BASIN SUMMARY REPORT 2020

For the Upper Portion of the Neches River Basin

Angelina & Neches River Authority

ANRA

Angelina & Neches River Authority

Cover Photos:
Front: Piney Creek at County Road 2781
Back: Hurricane Creek at Kiwani's Park

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ANRA's new Central Office Facilities, built in early 2019

Angelina & Neches River Authority

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EXECUTIVE SUMMARY FOR THE 2020 BASIN SUMMARY REPORT

Bloom near Angelina River at SH 21

EXECUTIVE SUMMARY FOR THE 2020 BASIN SUMMARY REPORT

About the Report

The Basin Summary Report, assembled every third biennium, 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 includes 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. Recommendations of management strategies for correcting identified water quality impairments are also included in the report.

To determine whether designated uses are supported, water quality parameters are examined and compared to criteria and screening levels as listed in the Texas Surface Water Quality Standards. Assessment data from the 2020 Texas Integrated Report for Clean Water Act Section 305(b) and 303(d) was used in this report.

About the Clean Rivers Program

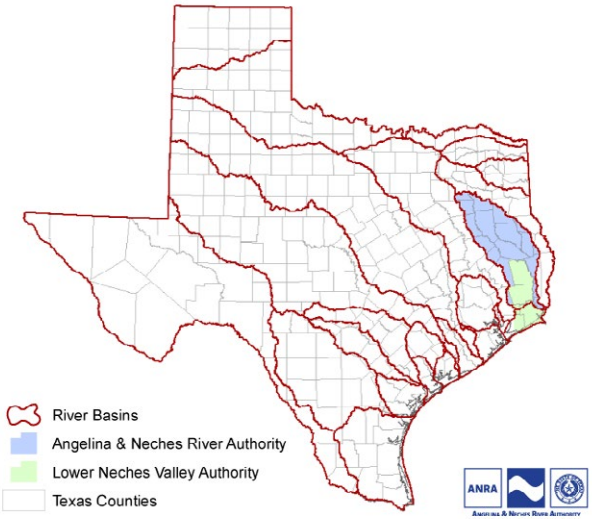
The mission of the Clean Rivers Program (CRP) is to maintain and improve the quality of water within each river basin in Texas through an ongoing partnership involving the Texas Commission on Environmental Quality (TCEQ), river authorities, other agencies, regional entities, local governments, industry, and citizens. The Clean Rivers Program utilizes a watershed management approach to identify and evaluate water quality issues. CRP funds for the Neches River Basin are shared equally among ANRA and the Lower Neches Valley Authority (LNVA). Those funds are used primarily to provide quality-assured data to TCEQ for use in water quality decision making, identify and evaluate water quality issues, promote cooperative watershed planning, and inform and engage stakeholders.

About the Angelina and Neches River Authority

In 1935, the Texas legislature created the Sabine & Neches Conservation District as a conservation and reclamation district. In 1949 the legislature divided the jurisdiction of the Sabine & Neches Conservation District into the Neches River Conservation District and Sabine River Authority. In 1977 the Neches River Conservation District was renamed and officially became the Angelina & Neches River Authority (ANRA).

ANRA's jurisdictional area 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.

ANRA has a legislative mandate to monitor, protect, and enhance water resources in the Neches River Basin that it fulfills in part though the activities of the Clean Rivers Program.



Significant Events & Activities

ANRA Relocation

In early 2019, after 48 years in its previous location in downtown Lufkin, ANRA moved into an all new, state of the art Central Office & Laboratory located on the Northwest side of loop 287 in Lufkin. The facility provides ANRA the ability to expand and improve services as well as a space to hold public meetings. The new laboratory space and capacity will allow for additional analyses to be brought online such as Total Kjeldahl Nitrogen (TKN) & Chlorophyll and Pheophytin testing.

Clean Rivers Program Activities

Due to cost increases at a contract laboratory, ANRA was forced to significantly scale back the Chlorophyll-*a*/Pheophytin sampling performed from Q4 of FY 2018 through FY 2019. We attempted to retain monitoring at a minimum of one site per segment. If a Wastewater Treatment Facility maintains a discharge in a given segment, we retained an upstream and a downstream site for that segment. For FY 2020, ANRA contracted with a new lab for Chlorophyll-*a*/Pheophytin analysis and we restarted collection of those parameters at all of our routine monitoring sites. Also in FY 2020 TKN monitoring was added at all of our monitoring sites. Now that ANRA has moved into our new office and laboratory, one of our goals for the near future is to bring these analysis in house to help further control costs and improve data quality and timeliness.

Other Water Quality Related Projects

Beginning in 2009, ANRA worked closely with the Texas Water Resources Institute (TWRI), Stephen F. Austin State University (SFASU), Texas A&M AgriLife Research, and other partners as part of a federal Clean Water Act §319(h) grant funded through the Texas State Soil and Water Conservation Board (TSSWCB) to develop a Watershed Protection Plan (WPP) for the Attoyac Bayou. This project recommended several strategies for improving water quality, and has been a conduit for numerous grant programs to help monitor and improve water quality in the watershed since 2015, and has also set the stage for other similar projects in the basin.

Using the Attoyac Bayou WPP as a springboard, ANRA, TRWI, SFA, and Pineywoods RC&D have worked with the EPA, TCEQ and the TSSWCB on several grant projects to address failing or nonexistent On-Site Sewage Facilities (OSSFs) with repair and replacements programs, education

and outreach efforts to residents of the watershed, continued water quality monitoring on the Attoyac and its tributaries to evaluate the effectiveness of water quality improvement efforts, and developed a database to catalog existing OSSFs as well as future installations of OSSFs in the watershed.

Work has also been started to address water quality impairments on the Angelina River and it's Tributaries, as well as tributaries of the middle Neches.

A watershed characterization project for La Nana Bayou was completed in August of 2019 and watershed characterization projects for the Angelina above Sam Rayburn, as well as Kickapoo Creek above Lake Palestine are ongoing.

A Total Maximum Daily Load (TMDL) project is actively addressing issues on Jack, Cedar, Hurricane, & Biloxi Creeks near Lufkin, as well as Sandy & Wolf Creeks near Jasper, and Hillebrandt Bayou & the Neches River Tidal near Beaumont.

Hurricane Harvey

Hurricane Harvey made landfall on August 25th, 2017 as a category 4 storm, bringing record setting rainfall, flooding, and damage to Houston, Beaumont and the surrounding area. For the most part, the upper and middle portions of the Neches River Basin did not experience significant flooding. However, the upper and middle Neches area did experience heavy rainfall, isolated flooding, road closures, and power outages. The storm was the wettest tropical cyclone on record in the United States. Unprecedented flooding was caused by the torrential rainfall as Harvey stalled near the coast. Throughout the basin, streams were inundated with storm water and sanitary sewer overflows were commonplace as the infrastructure couldn't handle the large volume of rainfall. 800 wastewater treatment facilities and 13 superfund sites were flooded, spreading sewage and toxic chemicals.

Encouraging Engagement

In late 2019 ANRA created a dedicated education and outreach program, and a full time coordinator for the program was hired in September 2019. The program is in its early stages and the materials being produced initially are geared toward elementary and middle school students, and are centered on environmental stewardship. A focus group comprised of teachers with experience at the targeted educational level was gathered and the material were presented and discussed before being released to teachers. Plans to expand the program include creating similar educational materials for high school students and eventually creating a curriculum of materials available for each educational level. Along with the new program, ANRA has supplied schools in Lufkin with the Major Rivers curriculum. The program will also be used to organize and participate in water quality and environmental stewardship related community events in the future.

ANRA also encourages stakeholder involvement through education and involvement of citizen scientists via the Texas Stream Team. ANRA is the regional partner for the Upper Neches Basin, providing training, monitoring kits, and replacement reagents to the volunteer monitors in the basin.

Through the Coordinated Monitoring Meeting process, ANRA collaborates with other agencies in the basin to establish a monitoring program to best address water quality issues basin-wide. ANRA is also an active participant in the TCEQ's Watershed Action Planning process. These two processes are integral to the success of the Clean Rivers Program.

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. 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 water quality issues throughout the Neches River Basin.

Integrated Report Assessment Changes

Since the previous Basin Summary Report produced by ANRA in 2015, there were three new listings for water bodies and five de-listings in the Texas Integrated Report for the Neches River Basin (see tables below for details).

Texas Integrated Report New Listings (Since 2015)

Segment ID/Name	Impairment Description	Year listed
0604C- Jack Creek	bacteria (recreation use)	2018
0604D- Piney Creek	bacteria (recreation use)	2018
0604A- Cedar Creek	Depressed DO	2020

Texas Integrated Report De-listings (Since 2015)

Segment ID/Name	Assessment Unit ID	Parameter	Reason for de-listing	Year de-listed
0606- Neches River Above Lake Palestine	0606_02	pH	meets criteria	2016
0612- Attoyac Bayou	0612_01	bacteria (recreation use)	meets criteria	2016
0615- Angelina River/Sam Rayburn Reservoir.	0615_01	impaired fish community	meets criteria	2016
0611D- West Mud Creek	0611D_02	bacteria (recreation use)	Data and/or information lacking to determine WQ status; original basis for listing was incorrect	2018
0605- Lake Palestine	0605_01 0605_11	pH	Applicable WQS attained based on new data	2020

EXECUTIVE SUMMARY FOR THE 2020 BASIN SUMMARY REPORT

Significant Findings

In general, historical and current water quality data of the Neches River basin included elevated bacteria levels, depressed dissolved oxygen, and dioxin and mercury in edible fish tissue. Data analysis displayed several issues in regards to nutrients. However, there are several segments, tributaries, and reservoirs within the basin that are fully supporting their designated uses.

Bacteria

Bacteria impairments are the most common reason for water bodies in the upper and middle portions of the Neches River Basin to be listed on the 303(d) List. Three classified segments (Neches River Above Lake Palestine, Angelina River Above Sam Rayburn Reservoir, and Attoyac Bayou) have a bacterial impairment listed in the 2020 Texas Integrated Report. Additionally, fourteen unclassified segments have impairments or concerns for E. coli bacteria.

Dissolved Oxygen

Depressed Dissolved Oxygen levels were common in the basin, apparent in two of the classified segments and five of the unclassified segments These impairments and concerns are most likely due to a combination of low flows and elevated nutrient levels.

Nutrients

Numerous segments had concerns for nutrients, particularly Ammonia, Nitrate and Total Phosphorus. Classified segments had concerns for Chlorophyll-*a* (0604), Nitrate (0606) and Total Phosphorus (0606 and 0611).

Mercury and Dioxin in Edible Fish Tissue

Fish consumption advisories issued by the Texas Department of State Health Services (DSHS) cover several water bodies in the Neches Basin. Lake Ratcliff has a fish consumption advisory due to mercury issued in 2012, while an advisory for mercury and dioxin covers the Neches River Below Lake Palestine, Sam Rayburn Reservoir, and B.A. Steinhagen, issued in 2014. See pages 305-306 for full details.

Summary of Impairments and Concerns in the Neches River Basin

Segment ID and Name	Bacteria	Nutrients	Dissolved Oxygen	pH	Mercury & Dioxins in Edible Fish Tissue
0604- Neches River below Lake Palestine		CS			NS
0604A- Cedar Creek	NS	CS	NS		
0604B- Hurricane Creek	NS				
0604C- Jack Creek	NS	CS			
0604D- Piney Creek	NS	CS	NS		
0604M- Biloxi Creek	NS	CS	NS		
0604T- Lake Ratcliff					NS
0605- Lake Palestine				NS	
0605A- Kickapoo Creek	NS		NS		
0606- Neches River above Lake Palestine	NS	CS	NS		
0606A- Prairie Creek	NS	CS			
0606D- Black Fork Creek	NS				
0609- Angelina River below Sam Rayburn Reservoir					NS
0610- Sam Rayburn Reservoir					NS
0610A- Ayish Bayou	NS				
0610P- Bayou Carrizo	CN				
0611- Angelina River above Sam Rayburn	NS	CS			
0611A- East Fork Angelina River	NS				
0611B- La Nana Bayou	NS	CS			
0611C- Mud Creek	NS				
0611D- West Mud Creek	NS	CS			
0611V- Bowles Creek			CS		
0612- Attoyac Bayou	NS				
0612F- West Creek	CS				
0615-Angelina River/Sam Rayburn Reservoir			NS		NS
0615A- Paper Mill Creek	NS				

FS = Fully Supporting, NC = No Concern, CN = Concern for Near Non-Attainment, CS = Concern for Screening Level, NS = Not Supporting, NA = Not Assessed

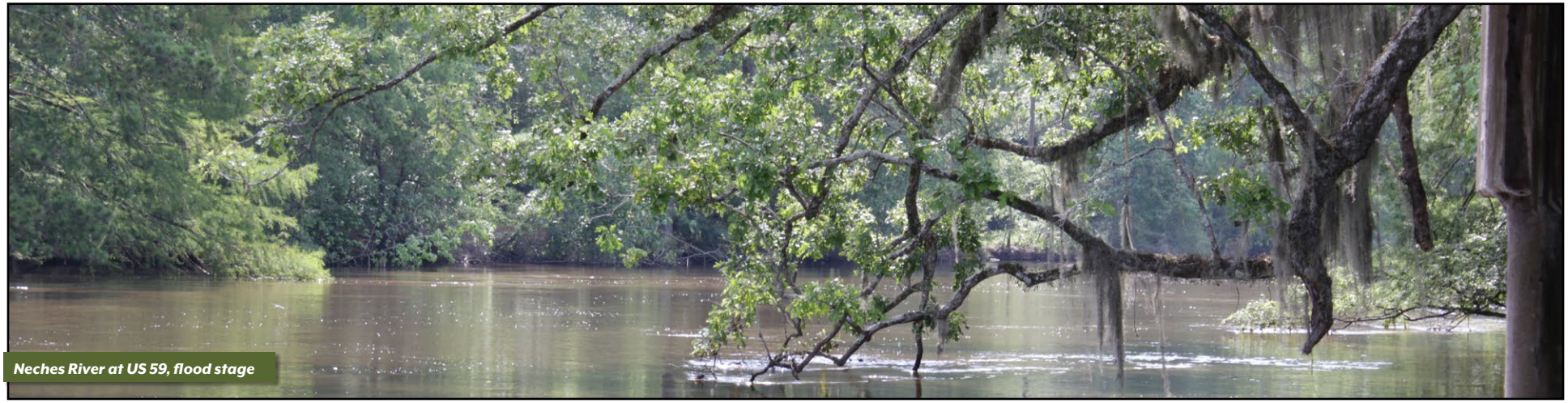
EXECUTIVE SUMMARY FOR THE 2020 BASIN SUMMARY REPORT

Detailed Impairments and Concerns for the Upper Neches Basin (*as listed in the 2020 Texas Integrated Report*)

Segment ID	Segment Name	Impairment Description	Impairment Category	Concerns	Level of Concern
0604	Neches River below Lake Palestine	Mercury in edible tissue Dioxin in edible tissue	5c 5c	Chlorophyll-*a*	CS
0604A	Cedar Creek	Bacteria (recreation use) Depressed dissolved oxygen	5c 5c	Bacteria (recreation use) Depressed dissolved oxygen Nitrate Total Phosphorus	CN CS CS CS
0604B	Hurricane Creek	Bacteria (recreation use)	5c	Bacteria (recreation use)	CN
0604C	Jack Creek	Bacteria (recreation use)	5c	Total Phosphorus	CS
0604D	Piney Creek	Bacteria (recreation use) Depressed dissolved oxygen	5c 5b	Ammonia Depressed dissolved oxygen	CS CS
0604M	Biloxi Creek	Bacteria (recreation use) Depressed dissolved oxygen	5c 5c	Ammonia Bacteria (recreation use) Total Phosphorus	CS CN CS
0604N	Buck Creek	No impairments		No concerns	
0604T	Lake Ratcliff	Mercury in edible tissue	5c	No concerns	
0605	Lake Palestine	pH	5b	Manganese in sediment	
0605A	Kickapoo Creek	Bacteria (recreation use) Depressed dissolved oxygen	5c 5c	No concerns	
0605F	Lake Athens	No Impairments		No concerns	
0606	Neches River above Lake Palestine	Bacteria (recreation use) Depressed dissolved oxygen	5c 5b	Depressed dissolved oxygen Nitrate Total Phosphorus Zinc	CN CS CS CN
0606A	Prairie Creek	Bacteria (recreation use)	5b	Ammonia Nitrate	CS CS
0606D	Black Fork Creek	Bacteria (recreation use)	5b	No concerns	
0609	Angelina River below Sam Rayburn Reservoir	Mercury in edible tissue Dioxin in edible tissue	5c 5c	No concerns	
0610	Sam Rayburn Reservoir	Mercury in edible tissue Dioxin in edible tissue	5c 5c	Iron in sediment Manganese in sediment Mercury in edible tissue	CS CS CS
0610A	Ayish Bayou	Bacteria (recreation use)	5c	No concerns	
0610P	Bayou Carrizo	No impairments		Bacteria (recreation use)	CN

EXECUTIVE SUMMARY FOR THE 2020 BASIN SUMMARY REPORT

Segment ID	Segment Name	Impairment Description	Impairment Category	Concerns	Level of Concern
0611	Angelina River above Sam Rayburn	Bacteria (recreation use)	5c	Bacteria (recreation use) Total Phosphorus	CN CS
0611A	East Fork Angelina River	Bacteria (recreation use)	5c	No concerns	
0611B	La Nana Bayou	Bacteria (recreation use)	5c	Nitrate Total Phosphorus	CN CS
0611C	Mud Creek	Bacteria (recreation use)	5b	No concerns	
0611D	West Mud Creek	Bacteria (recreation use)	5c	Ammonia Nitrate	CS CS
0611Q	Lake Nacogdoches	No Impairments		No concerns	
0611R	Lake Striker	No Impairments		No concerns	
0611V	Bowles Creek	No Impairments		Depressed dissolved oxygen	CS
0611W	Johnson Creek	No concerns		No concerns	
0612	Attoyac Bayou	Bacteria (recreation use)	5c	No concerns	
0612F	West Creek	No Impairments		Bacteria (recreation use)	CN
0612G	Lake Naconiche	No impairments		No concerns	
0613	Lake Tyler/Lake Tyler East	No Impairments		No concerns	
0614	Lake Jacksonville	No Impairments		No concerns	
0615	Angelina River/Sam Rayburn Reservoir	Depressed dissolved oxygen Mercury in edible tissue Dioxin in edible tissue	5c 5c 5c	No concerns	
0615A	Paper Mill Creek	Bacteria (recreation use)	5b	No concerns	



Neches River at US 59, flood stage

EXECUTIVE SUMMARY FOR THE 2020 BASIN SUMMARY REPORT

Summary of Statistically Significant Trends in the Upper Neches River Basin

Segment ID	Segment Name	AU	*E. coli*	Temp	DO	pH	Spec Cond	NH3	Cl	SO4	TKN	Total P	TSS	NO3	NO2	NO3/ NO2	Chl-*a*	Pheo
0604	Neches River below Lake Palestine	0604_01															↓	↓
0604	Neches River below Lake Palestine	0604_02				↓											↓	
0604	Neches River below Lake Palestine	0604_03				↓											↓	
0604	Neches River below Lake Palestine	0604_04				↓			↓			↓						
0604	Neches River below Lake Palestine	0604_05							↓		↑					↓	↑	
0604A	Cedar Creek	0604A_01	*- No trends identified for this Assessment Unit -*															
0604A	Cedar Creek	0604A_02	*- No trends identified for this Assessment Unit -*															
0604A	Cedar Creek	0604A_03	*- No trends identified for this Assessment Unit -*															
0604B	Hurricane Creek	0604B_01	*- No trends identified for this Assessment Unit -*															
0604B	Hurricane Creek	0604B_02	*- No trends identified for this Assessment Unit -*															
0604C	Jack Creek	0604C_01					↓		↓							↓		
0604D	Piney Creek	0604D_01	*- No trends identified for this Assessment Unit -*															
0604D	Piney Creek	0604D_02			↓					↓								
0604M	Biloxi Creek	0604M_02	↓			↓						↓						
0604M	Biloxi Creek	0604M_03	*- No trends identified for this Assessment Unit -*															
0604N	Buck Creek	0604N_01										↓						
0604T	Lake Ratcliff	0604T_01					↓			↓			↓					
0605	Lake Palestine	0605_01				↑	↑											
0605	Lake Palestine	0605_02				↓	↓		↓	↓								
0605	Lake Palestine	0605_03							↓									
0605	Lake Palestine	0605_09				↓			↓	↓	↓	↓						
0605	Lake Palestine	0605_10				↓			↓	↓	↓						↓	
0605	Lake Palestine	0605_11	*- No trends identified for this Assessment Unit -*															
0605A	Kickapoo Creek	0605A_01	*- No trends identified for this Assessment Unit -*															
0605A	Kickapoo Creek	0605A_02				↑												
0606	Neches River above Lake Palestine	0606_01				↑	↓		↓									
0606	Neches River above Lake Palestine	0606_02				↑	↓		↓			↓	↓					
0606A	Prairie Creek	0606A_01	*- No trends identified for this Assessment Unit -*															

EXECUTIVE SUMMARY FOR THE 2020 BASIN SUMMARY REPORT

Segment ID	Segment Name	AU	*E. coli*	Temp	DO	pH	Spec Cond	NH3	Cl	SO4	TKN	Total P	TSS	NO3	NO2	NO3/ NO2	Chl-*a*	Pheo
0606A	Prairie Creek	0606A_02	*- No trends identified for this Assessment Unit -*															
0606A	Prairie Creek	0606A_03	*- No trends identified for this Assessment Unit -*															
0606D	Black Fork Creek	0606D_02	*- No trends identified for this Assessment Unit -*															
0609	Angelina River below Sam Rayburn Reservoir		*-Please refer to LNVA's report for information on this Assessment Unit-*															
0610	Sam Rayburn Reservoir	0610_01				↓			↓	↓								
0610	Sam Rayburn Reservoir	0610_02	*- No trends identified for this Assessment Unit -*															
0610	Sam Rayburn Reservoir	0610_03				↓			↓	↓								
0610	Sam Rayburn Reservoir	0610_04			↑	↑	↑		↓	↓								
0610	Sam Rayburn Reservoir	0610_05	*- No trends identified for this Assessment Unit -*															
0610	Sam Rayburn Reservoir	0610_06					↑									↓		
0610	Sam Rayburn Reservoir	0610_07					↓		↓	↓			↓					
0610	Sam Rayburn Reservoir	0610_08	*- No trends identified for this Assessment Unit -*															
0610	Sam Rayburn Reservoir	0610_09							↓									
0610	Sam Rayburn Reservoir	0610_10				↑												
0610A	Ayish Bayou	0610A_01				↓						↓						
0610A	Ayish Bayou	0611A_02	*- No trends identified for this Assessment Unit -*															
0610P	Bayou Carrizo	0610P_01	*- No trends identified for this Assessment Unit -*															
0611	Angelina River above Sam Rayburn	0611_01															↓	
0611	Angelina River above Sam Rayburn	0611_02				↑												
0611	Angelina River above Sam Rayburn	0611_03				↑			↓			↓				↓		
0611	Angelina River above Sam Rayburn	0611_04				↑												
0611A	East Fork Angelina River	0611A_01				↑										↓		
0611A	East Fork Angelina River	0611A_02				↑	↓		↓									
0611B	La Nana Bayou	0611B_01	*- No trends identified for this Assessment Unit -*															
0611B	La Nana Bayou	0611B_02	*- No trends identified for this Assessment Unit -*															
0611B	La Nana Bayou	0611B_03	*- No trends identified for this Assessment Unit -*															
0611C	Mud Creek	0611C_01							↓	↓		↓				↓		
0611C	Mud Creek	0611C_02								↓		↓				↓		

EXECUTIVE SUMMARY FOR THE 2020 BASIN SUMMARY REPORT

Segment ID	Segment Name	AU	*E. coli*	Temp	DO	pH	Spec Cond	NH3	Cl	SO4	TKN	Total P	TSS	NO3	NO2	NO3/ NO2	Chl-*a*	Pheo
0611D	West Mud Creek	0611D_01	*- No trends identified for this Assessment Unit -*															
0611D	West Mud Creek	0611D_02	*- No trends identified for this Assessment Unit -*															
0611Q	Lake Nacogdoches	0611Q_01							↓									
0611R	Lake Striker	0611R_01							↓								↓	
0611V	Bowles Creek	0611V_01	*- No trends identified for this Assessment Unit -*															
0611W	Johnson Creek	0611W_01	*- No trends identified for this Assessment Unit -*															
0612	Attoyac Bayou	0612_01	*- No trends identified for this Assessment Unit -*															
0612	Attoyac Bayou	0612_02										↓						
0612	Attoyac Bayou	0612_03								↓						↓		
0612F	West Creek	0612F_01								↓						↓		
0612G	Lake Naconiche	0612G_01	*- No trends identified for this Assessment Unit -*															
0613	Lake Tyler/Lake Tyler East	0613_01											↑					
0613	Lake Tyler/Lake Tyler East	0613_02					↑		↑									
0613	Lake Tyler/Lake Tyler East	0613_03	*- No trends identified for this Assessment Unit -*															
0613	Lake Tyler/Lake Tyler East	0613_04	*- No trends identified for this Assessment Unit -*															
0614	Lake Jacksonville	0614_01	*- No trends identified for this Assessment Unit -*															
0614	Lake Jacksonville	0614_02				↓												
0615	Angelina River/Sam Rayburn Reservoir	0615_01				↓		↓	↓	↓	↓							
0615A	Paper Mill Creek	0615A_01				↓	↓		↓	↓	↓	↓				↓		

West Mud Creek- FM 3052

EXECUTIVE SUMMARY FOR THE 2020 BASIN SUMMARY REPORT

Recommendations

Water quality issues in the Neches basin are generally not attributable to a single point source, and addressing them requires a community focused approach that includes partnerships with individuals as well as organizations all working together to identify and implement solutions. With that in mind, based upon the evaluation of water quality presented in this Basin Summary Report, as well as recommendations from stakeholders and Steering Committee members, we believe the following recommendations present the best path forward.

Continued Routine Surface Water Quality Monitoring

Routine surface water quality monitoring is critical in order to conduct accurate evaluations of the overall health of an aquatic system. The Texas Clean Rivers Program (CRP) monitors water quality in relation to human health concerns, ecological condition, and designated uses. CRP partners across the State of Texas coordinate and conduct monitoring and assessments based on data collected from approximately 1800 monitoring stations state-wide, as well as encouraging stakeholder participation as an effort to improve surface water quality.

An Increased Focus on Stakeholder Education & Involvement

Over the past year, ANRA has focused on the importance of educating communities and building partnerships within the Neches River Basin. It is vital to provide education and outreach opportunities to stakeholders in order to increase the understanding of the importance of water quality, provide to them the different alternatives that can be used to address water quality issues, and promote environmental stewardship. Building partnerships within the Basin allows for a greater potential impact on water quality due to the combination of resources from different organizations state-wide.

With ninety-five percent of the lands of the State of Texas being privately owned, public involvement is crucial when it comes to addressing water quality issues. ANRA encourages the public's involvement through the Texas Stream Team, Major Rivers curriculum, and other education and outreach efforts. The Texas Stream Team, serving as a voluntary group of citizen scientists, is a great way for stakeholders to be directly engaged in their watersheds, in which monitoring efforts can be taken into their own hands by conducting research and contributing to water quality data through a database maintained by the Town of Flower Mound and The Meadows Center for Water and the Environment at Texas State University. The Major Rivers curriculum is a water education program that teaches school-aged children about the importance of water resources and how to properly care for those resources. ANRA, in partnership with TCEQ, is in the process of developing its own education and outreach materials to be distributed to school-aged children that teaches them the importance of the CRP program and it's role in improving water quality.

ANRA encourages landowners and stakeholders to incorporate Best Management Practices (BMPs) to ensure that operations are environmentally friendly and take into consideration the potential impacts that agricultural operations can have on water quality. BMPs are conservation practices available to landowners that can help protect and improve overall water quality and quantity, maintain and improve wildlife and fish habitat, as well as a host of other potential benefits. For more information on the Natural Resources Conservation Service's (NRCS) conservation practices, contact your local USDA Service Center or Soil and Water Conservation District or visit the Texas Water Development Board's (TWDB) suggested Water Conservation Best Management Practices at: https://www.twdb.texas.gov/conservation/BMPs/index.asp In the future, ANRA would like to participate in additional training opportunities, expand volunteer monitoring programs to other areas of the basin, as well as build relationships with other water quality partners. For more information on Texas Stream Team involvement, or the Major Rivers Curriculum, please visit:

https://www.meadowscenter.txstate.edu/Leadership/TexasStreamTeam.html

https://www.twdb.texas.gov/conservation/education/kids/MajorRivers/index.asp

Continue to seek grant funding for Watershed-Specific Supplemental Projects

ANRA is already actively participating in several special projects basin-wide to maintain and improve water quality and address impairments and concerns. These projects focus on bringing stakeholders in diverse watersheds together to address water quality issues. They can include data collection and interpretation, education and outreach, implementation of best management practices, assistance for low income households, and more. We believe these projects can be powerful tools to address existing water quality concerns as well as provide education that will foster understanding and appreciation for our natural resources that will help prevent future issues. We should continue to work with partners to seek out opportunities for these types of projects where possible.

Conclusions

The Angelina and Neches River Authority's jurisdictional service area consists of approximately 8,500 square miles that lie wholly or in part of 17 counties. ANRA has a robust surface water quality monitoring program in the basin, monitoring 37 stations on a quarterly basis for the Clean Rivers Program, as well as additional monitoring for other grant projects. 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 paper mill in Lufkin in 2007. There are several listed concerns for nutrients throughout the basin. Routine monitoring activities should be continued in order to better to assess these areas, as well as the incorporation of other water quality improvement techniques such as best management practices (BMPs). As the competing interests for water increase, the water in East Texas will continue to be one of the state's greatest natural resources. The population of Texas is expected to increase over the next 50 year planning horizon, therefore 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.

INTRODUCTION

INTRODUCTION TO THE BASIN SUMMARY REPORT

About the Basin Summary Report

The Basin Summary Report, assembled every third biennium, 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. 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).

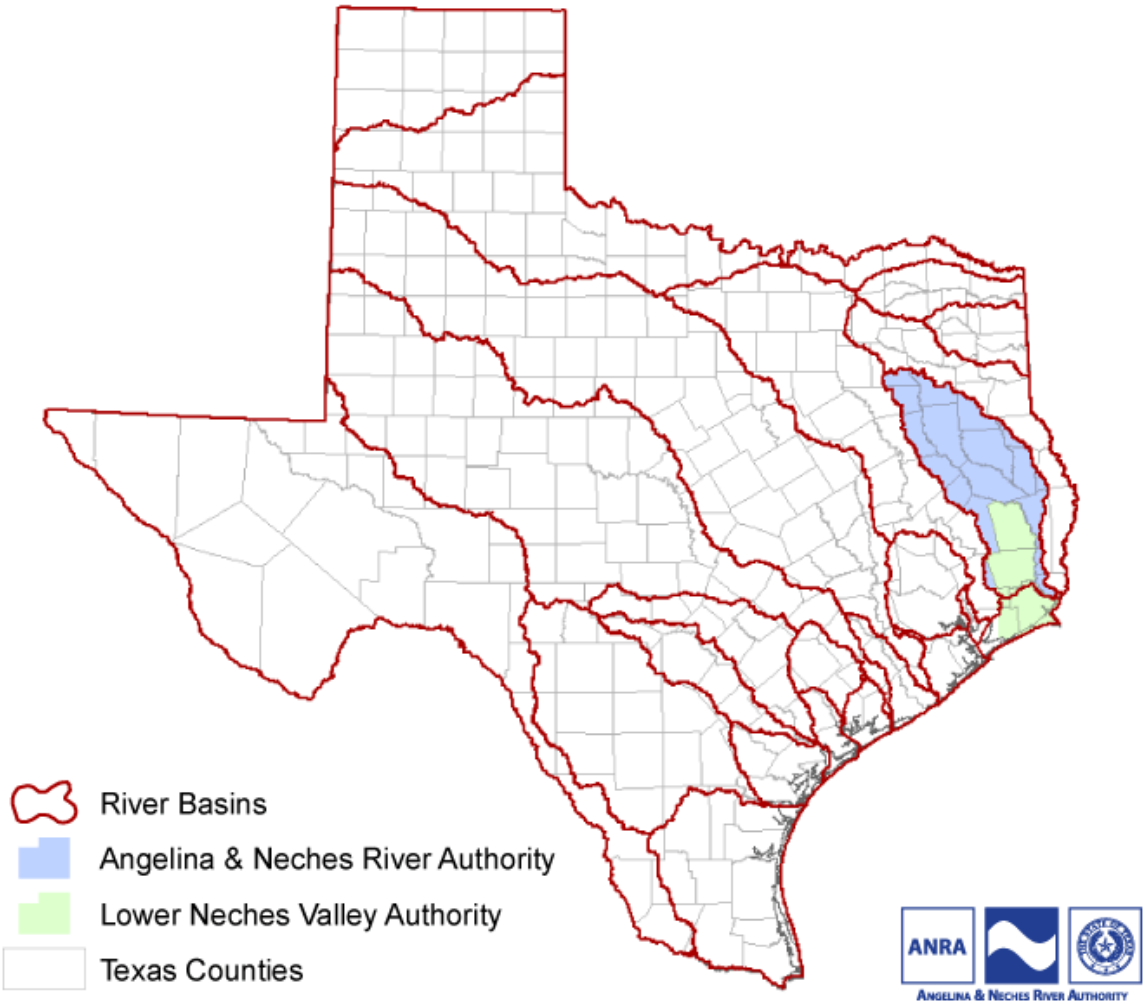
The 2020 Basin Summary Report was prepared by the Angelina & Neches River Authority in cooperation with the Texas Commission on Environmental Quality (TCEQ) under the authorization of the Texas Clean Rivers Act.

About the Angelina and 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 has the responsibility for monitoring, protecting, and enhancing water resources in the Neches River Basin.



GOALS AND OBJECTIVES OF THE TEXAS CLEAN RIVERS PROGRAM

The Texas Clean Rivers Program

Texas Clean Rivers Act

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.

Bloom near Attoyac River bank

The Clean Rivers Program Long-Term Plan

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 is designed to identify and evaluate water quality issues, establish priorities for corrective action, work to implement those actions, and adapt to changing priorities.

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.

Clean Rivers Program Long-Term Plan

Objective	Goal
1	Provide quality-assured data to the TCEQ 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 BASIN ENTITIES

Monitoring Activities

Water quality monitoring in 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 TCEQ also monitors within the Basin with the regional offices in Tyler and Beaumont conducting monitoring activities in the upper and lower portions of the basin respectively.

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), the Texas State Soil and Water Conservation Board (TSSWCB), and the Lower Neches Valley Authority.

Coordinated Monitoring Schedule

Every year the annual Coordinated Monitoring Meeting (CMM) allows entities in the basin to meet, establish basin monitoring priorities, and coordinate sampling schedules to make sure that adequate coverage is maintained with minimal duplication of effort. The CMM process is used to develop the Coordinated Monitoring Schedule (CMS) for the basin. The CMS is a comprehensive schedule of monitoring in the basin and is located at http://cms.lcra.org.

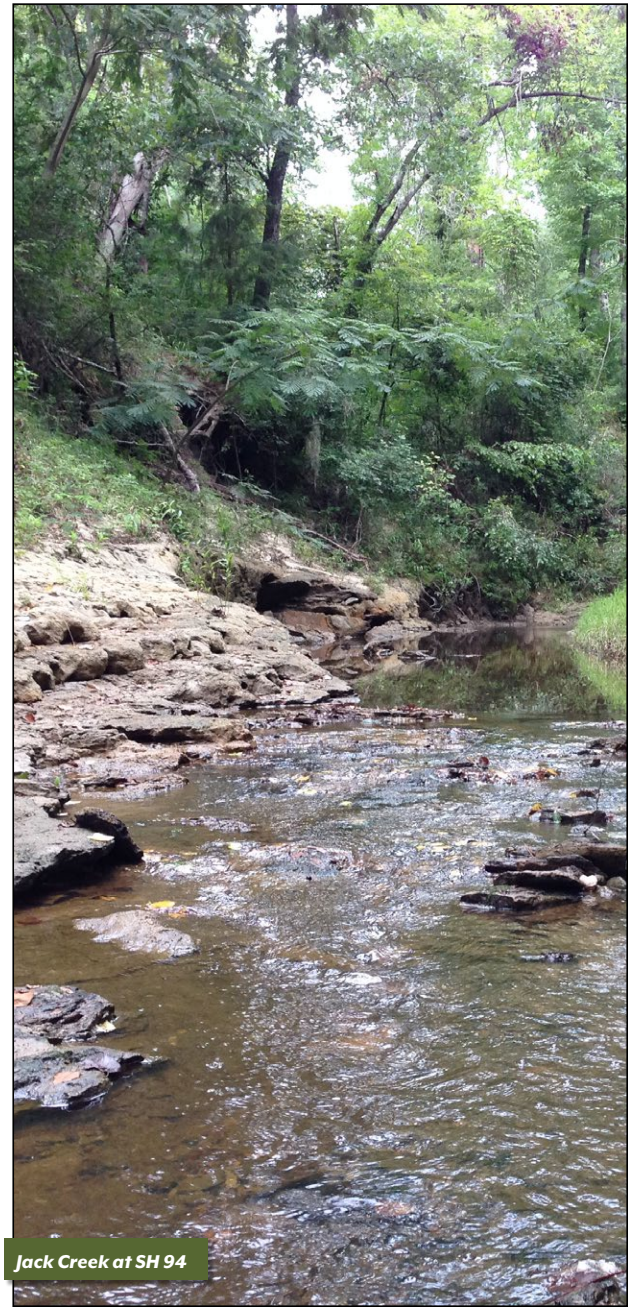
Watershed Action Planning

The Watershed Action Planning (WAP) process, established in 2011, is the state's coordinated approach to develop, coordinate, and track action to address water quality issues. The WAP process coordinates planning and activities among numerous agencies and interested parties, including the TCEQ, the Texas State Soil and Water Conservation Board (TSSWCB), the Texas Clean Rivers Program (CRP) partners, and stakeholders from the watershed. The WAP process is a flexible approach that utilizes a range of strategy options for addressing impaired water bodies on the 303(d) List and other water quality issues and provides a framework that each program area, partner agency, and stakeholder can use for planning, budgeting, and implementing activities to address water quality issues. The WAP process can also be used to address potential water quality issues before they develop to the level of an impairment.

A major product of the WAP process, the **Watershed Action Planning Strategy Table**, is a comprehensive strategy for protecting and improving the quality of water bodies. This table lists impaired and special interest water bodies. It also lists strategies to improve water quality, the status of each strategy, and the lead agency and program for tracking each strategy.

A critical aspect of the WAP process is input from stakeholders. The type of data and information to be gathered through local watershed discussions include:

- **Watershed Evaluation** – Develop and prepare watershed maps, land use classifications, and models; identify data gaps and data acquisition projects.
- **Pollution Sources** - Identify potential point and non-point sources of pollution; evaluate pollution sources; identify pollution control practices; identify data gaps.
- **Water Quality Monitoring** - Identify water quality monitoring sites; identify water quality indicators; identify data gaps.
- **Watershed Stakeholders** - Identify key stakeholders; characterize stakeholder support; identify issues of concern and watershed goals.
- **Public** – Characterize public support and identify issues of concern and watershed goals.
- **Watershed Planning Strategy** – Identify what option(s) (e.g. Use Attainability Analysis, Total Maximum Daily Load, Watershed Protection Plan, etc.) the public and local stakeholders recommend be considered to address each water quality issue.



Jack Creek at SH 94

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 10,054 square mile area are drained by the Neches River, Pine Island Bayou, and Village Creek.

Segments

The Neches River Basin has been divided into sixteen classified segments, including nine stream segments encompassing 710.1 stream miles and six reservoirs with a combined surface area of 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 including 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.

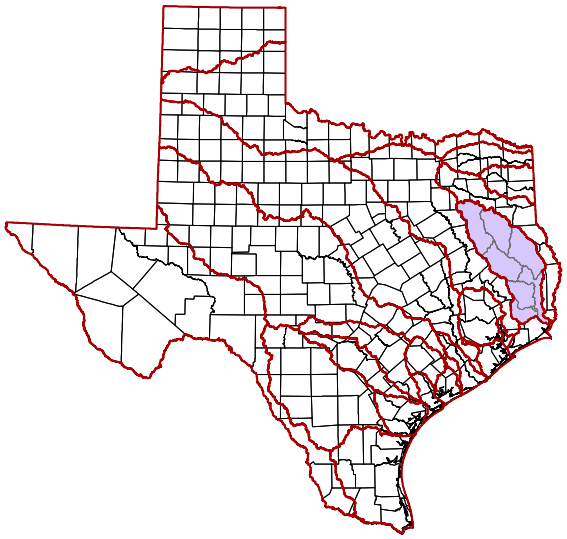
The two major rivers in the basin are the Angelina and Neches Rivers, which comprise an estimated 1.2 billion gallons of water discharge annually into the Gulf of Mexico. Two major reservoirs, Sam Rayburn Reservoir and Lake Palestine, are also included in the Upper Neches River Basin. Ten minor reservoirs 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.

Aquifers

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.

Ecoregions

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.



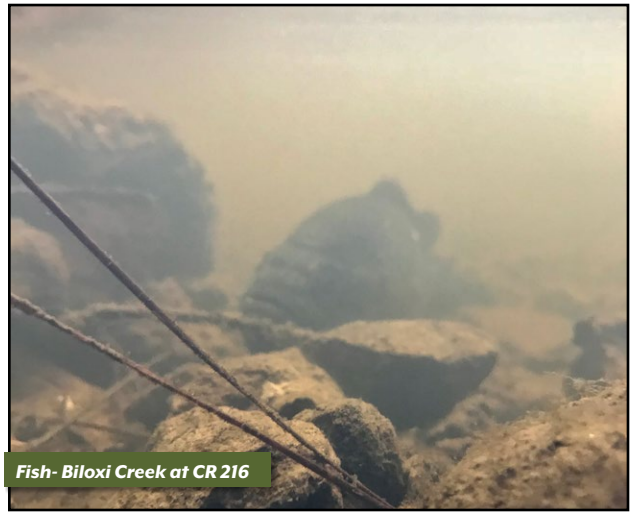
Basin	Approximate Area (in square Miles)
Neches River Basin (entirety)	10,054
Upper Angelina Sub-basin	1,616
Lower Angelina Sub-basin	1,947
Upper Neches Sub-basin	1,946
Middle Neches Sub-basin	1,608
Lower Neches Sub-basin	1,109

Rainfall

Rainfall patterns vary across the basin. In the northern half of the basin, average annual precipitation is 43 inches. Annual precipitation increases as you travel south towards 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



Fish- Biloxi Creek at CR 216

DESCRIPTIVE OVERVIEW OF THE NECHES BASIN

Ecosystem

East Texas is home to four National Forests (the Sabine, Angelina, Davy Crockett and Sam Houston) as well as the Big Thicket National Preserve. The East Texas Ecosystem includes forested, scrub-shrub, emergent, aquatic bed, and wetlands. Wetland and deep water areas like reservoirs 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.

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, highway construction, pipeline and transmission line installation, soil and water contamination, short-rotation management of commercial forests, and introduction of exotic species.

Soil Properties

The soil properties for each of the major segment watersheds of the Upper Neches Basin are summarized below using soil surveys and general soil maps for individual counties.

Soil Properties in the Upper Neches Basin

Segment ID	Segment Name	Soil Properties
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.
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.
0606	Neches River 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.
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.
0611	Angelina River Above Sam Rayburn Reservoir	This soil is 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. This soil ranges from moderate to strongly acidic.
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.
0613	Lake Tyler/Tyler East	This soil is 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. This soil ranges from moderate to strongly acidic.
0614	Lake Jacksonville	This soil is dominated by loam and sandy loam soils with a small percentage of clay loam soils. The slope of this segment ranges from 0 to 15 percent.
0615	Riverine portion of Sam Rayburn Reservoir (Angelina River Arm)	This soil is dominated by loam and sandy loam soils with a small percentage of clay loam soils. The slope of this segment ranges from 0 to 25 percent.

DESCRIPTIVE OVERVIEW OF THE NECHES BASIN

Carlson's Trophic State Index

Evaluation and Ranking of Reservoirs

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 surface water quality monitoring (SWQM) data. Thus, TSI calculations can classify reservoirs or lakes into different trophic states. The trophic states below are based on the TSI calculation for chlorophyll-*a*.

Trophic Classification of Neches Basin Reservoirs (2020)

Segment ID	Reservoir	TSI (Chl-*a*)	Trophic State
0611Q	Lake Nacogdoches	48.06	Mesotrophic
0604T	Lake Ratcliff	56.34	Eutrophic
0611R	Lake Striker	41.60	Mesotrophic
0614	Lake Jacksonville	41.62	Mesotrophic
0610	Sam Rayburn Reservoir	47.96	Mesotrophic
0605F	Lake Athens	51.54	Eutrophic
0603	B.A. Steinhagen	50.74	Eutrophic
0612G	Lake Naconiche	55.22	Eutrophic
0613	Lake Tyler	54.74	Eutrophic
0613	Lake Tyler East	55.06	Eutrophic
0605	Lake Palestine	62.60	Eutrophic

Algae at Hurricane Creek- Loop 287

Water Quality Characteristics of Trophic States

Trophic State	TSI (Chl-*a*) Index Range	Water Quality Characteristics
Oligotrophic	0-40	Clear waters with extreme clarity, low nutrient concentrations, little organic matter or sediment, and minimal biological activity.
Mesotrophic	> 40 - 50	Waters with moderate nutrient concentrations and, therefore, more biological productivity. Waters may be lightly clouded by organic matter, sediment, suspended solids or algae.
Eutrophic	> 50 -70	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	> 70	Very murky, highly productive waters due to excessive nutrient loading. Many clearwater species cannot survive.

IMPACTS OF HURRICANE HARVEY

Flooding in Orange, TX

Hurricane Harvey made landfall on August 25th, 2017 as a category 4 hurricane. The storm was the wettest tropical cyclone on record in the United States. Harvey made landfall at San Jose, Texas at peak intensity followed by a second landfall at Holiday Beach at category 3 intensity. Unprecedented flooding was caused by the torrential rainfall as Harvey stalled near the coast. On August 29th Harvey made a final landfall over Louisiana before drifting inland and weakening until it eventually dissipated on September 1st.

In preparation of landfall Governor Greg Abbott declared a state of emergency for 30 counties and mandatory evacuations were ordered for 7 counties. On August 26th, after landfall, an additional 20 counties were added to the state of emergency declaration.

At landfall, peak wind gust of 145 mph were measured at Rockport airport and peak storm surges of 12.5 feet were measured at Aransas Wildlife Refuge. On August 26th Harvey moved over Houston and remained there for 4 days. Nederland, TX now holds the continental U.S. rainfall record for the highest storm total rainfall, receiving 60.58 inches. Parts of Harris County received over 44 inches of rain, two reservoirs overflowed and over 1/3 of the county was flooded. On August 29th Harvey made landfall for the third time over Beaumont and Port Arthur. Beaumont received over 32 inches of rain causing a loss of service to its main water supply intake pump on the Neches River and its secondary water source in Hardin County. Leaving them without water for an unknown amount of time.

Harvey brought record setting rainfall, flooding, and damage to Houston, Beaumont, and the surrounding area. For the most part, the upper and middle portions of the Neches River Basin did not experience significant flooding. However, the area did experience heavy rainfall, isolated flooding, road closures, and power outages.

Throughout the basin, streams were inundated with storm water and sanitary sewer overflows were commonplace as the infrastructure couldn't handle the large volume of rainfall. 800 wastewater treatment facilities and 13 superfund sites were flooded spreading sewage and toxic chemicals.

Harvey is tied with Hurricane Katrina (2005) as the costliest tropical cyclone in the United States causing $126 billion dollars in damage. An estimated 300,000 structures and 500,000 vehicles were damaged or destroyed in Texas alone. 39,000 people lost their homes and were forced into shelters, 10,000 people were rescued from flooded homes and highways, and 738,000 people registered for assistance with the Federal Emergency Management Agency. 107 deaths were caused either directly or indirectly by Harvey nationwide. The World Meteorological Organization maintains an alphabetical list of storm names that repeats every seventh year. The only time that there is a change is if a storm is so deadly or costly that the future use of its name on a different storm would be inappropriate for obvious reasons of sensitivity. Hurricane Harvey met that criteria, and the name Harvey was retired from the list in 2018. ANRA employees and community members donated diapers, toiletries, and water to victims of Hurricane Harvey. Supplies were collected at the ANRA main office and driven to areas south of Conroe that were difficult to access due to storm damages.

Timeline of Hurricane Harvey Events

August 23, 2017
Texas' Governor Gregg Abbott declares a state of emergency for 30 Texas counties.

August 24, 2017
Harvey becomes a Category 1 Hurricane with projections for devastating winds, and rains resulting in historic flooding.

August 25, 2017
Hurricane Harvey strengthens and makes landfall along the Middle Texas Coast as a Category 4 hurricane with winds >115 mph, bringing severe flash floods and heavy rainfall.

August 26, 2017
Harvey makes a second landfall and downgrades to a Category 3 hurricane bringing 10-15 inches of rain. 20 more counties are added to the disaster declaration.

August 27, 2017
Governor Abbott adds 4 more counties to the state disaster declaration.

August 28, 2017
The Texas National Guard is activated by Governor Abbott..

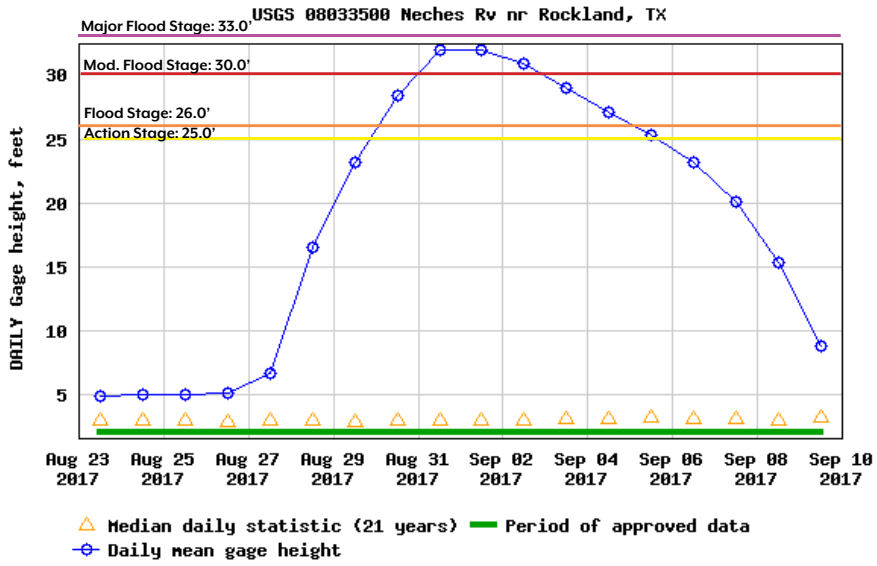
August 29, 2017
Detrimental flooding continues due to torrential rainfall caused by the stalling of Harvey. Harvey reaches peak intensity.

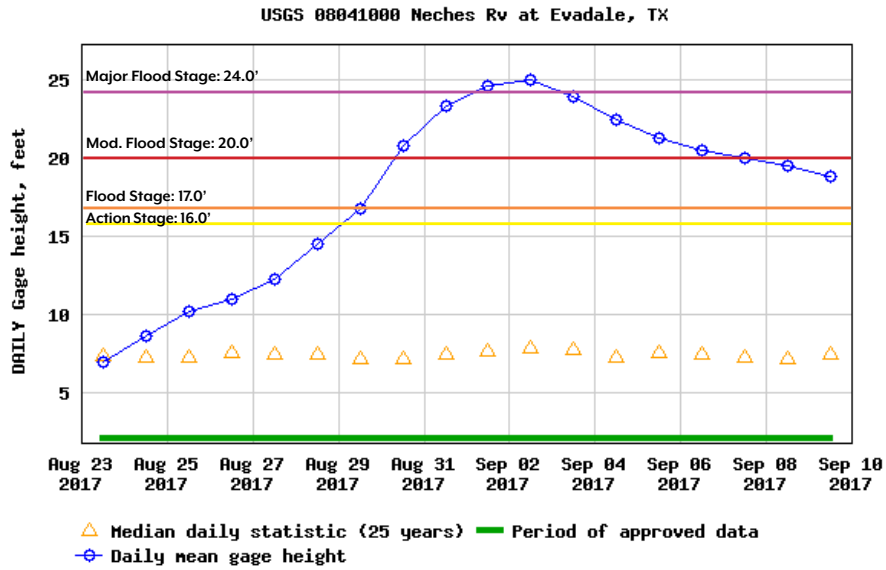
August 30, 2017
Harvey makes it's third landfall near Cameron, Louisiana, weakening, and becoming a tropical depression.

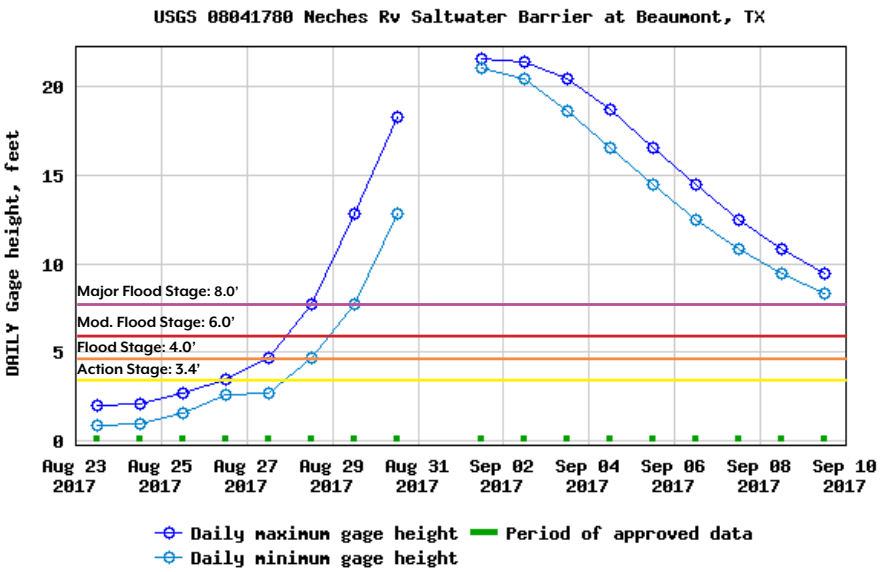
August 31, 2017
Governor Abbott increases Texas' National Guard deployment to a total of 24,000.. Storm dissipated by September 1, 2017.

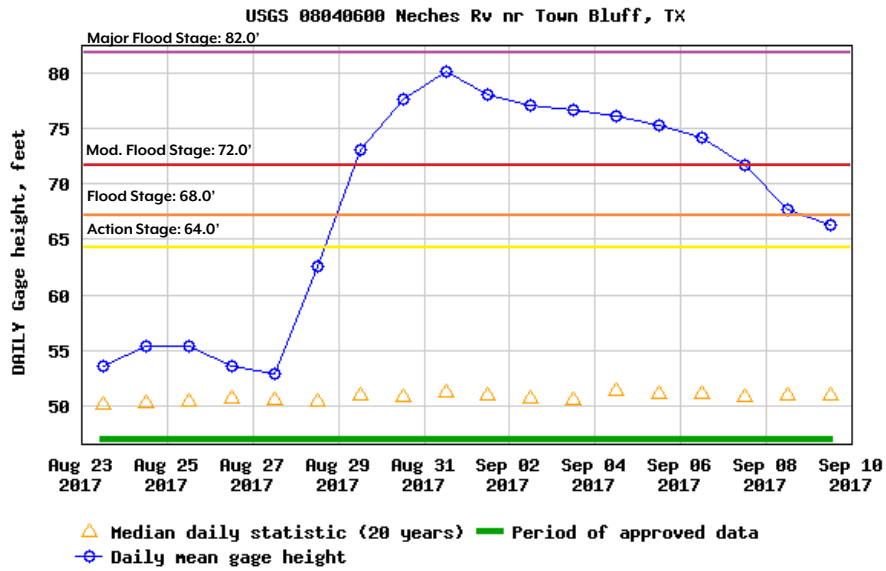
IMPACTS OF HURRICANE HARVEY

Daily USGS Gage Heights During Hurricane Harvey







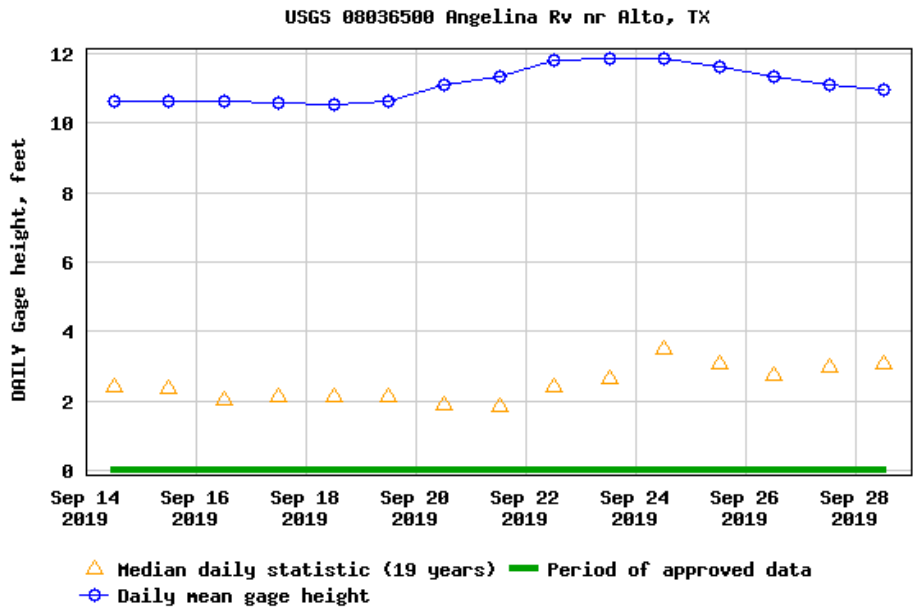


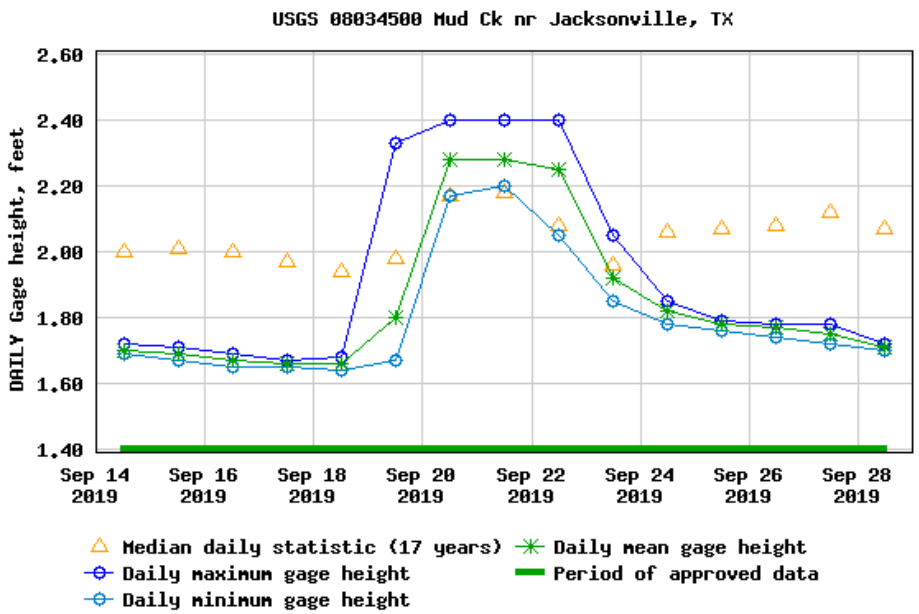
IMPACTS OF TROPICAL STORM IMELDA

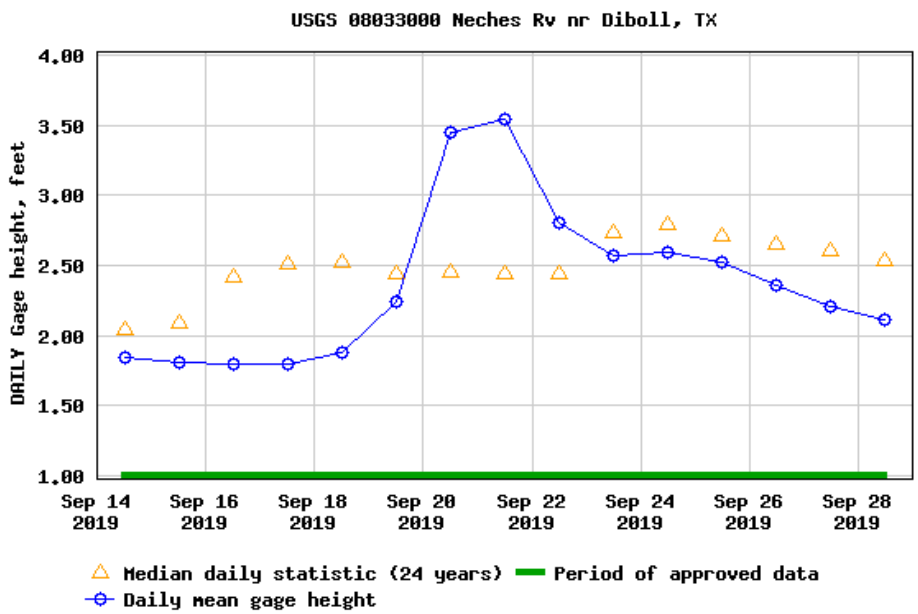
The worst storm since Hurricane Harvey, Tropical Storm Imelda made landfall on September 17th, 2019 near Freeport, Texas. Reported sustained wind speeds topped 40 mph with gusts reaching 48 mph. Imelda weakened after landfall becoming a tropical depression and moved further inland. The storm stalled between Lufkin and Houston, Texas from the evening of the 17th until the 19th, causing significant flooding. By the afternoon of the 19th remnants of the storm had moved northeast across Texas and the storm dissipated by the 21st. Imelda was the fifth wettest tropical cyclone on record in the Continental United States. The system brought heavy rain and dangerous flooding to part of southeast Texas, especially around the cities of Beaumont and Galveston. There was significant and damaging flooding along the I-10 corridor from Winnie eastward to Fannett, Beaumont, Vidor, and Orange Texas. This area received over 44 inches of rain from Imelda and during the peak of flooding vehicles were stuck on I-10 between Beaumont and Winnie for 2 days. More than 2,600 homes were flooded in Orange County and over 5,100 were flooded in Jefferson County. There was also widespread flooding in the Houston area, many bayous overflowed and flooded residential areas. All bus and rail services were suspended temporarily and George Bush Intercontinental Airport was closed briefly, cancelling 655 flights. Nine barges broke away from moorings in a shipyards and two of them hit the Interstate 10 bridge causing significant structural damage. 422 people in Harris County required high-water rescue and hundreds of homes were flooded.

In total more than 1,700 people were rescued from floodwaters and 5 deaths were attributed to the storm.

USGS Gage Readings During Tropical Storm Imelda







SUMMARY OF THE UPPER NECHES BASIN WATER QUALITY CHARACTERISTICS

To determine whether designated uses are supported, water quality parameters were examined and compared to criteria and screening levels as listed in the Texas Surface Water Quality Standards. Assessment data from the 2020 Texas Integrated Report for Clean Water Act Section 305(b) and 303(d) was used in this report.

In general, historical and current water quality data of the Neches River basin included elevated bacteria levels, depressed dissolved oxygen, and dioxin and mercury in edible fish tissue. Data analysis displayed several trends regarding nutrients that may be cause for concern in the future. However, there are several segments, tributaries, and reservoirs within the basin that are fully supporting their designated uses.

Sam Rayburn at SH 103

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PUBLIC PARTICIPATION

Neches River Rendezvous- 06/02/2018

EDUCATION AND OUTREACH

In Late 2019 the Angelina and Neches River Authority initiated an education and outreach program to improve public awareness and involvement in water quality and environmental stewardship in the basin. An education and outreach coordinator was hired in September 2019. The program is in its early stages and the materials being produced initially are geared toward elementary and middle school students, and are centered on environmental stewardship. Educational materials for students were discussed in a focus group comprised of teachers with experience at the targeted educational level before being released to teachers. Plans to expand the program include creating similar educational materials for high school students and eventually creating a curriculum of materials available for each educational level.

ANRA is a sponsor of the Neches River Rendezvous here in East Texas. This event is an annual summer tradition that promotes outdoor wilderness adventures offering a day of paddling on the scenic Neches River with a fun, family oriented experience.

ANRA has supplied schools in Lufkin with the a fun way to learn about water in Texas, the Major Rivers curriculum. This is an excellent way for Texas water providers to do cost-effective water education outreach in their communities with a program that has a proven track record of acceptance by Texas educators. Major Rivers and his horse Aquifer teach students about Texas' major water resources, how water is treated and delivered to their homes and schools, how to care for their water resources, and how to use them wisely.

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 Angelina County, Sam Rayburn Reservoir, the portion of San Augustine County within the Neches River Basin, and operates an Environmental Laboratory offering services to the public. Additionally, ANRA produces and sells biosolids compost through our Neches Compost Facility.

ANRA Publications

Every year, ANRA's Clean Rivers Program produces either a Basin Highlights Report or Basin Summary Report (every third biennium) that discusses water quality in the Neches River Basin. These reports are distributed to our Steering Committee members, interested stakeholders, and other interested parties.

ANRA Website

The Angelina & Neches River Authority provides the public with information concerning water quality issues on our website, 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.

Please visit us online at http://www.anra.org.

Spring Blooms

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, typically in late spring/early summer. 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 State Health Services, 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.

To become a member of the CRP Steering Committee, contact Carla Ethridge (cethridge@anra.org).

La Nana Bayou at CR 526

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.

In 2019, Kennard ISD joined the Texas Stream Team. ANRA supplied them with two monitoring kits that they intend to use for the expansion of their science education program.

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

Texas StreamTeam
Caring for Our Waters

Stream Team Volunteer Monitor Training
ANRA provided this private landowner with a monitoring kit and training for monitoring efforts on Mud Creek, located in the Upper Angelina sub-basin.

SPECIAL PROJECTS IN THE BASIN

Although not funded by the Clean Rivers Program, there have been multiple special projects in the basin over the past ten years that have been funded in part by Clean Water Act funds from EPA, as well as funds from the TCEQ, and the TSSWCB.

These projects focus on bringing stakeholders in diverse watersheds together to address water quality issues. They can include: data collection and interpretation, education and outreach, implementation of best management practices, assistance for low income households, and more.

The first major project in the basin was the Attoyac Bayou Watershed Protection Plan (WPP). The project began in 2009. and the Attoyac Bayou Watershed Partnership completed development of the plan in July of 2014. The goal of the WPP is to restore water quality in the Attoyac Bayou through conservation and stewardship of the watershed's resources and provide stakeholders with the most up-to-date information on the watershed's characteristics and uses. The Attoyac Bayou WPP project website has links to project documents, including the Watershed Protection Plan itself. For more information, please visit http://attoyac.tamu.edu.

The Attoyac WPP recommend several strategies for improving water quality, and it has been a conduit for several subsequent grant programs to help monitor and improve water quality in the watershed. It also set the stage for other similar projects in the basin that were not directly related, but shared techniques and knowledge gained during the development and implementation of the WPP.

The first project to follow the Attoyac WPP was the the Sam Rayburn OSSF Program Support and Attoyac Bayou OSSF Remediation project. This project had three primary goals. First was the development of a database to catalog permitted OSSFs in areas where ANRA was the Authorized Permitting Agent. Second was repair and/or replacement of OSSFs in the watershed for families that could not afford to install or repair systems for themselves, and third was a continuation of water quality monitoring at the sites where monitoring had begun during the development of the WPP in order to document water quality changes that would occur as a result of OSSF improvements and BMPs that were also being put in place.

After that project completed successfully in 2018, its efforts were continued by two new projects. In the first, TWRI, Pineywoods RC&D & ANRA partnered to continue the efforts to repair and replace failing OSSFs, and in the second ANRA partnered with TWRI and SFA to continue water quality monitoring. Both projects also continued to focus on education and outreach. At the successful close of those projects in 2019, both were again essentially extended by follow up projects that shared the same goals. At the time of this writing 49 OSSFs have been repaired/replaced, monthly monitoring had been performed for 47 months at five sites in the Attoyac watershed, and multiple educational events have been held each year.

Outside of the Attoyac watershed, several other projects have been completed or are in progress.

Watershed Characterizations have been performed or are underway on La Nana Creek, the Angelina River, and Kickapoo Creek. The intent of these projects is to compile best available data and collect new data where needed to document the existing water quality and environment in a watershed along with potential causes of any current or future water quality issues. As with the other projects, in addition to data collection and analysis, there is a focus on education and outreach. These characterization projects can also lay the groundwork for future WPP or Total Maximum Daily Load (TMDL) projects to address identified issues. These types of projects required diverse stakeholder involvement to target issues of concern within each watershed, and education and outreach are again a large component of the projects.

Because bacterial impairments are the most common type of impairment in the basin, TCEQ's TMDL team are working with TWRI, ANRA, and LNVA on projects focused specifically on bacterial impairments in the Middle and Lower Neches River. Specifically targeted are Jack, Cedar, Hurricane, and Biloxi Creeks in the middle portion of the Neches, and Sandy Creek, Wolf Creek, Hillebrandt Bayou, and the Neches River Tidal in the lower portion.

And the final project type is a Recreational Use-Attainability Analysis (RUAA). An RUAA is a site-specific study that is used to evaluate whether the existing recreational use category of a water body is appropriate, or if a change of standard should be considered. Many RUAAs have already been completed for various water bodies in the basin to ensure that those impaired water bodies were classified correctly, and another one is currently underway for Black Fork Creek which is located northwest of the City of Tyler.

More details about each of the above projects are available on the following pages. We invite you contact us if you need further info, or would like to get involved in water quality improvement efforts in the basin!

For more information on special projects in the Neches River Basin, please contact:

Carla Ethridge
Clean Rivers Program Manager
Angelina and Neches River Authority
936-633-7527
cethridge@anra.org

Project Partners

SPECIAL PROJECTS IN THE BASIN

On-site Sewage Facility (OSSF) Projects in the Attoyac Watershed

2013
Lake Sam Rayburn OSSF Program Support and Attoyac Bayou OSSF Remediation

Water Bodies	Attoyac Bayou (Segment 0612)
Counties	Nacogdoches, San Augustine, Shelby, Rusk
Project Period	September 2013 to May 2018

Through this project, ANRA developed a database of On-Site Sewage Facilities (OSSFs) within Control Zone Rayburn (CZR), the 2000-ft buffer zone around Sam Rayburn Reservoir, as well as the unincorporated portion of San Augustine County. The database is used to track and map all permitted systems in the area immediately surrounding Sam Rayburn Reservoir, as well as the unincorporated portion of San Augustine County within the Neches River Basin. This portion of the county includes a portion of the Attoyac Bayou watershed, a 303(d) listed water body impaired for bacteria. The database has since been expanded to also include Angelina County.

Failing or non-existent OSSFs in the area were identified through a combination of database tracking of complaints and violations, field reconnaissance and inspections, and consultations with local officials. Funds from the project were used to replace (in the case of failing systems) or install (in the case of non-existent systems) a total of 26 OSSFs in the Attoyac Bayou watershed.

This project laid the groundwork for future OSSF repair and replacement efforts through education, outreach, and local word of mouth, and established the need for more efforts in the same vein which lead to the following projects on this page.

The full report on this project is available at ANRA.org: https://www.anra.org/divisions/water_quality/crp/reports.html

This project was funded by TCEQ through a Clean Water Act Section 319 Grant.

2017
Attoyac Bayou Watershed Protection Plan Implementation – OSSF Remediation

Water Body	Attoyac Bayou (Segment 0612)
Counties	Nacogdoches, San Augustine, Shelby, Rusk
Project Period	March 2017 to February 2020

As the previous project was wrapping up, it was clear that there was still a need for additional OSSF assistance in the watershed, so TCEQ, TWRI, Pineywoods Resources Conservation & Development (RC&D), and ANRA began working on a second project to continue replacing or repairing failing OSSFs within the Attoyac Bayou Watershed and educating residents on best practices related to owning and maintaining OSSFs.

The project began in March of 2017, and was originally intended to replace/repair approximately 13 OSSFs. Response to the program was very positive, and additional funds were secured to provide an additional 10 repairs/replacements for a total of 23 systems.

This project also was a conduit for talks among the OSSF permitting authorities in the watershed regarding standardization of data collection for locations and types of OSSFs within their individual jurisdictional areas. The project's goal was to evaluate the potential and feasibility of developing a watershed-wide OSSF database to help identify current and future needs, thereby improving water quality in the watershed.

This project was primarily funded by TCEQ through a Clean Water Act Section 319 Grant with some OSSF repairs/replacements funded through Supplemental Environmental Projects (SEP) funds.

2019
Attoyac Bayou Watershed Protection Plan Implementation – OSSF Remediation

Water Body	Attoyac Bayou (Segment 0612)
Counties	Nacogdoches, San Augustine, Shelby, Rusk
Project Period	September, 2019 to August, 2021

This project is once again a continuation of the efforts and goals of the previous project.

At the end of both previous projects, there have been qualified applicants that have not been able to receive assistance from the project because funds have been used up. The project partners have all agreed that the need exists to continue efforts, and so as one project ends, we look for opportunities to continue the work in new projects with the same goals.

This project began in September of 2019, and is intended to run through August of 2021. The project will continue repairing and replacing failing or non-existent OSSFs while providing educational literature and events to the people of the watershed, and further cementing the data standardization and collaboration between permitting authorities.

If you or someone you know lives in the Attoyac Bayou watershed and needs assistance with an OSSF issue, then please contact Pineywoods RC&D at 936-568-0414 or pineywoodsrcd@att.net for more information.

The project is funded by TCEQ through a Clean Water Act Section 319 Grant, and depending on repair vs replacement ratios should have enough funds to repair or replace an additional 20 OSSFs.

SPECIAL PROJECTS IN THE BASIN

Attoyac Watershed Assessing Best Management Practice (BMP) Effectiveness

2013
Lake Sam Rayburn OSSF Program Support and Attoyac Bayou OSSF Remediation

Water Body	Attoyac Bayou (Segment 0612)
Counties	Nacogdoches, San Augustine, Shelby, Rusk
Project Period	September 2013 to May 2018

This project (also featured on the previous page) included a water quality monitoring component that was intended to help assess the effectiveness of ongoing efforts to improve the water quality in the watershed.

The project collected monthly water quality samples at 5 sites within the watershed for 24 months to supplement the quarterly monitoring that the CRP program performs.

The goal was to identify any changes in water quality following the replacement of failed or non-existent OSSFs, as well as monitoring effectiveness of Best Management Practices (BMPs) established by residents of the watershed as recommend by the Attoyac Bayou WPP.

Water quality monitoring conducted under this project tested not only for bacteria but for nutrients as well, including parameters for which Attoyac Bayou and Sam Rayburn Reservoir have concerns.

The full report on this project is available at ANRA.org: https://www.anra.org/divisions/water_quality/crp/reports.html

This project was funded by TCEQ through a Clean Water Act Section 319 Grant.

2016
Coordinating Facilitation and Implementation of the Attoyac Bayou Watershed Protection Plan and Monitoring Implementation Effectiveness

Water Body	Attoyac Bayou (Segment 0612)
Counties	Nacogdoches, San Augustine, Shelby, Rusk
Project Period	October 2016 to August 2019

The Texas State Soil and Water Conservation Board (TSSWCB), Texas Water Resource Institute (TWRI), Stephen F. Austin State University (SFA), and ANRA collaborated on this project to further educational efforts, promote BMPs, and also continue monitoring water quality to assess the effectiveness of the ongoing work in the watershed.

Work began in Oct, 2016, and was originally intended to end Mar, 2019, but all parties agreed to extend the project through Aug of 2019 at no additional cost to the state.

One goal of the WPP was to encourage residents to implement BMPs in the form of water quality management plans (WQMPs). WQMPs are developed between landowners and the local Soil & Water Conservation Districts (SWCDs) for farms, forestry and ranching operations and are specific to each site. During the project period, the Attoyac Bayou Technician wrote plans for eight sites over 1,967 acres. The practices implemented included livestock pipeline, watering facilities, cross fences, and prescribed grazing.

Several educational events were held and SFA collected samples monthly at five sites from Mar, 2017 through Aug, 2019. ANRA's lab analyzed the samples and sent the results to TWRI and TCEQ for use in determining the effectiveness of BMPs that had been implemented, as well as assessing water quality for the Texas Integrated Report.

This project was funded by the Texas State Soil and Water Conservation Board (TSSWCB) through a Clean Water Act, Section 319(h) grant from the U.S. EPA.

2019
Attoyac Bayou Watershed Protection Plan Implementation Effectiveness Monitoring and Facilitation Continuation

Water Body	Attoyac Bayou (Segment 0612)
Counties	Nacogdoches, San Augustine, Shelby, Rusk
Project Period	July 2019 to June 2021

This project is a continuation of the efforts and goals of the previous project, and has the same project partners.

Work continues in the watershed to implement BMPs and replace OSSFs, and it is important to continue assessing the quality of the water, as well as continue educational efforts. The project will collect 22 additional months of data starting in Sept 2019.

Project Goals are:

- To facilitate and support effective implementation of the Attoyac Bayou WPP
- To provide updates on implementation progress, keep stakeholders engaged and seek input on future implementation activities
- To support future funding acquisition, track management implementation, and encourage BMP adoption
- Evaluate progress made toward achieving WPP implementation milestones
- Coordinate and conduct relevant outreach and education activities in and around the watershed
- Monitor water quality in the Attoyac Bayou watershed to show BMP implementation effectiveness

This project is funded by the TSSWCB with State Nonpoint Source Grant program funding.

SPECIAL PROJECTS IN THE BASIN

Total Maximum Daily Load (TMDL) Projects

The Texas Commission on Environmental Quality (TCEQ) is working hard to address bacterial impairments on regional basis across the state. TMDLs can be a significant part of this process, because they are developed for water bodies that are quality-limited due to a pollutant or adverse conditions. A TMDL estimates the amount (load) of a pollutant that a water body can receive and still support its designated uses. A TMDL is usually paired with an implementation plan that puts the TMDL in action. The TMDL program is authorized by and created to fulfill the requirements of Section 303(d) of the federal Clean Water Act and its implementing regulations.

