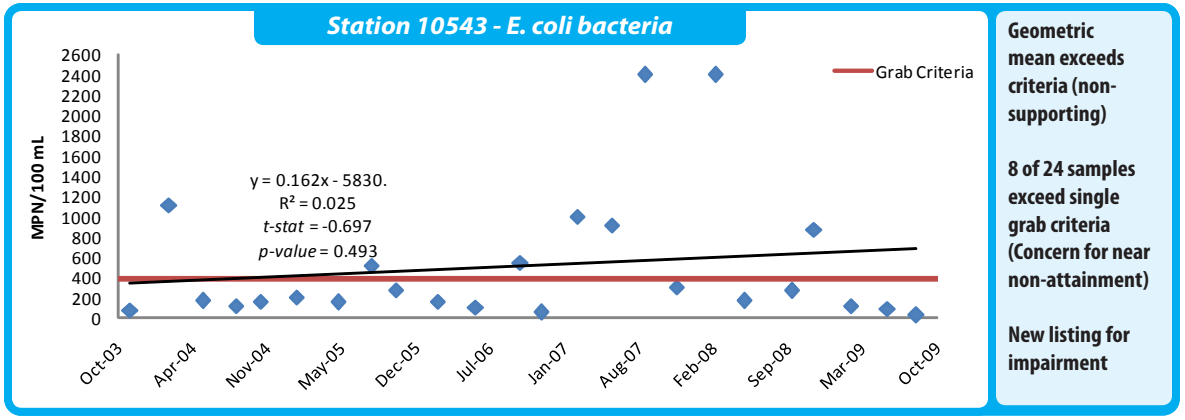
Dissolved Oxygen (DO) values ranged from 3 to 10.2 mg/L, with a median of 5.9 and a mean of 6.1 mg/L (n = 24). No values fell below the aquatic life use criteria of 3.0 mg/L, and no statistically significant trend was observed.

***E. coli* bacteria** results ranged from 29 to >2400 MPN/100 mL, with a geometric mean of 267 MPN/100 mL. Of the 24 samples during the evaluation period, 8 (33.3%) exceeded the single grab criteria of 394 MPN/100 mL. The geometric mean also exceeds the criteria of 126 MPN/100 mL. This station is non-supporting for both criteria. Assessment unit 0611D_02 is listed as impaired in the Draft 2010 303(d) list.

Total Suspended Solids (TSS) values ranged from <1 to 76 mg/L, with a mean of 6.9 mg/L. The result of 76 mg/L is the only value (out of 24 samples) during the period that is greater than 8 mg/L.

Total Dissolved Solids (TDS) values ranged from 121 to 284 mg/L, with a mean of 194 mg/L (n = 23). No trend was observed with the data set.

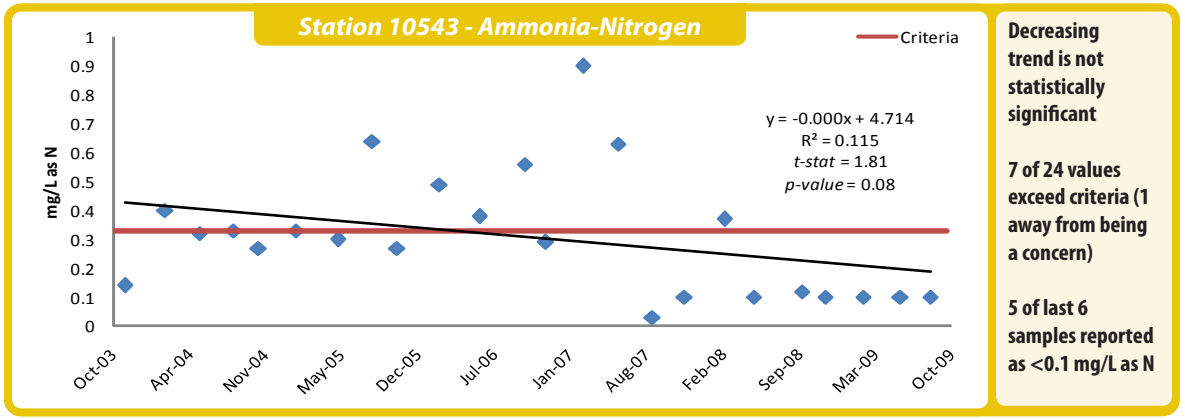
Ammonia-Nitrogen values ranged from 0.03 to 0.9 mg/L as N, with a mean of 0.31 mg/L as N. Of the 24 values evaluated, 7 (29.2%) exceeded the general use criteria of 0.33 mg/L as N. A decreasing trend is observed, but it is not statistically significant (*t-stat* = 1.81, *p-value* = 0.08). Five of the last six evaluated values have been below the method reporting limit of 0.1 mg/L as N.



Geometric mean exceeds criteria (non-supporting)

8 of 24 samples exceed single grab criteria (Concern for near non-attainment)

New listing for impairment



Decreasing trend is not statistically significant

7 of 24 values exceed criteria (1 away from being a concern)

5 of last 6 samples reported as <0.1 mg/L as N

Water Quality Parameters (continued)

Nitrate+Nitrite-Nitrogen values ranged from 0.14 to 3.14 mg/L as N, with a mean value of 0.57 mg/L as N (n = 24). One result exceeded the general use criteria of 1.95 mg/L as N.

Orthophosphorus values were low, ranging from <0.04 to 0.15 mg/L as P, with a mean of 0.052 mg/L as P. No values exceeded the criteria, and 14 of 24 values (58.3%) were reported as below the Ambient Water Reporting Limit (AWRL) of 0.04 mg/L as P.

Total Phosphorus values ranged from <0.06 to 0.2 mg/L as P, with a mean of 0.09 mg/L as P. No values exceeded criteria, and 11 of 23 values (47.8%) were reported as <0.06 mg/L as P.

Chlorophyll-*a* values were typically low (n = 24), with only one exceedance occuring (during the winter of 2003).

Additional Water Quality Parameters

Sulfate values ranged from 17.4 to 57.2 mg/L, with a mean of 38.1 mg/L. There were 3 exceedances (12.5%) during the evaluation period.

Water Quality Monitoring being conducted by City of Tyler personnel

STATION 18302
West Mud Creek at US 69
South of Tyler

Water Quality Parameters

pH values ranged from 6.7 to 8.2 S.U., with a mean of 7.3 S.U. (n = 22) Although a statistically significant decreasing trend exists (*t-stat* = 2.13, *p-value* = 0.046), no values fell outside of the range of pH 6 - 8.5 S.U.

Dissolved Oxygen (DO) values ranged from 4 to 10.4 mg/L, with a mean of 6.9 mg/L (n = 23). There were no values that exceeded criteria.

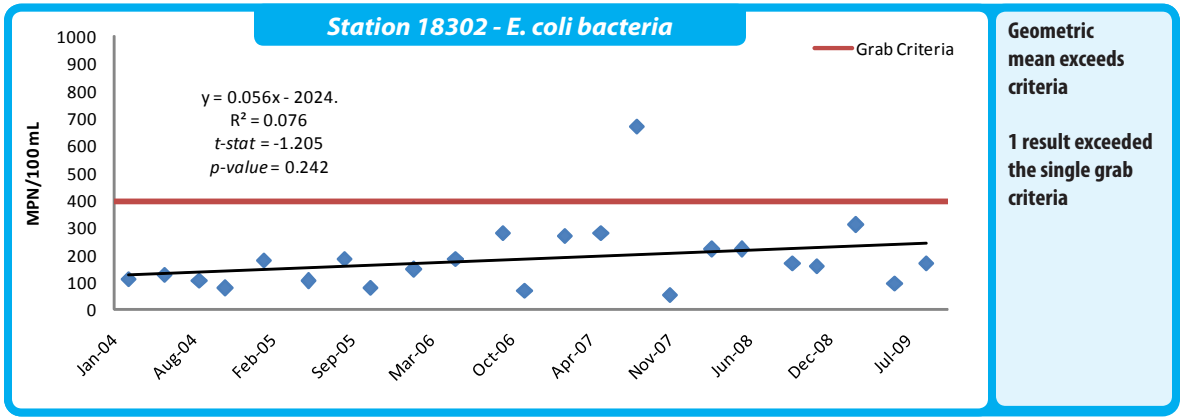
***E. coli* bacteria** results during the period ranged from a minimum of 55 to a maximum of 670 MPN/100 mL. The geometric mean of the data set was 157.4 MPN/100 mL (n = 23), which exceeds the contact recreation use criteria of 126 MPN/100 mL. One result (4.3%) exceeded the single grab limit of 394 MPN/100 mL.

Total Suspended Solids (TSS) values were low, with a range of <1 to 16 mg/L and a mean of 6.2 mg/L (n = 23).

Total Dissolved Solids (TDS) values ranged from 240 to 376 mg/L, with a mean of 296 mg/L (n = 23).

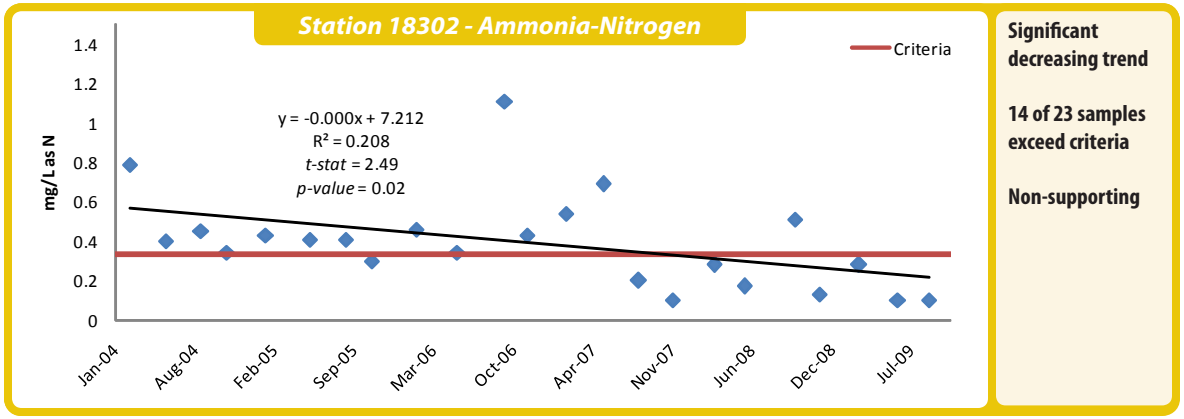
Ammonia-Nitrogen values were reported in the range of <0.1 to 1.11 mg/L as N, with a mean of 0.39 mg/L as N (n = 23). The general use criteria of 0.33 mg/L as N was exceeded for 14 of 23 samples (60.9%). A statistically significant downward trend is observed (*t-stat* = 2.49, *p-value* = 0.02).

Nitrate+Nitrite-Nitrogen values ranged from 0.1 to 7.9 mg/L as N. The general use criteria of 1.95 mg/L as N was exceeded for 20 of 23 samples (87%). An increasing trend is observed, but it is not statistically significant (*t-stat* = -1.18, *p-value* = 0.02). The elevated Nitrate+Nitrite values at this station are a concern, as is the apparent increasing trend in the data.



Geometric mean exceeds criteria

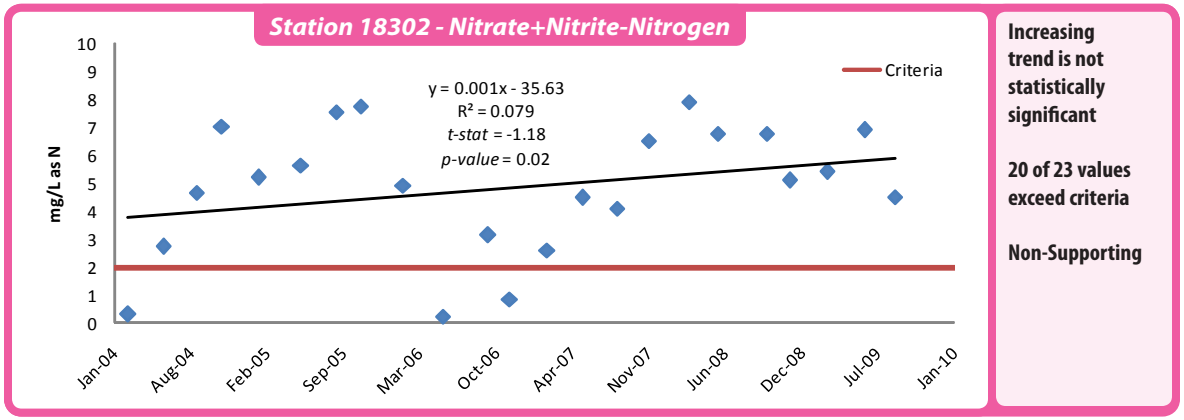
1 result exceeded the single grab criteria



Significant decreasing trend

14 of 23 samples exceed criteria

Non-supporting



Increasing trend is not statistically significant

20 of 23 values exceed criteria

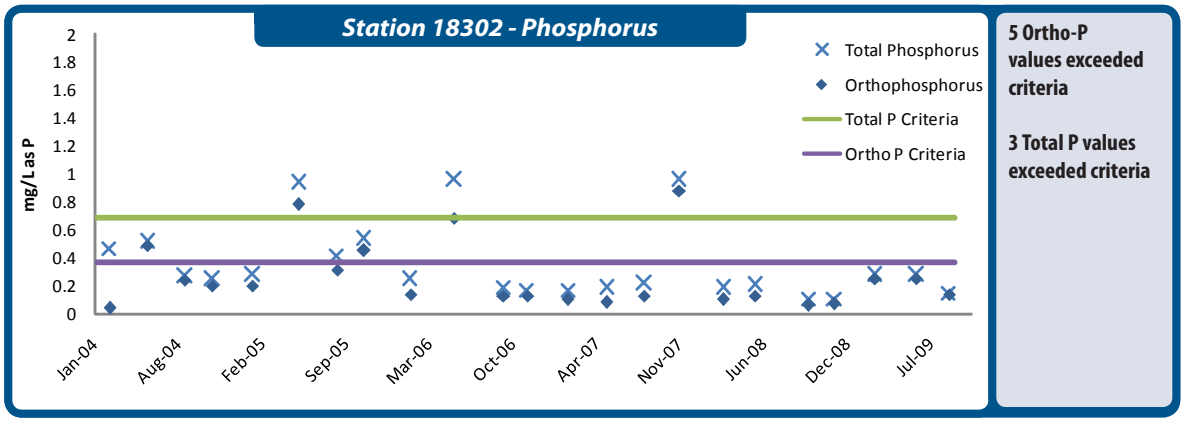
Non-Supporting

Water Quality Parameters (continued)

Orthophosphorus values ranged from <0.04 to 0.88 mg/L as P, with a mean value of 0.26 mg/L as P. Of the 23 data points evaluated, 5 (21.7%) exceeded the general use criteria of 0.37 mg/L as P.

Total Phosphorus values ranged from 0.1 to 0.96 mg/L as P, with a mean of 0.35 mg/L as P (n = 23). There were 3 exceedances (13%).

Chlorophyll-*a* values were low, with the highest value reported at 10.9 ug/L, and 19 of 21 results (90.5%) reported as below the method reporting limit.



Additional Water Quality Parameters

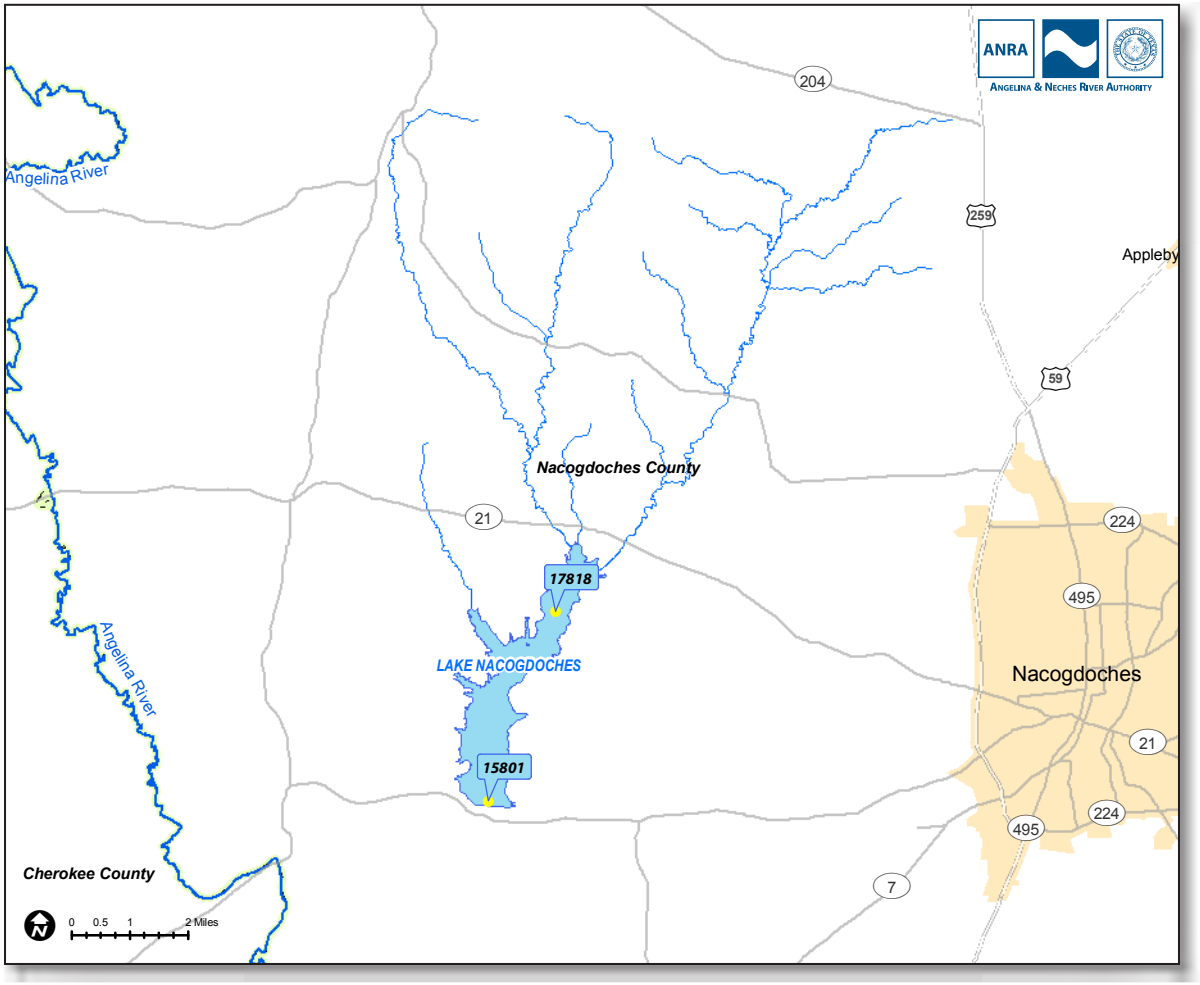
Sulfate values exceeded the general use criteria for 8 of 22 samples (36.4%). Values ranged from 42.9 to 64.9 mg/L, with a mean of 50.4 mg/L.

Segment 0611Q - Lake Nacogdoches (unclassified water body)

Segment Profile

Lake Nacogdoches is a reservoir encompassing 2,210 acres located approximately ten miles west of Nacogdoches in Nacogdoches County. The designated uses are aquatic life, general, and contact recreation use. It has a maximum depth of forty feet and was impounded in the year 1976. Aquatic hydrillas are the primary vegetation on this reservoir. Largemouth bass, crappie, and sunfish are the predominant fish species inhabiting the reservoir.

Lake Nacogdoches



Monitoring Stations on Segment 0611Q				
Station ID	***Station Name***	***Collecting Agency***	***Frequency***	***Parameters***
15801	Lake Nacogdoches at Dam	ANRA	Quarterly	Field, Conventionals, Bacteria
17818	Lake Nacogdoches Upper Lake	ANRA	Quarterly	Field, Conventionals, Bacteria

STATION 15801
Lake Nacogdoches
Main Pool Near Dam

Water Quality Parameters

pH values ranged from 6.4 to 8.2 S.U., with no values exceeding criteria. The mean pH was 8.2 S.U. (n = 26).

Dissolved Oxygen (DO) values ranged from 6.8 to 11.6 mg/L, with a mean of 8.4 mg/L (n = 26). There was no significant trend, and no values exceeded the criteria.

***E. coli* bacteria** results showed no exceedances, with a minimum value of <1 and a maximum value of 37 MPN/100 mL (n = 28).

Total Suspended Solids (TSS) values were low, ranging from <1 to 15 mg/L (n = 28).

Total Dissolved Solids (TDS) values were reported within the range of 38.7 to 104 mg/L, with a mean value of 80 mg/L (n = 27). There was no significant trend observed.

Ammonia-Nitrogen values ranged from <0.04 to 0.58 mg/L as N. There were 14 of 28 values exceeding the criteria (50%). Although there appears to be a decreasing trend, it is not statistically significant (*t-stat* = 1.12, *p-value*= 0.27). Since October 2007, 7 of 8 samples have been reported as <0.1 mg/L as N. This station is listed as a concern for ammonia, with the most likely source being non-point source pollution.

Nitrate+Nitrite-Nitrogen values showed 6 exceedances (21.4%), with values ranging from <0.04 to 0.84 mg/L as N (n = 28). The mean was 0.21 mg/L as N. The data showed a significant decreasing trend (t-stat = 5.93, p-value = 0.000003). The highest values were recorded in 2002 and 2003, with a significant decrease in Nitrate+Nitrite concentrations after that timeframe. All values since 2003 have been below the criteria of 0.37 mg/L as N.

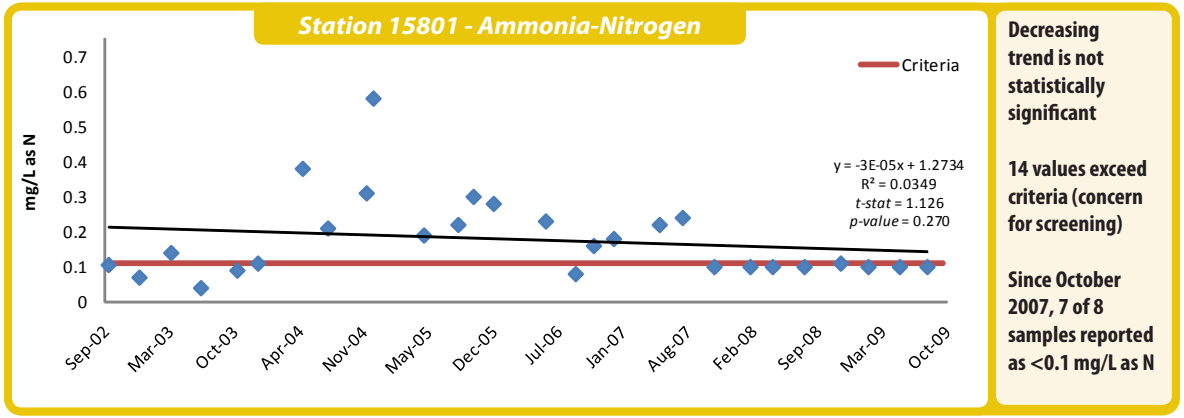
Orthophosphorus values were low, ranging from <0.04 to 0.06 mg/L as P. Of the 28 results evaluated, 21 of them (75%) were reported as <0.04 mg/L as P.

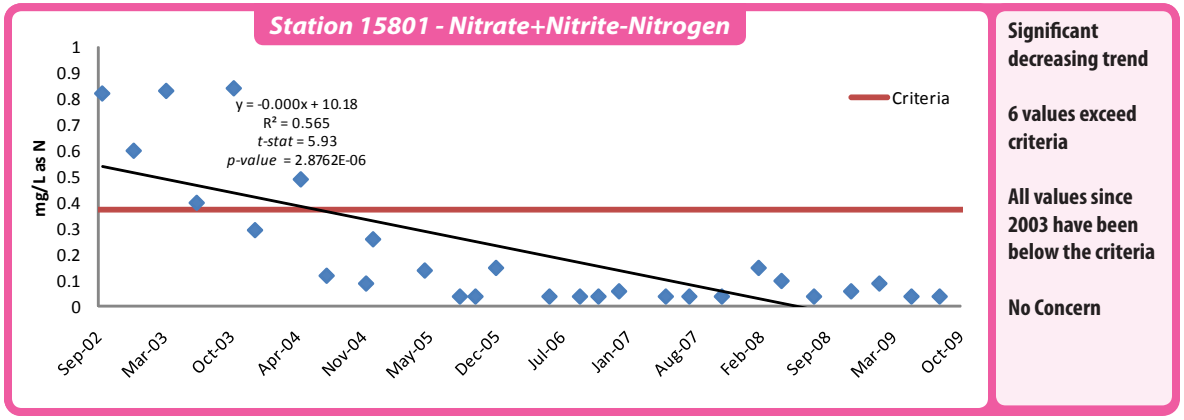
Total Phosphorus concentrations ranged from <0.06 to 0.69 mg/L as P. While 2 results exceeded the general use criteria of 0.20 mg/L as P, 17 of 28 samples (60.7%) had total phosphorus concentrations of <0.06 mg/L as P.

Chlorophyll-*a* values at this station ranged from 2.35 to 17.6 ug/L (n = 22).

Additional Water Quality Parameters

Sulfate values demonstrated a statistically significant increasing trend, although with a range of 14.5 to 33.9 mg/L (n = 27), no values exceeded criteria. An increasing trend was also observed with **Conductivity**.





STATION 17818
Lake Nacogdoches
Upper Lake

Water Quality Parameters

pH values ranged from 6.4 to 8.2 S.U., with a mean of 7.32 S.U. (n = 26). No values were outside of the criteria.

Dissolved Oxygen (DO) concentration ranged from a minimum of 6.4 to a maximum of 11.2 mg/L, with a mean of 8.5 mg/L (n = 26).

***E. coli* bacteria** results were typically low, with most values reported as <1 MPN/100 mL (n = 28), and all but one value was below 50 MPN/100 mL. The highest value reported (920 MPN/100 mL) may be an anomaly, as no other sample approached that level.

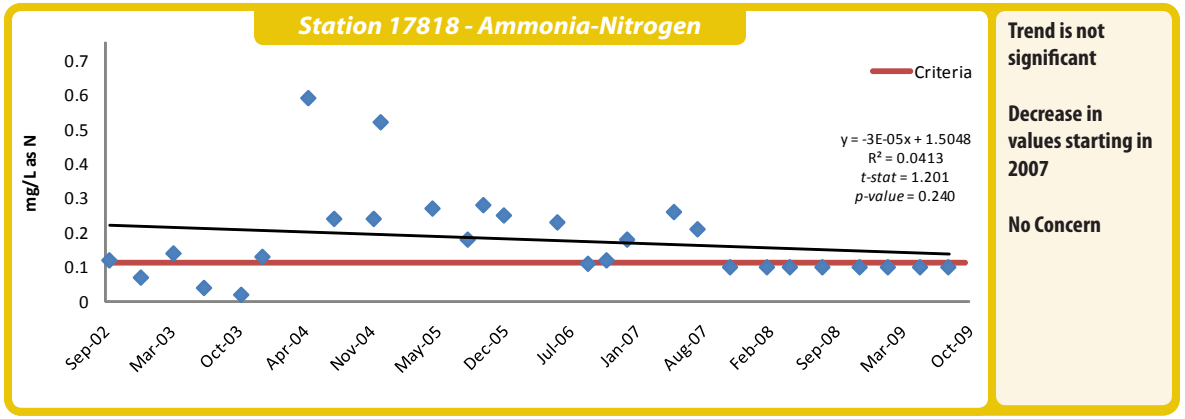
Total Suspended Solids (TSS) values were reported between <1 and 12.7 mg/L, with a mean of 3.2 mg/L (n = 28). This range is consistent with the other sampling station on this reservoir.

Total Dissolved Solids (TDS) results ranged from 25.3 to 174.5 mg/L, with a mean of 84.3 mg/L (n = 27).

Ammonia-Nitrogen concentrations ranged from <0.1 to 0.59 mg/L as N, with a mean of 0.18 mg/L as N (n = 28).

Nitrate+Nitrite-Nitrogen results ranged from <0.04 to 0.87 mg/L as N, with a mean of 0.22 mg/L as N (n = 28). Seven exceedances occurred in 2003 and 2004. A statistically significant decreasing trend is evident (*t-stat* = 5.86, *p-value* = 0.0000035). This pattern is consistent with the trend observed at Station 15801 near the dam site.

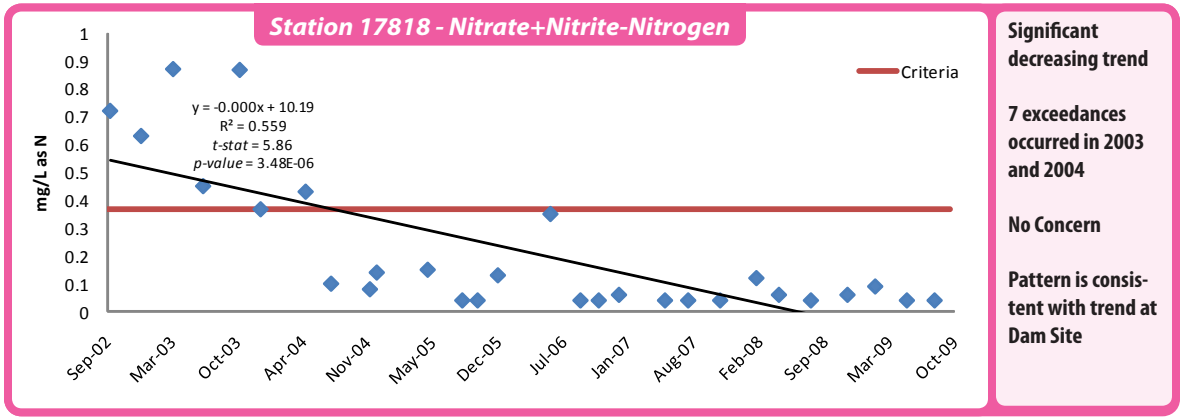
Orthophosphorus concentrations ranged from <0.04 to 0.09 mg/L as P. While there were 3 results which exceeded the screening criteria, 22 of 28 samples (78.6%) had a reported orthophophosphorus concentration of <0.04 mg/L as P.



Trend is not significant

Decrease in values starting in 2007

No Concern



Significant decreasing trend

7 exceedances occurred in 2003 and 2004

No Concern

Pattern is consistent with trend at Dam Site

Water Quality Parameters (continued)

Total Phosphorus concentrations ranged from <0.06 to 0.43 mg/L as P, with a mean of 0.09 mg/L as P. There were 2 values which exceeded the criteria. Of the 28 data points evaluated, 20 values (71.4%), including the 13 most recent points dating from October 2006 to August 2009, were reported as <0.06 mg/L as P.

Chlorophyll-*a* results ranged from a minimum of 2.53 and a maximum of 42.9 ug/L, and a mean of 8.56 ug/L (n = 22).

Additional Water Quality Parameters

Conductivity data shows a statistically significant increasing trend (*t-stat* = 2.958, *p-value* = 0.008).

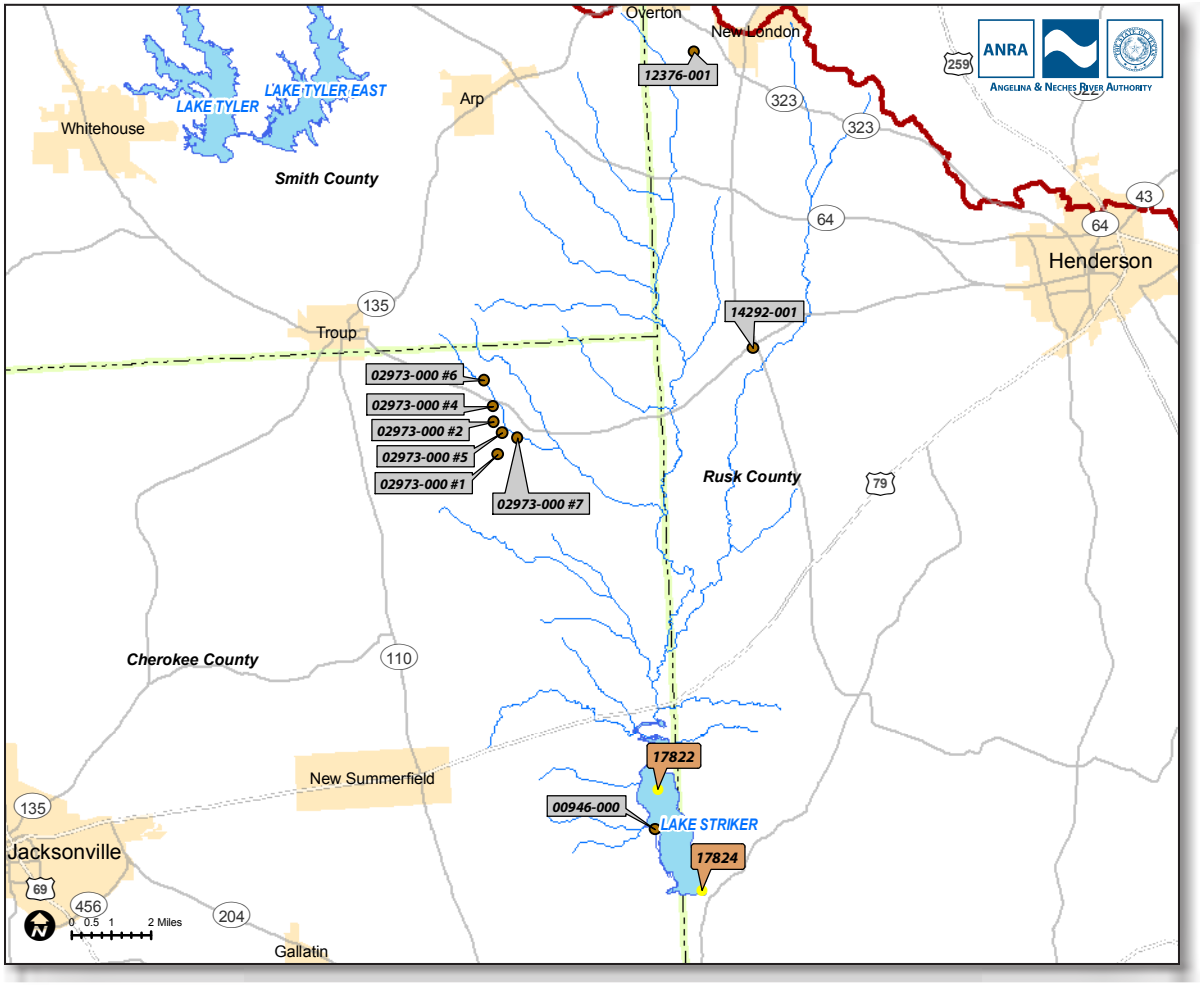
Lake Nacogdoches (Upper Lake)

Segment 0611R - Lake Striker (unclassified water body)

Segment Profile

Lake Striker is a 1,863 acre reservoir extending from the dam approximately 0.5 mile west of CR 2430 to the north end of the lake close to US HWY 79 in Rusk County north of Reklaw. The designated uses are aquatic life, general, and recreation use. Impounded in 1957, the reservoir has a maximum depth of 35 feet. Primary vegetation on this reservoir includes emergent and floating native vegetation. The largemouth bass, spotted bass, catfish, and crappie are among the predominant fish species (TPWD, 2009).

Lake Striker near powerplant



Monitoring Stations on Segment 0611R				
Station ID	***Station Name***	***Collecting Agency***	***Frequency***	***Parameters***
17822	Lake Striker Upper Lake	TCEQ	Quarterly	Field, Conventionals, Bacteria
17824	Lake Striker Near Dam	TCEQ	Quarterly	Field, Conventionals, Bacteria

STATION 17822
Lake Striker
Upper Lake

Water Quality Parameters

pH values ranged from 6.03 to 7.6 S.U., with a mean of 6.97 S.U. (n = 24), and no values exceeding the standards. Although the pH values appear to be trending upwards, the trend is not statistically significant.

Dissolved Oxygen (DO) values ranged from 4.6 to 12.5 mg/L, with a mean of 8.14 mg/L (n = 27). One result during the evaluation period was below the screening level criteria.

***E. coli* bacteria** levels ranged from <1 to 435 MPN/100 mL, with one value exceeding the limit for contact recreation. Generally, bacterial concentrations were low, with only 2 of 27 values greater than 20 MPN/100 mL.

Total Suspended Solids (TSS) values were low, with a maximum of 8 mg/L and a mean of 2.6 mg/L (n = 28).

Total Dissolved Solids (TDS) values were reported over a range of 92 - 328 mg/L, with a mean of 171 mg/L (n = 28). No trend was detected.

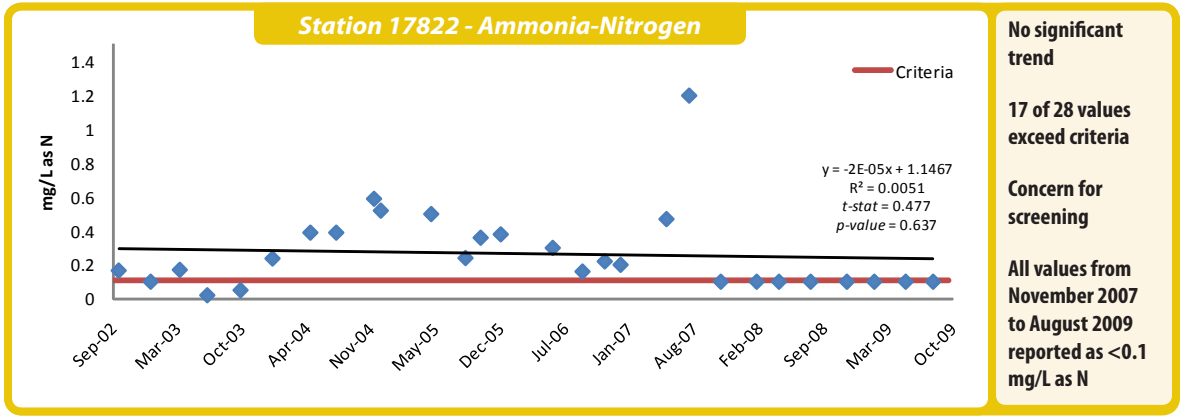
Ammonia-Nitrogen concentrations are of concern at this site, with 17 of 28 results (60.7%) exceeding the standard. Values ranged from <0.1 - 1.2 mg/L as N. Although no statistically significant trend exists, all results from November 2007 to August 2009 were reported as <0.1 mg/L as N, suggesting that the ammonia levels in the lake are improving. Non-point source pollution is the most likely cause of the elevated ammonia-nitrogen concentrations.

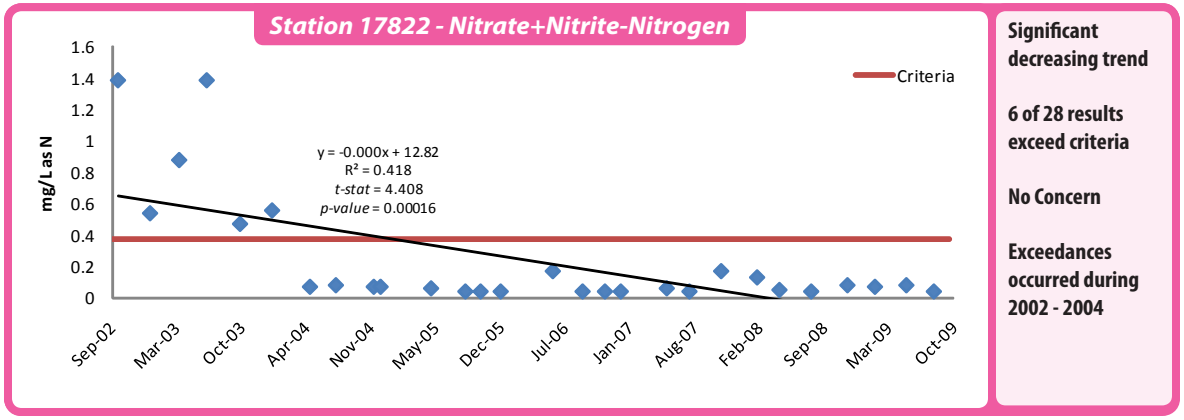
Nitrate+Nitrite-Nitrogen values, which ranged from <0.04 to 1.39 mg/L as N, showed a significant decreasing trend (*t-stat* = 4.408, *p-value* = 0.00016). There were 6 of 28 results (21.4%) that exceeded the standard, with these values occurring in 2002 through 2004.

Orthophosphorus values were typically low, and were reported over a range of <0.04 - 0.1 mg/L as P. The mean result was 0.045 mg/L as P. There were 17 of 27 results (63% of samples) reported as <0.04 mg/L as P.

Total Phosphorus concentrations were reported from a minimum of <0.06 to a maximum of 0.56 mg/L as P, with a mean of 0.24 mg/L as P (n = 28), and no statistically significant trend was observed.

Chlorophyll-*a* results ranged from <2 to 12.5 ug/L (n = 22). The majority of results were reported as less than the method limit of quantitation.





STATION 17824
Lake Striker
Near Dam SE of Powerplant

Water Quality Parameters

pH values ranged from 6.23 - 7.7 S.U., with a mean of 7.1 S.U. (n = 24) The data showed a statistically significant trend over time (*t-stat* = 2.49, *p-value* = 0.02).

Dissolved Oxygen (DO) concentrations ranged from 5.2 to 12.6 mg/L (n = 26), with no values below the screening criteria.

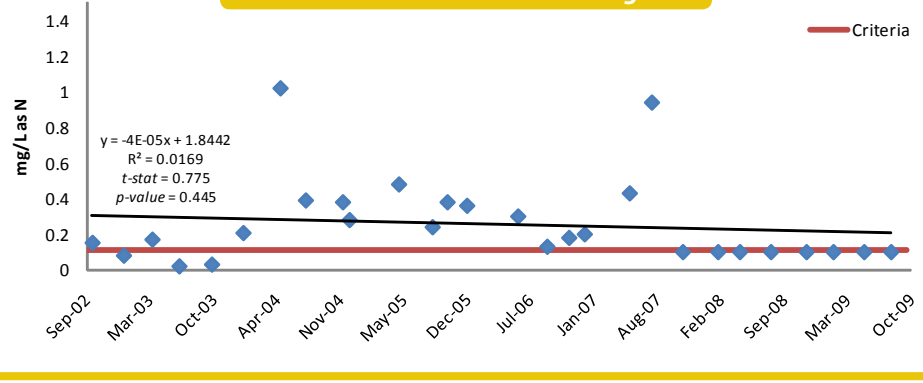
***E. coli* bacteria** results were typically low, with one reported value of 1600 MPN/100 mL which appears to be an anomaly. The majority of samples had *E. coli* concentrations of less than 10 MPN/100 mL (n = 27).

Total Suspended Solids (TSS) values ranged from <1 to 16.3 mg/L, with a mean of 2.5 mg/L (n = 28).

Total Dissolved Solids (TDS) values ranged from 93.3 - 213.3 mg/L, with a mean of 163 mg/L (n = 28).

Ammonia-Nitrogen results ranged from <0.02 to 1.02 mg/L as N, with a mean of 0.26 mg/L as N. Although there was not a significant trend, 17 of 28 values (61%) exceeded the standard. All values between October 2007 and September 2009 were reported as <0.1 mg/L as N. This is the same pattern observed with the data from the monitoring station at Lake Striker Upper Lake.

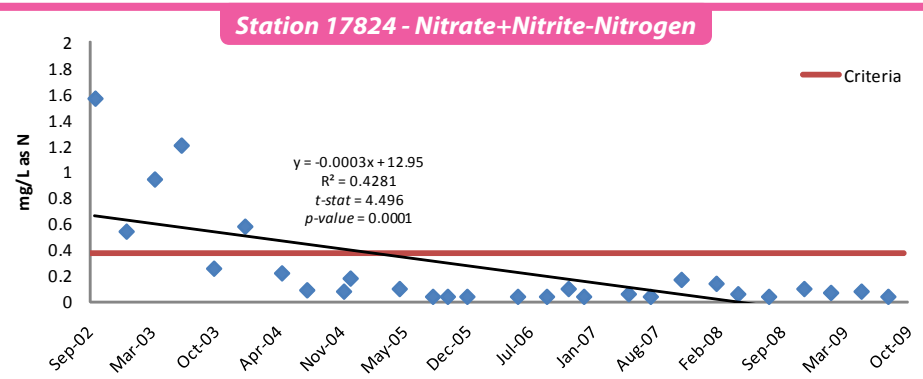
Nitrate+Nitrite-Nitrogen values followed the same decreasing trend observed with the data from the Lake Striker Upper Lake monitoring station. Analytical results ranged from <0.04 - 1.56 mg/L as N, with a mean of 0.24 mg/L as N. Results exceeded the standard for 6 of 28 samples (21.4%), with all 6 exceedances occurring from 2002 to 2004.



No significant trend

17 values exceed criteria (concern for screening)

All values between Oct 2007 and Sept 2009 reported as <0.1 mg/L as N



Decreasing trend

6 of 28 values exceed criteria

No Concern

All exceedances occurred from 2002 to 2004

Water Quality Parameters (continued)

Orthophosphorus values ranged from <0.04 - 0.09 mg/L as P (n = 27), with 5 exceedances (18.5%). No significant trend exists.

Total Phosphorus concentrations ranged from <0.06 - 0.3 mg/L as P, with a mean of 0.1 mg/L as P (n = 28).

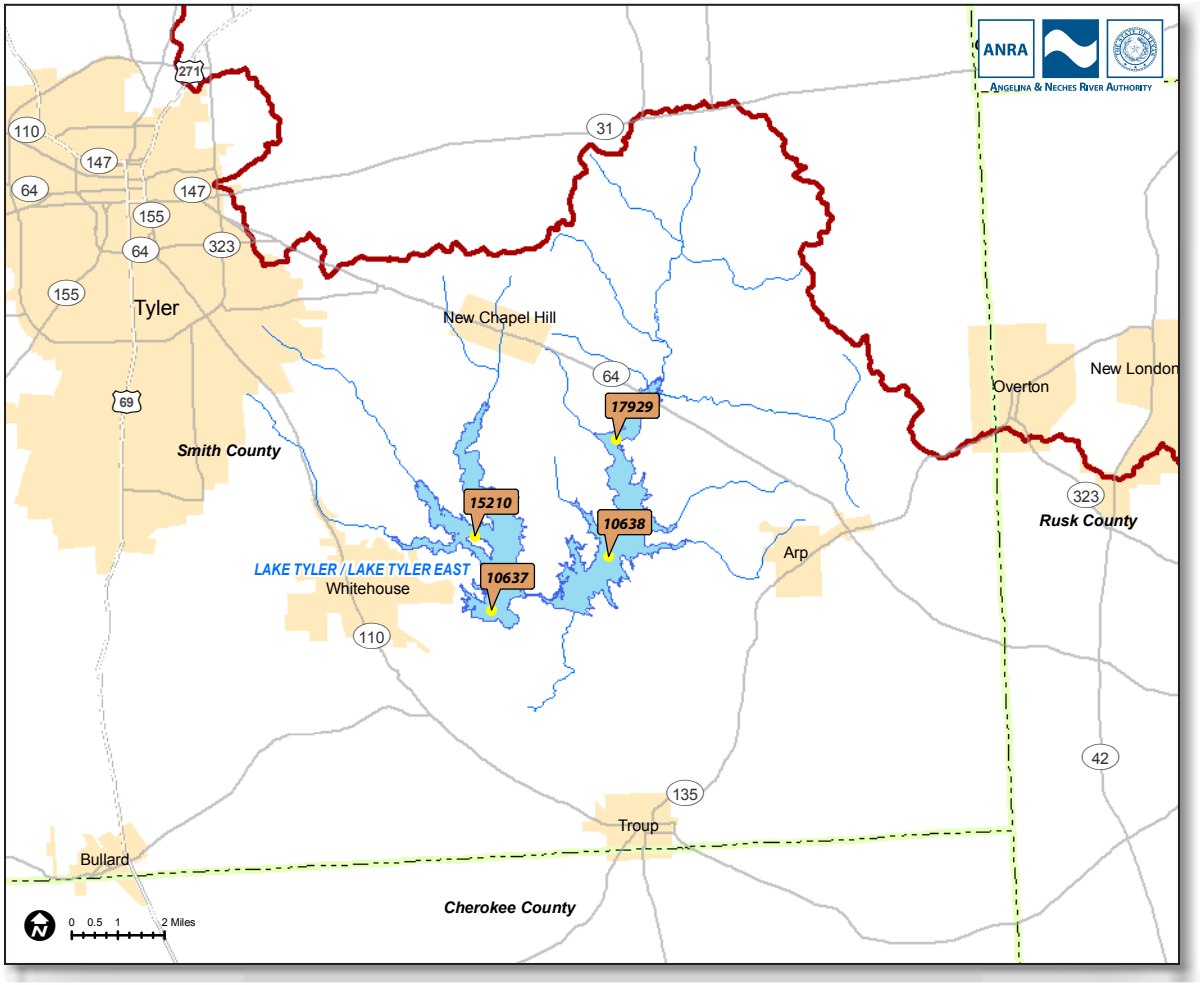
Chlorophyll-*a* values were reported over a range of <2 to 13.3 ug/L (n = 22), with the majority of results being reported as less than the limit of quantitation.

Lake Striker

Segment 0613 - Lake Tyler/Tyler East

Segment Profile

Segment 0613 extends from Whitehouse Dam and Mud Creek Dam in Smith County up to the normal pool elevation of 375.38 feet. The reservoir impounds both Prairie Creek and Mud Creek. Lake Tyler West and East include a total of 4,880 acres. This segment is designated for high aquatic life use, general use, fish consumption use, public water supply use, and recreation use. Lake Tyler West and East were impounded in 1949 and 1966, respectively. The reservoir serves as a major source for water supply and recreational use. There are several park areas adjacent to the lakes. The lakes have a storage capacity of 15 billion gallons of water within the watershed. The maximum depth is forty feet. According to Texas Parks and Wildlife Department (TPWD), there are frequent tournaments and many angler opportunities within the watershed. Predominant fish species include: largemouth bass, spotted bass, crappie, catfish, sunfish, white bass, and chain pickerel. There is moderate native vegetation including submergent and emergent aquatic life found on the upper ends of both lakes. Native vegetation and abundant hydrilla can be found on Lake Tyler East.



Monitoring Stations on Segment 0613

Station ID	Station Name	Collecting Agency	Frequency	Parameters
10637	Lake Tyler Midlake at Dam in Spillway Bay	TCEQ	Quarterly	Field, Conventionals, Bacteria
15210	Lake Tyler at Langley Island West of City of Tyler Water Intake Structure	TCEQ	Quarterly	Field, Conventionals, Bacteria
10638	Lake Tyler East Midlake Near Dam	TCEQ	Quarterly	Field, Conventionals, Bacteria
17929	Lake Tyler East Upper Lake	TCEQ	Quarterly	Field, Conventionals, Bacteria

STATION 10637
Lake Tyler
Midlake at Dam

Water Quality Parameters

pH values ranged from 6.8 to 8.8 S.U., with a mean of 7.5 S.U. (n = 38) and no exceedances.

Dissolved Oxygen (DO) values ranged from 4.1 to 11.9 mg/L, with a mean of 8.2 mg/L (n = 38). One value was below the DO screening level criteria of 5.0 mg/L. DO values show a decreasing trend over time.

***E. coli* bacteria** results ranged from <1 to 280 MPN/100 mL (n = 28). The sample result of 280 MPN/100 mL may be an outlier, as all other values were below 20 MPN/100 mL.

Total Suspended Solids (TSS) results were low, ranging from 2 - 7 mg/L (n = 36).

Total Dissolved Solids (TDS) results ranged from <10 to 90 mg/L (n = 34).

Ammonia-Nitrogen values range from <0.05 - 0.18 mg/L as N (n = 36), with 4 values exceeding criteria.

Nitrate+Nitrite-Nitrogen results ranged from <0.04 to 0.24 mg/L as N, with a mean of 0.07 mg/L as N (n = 36).

Orthophosphorus values were all <0.06 mg/L as P. (n = 36)

Total Phosphorus concentrations ranged from 0.02 to 0.09 mg/L as P (n = 35).

Chlorophyll-*a* values ranged from 1.6 to 31.5 ug/L (n = 36), with one value exceeding criteria. There is no concern for chlorophyll levels at this station.

STATION 15210
Lake Tyler at Langley Island
West of City of Tyler's Water Intake

Water Quality Parameters

pH values ranged from 6.7 to 8.9 S.U., with a mean of 7.6 S.U. (n = 38.)

Dissolved Oxygen (DO) values ranged from 4.8 to 12.1 mg/L, with a mean of 8.7 mg/L (n = 38). One value was below the DO screening level criteria of 5.0 mg/L.

***E. coli* bacteria** results ranged from <1 to 290 MPN/100 mL (n = 29).

Total Suspended Solids (TSS) results were low, ranging from 3 - 10 mg/L (n = 37).

Total Dissolved Solids (TDS) results ranged from 44 to 94 mg/L (n = 36).

Ammonia-Nitrogen values ranged from <0.05 - 0.21 mg/L as N, with 1 value exceeding criteria.

Nitrate+Nitrite-Nitrogen results ranged from <0.04 to 0.24 mg/L as N, with a mean of 0.07 mg/L as N (n = 37).

Orthophosphorus values were all <0.06 mg/L as P (n = 37).

Total Phosphorus concentrations ranged from 0.02 to 0.08 mg/L as P (n = 36).

Chlorophyll-*a* values ranged from 1.42 to 34.9 ug/L (n = 36), with 3 values exceeding the criteria of 26.7 ug/L. There appears to be an increasing trend, but it is not statistically significant.

STATION 10638
Lake Tyler East
Midlake Near Dam

Water Quality Parameters

pH values ranged from 6.7 to 8.7 S.U., with a mean of 7.3 S.U. (n = 39).

Dissolved Oxygen (DO) values ranged from 4.2 to 12.1 mg/L, with a mean of 8.2 mg/L (n = 39). One value was below the DO screening level criteria of 5.0 mg/L. The data showed a statistically significant decreasing trend.

***E. coli* bacteria** results ranged from <1 to 160 MPN/100 mL (n = 27).

Total Suspended Solids (TSS) results were low, ranging from 2 - 6 mg/L (n = 38).

Total Dissolved Solids (TDS) results ranged from <10 to 95 mg/L (n = 36).

Ammonia-Nitrogen values range from <0.05 - 0.19 mg/L as N (n = 35), with 4 values exceeding criteria.

Nitrate+Nitrite-Nitrogen results ranged from <0.04 to 0.17 mg/L as N, with a mean of 0.07 mg/L as N (n = 38).

Orthophosphorus values were all <0.06 mg/L as P (n = 38).

Total Phosphorus concentrations were all below 0.06 mg/L as P (n = 34).

Chlorophyll-*a* values ranged from <1 to 41.6 ug/L (n = 37), with 1 value exceeding criteria.

STATION 17929
Lake Tyler East
Upper Lake

Water Quality Parameters

pH values ranged from 6.7 to 9.2 S.U., with a mean of 7.5 S.U. (n = 22). The value of 9.2 S.U. exceeded criteria. The data showed a statistically significant decreasing trend.

Dissolved Oxygen (DO) values ranged from 6.4 to 10.1 mg/L, with a mean of 8.1 mg/L (n = 23).

***E. coli* bacteria** results ranged from <1 to 1400 MPN/100 mL (n = 18), with 1 value exceeding criteria.

Total Suspended Solids (TSS) results ranged from 4 - 20 mg/L, with a mean of 6.2 mg/L (n = 20).

Total Dissolved Solids (TDS) results ranged from 65 to 109 mg/L (n = 19).

Ammonia-Nitrogen values ranged from <0.05 - 0.12 mg/L as N (n = 20), with 1 value exceeding criteria.

Nitrate+Nitrite-Nitrogen results ranged from <0.04 to 0.26 mg/L as N, with a mean of 0.06 mg/L as N (n = 20).

Orthophosphorus values ranged from <0.04 to 0.08 mg/L as P (n = 20).

Total Phosphorus concentrations ranged from <0.05 to 0.08 mg/L as P (n = 20).

Chlorophyll-*a* values ranged from <3 to 47 ug/L (n = 19), with 1 value exceeding criteria.