Lower Neches Tributary TMDL Project

Water Body	Neches River Tidal, Sandy Creek, Wolf Creek, and Hillebrandt Bayou
Location	Polk, Tyler, Jasper, Hardin, Liberty, Jefferson, and Orange Counties
Project Start	September 2018

ANRA is working with, LNVA, TCEQ and TWRI to assess local water quality impairments in Polk, Tyler, Jasper, Hardin, Liberty, Jefferson and Orange Counties (Neches River Tidal, Sandy Creek, Wolf Creek, and Hillebrandt Bayou) and will implement an approach to address the multiple bacteria impairments within the Lower Neches River and Hillebrandt Bayou watersheds. Project goals include characterizing past and current watershed conditions to describe the potential contributors for bacteria pollution in the watershed, and delivering general education and outreach throughout the watershed to raise awareness about water quality and engage stakeholders on options for addressing water quality issues.

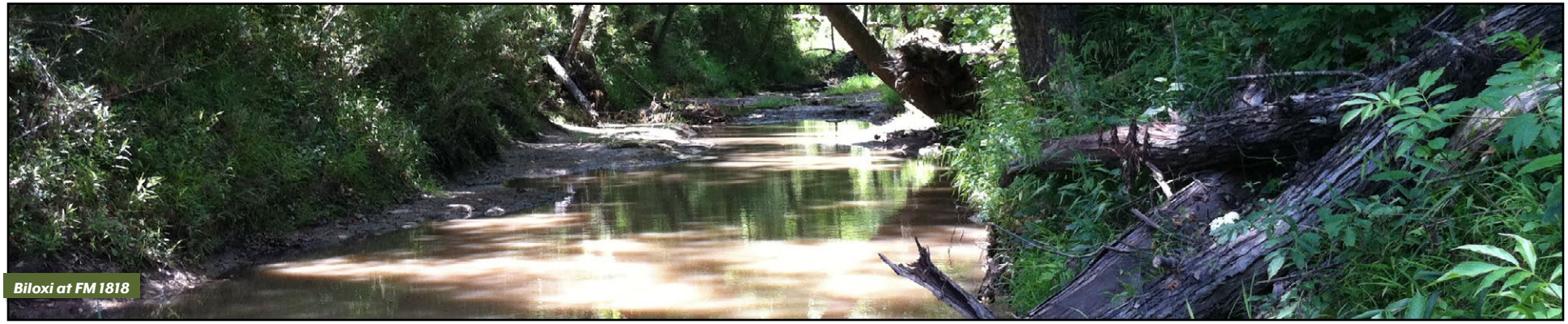
This project began in September of 2018. Once data collection is completed, analysis will begin, and stakeholder meetings will be held to present findings and begin deciding on future steps to address the bacterial impairments.

Middle Neches Tributary TMDL Project (Jack, Hurricane, Cedar, Biloxi)

Water Body	Biloxi, Cedar, Hurricane and Jack Creeks
Location	Angelina County
Project Start	September 2018

This project is a partnership of TCEQ, TWRI, and ANRA. It will assess local water quality impairments in Angelina County (Biloxi, Cedar, Hurricane and Jack Creeks) and will implement an approach to address the multiple bacteria impairments within the tributaries of the Neches River below Lake Palestine. Project goals include characterizing past and current watershed conditions to describe the potential contributors for bacteria pollution in the watershed, conducting supplemental water quality monitoring at eight existing CRP sites to further define current water quality conditions, and delivering general education and outreach throughout the watershed to raise awareness about water quality and engage stakeholders on options for addressing water quality issues.

This project began in September of 2018. Routine water quality monitoring was performed from December of 2018 until June of 2019. Analysis has begun, and initial stakeholder meetings have been held to present findings and begin deciding on future steps to address the bacterial impairments.



Biloxi at FM 1818

SPECIAL PROJECTS IN THE BASIN

Watershed Characterization Projects

A watershed characterization is a fundamental portion of the development of a Watershed Protection Plan, requiring diverse stakeholder involvement to target issues of concern within each watershed.

Angelina Watershed Characterization

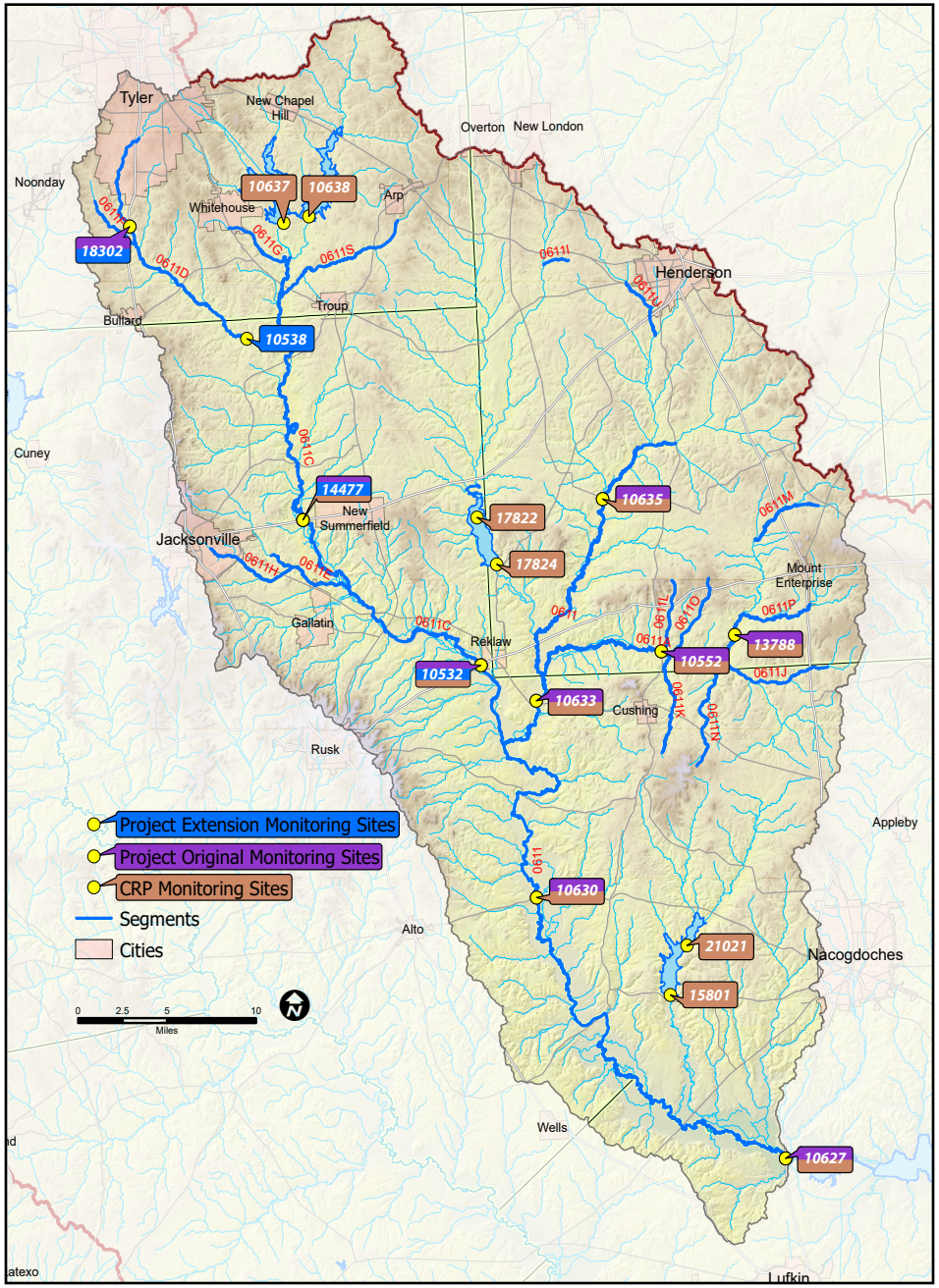
Water Body	Angelina River (Segment 0611)
Location	Angelina, Nacogdoches, Cherokee, Smith and Rusk Counties
Project Period	May 2017- February 2021

This project is a partnership between TSSWCB, TWRI, and ANRA. The goal for this project was to evaluate existing water quality and watershed data to identify and characterize potential sources of pollution in the watershed. The project began in May of 2017 and was originally intended to be closed out in April of 2019, but was extended to February of 2021 to enable some additional targeted monitoring on Mud and West Mud Creeks. TWRI and ANRA collected monthly water quality samples from March 2018 to February 2019 at nine sites. Routine field parameters were collected and water samples were analyzed for *E. coli* bacteria, Ammonia-N, Nitrate-N, Nitrite-N, sulfate, chloride, total phosphorus, and total suspended solids by ANRA's Environmental Laboratory. Monitoring data collected was combined with existing water quality data and characterization is currently underway to describe watershed conditions.

There is an extension in place for this project enabling an additional 12 months of monitoring on Mud and West Mud Creeks (Stations 18302, 10538, 14477, and 10532). Monitoring for this began in March of 2020 and will end in February of 2021.

Stakeholder engagement and general education activities were initiated through this project and will continue in the future. These programs have, and will, help raise stakeholder awareness of local water quality concerns and inform them of options to address these concerns moving forward.

This project is funded by the Texas State Soil and Water Conservation Board (TSSWCB) through a Clean Water Act, Section 319(h) grant from the U.S. EPA.



SPECIAL PROJECTS IN THE BASIN

Watershed Characterization Projects

Kickapoo Watershed Characterization

Water Body	Kickapoo Creek
Location	Henderson and Van Zandt Counties
Project Period	February 1, 2019 – January 31, 2021

This project is a partnership of Texas State Soil and Water Conservation Board (TSSWCB), Texas Institute for Applied Environmental Science (TIAER), and ANRA. The monitoring that will take place will assess local Water Quality impairments above Lake Palestine within the Kickapoo Creek segment (0605A). Project goals include three major themes. First, providing stakeholders and agencies with the sufficient information needed to address the bacteria and dissolved oxygen impairments within Kickapoo Creek (0605A). Second, developing a data inventory of existing water quality and land-use information to evaluate and characterize causes and sources of pollution for the segment. And third, collecting any additional water quality data needed to aid with assessment and identification of sources of pollution and/or impairments.

The project began February of 2019 and the project will continue through January of 2021. Once data collection is completed, analysis will begin, and stakeholder meetings will be held to present findings and begin deciding on future steps to address the bacterial impairments within the segment.

This work is being funded by the Texas State Soil and Water Conservation Board (TSSWCB).

For further information about this project please visit https://kickapoocreekwpp.com, or contact:

Carla Ethridge, ANRA (cethridge@anra.org)

Leah Taylor, TIAER (ltaylor@tarleton.edu)

La Nana Bayou Watershed Characterization

Water Body	La Nana Bayou (Segment 0611B)
Location	Nacogdoches County
Project Period	March 2018- April 2019

TCEQ, TWRI, and ANRA evaluated and characterized potential sources of pollution in the watershed and evaluated water quality conditions during the project period. ANRA collected monthly water quality samples from March 2018 to February 2019 at three sites in the watershed. Routine field parameters were collected and water samples were analyzed for *E. coli* bacteria, Ammonia-N, Nitrate-N, Nitrite-N, Sulfate, Chloride, Total Phosphorus and Total Suspended Solids by ANRA's Environmental Laboratory. Intensive sampling was also conducted on March 8, 2018 & December 3, 2018 to collect a high volume of samples across the watershed in a single day as a way to identify potential areas where loading may be occurring. Data collected were evaluated and developed into a watershed characterization report. A project proposal was submitted for a development of a Watershed Protection Plan (WPP) and is scheduled to be funded in the fall of 2020.

Stakeholder engagement and general education activities were initiated through this project and will continue in the future. These programs, paired with individual stakeholder meetings help raise stakeholder awareness of local water quality concerns and inform them of options to address these concerns moving forward.

For further information about this project please visit: https://www.tceq.texas.gov/waterquality/nonpoint-source/projects/la-nana-bayou-characterization#documents , or contact :

Carla Ethridge, ANRA (cethridge@anra.org)

Ed Rhodes, TWRI (Edward.Rhodes@ag.tamu.edu).

SPECIAL PROJECTS IN THE BASIN

Recreational Use Attainability Analysis (RUAA) Projects

TCEQ uses a watershed-based approach to address water quality, integrating water quality programs that allow for coordination among water quality management agencies, stakeholders, and the public. A Recreational Use-Attainability Analysis (RUAA) is a site-specific study that reevaluates the category of recreational use of a water body if there is reason to believe the current standard is inaccurate. This is one of the tools the TCEQ uses to implement its watershed-based approach. There are four categories of recreational use that can be assigned to an individual stream:

- **Primary Contact Recreation (PCR-1)**- Activities that are presumed to involve a significant risk of ingestion of water
- **Secondary Contact Recreation 1 (SCR-1)** - Activities that commonly occur but have limited body contact incidental to shoreline activity, with less significant risk of water ingestion.
- **Secondary Contact Recreation 2 (SCR-2)** - Activities with limited body contact incidental to shoreline activity due to water body characteristics or limited public access.
- **Noncontact Recreation (NCR)** - Activities that do not involve a significant risk of water ingestion.

Summary of Recreation Use and Attainability Analyses in the Neches River Basin

Segment	Length of Water body (miles)	Counties	Year Completed	Final Classification
0612-Attoyac Bayou	82	Nacogdoches - Rusk - San Augustine - Shelby	2012	PCR-1
0610A-Ayish Bayou	41	San Augustine	2014	PCR-1
0611A- East Fork of the Angelina River	29	Rusk - Nacogdoches	2014	PCR-1
0604M- Biloxi Creek	28	Angelina	2014	PCR-1
0604C- Jack Creek	16	Angelina	2014	PCR-1
0615A- Paper Mill Creek	7	Angelina	2014	SCR-1
0606D- Black Fork Creek	14	Smith	2020	(RUAA In Progress)
0605A- Kickapoo Creek in Henderson County	41	Henderson - Van Zandt	2014	PCR-1
0606- Neches River Above Lake Palestine	33	Henderson - Van Zandt - Smith	2014	PCR-1
0606A- Prairie Creek	12	Smith	2014	SCR-1
0611C-Mud Creek	56	Smith - Cherokee	2014	SCR-1
0611D- West Mud Creek	23	Smith - Cherokee	2014	PCR-1

ADDITIONAL INFORMATION AND RESOURCES

Online Resources

The Texas Commission on Environmental Quality
www.tceq.texas.gov

The Texas Clean Rivers Program
https://www.tceq.texas.gov/waterquality/clean-rivers/index.html

Clean Rivers Program Guidance
www.tceq.texas.gov/waterquality/clean-rivers/guidance/index.html

Coordinated Monitoring Schedule
cms.lcra.org

2020 Texas Integrated Report for the Clean Water Act Sections 305(b) and 303(d)
https://www.tceq.texas.gov/waterquality/assessment/public_comment

Texas Surface Water Quality Standards
www.tceq.texas.gov/waterquality/standards/eq_swqs.html

Clean Rivers Program Map Tool
https://www80.tceq.texas.gov/SwqmisWeb/public/crpmaps.html

Clean Rivers Program Data Tool
https://www80.tceq.texas.gov/SwqmisWeb/public/crpweb.faces

Surface Water Quality Monitoring Procedures
www.tceq.texas.gov/waterquality/monitoring/swqm_guides.html

Attoyac Bayou Watershed Protection Plan (WPP) Project
attoyac.tamu.edu

TIAER RUAA
https://www.tarleton.edu/tiaer/ruaa/index.html

Texas Stream Team
https://www.meadowscenter.txstate.edu/Leadership/TexasStreamTeam.html

Texas Invasives
www.texasinvasives.org

Texas Department of State Health Services Fish Consumption Advisories
https://www.dshs.texas.gov/seafood/advisories-bans.aspx

The Surface Water Quality Monitor Newsletter
https://www.tceq.texas.gov/waterquality/monitoring/newsletter.html

EPA's Surf Your Watershed
cfpub.epa.gov/surf/locate/index.cfm

USGS The National Map Streamer
nationalmap.gov/streamer

US Drought Monitor
droughtmonitor.unl.edu/

Texas Flood Watch
https://txpub.usgs.gov/floodwatch

Hurricane Harvey
https://www.usgs.gov/special-topic/hurricane-harvey

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THE TEXAS CLEAN RIVERS PROGRAM

WATER QUALITY REVIEW

Biloxi Creek at CR 216

WATER QUALITY TERMINOLOGY

In order to understand the issues involved in surface water quality monitoring and the assessment of the water quality data, it is first necessary to have an understanding of terminology, water quality parameters, and the TCEQ assessment process.

This review of water quality terminology is designed to provide a description of technical terms used in the Basin Summary 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 are as follows:

- 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.

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.

Texas Surface Water Quality Standards (TSWQS)

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 are developed to maintain the quality of surface waters in Texas so that they support public health and enjoyment, and protect aquatic life, consistent with the sustainable economic development of the state. TSWQS describe the physical, chemical, and biological conditions to be attained in waters in the state, as well as identifying uses and criteria associated with those uses. TSWQS also provide a basis on which the TCEQ regulatory programs [such as Permitting, Total Maximum Daily Load (TMDL), Non-Point Source (NPS), and Monitoring/Assessment] can establish reasonable methods to implement and attain the state's goals for water quality.

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. Criteria are numerical numbers representing a specific use for the water body. For example, for high aquatic life use, the dissolved oxygen 24-hour minimum criteria is 3.0 mg/L. Impairments occur when water quality conditions do not meet assigned uses/criteria as defined in the TSWQS.

Designated Uses

As defined in the 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 acceptable numerical values for a given parameter.

Aquatic life use has criteria for dissolved oxygen, fish and macrobenthic community index, and acute and chronic substances. Aquatic Life Use (ALU) has corresponding 24-hour dissolved oxygen criteria. Water bodies have assigned/presumed ALU. ALU categories are exceptional, high, intermediate, limited, and minimal.

General use includes criteria for chloride, sulfate, total dissolved solids (TDS), pH, and temperature. General use nutrients like ammonia, nitrates, total phosphorus, and chlorophyll-*a* are used to screen concerns for supported use of the waters. General Use criteria are used to protect overall water quality rather than a single specific use. A water body is classified as Fully Supporting for general use if it meets all of these criteria.

WATER QUALITY TERMINOLOGY (CONTINUED)

Public water supply use includes criteria for chlorides, sulfates, and TDS in drinking water. Criteria for these parameters are set so that public water supplies are capable of treating and delivering water of acceptable quality.

Contact recreational use is assessed using criteria for bacteria indicators such as *E. coli* (freshwater) or *Enterococcus* (tidally influenced waters or marine waters). Contact recreation use refers to the ability of the water body to support activities that involve physical contact with the water, such as swimming and wading. There are both primary and secondary contact recreation uses.

Primary contact recreation activities, such as swimming, are presumed to involve a significant risk of ingestion of water.

Secondary contact recreation activities, such as fishing, are presumed to involve a less significant risk of water ingestion than primary contact recreation due to limited body contact incidental to shoreline activity. The difference between secondary contact 1 and 2 are the frequency that the secondary contact recreation activities occur due to physical characteristics of the water body or limited public access.

Segments

For the purpose of managing Water Quality Standards, water bodies in the state are divided into classified and unclassified segments. A classified segment is a water body or portion of a water body that is individually defined 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 agency. Classified segments may include streams, rivers, bays, estuaries, wetlands, lakes, or reservoirs. The classified segments are assigned four-digit numbers. The first two digits correspond to the major basin in which they are located. The last two digits distinguish individual segments within the particular basin.

Because of the great extent of waters of the state, not all bodies of water are classified in the standards. For example, when managing a classified segment of the Neches River, it may be necessary to examine water quality in the tributaries that flow into that segment. Some of these tributaries may not be part of the classified segment system. When that happens, for management purposes, the tributary is assigned a unique tracking number that is referred to as an unclassified segment. This unclassified tributary will be designated with the number of the classified segment in whose watershed it is located, along with a letter; for instance, tributaries of Segment 0604 would be 0604A, 0604B, and so on. The same identification system applies to unclassified lakes.

Assessment Units

For assessment purposes, classified and unclassified segments are further subdivided into assessment units (AU). In the Integrated Report, use support is reported at the AU level for each segment.

A segment may consist of one or multiple assessment units, which are assigned unique identifying numbers based upon the segment number. For example, Segment 0612 (Attoyac Bayou) consists of three assessment units, AU 0612_01, 0612_02, and 0612_03.

Angelina River at FM 1911

WATER QUALITY TERMINOLOGY (CONTINUED)

Texas Integrated Report

The 303(d) List is a listing of impaired water bodies. The state must identify all water bodies where required pollution controls are not sufficient to attain or maintain applicable surface water quality standards. In Texas, this list is compiled by the TCEQ and is a part of the Texas Integrated Report for Clean Water Act Sections 305(b) and 303(d), also known more simply as the Texas Integrated Report. This report is prepared by TCEQ and submitted to the US Environmental Protection Agency (EPA) every two years in even numbered years.

The *Texas Integrated Report* describes the condition of all surface water bodies that were evaluated for the assessment period. For the 2020 assessment (currently in Draft form awaiting EPA approval), the TCEQ included data collected during a seven-year period (December 1, 2011 – November 30, 2018). The time frame was extended to ten years, if needed, to attain the minimum number of data points needed for the assessment.

If the measured values for a water body are found to be consistently failing to meet the criteria for its designated use, then that water body must be listed as impaired, which simply means that the water body is not supporting its use. When a water body is determined to be impaired, several things must happen:

- The water body must be listed on the 303(d) List;
- An evaluation must be undertaken to discover what is preventing the water body from supporting its use(s) or if the use(s) are inappropriate for the water body;
- Steps must then be taken to either remedy the problem, collect additional data or information, or to evaluate which uses are appropriate for the water body in question. These steps can include:
    - Additional monitoring
    - Development of a Total Maximum Daily Load
    - Preparation of a Watershed Protection Plan (WPP)
    - A review of the water quality standards

Collecting water samples-Cedar Creek, Ellis Avenue

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 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.

The most recent version of the *Texas Integrated Report*, as well as draft reports and reports from previous years, can be found at the following website:

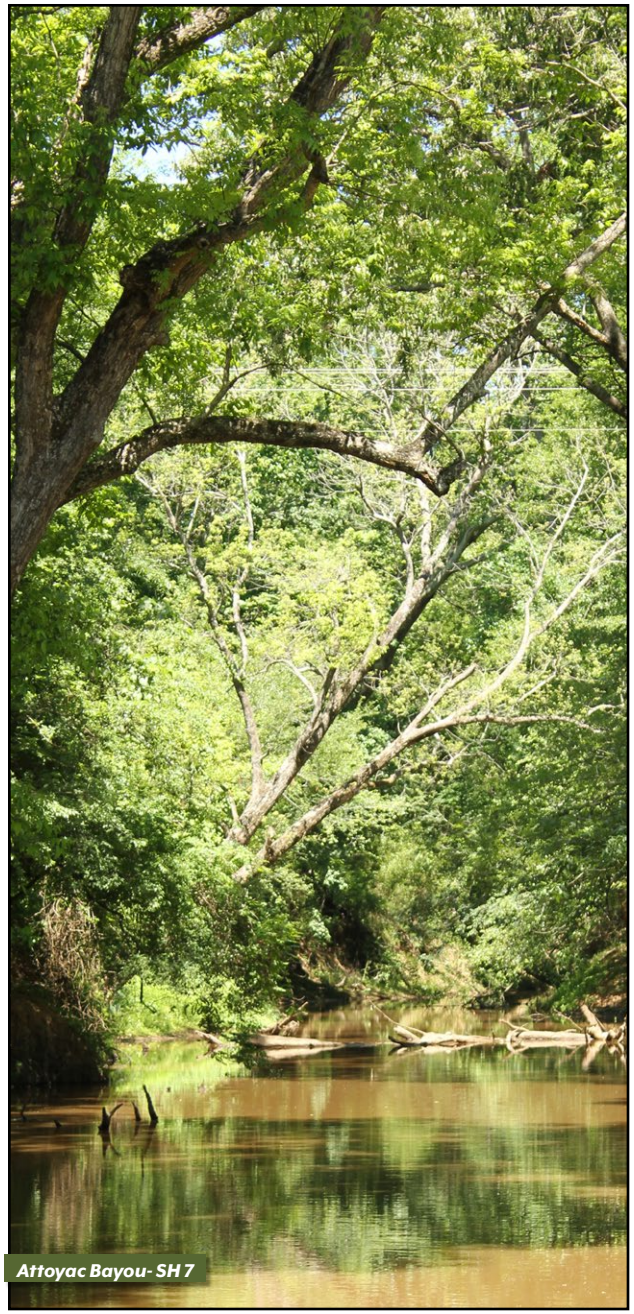
http://www.tceq.texas.gov/waterquality/assessment/305_303.html

WATER QUALITY TERMINOLOGY (CONTINUED)

Multiple tools are available to address water quality issues. Use Attainability Analysis (UAA), Best Management Practices (BMPs), Watershed Protection Plans (WPPs) and Total Maximum Daily Loads (TMDLs) are some of these tools.

- A **Use Attainability Analysis (UAA)** is a structured scientific assessment of the characteristics (physical, chemical, or biological) of a water body. If there is a general consensus among stakeholders and resource agencies that a presumed or designated use may not be appropriate, then a UAA may be conducted to evaluate the appropriate use(s) for that water body. UAAs can also be used to develop site-specific uses. In Texas, there are two types of UAAs that are available tools to assess the appropriateness of a water body's presumed or designated use. These types of UAAs are Aquatic Life Use UAAs (ALU UAA) and Recreational UAAs (RUAA).
- **Best Management Practices (BMPs)** are structural or non-structural practices which are intended to minimize the impacts of development on water bodies. Non-point Source BMPs are used to reduce or control impacts to water bodies from non-point sources, most commonly by reducing pollutant loading. There are many types of BMPs to address specific needs and site characteristics. Categories of BMPs include:
    - Preventative Practices
    - Cleanup Practices
    - Erosion Control Practices
    - Sediment Control Practices
    - Runoff Control Practices
    - Channel Protection Practices
    - Habitat Restoration Practices
    - In-Stream Remediation Practices
    - Other BMPs (such as public education)
- **Watershed Protection Plans (WPPs)** are a voluntary, proactive approach to integrating activities and prioritizing implementation of BMPs. They address complex water quality problems that cross multiple jurisdictions with the goal of improving, restoring or maintaining water quality within a particular watershed. Through the WPP process, the State of Texas encourages stakeholders and local landowners to holistically address all of the sources and causes of impairments and threats to resources within a watershed. Developed and implemented through diverse, well integrated partnerships, a WPP helps assure the long-term health of a watershed with strategies for protecting unimpaired waters and for restoring impaired waters.
- A **Total Maximum Daily Load (TMDL)** is a calculation of the maximum amount of a pollutant that a water body can receive and still meet water quality standards. It is the sum of the allowable loads of a single pollutant from all contributing point and non-point sources. The calculation must include a margin of safety to ensure that the water body can be used for the purposes the State has designated. The calculation must also account for seasonal variation in water quality. Once a TMDL and TMDL Implementation Plan (I-Plan) has been developed, the TMDL will be put into action and pollutant loads will be reduced through regulatory and voluntary activities. For example, discharge permits for any point sources associated with the water body may need to be modified to include more strict limitations on their output in order to reduce the amount of pollution in their discharge.

These and other tools, along with public education and the diligent work of stakeholders, resource agencies, and volunteers can and do make a difference. The quality of a water body can be improved to a point where it is capable of supporting its use(s), and the water body can then be removed from the 303(d) List of impaired water bodies.



Attoyac Bayou- SH 7

WATER QUALITY TERMINOLOGY (CONTINUED)

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.

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

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.

Quality Assurance Project Plan (QAPP)
The CRP Quality Assurance Project Plan (QAPP) describes ANRA's quality assurance policies, 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. This process ensures that data collected under the approved QAPP and submitted to SWQMIS have been collected and managed in such a 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 at www.anra.org.

Station 10622- Riverine Portion of Sam Rayburn

WATER QUALITY TERMINOLOGY (CONTINUED)

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 non-attainment of water quality standards, assess impacts of point and non-point source discharges, or to address stakeholder concerns. Examples of special studies include TMDL project-support monitoring, 24-hr Dissolved Oxygen studies, and toxins (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 waste load 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.

Flow measurement being conducted at the Angelina River- SH 204

WATER QUALITY PARAMETERS

Water Quality Parameters

ANRA monitoring personnel collect Field, Conventional, and bacteria parameters at monitoring stations.

Field measurements are collected on-site by direct monitoring in the water body. They are as follows:

- pH
- Dissolved Oxygen (DO)
- Specific Conductance
- Water Temperature
- Flow Severity
- Instantaneous Stream Flow
- Secchi-Disk Transparency
- Days Since Last Significant Rainfall
- Present Weather
- Total Water Depth

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-Nitrogen
- Nitrite-Nitrogen
- Total Phosphorus
- Chlorophyll-*a*
- Pheophytin
- Chloride
- Sulfate
- Total Suspended Solids
- *E. coli* bacteria
- Total Kjeldahl Nitrogen

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

Field Parameters

Parameter	Potential Impacts	Possible Sources/Causes
pH	pH is a measure of the acidity or basicity of an aqueous solution. 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.	pH can be affected by industrial and wastewater discharges, runoff, and accidental spills. Natural variation in seasons may also affect pH.
Dissolved Oxygen (DO)	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.	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	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.	Dissolved salt-forming substances such as sulfate, chloride, and sodium increase the conductivity of the water.
Temperature	Water temperature affects the oxygen content of the water (dissolved oxygen). Temperature also has an impact on cold-blooded animals.	Water temperature may be affected by alterations to the riparian zone, changes in ambient temperature, and discharges.
Flow	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.	Flow can be affected by both natural and man-made sources.
Secchi Disk Transparency	Secchi-Disk Transparency is important for assessing eutrophication and for determining trends in water clarity.	Human activities that add nutrients to lakes, reservoirs, and surrounding watersheds can cause the eutrophication

WATER QUALITY PARAMETERS (CONTINUED)

Conventional Parameters

Parameter	Potential Impacts	Possible Sources/Causes
Ammonia-Nitrogen	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.	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	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.	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*	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.	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*)	*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.	*E. coli* is abundant in the gastrointestinal 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-Nitrogen Nitrite-Nitrogen Nitrate+Nitrite-Nitrogen	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.	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. High levels of nitrates are often indicative of human-caused pollution.
Total Phosphorus	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.	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 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 Suspended Solids (TSS)	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.	Elevated TSS can result from multiple point and non-point sources. Soil erosion and runoff are two primary sources.
Sulfate	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 quality.	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.

ANRA ENVIRONMENTAL LABORATORY

For water samples collected by ANRA, analysis of conventional parameters is performed by the ANRA Environmental Laboratory. The ANRA Environmental Laboratory is certified by the National Environmental Laboratory Accreditation Program (NELAP) for the chemical and microbiological analysis of surface water, wastewater, and drinking water samples. The laboratory performs analysis of drinking water, wastewater, and surface water samples for numerous entities and private individuals in the basin, including the Clean Rivers Program. For more information regarding analytical testing services and ANRA, please visit http://www.anra.org/divisions/water_quality/lab/

Since 2015, the ANRA Environmental Laboratory has been through some intense changes, especially over the course of the past 2 years. The ANRA Central Office relocated in 2019 to it's brand new building, allowing for many improvements to the ANRA Laboratory. The lab now has a brand new deionized water system. The ANRA Environmental Laboratory purchased some upgrades to the segmented flow analyzer in 2019, and is working to bring online a new method for analyzing Total Phosphorus and Total Kjeldahl Nitrogen. The lab is also working on bringing in-house the analysis of all Chlorophyll a and Pheophytin a samples.

Deionized Water System

Ion Chromatograph

Routine testing with Quanti-tray

Auto Analyzer 3

DATA REVIEW METHODOLOGY

Trend Analysis

In order to review and evaluate water quality trends for this report, data from the period of January 1, 2000 to October 31, 2019 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: http://www80.tceq.texas.gov/SwqmisPublic/public/default.htm

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 SQL Server to be queried and graphed using the R statistical software package.

Data not identified as "Routine" monitoring, and vertical profile data were excluded from analysis

The table below lists the parameters that were examined.

For most parameters, a single parameter code was assessed (see table below). The exceptions are Chlorophyll-*a* and Nitrate+Nitrite.

Assessed Parameters for the 2020 Basin Summary Report

Code	Parameter
31699	*E. coli* (MPN/100 mL)
00010	Water Temperature (C)
00300	Dissolved Oxygen (mg/L)
00400	pH (S.U.)
00094	Specific Conductance (us/cm @ 25C)
00078	Secchi Transparency (Meters)
00610	Ammonia-Nitrogen (mg/L as N)
00940	Chloride (mg/L)
00945	Sulfate (mg/L)
00625	*TKN (Total Kjeldahl Nitrogen) (mg/L as N)*
00665	Total Phosphorus (mg/L as P)
00530	Total Suspended Solids (mg/L)
00620	Nitrate (Total) (mg/L)
00615	Nitrite (Total) (mg/L)
N+N	Nitrate + Nitrite (mg/L as N)
Chlor	Chlorophyll-*a* (ug/L)
32218	Pheophytin (ug/L)

For Chlorophyll-*a*, two different (but comparable) parameter codes exist and we combined the data for the purposes of the report.

For Nitrate plus Nitrite, because ANRA has begun analyzing the parameters separately in recent years and the combined parameter is no longer available at every site, a pseudo combined parameter was created for analysis purposes. Individual Nitrate and Nitrate results from each sampling event were summed, and if either result was reported as a non-detect, then the less than sign was retained for the summed result. This data set was then combined with existing N+N results to create a larger data set for N+N. The parameter codes included in the combined data were: 00593, 00630, 00631, 00618, 00620, 00613, and 00615.

The count, minimum, maximum, and mean for each parameter was determined. In the case of *E. coli* bacteria, the geometric mean was calculated. The number of values exceeding criteria were counted.

For each monitoring station, the data was plotted against time to identify trends, and then evaluated against the criteria to determine if a given trend was statistically significant. Our criteria for significance was: more than 19 samples collected over at least 10 years, with no significant gaps in monitoring, as well as a *t-stat* >= |2| and a *p-value* < 0.1, and less than 50% censored values (non-detects).

A linear regression against time was performed. 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. For parameters reported as a greater than (>) value, the greater than sign was dropped and the value was used as-is for calculation purposes.

To determine if water bodies met the established criteria for their designated uses, the data was compared to the uses and criteria specified in the *TSWQS*, as well as the screening levels for nutrient parameters listed in the *Draft 2020 Guidance for Assessing and Reporting Surface Water Quality in Texas*.

Summary tables are presented for each monitoring site. Parameters with a statistically significant decreasing trend are identified with a downward arrow (↓). Parameters with a statistically significant increasing trend are identified with an upward arrow (↑). In cases where the trend was being influenced by changes in the analytical limit of quantitation (LOQ), such as was common with Chlorophyll-*a*, this was noted in the report. In those cases, the trends were not considered to be of statistical significance.

Graphs were created for all parameters that were statistically significant or of interest for some other reason.

On the graphs, parameter concentrations are represented by unconnected black dots (•). Each parameter's water quality standard or screening level is represented by a dashed red line (-----), with the numeric value listed as well. For some parameters such as dissolved oxygen, pH, and *E. coli*, there may be multiple criteria. The trend line for each parameter versus time is shown as a blue line (——). The *t-stat*, *p-value*, and linear regression equation are listed on each graph. The *t-stat* and *p-value*, including those for parameters that are not graphed, are also included in the water quality summary tables presented with each station.

Flow values for each station are also presented on the graphs in a separate plot with a shared time axis.

Screening Levels for Nutrient Parameters

Water Body Type	Ammonia (mg/L as N)	Nitrate (mg/L as N)	Total Phosphorus (mg/L as P)	Chlorophyll-*a* (µg/L)
Freshwater Stream	0.33	1.95	0.69	14.1
Reservoir	0.11	0.37	0.20	26.7

WATERSHED SUMMARIES

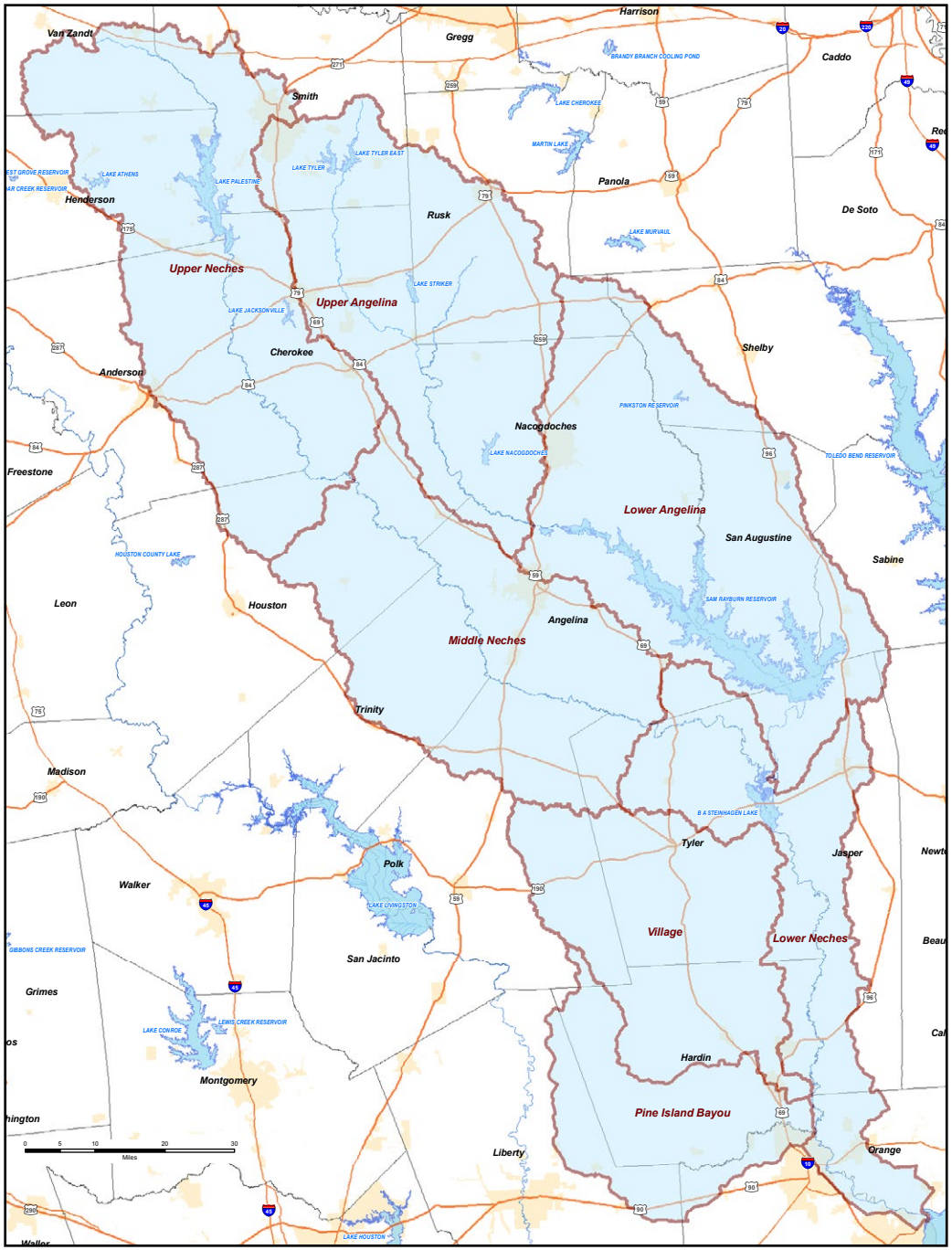
For the purpose of this report, data will be divided and presented based upon sub-basins (as defined by their 8-digit hydrologic unit code (HUC)).

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:

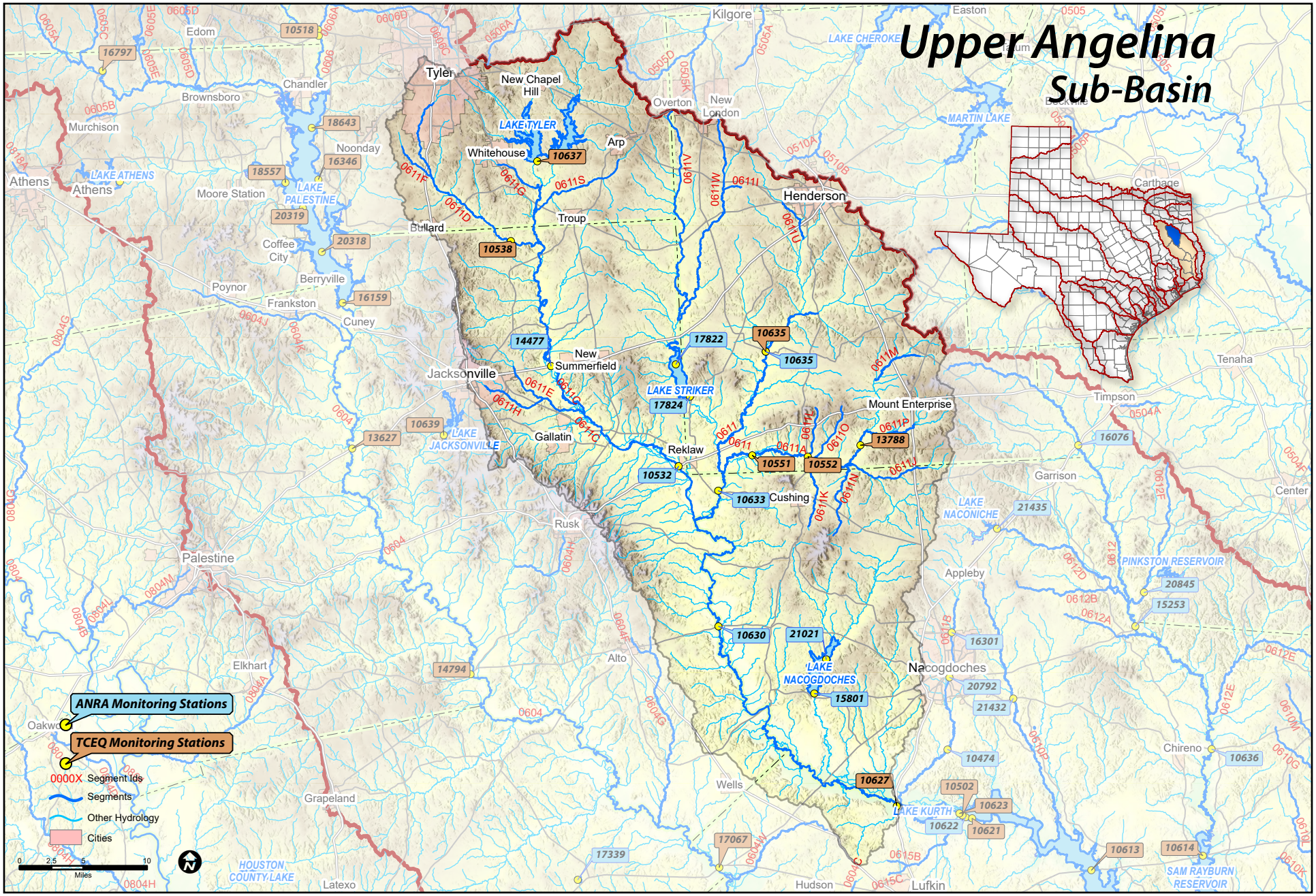
- Upper Angelina
- Lower Angelina
- Upper Neches
- Middle Neches
- Lower Neches

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 2020 Texas Integrated Report, 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.

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 (LNVA).



UPPER ANGELINA OVERVIEW MAP



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. As of the 2010 census, there are an estimated 66,356 households, including 157,794 individuals residing within the sub-basin.

Segments in the Upper Angelina Sub-Basin

Segment ID	Segment Name
0611	Angelina River Above Sam Rayburn
0611A	East Fork Angelina River (unclassified water body)
0611C	Mud Creek (unclassified water body)
0611D	West Mud Creek (unclassified water body)
0611Q	Lake Nacogdoches (unclassified water body)
0611R	Lake Striker (unclassified water body)
0611V	Bowles Creek (unclassified water body)
0611W	Johnson Creek (unclassified water body)
0613	Lake Tyler / Lake Tyler East

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-density 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.

Cattle and poultry operations are common within the sub-basin.

West Mud Creek at FM 3052

Texas Surface Water Quality Standards for the Upper Angelina Sub-Basin
Site-Specific Uses and Numeric Criteria for Classified Segments in the Upper Angelina Sub-Basin

Segment ID	Segment Name	Recreation Use	Aquatic Life Use	Domestic Water Supply Use	Other Use	Chloride (mg/L)	Sulfate (mg/L)	TDS (mg/L)	Dissolved Oxygen (mg/L)	pH Range (S.U.)	*E. coli* Bacteria #/100 mL	Temp (°F)
0611	Angelina River Above Sam Rayburn	PCR	H	PS		125	50	250	5.0	6.0 - 8.5	126	90
0613	Lake Tyler / Lake Tyler East	PCR	H	PS		50	50	200	5.0	6.5 - 9.0	126	93

PCR = Primary Contact Recreation SCR1 = Secondary Contact Recreation 1 SCR2 = Secondary Contact Recreation 2 NCR = Noncontact Recreation

H = High Aquatic Life Use I = Intermediate Aquatic Life Use PS = Public Supply

* The criteria for Chloride, Sulfate, and TDS are listed as the maximum annual averages for the segment. Dissolved Oxygen criteria are listed as minimum 24-hour means at any site within the segment. The pH criteria are listed as minimum and maximum values expressed in standard units at any site within the segment. The criteria for Temperature are listed as maximum values at any site within the segment.

PROFILE OF THE UPPER ANGELINA SUB-BASIN

Permitted Discharges in the Upper Angelina Sub-Basin

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

First Segment in Drainage Path	Segment ID as identified in Permit	Permit Number	Outfall Number	NPDES Number	Permittee	County	TCEQ Region
0611R	0611	WQ0012376001	001	TX0087360	CITY OF NEW LONDON	RUSK	5
0611	0611	WQ0004414000	001	TX0124842	NACOGDOCHES POWER LLC	NACOGDOCHES	10
0611P	0611	WQ0014283001	001	TX0122173	CITY OF MOUNT ENTERPRISE	RUSK	5
0611R	0611	WQ0014292001	001	TX0124371	CARLISLE ISD	RUSK	5
0611D	0611	WQ0010653002	001	TX0047988	CITY OF TYLER	SMITH	5
0611K	0611	WQ0010437001	001	TX0053937	CITY OF CUSHING	NACOGDOCHES	10
0611C	0611	WQ0013585001	001	TX0107875	CITY OF NEW SUMMERFIELD	CHEROKEE	5
0611D	0611	WQ0013168001	001	TX0098795	LIBERTY UTILITIES WOODMARK SEWER CORP	SMITH	5
0611C	0611	WQ0010304001	001	TX0033529	CITY OF TROUP	CHEROKEE	5
0611R	0611	WQ0000946000	001	TX0001066	LUMINANT GENERATION CO LLC	CHEROKEE	5
0611U	0611	WQ0010187001	001	TX0052779	CITY OF HENDERSON	RUSK	5
0611G	0611	WQ0011222001	001	TX0072770	CITY OF WHITEHOUSE	SMITH	5
0611R	0611	WQ0002973000	005	TX0104175	UNIMIN CORP	CHEROKEE	5
0611D	0611	WQ0013000001	001	TX0101010	TALL TIMBERS UTILITY CO INC	SMITH	5
0611R	0611	WQ0002973000	001	TX0104175	UNIMIN CORP	CHEROKEE	5
0611S	0611	WQ0010511001	001	TX0054194	CITY OF ARP	SMITH	5
0611	0611	WQ0005154000	001	TX0136093	CLEAR WATER SOLUTIONS LLC	RUSK	5
0611H	0611	WQ0010693003	001	TX0100587	CITY OF JACKSONVILLE	CHEROKEE	5
0611R	0611	WQ0002973000	007	TX0104175	UNIMIN CORP	CHEROKEE	5
0611R	0611	WQ0002973000	002	TX0104175	UNIMIN CORP	CHEROKEE	5
0611R	0611	WQ0002973000	006	TX0104175	UNIMIN CORP	CHEROKEE	5

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.

Segment 0611 has four assessment units. Two of those assessment units, AU 0611_01 and AU 0611_04, are listed in the 2020 Texas Integrated Report as not supporting for Primary Contact Recreation due to bacteria impairments and AU 0611_03 is listed with a Concern for Near Non-Attainment for bacteria, with a geometric mean of 130.41 MPN/100 mL based on 23 samples. In the assessment, the geometric mean of *E. coli* bacteria results for AU 0611_01 was 151.35 MPN/100 mL based on 33 samples, and AU 0611_04 had a geometric mean of 185.80 MPN/100 mL based on 47 samples, which exceed the standard of 126 MPN/100 mL for Primary Contact Recreation. AU 0611_04 is also listed with a concern for screening level of Total Phosphorus.

There were no other impairments or concerns listed for this segment in the 2020 Texas Integrated Report.

ANRA Monitoring Sites
TCEQ Monitoring Sites
Wastewater Outfalls
Classified Segments
Other Hydrology
Segment Watershed
Counties

SEGMENT 0611 - ANGELINA RIVER ABOVE SAM RAYBURN RESERVOIR

Designated Uses

The designated uses for this classified segment include contact recreation, high aquatic life use, fish consumption use, public water supply use, and general use.

Assessment Units

AU ID	Description
0611_01	From the aqueduct crossing upstream to the confluence with Old River Channel in Nacogdoches County about 2.8 km downstream of County Hwy 2625 at NHD RC 12020004000039
0611_02	From a point immediately upstream of the confluence with Old River channel about 2.8 km downstream of County Hwy 2625 upstream to the confluence with Mud Creek (0611C)
0611_03	From a point immediately upstream of the confluence with Mud Creek (0611C) upstream to the confluence with East Fork Angelina River (0611A)
0611_04	From a point immediately upstream of confluence with East Fork Angelina River (0611A) upstream to confluence with Barnhardt and Mill Creeks

Monitoring Stations

Station ID	AU ID	Description	Earliest Data	Latest Data	Notes
10623	0611_01	SAM RAYBURN RESERVOIR AT CONFLUENCE OF ANGELINA RIVER 0.75 KM NORTHWEST OF PAPER MILL CREEK	1986	2019	Monitored 1986-1989, 1999- present.
10627	0611_01	ANGELINA RIVER AT US 59	1968	2019	Monitored continuously since 1968.
10630	0611_02	ANGELINA RIVER AT SH 21	1977	1997	Monitored 1977, 1984,1997- present.
10633	0611_03	ANGELINA RIVER 340 METERS UPSTREAM OF SH 204	1977	2019	Monitored 1977, 1984, 1996- present.
10635	0611_04	ANGELINA RIVER AT FM 1798	1977	2019	Monitored 1977, 1984, 2000- present.

Panorama of the Angelina River 340 meters upstream of SH 204

SEGMENT 0611 - ANGELINA RIVER ABOVE SAM RAYBURN RESERVOIR

Assessment Summary (as listed in the 2020 Texas Integrated Report)

Parameter	Standard	0611_01 Assessment	0611_02- Assessment	0611_03- Assessment	0611_04- Assessment
Chloride (mg/L)	125	FS	FS	FS	FS
Sulfate (mg/L)	50	FS	FS	FS	FS
TDS (mg/L)	250	FS	FS	FS	FS
DO Grab Screening Level (mg/L)	5	NC	NC	NC	NC
DO Grab Minimum (mg/L)	3	FS	FS	FS	FS
24 Hour DO Average					
24 Hour DO Minimum					
pH (SU)	6.0 - 8.5	FS	FS	FS	FS
Temp (C)	32.2	FS	FS	FS	FS
E. coli geomean (MPN/100mL)	126	NS	FS	CN	NS
Ammonia Nitrogen (mg/L)	0.33	NC	NC	NC	NC
Nitrate Nitrogen (mg/L)	1.95	NC	NC	NC	NC
Total Phosphorus (mg/L)	0.69	NC	NC	NC	CS
Chl-*a* (µg/L)	14.1	NC	NC	NC	NC
Mercury in Edible Tissue					
Dioxin in Edible Tissue					

FS = Fully Supporting NC = No Concern CN = Concern for Near Non-Attainment CS = Concern for Screening Level NS = Not Supporting NA = Not Assessed

Alligator- Angelina River at US 84

SEGMENT 0615 - ANGELINA RIVER / SAM RAYBURN RESERVOIR

Monitoring Station 10623 - Sam Rayburn Reservoir at Confluence of Angelina River Northwest of Paper Mill Creek

Monitoring Station 10623 is monitored quarterly by TCEQ Region 10 personnel for field and conventional parameters and for *E. coli* bacteria. This station is located in assessment unit 0615_01.

There are no significant trends for this station.

This assessment unit is listed in the 2020 Texas Integrated Report for Non Support for its Aquatic Life Use due to depressed Dissolved Oxygen, as well as impairments for Mercury and Dioxin in edible fish tissue. There are no other impairments or concerns listed.

Water Quality Monitoring Results for Station 10623

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	65	22	2.00	4800.00	76.95	1.83	0.14	
Water Temperature (C)	77	0	6.30	31.90	20.02	3.30	0.93	
Dissolved Oxygen (mg/L)	77	1	1.60	11.70	7.19	3.26	0.31	
pH (S.U.)	77	2	6.30	8.40	7.21	18.77	0.76	
Specific Conductance (us/cm @ 25C)	76	0	102.00	520.00	211.43	2.42	0.27	
Ammonia-Nitrogen (mg/L as N)	76	3	0.02	0.18	0.06	2.49	0.56	
Chloride (mg/L)	75	0	8.00	79.00	21.90	1.77	0.37	
Sulfate (mg/L)	77	0	7.00	68.00	25.06	3.88	0.59	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	74	0	0.31	1.83	0.65	3.04	0.50	
Total Phosphorus (mg/L as P)	73	18	0.06	0.73	0.19	1.08	0.37	
Total Suspended Solids (mg/L)	77	0	5.00	47.00	17.09	1.12	0.18	
Nitrate (Total) (mg/L)	8	0	0.05	0.42	0.22	-0.84	0.40	
Nitrite (Total) (mg/L)	8	0	0.05	0.05	0.05	3.72E+14	0.14	
Nitrate + Nitrite (mg/L as N)	77	26	0.04	1.46	0.33	1.39	0.84	
Chlorophyll-*a* (ug/L)	76	5	1.00	168.00	12.04	1.21	0.62	
Pheophytin (ug/L)	26	0	2.37	29.50	6.53	0.22	0.91	

Riverine portion of Sam Rayburn Reservoir

SEGMENT 0611 - ANGELINA RIVER ABOVE SAM RAYBURN RESERVOIR

Monitoring Station 10627 - Angelina River at US 59

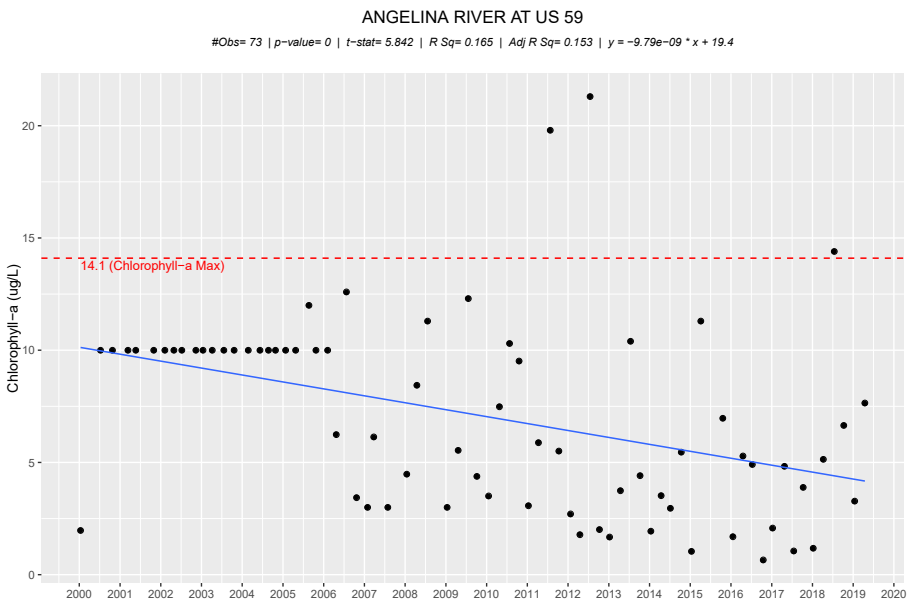
Located in AU 0611_01, Monitoring Station 10627 is monitored quarterly by TCEQ Region 10 (Beaumont) personnel for field parameters, conventional parameters, *E. coli* bacteria, and flow.

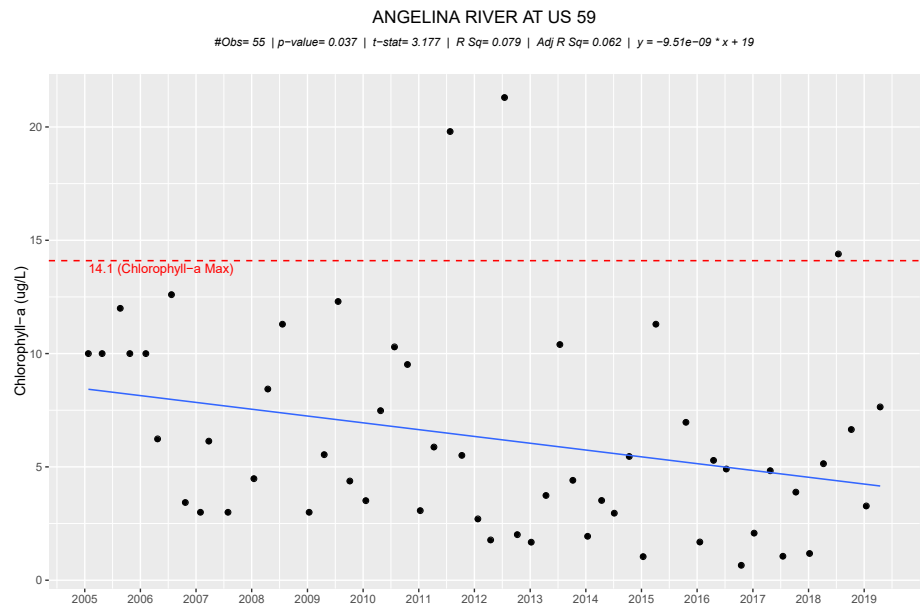
A statistically significant decreasing trend was observed for Chlorophyll-*a*. For the full period of 2000-2020, the trend was not considered statistically significant because it resulted from a change in LOQ. However, after excluding the data prior to 2005, the decreasing trend for chloride remained and can be considered statistically significant.

This assessment unit is listed in the 2020 Texas Integrated Report with an impairment for *E. coli* bacteria. There are no other concerns or impairments listed.

Water Quality Monitoring Results for Station 10627 - Angelina River at US 59

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	77	44	6.00	1842.00	26.45	1.69	0.44	
Water Temperature (C)	89	0	6.40	31.40	20.30	3.44	0.74	
Dissolved Oxygen (mg/L)	88	0	4.60	12.20	7.66	5.11	0.33	
pH (S.U.)	89	0	6.20	8.40	7.17	24.72	0.99	
Specific Conductance (us/cm @ 25C)	88	0	94.00	439.00	193.80	4.59	0.84	
Ammonia-Nitrogen (mg/L as N)	85	0	0.02	0.17	0.06	0.36	0.00	
Chloride (mg/L)	86	0	7.00	63.00	19.83	2.31	0.43	
Sulfate (mg/L)	86	1	5.00	63.00	23.77	5.29	0.21	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	71	0	0.33	0.92	0.61	4.40	0.63	
Total Phosphorus (mg/L as P)	84	0	0.04	0.25	0.12	5.21	0.31	
Total Suspended Solids (mg/L)	86	0	5.00	132.00	28.77	1.05	0.37	
Nitrate (Total) (mg/L)	20	0	0.05	0.66	0.18	2.25	0.18	
Nitrite (Total) (mg/L)	20	0	0.05	0.05	0.05	4.5E+16	0.18	
Nitrate + Nitrite (mg/L as N)	87	0	0.04	0.76	0.22	3.65	0.10	
Chlorophyll-*a* (ug/L)	73	3	0.66	21.30	7.08	5.84	0.00	↓
Pheophytin (ug/L)	23	0	1.00	19.40	5.98	0.79	0.73	





SEGMENT 0611 - ANGELINA RIVER ABOVE SAM RAYBURN RESERVOIR

Monitoring Station 10630 - Angelina River at SH 21

Monitoring Station 10630 (Angelina River at SH 21) is located in assessment unit 0611_02. This station is monitored quarterly by ANRA for field parameters, conventional parameters, flow, and *E. coli* bacteria.

A statistically significant increasing trend was observed for pH.

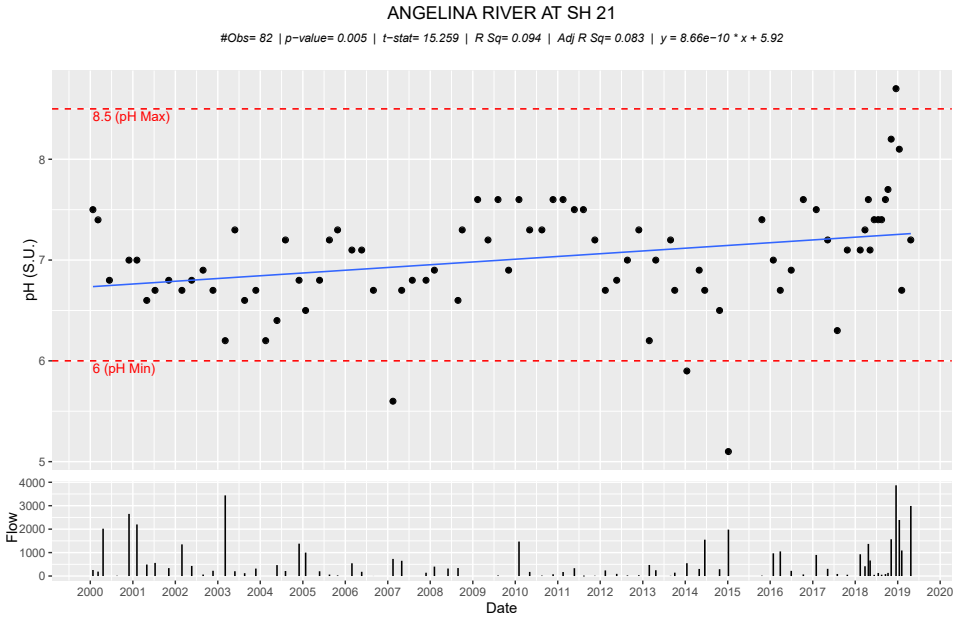
There are decreasing trends observed for Nitrate and Nitrite that are not considered statistically significant due to large gaps in the data. The decreasing trends shown for Chlorophyll-*a* and Pheophytin are not considered statistically significant because greater than fifty-percent of the observed data are censored values that resulted from changes in LOQ.

There are no concerns or impairments listed for this assessment unit i n the 2020 Texas Integrated Report.

Water Quality Monitoring Results for Station 10630- Angelina River at SH 21

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	73	26	7.00	2400.00	50.59	-0.06	0.52	
Water Temperature (C)	82	0	6.50	30.80	19.01	3.33	0.80	
Dissolved Oxygen (mg/L)	82	0	4.50	11.80	7.64	6.08	0.72	
pH (S.U.)	82	4	5.10	8.70	7.02	15.26	0.01	↑
Specific Conductance (us/cm @ 25C)	84	0	106.00	456.00	205.12	2.65	0.14	
Ammonia-Nitrogen (mg/L as N)	83	0	0.05	0.24	0.08	-0.99	0.00	
Chloride (mg/L)	82	0	8.00	90.00	22.29	0.77	0.06	
Sulfate (mg/L)	82	4	5.00	80.00	27.87	2.80	0.66	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	34	0	0.37	0.92	0.58	1.30	0.62	
Total Phosphorus (mg/L as P)	82	0	0.02	0.47	0.12	3.77	0.18	
Total Suspended Solids (mg/L)	82	0	4.00	64.00	23.36	0.68	0.05	
Nitrate (Total) (mg/L)	31	0	0.05	0.75	0.27	3.24	0.04	
Nitrite (Total) (mg/L)	31	0	0.05	0.05	0.05	1.81E+16	0.07	
Nitrate + Nitrite (mg/L as N)	83	0	0.04	1.09	0.27	2.88	0.35	
Chlorophyll-*a* (ug/L)	74	6	1.00	43.30	7.45	3.62	0.04	
Pheophytin (ug/L)	67	0	2.00	30.30	4.19	5.25	0.00	

Angelina River at SH 21



SEGMENT 0611 - ANGELINA RIVER ABOVE SAM RAYBURN RESERVOIR

Monitoring Station 10633 - Angelina River Upstream of SH 204

Located in AU 0611_03, Monitoring Station 10633 is monitored quarterly by ANRA for field parameters, conventional parameters, flow, and *E. coli* bacteria. In 2012, it was necessary to relocate the monitoring station due to the installation of a wastewater outfall for Nacogdoches Power. The monitoring station, originally located at the SH 204 bridge, is currently located approximately 340 meters upstream of the bridge crossing.

Statistically significant decreasing trends are observed for Chloride, Total Phosphorus and Nitrate+Nitrite.

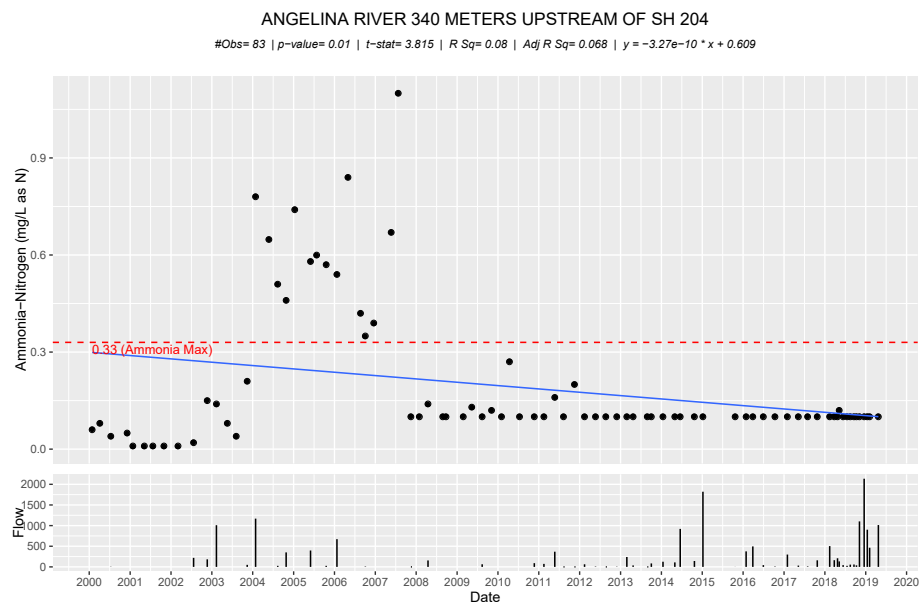
The decreasing trend for Ammonia-Nitrogen is not considered statistically significant due to greater than fifty-percent of the observed data being censored values. However, there are numerous values that exceed the criteria during the period of 2004-2008. The elevated values from this period appear in multiple watersheds sampled by different agencies and analyzed by different labs, so it is unlikely to be caused by sampling issues or a point source. Monitoring of atmospheric deposition conducted by the National Atmospheric Deposition Program does not show any elevated values for the time period in question. Agricultural runoff appears to be the most likely source. The range for Ammonia-Nitrogen results was <0.01 to 1.1mg/L as N, with a mean of 0.19 mg/L as N. Since 2008, majority of the results have been reported as <0.1mg/L as N.

The trend observed for Nitrite is not considered significant due to all observed values being censored values.

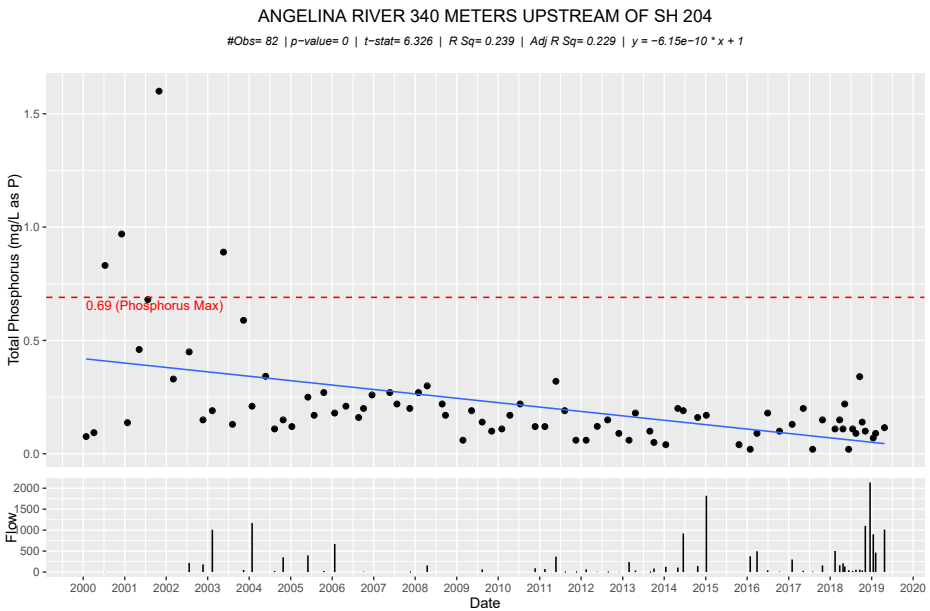
This Assessment unit is listed in the 2020 Texas Integrated Report with a concern for near non-attainment for *E. coli* bacteria. There are no other concerns or impairments listed.

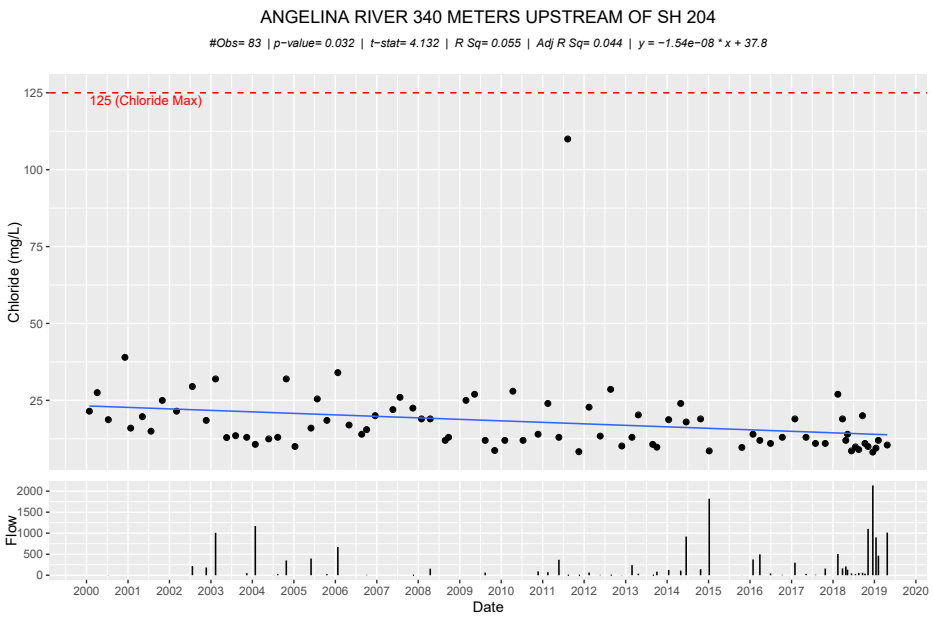
Water Quality Monitoring Results for Station 10633 - Angelina River Upstream of SH 204

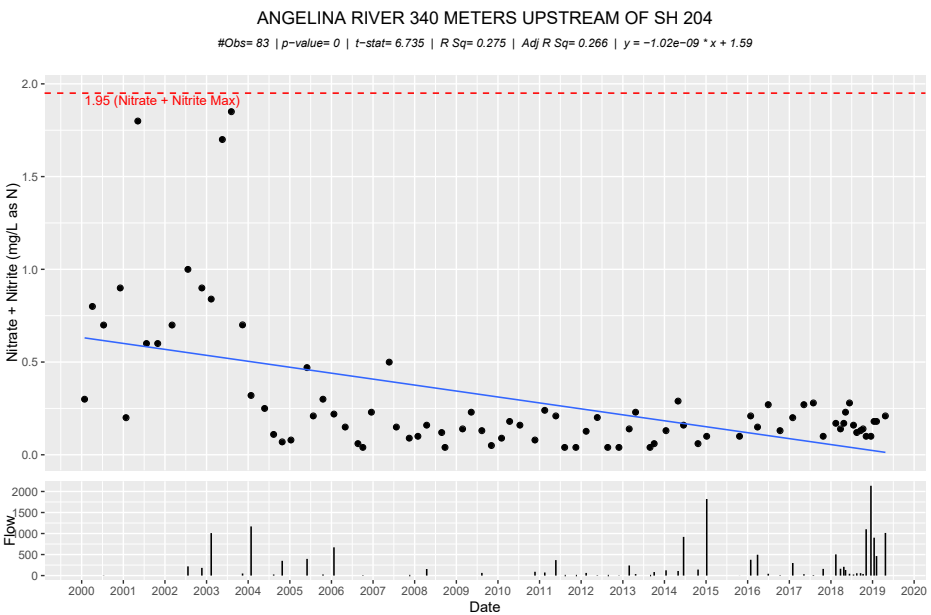
Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	80	42	18.00	4840.00	154.42	1.74	0.27	
Water Temperature (C)	81	0	6.40	28.10	18.29	3.17	0.70	
Dissolved Oxygen (mg/L)	82	1	2.10	11.90	7.26	5.56	0.33	
pH (S.U.)	80	3	5.60	8.40	7.01	15.90	0.74	
Specific Conductance (us/cm @ 25C)	83	0	15.00	1470.00	174.90	0.30	0.36	
Ammonia-Nitrogen (mg/L as N)	83	15	0.01	1.10	0.19	3.81	0.01	
Chloride (mg/L)	83	0	8.20	110.00	18.08	4.13	0.03	↓
Sulfate (mg/L)	83	2	5.00	550.00	29.86	1.10	0.66	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	parameter not collected for this station							
Total Phosphorus (mg/L as P)	82	4	0.02	1.60	0.22	6.33	0.00	↓
Total Suspended Solids (mg/L)	83	0	1.33	72.00	16.30	-1.76	0.00	
Nitrate (Total) (mg/L)	23	0	0.05	0.23	0.12	0.33	0.92	
Nitrite (Total) (mg/L)	23	0	0.05	0.05	0.05	1.05E+15	0.01	
Nitrate + Nitrite (mg/L as N)	83	0	0.04	1.85	0.30	6.74	0.00	↓
Chlorophyll-*a* (ug/L)	60	2	2.00	52.10	4.78	0.78	0.85	
Pheophytin (ug/L)	52	0	2.00	22.80	2.89	0.71	0.93	



SEGMENT 0611 - ANGELINA RIVER ABOVE SAM RAYBURN RESERVOIR







SEGMENT 0611 - ANGELINA RIVER ABOVE SAM RAYBURN RESERVOIR

Monitoring Station 10635 - Angelina River at FM 1798

Monitoring Station 10635 (Angelina River at FM 1798) is located in AU 0611_04. This station is monitored quarterly by ANRA for field parameters, conventional parameters, flow, and *E. coli* bacteria.

A statistically significant increasing trend was observed for pH with the mean still within screening limits.

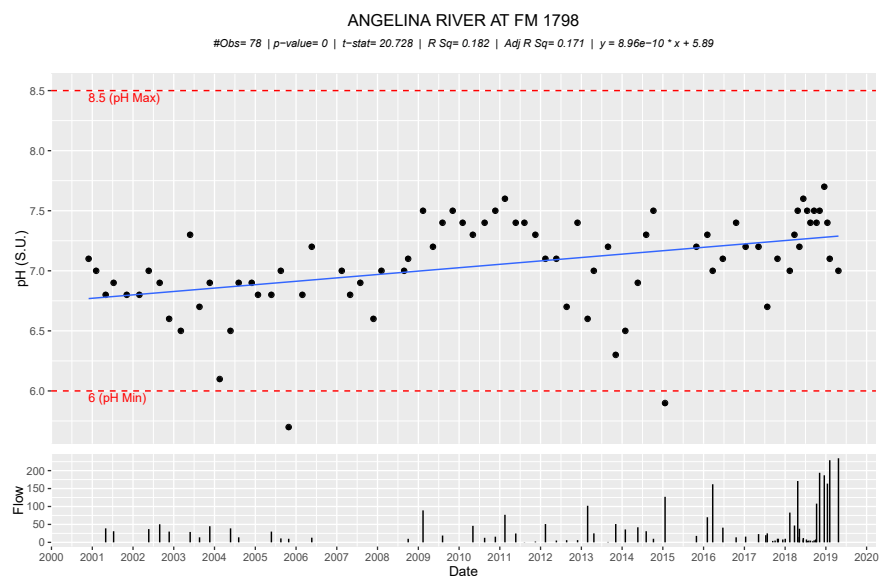
Trends identified for Ammonia-Nitrogen, Pheophytin and Chlorophyll-*a* are not considered statistically significant due to greater than fifty-percent of the observed values being censored values that resulted from a change in the LOQ. The trend identified for Nitrite Nitrogen is not considered statistically significant due to having a large gap in data.

This assessment unit is listed in the 2020 Texas Integrated Report as impaired for *E. coli* bacteria. It is also listed with a concern for Total Phosphorus. There are no other concerns or impairments listed.