Summary for the Upper Angelina Sub-Basin

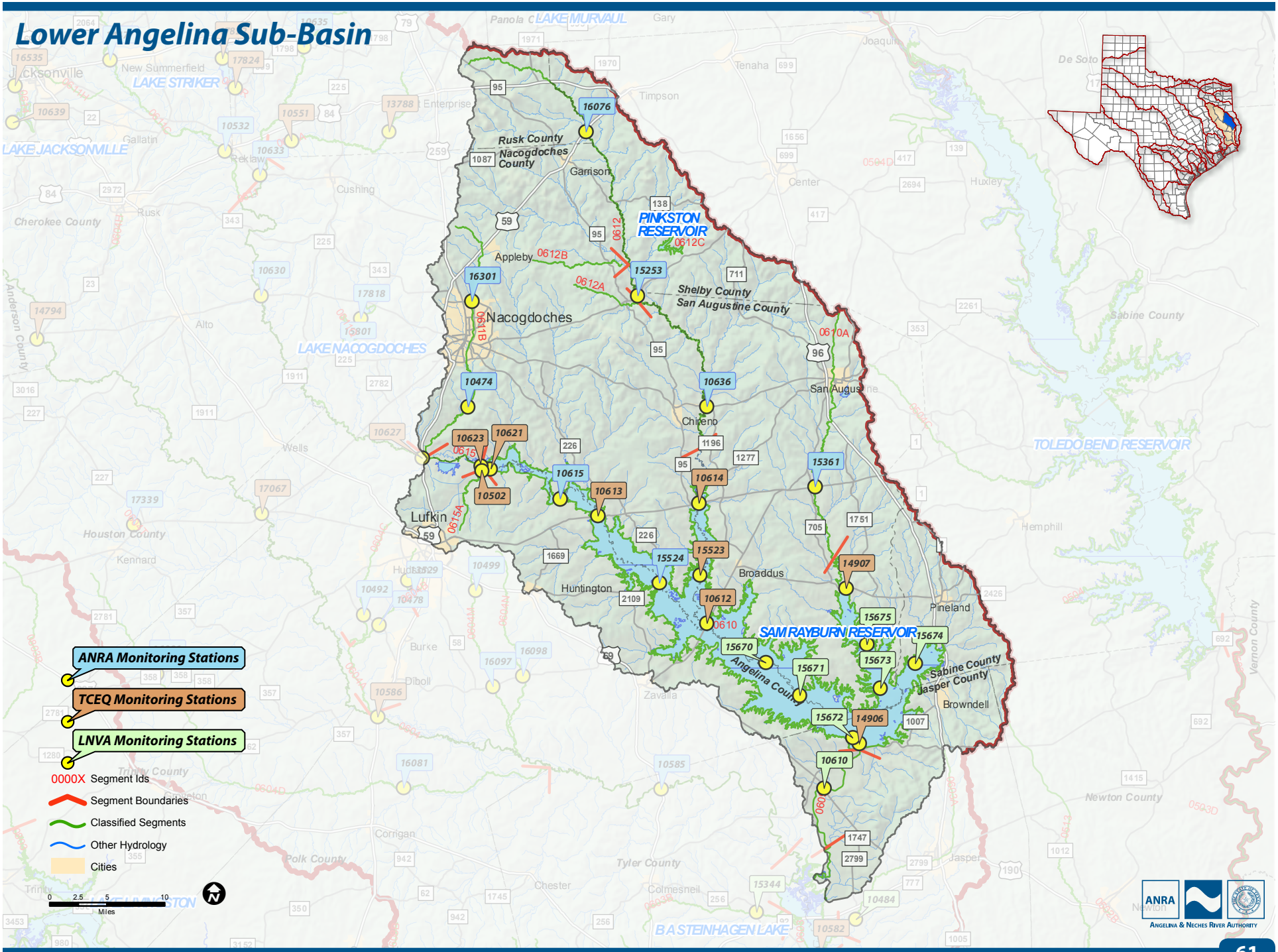
Water Quality Issues Summary for the Upper Angelina Sub-Basin				
Water Quality Issue	***Affected Area***	***Possible Influences/Causes***	***Possible Effects***	***Possible Solutions/Actions Taken***
Multiple areas listed on 2008 303(d) list for nonsupport due to bacteria	0611_01 Angelina River above Sam Rayburn - Lower boundary to FM 1911 0611_03 FM 343 to US 84	• Point Source Municipal discharges and NPS • NPS, PS, and unknown • Nacogdoches County has a large number of cattle and poultry	• Risk for contact recreational activities • Bacterial loading from agriculture runoff not reduced by instream flow	• Improvement upon poultry activities to reduce agricultural non-point source runoff and bacterial loading • Restrictions on TPDES permits to monitor and report grab sample *E. coli* levels
2008 303 (d) listing for bacteria 2008 303 (d) listing for acute and chronic substances in water (lead in water)	0611A East Fork Angelina River (Confluence with Grassy Lake area to headwaters)	• Source unknown • Rusk County has a large number of cattle and poultry	• Risk for contact recreation • Bacterial loading from agriculture runoff not reduced by instream flow • Chronic and acute substances may harm biotic community	• Improvement upon poultry activities to reduce agricultural non-point source runoff and bacterial loading. • Determine origin of lead sources
Concern for screening nutrient Ammonia–Nitrogen	Lake Striker and Lake Nacogdoches, Stations 18302 (near Tyler), Stations 10532, 10633 (under Lake Striker)	• Non-point source pollution • Municipal Point Source Discharge	• Effect on aquatic biological community	• Continue monitoring activities to ensure impairments are not occurring
Trend in decreasing dissolved oxygen concentrations	Lake Tyler midlake at dam, Lake Tyler East midlake near dam	• Unknown sources • May be caused by decomposing aquatic vegetation	• Effect on aquatic biological community	• Continue monitoring water quality conditions for dissolved oxygen impairments • Monitor aquatic vegetation • Treat invasive plants
Significant decreasing trends in Nitrate-Nitrite levels	Segment 0611 Stations: 10633 and 10627	• Unknown	• Less toxic environment for aquatic organisms • May lead to decreased plant blooms	• Continue monitoring
Significant decrease in several nutrient parameters	0611C Mud Creek	• Unknown	• Reduced nutrients may be caused by reduced effluent loading	• Continue monitoring

Summary for the Upper Angelina Sub-Basin

Water Quality Issues Summary for the Upper Angelina Sub-Basin (continued)

Water Quality Issue	*Affected Area*	*Possible Influences/Causes*	*Possible Effects*	*Possible Solutions/Actions Taken*
Concern for screening levels for ammonia-nitrogen	0611C Mud Creek	• Municipal non-point source pollution • Natural conditions	• Toxic to aquatic life • May lead to increased plant biomass and algal concentrations	• Determine sources of nutrient loading • Continued monitoring
Concern for screening levels for dissolved oxygen	0611C Mud Creek	• Unknown	• May affect aquatic life community	• Continued monitoring
Non-support for *E. coli* geometric mean	Segment 0611 Angelina above Sam Rayburn Reservoir	• Municipal point source and non-point source pollution	• Concern for contact recreation	• Continued monitoring efforts to determine if nutrient and *E. coli* trends still occur • Addition of *E. coli* grab sample effluent discharge limits on TPDES permits
DRAFT 2010 303 (d) list potential new impairment for non-support for *E. coli* for single grab and geometric mean	0611D West Mud Creek	• Municipal point source discharges • Non-point source pollution • Wet weather discharges and wildlife other than waterfoul	• Concern for non-attainment	• Review of criteria for water body • Addition of *E. coli* grab sample effluent discharge limits on TPDES permits
Concern for screening for ammonia, nitrate, and phosphorus	0611D West Mud Creek	• Municipal point source and non-point source pollution	• Concern for non-attainment	• Determine sources of nutrient loading

Lower Angelina Sub-Basin



Profile of the Lower Angelina Sub-Basin

Population

The Lower Angelina Sub-Basin includes, partially or wholly, Angelina, Jasper, Nacogdoches, Newton, Rusk, Sabine, Shelby and San Augustine counties. The sub-basin includes the following cities: Chireno, Garrison, Nacogdoches, Lufkin, Huntington, Broaddus, Pineland, Browndell, San Augustine, and Appleby. Approximately 282,020 persons reside within the counties included in the sub-basin.

Land Characteristics and Use

In the Lower Angelina Sub-Basin, evergreen forest, shrub, woody wetlands, young forest, grassland, and piney hardwood are emergent. Land coverage in the northern part of the sub-basin includes hay, pasture, shrub, developed open space, and developed low intensity regions located around Lufkin and Nacogdoches. Within the southern portion of the sub-basin, land use includes emergent herbaceous and mixed forest. There are areas of willow oak, water oak, and blackgum located at the upper reaches of Sam Rayburn reservoir. Carrizo-Wilcox, Sparta, Yegua Jackson, and Gulf Coast are the aquifers which supply the region. This South-Central Plains Ecoregion includes floodplains, low terraces, southern tertiary uplands, and tertiary uplands. Some counties have experienced an increase in total number of farms, while others have not from 2002 to 2007. Within all the counties in the sub-basin, there are approximately 50,807,436 broilers and other meat-type chickens, not including Sabine county which did not disclose data for the USDA Agricultural Census. A total of 176,297 heads of cattle are also included within the sub-basin.

Segments included in the Lower Angelina Sub-Basin

Segment ID	*Segment Name*	*Length or Acreage*
0609	Angelina River Below Sam Rayburn Reservoir	13 miles
0610	Sam Rayburn Reservoir	106,666 acres
0610A	Ayish Bayou (unclassified water body)	32 miles
0611B	La Nana Bayou (unclassified water body)	32 miles
0612	Attoyac Bayou	82 miles
0612A	Terrapin Creek (unclassified water body)	8.5 miles
0612B	Waffelow Creek (unclassified water body)	10.5 miles
0612C	Pinkston Reservoir (unclassified water body)	523 acres
0615	Angelina River/Sam Rayburn Reservoir	5,068 acres
0615A	Papermill Creek (unclassified water body)	9 miles

Sam Rayburn Reservoir near spillway

Profile of the Lower Angelina Sub-Basin

Permitted Discharges There are thirty-two permitted discharges included in the Lower Angelina sub-basin.

Permitted Discharges in the Lower Angelina Sub-Basin

Segment ID	Permit Number	Outfall Number	NPDES Number	Permittee	County	TCEQ Region	Map Location
0609	10998-001	001	031283	Brookland FWSD	Jasper	10 - Beaumont	Not Mapped
0611	14201-001	001	123021	Angelina County WCID No 3	Angelina	10 - Beaumont	Page 95 & 30
0611	14729-001	001	128937	Redland Water Supply Corp	Angelina	10 - Beaumont	Page 95 & 30
0611B	04198-000	001	121053	Cal-Tex Lumber Co Inc	Nacogdoches	10 - Beaumont	Pages 81, 30 & 95
0611B	10342-004	001	055123	City of Nacogdoches	Nacogdoches	10 - Beaumont	Pages 81, 30 & 95
0611B	13927-001	001	118613	D & M Wsc	Nacogdoches	10 - Beaumont	Pages 81, 30 & 95
0610	00368-000	001	001643	Donohue Industries Inc	Angelina	10 - Beaumont	Page 65
0610	00368-000	002	001643	Donohue Industries Inc	Angelina	10 - Beaumont	Page 65
0610	00368-000	004	001643	Donohue Industries Inc	Angelina	10 - Beaumont	Page 65
0610	00368-000	005	001643	Donohue Industries Inc	Angelina	10 - Beaumont	Page 65
0610	01820-000	001	046892	Temple-Inland Forest Products Corp	Sabine	10 - Beaumont	Page 65
0610	01820-000	002	046892	Temple-Inland Forest Products Corp	Sabine	10 - Beaumont	Page 65
0610	01820-000	003	046892	Temple-Inland Forest Products Corp	Sabine	10 - Beaumont	Page 65
0610	03848-000	001	113689	TIN Inc	Sabine	10 - Beaumont	Page 65
0610	10249-001	001	027154	City of Pineland	Sabine	10 - Beaumont	Page 65
0610	10268-001	001	022349	City of San Augustine	San augustine	10 - Beaumont	Page 65
0610	10947-001	001	054224	Shirley Creek Marina Inc	Nacogdoches	10 - Beaumont	Page 65
0610	11337-001	001	031275	Westwood Wsc	Jasper	10 - Beaumont	Page 65
0610	11620-001	001	056154	Angelina & Neches River Authority	Angelina	10 - Beaumont	Page 65
0610	11772-001	001	057673	City of Broaddus	San augustine	10 - Beaumont	Page 65
0610	11895-001	001	068039	Texas Airstream Harbor Inc	Angelina	10 - Beaumont	Page 65
0610	13092-001	001	099082	Brookeland ISD	Sabine	10 - Beaumont	Page 65
0610	13161-001	001	098744	Stephen F Austin State University	San augustine	10 - Beaumont	Page 65
0610	13903-001	001	118419	Community Estates Inc	Nacogdoches	10 - Beaumont	Page 65
0610	14693-001	001	066753	Rogers, Gordon Dean	Angelina	10 - Beaumont	Page 65
0610A	10268-002	001	122351	City of San Augustine	San augustine	10 - Beaumont	Page 65 & 79
0610A	10788-001	001	023701	Rayburn Country MUD	Jasper	10 - Beaumont	Page 65 & 79
0612	11304-001	001	076503	City of Garrison	Nacogdoches	10 - Beaumont	Page 85
0612	13917-001	001	118915	Chireno ISD	Nacogdoches	10 - Beaumont	Page 85
0612A	14027-001	001	118354	Martinsville ISD	Nacogdoches	10 - Beaumont	Page 92
0612C	14352-001	001	124940	City of Center	Shelby	10 - Beaumont	Pages 85 & 94
0615A	11588-001	001	054127	Moffett Twin-Oaks Mobile Home Property Trust	Angelina	10 - Beaumont	Pages 95 & 99

Texas Surface Water Quality Standards (2008) Criteria

Numeric and Screening Level Criteria for Specified Uses for the Lower Angelina Sub-Basin

Segment ID	*Assigned Use*	*Screening Levels for Specified Use*
0609	General Use	Ammonia: 0.33 mg/L, Chlorophyll-a- 14.10 ug/L, Nitrate-Nitrite: 1.95 mg/L, Orthophosphorus- 0.37 mg/L, Total Phosphorus: 0.69 mg/L, pH: 6-8.5
	Public Water Supply Use	Chloride: 70 mg/L, Sulfate: 50 mg/L, TDS: 250 mg/L
	Contact Recreation Use	*E. coli* geomean: 126 MPN/ 100 mL, *E. coli* single sample: 394 MPN/ 100 mL
	High Aquatic Life Use	DO screening level: 5.0 mg/L, DO grab minimum: 3.0 mg/L, DO 24-hour average: 5.0 mg/L, DO 24-hr minimum: 3.0 mg/L
0610	General Use	Ammonia: 0.11 mg/L, Chlorophyll-a: 26.7 ug/L, Nitrate-Nitrite: 0.37 mg/L, Orthophosphorus: 0.05 mg/L, Total Phosphorus: 0.20 mg/L, pH: 6- 8.5
	Public Water Supply Use	Chloride: 100 mg/L, Sulfate: 100 mg/L, TDS: 400 mg/L
	Contact Recreation Use	*E. coli* geomean: 126 MPN/ 100 mL, *E. coli* single sample: 394 MPN/ 100 mL
	High Aquatic Life Use	DO Screening level: 5.0 mg/L, DO grab minimum: 3.0 mg/L, DO 24-hour average- 5.0 mg/L, DO 24-hr minimum: 3.0 mg/L
0610A	General Use	Ammonia: 0.33 mg/L, Chlorophyll-a: 14.10 ug/L, Nitrate-Nitrite: 1.95 mg/L, Orthophosphorus: 0.37 mg/L, Total Phosphorus: 0.69 mg/L
	Recreation Use	*E. coli* geomean: 126 MPN/ 100 mL, *E. coli* single sample: 394 MPN/ 100 mL
0611B	Recreation Use	*E. coli* geomean: 126 MPN/ 100 mL, *E. coli* single sample: 394 MPN/ 100 mL
	Aquatic Life Use	DO screening level- 5.0 mg/L, DO grab minimum: 3.0 mg/L
612	General Use	Ammonia: 0.33 mg/L, Chlorophyll-a: 14.10 ug/L, Nitrate-Nitrite: 1.95 mg/L, Orthophosphorus: 0.37 mg/L, Total Phosphorus: 0.69 mg/L
	Public Water Supply Use	Chloride: 75 mg/L, Sulfate: 50 mg/L, TDS: 200 mg/L
	Contact Recreation Use	*E. coli* geomean: 126 MPN/ 100 ml, *E. coli* single sample: 394 MPN/ 100 ml
	High Aquatic Life Use	DO screening level- 5.0 mg/L, DO grab minimum- 3.0 mg/L
0612C	General Use	Not Assessed. Limited data exists.
615	General Use	Ammonia: 0.11 mg/L, Chlorophyll-a: 26.7 ug/L, Nitrate-Nitrite: 0.37 mg/L, Orthophosphorus: 0.05 mg/L, Total Phosphorus: 0.2 mg/L,
	Public Water Supply Use	Chloride: 150 mg/L, Sulfate: 100 mg/L, TDS: 500 mg/L, pH: 6.5- 9
	Contact Recreation Use	*E. coli* geomean: 126 MPN/ 100 mL, *E. coli* single sample: 394 MPN/ 100 mL
	Intermediate Aquatic Life Use	DO Screening level: 5.0 mg/L, DO grab minimum: 3.0 mg/L, DO 24-hourr minimum: 3.0 mg/L, DO 24-hour average- 5.0 mg/L
0615A	General Use	Ammonia: 0.33 mg/L, Chlorophyll-a: 14.1 ug/L, Nitrate-Nitrite: 1.95 mg/L, Orthophosphorus: 0.37 mg/L, Total Phosphorus: 0.69 mg/L, pH 6.5-9
	Contact Recreation USe	*E. coli* geomean: 126 MPN/ 100 mL, *E. coli* single sample: 394 MPN/ 100 mL
	Aquatic Life Use	DO grab screening level: 5 mg/L, DO grab minimum 3.0 mg/L

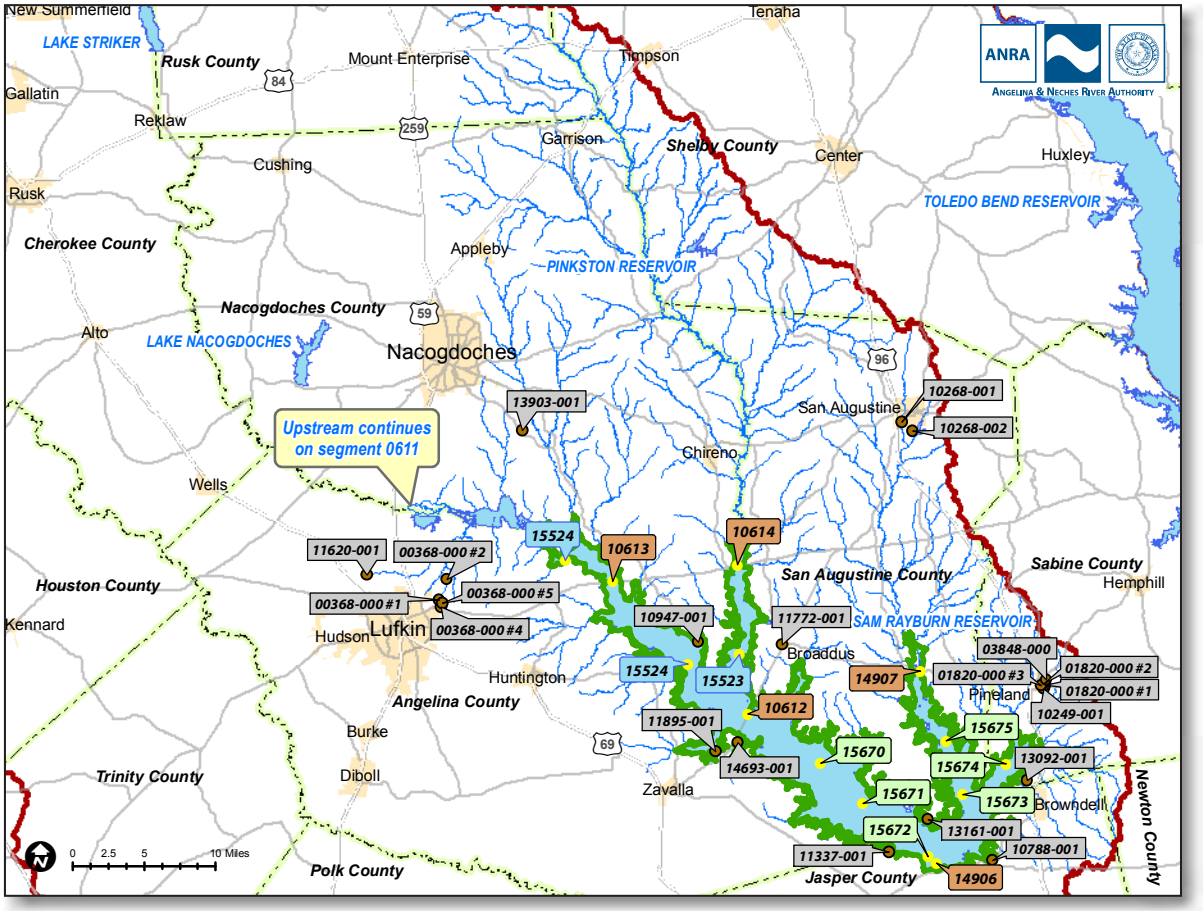
Segment 0610 - Sam Rayburn Reservoir

Segment Profile

This segment includes 106,666 acres from Sam Rayburn Dam in Jasper County to a point 5.6 kilometers (3.5 miles) upstream of Marion's Ferry on the Angelina River Arm in Angelina/Nacogdoches County and to a point 3.9 km (2.4 miles) downstream of Curry Creek on the Attoyac Bayou Arm in Nacogdoches. Construction of the dam began in 1956 for the purpose of hydroelectric power generation, flood control, municipal/industrial/agricultural water conservation, and recreational uses. The designated uses are general use, high aquatic life use, public water supply use, contact recreation, and fish consumption. Located around Sam Rayburn are various contact recreational areas including trails, campgrounds, boating ramps, marinas, designated swimming areas, and group areas.

Multiple locations within Sam Rayburn Reservoir are listed on the 303 (d) list due to mercury (Hg) presence in edible fish tissue. All areas were first listed on the 303(d) list in 1996 and are currently under a 5c classification.

There are multiple monitoring stations located on Sam Rayburn Reservoir, with routine monitoring being performed by TCEQ Region 5, LNVA, and ANRA. Only a portion of the stations are discussed in the Upper Neches Basin Summary Report.



Selected Monitoring Stations on Segment 0610

Station ID	Station Name	Collecting Agency	Frequency	Parameters
10612	Sam Rayburn Reservoir at SH 147	TCEQ	Quarterly	Field, Conventionals, Bacteria, Organics (water)
10613	Sam Rayburn Reservoir at SH 103 (West of Etoile)	TCEQ	Quarterly	Field, Conventionals, Bacteria, Organics (water), Metals (water, sediment)
10614	Sam Rayburn Reservoir at SH 103 (East of Etoile)	TCEQ	Quarterly	Field, Conventionals, Bacteria
14906	Sam Rayburn Reservoir at Main Pool	TCEQ	Quarterly	Field, Conventionals, Bacteria, Organics (water), Metals (water, sediment)
14907	Sam Rayburn Reservoir at FM 83	TCEQ	Quarterly	Field, Conventionals, Bacteria
15523	Sam Rayburn Reservoir near Alligator Cove	ANRA	Quarterly	Field, Conventionals, Bacteria
15524	Sam Rayburn Reservoir at Shirley Creek	ANRA	Quarterly	Field, Conventionals, Bacteria

Segment 0610 - Sam Rayburn Reservoir

Impairments and Concerns

There are numerous assessment units in Segment 0610 that are listed on the 303 (d) list. Those areas are listed in the table below.

Impairments on Segment 0610 Listed on the 2008 303 (d) List

Assessment Unit	*Description*	*Reason*	*Category*	*Year Listed*
0610_01	Main Pool by Dam	Mercury in edible fish tissue	5c	1996
0610_02	Lower Angelina River arm	Mercury in edible fish tissue	5c	1996
0610_03	Mid-Angelina River arm (SH 147)	Mercury in edible fish tissue	5c	1996
0610_04	Upper Mid-Angelina arm	Mercury in edible fish tissue	5c	1996
0610_05	Lower Attoyac Bayou arm	Mercury in edible fish tissue	5c	1996
0610_06	Upper Attoyac Bayou arm	Mercury in edible fish tissue	5c	1996
0610_07	Upper Angelina River arm	Mercury in edible fish tissue	5c	1996
0610_08	Bear Creek arm	Mercury in edible fish tissue	5c	1996
0610_09	Lower Ayish Bayou arm	Mercury in edible fish tissue	5c	1996
0610_10	Upper Ayish Bayou arm	Mercury in edible fish tissue	5c	1996

STATION 10612
Sam Rayburn Reservoir at SH 147
SW of Broaddus and NE of Zavalla

Water Quality Parameters

pH values were reported over a range of 6.5 to 8.8 S.U., with a mean of 8.8 S.U. (n = 90). No significant trend was observed, and no values exceeded the criteria.

Dissolved Oxygen (DO) values ranged from 6.1 to 11.7 mg/L, with a mean of 8.59 mg/L (n = 89). A statistically significant decreasing trend was observed (*t-stat* = 2.10, *p-value* = 0.038). No values exceeded criteria. Based on the data, the dissolved oxygen levels are not a concern.

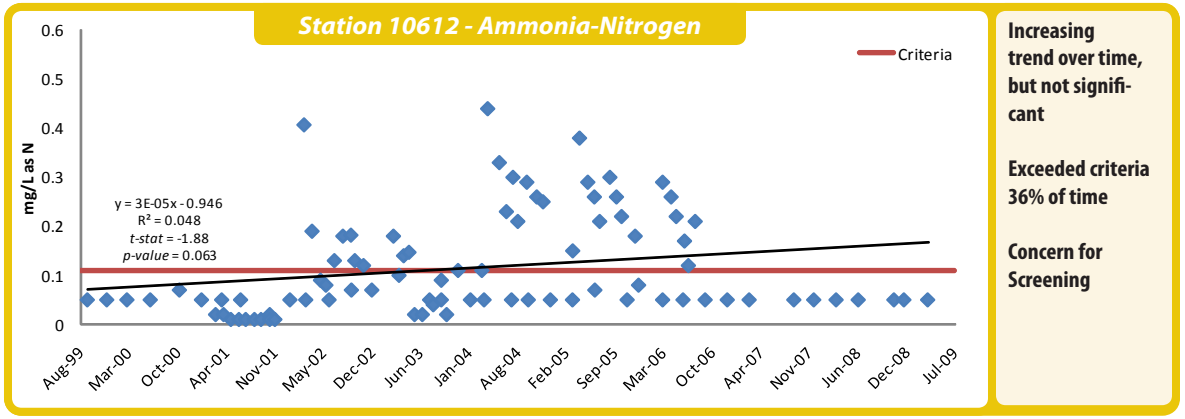
***E. coli* bacteria** results were low, ranging from <1 to 21 MPN/100 mL (n = 80).

Total Suspended Solids (TSS) values were reported between <1 and 22.3 mg/L, with a mean of 4.6 mg/L (n = 53). No significant trend was observed with the data.

Total Dissolved Solids (TDS) values ranged from 69 to 137 mg/L, with a mean of 90.1 mg/L (n = 52). A statistically significant decreasing trend was observed. No values exceeded the 400 mg/L criteria for general use and public water supply use.

Ammonia-Nitrogen values appear to have an increasing trend, but it is not statistically significant. Concentrations ranged from <0.05 to 0.44 mg/L as N, with a mean of 0.12 mg/L as N (n = 89). The criterion of 0.11 mg/L as N was exceeded 32 times (36% of samples).

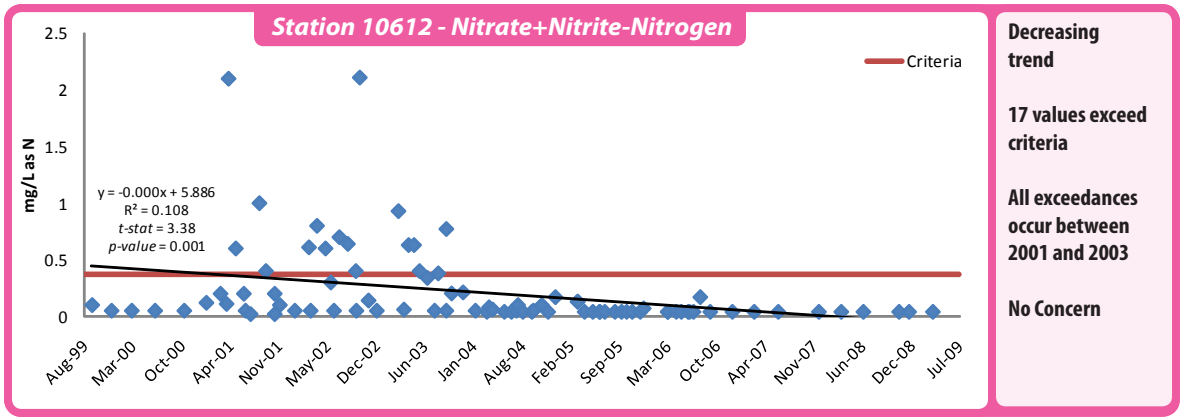
Nitrate+Nitrite-Nitrogen values were reported over a range of <0.02 to 2.11 mg/L as N, with a mean of 0.21 mg/L as N (n = 89). The 0.37 mg/L as N criteria was exceeded 17 times (19%), with all exceedances occurring between 2001 and 2003. A significant decreasing trend was found to exist (*t-stat* = 3.38, *p-value* = 0.001).



Increasing trend over time, but not significant

Exceeded criteria 36% of time

Concern for Screening



Decreasing trend

17 values exceed criteria

All exceedances occur between 2001 and 2003

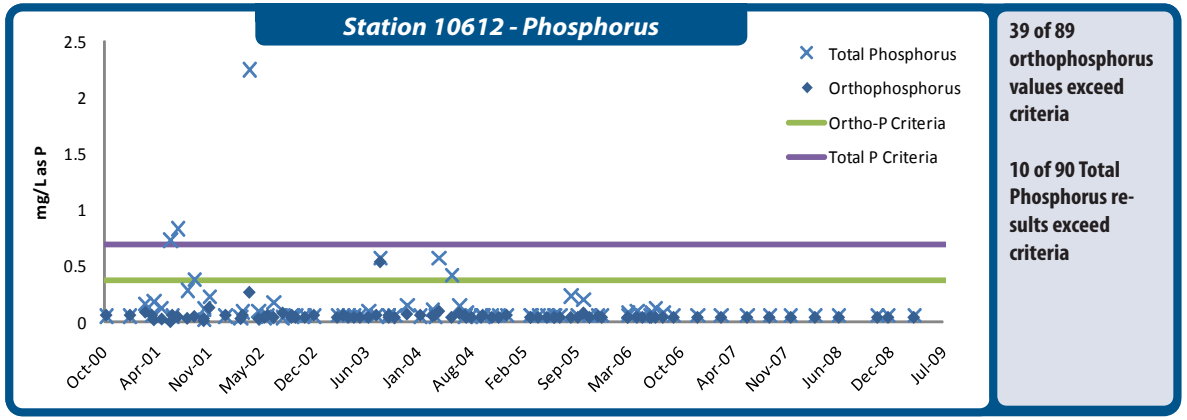
No Concern

Water Quality Parameters (continued)

Orthophosphorus concentrations were low, ranging from <0.01 to 0.54 mg/L as P, with a mean of 0.06 mg/L as P (n = 89). The criteria of 0.05 mg/L as P was exceeded on 39 occasions (44%).

Total Phosphorus concentrations ranged from <0.02 to 2.25 mg/L as P, with a mean of 0.13 mg/L as P (n = 90). The general use criteria of 0.2 mg/L as P was exceeded for 10 of 90 samples (11.1%).

Chlorophyll-*a* results ranged from 3.27 to 30.4 ug/L, with a mean of 13.7 ug/L, and 3 of 59 samples (5.1%) exceeding the General Use criteria.



39 of 89 orthophosphorus values exceed criteria

10 of 90 Total Phosphorus results exceed criteria

Additional Water Quality Parameters

Chloride concentrations demonstrated a statistically significant decreasing trend. Values ranged from 9 - 23 mg/L (n = 54), with no values exceeding the 100 mg/L criteria.

Station 10612, located in assessment unit 0610_03 Sam Rayburn Mid-Angelina arm, has concerns for **Arsenic**, **Manganese,** and **Iron** in sediment, as well as being non-supporting for fish consumption use due to **Mercury** in fish edible tissue.

STATION 10613
Sam Rayburn Reservoir at SH 103
West of Etoile

Water Quality Parameters

pH values ranged from 6.4 to 9.1 S.U., with a mean of 7.6 S.U. (n = 40), and 3 results (7.5%) exceeding the criteria. Although not a significant trend, pH does appear to be increasing over time.

Dissolved Oxygen (DO) values ranged from 4.5 to 11.9 mg/L, with a mean of 8.6 mg/L (n = 40).

***E. coli* bacteria** results were reported in the range of <2 to 260 MPN/100 mL (n = 31). No results exceeded the single grab criteria for contact recreation use.

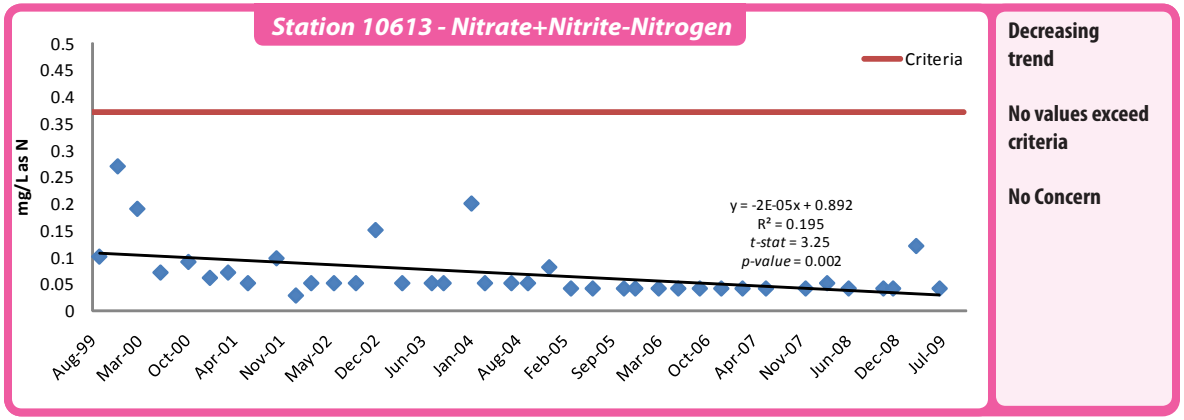
Total Suspended Solids (TSS) values were low, ranging from <1 to 23 mg/L, with a mean of 10 mg/L (n = 40).

Total Dissolved Solids (TDS) values showed a significant decreasing trend. Results ranged from 80 - 512 mg/L (n = 40), with 2 exceedances. 4 values of >200 mg/L occurring in 1999 and 2000 may be skewing the trend analysis.

Ammonia-Nitrogen values show a statistically significant decreasing trend over time, although the trend analysis may be skewed due to two exceedances in 1999 and 2000. The highest reported value was 0.2 mg/L as N, with a mean of 0.06 mg/L as N (n = 40).

Nitrate+Nitrite-Nitrogen values show a significant decreasing trend, with no values exceeding the criteria. Results ranged from 0.03 - 0.27 mg/L as N, with a mean of 0.068 mg/L as N (n = 39).

Orthophosphorus concentrations ranged from <0.01 to 0.06 mg/L as P, with 37 of 40 values (92.5%) being reported below the method limit of quantitation.



Decreasing trend

No values exceed criteria

No Concern

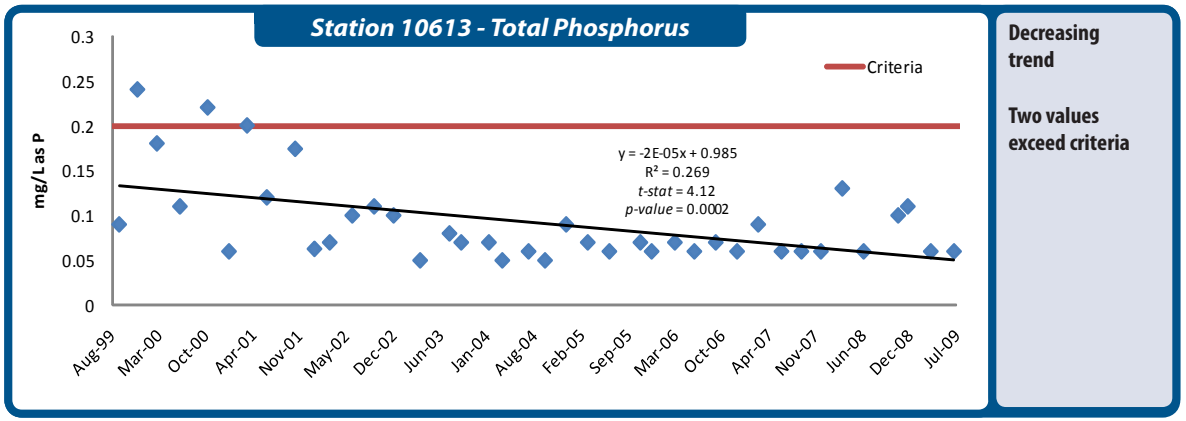
Water Quality Parameters (continued)

Total Phosphorus concentrations showed a statistically significant decreasing trend, with values ranging from <0.05 to 0.24 mg/L as P, with a mean of 0.09 mg/L as P. (n = 40) Two data points exceeded the 0.20 mg/L as P criteria for general use.

Chlorophyll-*a* results ranged from <3 to 39.2 ug/L, with a mean of 15.8 ug/L (n = 38). There were a total of 5 exceedances (13% of results) reported during the evaluation period.

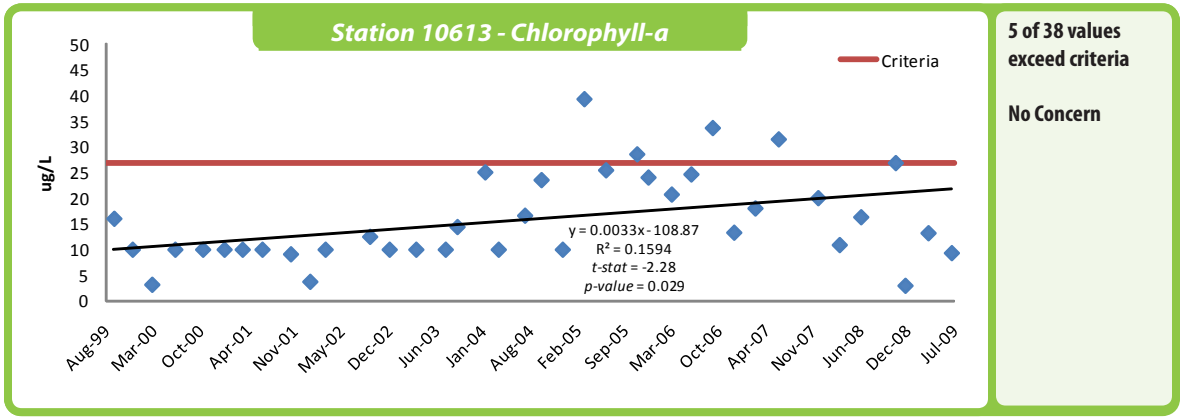
Additional Water Quality Parameters

Chloride, **Sulfate**, and **Conductivity** results (n = 40 for all parameters) showed statistically significant decreasing trends over time. All three parameters showed high values in 1999 and 2000, with results decreasing after that time frame and staying relatively consistent.



Decreasing trend

Two values exceed criteria



5 of 38 values exceed criteria

No Concern

Station 10613, located in the 0610_07 Sam Rayburn Upper Angelina Arm assessment unit, is listed as a concern for **Mercury** in edible fish tissue. The most likely source of the contamination is atmospheric deposition.

STATION 10614
Sam Rayburn Reservoir at SH 103
East of Etoile

Water Quality Parameters

pH values ranged from 6.4 to 8.3 S.U., with a mean of 7.3 S.U. (n = 40), and no values exceeding the criteria.

Dissolved Oxygen (DO) values ranged from 3.8 to 11.2 mg/L, with a mean of 7.9 mg/L (n = 40).

***E. coli* bacteria** results, while typically low, ranged from <2 to 3100 MPN/100 mL (n = 32). The geometric mean of the data set was 25.1 MPN/100 mL. Four values exceeded the single grab criteria, with three of those results being reported in March, possibly suggesting a seasonal component.

Total Suspended Solids (TSS) values ranged from a minimum of <1 mg/L to a maximum of 90 mg/L, with a mean value of 16.2 mg/L (n = 40).

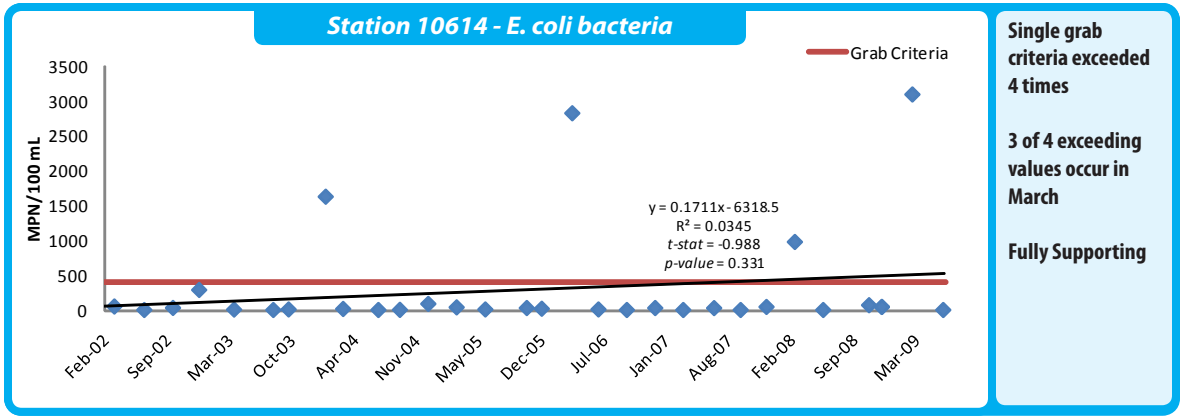
Total Dissolved Solids (TDS) values were reported in the range of 71 - 232 mg/L, with a mean of 102.5 mg/L (n = 40). No trend was observed.

Ammonia-Nitrogen concentrations ranged from <0.02 to 0.19 mg/L as N, with a mean of 0.056 mg/L as N. Of 38 data points evaluated, 29 were reported as less than the limit of quantitation.

Nitrate+Nitrite-Nitrogen values ranged from <0.04 to 0.68 mg/L as N (n = 39). The general use criteria of 0.37 mg/L as N was exceeded 7 times.

Orthophosphorus ranged from <0.01 to 0.07 mg/L as P, with **Total Phosphorus** ranging from <0.02 to 0.18 mg/L as P (n = 40 for both parameters).

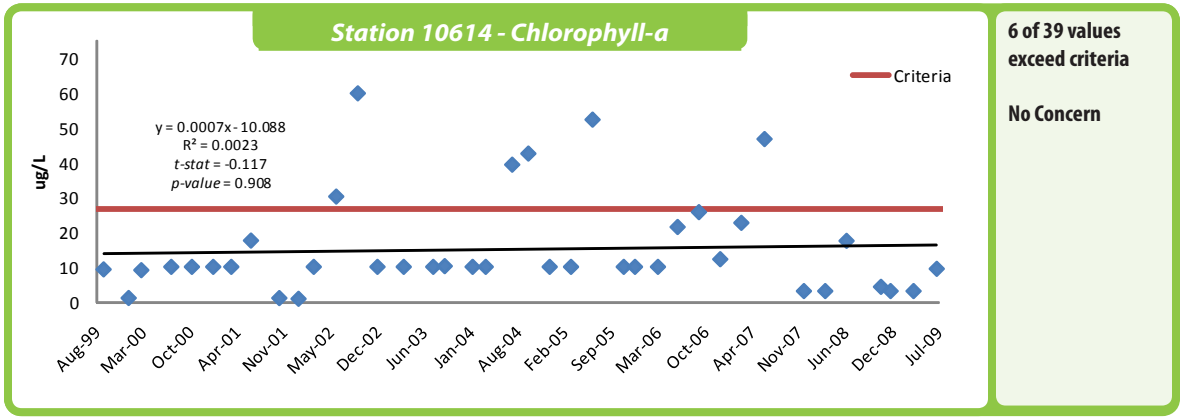
Chlorophyll-*a* values ranged from 0.77 to 60.1 ug/L (n = 39). Six data points exceeded the criteria of 26.7 ug/L.



Single grab criteria exceeded 4 times

3 of 4 exceeding values occur in March

Fully Supporting



6 of 39 values exceed criteria

No Concern

Station 10614, located in the 0610_06 Sam Rayburn Upper Attoyac Bayou Arm assessment unit, is listed as a concern for **Mercury** in edible fish tissue. The most likely source of the contamination is atmospheric deposition.

STATION 14906
Sam Rayburn Reservoir at Main Pool
North of the Power Plant Intake

Water Quality Parameters

pH values ranged from 6.5 - 8.6 S.U. (n = 95), with no trend.

Dissolved Oxygen (DO) values ranged from 5 - 11.8 mg/L, with a mean of 8.5 mg/L (n = 92). No values exceeded the screening criteria.

***E. coli* bacteria** results were all below the criteria for contract recreation, with values being reported over a range of <1 - 40 MPN/100 mL (n = 85).

Total Suspended Solids (TSS) levels ranged from <1 to 59.7 mg/L, with a mean of 4.4 mg/L (n = 61).

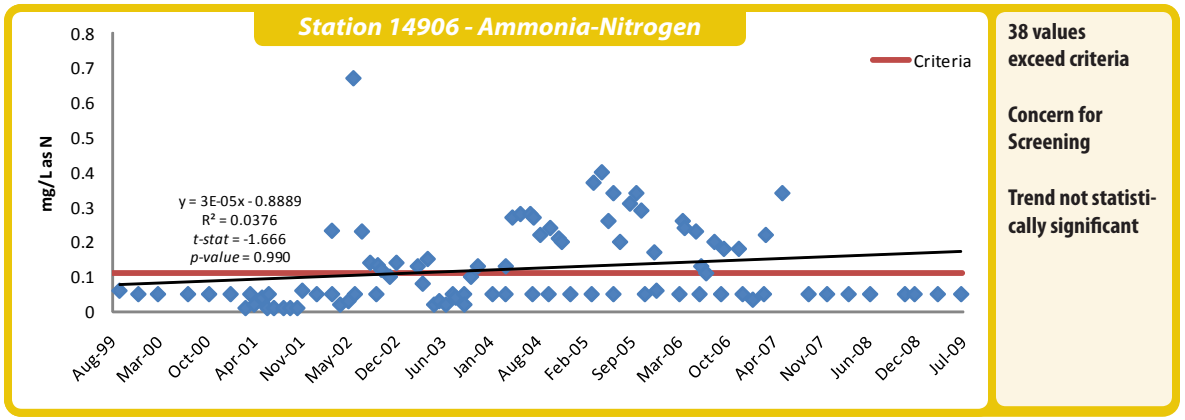
Total Dissolved Solids (TDS) values ranged from 48 - 262 mg/L (n = 62), with no trend observed.

Ammonia-Nitrogen concentrations ranged from <0.01 to 0.67 mg/L as N, with a mean of 0.12 mg/L as N (n = 94). Thirty-eight data points (40% of results) exceeded the 0.11 mg/L as N criteria. Although not statistically significant, the results display an increasing trend over time.

Nitrate+Nitrite-Nitrogen results ranged from <0.02 to 1.9 mg/L as N (n = 98), with 15 exceedances (15.3%). Nitrate-nitrite levels were found to decrease over time, with the trend being statistically significant (*t-stat* = 3.83, *p-value* = 0.0002).

Total Phosphorus concentrations were found to have a statistically significant decreasing trend, with 7 values exceeding the criteria. Results ranged from 0.013 - 0.77 mg/L as P (n = 95).

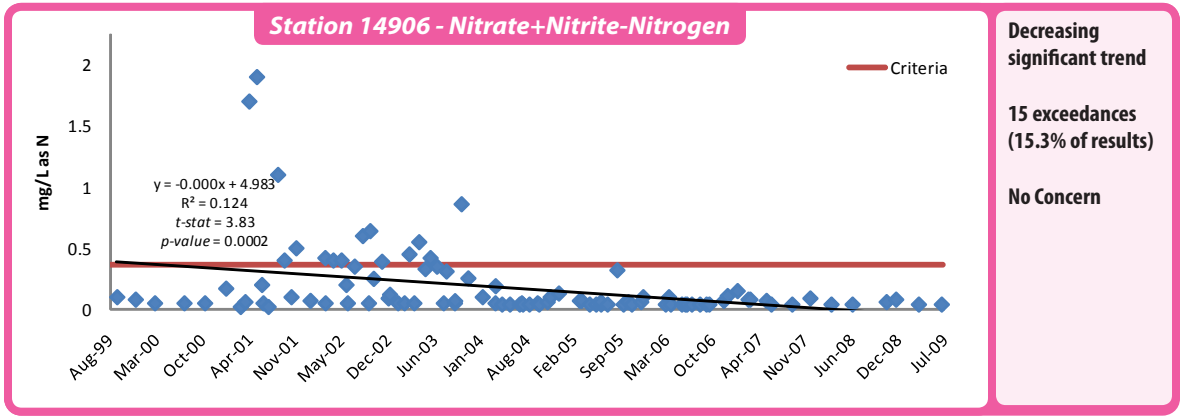
Chlorophyll-*a* values ranged from 2.52 - 46.4 ug/L (n = 68), with only one value exceeding the criteria of 26.7 ug/L.



38 values exceed criteria

Concern for Screening

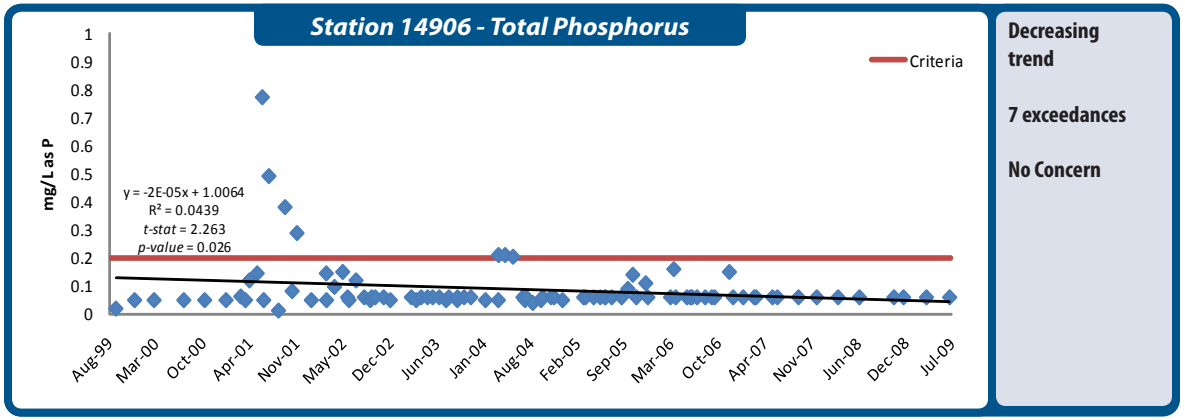
Trend not statistically significant



Decreasing significant trend

15 exceedances (15.3% of results)

No Concern



Decreasing trend

7 exceedances

No Concern

Station 14906, located in assessment unit 0610_01 Main Pool by Dam to the Bear Creek and Ayish arms, has concerns for **Manganese** in sediment, **Ammonia-Nitrogen**, and **Mercury** in fish tissue.

STATION 14907
Sam Rayburn Reservoir at FM 83
West of Pineland

Water Quality Parameters

pH values at this station ranged from 6.5 - 8.5 S.U., with a mean of 7.3 S.U. (n = 41). No significant trend was observed.

Dissolved Oxygen (DO) values ranged from 5 - 10.9 mg/L, with a mean of 7.6 mg/L (n = 41), and no values exceeding criteria.

***E. coli* bacteria** results ranged from a minimum of <2 MPN/100 mL to a maximum of >4800 MPN/100 mL. Only 3 values exceeded the single grab criteria. The geometric mean of the data set was 16.2 MPN/100 mL (n = 30).

Total Suspended Solids (TSS) results ranged from <1 to 34 mg/L, with a mean of 11.25 mg/L (n = 40).

Total Dissolved Solids (TDS) reported values were between 74 - 188 mg/L, with a mean of 103 mg/L (n = 40). There was no detectable trend.

Ammonia-Nitrogen concentrations ranged from <0.02 to 0.14 mg/L as N, with a mean of 0.056 mg/L as N (n = 39).

Nitrate+Nitrite-Nitrogen results ranged from 0.02 - 0.17 mg/L as N, with a mean of 0.06 mg/L as N (n = 39).

Orthophosphorus values ranged from <0.01 to 0.09 mg/L as P, with **Total Phosphorus** concentrations ranging from <0.02 to 0.14 mg/L as P (n = 40 for both parameters).

Chlorophyll-*a* values ranged from <3 to 23.2 ug/L (n = 38).

Station 14907, located in assessment unit 0610_10 Upper Ayish Bayou arm, has a concern for **Mercury** in edible fish tissue.

Based upon data evaluation, this station is very healthy and rarely exceeds criteria.

STATION 15523
Sam Rayburn Reservoir at Alligator Cove
Attoyac River Channel

Water Quality Parameters

pH values ranged from 6.35 - 8.9 S.U., with a mean of 7.6 S.U. (n = 55).

Dissolved Oxygen (DO) values ranged from 5.8 to 13.2 mg/L (n = 55). No values were outside of the criteria.

***E. coli* bacteria** results were low, ranging from <1 to 41 MPN/100 mL (n = 56).

Total Suspended Solids (TSS) results ranged from 2.67 - 24 mg/L, with a mean of 6.3 mg/L (n = 20).

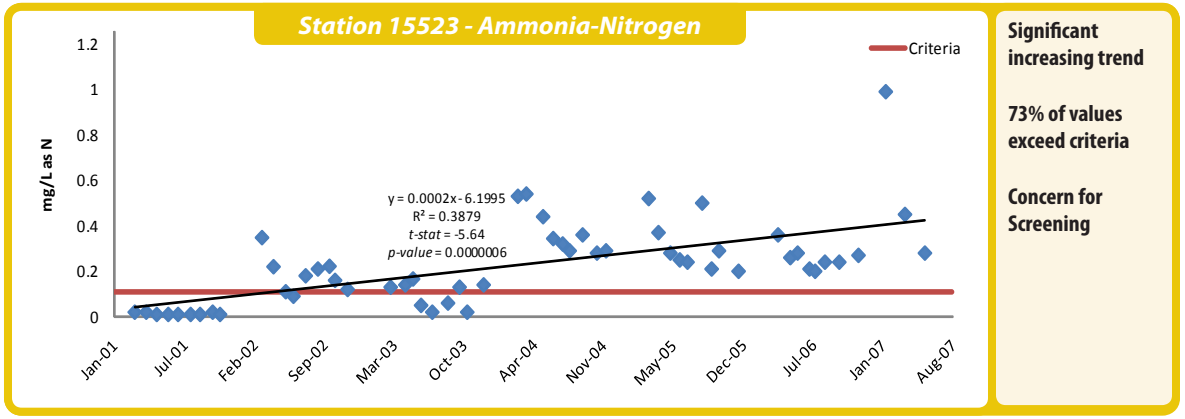
Total Dissolved Solids (TDS) reported values ranged from 68 - 201 mg/L, with a mean of 92 mg/L (n = 20).

Ammonia-Nitrogen concentrations displayed an increasing significant trend (*t-stat* = -5.64, *p-value* = 0.0000006). Ammonia-Nitrogen results exceeded the criteria of 0.11 mg/L as N for 41 of 56 events (73.2% of the time). This is a concern for screening. Reported values ranged from <0.01 - 0.99 mg/L as N.

Nitrate+Nitrite-Nitrogen results ranged from <0.04 - 2 mg/L as N, with a mean of 0.32 mg/L as N, and 19 of 56 values (33.9%) exceeding the criteria. A statistically significant decreasing trend over time was observed.

Orthophosphorus values had 7 exceedances (12.5% of samples), with a maximum value of 0.84 mg/L as P (n = 56).

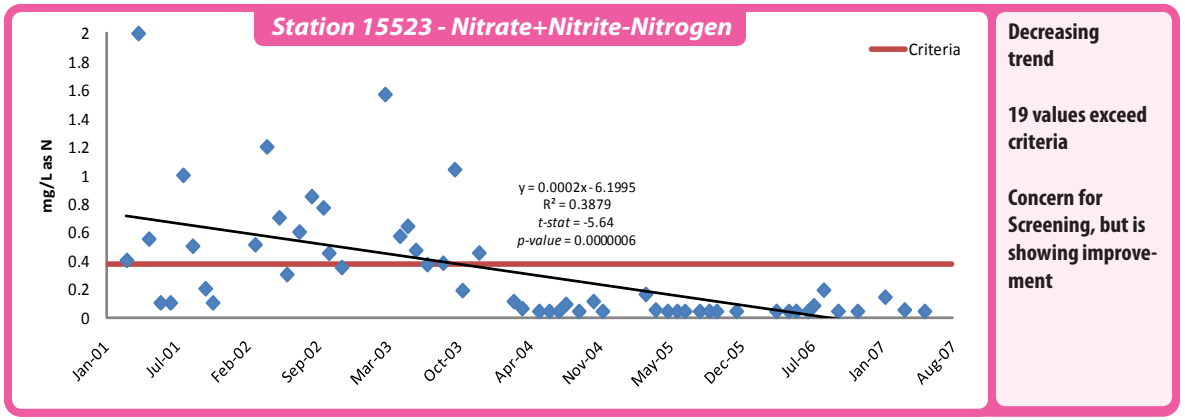
Total Phosphorus concentrations exceeded criteria for 11 of 56 samples (19.6%), with a range of <0.04 to 4.5 mg/L as P.



Significant increasing trend

73% of values exceed criteria

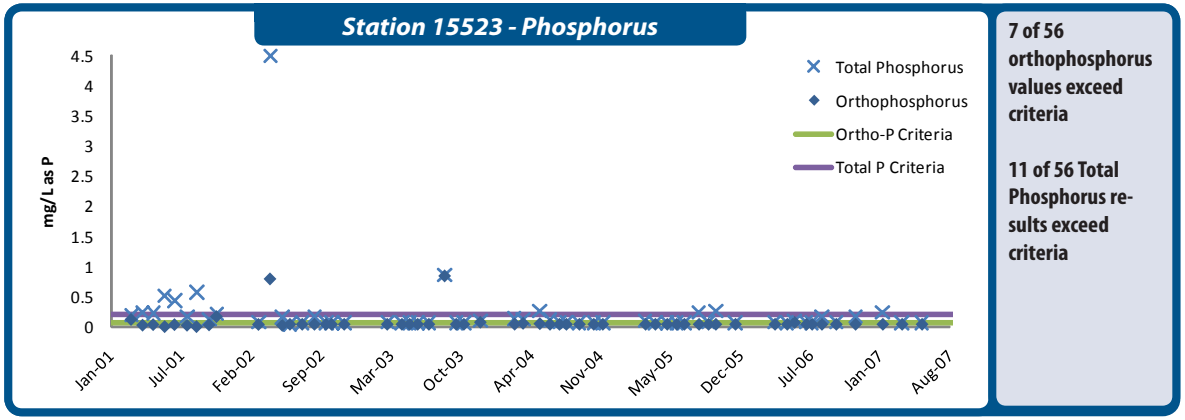
Concern for Screening



Decreasing trend

19 values exceed criteria

Concern for Screening, but is showing improvement



7 of 56 orthophosphorus values exceed criteria

11 of 56 Total Phosphorus results exceed criteria

Water Quality Parameters (continued)

Chlorophyll-*a* values ranged from <5 - 49.6 ug/L (n = 27), with 6 values exceeding the criteria.

Additional Water Quality Parameters

Conductivity data showed an increasing trend, with values ranging from 66 to 143 umhos/cm (n = 54).

Station 15523, located in assessment unit 0610_05 Lower Attoyac arm, has concerns for **Mercury** in edible fish tissue, **Nitrate**, and **Ammonia**.

Routine monitoring of this station by ANRA ended in 2007. ANRA had been collecting samples under an agreement with LNVA. With the termination of that agreement, monitoring was discontinued. The station is currently listed on the Coordinated Monitoring Schedule for Biological and Dissolved Oxygen monitoring.

STATION 15524
Sam Rayburn Reservoir at Shirley Creek
Angelina River Channel

Water Quality Parameters

pH values ranged from 6.47 - 8.8 S.U., with a mean of 7.58 S.U. (n = 61).

Dissolved Oxygen (DO) values show a statistically significant decreasing trend. With results ranging from 5.6 - 10.4 mg/L (n = 62), no data exceeded the criteria of 5.0 mg/L for screening levels for aquatic life use.

***E. coli* bacteria** results ranged from <1 to 30 MPN/100 mL (n = 64), with no values exceeding criteria.

Total Suspended Solids (TSS) results ranged from 1.67 - 19 mg/L, with a mean of 5.0 mg/L (n = 28).

Total Dissolved Solids (TDS) were reported in the range of 10 - 136 mg/L (n = 28).

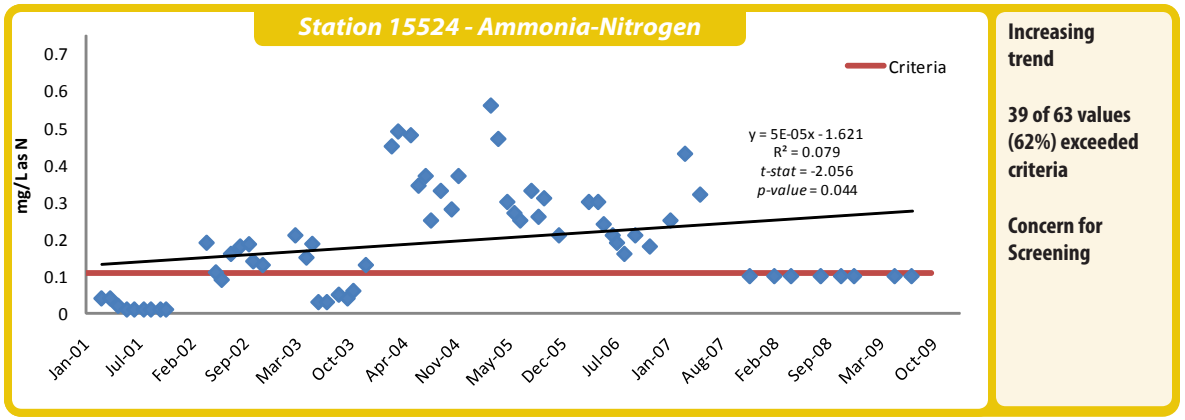
Ammonia-Nitrogen concentrations show a statistically significant increasing trend, ranging from <0.01 to 0.56 mg/L as N (n = 63). 39 values exceeded the criteria.