Water Quality Monitoring Results for Station 10635- Angelina River at FM 1798

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	98	66	17.00	24000.00	104.7	-1.05	0.16	
Water Temperature (C)	76	0	3.10	28.50	17.72	2.49	0.48	
Dissolved Oxygen (mg/L)	77	0	3.40	12.70	8.01	5.85	0.33	
pH (S.U.)	78	2	5.70	7.70	7.05	20.73	0.00	↑
Specific Conductance (us/cm @ 25C)	78	0	96.00	746.00	210.58	-0.10	0.01	
Ammonia-Nitrogen (mg/L as N)	75	0	0.05	0.23	0.09	-2.35	0.00	
Chloride (mg/L)	77	0	8.00	100.00	24.80	-0.09	0.04	
Sulfate (mg/L)	77	2	8.00	161.00	22.01	0.49	0.33	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	25	0	0.35	0.84	0.55	-1.55	0.00	
Total Phosphorus (mg/L as P)	74	17	0.02	3.50	0.63	-1.57	0.01	
Total Suspended Solids (mg/L)	77	0	2.50	74.00	21.32	0.67	0.29	
Nitrate (Total) (mg/L)	30	0	0.09	1.21	0.40	2.97	0.10	
Nitrite (Total) (mg/L)	29	0	0.05	0.05	0.05	6.42E+15	0.08	
Nitrate + Nitrite (mg/L as N)	76	1	0.04	2.66	0.43	2.81	0.18	
Chlorophyll-*a* (ug/L)	67	0	2.00	10.00	4.84	14.25	0.00	
Pheophytin (ug/L)	61	0	2.00	9.13	3.19	14.13	0.00	

Flow Measurement being conducted at Station 10633- Angelina River at FM 1798



SEGMENT 0611 - ANGELINA RIVER ABOVE SAM RAYBURN RESERVOIR

SUMMARY OF WATER QUALITY TRENDS

Trend Analysis Summary for Segment 0611 - Angelina River Above Sam Rayburn Reservoir

AU	Station ID	Station Description	*E. coli*	Temp	DO	pH	Spec Cond	NH3	Cl	SO4	TKN	Total P	TSS	NO3	NO2	NO3/ NO2	Chl-*a*	Pheo
0611_01	10627	Angelina River at US 59	*- No trends identified for this Assessment Unit -*															
0611_02	10630	Angelina River at SH 21				↑												
0611_03	10633	Angelina River Upstream of SH 204							↓			↓				↓		
0611_04	10635	Angelina River at FM 1798				↑												

↑ = Statistically significant increasing trend ↓ = Statistically significant decreasing trend

Water Quality Issues Summary for Segment 0611 - Angelina River Above Sam Rayburn Reservoir

Water Quality Issue	Affected Area	Possible Influences/Causes	Possible Effects	Possible Solutions / Actions Taken
Impairment/ Concern for *E. coli* bacteria	0611_01 (impairment) 0611_03 (concern) 0611_04 (impairment)	• Municipal wastewater discharges • Failing (and non-existent) septic systems • Wildlife (deer and feral hogs) • Livestock and agricultural operations including cattle and poultry operations	• Water body does not meet the water quality standard for Primary Contact Recreation • Primary Contact Recreation in the water body has an increased risk of gastrointestinal illness	• Continue Monitoring
Concern for screening level for Total Phosphorus	AU 0611_04	• Municipal wastewater discharge • Non point sources of pollution • Storm water runoff	• Can increase production of algae • Algae production can cause swings in dissolved oxygen, which can be detrimental to the aquatic life community.	• Continue Monitoring • Evaluate wastewater effluent permit limits

Angelina River at US 84

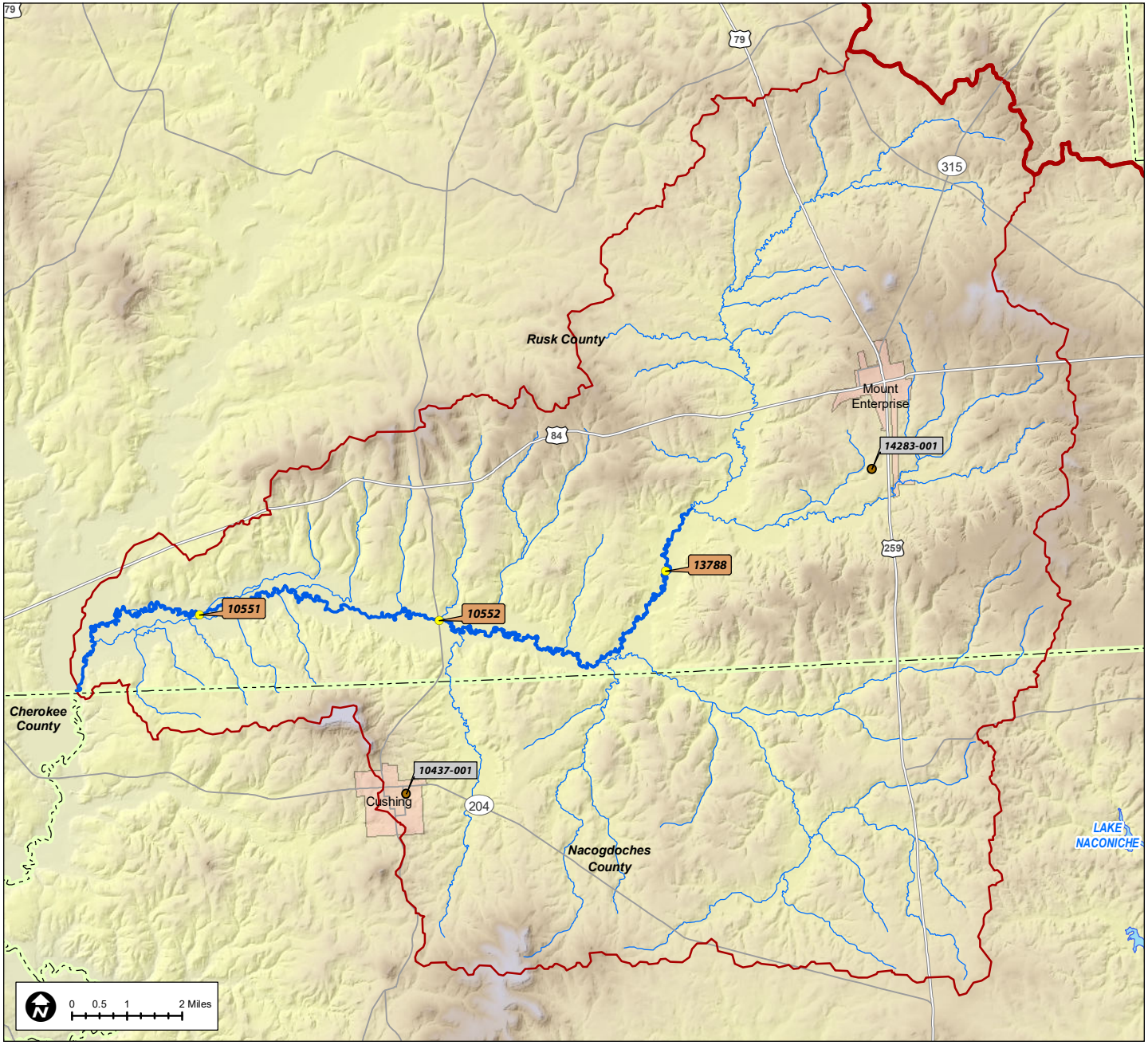
SEGMENT 0611A - EAST FORK ANGELINA RIVER

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 29.1 miles in length. The segment is designated for aquatic life, general, and recreation use.

Segment 0611A has two assessment units 0611A_01 and 0611A_02. Both assessment units are listed in the 2020 Texas Integrated Report as impaired for bacteria.

There were no other impairments or concerns listed for this segment in the 2020 Texas Integrated Report.



ANRA Monitoring Sites
TCEQ Monitoring Sites
Wastewater Outfalls
Classified Segments
Other Hydrology
Segment Watershed
Counties

SEGMENT 0611A - EAST FORK ANGELINA RIVER

Designated Uses

The designated uses for this unclassified segment include contact recreation, high aquatic life use and general use.

Assessment Units

AU ID	Description
0611A_01	From the confluence with Angelina River (0611) at Rusk/Nacogdoches county line upstream to confluence with Beech Creek (0611J) in Rusk County
0611A_02	From a point immediately upstream of confluence with Beech Creek (0611J) upstream to confluence with Wooten Creek (0611P)

Monitoring Stations

Station ID	AU ID	Description	Earliest Data	Latest Data	Notes
10551	0611A_01	EAST FORK ANGELINA RIVER AT RUSK CR 4238	1984	2019	Monitored in 1984, 1996-present.
10552	0611A_01	EAST FORK ANGELINA RIVER AT FM 225	1977	2019	Monitored in 1977, 1998-present.
13788	0611A_02	EAST FORK ANGELINA RIVER AT RUSK CR 3218	1993	2019	Monitored 1993-1997, 2006-present.

Assessment Summary for Segment *(as listed in the 2020 Texas Integrated Report)*

Parameter	Standard	0611A_01 Assessment	0611A_02 Assessment
Chloride (mg/L)	125		
Sulfate (mg/L)	50		
TDS (mg/L)	250		
DO Grab Screening Level (mg/L)	5	NC	NC
DO Grab Minimum (mg/L)	3	FS	FS
24 Hour DO Average			
24 Hour DO Minimum			
pH (SU)	6.0 - 8.5		
Temp (C)	32.2		
E. coli geomean (MPN/100mL)	126	NS	NS
Ammonia Nitrogen (mg/L)	0.33	NC	NC
Nitrate Nitrogen (mg/L)	1.95	NC	NC
Total Phosphorus (mg/L)	0.69	NC	NC
Chl-*a* (µg/L)	14.1	NC	NC
Mercury in Edible Tissue			
Dioxin in Edible Tissue			

FS = Fully Supporting NC = No Concern CN = Concern for Near Non-Attainment
CS = Concern for Screening Level NS = Not Supporting NA = Not Assessed

East Fork Angelina River- CR 4238

SEGMENT 0611A - EAST FORK ANGELINA RIVER

Monitoring Station 10551 – East Fork Angelina River at Rusk CR 4238

This station, located in AU 0611A_01, is monitored quarterly by TCEQ Region 5 (Tyler) for field parameters, conventional parameters, flow, and *E. coli* bacteria.

This site has been monitored very sporadically for parameters other than *E. coli* and TDS. Most parameters have insufficient data for statistical analysis.

This assessment unit is listed in the 2020 Texas Integrated Report as impaired for *E. coli* bacteria. There are no other impairments or concerns listed.

East Fork Angelina River- CR 4238

Water Quality Monitoring Results for Station 10551- East Fork Angelina river at Rusk CR 4238

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	48	30	26.00	4600.00	59.23	-0.69	0.23	
Water Temperature (C)	7	0	6.30	26.80	15.43	0.66	0.98	
Dissolved Oxygen (mg/L)	7	0	5.80	12.30	9.09	1.23	0.95	
pH (S.U.)	7	0	6.70	7.60	7.17	15.33	0.02	
Specific Conductance (us/cm @ 25C)	7	0	63.00	137.00	102.71	0.24	0.40	
Secchi Transparency (Meters)	3	0	0.32	0.50	0.39	2.05	0.30	
Ammonia-Nitrogen (mg/L as N)	3	0	0.03	0.13	0.07	0.20	0.88	
Chloride (mg/L)	3	0	10.70	14.00	12.73	1.68	0.36	
Sulfate (mg/L)	3	0	7.10	47.90	30.30	-0.76	0.58	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	parameter not collected for this station							
Total Phosphorus (mg/L as P)	3	1	0.04	1.10	0.44	-0.02	0.99	
Total Suspended Solids (mg/L)	3	0	2.00	19.70	10.01	-0.26	0.83	
Nitrate (Total) (mg/L)	parameter not collected for this station							
Nitrite (Total) (mg/L)	parameter not collected for this station							
Nitrate + Nitrite (mg/L as N)	3	0	0.40	1.00	0.70	-0.43	0.73	
Chlorophyll-*a* (ug/L)	parameter not collected for this station							
Pheophytin (ug/L)	parameter not collected for this station							

East Fork Angelina River- CR 4238

SEGMENT 0611A - EAST FORK ANGELINA RIVER

Monitoring Station 10552 – East Fork Angelina River at FM 225

This station, located in 0611A_01, is monitored quarterly by TCEQ Region 5 (Tyler) for field parameters, conventional parameters, flow, and *E. coli* bacteria.

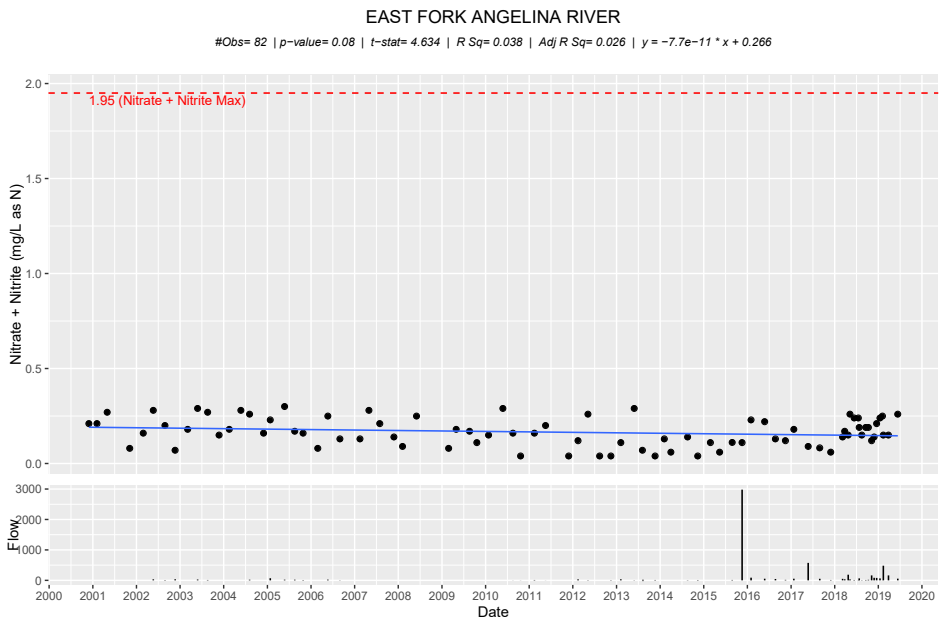
There is a statistically significant increasing trend observed for pH at this station, with the mean still within the designated use criteria. There is a statistically significant decreasing trend observed for Nitrate+Nitrite.

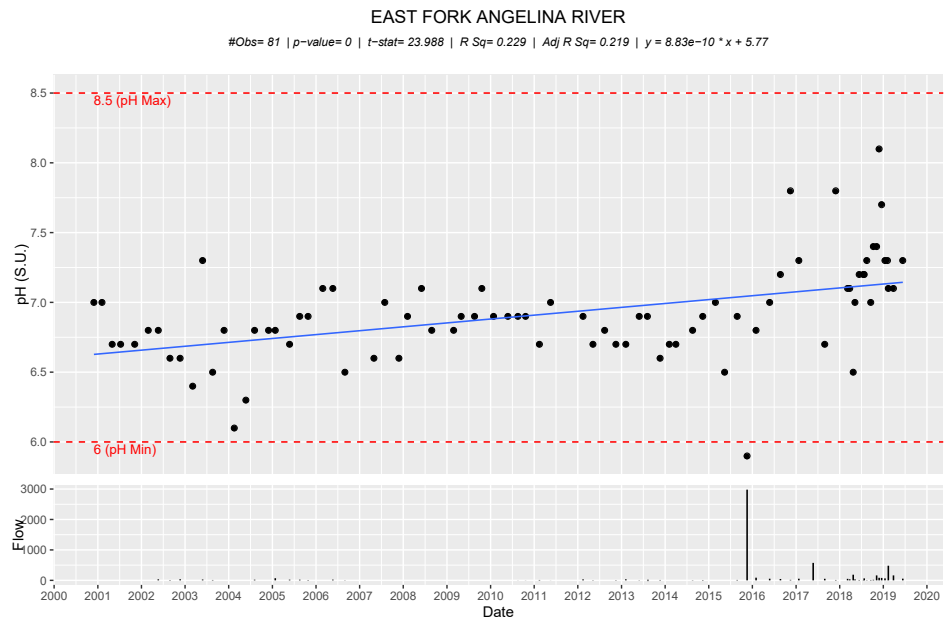
Decreasing trends observed for Chlorophyll-*a* and Pheophytin are not considered statistically significant due to greater than fifty-percent of observed data being censored values.

This assessment unit is listed in the 2020 Texas Integrated Report as impaired for *E. coli* bacteria . There are no other impairments or concerns listed.

Water Quality Monitoring Results for Station 10552- East Fork Angelina River at FM 225

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	63	39	31.00	2900.00	32.06	-0.20	0.35	
Water Temperature (C)	83	0	4.90	27.00	17.34	2.71	0.52	
Dissolved Oxygen (mg/L)	82	0	3.60	12.30	8.07	6.40	0.31	
pH (S.U.)	81	1	5.90	8.10	6.92	23.99	0.00	↑
Specific Conductance (us/cm @ 25C)	83	0	46.00	1230.00	115.83	-0.51	0.09	
Ammonia-Nitrogen (mg/L as N)	81	0	0.02	0.18	0.06	0.38	0.01	
Chloride (mg/L)	78	0	2.99	35.00	10.64	2.57	0.46	
Sulfate (mg/L)	80	1	3.12	60.00	12.54	1.52	0.86	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	63	0	0.17	1.56	0.51	0.47	0.05	
Total Phosphorus (mg/L as P)	74	0	0.02	0.46	0.08	1.99	0.93	
Total Suspended Solids (mg/L)	81	0	3.00	292.00	19.94	0.69	0.94	
Nitrate (Total) (mg/L)	20	0	0.07	0.24	0.16	3.15	0.39	
Nitrite (Total) (mg/L)	20	0	0.05	0.05	0.05	4.50E+16	0.19	
Nitrate + Nitrite (mg/L as N)	82	0	0.04	0.30	0.17	4.63	0.08	↓
Chlorophyll-*a* (ug/L)	65	0	0.42	10.00	4.79	14.63	0.00	
Pheophytin (ug/L)	21	0	5.00	15.10	5.75	2.67	0.05	





SEGMENT 0611A - EAST FORK ANGELINA RIVER

Monitoring Station 13788 – East Fork Angelina River at Rusk CR 3218

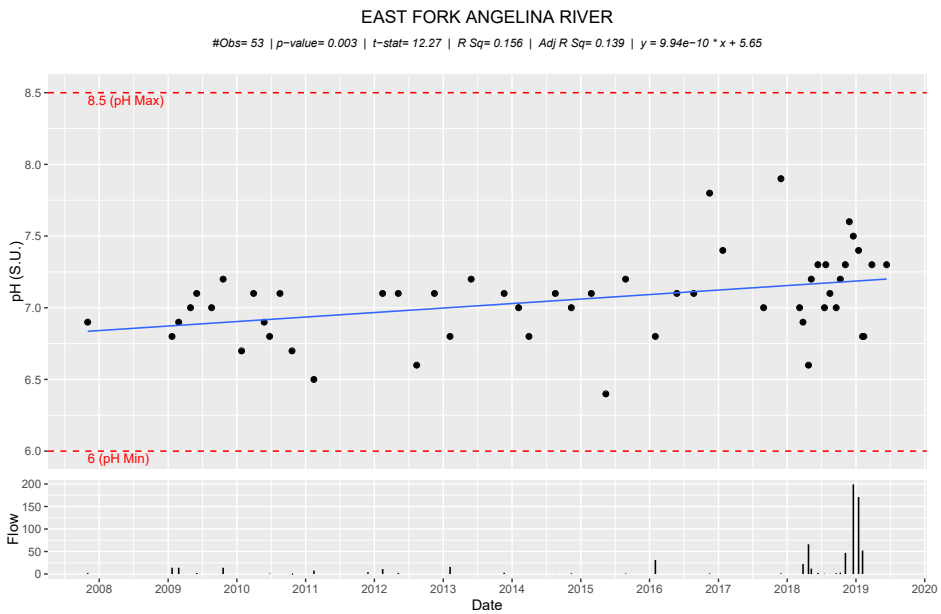
This station, located in assessment unit 611A_02, is monitored quarterly by TCEQ Region 5 (Tyler) for field parameters, conventional parameters, flow, and *E. coli* bacteria.

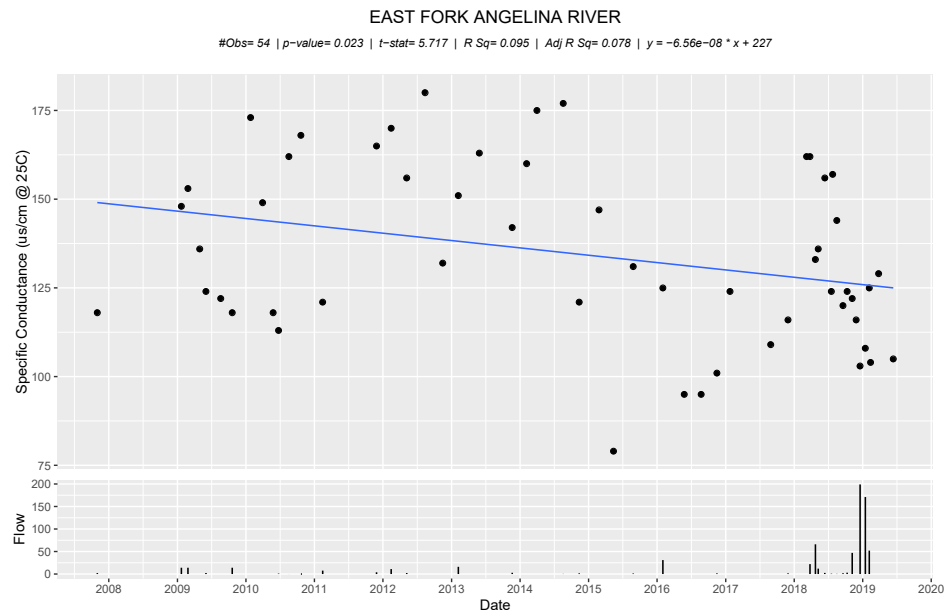
Statistically significant decreasing trends were observed for Specific Conductance, and Chloride. There is a statistically significant increasing trend identified for pH, with the mean still within the designated use criteria.

This assessment unit is listed in the 2020 Texas Integrated Report as impaired for *E. coli* bacteria. There are no other impairments or concerns listed.

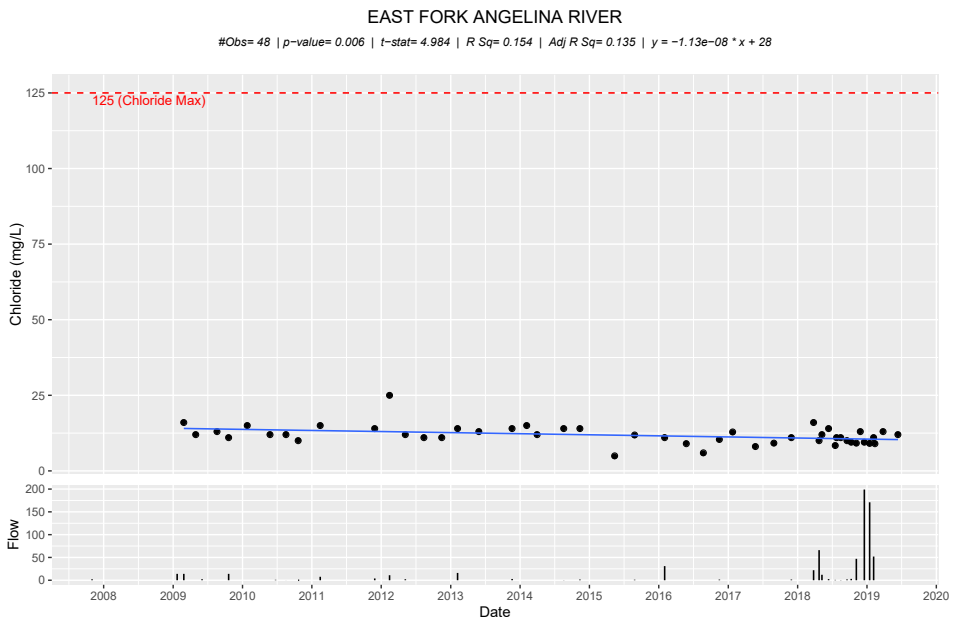
Water Quality Monitoring Results for Station 13788- East Fork Angelina River at Rusk CR 3218

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	35	27	10.00	8700.00	33.10	-1.18	0.18	
Water Temperature (C)	54	0	4.70	27.10	17.32	0.96	0.55	
Dissolved Oxygen (mg/L)	54	2	0.50	12.10	8.08	2.40	0.72	
pH (S.U.)	53	0	6.40	7.90	7.06	12.27	0.00	↑
Specific Conductance (us/cm @ 25C)	54	0	79.00	180.00	134.57	5.72	0.02	↓
Ammonia-Nitrogen (mg/L as N)	48	0	0.02	0.17	0.07	-0.34	0.16	
Chloride (mg/L)	48	0	5.00	25.00	11.82	4.98	0.01	↓
Sulfate (mg/L)	47	1	4.80	66.00	17.75	2.01	0.22	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	30	0	0.23	1.51	0.63	2.24	0.16	
Total Phosphorus (mg/L as P)	43	0	0.02	0.25	0.08	0.57	0.82	
Total Suspended Solids (mg/L)	50	0	4.00	56.00	15.53	-1.21	0.08	
Nitrate (Total) (mg/L)	12	0	0.12	0.33	0.20	0.37	0.76	
Nitrite (Total) (mg/L)	12	0	0.05	0.05	0.05	8.73E+13	0.13	
Nitrate + Nitrite (mg/L as N)	50	0	0.04	0.38	0.16	-1.70	0.01	
Chlorophyll-*a* (ug/L)	34	1	0.30	109.00	5.37	0.88	0.45	
Pheophytin (ug/L)	parameter not collected at this station							





SEGMENT 0611A - EAST FORK ANGELINA RIVER



East Fork Angelina River- CR 4238

SUMMARY OF WATER QUALITY TRENDS

Trend Analysis Summary for Segment 0611 - Angelina River Above Sam Rayburn Reservoir

AU	Station ID	Station Description	*E. coli*	Temp	DO	pH	Spec Cond	NH3	Cl	SO4	TKN	Total P	TSS	NO3	NO2	NO3/ NO2	Chl-*a*	Pheo
0611A_01	10551	East Fork Angelina River at Rusk CR 4238	*- No trends identified for this Assessment Unit -*															
0611A_01	10552	East Fork Angelina River at FM 225				↑										↓		
0611A_02	13788	East Fork Angelina River at Rusk CR 3218				↑	↓		↓									

↑ = Statistically significant increasing trend ↓ = Statistically significant decreasing trend

Water Quality Issues Summary for Segment 0611 - Angelina River Above Sam Rayburn Reservoir

Water Quality Issue	Affected Area	Possible Influences/Causes	Possible Effects	Possible Solutions / Actions Taken
Impairment/concern for *E. coli* bacteria	Entire Segment AU 0611A_01- Non-support AU 0611A_02- Concern for near non-attainment	• Municipal wastewater discharges • Failing (and non-existent) septic systems • Wildlife (deer and feral hogs) • Livestock and agricultural operations including cattle and poultry operations	• Water body does not meet the water quality standard for Primary Contact Recreation • Primary Contact Recreation in the water body has an increased risk of gastrointestinal illness	• Continue Monitoring

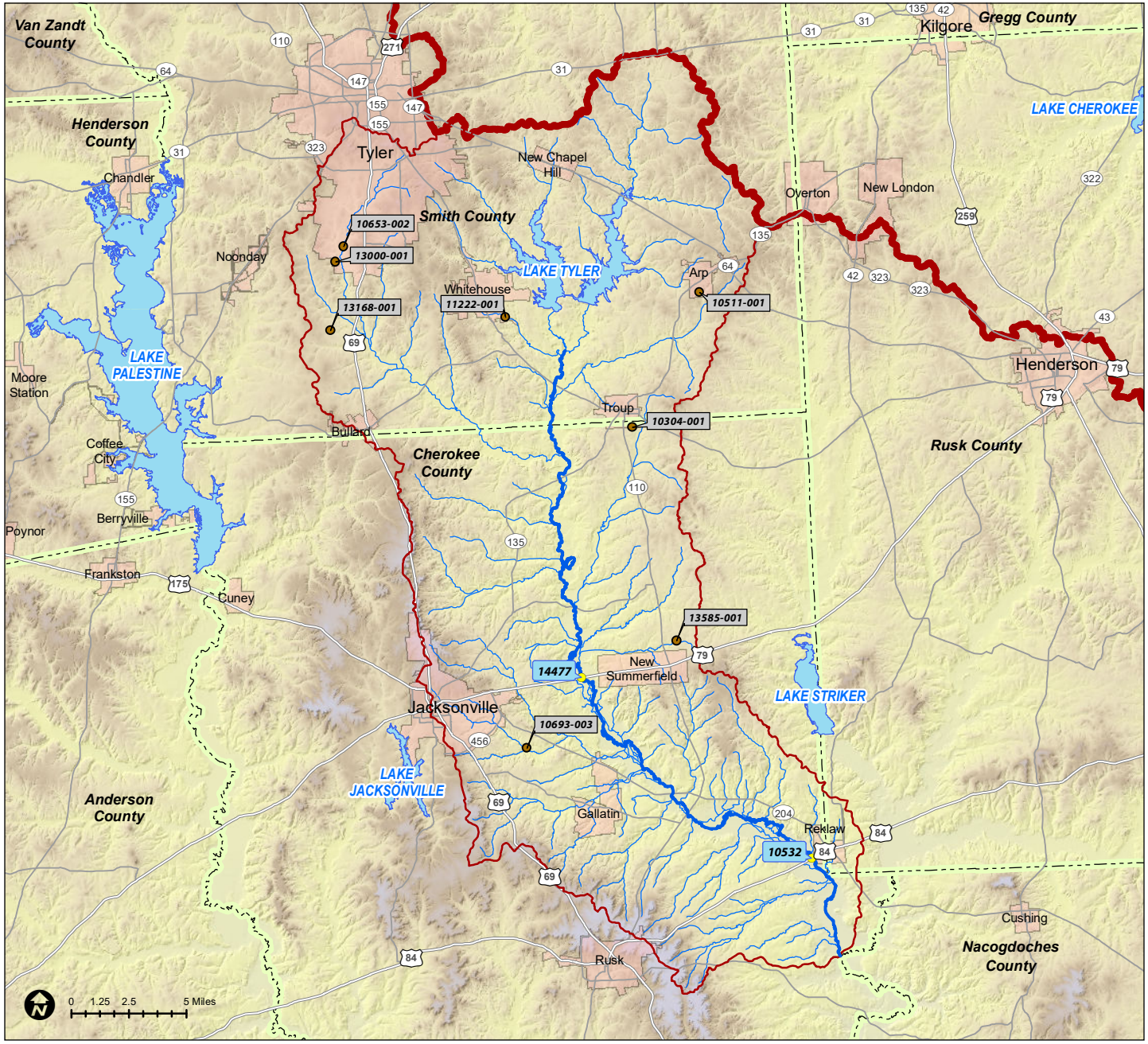
SEGMENT 0611C - MUD CREEK

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.

Mud Creek has two assessment units. AU 0611C_01, which reaches from the confluence with the Angelina River (Segment 0611) at the Cherokee and Nacogdoches county line south of the City of Reklaw upstream to the top of the channelized/dredged portion south of US 79, is listed in the 2020 Texas Integrated Report as impaired for *E. coli* bacteria. Based on 26 samples assessed, the geometric mean is 200.88 MPN/100 mL, which exceeds the criteria for Primary Contact Recreation.

There were no other impairments or concerns listed for this segment in the 2020 Texas Integrated Report.



ANRA Monitoring Sites
Wastewater Outfalls
Classified Segments
Other Hydrology
Segment Watershed
Counties

SEGMENT 0611C - MUD CREEK

Designated Uses

The designated uses for this unclassified segment include contact recreation, high aquatic life use, fish consumption use, public water supply use, and general use.

Assessment Units

AU ID	Description
0611C_01	From the confluence with Angelina River (0611), per WQS App. D, at the Cherokee and Nacogdoches county line south of City of Reklaw upstream to top of channelized/dredged portion about 2.3 km south of US Hwy 79 at -95.150452N/31.956933W
0611C_02	From a point immediately upstream of channelized/dredged portion about 2.3 km south of US Hwy 79 at -95.150452N/31.956933W upstream to confluence with Prairie Creek in Smith County, per WQS App. D

Monitoring Stations

Station ID	AU ID	Description	Earliest Data	Latest Data	Notes
14477	0611C_01	MUD CREEK AT US 79	1995	2019	Monitored 1995-1996, 2000- present.
10532	0611C_02	MUD CREEK AT US 84	1977	2019	Monitored 1977, 1984, 1996- present.

Mud Creek at railroad crossing near CR 4223

SEGMENT 0611C - MUD CREEK

Assessment Summary ***(as listed in the 2020 Texas Integrated Report)***

Parameter	Standard	0611C_01 Assessment	0611C_02 Assessment
Chloride (mg/L)	125		
Sulfate (mg/L)	50		
TDS (mg/L)	250		
DO Grab Screening Level (mg/L)	5	NC	NC
DO Grab Minimum (mg/L)	3	FS	FS
24 Hour DO Average	5		
24 Hour DO Minimum	3		
pH (SU)	6.0 - 8.5		
Temp (C)	32.2		
E. coli geomean (MPN/100mL)	126	NS	FS
Ammonia Nitrogen (mg/L)	0.33	NC	NC
Nitrate Nitrogen (mg/L)	1.95	NC	NC
Total Phosphorus (mg/L)	0.69	NC	NC
Chl-*a* (µg/L)	14.1	NC	NC
Mercury in Edible Tissue			
Dioxin in Edible Tissue			

FS = Fully Supporting NC = No Concern CN = Concern for Near Non-Attainment
CS = Concern for Screening Level NS = Not Supporting NA = Not Assessed

Mud Creek at 347

Mud Creek at SH 204

SEGMENT 0611C - MUD CREEK

Monitoring Station 14477 - Mud Creek at US 79

Monitoring Station 14477, located in assessment unit 0611C_01, is sampled by ANRA on a quarterly basis for field parameters, conventional parameters, flow, and *E. coli* bacteria.

Statistical analysis of the water body does show a decreasing trend for Ammonia-Nitrogen due to some abnormally high values from 2004-2008. The trend is not considered statistically significant due to greater than fifty-percent of the observed data being censored values. We loThe elevated values from this period appear in multiple watersheds sampled by different agencies and analyzed by different labs, so it is unlikely to be caused by sampling issues or a point source. Monitoring of atmospheric deposition conducted by the National Atmospheric Deposition Program does not show any elevated values for the time period in question. Agricultural runoff appears to be the most likely source. The range for Ammonia-Nitrogen results was <0.10 to 1.16 mg/L as N, with a mean of 0.21 mg/L as N. Since 2008, the majority of results have been reported as < 0.10 mg/L as N.

There are statistically significant decreasing trends identified for Chloride, Sulfate, Nitrate+Nitrogen and Total Phosphorus. This appears to be mostly influenced by dilution via higher observed flows. A decreasing trend is observed with Chlorophyll-*a* but is not considered statistically significant due to greater than fifty-percent of the observed values being censored values influenced by a change in limit of quantitation. The trend observed for Nitrite also had greater than fifty-percent of observed values as censored values, therefore it is not considered to be statistically significant.

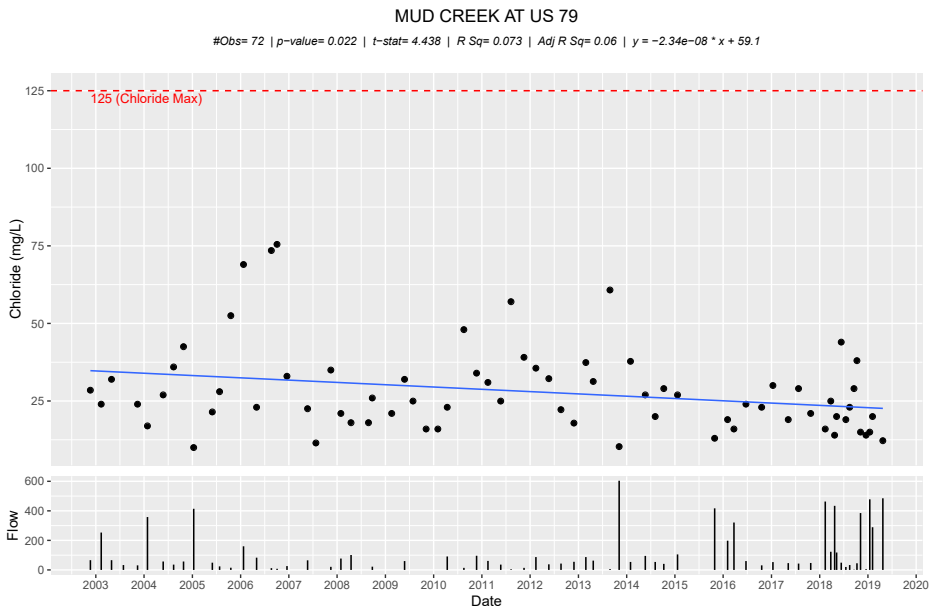
This assessment unit is listed in the 2020 Texas Integrated Report as impaired for *E. coli* bacteria with a geometric mean of 200.88 MPN/100 mL, based on 26 samples. There are no other impairments or concerns listed.

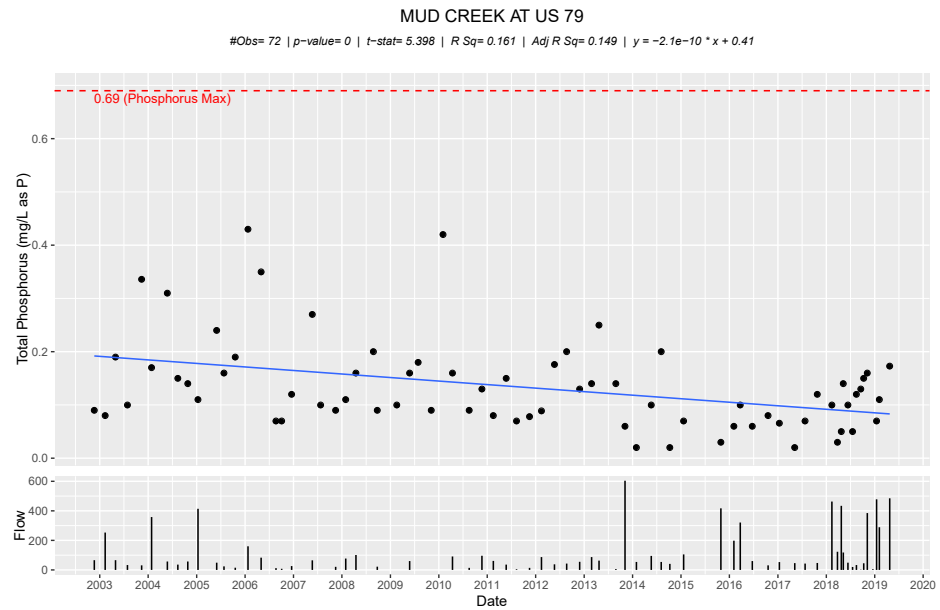
Water Quality Monitoring Results for Station 14477- Mud Creek at US 79

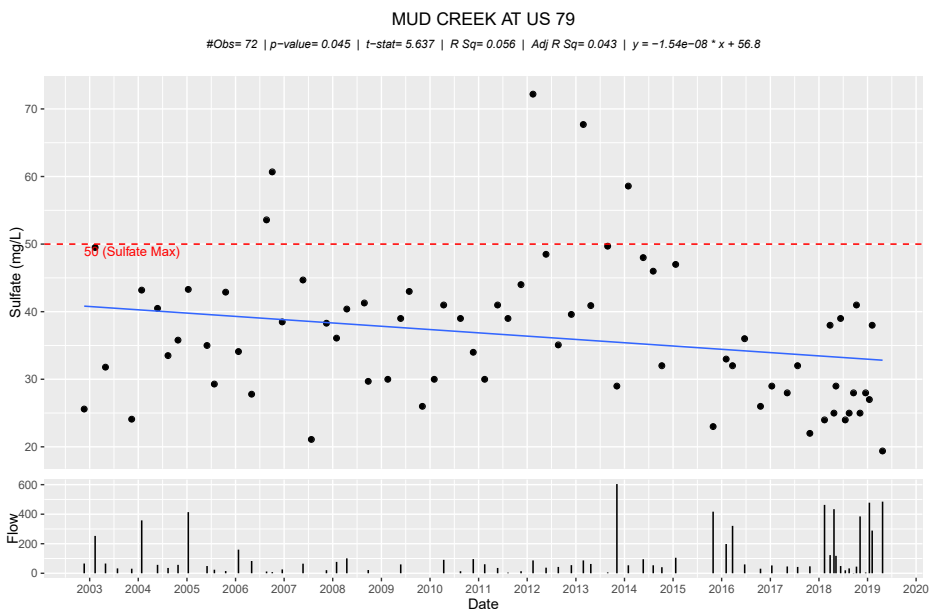
Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	73	33	22.00	2420.00	136.36	1.37	0.43	
Water Temperature (C)	71	0	4.10	29.00	18.80	2.84	0.89	
Dissolved Oxygen (mg/L)	73	0	4.00	13.60	7.69	3.89	0.90	
pH (S.U.)	70	0	6.10	8.00	7.21	20.23	0.72	
Specific Conductance (us/cm @ 25C)	73	0	130.00	556.00	264.78	3.73	0.38	
Ammonia-Nitrogen (mg/L as N)	73	14	0.07	1.16	0.21	6.52	0.00	
Chloride (mg/L)	72	0	10.00	75.50	28.09	4.44	0.02	↓
Sulfate (mg/L)	72	5	19.40	72.20	36.42	5.64	0.05	↓
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	parameter not collected for this station							
Total Phosphorus (mg/L as P)	72	0	0.02	0.43	0.13	5.40	0.00	↓
Total Suspended Solids (mg/L)	73	0	1.33	77.00	19.66	-0.98	0.02	
Nitrate (Total) (mg/L)	22	0	0.13	1.90	0.70	0.70	0.62	
Nitrite (Total) (mg/L)	21	0	0.05	0.05	0.05	1.38E+15	0.01	
Nitrate + Nitrite (mg/L as N)	73	2	0.07	3.16	0.84	3.56	0.05	↓
Chlorophyll-*a* (ug/L)	59	0	2.00	11.60	3.39	3.93	0.02	
Pheophytin (ug/L)	51	0	2.00	5.00	2.38	3.10	0.37	

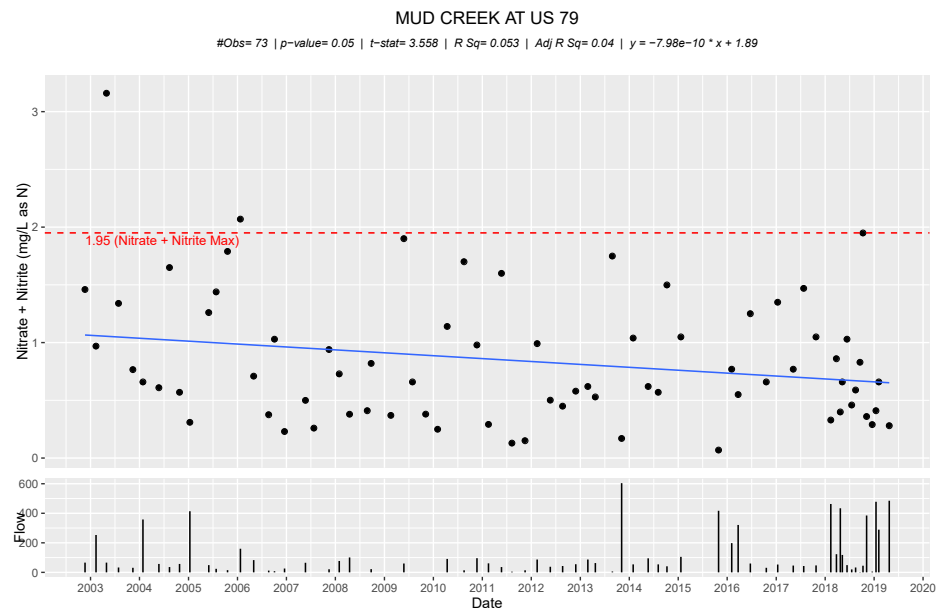
Mud Creek at US 79

SEGMENT 0611C - MUD CREEK









SEGMENT 0611C - MUD CREEK

Monitoring Station 10532 - Mud Creek at US 84

Monitoring Station 10532 is located on US 84 just southwest of Reklaw. This station is monitored quarterly by ANRA for field parameters, conventional parameters, flow, and *E. coli* bacteria. This station is located in AU 0611C_02.

Statistical analysis shows a significant decreasing trend for Sulfate ,Total Phosphorus and Nitrate+Nitrite

Ammonia- Nitrogen shows a decreasing trend due to some abnormally high values from 2004-2008. The trend is not considered to be statistically significant due to greater than fifty-percent of the observed data being censored values that was influenced by a change in LOQ. The elevated values from this period appear in multiple watersheds sampled by different agencies and analyzed by different labs, so it is unlikely to be caused by sampling issues or a point source. Monitoring of atmospheric deposition conducted by the National Atmospheric Deposition Program does not show any elevated values for the time period in question. Agricultural runoff appears to be the most likely source. The range for Ammonia-Nitrogen results was <0.10 to 1.11 mg/L as N, with a mean of 0.20 mg/L as N. Since 2008, the majority of results have been reported as < 0.10 mg/L as N. The observed trend for Nitrite is not considered statistically significant due to all of the observed data being censored values.

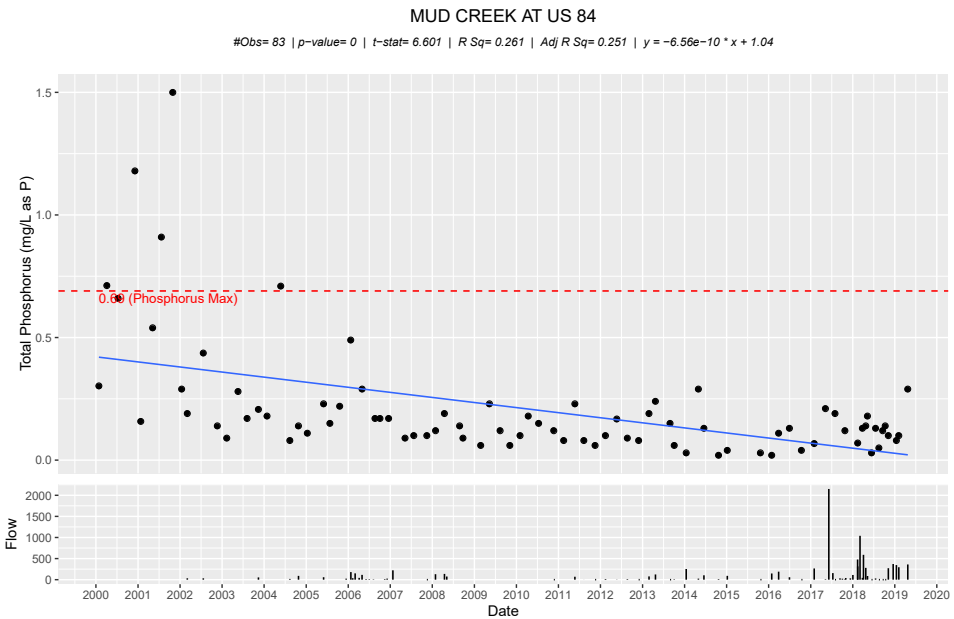
This assessment unit has no impairments or concerns listed in the 2020 Texas Integrated Report.

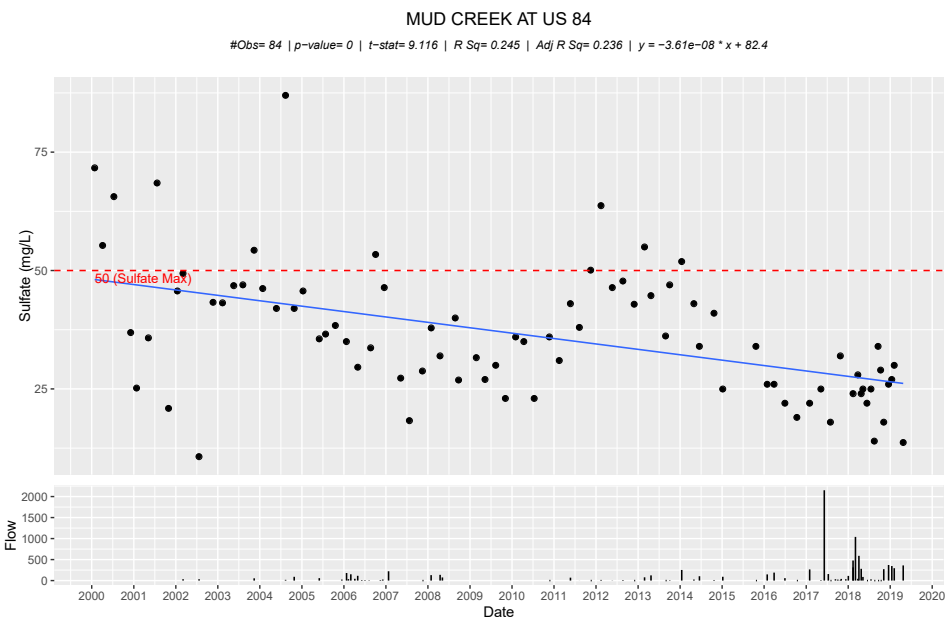
Water Quality Monitoring Results for Station 10532- Mud Creek at US 84

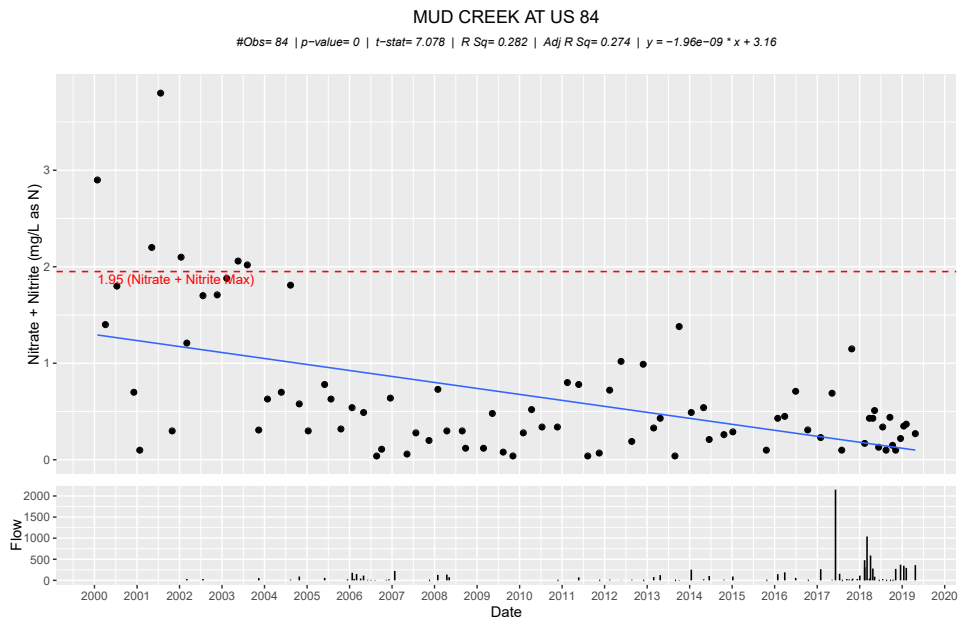
Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	116	72	11.00	2800.00	122.37	-0.22	0.22	
Water Temperature (C)	83	0	6.00	29.60	18.52	2.77	0.50	
Dissolved Oxygen (mg/L)	84	4	1.80	11.60	6.81	4.70	0.30	
pH (S.U.)	82	0	6.10	7.90	7.14	26.27	0.96	
Specific Conductance (us/cm @ 25C)	85	0	82.00	542.00	240.86	3.81	0.75	
Ammonia-Nitrogen (mg/L as N)	84	16	0.01	1.11	0.20	3.86	0.01	
Chloride (mg/L)	84	0	9.68	67.50	23.92	3.01	0.67	
Sulfate (mg/L)	84	11	10.70	87.00	36.30	9.12	0.00	↓
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	parameter not collected for this station							
Total Phosphorus (mg/L as P)	83	5	0.02	1.50	0.21	6.60	0.00	↓
Total Suspended Solids (mg/L)	84	0	1.67	73.00	14.44	-1.37	0.00	
Nitrate (Total) (mg/L)	23	0	0.05	1.10	0.31	0.71	0.57	
Nitrite (Total) (mg/L)	23	0	0.05	0.05	0.05	1.05E+15	0.01	
Nitrate + Nitrite (mg/L as N)	84	6	0.04	3.80	0.65	7.08	0.00	↓
Chlorophyll-*a* (ug/L)	56	4	2.00	137.00	8.25	-1.10	0.15	
Pheophytin (ug/L)	48	0	2.00	8.00	2.86	1.27	1.00	

Station 10532- Mud Creek at 84

SEGMENT 0611C - MUD CREEK







SEGMENT 0611C - MUD CREEK

SUMMARY OF WATER QUALITY TRENDS

Trend Analysis Summary for Segment 0611 - Angelina River Above Sam Rayburn Reservoir

AU	Station ID	Station Description	*E. coli*	Temp	DO	pH	Spec Cond	NH3	Cl	SO4	TKN	Total P	TSS	NO3	NO2	NO3/ NO2	Chl-*a*	Pheo
0611C_01	14477	Mud Creek at US 59							↓	↓		↓				↓		
0611C_02	10532	Mud Creek at US 84								↓		↓				↓		

↑ = Statistically significant increasing trend ↓ = Statistically significant decreasing trend

Water Quality Issues Summary for Segment 0611 - Angelina River Above Sam Rayburn Reservoir

Water Quality Issue	Affected Area	Possible Influences/Causes	Possible Effects	Possible Solutions / Actions Taken
Impairment for *E. coli* bacteria	Lower Assessment Unit (0611C_01)	• Failing (and non-existent) septic systems • Wildlife (deer and feral hogs) • Livestock and agricultural operations including cattle and poultry operations	• Water body does not meet the water quality standard for Primary Contact Recreation • Primary Contact Recreation in the water body has an increased risk of gastrointestinal illness	• Continue Monitoring

Station 14477- Mud Creek at US 79

SEGMENT 0611D - WEST MUD CREEK

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.

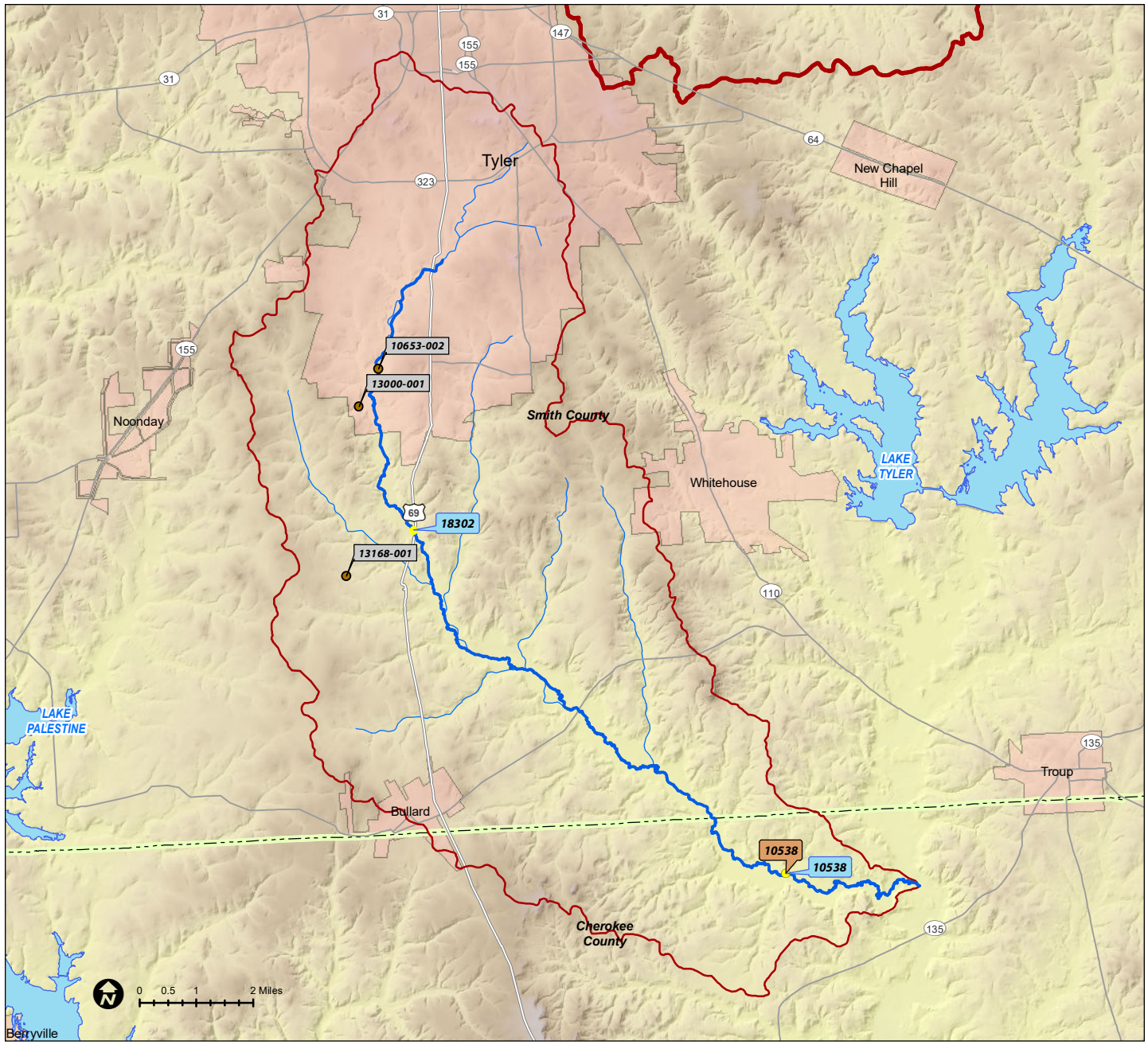
This segment is part of a Clean Water Act Watershed Characterization Project and monthly monitoring was performed on two sites in 2018/2019. Two additional sites will be monitored in 2020.

West Mud Creek has two assessment units. AU 0611D_01 is listed in the 2020 Texas Integrated Report as impaired for *E. coli* bacteria with a geometric mean of 378.43 MPN/100 mL (based on 21 samples assessed), which exceeds the criteria for Primary Contact Recreation. AU 0611D_01 is also listed in the 2020 Texas Integrated Report as having a concern for nutrient levels with Ammonia and Nitrate both exceeding their screening levels.

There were no other impairments or concerns listed in the 2020 Texas Integrated Report.

There are currently no stations being monitored in AU 0611_02, therefore it has been excluded from the Assessment Summary table.

- ANRA Monitoring Sites
- TCEQ Monitoring Sites
- Wastewater Outfalls
- Classified Segments
- Other Hydrology
- Segment Watershed
- Counties



SEGMENT 0611D - WEST MUD CREEK

Designated Uses

The designated uses for this unclassified segment include contact recreation, high aquatic life use, fish consumption use, public water supply use, and general use.

Assessment Units

AU ID	Description
0611D_01	From the confluence with Mud Creek (0611C), per WQS App. D, upstream to confluence with unnamed tributary about 75 m north of WWTP in City of Tyler at NHD RC 12020004000212
0611D_02	From the confluence with unnamed tributary about 75 m north of WWTP in City of Tyler upstream to confluence of unnamed tributary about 300 meters upstream of the most northern crossing of US 69 in City of Tyler, per WQS App. D, at NHD RC 12020004000212

Monitoring Stations

Station ID	AU ID	Description	Earliest Data	Latest Data	Notes
18302	0611D_01	WEST MUD CREEK AT US 69	2004	2019	CRP monitored from 2004-2012. It is being monitored for a CWA Grant Project from 2018-2021.
10538	0611D_01	WEST MUD CREEK AT FM3052 APPROX 4.5MI SW OF THE CITY OF TROUP AND EAST OF BULLARD	1986	2019	Monitored from 1986-1987, 2000-2002, and began again in 2017(for TCEQ Bacteria project) Will be monitored 2020-2021 for a CWA Grant Project.
10540	0611D_01	WEST MUD CREEK AT FM 346	1987	2007	Monitored in 1987 and from 1997-2007.
10542	0611D_02	WEST MUD CREEK ABOVE CITY OF TYLER SOUTHSIDE WWTP	1984	2012	Monitored in 1984 and from 1998-2012

Station 20845- West Mud Creek at FM 2913

SEGMENT 0611D - WEST MUD CREEK

Assessment Summary ***(as listed in the 2020 Texas Integrated Report)***

Parameter	Standard	0611D_01 Assessment
Chloride (mg/L)	125	
Sulfate (mg/L)	50	
TDS (mg/L)	250	
DO Grab Screening Level (mg/L)	3	NA
DO Grab Minimum (mg/L)	2	NA
24 Hour DO Average		
24 Hour DO Minimum		
pH (SU)	6.0 - 8.5	
Temp (C)	32.2	
E. coli geomean (MPN/100mL)	126	NS
Ammonia Nitrogen (mg/L)	0.33	CS
Nitrate Nitrogen (mg/L)	1.95	CS
Total Phosphorus (mg/L)	0.69	NA
Chl-*a* (µg/L)	14.1	NA
Mercury in Edible Tissue		
Dioxin in Edible Tissue		

FS = Fully Supporting NC = No Concern CN = Concern for Near Non-Attainment
CS = Concern for Screening Level NS = Not Supporting NA= Not Assessed

West Mud Creek at FM 3052

West Mud Creek near WWTF (Station 10543)

SEGMENT 0611D - WEST MUD CREEK

Monitoring Station 18302 - West Mud Creek at US 69

Monitoring Station 18302 is monitored quarterly by TCEQ Region 5 (Tyler) for field parameters, conventional parameters, flow, and *E. coli* bacteria.

CRP monitoring was discontinued at this site in 2012 and was included in a CWA Watershed Characterization Project that began in 2018. Additional data is expected to be collected in 2020.

Statistical analysis shows decreasing trends for Ammonia-Nitrogen, Specific Conductance, Total Phosphorus and Nitrate+Nitrite These trends are not considered statistically significant due to large gaps in observed data. However, approximately 86% of the observed values for Nitrate+Nitrite are above the 1.95 mg/L as N screening level set for this parameter. Total Phosphorus and Ammonia-Nitrogen also have values which exceed the screening levels set for each parameter. Decreasing trends are also observed with Chlorophyll-*a* and Pheophytin but are not considered statistically significant due to greater than fifty-percent of the data being censored values that were influenced by a change in LOQ.

This assessment unit (0611D_01) is listed in the 2020 Texas Integrated Report as impaired for *E. coli* bacteria. It is also listed with a concern for screening levels of Ammonia-Nitrogen and Nitrate-Nitrogen.

Water Quality Monitoring Results for Station 18302- West Mud Creek at US 69

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	44	32	44.00	2400.00	200.40	-1.51	0.04	
Water Temperature (C)	44	0	10.00	28.20	19.72	2.46	0.61	
Dissolved Oxygen (mg/L)	44	0	4.00	10.42	6.84	4.27	0.91	
pH (S.U.)	43	0	6.70	8.20	7.30	17.44	0.85	
Specific Conductance (us/cm @ 25C)	44	0	227.00	636.00	434.05	7.76	0.01	
Ammonia-Nitrogen (mg/L as N)	44	21	0.10	1.40	0.36	2.76	0.10	
Chloride (mg/L)	44	0	23.00	69.00	48.07	5.32	0.14	
Sulfate (mg/L)	44	13	20.00	813.00	65.61	2.00	0.13	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	parameter not collected for this station							
Total Phosphorus (mg/L as P)	44	3	0.04	0.96	0.25	4.41	0.00	
Total Suspended Solids (mg/L)	44	0	1.00	43.00	8.33	-1.63	0.01	
Nitrate (Total) (mg/L)	12	0	0.94	4.60	2.95	-0.34	0.71	
Nitrite (Total) (mg/L)	12	0	0.05	0.30	0.11	2.33	0.04	
Nitrate + Nitrite (mg/L as N)	44	37	0.24	7.90	4.26	3.74	0.05	
Chlorophyll-*a* (ug/L)	30	0	2.00	10.90	3.97	3.49	0.01	
Pheophytin (ug/L)	23	0	1.60	5.00	2.46	4.88	0.00	

Doppler Boat-West Mud Creek at US 69

SEGMENT 0611D - WEST MUD CREEK

Monitoring Station 10542 - West Mud Creek Above City of Tyler's South side Wastewater Treatment Plant

Monitoring Station 10542 is located on West Mud Creek immediately upstream of the City of Tyler's South side wastewater treatment plant. This station was previously monitored quarterly by TCEQ Region 5 (Tyler) for field parameters, conventional parameters, flow, and *E. coli* bacteria, but since 2012, it is no longer being monitored.

Due to having less than ten years of data at this station, trends are not considered to be statistically significant.

Water Quality Monitoring Results for Station 10542- West Mud Creek

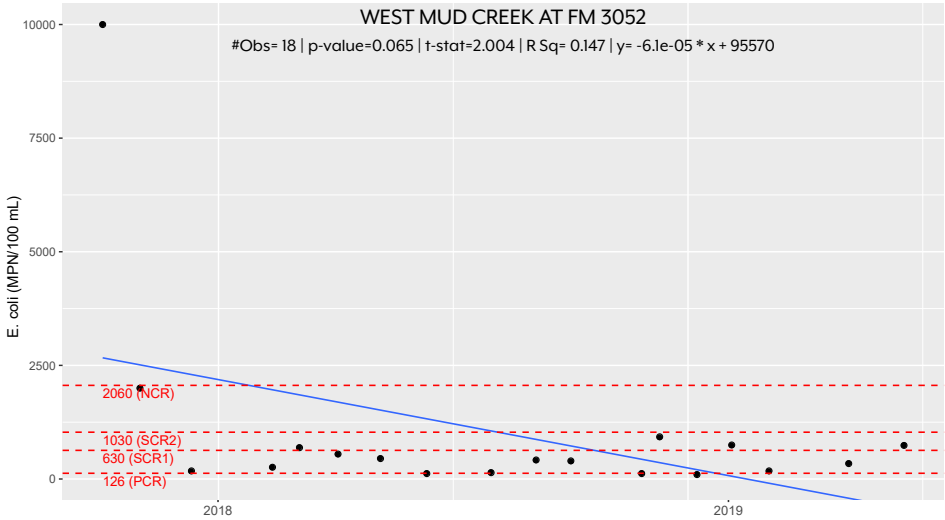
Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	40	27	29.00	2400.00	252.38	-0.14	0.66	
Water Temperature (C)	34	0	8.00	27.60	18.05	1.47	0.75	
Dissolved Oxygen (mg/L)	34	0	3.00	10.18	6.05	2.16	0.51	
pH (S.U.)	33	0	6.50	7.90	7.14	8.47	0.92	
Specific Conductance (us/cm @ 25C)	33	0	183.00	390.00	298.55	1.10	0.22	
Ammonia-Nitrogen (mg/L as N)	34	8	0.03	0.90	0.25	3.99	0.00	
Chloride (mg/L)	34	0	17.00	44.80	29.21	0.01	0.06	
Sulfate (mg/L)	34	5	17.40	75.40	38.31	0.74	0.58	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	parameter not collected for this station							
Total Phosphorus (mg/L as P)	33	0	0.06	0.20	0.09	1.89	0.24	
Total Suspended Solids (mg/L)	34	0	1.00	76.00	7.23	-0.61	0.42	
Nitrate (Total) (mg/L)	parameter not collected for this station							
Nitrite (Total) (mg/L)	parameter not collected for this station							
Nitrate + Nitrite (mg/L as N)	34	1	0.10	3.14	0.50	2.10	0.10	
Chlorophyll-*a* (ug/L)	32	1	2.00	21.00	4.03	4.93	0.00	
Pheophytin (ug/L)	24	0	2.00	5.00	2.46	4.98	0.00	

Monitoring Station 10538 - West Mud Creek at FM 3052

Monitoring Station 10538 is located on West Mud Creek approximately 4.5 miles southwest of the City of Troup and East of Bullard.

This station is monitored for a special project by TCEQ for *E. coli* bacteria.

This assessment unit is listed as impaired for *E. coli* bacteria in the 2020 Texas Integrated Report. It is also listed in the 2020 Texas Integrated Report as having a concern for nutrient levels with Ammonia and Nitrate both exceeding their screening levels.



Water Quality Monitoring Results for Station 10538- West Mud Creek

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	18	15	98.00	10000.00	56.11	2.00	0.06	

SEGMENT 0611D - WEST MUD CREEK

SUMMARY OF WATER QUALITY TRENDS

Trend Analysis Summary for Segment 0611D - West Mud Creek

There are no statistically significant trends identified for this segment.

Water Quality Issues Summary for Segment 0611D - West Mud Creek

Water Quality Issue	Affected Area	Possible Influences/Causes	Possible Effects	Possible Solutions / Actions Taken
Impairment for *E. coli* bacteria	0611D_01	• Rapid urbanization in the upper portion of the watershed • Stormwater runoff • Point-source pollution from wastewater discharges, sewer line breaks, overflows, etc. • Failing (and non-existent) septic systems • Domestic animals and wildlife	• Water body does not meet the water quality standard for Primary Contact Recreation • Primary Contact Recreation in the water body has an increased risk of gastrointestinal illness	• Continue monitoring • A RUAA is being conducted on this water body to determine if the most appropriate contact recreation standard is being applied
Concern for Ammonia-Nitrogen	0611D_01	• Rapid urbanization in the upper portion of the watershed • Stormwater runoff • Point-source pollution from wastewater discharges, sewer line breaks, overflows, etc. • Improper fertilizer use	• Detrimental impact on aquatic biological community	• Continue monitoring • Determination of source of nutrient loading • Evaluation of discharge permit limits
Concern for Nitrate-Nitrogen	0611D_01	• Rapid urbanization in the upper portion of the watershed • Stormwater runoff • Point-source pollution from wastewater discharges, sewer line breaks, overflows, etc. • Improper fertilizer use	• Detrimental impact on aquatic biological community	• Continue monitoring • Determination of source of nutrient loading • Evaluation of discharge permit limits

West Mud Creek at FM 3052

SEGMENT 0611Q - LAKE NACOGDOCHES

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 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 has one assessment unit with two monitoring sites. There are no impairments or concerns listed in the 2020 Texas Integrated Report.

ANRA Monitoring Sites
Wastewater Outfalls
Classified Segments
Other Hydrology
Segment Watershed
Counties

SEGMENT 0611Q - LAKE NACOGDOCHES

Designated Uses

The designated uses for this unclassified segment include contact recreation, high aquatic life use, fish consumption use, public water supply use, and general use.

Assessment Units in Segment 0611Q - Lake Nacogdoches

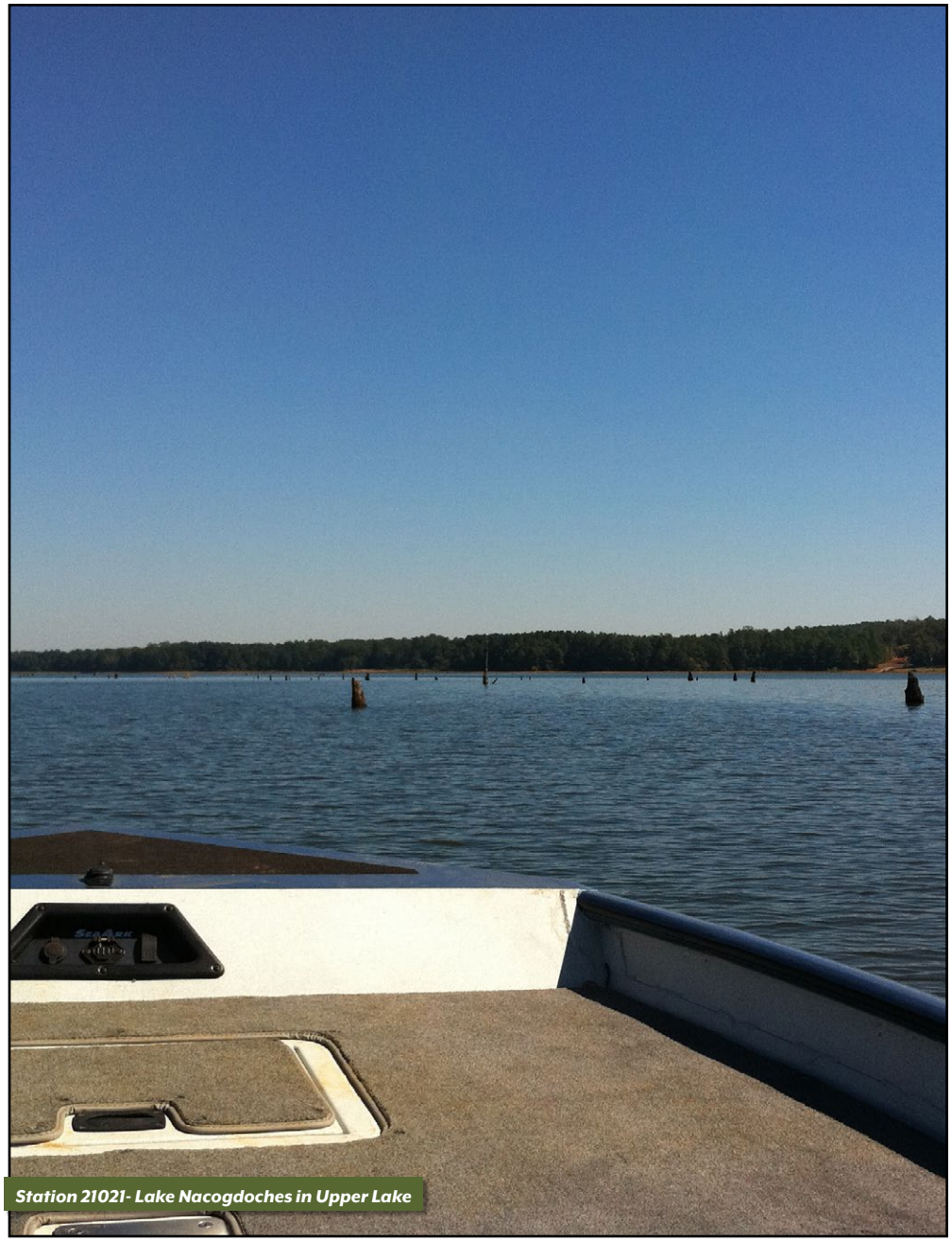
AU ID	Description
0611Q_01	Entire water body

Monitoring Stations in Segment 061Q - Lake Nacodoches

Station ID	AU ID	Description	Earliest Data	Latest Data	Notes
15801	0611Q_01	LAKE NACOGDOCHES AT DAM	1997	2019	Monitored in 1997, 2000- present.
21021	0611Q_01	LAKE NACOGDOCHES NEAR ISLAND IN UPPER LAKE	2004	2019	Monitored continuously since 2004.

Station 21021- Lake Nacogdoches in Upper Lake

SEGMENT 0611Q - LAKE NACOGDOCHES



Station 21021- Lake Nacogdoches in Upper Lake

Assessment Summary ***(as listed in the 2020 Texas Integrated Report)***

Parameter	Standard	0611Q_01 Assessment
Chloride (mg/L)	125	
Sulfate (mg/L)	50	
TDS(mg/L)	250	
DO Grab Screening Level (mg/L)	5	NC
DO Grab Minimum (mg/L)	3	FS
24 Hour DO Average		
24 Hour DO Minimum		
pH (SU)	6.0 - 8.5	
Temp (C)	32.2	
E. coli geomean (MPN/100mL)	126	FS
Ammonia Nitrogen (mg/L)	0.11	NA
Nitrate Nitrogen (mg/L)	0.37	NA
Total Phosphorus (mg/L)	0.2	NA
Chl-*a* (µg/L)	26.7	NA
Mercury in Edible Tissue		
Dioxin in Edible Tissue		

FS = Fully Supporting NC = No Concern CN = Concern for Near Non-Attainment
CS = Concern for Screening Level NS = Not Supporting NA = Not Assessed

SEGMENT 0611Q - LAKE NACOGDOCHES

Monitoring Station 15801 - Lake Nacogdoches At Dam

Monitoring Station 15801 is monitored quarterly by ANRA for field parameters, conventional parameters, and *E. coli* bacteria. This monitoring station is located in the main pool of the lake near the dam.

Ammonia- Nitrogen shows a decreasing trend due to some abnormally high values from 2004-2008. This trend is not considered to be statistically significant due to greater than fifty-percent of observed values being censored values. The elevated values from this period appear in multiple watersheds sampled by different agencies and analyzed by different labs, so it is unlikely to be caused by sampling issues or a point source. Monitoring of atmospheric deposition conducted by the National Atmospheric Deposition Program does not show any elevated values for the time period in question. Agricultural runoff appears to be the most likely source. The range for Ammonia-Nitrogen results was <0.10 to 0.58 mg/L as N, with a mean of 0.14 mg/L as N. Since 2008, the majority of results have been reported as < 0.10 mg/L as N.

Total Phosphorus and Pheophytin also show decreasing trends that aren't considered statistically significant due to majority of the observed data being censored values that were caused by a change in LOQ.

This assessment unit is not listed in the 2020 Texas Integrated Report with any concern or impairment.

Water Quality Monitoring Results for Station 15801-Lake Nacogdoches

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	57	0	1.00	27.00	1.44	0.74	0.76	
Water Temperature (C)	55	0	8.70	32.00	21.97	2.21	0.89	
Dissolved Oxygen (mg/L)	57	0	5.80	11.60	8.65	4.60	0.83	
pH (S.U.)	55	0	6.40	8.30	7.46	11.87	0.38	
Specific Conductance (us/cm @ 25C)	57	0	94.00	265.00	140.86	3.40	0.83	
Ammonia-Nitrogen (mg/L as N)	57	15	0.08	0.58	0.14	6.10	0.00	
Chloride (mg/L)	56	0	7.10	44.00	12.15	3.24	0.12	
Sulfate (mg/L)	56	2	14.00	96.30	28.51	0.74	0.58	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	parameter not collected for this station							
Total Phosphorus (mg/L as P)	57	2	0.02	0.69	0.07	3.10	0.01	
Total Suspended Solids (mg/L)	57	0	1.00	15.00	2.89	1.32	0.87	
Nitrate (Total) (mg/L)	15	0	0.05	0.18	0.07	0.50	0.75	
Nitrite (Total) (mg/L)	15	0	0.05	0.05	0.05	8.15E+14	0.06	
Nitrate + Nitrite (mg/L as N)	57	0	0.04	0.28	0.09	-0.33	0.13	
Chlorophyll-*a* (ug/L)	55	1	2.00	37.40	5.63	1.14	0.76	
Pheophytin (ug/L)	51	0	2.00	5.00	2.24	5.92	0.00	

Lake Nacogdoches Upper Lake

SEGMENT 0611Q - LAKE NACOGDOCHES

Monitoring Station 21021 - Lake Nacogdoches Near Island in Upper Lake

Monitoring Station 21021 is monitored quarterly by ANRA for field parameters, conventional parameters, and *E. coli* bacteria. This monitoring station is located in the upper portion of the lake. Water quality results and trends at this station are very similar to those seen at station 15801.

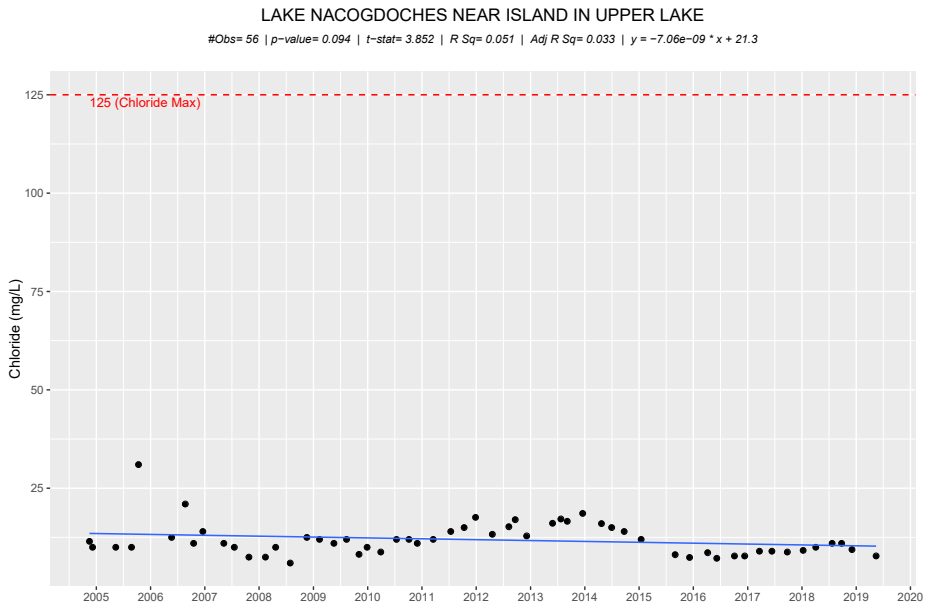
A decreasing trend is shown for Ammonia-Nitrogen due to some abnormally high values from 2004-2008. This trend is not considered to be statistically significant due to greater than fifty-percent of observed values being censored values. The elevated values from this period appear in multiple watersheds sampled by different agencies and analyzed by different labs, so it is unlikely to be caused by sampling issues or a point source. Monitoring of atmospheric deposition conducted by the National Atmospheric Deposition Program does not show any elevated values for the time period in question. Agricultural runoff appears to be the most likely source. The range for Ammonia-Nitrogen results was <0.10 to 0.52 mg/L as N, with a mean of 0.0.14 mg/L as N. Since 2008, the majority of results have been reported as < 0.10 mg/L as N.

There is a statistically significant decreasing trend identified for Chloride.

Total Phosphorus and Pheophytin also show decreasing trends that aren't considered statistically significant due to majority of the observed data being censored values that were caused by a change in LOQ.

Water Quality Monitoring Results for Station 21021- Lake Nacogdoches Near Pine Island in Upper Lake

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	57	1	1.00	980.00	1.61	0.20	0.94	
Water Temperature (C)	55	4	8.20	32.90	22.35	2.02	0.78	
Dissolved Oxygen (mg/L)	57	0	6.00	11.90	8.82	4.89	0.91	
pH (S.U.)	55	0	6.40	8.50	7.47	11.88	0.18	
Specific Conductance (us/cm @ 25C)	57	0	95.00	264.00	141.74	3.30	0.87	
Ammonia-Nitrogen (mg/L as N)	57	17	0.10	0.52	0.14	6.70	0.00	
Chloride (mg/L)	56	0	6.00	31.00	11.91	3.85	0.09	↓
Sulfate (mg/L)	56	1	14.00	70.40	27.75	0.74	0.58	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	parameter not collected for this station							
Total Phosphorus (mg/L as P)	57	0	0.02	0.16	0.05	10.27	0.00	
Total Suspended Solids (mg/L)	57	0	1.00	18.40	3.35	1.21	0.85	
Nitrate (Total) (mg/L)	15	0	0.05	0.17	0.07	0.70	0.62	
Nitrite (Total) (mg/L)	15	0	0.05	0.05	0.05	8.15E+14	0.06	
Nitrate + Nitrite (mg/L as N)	57	0	0.04	0.35	0.09	0.09	0.33	
Chlorophyll-*a* (ug/L)	51	0	2.00	17.00	5.98	2.20	0.36	
Pheophytin (ug/L)	47	0	2.00	5.00	2.32	4.97	0.01	



SEGMENT 0611Q - LAKE NACOGDOCHES

SUMMARY OF WATER QUALITY TRENDS

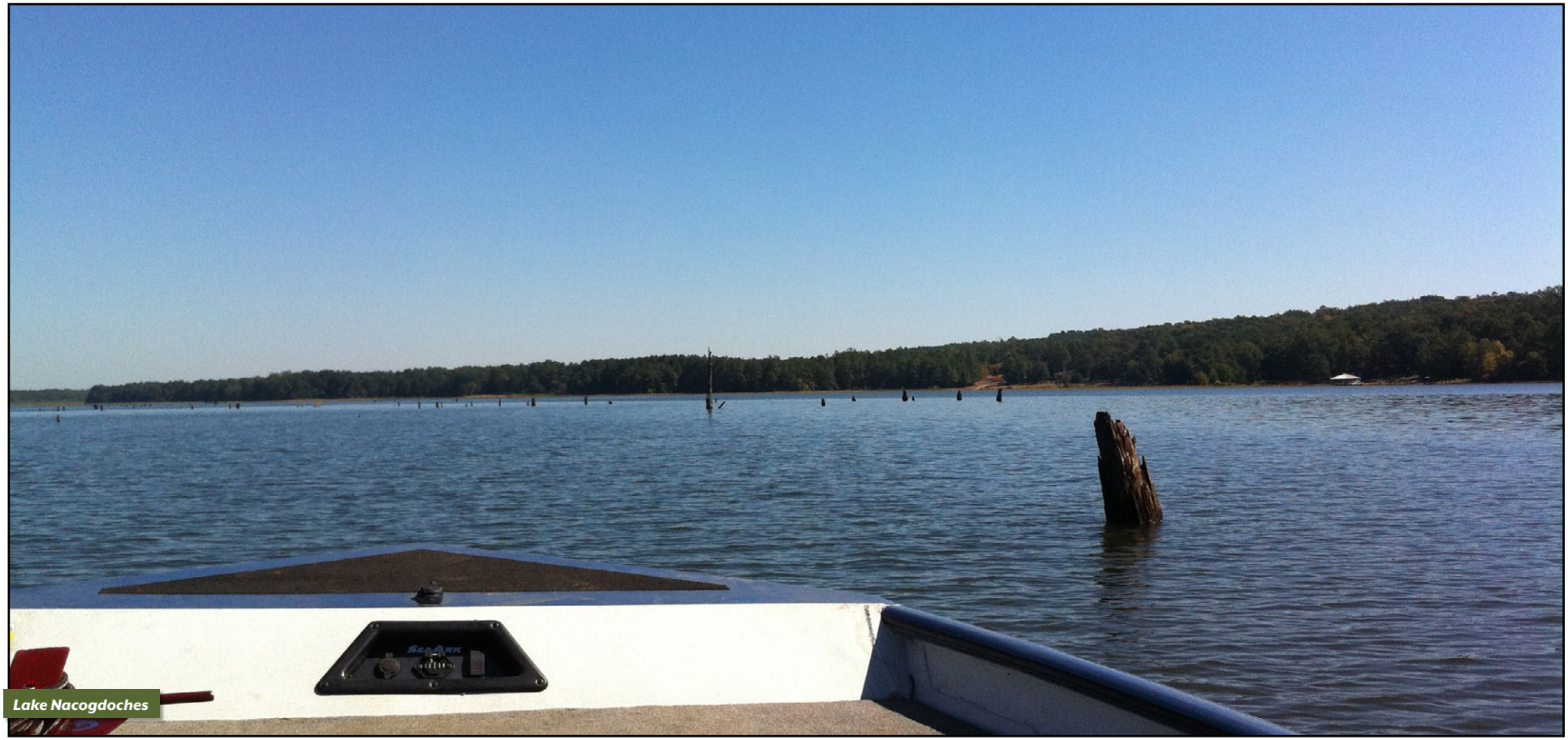
Trend Analysis Summary for Segment 0611Q - Lake Nacogdoches

AU	Station ID	Station Description	*E. coli*	Temp	DO	pH	Spec Cond	NH3	Cl	SO4	TKN	Total P	TSS	NO3	NO2	NO3/ NO2	Chl-*a*	Pheo
0611Q_01	15801	Lake Nacogdoches At Dam	*- No trends identified for this Assessment Unit -*															
0611Q_01	21021	Lake Nacogdoches Near Island in Upper Lake							↓									

↑ = Statistically significant increasing trend ↓ = Statistically significant decreasing trend

Summary of Water Quality Issues for Segment 0611- Lake Nacogdoches

There are no concerns or impairments listed for this segment in the 2020 Texas Integrated Report.



Lake Nacogdoches

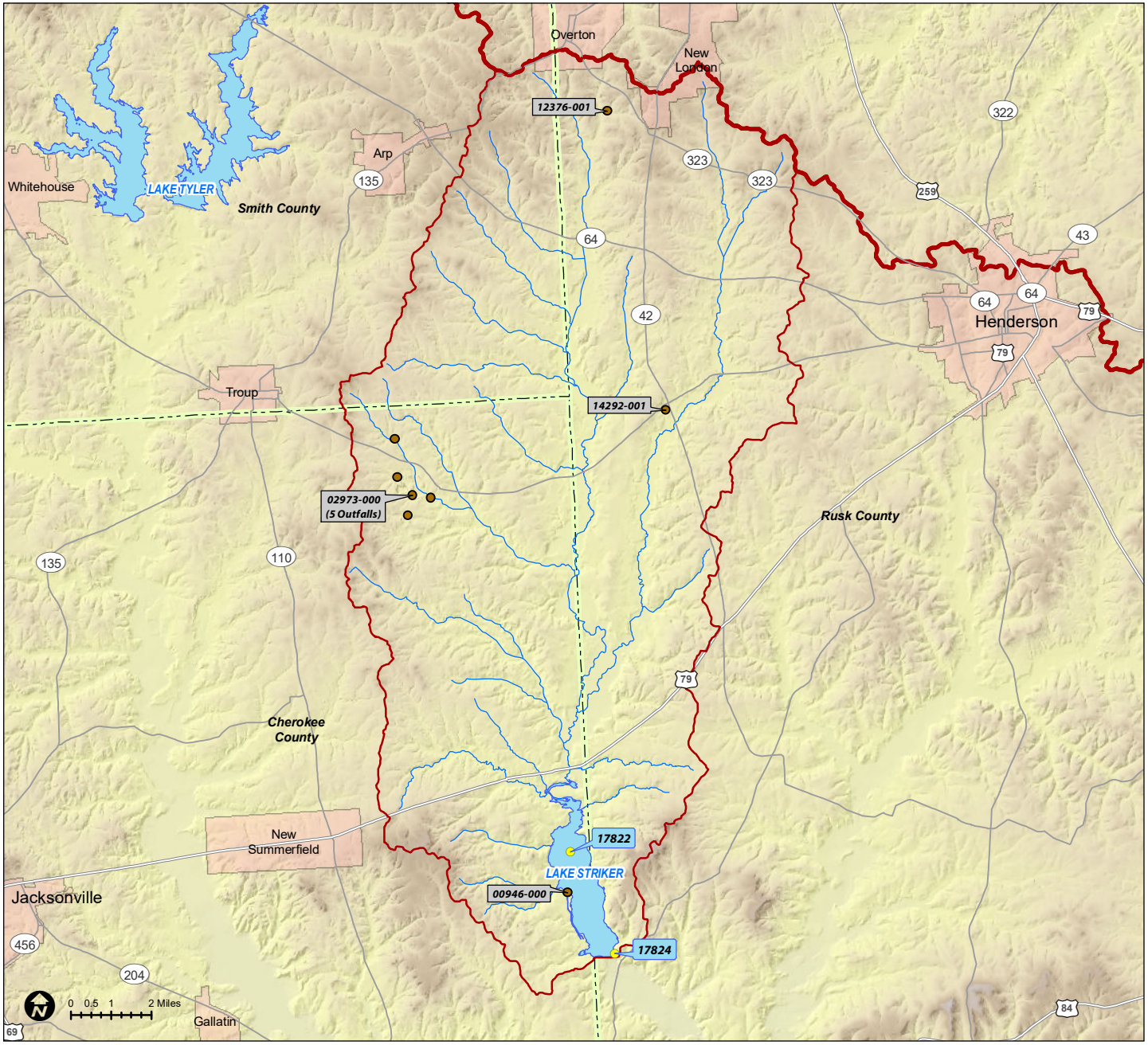
SEGMENT 0611R - LAKE STRIKER

Segment Profile

Lake Striker is a 1,863 acre reservoir extending from the dam approximately half a 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.

Lake Striker has one assessment unit with two monitoring sites. There are no concerns or impairments listed in the 2020 Texas Integrated Report.

Although Lake Striker is not assessed for pH, there are historical issues with low pH for this water body.



ANRA Monitoring Sites
Wastewater Outfalls
Classified Segments
Other Hydrology
Segment Watershed
Counties

SEGMENT 0611R - LAKE STRIKER

Designated Uses

The designated uses for this unclassified segment include contact recreation, high aquatic life use, fish consumption use, public water supply use, and general use.

Assessment Units

AU ID	Description
0611R_01	Entire water body

Monitoring Stations

Station ID	AU ID	Description	Earliest Data	Latest Data	Notes
17822	0611R_01	LAKE STRIKER UPPER LAKE	2002	2019	Monitored continuously since 2002
17824	0611R_01	LAKE STRIKER SE OF POWERPLANT	2002	2019	Monitored continuously since 2002

Assessment Summary *(as listed in the Draft 2014 Texas Integrated Report)*

Parameter	Standard	0611R_01 Assessment
Chloride (mg/L)	125	
Sulfate (mg/L)	50	
TDS(mg/L)	250	
DO Grab Screening Level (mg/L)	5	NC
DO Grab Minimum (mg/L)	3	FS
24 Hour DO Average		
24 Hour DO Minimum		
pH (SU)	6.0 - 8.5	
Temp (C)	32.2	
E. coli geomean (MPN/100mL)	126	FS
Ammonia Nitrogen (mg/L)	0.11	NA
Nitrate Nitrogen (mg/L)	0.37	NA
Total Phosphorus (mg/L)	0.2	NA
Chl-*a* (µg/L)	26.7	NA
Mercury in Edible Tissue		
Dioxin in Edible Tissue		

FS = Fully Supporting NC = No Concern CN = Concern for Near Non-Attainment
CS = Concern for Screening Level NS = Not Supporting NA = Not Assessed

Giant Salvania- Lake Striker Upper Lake (Dec 2015)

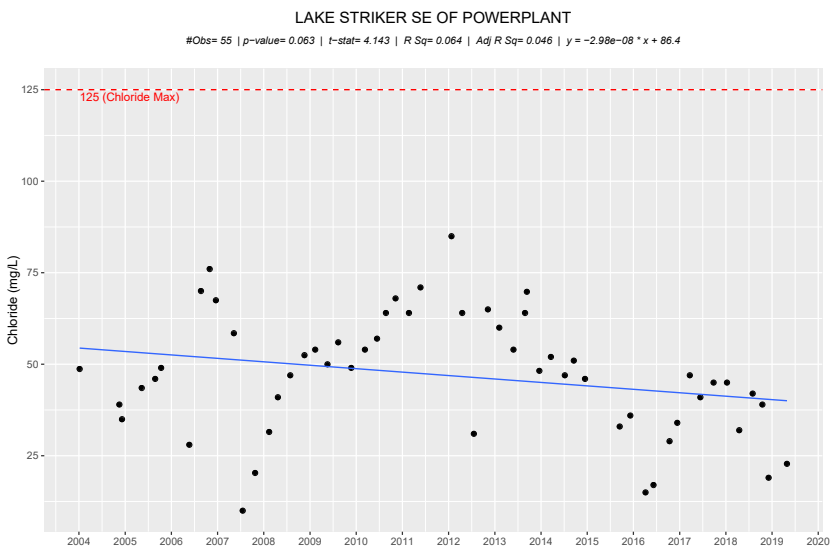
SEGMENT 0611R - LAKE STRIKER

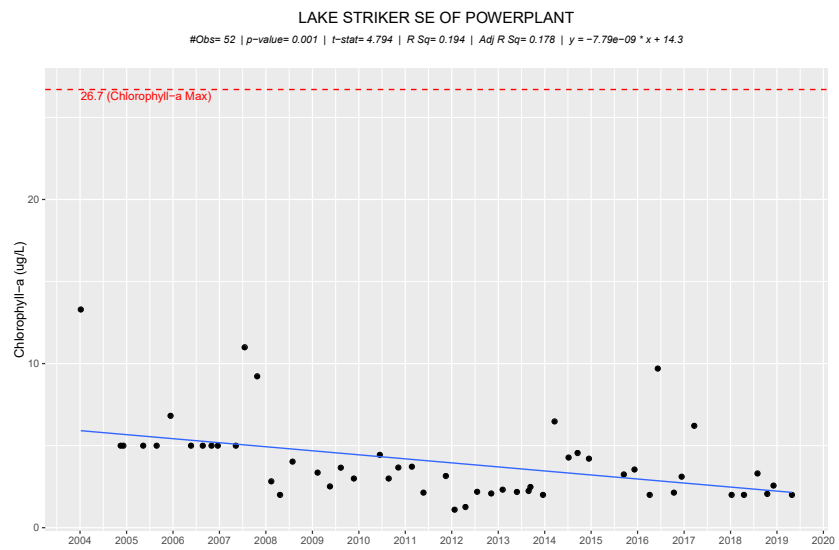
Monitoring Station 17824 - Lake Striker, Main Pool

Monitoring Station 17824 is located near the dam in the main pool of Lake Striker. This station is located southeast of the Luminant Energy power plant. Station 17824 is monitored quarterly by ANRA for field parameters, conventional parameters, and *E. coli* bacteria. At this station, there are significant decreasing trends for Chloride, and Chlorophyll-*a*. Total Phosphorus, Pheophytin, and Nitrate+Nitrite all show a decreasing trend but this is due to a change in LOQ with greater than 50% censored data, and therefore, not considered statistically significant. A decreasing trend is shown for Ammonia-Nitrogen due to some abnormally high values from 2004-2008. This trend is not considered to be statistically significant due to greater than fifty-percent of observed values being censored values. We looked at several possible sources for the elevated observed values, such as atmospheric deposition and possible WWTF excursions, it is likely that these trends resulted from excess fertilizer runoff. The range for Ammonia-Nitrogen results was <0.10 to 0.52 mg/L as N, with a mean of 0.0.14 mg/L as N. Since 2008, the majority of data has been reported as <0.1 mg/L as N.

Water Quality Monitoring Results for Station 17824- Lake Striker, Main Pool

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	52	0	1.00	76.00	3.00	-0.74	0.26	
Water Temperature (C)	55	2	8.00	33.30	21.06	2.54	0.80	
Dissolved Oxygen (mg/L)	57	0	5.20	12.60	8.55	4.19	0.94	
pH (S.U.)	55	5	5.00	7.90	6.94	9.76	0.33	
Specific Conductance (us/cm @ 25C)	57	0	78.00	475.00	266.11	3.87	0.16	
Ammonia-Nitrogen (mg/L as N)	56	13	0.05	0.94	0.14	4.88	0.00	
Chloride (mg/L)	55	0	10.00	85.00	46.99	4.14	0.06	↓
Sulfate (mg/L)	56	8	7.78	87.00	33.70	2.20	0.53	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	13	0	0.20	0.47	0.33	3.51	0.01	
Total Phosphorus (mg/L as P)	55	2	0.02	0.30	0.06	4.36	0.00	
Total Suspended Solids (mg/L)	55	0	1.00	9.10	3.14	-1.49	0.00	
Nitrate (Total) (mg/L)	15	0	0.05	0.15	0.07	0.96	0.48	
Nitrite (Total) (mg/L)	15	0	0.05	0.05	0.05	8.35E+14	0.05	
Nitrate + Nitrite (mg/L as N)	57	1	0.04	0.58	0.09	1.08	0.84	
Chlorophyll-*a* (ug/L)	52	0	1.10	13.30	4.00	4.79	0.00	↓
Pheophytin (ug/L)	33	0	2.00	5.00	2.39	4.95	0.02	





SEGMENT 0611R - LAKE STRIKER

Monitoring Station 17822- Lake Striker Upper Lake

Monitoring Station 17824 is located near the dam in the main pool of Lake Striker. This station is located southeast of the Luminant Energy power plant. Station 17824 is monitored quarterly by ANRA for field parameters, conventional parameters, and *E. coli* bacteria.

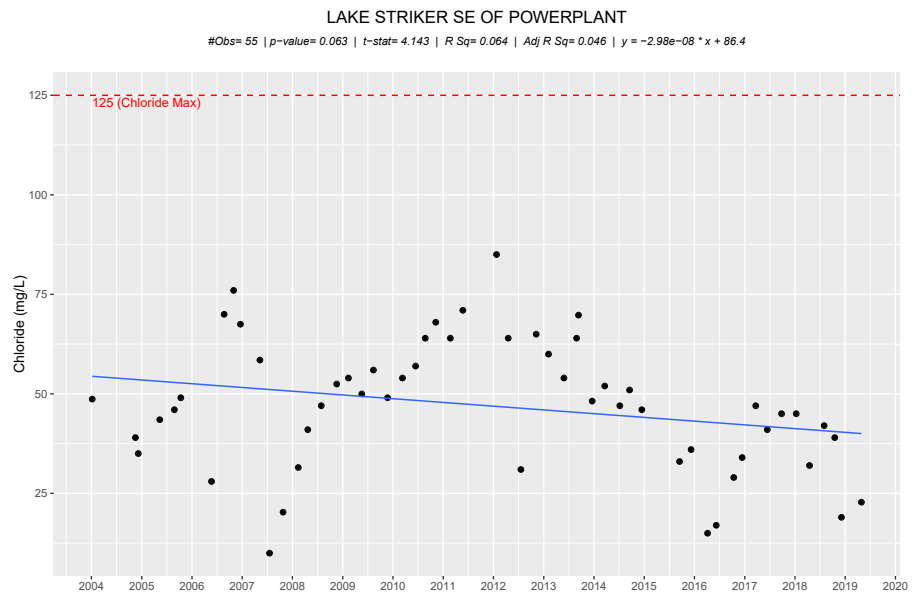
At this station, there is a significant decreasing trend for Chloride.

There are decreasing trends shown for Pheophytin and Ammonia-Nitrogen but the trends are not considered significant because they resulted from a change in LOQ with greater than 50% of observed data being censored values. This site displayed the same elevated values for ammonia from 2004-2008 that was observed at the Lake Striker Main Pool site.

Water Quality Monitoring Results for Station 17822- Lake Striker, Upper Lake

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	52	0	1.00	100.00	2.71	-1.57	0.07	
Water Temperature (C)	55	3	8.60	34.00	21.51	2.45	0.88	
Dissolved Oxygen (mg/L)	57	0	4.60	12.50	8.47	3.74	0.69	
pH (S.U.)	55	4	5.10	7.60	6.85	10.14	0.51	
Specific Conductance (us/cm @ 25C)	57	0	86.00	478.00	268.16	3.82	0.19	
Ammonia-Nitrogen (mg/L as N)	56	14	0.05	1.20	0.16	4.87	0.00	
Chloride (mg/L)	55	0	12.00	113.30	49.79	4.95	0.01	↓
Sulfate (mg/L)	56	9	15.00	88.00	35.24	2.03	0.67	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	13	0	0.20	0.49	0.36	2.67	0.05	
Total Phosphorus (mg/L as P)	55	1	0.02	0.56	0.07	2.01	0.20	
Total Suspended Solids (mg/L)	55	0	1.00	10.00	3.65	-1.93	0.00	
Nitrate (Total) (mg/L)	15	0	0.05	0.13	0.07	0.64	0.70	
Nitrite (Total) (mg/L)	15	0	0.05	0.05	0.05	8.35E+14	0.05	
Nitrate + Nitrite (mg/L as N)	57	1	0.04	0.56	0.08	0.84	0.97	
Chlorophyll-*a* (ug/L)	49	1	0.95	55.10	5.05	-0.07	0.60	
Pheophytin (ug/L)	30	0	2.00	5.00	2.47	3.86	0.05	

Station 17824- Lake Striker- Upper Lake



SEGMENT 0611R - LAKE STRIKER

SUMMARY OF WATER QUALITY TRENDS

Trend Analysis Summary for Segment 0611R- Lake Striker

AU	Station ID	Station Description	*E. coli*	Temp	DO	pH	Spec Cond	NH3	Cl	SO4	TKN	Total P	TSS	NO3	NO2	NO3/ NO2	Chl-*a*	Pheo
0611R_01	17822	Lake Striker Upper Lake							↓								↓	
0611R_01	17824	Lake Striker Near Dam							↓									

↑ = Statistically significant increasing trend ↓ = Statistically significant decreasing trend

Summary of Water Quality Issues for Segment 0611R- Lake Striker

There are no concerns or impairments listed for this segment in the 2020 Texas Integrated Report.

Lake Striker- Upper Lake

SEGMENT 0611V - BOWLES CREEK

Segment Profile

Lake Striker is a 1,863 acre reservoir extending from the dam approximately half a 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.

Bowles Creek has one assessment unit. It is listed in the 2020 Texas Integrated Report with a concern for depressed dissolved oxygen in water. Of the 10 samples assessed, 5 samples exceeded the screening level of 5 mg/L.

Wastewater Outfalls
Classified Segments
Other Hydrology
Segment Watershed
Counties

SEGMENT 0611V - BOWLES CREEK

Designated Uses

The designated uses for this unclassified segment include contact recreation, high aquatic life use, fish consumption use, public water supply use, and general use.

Assessment Units

AU ID	Description
0611V_01	From the confluence with Striker Creek in Cherokee County upstream to the headwaters in the City of Overton, 0.09 mi west of FM 2089

Monitoring Stations

Station ID	AU ID	Description	Earliest Data	Latest Data	Notes
21429	0611V_01	Bowles Creek at CR 4194; Upstream of Lake Striker	2013	2018	Monitored continuously from 2013-2018.

Assessment Summary *(as listed in the Draft 2018 Texas Integrated Report)*

Parameter	Standard	0611V_01 Assessment
Chloride (mg/L)	125	
Sulfate (mg/L)	50	
TDS(mg/L)	250	
DO Grab Screening Level (mg/L)	5	CS
DO Grab Minimum (mg/L)	3	FS
24 Hour DO Average		
24 Hour DO Minimum		
pH (SU)	6.0 - 8.5	
Temp (C)	32.2	
E. coli geomean (MPN/100mL)	126	FS
Ammonia Nitrogen (mg/L)	0.11	NA
Nitrate Nitrogen (mg/L)	0.37	NA
Total Phosphorus (mg/L)	0.2	NA
Chl-*a* (µg/L)	26.7	NA
Mercury in Edible Tissue		
Dioxin in Edible Tissue		

FS = Fully Supporting NC = No Concern CN = Concern for Near Non-Attainment
CS = Concern for Screening Level NS = Not Supporting NA = Not Assessed

Bowles Creek

SEGMENT 0611V - BOWLES CREEK

Monitoring Station 21429

Bowles Creek at CR 4194; Upstream of Lake Striker

Monitoring Station 21429 is located upstream of Lake Striker at Cherokee CR 4608/Rusk CR 4194. Station 21429 is monitored quarterly by ANRA from 2014 to 2018 for field parameters, conventional parameters, and *E. coli* bacteria.

Due to having less than 10 years of data collection at this site, any trends at this station are not considered to be statistically significant. Decreasing trends were observed for Secchi transparency, Chloride, and Pheophytin, and an increasing trend was shown for Ammonia-Nitrogen. The bacteria geomean of 64.97 is still well below the Primary Contact Recreation Criteria.

This assessment unit is listed in the 2020 Texas Integrated Report with a concern for depressed dissolved oxygen.

Water Quality Monitoring Results for Station 21429

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	52	0	1.00	100.00	2.71	-1.57	0.07	
Water Temperature (C)	55	3	8.60	34.00	21.51	2.45	0.88	
Dissolved Oxygen (mg/L)	57	0	4.60	12.50	8.47	3.74	0.69	
pH (S.U.)	55	4	5.10	7.60	6.85	10.14	0.51	
Specific Conductance (us/cm @ 25C)	57	0	86.00	478.00	268.16	3.82	0.19	
Ammonia-Nitrogen (mg/L as N)	56	14	0.05	1.20	0.16	4.87	0.00	
Chloride (mg/L)	55	0	12.00	113.30	49.79	4.95	0.01	
Sulfate (mg/L)	56	9	15.00	88.00	35.24	2.03	0.67	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	13	0	0.20	0.49	0.36	2.67	0.05	
Total Phosphorus (mg/L as P)	55	1	0.02	0.56	0.07	2.01	0.20	
Total Suspended Solids (mg/L)	55	0	1.00	10.00	3.65	-1.93	0.00	
Nitrate (Total) (mg/L)	15	0	0.05	0.13	0.07	0.64	0.70	
Nitrite (Total) (mg/L)	15	0	0.05	0.05	0.05	8.35E+14	0.05	
Nitrate + Nitrite (mg/L as N)	57	1	0.04	0.56	0.08	0.84	0.97	
Chlorophyll-*a* (ug/L)	49	1	0.95	55.10	5.05	-0.07	0.60	
Pheophytin (ug/L)	30	0	2.00	5.00	2.47	3.86	0.05	

SUMMARY OF WATER QUALITY TRENDS

Trend Analysis Summary for Segment 0611V-Bowles Creek

There are no statistically significant trends identified for this segment.

Summary of Water Quality Issues for Segment 0611V-Bowles Creek

There are no impairments or concerns listed for this segment in the 2020 Texas Integrated Report.

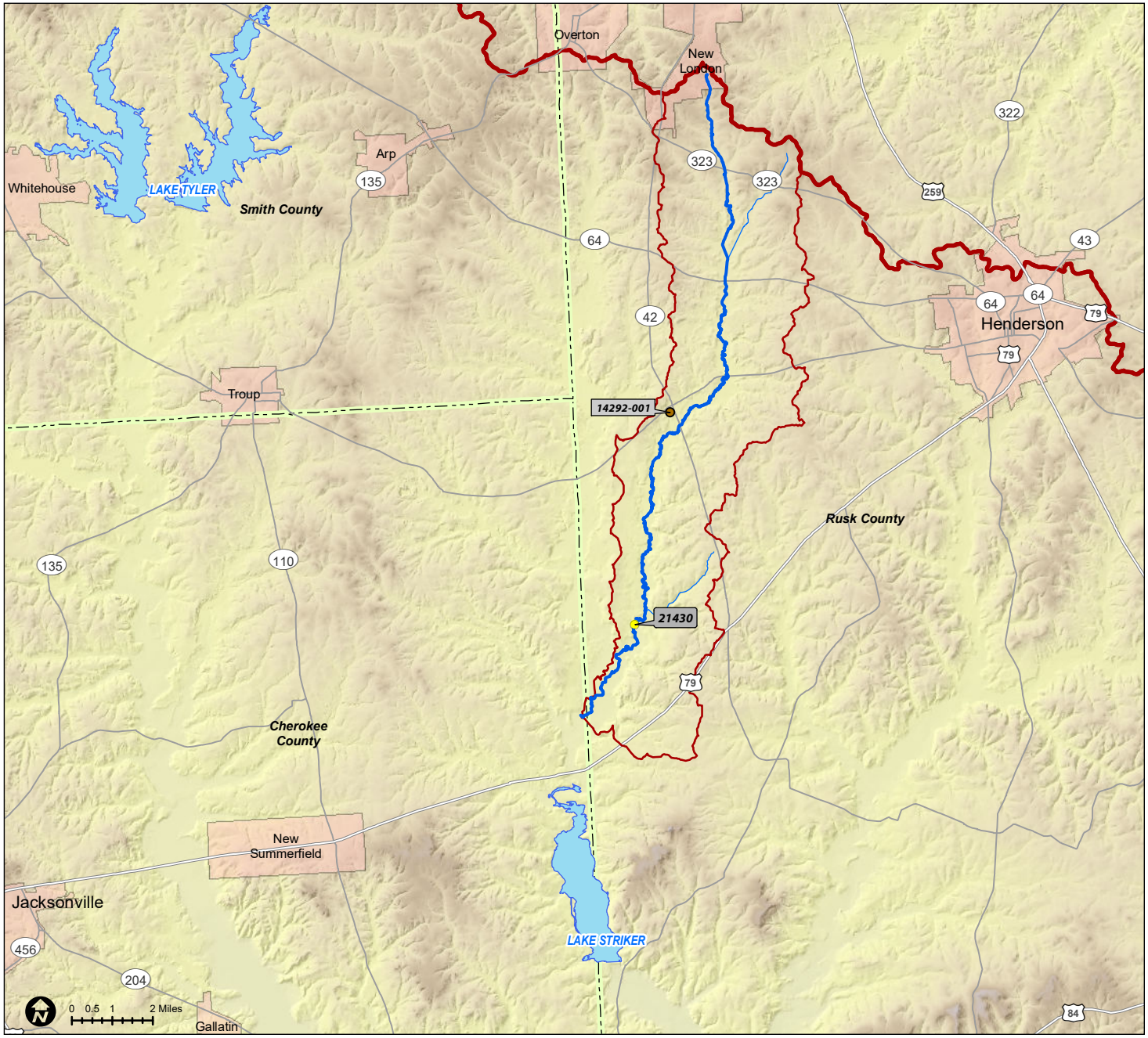
Bowles Creek- Station 21429

SEGMENT 0611W -JOHNSON CREEK

Segment Profile

Monitoring Station 21430 is located upstream of Lake Striker at Rusk CR 476. Station 21430 was monitored quarterly by ANRA from 2014 to 2018 for field parameters, conventional parameters, and *E. coli* bacteria.

Johnson Creek has one assessment unit with no concerns or impairments listed in the 2020 Texas Integrated Report.



SEGMENT 0611W- JOHNSON CREEK

Station 21430- Johnson Creek at 476

Designated Uses

The designated uses for this unclassified segment include contact recreation, high aquatic life use, fish consumption use, public water supply use, and general use.

Assessment Units

AU ID	Description
0611W_01	Entire water body

Monitoring Stations

Station ID	AU ID	Description	Earliest Data	Latest Data	Notes
21430	0611W_01	Johnson Creek at CR 476; Upstream of Lake Striker	2013	2018	Monitored continuously from 2013-2018.

SEGMENT 0611W- JOHNSON CREEK

Assessment Summary ***(as listed in the Draft 2018 Texas Integrated Report)***

Parameter	Standard	0611W_01 Assessment
Chloride (mg/L)	125	
Sulfate (mg/L)	50	
TDS(mg/L)	250	
DO Grab Screening Level (mg/L)	5.00	NC
DO Grab Minimum (mg/L)	3.00	FS
24 Hour DO Average		
24 Hour DO Minimum		
pH (SU)	6.0 - 8.5	
Temp (C)	32.2	
E. coli geomean (MPN/100mL)	126	NC
Ammonia Nitrogen (mg/L)	0.11	NC
Nitrate Nitrogen (mg/L)	0.37	NC
Total Phosphorus (mg/L)	0.20	NC
Chl-*a* (µg/L)	26.7	NC
Mercury in Edible Tissue		
Dioxin in Edible Tissue		

FS = Fully Supporting NC = No Concern CN = Concern for Near Non-Attainment
CS = Concern for Screening Level NS = Not Supporting NA = Not Assessed

Johnson Creek

SEGMENT 0611W- JOHNSON CREEK

Monitoring Station 21430 - Johnson Creek at CR 476

Monitoring Station 21430 is located upstream of Lake Striker at Rusk CR 476. Station 21430 is monitored quarterly by ANRA for field parameters, conventional parameters, and *E. coli* bacteria.

There are no trends at this station.

There are no concerns or impairments listed for this assessment unit in the 2020 Texas Integrated Report.

Water Quality Monitoring Results for Station 21430

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	18	10	5.00	1000.00	82.02	-0.76	0.40	
Water Temperature (C)	16	0	2.10	26.50	16.38	-0.85	0.28	
Dissolved Oxygen (mg/L)	18	2	1.30	12.70	7.07	1.59	0.23	
pH (S.U.)	18	10	3.50	7.10	5.32	-5.95	0.00	
Specific Conductance (us/cm @ 25C)	18	0	196.00	706.00	345.61	1.10	0.50	
Ammonia-Nitrogen (mg/L as N)	18	0	0.10	0.22	0.11	1.67	0.27	
Chloride (mg/L)	18	2	32.00	210.00	73.63	-0.04	0.78	
Sulfate (mg/L)	18	3	5.00	72.00	27.77	4.38	0.00	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	parameter not collected for this station							
Total Phosphorus (mg/L as P)	18	0	0.02	0.09	0.04	-1.98	0.04	
Total Suspended Solids (mg/L)	18	0	2.50	18.00	7.02	-0.09	0.77	
Nitrate (Total) (mg/L)	12	0	0.05	0.65	0.11	-0.67	0.49	
Nitrite (Total) (mg/L)	11	0	0.05	0.05	0.05	1.10E+15	0.04	
Nitrate + Nitrite (mg/L as N)	18	0	0.02	0.70	0.13	-1.16	0.22	
Chlorophyll-*a* (ug/L)	16	1	2.00	22.00	4.91	-0.36	0.65	
Pheophytin (ug/L)	16	0	2.00	8.24	2.50	0.83	0.54	

SUMMARY OF WATER QUALITY TRENDS

Trend Analysis Summary for Segment 0611W- Johnson Creek

There are no significant trends for this segment.

Summary of Water Quality Issues for Segment 0611W-Johnson Creek

There are no concerns or impairments listed for this segment in the 2020 Texas Integrated Report.

Johnson Creek at CR 476

SEGMENT 0613 - LAKE TYLER/TYLER EAST

Segment Profile

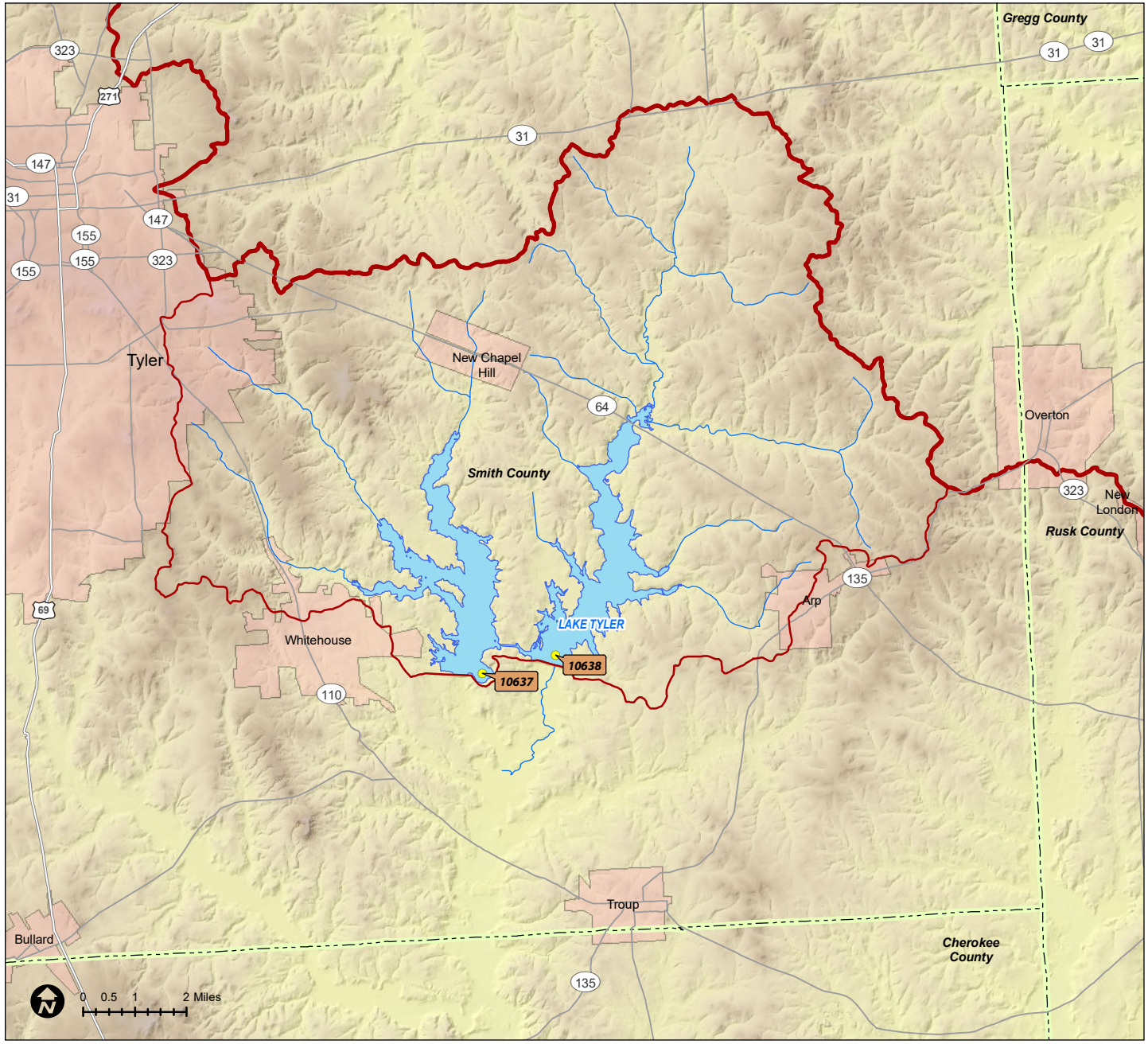
Segment 0613 extends from Whitehouse Dam and Mud Creek Dam in Smith County up to the normal pool elevation of 375.38 feet. The reservoir impounds both Prairie Creek and Mud Creek. Lake Tyler West and East include a total of 4,880 acres. Lake Tyler West and East were impounded in 1949 and 1966, respectively.

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. 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.

This segment is designated for high aquatic life use, general use, fish consumption use, public water supply use, and recreation use.

There were no impairments or concerns listed for this segment in the 2020 Texas Integrated Report.

- ANRA Monitoring Sites
- TCEQ Monitoring Sites
- Wastewater Outfalls
- Classified Segments
- Other Hydrology
- Segment Watershed
- Counties



SEGMENT 0613 - LAKE TYLER/TYLER EAST

Designated Uses

The designated uses for this classified segment include contact recreation, high aquatic life use, fish consumption use, public water supply use, and general use.

Assessment Units

AU ID	Description
0613_01	Lake Tyler lower reservoir
0613_02	Lake Tyler upper reservoir
0613_03	Lake Tyler East lower reservoir
0613_04	Lake Tyler East upper reservoir

Monitoring Stations

Station ID	AU ID	Description	Earliest Data	Latest Data	Notes
10637	0613_01	LAKE TYLER MIDLAKE AT DAM	1973	2019	Monitored 1973-1979, 1981-1982, 1985-2019
15210	0613_02	LAKE TYLER AT LANGLEY ISLAND	1997	2017	Monitored continuously since 1997.
10638	0613_03	LAKE TYLER EAST NEAR DAM	1973	2019	Monitored 1973-1979, 1981-1982, 1985-2019
17929	0613_04	LAKE TYLER EAST UPPER MID LAKE	2003	2017	Monitored continuously since 1997.
14235	0613_04	LAKE TYLER EAST AT SH 64	1995	2004	Monitored 1995 and 1998-2004.

Lake Tyler

SEGMENT 0613 - LAKE TYLER/TYLER EAST

Assessment Summary ***(as Listed in the 2020 Texas Integrated Report)***

Parameter	Standard	0613_01 Assessment	0613_02 Assessment	0613_03 Assessment	0613_04 Assessment
Chloride (mg/L)	50	FS	FS	FS	FS
Sulfate (mg/L)	50	FS	FS	FS	FS
TDS(mg/L)	200	FS	FS	FS	FS
DO Grab Screening Level (mg/L)	5.00	NC	NC	NC	NC
DO Grab Minimum (mg/L)	3.00	FS	FS	FS	FS
24 Hour DO Average					
24 Hour DO Minimum					
pH (SU)	6.0 -9.0	FS	FS	FS	FS
Temp (C)	33.9	FS	FS	FS	FS
E. coli geomean (MPN/100mL)	126	FS	FS	FS	FS
Ammonia Nitrogen (mg/L)	0.11	FS	FS	FS	FS
Nitrate Nitrogen (mg/L)	0.37	FS	FS	FS	FS
Total Phosphorus (mg/L)	0.20	FS	FS	FS	FS
Chl-*a* (µg/L)	26.7	FS	FS	FS	Fs
Mercury in Edible Tissue					
Dioxin in Edible Tissue					

FS = Fully Supporting NC = No Concern CN = Concern for Near Non-Attainment CS = Concern for Screening Level NS = Not Supporting NA = Not Assessed

Lake Tyler

SEGMENT 0613 - LAKE TYLER/TYLER EAST

Monitoring Station 10637 - Lake Tyler Mid-Lake at Dam

Monitoring Station 10637 is located near the dam on Lake Tyler. This station is monitored quarterly by TCEQ Region 5 for field parameters, conventional parameters, and *E. coli* , and annually for Metals in Sediment.

Statsitical analysis identified a decreasing trend for Total Phosphorus that resulted from a change in LOQ therefore, they is not considered to be statistically significant. There was a statisitcally significant increasing trend identified for Total Suspended Solids.

There are no impairments or concerns listed in the 2020 Texas Integrated Report.

Water Quality Monitoring Results for Station 10637

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	57	1	0.00	280.00		0.97	0.47	
Water Temperature (C)	73	0	6.20	32.70	21.91	2.68	0.49	
Dissolved Oxygen (mg/L)	73	0	4.10	11.90	8.49	5.28	0.21	
pH (S.U.)	73	0	6.80	8.80	7.60	15.21	0.30	
Specific Conductance (us/cm @ 25C)	72	0	82.00	154.00	111.17	6.97	0.27	
Ammonia-Nitrogen (mg/L as N)	69	7	0.02	0.18	0.06	2.50	0.66	
Chloride (mg/L)	71	0	5.00	16.00	10.64	4.43	0.55	
Sulfate (mg/L)	71	0	5.00	16.00	9.68	4.71	0.56	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	66	0	0.27	0.90	0.49	4.68	1.00	
Total Phosphorus (mg/L as P)	63	0	0.02	0.08	0.04	10.76	0.00	
Total Suspended Solids (mg/L)	70	0	2.00	7.00	4.44	2.56	0.01	↑
Nitrate (Total) (mg/L)	8	0	0.05	0.13	0.07	1.50	0.21	
Nitrite (Total) (mg/L)	8	0	0.05	0.05	0.05	3.57E+14	0.13	
Nitrate + Nitrite (mg/L as N)	70	0	0.04	0.27	0.08	2.13	0.59	
Chlorophyll-*a* (ug/L)	68	3	1.60	40.70	12.27	2.43	0.78	
Pheophytin (ug/L)	23	0	1.01	35.20	7.85	1.10	0.41	

Lake Tyler

SEGMENT 0613 - LAKE TYLER/TYLER EAST

Monitoring Station 15210 - Lake Tyler at Langley Island

Station 15210 is located approximately 100 meters west of the City of Tyler's water intake structure. This station is monitored quarterly by TCEQ Region 5 for field parameters, conventional parameters, and *E. coli* , and annually for Metals in Sediment.

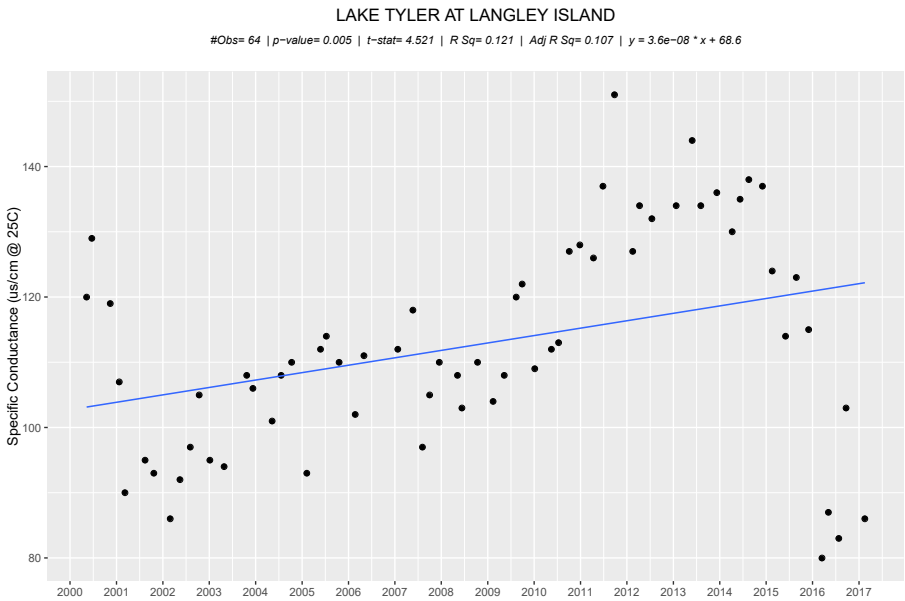
Statistical Analysis shows significant increasing trends for Specific Conductance and Chloride.

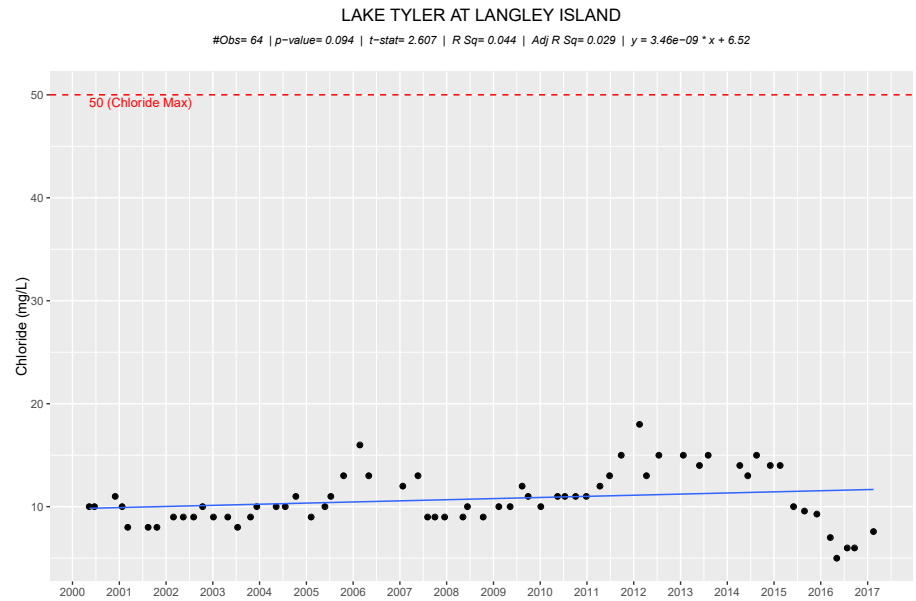
There were decreasing trends identified for Total Phosphorus and Nitrate but are not considered statistically significant because they resulted from a change in LOQ.

There are no impairments or concerns listed for this assessment unit in the 2020 Texas Integrated Report.

Water Quality Monitoring Results for Station 15210

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	51	2	1.00	290.00	3.82	0.64	0.73	
Water Temperature (C)	65	0	6.70	32.80	22.14	2.17	0.49	
Dissolved Oxygen (mg/L)	65	0	4.80	12.20	8.85	6.38	0.66	
pH (S.U.)	65	1	6.70	9.20	7.70	12.20	0.19	
Specific Conductance (us/cm @ 25C)	64	0	80.00	151.00	112.70	4.52	0.00	↑
Ammonia-Nitrogen (mg/L as N)	62	3	0.02	0.21	0.06	2.88	0.31	
Chloride (mg/L)	64	0	5.00	18.00	10.74	2.61	0.09	↑
Sulfate (mg/L)	64	0	5.00	18.00	9.90	2.83	0.30	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	59	0	0.20	0.75	0.49	5.06	0.30	
Total Phosphorus (mg/L as P)	57	0	0.02	0.08	0.05	8.23	0.00	
Total Suspended Solids (mg/L)	63	0	2.50	10.00	4.78	2.74	0.39	
Nitrate (Total) (mg/L)	8	0	0.05	0.13	0.07	1.62	0.18	
Nitrite (Total) (mg/L)	8	0	0.05	0.05	0.05	3.57E+14	0.13	
Nitrate + Nitrite (mg/L as N)	64	0	0.02	0.24	0.07	3.75	0.03	
Chlorophyll-*a* (ug/L)	61	5	2.39	35.70	13.02	2.51	0.52	
Pheophytin (ug/L)	24	0	5.00	27.40	7.62	0.63	0.75	





SEGMENT 0613 - LAKE TYLER/TYLER EAST

Monitoring Station 10638 - Lake Tyler East at Dam

Monitoring Station 10638 is located near the dam on Lake Tyler East. This station is monitored quarterly by TCEQ Region 5 for field parameters, conventional parameters, and *E. coli* , and annually for Metals in Sediment.

Statistical analysis shows a decreasing trend for Total Phosphorus but it is not considered significant because it resulted from a change in LOQ, having greater than 50% of observed data points as censored values.

There are no impairments or concerns listed for this assessment unit in the 2020 Texas Integrated Report.

Water Quality Monitoring Results for Station 10638

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	56	1	1.00	160.00	2.84	1.16	0.43	
Water Temperature (C)	72	0	6.50	32.50	22.06	2.97	0.73	
Dissolved Oxygen (mg/L)	72	0	4.20	12.10	8.31	5.16	0.34	
pH (S.U.)	72	0	6.70	8.70	7.41	16.89	0.79	
Specific Conductance (us/cm @ 25C)	71	0	58.00	148.00	99.03	5.97	0.79	
Ammonia-Nitrogen (mg/L as N)	67	7	0.02	0.22	0.06	2.94	0.36	
Chloride (mg/L)	71	0	5.00	19.00	12.29	4.36	0.82	
Sulfate (mg/L)	71	0	4.00	17.00	8.26	2.63	0.69	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	62	0	0.29	1.01	0.52	4.52	0.51	
Total Phosphorus (mg/L as P)	62	0	0.02	0.06	0.04	10.65	0.00	
Total Suspended Solids (mg/L)	71	0	2.00	9.00	4.45	1.27	0.00	
Nitrate (Total) (mg/L)	8	0	0.05	0.11	0.06	1.44	0.24	
Nitrite (Total) (mg/L)	8	0	0.05	0.05	0.05	3.57E+14	0.13	
Nitrate + Nitrite (mg/L as N)	70	0	0.02	0.29	0.07	2.52	0.41	
Chlorophyll-*a* (ug/L)	68	2	3.03	41.60	12.25	2.17	0.90	
Pheophytin (ug/L)	24	0	4.54	38.10	8.55	1.81	0.14	

Lake Tyler

SEGMENT 0613 - LAKE TYLER/TYLER EAST

Monitoring Station 17929 - Lake Tyler East Upper Lake

Monitoring Station 17929 is located near the east shore on Lake Tyler East in the upper portion of the lake, southwest of SH 64. This station is monitored quarterly by TCEQ Region 5 for field parameters, conventional parameters, and *E. coli* , and annually for Metals in Sediment.

A decreasing trend for Total Phosphorus was identified but it is not considered statistically significant due to greater than fifty-percent of the observed values being censored values influenced by a change in LOQ.

There are no impairments or concerns listed for this assessment unit in the 2020 Texas Integrated Report.

Water Quality Monitoring Results for Station 17929

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	41	3	1.00	1400.00	5.44	0.90	0.47	
Water Temperature (C)	51	0	6.40	32.60	22.79	2.16	0.88	
Dissolved Oxygen (mg/L)	51	0	6.40	12.60	8.43	3.36	0.20	
pH (S.U.)	51	4	5.90	9.20	7.46	9.56	0.19	
Specific Conductance (us/cm @ 25C)	50	0	47.00	144.00	102.66	3.46	0.92	
Ammonia-Nitrogen (mg/L as N)	47	2	0.02	0.13	0.05	1.74	0.91	
Chloride (mg/L)	48	0	5.00	29.00	13.74	3.19	0.32	
Sulfate (mg/L)	48	0	4.90	18.00	9.02	0.03	0.09	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	43	0	0.22	0.91	0.57	2.28	0.58	
Total Phosphorus (mg/L as P)	43	0	0.02	0.08	0.04	8.63	0.00	
Total Suspended Solids (mg/L)	49	0	2.90	20.00	6.12	1.64	0.85	
Nitrate (Total) (mg/L)	5	0	0.05	0.05	0.05	1.62E+15	0.23	
Nitrite (Total) (mg/L)	5	0	0.05	0.05	0.05	1.62E+15	0.23	
Nitrate + Nitrite (mg/L as N)	49	1	0.02	0.42	0.07	0.54	0.88	
Chlorophyll-*a* (ug/L)	46	4	3.00	47.00	15.45	1.44	0.80	
Pheophytin (ug/L)	10	0	5.00	7.68	5.30	0.22	0.86	

Lake Tyler

SEGMENT 0613 - LAKE TYLER/TYLER EAST

Monitoring Station 14235 - Lake Tyler East Upper Lake

Monitoring Station 14253 is located near the east shore on Lake Tyler East in the upper portion of the lake, southwest of SH 64. This station is no longer being monitored.

There are no trends identified for this station.

There are no impairments or concerns listed for this assessment unit in the 2020 Texas Integrated Report.

Water Quality Monitoring Results for Station 14235

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	10	3	1.00	490.00	6.48	0.64	0.56	
Water Temperature (C)	16	0	6.20	32.60	21.51	0.39	0.97	
Dissolved Oxygen (mg/L)	16	0	6.60	10.50	8.26	1.34	0.80	
pH (S.U.)	15	0	6.50	7.80	7.13	2.60	0.67	
Specific Conductance (us/cm @ 25C)	15	0	62.00	121.00	89.67	1.28	0.64	
Ammonia-Nitrogen (mg/L as N)	15	2	0.05	0.16	0.06	-1.54	0.10	
Chloride (mg/L)	15	0	7.00	18.00	12.27	2.30	0.10	
Sulfate (mg/L)	15	0	6.00	14.00	7.87	2.87	0.03	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	13	0	0.48	0.78	0.62	3.85	0.02	
Total Phosphorus (mg/L as P)	14	0	0.05	0.08	0.06	2.84	0.05	
Total Suspended Solids (mg/L)	15	0	6.00	23.00	11.13	3.77	0.00	
Nitrate (Total) (mg/L)	3	0	0.05	0.12	0.07	2.29	0.27	
Nitrite (Total) (mg/L)	3	0	0.05	0.05	0.05	7.86E+13	0.27	
Nitrate + Nitrite (mg/L as N)	15	0	0.05	0.17	0.09	0.38	0.87	
Chlorophyll-*a* (ug/L)	15	0	10.00	20.50	13.07	-1.01	0.19	
Pheophytin (ug/L)	15	0	5.00	29.70	11.90	-1.99	0.05	

SUMMARY OF WATER QUALITY TRENDS

Trend Analysis Summary for Segment 0613 - Lake Tyler/Tyler East

AU	Station ID	Station Description	*E. coli*	Temp	DO	pH	Spec Cond	NH3	Cl	SO4	TKN	Total P	TSS	NO3	NO2	NO3/ NO2	Chl-*a*	Pheo
0613_01	10637	Lake Tyler Mid-Lake at Dam											↑					
0613_02	15210	Lake Tyler at Langley Island					↑		↑									
0613_03	10638	Lake Tyler East at Dam	*- No trends identified for this Assessment Unit -*															
0613_04	17929	Lake Tyler Upper Lake	*- No trends identified for this Assessment Unit -*															

↑ = Statistically significant increasing trend ↓ = Statistically significant decreasing trend

Summary of Water Quality Issues for Segment 0613-Lake Tyler/Tyler East

There are no impairments or concerns listed for this segment in the 2020 Texas Integrated Report.

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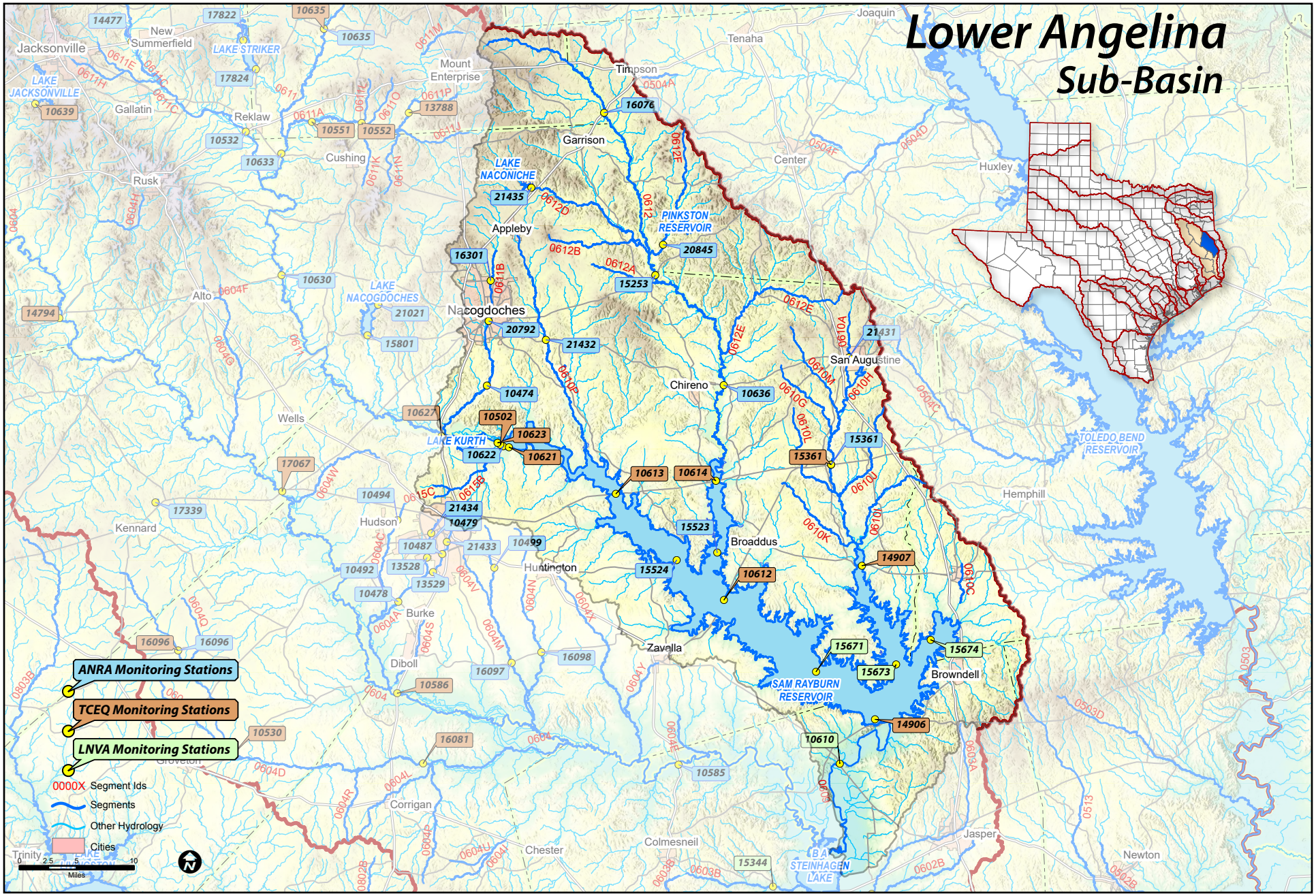
LOWER ANGELINA OVERVIEW MAP



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.

As of the 2010 census, there are an estimated 41,852 households, including 90,064 individuals residing within the sub-basin. The City of Nacogdoches is the largest city in the Lower Angelina Sub-Basin with a population of 32,996, is located almost entirely within the Lower Angelina 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.

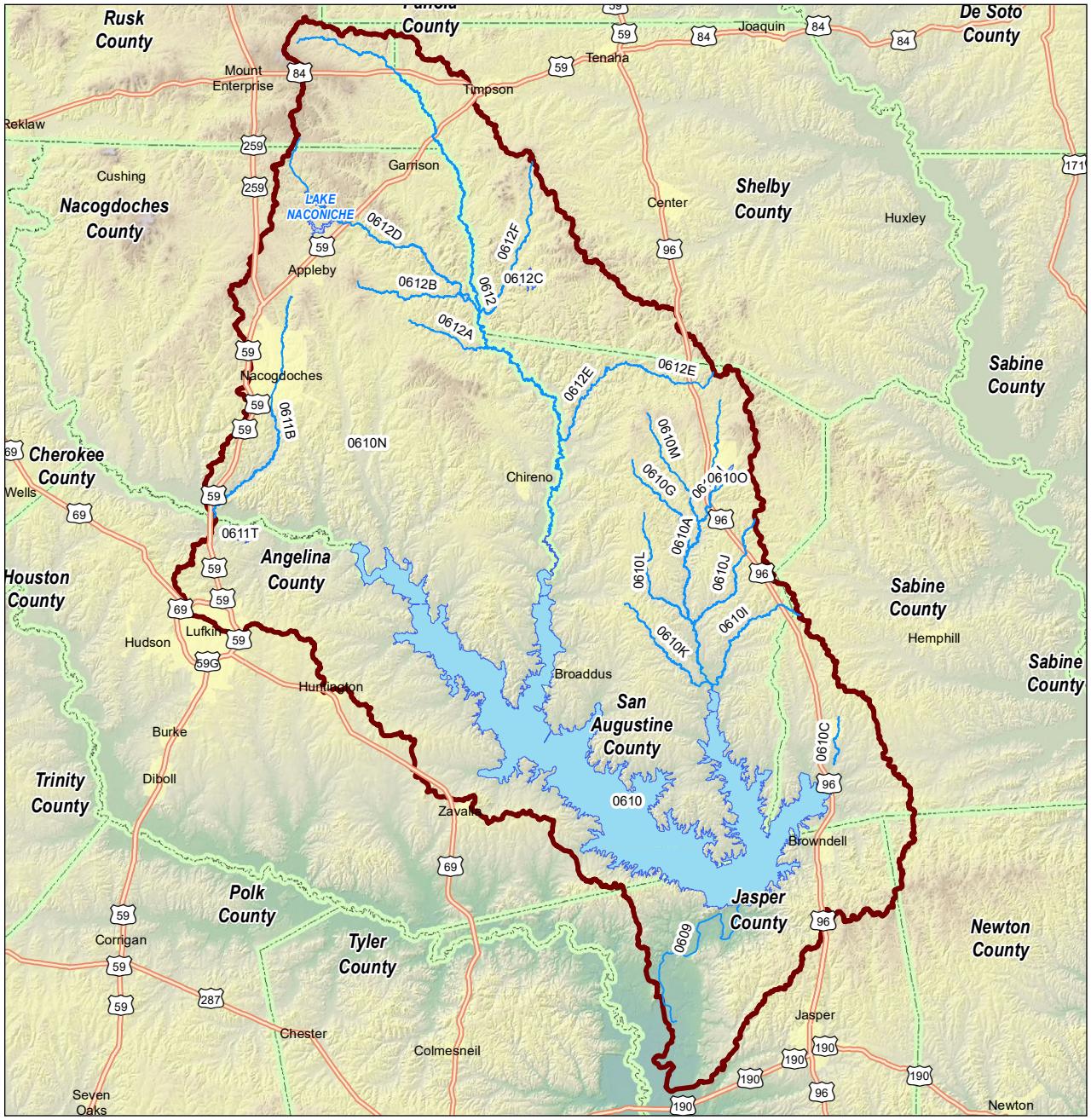
The area is very rural and heavily agricultural. Poultry and cattle operations are common within the Lower Angelina sub-basin, particularly in the Attoyac Bayou (Segment 0612) watershed.

Sam Rayburn Reservoir at Shirley Creek Boat Ramp

PROFILE OF THE LOWER ANGELINA SUB-BASIN

Segments in the Lower Angelina Sub-Basin

Segment ID	Segment Name
0609	Angelina River Below Sam Rayburn Reservoir
0610	Sam Rayburn Reservoir
0610A	Ayish Bayou (unclassified water body)
0610P	Bayou Carrizo (unclassified water body)
0611B	La Nana Bayou (unclassified water body)
0612	Attoyac Bayou
0612A	Terrapin Creek (unclassified water body)
0612B	Waffelow Creek (unclassified water body)
0612C	Pinkston Reservoir Unclassified water body)
0612D	Naconiche Creek (unclassified water body)
0612E	Big Iron Ore Creek (unclassified water body)
0612F	West Creek (unclassified water body)
0612G	Lake Naconiche (unclassified waterbody)
0615	Angelina River/Sam Rayburn Reservoir
0615A	Paper Mill Creek (unclassified water body)



PROFILE OF THE LOWER ANGELINA SUB-BASIN

Permitted Discharges in the Lower Angelina Sub-Basin

A total of thirty-three permitted discharges are within the Lower Angelina sub-basin.

First Segment in Drainage Path	Segment ID as identified in Permit	Permit Number	Outfall Number	NPDES Number	Permittee	County	TCEQ Region
0615B	0615	WQ0011620001	001	TX0056154	ANGELINA & NECHES RIVER AUTHORITY	ANGELINA	10 - Beaumont
0610	0610	WQ0011895001	001	TX0068039	TEXAS AIRSTREAM HARBOR INC	ANGELINA	10 - Beaumont
0615A	0610	WQ0000368000	001	TX0001643	VERDANT INDUSTRIES LLC	ANGELINA	10 - Beaumont
0615A	0610	WQ0000368000	002	TX0001643	VERDANT INDUSTRIES LLC	ANGELINA	10 - Beaumont
0615A	0610	WQ0000368000	004	TX0001643	VERDANT INDUSTRIES LLC	ANGELINA	10 - Beaumont
0610	0610	WQ0011772001	001	TX0057673	CITY OF BROADDUS	SAN AUGUSTINE	10 - Beaumont
0615A	0610	WQ0000368000	005	TX0001643	VERDANT INDUSTRIES LLC	ANGELINA	10 - Beaumont
0611B	0611	WQ0004198000	001	TX0121053	CAL-TEX LUMBER CO INC	NACOGDOCHES	10 - Beaumont
0610	0610	WQ0001820000	001	TX0046892	GEORGIA-PACIFIC WOOD PRODUCTS LLC	SABINE	10 - Beaumont
0610	0610	WQ0001820000	002	TX0046892	GEORGIA-PACIFIC WOOD PRODUCTS LLC	SABINE	10 - Beaumont
0610	0610	WQ0001820000	003	TX0046892	GEORGIA-PACIFIC WOOD PRODUCTS LLC	SABINE	10 - Beaumont
0612	0612	WQ0013917002	001	TX0137537	CHIRENO ISD	NACOGDOCHES	10 - Beaumont
0612A	0612	WQ0014027001	001	TX0118354	MARTINSVILLE ISD	NACOGDOCHES	10 - Beaumont
0610	0610	WQ0013092001	001	TX0099082	BROOKELAND ISD	SABINE	10 - Beaumont
0610	0610	WQ0013161001	001	TX0098744	STEPHEN F AUSTIN STATE UNIVERSITY	SAN AUGUSTINE	10 - Beaumont
0610A	0610	WQ0010268001	001	TX0022349	CITY OF SAN AUGUSTINE	SAN AUGUSTINE	10 - Beaumont
0610O	0610	WQ0010268002	001	TX0122351	CITY OF SAN AUGUSTINE	SAN AUGUSTINE	10 - Beaumont
0611B	0611	WQ0010342004	001	TX0055123	CITY OF NACOGDOCHES	NACOGDOCHES	10 - Beaumont
0610C	0610	WQ0010249001	001	TX0027154	CITY OF PINELAND	SABINE	10 - Beaumont
0610	0610	WQ0001820000	006	TX0046892	GEORGIA-PACIFIC WOOD PRODUCTS LLC	SABINE	10 - Beaumont
0615	0611	WQ0015021001	001	TX0133329	ANGELINA COUNTY WCID NO 3	ANGELINA	10 - Beaumont
0612C	0612	WQ0014352002	001	TX0133311	CITY OF CENTER	SHELBY	10 - Beaumont
0609	0609	WQ0010998001	001	TX0031283	BROOKELAND FWSD	JASPER	10 - Beaumont
0615	0615	WQ0005195000	001	TX0136964	BAILEY BARK MATERIALS INC	NACOGDOCHES	10 - Beaumont
0615	0615	WQ0005195000	002	TX0136964	BAILEY BARK MATERIALS INC	NACOGDOCHES	10 - Beaumont
0610	0610	WQ0011337001	001	TX0031275	WESTWOOD WSC	JASPER	10 - Beaumont
0615A	0615	WQ0011588001	001	TX0054127	OREAL INC	ANGELINA	10 - Beaumont
0610	0610	WQ0015207001	001	TX0135089	SHERRY SMITH MILNER	ANGELINA	10 - Beaumont
0610	0610	WQ0015339001	001	TX0136182	NEW WATER SUPPLY CORPORATION	SAN AUGUSTINE	10 - Beaumont
0610	0610	WQ0015357001	001	TX0136328	NEW WSC	SAN AUGUSTINE	10 - Beaumont
0612	0612	WQ0011304001	001	TX0076503	CITY OF GARRISON	NACOGDOCHES	10 - Beaumont
0610	0610	WQ0014345001	001	TX0134449	WODEN ISD	NACOGDOCHES	10 - Beaumont
0610	0610	WQ0010788001	001	TX0023701	RAYBURN COUNTRY MUD	JASPER	10 - Beaumont

PROFILE OF THE LOWER ANGELINA SUB-BASIN

Texas Surface Water Quality Standards for the Lower Angelina Sub-Basin
Site-Specific Uses and Numeric Criteria for Classified Segments in the Lower Angelina Sub-Basin

Segment ID	Segment Name	Recreation Use	Aquatic Life Use	Domestic Water Supply Use	Other Use	Chloride (mg/L)	Sulfate (mg/L)	TDS (mg/L)	Dissolved Oxygen (mg/L	pH Range (S.U.)	*E. coli* Bacteria #/100 mL	Temp (°F)
0609	Angelina River Below Sam Rayburn	PCR	H	PS		70	50	250	5.0	6.0 - 8.5	126	90
0610	Sam Rayburn Reservoir	PCR	H	PS		100	100	400	5.0	6.0 - 8.5	126	93
0611	Angelina River Above Sam Rayburn Reservoir	PCR	H	PS		125	50	250	5.0	6.0 - 8.5	126	90
0612	Attoyac Bayou	PCR	H	PS		75	50	200	5.0	6.0 - 8.5	126	90
0615	Angelina River/Sam Rayburn Reservoir	PCR	H	PS		150	100	500	5.0	6.5 - 9.0	126	93

PCR = Primary Contact Recreation SCR1 = Secondary Contact Recreation 1 SCR2 = Secondary Contact Recreation 2 NCR = Noncontact Recreation
H = High Aquatic Life Use I = Intermediate Aquatic Life Use PS = Public Supply
* The criteria for Chloride, Sulfate, and TDS are listed as the maximum annual averages for the segment. Dissolved Oxygen criteria are listed as minimum 24-hour means at any site within the segment. The pH criteria are listed as minimum and maximum values expressed in standard units at any site within the segment. The criteria for Temperature are listed as maximum values at any site within the segment.