Nitrate+Nitrite-Nitrogen results ranged from <0.04 to 2 mg/L as N, with 17 of 64 values exceeding the criteria. Improved water quality conditions are indicated by a significant decreasing trend.

Orthophosphorus values ranged from 0.012 to 0.54 mg/L as P, with a mean of 0.05 mg/L as P (n = 64), and 5 exceedances.

Total Phosphorus concentrations ranged from 0.042 to 3.9 mg/L as P, with a mean of 0.176 mg/L as P (n = 64) and 11 values exceeding criteria.

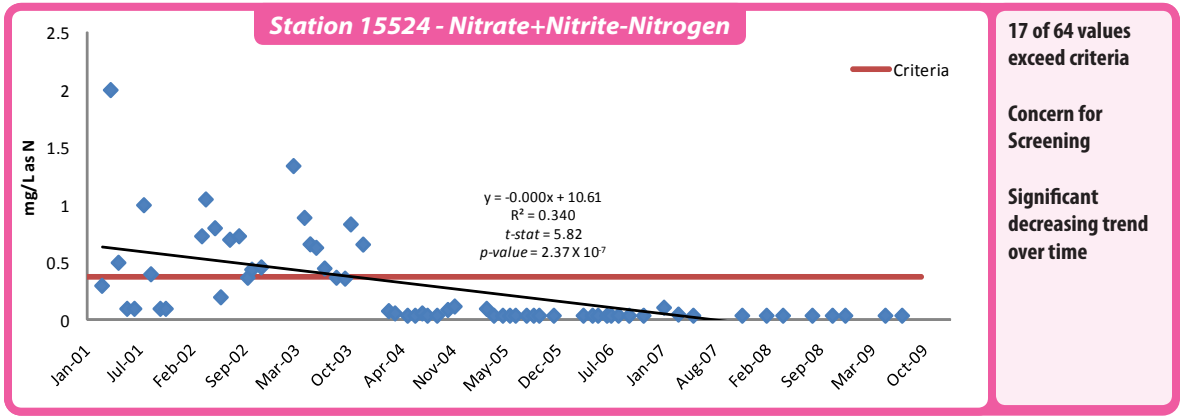
Chlorophyll-*a* values ranged from <5 to 53.5 ug/L, with a mean of 18.8 ug/L and 4 of 35 values exceeding criteria.



Increasing trend

39 of 63 values (62%) exceeded criteria

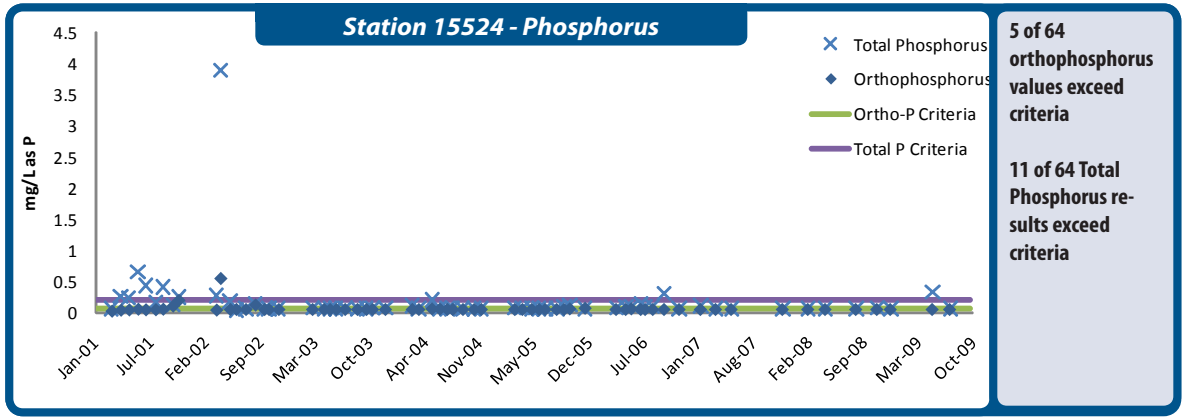
Concern for Screening



17 of 64 values exceed criteria

Concern for Screening

Significant decreasing trend over time



5 of 64 orthophosphorus values exceed criteria

11 of 64 Total Phosphorus results exceed criteria

Station 15524 - Sam Rayburn at Shirley Creek

Station 15524, located in assessment unit 0610_04 Mid Angelina River arm, has concerns for **Mercury** in edible fish tissue, **Nitrate**, and **Ammonia**.

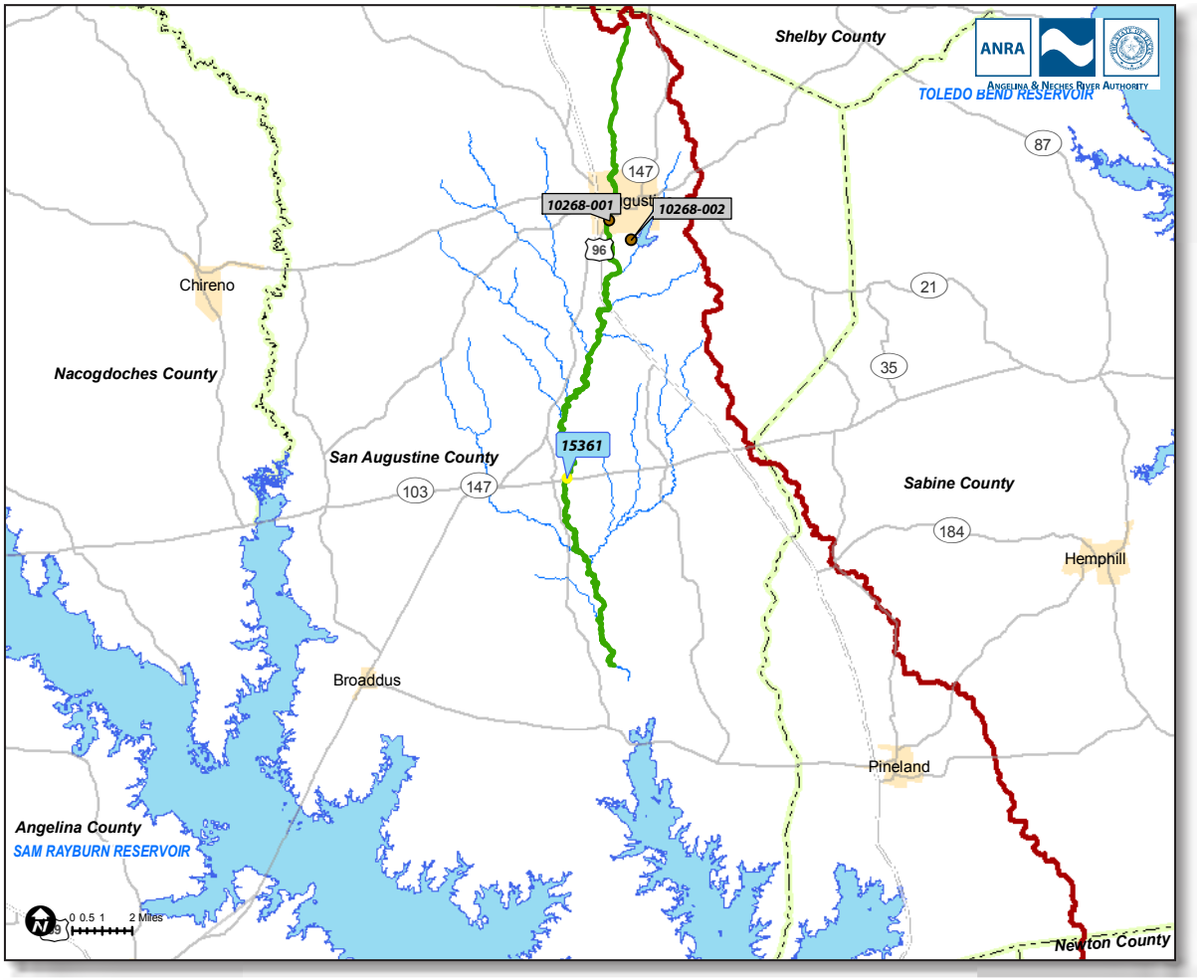
Nutrient concerns may be due to unspecified urban stormwater run-off, point source municipal discharge, and non-point source pollution.

Segment 0610A - Ayish Bayou (unclassified water body)

Segment Profile

Ayish Bayou is a 32 mile-length freshwater stream extending from the confluence of Sam Rayburn Reservoir south of San Augustine in San Augustine County to the upstream perennial portion of the stream north of San Augustine in San Augustine County. This stream segment, including the upper, middle, and lower portions, is listed on the 303 (d) list for bacteria. Currently, it is classified under a 5a category. The first year this water body was listed for impairments was 2000.

Ayish Bayou at SH 103



Monitoring Stations on Segment 0610A

Station ID	Station Name	Collecting Agency	Frequency	Parameters
15361	Ayish Bayou at SH 103	ANRA	Quarterly	Field, Conventionals, Bacteria, Flow

STATION 15361
Ayish Bayou at SH 103
East of FM 705

Water Quality Parameters

pH values ranged from 6.4 to 8.7 S.U., with a mean of 7.28 S.U. (n = 38).

Dissolved Oxygen (DO) values ranged from 1.3 to 12 mg/L (n = 39). The DO grab screening level of 5.0 mg/L was exceeded 8 times, with 5 occurrences in July, 2 in October, and 1 in September. A significant decreasing trend was observed.

***E. coli* bacteria** results ranged from 43 to 1990 MPN/100 mL (n = 29). The single grab criteria was exceeded on 6 occasions. The geometric mean was 185.6 MPN/100 mL, which is a concern, as this is higher than the criteria.

Total Suspended Solids (TSS) results ranged from 1.33 to 75.7 mg/L, with a mean of 15.6 mg/L (n = 28).

Total Dissolved Solids (TDS) results ranged from 81.3 to 149 mg/L,with a mean of 111 mg/L (n = 28).

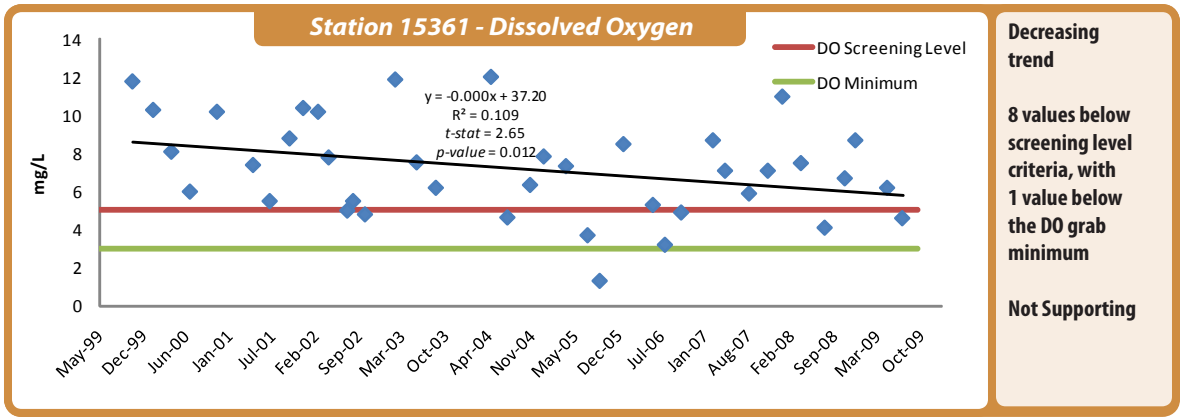
Ammonia-Nitrogen concentrations ranged from <0.01 to 1.31 mg/L as N (n = 28). Nine data points exceeded the criteria of 0.11 mg/L as N (32% occurrence rate).

Nitrate+Nitrite-Nitrogen results ranged from <0.04 to 3.2 mg/L as N (n = 28), with 2 exceedances and a decreasing trend.

Orthophosphorus values ranged from 0.024 to 0.582 mg/L as P (n = 28), with 2 exceedances.

Total Phosphorus results ranged from 0.042 to 1.048 mg/L as P (n = 28), with 2 exceedances.

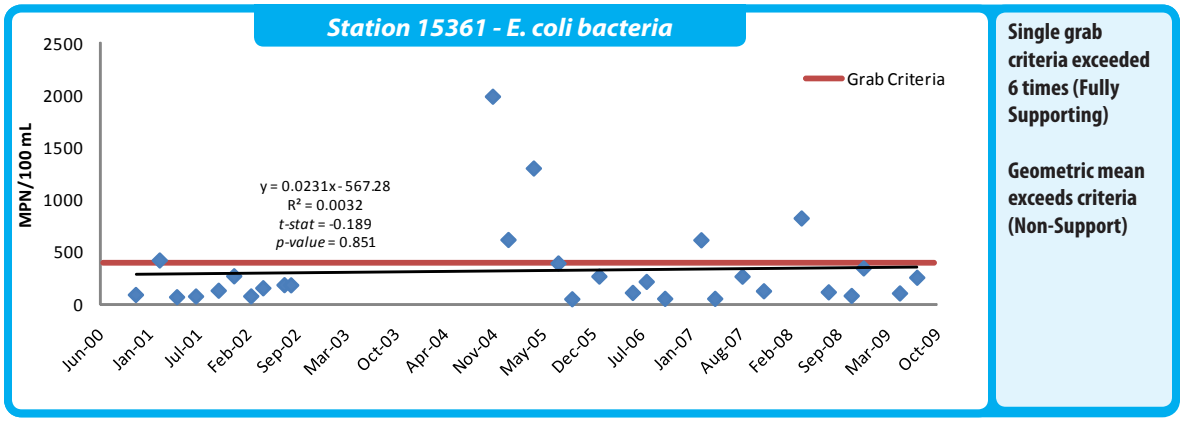
Chlorophyll-*a* values ranged from <2 to 7.9 ug/L (n = 19).



Decreasing trend

8 values below screening level criteria, with 1 value below the DO grab minimum

Not Supporting



Single grab criteria exceeded 6 times (Fully Supporting)

Geometric mean exceeds criteria (Non-Support)

Station 15361, located in assessment unit 0610A_01 Lower Portion Downstream of US 69, has concerns for ***E. coli* bacteria** geometric mean (not supporting), **Ammonia**, **Dissolved Oxygen** grab screening level, and **Chronic Toxic Substances in Water - Lead**.

Nutrient concern for ammonia may be due to point source pollution.

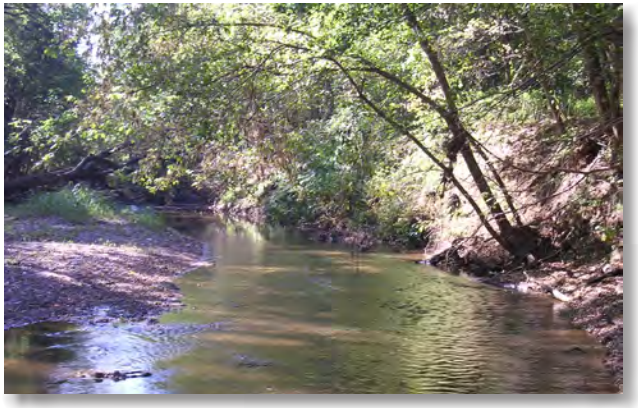
For this station, a gap in routine monitoring exists from late 2001 to late 2004.

Segment 0611B - La Nana Bayou (unclassified water body)

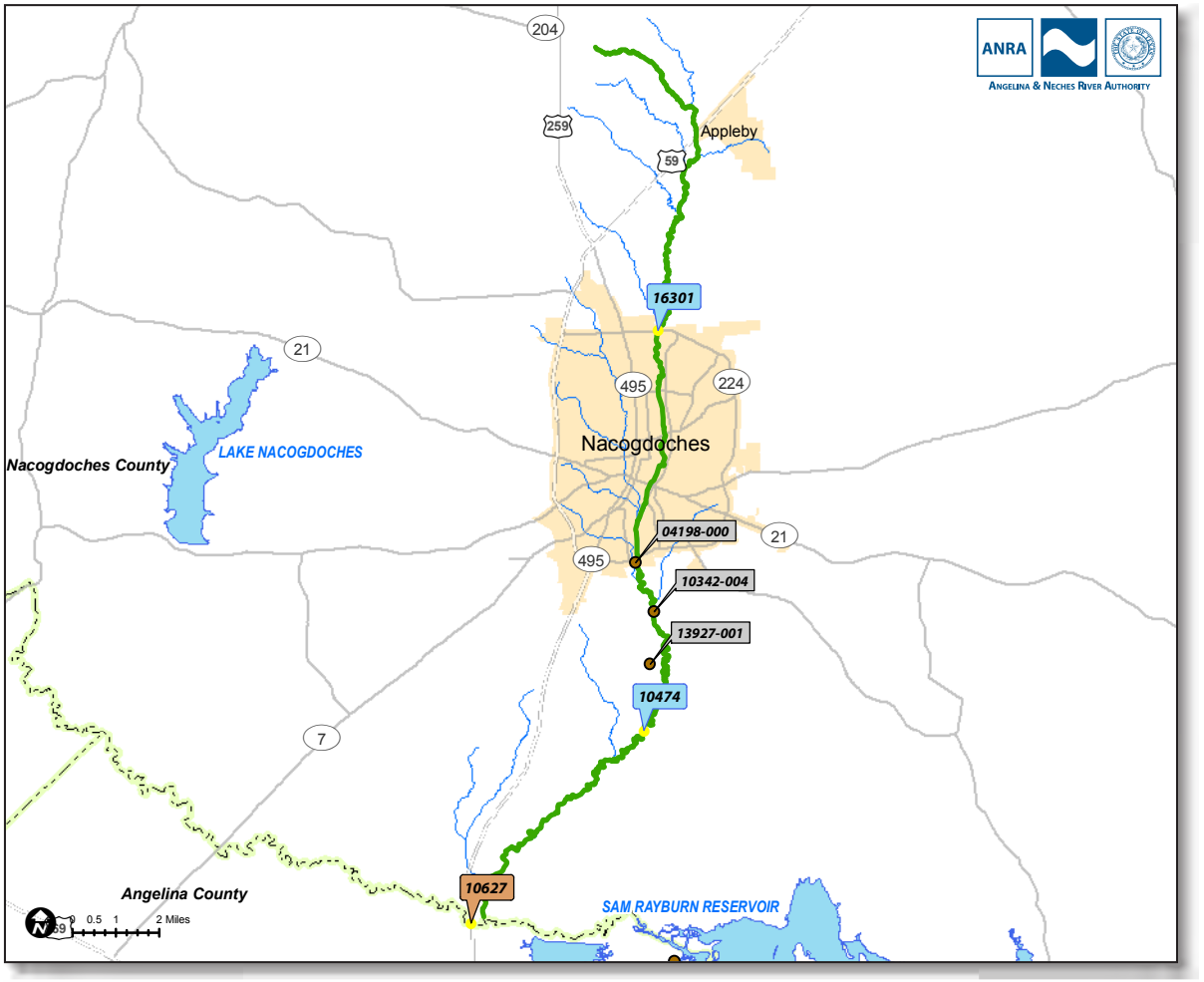
Segment Profile

This 32 mile freshwater stream extends from the confluence of the Angelina River south of Nacogdoches in Nacogdoches County to the upstream perennial portion of the stream north of Nacogdoches in Nacogdoches County. There are a couple of areas within the segment impaired for nonsupport of contact recreational use. These areas were first listed on the 303 (d) list in the year 2000 due to bacteria and are currently classified under category 5a. The areas included are from the mouth to SH 7.

Beginning in FY 2011, a new monitoring station will be added to the Coordinated Monitoring Schedule for the middle assessment unit area within the La Nana Bayou watershed. This site will be located at SH 21.



La Nana Bayou at Loop 224 N



Monitoring Stations on Segment 0611B				
Station ID	***Station Name***	***Collecting Agency***	***Frequency***	***Parameters***
10474	La Nana Bayou at CR 526 South of Nacogdoches	ANRA	Quarterly	Field, Conventionals, Bacteria, Flow
16301	La Nana Bayou at Loop 224 N in Nacogdoches	ANRA	Quarterly	Field, Conventionals, Bacteria, Flow

STATION 10474
La Nana Bayou at CR 526
South of Nacogdoches

Water Quality Parameters

pH values ranged from 6.71 to 9.4 S.U., with a mean of 7.3 S.U. (n = 37). Two values exceeded the criteria.

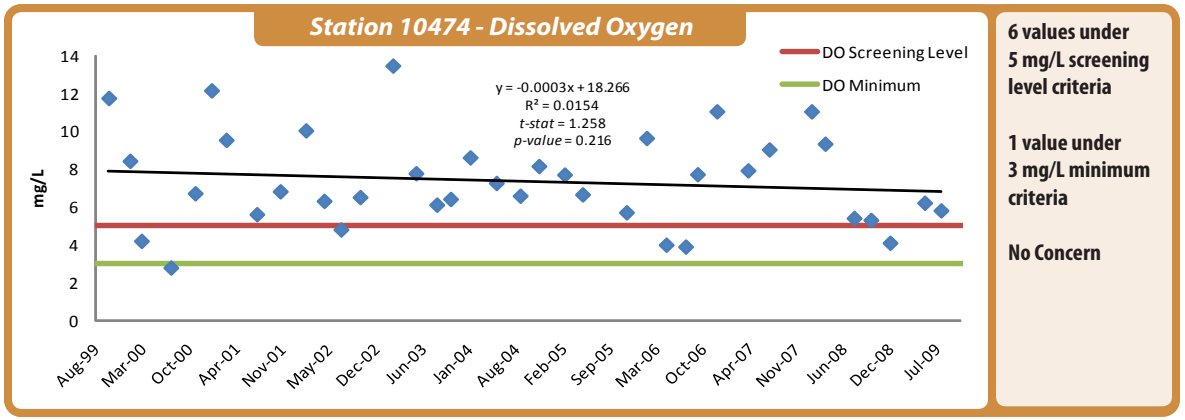
Dissolved Oxygen (DO) values ranged from 2.8 to 13.4 mg/L, with a mean of 7.36 mg/L (n = 38). This station, which is designated for aquatic life use, had 6 values (16% of results) under the DO screening level of 5 mg/L and 1 value under the 3 mg/L grab criteria.

***E. coli* bacteria** exceedances occurred 16 times (26.7% of samples), with a range of 29 - 3970 MPN/100 mL. The geometric mean of the data set was 277 MPN/100 mL (n = 60), which exceeds criteria. A 303 (d) listing for bacteria has been in place since 2000, with a current classification of 5a. The origin of the bacteria may be non-point source pollution of municipal point source discharge.

Total Suspended Solids (TSS) values ranged from 2.8 to 54.7 mg/L, with a mean of 11 mg/L (n = 40).

Total Dissolved Solids (TDS) values ranged from 87 - 340 mg/L, with a mean of 201 mg/L (n = 40).

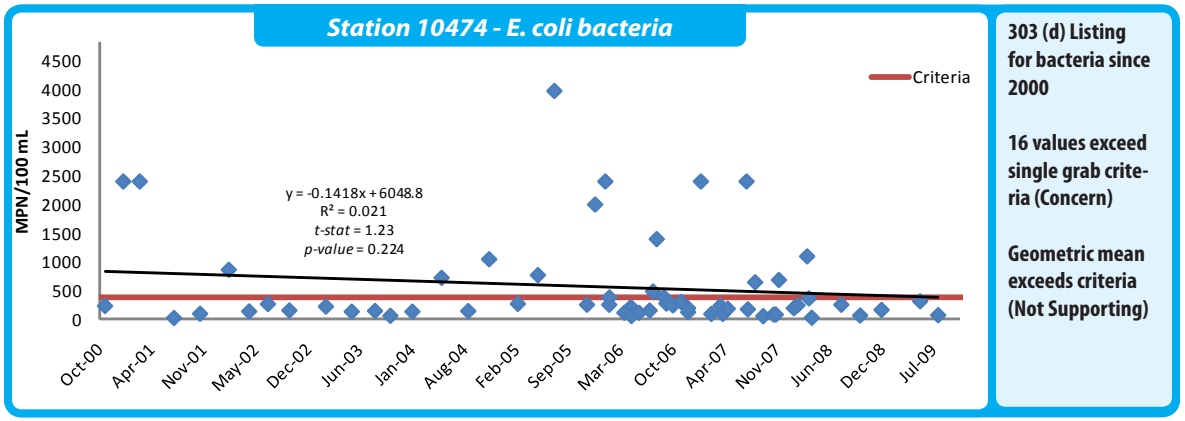
Ammonia-Nitrogen concentrations ranged from <0.01 to 4.65 mg/L as N, with a mean of 0.48 mg/L as N and a median value of 0.29 mg/L as N (n = 38). These elevated values are of concern. There are no criteria listed for nutrients on this segment on the 2008 Water Quality Inventory.



6 values under 5 mg/L screening level criteria

1 value under 3 mg/L minimum criteria

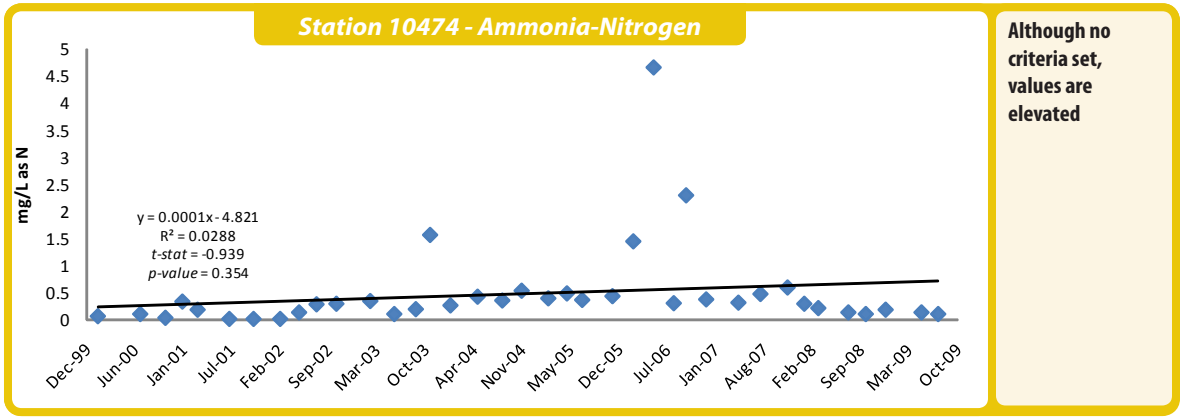
No Concern



303 (d) Listing for bacteria since 2000

16 values exceed single grab criteria (Concern)

Geometric mean exceeds criteria (Not Supporting)



Although no criteria set, values are elevated

Nitrate+Nitrite-Nitrogen results ranged from <0.04 to 13.4 mg/L as N, with a mean of 2.3 mg/L as N (n = 40). Although there are no nutrient criteria set for La Nana Bayou, Segment 0611 has a criteria of 1.95 mg/L as N. A statistically significant upward trend is observed.

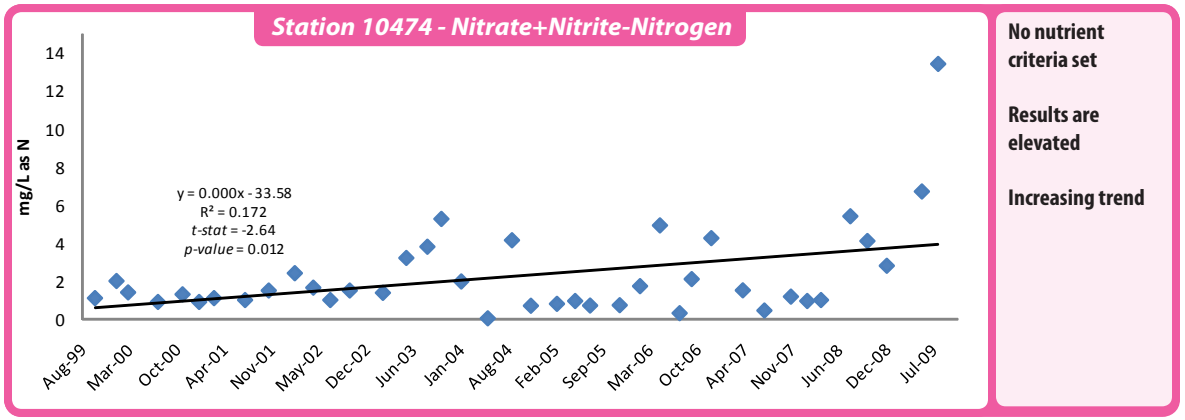
Orthophosphorus values ranged from 0.06 to 4.12 mg/L as P, with a mean of 0.99 mg/L as P (n = 38). Again, although there is no criteria set for this segment, the values exceed what is typically observed at other stations in this sub-basin.

Total Phosphorus concentrations ranged from 0.17 to 7.3 mg/L as P, with a mean of 1.75 mg/L as P (n = 40). As with orthophosphorus, these results exceed what is typically seen for other segments in the sub-basin. There is a statistically significant decreasing trend, so hopefully these values will continue to improve over time.

Chlorophyll-*a* values ranged from <2 to 54.7 ug/L, with a mean of 7.1 ug/L (n = 23).

Additional Water Quality Parameters

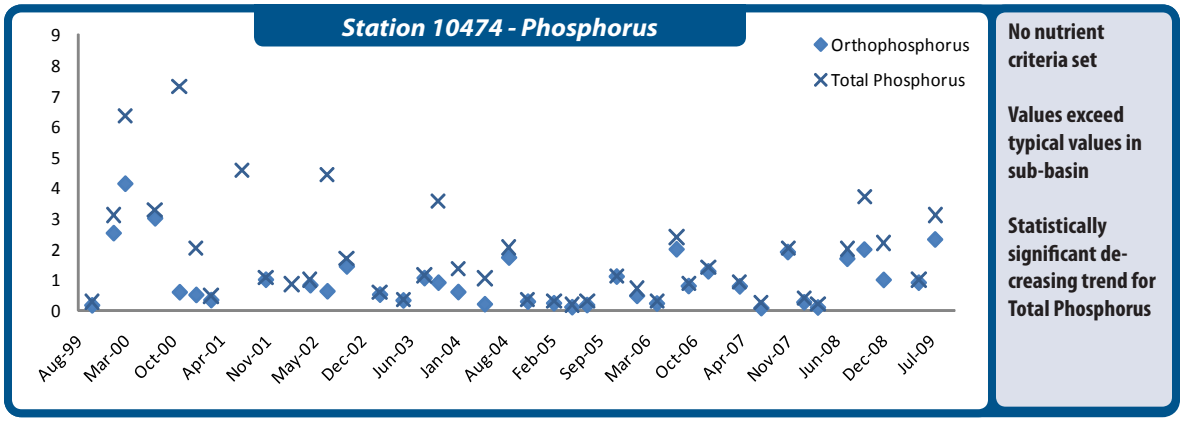
Chloride, Sulfate, and **Conductivity** values are all elevated at this station (n = 40 for all parameters). For chloride , the maximum reported value is 100 mg/L, while sulfate had a maximum reported value of 108 mg/L. These values are over twice what is normally seen in the basin. Conductivity had a maximum reported value of 569 umhos/cm. These values, in combination with the elevated bacteria, TDS, and nutrients concentrations, suggests that non-point source and point source pollution are having a significant impact on this stream segment.



No nutrient criteria set

Results are elevated

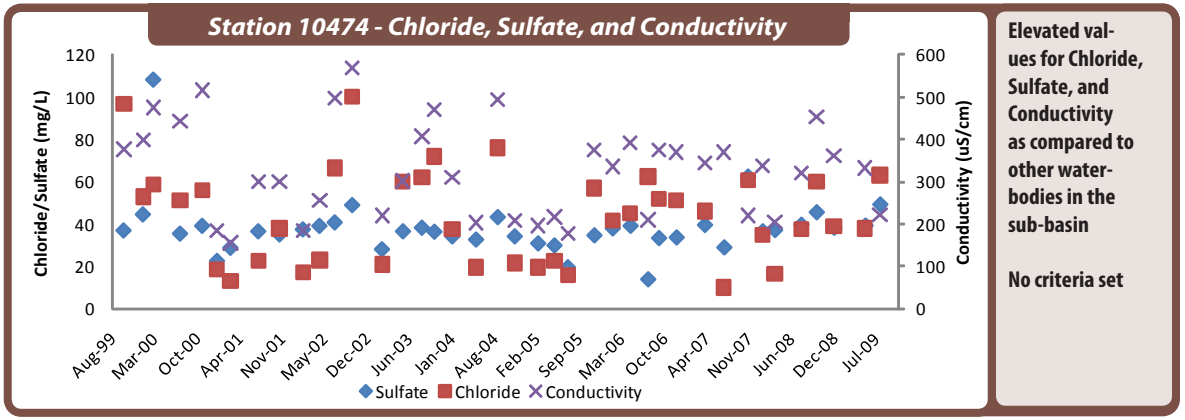
Increasing trend



No nutrient criteria set

Values exceed typical values in sub-basin

Statistically significant decreasing trend for Total Phosphorus



Elevated values for Chloride, Sulfate, and Conductivity as compared to other waterbodies in the sub-basin

No criteria set

STATION 16301
La Nana Bayou at Loop 224 N
North Loop in Nacogdoches

Water Quality Parameters

Monitoring was conducted at this station in 1999 and 2000, but was discontinued. Monitoring resumed in 2008, but there is not enough data to evaluate.

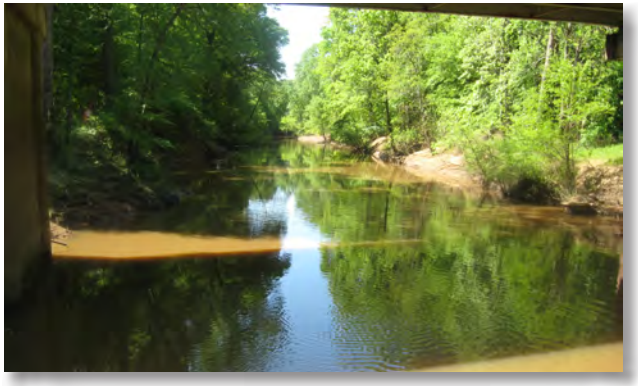
This station is a useful addition to the Coordinated Monitoring Schedule, as it will yield information regarding nutrients and bacteria prior to the segment entering and traversing the City of Nacogdoches.

Segment 0612 - Attoyac Bayou

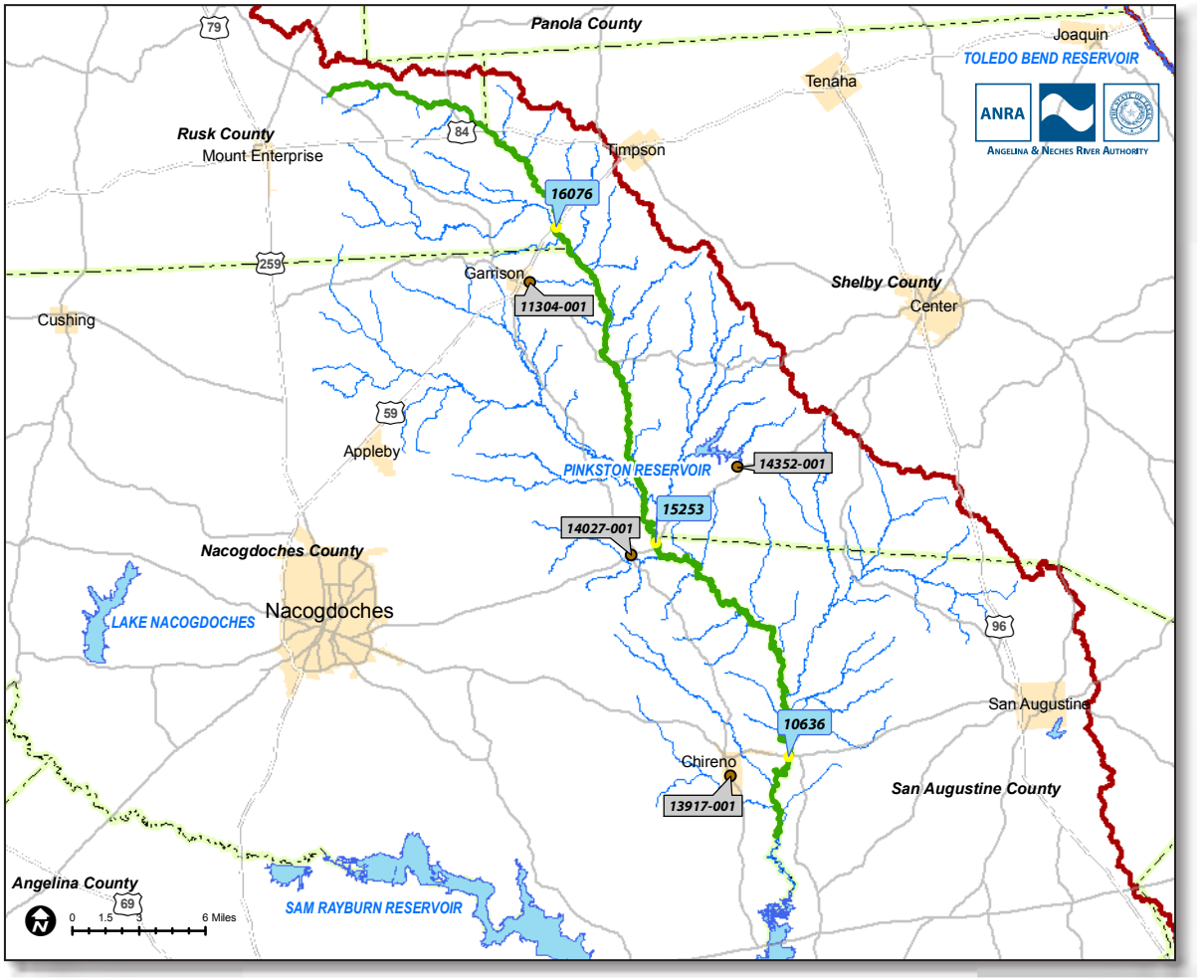
Segment Profile

Attoyac Bayou is a freshwater stream measuring 81.7 miles in length from a point 3.9 km (2.4 miles) downstream of Curry Creek in Nacogdoches/San Augustine County to FM 95 in Rusk County. The designated uses for this segment include the following: high aquatic life, general, contact recreation, and public water supply. The area surrounding the watershed is managed for agricultural (cattle and poultry), silvicultural, recreational, and wildlife uses. The watershed contains many rural residents. This segment has three areas that are listed on the 303(d) list due to bacteria. These assessment units are currently under category 5a (2008) and were first listed in 2004. The areas listed for impairments are as follows:

- 0612_01 Mouth to 8.2 miles downstream of SH 7
- 0612_02 8.2 miles below SH 7 to Bear Creek confluence
- 0612_03 Bear Creek confluence to headwaters



Attoyac Bayou at SH 21



Monitoring Stations on Segment 0612

Station ID	Station Name	Collecting Agency	Frequency	Parameters
10636	Attoyac Bayou at SH 21	ANRA	Quarterly	Field, Conventionals, Bacteria, Flow
15253	Attoyac Bayou at SH 7	ANRA	Quarterly	Field, Conventionals, Bacteria, Flow
16076	Attoyac Bayou at US 59	ANRA	Quarterly	Field, Conventionals, Bacteria, Flow

STATION 10636
Attoyac Bayou at SH 21
East of Chireno

Water Quality Parameters

pH values were reported ranging from 6.34 to 8.2 S.U., with a mean of 7.14 S.U. (n = 23). No values exceeded the criteria, and a statistically significant decreasing trend was observed..

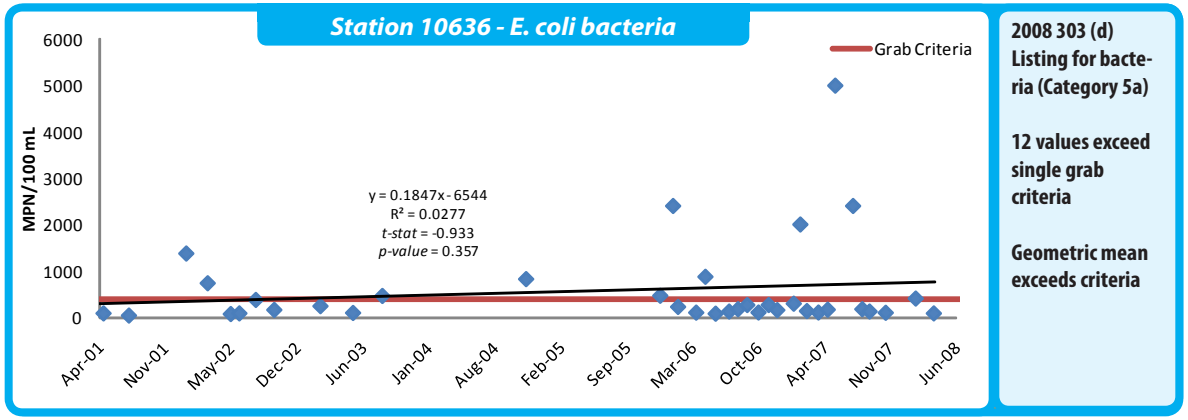
Dissolved Oxygen (DO) results ranged from 5.36 to 11.3 mg/L, with a mean of 7.88 mg/L (n = 23), and no exceedances. There is a statistically significant decreasing trend over time.

***E. coli* bacteria** results ranged from 32 to 5000 MPN/100 mL, with 12 of 38 values (32%) exceeding the contact recreation single grab criteria. The geometric mean of 249.8 exceeds the criteria as well. This station is located in assessment unit 0612_01 (mouth to 8.2 miles downstream of SH 7), which is on the 2008 303 (d) list for bacteria, in category 5a. Non-point source pollution is a likely cause of the bacteriological conditions.

Total Suspended Solids (TSS) results ranged from 5.67 to 70 mg/L, with a mean of 29.4 mg/L (n = 19). The data shows a statistically significant increasing trend over time (*t-stat* = -2.389, *p-value* = 0.029).

Total Dissolved Solids (TDS) results ranged from a minimum of 54 mg/L to a maximum of 140 mg/L. The mean was 97.9 mg/L (n = 19).

Ammonia-Nitrogen concentrations ranged from <0.01 to 0.71 mg/L as N, with a mean of 0.095 mg/L as N (n = 18). Although the value of 0.71 mg/L as N exceeds the criteria, all other values are below the standard, with the second-highest value being reported as 0.13 mg/L as N, and 44% of samples being reported below the analytical reporting limit.



2008 303 (d) Listing for bacteria (Category 5a)

12 values exceed single grab criteria

Geometric mean exceeds criteria

Water Quality Parameters (continued)

Nitrate+Nitrite-Nitrogen results ranged from 0.29 to 5.4 mg/L as N, with a mean of 1.52 mg/L as N (n = 19). The general use and public water supply use criteria of 1.95 mg/L as N was exceeded 4 times (21% of samples). The data is fully supporting for the designated uses.

Orthophosphorus values ranged from <0.01 to 0.71 mg/L as P, with a mean of 0.1 mg/L as P (n = 19). One value exceeded criteria, and a decreasing trend was observed, although it is not statistically significant. The data is fully supporting for the designated uses.

Total Phosphorus concentrations ranged from 0.08 to 1.62 mg/L as P, with a mean of 0.3 mg/L as P (n = 19). The criteria was exceeded 2 times for this parameter (10.5% of samples). As with orthophosphorus, a decreasing trend was observed, but it was not statistically significant. The data is fully supporting for the designated uses.

Chlorophyll-a did not have enough data to evaluate (6 data points.

Litter (and evidence of contact recreation) at Attoyac Bayou at SH 21

STATION 15253
Attoyac Bayou at SH 7
Northeast of Martinsville

Water Quality Parameters

pH values ranged from 5.95 to 8.1 S.U., with a mean of 7.18 S.U. (n = 21). One value is below the criteria. Although the data shows an increasing trend over time, it is not statistically significant.

Dissolved Oxygen (DO) values ranged from 3.6 - 10.9 mg/L, with a mean of 7.18 mg/L (n = 23). One value was below the aquatic life use screening level.

***E. coli* bacteria** results showed 3 exceedances of the single grab criteria, with results ranging from 75 - 820 MPN/100 mL (n = 24). The geometric mean of 220 MPN/100 mL also exceeds the criteria for contact recreational use. This station is located in assessment unit 0612_02 (8.2 miles below SH 7 to Bear Creek), which is listed on the 2008 303 (d) list impaired due to bacteria.

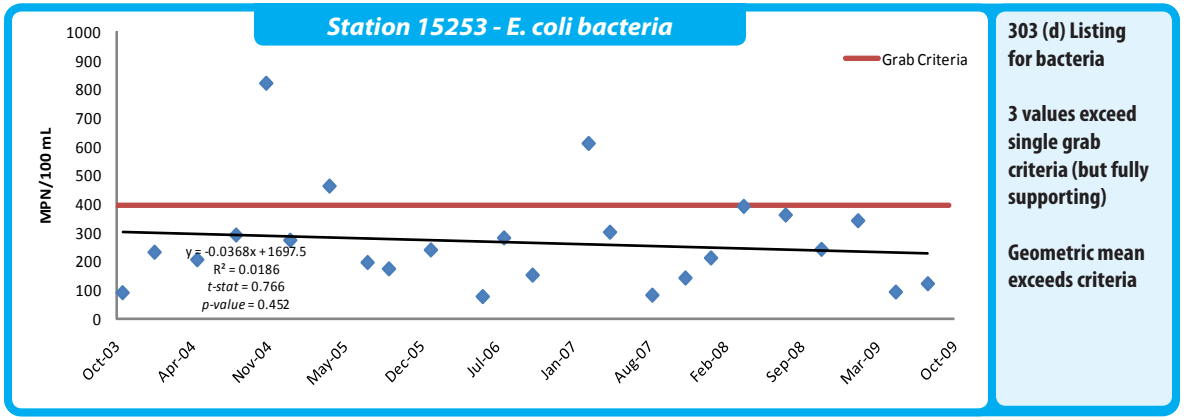
Total Suspended Solids (TSS) results ranged from <1 to 84.8 mg/L, with a mean of 28.1 mg/L (n = 24).

Total Dissolved Solids (TDS) results ranged from 82.7 to 183 mg/L, with a mean of 115 mg/L (n = 24).

Ammonia-Nitrogen concentrations show a decreasing trend (*t-stat* = 3.09, *p-value* = 0.005) with 15 exceedances (62.5%). Reported results ranged from <0.1 to 1.31 mg/L as N, with a mean of 0.44 mg/L as N (n = 24).

Nitrate+Nitrite-Nitrogen results ranged from <0.04 to 2.1 mg/L as N, with a mean of 0.41 mg/L as N (n = 24). One value exceeded criteria, but data displayed full support.

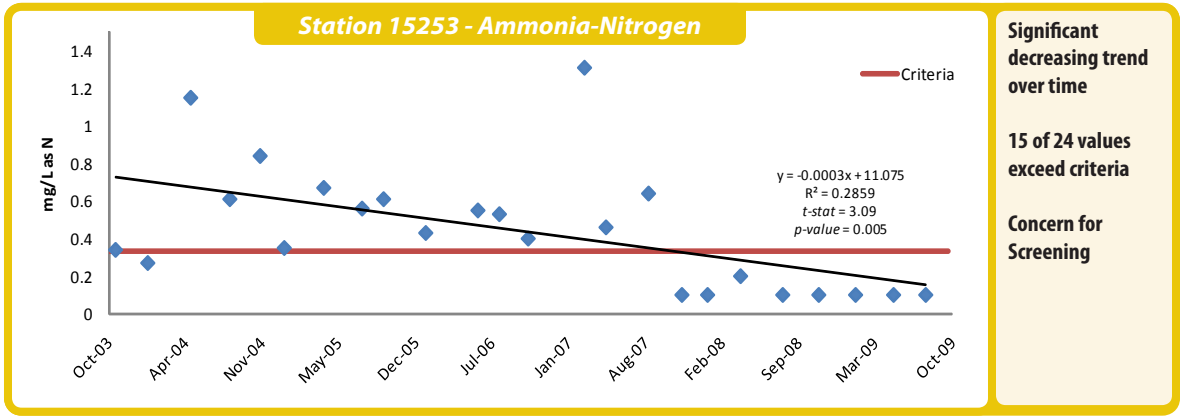
Orthophosphorus values were reported over a range of <0.04 - 0.12 mg/L as P, with a mean of 0.06 mg/L as P (n = 24). No values exceeded criteria.



303 (d) Listing for bacteria

3 values exceed single grab criteria (but fully supporting)

Geometric mean exceeds criteria



Significant decreasing trend over time

15 of 24 values exceed criteria

Concern for Screening

Water Quality Parameters (continued)

Total Phosphorus concentrations showed a decreasing trend over time, with no values exceeding criteria. Values ranged from a minimum of <0.06 mg/L as P to a maximum of 0.43 mg/L as P (n = 24)..

Chlorophyll-*a* values were reported over a range of <2 - 14.3 ug/L (n = 23), with one value exceeding criteria.

Pasture land at Attoyac Bayou at SH 7

STATION 16076
Attoyac Bayou at US 59
Northeast of Garrison

Water Quality Parameters

pH values range from 5.8 - 8.5 S.U., with a mean of 7.12 S.U. (n = 35). One value exceeded the pH criteria. There is an increasing trend over time, but it is not statistically significant.

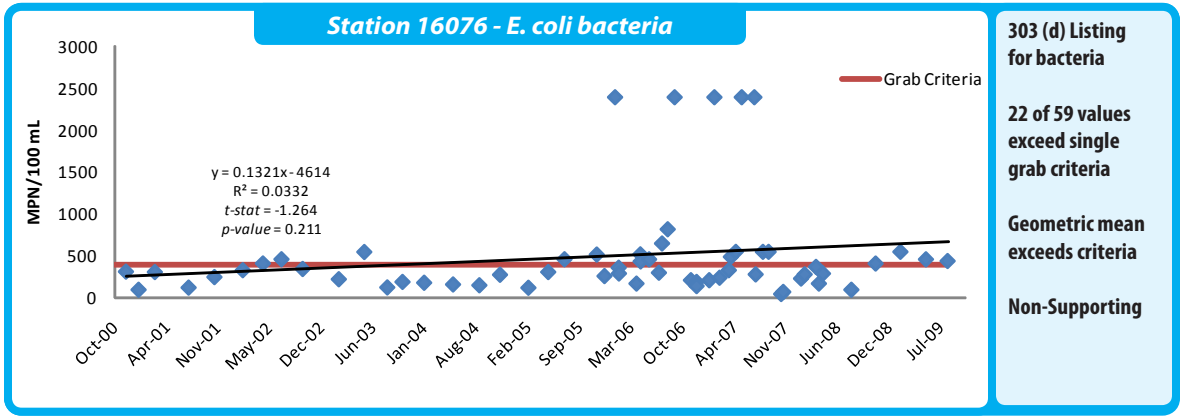
Dissolved Oxygen (DO) values ranged from 3.2 - 13.2 mg/L, with a mean of 8.18 mg/L (n = 36). Two values were below the DO screening level criteria.

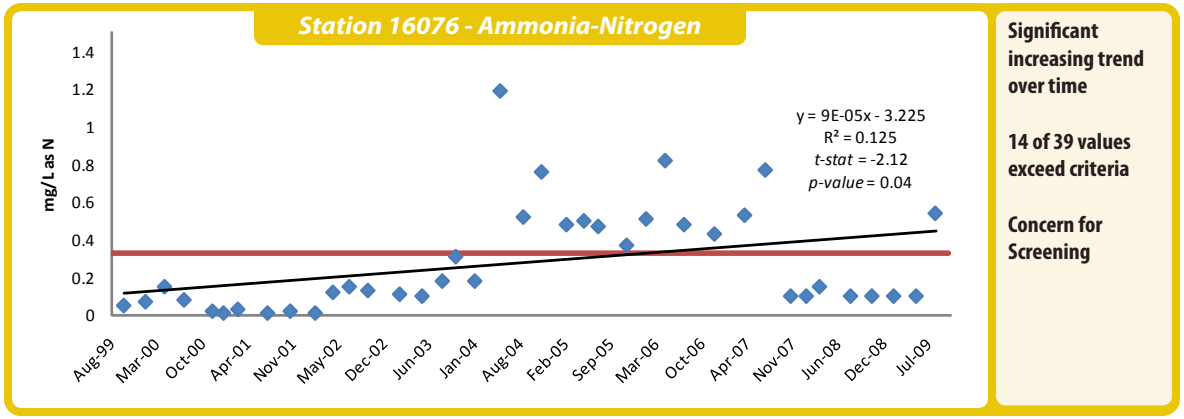
***E. coli* bacteria** results were reported over the range of 45 to >2400 MPN/100 mL. There were 22 of 59 results (37.3% of samples) that exceeded the single grab criteria for *E. coli*, with 4 values being reported as >2400 MPN/100 mL. The geometric mean of 330 MPN/100 mL was greater than the criteria. This station is located in assessment unit 0612_03 (Bear Creek to headwaters), and is listed on the 2008 303 (d) list for bacteria (category 5a).

Total Suspended Solids (TSS) results were within the range of 2.33 to 44.7 mg/L, with a mean of 18.8 mg/L (n = 39). These values are much lower than the TSS concentrations reported at other stations on Attoyac Bayou.

Total Dissolved Solids (TDS) results were reported between 51 - 161 mg/L, with a mean of 101 mg/L (n = 39).

Ammonia-Nitrogen concentrations ranged from <0.01 to 1.19 mg/L as N, with a mean of 0.28 mg/L as N (n = 39). There were 14 values (35.9% of results) which exceeded the criteria, and a statistically significant increasing trend was observed. Possible sources of the elevated ammonia concentrations include municipal discharge and non-point source pollution. There are also two landfills located upstream on the westward section.





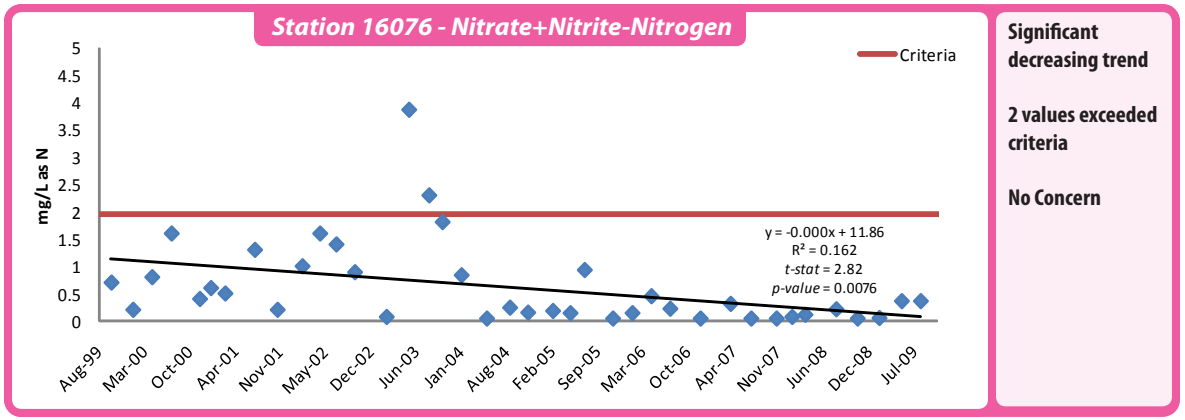
Water Quality Parameters (continued)

Nitrate+Nitrite-Nitrogen concentrations were reported between <0.04 - 3.87 mg/L as N, with a mean of 0.62 mg/L as N (n = 39). There were 2 values exceeding criteria, and a significant decreasing trend.

Orthophosphorus values ranged from <0.01 - 0.87 mg/L as P, with a mean of 0.09 mg/L as P (n = 38). There was one value which exceeded the criteria.

Total Phosphorus concentrations were reported in the range of <0.06 to 0.86 mg/L as P, with a mean of 0.19 mg/L as P (n = 38). One value exceeded the criteria. A statistically significant decreasing trend is present.

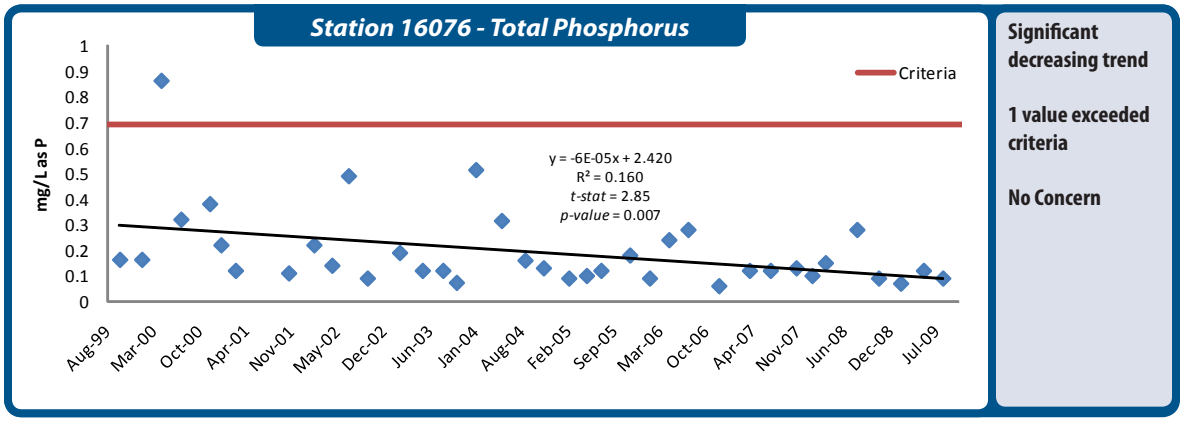
Chlorophyll-*a* values ranged from <2 - 31.3 ug/L with a mean of 6.2 ug/L (n = 22) and 2 values exceeding the criteria.



Significant decreasing trend

2 values exceeded criteria

No Concern



Significant decreasing trend

1 value exceeded criteria

No Concern

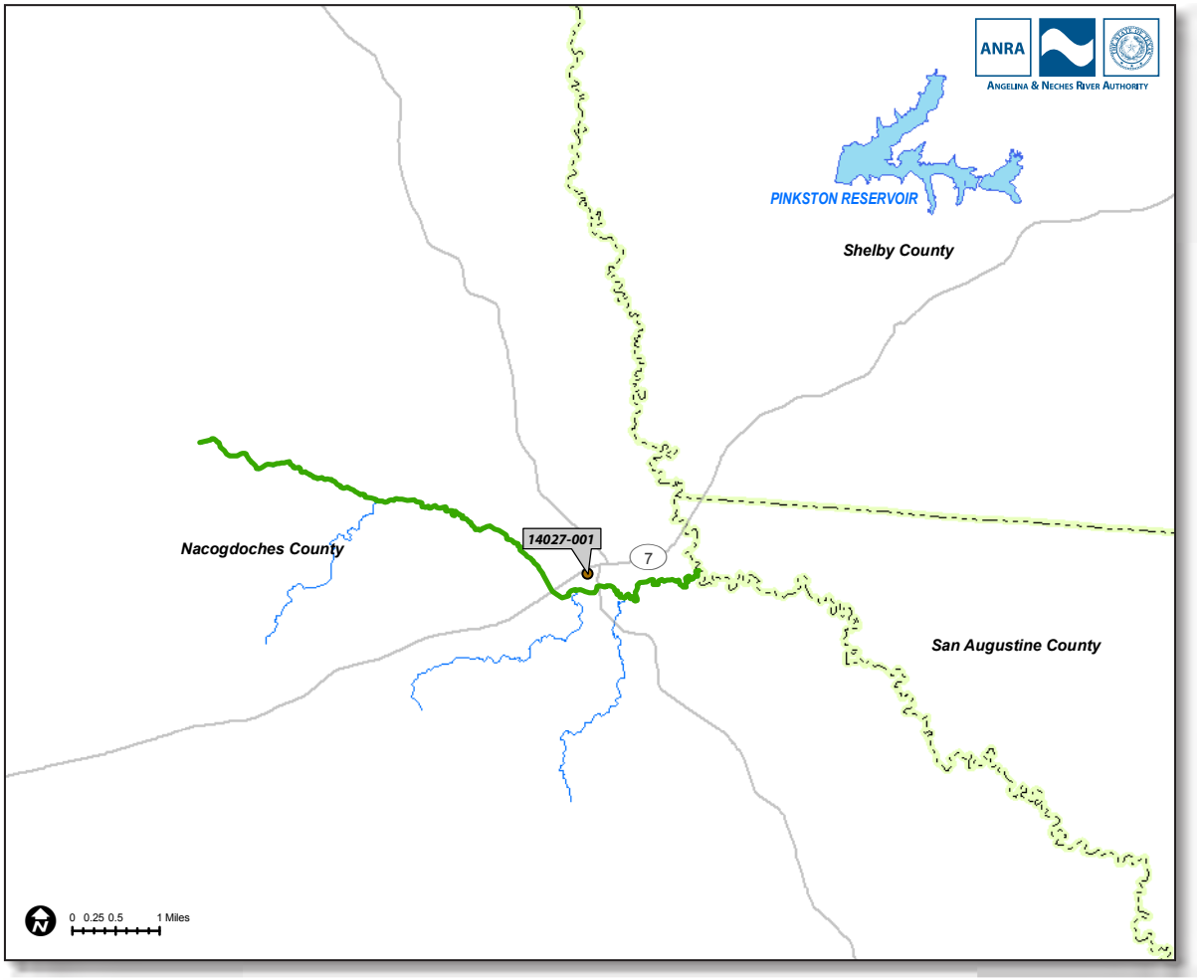
Segment 0612A - Terrapin Creek (unclassified water body)

Segment Profile

This segment is an 8.5 mile-length freshwater stream from the confluence of Attoyac Bayou east of Martinsville in Nacogdoches County to the upstream perennial portion of the stream northwest of Martinsville in Nacogdoches County.

There are no monitoring stations for this segment listed on the Coordinated Monitoring Schedule.

Screening levels and criteria have not been assessed, and limited data exists for this unclassified segment.



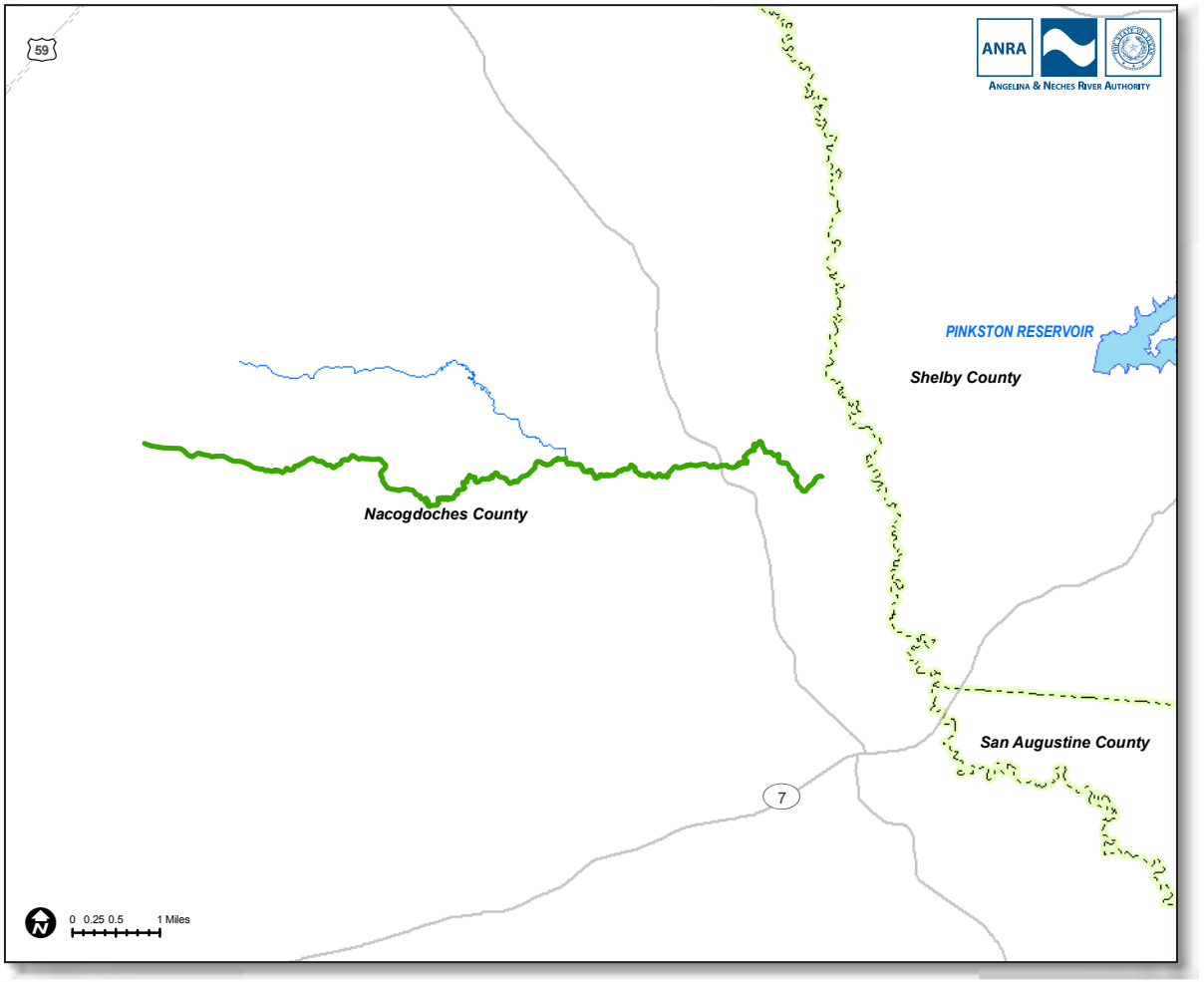
Segment 0612B - Waffelow Creek (unclassified water body)

Segment Profile

This segment is a 10.5 mile-length freshwater stream from the confluence of Attoyac Bayou north of Martinsville in Nacogdoches County to the upstream perennial portion of the stream northeast of Nacogdoches in Nacogdoches County.

There are no monitoring stations for this segment listed on the Coordinated Monitoring Schedule.

Screening levels and criteria have not been assessed, and limited data exists for this unclassified segment.



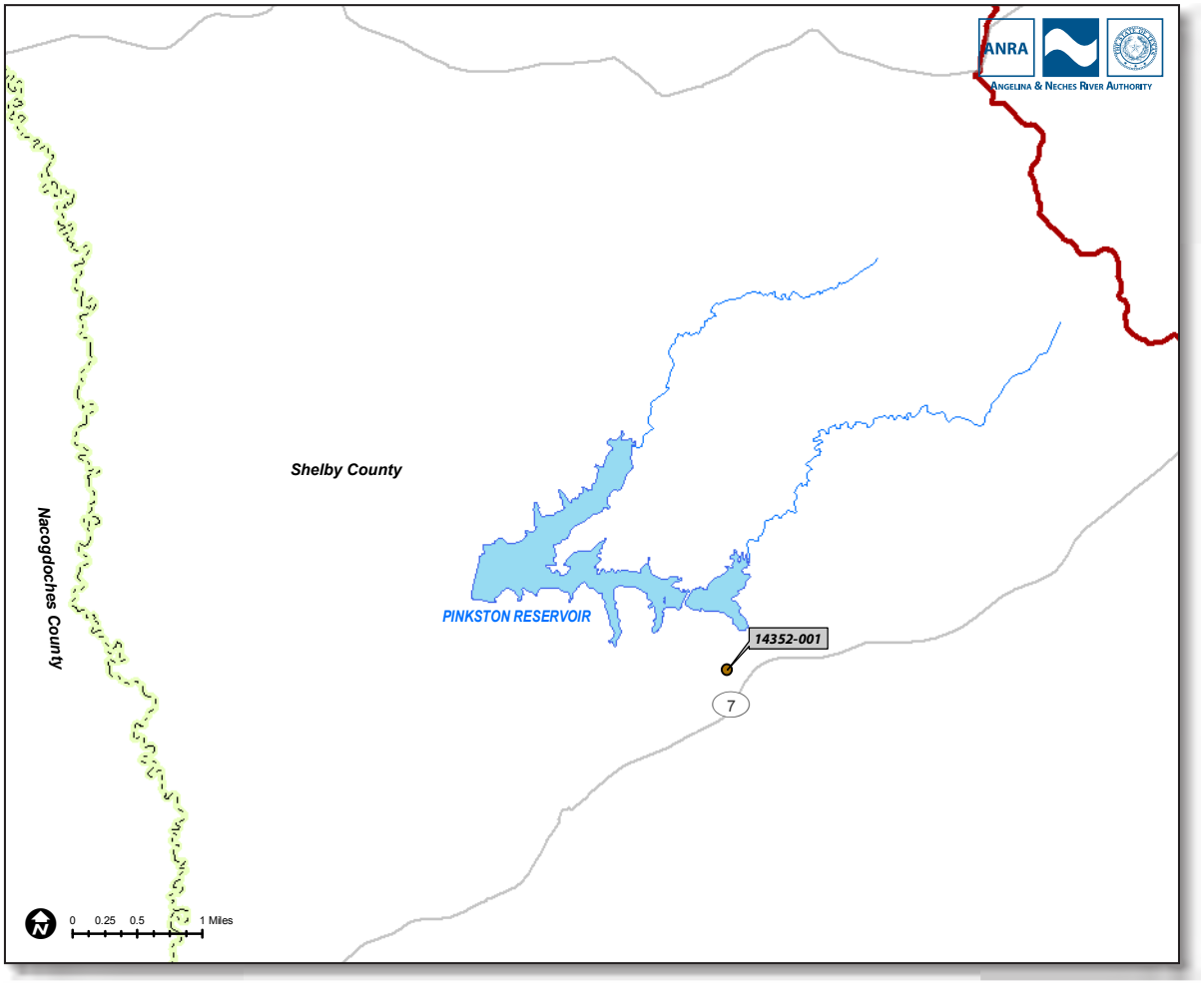
Segment 0612C - Pinkston Reservoir (unclassified water body)

Segment Profile

This segment includes 523-acres composed of a fresh-water reservoir which is located approximately 12 miles southwest of Center in Shelby County, impounding Sandy Creek.

There are no monitoring stations for this segment listed on the Coordinated Monitoring Schedule.

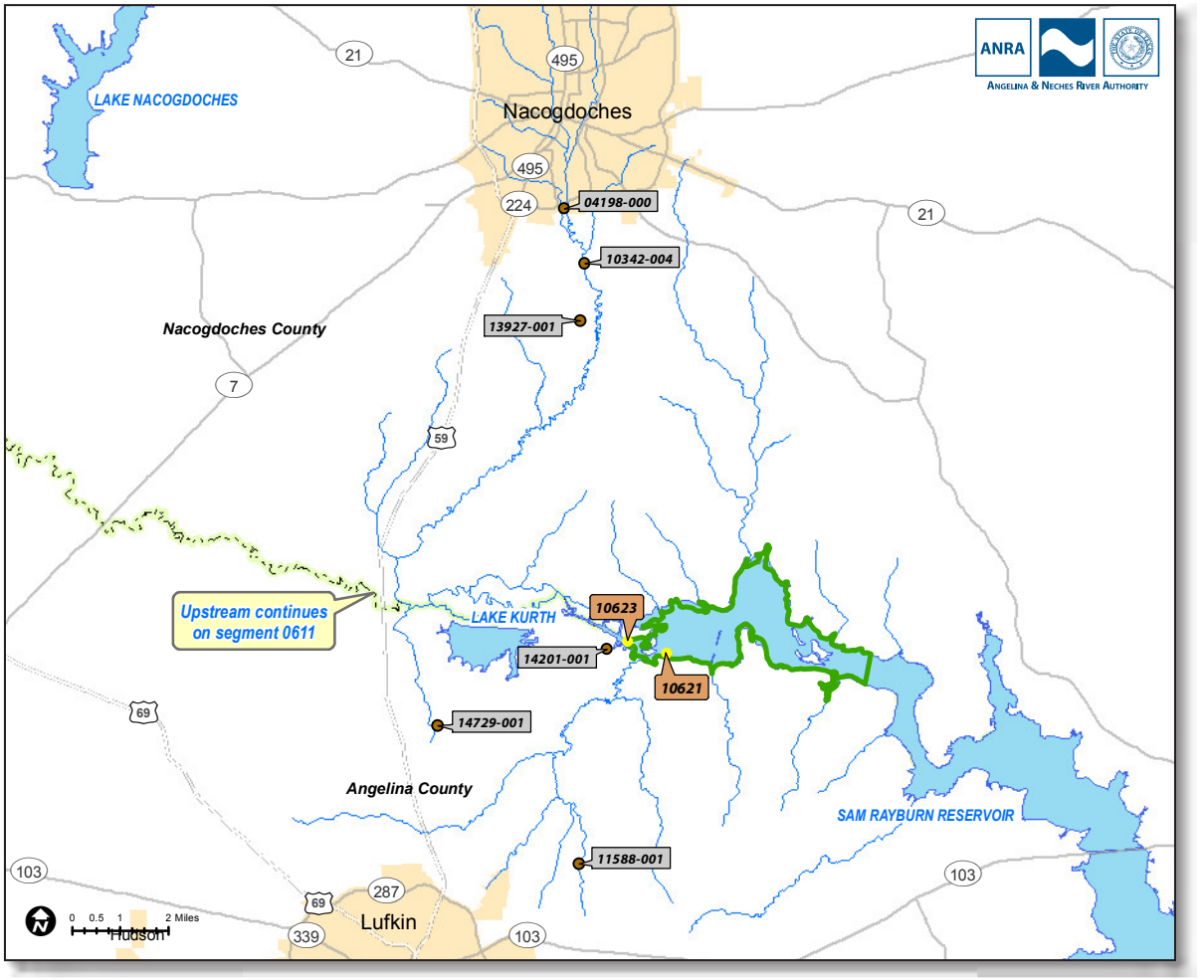
Screening levels and criteria have not been assessed, and limited data exists for this unclassified segment.



Segment 0615 - Angelina River/Sam Rayburn Reservoir

Segment Profile

The riverine portion of Sam Rayburn Reservoir extends from a point 5.6 kilometers (3.5 miles) upstream of Marion's Ferry to a point 2.75 kilometers (1.71 miles) upstream of the confluence of Paper Mill Creek. The segment includes 5,068 acres. The designated uses for this segment include intermediate aquatic life use, contact recreation, general use, and public water supply.



Monitoring Stations on Segment 0615

Station ID	Station Name	Collecting Agency	Frequency	Parameters
10621	Sam Rayburn Reservoir Angelina River, downstream of confluence with Paper Mill Creek Lower Channel	TCEQ	Quarterly	Field, Conventionals, Bacteria, Metals in Water
10623	Sam Rayburn Reservoir at the confluence of the Angelina River 0.75 km NW of Paper Mill Creek	TCEQ	Quarterly	Field, Conventionals, Bacteria, Metals in Water

Segment 0615 - Angelina River/Sam Rayburn Reservoir

Impairments and Concerns

There are two areas on Segment 0615 that are listed on the 303 (d) list. Those areas are listed in the table to the right.

Impairments on Segment 0615 Listed on the 303 (d) List

Assessment Unit	*Description*	*Reason*	*Category*	*Year Listed*
0615_01	Upstream of Paper Mill Creek	Depressed Dissolved Oxygen Mercury in edible fish tissue	5c 5c	2002 2002
0615_02	Downstream of Paper Mill Creek	Depressed Dissolved Oxygen Impaired fish community Mercury in edible fish tissue Bacteria	5c 5c 5c 5c	2002 2002 2002 2006

STATION 10621
Sam Rayburn Near Confluence
Downstream of Paper Mill Creek Confluence

Water Quality Parameters

pH values were within the range of 6.5 to 8.1 S.U., with a mean of 7.34 S.U. (n = 39).

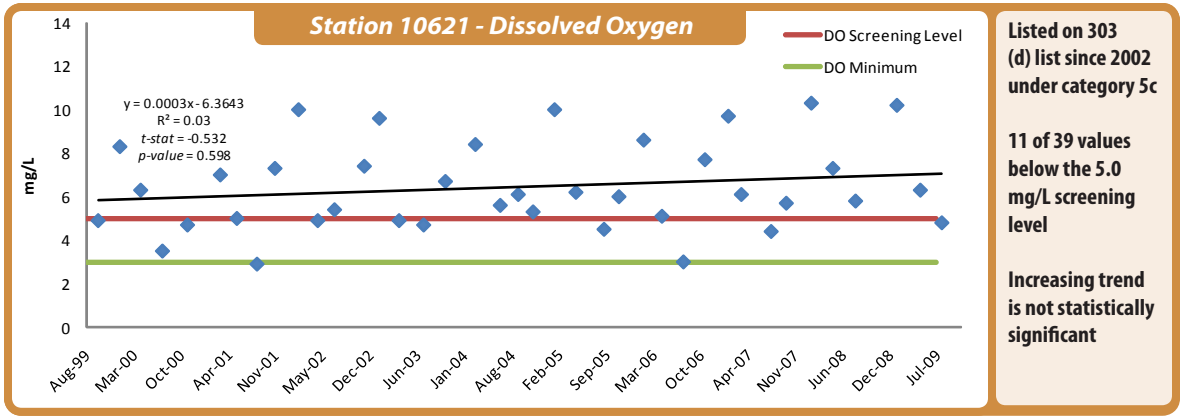
Dissolved Oxygen (DO) values ranged from 2.9 - 10.3 mg/L, with a mean of 6.42 mg/L (n = 39). This station is listed on the 303 (d) list for depressed DO, Currently under category 5c, it was first listed in 2002. DO levels appear to be increasing, which is beneficial for the aquatic life.

***E. coli* bacteria** reported values ranged from 10 to >4800 MPN/100 mL with a geometric mean of 132.3, which exceeds the criteria. Of the single grab samples, 5 of 29 samples (17.2%) exceeded the criteria.

Total Suspended Solids (TSS) results ranged from 4 to 115 mg/L, with a mean of 22.6 mg/L (n = 39).

Total Dissolved Solids (TDS) results were reported in a range of 122 to 842 mg/L, with a mean of 252 mg/L (n = 38). The criteria of 500 mg/L was exceeded 4 times. A decreasing trend was observed. Since 2004, all values except one have been below 200 mg/L.

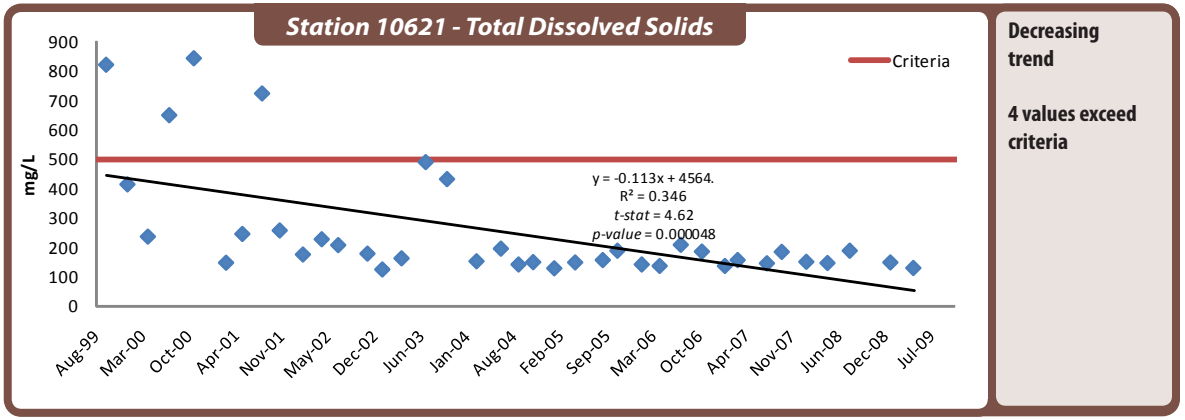
Ammonia-Nitrogen concentrations ranged from <0.05 to 0.92 mg/L as N, with a mean of 0.13 mg/L as N (n = 39). The criteria of 0.11 mg/L as N was exceeded 9 times (23.1%). A statistically significant decreasing trend was observed.



Listed on 303 (d) list since 2002 under category 5c

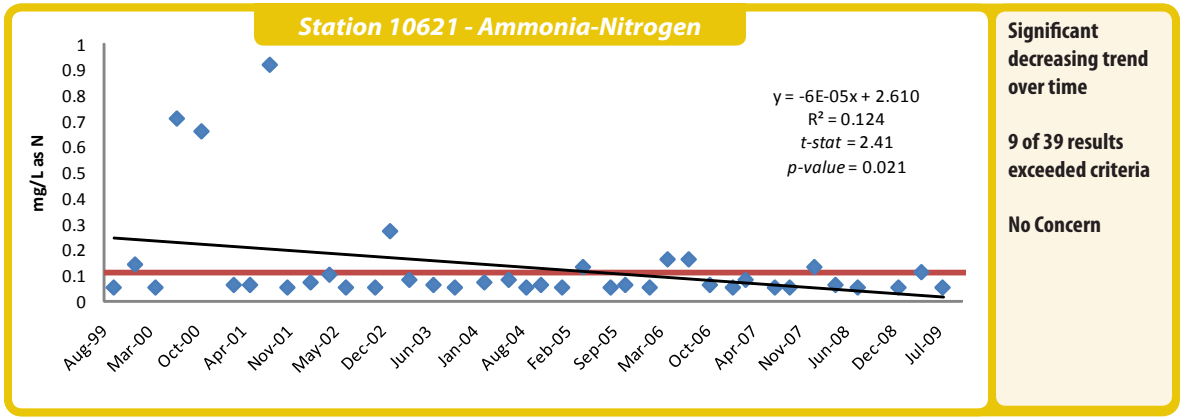
11 of 39 values below the 5.0 mg/L screening level

Increasing trend is not statistically significant



Decreasing trend

4 values exceed criteria



Significant decreasing trend over time

9 of 39 results exceeded criteria

No Concern

Water Quality Parameters (continued)

Nitrate+Nitrite-Nitrogen results ranged from <0.05 to 1.81 mg/L as N, with a mean of 0.39 mg/L as N (n = 39). The criteria of 0.37 mg/L as N was exceeded 14 times (35.9%). A decreasing trend was found to occur.

Orthophosphorus values ranged from <0.04 to 0.49 mg/L as P, with a mean of 0.09 mg/L as P. The criteria of 0.05 mg/L as P was exceeded 15 times (40.5% of samples), while results were reported as less than the method reporting limit for 21 of 37 samples (56.8%).

Total Phosphorus concentrations ranged from <0.06 to 0.75 mg/L as P, with a mean of 0.20 mg/L as P (n = 38). The criteria was exceeded 14 times (36.8% of results). A statistically significant downward trend is observed.

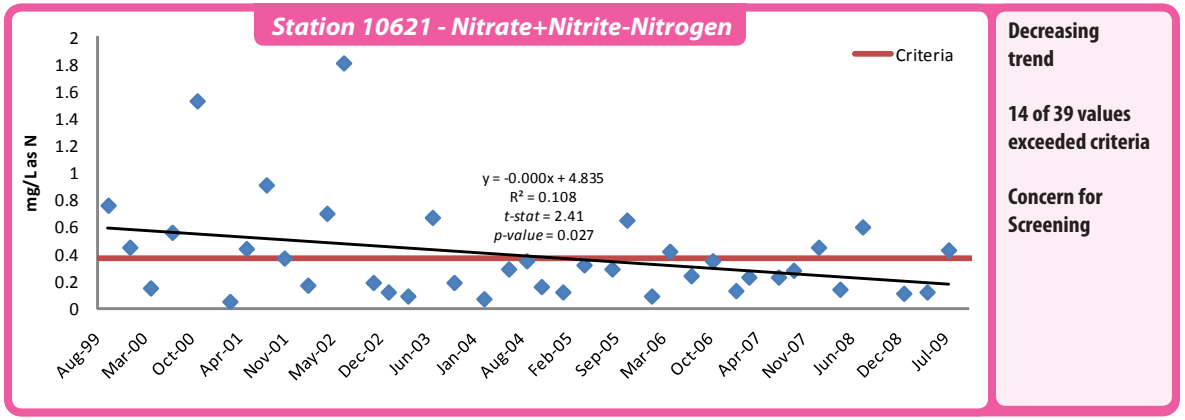
Chlorophyll-*a* values ranged from <1 to 22.3 ug/L (n = 38).

Additional Water Quality Parameters

Conductivity measurements showed a significant reduction over time. Values ranged from 105 up to 1268 umhos/cm, with a mean of 347 umhos/cm (n = 39). All values since 2004 have been less than 500 umhos/cm. The trend with the conductivity data reflects the same trend observed with TDS.

Chloride results displayed a significant decreasing trend over time (*t-stat* = 3.95, *p-value* = 0.0003). Results ranged from 8 - 186 mg/L, with a mean of 38 mg/L (n = 39). The criteria of 150 mg/L was exceeded 3 times, with all exceedances occurring in 1999 and 2000.

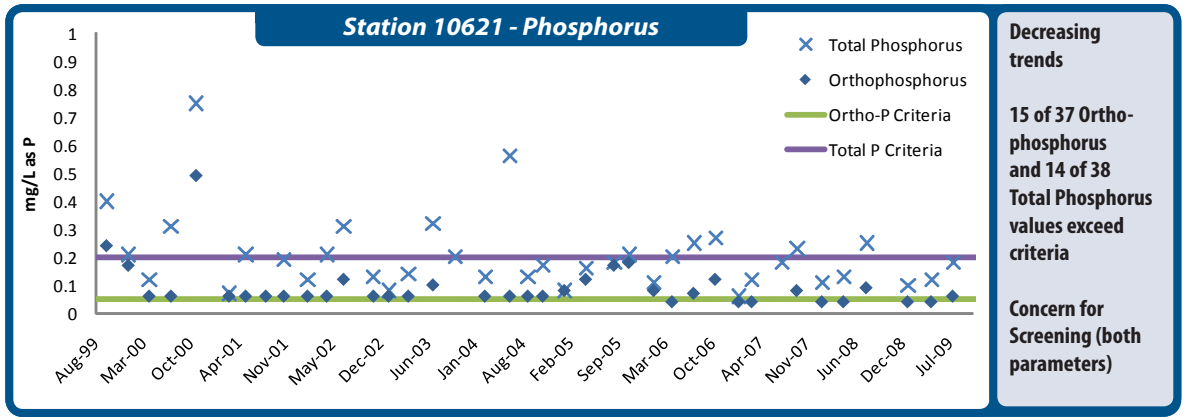
Sulfate values ranged from 15 to 205 mg/L, with a mean of 50.4 mg/L (n = 39). The criteria of 100 mg/L was exceeded 5 times (12.8% of samples), with all exceedances occurring prior to 2004. The results showed a significant decreasing trend over time.



Decreasing trend

14 of 39 values exceeded criteria

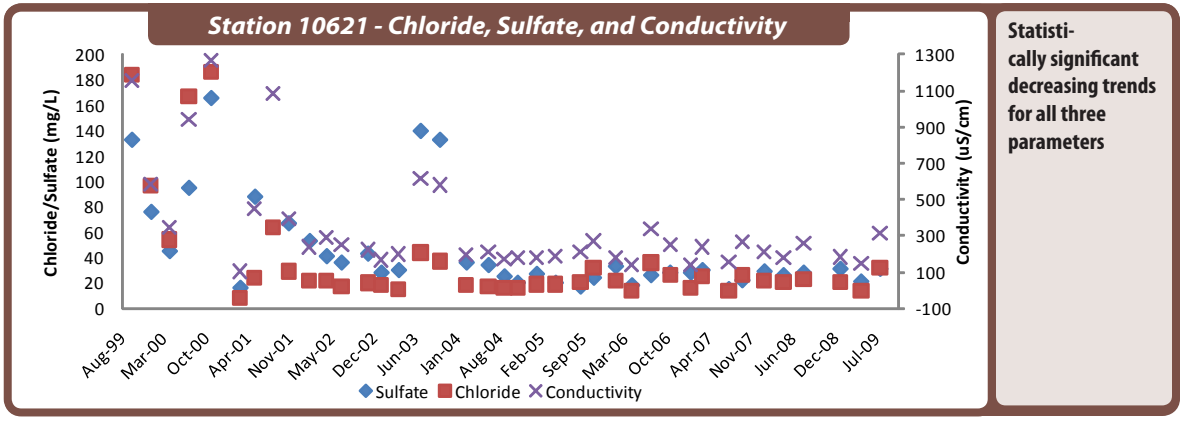
Concern for Screening



Decreasing trends

15 of 37 Orthophosphorus and 14 of 38 Total Phosphorus values exceed criteria

Concern for Screening (both parameters)



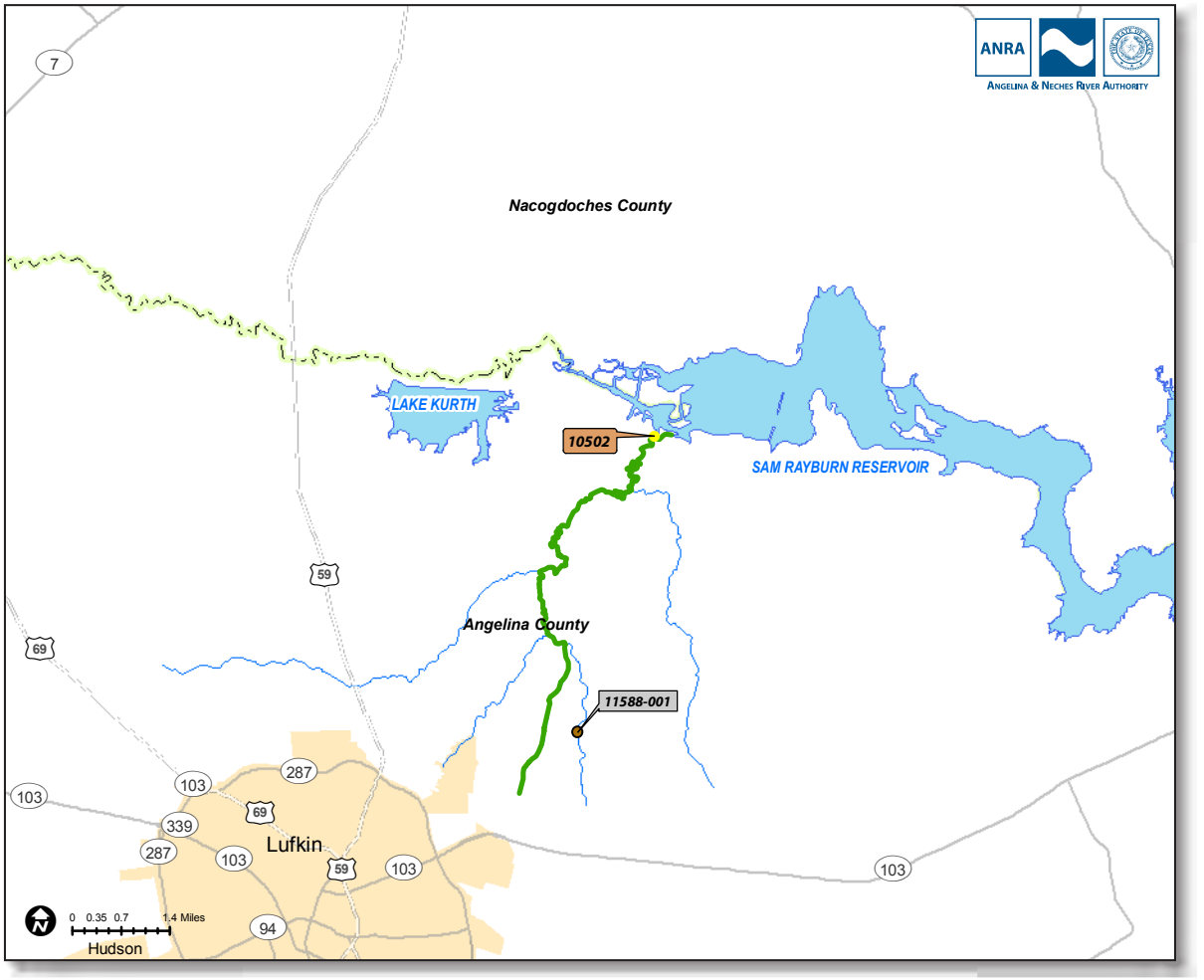
Statistically significant decreasing trends for all three parameters

Segment 0615A - Paper Mill Creek (unclassified water body)

Segment Profile

This segment includes a total of 9 miles from the confluence of Sam Rayburn Reservoir (Angelina River Arm) northeast of Lufkin in Angelina County to the upstream perennial portion of the stream in Lufkin in Angelina County. The designated uses for this segment include aquatic life, general, and contact recreation use.

A definite improvement in water quality in this segment is observed beginning in 2004, as evidenced by significant decreases in nutrient loading (ammonia, nitrate+nitrite, and phosphorus), decreases in TDS, conductivity, sulfate, and chloride, and increases in dissolved oxygen levels. This improvement in the water quality coincides with the closure of Abitibi Paper Mill. While this improvement is also evident in Segment 0615 (Angelina River/Sam Rayburn riverine portion) and Segment 0610 (Sam Rayburn Reservoir), it is most clearly observed in this segment, which was the receiving waters for Abitibi's wastewater discharge.



Monitoring Stations on Segment 0615A

Station ID	Station Name	Collecting Agency	Frequency	Parameters
10502	Paper Mill Creek Above Angelina River	TCEQ	Quarterly	Field, Conventionals, Bacteria, Color

STATION 10502
Paper Mill Creek Above Angelina River
Upstream of Angelina River Confluence

Water Quality Parameters

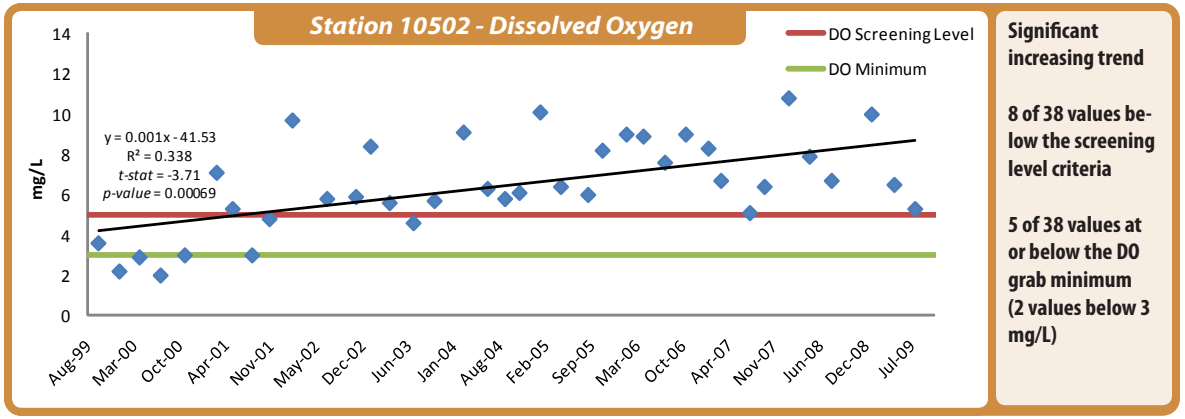
pH values ranged from 6.6 to 8.8 S.U., with a mean of 7.6 S.U. (n = 38).

Dissolved Oxygen (DO) values ranged from 2 to 10.8 mg/L (n = 38). Eight values (21%) were below the screening criteria, with 5 values at or below the DO grab minimum. A significant increasing trend was found, indicating an improvement in water quality.

***E. coli* bacteria** reported values ranged from 20 - 4840 MPN/100 mL (n = 28), with 7 values exceeding the criteria. The geometric mean was 191 MPN/100 mL, which exceeds the 126 MPN/100 mL criteria for contact recreation. A statistically significant trend was observed.

Total Suspended Solids (TSS) results ranged from 5 to 132 mg/L (n = 39), with a mean of 22.6 mg/L and no significant trend.

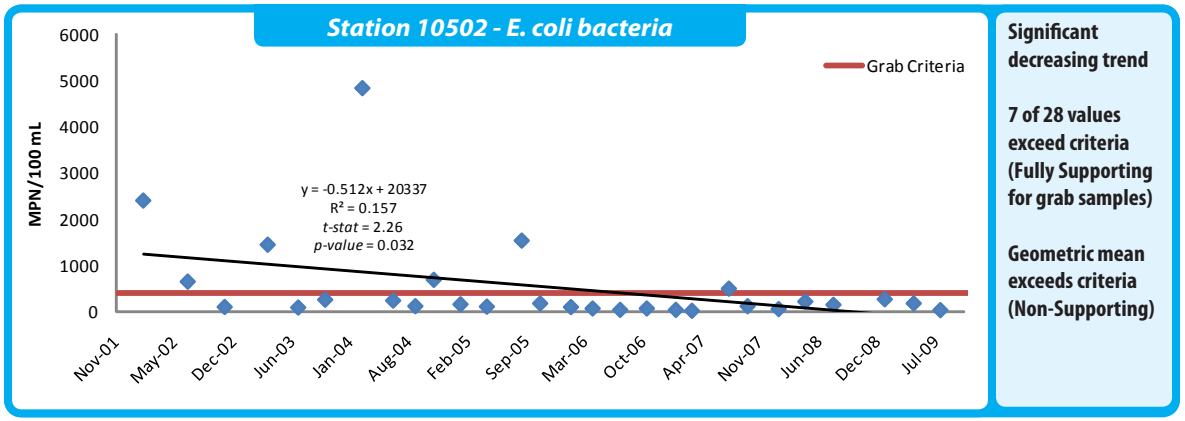
Total Dissolved Solids (TDS) results ranged from 86 to 2380 mg/L (n = 38), with a mean of 668 mg/L. The data showed a significant downward trend and a noticeable reduction in TDS values beginning in 2004.



Significant increasing trend

8 of 38 values below the screening level criteria

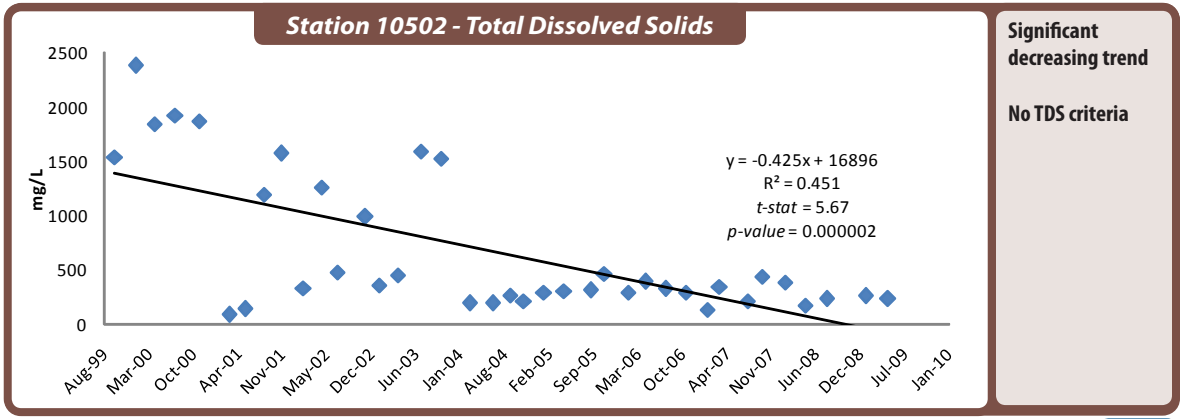
5 of 38 values at or below the DO grab minimum (2 values below 3 mg/L)



Significant decreasing trend

7 of 28 values exceed criteria (Fully Supporting for grab samples)

Geometric mean exceeds criteria (Non-Supporting)



Significant decreasing trend

No TDS criteria

Water Quality Parameters (continued)

Ammonia-Nitrogen values ranged from <0.05 to 3.4 mg/L as N, with a mean of 0.41 mg/L as N. The criteria of 0.33 mg/L as N was exceeded for 7 of 39 samples (17.9%). Ammonia levels displayed a decreasing trend over time.

Nitrate+Nitrite-Nitrogen data ranged from <0.05 to 8.63 mg/L as N (n = 39), with the criteria of 1.95 mg/L as N being exceeded twice. There was a significant decreasing trend observed (*t-stat* = 2.13, *p-value* = 0.04).

Orthophosphorus values ranged from <0.04 to 0.9 mg/L as P (n = 38). The criteria of 0.37 mg/L as P was exceeded 11 times (28.9%), and a decreasing trend was observed (*t-stat* = 2.06, *p-value* = 0.046). This is a concern for screening.

Total Phosphorus concentrations range from <0.05 to 7.17 mg/L as P, with a mean of 0.58 mg/L as P (n = 38). The criteria of 0.69 mg/L as P was exceeded 5 times (13% of results). A decreasing trend was observed (*t-stat* = 2.02, *p-value* = 0.05).

Chlorophyll-*a* values exceeded criteria twice, with results ranging from <1 to 50.7 ug/L (n = 38).

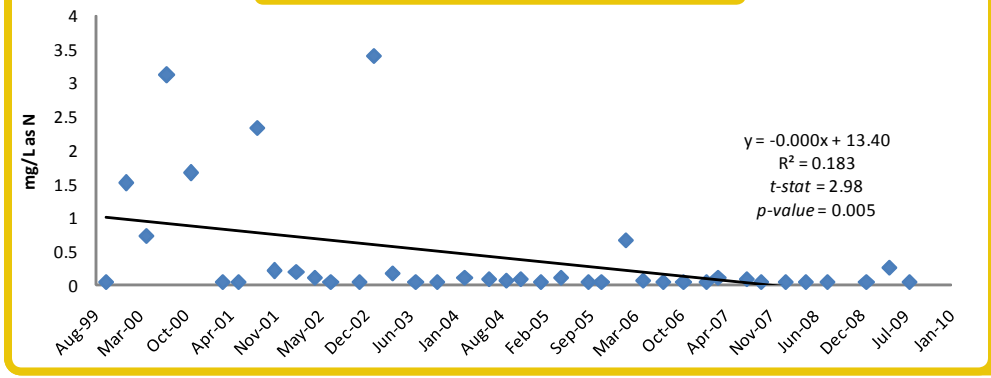
Additional Water Quality Parameters

Conductivity values were reported in the range of 104 to 3381 umhos/cm (n = 38). A decreasing trend was observed (*t-stat* = 5.51, *p-value* = 0.000003). A noticeable reduction in conductivity is observed starting in 2004. The conductivity trend matched the trend observed with TDS.

Chloride levels ranged from 8 - 592 mg/L (n = 39), with a decreasing trend observed.

Sulfate levels ranged from <1 to 646 mg/L, with a mean of 152 mg/L (n = 39). A statistically significant decreasing trend was observed, with a noticeable decrease in sulfate concentrations beginning in 2004.

Station 10502 - Ammonia-Nitrogen

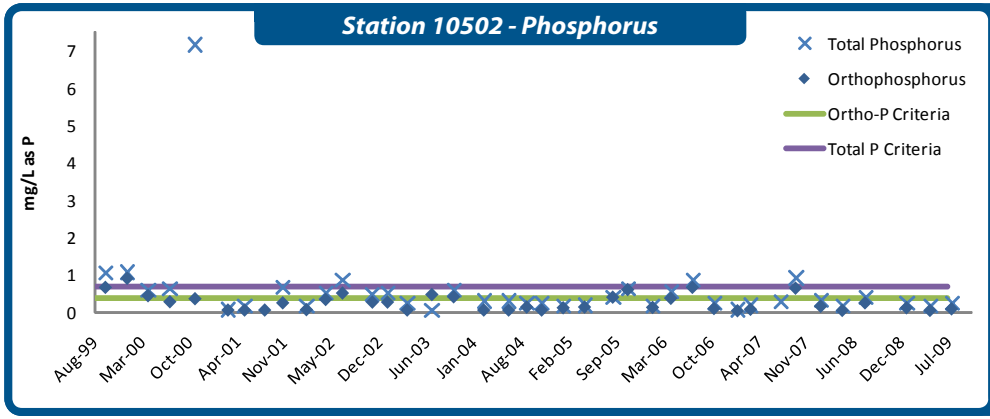


Significant decreasing trend

7 of 39 samples exceed criteria

No Concern

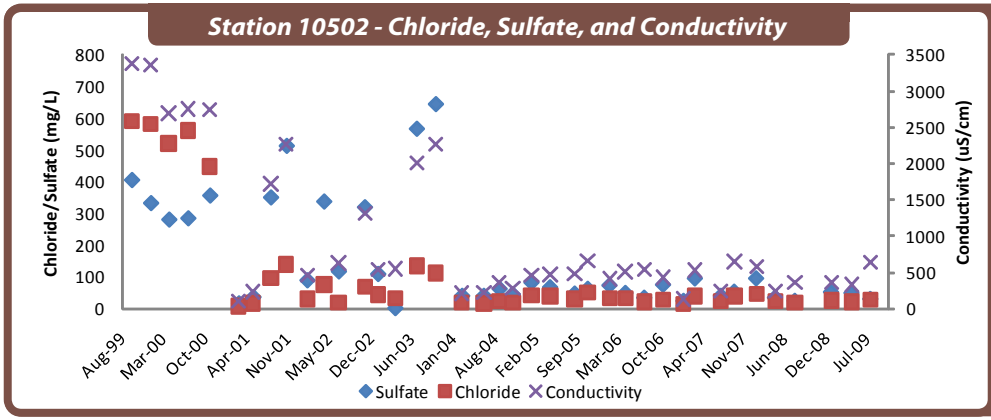
Station 10502 - Phosphorus



11 of 38 orthophosphorus and 5 of 38 Total Phosphorus values exceeded criteria

Both parameters exhibited a statistically significant decreasing trend

Station 10502 - Chloride, Sulfate, and Conductivity



Decreasing trends for all three parameters

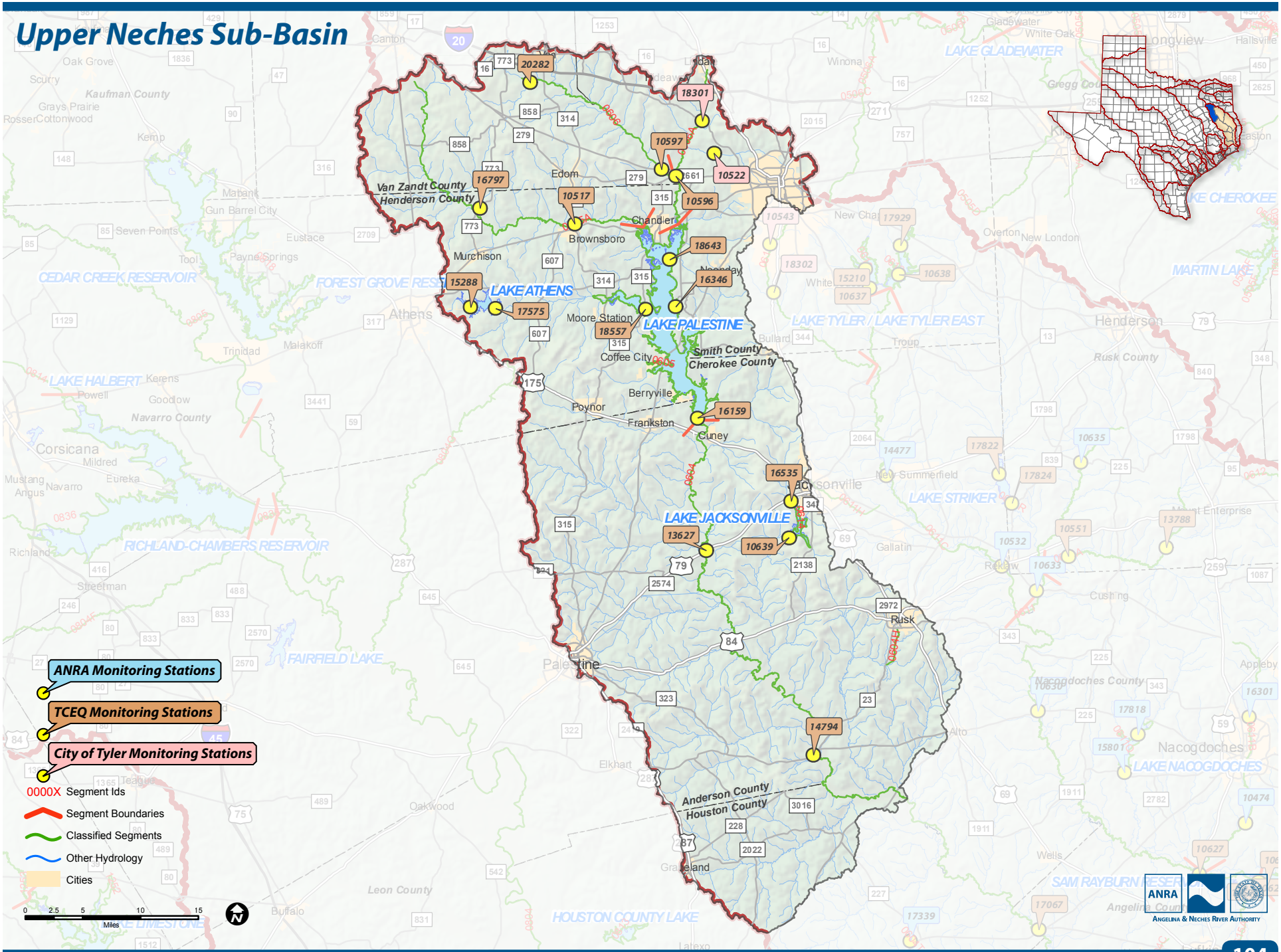
Summary for the Lower Angelina Sub-Basin

Water Quality Issues Summary for the Lower Angelina Sub-Basin				
Water Quality Issue	***Affected Area***	***Possible Influences/Causes***	***Possible Effects***	***Possible Solutions/Actions Taken***
Mercury in edible fish tissue	Since 1996, Sam Rayburn Reservoir has been listed on the 303 (d) list	• Atmospheric deposition • Unknown sources	• Causes serious health concerns that affect the public, including children and pregnant women • Bioaccumulation over years of consumption is threatening; fishing is primary use of water	• Post health advisories around area to publicize health risks associated with consumption of methylated mercury in fish tissue • Enforce strict limitations on air permits • Ensure safe disposal of mercury-containing products for the general public
Elevated bacteria levels; Listed on 2008 303 (d) list due to impairments	Segment 0610A Ayish Bayou Segment 0611 Angelina River above Sam Rayburn from US 84 to lower boundary Segment 0611B La Nana Bayou (mouth to SH7) Segment 0612 Attoyac Bayou	• Agricultural activities including cattle farming and poultry activities within the area may induce non-point source pollution via runoff • Point source municipal discharge • Unknown	• Risk for contact recreation • Bacterial loading from agriculture runoff not reduced by instream flow	• Track source for bacterial contamination and monitor flow conditions • A multi-partner extensive 3-year study of Attoyac Bayou funded by TSSWCB will assess bacterial and nutrient levels, develop load duration curves, perform bacterial source tracking, complete a UAA, and develop a watershed protection plan
Significant decreasing trend of dissolved oxygen levels	Observed at two stations at Sam Rayburn Reservoir (SH 147; SH 103)	• Aquatic invasive plants (Giant Salvinia)	• Detrimental to aquatic community	• Increased enforcement of boating activities to control spread of invasive plants • Solutions to invasive plants (i.e. weevil) and continued monitoring to determine if treatment is valid
Significant decreasing trend of nitrate-nitrite, total phosphorus, and chloride levels	Several stations at Sam Rayburn Reservoir	• Closure of Abitibi Paper Mill has reduced the nutrient loading entering the reservoir • Efficient On-site Sewage Facilities (OSSF) program around Sam Rayburn	• Decreases in excess nutrient loading for vegetation community	• Continued monitoring

Summary for the Lower Angelina Sub-Basin

Water Quality Issues Summary for the Lower Angelina Sub-Basin (continued)				
Water Quality Issue	***Affected Area***	***Possible Influences/Causes***	***Possible Effects***	***Possible Solutions/Actions Taken***
Concerns for screening nutrient Ammonia-Nitrogen	Segment 0612 Attoyac Bayou: Station upstream and downstream display increasing ammonia trends, Middle Station displays decreasing ammonia trends. All trends are statistically significant Sam Rayburn Reservoir: Two stations display increasing trends and one station displays decreasing trend. All trends mentioned were statistically significant Segment 0610A Ayish Bayou	• Unknown • Non-point source • Point Source Municipal Discharge	• Excess ammonia levels may be harmful to aquatic community	• Continued monitoring • Determination of source • Stricter enforcement of effluent permit discharge limits
Decreasing nutrient trends for Nitrate-nitrite, phosphorus, chlorides, and sulfates	Segment 0610A Ayish Bayou	• Unknown	• Decreased excess nutrient loading in waterbody • Beneficial to biotic community	• Continued monitoring

Upper Neches Sub-Basin



Population

The counties included within the sub-basin are as followed: Van Zandt, Smith, Cherokee, Houston, Anderson, Henderson, and Smith. The following cities lie partially or wholly within the sub-basin: Van, Edom, Murchison, Brownsboro, Noonday, Chandler, Moore Station, Coffee City, Berryville, Cuney, Frankston, Poynor, Palestine, Jacksonville, Grapeland, Alto, Rusk, and Bullard. Lake Athens, Lake Palestine, and Lake Jacksonville are major reservoirs located within the sub-basin. There is an estimated population of 421,076 encompassing all counties within the watershed.

Land Characteristics and Use

Vegetation within the sub-basin includes willow-oak water-oak blackgum, post-oak woods, grassland mosaic, and forest. Land use coverage includes hay, pasture, mixed forest, woody wetland, deciduous forest, and cultivated crops. In the southern portion, evergreen, deciduous, and mixed forest dominate the region. Within the Lake Palestine area, there is developed open space, mixed forest, and hay/ pasture. Floodplains and low terraces (South Central Plains), northern post oak savanna (East Central Plains), and tertiary uplands (South Central Plains) are the major Ecoregions located in the sub-basin.

Average annual precipitation is 42 inches. The Carrizo-Wilcox aquifer supplies water to this area.

USDA 2007 Census Agricultural data indicates that all the counties within the sub-basin have increased the number of farms since 2002. The net change has ranged from a 2 - 17% increase in number of farms for every county from 2002 to 2007. Although the number of farms has increased, the average size of farms has decreased in acreage during the same timeframe. Van Zandt county has 101,448 heads of cattle and calves and has approximately 3,675 acres in nursery, greenhouse, and floriculture activities. Henderson county has 64,535 heads of cattle and calves. Smith county has 55,302 heads of cattle and calves and 5,607 horses and ponies. Within Anderson county, there are 59,917 heads of cattle and calves and an undisclosed amount of pigs and hogs (pigs and hogs rank 6 in state for livestock item). Cherokee county has 62,691 heads of cattle and calves and 1,657,888 broilers and other meat-type chickens. Houston county has 83,943 cattle and calves, and a large quantity of sheep and lamb with data not disclosed.

Segments included in the Upper Neches Sub-Basin

Segment ID	*Segment Name*	*Length or Acreage*
0604	Neches River Below Lake Palestine	231 Miles
0604H	One Eye Creek (unclassified water body)	9.4 Miles
0605	Lake Palestine	23,500 Acres
0605A	Kickapoo Creek (unclassified water body)	42.6 Miles
0606	Neches River Above Lake Palestine	27 Miles
0606A	Prairie Creek (unclassified water body)	13 Miles
0614	Lake Jacksonville	1,320 Acres

Permitted Discharges

There are thirty permitted discharges included in the Upper Neches sub-basin.