Attoyac Bayou at FM 138

SEGMENT 0609 - ANGELINA RIVER BELOW SAM RAYBURN RESERVOIR

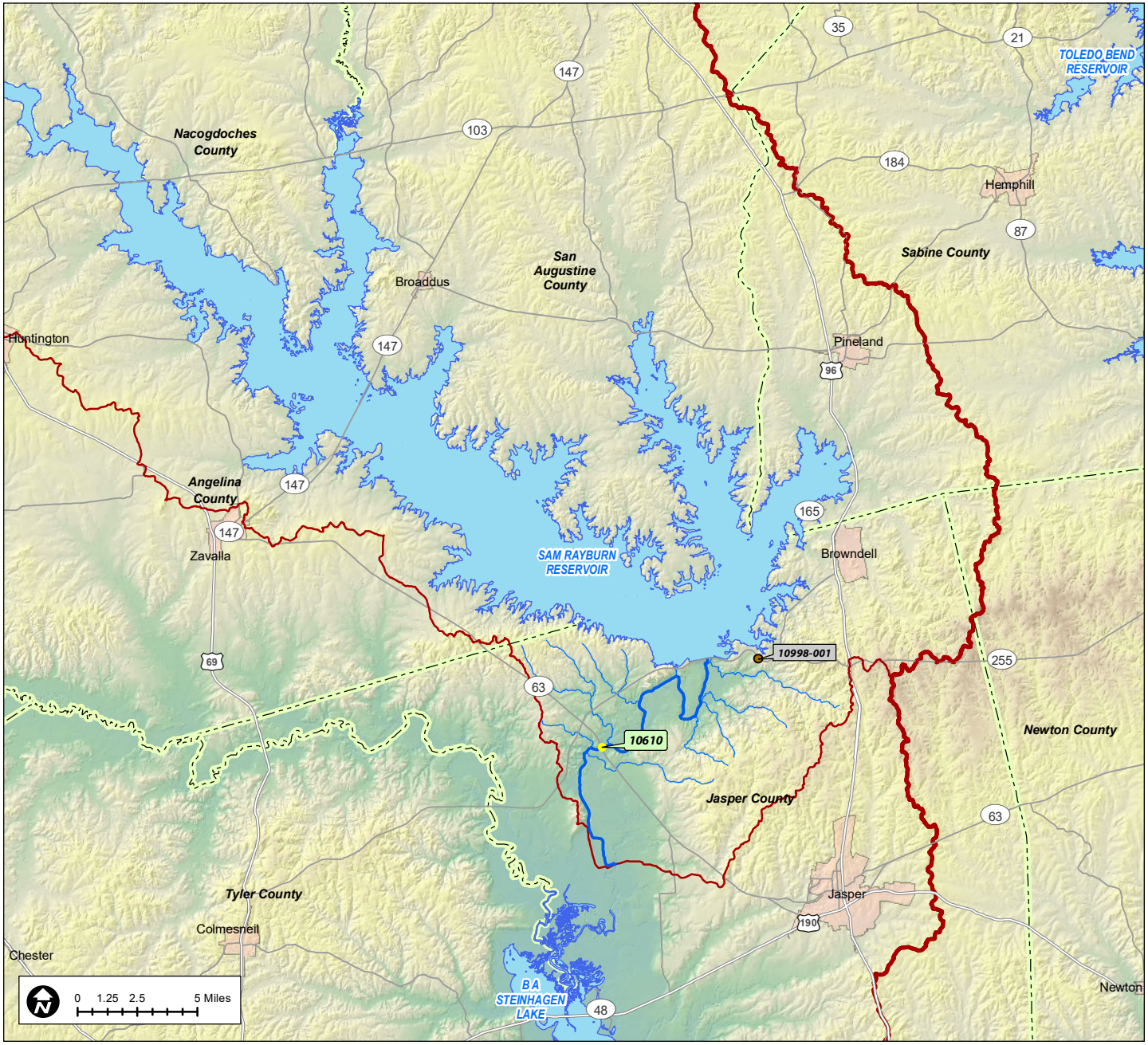
Segment Profile

The Angelina River below Sam Rayburn Reservoir stretches from a point immediately upstream of the confluence of Indian Creek in Jasper County to Sam Rayburn Dam in Jasper County.

There is one monitoring station on this segment (Monitoring Station 10610 - Angelina River at SH 63). Monitoring at this station is conducted quarterly by LNVA for conventional parameters, field parameters, flow, and *E. coli* bacteria.

There are impairments for Dioxin in edible tissue and Mercury in edible tissue listed for Segment 0609 in the 2020 Texas Integrated Report. No other impairments or concerns were identified for this segment.

For more information about this segment, please refer to the LNVA's 2020 Basin Summary Report.



ANRA Monitoring Sites
LNVA Monitoring Sites
TCEQ Monitoring Sites
Wastewater Outfalls
Classified Segments
Other Hydrology
Segment Watershed
Counties

SEGMENT 0610 - SAM RAYBURN RESERVOIR

Segment Profile

Sam Rayburn Reservoir includes the area 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/San Augustine County, up to the normal pool elevation of 164.4 feet (except on the Angelina River Arm). Sam Rayburn Reservoir impounds both the Angelina River and Attoyac Bayou.

Sam Rayburn Reservoir is designed for flood regulation and control, hydroelectric power generation, and water conservation for municipal, industrial, agricultural, and recreational purposes.

The Texas Department of State Health Services (DSHS) issued a fish consumption advisory for this water body in 2014, see page 305 for further details.

The designated uses are general use, high aquatic life use, public water supply use, primary 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.

- ANRA Monitoring Sites
- LNVA Monitoring Sites
- TCEQ Monitoring Sites
- Wastewater Outfalls
- Classified Segments
- Other Hydrology
- Segment Watershed
- Counties

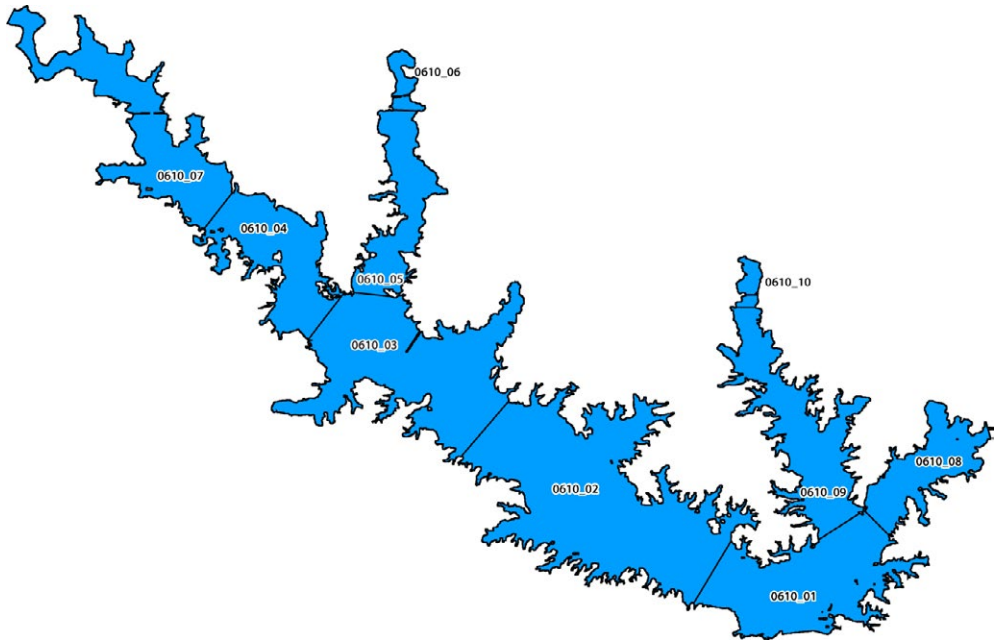
SEGMENT 0610 - SAM RAYBURN RESERVOIR

In the 2020 Texas Integrated Report, all assessment units of Sam Rayburn Reservoir are listed as having a concern for Mercury and Dioxin in edible tissue.

Concerns for Iron in sediment, Manganese in sediment, and Mercury in edible tissue have also been listed for all assessment units of the reservoir.

Assessment Units in the Sam Rayburn Reservoir (Segment 0610)

AU ID	Description
0610_01	Sam Rayburn main pool by the dam to the Bear Creek and Ayish Arms
0610_02	Sam Rayburn lower Angelina River arm
0610_03	Sam Rayburn mid-Angelina River arm (area around SH 147)
0610_04	Sam Rayburn upper mid-Angelina River arm
0610_05	Sam Rayburn lower Attoyac Bayou arm
0610_06	Sam Rayburn upper Attoyac Bayou arm
0610_07	Sam Rayburn upper Angelina arm
0610_08	Sam Rayburn Bear Creek arm
0610_09	Sam Rayburn lower Ayish Bayou arm
0610_10	Sam Rayburn upper Ayish Bayou arm



Sam Rayburn Reservoir at Shirley Creek Boat Ramp

SEGMENT 0610 - SAM RAYBURN RESERVOIR

Designated Use Criteria

Sam Rayburn Reservoir has a designated Public Water Supply use and a High ALU and corresponding DO criteria. Sam Rayburn Reservoir also has a designated primary contact recreation use with a corresponding *E. coli* geometric mean criteria of 126 MPN/100 mL.

Monitoring Stations

Station ID	AU ID	Description	Earliest Data	Latest Data	Notes
14906	0610_01	SAM RAYBURN RESERVOIR AT MAIN POOL APPROXIMATELY 0.70 KM NORTH OF THE POWER PLANT INTAKE AT REC RD 255/ANGELINA RIVER	1995	2019	Monitored continuously since 1995.
15671	0610_02	SAM RAYBURN RESERVOIR USGS SITE FC 7.21 KM SOUTHWEST OF FM 3173/FM 705 INTERSECTION	1994	2018	Monitored 1994-1999, 2008-2010, 2012- present.
15670	0610_02	SAM RAYBURN RESERVOIR USGS SITE GC 9.84 KM SOUTHEAST OF SH 147 6.56 KM NORTHEAST OF FM 2743/ FM 3373 INTERSECTION	1994	2018	Monitored 1994-1999, 2008-2010, 2012- 2018..
10612	0610_03	SAM RAYBURN RESERVOIR AT SH 147 BRIDGE 9.75 KM SOUTHWEST OF BROADDUS AND 12.4 KM NORTHEAST OF ZAVALLA	1969	2019	Monitored 1969-1989, 1991- present.
15524	0610_04	SAM RAYBURN RESERVOIR NEAR SHIRLEY CREEK IN THE ANGELINA RIVER CHANNEL 5.13 KM NE OF FM 2109/ FM 2801 INTERSECTION	1995	2019	Monitored 1995-1996, 2001- present.
15523	0610_05	SAM RAYBURN RESERVOIR ADJACENT TO ALLIGATOR COVE IN THE ATTOYAC RIVER CHANNEL 3.94 KM NORTHWEST OF FM 3185/ SH 147 INTERSECTION	1995	2019	Monitored 1995-1996, 2001-2007, 2010- present.
10614	0610_06	SAM RAYBURN RESERVOIR WEST SHORE AT SH 103 6.6 MILES EAST OF ETOILE	1986	2019	Monitored 1986-1987, 1996-1997, 1999- present.
10615	0610_07	SAM RAYBURN RESERVOIR AT MARIONS FERRY 3.08 KM NORTH OF FM 1669/ SH 103 INTERSECTION	1986	2011	Monitored 1986-1987, 1995-1996, 1999-2011. This station is no longer being monitored.
21100	0610_07	SAM RAYBURN RESERVOIR ON ANGELINA RIVER CHANNEL 0.75 KM DOWNSTREAM OF MARIONS FERRY BOAT RAMP 4.2 KM NORTH AND 2.2 KM EAST OF FM 1669/ SH 103 INTERSECTION NEAR LUFKIN	2012	2018	This station is no longer being monitored. IT was discontinued due to budget concerns and was comparable to Station 10613, located in the same AU.
10613	0610_07	SAM RAYBURN RESERVOIR AT SH 103 3.73 KM WEST-SOUTHWEST OF ETOILE	1969	2019	Monitored continuously since 1969.
15674	0610_08	SAM RAYBURN RESERVOIR USGS SITE LC 1.7 KM NORTHWEST OF MILL CREEK PARK SWIMMING AREA 3.96 KM NW OF ST LOOP 149/ US 96 INTERSECTION	1994	2018	Monitored 1994-1999, 2008-2010, 2012-2018. This station is no longer being monitored.
15673	0610_09	SAM RAYBURN RESERVOIR USGS SITE AC 2.5 KM EAST NORTHEAST OF FM 705/FM 3127 INTERSECTION	1994	2018	Monitored from 1994-1999, 2008-2010, 2012-2018. This station is no longer being monitored.
15675	0610_09	SAM RAYBURN RESERVOIR USGS SITE MC 4.86 KM EAST NORTHEAST OF FM 3173/FM 705 INTERSECTION 8.8 KM DOWNSTREAM OF FM 83	1994	2018	Monitored 1994-1999, 2006-2010, 2012-2018.
14907	0610_10	SAM RAYBURN RESERVOIR AT FM 83 BRIDGE CROSSING 13.5 KM WEST OF PINELAND	1995	2019	Monitored 1995-1997, 1999-2019.

The water quality monitoring results for Sam Rayburn Reservoir are presented in this report by assessment unit. The assessment units are not presented in numerical order, but are presented beginning upstream and following the path of the Angelina River down to the dam. As the Attoyac Bayou and Ayish Bayou arms are reached, they will be discussed, followed by the Bear Creek arm, with the Main Pool presented last.

SEGMENT 0610 - SAM RAYBURN RESERVOIR

Assessment Summary ***(As reported in the 2020 Texas Integrated Report)***

Parameter	Standard	0610_01 Assessment	0610_02 Assessment	0610_03 Assessment	0610_04 Assessment	0610_05 Assessment	0610_06 Assessment	0610_07 Assessment	0610_08 Assessment	0610_09 Assessment	0610_10 Assessment
Chloride (mg/L)	100	FS	FS	FS	FS	FS	FS	FS	FS	FS	FS
Sulfate (mg/L)	100	FS	FS	FS	FS	FS	FS	FS	FS	FS	FS
TDS (mg/L)	400	FS	FS	FS	FS	FS	FS	FS	FS	FS	FS
DO Grab Screening Level (mg/L)	5.00	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
DO Grab Minimum (mg/L)	3.00	FS	FS	FS	FS	FS	FS	FS	FS	FS	FS
24 Hour DO Average (mg/L)	5.00	- No data collected for this parameter duing the assessment period -									
24 Hour DO Minimum (mg/L)	3.00	- No data collected for this parameter duing the assessment period -									
pH (SU)	6.0 - 8.5	FS	FS	FS	FS	FS	FS	FS	FS	FS	FS
Temp (C)	33.9	FS	FS	FS	FS	FS	FS	FS	FS	FS	FS
E. coli geomean (MPN/100mL)	126	FS	FS	FS	FS	FS	FS	FS	FS	FS	FS
Ammonia Nitrogen (mg/L)	0.11	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nitrate Nitrogen (mg/L)	0.37	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Total Phosphorus (mg/L)	0.20	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Chl-*a* (µg/L)	26.7	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Mercury in Edible Tissue		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Dioxin in Edible Tissue		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Iron in Sediment		CS	CS	CS	CS	CS	CS	CS	CS	CS	CS
Manganese in Sediment		CS	CS	CS	CS	CS	CS	CS	CS	CS	CS

FS = Fully Supporting NC = No Concern CN = Concern for Near Non-Attainment CS = Concern for Screening Level NS = Not Supporting NA = Not Assessed

SEGMENT 0610 - SAM RAYBURN RESERVOIR

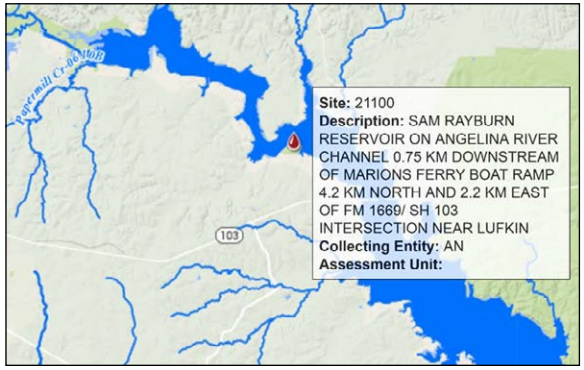
Monitoring Station 21100 - Sam Rayburn Reservoir on Angelina River Channel Downstream of Marion's Ferry Boat Ramp

Monitoring Station 21100 is located in AU 0610_07. Prior to the drought in 2011, ANRA monitored this assessment unit at Monitoring Station 10615, which is located near the boat ramp at Marion's Ferry. Due to drought conditions, it was necessary to relocate monitoring, as the site was no longer accessible as the reservoir levels dropped. In FY 2012, a new monitoring site (21100) was created three quarters of a kilometer downstream of the boat ramp on the main river channel. Since 2018, this station is no longer being monitored.

There is less than 10 years of data for this site, data was combined for stations 10615 and 21100 for analytical purposes since the data was comparable between the sites. In 2018, TCEQ discontinued this site because 10613 is representative of this AU.

Analysis shows significant decreasing trends for Specific Conductance, pH, Sulfate, and Total Phosphorus. There was a trend observed for Nitrite that is not considered to be statistically significant due to having less than 19 observations.

Assessment unit 0610_07 is listed in the 2020 Texas Integrated Report with impairments for Dioxin and Mercury in edible tissue. There are also concerns for screening levels listed for Iron and manganese in sediment..



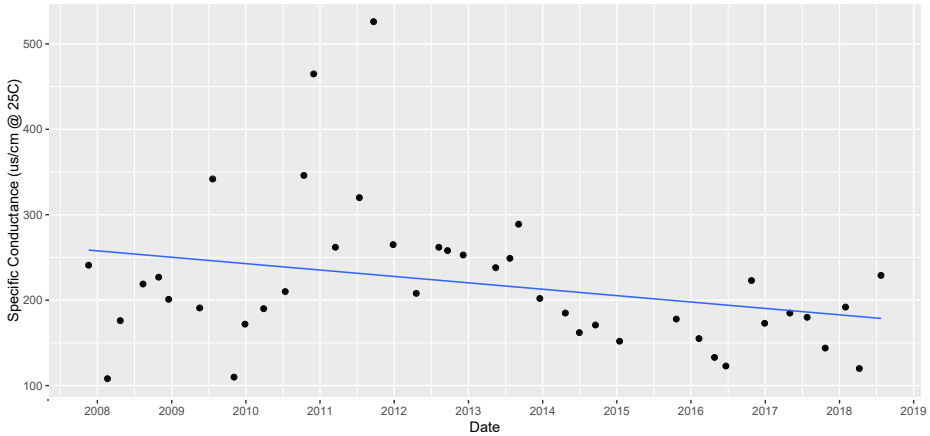
Water Quality Monitoring Results for Stations 21100+10615

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	42	4	1	980	11.11	1.85	0.10	
Water Temperature (C)	40	0	6.2	32.2	20.70	0.85	0.69	
Dissolved Oxygen (mg/L)	41	1	1.4	10.4	7.01	2.41	0.43	
pH (S.U.)	40	1	5.2	8.0	7.08	7.76	0.06	↓
Specific Conductance (us/cm @ 25C)	42	0	108	526	219.88	3.16	0.07	↓
Ammonia-Nitrogen (mg/L as N)	42	0	0.1	0.28	0.11	2.89	0.14	
Chloride (mg/L)	42	0	5	79	23.24	1.87	0.37	
Sulfate (mg/L)	42	0	11	94.7	28.50	3.69	0.01	↓
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	Parameter not collected for this station							
Total Phosphorus (mg/L as P)	41	0	0.02	0.57	0.14	3.78	0.00	↓
Total Suspended Solids (mg/L)	42	0	3.2	89	20.89	2.23	0.10	
Nitrate (Total) (mg/L)	12	0	0.05	0.19	0.09	0.50	0.71	
Nitrite (Total) (mg/L)	12	0	0.05	0.05	0.05	3.58E+14	0.06	
Nitrate + Nitrite (mg/L as N)	42	0	0.02	0.68	0.10	0.74	0.24	
Chlorophyll-*a* (ug/L)	41	0	2.0	61.3	16.85	0.71	0.88	
Pheophytin (ug/L)	41	0	2	37.1	6.64	1.91	0.16	

21100 - Sam Rayburn Reservoir on Angelina River Channel Downstream of Marion's Ferry Boat Ramp

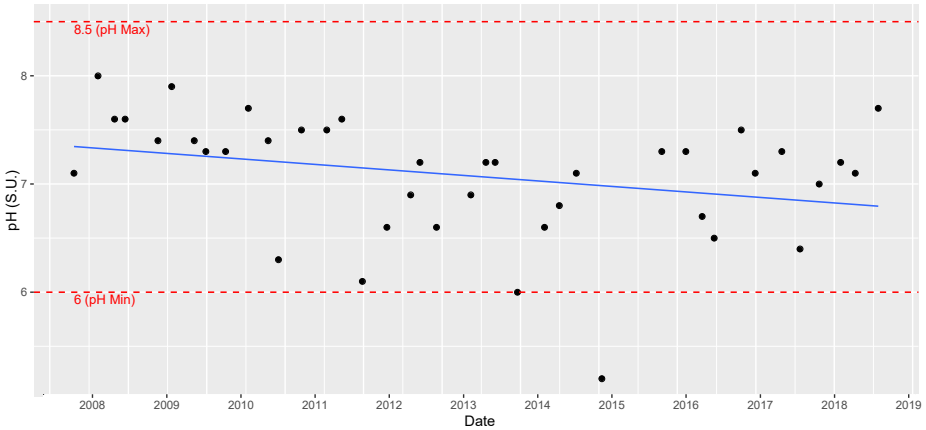
SAM RAYBURN RESERVOIR DOWNSTREAM OF MARRION'S FERRY BOAT RAMP

*#Obs= 42 | p−value= 0.067 | t−stat= 3.162 | R Sq= 0.082 | Adj R Sq= 0.059 | y = −2.37e−07 * x + 542*



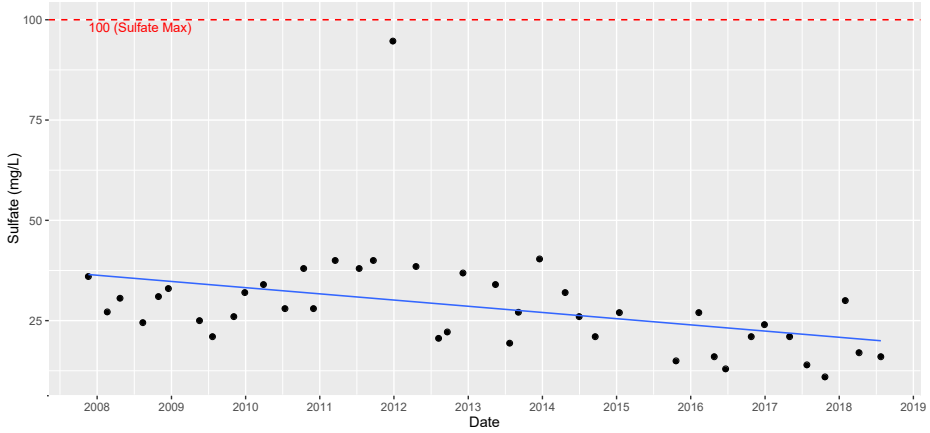
SAM RAYBURN RESERVOIR DOWNSTREAM OF MARRION'S FERRY BOAT RAMP

*#Obs= 40 | p−value= 0.061 | t−stat= 7.763 | R Sq= 0.089 | Adj R Sq= 0.065 | y = −1.7e−09 * x + 9.41*



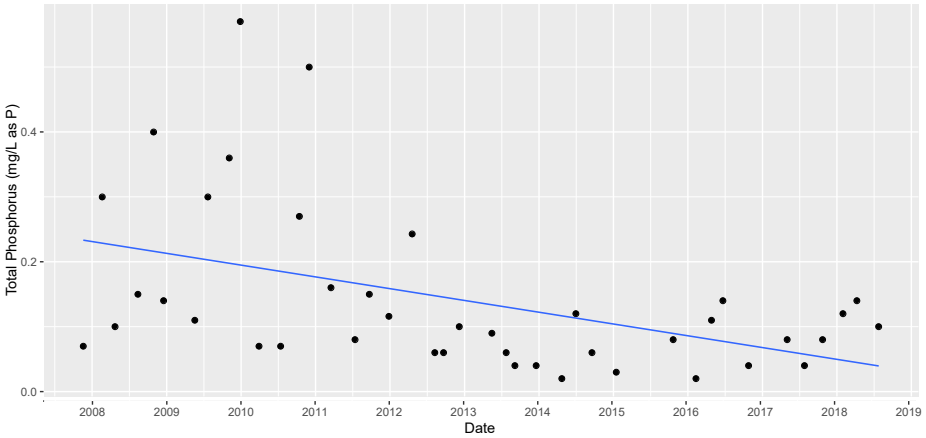
SAM RAYBURN RESERVOIR DOWNSTREAM OF MARRION'S FERRY BOAT RAMP

*#Obs= 42 | p−value= 0.013 | t−stat= 3.691 | R Sq= 0.144 | Adj R Sq= 0.122 | y = −4.9e−08 * x + 95.1*



SAM RAYBURN RESERVOIR DOWNSTREAM OF MARRION'S FERRY BOAT RAMP

*#Obs= 41 | p−value= 0.003 | t−stat= 3.777 | R Sq= 0.209 | Adj R Sq= 0.188 | y = −5.75e−10 * x + 0.92*



SEGMENT 0610 - SAM RAYBURN RESERVOIR

Monitoring Station 10613 - Sam Rayburn Reservoir at SH 103 3.73 km West-Southwest Of Etoile

Monitoring Station 10613 is located in AU 0610_07. Monitoring is conducted at this station quarterly by the TCEQ Region 10 field office for field parameters, conventional parameters, and *E. coli* bacteria. In the past, this station has also been monitored for metals in water and metals in sediment.

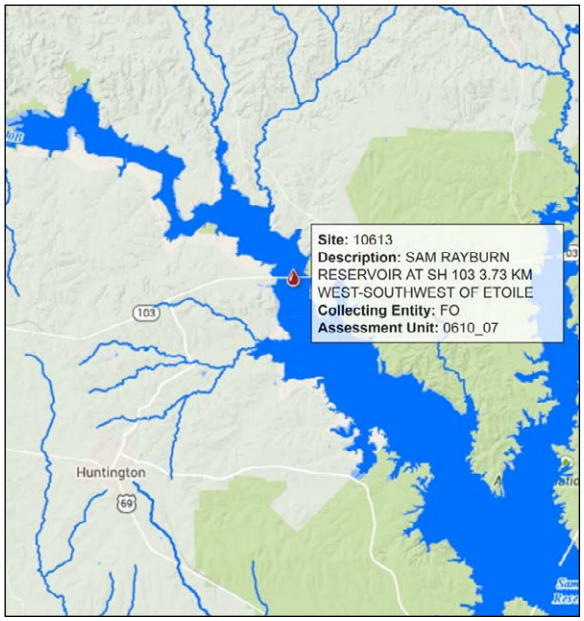
Analysis shows statistically significant decreasing trends for Specific Conductance, Chloride, Sulfate and Total Phosphorus.

There are elevated pH levels on the Angelina arm of Sam Rayburn Reservoir from the 103 bridge south. The cause for the elvated pH levels is unknown.

Assessment unit 0610_07 is listed in the 2020 Texas Integrated Report with impairments for Dioxin and Mercury in edible tissue. There are also concerns for screening levels listed for Iron and manganese in sediment.

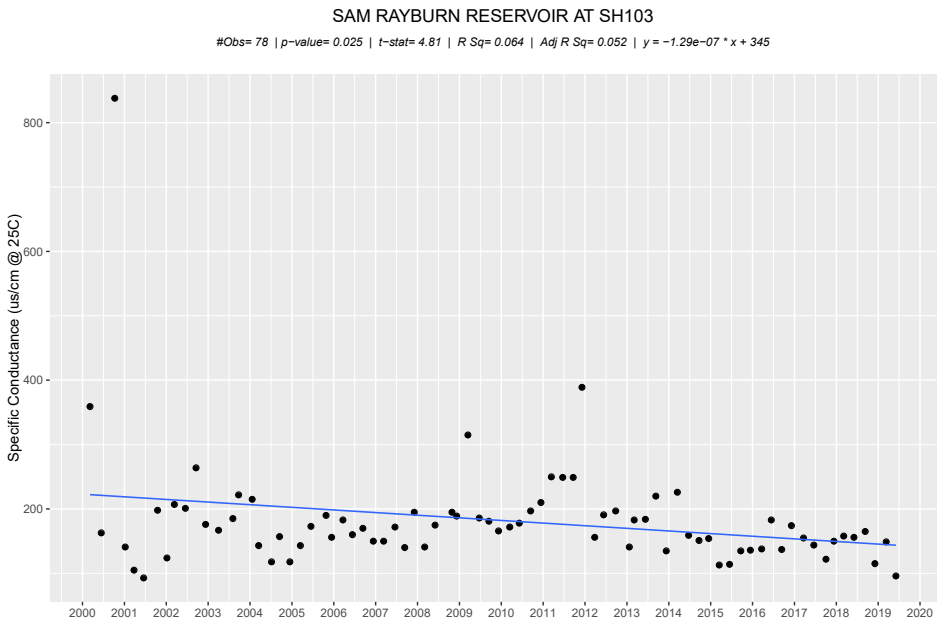
Water Quality Monitoring Results for Station 10613

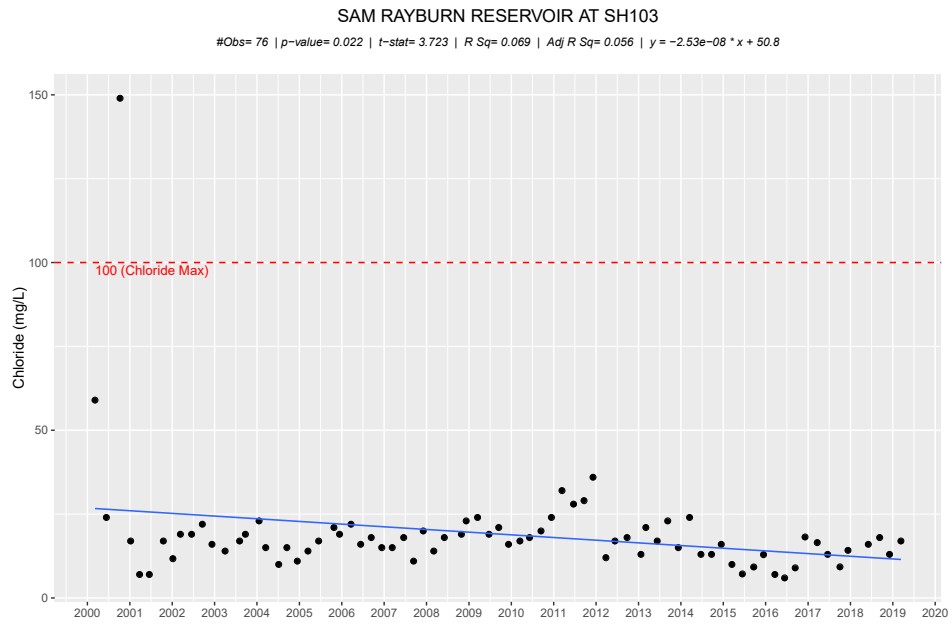
Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	66	3	1.00	260.00	4.45	1.06	0.50	
Water Temperature (C)	78	0	7.10	32.70	21.39	2.16	0.28	
Dissolved Oxygen (mg/L)	78	0	4.50	11.90	8.67	5.88	0.37	
pH (S.U.)	78	4	6.40	9.10	7.52	14.67	0.53	
Specific Conductance (us/cm @ 25C)	78	0	93.00	838.00	182.76	4.81	0.02	↓
Ammonia-Nitrogen (mg/L as N)	74	2	0.02	0.31	0.05	2.12	0.74	
Chloride (mg/L)	76	1	6.00	149.00	19.13	3.72	0.02	↓
Sulfate (mg/L)	76	0	9.00	78.00	24.67	4.99	0.02	↓
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	71	0	0.39	1.40	0.78	4.52	0.84	
Total Phosphorus (mg/L as P)	71	1	0.02	0.22	0.08	4.54	0.04	↓
Total Suspended Solids (mg/L)	75	0	1.00	41.00	11.49	0.74	0.28	
Nitrate (Total) (mg/L)	10	0	0.01	0.20	0.07	1.74	0.22	
Nitrite (Total) (mg/L)	10	0	0.01	0.05	0.05	22.23	0.00	
Nitrate + Nitrite (mg/L as N)	75	1	0.02	0.39	0.07	2.75	0.18	
Chlorophyll-*a* (ug/L)	72	14	1.42	57.90	18.27	0.17	0.12	
Pheophytin (ug/L)	24	0	0.79	57.90	14.60	0.02	0.84	

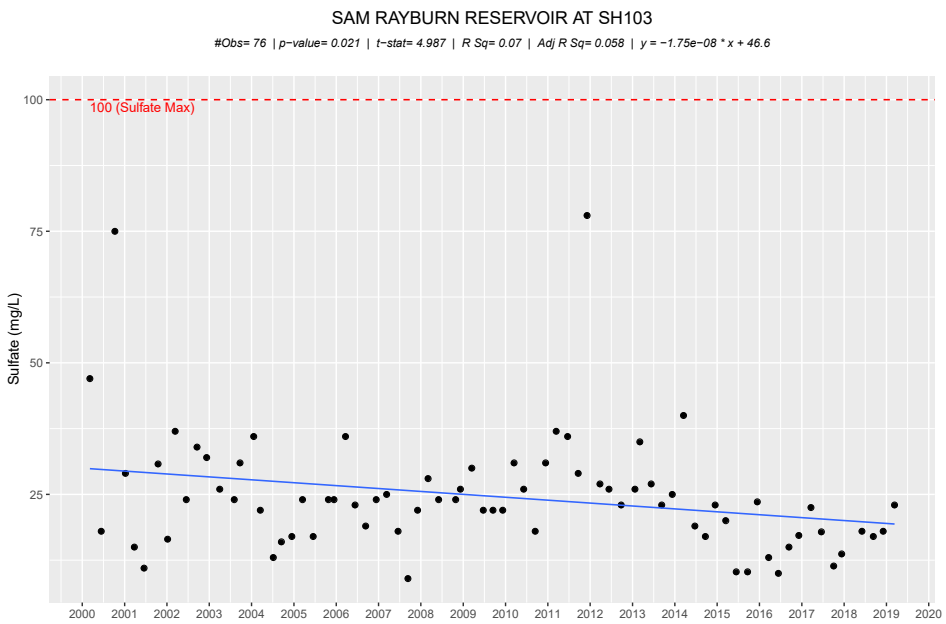


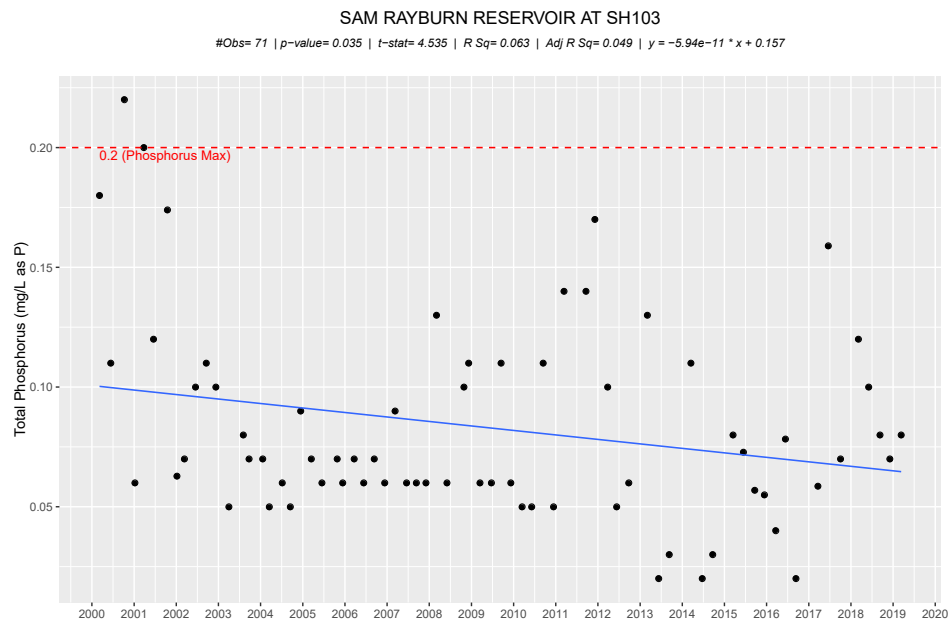
Sam Rayburn Reservoir

SEGMENT 0610 - SAM RAYBURN RESERVOIR









SEGMENT 0610 - SAM RAYBURN RESERVOIR

Monitoring Station 15524 - Sam Rayburn Reservoir Near Shirley Creek

Monitoring Station 15524 is located in assessment unit AU 0610_04 (upper mid-Angelina River arm). ANRA monitors this station quarterly for field parameters, conventional parameters, and *E. coli* bacteria.

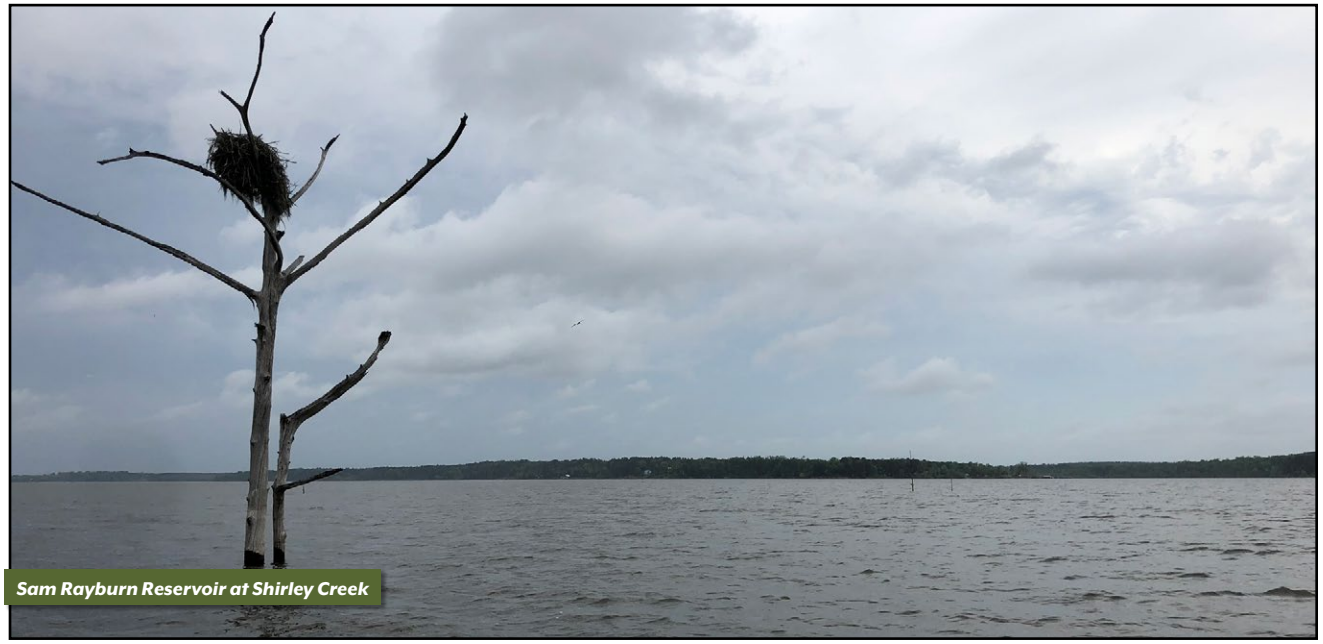
Analysis shows statistically significant increasing trends for Dissolved Oxygen, Specific Conductance, and pH. There are statistically significant decreasing trends observed for Chloride, Sulfate and Pheophytin.

Decreasing trends observed for Nitrate+Nitrite, Total Phosphorus, and Ammonia-Nitrogen are not considered to be statistically significant due to having greater than fifty-percent censored values.

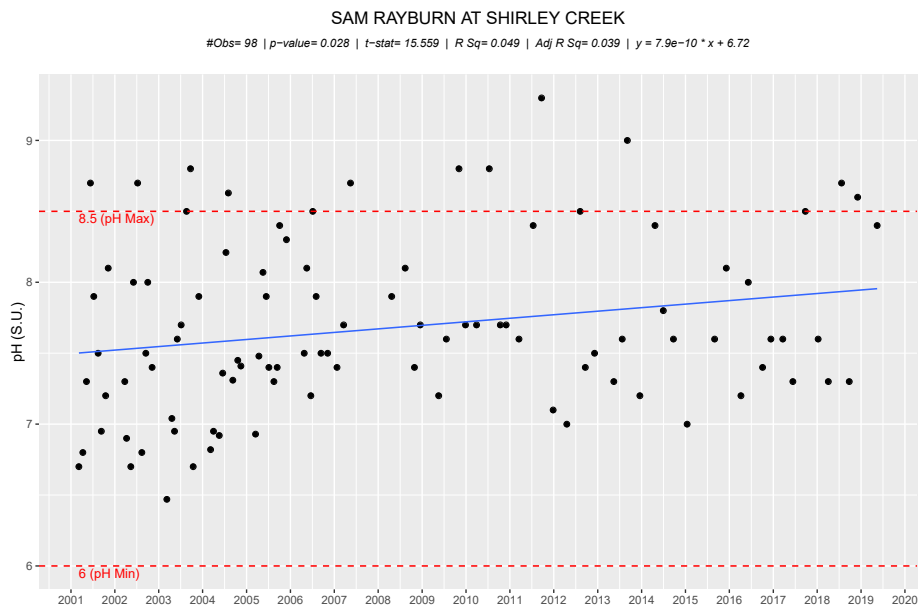
This assessment unit is listed in the 2020 Texas Integrated Report as impaired for Mercury and Dioxin in edible issue. It is also listed with concerns with screening levels of Manganese and Iron in sediment.

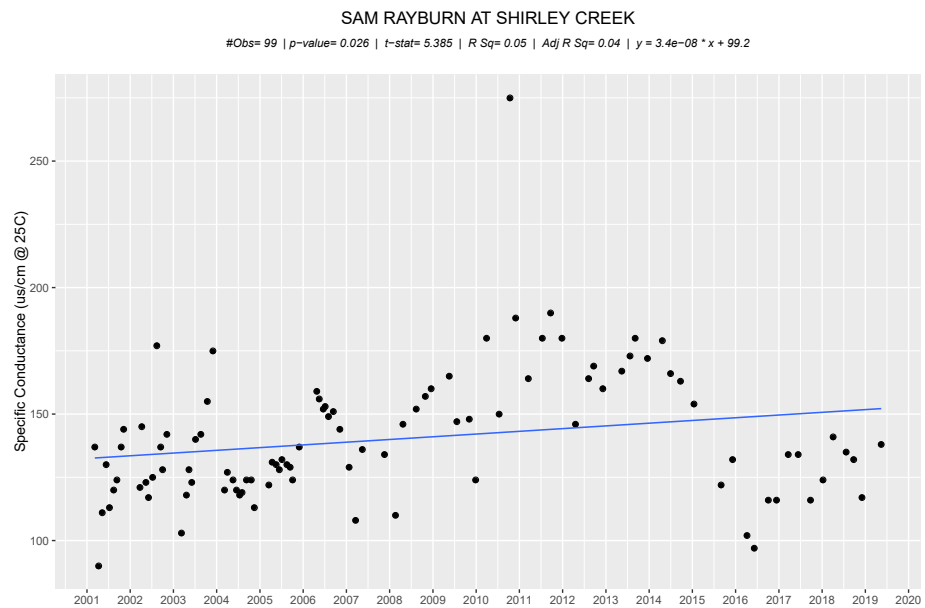
Water Quality Monitoring Results for Station 15524

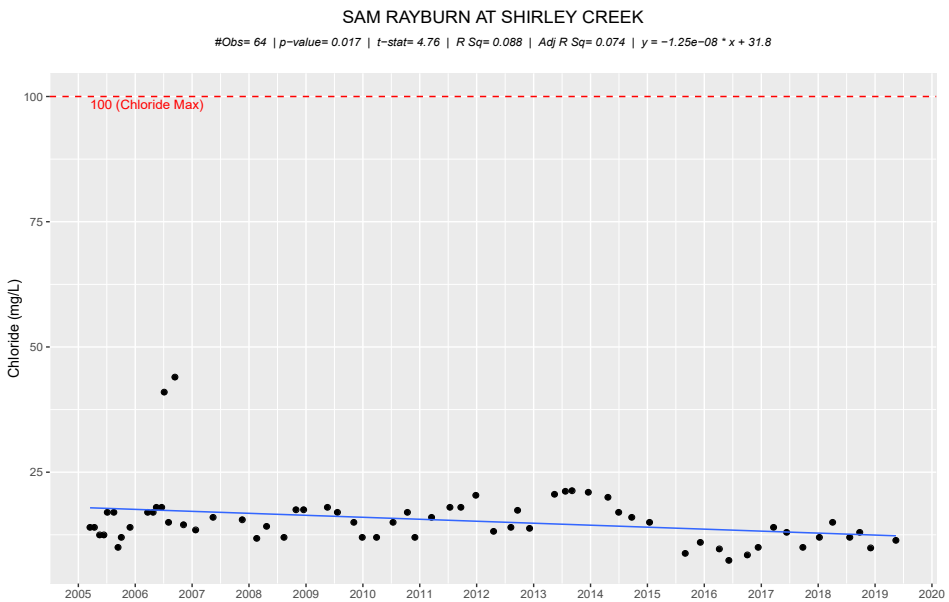
Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	101	0	1.00	62.00	1.54	1.68	0.27	
Water Temperature (C)	98	0	8.20	31.90	23.15	6.25	0.15	
Dissolved Oxygen (mg/L)	99	0	4.60	13.60	8.52	5.94	0.06	↑
pH (S.U.)	98	11	6.47	9.30	7.68	15.56	0.03	↑
Specific Conductance (us/cm @ 25C)	99	0	90.00	275.00	140.33	5.39	0.03	↑
Ammonia-Nitrogen (mg/L as N)	100	39	0.01	0.56	0.16	4.32	0.02	
Chloride (mg/L)	64	0	7.40	44.00	15.50	4.76	0.02	↓
Sulfate (mg/L)	65	0	11.00	38.30	22.74	7.10	0.00	↓
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	parameter not collected for this station							
Total Phosphorus (mg/L as P)	101	11	0.02	3.90	0.13	2.58	0.04	
Total Suspended Solids (mg/L)	65	0	1.67	19.00	4.95	2.24	0.59	
Nitrate (Total) (mg/L)	15	0	0.05	0.10	0.05	-1.18	0.14	
Nitrite (Total) (mg/L)	15	0	0.05	0.05	0.05	8.15E+14	0.06	
Nitrate + Nitrite (mg/L as N)	101	18	0.02	2.00	0.20	6.05	0.00	
Chlorophyll-*a* (ug/L)	68	8	5.00	53.70	19.06	1.62	0.85	
Pheophytin (ug/L)	51	0	2.00	16.80	4.37	2.74	0.09	↓

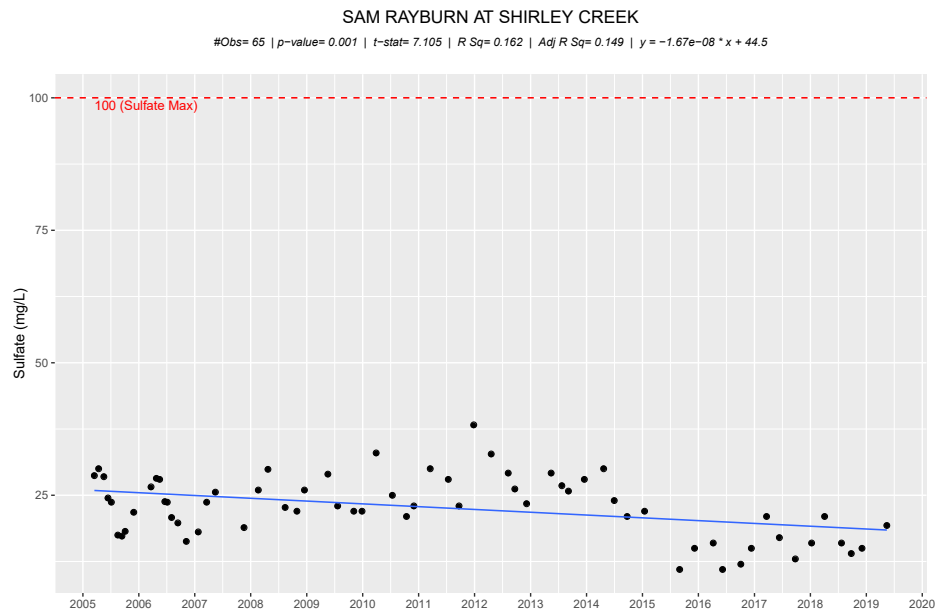


Sam Rayburn Reservoir at Shirley Creek

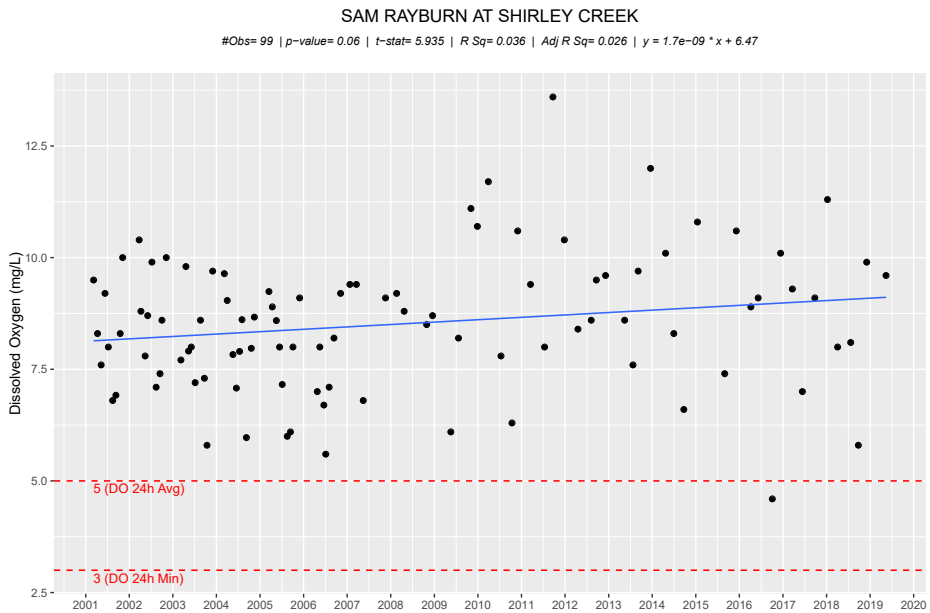

SAM RAYBURN AT SHIRLEY CREEK
#Obs= 98 | p−value= 0.028 | t−stat= 15.559 | R Sq= 0.049 | Adj R Sq= 0.039 | y = 7.9e−10 * x + 6.72
pH (S.U.)
8.5 (pH Max)
6 (pH Min)

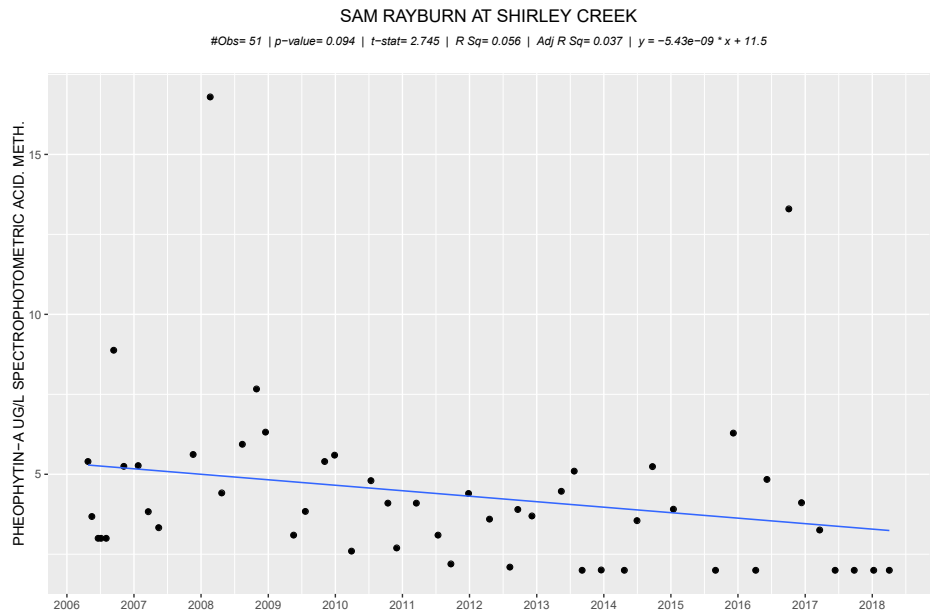

SAM RAYBURN AT SHIRLEY CREEK
#Obs= 99 | p−value= 0.026 | t−stat= 5.385 | R Sq= 0.05 | Adj R Sq= 0.04 | y = 3.4e−08 * x + 99.2
Specific Conductance (us/cm @ 25C)


SAM RAYBURN AT SHIRLEY CREEK
#Obs= 64 | p−value= 0.017 | t−stat= 4.76 | R Sq= 0.088 | Adj R Sq= 0.074 | y = −1.25e−08 * x + 31.8
Chloride (mg/L)
100 (Chloride Max)


SAM RAYBURN AT SHIRLEY CREEK
#Obs= 65 | p−value= 0.001 | t−stat= 7.105 | R Sq= 0.162 | Adj R Sq= 0.149 | y = −1.67e−08 * x + 44.5
Sulfate (mg/L)
100 (Sulfate Max)

SEGMENT 0610 - SAM RAYBURN RESERVOIR





15524 - CRP monitoring event, Sam Rayburn Reservoir at Shirley Creek

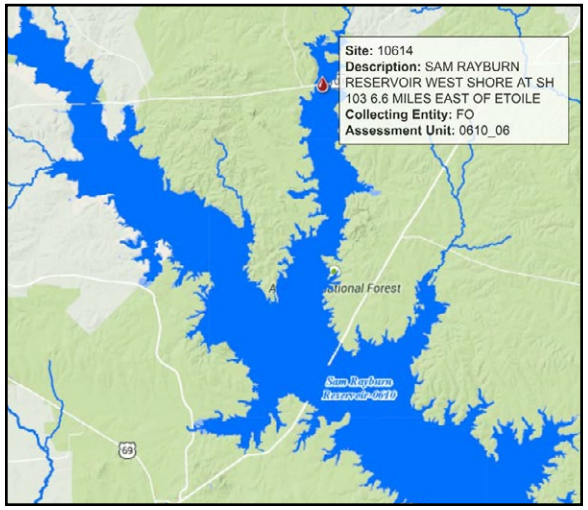
SEGMENT 0610 - SAM RAYBURN RESERVOIR

Monitoring Station 10614 - Sam Rayburn Reservoir West Shore at SH 103 East of Etoile

Monitoring Station 10614 is located in assessment unit AU 0610_06 (Upper Attoyac Bayou arm). Monitoring is conducted at this station quarterly by the TCEQ Region 10 field office for field parameters, conventional parameters, and *E. coli* bacteria. AU 0610_06 includes 1.8 sq miles of reservoir surface. It begins approximately at the confluence of the Attoyac Bayou and Granberry Branch, 5.1 miles north of the SH 103 crossing and ends approximately 0.75 miles downstream of the SH 103 crossing. Its primary inflow is the Attoyac Bayou. It includes the SH 103 crossing, one active monitoring station, and has two previously permitted Municipal Solid Waste sites in its drainage area.

There is a statistically significant increasing trend observed for Specific Conductance as well as a decreasing trend for Nitrate+Nitrite identified for this station. No causes for these trends have been identified.

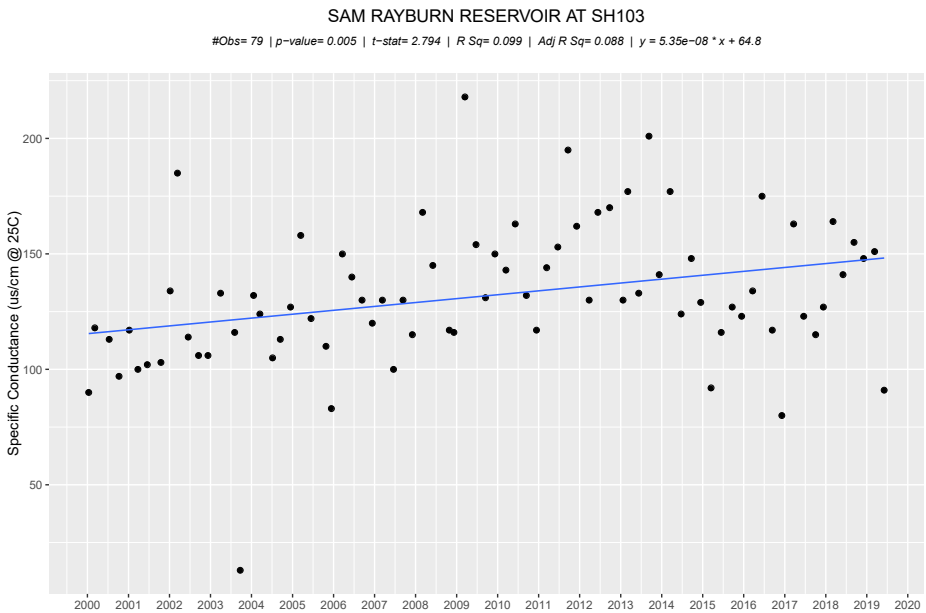
In the 2020 Texas Integrated Report, this assessment unit is listed as impaired for mercury and dioxin in edible tissue. There are also concerns for screening levels listed for iron and manganese in sediment, as well as mercury in edible tissue.

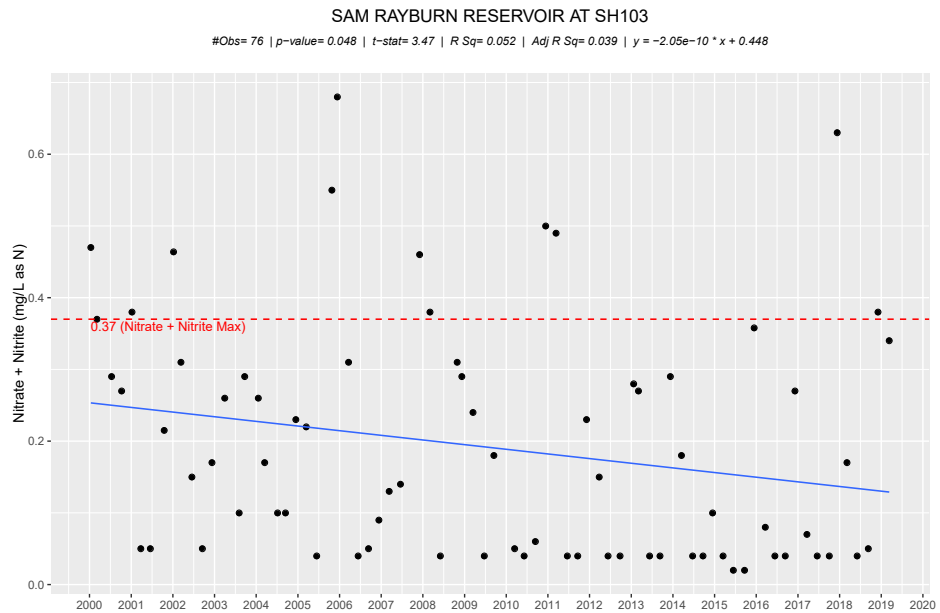


Water Quality Monitoring Results for Station 10614

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	67	9	2.00	4800.00	28.50	-0.01	0.73	
Water Temperature (C)	79	0	6.30	32.40	20.56	1.83	0.19	
Dissolved Oxygen (mg/L)	79	0	3.80	11.20	7.77	7.07	0.44	
pH (S.U.)	79	0	6.40	8.30	7.23	19.51	0.27	
Specific Conductance (us/cm @ 25C)	79	0	13.00	218.00	131.82	2.79	0.00	↑
Secchi Transparency (Meters)	79	0	0.10	1.00	0.49	2.51	0.62	
Ammonia-Nitrogen (mg/L as N)	74	1	0.02	0.19	0.05	4.33	0.21	
Chloride (mg/L)	77	0	5.00	21.00	10.27	4.17	0.95	
Sulfate (mg/L)	77	0	6.00	33.00	16.12	2.91	0.84	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	70	0	0.29	1.14	0.72	3.56	0.50	
Total Phosphorus (mg/L as P)	72	0	0.02	0.18	0.08	4.59	0.11	
Total Suspended Solids (mg/L)	77	0	1.00	90.00	15.57	1.82	0.63	
Nitrate (Total) (mg/L)	10	0	0.01	0.24	0.12	2.21	0.13	
Nitrite (Total) (mg/L)	10	0	0.01	0.05	0.05	22.23	0.00	
Nitrate + Nitrite (mg/L as N)	76	11	0.02	0.68	0.19	3.47	0.05	↓
Chlorophyll-*a* (ug/L)	74	15	0.55	63.40	16.52	0.72	0.55	
Pheophytin (ug/L)	25	0	0.50	66.60	10.26	0.27	0.94	

Sam Rayburn Reservoir





Sam Rayburn Reservoir

SEGMENT 0610 - SAM RAYBURN RESERVOIR

Monitoring Station 15523 - Sam Rayburn Reservoir Adjacent to Alligator Cove

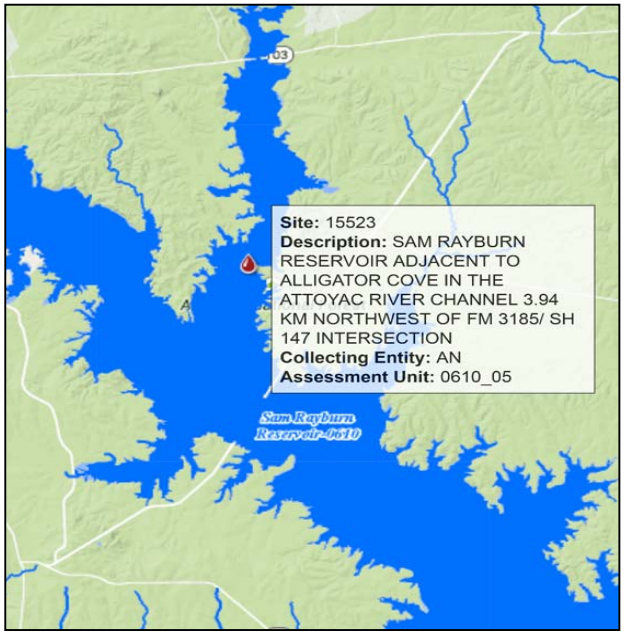
Monitoring Station 15523 is located in assessment unit AU 0610_05 (Lower Attoyac Bayou arm). Monitoring is conducted at this station quarterly by ANRA for field parameters, conventional parameters, and *E. coli* bacteria. AU 0610_05 encompasses 10.3 sq miles of reservoir surface. It begins 0.75 miles below the SH 103 bridge over the Attoyac Bayou, and extends 8.9 miles south to the mouth of the Attoyac arm of the reservoir. It includes three inactive sampling sites, one active sampling site, a power line crossing, and Jackson Hill Park and Marina. There are seven small - to medium-sized neighborhoods on the eastern shore, and one small neighborhood on the western shore; otherwise, the shoreline is forested. The shoreline itself appears mostly undeveloped, but there are numerous pine plantations in the drainage area, some buffered by less than 200 ft of undeveloped forest from the water's edge.
Trends identified for this station are not considered to be statistically significant due to a large gap in data collection from 2008-2011. However, decreasing trends for sulfate and chloride as well as increasing trends for Dissolved Oxygen and pH were still present after excluding data prior to 2012. The decreasing trend for Specific Conductance became an increasing trend after excluding data prior to 2012.

Statistical analysis identified decreasing trends for Ammonia-Nitrogen, Total Phosphorus and Nitrate+Nitrite that are not considered to be statistically significant due to having greater than fifty percent censored values, along with a large gap in data collection.

In the 2020 Texas Integrated Report, this assessment unit is listed as impaired for mercury and dioxin in edible tissue. There are also concerns for screening levels listed for iron and manganese in sediment, as well as mercury in edible tissue.

Water Quality Monitoring Results for Station 15523

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	89	0	1.00	41.00	1.47	1.02	0.72	
Water Temperature (C)	86	0	7.80	32.30	23.67	6.08	0.23	
Dissolved Oxygen (mg/L)	88	0	5.80	13.20	8.60	6.24	0.05	
pH (S.U.)	88	7	6.35	9.20	7.71	16.29	0.02	
Specific Conductance (us/cm @ 25C)	87	0	66.00	270.00	127.10	3.76	0.00	
Ammonia-Nitrogen (mg/L as N)	89	41	0.01	0.99	0.18	3.71	0.04	
Chloride (mg/L)	52	0	6.50	42.00	14.49	4.50	0.01	
Sulfate (mg/L)	53	0	10.60	40.90	21.14	5.73	0.01	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	parameter not collected for this station							
Total Phosphorus (mg/L as P)	89	12	0.02	4.50	0.15	2.46	0.05	
Total Suspended Solids (mg/L)	53	0	2.67	24.00	6.16	2.26	0.49	
Nitrate (Total) (mg/L)	15	0	0.05	0.09	0.05	-1.34	0.08	
Nitrite (Total) (mg/L)	15	0	0.05	0.05	0.05	8.15E+14	0.06	
Nitrate + Nitrite (mg/L as N)	89	19	0.02	2.00	0.23	5.73	0.00	
Chlorophyll-*a* (ug/L)	56	9	5.00	59.20	20.93	2.47	0.54	
Pheophytin (ug/L)	39	0	2.00	16.00	3.89	1.03	0.80	



Sam Rayburn near Alligator Cove

SEGMENT 0610 - SAM RAYBURN RESERVOIR

Monitoring Station 10612 - Sam Rayburn Reservoir at SH 147

Monitoring Station 10612 is located in assessment unit AU 0610_03 (Mid-Angelina River arm). Monitoring is conducted at this station quarterly by the TCEQ Region 10 field office for field parameters, conventional parameters, *E. coli* bacteria, and metals in sediment.

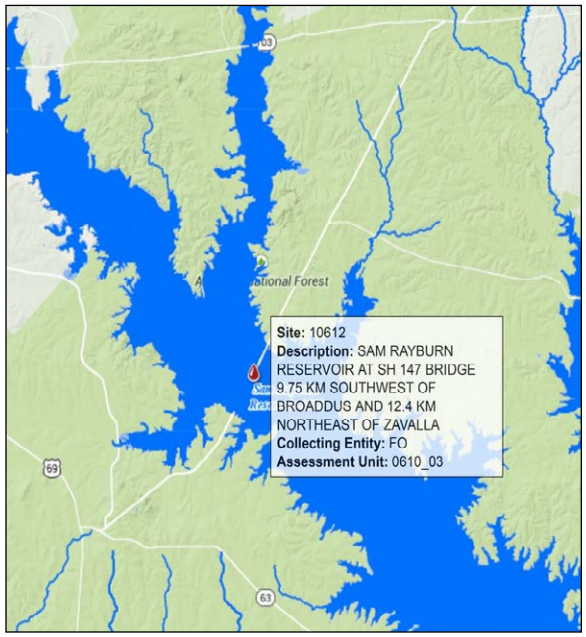
Analysis shows statistically significant decreasing trends for pH , Chloride and Sulfate.

Decreasing trends identified for Nitrate+Nitrite and Ammonia-Nitrogen are not considered to be statistically significant due to having greater than fifty-percent censored values.

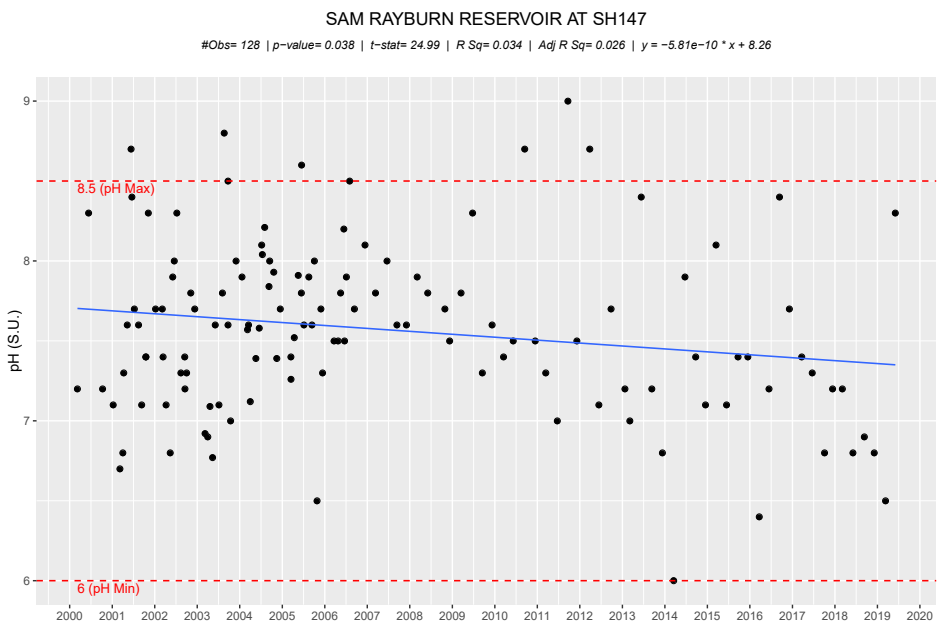
In the 2020 Texas Integrated Report, this assessment unit is listed as impaired for mercury and dioxin in edible tissue. There are also concerns for screening levels listed for iron and manganese in sediment.

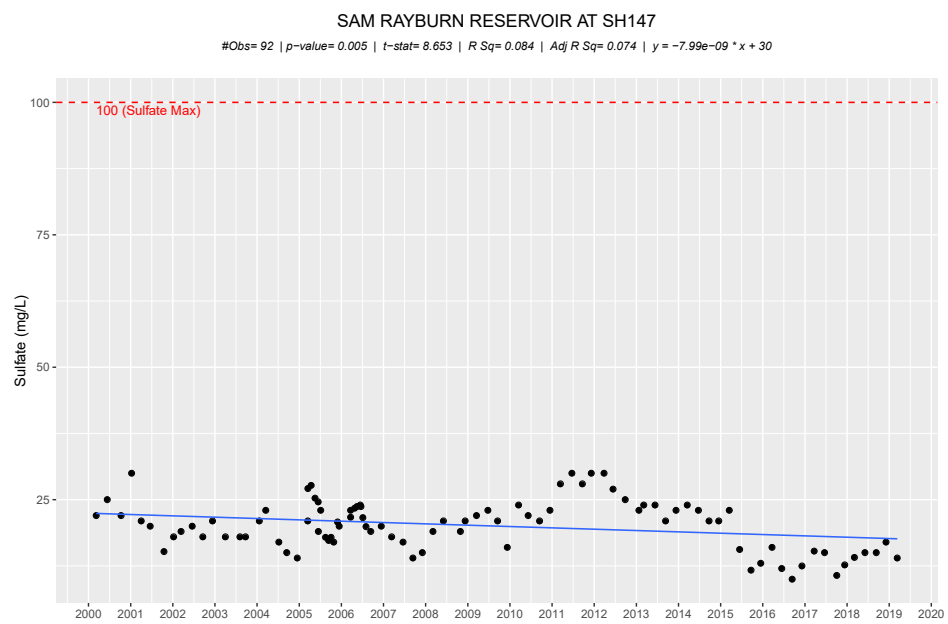
Water Quality Monitoring Results for Station 10612

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	119	0	1.00	20.80	1.67	1.41	0.89	
Water Temperature (C)	128	0	7.40	31.80	22.51	5.72	0.57	
Dissolved Oxygen (mg/L)	125	0	5.10	12.40	8.72	8.50	0.32	
pH (S.U.)	128	6	6.00	9.00	7.57	24.99	0.04	↓
Specific Conductance (us/cm @ 25C)	127	0	91.00	251.00	134.09	8.31	0.17	
Ammonia-Nitrogen (mg/L as N)	125	33	0.01	0.44	0.10	4.46	0.01	
Chloride (mg/L)	92	0	6.00	23.00	13.11	8.72	0.00	↓
Sulfate (mg/L)	92	0	10.00	30.00	20.16	8.65	0.01	↓
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	68	0	0.10	0.72	0.51	6.88	0.13	
Total Phosphorus (mg/L as P)	121	11	0.02	2.25	0.12	2.24	0.12	
Total Suspended Solids (mg/L)	89	0	1.00	22.30	4.71	1.66	0.38	
Nitrate (Total) (mg/L)	10	0	0.03	0.17	0.06	1.08	0.57	
Nitrite (Total) (mg/L)	10	0	0.01	0.05	0.05	22.22	0.00	
Nitrate + Nitrite (mg/L as N)	125	17	0.02	2.11	0.17	4.92	0.00	
Chlorophyll-*a* (ug/L)	93	3	3.27	30.40	13.54	3.86	0.38	
Pheophytin (ug/L)	29	0	3.00	32.20	9.03	1.31	0.36	

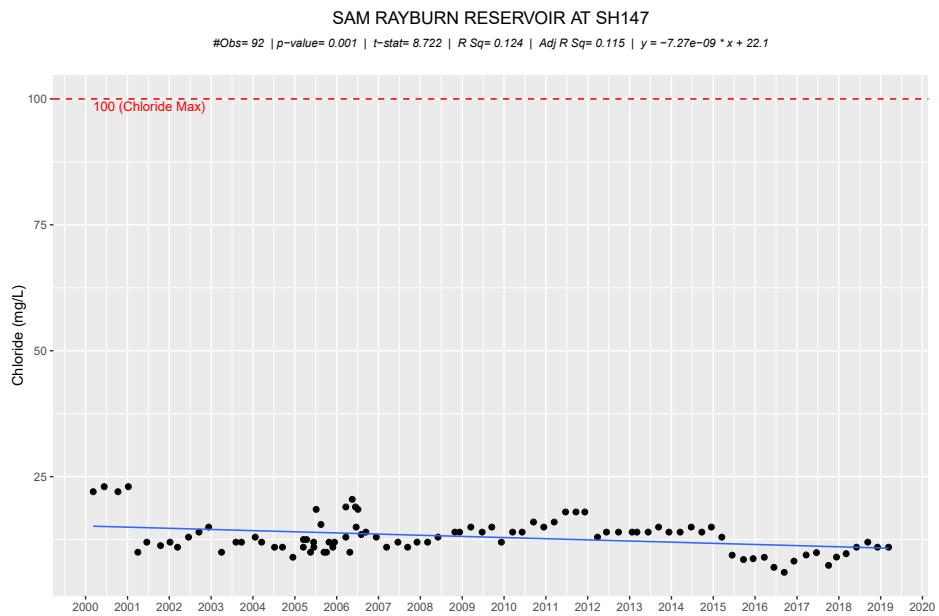


Sam Rayburn Reservoir





Sam Rayburn Reservoir dam



SEGMENT 0610 - SAM RAYBURN RESERVOIR

Monitoring Stations 15670 - Sam Rayburn Reservoir USGS Site GC

Monitoring Station 15670 is in assessment unit 0610_02 (Lower Angelina River arm) located approximately 9.84 km southeast of SH 147 and 6.56 km northeast of the FM 2743/FM 3373 intersection. Assessment Unit 0610_02 encompasses 43.7 sq miles of reservoir surface. It begins 4.8 miles southeast of the SH 147 bridge, and extends 11.6 miles southeast to a point about half a mile northwest of the intersection of Angelina, San Augustine and Jasper Counties. It includes two inactive sampling sites, two active sampling sites, and one permitted wastewater discharge.

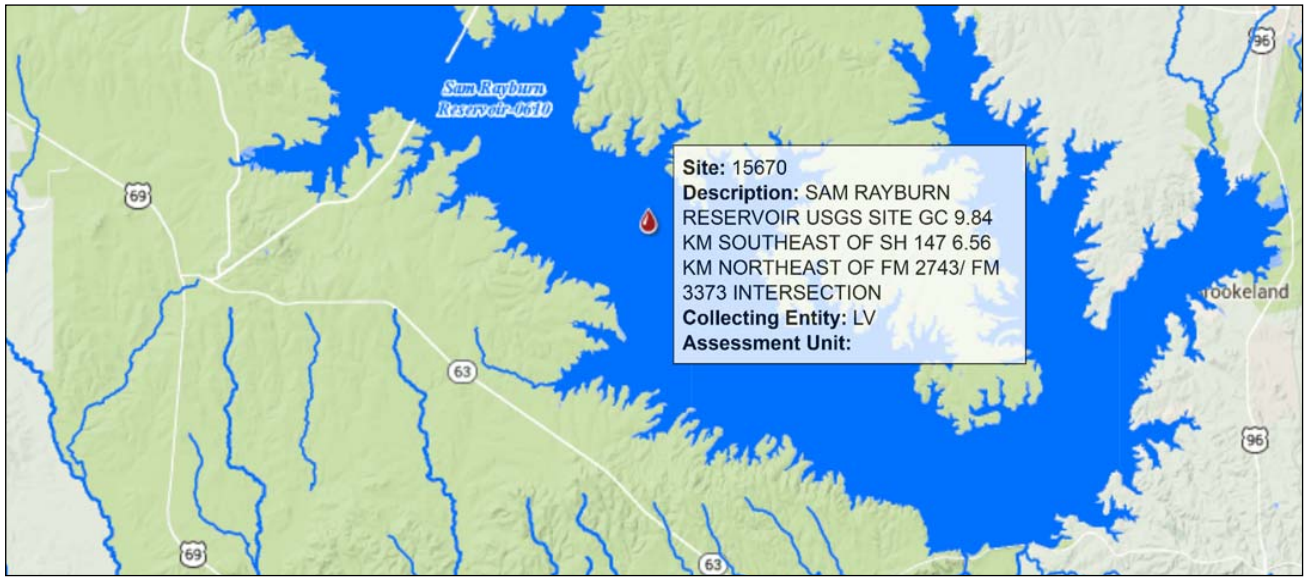
This station is no longer being monitored. This station was monitored from 1994-1999, 2008-2010, and 2012-2018. There are not enough data points to conduct statistical analysis.

In the 2020 Texas Integrated Report, this assessment unit is listed as impaired for mercury and dioxin in edible tissue. There are also concerns for screening levels listed for iron and manganese in sediment.

Water Quality Monitoring Results for Station 15670

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	18	0	1.00	10.00	1.14	-1.47	0.11	
Water Temperature (C)	18	0	8.10	31.40	22.30	-0.37	0.21	
Dissolved Oxygen (mg/L)	18	0	4.70	11.20	8.39	3.35	0.08	
pH (S.U.)	18	0	6.40	8.40	7.38	3.64	0.26	
Specific Conductance (us/cm @ 25C)	18	0	108.00	164.00	138.83	3.85	0.08	
Ammonia-Nitrogen (mg/L as N)	17	1	0.10	1.10	0.16	-1.42	0.13	
Chloride (mg/L)	18	0	8.20	15.20	12.53	4.30	0.04	
Sulfate (mg/L)	18	0	12.90	34.90	22.48	3.09	0.07	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	parameter not collected for this station							
Total Phosphorus (mg/L as P)	18	0	0.02	0.15	0.04	0.56	0.79	
Total Suspended Solids (mg/L)	18	0	3.20	5.40	4.62	0.89	0.22	
Nitrate (Total) (mg/L)	parameter not collected for this station							
Nitrite (Total) (mg/L)	parameter not collected for this station							
Nitrate + Nitrite (mg/L as N)	18	0	0.02	0.06	0.05	3.36	0.14	
Chlorophyll-*a* (ug/L)	3	0	4.60	12.00	7.47	7.29	0.09	
Pheophytin (ug/L)	parameter not collected at this station							

Sam Rayburn Reservoir



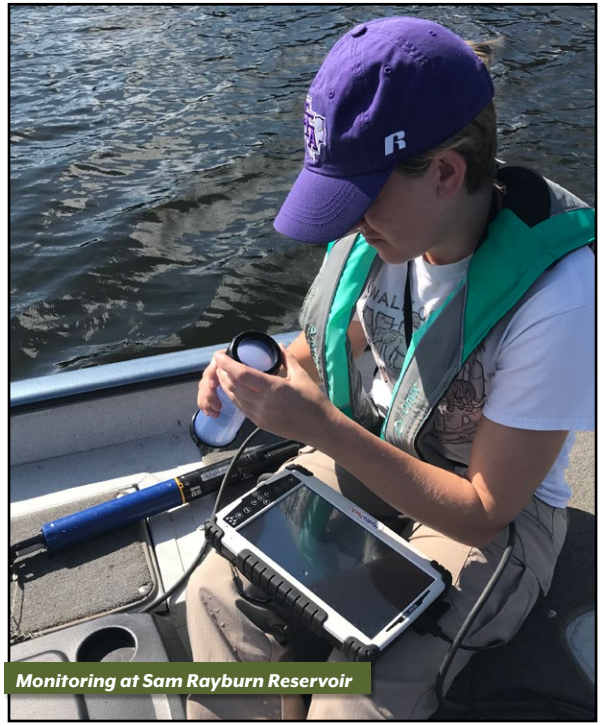
SEGMENT 0610 - SAM RAYBURN RESERVOIR

Monitoring Station 15671 - Sam Rayburn Reservoir USGS Site FC

Monitoring Station 15671 is in assessment unit 0610_02 (Lower Angelina River arm) approximately 7.21 km southwest of the FM 3173/FM 705 intersection. Monitoring is conducted at this station quarterly by LNVA for field parameters, conventional parameters, and *E. coli* bacteria. Monitoring was previously conducted in this AU at Monitoring Station 15522 - Sam Rayburn Reservoir Near Veach Basin. Monitoring was transitioned to the current stations in 2008.

There are no trends identified for this station.

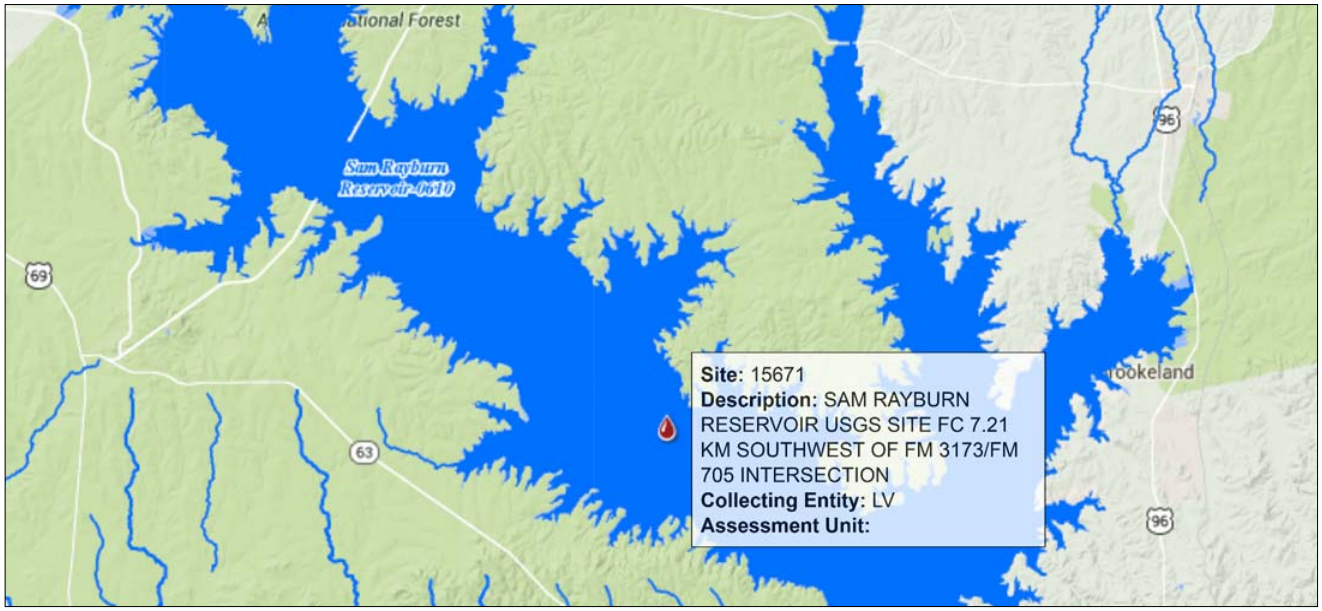
In the 2020 Texas Integrated Report, this assessment unit is listed as impaired for mercury and dioxin in edible tissue. There are also concerns for screening levels listed for iron and manganese in sediment.



Monitoring at Sam Rayburn Reservoir

Water Quality Monitoring Results for Station 15671

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	19	0	1.00	10.00	1.27	-2.23	0.02	
Water Temperature (C)	19	0	8.20	31.20	21.89	0.15	0.43	
Dissolved Oxygen (mg/L)	19	0	5.50	11.30	8.54	3.51	0.09	
pH (S.U.)	19	0	6.80	8.20	7.46	5.38	0.26	
Specific Conductance (us/cm @ 25C)	19	0	108.00	165.00	137.84	4.83	0.02	
Ammonia-Nitrogen (mg/L as N)	18	1	0.10	0.20	0.11	-0.10	0.17	
Chloride (mg/L)	19	0	8.00	15.30	12.09	5.43	0.00	
Sulfate (mg/L)	19	0	12.70	34.90	21.56	3.76	0.02	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	parameter not collected for this station							
Total Phosphorus (mg/L as P)	19	0	0.02	0.18	0.04	-0.29	0.57	
Total Suspended Solids (mg/L)	19	0	2.10	5.00	4.48	1.28	0.69	
Nitrate (Total) (mg/L)	parameter not collected for this station							
Nitrite (Total) (mg/L)	parameter not collected for this station							
Nitrate + Nitrite (mg/L as N)	19	0	0.02	0.06	0.05	3.13	0.22	
Chlorophyll-*a* (ug/L)	3	0	3.10	10.60	6.00	2.15	0.28	
Pheophytin (ug/L)	parameter not collected at this station							



SEGMENT 0610 - SAM RAYBURN RESERVOIR

Monitoring Station 14907 - Sam Rayburn Reservoir at FM 83

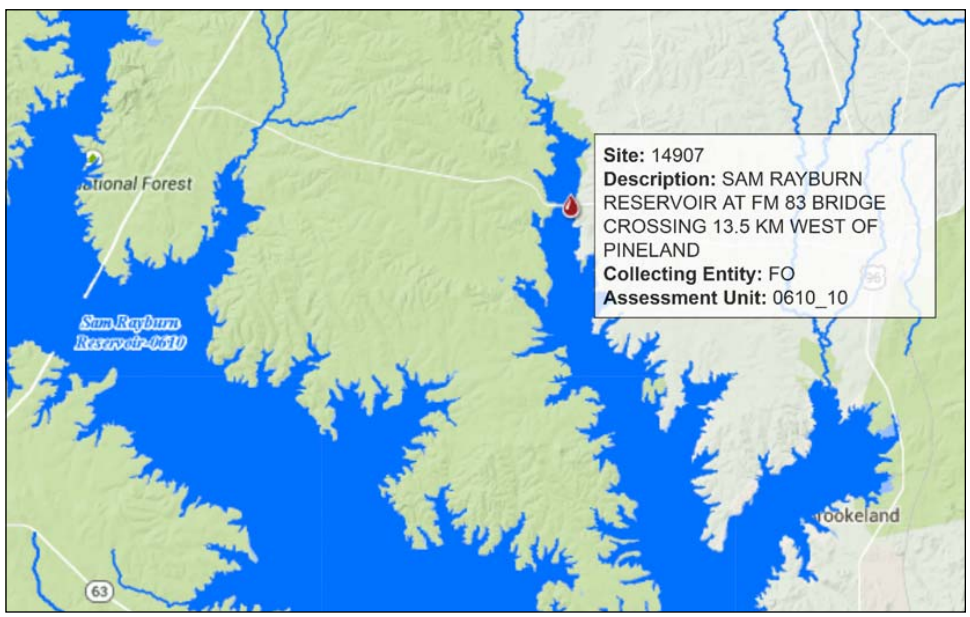
Monitoring Station 14907 is located in AU 0610_10 (Upper Ayish Bayou arm). Monitoring is conducted at this station quarterly by the TCEQ Region 10 field office for field parameters, conventional parameters, and *E. coli* bacteria.

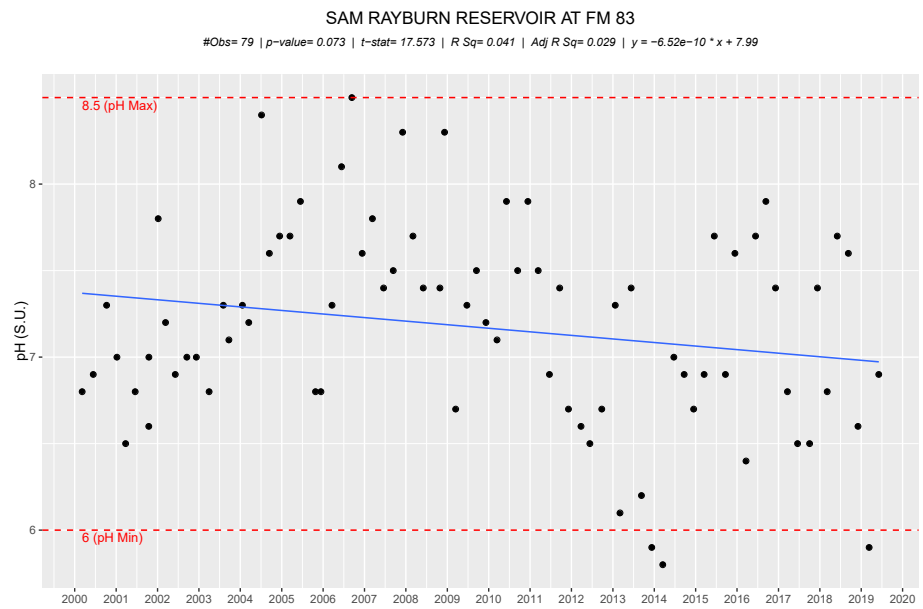
A statistically significant decreasing trend was observed for pH. The decreasing trend observed for Ammonia-Nitrogen is not considered to be statistically significant due to having greater than fifty-percent censored data.

In the 2020 Texas Integrated Report, this assessment unit is listed as impaired for mercury and dioxin in edible tissue. There are also concerns for screening levels listed for iron and manganese in sediment.

Water Quality Monitoring Results for Station 14907

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	65	10	1.00	4800.00	15.69	-0.01	0.74	
Water Temperature (C)	79	0	6.50	32.00	20.91	2.18	0.29	
Dissolved Oxygen (mg/L)	79	1	2.90	10.90	7.43	5.76	0.91	
pH (S.U.)	79	3	5.80	8.50	7.17	17.57	0.07	↓
Specific Conductance (us/cm @ 25C)	79	0	87.00	204.00	139.10	7.39	0.64	
Ammonia-Nitrogen (mg/L as N)	76	3	0.02	0.19	0.05	4.43	0.09	
Chloride (mg/L)	76	0	5.00	19.00	10.85	5.60	0.28	
Sulfate (mg/L)	77	0	7.00	47.00	17.48	3.61	0.97	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	72	0	0.24	1.33	0.62	4.36	0.84	
Total Phosphorus (mg/L as P)	71	0	0.02	0.16	0.06	4.20	0.11	
Total Suspended Solids (mg/L)	76	0	1.00	56.00	12.59	0.80	0.57	
Nitrate (Total) (mg/L)	10	0	0.01	0.09	0.05	4.43	0.01	
Nitrite (Total) (mg/L)	10	0	0.01	0.05	0.05	22.23	0.00	
Nitrate + Nitrite (mg/L as N)	76	1	0.02	0.58	0.07	1.34	0.87	
Chlorophyll-*a* (ug/L)	72	1	0.43	43.70	11.34	1.75	0.88	
Pheophytin (ug/L)	25	0	0.93	80.60	10.62	0.37	0.85	





SEGMENT 0610 - SAM RAYBURN RESERVOIR

Monitoring Station 15673 - Sam Rayburn Reservoir USGS Site AC

Monitoring Station 15673 is in assessment unit 0610_09 (Lower Ayish Bayou arm) located 2.5 km east northeast of the FM 705/FM 3127 intersection. Monitoring is conducted at this station quarterly by LNVA for field parameters, conventional parameters, and *E. coli* bacteria. With less than 20 data points, there is not enough data at this stations to properly conduct statistical review and trend analyses. Summaries of water quality results at these stations are provided.

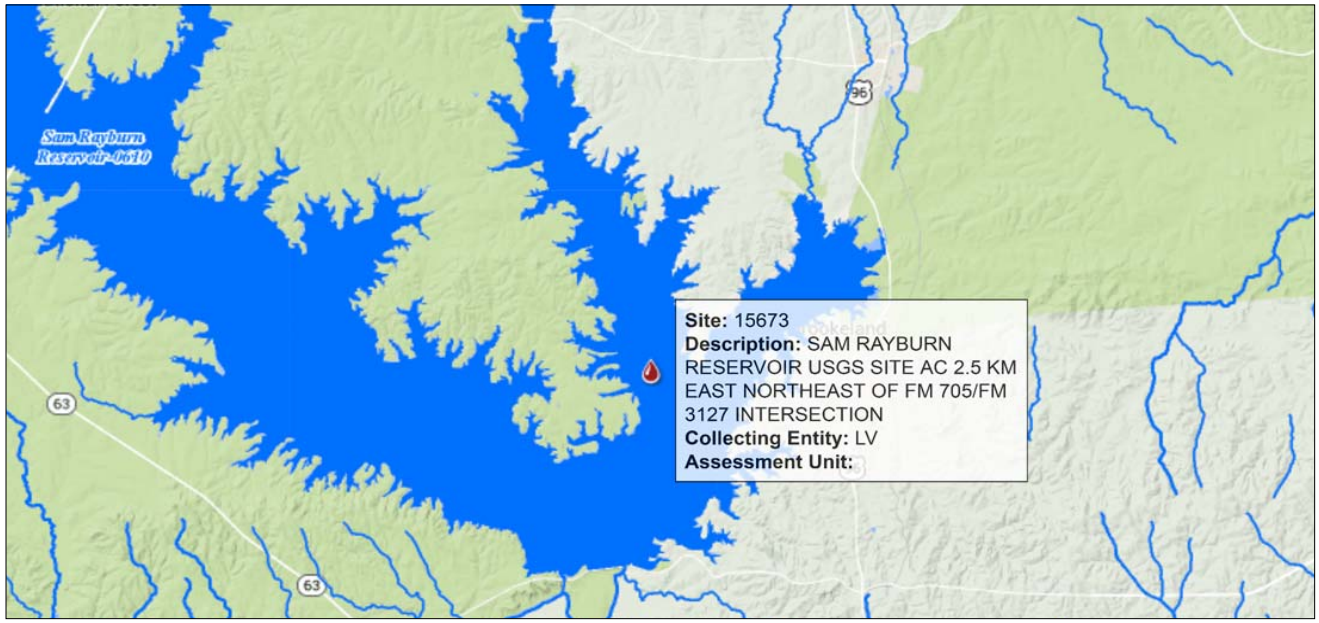
This AU covers 17.5 sq miles of reservoir surface. It begins approximately 0.6 miles south of the FM 83 crossing and extends 11.1 miles downstream to the mouth of the Attoyac arm of the reservoir. The entire western shore is designated Angelina National Forest, but only a single 530-acre tract of the shoreline itself is owned by the US Forest Service. The eastern shore is almost entirely privately owned, with the exception of one 300-acre tract designated Angelina National Forest and owned by the US Forest Service, and San Augustine Park, a 250-acre USACE park. The drainage area contains two previously permitted MSW sites, two inactive monitoring sites, and two active monitoring sites.

There are no significant trends observed for this station.

In the 2020 Texas Integrated Report, this assessment unit is listed as impaired for mercury and dioxin in edible tissue. There are also concerns for screening levels listed for iron and manganese in sediment.

Water Quality Monitoring Results for Station 15673

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	19	0	1.00	10.00	1.32	-2.05	0.04	
Water Temperature (C)	19	0	8.00	32.10	22.09	0.34	0.55	
Dissolved Oxygen (mg/L)	19	0	5.90	11.10	8.42	3.69	0.07	
pH (S.U.)	19	0	6.80	8.20	7.34	5.12	0.31	
Specific Conductance (us/cm @ 25C)	19	0	108.00	162.00	133.89	4.05	0.08	
Ammonia-Nitrogen (mg/L as N)	18	2	0.10	0.30	0.11	-0.73	0.17	
Chloride (mg/L)	19	0	8.30	14.70	11.57	5.15	0.01	
Sulfate (mg/L)	19	0	12.20	30.40	21.17	4.38	0.01	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	parameter not collected for this station							
Total Phosphorus (mg/L as P)	19	1	0.02	0.42	0.06	-1.07	0.23	
Total Suspended Solids (mg/L)	19	0	2.40	6.00	4.56	1.50	0.87	
Nitrate (Total) (mg/L)	parameter not collected for this station							
Nitrite (Total) (mg/L)	parameter not collected for this station							
Nitrate + Nitrite (mg/L as N)	19	0	0.02	0.05	0.05	4.09	0.02	
Chlorophyll-*a* (ug/L)	3	0	3.80	4.60	4.17	0.22	0.91	
Pheophytin (ug/L)	parameter not collected for this station							



SEGMENT 0610 - SAM RAYBURN RESERVOIR

Monitoring Station 15675 - Sam Rayburn Reservoir USGS Site MC

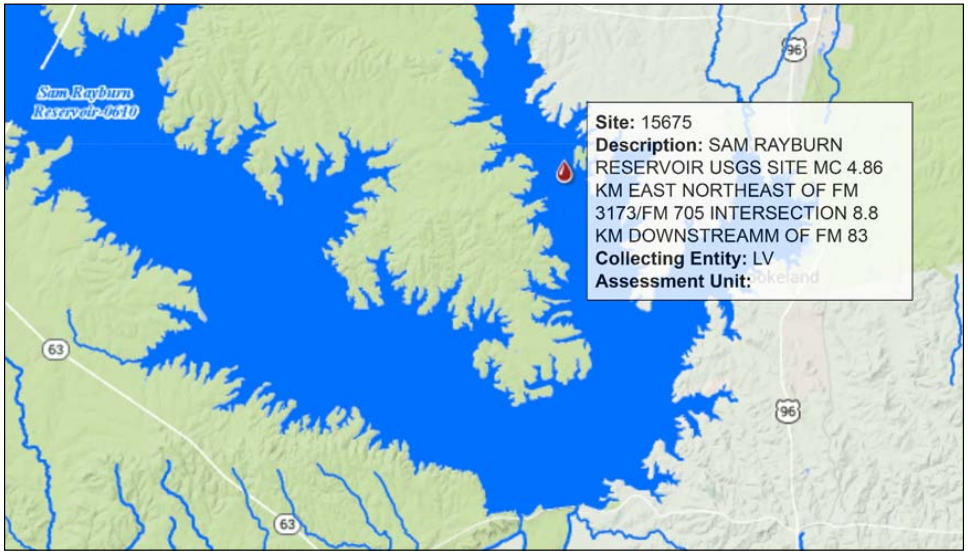
Monitoring Station 15675 is in assessment unit 0610_09 (Lower Ayish Bayou arm) located 4.86 km east northeast of the FM 3173/FM 705 intersection 8.8 km downstream of FM 83. Station Monitoring is conducted at this station quarterly by LNVA for field parameters, conventional parameters, and *E. coli* bacteria. Monitoring was previously conducted in this AU as Monitoring Station 15526 - Sam Rayburn Reservoir at Needmore Point. Monitoring was transitioned to the current stations (15673 and 15675) in 2008.

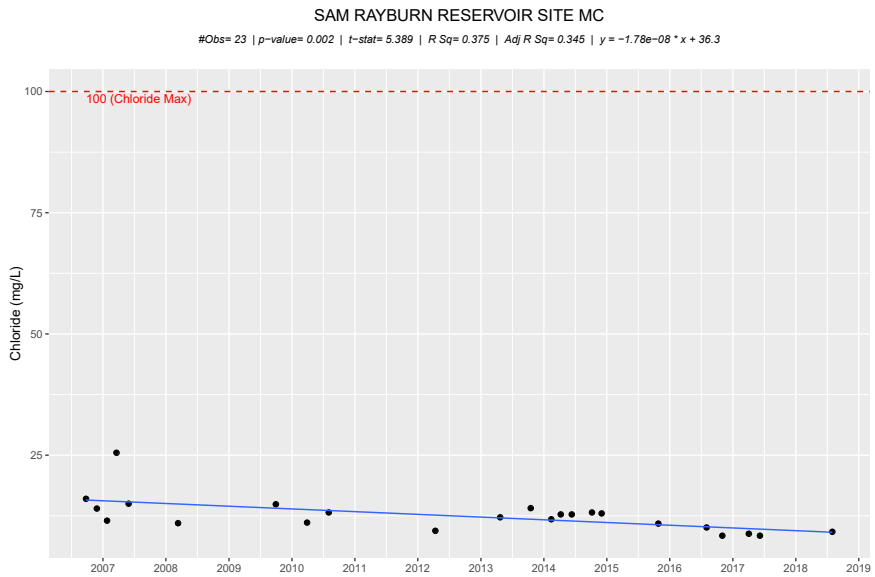
Statistical analysis shows a significant decreasing trend for Chloride. Decreasing trends were also identified for Ammonia-Nitrogen and Nitrate+Nitrite but they are not considered statistically significant due to having greater than fifty percent censored values.

In the 2020 Texas Integrated Report, this assessment unit is listed as impaired for mercury and dioxin in edible tissue. There are also concerns for screening levels listed for iron and manganese in sediment.

Water Quality Monitoring Results for Station 15675

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	23	0	1.00	13.00	1.31	0.74	0.65	
Water Temperature (C)	23	0	7.90	33.10	22.23	-0.15	0.12	
Dissolved Oxygen (mg/L)	22	1	1.50	11.40	8.04	1.48	0.98	
pH (S.U.)	23	0	6.70	8.20	7.41	9.42	0.66	
Specific Conductance (us/cm @ 25C)	23	0	105.00	158.00	130.83	2.94	0.85	
Ammonia-Nitrogen (mg/L as N)	22	5	0.05	0.32	0.13	2.73	0.08	
Chloride (mg/L)	23	0	8.40	25.50	12.49	5.39	0.00	↓
Sulfate (mg/L)	23	0	11.60	28.20	20.91	2.45	0.56	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	parameter not collected for this station							
Total Phosphorus (mg/L as P)	23	1	0.02	0.22	0.04	0.86	0.67	
Total Suspended Solids (mg/L)	23	0	1.00	9.20	4.82	-0.84	0.04	
Nitrate (Total) (mg/L)	parameter not collected for this station							
Nitrite (Total) (mg/L)	parameter not collected for this station							
Nitrate + Nitrite (mg/L as N)	23	0	0.04	0.15	0.05	2.85	0.10	
Chlorophyll-*a* (ug/L)	8	0	5.00	13.70	7.10	0.39	0.75	
Pheophytin (ug/L)	5	0	3.00	5.00	3.80	2.96	0.06	





SEGMENT 0610 - SAM RAYBURN RESERVOIR

Monitoring Station 15674 - Sam Rayburn Reservoir USGS Site LC

Monitoring Station 15674 is located in assessment unit 0610_08 (Upper Bear Creek arm). This station is located 1.7 km northwest of the Mill Creek Park swimming area, 3.69 km northwest of the Loop 149/US 96 intersection. Monitoring is conducted at this station quarterly by LNVA for field parameters, conventional parameters, and *E. coli* bacteria. There are not enough data points at this station to properly conduct statistical review and trend analyses. A summary of water quality results at this station is provided. Monitoring was previously conducted in this AU by ANRA at Monitoring Station 15527 - Sam Rayburn Reservoir Near Mill Creek. Monitoring was transitioned to the current station in 2008.

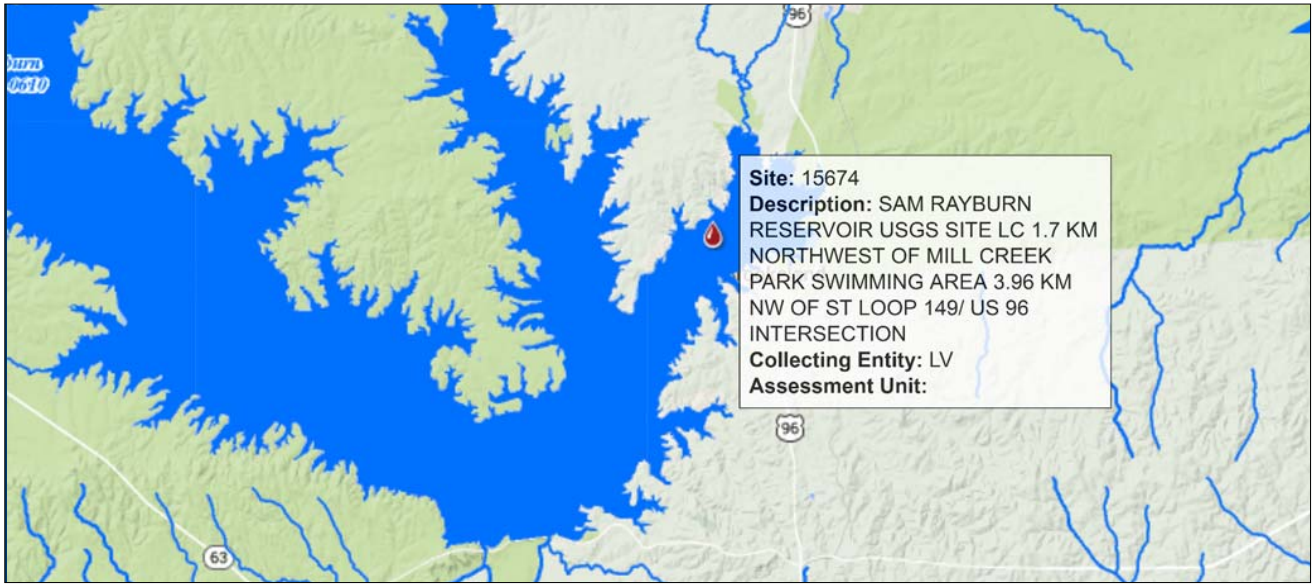
AU 0610_08 covers 9.7 sq miles of reservoir surface, beginning 1000 ft upstream of US 96 at the Devils Ford/ Curry Creek crossing and extending southeast 6.4 miles to the mouth of the Bear Creek Arm of the reservoir. It drains approximately 140 sq miles, 54 of which are Sabine National Forest. The drainage area contains the incorporated Cities of Pineland and Browndell, four previously permitted municipal solid waste sites, and six permitted wastewater outfalls.

There are no statistically significant trends identified for this station.

In the 2020 Texas Integrated Report, this assessment unit is listed as impaired for mercury and dioxin in edible tissue. There are also concerns for screening levels listed for iron and manganese in sediment..

Water Quality Monitoring Results for Station 15674

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	19	0	1.00	10.00	1.67	-1.88	0.05	
Water Temperature (C)	19	0	7.80	32.80	22.52	0.44	0.62	
Dissolved Oxygen (mg/L)	19	0	6.50	11.60	8.60	2.98	0.24	
pH (S.U.)	19	0	6.70	7.90	7.35	4.78	0.00	
Specific Conductance (us/cm @ 25C)	19	0	107.00	159.00	131.95	3.70	0.13	
Ammonia-Nitrogen (mg/L as N)	18	2	0.10	0.20	0.11	0.19	0.29	
Chloride (mg/L)	19	0	8.70	14.40	11.45	4.81	0.01	
Sulfate (mg/L)	18	0	11.80	28.90	21.71	3.73	0.03	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	parameter not collected for this station							
Total Phosphorus (mg/L as P)	19	1	0.02	0.28	0.05	-0.76	0.34	
Total Suspended Solids (mg/L)	19	0	4.00	10.60	5.39	1.03	0.92	
Nitrate (Total) (mg/L)	parameter not collected for this station							
Nitrite (Total) (mg/L)	parameter not collected for this station							
Nitrate + Nitrite (mg/L as N)	19	0	0.02	0.05	0.05	4.09	0.02	
Chlorophyll-*a* (ug/L)	3	0	3.00	8.20	5.40	1.26	0.43	
Pheophytin (ug/L)	parameter not collected for this station							



SEGMENT 0610 - SAM RAYBURN RESERVOIR

Monitoring Station 14906 - Sam Rayburn Reservoir at Main Pool

Station 14906 is located in AU 0610_01. Monitoring is conducted at this station quarterly by the TCEQ Region 10 field office for field parameters, conventional parameters, *E. coli* bacteria, and metals in sediment. Assessment Unit 0610_01 (Sam Rayburn Main Pool) covers 21.7 sq miles of reservoir surface. It begins in the northwest at the mouth of the lower Angelina arm of the reservoir, and in the northeast at the mouths of the lower Ayish arm and the Bear Creek arm of the reservoir. It extends down to the dam. Its direct drainage area contains two permitted wastewater outfalls.

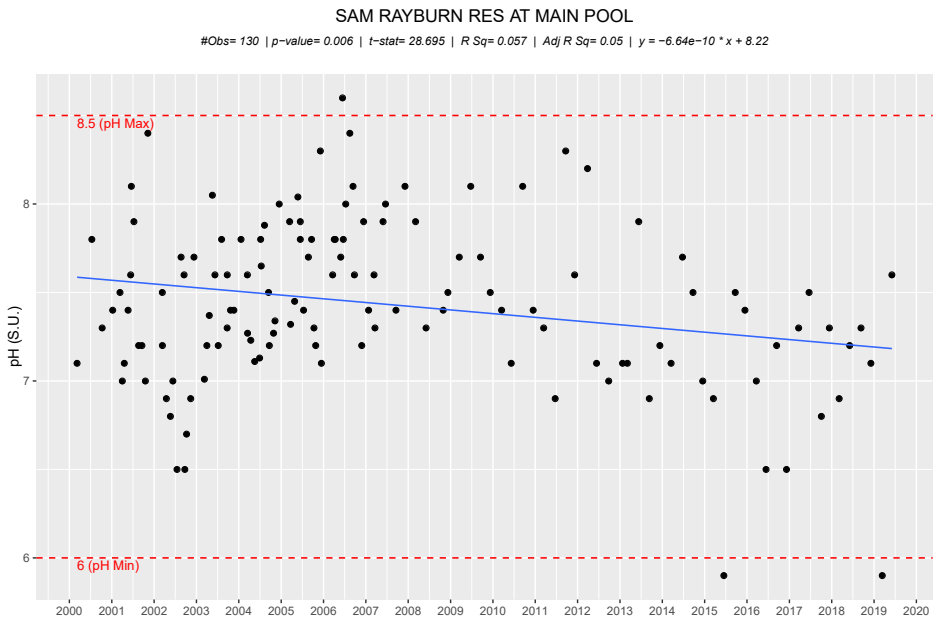
Statistically significant decreasing trends were identified for pH, Chloride and Sulfate. Decreasing trends observed for Pheophytin, Ammonia-Nitrogen, and Nitrate+Nitrite are not considered to be statistically significant due to having greater than fifty percent censored values. The decreasing trend observed for Chlorophyll-*a* is not considered to be statistically significant because the trend is influenced by a change in LOQ.

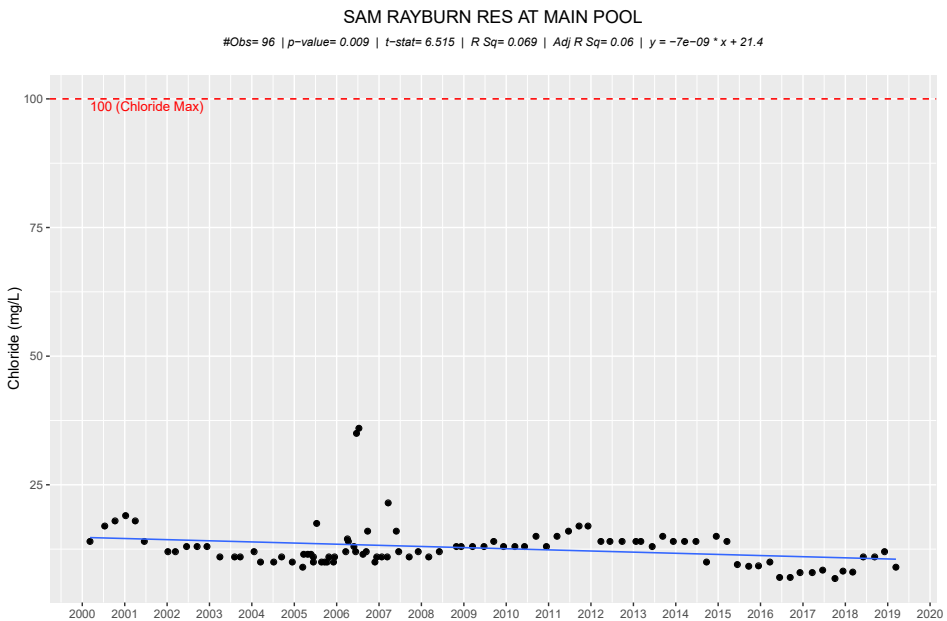
In the 2020 Texas Integrated Report, this assessment unit is listed as impaired for mercury and dioxin in edible tissue. There are also concerns for screening levels listed for iron and manganese in sediment.

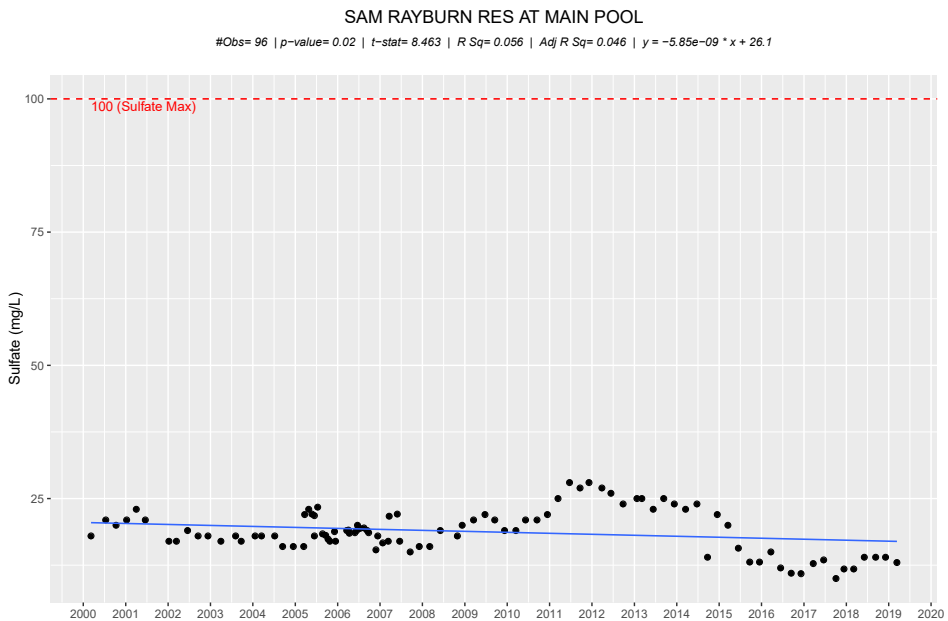
Water Quality Monitoring Results for Station 14906

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	120	0	1.00	40.00	1.64	0.18	0.52	
Water Temperature (C)	132	0	8.00	32.10	22.21	6.01	0.46	
Dissolved Oxygen (mg/L)	125	0	5.00	11.80	8.60	7.66	0.28	
pH (S.U.)	130	3	5.90	8.60	7.43	28.70	0.01	↓
Specific Conductance (us/cm @ 25C)	132	0	99.00	245.00	129.45	8.85	0.21	
Ammonia-Nitrogen (mg/L as N)	129	38	0.01	0.67	0.10	4.04	0.01	
Chloride (mg/L)	96	0	6.79	36.00	12.78	6.52	0.01	↓
Sulfate (mg/L)	96	0	10.00	28.00	18.84	8.46	0.02	↓
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	68	0	0.10	1.33	0.42	3.25	0.63	
Total Phosphorus (mg/L as P)	124	8	0.01	1.03	0.08	2.34	0.17	
Total Suspended Solids (mg/L)	94	0	1.00	59.70	4.64	0.58	0.74	
Nitrate (Total) (mg/L)	10	0	0.05	0.13	0.08	-1.37	0.06	
Nitrite (Total) (mg/L)	10	0	0.01	0.05	0.05	22.23	0.00	
Nitrate + Nitrite (mg/L as N)	130	15	0.02	1.90	0.16	4.87	0.00	
Chlorophyll-*a* (ug/L)	98	1	2.22	46.40	7.45	4.97	0.00	
Pheophytin (ug/L)	34	0	1.00	15.90	5.42	2.60	0.06	

SEGMENT 0610 - SAM RAYBURN RESERVOIR







SEGMENT 0610 - SAM RAYBURN RESERVOIR

SUMMARY OF WATER QUALITY TRENDS

Trend Analysis Summary for Segment 0610 - Sam Rayburn Reservoir

AU	Station ID	Station Description	*E. coli*	Temp	DO	pH	Spec Cond	NH3	Cl	SO4	TKN	Total P	TSS	NO3	NO2	NO3/ NO2	Chl-*a*	Pheo
0610_01	14906	Sam Rayburn Reservoir at Main Pool				↓			↓	↓								
0610_02	15671	Sam Rayburn Reservoir USGS Site FC	*- No trends identified for this Assessment Unit -*															
0610_02	15670	Sam Rayburn Reservoir USGS Site GC	*- No trends identified for this Assessment Unit -*															
0610_03	10612	Sam Rayburn Reservoir at SH 147				↓			↓	↓								
0610_04	15524	Sam Rayburn Reservoir near Shirley Creek			↑	↑	↑		↓	↓								↓
0610_05	15523	Sam Rayburn Reservoir near Alligator Cove	*- No trends identified for this Assessment Unit -*															
0610_06	10614	Sam Rayburn Reservoir at SH 103 East of Etoile					↑									↓		
0610_07	21100	Sam Rayburn Reservoir downstream of Marion's Ferry	*- No trends identified for this Assessment Unit -*															
0610_07	10613	Sam Rayburn Reservoir at SH 103 West of Etoile					↓		↓	↓			↓					
0610_08	15674	Sam Rayburn Reservoir USGS Site LC	*- No trends identified for this Assessment Unit -*															
0610_09	15673	Sam Rayburn Reservoir USGS Site AC	*- No trends identified for this Assessment Unit -*															
0610_09	15675	Sam Rayburn Reservoir USGS Site MC							↓									
0610_10	14907	Sam Rayburn Reservoir at FM 83				↑												

↑ = Statistically significant increasing trend ↓ = Statistically significant decreasing trend

Water Quality Issues Summary for Segment 0610 - Sam Rayburn Reservoir

Water Quality Issue	Affected Area	Possible Influences/Causes	Possible Effects	Possible Solutions / Actions Taken
Dioxin in Edible Tissue	The Neches River (Segment 0604) and all contiguous waters from the SH 7 bridge west of Lufkin, TX downstream to the US 96 bridge near Evadale, TX including B.A. Steinhagen Reservoir and Sam Rayburn Reservoir	• Pulp and paper bleaching processes	• The Texas DSHS has concluded that consuming fish from this water body poses an apparent hazard to public health	• A comprehensive Fish Consumption Advisory issued by the Texas DSHS recommends consumption advice for six species of fish • ADV-51 issued on January 24, 2014
Mercury in Edible Tissue	The Neches River (Segment 0604) and all contiguous waters from the SH 7 bridge west of Lufkin, TX downstream to the US 96 bridge near Evadale, TX including B.A. Steinhagen Reservoir and Sam Rayburn Reservoir	• Atmospheric deposition from coal-fired power plants, large boilers and heaters, steel production, and incinerators	• The Texas DSHS has concluded that consuming fish from this water body poses an apparent hazard to public health	• A comprehensive Fish Consumption Advisory issued by the Texas DSHS recommends consumption advice for six species of fish • ADV-51 issued on January 24, 2014
Concern for Metals in Sediment (Iron and Manganese)	Entire reservoir	• Iron oxide coatings on sediments are ubiquitous in the oxygenated environment • Weathering of geological formations • Discharge of surface and groundwater into the lake, followed by sedimentation • Organic and inorganic particulate matter	• Source of dissolved iron and manganese in water	• Collect additional data and re-evaluate

SEGMENT 0610A - AYISH BAYOU

Segment Profile

Ayish Bayou (Segment 0610A) is an unclassified 32 mile-length perennial freshwater stream extending from the confluence with Sam Rayburn Reservoir south of San Augustine in San Augustine County to the dam impounding Bland Lake, approximately 0.1 km upstream of FM 1279 near the City of San Augustine.

The Ayish Bayou watershed is 123,540 acres (193 sq. miles) and drains into the northeast arm of Sam Rayburn Reservoir. It is primarily situated in San Augustine County, but does extend very slightly into Sabine (903 acres) and Shelby (13 acres) Counties.

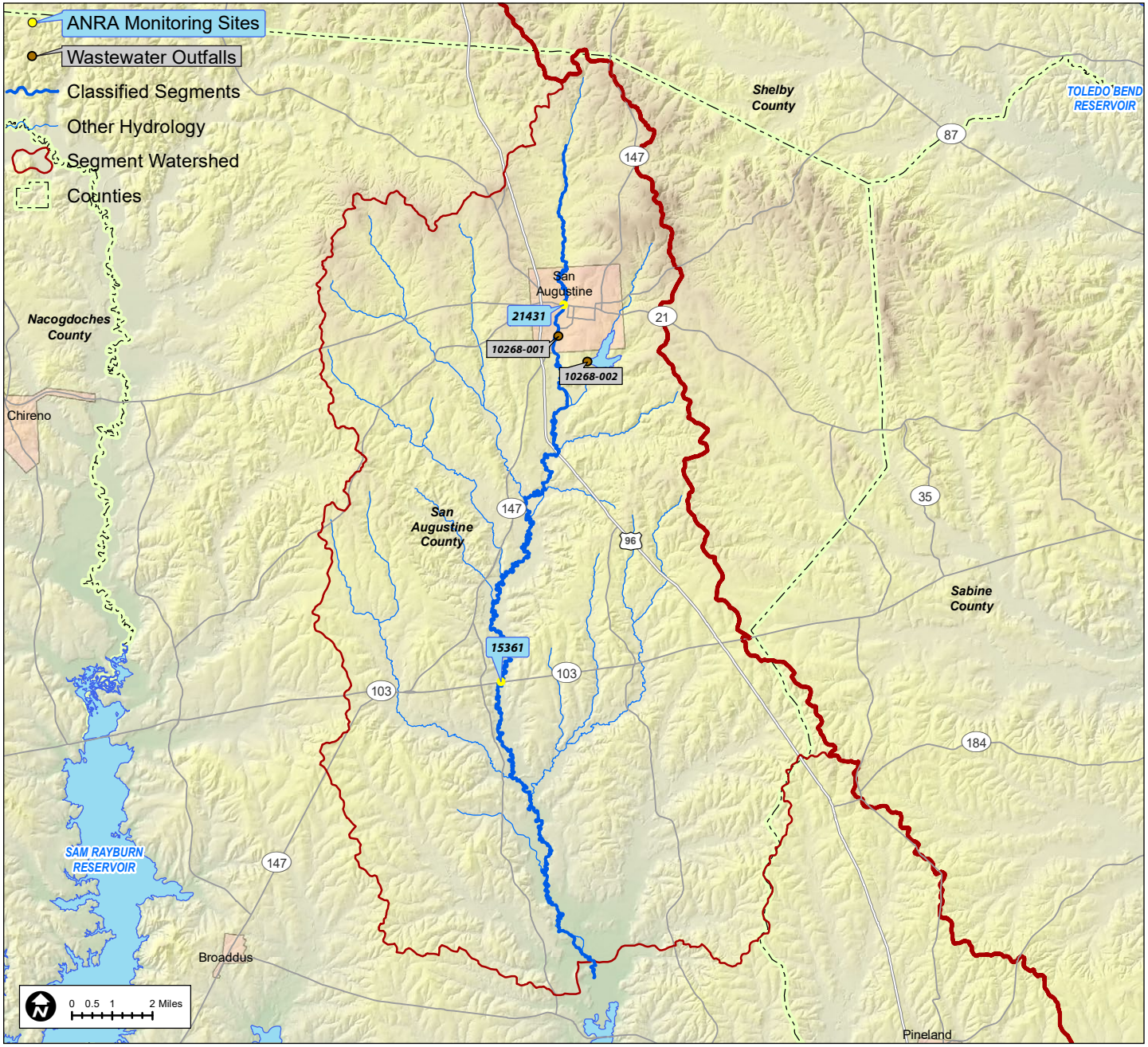
The City of San Augustine is the only incorporated city within the watershed and it is fully contained in the watershed.

A recreational use attainability analysis (RUAA) was conducted on Ayish Bayou (0610A) in the summer of 2014 to determine the appropriate recreational use and numeric criteria, in which it was determined that the appropriate use for this water body was primary contact recreation (PCR).

Ayish Bayou (Segment 0610A) is listed in the Draft 2020 303(d) List for not supporting primary contact recreation due to bacteria impairments. Both Assessment Units are listed as category 5c.

In AU 0610A_01, the geometric mean for *E. coli* exceeded the criteria of 126 MPN/100 mL with a value of 251.14 MPN/100 mL, based upon 41 samples assessed.

In AU 0610A_02, the geometric mean for *E. coli* exceeded the standard with a value of 340.46 MPN/100 mL, based upon 19 samples assessed.



SEGMENT 0610A - AYISH BAYOU

Designated Use Criteria

The designated uses for this unclassified segment include contact recreation, high aquatic life use, fish consumption use, public water supply use, and general use.

Assessment Units in Segment 0610A - Ayish Bayou

AU ID	Description
0610A_01	From the headwaters of Sam Rayburn Reservoir, per WQS App. D, about 2.4 km north of FM 83 upstream to confluence with unnamed tributary about 0.4 km SW of intersection of SH 147 and AT and SF Railroad at NHD RC 12020005000036.
0610A_02	From the confluence with unnamed tributary about 0.4 km SW of intersection of SH 147 and AT and SF Railroad in the City of San Augustine upstream to the Bland Lake dam, per WQS App. D.

Monitoring Stations in Segment 0610A - Ayish Bayou

Assessment Unit	Monitoring Station ID	Description	Initial Monitoring Event	Latest Monitoring Event	Notes
0610A_01	15361	AYISH BAYOU AT SH 103 0.8 KM EAST OF FM 705	1996	2019	Monitored continuously since 1996.
0610A_02	21431	AYISH BAYOU AT WEST COLUMBIA STREET IN CITY OF SAN AUGUSTINE	2013	2019	Monitored continuously since 2013.

Flow Measurement at Ayish Bayou at West Columbia Street

SEGMENT 0610A - AYISH BAYOU

Assessment Summary (as listed in the 2020 Texas Integrated Report)

Parameter	Standard	0610A_01 Assessment	0610A_02 Assessment
Chloride (mg/L)	75		
Sulfate (mg/L)	50		
TDS (mg/L)	200		
DO Grab Screening Level (mg/L)	5.00	NC	
DO Grab Minimum (mg/L)	3.00	FS	
24 Hour DO Average			
24 Hour DO Minimum			
pH (SU)	6.0 - 8.5		
Temp (C)	32.2		
E. coli geomean (MPN /100 mL)	126	NS	NS
Ammonia Nitrogen (mg/L)	0.33	NC	
Nitrate Nitrogen (mg/L)	1.95	NC	
Total Phosphorus (mg/L)	0.69	NC	
Chl-*a* (µg/L)	14.1	NC	
Mercury in Edible Tissue			
Dioxin in Edible Tissue			

FS = Fully Supporting NC = No Concern CN = Concern for Near Non-Attainment
CS = Concern for Screening Level NS = Not Supporting NA = Not Assessed

Ayish Bayou at West Columbia Street

SEGMENT 0610A - AYISH BAYOU

Monitoring Station 15361 - Ayish Bayou at SH 103

Located in AU 0610A_01, Monitoring Station ID 15361 is monitored quarterly for field and conventional parameters, flow, and *E. coli* bacteria. This monitoring station is located downstream of the City of San Augustine's wastewater treatment facility.

There was a significant gap in data at this site from 2002-2005.

There are significant decreasing trends observed for pH and Total Phosphorus that persist after excluding data prior to 2005.

There were decreasing trends observed for Nitrate+Nitrite and Sulfate for the full period that did not persist after excluding data prior to 2005. For this reason these trends are not considered to be statistically significant.

The trends identified for Ammonia-Nitrogen and Pheophytin are not considered to be statistically significant due to having greater than fifty-percent censored values.

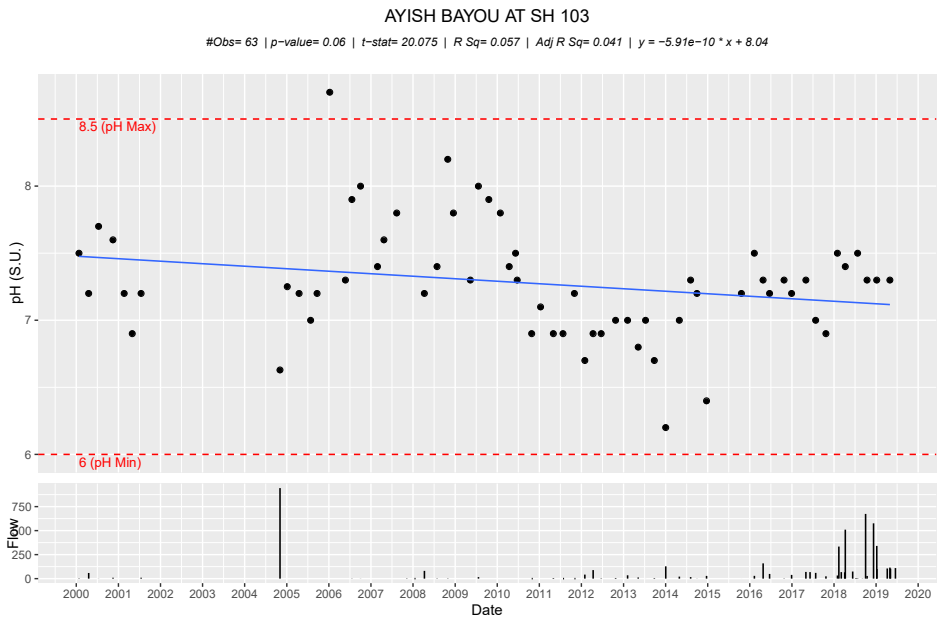
This AU is listed as impaired for *E. coli* bacteria in the Draft 2020 assessment.

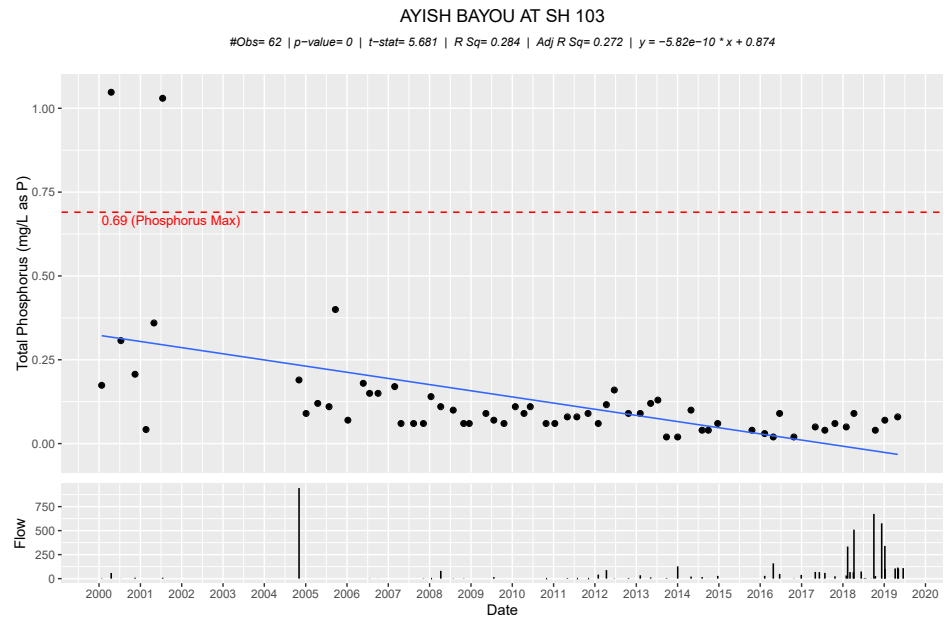
Water Quality Monitoring Results for Station 15361

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	85	60	2.00	24000.00	100.26	-1.48	0.07	
Water Temperature (C)	63	0	4.50	26.60	17.87	3.26	0.79	
Dissolved Oxygen (mg/L)	64	5	1.20	11.20	6.68	2.69	0.98	
pH (S.U.)	63	1	6.20	8.70	7.28	20.08	0.06	↓
Specific Conductance (us/cm @ 25C)	65	0	93.00	312.00	166.72	1.89	0.02	
Ammonia-Nitrogen (mg/L as N)	64	11	0.01	1.31	0.19	2.82	0.06	
Chloride (mg/L)	64	0	5.00	35.00	11.79	3.43	0.40	
Sulfate (mg/L)	64	0	6.80	49.60	17.89	4.92	0.01	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	parameter not collected for this station							
Total Phosphorus (mg/L as P)	62	2	0.02	1.05	0.13	5.68	0.00	↓
Total Suspended Solids (mg/L)	64	0	1.33	75.70	16.12	1.24	1.00	
Nitrate (Total) (mg/L)	14	0	0.05	0.34	0.20	-0.82	0.31	
Nitrite (Total) (mg/L)	14	0	0.05	0.05	0.05	1.68E+15	0.05	
Nitrate + Nitrite (mg/L as N)	64	2	0.04	3.20	0.37	4.54	0.00	
Chlorophyll-*a* (ug/L)	56	3	2.00	34.90	4.06	1.49	0.33	
Pheophytin (ug/L)	52	0	2.00	5.18	2.29	4.90	0.01	

Ayish Bayou at SH 103

SEGMENT 0610A - AYISH BAYOU





21431 - Ayish Bayou at West Columbia Street

SEGMENT 0610A - AYISH BAYOU

Monitoring Station 21431 - Ayish Bayou at West Columbia Street

Monitoring station 21431, is located at West Columbia Street in the City of San Augustine. It is located in AU 0610A_02.

Monitoring was begun here in 2013 due to the lack of a monitoring site in this AU. There is not yet a long enough period of record to perform analysis for significant trends.

This assessment unit is listed in the 2020 Texas Integrated Report as impaired for *E. coli* bacteria. There are no other impairments or concerns listed.

Water Quality Monitoring Results for Station 21431

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	21	20	91.00	980.00	347.29	-0.69	0.33	
Water Temperature (C)	19	0	7.90	26.40	17.24	-0.67	0.27	
Dissolved Oxygen (mg/L)	21	0	6.00	11.50	8.30	1.02	0.88	
pH (S.U.)	21	0	6.00	7.90	7.04	-0.91	0.00	
Specific Conductance (us/cm @ 25C)	21	0	53.00	152.00	102.24	1.28	0.55	
Ammonia-Nitrogen (mg/L as N)	21	0	0.10	0.10	0.10	1.94E+15	0.09	
Chloride (mg/L)	21	0	5.60	14.00	8.03	4.99	0.00	
Sulfate (mg/L)	21	0	5.00	24.80	11.46	2.05	0.10	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	parameter not collected for this station							
Total Phosphorus (mg/L as P)	19	0	0.02	0.10	0.04	0.63	0.75	
Total Suspended Solids (mg/L)	21	0	3.00	35.00	10.36	1.22	0.32	
Nitrate (Total) (mg/L)	14	0	0.05	0.27	0.11	-2.14	0.04	
Nitrite (Total) (mg/L)	14	0	0.05	0.05	0.05	1.68E+15	0.05	
Nitrate + Nitrite (mg/L as N)	21	0	0.05	0.59	0.17	0.84	0.55	
Chlorophyll-*a* (ug/L)	17	0	2.00	6.26	2.50	0.93	0.52	
Pheophytin (ug/L)	17	0	2.00	2.00	2.00	1.43E+16	0.10	

21431 - Ayish Bayou at West Columbia Street

SEGMENT 0610A - AYISH BAYOU

SUMMARY OF WATER QUALITY TRENDS

Trend Analysis Summary for Segment 0610A - Ayish Bayou

AU	Station ID	Station Description	*E. coli*	Temp	DO	pH	Spec Cond	NH3	Cl	SO4	TKN	Total P	TSS	NO3	NO2	NO3/ NO2	Chl-*a*	Pheo
0610A_01	15361	Ayish Bayou at SH 103				↓						↓						
0610A_02	21431	Ayish Bayou at West Columbia Street	*- No trends identified for this Assessment Unit -*															

↑ = Statistically significant increasing trend ↓ = Statistically significant decreasing trend

Water Quality Issues Summary for Segment 0610A - Ayish Bayou

Water Quality Issue	Affected Area	Possible Influences/Causes	Possible Effects	Possible Solutions / Actions Taken
Impairment for *E. coli* bacteria	Both assessment units	• Point-source pollution from wastewater discharges, sewer line breaks, overflows, etc. • Stormwater runoff • Failing (and non-existent) septic systems • Domestic animals and wildlife • Livestock and agricultural operations	• Water body does not meet the water quality standard for Primary Contact Recreation • Primary Contact Recreation in the water body has an increased risk of gastrointestinal illness	• Continue monitoring • Implement BMPs addressing agriculture practices. • Explore possibility of a WPP.

Ayish Bayou at SH 103

SEGMENT 0610P - BAYOU CARRIZO

Segment Profile

Bayou Carrizo (Segment 0610P) is an unclassified perennial freshwater stream extending from the confluence with Sam Rayburn Reservoir to the head waters near FM 941 in the City of Appleby.

This segment is listed in the 2020 Texas Integrated Report with a concern for *E. coli* bacteria in water.

ANRA Monitoring Sites
Wastewater Outfalls
Classified Segments
Other Hydrology
Segment Watershed
Counties

SEGMENT 0610P - BAYOU CARRIZO

Designated Use Criteria

The designated uses for this unclassified segment include contact recreation, high aquatic life use, fish consumption use, public water supply use, and general use.

Assessment Units in Segment 0610P - Bayou Carrizo

AU ID	Description
0610P_01	From the confluence with Sam Rayburn Reservoir upstream to the headwaters near FM 941 in the City of Appleby

Monitoring Stations in Segment 0610P - Bayou Carrizo

Assessment Unit	Monitoring Station ID	Description	Initial Monitoring Event	Latest Monitoring Event	Notes
0610P_01	21432	BAYOU CARRIZO AT SH 21 NEAR NACOGDOCHES	2013	2019	Monitored continuously since 2013.

Assessment Summary (as listed in the F2020 Texas Integrated Report)

Parameter	Standard	0610P_01 Assessment
Chloride (mg/L)	75	
Sulfate (mg/L)	50	
TDS (mg/L)	200	
DO Grab Screening Level (mg/L)	5.00	NC
DO Grab Minimum (mg/L)	3.00	FS
24 Hour DO Average		
24 Hour DO Minimum		
pH (SU)	6.0 - 8.5	
Temp (C)	32.2	
E. coli geomean (MPN /100 mL)	126	CN
Ammonia Nitrogen (mg/L)	0.33	NC
Nitrate Nitrogen (mg/L)	1.95	NC
Total Phosphorus (mg/L)	0.69	NC
Chl-a (µg/L)	14.1	NC
Mercury in Edible Tissue		
Dioxin in Edible Tissue		

FS = Fully Supporting NC = No Concern CN = Concern for Near Non-Attainment
CS = Concern for Screening Level NS = Not Supporting NA = Not Assessed

Bayou Carrizo at SH 21

SEGMENT 0610P - BAYOU CARRIZO

Monitoring Station 21432 - Bayou Carrizo at SH 21

Monitoring station 21432, is located at State Highway 21 near Nacogdoches. It is located in AU 0610P_01. Monitoring was begun here in 2013.

Although not considered statistically significant due to having less than 10 years of data, there was a decreasing trend observed for chloride.

This assessment unit is listed in the 2020 Texas Integrated Report as impaired for *E. coli* bacteria. There are no other impairments or concerns listed.

Water Quality Monitoring Results for Station 21432

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	21	16	39.00	2400.00		1.68	0.14	
Water Temperature (C)	19	0	2.30	26.40	16.57	-1.38	0.09	
Dissolved Oxygen (mg/L)	21	3	1.60	12.60	7.52	0.47	0.95	
pH (S.U.)	21	0	6.10	7.50	7.12	-0.33	0.00	
Specific Conductance (us/cm @ 25C)	21	0	144.00	467.00	216.24	1.22	0.49	
Ammonia-Nitrogen (mg/L as N)	21	0	0.10	0.10	0.10	1.90777E+15	0.10	
Chloride (mg/L)	21	0	7.60	21.00	12.20	2.93	0.03	
Sulfate (mg/L)	21	0	5.00	78.00	35.12	0.81	0.63	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	parameter not collected for this station							
Total Phosphorus (mg/L as P)	21	0	0.02	0.08	0.04	1.61	0.24	
Total Suspended Solids (mg/L)	21	0	2.50	56.00	13.02	0.68	0.61	
Nitrate (Total) (mg/L)								
Nitrite (Total) (mg/L)								
Nitrate + Nitrite (mg/L as N)	21	0	0.02	0.83	0.29	0.90	0.51	
Chlorophyll-a (ug/L)	20	1	2.00	221.00	13.72	0.59	0.59	
Pheophytin (ug/L)	20	0	2.00	30.40	3.60	0.65	0.59	

SUMMARY OF WATER QUALITY TRENDS

Trend Analysis Summary for Segment 0610P - Bayou Carrizo

There were no significant trends identified for this segment.

Summary of Water Quality Issues for Segment 0610P-Bayou Carrizo

Water Quality Issue	Affected Area	Possible Influences/Causes	Possible Effects	Possible Solutions / Actions Taken
Concern for *E. coli* bacteria	0610P_01	• Point-source pollution from wastewater discharges, sewer line breaks, overflows, etc. • Stormwater runoff • Failing (and non-existent) septic systems • Domestic animals and wildlife • Livestock and agricultural operations	• Water body does not meet the water quality standard for Primary Contact Recreation • Primary Contact Recreation in the water body has an increased risk of gastrointestinal illness	• Continue monitoring

SEGMENT 0611B - LA NANA BAYOU

Segment Profile

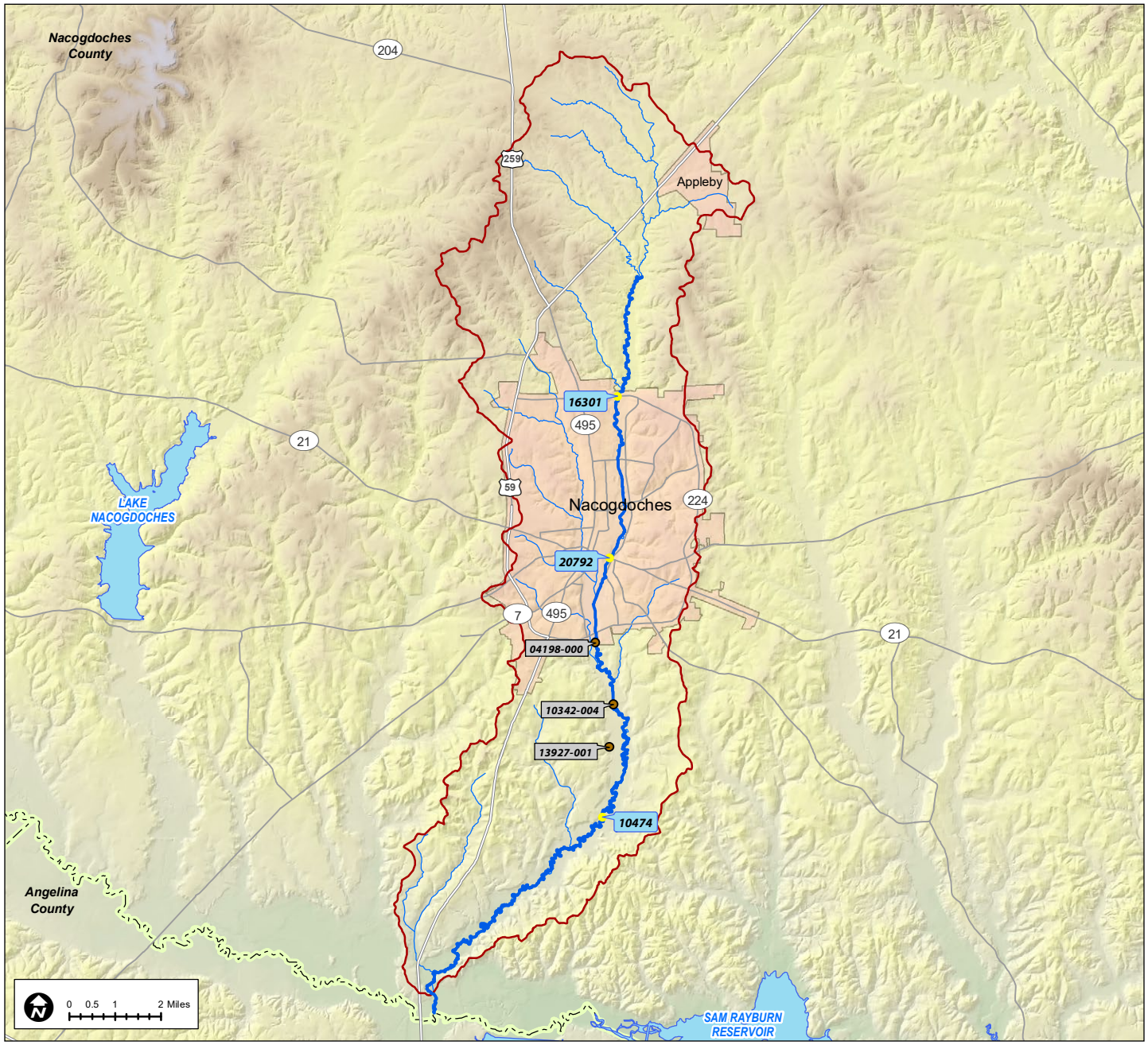
La Nana Bayou (Segment 0611B) is a 32 mile freshwater stream that extends from the confluence of the Angelina River south of Nacogdoches in Nacogdoches County to the upstream perennial portion of the stream north of Nacogdoches in Nacogdoches County.

In 2017, TCEQ funded a watershed characterization project through a Clean Water Act grant from EPA for this segment. Work was performed by TWRI and ANRA. See page 32 for further details.

La Nana Bayou is listed on the Draft 2020 303(d) List for not supporting primary contact recreation due to *E. coli* bacteria impairments. In AU 0611B_01, the geometric mean for *E. coli* exceeded the criterion of 126 MPN/100 mL with a value of 279.46 MPN/100 mL, based upon 26 samples assessed. In AU 0611B_02, the geometric mean for *E. coli* exceeded the standard with a value of 576.58 MPN/100 mL, based upon 35 samples assessed. In AU 0611B_03, the geometric mean for *E. coli* bacteria exceeded the standard with a value of 443.93 MPN/100 mL, based on 20 samples. Concerns for Nitrate+Nitrite and Total Phosphorus are also present in AU 0611B_01.

There are no other impairments or concerns listed for this segment.

- ANRA Monitoring Sites
- Wastewater Outfalls
- Classified Segments
- Other Hydrology
- Segment Watershed
- Counties



SEGMENT 0611B - LA NANA BAYOU

Designated Uses

La Nana Bayou has a designated Intermediate ALU and corresponding dissolved oxygen criteria of 4.0 mg/L in Appendix D of the TSWQS. The perennial stream has a primary contact recreation use with a corresponding *E. coli* geometric mean criteria of 126 MPN/100 mL.

Assessment Units in Segment 0611B - La Nana Bayou

AU ID	Description
0611B_01	From the confluence with Angelina River (0611), per WQS App. D, upstream to State Loop 224 in City of Nacogdoches.
0611B_02	From the upstream side of State Loop 224 upstream to FM 1878 in City of Nacogdoches, per WQS App. D.
0611B_03	From the upstream side of FM 1878 in City of Nacogdoches upstream to confluence with Banita Creek.

Monitoring Stations in Segment 0611B - La Nana Bayou

Assessment Unit	Monitoring Station ID	Description	Initial Monitoring Event	Latest Monitoring Event	Notes
0611B_01	10474	LA NANA BAYOU AT NACOGDOCHES CR 526 6.9 MI SOUTH OF NACOGDOCHES BETWEEN FM 2863 AND FM 3228	1969	2019	Monitored from 1969-1989,1996- present.
0611B_02	20792	LA NANA BAYOU IMMEDIATELY UPSTREAM OF EAST MAIN STREET/STATE HIGHWAY 7/ STATE HIGHWAY 21 IN NACOGDOCHES	2010	2019	Monitored continuously since 2010.
0611B_03	16301	LA NANA BAYOU AT LOOP 224 NORTH IN THE CITY OF NACOGDOCHES 1.2 KM EAST OF THE INTERSECTION OF US BUS 59F/ST LOOP 224 NORTH	1998	2019	Monitored from 1998-2000 and 2008-2019.

10474 - La Nana Bayou at CR 526

20792 - La Nana Bayou at East Main Street

16301 - La Nana Bayou at Loop 224N

SEGMENT 0611B - LA NANA BAYOU

Assessment Summary (as listed in the 2020 Texas Integrated Report)

Parameter	Standard	0611B_01 Assessment	0611B_02 Assessment	0611B_03 Assessment
Chloride (mg/L)	125			
Sulfate (mg/L)	50			
TDS (mg/L)	250			
DO Grab Screening Level (mg/L)	4.00	NC	NC	NC
DO Grab Minimum (mg/L)	3.00	FS	FS	FS
24 Hour DO Average (mg/L)	5.00			NA
24 Hour DO Minimum (mg/L)	3.00			NA
pH (SU)	6.0 - 8.5			
Temp (C)	32.2			
E. coli geomean (MPN /100 mL)	126	NS	NS	NS
Ammonia Nitrogen (mg/L)	0.33	NC	NC	NC
Nitrate Nitrogen (mg/L)	1.95	CS	NC	NC
Total Phosphorus (mg/L)	0.69	CS	NC	NC
Chl-*a* (µg/L)	14.1	NC	NC	NC
Mercury in Edible Tissue				
Dioxin in Edible Tissue				

FS = Fully Supporting NC = No Concern CN = Concern for Near Non-Attainment
CS = Concern for Screening Level NS = Not Supporting NA = Not Assessed

La Nana Bayou at Loop 224 N

SEGMENT 0611B - LA NANA BAYOU

Monitoring Station 10474 - La Nana Bayou at CR 526

Located in AU 0611B_01, Monitoring Station ID 10474 is monitored quarterly for field and conventional parameters, flow, and *E. coli* bacteria. This monitoring station is located 6.9 miles south of Nacogdoches at CR 526.

Decreasing trends identified for Chlorophyll-*a* and Pheophytin are not considered statistically significant due to having greater than fifty percent censored values that resulted form a change in LOQ.

This assessment unit is listed in the 2020 Texas Integrated Report with an impairment for *E. coli* bacteria. There are also concerns listed for Nitrate and Total Phosphorus. There are no other concerns or impairments listed.

10474- Flow Measurement being conducted

Water Quality Monitoring Results for Station 10474

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	105	83	29.80	3972.00	303.07	-0.36	0.16	
Water Temperature (C)	82	0	4.20	28.70	19.03	4.09	0.97	
Dissolved Oxygen (mg/L)	81	1	2.80	13.40	7.40	4.17	0.54	
pH (S.U.)	81	2	6.30	9.40	7.27	21.80	0.36	
Specific Conductance (us/cm @ 25C)	84	0	135.00	702.00	351.61	3.06	0.62	
Ammonia-Nitrogen (mg/L as N)	83	21	0.01	4.65	0.35	2.33	0.12	
Chloride (mg/L)	76	0	9.70	100.00	44.03	2.71	0.82	
Sulfate (mg/L)	76	10	8.90	108.00	40.16	2.94	0.56	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	parameter not collected for this station							
Total Phosphorus (mg/L as P)	83	59	0.12	7.30	1.83	2.03	0.60	
Total Suspended Solids (mg/L)	76	0	2.80	340.00	15.94	-0.12	0.53	
Nitrate (Total) (mg/L)	22	0	0.63	7.60	2.84	1.52	0.19	
Nitrite (Total) (mg/L)	23	0	0.05	0.19	0.06	2.13	0.07	
Nitrate + Nitrite (mg/L as N)	84	33	0.04	13.40	2.41	-0.14	0.12	
Chlorophyll-*a* (ug/L)	59	2	2.00	54.70	4.18	3.77	0.00	
Pheophytin (ug/L)	51	0	2.00	5.00	2.19	7.26	0.00	

La Nana Bayou at CR 526

SEGMENT 0611B - LA NANA BAYOU

Monitoring Station 20792 - La Nana Bayou at East Main Street

Located in AU 0611B_02, Monitoring Station ID 20792 is monitored quarterly for field and conventional parameters, flow, and *E. coli* bacteria. Because there are less than twenty samples, any trends at this station are not considered to be statistically significant.

Trends identified for this station are not considered to be statistically significant due to having less than 10 years of data, however, there were decreasing trends for Specific Conductance and Total Suspended Solids and increasing trends for *E. coli* bacteria and pH.

Along with having less than 10 years of data, trends identified for Nitrite-Nitrogen and Ammonia Nitrogen are not considered significant due to having greater than fifty percent censored data.

This assessment unit is listed in the 2020 Texas Integrated Report as impaired for *E. coli* bacteria. There are no other impairments or concerns listed for this assessment unit.

Water Quality Monitoring Results for Station 20792

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	41	36	23.00	2400.00	493.92	-2.06	0.02	
Water Temperature (C)	39	0	2.50	28.60	17.79	0.06	0.37	
Dissolved Oxygen (mg/L)	40	1	2.70	13.00	8.15	1.17	0.98	
pH (S.U.)	41	0	6.40	7.90	7.23	6.34	0.02	
Specific Conductance (us/cm @ 25C)	41	0	141.00	512.00	234.95	3.30	0.05	
Secchi Transparency (Meters)	41	0	0.10	1.20	0.56	0.14	0.47	
Ammonia-Nitrogen (mg/L as N)	41	1	0.10	0.54	0.12	2.38	0.09	
Chloride (mg/L)	33	0	9.30	104.00	19.18	-0.96	0.19	
Sulfate (mg/L)	33	0	18.00	49.40	30.47	4.01	0.01	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	parameter not collected for this station							
Total Phosphorus (mg/L as P)	40	0	0.02	0.15	0.06	2.18	0.13	
Total Suspended Solids (mg/L)	33	0	2.50	44.00	8.35	2.12	0.08	
Nitrate (Total) (mg/L)	22	0	0.06	0.64	0.33	0.21	0.98	
Nitrite (Total) (mg/L)	23	0	0.05	0.05	0.05	1.03E+15	0.02	
Nitrate + Nitrite (mg/L as N)	41	0	0.04	0.69	0.33	-1.37	0.04	
Chlorophyll-*a* (ug/L)	28	0	2.00	4.78	2.21	1.09	0.95	
Pheophytin (ug/L)	28	0	2.00	2.50	2.02	5.53	0.88	

La Nana Bayou at East Main Street Nacogdoches; flood stage

SEGMENT 0611B - LA NANA BAYOU

Monitoring Station 16301 - La Nana Bayou at Loop 224N

Located in AU 0611B_03, Monitoring Station ID 16301 is monitored quarterly for field and conventional parameters, flow, and *E. coli* bacteria.

Trends identified for this station are not considered statistically significant due to a significant gap in data from 2001-2008. However, there were decreasing trends for Specific Conductance and Total Phosphorus that persist after excluding data prior to 2009. Along with having a large data gap, the trend identified for Nitrate-Nitrogen is not considered significant due to having greater than fifty percent censored values

This assessment unit is listed in the 2020 Texas Integrated Report as impaired for *E. coli* bacteria. There are no other impairments or concerns listed for this assessment unit.

Water Quality Monitoring Results for Station 16301

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	48	42	4.00	2400.00	278.47	0.92	0.63	
Water Temperature (C)	49	0	2.60	28.10	17.88	2.41	0.72	
Dissolved Oxygen (mg/L)	50	4	1.30	13.00	7.37	0.45	0.14	
pH (S.U.)	51	2	5.70	7.90	7.21	12.43	0.65	
Specific Conductance (us/cm @ 25C)	51	0	140.00	354.00	206.12	5.18	0.07	
Ammonia-Nitrogen (mg/L as N)	50	1	0.03	0.37	0.11	1.17	0.65	
Chloride (mg/L)	43	0	5.00	23.70	11.87	2.43	0.68	
Sulfate (mg/L)	43	3	9.00	67.00	33.62	1.81	0.86	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	parameter not collected for this station							
Total Phosphorus (mg/L as P)	50	1	0.02	0.80	0.09	5.35	0.00	
Total Suspended Solids (mg/L)	43	0	1.20	95.00	10.56	0.73	0.77	
Nitrate (Total) (mg/L)	22	0	0.05	0.61	0.30	0.86	0.50	
Nitrite (Total) (mg/L)	23	0	0.05	0.05	0.05	1.03E+15	0.02	
Nitrate + Nitrite (mg/L as N)	51	0	0.03	1.30	0.31	2.37	0.16	
Chlorophyll-a (ug/L)	39	2	2.00	71.40	5.11	1.12	0.36	
Pheophytin (ug/L)	39	0	2.00	6.18	2.34	0.97	0.95	

Flowers at La Nana Bayou

SEGMENT 0611B - LA NANA BAYOU

SUMMARY OF WATER QUALITY TRENDS

Trend Analysis Summary for Segment 0611B - La Nana Bayou

There were no statistically significant trends identified for this segment.