Permitted Discharges in the Upper Neches Sub-Basin

Segment ID	Permit Number	Outfall Number	NPDES Number	Permittee	County	TCEQ Region	Map Location
0604	10181-002	001	055239	City of Grapeland	Houston	10 - Beaumont	Page 108
0604	10441-001	001	033456	City of Frankston	Anderson	05 - Tyler	Page 108
0604	10447-001	001	054399	City of Rusk	Cherokee	05 - Tyler	Page 108
0604	11787-001	001	071188	City of Bullard	Cherokee	05 - Tyler	Page 108
0604	13538-001	001	105902	La Poyner ISD	Henderson	05 - Tyler	Page 108
0604	13728-001	001	112593	City of Cuney	Cherokee	05 - Tyler	Page 108
0605	03897-000	001	112992	Texas Parks & Wildlife Department and Athens Municipal Water Authority	Henderson	05 - Tyler	Page 112
0605	10540-001	001	062707	City of Brownsboro	Henderson	05 - Tyler	Page 112
0605	11012-001	001	033499	City of Chandler	Henderson	05 - Tyler	Page 112
0605	13972-001	001	072087	City of Murchison	Henderson	05 - Tyler	Page 112
0605	14079-001	001	118273	Southern Utilities Company	Cherokee	05 - Tyler	Page 112
0605	14080-001	001	118362	Southern Utilities Company	Smith	05 - Tyler	Page 112
0606	01590-000	001	001449	Delek Refining Limited	Smith	05 - Tyler	Page 122
0606	01590-000	002	001449	Delek Refining Limited	Smith	05 - Tyler	Page 122
0606	01590-000	003	001449	Delek Refining Limited	Smith	05 - Tyler	Page 122
0606	01590-000	004	001449	Delek Refining Limited	Smith	05 - Tyler	Page 122
0606	01590-000	005	001449	Delek Refining Limited	Smith	05 - Tyler	Page 122
0606	01590-000	006	001449	Delek Refining Limited	Smith	05 - Tyler	Page 122
0606	01590-000	007	001449	Delek Refining Limited	Smith	05 - Tyler	Page 122
0606	01590-000	008	001449	Delek Refining Limited	Smith	05 - Tyler	Page 122
0606	01590-000	009	001449	Delek Refining Limited	Smith	05 - Tyler	Page 122
0606	01590-000	010	001449	Delek Refining Limited	Smith	05 - Tyler	Page 122
0606	01590-000	011	001449	Delek Refining Limited	Smith	05 - Tyler	Page 122
0606	01590-000	012	001449	Delek Refining Limited	Smith	05 - Tyler	Page 122
0606	10376-001	001	054071	City of Van	Van Zandt	05 - Tyler	Page 122
0606	10412-002	001	105066	City of Lindale	Smith	05 - Tyler	Page 122
0606	10653-001	001	047996	City of Tyler	Smith	05 - Tyler	Page 122
0606	13905-001	001	118591	Ben Wheeler WSC	Van Zandt	05 - Tyler	Page 122
0606	13974-001	001	065650	Ben Wheeler WSC	Van Zandt	05 - Tyler	Page 122
0606	13974-002	001	070548	Ben Wheeler WSC	Van Zandt	05 - Tyler	Page 122

Texas Surface Water Quality Standards (2008) Criteria

Numeric and Screening Level Criteria for Specified Uses for the Upper Neches Sub-Basin

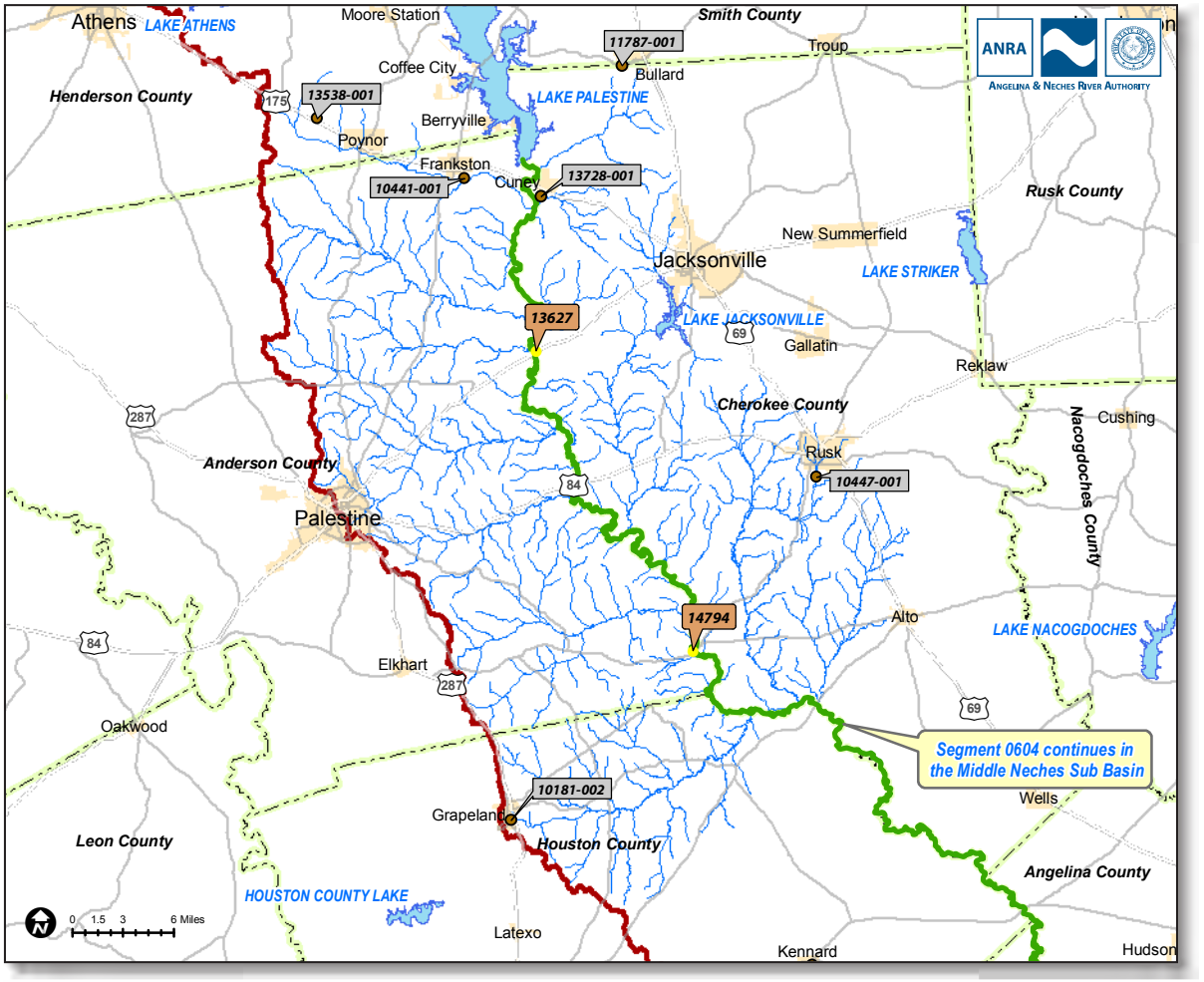
Segment ID	*Assigned Use*	*Screening Levels for Specified Use*
604	General Use	Ammonia: 0.33 mg/L, Chlorophyll-a: 14.1 ug/L, Nitrate: 1.95 mg/L, Orthophosphorus: 0.37 mg/L, Total Phosphorus: 0.69 mg/L, Temperature: 32.8C/ 91 F
	Public Water Supply	Chloride: 50 mg/L, Sulfate: 50 mg/L, TDS: 200 mg/L, pH: 6-8.5
	Contact Recreation Use	E. *coli* geomean: 126 MPN/ 100 ml, E. *coli* single sample: 394 MPN/ 100 ml
	High Aquatic Life Use	DO screening level: 5.0 mg/L, DO grab minimum: 3.0 mg/L, DO 24-hour minimum: 3.0 mg/L, DO 24-hour average: 5.0 mg/L
0604H	General Use	Ammonia: 0.33 mg/L, Chlorophyll-a: 14.1 ug/L, Nitrate: 1.95 mg/L, Orthophosphorus: 0.37 mg/L, Total Phosphorus: 0.69 mg/L, Temperature: 32.8C/ 91 F
	Aquatic Life Use	DO screening level: 4.0 mg/L, DO grab minimum: 3.0 mg/L
605	General Use	Ammonia: 0.11 mg/L, Chlorophyll-a: 26.7 ug/L, Nitrate: 0.37 mg/L, Orthophosphorus: 0.05 mg/L, Total Phosphorus: 0.20 mg/L, Temperature: 32.20C/ 90 F
	Public Water Supply	Chloride: 50 mg/L, Sulfate: 50 mg/L, TDS: 200 mg/L, pH: 6-8.5
	Contact Recreation Use	E. *coli* geomean: 126 MPN/ 100 ml, E. *coli* single sample: 394 MPN/ 100 ml
	High Aquatic Life Use	DO screening level: 5.0 mg/L, DO grab minimum: 3.0 mg/L, DO 24-hour minimum: 3.0 mg/L, DO 24-hour average: 5.0 mg/L
0605A	General Use	Ammonia: 0.33 mg/L, Chlorophyll-a: 14.10 mg/L, Nitrate: 1.95 mg/L, Orthophosphorus: 0.37 mg/L, Total Phosphorus: 0.69 mg/L
	Recreation Use	E. *coli* geomean: 126 MPN/ 100 mL, E. *coli* single sample: 394 MPN/ 100 mL
	Aquatic Life Use	DO screening level: 3.0 mg/L, DO grab minimum: 2.0 mg/L, DO 24-hour minimum: 2.0 mg/L, DO 24 hour average: 3.0 mg/L
606	General Use	Ammonia: 0.33 mg/L, Chlorophyll-a: 14.1 ug/L, Nitrate: 1.95 mg/L, Orthophosphorus: 0.37 mg/L, Total Phosphorus: 0.69 mg/L, Temperature 35C/ 95F
	Public Water Supply Use	Chloride: 100 mg/L, sulfate: 50 mg/L, TDS: 300 mg/L, pH: 6- 8.5
	Recreation Use	E. *coli* geomean: 126 MPN/ 100 mL, E. *coli* single sample: 394 MPN/ 100 mL
	Aquatic Life Use	DO screening level: 4.0 mg/L, DO grab minimum: 3.0 mg/L, DO 24-hour minimum: 3.0 mg/L, DO 24 hour average: 4.0 mg/L
606A	General Use	Ammonia: 0.33 mg/L, Chlorophyll-a: 14.1 ug/L, Nitrate: 1.95 mg/L, Orthophosphorus: 0.05 mg/L, Total Phosphorus: 0.69 mg/L
	Recreation Use	E. *coli* geomean: 126 MPN/ 100 mL, E. *coli* single sample: 394 MPN/ 100 mL
614	General Use	Ammonia: 0.11 mg/L, Chlorophyll-a: 26.7 ug/L, Nitrate: 0.37 mg/L, Orthophosphorus: 0.05 mg/L, Total Phosphorus: 0.20 mg/L, Temperature: 33.9 C / 93F
	Public Water Supply Use	Chloride: 50 mg/L, Sulfate: 75 mg/L, TDS: 750 mg/L, pH: 6.5- 9.0
	Recreation Use	E. *coli* geomean: 126 MPN/ 100 mL, E. *coli* single sample: 394 MPN/ 100 mL
	High Aquatic Life Use	DO screening level: 5.0 mg/L, DO grab minimum: 3.0 mg/L

Segment 0604 - Neches River Below Lake Palestine

Segment Profile

This 231 miles-long freshwater stream extends from a point immediately upstream of the confluence of Hopson Mill Creek in Jasper/Tyler County to Blackburn Crossing Dam in Anderson/Cherokee County. Contact recreation, public water supply, general, and high aquatic life use are the designated uses for this segment. Segment 0604 spans the Upper, Middle, and Lower Neches Sub-Basins. One the 2008 303 (d) list, one area is from SH 21 to US 84 was listed as impaired due to bacteria and lead in water. The first year this was listed was 2002, under category 5c. In the 2010 Draft Integrated Report, the listing meets the criteria and may be delisted for lead in water.

Neches River



Monitoring Stations on the Upper Portion of Segment 0604				
Station ID	***Station Name***	***Collecting Agency***	***Frequency***	***Parameters***
13627	Neches River at US 79	TCEQ	Quarterly	Field, Conventionals, Bacteria, Flow
14794	Neches River at SH 259	TCEQ	Quarterly	Field, Conventionals, Bacteria, Flow, Metals (water)

STATION 13627
Neches River at US 79
One mile downstream from Railroad Bridge

Water Quality Parameters

pH values ranged from 5.7 to 8.1 S.U., with a mean of 7.05 S.U. (n = 71) A statistically significant increasing trend was found, with one value below criteria.

Dissolved Oxygen (DO) values ranged from 3.9 to 11.3 mg/L, with a mean of 7.8 mg/L (n = 71). Three values were below the screening level criteria.

***E. coli* bacteria** results ranged from 16 to 2400 MPN/100 mL, with a geometric mean of 78.2 MPN/100 mL (n = 39). Two values exceeded the criteria for contact recreation.

Total Suspended Solids (TSS) results ranged from 3 to 44 mg/L., with a mean of 19 mg/L (n = 38).

Total Dissolved Solids (TDS) results ranged from 91 to 197 mg/L, with am mean of 129 mg/L (n = 37). The data showed an increasing trend, but it was not statistically significant.

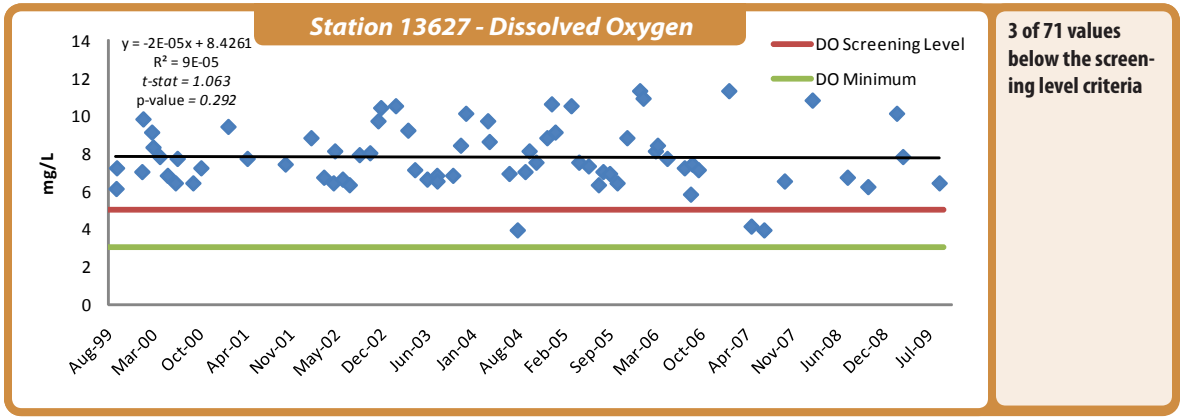
Ammonia-Nitrogen results ranged from <0.05 to 0.17 mg/L as N, with a mean of 0.07 mg/L as N (n = 37). No values exceeded the criteria.

Nitrate+Nitrite-Nitrogen results ranged from <0.04 to 0.53 mg/L as N, with a mean of 0.17 mg/L as N (n = 71). No values exceeded the criteria.

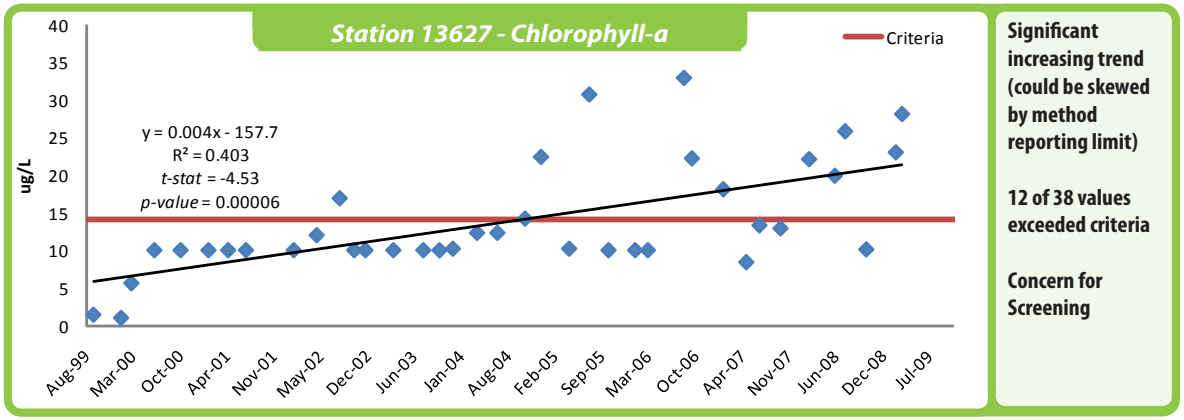
Orthophosphorus values ranged from 0.005 to 0.11 mg/L as P, with a mean of 0.036 mg/L as P (n = 72).

Total Phosphorus results ranged from 0.04 to 0.11 mg/L as P, with a mean of 0.06 mg/L as P (n = 37).

Chlorophyll-*a* values exceeded criteria 12 times (23% of samples), with values ranging from 4.68 - 34.9 ug/L (n = 38). A significant increasing trend was observed.



3 of 71 values below the screening level criteria



Significant increasing trend (could be skewed by method reporting limit)

12 of 38 values exceeded criteria

Concern for Screening

STATION 14794
Neches River at SH 294
Southwest of Rusk

Water Quality Parameters

pH values ranged from 5.9 to 7.5 S.U., with a mean of 7.0 S.U. (n = 36). There was one value that fell below the criteria.

Dissolved Oxygen (DO) values ranged from 4.2 to 11.1 mg/L, with a mean of 8.1 mg/L (n = 36). Two values were below the 5.0 mg/L screening level criteria.

***E. coli* bacteria** results ranged from <1 to 2000 MPN/100 mL (n = 29), with 4 values exceeding the single grab criteria for contact recreation.

Total Suspended Solids (TSS) results ranged from 6 to 78 mg/L, with a mean of 26 mg/L (n = 33).

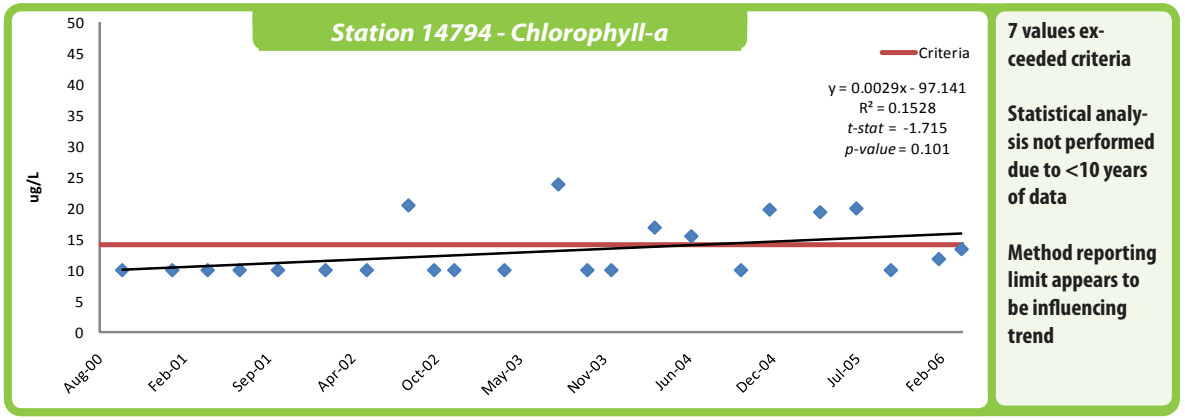
Total Dissolved Solids (TDS) results ranged from 83 to 183 mg/L, with am mean of 130 mg/L (n = 33).

Ammonia-Nitrogen results ranged from <0.05 to 0.09 mg/L as N (n = 34).

Orthophosphorus values ranged from <0.04 to 0.13 mg/L as P (n = 34). No values exceeded the criteria.

Total Phosphorus results ranged from <0.05 to 0.19 mg/L as P (n = 34).

Chlorophyll-*a* values exceeded criteria 7 times (30% of samples), with values ranging from <10 - 23.9 ug/L (n = 23). These exceedances are not currently a concern, but if one more data point exceeded the criteria, this would be a concern for screening.



7 values exceeded criteria

Statistical analysis not performed due to <10 years of data

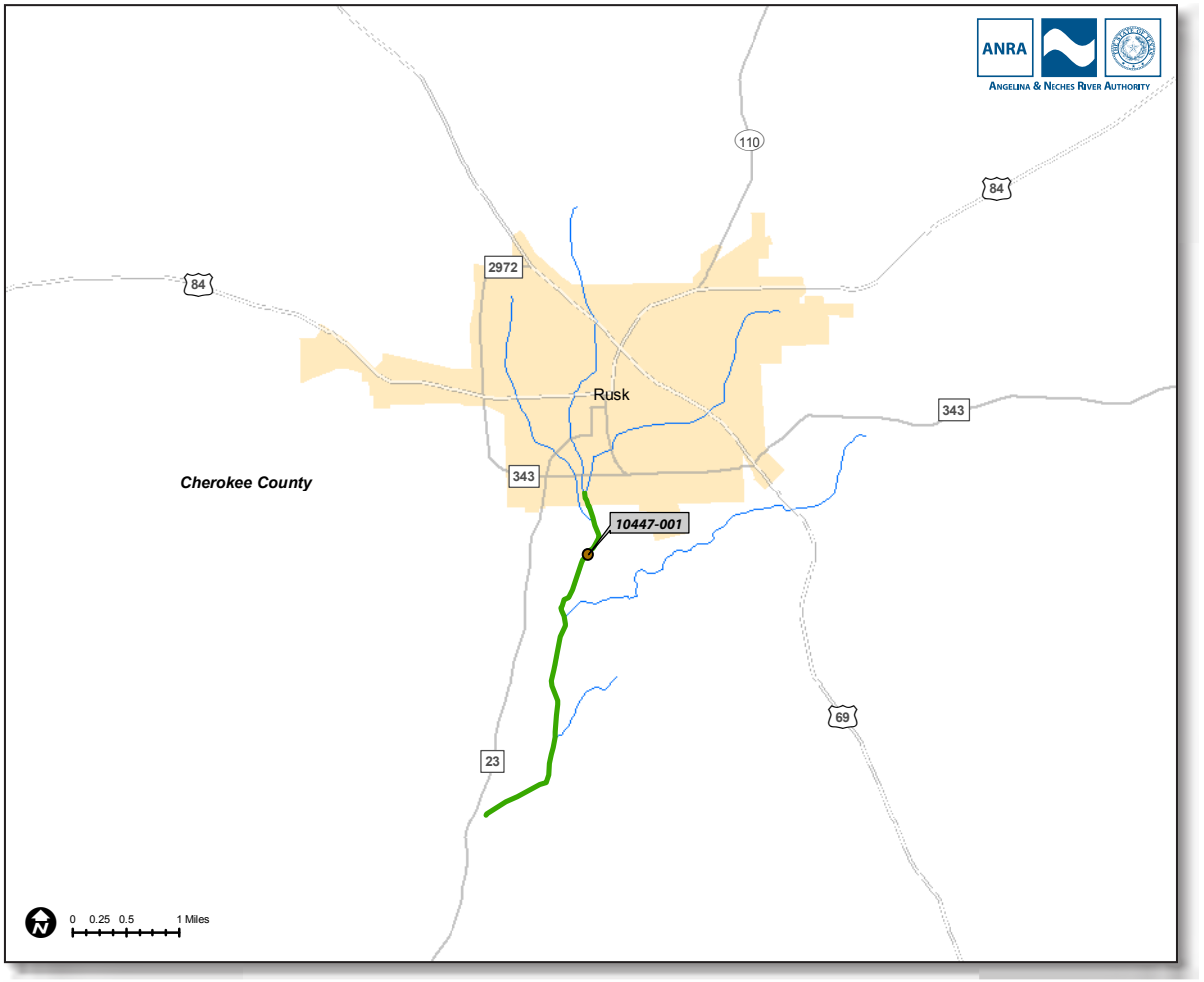
Method reporting limit appears to be influencing trend

Segment 0604H - One Eye Creek (unclassified water body)

Segment Profile

One Eye Creek is a 9.4 mile-length perennial stream from the confluence with Beans Creek southwest of Rusk to the dam at State Hospital Reservoir north of Rusk in Cherokee County.

No monitoring stations on this segment are discussed in the Upper Neches Basin Summary Report. There is not enough data available for the monitoring period discussed in this report for this unclassified segment to be analyzed.



Segment 0605 - Lake Palestine

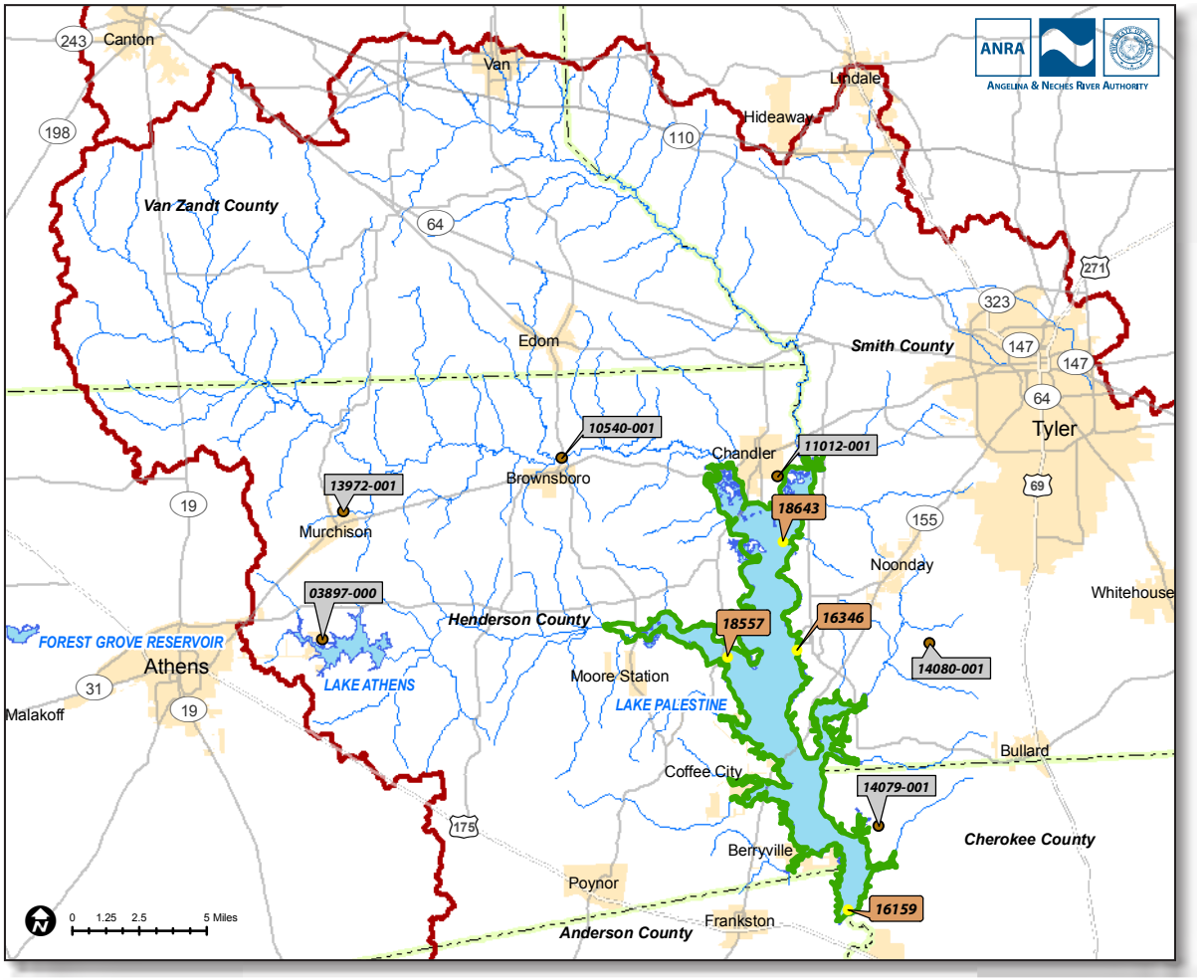
Segment Profile

Lake Palestine is an 23,500-acre reservoir from the Blackburn Crossing Dam in Anderson/Cherokee County to a point 6.7 km (4.2 miles) downstream of FM 279 in Henderson/Smith County, up to normal pool elevation of 345 feet (impounds Neches River). It was impounded in 1962. Designated uses for this segment are general, public water supply, contact recreation, fish consumption, and high aquatic life use.

Lake Palestine is a popular angler site and houses several largemouth bass tournaments annually. Predominate fish species located within the lake include largemouth bass, spotted bass, white and hybrid striped bass, crappie, flathead and channel catfish, and sunfish. Vegetation within the reservoir is moderate in upper end and creek arms, especially near Kickapoo Creek. The upper lake is shallow and has heavy aquatic vegetation. Vegetation may include emergent, floating plants, and native submergent plants (TPWD, 2009).

There are several areas in Lake Palestine listed on the 2008 303 (d) is due to nonsupport of general use and public water supply use for pH levels. The first year listed was 2006. Areas of concern for pH levels are mid-lake near Tyler public water supply intake, flat creek arm, and the upper lake. Based upon the Draft 2010 Integrated Report, there are Chlorophyll-*a* concerns throughout the lake, as well as pH impairments.

The City of Tyler has had complaints on seasonal taste and odor issues since 2004.



Monitoring Stations on Segment 0605

Station ID	Station Name	Collecting Agency	Frequency	Parameters
16159	Lake Palestine at Dam	TCEQ	Quarterly	Field, Conventionals, Bacteria
16346	City of Tyler Raw Water Intake Structure	TCEQ	Metals & Organics 1x, Others Quarterly	Field, Conventionals, Bacteria, Organics (sediment), Metals (sediment)
18557	Lake Palestine in Flat Bay	TCEQ	Metals 1x, Others Quarterly	Field, Conventionals, Bacteria, Metals (sediment)
18643	Lake Palestine Upper East Shore	TCEQ	Metals & Organics 1x, Others Quarterly	Field, Conventionals, Bacteria, Organics (sediment), Metals (sediment)

STATION 16159
Lake Palestine
At Dam

Water Quality Parameters

pH values ranged from 6.5 to 8.7 S.U., with a mean of 7.3 S.U. (n = 42). One value exceeded criteria.

Dissolved Oxygen (DO) values ranged from 1.2 to 11.4 mg/L (n = 42). There were 7 values that were below the 5.0 mg/L screening level (16.7% of results). A decreasing trend is observed, but it is not statistically significant.

***E. coli* bacteria** results ranged from <1 to 20 MPN/100 mL (n = 28).

Total Suspended Solids (TSS) values were consistently low, ranging from 1 to 9 mg/L (n = 39).

Total Dissolved Solids (TDS) results ranged from 85 to 195 mg/L (n = 36).

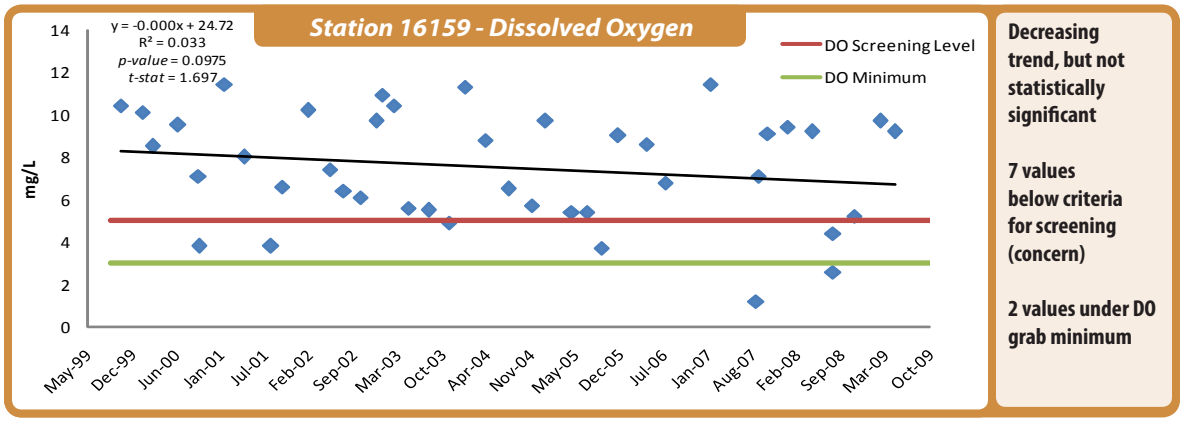
Ammonia-Nitrogen values ranged from <0.05 to 0.34 mg/L as N (n = 37). Seven values exceeded criteria.

Nitrate+Nitrite-Nitrogen results ranged from <0.04 to 0.46 mg/L as N (n = 39). Five values exceeded the criteria, with all exceedances occurring during Fall months (October - December), creating a noticeable pattern.

Orthophosphorus values were all reported as less than the method reporting limit (n = 39).

Total Phosphorus results were low, with a maximum of 0.07 mg/L as P (n = 37).

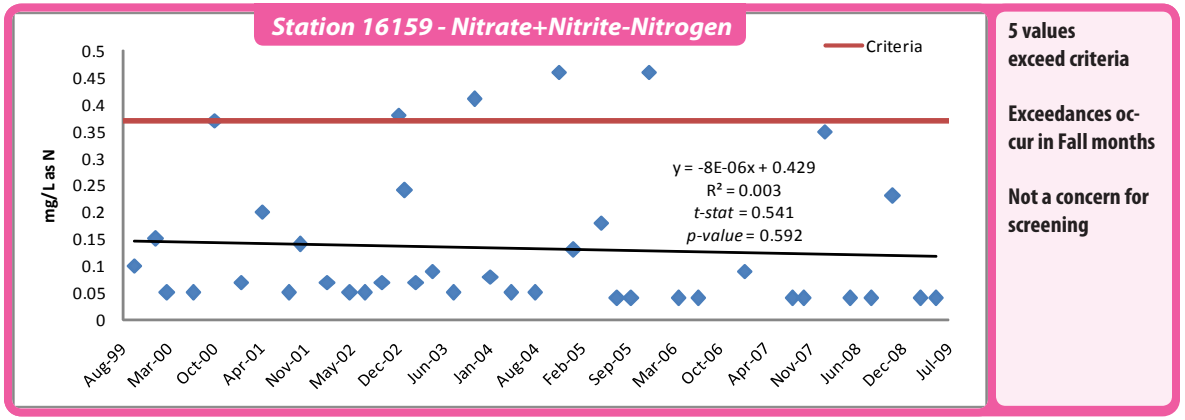
Chlorophyll-*a* values ranged from <1 to 237 ug/L, with a mean of 26.1 ug/L (n = 37). There were 10 exceedances within the 37 data points plotted (27% of results). The data is one exceedance away from being a concern for screening.



Decreasing trend, but not statistically significant

7 values below criteria for screening (concern)

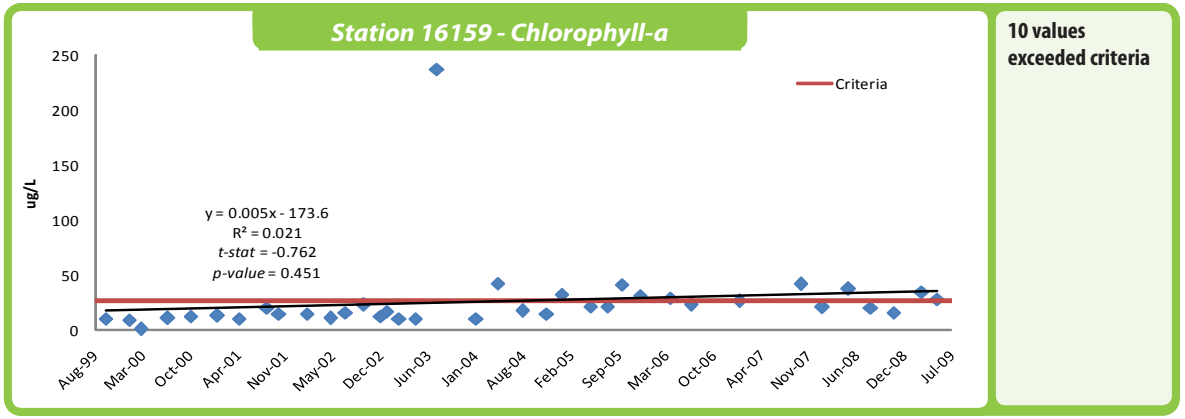
2 values under DO grab minimum



5 values exceed criteria

Exceedances occur in Fall months

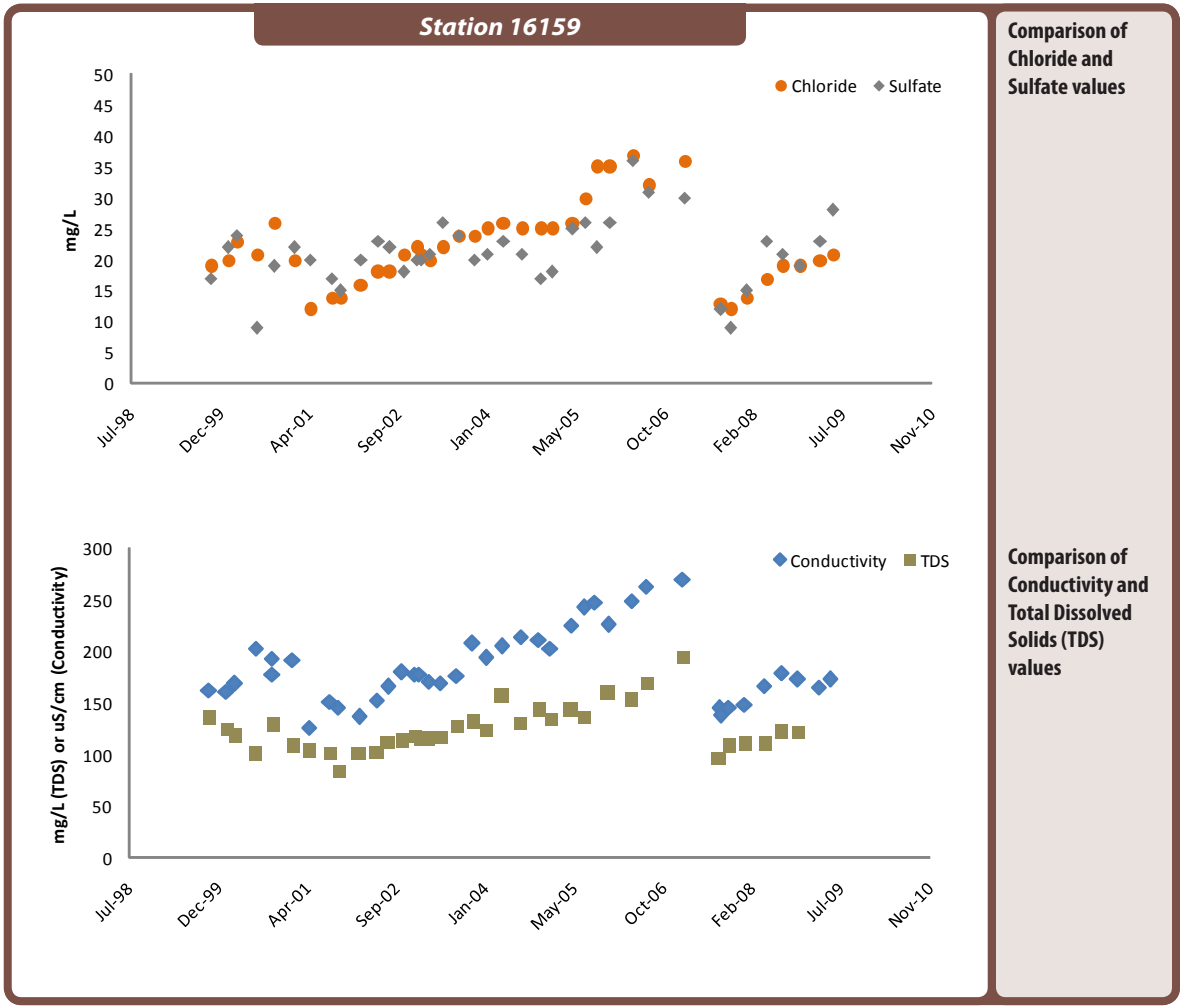
Not a concern for screening



10 values exceeded criteria

Additional Water Quality Parameters

Conductivity, **Chloride**, **Sulfate**, and **Total Dissolved Solids** all displayed a similar trend, with a steady increase in values through late 2006/early 2007, followed by a sharp decline and another gradual increase. Over the evaluation period, there were 42 conductivity measurements, 39 chloride and sulfate results, and 36 total dissolved solids results reported.



Comparison of Chloride and Sulfate values

Comparison of Conductivity and Total Dissolved Solids (TDS) values

STATION 16346
Lake Palestine
City of Tyler Raw Water Intake Structure

Water Quality Parameters

pH values ranged from 6.6 to 9.6 S.U., with a mean of 7.93 S.U. (n = 48) There were 13 exceedances, found mostly during June - November. No significant trend was observed with the data.

Dissolved Oxygen (DO) values ranged from 4.8 to 13.2 mg/L, with a mean of 9.0 mg/L (n = 48). There was 1 value below the screening level.

***E. coli* bacteria** results ranged from <1 to 10 MPN/100 mL (n = 31). This is fully supporting for contact recreation use.

Total Suspended Solids (TSS) results were reported in the range of 4 - 14 mg/L (n = 47).

Total Dissolved Solids (TDS) results displayed a statistically significant increasing trend over time. Values ranged from 74 - 206 mg/L (n = 43, with 2 exceedances.

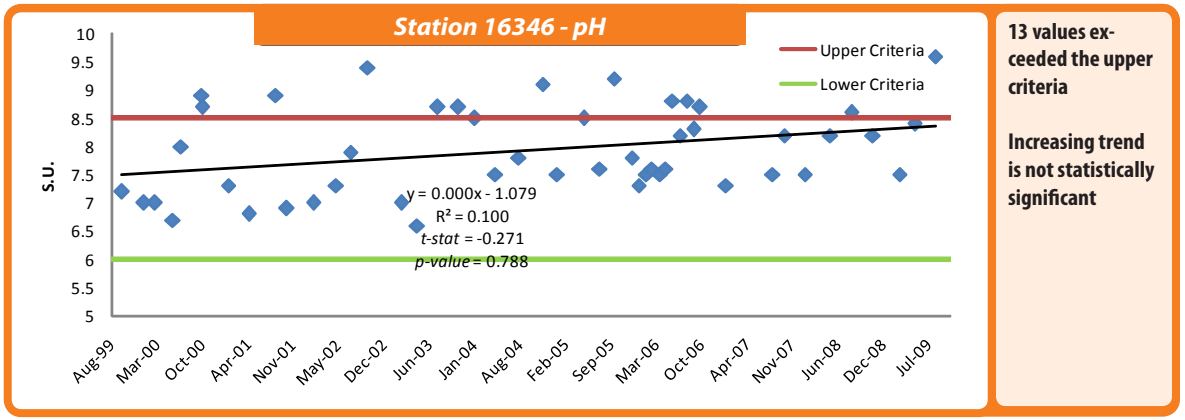
Ammonia-Nitrogen concentrations ranged from <0.05 to 0.22 mg/L as N (n = 46).

Nitrate+Nitrite-Nitrogen results ranged from <0.04 to 0.25 mg/L as N (n = 47).

Orthophosphorus levels had a maximum value of 0.06 mg/L as P (n = 47).

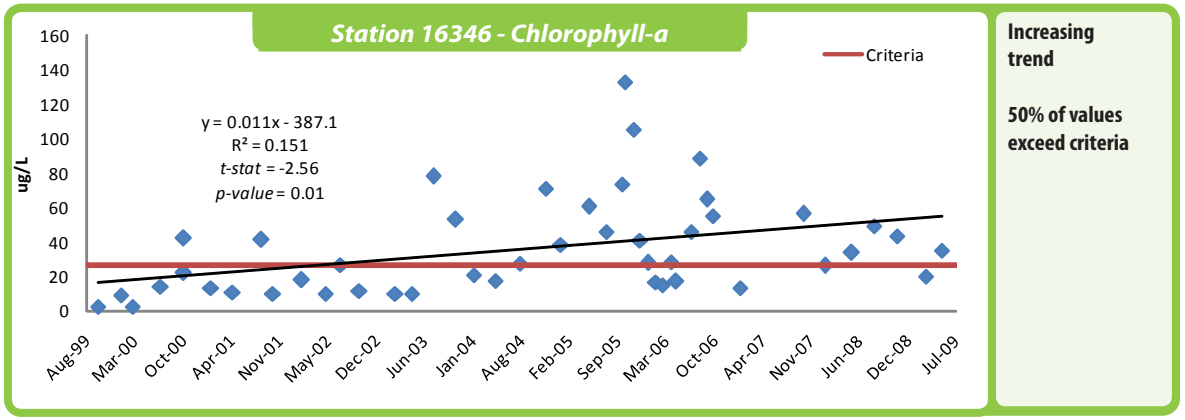
Total Phosphorus concentrations ranged from <0.05 to 0.34 mg/L as P (n = 47). Two values exceeded the 0.2 mg/L as P criteria.

Chlorophyll-*a* values ranged from 2.14 to 133 ug/L, with a mean of 35.9 ug/L (n = 46. A statistically significant increasing trend is observed, with 50% of the reported values exceeding the criteria.



13 values exceeded the upper criteria

Increasing trend is not statistically significant



Increasing trend

50% of values exceed criteria

The elevated Chlorophyll-a values may indicate algal blooms due to nutrient enrichment. Since 2003, there has been an increasing trend. Some values are 2-3 times higher than the criteria.

STATION 18557
Lake Palestine
Flat Bay

Water Quality Parameters

pH values ranged from 7 to 9.5 S.U., with a mean of 8.14 S.U. (n = 24). The criteria was exceeded 7 times (29%), which is non-supporting. An increasing trend was observed, but it is not statistically significant.

Dissolved Oxygen (DO) values ranged from 6.2 to 13.7 mg/L, with a mean of 9.3 mg/L (n = 24). No values were outside of the criteria.

***E. coli* bacteria** results ranged from <1 to 10 MPN/100 mL (n = 12).

Total Suspended Solids (TSS) results ranged from 4 – 16 mg/L (n = 23).

Total Dissolved Solids (TDS) results ranged from 97 – 204 mg/L, with a mean of 151 mg/L (n = 19). TDS had a statistically significant decreasing trend. However, data started in 2005, so the timeframe for results is not sufficient for recent evaluation of the criteria.

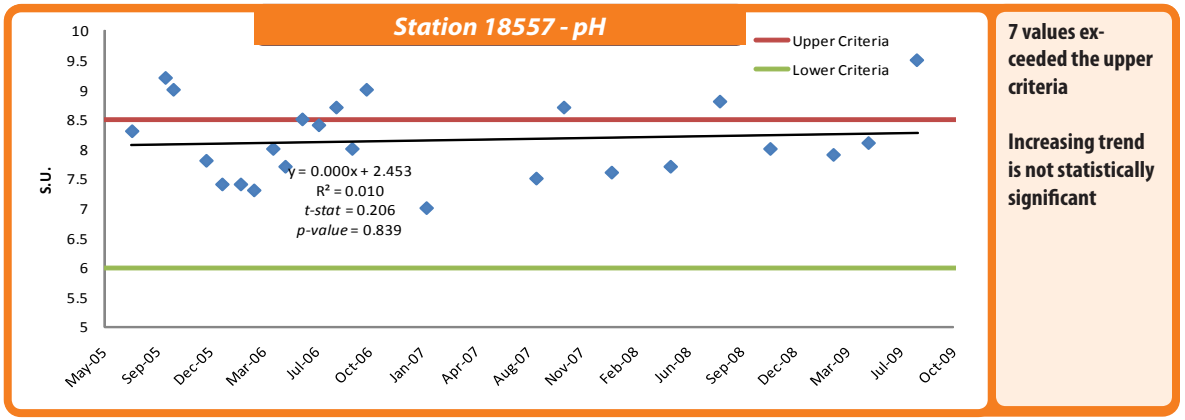
Ammonia-Nitrogen concentrations ranged from <0.05 to 0.08 mg/L as N (n = 22). No values exceeded criteria.

Nitrate+Nitrite-Nitrogen results ranged from <0.04 to 0.17 mg/L as N (n = 23), with all values below the criteria.

Orthophosphorus values results ranged from <0.04 to 0.07 mg/L as P (n = 23).

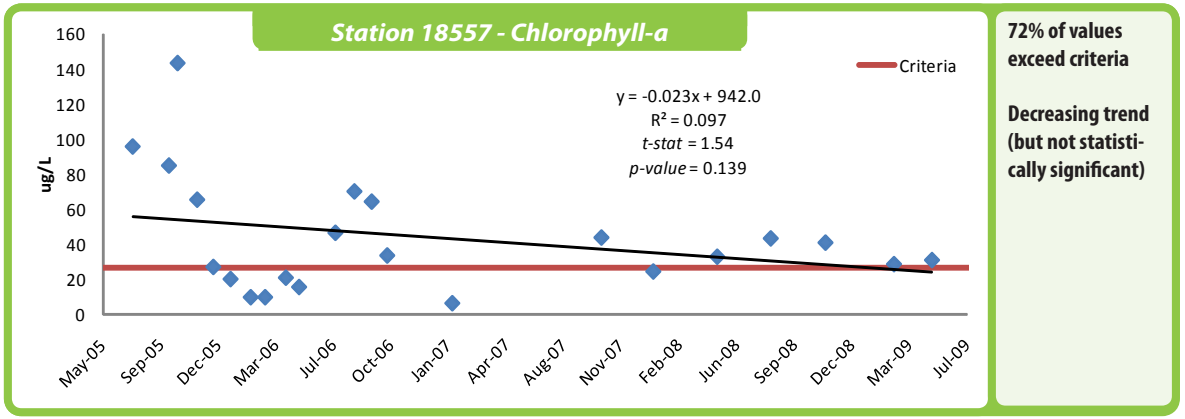
Total Phosphorus concentrations were reported in the range of <0.06 to 0.09 mg/L as P (n = 23).

Chlorophyll-*a* values ranged from 6.59 ug/L to 143 ug/L. The mean value was 43.6 ug/L (n = 22), which is almost double the criteria. 72% of values exceeded the criteria.



7 values exceeded the upper criteria

Increasing trend is not statistically significant



72% of values exceed criteria

Decreasing trend (but not statistically significant)

The elevated DO and Chlorophyll-a values, combined with the high pH, indicates that photosynthetic plants are removing the carbon dioxide from the water, increasing the pH, increasing the chlorophyll-a concentrations, and expelling oxygen into the water. These plants may not be found at the surface (such as floating hyacinth), but instead may be lower within the water column

STATION 18643
Lake Palestine
Upper East Shore

Water Quality Parameters

pH values ranged from 7.3 to 9.6 S.U., with a mean of 8.1 S.U. (n = 19). There were 5 reported values (26% of values) which exceeded the criteria occurring during the months of August through October. For assessment, based upon the binomial method for attainment and concerns, there is enough data to evaluate a non-support for pH.

Dissolved Oxygen (DO) values support the aquatic life use designation, with all 19 values above the screening level criteria.

***E. coli* bacteria** results levels support contact recreation use, but not enough data exists to perform statistical analysis (n = 9).

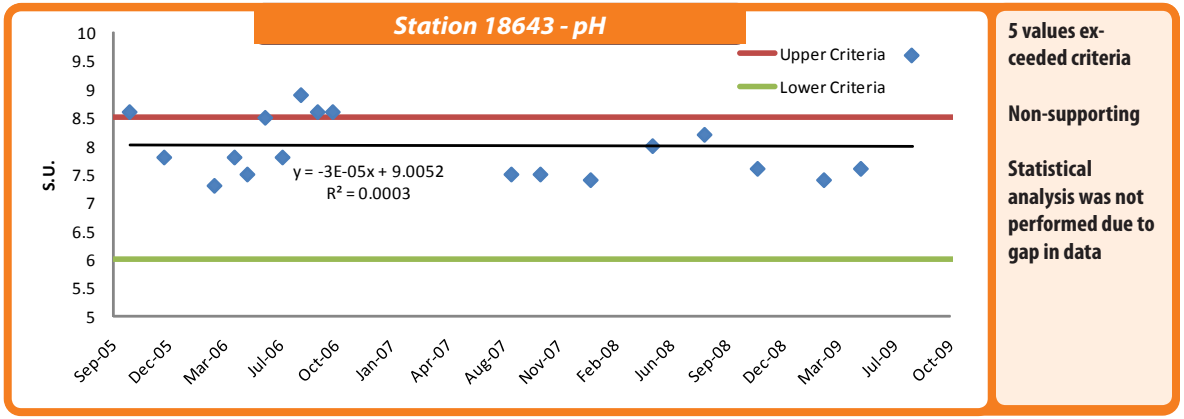
Total Dissolved Solids (TDS) results were found to be reduced by half since 2006. From 2007 to 2008, the data indicates that the values are under the criteria. (n = 16)

Ammonia-Nitrogen and **Nitrate+Nitrite-Nitrogen** concentrations are all under criteria, although there are not enough data points for statistical analysis (Ammonia-N, 17 samples; Nitrate+Nitrite-N, 18 samples).

Orthophosphorus values since December 2005 have been under the criteria (n = 18).

Total Phosphorus data showed 3 values exceeding criteria occurring prior to 2006 (n = 18).

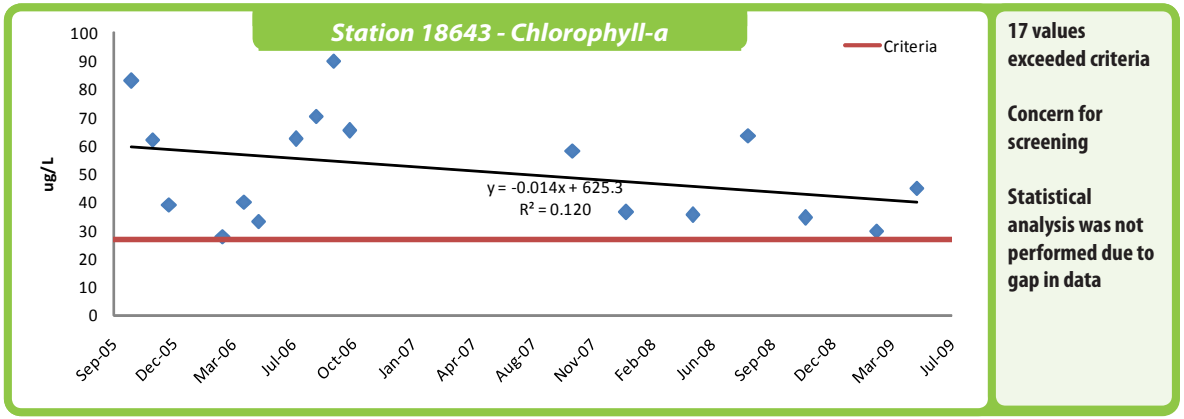
Chlorophyll-*a* values ranged from 27.8 to 90 ug/L, with a mean of 51.5 ug/L. All 17 values reported exceeded the criteria of 26.7 ug/L. This is a concern for screening.



5 values exceeded criteria

Non-supporting

Statistical analysis was not performed due to gap in data



17 values exceeded criteria

Concern for screening

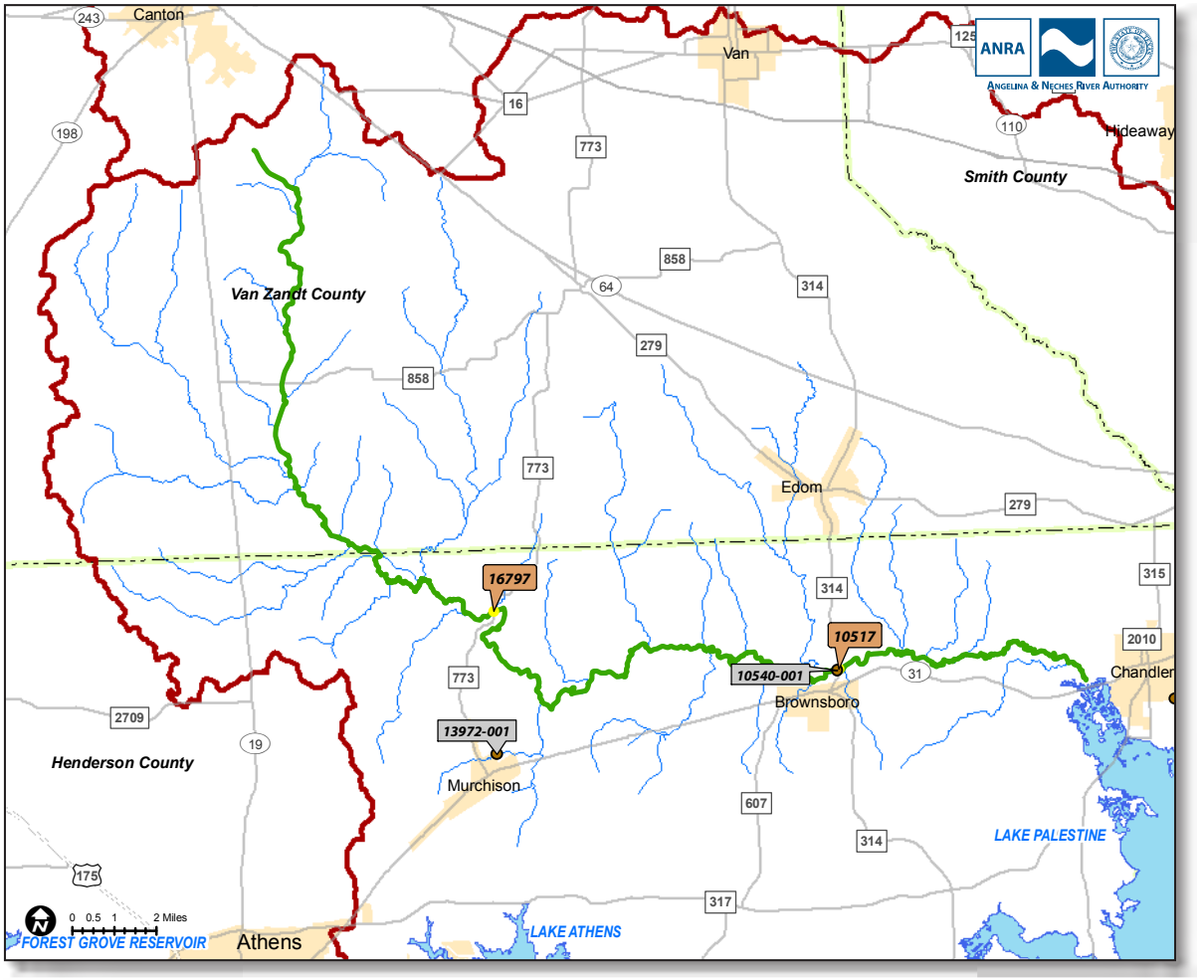
Statistical analysis was not performed due to gap in data

Segment 0605A - Kickapoo Creek (unclassified water body)

Segment Profile

Kickapoo Creek extends 42.6 miles from the confluence of Lake Palestine east of Brownsboro in Henderson County to the upstream perennial portion of the stream northeast of Murchinson in Henderson County. Aquatic life, general, and contact recreation are the designated uses for this segment. An area within this segment, 0605A_01, which is located downstream of FM 1803, has two listings on the 303(d) list. The reasons for the listings are due to elevated bacteria numbers and depressed oxygen, which were listed in the years 2000 and 2006, respectively. These listings are classified under a 5c category. Within the Kickapoo Creek watershed, there is one recycling station, three permitted landfills, and two permitted wastewater outfalls.

Kickapoo Creek at FM 314



Monitoring Stations on Segment 0605A

Station ID	Station Name	Collecting Agency	Frequency	Parameters
10517	Kickapoo Creek at FM 314	TCEQ	Metals 3x, Others Quarterly	Field, Conventionals, Bacteria, Flow, Metals (water)
16797	Kickapoo Creek at FM 773	TCEQ	Quarterly	Field, Conventionals, Bacteria, Flow

STATION 10517
Kickapoo Creek at FM 314
Near Brownsboro

Water Quality Parameters

pH values ranged from 6.2 to 8.2 S.U., with a mean of 6.95 S.U.

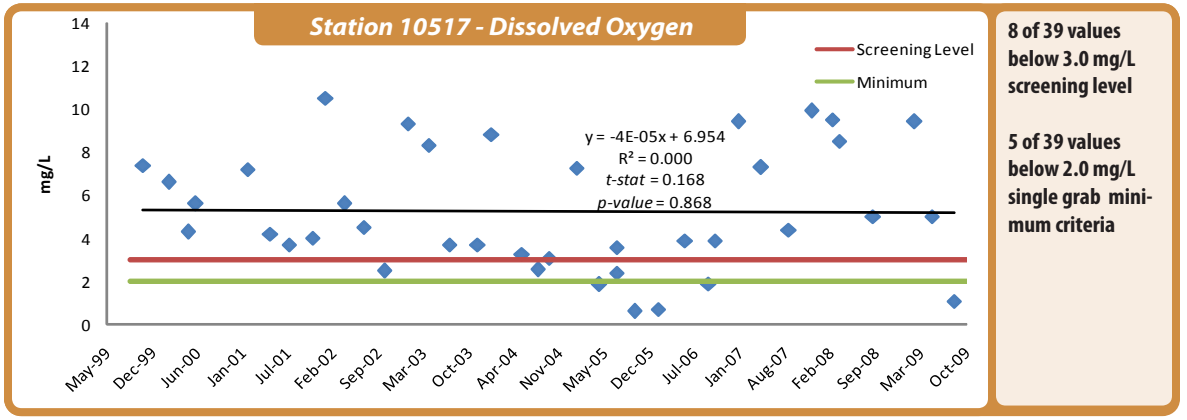
Dissolved Oxygen (DO) values were reported over the range of 0.62 - 10.5 mg/L, with a mean of 5.24 mg/L. 8 of 39 values were below the 3.0 DO mg/L screening level, with 5 of 39 values being below the 2.0 single grab minimum criteria.

***E. coli* bacteria** results ranged from 14 - 1700 MPN/100 mL, with a geometric mean of 227.3. 18 of 56 reported values (32.1 % of samples) exceeded the criteria for contact recreation. This is non-supporting.

Total Suspended Solids (TSS) results ranged from 2 - 100 mg/L, with a mean of 17.1 mg/L.