Summary of Water Quality Issues for Segment 0611B-La Nana Bayou

Water Quality Issue	Affected Area	Possible Influences/Causes	Possible Effects	Possible Solutions / Actions Taken
Impairments for *E. coli* bacteria	Entire water body	• Municipal wastewater discharge, wastewater collection system leaks or spills. • Nonpoint sources of pollution • Stormwater runoff	• Water body does not meet the water quality standard for Primary Contact Recreation • Primary Contact Recreation in the water body has an increased risk of gastrointestinal illness	• Continue monitoring • A watershed characterization has been completed. Work is ongoing to increase local stakeholder engagement to pursue further options for watershed improvement such as a watershed protection plan and/or a TMDL.
Concern for Nitrate-Nitrogen	AU 0611B_01 (lower assessment unit)	• Municipal wastewater discharge • Nonpoint sources of pollution • Stormwater runoff	• Detrimental effect on aquatic biological community	• Continue monitoring
Concern for Total Phosphorus	AU 0611B_01 (lower assessment unit)	• Municipal wastewater discharge • Nonpoint sources of pollution • Stormwater runoff	• Can increase production of algae • Algae production can cause swings in dissolved oxygen, which can be detrimental to the aquatic biological community	• Continue monitoring

La Nana Bayou at CR 526

SEGMENT 0612 - ATTOYAC BAYOU

Segment Profile

The Attoyac Bayou is 92 miles long from the intermittent headwaters, all the way downstream to the riverine portion of Sam Rayburn Reservoir just north of where the Attoyac arm of Sam Rayburn crosses SH 103. The area surrounding the watershed is managed for agricultural (cattle and poultry), silvicultural, recreational, and wildlife uses.

The Attoyac Bayou flows from the north into Sam Rayburn Reservoir. Its watershed encompasses slightly more than 364,350 acres (569 square miles) and includes portions of four counties. Rusk and Nacogdoches County are on the west and Shelby and San Augustine County to the east. Approximately two thirds of the border between Rusk and Shelby Counties is demarcated by the Attoyac Bayou, as well as the entire shared border between Nacogdoches and Shelby Counties, and the shared border between Nacogdoches and San Augustine Counties.

Development of a Watershed Protection Plan began in 2009 and extensive targeted monitoring was performed at several sites from 2010-2012. The Plan was completed in 2014. Since that time, work has been ongoing in the watershed to improve water quality by holding educational events, working with landowners to implement BMPs, and also through efforts to repair/replace OSSFs for low-income households in the watershed. Attoyac Bayou (Segment 0612) is listed on the 2020 303(d) List for not supporting primary contact recreation due to bacteria impairments. All three Assessment Units are listed as category 5c, and were first listed in 2004.

In AU 0612_01, the geometric mean for *E. coli* exceeded the standard of 126 MPN/100 mL, with a value of 197.46 MPN/100 mL based upon 40 samples assessed from the period of 12/1/2011 to 11/30/2018.

In AU 0612_02, the geometric mean for *E. coli* exceeded the standard of 126 MPN/100 mL with a value of 187.58 MPN/100 mL based upon an assessment of 40 samples in the 2020 Texas Integrated Report.

In AU 0612_03, the geometric mean for *E. coli* exceeded the standard of 126 MPN/100 mL with a value of 261.92 MPN/100 mL based upon 21 samples assessed in the 2020 assessment.

SEGMENT 0612 - ATTOYAC BAYOU

Designated Uses

Attoyac Bayou has a designated Public Water Supply use and a High ALU and corresponding DO criteria. Attoyac Bayou also has a designated contact recreation use with a corresponding *E. coli* geometric mean criteria of 126 MPN/100 mL.

Assessment Units in Segment 0612- Attoyac Bayou

AU ID	Description
0612_01	From the lower boundary approximately at confluence with Granberry Branch upstream to confluence with Polly Branch.
0612_02	From a point immediately upstream of Polly Branch confluence upstream to confluence with Bear Bayou.
0612_03	From a point immediately upstream of Bear Bayou upstream to upper boundary at FM 95.

Monitoring Stations in Segment 0612- Attoyac Bayou

Assessment Unit	Monitoring Station ID	Description	Initial Monitoring Event	Latest Monitoring Event	Notes
0612_01	10636	ATTOYAC BAYOU AT SH 21 0.71 KM WEST OF INTERSECTION OF SH 21/ FM 1196 4.77 KM EAST OF CHIRENO	1972	2019	Monitored continuously since 1972.
0612_02	15253	ATTOYAC BAYOU AT SH 7 1.75 KM NORTHEAST OF MARTINSVILLE	1997	2019	Monitored 1997 and began again in 2003.
0612_02	20841	ATTOYAC BAYOU AT FM 138 9.65 KM SOUTHEAST OF US 59 IN GARRISON	2010	2019	This station is collecting data for BMP effectiveness monitoring via CWA section 319 grants
0612_03	16076	ATTOYAC BAYOU AT US 59 4.12 KM NORTHEAST OF GARRISON	1997	2019	Monitored continuously since 1997.

ANRA is currently monitoring at an additional station (20841 - Attoyac Bayou at FM 138). This station is part of a Clean Water Act Section 319 grant. Since the monitoring is not routine and is biased to assess the implementation of best management practices listed in the Attoyac Bayou Watershed Protection Plan, this data will not be presented in the Basin Summary Report.

Attoyac Bayou at US 59

Attoyac Bayou at SH 7

Attoyac Bayou at SH 21

SEGMENT 0612 - ATTOYAC BAYOU

Assessment Summary (as listed in the 2020 Texas Integrated Report)

Parameter	Standard	0612_01 Assessment	0612_02 Assessment	0612_03 Assessment
Chloride (mg/L)	75	FS	FS	FS
Sulfate (mg/L)	50	FS	FS	FS
TDS (mg/L)	200	FS	FS	FS
DO Grab Screening Level (mg/L)	5.00	NC	NC	NC
DO Grab Minimum (mg/L)	3.00	FS	FS	FS
24 Hour DO Average				
24 Hour DO Minimum				
pH (SU)	6.0 - 8.5	FS	FS	FS
Temp (C)	32.2	FS	FS	FS
E. coli geomean (MPN /100 mL)	126	NS	NS	NS
Ammonia Nitrogen (mg/L)	0.33	NC	NC	NC
Nitrate Nitrogen (mg/L)	1.95	NC	NC	NC
Total Phosphorus (mg/L)	0.69	NC	NC	NC
Chl-*a* (µg/L)	14.1	NC	NC	NC
Mercury in Edible Tissue				
Dioxin in Edible Tissue				

FS = Fully Supporting NC = No Concern CN = Concern for Near Non-Attainment
CS = Concern for Screening Level NS = Not Supporting NA = Not Assessed

Mussel found at Attoyac Bayou at SH 7

Attoyac Bayou at FM 138

SEGMENT 0612 - ATTOYAC BAYOU

Monitoring Station 10636 - Attoyac Bayou at SH 21

Monitoring Station 10636 is located in AU_0612_01. ANRA monitors this station quarterly for field and conventional parameters, flow, and *E. coli* bacteria.

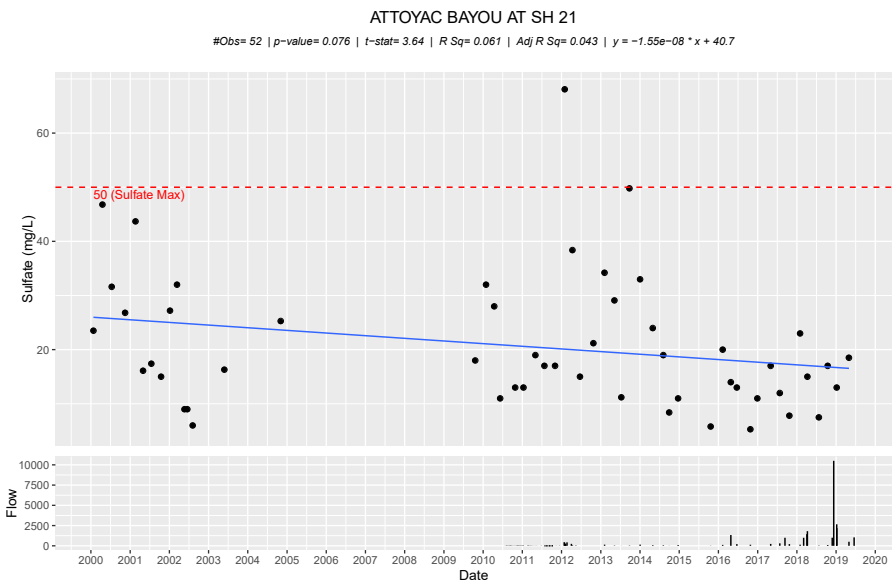
Full period trends at this station are not considered to be statistically significant due to a large gap in data from 2005-2009. There were decreasing trends identified for Sulfate and Total Phosphorus that persist even after excluding values prior to 2009. The decreasing trends for Specific Conductance and Nitrate+Nitrite do not persist when excluding data prior to 2009. The following graphs illustrate the full period data vs. 2009-Present data for parameters with discussed trends.

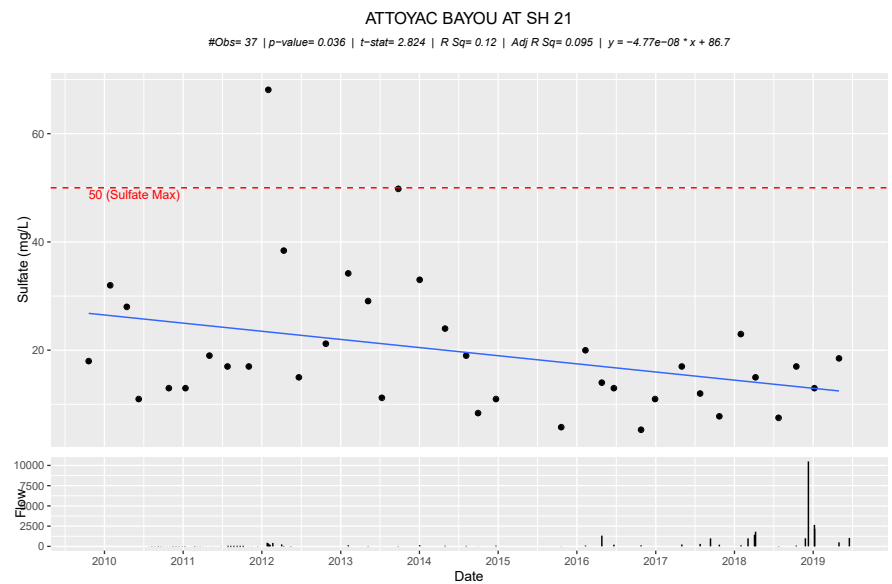
The decreasing trends identified for Chlorophyll-*a* and Pheophytin are not considered to be statistically significant due to having greater than fifty percent censored values as well as a large gap in observations.

This AU is listed as impaired for *E. coli* bacteria. No other impairments or concerns are identified for this AU in the 2020 Texas Integrated Report.

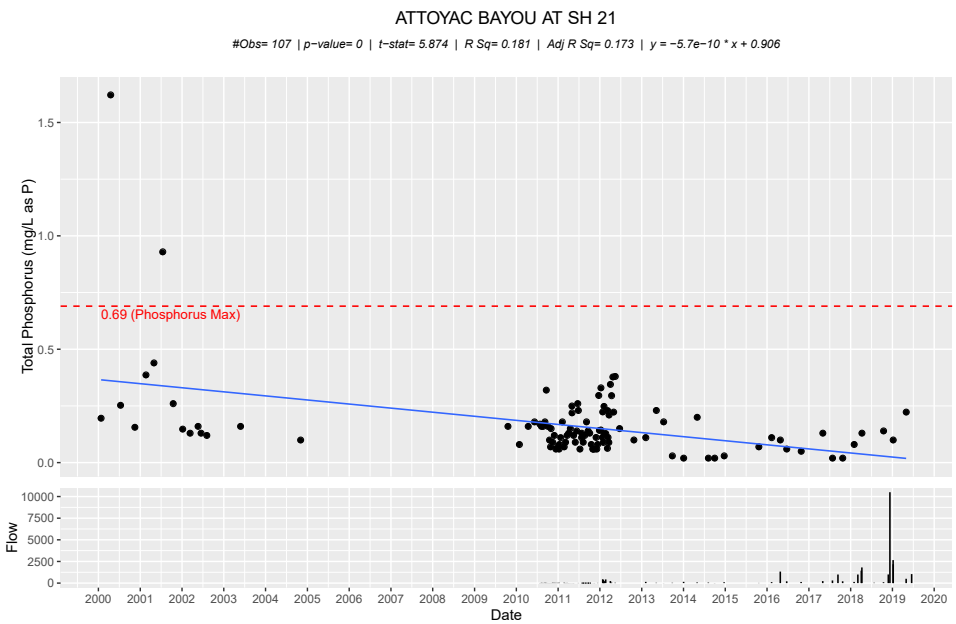
Water Quality Monitoring Results for Station 10636

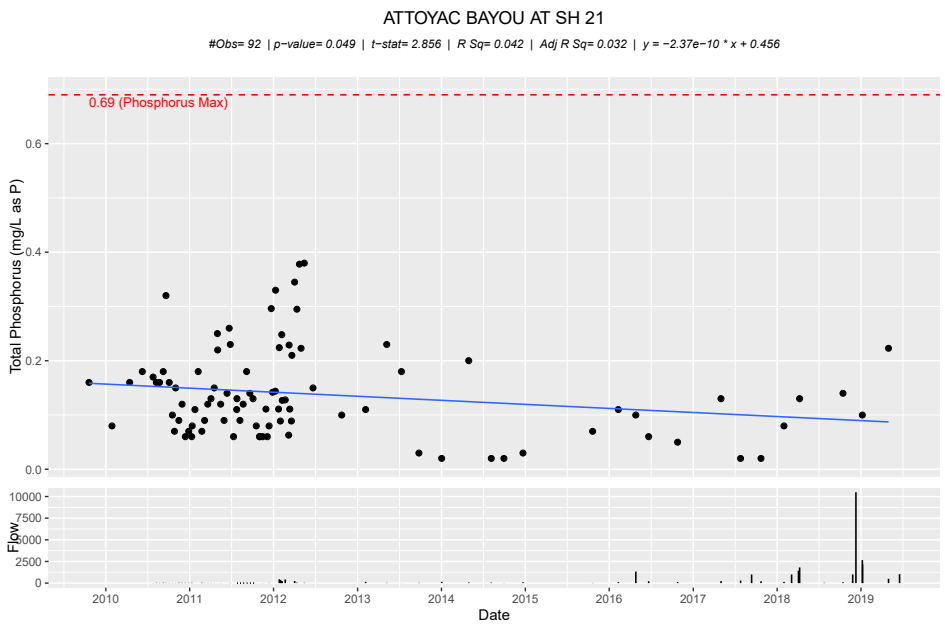
Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	152	101	13.00	9200.00	192.39	-0.93	0.11	
Water Temperature (C)	95	0	4.30	29.40	17.78	2.77	0.93	
Dissolved Oxygen (mg/L)	96	0	3.50	12.30	7.95	4.73	0.85	
pH (S.U.)	97	7	6.34	8.90	7.57	15.67	0.59	
Specific Conductance (us/cm @ 25C)	97	0	86.00	278.00	141.43	2.48	0.04	
Ammonia-Nitrogen (mg/L as N)	109	1	0.01	0.71	0.10	0.52	0.25	
Chloride (mg/L)	52	0	5.70	44.00	11.60	3.10	0.41	
Sulfate (mg/L)	52	1	5.30	68.10	20.69	3.64	0.08	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	6	0	0.48	0.84	0.66	2.83	0.06	
Total Phosphorus (mg/L as P)	107	2	0.02	1.62	0.17	5.87	0.00	
Total Suspended Solids (mg/L)	109	0	2.90	310.00	41.02	-0.10	0.24	
Nitrate (Total) (mg/L)	14	0	0.18	0.78	0.55	0.29	0.95	
Nitrite (Total) (mg/L)	14	0	0.05	0.05	0.05	1.68E+15	0.05	
Nitrate + Nitrite (mg/L as N)	109	2	0.04	5.40	0.51	5.44	0.00	
Chlorophyll-*a* (ug/L)	43	0	1.00	10.00	3.30	6.20	0.00	
Pheophytin (ug/L)	42	0	0.50	18.20	2.60	4.37	0.00	

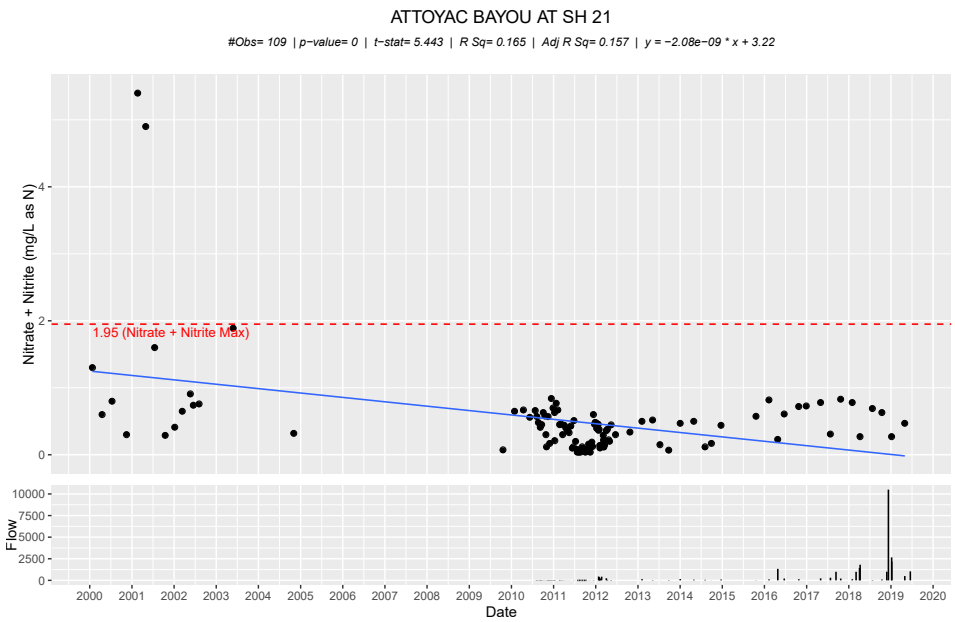


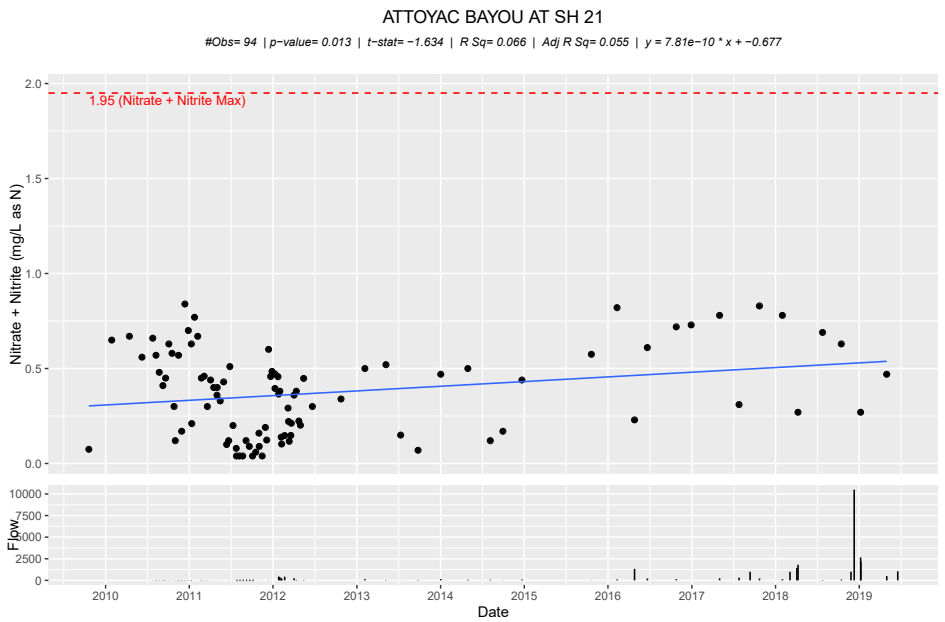


SEGMENT 0612 - ATTOYAC BAYOU

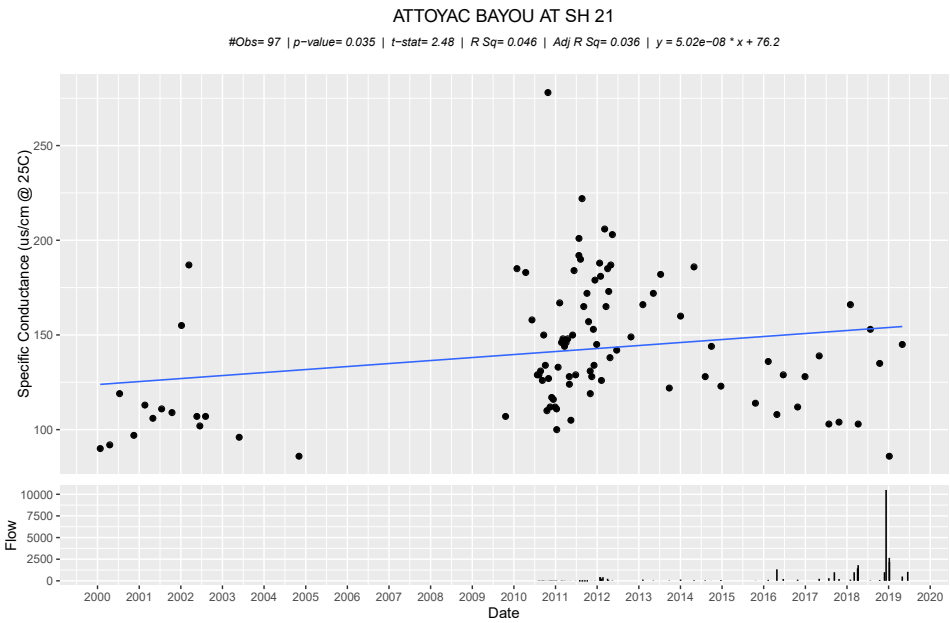


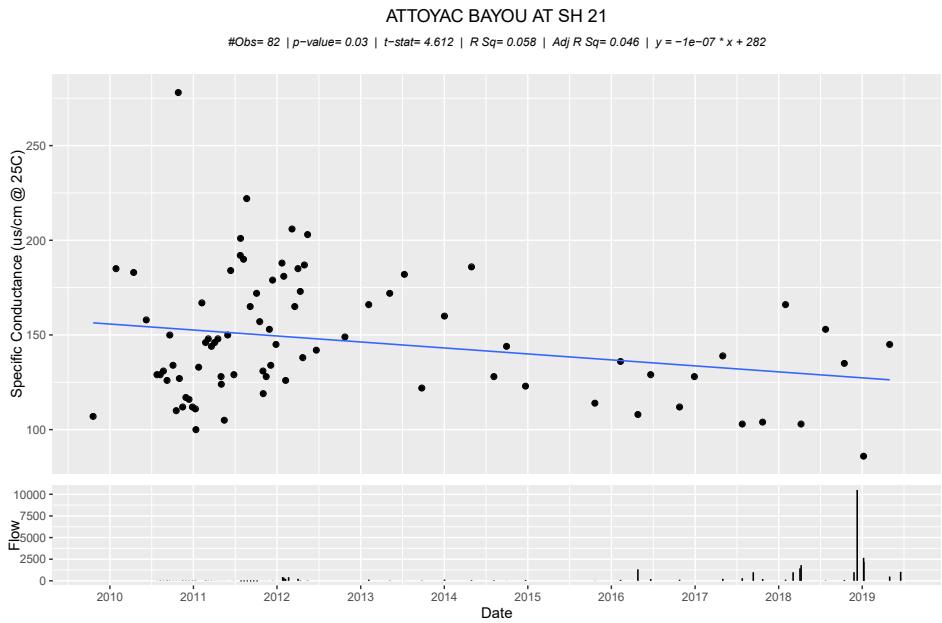






SEGMENT 0612 - ATTOYAC BAYOU





Attoyac Bayou at FM 138

SEGMENT 0612 - ATTOYAC BAYOU

Monitoring Station 15253 - Attoyac Bayou at SH 7

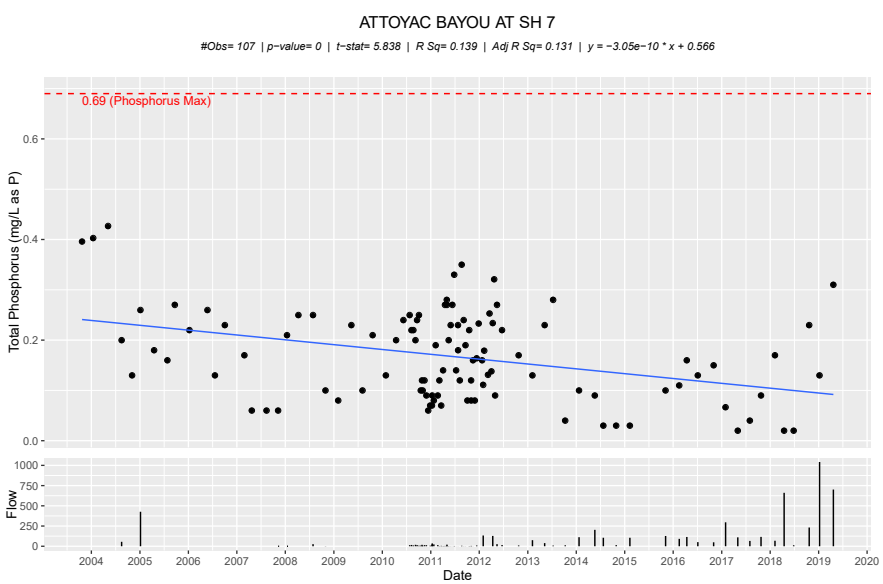
Monitoring Station ID 15253 is located in AU_0612_02. ANRA monitors this station quarterly for field and conventional parameters, flow, and *E. coli* bacteria. This monitoring station was sampled extensively in 2011 and 2012 as part of the Attoyac Bayou WPP project. The monitoring regime for this project included biweekly sampling (compared to quarterly monitoring during the rest of the period of record).

A statistically significant decreasing trend was observed for Total Phosphorus.

Decreasing trends observed for Ammonia-Nitrogen, Chlorophyll-*a*, and Pheophytin are not considered statistically significant due to having greater than fifty percent censored value with Chlorophyll-*a* and Pheophytin resulting from a change in LOQ. This assessment unit is listed in the 2020 Texas Integrated Report as impaired for *E. coli* bacteria. There are no other concerns or impairments listed.

Water Quality Monitoring Results for Station 15253

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	107	69	14.00	2400.00	183.43	-0.08	0.46	
Water Temperature (C)	102	0	3.50	28.40	17.79	3.26	0.36	
Dissolved Oxygen (mg/L)	103	5	0.50	11.60	6.97	2.14	0.61	
pH (S.U.)	102	2	5.95	8.60	7.39	12.16	0.95	
Specific Conductance (us/cm @ 25C)	104	0	79.00	273.00	155.41	2.26	0.19	
Ammonia-Nitrogen (mg/L as N)	107	19	0.04	1.31	0.20	8.16	0.00	
Chloride (mg/L)	61	0	5.60	24.00	13.31	2.59	0.78	
Sulfate (mg/L)	61	1	5.20	64.90	20.46	2.53	0.33	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	Parameter not collected for this station.							
Total Phosphorus (mg/L as P)	107	0	0.02	0.43	0.17	5.84	0.00	↓
Total Suspended Solids (mg/L)	107	0	1.00	280.00	34.66	-0.42	0.20	
Nitrate (Total) (mg/L)	14	0	0.21	0.54	0.40	2.13	0.10	
Nitrite (Total) (mg/L)	14	0	0.05	0.05	0.05	1.61E+15	0.03	
Nitrate + Nitrite (mg/L as N)	107	1	0.04	2.10	0.32	2.35	0.18	
Chlorophyll-*a* (ug/L)	56	1	2.00	14.30	3.96	5.89	0.00	
Pheophytin (ug/L)	48	0	2.00	5.00	2.29	6.19	0.00	



15253- Attoyac Bayou at SH 7

SEGMENT 0612 - ATTOYAC BAYOU

Monitoring Station 16076 - Attoyac Bayou at US 59

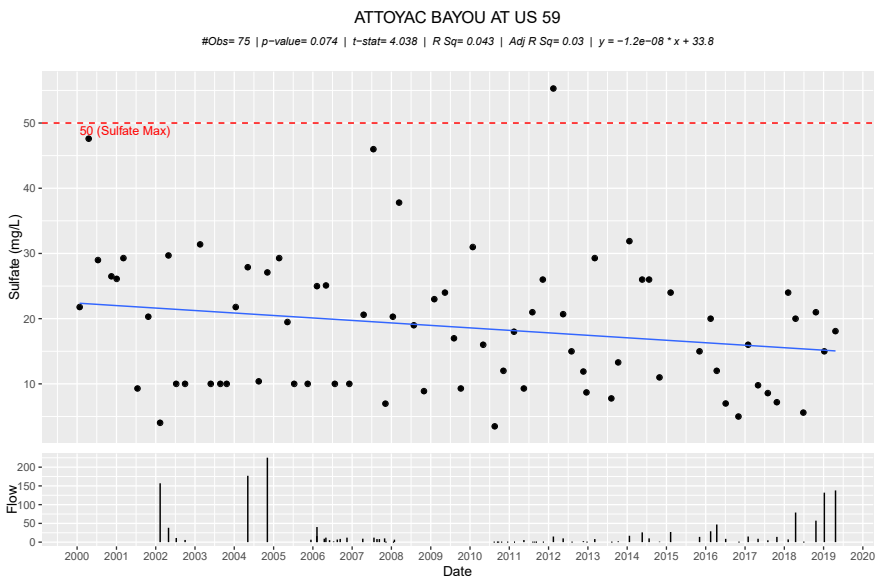
Located in AU 0612_03, Monitoring Station 16076 is ANRA's most northern sampling location on the Attoyac Bayou. ANRA monitors this station quarterly for field and conventional parameters, flow, and *E. coli* bacteria.

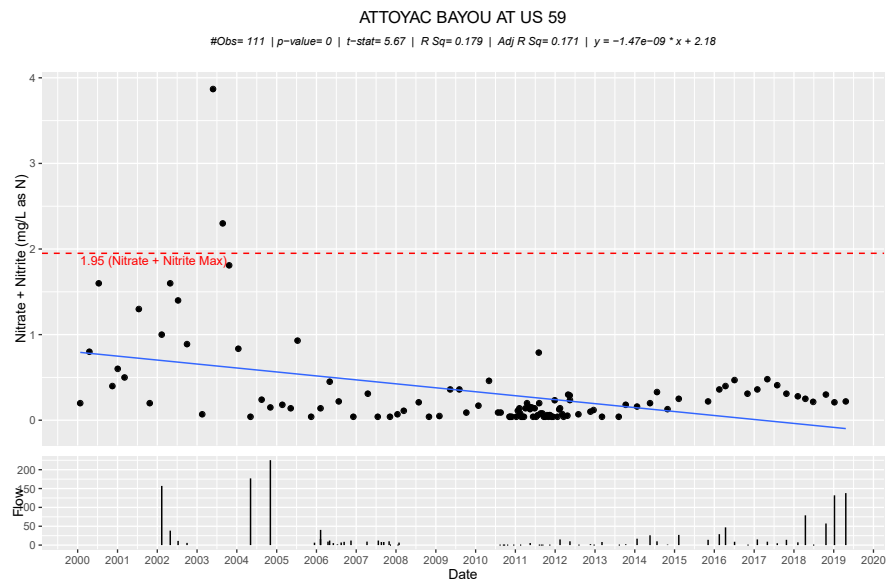
Analysis shows statistically significant decreasing trends for Sulfate and Nitrate+Nitrite.

This AU, as with all assessment units of the Attoyac Bayou, is listed in the 2020 Texas Integrated Report as impaired for *E. coli* bacteria.

Water Quality Monitoring Results for Station 16076

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	132	109	12.00	2400.00	221.14	1.43	0.69	
Water Temperature (C)	106	0	2.20	29.40	16.79	3.11	0.93	
Dissolved Oxygen (mg/L)	105	6	0.70	13.20	7.00	4.69	0.11	
pH (S.U.)	105	2	5.70	8.50	7.31	12.98	0.24	
Specific Conductance (us/cm @ 25C)	108	0	40.00	312.00	132.58	0.99	0.00	
Ammonia-Nitrogen (mg/L as N)	111	23	0.01	1.30	0.24	2.30	0.23	
Chloride (mg/L)	75	0	5.00	40.00	12.51	4.52	0.21	
Sulfate (mg/L)	75	1	3.50	55.30	18.75	4.04	0.07	↓
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	parameter not collected at this station							
Total Phosphorus (mg/L as P)	110	2	0.02	4.00	0.20	1.66	0.30	
Total Suspended Solids (mg/L)	111	0	5.20	790.00	38.50	0.04	0.62	
Nitrate (Total) (mg/L)	14	0	0.16	0.43	0.28	1.05	0.46	
Nitrite (Total) (mg/L)	14	0	0.05	0.05	0.05	1.61E+15	0.03	
Nitrate + Nitrite (mg/L as N)	111	2	0.04	3.87	0.32	5.67	0.00	↓
Chlorophyll-*a* (ug/L)	55	6	2.00	326.00	12.27	0.35	0.88	
Pheophytin (ug/L)	47	0	2.00	20.00	3.34	1.34	0.42	





SEGMENT 0612 - ATTOYAC BAYOU

SUMMARY OF WATER QUALITY TRENDS

Trend Analysis Summary for Segment 0612 - Attoyac Bayou

AU	Station ID	Station Description	*E. coli*	Temp	DO	pH	Spec Cond	NH3	Cl	SO4	TKN	Total P	TSS	NO3	NO2	NO3/ NO2	Chl-*a*	Pheo
0612_01	10636	Attoyac Bayou at SH 21	*- No trends identified for this Assessment Unit -*															
0612_02	15253	Attoyac Bayou at SH 7										↓						
0612_03	16076	Attoyac Bayou at US 59								↓						↓		

↑ = Statistically significant increasing trend ↓ = Statistically significant decreasing trend

Water Quality Issues Summary for Segment 0612 - Attoyac Bayou

Water Quality Issue	Affected Area	Possible Influences/Causes	Possible Effects	Possible Solutions / Actions Taken
Impairment for *E. coli* bacteria	Attoyac Bayou (upper, middle, and lower portions)	• Municipal wastewater discharge • Failing (and non-existent) septic systems • Wildlife (deer and feral hogs) • Livestock and agricultural operations, including cattle and poultry operations	• Water body does not meet the water quality standard for Primary Contact Recreation • Primary Contact Recreation in the water body has an increased risk of gastrointestinal illness	• Continue monitoring • A TSSWCB-funded CWA §319 grant was used to assess nutrient parameters, develop load duration curves, perform bacterial source tracking, conduct a RUAA, and develop a watershed protection plan (WPP) • The Attoyac Bayou WPP has been accepted by EPA • ANRA is using grants to replace failing septic systems within the watershed as well as monitor effectiveness of Best Management Practices • Other BMPs will be implemented as part of the Attoyac Bayou WPP

Attoyac Bayou at US 59

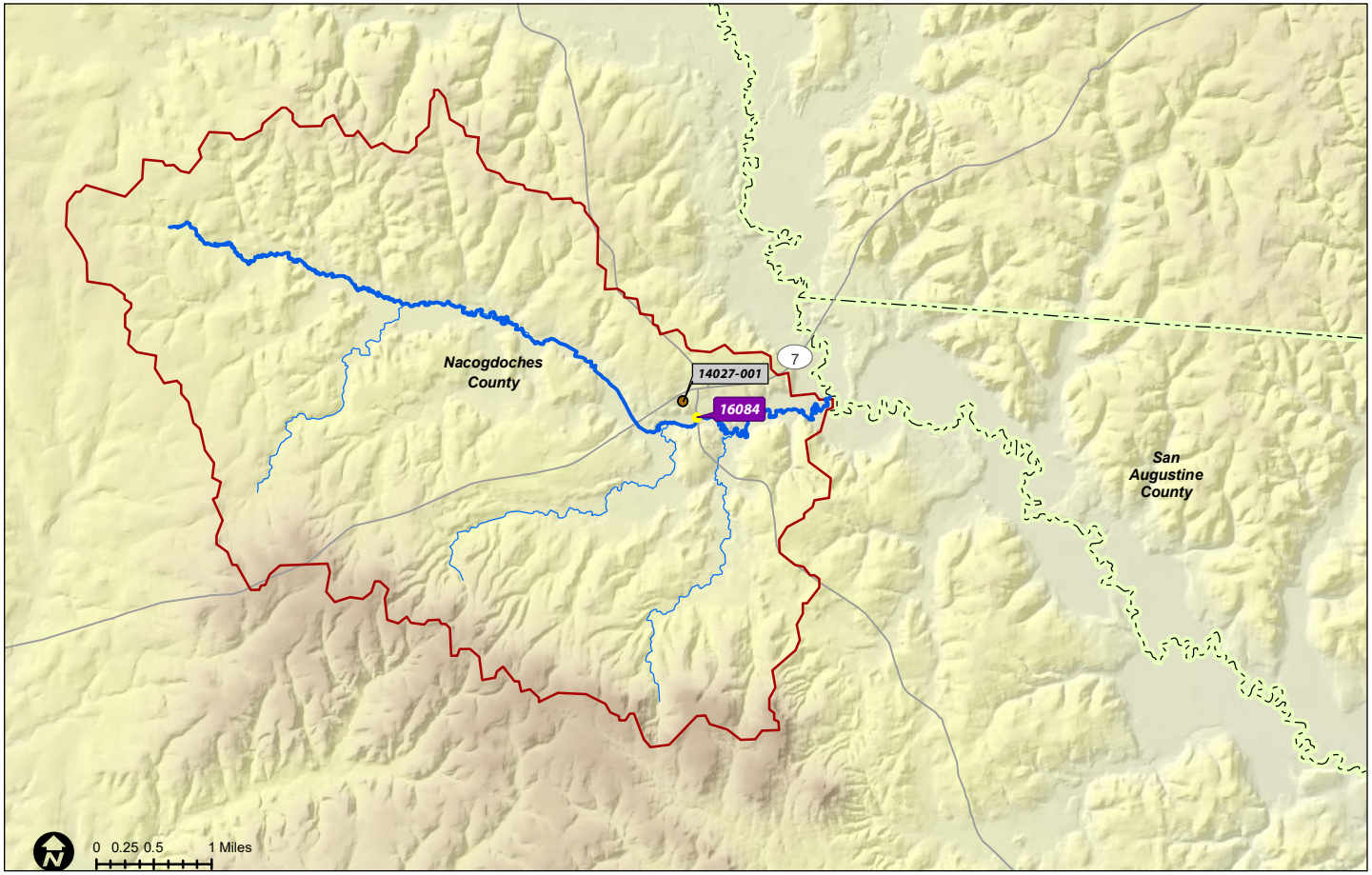
SEGMENT 0612A - TERRAPIN CREEK

Segment Profile

This segment is a 9.5-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.

A tributary to the Attoyac Bayou, Terrapin Creek was monitored in 2011 and 2012 as part of the study to develop a watershed protection plan for the Attoyac. It is currently being monitored by SFA as a series of projects to assess BMP effectiveness in the watershed.

Due to the limited time frame of sampling, data for this unclassified segment is not used for assessment and is presented in the Basin Summary Report.



- ANRA Monitoring Sites
- SFA Monitoring Sites
- TCEQ Monitoring Sites
- Wastewater Outfalls
- Classified Segments
- Other Hydrology
- Segment Watershed
- Counties

Assessment Units in Segment 0612A- Terrapin Creek

AU ID	Description
0612A_01	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

Monitoring Stations in Segment 0612A- Terrapin Creek

Station ID	AU ID	Description	Earliest Data	Latest Data	Notes
16084	0612A_01	TERRAPIN CREEK AT SH 95 1 MI SOUTH OF MARTINSVILLE	1997	2019	Monitored 1997-1998 and began again in 2010.

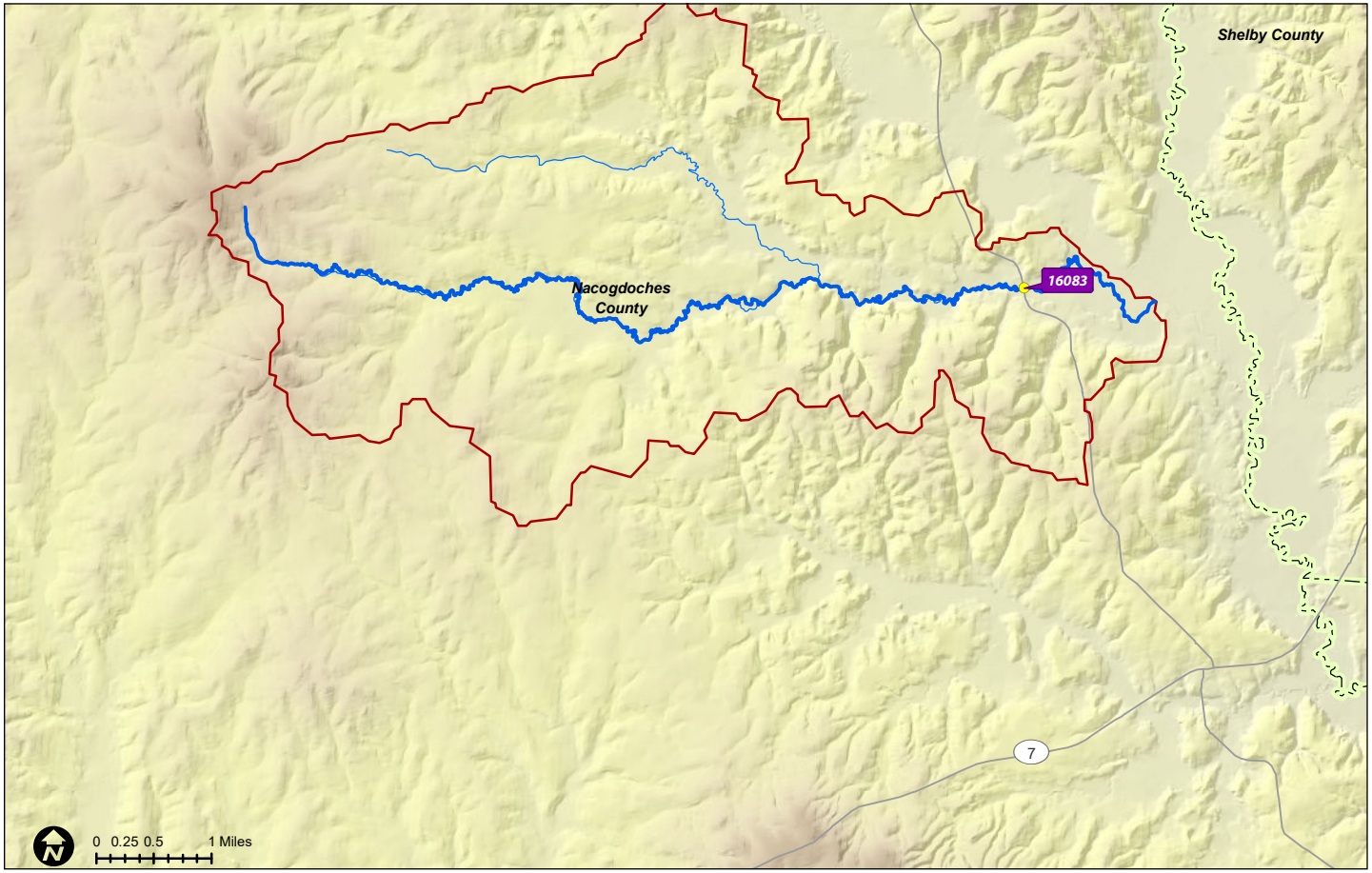
SEGMENT 0612B - WAFFELOW CREEK

Segment Profile

This segment is a 14-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.

A tributary to the Attoyac Bayou, Waffelow Creek was monitored in 2011 and 2012 as part of the study to develop a watershed protection plan for the Attoyac. It is currently being monitored by SFA as a series of projects to assess BMP effectiveness in the watershed.

Due to the limited time frame of sampling and significant gaps in data, this unclassified segment is not used for assessment and is presented in the Basin Summary Report.



- ANRA Monitoring Sites
- SFA Monitoring Sites
- TCEQ Monitoring Sites
- Wastewater Outfalls
- Classified Segments
- Other Hydrology
- Segment Watershed
- Counties

Assessment Units in Segment 0612B- Waffelow Creek

AU ID	Description
0612B_01	From the confluence of Naconiche Creek north of Martinsville in Nacogdoches County upstream to confluence with unnamed tributary about 0.27 km west of CR 234 at NHD RC 12020005000207
0612B_02	From a point immediately upstream of confluence with unnamed tributary about 0.27 km west of CR 234 upstream to headwaters

Monitoring Stations in Segment 0612B- Waffelow Creek

Station ID	AU ID	Description	Earliest Data	Latest Data	Notes
16083	0612B_01	WAFFELOW CREEK AT FM 95 3.65 MI NORTH NORTHWEST OF MARTINSVILLE	1997	2019	Monitored from 1997-1998, 2010-2012, and 2014 to present.

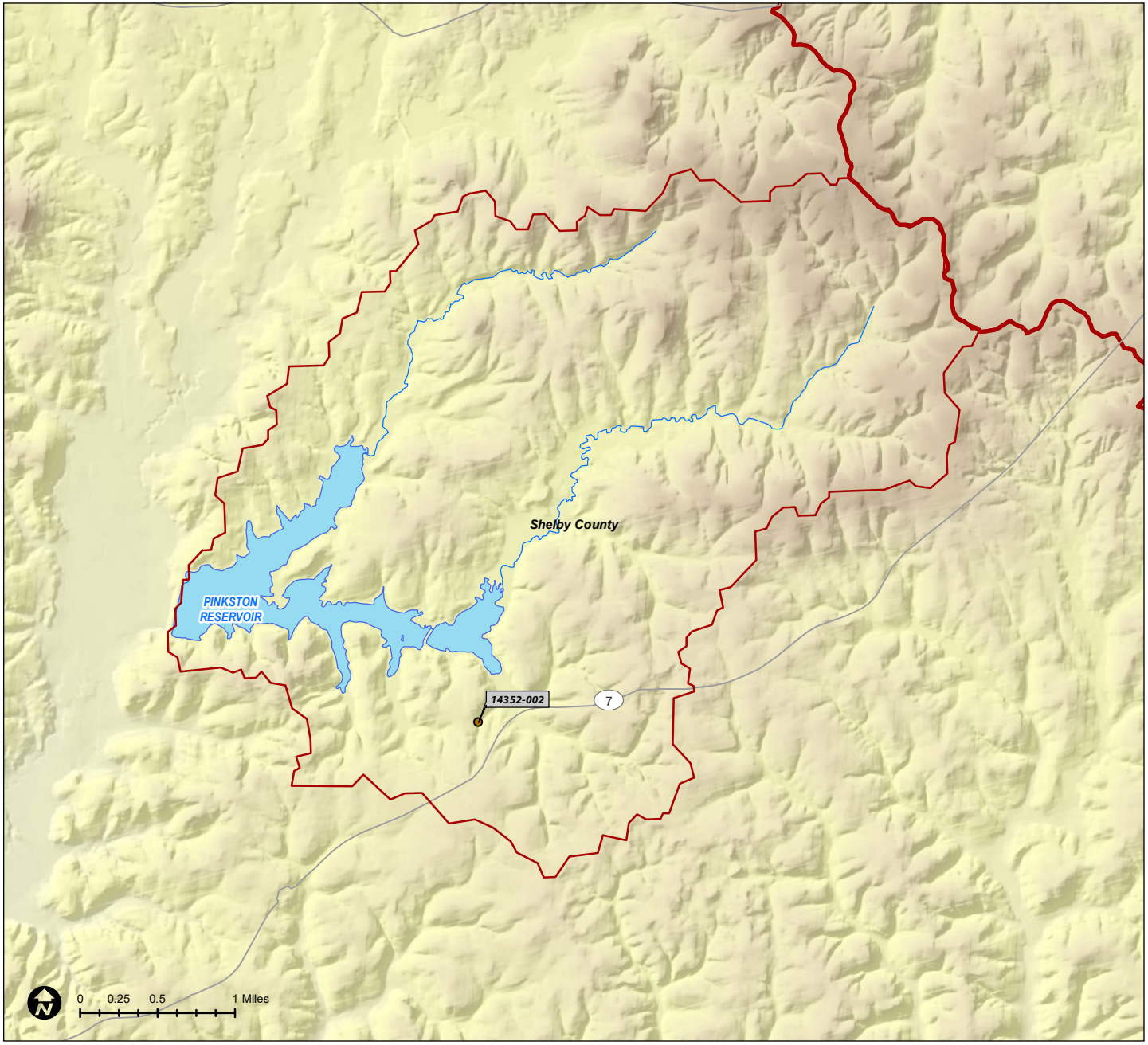
SEGMENT 0612C - PINKSTON RESERVOIR

Segment Profile

Segment 0612C (unclassified) includes 523 acres composed of a freshwater 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.



Wastewater Outfalls
Classified Segments
Other Hydrology
Segment Watershed
Counties

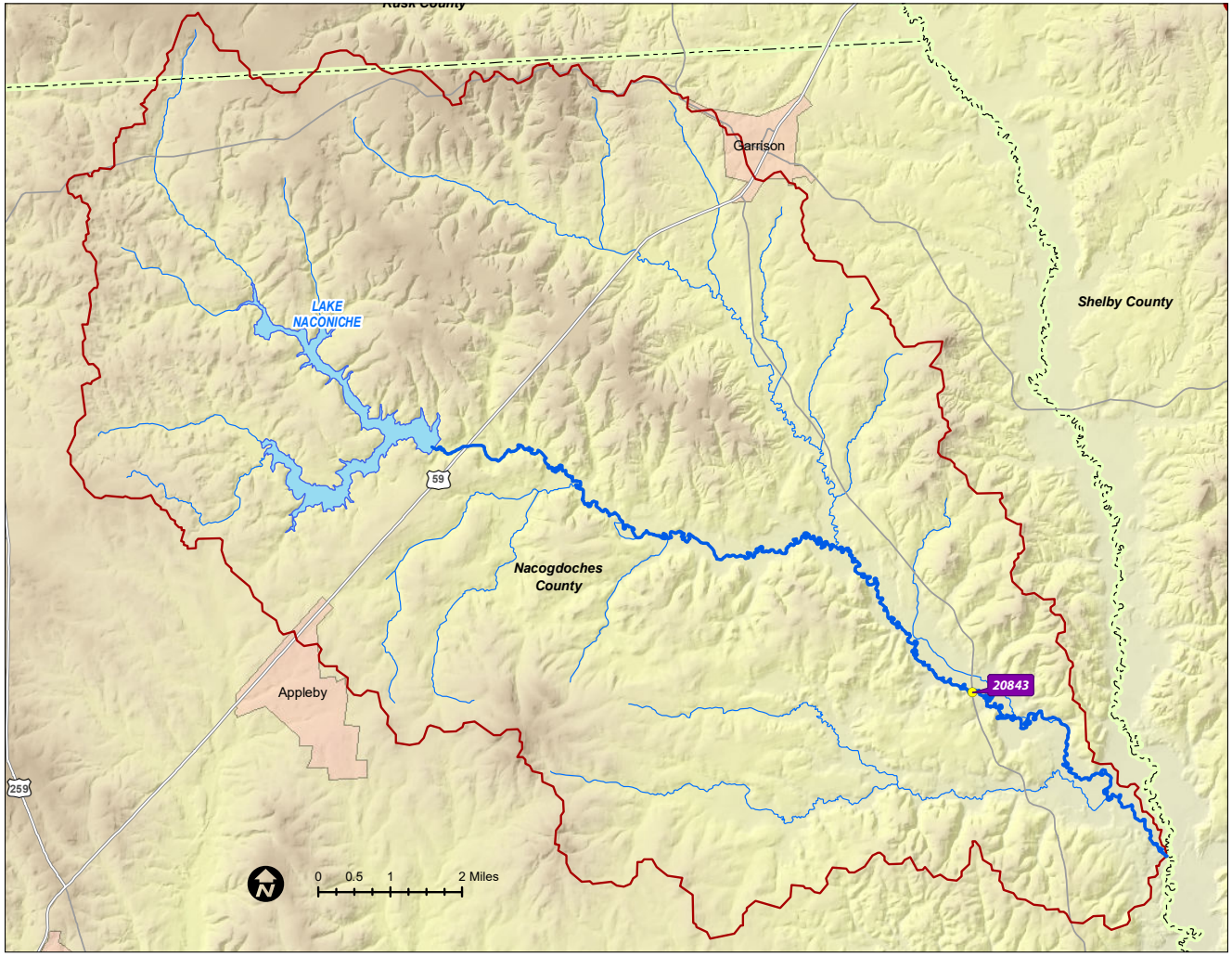
SEGMENT 0612D - NACONICHE CREEK

Segment Profile

A tributary to the Attoyac Bayou, Naconiche Creek is 32 miles long and stretches from the confluence with the Attoyac Bayou in Nacogdoches County to the headwaters located approximately 3.2 km upstream of FM 1087 in Rusk County. Naconiche Creek was monitored in 2011 and 2012 as part of the study to develop a watershed protection plan for the Attoyac. It is currently being monitored by SFA as part of a series of projects to assess BMP effectiveness in the watershed.

Due to the limited time frame of sampling, data for this unclassified segment is not used for assessment and is presented in the Basin Summary Report.

Lake Naconiche was completed and began to fill in 2008. It is discussed separately, later in this document.



ANRA Monitoring Sites
SFA Monitoring Sites
TCEQ Monitoring Sites
Wastewater Outfalls
Classified Segments
Other Hydrology
Segment Watershed
Counties

Assessment Units in Segment 0612D- Naconiche Creek

AU ID	Description
0612C_01	From the confluence with the Attoyac Bayou in Nacogdoches Co. to Lake Naconiche Dam in Nacogdoches County

Monitoring Stations in Segment 0612D- Naconiche Creek

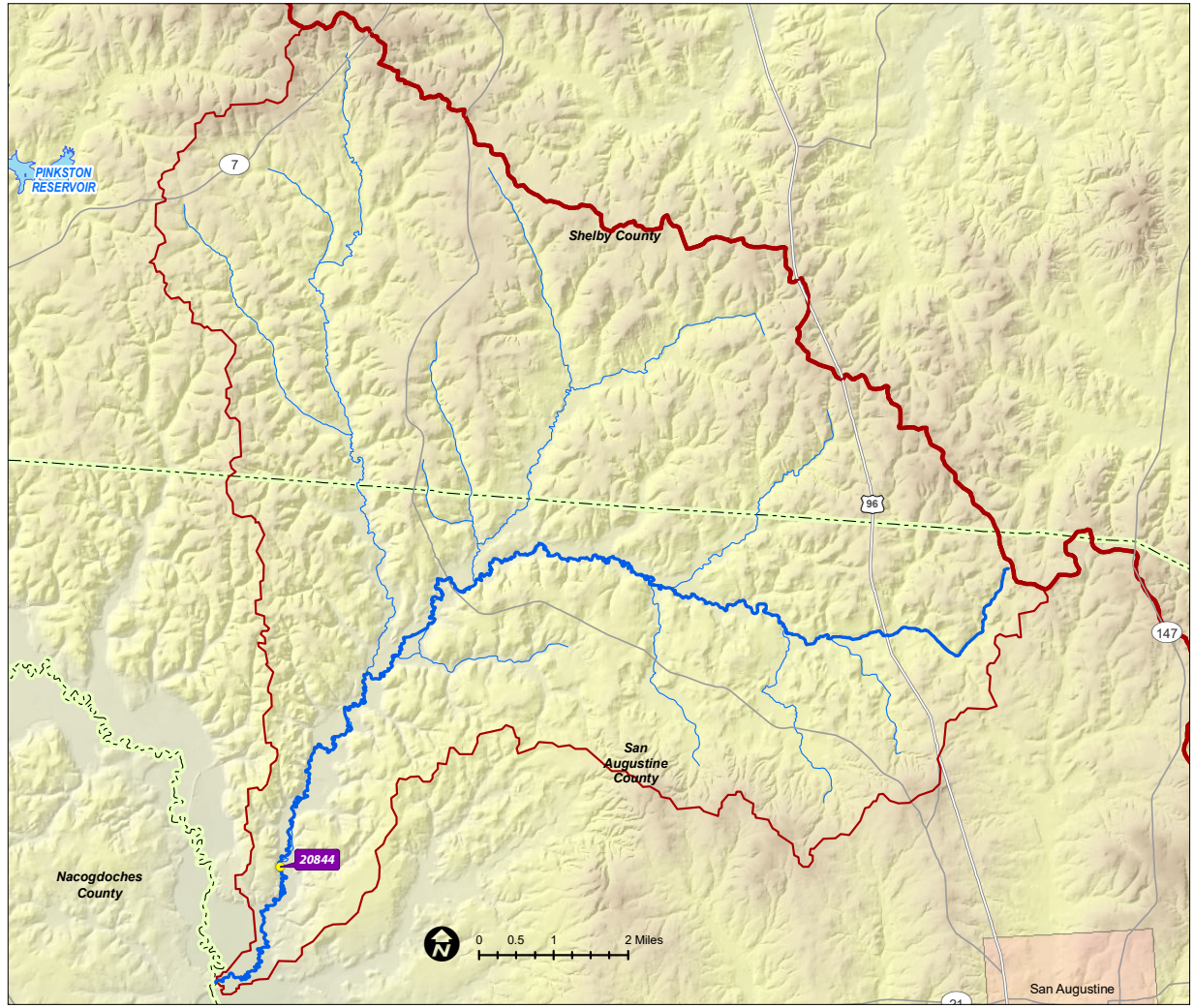
Station ID	AU ID	Description	Earliest Data	Latest Data	Notes
20843	0612C_01	NACONICHE CREEK AT FM 95 APPROXIMATELY 9 KM N OF INTERSECTION WITH SH 7 IN MARTINSVILLE	2010	2019	Monitored continuously since 2010.

SEGMENT 0612E - BIG IRON ORE CREEK

Segment Profile

Big Iron Ore Creek is a tributary to the Attoyac Bayou. This 24.3-mile long stream stretches from the confluence with the Attoyac Bayou in San Augustine County to the headwaters approximately 4.3 km upstream of US Hwy 96. This segment was monitored in 2011 and 2012 as part of the study to develop a watershed protection plan for the Attoyac. It is currently being monitored by SFA as part of a series of projects to assess BMP effectiveness in the watershed.

Due to the limited time frame of sampling, data for this unclassified segment is not used for assessment and is not presented in the Basin Summary Report.



- ANRA Monitoring Sites
- SFA Monitoring Sites
- TCEQ Monitoring Sites
- Wastewater Outfalls
- Classified Segments
- Other Hydrology
- Segment Watershed
- Counties

Assessment Units in Segment 0612E- Big Iron Ore Creek

AU ID	Description
0612E_01	From the confluence with the Attoyac Bayou in San Augustine Co. to the headwaters approximately 4.3 km upstream of US Hwy 96 in San Augustine Co.

Monitoring Stations in Segment 0612D- Naconiche Creek

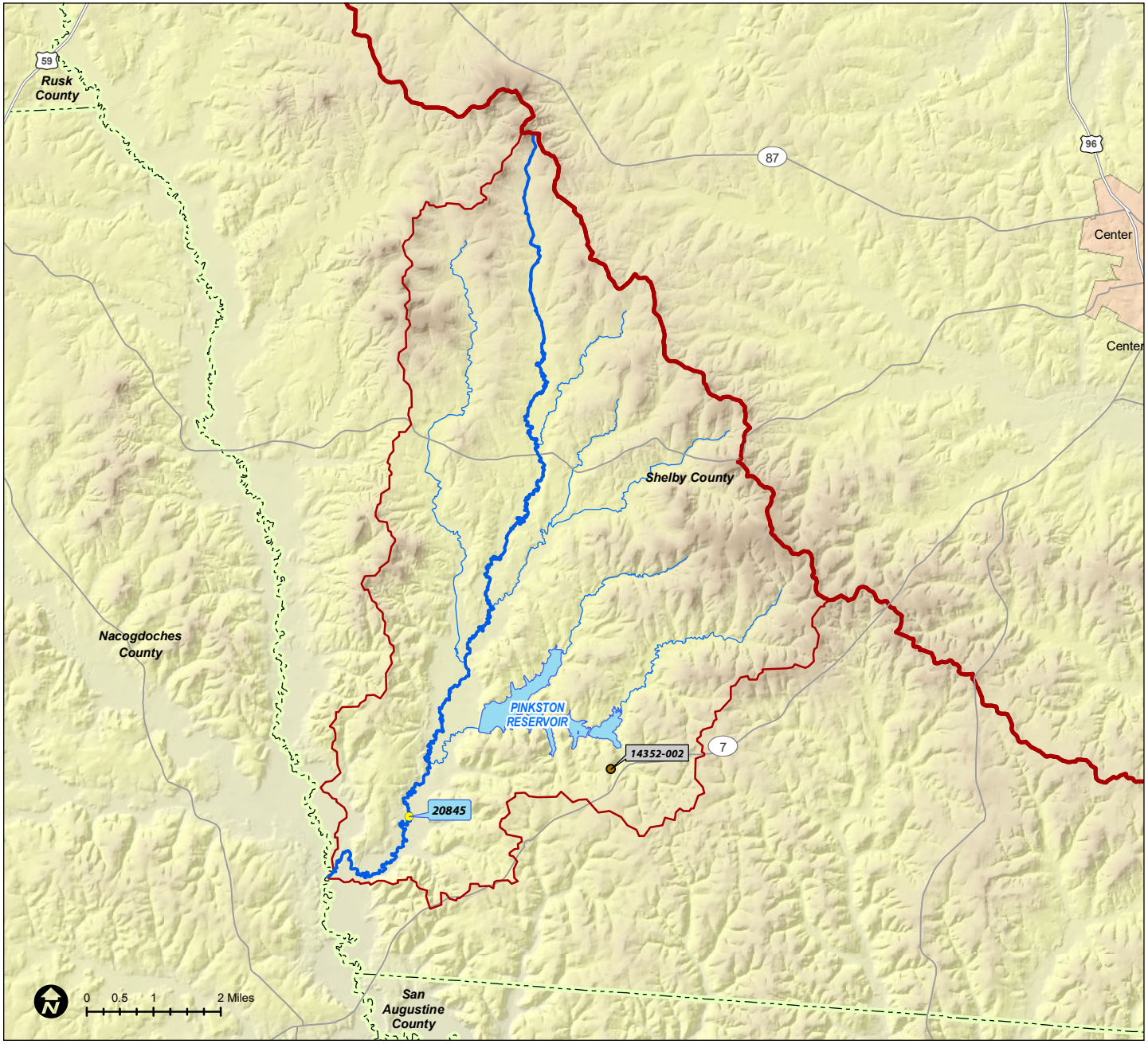
Station ID	AU ID	Description	Earliest Data	Latest Data	Notes
20844	0612E_01	BIG IRON ORE CREEK AT FM 354 APPROXIMATELY 9.65 KM N OF INTERSECTION WITH SH 21 AND NE OF SAN AUGUSTINE	2010	2019	Monitored 2010-2012 and began again in 2014.

SEGMENT 0612F - WEST CREEK

Segment Profile

West Creek is a tributary to the Attoyac Bayou. This 20.5-mile long stream stretches from the confluence with Attoyac Bayou in Shelby County to the headwaters approximately 2.2 km upstream of CR 4054. 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 was monitored in 2011 and 2012 as part of the study to develop a watershed protection plan for the Attoyac. It is currently being monitored by ANRA as a routine Clean Rivers Program monitoring station.

This segment is listed in the 2020 Texas Integrated Report with a concern for *E. coli* bacteria. There are no other concerns or impairments listed for this water body.



ANRA Monitoring Sites
Wastewater Outfalls
Classified Segments
Other Hydrology
Segment Watershed
Counties

SEGMENT 0612F - WEST CREEK

Designated Uses

The designated uses for this unclassified segment include the following: high aquatic life, general, contact recreation, and public water supply.

Assessment Units in Segment 0612F- West Creek

AU ID	Description
0612F_01	WEST CREEK AT FM 2913 2.57 KM N OF INTERSECTION WITH SH 7

Monitoring Stations in Segment 0612F- West Creek

Station ID	AU ID	Description	Earliest Data	Latest Data	Notes
20845	0612F_01	WEST CREEK AT FM 2913 2.57 KM N OF INTERSECTION WITH SH 7	2010	2019	Monitored continuously since 2010.

Assessment Summary (as listed in the 2020 Texas Integrated Report)

Parameter	Standard	0612F_01 Assessment
Chloride (mg/L)	75	
Sulfate (mg/L)	50	
TDS (mg/L)	200	
DO Grab Screening Level (mg/L)	3.00	NC
DO Grab Minimum (mg/L)	2.00	FS
24 Hour DO Average (mg/L)		
24 Hour DO Minimum (mg/L)		
pH (SU)	6.0 - 8.5	
Temp (C)	32.22	
E. coli geomean (MPN /100 mL)	126	CN
Ammonia Nitrogen (mg/L)	0.33	NC
Nitrate Nitrogen (mg/L)	1.95	NC
Total Phosphorus	0.69	NC
Chl-*a* (µg/L)	14.10	NC
Mercury in Edible Tissue		
Dioxin in Edible Tissue		

FS = Fully Supporting NC = No Concern CN = Concern for Near Non-Attainment
CS = Concern for Screening Level NS = Not Supporting NA = Not Assessed

West Creek at FM 2913

SEGMENT 0612F - WEST CREEK

Monitoring Station 20845 - West Creek at FM 2913

Monitoring Station 20845 is located in AU 0612F_01. ANRA monitors this station quarterly for field and conventional parameters, flow, and *E. coli* bacteria.

Analysis shows a decreasing trend for pH that is not considered to be statistically significant due to having less than ten years of data as well as a significant gap in data.

This AU is listed in the 2020 Texas Integrated Report with a concern for *E. coli* bacteria.

Water Quality Monitoring Results for Station 20845

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	66	44	38.00	2400.00	177.46	0.05	0.73	
Water Temperature (C)	62	0	5.30	27.60	16.91	1.26	0.97	
Dissolved Oxygen (mg/L)	63	1	1.40	12.30	7.14	-1.35	0.00	
pH (S.U.)	64	2	6.40	8.80	7.59	13.72	0.00	
Specific Conductance (us/cm @ 25C)	64	0	109.00	289.00	173.91	1.26	0.34	
Ammonia-Nitrogen (mg/L as N)	66	0	0.04	0.20	0.11	3.28	0.38	
Chloride (mg/L)	21	0	7.20	23.00	13.59	1.98	0.17	
Sulfate (mg/L)	21	1	5.04	55.00	25.80	0.77	0.63	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	parameter not collected for this station							
Total Phosphorus (mg/L as P)	66	0	0.02	0.21	0.09	2.22	0.34	
Total Suspended Solids (mg/L)	66	0	2.50	73.60	15.66	0.59	0.96	
Nitrate (Total) (mg/L)	14	0	0.09	0.71	0.31	1.02	0.41	
Nitrite (Total) (mg/L)	14	0	0.05	0.05	0.05	1.61E+15	0.03	
Nitrate + Nitrite (mg/L as N)	66	0	0.04	0.84	0.23	-1.69	0.02	
Chlorophyll-*a* (ug/L)	17	0	2.00	7.82	3.21	-1.13	0.20	
Pheophytin (ug/L)	17	0	2.00	2.00	2.00	1.42E+16	0.10	

West Creek at FM 2913

SEGMENT 0612F - WEST CREEK

SUMMARY OF WATER QUALITY TRENDS

Trend Analysis Summary for Segment 0612F - West Creek

There were no significant trends identified for this segment.

Water Quality Issues Summary for Segment 0612F - West Creek

Water Quality Issue	Affected Area	Possible Influences/Causes	Possible Effects	Possible Solutions / Actions Taken
Concern for *E. coli* bacteria	0612F_01	• Municipal wastewater discharge • Failing (and non-existent) septic systems • Wildlife (deer and feral hogs) • Livestock and agricultural operations, including cattle and poultry operations	• Water body does not meet the water quality standard for Primary Contact Recreation • Primary Contact Recreation in the water body has an increased risk of gastrointestinal illness	• Continue monitoring

West Creek at FM 2913

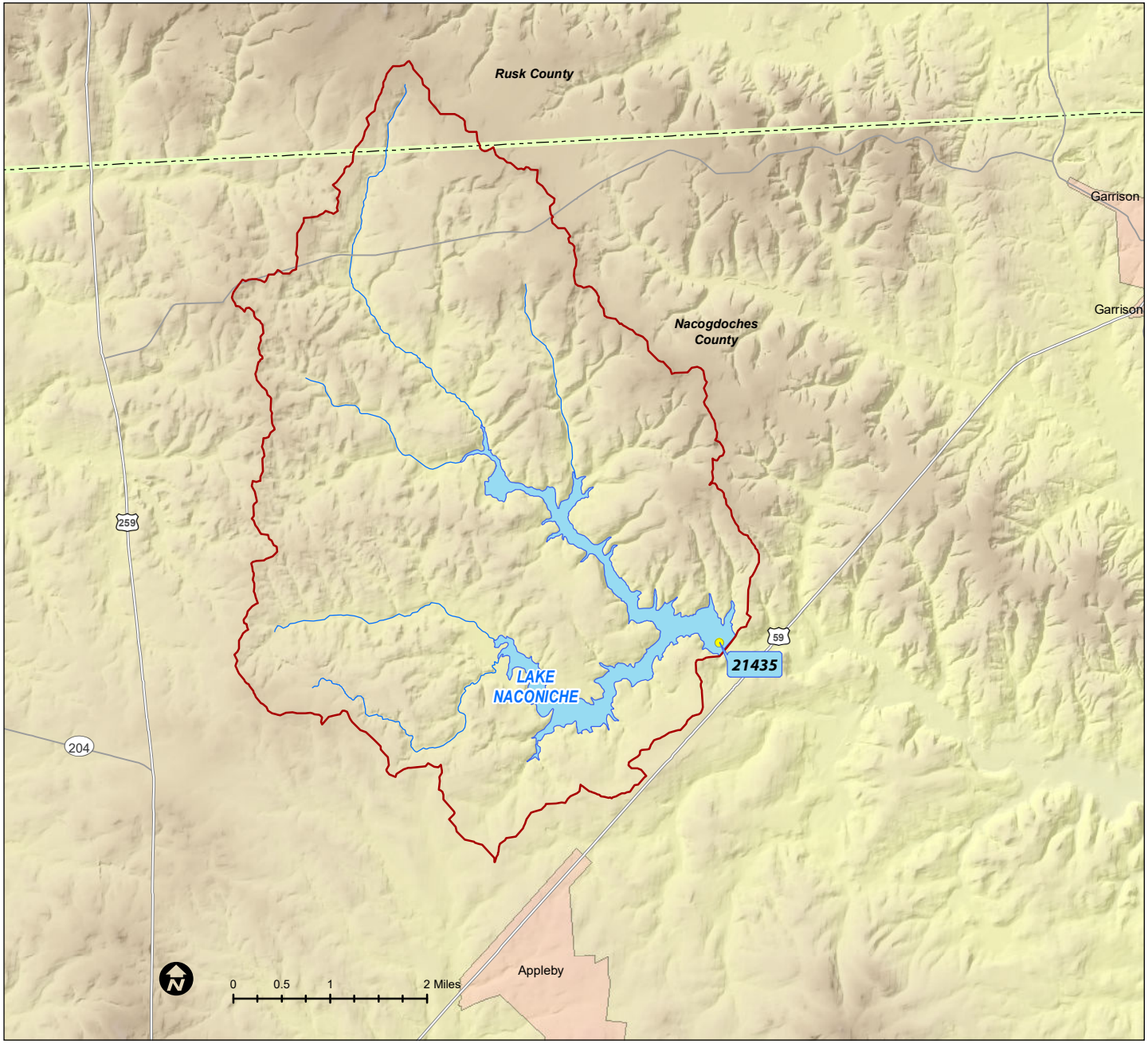
SEGMENT 0612G- LAKE NACONICHE

Segment Profile

Lake Naconiche is a 692-acre lake located fourteen miles northeast of Nacogdoches off of U.S. Highway 59. This water body is a part of the Attoyac Bayou Watershed.

This segment is currently being monitored by ANRA as a routine Clean Rivers Program monitoring station.

There are no impairments or concerns listed in the 2020 Texas Integrated Report for this water body.



ANRA Monitoring Sites
Wastewater Outfalls
Classified Segments
Other Hydrology
Segment Watershed
Counties

SEGMENT 0612G - LAKE NACONICHE

Designated Uses

The designated uses for this unclassified segment include the following: high aquatic life, general, contact recreation, and public water supply.

Assessment Units in Segment 0612G- Lake Naconiche

AU ID	Description
0612G_01	NACONICHE LAKE NEAR THE DAM 226 METERS NORTH AND 715 METERS WEST OF INTERSECTION OF FM 2435 AND US 59 NORTHEAST OF CITY OF NACOGDOCHES

Monitoring Stations in Segment 0612G- Lake Naconiche

Station ID	AU	Description	Earliest Data	Latest Data	Notes
21435	0612G_01	NACONICHE LAKE NEAR THE DAM 226 METERS NORTH AND 715 METERS WEST OF INTERSECTION OF FM 2435 AND US 59 NORTHEAST OF CITY OF NACOGDOCHES	2013	2019	Monitored continuously since 2013.

Assessment Summary (as listed in the 2020 Texas Integrated Report)

Parameter	Standard	0612G_01 Assessment
Chloride (mg/L)	75	
Sulfate (mg/L)	50	
TDS (mg/L)	200	
DO Grab Screening Level (mg/L)	5.00	NC
DO Grab Minimum (mg/L)	3.00	FS
24 Hour DO Average (mg/L)		
24 Hour DO Minimum (mg/L)		
pH (SU)	6.0 - 8.5	
Temp (C)	32.22	
E. coli geomean (MPN /100 mL)	126	NC
Ammonia Nitrogen (mg/L)	0.11	NA
Nitrate Nitrogen (mg/L)	26.70	NA
Total Phosphorus	0.37	NA
Chl-*a* (µg/L)	0.20	NA
Mercury in Edible Tissue		
Dioxin in Edible Tissue		

FS = Fully Supporting NC = No Concern CN = Concern for Near Non-Attainment
CS = Concern for Screening Level NS = Not Supporting NA = Not Assessed

Lake Naconiche

SEGMENT 0612G - LAKE NACONICHE

Monitoring Station 21435 - Lake Naconiche

Monitoring Station 21435 is located in AU 0612G_01, Lake Naconiche, main pool. ANRA monitors this station quarterly for field and conventional parameters, flow, and *E. coli* bacteria.

Due to having less than ten years of data, trends identified for this staiton are not considered to be statistically significant.

Analysis shows a statistically significant decreasing trend for Specific Conductance. Decreasing trends identified for Sulfate and Chloride are not considered statistically significant due to having greater than fifty percent censored values.

There are no concerns or impairments listed for this segment in the 2020 Texas Integrated Report.

Water Quality Monitoring Results for Station 21435

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	21	0	1.00	16.00		-1.06	0.24	
Water Temperature (C)	19	0	9.00	30.60	20.62	-0.28	0.48	
Dissolved Oxygen (mg/L)	21	0	3.40	10.10	7.55	-0.11	0.45	
pH (S.U.)	21	1	6.00	8.60	7.34	-0.29	0.04	
Specific Conductance (us/cm @ 25C)	21	0	65.00	120.00	82.90	5.71	0.00	
Ammonia-Nitrogen (mg/L as N)	21	6	0.10	0.79	0.21	0.43	0.79	
Chloride (mg/L)	21	0	5.54	14.70	8.53	4.68	0.00	
Sulfate (mg/L)	21	0	5.00	7.51	5.26	3.71	0.03	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)								
Total Phosphorus (mg/L as P)	21	0	0.02	0.07	0.03	-0.65	0.34	
Total Suspended Solids (mg/L)	21	0	2.50	8.00	3.59	-0.23	0.51	
Nitrate (Total) (mg/L)	15	0	0.05	0.33	0.12	-0.21	0.74	
Nitrite (Total) (mg/L)	15	0	0.05	0.05	0.05	8.35E+14	0.05	
Nitrate + Nitrite (mg/L as N)	21	2	0.04	0.61	0.18	-0.36	0.57	
Chlorophyll-*a* (ug/L)	19	2	2.00	41.70	11.37	0.37	0.83	
Pheophytin (ug/L)	19	0	2.00	9.62	3.04	-0.13	0.72	

SUMMARY OF WATER QUALITY TRENDS

Trend Analysis Summary for Segment 0612G - Lake Naconiche

There are no trends identified for this segment.

Water Quality Issues Summary for Segment 0612G - Lake Naconiche

There are no impairments or concerns listed for this segment.