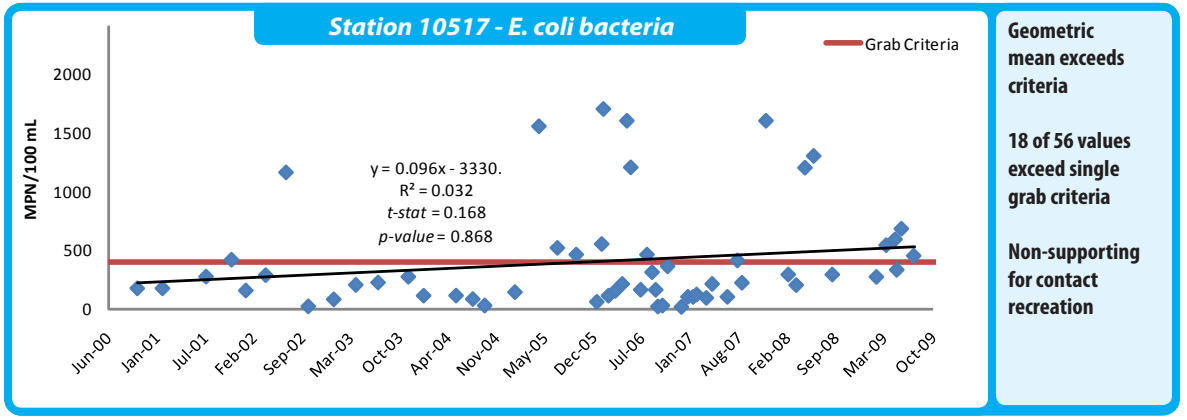
Total Dissolved Solids (TDS) results ranged from 116 - 491 mg/L, with a mean of 242 mg/L.

Ammonia-Nitrogen concentrations ranged from <0.01 to 9.13 mg/L as N, with a mean of 1.7 mg/L as N. 28 of 40 values (70% of samples) exceeded the Ammonia-N criteria of 0.33 mg/L as N. This is non-supporting.



8 of 39 values below 3.0 mg/L screening level

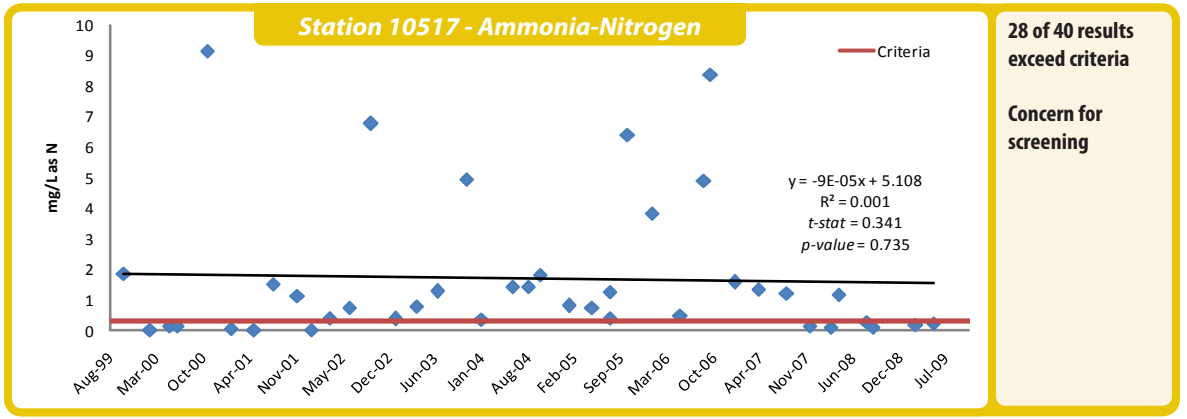
5 of 39 values below 2.0 mg/L single grab minimum criteria



Geometric mean exceeds criteria

18 of 56 values exceed single grab criteria

Non-supporting for contact recreation



28 of 40 results exceed criteria

Concern for screening

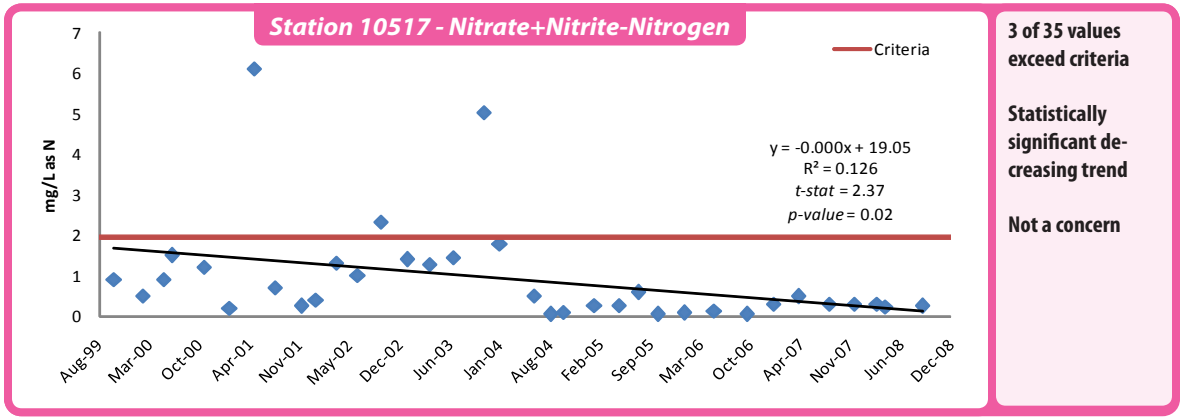
Water Quality Parameters (continued)

Nitrate+Nitrite-Nitrogen results ranged from <0.04 to 6.1 mg/L as N, with a mean of 0.92 mg/L as N, and 3 of 35 values (8.6%) exceeding criteria. A statistically significant decreasing trend is observed (*t-stat* = 2.37, *p-value* = 0.02).

Orthophosphorus values ranged from 0.001 - 2.94 mg/L as P, with a mean of 0.504 mg/L as P. 12 of 39 values (30.8% of results) exceeded the criteria of 0.37 mg/L as P.

Total Phosphorus concentrations ranged from 0.008 - 9.1 mg/L as P, with a mean of 0.94 mg/L as P, and 12 of 38 values (31.6%) exceeding the 0.69 mg/L as P criteria for general use.

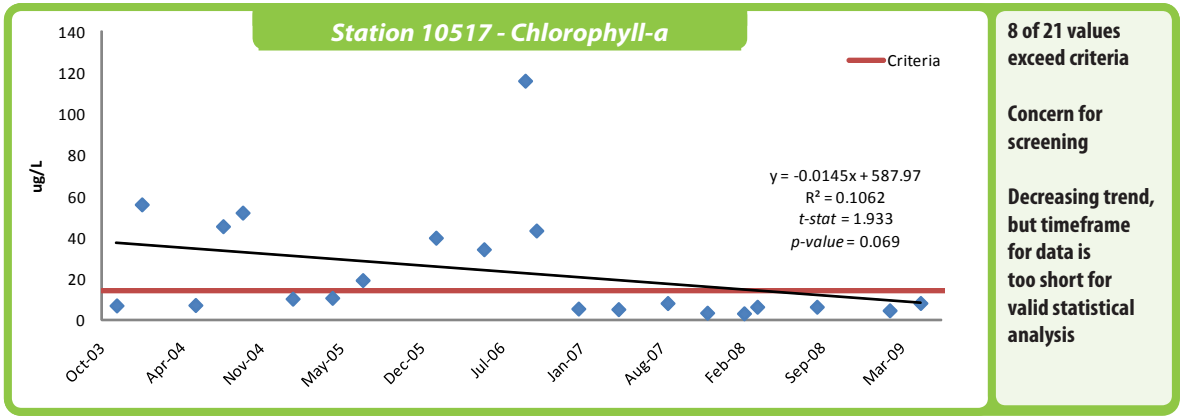
Chlorophyll-*a* values ranged from 2.97 - 116 ug/L, with a mean of 23.3 ug/L. 8 of 21 values (38.1% of results) exceeded the criteria for general use. A decreasing trend was observed, but due to an insufficient timeframe for data (<10 years), statistical analysis was not performed.



3 of 35 values exceed criteria

Statistically significant decreasing trend

Not a concern



8 of 21 values exceed criteria

Concern for screening

Decreasing trend, but timeframe for data is too short for valid statistical analysis

STATION 16797
Kickapoo Creek at FM 773
North of Murchinson

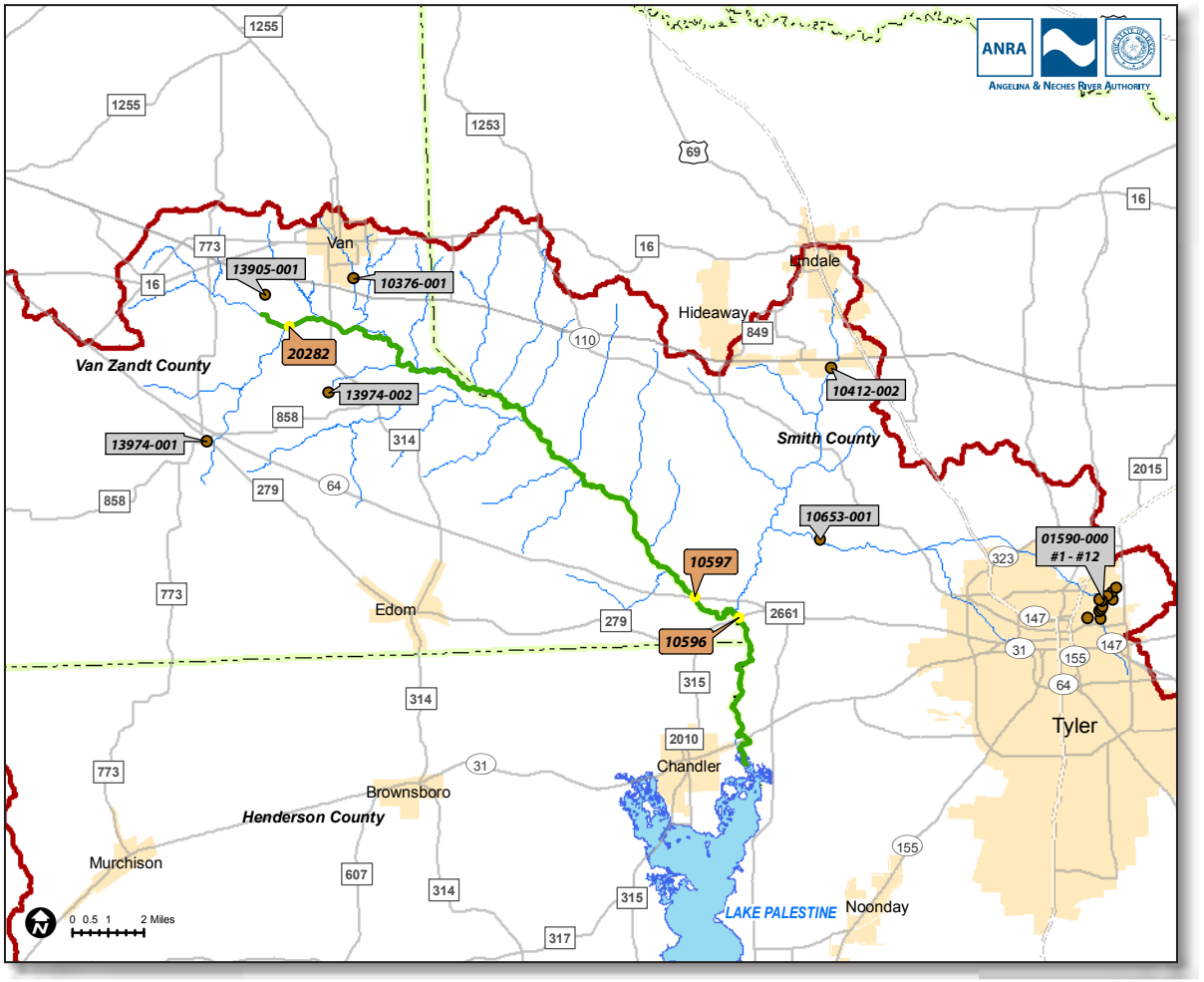
Water Quality Parameters

Not enough data is available at this station for analysis. While some results are available for samples occurring in 2000 and prior, there are no results between 2000 and 2008. The addition of this station back to the Coordinated Monitoring Schedule since 2008 will allow for an evaluation of the water quality upstream of Station 10517, where issues with elevated bacteria and depressed dissolved oxygen are a concern.

Segment 0606 - Neches River Above Lake Palestine

Segment Profile

This freshwater stream includes 27 miles from a point 6.7 km (4.2 miles) downstream of FM 279 in Henderson/ Smith County to Rhines Lake Dam in Van Zandt County. Aquatic life, general, contact recreation, and public water supply are the designated uses for this segment. There are several listings within this segment on the 303(d) list of impaired water bodies.



Impairments in Segment 0606			
Location	***Reason for Listing***	***Category***	***Year Listed***
Lower boundary to Prairie Creek	Bacteria	5c	2008
Prairie Creek to river mile 7.0	Depressed Dissolved Oxygen	5c	1996
	pH	5c	2002
	Zinc in water	5c	1996
River mile 7.0 to headwaters	Depressed Dissolved Oxygen	5c	1996
	pH	5c	2002

Monitoring Stations on Segment 0606				
Station ID	***Station Name***	***Collecting Agency***	***Frequency***	***Parameters***
10596	Neches River at FM 279	TCEQ	Quarterly	Field, Conventionals, Bacteria, Flow
10597	Neches River at SH 64	TCEQ	5X	Metals (water)
20282	Neches River at Van Zandt CR 4511	TCEQ	1X	Aquatic Habitat, Nekton

STATION 10596
Neches River at FM 279
West of Tyler and Northeast of Chandler

Water Quality Parameters

pH values ranged from 5.9 to 7.6 S.U., with a mean of 6.9 S.U. (n = 39). One value exceeded the criterion.

Dissolved Oxygen (DO) values ranged from 5.1 to 10.5 mg/L (n = 39) with no exceedances.

***E. coli* bacteria** results ranged from 35 to 1600 MPN/100 mL. Three exceedances were recorded (11% of values), with a geometric mean of 164 MPN/100 mL (n = 27).

Total Suspended Solids (TSS) results ranged from 4 to 31 mg/L (n = 37).

Total Dissolved Solids (TDS) results ranged from 144 to 474 mg/L. Thirteen exceedances were found in the data set, comprising 36% of the values (n = 36).

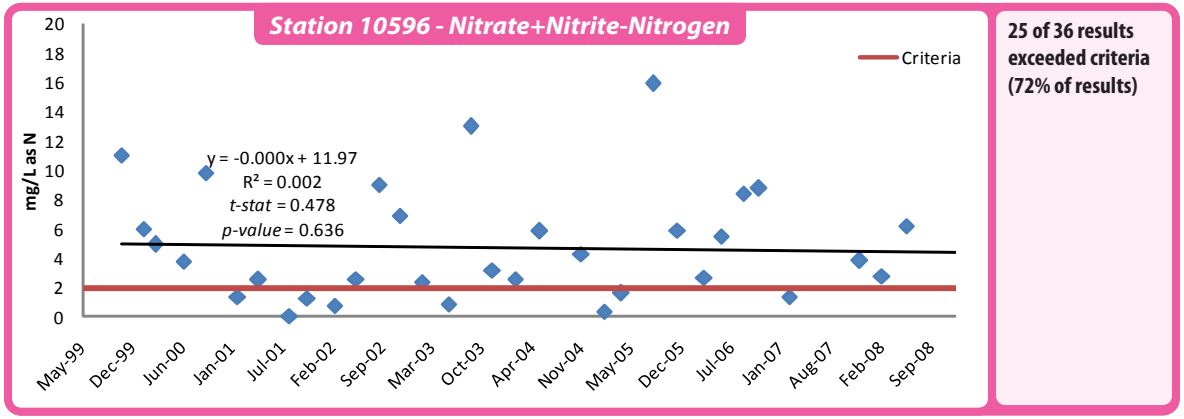
Ammonia-Nitrogen concentrations ranged from 0.05 to 0.49 mg/L as N (n = 37). There was one value which exceeded the criteria.

Nitrate+Nitrite-Nitrogen results ranged from 0.05 to 15.9 mg/L as N (n = 34), with 25 values (74% of the results) above the nutrient screening level for general use.

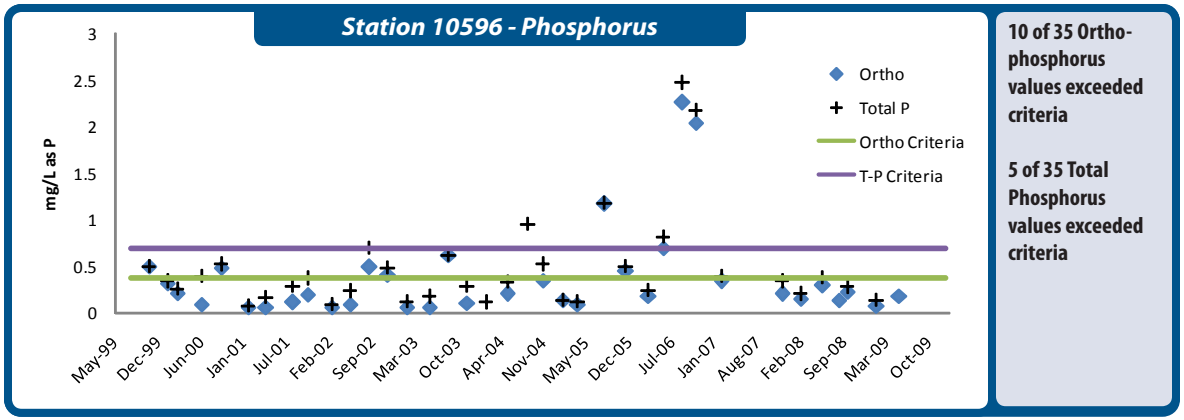
Orthophosphorus values ranged from 0.06 to 2.26 mg/L as P (n = 35). Ten values exceeded the criteria (28.6% of the results). Although the data exhibited an increasing trend, it was not statistically significant.

Total Phosphorus concentrations ranged from 0.07 to 2.47 mg/L as P (n = 35). There were five exceedances. Although there was not a significant trend present, the data exhibited an increasing trend.

Chlorophyll-*a* values ranged from 0.6 to 10 ug/L (n = 37). No exceedances occurred.



25 of 36 results exceeded criteria (72% of results)



10 of 35 Ortho-phosphorus values exceeded criteria

5 of 35 Total Phosphorus values exceeded criteria

STATION 10597
Neches River at SH 64
West of Tyler

Water Quality Parameters

pH values ranged from 3.5 to 7 S.U., with a mean of 6.1 S.U. (n = 40). There were 10 values below the criteria (25% of results). There is a statistically significant decreasing trend found. The low pH at this station is due to natural conditions (groundwater sulfur deposits).

Dissolved Oxygen (DO) values ranged from 0.4 to 9.7 mg/L, with a mean of 4.03 mg/L (n = 40). 22 values (55% of the data) were below the screening level, with 17 values below the grab minimum criteria.

***E. coli* bacteria** results ranged from 10 to >2400 MPN/100 mL (n = 25). One value was found to exceed the criteria.

Total Suspended Solids (TSS) results ranged from 1 to 236 mg/L, with a mean value of 25 mg/L (n = 37).

Total Dissolved Solids (TDS) results ranged from 110 to 436, with the mean at 222 mg/L (n = 36). There were six exceedances (17% of samples).

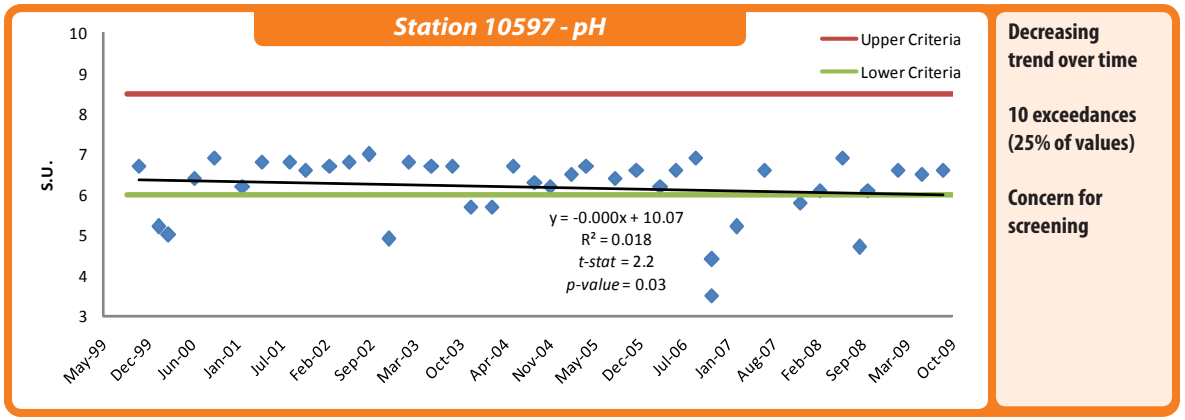
Ammonia-Nitrogen concentrations ranged from 0.05 to 4.59 mg/L as N (n = 36). There were 5 exceedances.

Nitrate+Nitrite-Nitrogen results ranged from 0.05 to 0.11 mg/L as N (n = 33). There were no exceedances.

Orthophosphorus values ranged from 0.03 to 0.28 mg/L as P (n = 33). All data was found within the criteria.

Total Phosphorus concentrations ranged from 0.035 to 0.7 mg/L as P (n = 34). There was one exceedance. Although not significant, a decreasing trend was noticed.

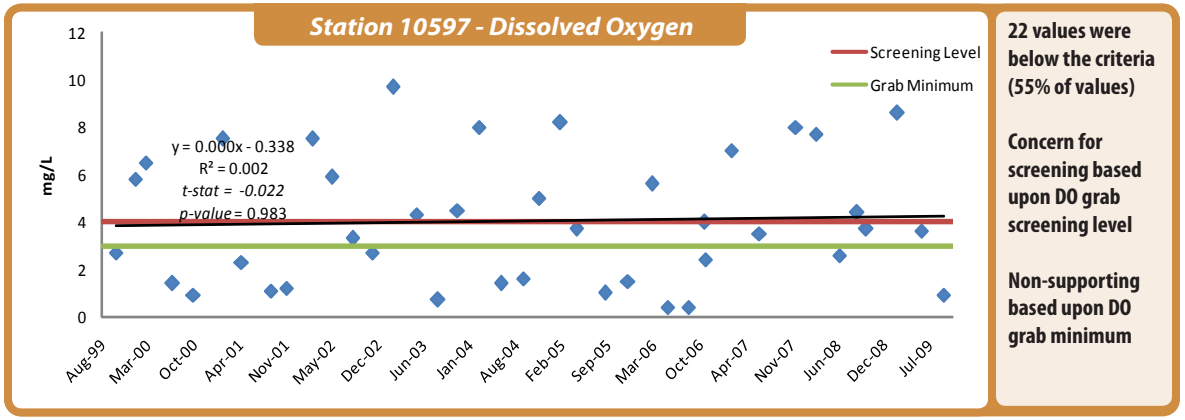
Chlorophyll-*a* values ranged from <1 to 67.6 ug/l, with a mean of 13 ug/L (n = 35). Seven values were found to exceed the criteria (20% exceedance rate).



Decreasing trend over time

10 exceedances (25% of values)

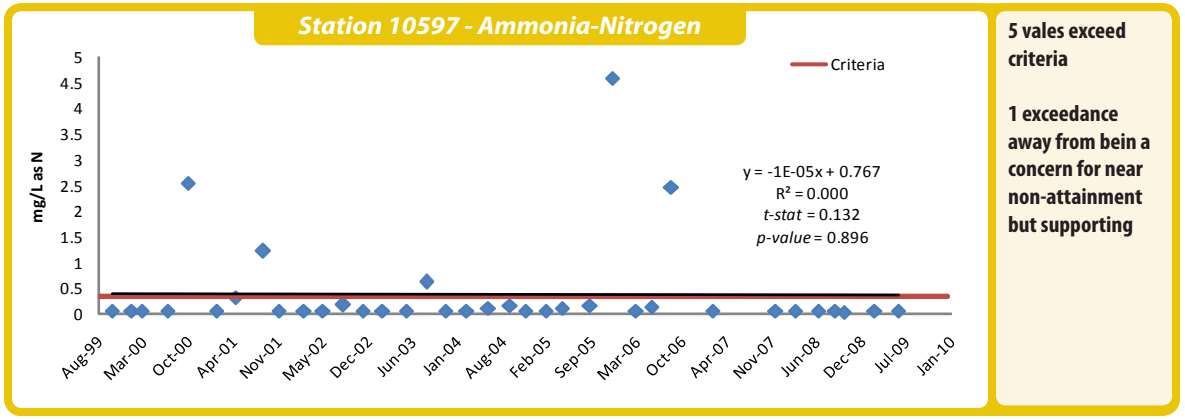
Concern for screening



22 values were below the criteria (55% of values)

Concern for screening based upon DO grab screening level

Non-supporting based upon DO grab minimum



5 vales exceed criteria

1 exceedance away from bein a concern for near non-attainment but supporting

STATION 20282
Neches River at CR 4511
Van Zandt

Water Quality Parameters

This station is part of a Use Attainability Analysis (UAA) study on the Upper Neches River. This station is being monitored by TCEQ Region 5 (Tyler) staff for aquatic habitat and nekton, targeted toward a certain time of year (critical or index period).

Segment 0606A - Prairie Creek (unclassified water body)

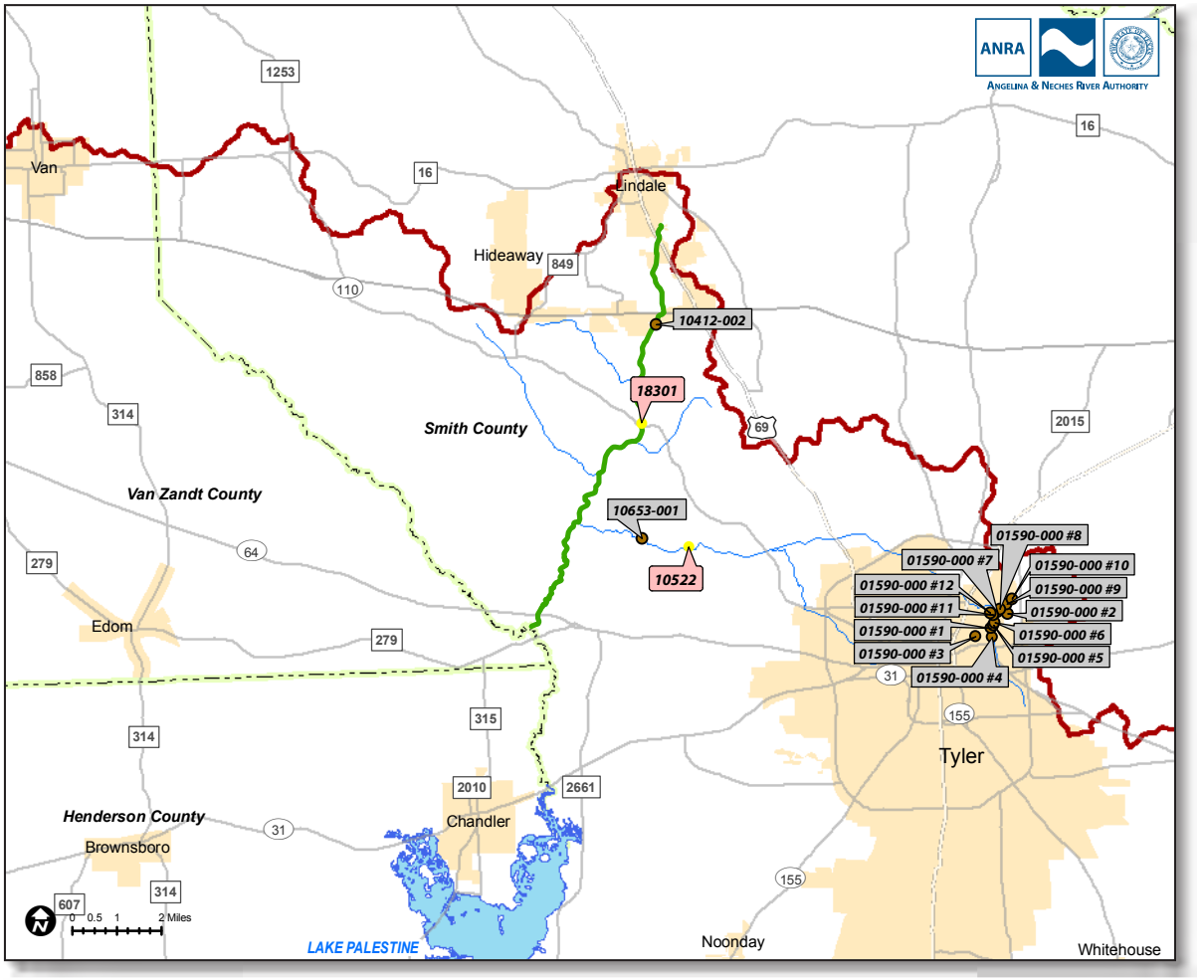
Segment Profile

This freshwater stream includes a 13-mile length perennial stream from the confluence of the Neches River west of Tyler in Smith County to a point immediately upstream of the confluence of Caney Creek. Designated uses for this segment are general, contact recreation, and high aquatic life use. In 2002, an area within this segment was listed on the 303(d) list due to nonsupport of contact recreation from elevated bacteria levels.

For discussion purposes, Segment 0606D Black Fork Creek (unclassified water body) is grouped with 0606A Prairie Creek (unclassified water body). Both streams are monitored by the City of Tyler, with samples collected and submitted to the Angelina & Neches River Authority Environmental Laboratory for analyses.

Black Fork Creek is a perennial stream beginning at the confluence with Prairie Creek ending at a point 0.4 km downstream of FM 14 in Tyler.

Within the Draft 2010 Integrated Report, a section of Black Fork Creek has a concern for screening for ammonia. Also in the the Draft 2010 report, portions of Prairie Creek are listed as impaired due to bacteria (category 5b).



Monitoring Stations on Segment 0606A and 0606D				
Station ID	***Station Name***	***Collecting Agency***	***Frequency***	***Parameters***
10522	Black Fork Creek at CR 46 Upstream of Tyler Westside WWTP	City of Tyler	Quarterly	Field, Conventionals, Bacteria, Flow
18301	Prairie Creek at SH 110	City of Tyler	Quarterly	Field, Conventionals, Bacteria, Flow

STATION 10522
Black Fork Creek at CR 46
Upstream of Tyler Westside WWTP

Water Quality Parameters

pH values ranged from 6.4 to 8.2 S.U. The mean was found to be 7.08 S.U. (n = 23), with no exceedances.

Dissolved Oxygen (DO) values ranged from 4.4 to 10.15 mg/L, with a mean of 6.4 mg/L (n = 24).

***E. coli* bacteria** results ranged from 2 to 104.1 MPN/100 mL (n = 22), with no values exceeding the criteria for contact recreation.

Total Suspended Solids (TSS) results ranged from 1 to 75.3 mg/L (n = 24). The mean was found to be 7.86 mg/L.

Total Dissolved Solids (TDS) results ranged from 132 to 279 mg/L. The mean was 163 mg/L (n = 24).

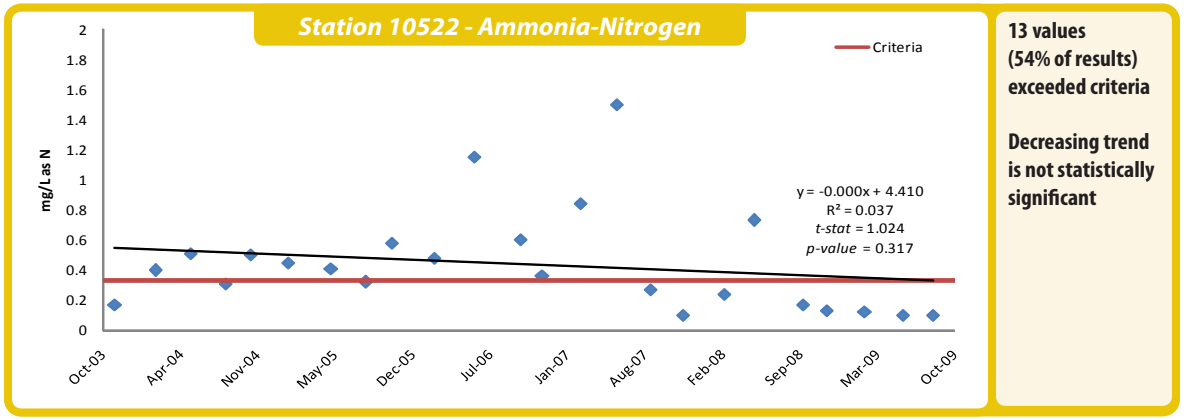
Ammonia-Nitrogen concentrations ranged from <0.1 to 1.5 mg/L as N (n = 24). Thirteen values (54%) were found to exceed the criteria for general use nutrient screening.

Nitrate+Nitrite-Nitrogen results ranged from 0.06 to 1.53 mg/L as N with a mean of 0.46 mg/L as N (n = 24). All data points were under the criteria for general use nutrient screening level of 1.95 mg/L as N.

Orthophosphorus values ranged from <0.04 to 0.17 mg/L as P (n = 24). All values were under the criteria limit.

Total Phosphorus concentrations ranged from 0.06 to 0.49 mg/L as P (n = 24). All values were under the criteria limit of 0.69 mg/L. as P.

Chlorophyll-*a* values ranged from 2 to 104.1 ug/L, with a mean of 8.6 ug/L (n = 22). One value exceeded the criteria.



13 values (54% of results) exceeded criteria

Decreasing trend is not statistically significant

STATION 18301
Prairie Creek at SH 110
Northwest of Tyler and Southwest of Lindale

Water Quality Parameters

pH values ranged from 6.3 to 8.1 S.U. A mean of 7.06 S.U. (n = 23) was found with no exceedances.

Dissolved Oxygen (DO) values ranged from 3.8 to 10.31 mg/L (n = 24). There was one value that fell below the screening level criteria. Although not significant, the data displays a decreasing trend.

***E. coli* bacteria** values ranged from 5 to 1700 MPN/100 mL, with three exceedances. The geometric mean was 134.7 (n = 24), which exceeds the criteria for contact recreation use.

Total Suspended Solids (TSS) values ranged from 2.3 to 34 mg/L (n = 24).

Total Dissolved Solids (TDS) results ranged from 76 to 131 mg/L, with a mean of 102 mg/L (n = 24).

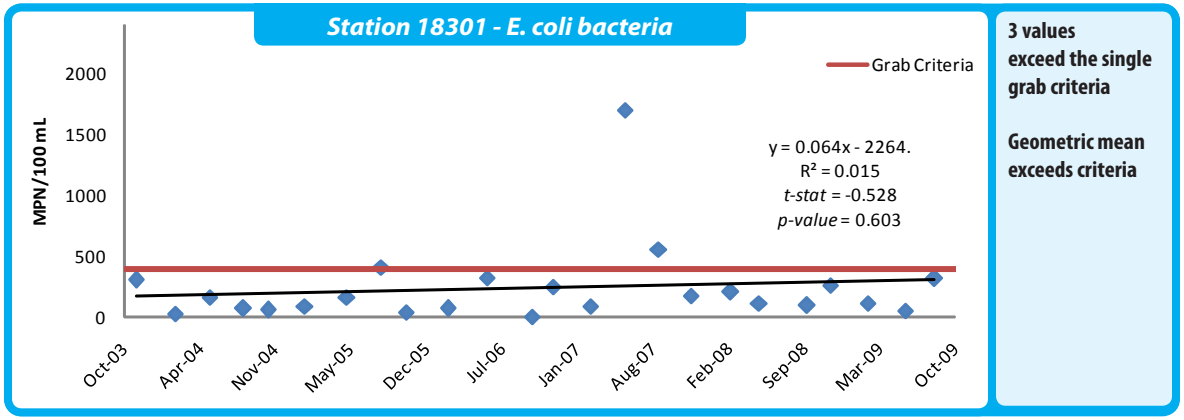
Ammonia-Nitrogen concentrations ranged from <0.1 to 1.1 mg/L as N, with a mean of 0.28 mg/L as N (n = 24). Seven values exceeded the criteria (29% of the results).

Nitrate+Nitrite-Nitrogen results ranged from <0.04 to 0.999 mg/L as N (n = 24).

Orthophosphorus values ranged from <0.04 to 0.09 mg/L as P (n = 24).

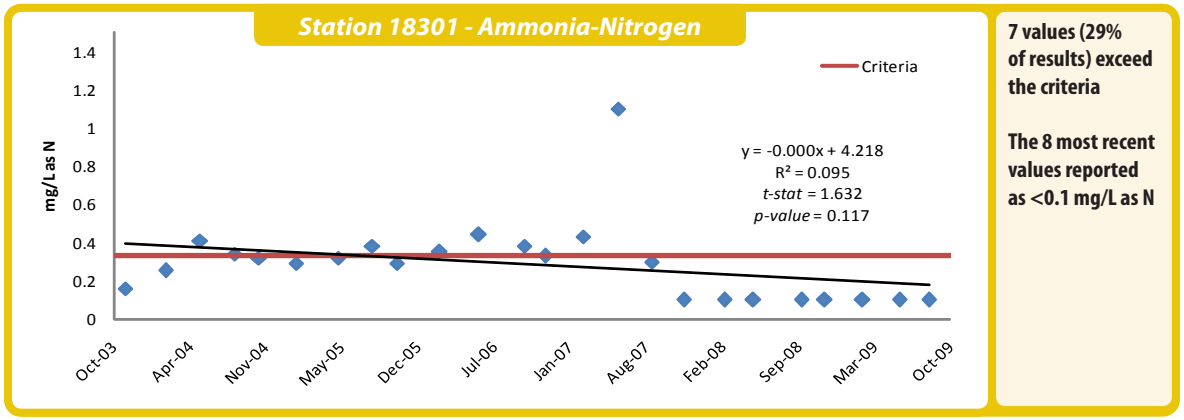
Total Phosphorus concentrations ranged from <0.06 to 1.08 mg/L (n = 23). One values exceeded the criteria.

Chlorophyll-*a* values ranged from 2 to 15.7 ug/L. The mean was found to be 4.8 ug/L (n = 22).



3 values exceed the single grab criteria

Geometric mean exceeds criteria



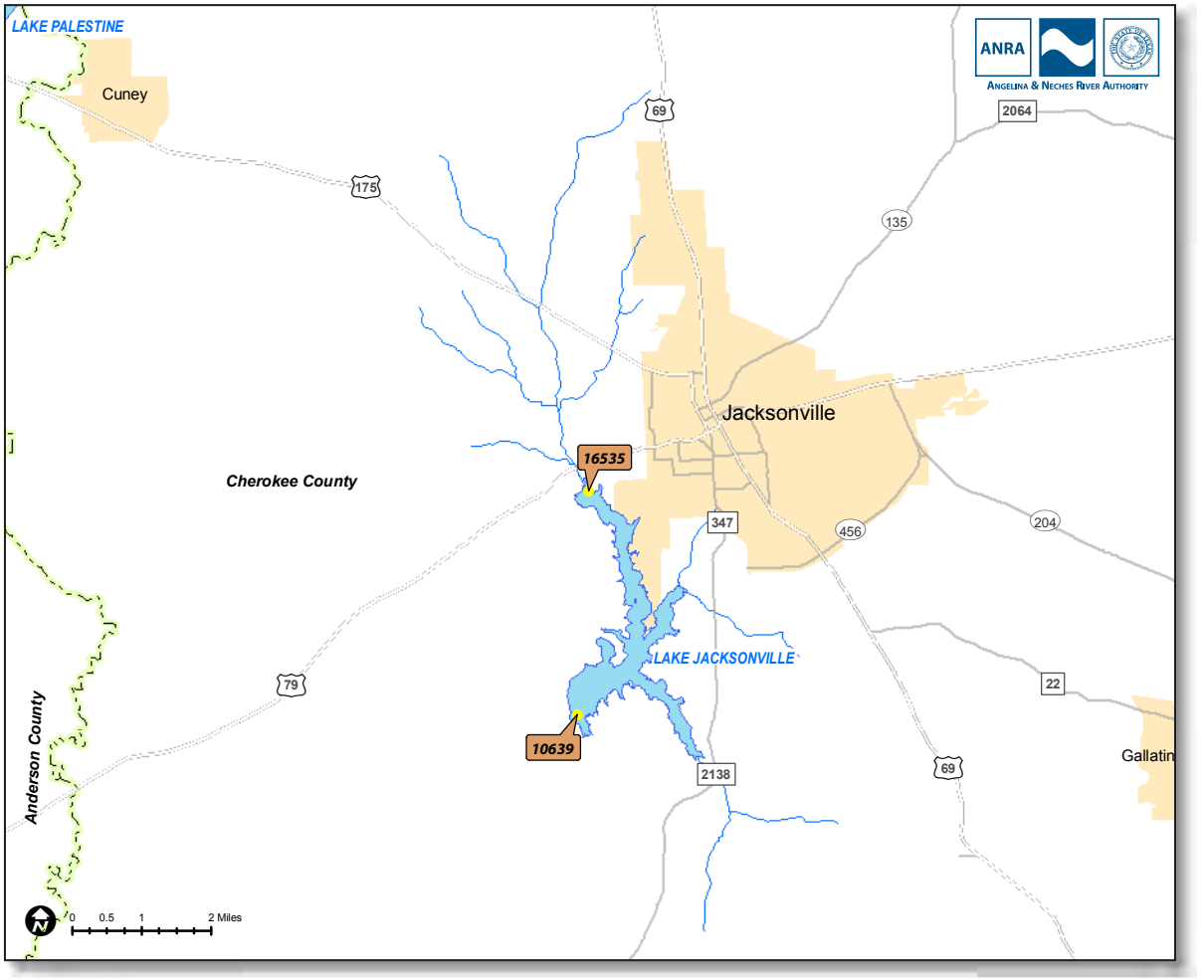
7 values (29% of results) exceed the criteria

The 8 most recent values reported as <0.1 mg/L as N

Segment 0614 - Lake Jacksonville

Segment Profile

Segment 0614 is designated as a classified reservoir, Lake Jacksonville. The description of this lake includes from an area from Buckner Dam in Cherokee county up to a normal pool elevation of 422 feet (impounds Gum Creek). The reservoir is classified for public water supply use, high aquatic life use, general use, and contact recreation use. Station 10639 is in the assessment unit for the lower portion of the reservoir, whereas Station 16535 is in the assessment unit for the upper reservoir.



Monitoring Stations on Segment 0614				
Station ID	***Station Name***	***Collecting Agency***	***Frequency***	***Parameters***
10639	Lake Jacksonville Near Dam	TCEQ	Quarterly	Field, Conventionals, Bacteria
16535	Lake Jacksonville Upper Lake	TCEQ	Quarterly	Field, Conventionals, Bacteria

STATION 10639
Lake Jacksonville
Near Dam

Water Quality Parameters

pH values ranged from 6.6 to 8 S.U., with a mean of 7.4 S.U. (n = 40). The data was fully supporting, with no values outside of the criteria for general use.

Dissolved Oxygen (DO) values ranged from 6.1 to 10.7 mg/L (n = 40). All DO values were found to be within the criteria for aquatic life use.

***E. coli* bacteria** results ranged from 1 to 18 MPN/100 mL (n = 26). All values were well below the criteria for contact recreation use.

Total Suspended Solids (TSS) results were all below 4 mg/L (n = 41).

Total Dissolved Solids (TDS) results ranged from 18 to 81 mg/L, with a mean of 61 mg/L (n = 40).

Ammonia-Nitrogen concentrations ranged from <0.05 to 0.2 mg/L as N, with one exceedance (fully supporting). The mean was 0.058 mg/L as N (n = 40).

Nitrate+Nitrite-Nitrogen results ranged from <0.04 to 0.19 mg/L as N (n = 40). No exceedances were found.

Orthophosphorus values ranged from <0.04 to 0.06 mg/L as P (n = 40).

Total Phosphorus concentrations were all reported below the 0.06 mg/L as P method reporting limit (n = 39).

Chlorophyll-*a* values ranged from <1 to 15.1 ug/l, with a mean of 7.86 ug/L (n = 39). All values were fully supporting of the criteria.

STATION 16535
Lake Jacksonville Upper Lake
Near Raw Water Intake Structure

Water Quality Parameters

pH values ranged from 6.8 to 9.7 S.U., with a mean of 7.8 S.U. (n = 40). There were three exceedances of the criteria, which accounted for 7.5% or reported values. The data is fully supporting.

Dissolved Oxygen (DO) values ranged from 6.0 to 11.9 mg/L, with a mean of 8.7 mg/L (n = 40). No values exceeded the criteria for aquatic life use.

***E. coli* bacteria** results ranged from <1 to 291 MPN/100 mL, with a geometric mean of 3 MPN/100 mL (n = 26). No values were found to exceed the criteria for contact recreation use for single grab samples.

Total Suspended Solids (TSS) results values ranged from <1.0 to 7.0 mg/L, with a mean of 3.3 mg/L (n = 40).

Total Dissolved Solids (TDS) results ranged from 35.0 to 99.0 mg/L, with a mean of 63.3 mg/L (n = 39).

Ammonia-Nitrogen concentrations ranged from 0.05 to 0.14 mg/L as N (n = 36). One value exceeded the criteria.

Nitrate+Nitrite-Nitrogen results ranged from <0.04 to 0.17 mg/L as N, with a mean 0.059 mg/L as N (n = 39). No values were found to exceed the criteria.

Orthophosphorus values were all reported below the analytical method reporting limit (n = 39).

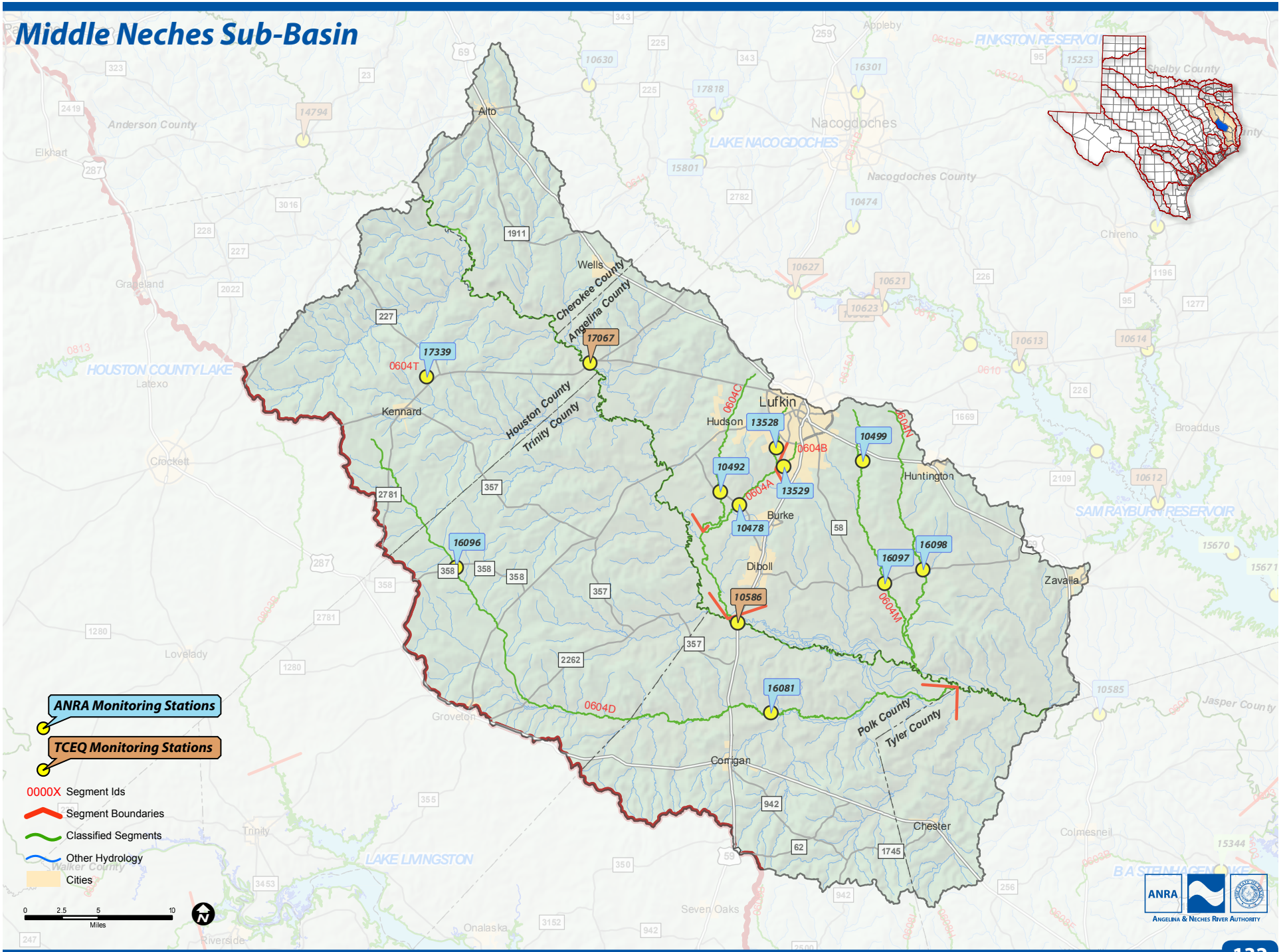
Total Phosphorus concentrations were all below 0.06 mg/L as P (n = 37).

Chlorophyll-*a* values ranged from <1 to 46.4 ug/L. One value exceeded the criteria. The mean of the data is 9.4 ug/L (n = 37). The data is fully supporting.

Summary for the Upper Neches Sub-Basin

Water Quality Issues Summary for the Upper Neches Sub-Basin				
Water Quality Issue	***Affected Area***	***Possible Influences/Causes***	***Possible Effects***	***Possible Solutions/Actions Taken***
Listing on 303(d) list for impairment due to bacteria	Kickapoo Creek, and Prairie Creek	• Non-point sources • Point source municipal discharges	• Public health risk for contact recreation	• Stricter limitations on effluent discharges, specifically *E. coli* level values
Lead in water 2008 303 (d) Listing	Neches River below Lake Palestine from SH 21 to US 84	• Non-point sources • Point source municipal discharges	• Risk for living organisms, including humans	• Determine origin/source • Determine persistence in waterbody
Depressed dissolved oxygen listing on 2008 303(d) list	Kickapoo Creek Portions of Segment 0606 Neches River above Lake Palestine (Prairie Creek to headwaters)	• Unknown	• Aquatic life community affected	• Continued monitoring • Efforts to determine causes of low dissolved oxygen, either natural or anthropogenic
Listed on 2008 303(d) list for impairment due to pH levels	Lake Palestine	• Natural occurrence	• Effect on public water supply use	• Determine origins of source
Concern for screening Chlorophyll-*a* Increasing significant trend	Neches River at US 79 Areas of Lake Palestine Kickapoo Creek at FM 314	• Unknown	• Increasing number of phytoplankton biomass	• Monitor dissolved oxygen values closely

Middle Neches Sub-Basin



Profile of the Middle Neches Sub-Basin

Population

Cherokee, Angelina, Houston, Trinity, Polk, and Tyler counties are included within the sub-basin. The following cities which lie partially or wholly within the sub-basin are as followed: Lufkin, Hudson, Burke, Diboll, Huntington, Zavalla, Chester, Corrigan, Wells, Alto, Kennard, and Groveton. The estimated population is 261,361.

Land Use

Total number of farms included within the sub-basin is approximately 4,059, with all counties experiencing an increase in the number of farms from 2002 to 2007. With the exception of Houston county, there are approximately 62,412 head of cattle. The poultry industry is prevalent in the area, with Angelina county having 1,285,540 broilers and other meat-type chickens. The South Central Plains ecoregion includes floodplains, tertiary uplands, and southern tertiary uplands. The average annual precipitation is 25.6 inches. Carrizo-Wilcox, Yegua Jackson, and Gulf Coast are the aquifers supplying this region.

Neches River

Segments included in the Middle Neches Sub-Basin

Segment ID	*Segment Name*	*Length or Acreage*
0604	Neches River Below Lake Palestine	231 Miles
0604A	Cedar Creek (unclassified water body)	23 Miles
0604B	Hurricane Creek (unclassified water body)	4 Miles
0604C	Jack Creek (unclassified water body)	16 Miles
0604D	Piney Creek (unclassified water body)	70 Miles
0604M	Biloxi Creek (unclassified water body)	23.3 Miles
0604N	Buck Creek (unclassified water body)	22.6 Miles
0604T	Lake Ratcliff (unclassified water body)	52.9 Acres

Impairments and Concerns

There are several segments in the Middle Neches Sub-Basin that are listed on the 303 (d) list of impaired water bodies.

Impairments in the Middle Neches Sub-Basin Listed on the 303 (d) List

Assessment Unit	*Description*	*Reason*	*Category*	*Year Listed*
0604A_01	Cedar Creek Lower area downstream of FM 2497	Bacteria	5c	2000
0604A_02	Cedar Creek Upper area upstream of FM 2497	Bacteria	5c	2000
0604B_01	Hurricane Creek Entire Segment	Bacteria	5c	2000
0604C_01	Jack Creek Entire water body	Bacteria	5c	2000
0604D_01	Piney Creek Lower 25 miles	Bacteria Depressed dissolved oxygen	5c 5c	2006 2004
0604M_02	Biloxi Creek Lower portion below CR 228	Bacteria	5c	2004
0604M_03	Biloxi Creek Upper portion above CR 228	Bacteria Depressed dissolved oxygen	5c	2004 2006
0604T	Lake Ratcliff Entire Lake	Mercury in edible fish tissue	5c	2002

Permitted Discharges

There are twenty-seven permitted discharges included in the Middle Neches sub-basin.

Permitted Discharges in the Middle Neches Sub-Basin

Segment ID	Permit Number	Outfall Number	NPDES Number	Permittee	County	TCEQ Region	Map Location
0604	01598-000	001	006076	Georgia-Pacific Wood Products South LLC	Polk	10 - Beaumont	Page 136
0604	01598-000	002	006076	Georgia-Pacific Wood Products South LLC	Polk	10 - Beaumont	Page 136
0604	01598-000	004	006076	Georgia-Pacific Wood Products South LLC	Polk	10 - Beaumont	Page 136
0604	01598-000	005	006076	Georgia-Pacific Wood Products South LLC	Polk	10 - Beaumont	Page 136
0604	01598-000	006	006076	Georgia-Pacific Wood Products South LLC	Polk	10 - Beaumont	Page 136
0604	04234-000	001	123064	Clemsa Lumber Compary	Angelina	10 - Beaumont	Not Mapped
0604	10191-001	001	053422	City of Huntington	Angelina	10 - Beaumont	Page 136
0604	10546-001	001	025020	City of Alto	Cherokee	05 - Tyler	Page 136
0604	11196-001	001	071021	City of Wells	Cherokee	05 - Tyler	Page 136
0604	11474-001	001	056596	City of Kennard	Houston	10 - Beaumont	Page 136
0604	13871-001	001	118991	City of Zavalla	Angelina	10 - Beaumont	Page 136
0604	14086-001	001	118966	Apple Springs ISD	Trinity	10 - Beaumont	Page 136
0604A	01153-000	003	001201	Temple-Inland Inc.	Angelina	10 - Beaumont	Pages 136 & 139
0604A	01153-000	004	001201	Temple-Inland Inc.	Angelina	10 - Beaumont	Pages 136 & 139
0604A	01153-000	006	001201	Temple-Inland Inc.	Angelina	10 - Beaumont	Pages 136 & 139
0604A	01153-000	001A	001201	Temple-Inland Inc.	Angelina	10 - Beaumont	Pages 136 & 139
0604A	01153-000	001B	001201	Temple-Inland Inc.	Angelina	10 - Beaumont	Pages 136 & 139
0604A	10214-001	001	024309	City of Lufkin	Angelina	10 - Beaumont	Pages 136, 139 & 143
0604A	10288-001	001	024872	City of Diboll	Angelina	10 - Beaumont	Pages 136 & 139
0604A	11826-001	001	068958	City of Hudson	Angelina	10 - Beaumont	Pages 136, 139, 146
0604B	01737-000	001	082261	Georgia-Pacific Chemicals LLC	Angelina	10 - Beaumont	Pages 139 & 143
0604D	01902-000	001	064491	Georgia-Pacific Wood Products South LLC	Polk	10 - Beaumont	Pages 136 & 149
0604D	01902-000	002	064491	Georgia-Pacific Wood Products South LLC	Polk	10 - Beaumont	Pages 136 & 149
0604D	10787-001	001	057002	City of Corrigan	Polk	10 - Beaumont	Pages 136 & 149
0604D	11139-001	001	075701	Moscow WSC	Polk	10 - Beaumont	Pages 136 & 149
0604M	01268-000	001	065412	Lufkin Industries, Inc.	Angelina	10 - Beaumont	Pages 136 & 152
0604N	14128-001	001	119679	Angelina WSC	Angelina	10 - Beaumont	Pages 136, 152 & 155

Texas Surface Water Quality Standards (2008) Criteria

Numeric and Screening Level Criteria for Specified Uses for the Middle Neches Sub-Basin

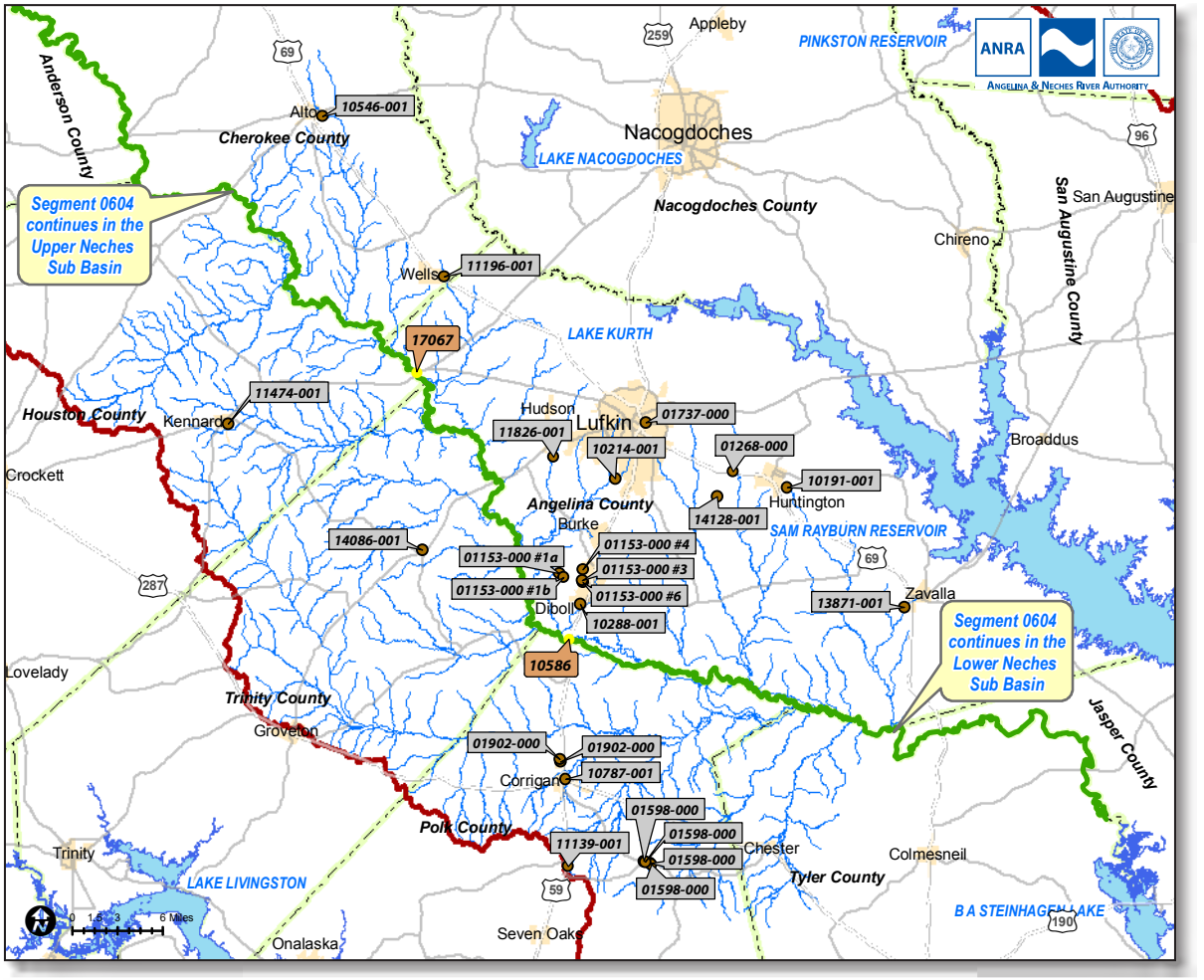
Segment ID	*Assigned Use*	*Screening Levels for Specified Use*
604	General Use	Ammonia: 0.33 mg/L, Chlorophyll-a: 14.1 ug/L, Nitrate: 1.95 mg/L, Orthophosphorus: 0.37 mg/L, Total Phosphorus: 0.69 mg/L, Temperature: 32.8C/ 91 F
	Public Water Supply	Chloride: 50 mg/L, Sulfate: 50 mg/L, TDS: 200 mg/L, pH: 6-8.5
	Contact Recreation Use	E. *coli* geomean: 126 MPN/ 100 ml, E. *coli* single sample: 394 MPN/ 100 ml
	High Aquatic Life Use	DO screening level: 5.0 mg/L, DO grab minimum: 3.0 mg/L, DO 24-hour minimum: 3.0 mg/L, DO 24-hour average: 5.0 mg/L
604A	General Use	Ammonia: 0.33 mg/L, Chlorphyll-a: 14.10 mg/L, Nitrate: 1.95 mg/L, Orthophosphorus: 0.37 mg/L, Total Phosphorus: 0.69 mg/L
	Recreation Use	E. *coli* geomean: 126 MPN/ 100 ml, E. *coli* single sample: 394 MPN/ 100 ml
	Aquatic Life Use	DO screening level: 4.0 mg/L, DO grab minimum: 3.0 mg/L
604B	General Use	Ammonia: 0.33 mg/L, Chlorphyll-a: 14.10 mg/L, Nitrate: 1.95 mg/L, Orthophosphorus: 0.37 mg/L, Total Phosphorus: 0.69 mg/L
	Recreation Use	E. *coli* geomean: 126 MPN/ 100 ml, E. *coli* single sample: 394 MPN/ 100 ml
604C	General Use	Ammonia: 0.33 mg/L, Chlorphyll-a: 14.10 mg/L, Nitrate: 1.95 mg/L, Orthophosphorus: 0.37 mg/L, Total Phosphorus: 0.69 mg/L
	Recreation Use	E. *coli* geomean: 126 MPN/ 100 ml, E. *coli* single sample: 394 MPN/ 100 ml
	Aquatic Life Use	DO screening level: 4.0 mg/L, DO grab minimum: 3.0 mg/L
604M	General Use	Ammonia: 0.33 mg/L, Chlorphyll-a: 14.10 mg/L, Nitrate: 1.95 mg/L, Orthophosphorus: 0.37 mg/L, Total Phosphorus: 0.69 mg/L
	Recreation Use	E. *coli* geomean: 126 MPN/ 100 ml, E. *coli* single sample: 394 MPN/ 100 ml
	Aquatic Life Use	DO screening level: 3.0 mg/L, DO grab minimum: 2.0 mg/L, DO 24-hour minimum: 2.0 mg/L, DO 24-hour average: 3.0 mg/L
604N	General Use	Ammonia: 0.33 mg/L, Chlorphyll-a: 14.10 mg/L, Nitrate: 1.95 mg/L, Orthophosphorus: 0.37 mg/L, Total Phosphorus: 0.69 mg/L
	Recreation Use	E. *coli* geomean: 126 MPN/ 100 ml, E. *coli* single sample: 394 MPN/ 100 ml
	Aquatic Life Use	DO screening level: 3.0 mg/L, DO grab minimum: 2.0 mg/L
604T	General Use	Ammonia: 0.33 mg/L, Chlorphyll-a: 14.10 mg/L, Nitrate: 1.95 mg/L, Orthophosphorus: 0.37 mg/L, Total Phosphorus: 0.69 mg/L
	Recreation Use	E. *coli* geomean: 126 MPN/ 100 ml, E. *coli* single sample: 394 MPN/ 100 ml

Segment 0604 - Neches River Below Lake Palestine

Segment Profile

This 225 mile-length Freshwater Stream extends from a point immediately upstream of the confluence of Hopson Mill Creek in Jasper/ Tyler County to Blackburn Crossing Dam in Anderson/ Cherokee County. Contact recreation, public water supply, general, and high aquatic life use are the designated uses for this segment.

The entire length of Segment 0604 spans across the Upper, Middle and Lower Neches Sub-Basins.



Monitoring Stations on the Middle Portion of Segment 0604

Station ID	Station Name	Collecting Agency	Frequency	Parameters
10586	Neches River at US 59	TCEQ	Quarterly	Field, Conventionals, Bacteria, Flow
17067	Neches River at SH 7	TCEQ	Quarterly	Field, Conventionals, Bacteria

STATION 10586
Neches River at US 59
South of Diboll

Water Quality Parameters

pH values ranged from 6.3 to 7.9 S.U. All thirty-nine values were within the criteria of 6 and 8.5 S.U. (n = 39).

Dissolved Oxygen (DO) values ranged from 4 to 11.2 mg/L, with a mean of 7.5 mg/L (n = 39). Two values fell below the screening level criteria for aquatic life.

***E. coli* bacteria** results ranged from 10 to 4838 MPN/100 mL, with a geometric mean of 96 MPN/100 mL (n = 27). Two data points (7.4%) exceeded the criteria for contact recreation use. The data is fully supporting.

Total Suspended Solids (TSS) values ranged from 4 to 92 mg/L, with a mean of 35 mg/L (n = 39). The data displayed a decreasing significant trend.

Total Dissolved Solids (TDS) values ranged from 98 to 202 mg/L, with a mean of 156 mg/L (n = 38). The criteria of 200 mg/L was exceeded once.

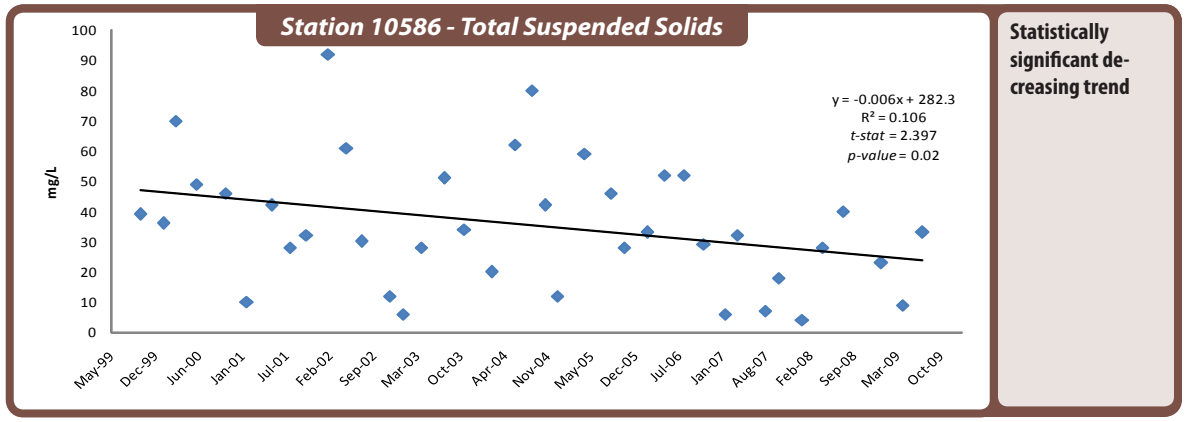
Ammonia-Nitrogen concentrations ranged from <0.05 to 0.27 mg/L as N (n = 38), with no exceedances.

Nitrate+Nitrite-Nitrogen values ranged from <0.04 to 0.4 mg/L as N, with a mean of 0.19 mg/L as N (n = 39). No values exceeded the criteria.

Orthophosphorus concentrations values ranged from <0.04 to 0.22 mg/L as P, with a mean of 0.07 mg/L as P (n = 38). No values exceeded the criteria.

Total Phosphorus values ranged from 0.05 to 0.28 mg/L as P, with a mean of 0.15 mg/L as P (n = 39). No values exceeded the criteria.

Chlorophyll-*a* results ranged from 1.78 to 24.6 ug/L (n = 39). There were four exceedances found (10% of values).



STATION 17067
Neches River at SH 7
West of Lufkin

Water Quality Parameters

pH values ranged from 6.4 to 8 S.U., with a mean of 7.33 S.U. No values were found to exceed the criteria (n = 35).

Dissolved Oxygen (DO) values ranged from 4.7 to 11.5 mg/L, with a mean of 7.8 mg/L (n = 35). There were two values (5.7%) below the screening level criteria.

***E. coli* bacteria** results ranged from 10 to 2827 MPN/100 mL, with a geometric mean of 98 MPN/100 mL (n = 27). Three exceedances were observed.

Total Suspended Solids (TSS) values ranged from 4 to 82 mg/L. The mean was found to be 30 mg/L (n = 35).

Total Dissolved Solids (TDS) values ranged from 99 to 168 mg/L. All values were found to be under the criteria of 200 mg/L The mean was 137 mg/L (n = 34).

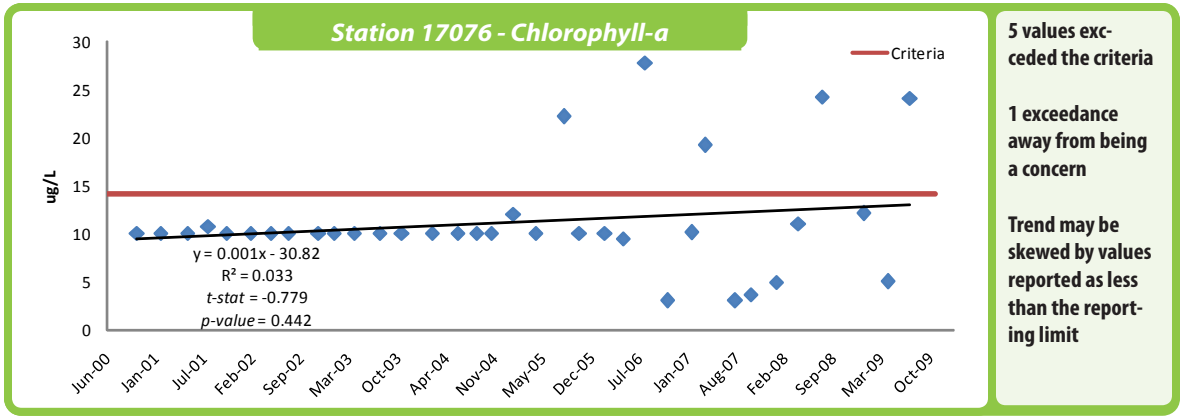
Ammonia-Nitrogen concentrations ranged from <0.05 to 0.11 mg/L as N (n = 34). No exceedances occurred.

Nitrate+Nitrite-Nitrogen values ranged from <0.04 to 0.48 mg/L as N (n = 35). No exceedances occurred.

Orthophosphorus concentrations ranged from <0.04 to 0.08 mg/L as P (n = 34), with no exceedances.

Total Phosphorus concentrations ranged from <0.05 to 0.19 mg/L as P, with a mean of 0.09 mg/L as P (n = 34). No exceedances were found.

Chlorophyll-*a* results ranged from 3 to 27.8 ug/L (n = 35). The criteria of 14.1 ug/L was exceeded five times (14% exceedance rate). The mean was found to be 11.2 ug/L. For the first half of the evaluation period, values were reported as <10 ug/L, which was the reporting limit at that time.



5 values exceeded the criteria

1 exceedance away from being a concern

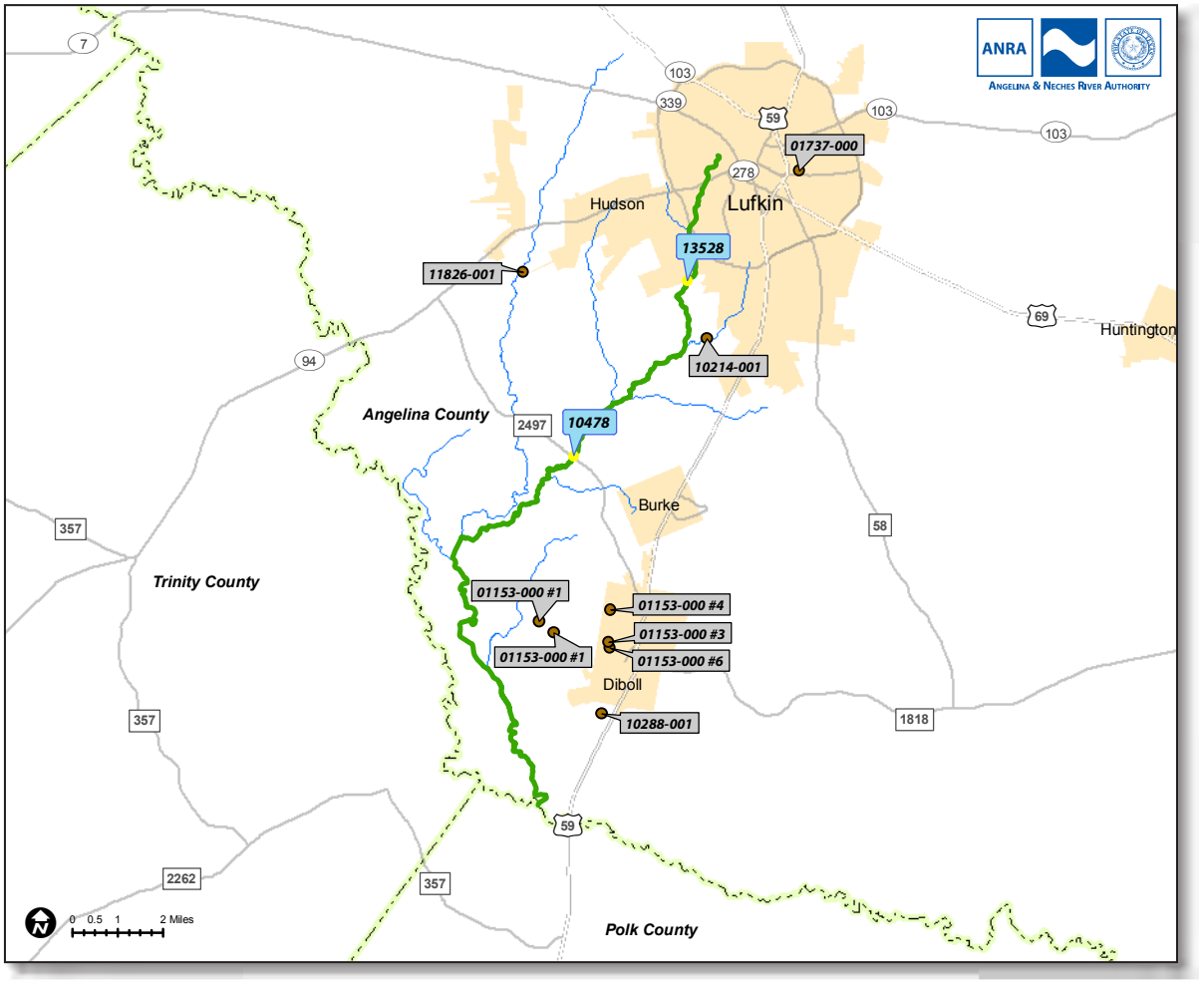
Trend may be skewed by values reported as less than the reporting limit

Segment 0604A - Cedar Creek (unclassified water body)

Segment Profile

Cedar Creek is a 23-mile length freshwater stream that extends from the confluence of the Neches River southwest of Lufkin to the upstream perennial portion of the stream in Lufkin in Angelina County. This segment is designated for contact recreation, general use, and aquatic life use. These upper and lower portions of this segment are on the 303(d) list for impaired bodies of water. It was first listed in the year 2000 for nonsupport of contact recreational use due to elevated bacterial levels, and is currently under a 5c categorization.

Cedar Creek at FM 2497



Monitoring Stations on Segment 0604A				
Station ID	***Station Name***	***Collecting Agency***	***Frequency***	***Parameters***
10478	Cedar Creek at FM 2497	ANRA	Metals 3x, Others Quarterly	Field, Conventionals, Bacteria, Flow, Metals (water)
13528	Cedar Creek at CR 1336	ANRA	Quarterly	Field, Conventionals, Bacteria, Flow

STATION 10478
Cedar Creek at FM 2497
North of Diboll

Water Quality Parameters

pH values ranged from 6.7 to 8.1 S.U., with a mean of 7.5 S.U. From thirty-nine data points, a significant increasing trend was found to exist (*t-stat* = 2.33, *p-value* = 0.025). No exceedances were found.

Dissolved Oxygen (DO) values ranged from 4.3 to 11.7 mg/L, with a mean of 7.7 mg/L (n = 41). A significant decreasing trend was found to exist (*t-stat* = 2.40, *p-value* = 0.02). No exceedances were found.

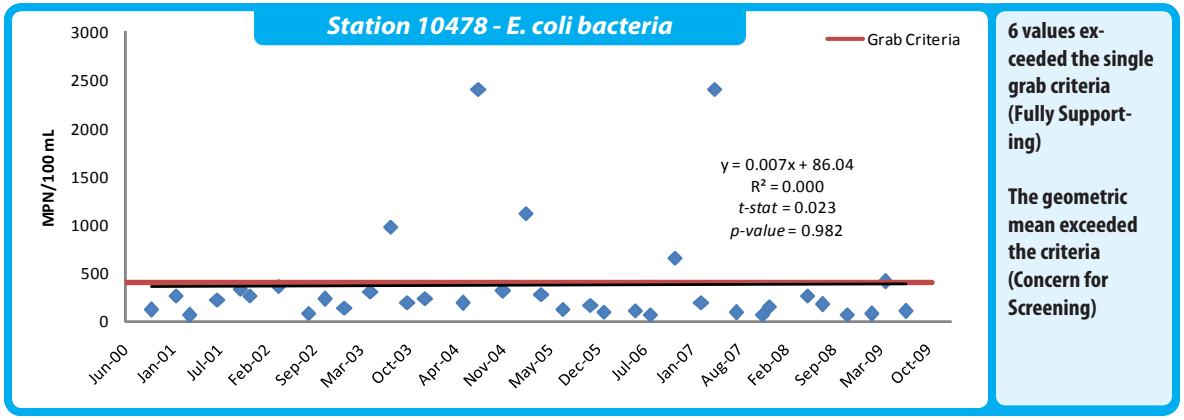
***E. coli* bacteria** results ranged from 58 to >2400 MPN/100 mL, with 6 values exceeding the criteria. The geometric mean of the data set was 212 MPN/100 mL (n = 36), exceeding the criteria for contact recreation use.

Total Suspended Solids (TSS) values ranged from 3.3 to 77 mg/L, with a mean of 16 mg/L (n = 39).

Total Dissolved Solids (TDS) values ranged from 260 to 780 mg/L, with a mean of 573 mg/L (n = 38).

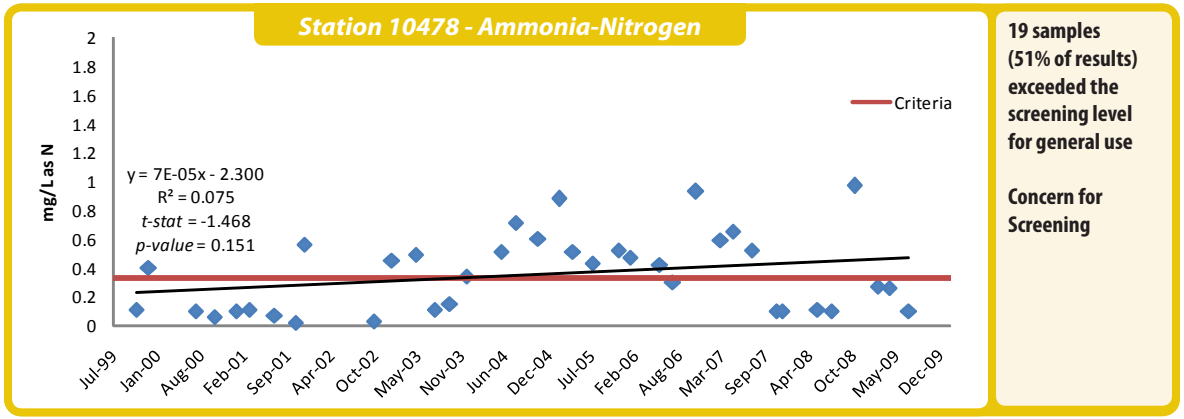
Ammonia-Nitrogen concentrations ranged from 0.02 to 0.97 mg/L as N (n = 37). Nineteen samples (51% of results) exceeded the screening level for general use.

Nitrate+Nitrite-Nitrogen values were found to display an increasing significant trend. Values ranged from 0.2 to 26.6 mg/L as N, with a mean of 8.14 mg/L as N (n = 39). The criteria of 1.95 mg/L as N was exceeded on 31 occasions (a 78% exceedance rate).



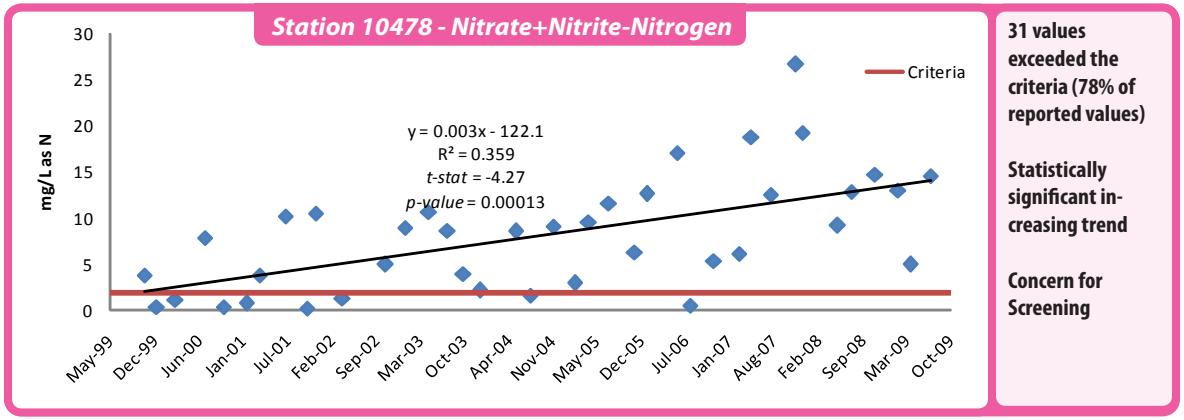
6 values exceeded the single grab criteria (Fully Supporting)

The geometric mean exceeded the criteria (Concern for Screening)



19 samples (51% of results) exceeded the screening level for general use

Concern for Screening



31 values exceeded the criteria (78% of reported values)

Statistically significant increasing trend

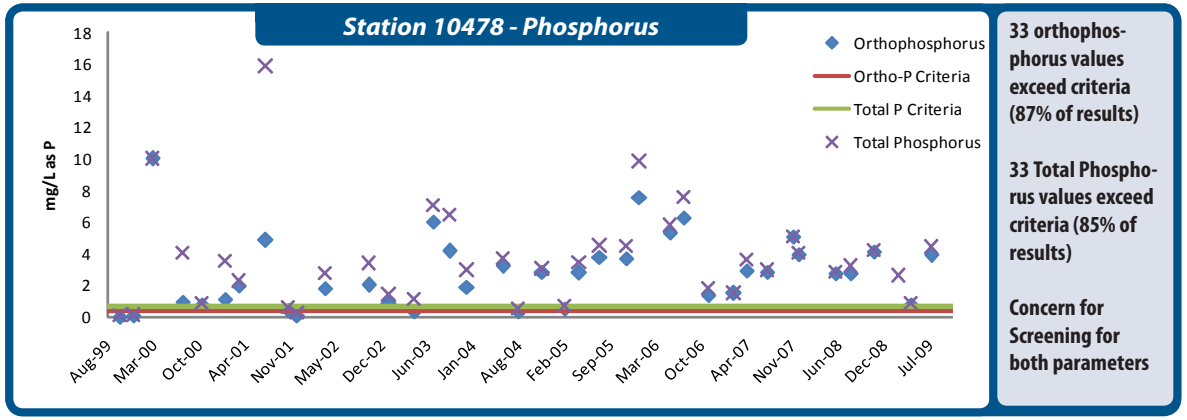
Concern for Screening

Water Quality Parameters (continued)

Orthophosphorus concentrations ranged from 0.009 to 10 mg/L as P, with a mean value of 2.7 mg/L as P (n = 38). The criteria was exceeded 33 times (87% exceedance rate).

Total Phosphorus concentrations ranged from 0.053 to 15.85 mg/L as P, with a mean value of 3.66 mg/L as P (n = 39). The criteria for screening level of 0.69 mg/L as P was exceeded 33 times (85% exceedance rate).

Chlorophyll-*a* results ranged from 2 to 11.4 ug/l, with a mean of 4.4 ug/L (n = 23). No exceedances occurred.



33 orthophosphorus values exceed criteria (87% of results)

33 Total Phosphorus values exceed criteria (85% of results)

Concern for Screening for both parameters

Flow Measurement at Station 10478 - Cedar Creek at FM 2497

STATION 13528
Cedar Creek at CR 1336

Water Quality Parameters

pH values ranged from 6.5 to 8.3 S.U., with a mean of 7.4 S.U. (n = 26). No exceedances were found to occur.

Dissolved Oxygen (DO) values ranged from 0.3 to 10.7 mg/L, with a mean of 5.8 mg/L (n = 28). Six values (21%) were below the screening level criteria, with 2 values below the DO grab minimum.

***E. coli* bacteria** results ranged from 5 to >2420 MPN/100 mL, with a geometric mean of 148.6 MPN/100 mL (n = 28), which exceeds the criteria. For single grab samples, 8 results were exceedances (29% of samples).

Total Suspended Solids (TSS) values ranged from <1 to 64 mg/L, with a mean of 12 mg/L (n = 28).

Total Dissolved Solids (TDS) values ranged from 81.3 to 788 mg/L, with a mean of 361 mg/L. (n = 28)

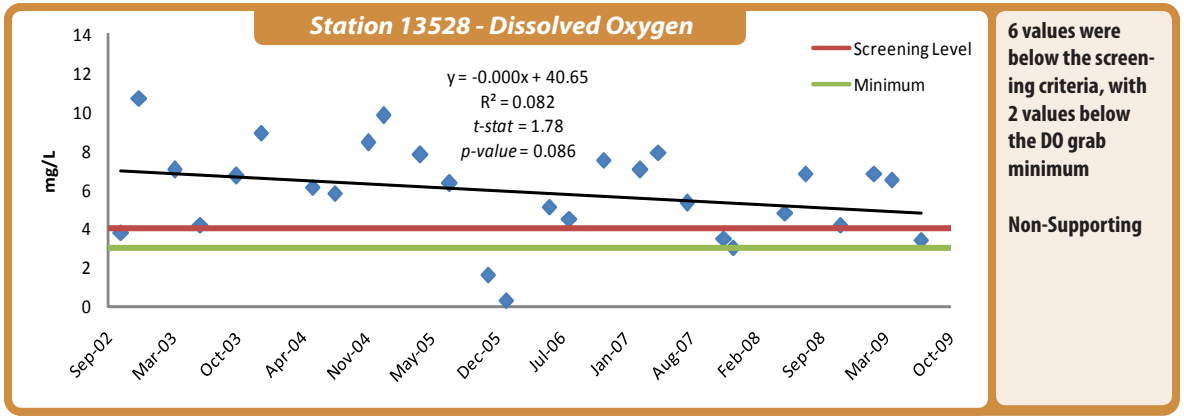
Ammonia-Nitrogen concentrations ranged from 0.04 to 1.14 mg/L as N (n = 28). The criteria for screening general use was exceeded on 15 occasions (54%).

Nitrate+Nitrite-Nitrogen values ranged from <0.04 to 12 mg/L as N, with a mean of 0.92 mg/L as N (n = 28). Two exceedances occurred.

Orthophosphorus concentrations ranged from 0.06 to 0.74 mg/L as P (n = 28). Two exceedances occurred.

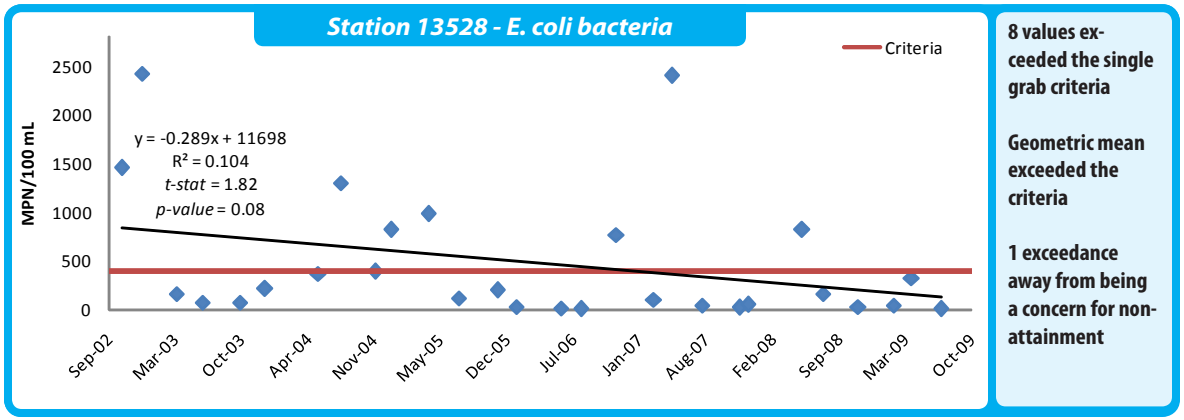
Total Phosphorus concentrations ranged from 0.1 to 1.062 mg/L as P, with a mean of 0.3 mg/L as P (n = 28). Three exceedances occurred.

Chlorophyll-*a* results ranged from 2 to 50 ug/L, with a mean of 7.6 ug/L (n = 23). Two exceedances occurred.



6 values were below the screening criteria, with 2 values below the DO grab minimum

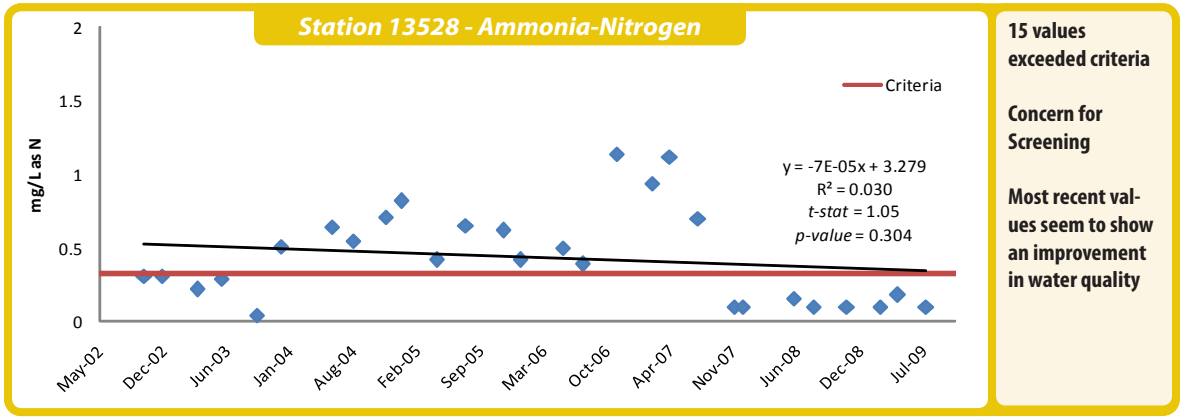
Non-Supporting



8 values exceeded the single grab criteria

Geometric mean exceeded the criteria

1 exceedance away from being a concern for non-attainment



15 values exceeded criteria

Concern for Screening

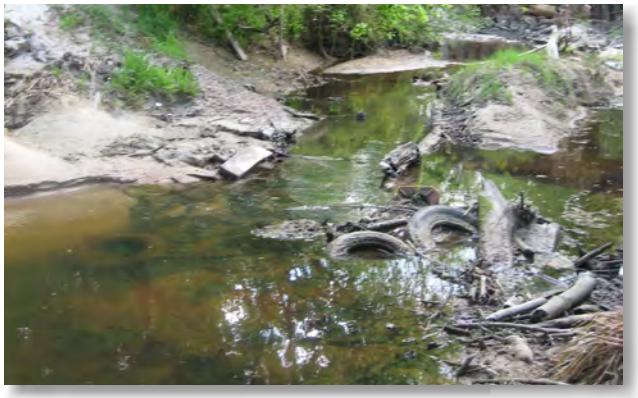
Most recent values seem to show an improvement in water quality

Segment 0604B - Hurricane Creek (unclassified water body)

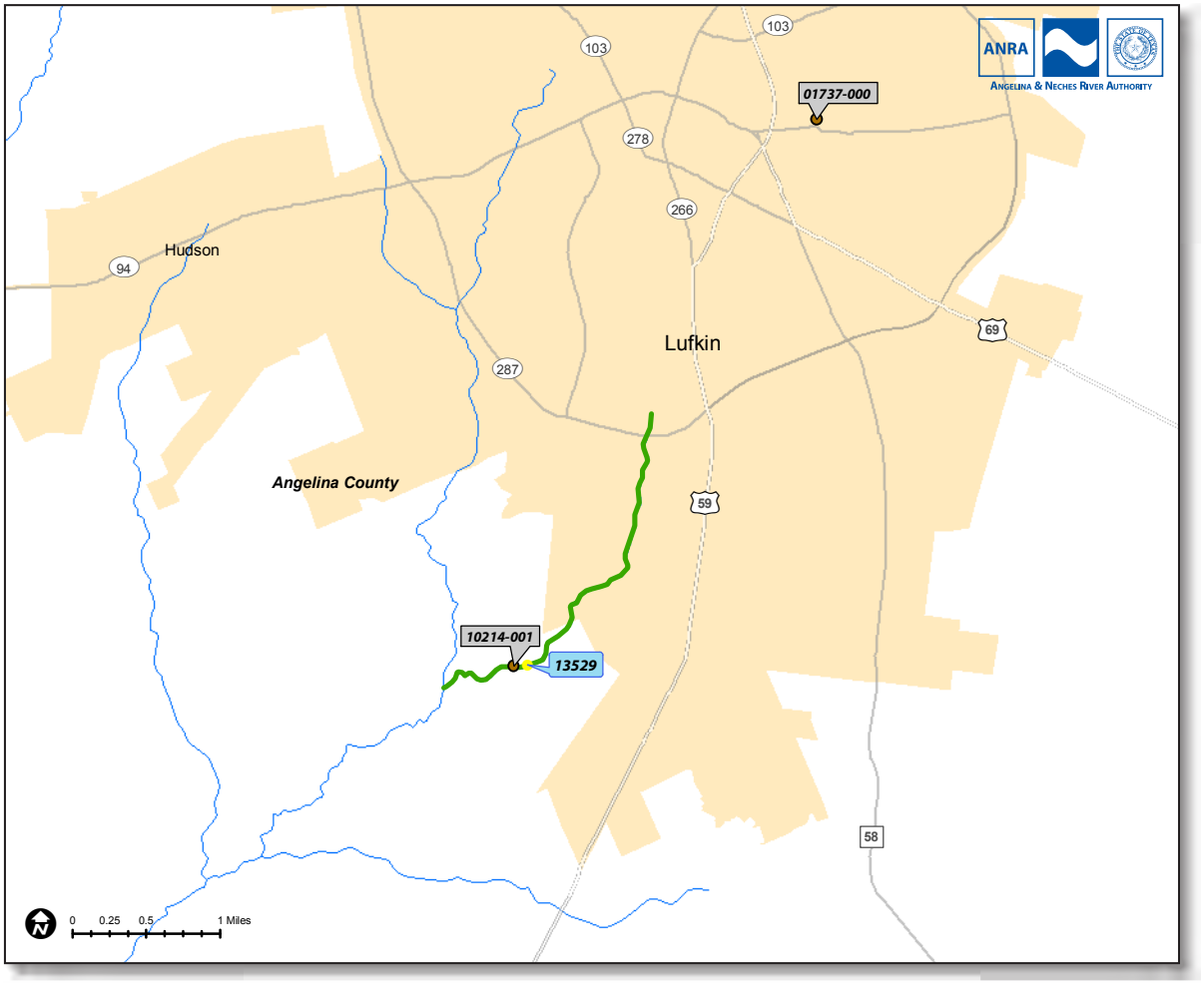
Segment Profile

Covering an area of four miles, this water body stretches from the confluence of Cedar Creek south of Lufkin to the upstream perennial portion of the stream in Lufkin in Angelina County. General and recreation use are designated uses for this segment. This segment is on the 303(d) list for impaired bodies of water. It was first listed in the year 2000 for nonsupport of contact recreational use due to elevated bacterial levels. It is currently under a 5c categorization. There is a partial impairment listing for lead as a chronic toxic substance and concern for screening for ammonia.

This small stream is very shallow and has large quantities of non-point source pollution. Monitoring Station 13529 is located upstream of the City of Lufkin WWTP outfall.



Trash (discarded tires) in Hurricane Creek



Monitoring Stations on Segment 0604B

Station ID	Station Name	Collecting Agency	Frequency	Parameters
13529	Hurricane Creek at SH 324	ANRA	Metals 3x, Others Quarterly	Field, Conventionals, Bacteria, Flow, Metals (water)

STATION 13529
Hurricane Creek at SH 324
South of Lufkin, Upstream of WWTP Discharge

Water Quality Parameters

pH values ranged from 6.8 to 8 S.U. The mean was 7.4 S.U. (n = 46).

Dissolved Oxygen (DO) values ranged from 0.2 to 11 mg/L (n = 48). Nine values (19%) fell below 4.0 mg/L.

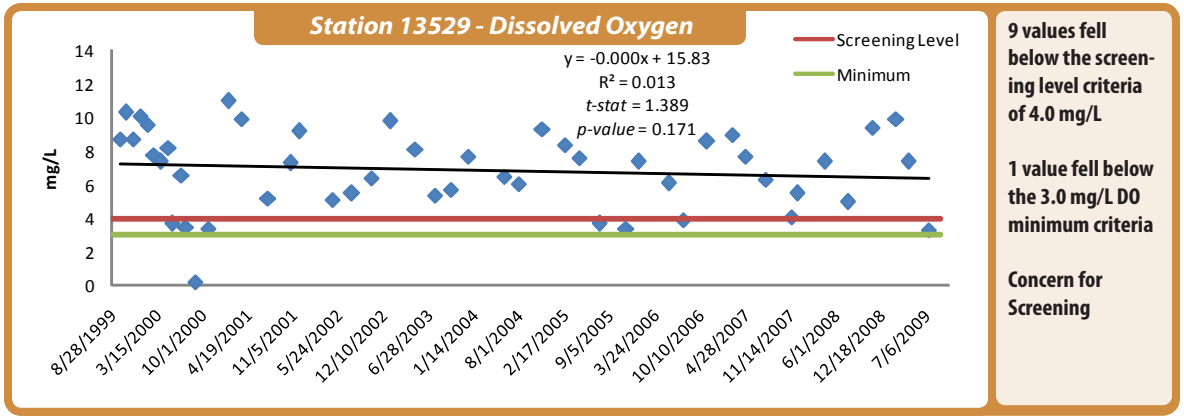
***E. coli* bacteria** results ranged from 19 to 3973 MPN/100 mL, with a geometric mean of 324 MPN/100 mL (n = 36), exceeding the criteria for contact recreation use. The single grab criteria was exceeded 19 times (53%).

Total Suspended Solids (TSS) values ranged from 1.33 to 166 mg/L. A mean of 27 mg/L was calculated from 48 data points.

Total Dissolved Solids (TDS) values ranged from 189 to 666 mg/L, with a mean of 403 mg/L (n = 40).

Ammonia-Nitrogen concentrations displayed an increasing trend, although it was not statistically significant. Values ranged from <0.01 to 1.25 mg/L as N (n = 40). The criteria for grab sample of 0.33 mg/L as N was exceeded 17 times (43%).

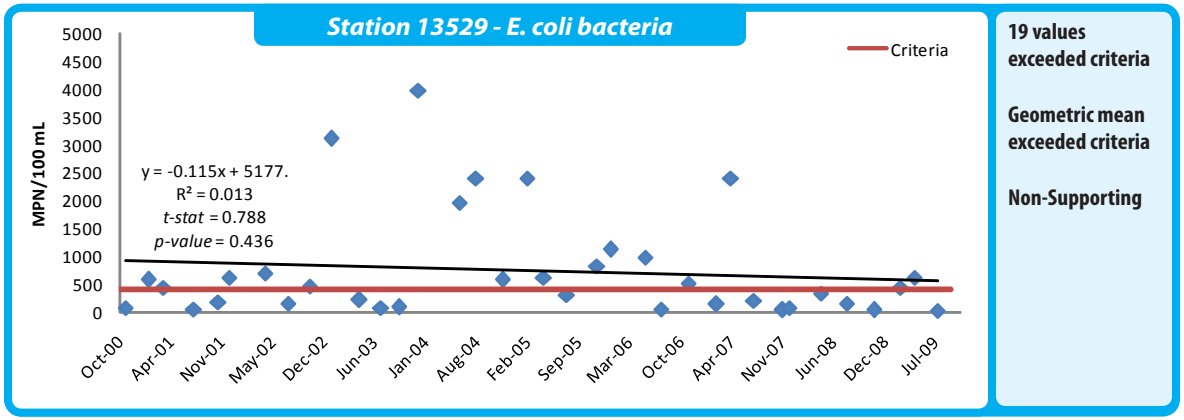
Nitrate+Nitrite-Nitrogen values displayed a decreasing significant trend. Values ranged from <0.04 to 2.49 mg/L as N, with a mean value of 0.48 mg/L as N (n = 40). One data point exceeded the criteria of 1.95 mg/L as N.



9 values fell below the screening level criteria of 4.0 mg/L

1 value fell below the 3.0 mg/L DO minimum criteria

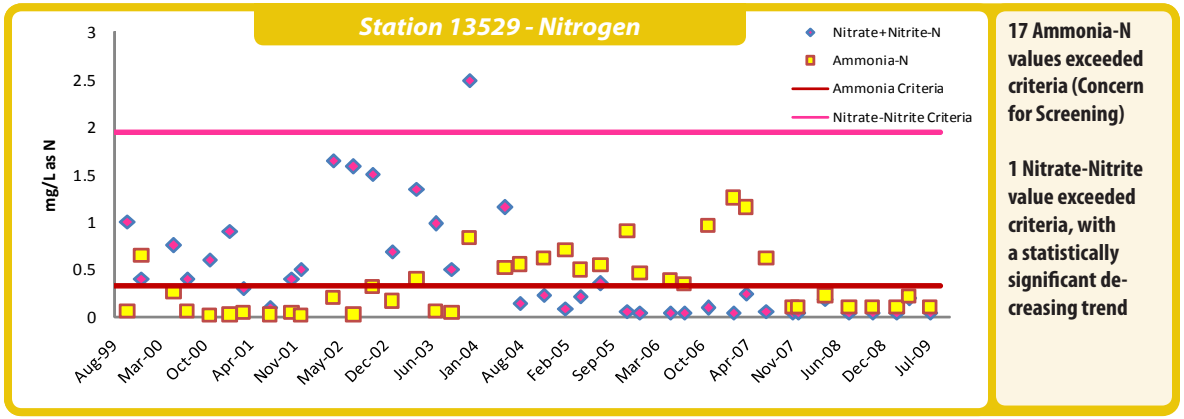
Concern for Screening



19 values exceeded criteria

Geometric mean exceeded criteria

Non-Supporting



17 Ammonia-N values exceeded criteria (Concern for Screening)

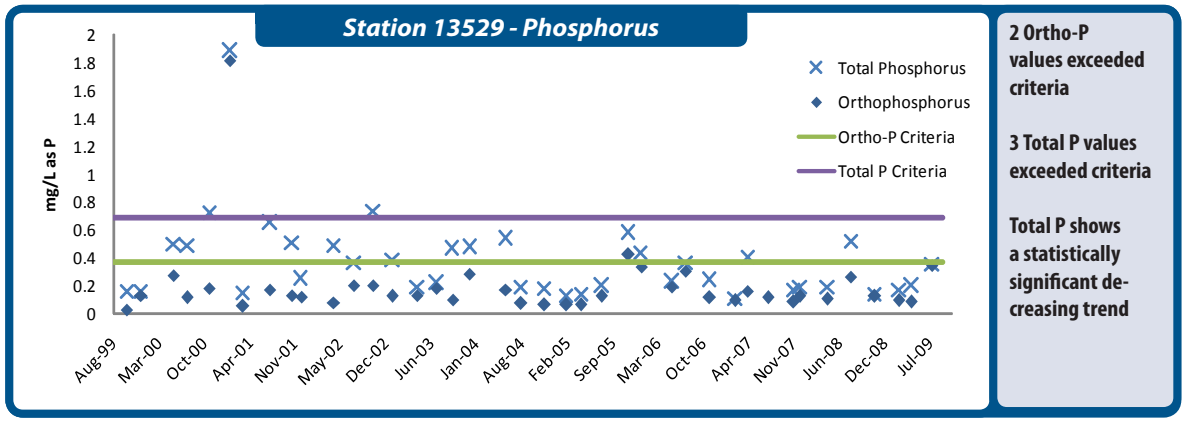
1 Nitrate-Nitrite value exceeded criteria, with a statistically significant decreasing trend

Water Quality Parameters (continued)

Orthophosphorus concentrations ranged from 0.026 to 1.8 mg/L as P, with a mean of 0.19 mg/L as P (n = 40). Two exceedances occurred.

Total Phosphorus values displayed a significant decreasing trend (*t-stat* = 2.50, *p-value* = 0.02). A total of 39 data points ranged from 0.1 to 1.9 mg/L as P. Three exceedances occurred.

Chlorophyll-*a* results ranged from 2 to 10 ug/L (n = 23). No exceedances occurred.



2 Ortho-P values exceeded criteria

3 Total P values exceeded criteria

Total P shows a statistically significant decreasing trend

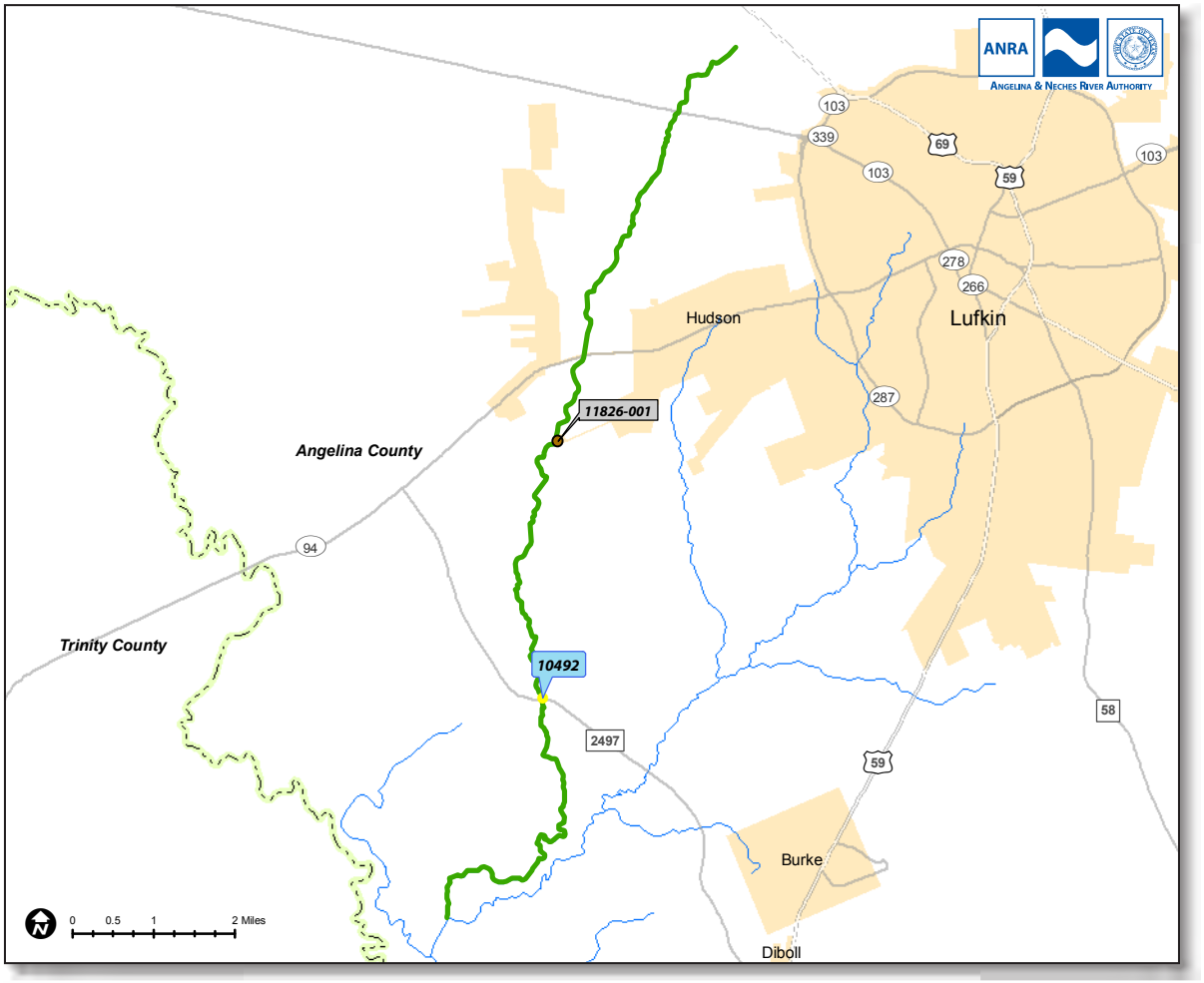
Station 13529 - Hurricane Creek at SH 324 (downstream)

Segment 0604C - Jack Creek (unclassified water body)

Segment Profile

This freshwater stream extends sixteen miles from the confluence of Cedar Creek southwest of Lufkin in Angelina County to the upstream perennial portion of the stream in northeast Lufkin in Angelina County. This segment is designated for contact recreation, general use, and aquatic life use. Jack Creek was placed on the 303(d) list for impaired bodies of water in the year 2000 for non-support of contact recreational use due to elevated bacteria levels. It is currently under a 5c categorization.

Jack Creek at FM 2497



Monitoring Stations on Segment 0604C

Station ID	Station Name	Collecting Agency	Frequency	Parameters
10492	Jack Creek at FM 2497	ANRA	Quarterly	Field, Conventionals, Bacteria, Flow, Metals (water)

STATION 10492
Jack Creek at FM 2497
Southwest of Lufkin

Water Quality Parameters

pH values ranged from 6.6 to 8.2 S.U., with a mean of 7.5 S.U. (n = 38).

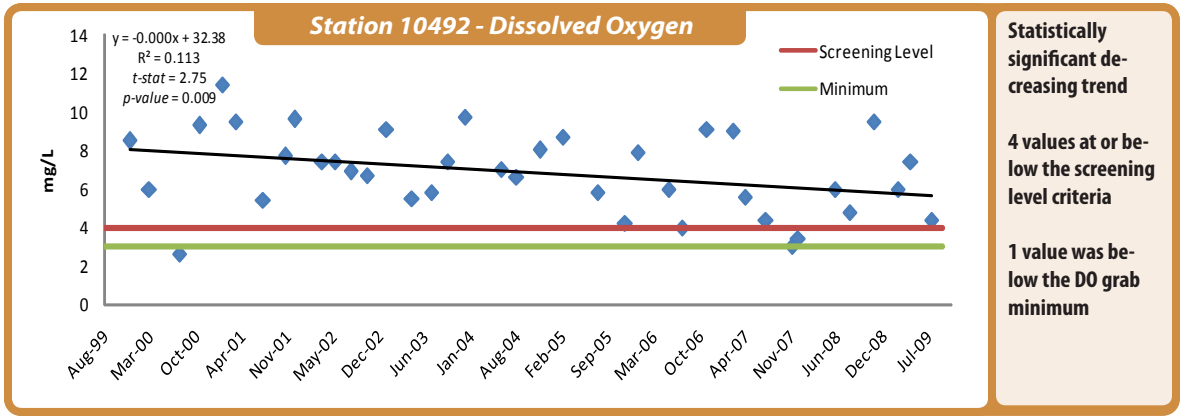
Dissolved Oxygen (DO) values ranged from 2.6 to 11.4 mg/L, with a mean of 6.8 mg/L (n = 39). A significant decreasing trend was observed. Four values were below the DO screening level criteria, with one value below the DO grab minimum.

***E. coli* bacteria** results ranged from 13.4 to >2400 MPN/100 mL. The geometric mean was 180 MPN/100 mL (n = 35), exceeding the criteria for contact recreational use. In addition, 8 exceedances were found.

Total Suspended Solids (TSS) values ranged from 1 to 143 mg/L. The mean was 15 mg/L (n = 35).

Total Dissolved Solids (TDS) values ranged from 156 to 892 mg/L. The mean was 499 mg/L (n = 35).

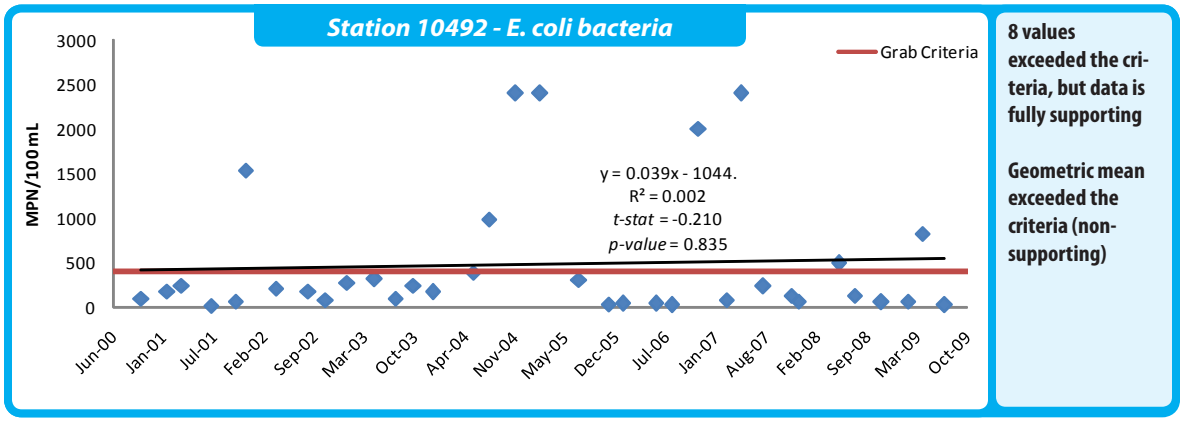
Ammonia-Nitrogen concentrations displayed a statistically significant increasing trend. Values ranged from <0.01 to 4.93 mg/L as N. Thirty-five data points yielded a calculated mean of 0.66 mg/L as N, double the criteria for general use. Nineteen exceedances (54% or results) occurred.



Statistically significant decreasing trend

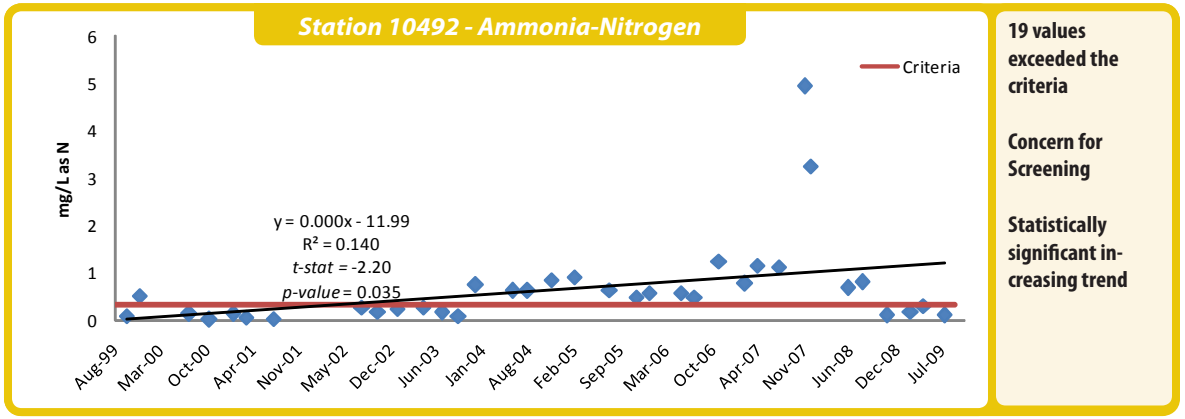
4 values at or below the screening level criteria

1 value was below the DO grab minimum



8 values exceeded the criteria, but data is fully supporting

Geometric mean exceeded the criteria (non-supporting)



19 values exceeded the criteria

Concern for Screening

Statistically significant increasing trend

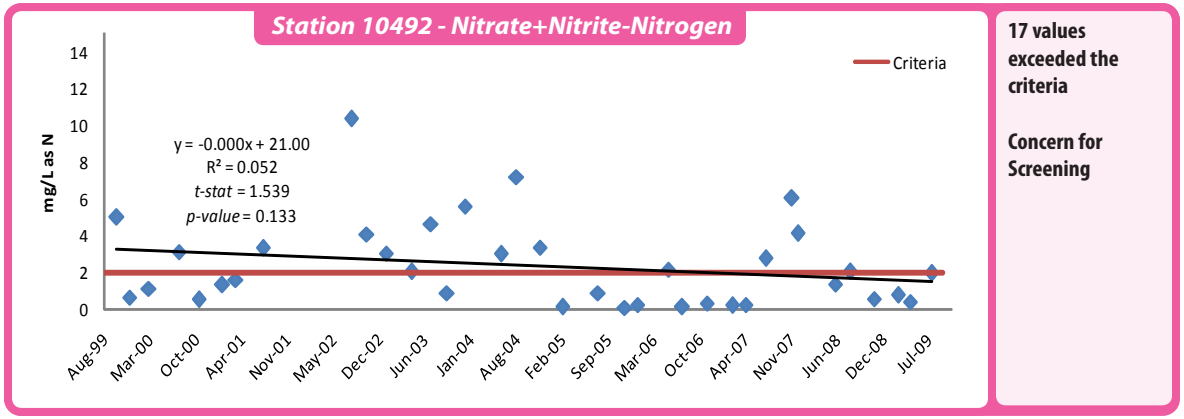
Water Quality Parameters (continued)

Nitrate+Nitrite-Nitrogen values from 0.08 to 10.36 mg/L as N (n = 36). Seventeen exceedances (47%) occurred.

Orthophosphorus concentrations ranged from 0.01 to 6.15 mg/L as P. The average, taken from 34 data points, was found to be 1.3 mg/L as P. There were 24 exceedances (71% of results).

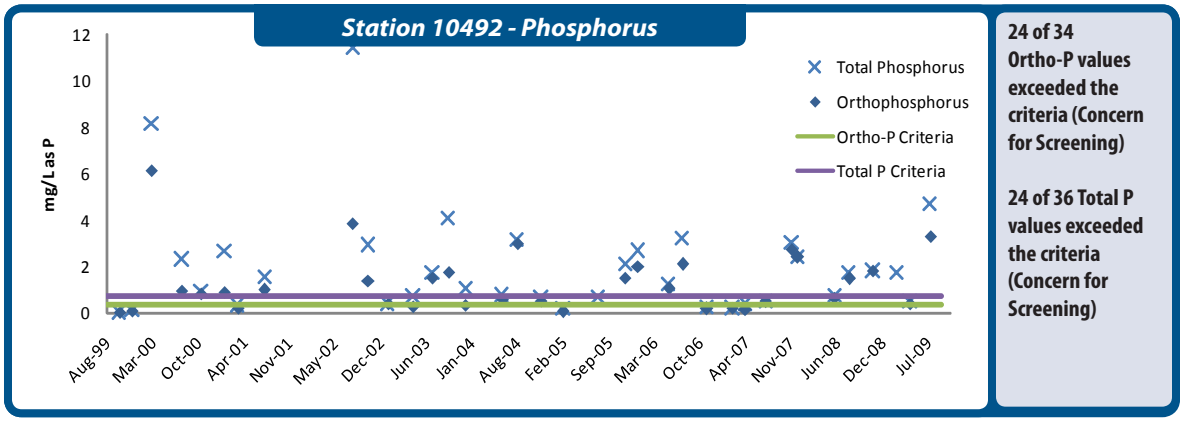
Total Phosphorus concentrations ranged from 0.018 to 11.4 mg/L as P. The mean was 1.96 mg/L as P (n = 36), more than double the criteria. Twenty-four data points exceeded the criteria (67% of results).

Chlorophyll-*a* results ranged from 2 to 14.1 ug/L (n = 22). No values were found to exceed the criteria.



17 values exceeded the criteria

Concern for Screening



24 of 34 Ortho-P values exceeded the criteria (Concern for Screening)

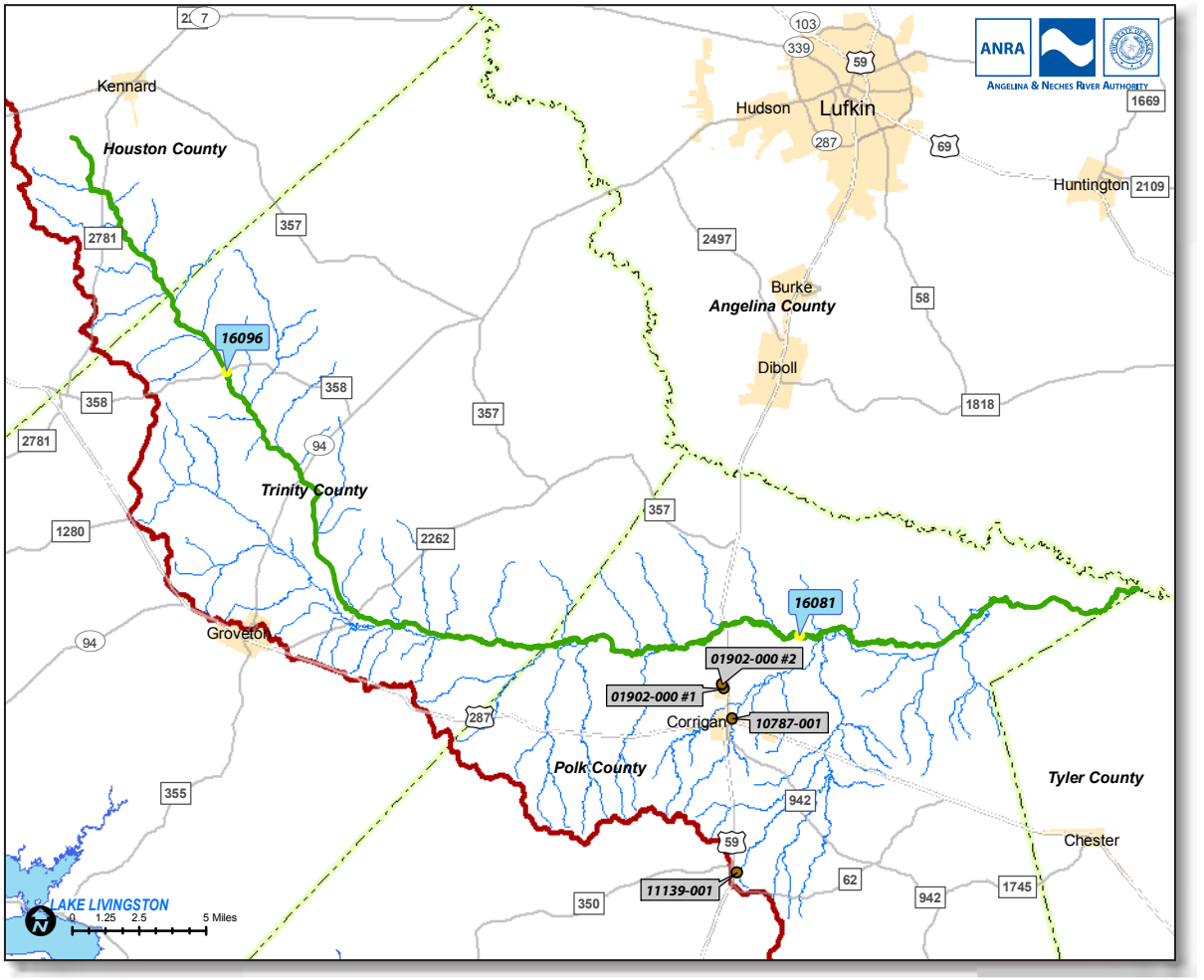
24 of 36 Total P values exceeded the criteria (Concern for Screening)

Segment 0604D - Piney Creek (unclassified water body)

Segment Profile

This freshwater stream encompasses 70 miles in stream length from the confluence of the Neches River at the Polk/Tyler/Angelina County lines east of Corrigan to the upstream perennial portion of the stream east of Crockett in Houston County. This segment is designated for contact recreation, general use, and aquatic life use.

Piney Creek at FM 358, Upstream of Crossing



Monitoring Stations on Segment 0604D				
Station ID	***Station Name***	***Collecting Agency***	***Frequency***	***Parameters***
16081	Piney Creek at FM 1987	ANRA	Quarterly	Field, Metals (water), Conventionals (prior to 2007)
16096	Piney Creek at FM 358	ANRA	Quarterly	Field, Conventionals, Bacteria, Flow

STATION 16081
Piney Creek at FM 1987
Northeast of Corrigan

Water Quality Parameters

pH values ranged from 5.4 to 7.6 S.U., with a mean of 6.5 S.U. (n = 34).

Dissolved Oxygen (DO) values ranged from 0.7 to 10.6 mg/L, with a mean of 5.5 mg/L (n = 34). Sixteen data points (17%) were below the screening level. Six grab samples fell below the DO grab minimum of 3.0 mg/L.

***E. coli* bacteria** results ranged from 6 to 1990 MPN/100 mL. There were 3 instances that exceeded the single grab sample for contact recreation. The bacteria geo-mean was calculated to be 119.2 MPN/100 mL (n = 28).

Total Suspended Solids (TSS) values ranged from 4.67 to 26.3 mg/L (n = 32).

Total Dissolved Solids (TDS) values ranged from 80 to 339 mg/L (n = 32).

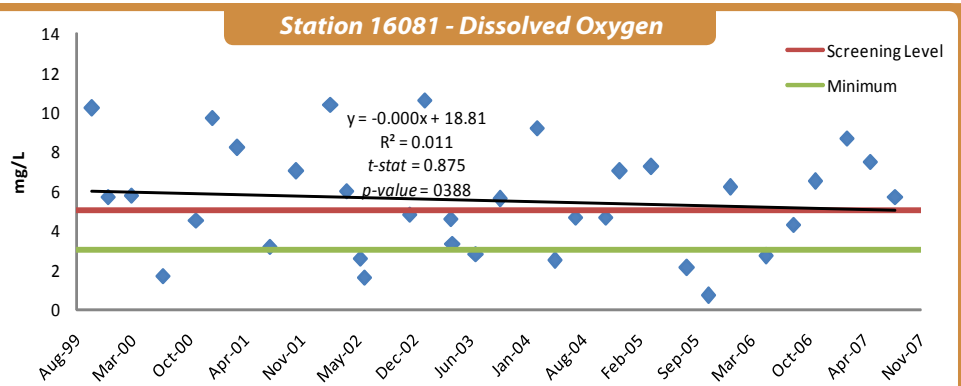
Ammonia-Nitrogen showed a significant increasing trend, ranging from <0.01 to 1.98 mg/L as N, with a mean of 0.615 mg/L as N (n = 32), and 15 exceedances (47%).

Nitrate+Nitrite-Nitrogen values had a significant decreasing trend, ranging from <0.04 to 2 mg/L as N, with a mean of 0.53 mg/L as N (n = 32) and 1 exceedance.

Orthophosphorus displayed a significant decreasing trend. Values ranged from 0.04 to 0.592 mg/L as P (n = 31). There was one exceeding the criteria

Total Phosphorus concentrations ranged from 0.07 to 3.95 mg/L (n = 31). A total of five data points (16%) exceeded the criteria.

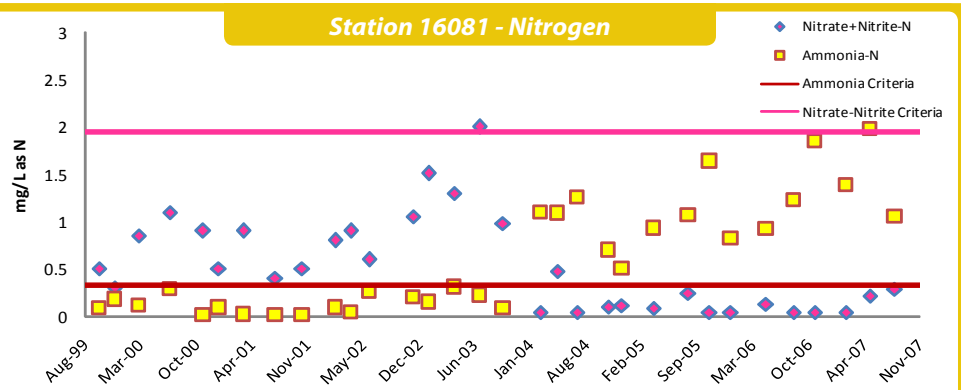
Chlorophyll-*a* results ranged from 5 to 44.6 ug/L (n = 15), with 2 exceedances.



16 values below the 5.0 mg/L screening level

6 samples below the DO grab minimum of 3.0 mg/L

Concern for Screening



15 Ammonia-N values (47%) exceeded criteria (Concern for Screening)

1 Nitrate value exceeded criteria

Ammonia-N had a statistically significant increasing trend (*t-stat* = -8.38, *p-value* = 2.34 x 10^{-9})

Nitrate+Nitrite-N had a statistically significant decreasing trend (*t-stat* = 3.44, *p-value* = 0.0017)

STATION 16096
Piney Creek at FM 358
East of Pennington

Water Quality Parameters

This station was added to the Coordinated Monitoring Schedule in 2007. There is not enough data available to perform an evaluation. ANRA is currently monitoring this station quarterly for field measurements, conventionals, bacteria, and flow.

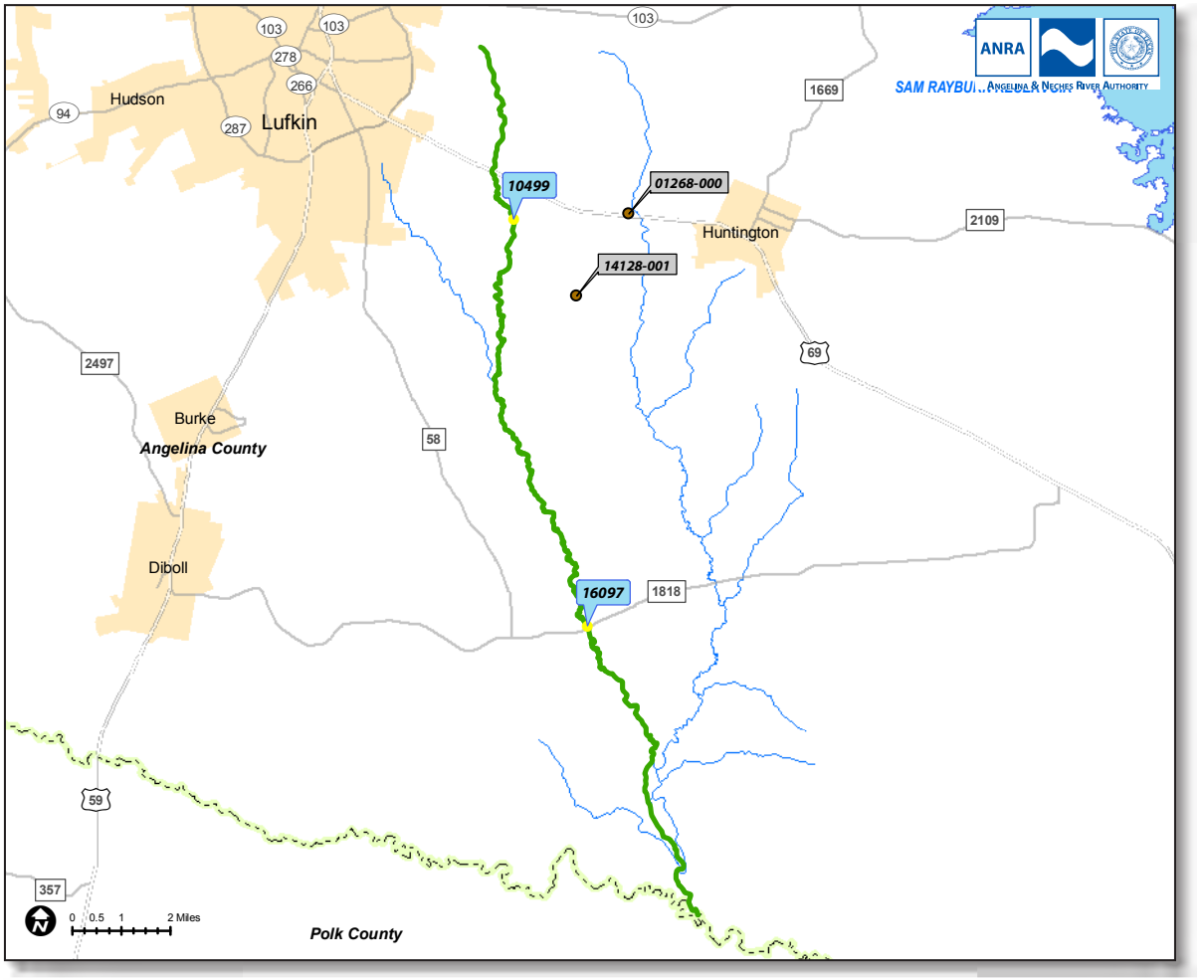
Piney Creek at FM 358, Downstream of crossing

Segment 0604M - Biloxi Creek (unclassified water body)

Segment Profile

Biloxi Creek is 23 miles in length and is from the confluence with the Neches River southeast of Diboll to FM 325 east of Lufkin in Angelina County. This segment is designated for contact recreation, general use, and aquatic life use. The lower portion below CR 228 was first listed on the 303(d) list for impaired water bodies in the year 2004 for bacteria levels. It is currently under a 5c classification. The upper portion of this segment above CR 228 was also placed on the 303(d) list. In 2004, it was listed for nonsupport of contact recreation due to elevated bacteria levels. It was listed in the year 2006 for nonsupport of aquatic life use due to depressed dissolved oxygen levels. Both of the listings within the upper portion are currently under a 5c classification.

Biloxi Creek at CR 216



Monitoring Stations on Segment 0604M				
Station ID	***Station Name***	***Collecting Agency***	***Frequency***	***Parameters***
10499	Biloxi Creek at Angelina CR 216	ANRA	6x	Bacteria, Flow
16097	Biloxi Creek at FM 1818	ANRA	Quarterly	Field, Conventionals, Bacteria, Flow, Metals (water)

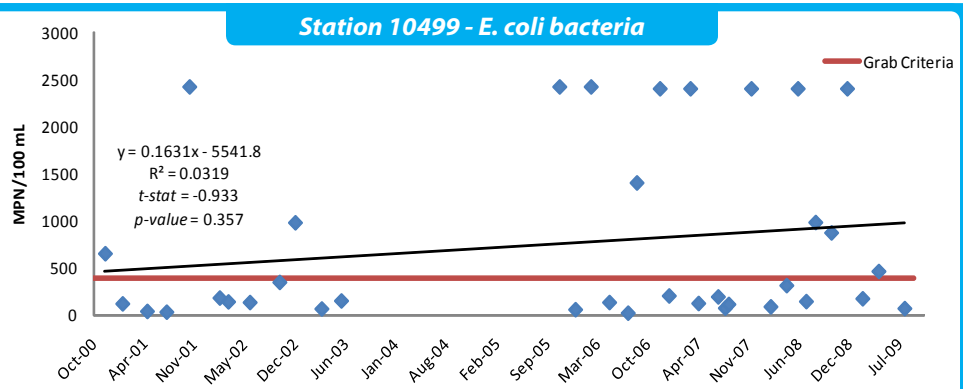
STATION 10499
Biloxi Creek at Angelina CR 216
Southeast of Lufkin

Water Quality Parameters

This station was not evaluated for field or conventional parameters due to a large gap in data between 2003 and 2007 in which this station was not being monitored. Currently, ANRA only collects bacteria samples at this station.

Although there was a gap in the bacteria data for 2004, there were enough *E. coli* results to evaluate..

***E. coli* bacteria** results ranged from 17 to >2400 MPN/100 mL. The geometric mean of 294 MPN/100 mL exceeded the criteria for contact recreation use. Of the 36 reported values, 14 exceeded the single grab sample criteria (39% of samples).



14 of 36 values (39%) exceed criteria

The geometric mean exceeds criteria

Non-Supporting for both single grab and geometric mean

Elevated bacteria values at this monitoring station are attributable to the high levels of pollution found in this creek. Numerous items, such as tires, a discarded vending machine, and dead animals, have been discovered in the water at this station.

Pollution in Biloxi Creek at CR 216

STATION 16097
Biloxi Creek at FM 1818
East of Diboll

Water Quality Parameters

pH values ranged from 6.1 to 8 S.U. (n = 38).

Dissolved Oxygen (DO) values ranged from 2.1 to 12.2 mg/L (n = 38). The dissolved oxygen screening level of 3.0 mg/L was exceeded once.

***E. coli* bacteria** results ranged from <1 to >2420 MPN/100 mL (n = 33), with 10 values (30%) exceeding the single grap criteria. The geometric mean of 294 MPN/100 mL also exceeded the criteria for contact recreation use.

Total Suspended Solids (TSS) values ranged from 10.3 to 314 mg/L, with a mean of 28.2 mg/L (n = 37).

Total Dissolved Solids (TDS) values ranged from 112 to 557 mg/L. The mean value was 309 mg/L (n = 37).

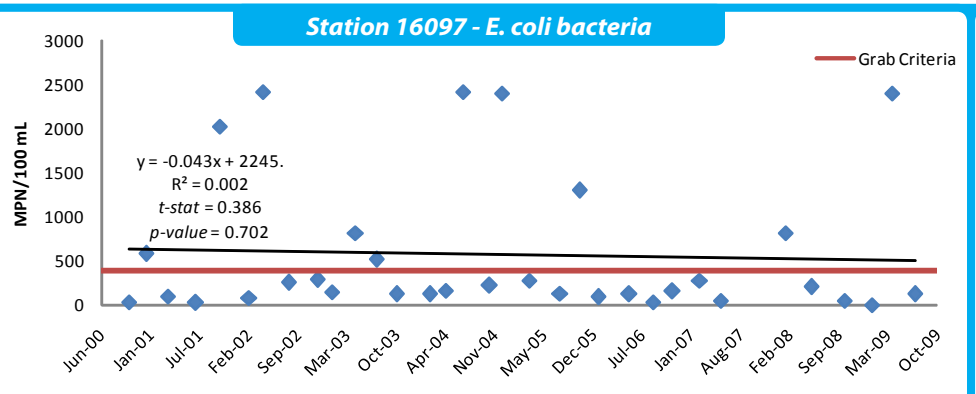
Ammonia-Nitrogen concentrations displayed an increasing significant trend. Data ranged from <0.01 to 1.24 mg/L as N. The mean was 0.38 mg/L as N (n = 37). There were 14 exceedances (38%).

Nitrate+Nitrite-Nitrogen values displayed a significant decreasing trend. Data ranged from <0.04 to 1.69 mg/L as N, with a mean of 0.42 mg/L as N (n = 38). No values were found to exceed the criteria.

Orthophosphorus results ranged from 0.006 to 0.51 mg/L as P (n = 36), with 2 values exceeding the criteria.

Total Phosphorus concentrations ranged from 0.25 to 3.4 mg/L as P (n = 38). A total of 6 data points exceeded the criteria of 0.69 mg/L as P.

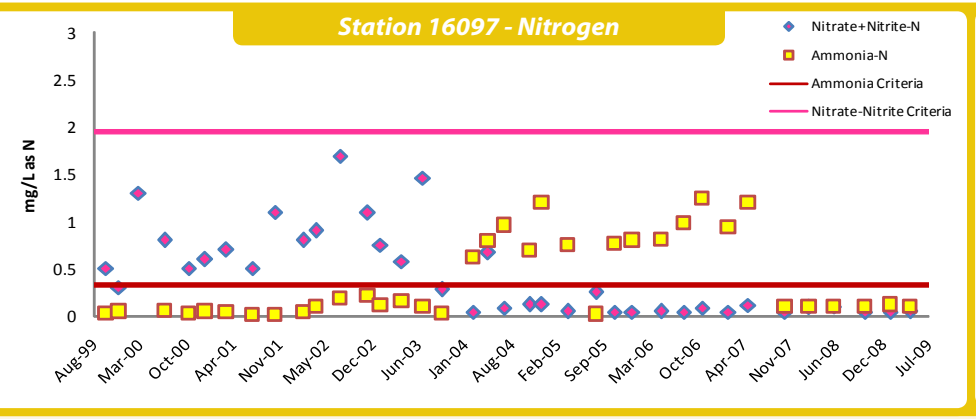
Chlorophyll-*a* results ranged from 2 to 42.3 ug/L (n = 21). Three values were found to exceed the criteria.



10 values exceeded the criteria

Concern for non-support for single grab

The geometric mean exceeded the criteria (non-supporting)



14 Ammonia-N values exceeded criteria (Concern for Screening)

No exceedances were found for Nitrate+Nitrite-N

Ammonia-N had a statistically significant increasing trend (*t-stat* = -2.37, *p-value* = 0.023)

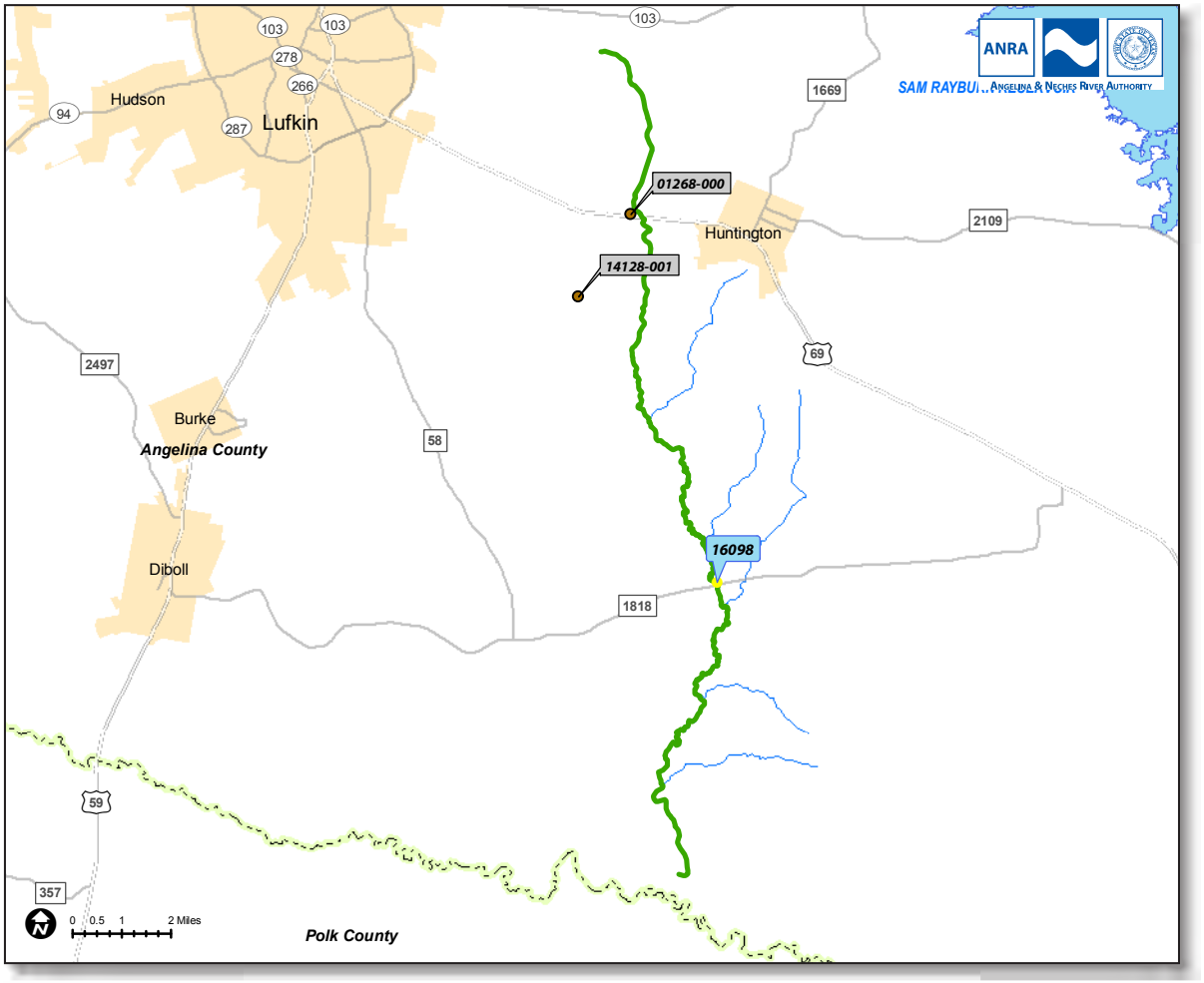
Nitrate+Nitrite-N had a statistically significant decreasing trend (*t-stat* = 5.55, *p-value* = 2.76 x 10^{-6})

Segment 0604N - Buck Creek (unclassified water body)

Segment Profile

Buck Creek includes 23 miles of freshwater stream from its confluence with Biloxi Creek south of Huntington to a point 2.1 miles upstream of FM 1475, northwest of Huntington in Angelina County. This segment is designated for contact recreation, general use, and aquatic life use.

Tire Dump located downstream of Buck Creek at FM 1818



Monitoring Stations on Segment 0604N

Station ID	Station Name	Collecting Agency	Frequency	Parameters
16098	Buck Creek at FM 1818	ANRA	Quarterly	Field, Conventionals, Bacteria, Flow, Metals (water)

STATION 16098
Buck Creek at FM 1818
East of Diboll

Water Quality Parameters

pH values ranged from 6.1 to 7.8 S.U. (n = 39).

Dissolved Oxygen (DO) values ranged from 2.5 to 13 mg/L. The mean was 7.8 mg/L (n = 39). One value was below the screening level (fully supporting).

***E. coli* bacteria** results ranged from 13 to >2400 MPN/100 mL. The criteria for single grab samples of 394 MPN/100 mL was exceeded on 3 occasions (9%). The geometric mean of the data set was 102 MPN/100 mL (n = 34), which is below the criteria.

Total Suspended Solids (TSS) values ranged from <1 to 172 mg/L, with a mean of 22 mg/L (n = 39).

Total Dissolved Solids (TDS) values ranged from 133 to 768 mg/L. The mean value was 346 mg/L (n = 39).

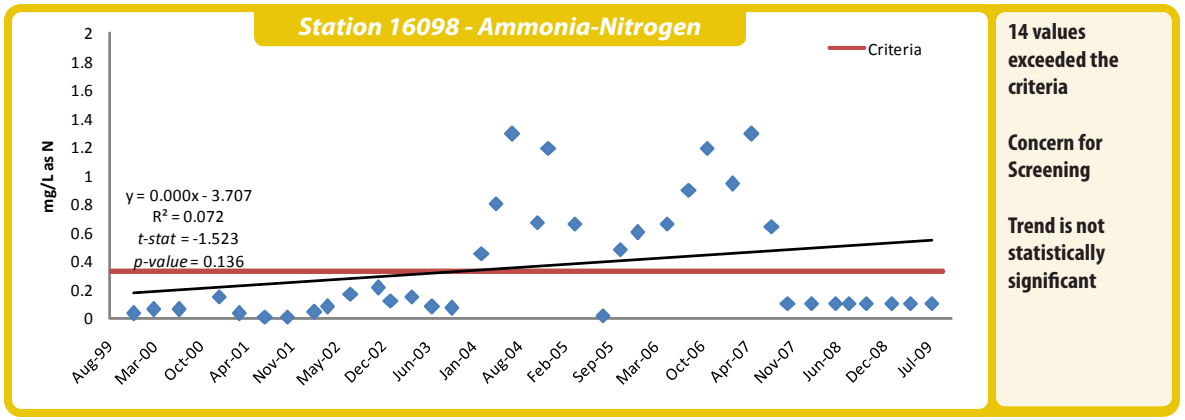
Ammonia-Nitrogen results ranged from <0.01 to 1.29 mg/L as N (n = 38), with 14 exceedances (37% of values).

Nitrate+Nitrite-Nitrogen values displayed a significant decreasing trend. Values ranged from <0.04 to 2.59 mg/L as N (n = 39), with one value exceeding the criteria.

Orthophosphorus concentrations displayed a significant decreasing trend. Values ranged from 0.014 to 0.75 mg/L as P (n = 37), with one value exceeding the criteria.

Total Phosphorus results displayed a significant decreasing trend. Values ranged from 0.042 to 2.25 mg/L as P (n = 39), with 4 samples exceeding the criteria.

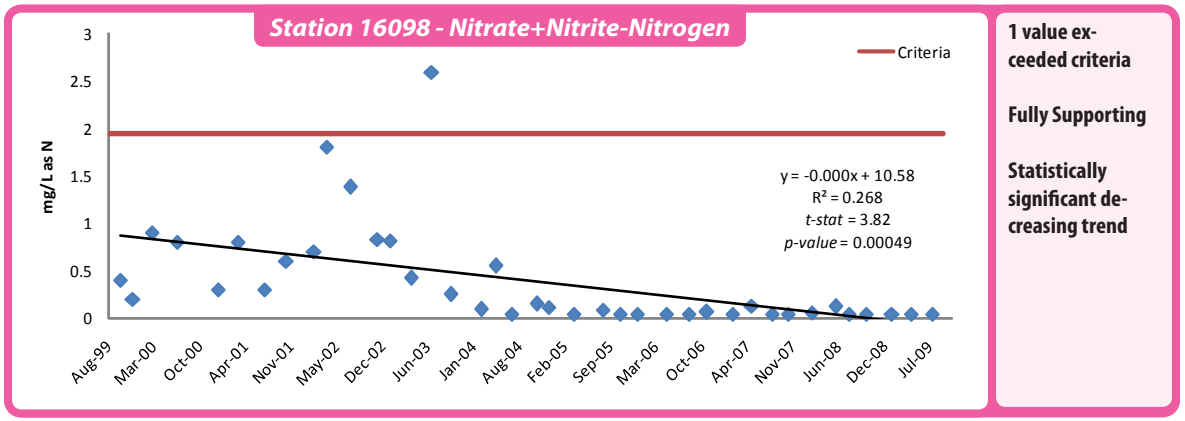
Chlorophyll-*a* results ranged from 2 to 16.2 ug/L (n = 23). There was one instance where the data exceeded the criteria.



14 values exceeded the criteria

Concern for Screening

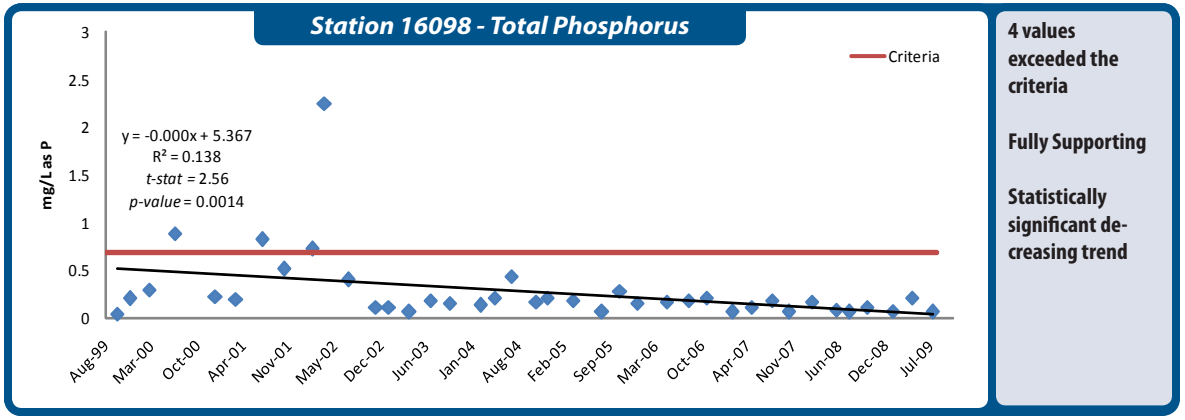
Trend is not statistically significant



1 value exceeded criteria

Fully Supporting

Statistically significant decreasing trend



4 values exceeded the criteria

Fully Supporting

Statistically significant decreasing trend

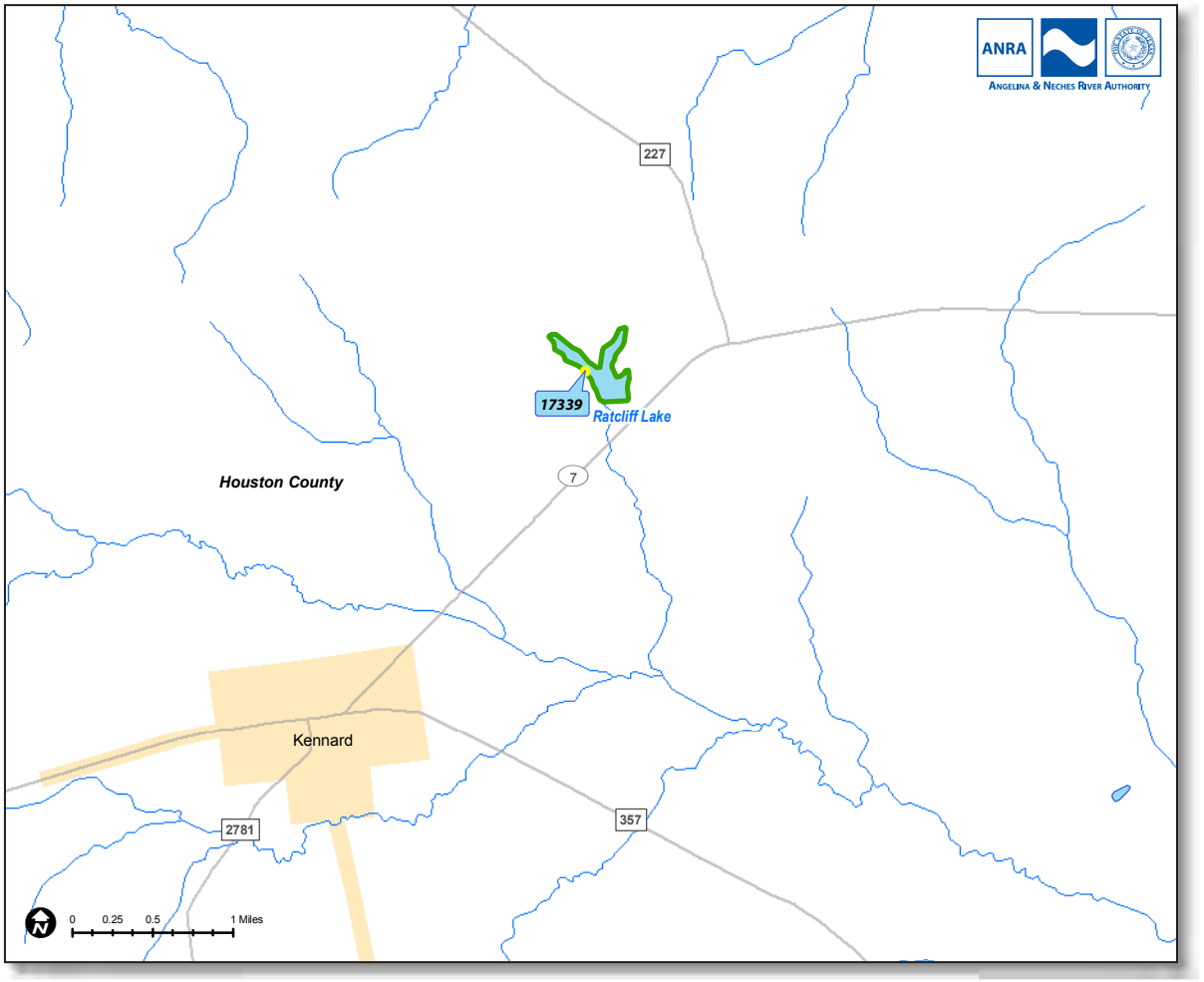
Segment 0604T - Lake Ratcliff (unclassified water body)

Segment Profile

The 53-acre reservoir is located within Houston County 3.4 miles northeast of Kennard. This segment is designated for contact recreation, general use, and aquatic life use. The lake has a designated camping area, swimming area, and a concession area for summer visitors. This reservoir was listed on the 303(d) list for mercury in edible fish tissue in 2002 and is currently under a 5c classification.

The monitoring station on Lake Ratcliff was added to the Coordinated Monitoring Schedule in Fiscal Year 2010. No data is available for this station for the period being evaluated in the Upper Neches Basin Summary Report.

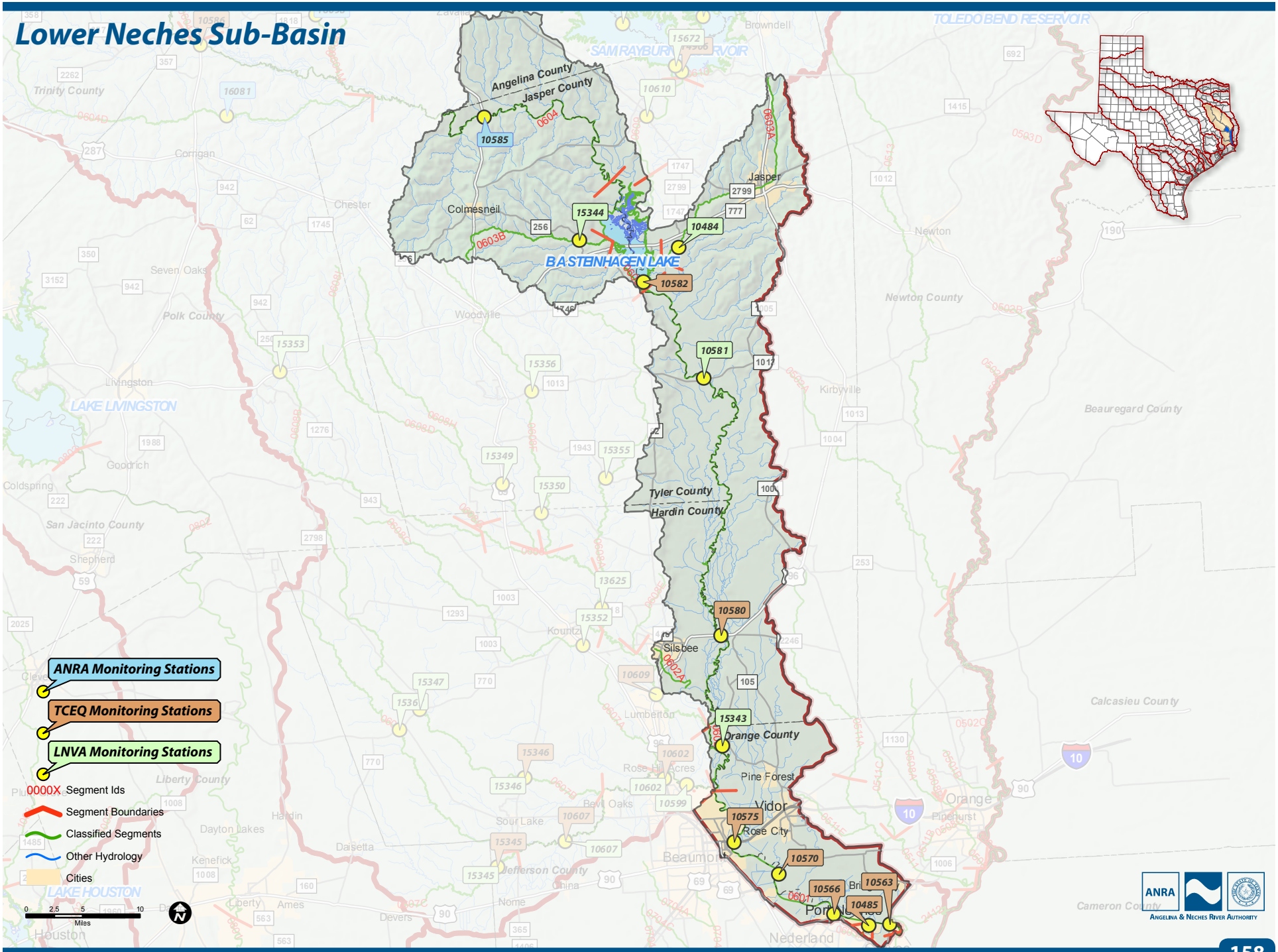
Lake Ratcliff



Monitoring Stations on Segment 0604T

Station ID	Station Name	Collecting Agency	Frequency	Parameters
17339	Lake Ratcliff where NW arm of lake joins main body	ANRA	Quarterly	Field, Conventionals, Bacteria

Lower Neches Sub-Basin



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Angelina & Neches River Authority

Profile of the Lower Neches Sub-Basin

CRP monitoring conducted by ANRA in the Lower Neches Sub-Basin includes only one station on Segment 0604 (Neches River Below Lake Palestine). This segment spans the Upper, Middle, and Lower Neches Sub-Basins. While the sub-basin is within ANRA's jurisdictional service area, the majority of the CRP monitoring in the sub-basin (B.A. Steinhagen Reservoir and below) is performed by TCEQ and LNVA. For more information on the water quality in this portion of the basin, please refer to the Basin Summary Report produced by the Lower Neches Valley Authority.

Segment 0604 Profile

This freshwater stream segment encompasses 231 miles from a point immediately upstream of the confluence of Hopson Mill Creek in Jasper/Tyler County to Blackburn Crossing Dam in Anderson/Cherokee County. This segment is designated for the following uses: public water supply, aquatic life, general, and recreation.

Permitted Discharges

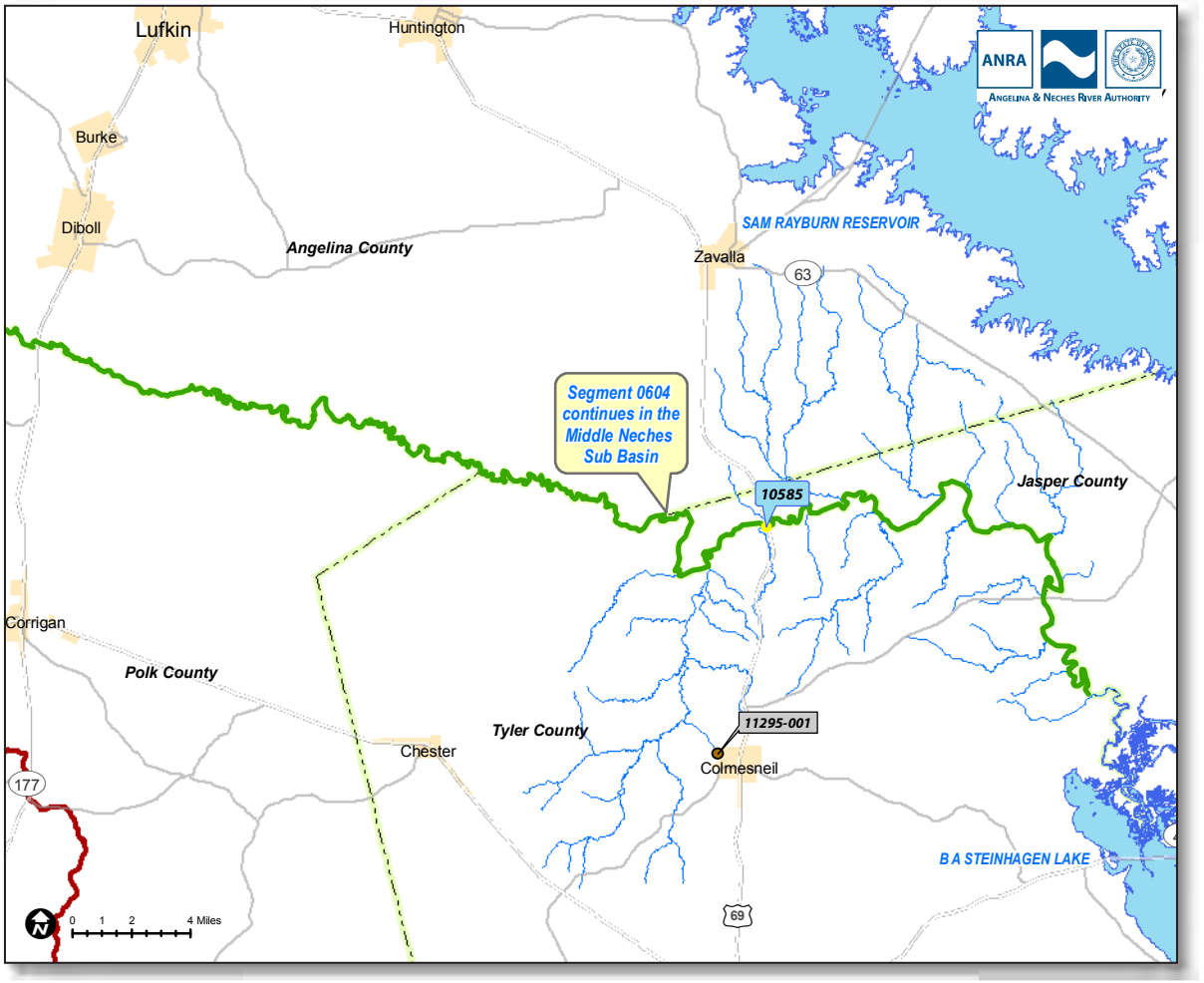
The City of Colmesneil (Permit #11295-001, NPDES #0100692) is the only permitted discharger in the portion of the Lower Neches sub-basin monitored under the Clean Rivers Program by the Angelina & Neches River Authority.

Water Quality Criteria

The water quality criteria (2008 standards) are listed under Segment 0604 in the section discussing the Middle Neches sub-basin.

Segments included in the Lower Neches Sub-Basin

Segment ID	Segment Name	Length or Acreage
0604	Neches River Below Lake Palestine	231 Miles



Monitoring Stations on the Lower Portion of Segment 0604

Station ID	Station Name	Collecting Agency	Frequency	Parameters
10585	Neches River at US 69	ANRA	Quarterly	Field, Conventionals, Bacteria, Flow

STATION 10585
Neches River at US 69
Northwest of Rockland in Tyler County

Water Quality Parameters

pH values ranged from 5.86 to 8.7 S.U., with a mean of 7.02 S.U. (n = 70). There were four exceedances (5.7%) occurring below 6 and above 8.5 S.U.

Dissolved Oxygen (DO) values ranged from 4.65 to 12.9 mg/L. One exceedance occurred below the screening criteria of 5.0 mg/L. The mean was 7.66 mg/L (n = 71).

***E. coli* bacteria** results ranged from 8 to >2400 MPN/100 mL, with a geometric mean of 63 MPN/100 mL (n = 23). There were three exceedances (13%) found.

Total Suspended Solids (TSS) values) ranged from 6 to 118 mg/L, with a mean of 32 mg/L (n = 23).

Total Dissolved Solids (TDS) values ranged from 56 to 248 mg/L The mean was found to be 146.8 mg/L (n = 42). There were four exceedances.

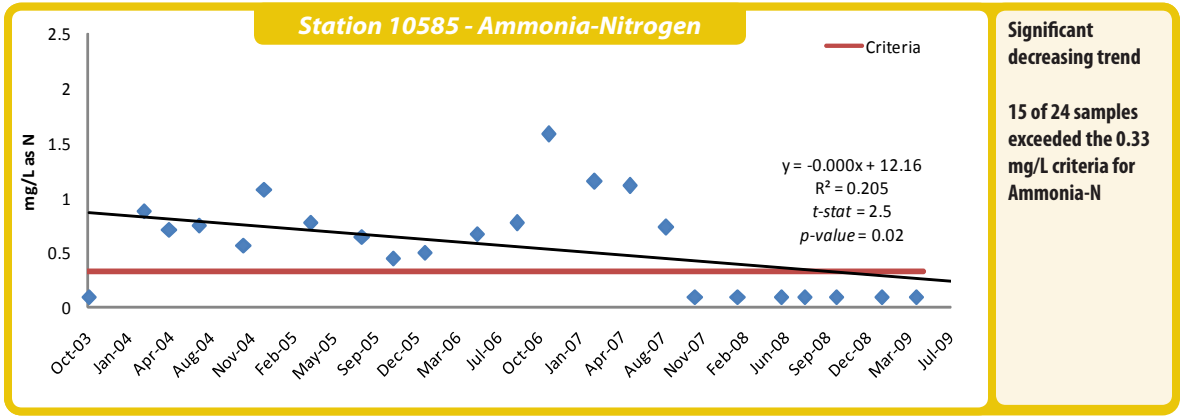
Ammonia-Nitrogen concentrations ranged from <0.04 to 0.5 mg/L as N. The criteria exceeded for 15 of 24 data points (63%). There was a significant decreasing trend.

Nitrate+Nitrite-Nitrogen values ranged from <0.04 to 0.5 mg/L as N (n = 64), with no exceedances.

Orthophosphorus concentrations ranged from <0.02 to 0.17 mg/L as P (n = 67), with no exceedances.

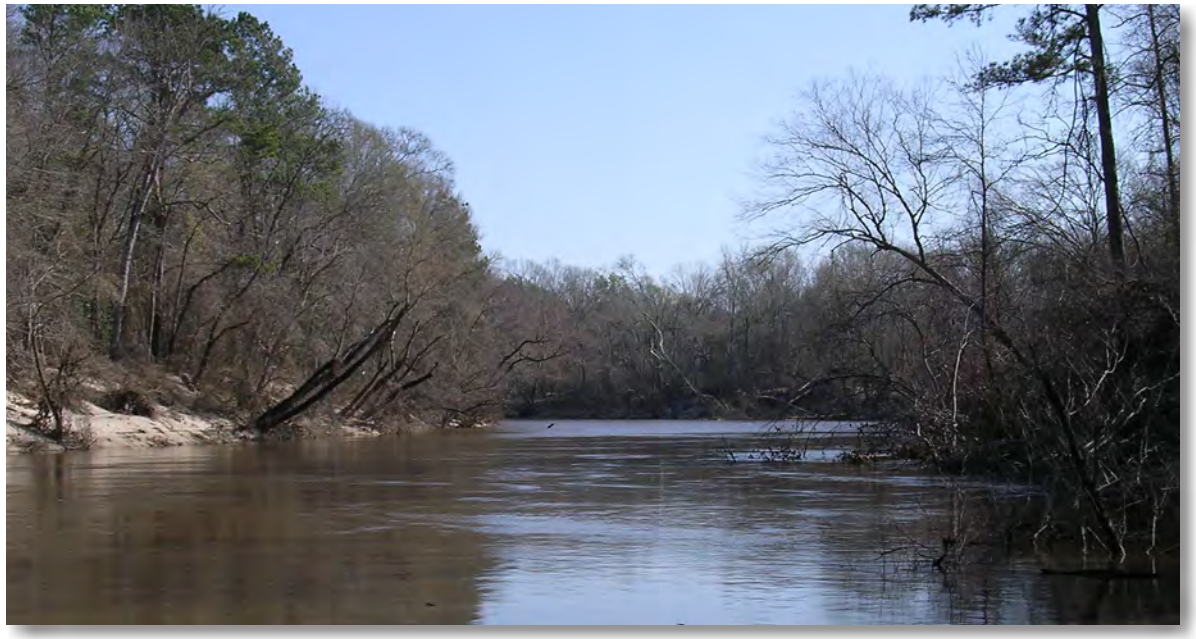
Total Phosphorus values ranged from 0.09 to 1.9 mg/L as P, with a mean was 0.28 mg/L as P (n = 23). Two exceedances occurred (9%).

Chlorophyll-*a* results values ranged from 4.68 to 34.9 ug/L (n = 23), with the criteria of 14.1 ug/L being exceeded six times (26%). The data does not indicate a concern.



Significant decreasing trend

15 of 24 samples exceeded the 0.33 mg/L criteria for Ammonia-N



Neches River at US 69

Summary for the Middle & Lower Neches Sub-Basins

Water Quality Issues Summary for the Middle & Lower Neches Sub-Basins

Water Quality Issue	*Affected Area*	*Possible Influences/Causes*	*Possible Effects*	*Possible Solutions/Actions Taken*
Listing on 303(d) list for impairment due to bacteria	Cedar Creek Hurricane Creek Jack Creek Piney Creek Biloxi Creek	• Non-point sources • Most concerns are located on perennial streams • Point source municipal discharges	• Public health risk for contact recreation	• Stricter limitations on effluent discharges, specifically adding *E. coli* monitoring to permits
Concerns for screening nutrient Ammonia Nitrogen Decreasing significant trend	Neches River at US 69	• Unknown	• Decreased excess ammonia levels could be beneficial for aquatic organisms	• Continued monitoring of nutrient levels
Concerns for screening nutrient Ammonia Nitrogen Increasing trends	Hurricane Creek at FM 324 Cedar Creek at FM 2497 Cedar Creek at CR 1336 Jack Creek at FM 2497 Biloxi Creek at FM 1818 Piney Creek at 1987	• Non-point source • Point source municipal discharges • Biloxi at FM 1818 is littered area caused by humans	• Toxic to aquatic life • May lead to increased plant biomass and algal concentrations • Nitrates may contaminate ground and surface waters	• Continued monitoring of nutrient levels
Depressed dissolved oxygen listing on 303(d) list	Piney Creek Biloxi Creek	• Unknown	• Aquatic life community affected	• Continued monitoring • Efforts to determine causes of low dissolved oxygen, either natural or anthropogenic
Lead in water	Neches River below Lake Palestine - 303(d) listing Cedar Creek, Biloxi Creek - partial impairment	• Non-point sources • Point source municipal discharges • Anthropogenic littering	• Risk for living organisms, including humans	• Determine origins/source • Determine persistence in waterbody • Enhance awareness of laws against littering in areas presumed to be "dump sites"
Trends in Nitrate-Nitrite Increasing trends	Cedar Creek Jack Creek	• Increasing trends may indicate problems with nutrient loading	• Increased available nitrogen to plant life • May be harmful to living organisms	• Determine sources • Continued monitoring of nutrient levels

Recommendations and Conclusions

Recommendations and Comments

The Environmental Division of the Angelina & Neches River Authority is currently being restructured, with the Clean Rivers Program, the On-Site Sewage Facilities (OSSF) Program, and the Environmental Laboratory being reorganized under a central management structure. This change has allowed for a more streamlined approach to addressing water quality monitoring and analysis, and has resulted in improved communication and coordination between departments. One of the advantages of this restructuring has been an improved sharing of resources and an expanded knowledge base from which to draw. For example, our geographical information systems (GIS) capabilities have been expanded, and while in the past they have been used primarily for Clean Rivers Program functions, these tools can be used in our OSSF program to map septic systems around Sam Rayburn Reservoir. By mapping the permitted systems and utilizing staff from both departments, it may be possible to better correlate any degradation in water quality within the lake with failing or unpermitted/illegal septic systems.

The departmental restructuring also allows our CRP and Laboratory staff to work more cohesively by combining sampling and analysis more effectively. The primary benefit of this has been a combined approach to monitoring projects, such as conducting swim beach monitoring and *E. coli* testing at Sam Rayburn Reservoir for the U.S. Army Corps of Engineers.

Funding from the Clean Rivers Program has remained unchanged since the program's inception. As costs increase every year, monitoring activities have to be decreased in order to fund fixed costs such as salaries and benefits as well as variable costs including travel, supplies and equipment. Because sufficient funds are not available to supplement water quality monitoring activities, ANRA believes that grants-based sources may be the best solution for expanding monitoring within the basin. ANRA is currently partnering with several other agencies and institutions as part of a Section 319(h) grant funded by the Texas State Soil and Water Conservation Board to address water quality issues in the Attoyac Bayou. This far-reaching project will not only assess bacterial and nutrient concerns, but will also examine land usage, complete a Recreational Use Attainability Analysis, look to increase stakeholder participation, and ultimately result in the development of a Watershed Protection Plan for the Attoyac Bayou. This type of encompassing approach could provide a useful model for addressing similar issues at other segments in the basin. An added benefit is that grants-based funding allows ANRA to perform additional sampling and chemical/microbiological analyses above and beyond what can be funded through the Texas Clean Rivers Program, with all data being collected under an approved QAPP and made available to TCEQ for use in water quality assessments.

The stakeholder process provides valuable information to both the regulated community and the general public. In the future, ANRA intends to focus even more effort into stakeholder participation and public outreach. Improved stakeholder involvement is absolutely crucial to address water quality concerns in the basin.

Conclusions

Generally speaking, waters in the Middle and Upper Neches River Basin support the designated uses as defined in the Texas Surface Water Quality Standards. Bacterial levels which do not support contact recreational use are the most common issues found in this portion of East Texas. With much of this area being rural and sparsely populated, non-point sources are the most likely cause of bacterial contamination of streams. Other areas have shown a recent improvement in water quality, particularly Paper Mill Creek and portions of Sam Rayburn Reservoir following the closure of the Abitibi Paper Mill in Lufkin. There are several areas of concern for nutrients, and routine monitoring activities should be continued in order to better to assess these areas.

As the competing interests for water increase, the water in East Texas will continue to be one of the state's greatest natural resources. As the population of Texas is expected to increase over the next 50 year planning horizon, it is of critical importance that this valuable resource be monitored, maintained, and enhanced in order to meet the growing demands of the State of Texas.

ANRA

ANGELINA & NECHES RIVER AUTHORITY

MISSION STATEMENT

"The Angelina & Neches River Authority, operating as an independent governmental agency, shall pursue any responsible means to assure the controlling, storing, and preserving of water resources in the Neches River Basin. This pursuit shall include the construction, maintenance, operation, monitoring, and testing of this resource."

2010 Upper Neches Basin Summary Report

The 2010 Basin Summary Report was prepared by the Angelina & Neches River Authority in cooperation with the Texas Commission on Environmental Quality (TCEQ) under the authorization of the Texas Clean Rivers Act.

ANRA

ANGELINA & NECHES RIVER AUTHORITY

TCEQ

THE TEXAS CLEAN RIVERS PROGRAM