Lake Naconiche

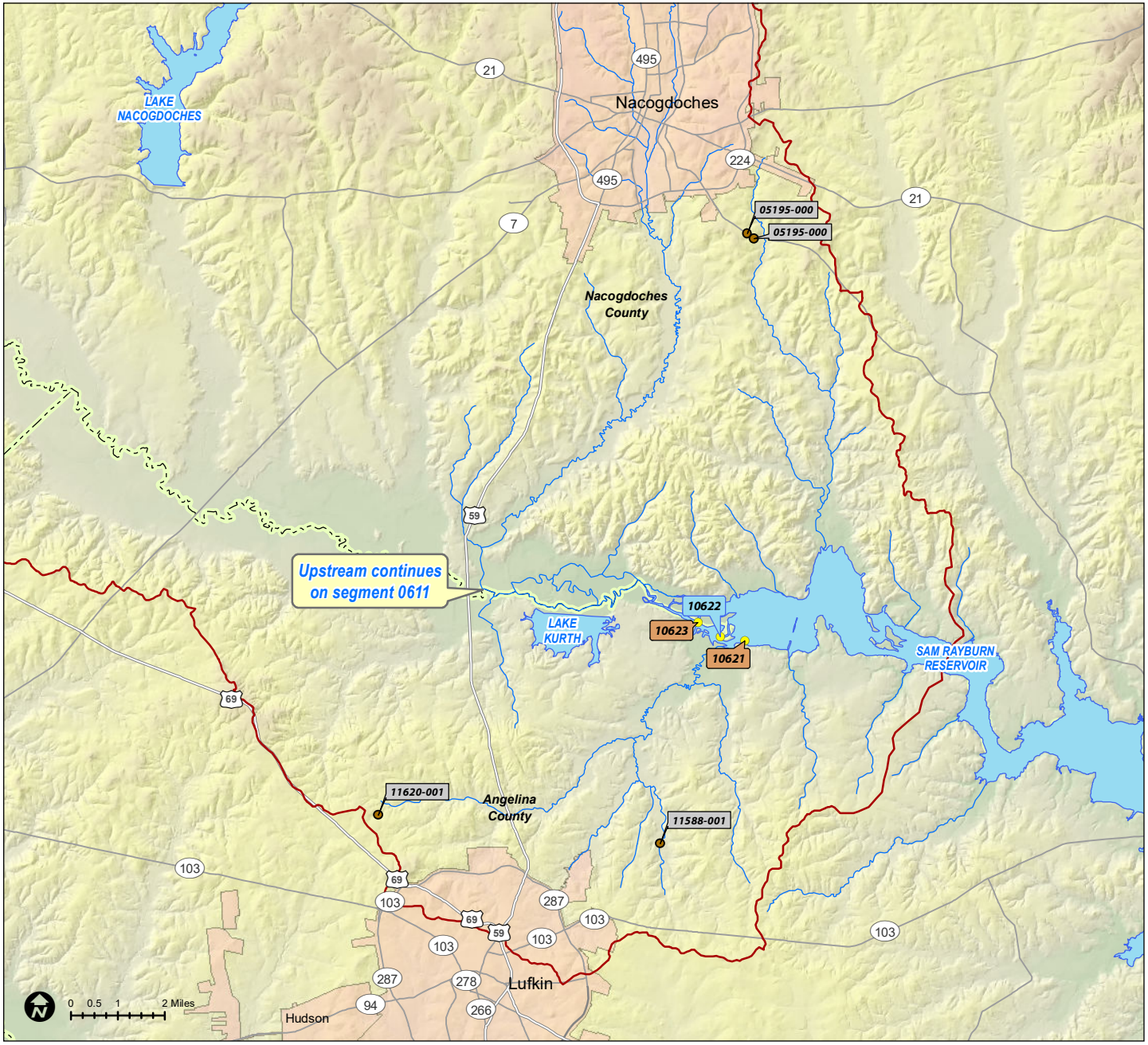
SEGMENT 0615 - ANGELINA RIVER / SAM RAYBURN RESERVOIR

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.

Segment 0615 is listed in the 2020 Texas Integrated Report as impaired for depressed Dissolved Oxygen.

A fish consumption advisory is also in affect for Dioxin in Edible Tissue and Mercury in Edible Tissue, please see page 305 for further details. ANRA is currently performing five 24-hour dissolved oxygen measurements per year to determine if this impairment is still valid.



ANRA Monitoring Sites
TCEQ Monitoring Sites
Wastewater Outfalls
Classified Segments
Other Hydrology
Segment Watershed
Counties

SEGMENT 0615 - ANGELINA RIVER SAM RAYBURN RESERVOIR

Designated Uses

The designated uses for this classified segment include the following: high aquatic life, general, contact recreation, and public water supply.

Assessment Units in Segment 0615 - Angelina River Sam Rayburn Reservoir

AU ID	Description
0615_01	Entire water body

Monitoring Stations in Segment 0615 - Angelina River Sam Rayburn Reservoir

Station ID	AU ID	Description	Earliest Data	Latest Data	Notes
10621	0615_01	SAM RAYBURN RESERVOIR NEAR ANGELINA RIVER 0.7 KM DOWNSTREAM OF CONFLUENCE WITH PAPER MILL CREEK LOWER CHANNEL	1986	2019	Monitored continuously since 1986.
10622	0615_01	ANGELINA RIVER/SAM RAYBURN RESERVOIR 0.2 KM DOWNSTREAM FROM PAPER MILL CREEK CONFLUENCE NW CORNER OF SAM RAYBURN RESERVOIR	1977	1987	Monitored 1977, 1984, and 1986-1987. This station was added again in 2020 for 24-hour dissolved oxygen monitoring.

Water Hyacinth at Sam Rayburn Reservoir

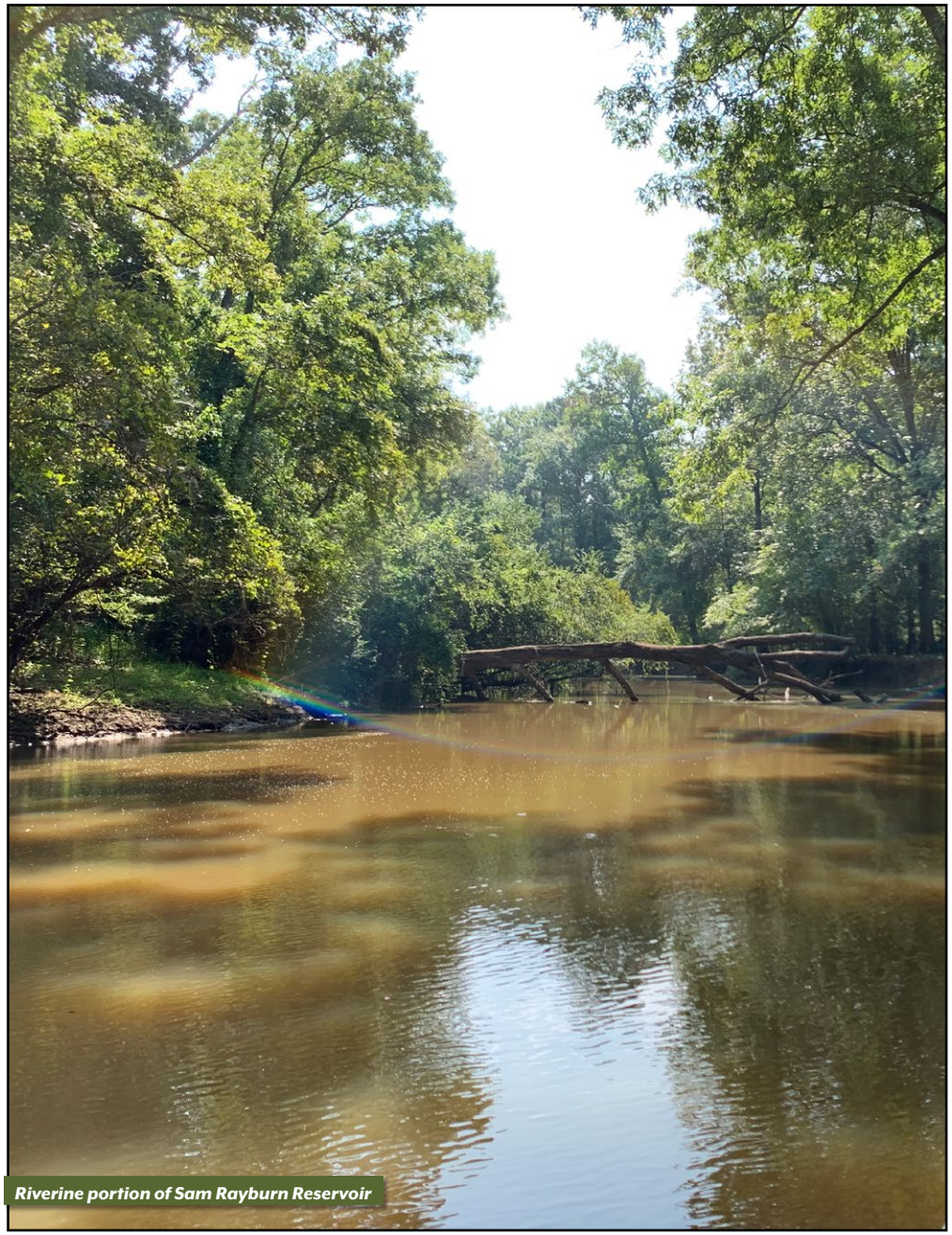
SEGMENT 0615 - ANGELINA RIVER SAM RAYBURN RESERVOIR

Assessment Summary - (as listed in the 2020 Texas Integrated Report)

Parameter	Standard	0615_01 Assessment
Chloride (mg/L)	150	FS
Sulfate (mg/L)	100	FS
TDS (mg/L)	500	FS
DO Grab Screening Level (mg/L)	5.00	NA
DO Grab Minimum (mg/L)	3.00	FS
24 Hour DO Average (mg/L)	5.00	NS
24 Hour DO Minimum (mg/L)	3.00	
pH (SU)	6.0 - 9.0	FS
Temp (C)	33.9	FS
E. coli geomean (MPN /100 mL)	126	FS
Ammonia Nitrogen (mg/L)	0.11	NA
Nitrate Nitrogen (mg/L)	0.37	NA
Total Phosphorus	0.20	NA
Chl-*a* (µg/L)	26.7	NA
Mercury in Edible Tissue		NS
Dioxin in Edible Tissue		NS

FS = Fully Supporting NC = No Concern CN = Concern for Near Non-Attainment
CS = Concern for Screening Level NS = Not Supporting NA = Not Assessed

Riverine portion of Sam Rayburn Reservoir



Riverine portion of Sam Rayburn Reservoir

SEGMENT 0615 - ANGELINA RIVER / SAM RAYBURN RESERVOIR

Monitoring Station 10621 - Sam Rayburn Reservoir Near Angelina River Downstream of Confluence with Paper Mill Creek

Monitoring Station 10621 is monitored quarterly by TCEQ Region 10 personnel for field and conventional parameters and for *E. coli* bacteria.

Analysis shows significant decreasing trends for pH, Chloride, TKN, Specific Conductance, and Sulfate. . These trends could have resulted from the paper mill idling indefinitely beginning in 2004, before closing permanently in 2007.

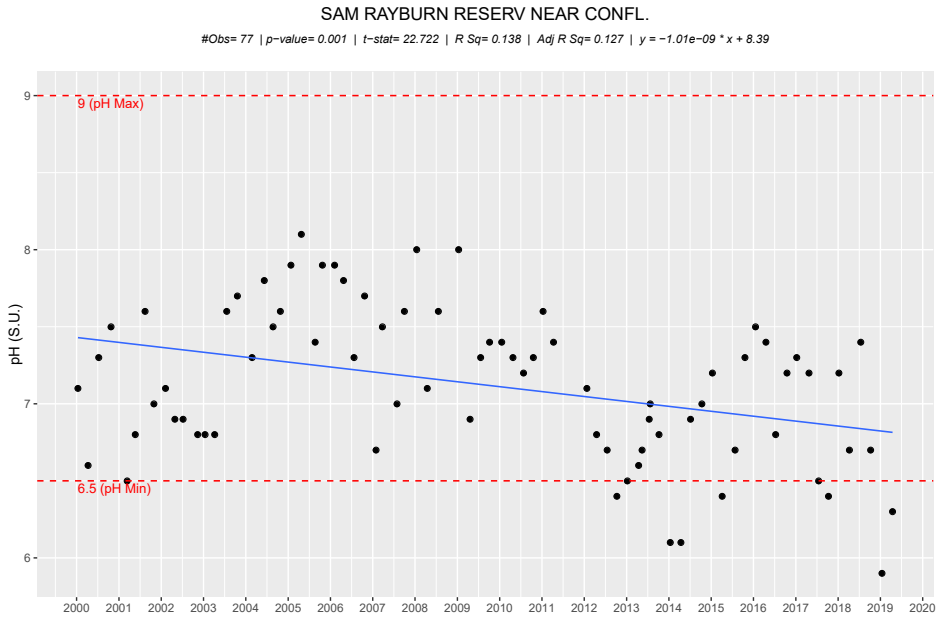
Trends observed for Ammonia-Nitrogen, Nitrate+Nitrite, and Chlorophyll-*a* are not considered to be statistically significant due to having greater than fifty percent censored values.

Segment 0615 is listed for not supporting its designated Aquatic Life Use due to depressed Dissolved Oxygen. Although data at this station is showing an increasing trend for Dissolved Oxygen, this trend is not statistically significant.

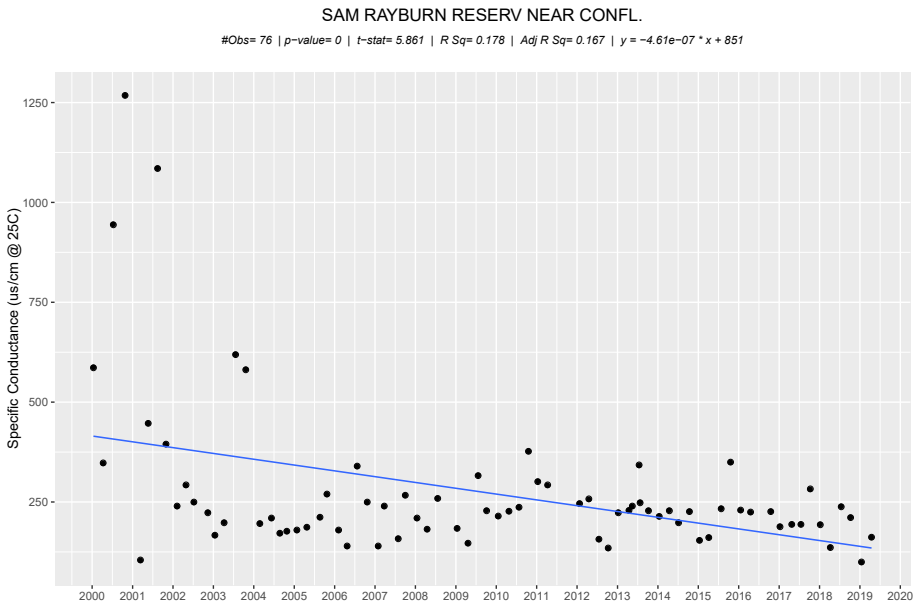
Water Quality Monitoring Results for Station 10621

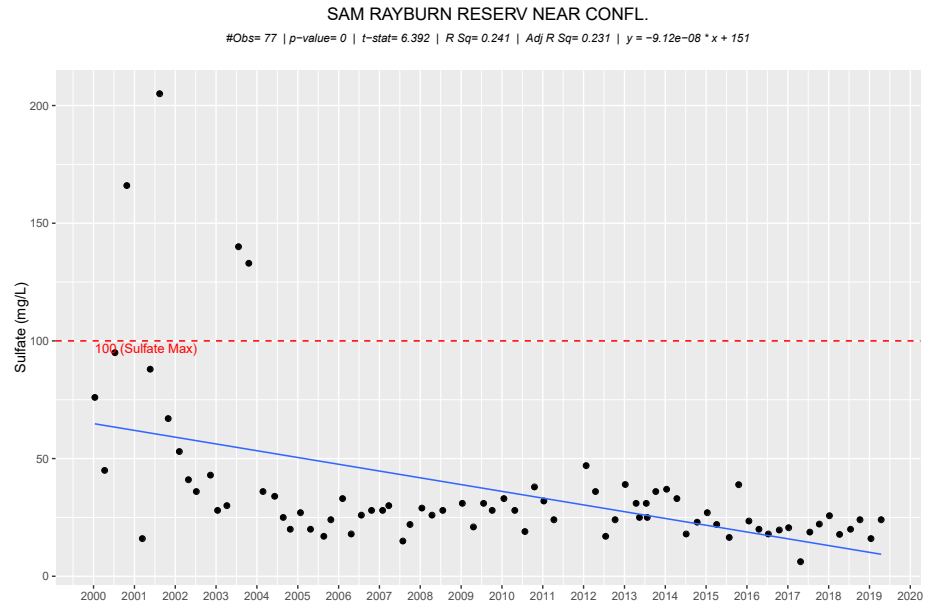
Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	65	27	10.00	4800.00	113.45	1.45	0.29	
Water Temperature (C)	77	0	6.30	31.20	19.70	3.45	0.87	
Dissolved Oxygen (mg/L)	77	2	0.70	11.60	6.75	2.54	0.24	
pH (S.U.)	77	7	5.90	8.10	7.12	22.72	0.00	↓
Specific Conductance (us/cm @ 25C)	76	0	100.00	1268.00	274.93	5.86	0.00	↓
Ammonia-Nitrogen (mg/L as N)	75	13	0.02	0.92	0.10	3.69	0.01	
Chloride (mg/L)	76	2	5.00	186.00	27.83	4.75	0.00	↓
Sulfate (mg/L)	77	4	6.17	205.00	36.83	6.39	0.00	↓
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	73	0	0.32	1.87	0.74	6.04	0.01	↓
Total Phosphorus (mg/L as P)	74	31	0.06	0.75	0.21	2.38	0.82	
Total Suspended Solids (mg/L)	76	0	4.00	115.00	23.47	1.30	0.58	
Nitrate (Total) (mg/L)	8	0	0.07	0.67	0.24	-0.06	0.91	
Nitrite (Total) (mg/L)	8	0	0.05	0.05	0.05	3.72E+14	0.14	
Nitrate + Nitrite (mg/L as N)	77	28	0.04	1.81	0.36	3.38	0.06	
Chlorophyll-*a* (ug/L)	75	1	1.00	36.20	7.61	3.56	0.06	
Pheophytin (ug/L)	25	0	4.97	11.90	5.69	0.83	0.97	

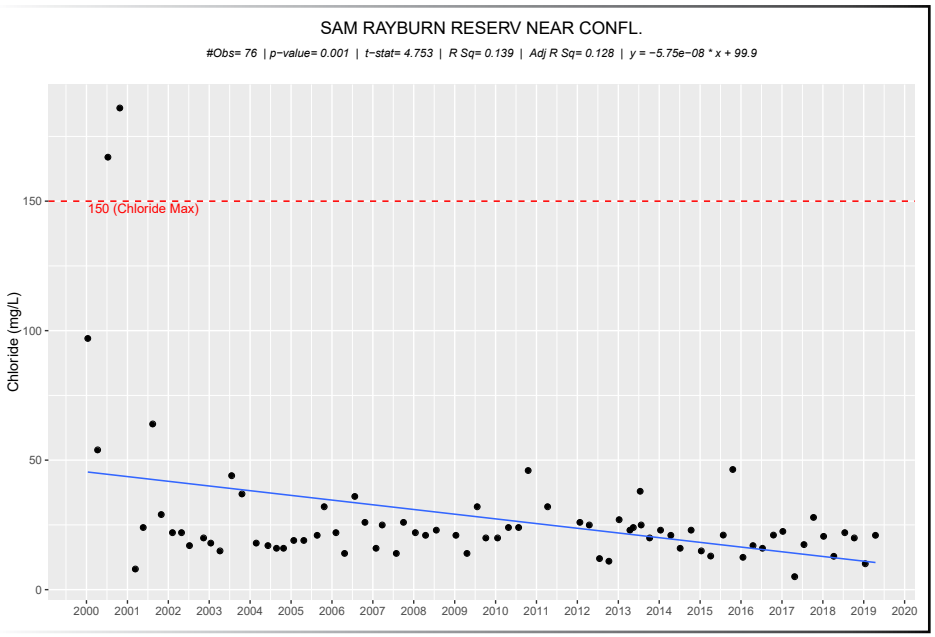
Riverine portion of Sam Rayburn Reservoir

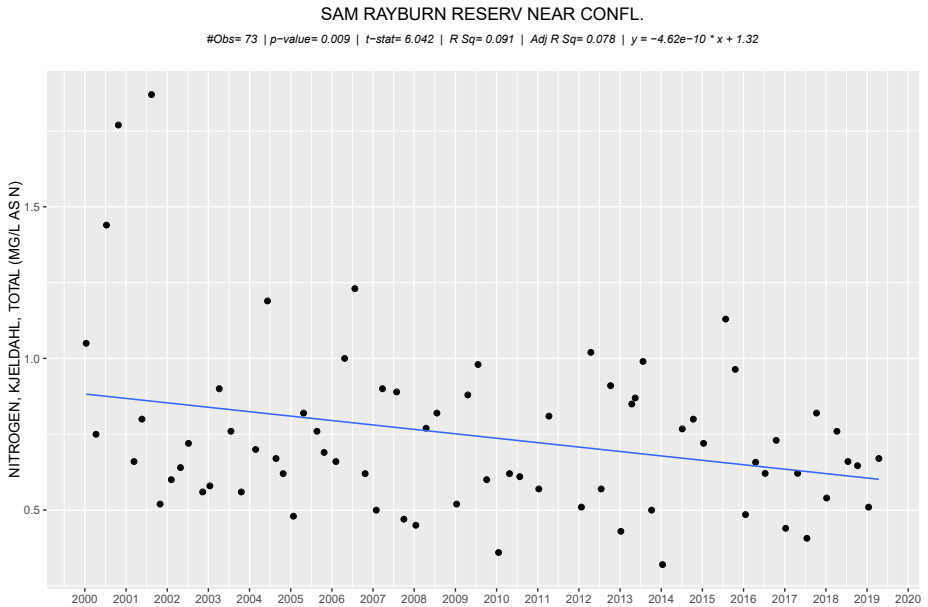


SEGMENT 0615 - ANGELINA RIVER / SAM RAYBURN RESERVOIR









SEGMENT 0615 - ANGELINA RIVER / SAM RAYBURN RESERVOIR

SUMMARY OF WATER QUALITY TRENDS

Trend Analysis Summary for Segment 0615 - Angelina River / Rayburn Reservoir

AU	Station ID	Station Description	*E. coli*	Temp	DO	pH	Spec Cond	NH3	Cl	SO4	TKN	Total P	TSS	NO3	NO2	NO3/ NO2	Chl-*a*	Pheo
0615_01	10623	Sam Rayburn Reservoir at Confluence of Angelina River					↓											
0615_01	10621	Sam Rayburn Reservoir Downstream of Paper Mill Creek				↓	↓		↓	↓	↓							

↑ = Statistically significant increasing trend ↓ = Statistically significant decreasing trend

Water Quality Issues Summary for Segment 0615 - Angelina River / Rayburn Reservoir

Water Quality Issue	Affected Area	Possible Influences/Causes	Possible Effects	Possible Solutions / Actions Taken
Dioxin in Edible Tissue	The Neches River (Segment 0604) and all contiguous waters from the SH 7 bridge west of Lufkin, TX downstream to the US 96 bridge near Evadale, TX including B.A. Steinhagen Reservoir and Sam Rayburn Reservoir	• Pulp and paper bleaching processes	• The Texas DSHS has concluded that consuming fish from this water body poses an apparent hazard to public health	• A comprehensive Fish Consumption Advisory issued by the Texas DSHS recommends consumption advice for six species of fish • ADV-51 issued on January 24, 2014
Mercury in Edible Tissue	The Neches River (Segment 0604) and all contiguous waters from the SH 7 bridge west of Lufkin, TX downstream to the US 96 bridge near Evadale, TX including B.A. Steinhagen Reservoir and Sam Rayburn Reservoir	• Atmospheric deposition from coal-fired power plants, large boilers and heaters, steel production, and incinerators	• The Texas DSHS has concluded that consuming fish from this water body poses an apparent hazard to public health	• A comprehensive Fish Consumption Advisory issued by the Texas DSHS recommends consumption advice for six species of fish • ADV-51 issued on January 24, 2014
Depressed Dissolved Oxygen	Entire segment	• Aquatic vegetation • Nutrient loading into the water body	• Detrimental effect on aquatic biological community	• Continue monitoring • Conduct 24-hour DO measurements • Conduct an Aquatic Life UAA

SEGMENT 0615A - PAPER MILL CREEK

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.

Segment 0615A is listed as impaired for *E. coli* bacteria in the 2020 Texas Integrated Report, with a geometric mean of 230.96 MPN/100 mL based on 25 sample

An RUAA was conducted by TCEQ on this water body in 2014, and it was determined that Secondary Contact Recreation (SCR-1) is the appropriate recreational use and numeric criteria for this segment.

ANRA Monitoring Sites
TCEQ Monitoring Sites
Wastewater Outfalls
Classified Segments
Other Hydrology
Segment Watershed
Counties

SEGMENT 0615A - PAPER MILL CREEK

Designated Uses

The designated uses for this unclassified segment include aquatic life, general, and contact recreation use.

Assessment Units in Segment 0615A - Paper Mill Creek

AU ID	Description
0615A_01	Entire water body

Monitoring Stations in Segment 0615A - Paper Mill Creek

Station ID	AU ID	Description	Earliest Data	Latest Data	Notes
10502	0615A_01	PAPER MILL CREEK UPPER BIFURCATION CHANNEL IMMEDIATELY UPSTREAM OF ANGELINA RIVER CONFLUENCE NW CORNER OF SAM RAYBURN RESERVOIR	1986	2019	Monitored 1986-1989 and began again in 1991.

Assessment Summary for Segment (as listed in the 2020 Texas Integrated Report)

Parameter	Standard	0615A_01 Assessment
Chloride (mg/L)	150	
Sulfate (mg/L)	100	
TDS (mg/L)	500	
DO Grab Screening Level (mg/L)	2.00	NC
DO Grab Minimum (mg/L)	1.50	FS
24 Hour DO Average (mg/L)	5.00	
24 Hour DO Minimum (mg/L)	3.00	
pH (SU)	6.0 - 9.0	
Temp (C)	33.9	
E. coli geomean (MPN/100 mL)	126	NS
Ammonia Nitrogen (mg/L)	0.33	NC
Nitrate Nitrogen (mg/L)	1.95	NC
Total Phosphorus (mg/L)	0.69	NC
Chl-*a* (µg/L)	14.1	NC
Mercury in Edible Tissue (mg/L)		
Dioxin in Edible Tissue (mg/L)		

FS = Fully Supporting NC = No Concern CN = Concern for Near Non-Attainment

CS = Concern for Screening Level NS = Not Supporting NA = Not Assessed

Blooms in May

SEGMENT 0615A - PAPER MILL CREEK

Monitoring Station 10502 - Paper Mill Creek Upper Channel Upstream of Angelina River Confluence

Monitoring Station 10502 is monitored quarterly by TCEQ Region 10 personnel for field and conventional parameters and for *E. coli* bacteria.

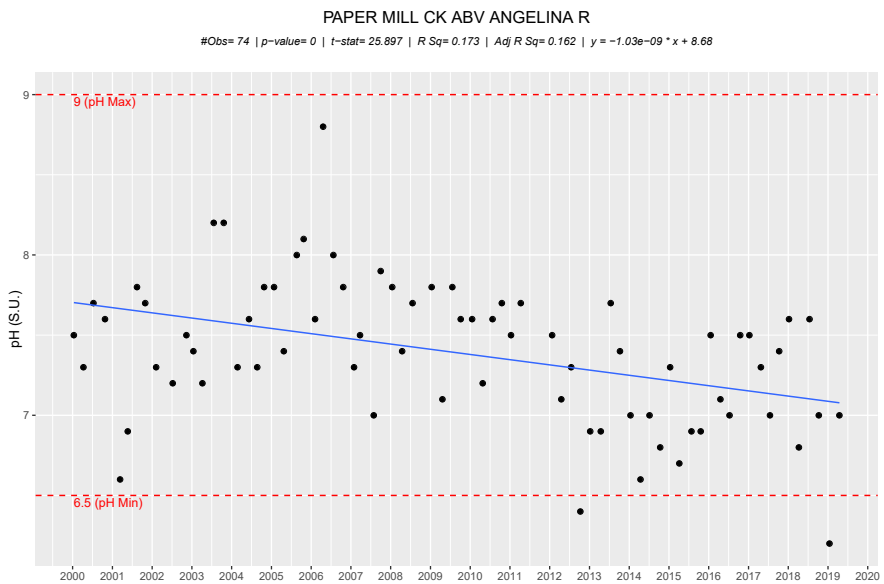
There are statistically significant decreasing trends observed for pH, TKN, Chloride, Specific Conductance, Sulfate, Total Phosphorus, and Nitrate+Nitrite. These trends could have resulted from the paper mill idling indefinitely beginning in 2004, before closing permanently in 2007.

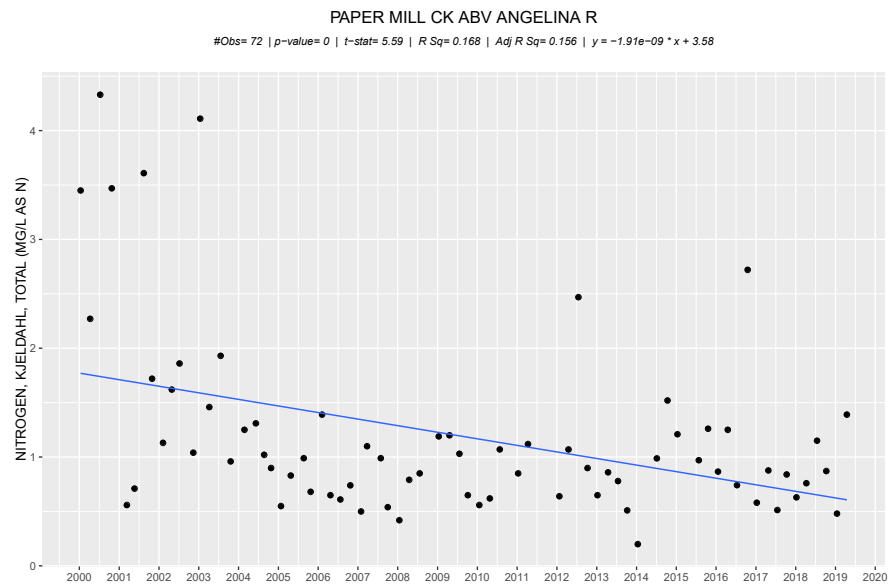
The decreasing trend for Ammonia-Nitrogen is not considered to be statistically significant due to having greater than fifty percent censored values.

This assessment unit is listed as impaired for *E. coli* bacteria.

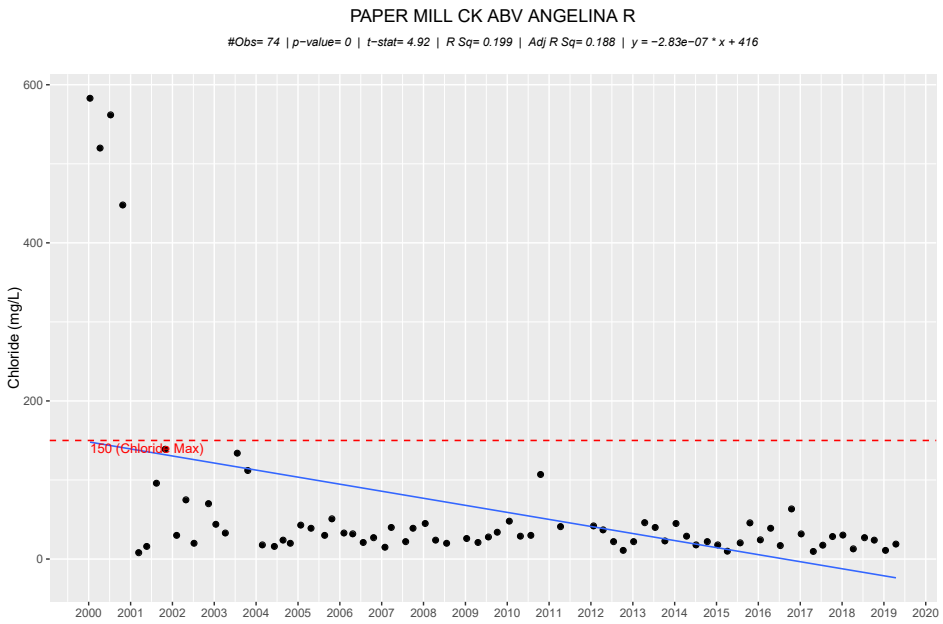
Water Quality Monitoring Results for Station 10502

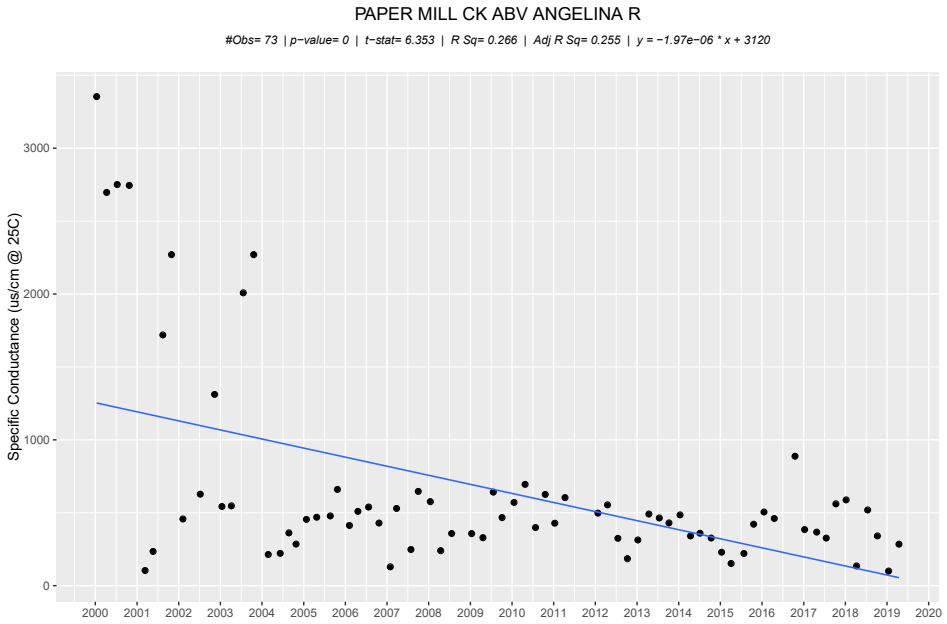
Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	62	37	13.00	22000.00	195.38	-0.35	0.52	
Water Temperature (C)	74	0	5.50	32.10	19.11	4.89	0.12	
Dissolved Oxygen (mg/L)	74	5	1.80	12.40	7.00	1.67	0.05	
pH (S.U.)	74	2	6.20	8.80	7.39	25.90	0.00	↓
Specific Conductance (us/cm @ 25C)	73	0	101.00	3354.00	654.92	6.35	0.00	↓
Ammonia-Nitrogen (mg/L as N)	73	9	0.05	3.40	0.27	3.90	0.00	
Chloride (mg/L)	74	4	8.00	583.00	62.44	4.92	0.00	↓
Sulfate (mg/L)	75	14	1.00	646.00	98.57	6.17	0.00	↓
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	72	0	0.20	4.33	1.20	5.59	0.00	↓
Total Phosphorus (mg/L as P)	71	6	0.05	7.17	0.42	2.99	0.02	↓
Total Suspended Solids (mg/L)	74	0	4.80	149.00	29.05	-0.20	0.19	
Nitrate (Total) (mg/L)	8	0	0.09	1.54	0.47	1.91	0.11	
Nitrite (Total) (mg/L)	8	0	0.05	1.08	0.18	1.73	0.14	
Nitrate + Nitrite (mg/L as N)	75	3	0.05	8.63	0.59	3.38	0.01	↓
Chlorophyll-*a* (ug/L)	71	9	1.00	101.00	10.76	0.81	0.92	
Pheophytin (ug/L)	25	0	1.00	20.90	6.35	0.47	0.94	

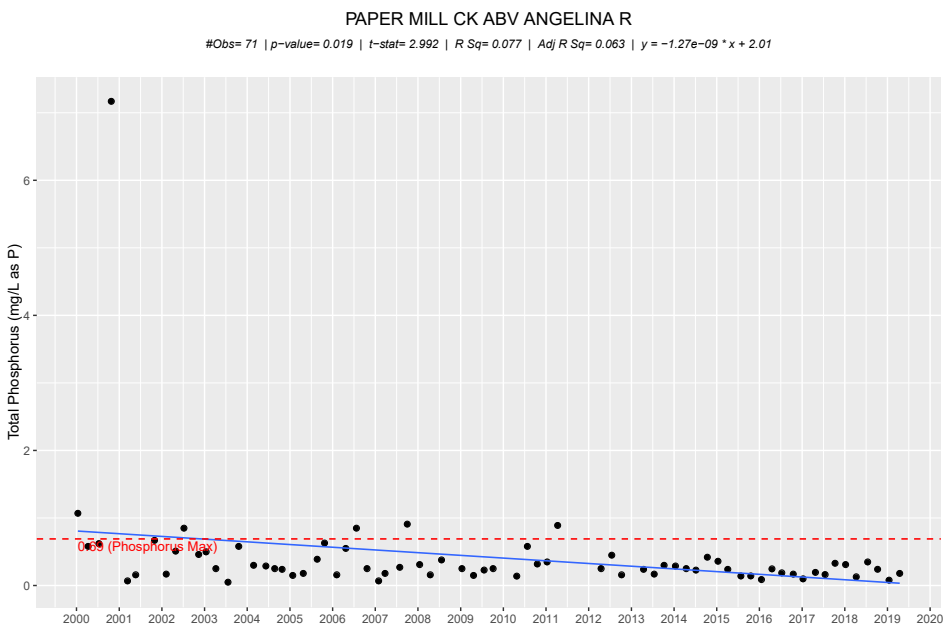


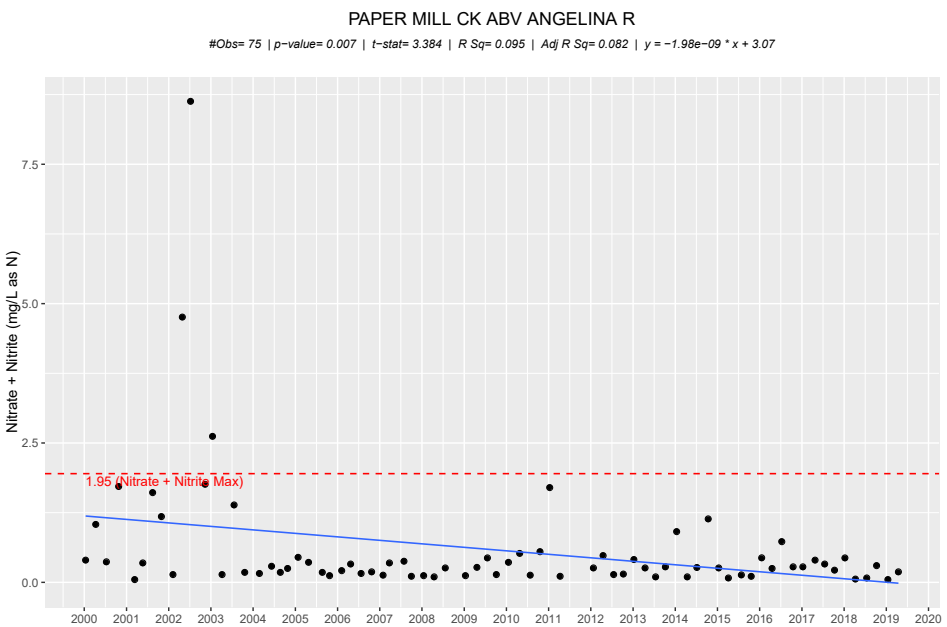


SEGMENT 0615A - PAPER MILL CREEK

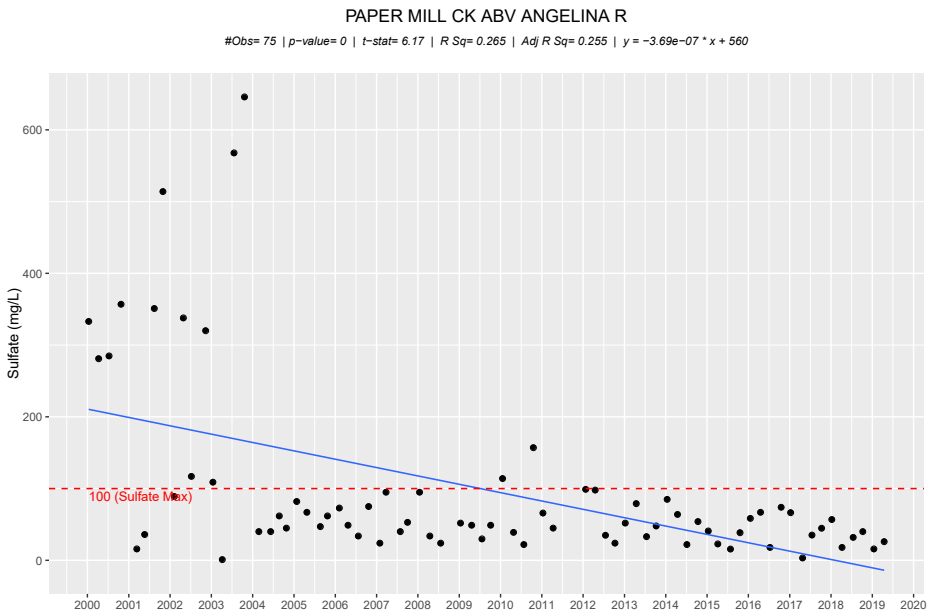








SEGMENT 0615A - PAPER MILL CREEK



SUMMARY OF WATER QUALITY TRENDS

Trend Analysis Summary for Segment 0615A - Paper Mill Creek

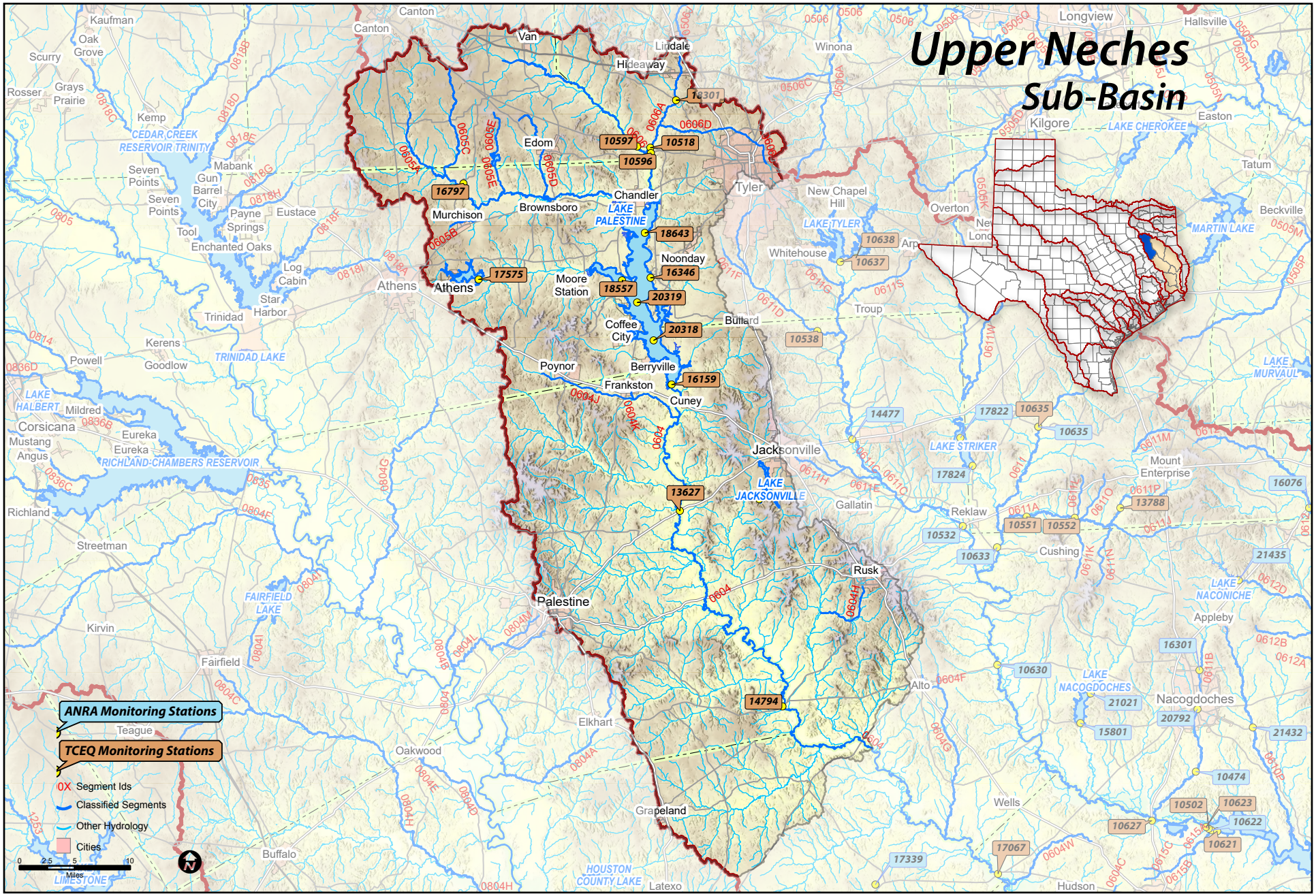
AU	Station ID	Station Description	*E. coli*	Temp	DO	pH	Spec Cond	NH3	Cl	SO4	TKN	Total P	TSS	NO3	NO2	NO3/ NO2	Chl-*a*	Pheo
0615A_01	10502	Paper Mill Creek Upper Channel Upstream of Angelina River Confluence				↓	↓		↓	↓	↓	↓				↓		

↑ = Statistically significant increasing trend ↓ = Statistically significant decreasing trend

Water Quality Issues Summary for Segment 0615A - Paper Mill Creek

Water Quality Issue	Affected Area	Possible Influences/Causes	Possible Effects	Possible Solutions / Actions Taken
Impairment for *E. coli* bacteria	Entire water body	• Municipal wastewater discharge, wastewater collection system leaks or spills. • Nonpoint sources of pollution • Stormwater runoff	• Water body does not meet the water quality standard for Primary Contact Recreation • Primary Contact Recreation in the water body has an increased risk of gastrointestinal illness	• Continue monitoring

UPPER NECHES OVERVIEW MAP



PROFILE OF THE UPPER NECHES SUB-BASIN

Population

The counties included within the sub-basin are Anderson, Cherokee, Henderson, Houston, Smith, and Van Zandt. 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. As of the 2010 census, there are an estimated 69,780 households, including 165,557 individuals residing within the sub-basin.

Land Characteristics and Use

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.

Segments in the Upper Neches Sub-Basin

Segment ID	Segment Name
0604	Neches River Below Lake Palestine
0604H	One Eye Creek (unclassified water body)
0605	Lake Palestine
0605A	Kickapoo Creek (unclassified water body)
0606	Neches River Above Lake Palestine
0606A	Prairie Creek (unclassified water body)
0606D	Black Fork Creek (unclassified water body)
0614	Lake Jacksonville

Lake Palestine

PROFILE OF THE UPPER NECHES SUB-BASIN

Permitted Discharges in the Upper Neches Sub-Basin

First Segment in Drainage Path	Segment ID as identified in Permit	Permit Number	Outfall Number	NPDES Number	Permittee	County	TCEQ Region
0606D	0604	WQ0001590000	013	TX0001449	DELEK REFINING LTD	SMITH	5-Tyler
0604	0606	WQ0011787001	001	TX0071188	CITY OF BULLARD	CHEROKEE	5-Tyler
0606	0606	WQ0013905001	001	TX0118591	BEN WHEELER WSC	VAN ZANDT	5-Tyler
0606D	0605	WQ0010653001	001	TX0047996	CITY OF TYLER	SMITH	5-Tyler
0605B	0604	WQ0013972001	001	TX0072087	CITY OF MURCHISON	HENDERSON	5-Tyler
0606	0605	WQ0013974001	001	TX0065650	BEN WHEELER WSC	VAN ZANDT	5-Tyler
0604	0604	WQ0013728002	001	TX0112593	CITY OF CUNEY	CHEROKEE	5-Tyler
0604K	0604	WQ0010441001	001	TX0033456	CITY OF FRANKSTON	ANDERSON	5-Tyler
0604H	0604	WQ0010447001	001	TX0054399	CITY OF RUSK	CHEROKEE	5-Tyler
0606A	0606	WQ0010412002	001	TX0105066	CITY OF LINDALE	SMITH	5-Tyler
0605A	0605	WQ0015007001	001	TX0133086	RPM WSC	VAN ZANDT	5-Tyler
0604J	0604	WQ0013538001	001	TX0105902	LA POYNOR ISD	HENDERSON	5-Tyler
0606	0606	WQ0010376001	001	TX0054071	CITY OF VAN	VAN ZANDT	5-Tyler
0606	0606	WQ0015715001	001	TX0138681	LKW SALINE CREEK SENIOR VILLAGE LTD	SMITH	5-Tyler
0605	0605	WQ0005269000	001	TX0139114	NGO INDUSTRIAL HOLDINGS LLC	ANDERSON	5-Tyler
0605A	0604	WQ0010540001	001	TX0062707	CITY OF BROWNSBORO	HENDERSON	5-Tyler
0606	0606	WQ0015651001	001	TX0138240	CORNELIUS ERIKS AND SUSAN CHARLOTTE ERIKS	HENDERSON	12-Houston
0606	0606	WQ0013849002	001	TX0137995	LIBERTY UTILITIES SILVERLEAF WATER LLC	SMITH	5-Tyler
0606D	0606	WQ0001590000	014	TX0001449	DELEK REFINING LTD	SMITH	5-Tyler
0606D	0606	WQ0001590000	015	TX0001449	DELEK REFINING LTD	SMITH	5-Tyler
0604	0606	WQ0011012001	001	TX0033499	CITY OF CHANDLER	HENDERSON	5-Tyler
0606D	0606	WQ0001590000	004	TX0001449	DELEK REFINING LTD	SMITH	5-Tyler
0606D	0606	WQ0001590000	005	TX0001449	DELEK REFINING LTD	SMITH	5-Tyler
0606D	0606	WQ0001590000	006	TX0001449	DELEK REFINING LTD	SMITH	5-Tyler
0606D	0606	WQ0001590000	008	TX0001449	DELEK REFINING LTD	SMITH	5-Tyler
0606D	0606	WQ0001590000	010	TX0001449	DELEK REFINING LTD	SMITH	5-Tyler
0606D	0606	WQ0001590000	011	TX0001449	DELEK REFINING LTD	SMITH	5-Tyler
0606D	0606	WQ0001590000	012	TX0001449	DELEK REFINING LTD	SMITH	5-Tyler
0606	0606	WQ0015423001	001	TX0136743	SUNDOWN RANCH INC	VAN ZANDT	5-Tyler
0606A	0606	WQ0015074001	001	TX0134287	HELMS, TONDA JOLANE	SMITH	5-Tyler
0605	0604	WQ0014079001	001	TX0118273	SOUTHERN UTILITIES CO	CHEROKEE	5-Tyler
0605	0605	WQ0014080001	001	TX0118362	SOUTHERN UTILITIES CO	SMITH	5-Tyler
0604	0605	WQ0015094001	001	TX0134571	CRAFT-TURNEY WSC	CHEROKEE	5-Tyler
0604	0604	WQ0010181002	001	TX0055239	CITY OF GRAPELAND	HOUSTON	10-Beaumont
0606D	0605	WQ0001590000	003	TX0001449	DELEK REFINING LTD	SMITH	5-Tyler
0605	0605	WQ0005144000	001	TX0135861	APEX TEXAS POWER LLC	CHEROKEE	5-Tyler
0606D	0605	WQ0001590000	001	TX0001449	DELEK REFINING LTD	SMITH	5-Tyler
0606D	0605	WQ0001590000	002	TX0001449	DELEK REFINING LTD	SMITH	5-Tyler

PROFILE OF THE UPPER NECHES SUB-BASIN

Texas Surface Water Quality Standards for the Upper Neches Sub-Basin
Site-Specific Uses and Numeric Criteria for Classified Segments in the Upper Neches Sub-Basin

Segment ID	Segment Name	Recreation Use	Aquatic Life Use	Domestic Water Supply Use	Other Use	Chloride (mg/L)	Sulfate (mg/L)	TDS (mg/L)	Dissolved Oxygen (mg/L	pH Range (S.U.)	*E. coli* Bacteria #/100 mL	Temp (°F)
0604	Neches River Below Lake Palestine	PCR	H	PS		50	50	200	5.0	6.0 - 8.5	126	91
0605	Lake Palestine	PCR	H	PS		50	50	200	5.0	6.5 - 9.0	126	90
0606	Neches River Above Lake Palestine	PCR	I	PS		100	50	300	4.0	6.0 - 8.5	126	95
0614	Lake Jacksonville	PCR	H	PS		50	75	750	5.0	6.5 - 9.0	126	93

PCR = Primary Contact Recreation SCR1 = Secondary Contact Recreation 1 SCR2 = Secondary Contact Recreation 2 NCR = Noncontact Recreation
H = High Aquatic Life Use I = Intermediate Aquatic Life Use PS = Public Supply
* The criteria for Chloride, Sulfate, and TDS are listed as the maximum annual averages for the segment. Dissolved Oxygen criteria are listed as minimum 24-hour means at any site within the segment. The pH criteria are listed as minimum and maximum values expressed in standard units at any site within the segment. The criteria for Temperature are listed as maximum values at any site within the segment.

Neches River at US 59- Flood Stage

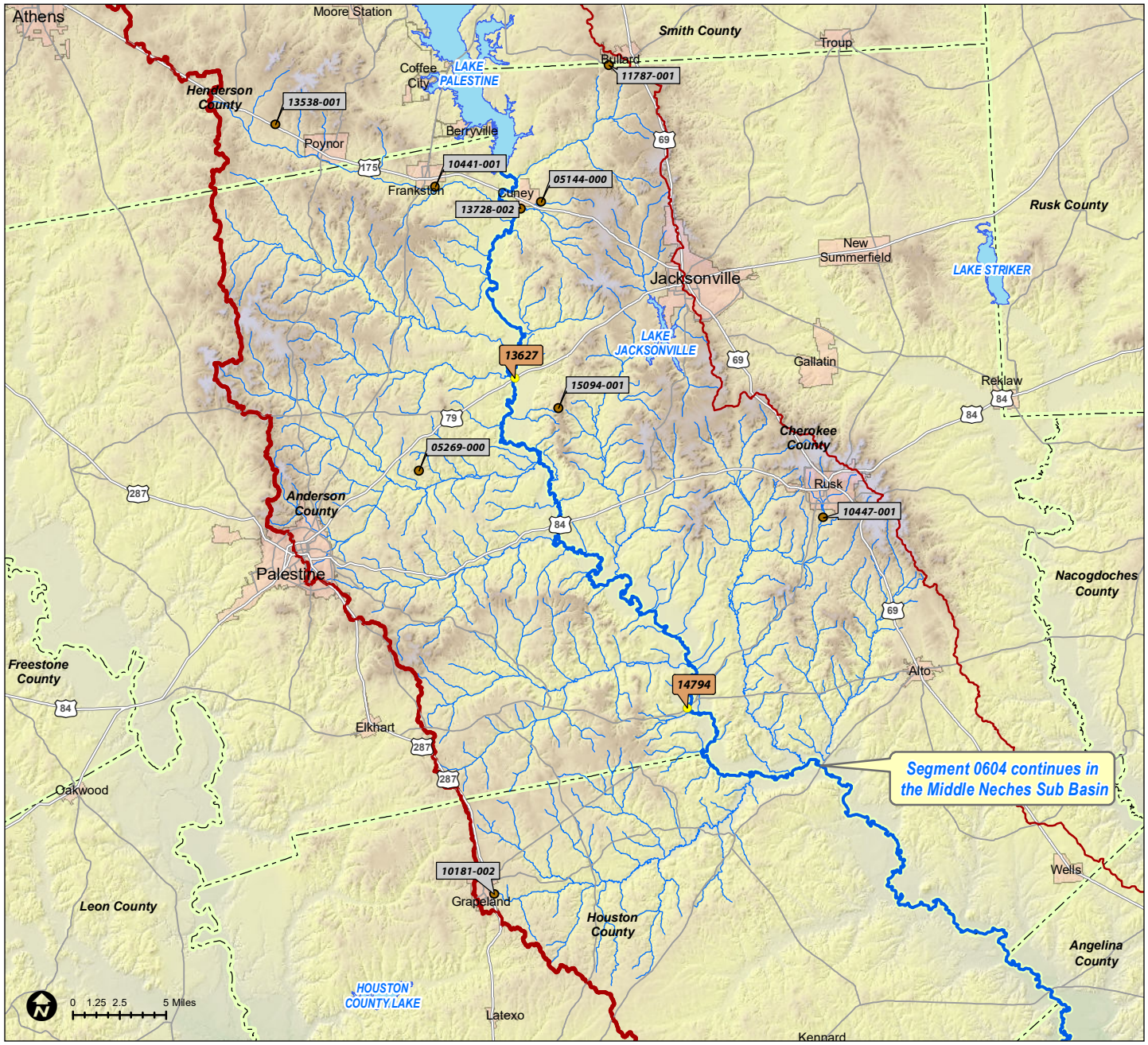
SEGMENT 0604 - NECHES RIVER BELOW LAKE PALESTINE (UPPER NECHES SUB-BASIN PORTION)

Segment Profile

This 231-mile 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.

Assessment unit 0604_05 is listed in the 2020 Texas Integrated Report with a concern for Chlorophyll-*a*. For AU 0604_05, 13 of 25 samples for the 2020 assessment exceeded the nutrient screening level.

Data is only presented in this section for the portion of Segment 0604 that lies within the Upper Neches Sub-Basin.



- ANRA Monitoring Sites
- TCEQ Monitoring Sites
- Wastewater Outfalls
- Classified Segments
- Other Hydrology
- Segment Watershed
- Counties

SEGMENT 0604 - NECHES RIVER BELOW LAKE PALESTINE (UPPER NECHES SUB-BASIN PORTION)

Designated Uses

The designated uses for this classified segment include contact recreation, high aquatic life use, domestic water supply use and general use.

Assessment Units

AU ID	Description
0604_04	From the confluence with Cedar Creek in Cherokee County near Hargrove Lake upstream to the confluence with Beech Creek in Anderson County at NHD RC 12020001006717
0604_05	From the confluence with Beech Creek in Anderson County upstream to the Blackburn Crossing Dam

Monitoring Stations

Station ID	AU ID	Description	Earliest Data	Latests data	Notes
14794	0604_04	NECHES RIVER AT SH 294 23.12 KM SOUTHWEST OF RUSK IN ANDERSON COUNTY	2000	2019	Monitored continuously since 2000.
10591	0604_05	NECHES RIVER AT US 175 EAST OF FRANKSTON	1972	2010	Monitored from 1972-1978, 1996-1997 and 2000-2010.
13627	0604_05	NECHES RIVER DOWNSTREAM LAKE PALESTINE AT US 79 4.4 MI NORTH OF NECHES 0.67 MI DOWNSTREAM FROM RAILROAD BRIDGE	1981	2019	Monitored continuously since 1981.

Assessment Summary *(As reported in the 2020 Texas Integrated Report)*

Parameter	Standard	0604_04 Assessment	0604_05 Assessment
Chloride (mg/L)	50	FS	FS
Sulfate (mg/L)	50	FS	FS
TDS(mg/L)	200	FS	FS
DO Grab Screening Level (mg/L)	5	NC	NC
DO Grab Minimum (mg/L)	3	FC	FS
24 Hour DO Average	5		
24 Hour DO Minimum	3		
pH (SU)	6.0 - 8.5	FS	FS
Temp (C)	32.8	FS	FS
E. coli geomean (MPN/100mL)	126	FS	FS
Ammonia Nitrogen (mg/L)	0.33	NC	NC
Nitrate Nitrogen (mg/L)	1.95	NC	NC
Total Phosphorus (mg/L)	0.69	NC	NC
Chl-*a* (µg/L)	14.1	NC	CS
Mercury in Edible Tissue			
Dioxin in Edible Tissue			

FS = Fully Supporting NC = No Concern CN = Concern for Near Non-Attainment CS = Concern for Screening Level
NS = Not Supporting NA = Not Assessed

Neches River at US 59- Flowers

SEGMENT 0604 - NECHES RIVER BELOW LAKE PALESTINE (UPPER NECHES SUB-BASIN PORTION)

Monitoring Station 14794 - Neches River at SH 294

Monitoring Station 14794 is in assessment unit 0604-04. This station is located on the Neches River at SH 294 and is monitored quarterly by TCEQ Region 5 (Tyler) personnel for field parameters, conventional parameters, flow, and *E. coli* bacteria.

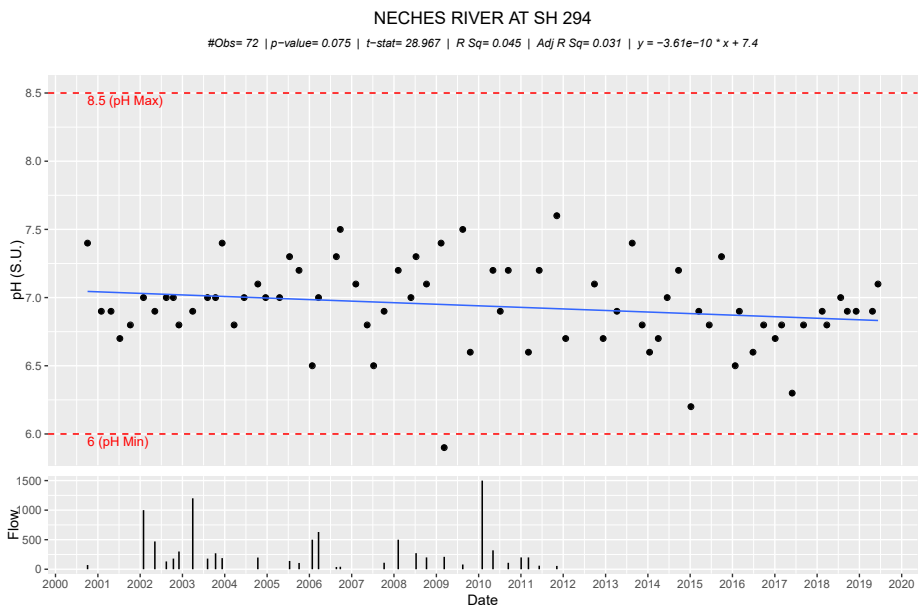
Analysis shows statistically significant decreasing trends for pH, Chloride, and Total Phosphorus.

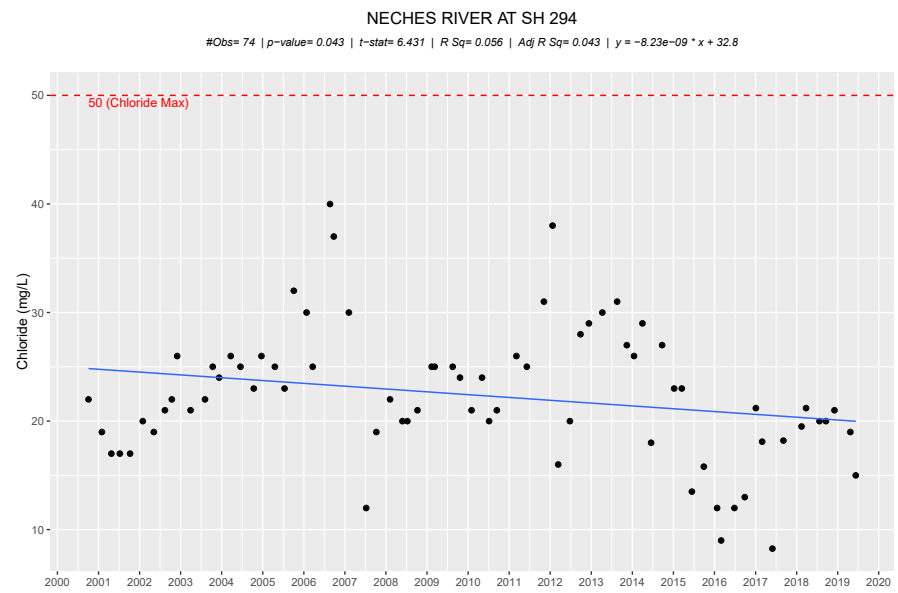
The trend identified for Ammonia-Nitrogen is not considered to be statistically significant due to having greater than fifty-percent censored values.

There are no concerns or impairments listed for this assessment unit in the 2020 Texas Integrated Report.

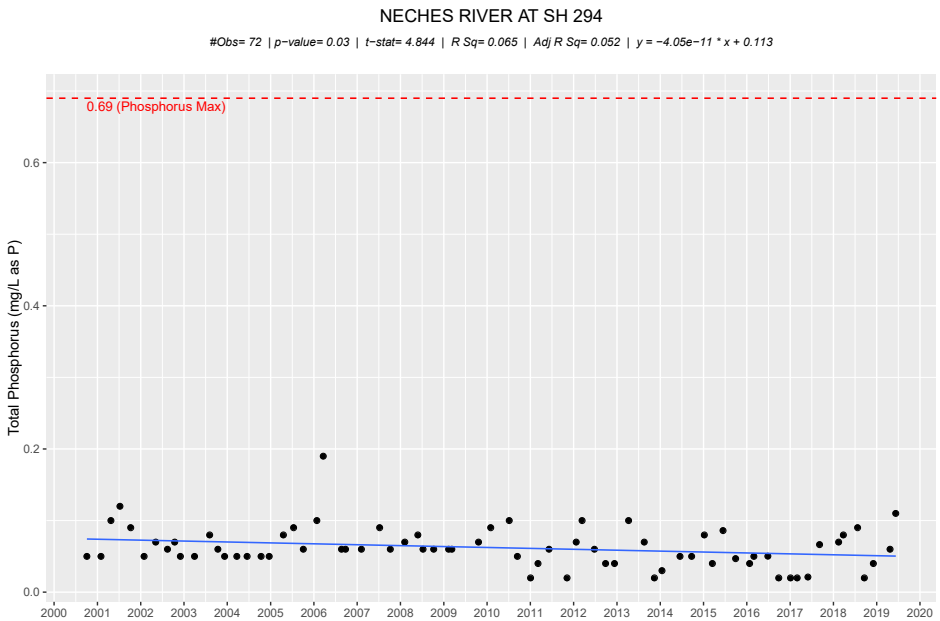
Water Quality Monitoring Results for Station 14794

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	63	16	0.00	2000.00	35.33	2.34	0.17	
Water Temperature (C)	74	0	6.00	31.10	19.95	3.08	0.89	
Dissolved Oxygen (mg/L)	73	0	4.20	12.00	8.13	6.04	0.56	
pH (S.U.)	72	1	5.90	7.60	6.94	28.97	0.08	↓
Specific Conductance (us/cm @ 25C)	74	0	90.00	284.00	180.23	6.84	0.27	
Ammonia-Nitrogen (mg/L as N)	72	0	0.02	0.09	0.05	8.32	0.05	
Chloride (mg/L)	74	0	8.25	40.00	22.39	6.43	0.04	↓
Sulfate (mg/L)	75	0	10.60	50.00	20.99	3.82	0.83	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	68	0	0.33	0.94	0.63	3.69	0.14	
Total Phosphorus (mg/L as P)	72	0	0.02	0.19	0.06	4.84	0.03	↓
Total Suspended Solids (mg/L)	73	0	4.00	78.00	25.08	2.50	0.63	
Nitrate (Total) (mg/L)	9	0	0.05	0.29	0.15	-0.74	0.26	
Nitrite (Total) (mg/L)	9	0	0.01	0.05	0.05	24.53	0.00	
Nitrate + Nitrite (mg/L as N)	73	0	0.04	0.55	0.16	3.21	0.21	
Chlorophyll-*a* (ug/L)	72	19	2.22	35.70	12.05	3.01	0.23	
Pheophytin (ug/L)	23	0	5.00	14.60	6.86	0.42	0.93	

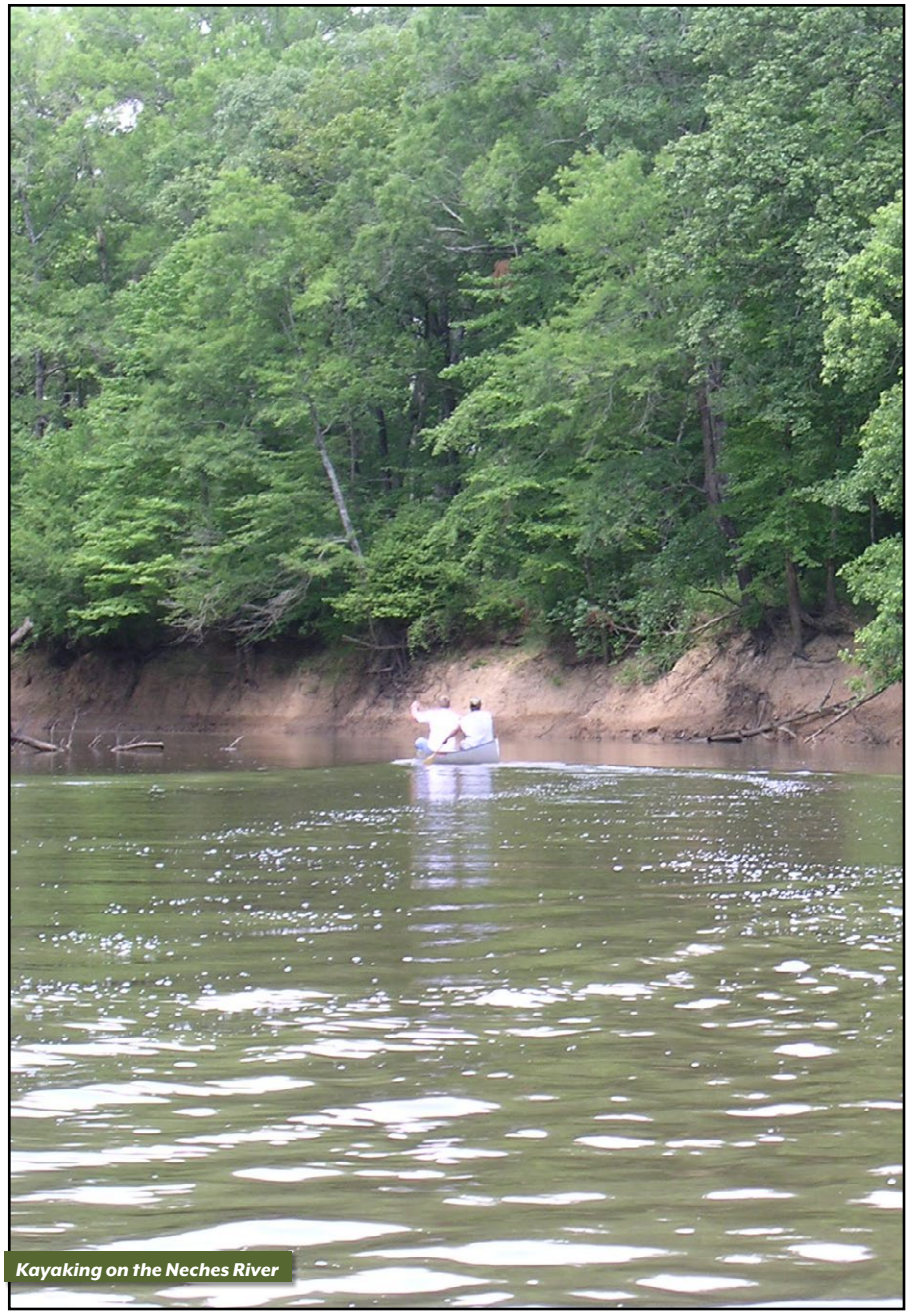




SEGMENT 0604 - NECHES RIVER BELOW LAKE PALESTINE (UPPER NECHES SUB-BASIN PORTION)



Neches River below Lake Palestine



Kayaking on the Neches River

SEGMENT 0604 - NECHES RIVER BELOW LAKE PALESTINE (UPPER NECHES SUB-BASIN PORTION)

Monitoring Station 10591 - Neches River at US 175

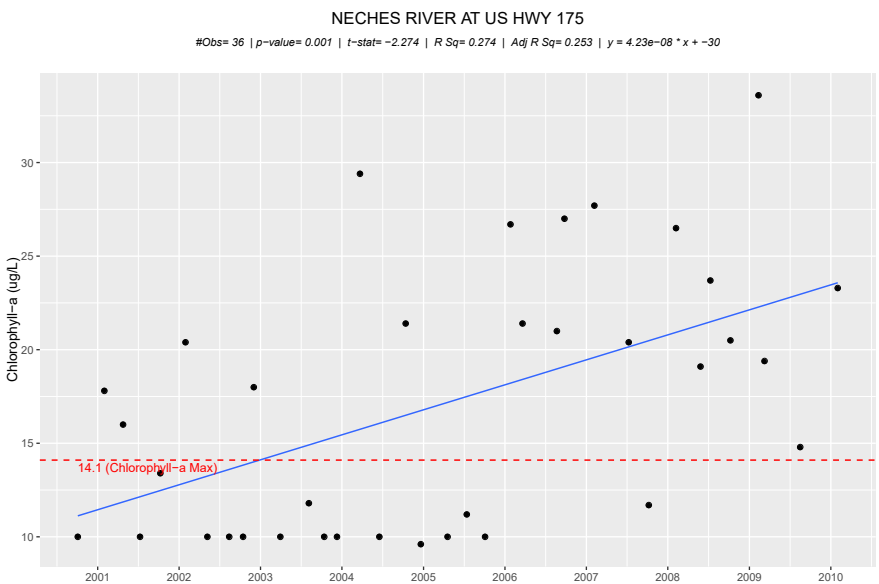
Monitoring Station 10591 is in assessment unit 0604-05. This station is located on the Neches River at US 175 East of Frankston. Monitoring was discontinued at this station in 2010.

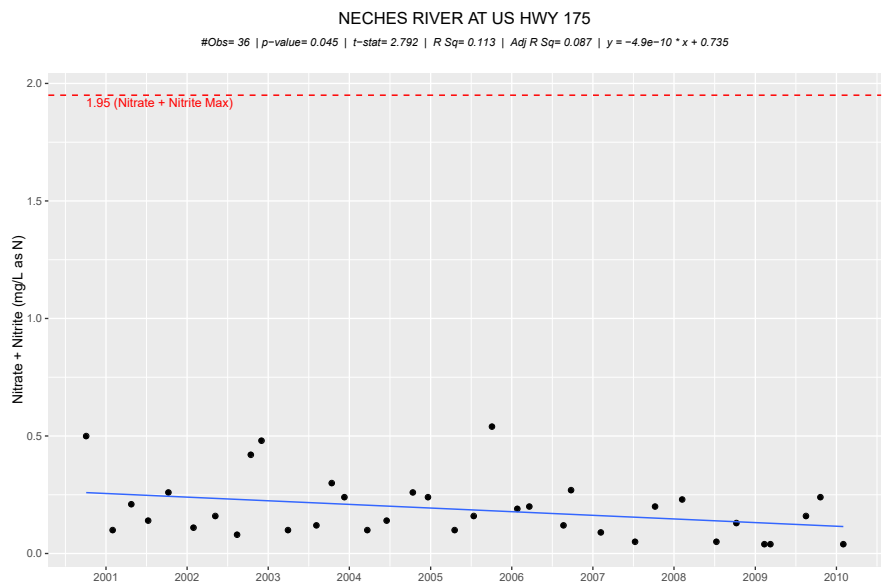
Analysis shows a statistically significant decreasing trend for Nitrate+Nitrite. A statistically significant increasing trend is observed for Chlorophyll-*a*.

There is a concern for Chlorophyll-*a* listed for this assessment unit in the 2020 Texas Integrated Report.

Water Quality Monitoring Results for Station 10591

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	32	4	8.00	1100.00	19.99	-0.64	0.41	
Water Temperature (C)	38	0	7.60	29.10	19.49	1.07	0.80	
Dissolved Oxygen (mg/L)	38	0	3.50	12.00	7.69	1.00	0.60	
pH (S.U.)	37	1	5.70	7.60	6.94	10.01	0.95	
Specific Conductance (us/cm @ 25C)	38	0	125.00	296.00	186.89	1.13	0.28	
Secchi Transparency (Meters)	32	0	0.20	1.00	0.71	2.18	0.59	
Ammonia-Nitrogen (mg/L as N)	37	2	0.05	0.38	0.12	2.05	0.17	
Chloride (mg/L)	37	0	11.00	39.00	21.95	0.40	0.26	
Sulfate (mg/L)	37	0	10.00	30.00	20.95	1.02	0.18	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	35	0	0.42	1.04	0.77	0.87	0.08	
Total Phosphorus (mg/L as P)	36	0	0.05	0.13	0.06	0.78	0.41	
Total Suspended Solids (mg/L)	37	0	4.00	33.00	12.08	0.57	0.76	
Nitrate (Total) (mg/L)	8	0	0.05	0.25	0.14	-0.97	0.33	
Nitrite (Total) (mg/L)	8	0	0.05	0.05	0.05	3.45E+14	0.12	
Nitrate + Nitrite (mg/L as N)	36	0	0.04	0.54	0.19	2.79	0.05	↓
Chlorophyll-*a* (ug/L)	36	20	9.61	33.60	17.11	-2.27	0.00	↑
Pheophytin (ug/L)	23	0	3.47	44.20	11.07	0.08	0.88	





SEGMENT 0604 - NECHES RIVER BELOW LAKE PALESTINE (UPPER NECHES SUB-BASIN PORTION)

Monitoring Station 13627 - Neches River at US 79

Monitoring Station 13627 is found within AU 0604_05. This station is located on the Neches River at the US 79 bridge crossing downstream from Lake Palestine and is monitored quarterly by TCEQ Region 5 (Tyler) personnel for field parameters, conventional parameters, flow, and *E. coli* bacteria.

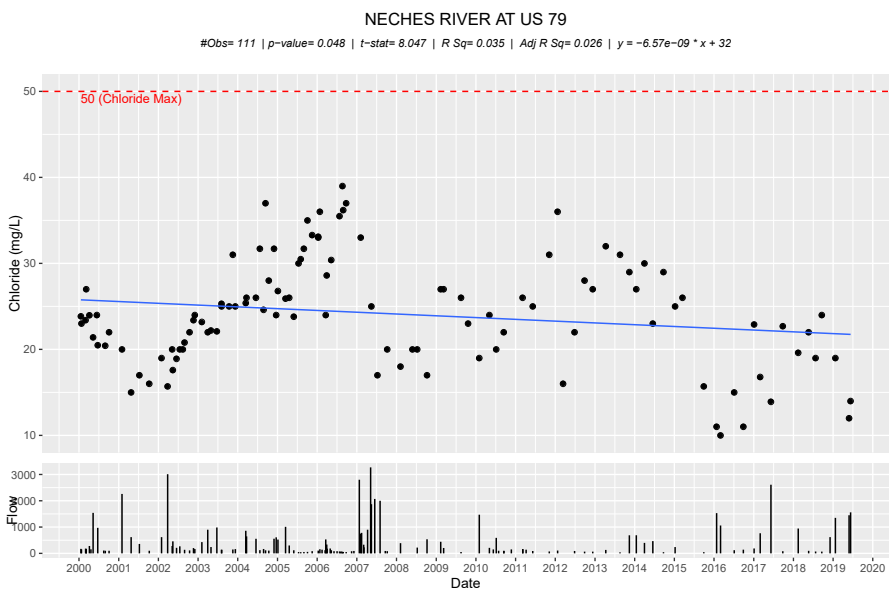
Statistical analysis shows a significant increasing trend for Total Kjeldahl Nitrogen at this station. There is also a significant decreasing trend observed for Chloride.

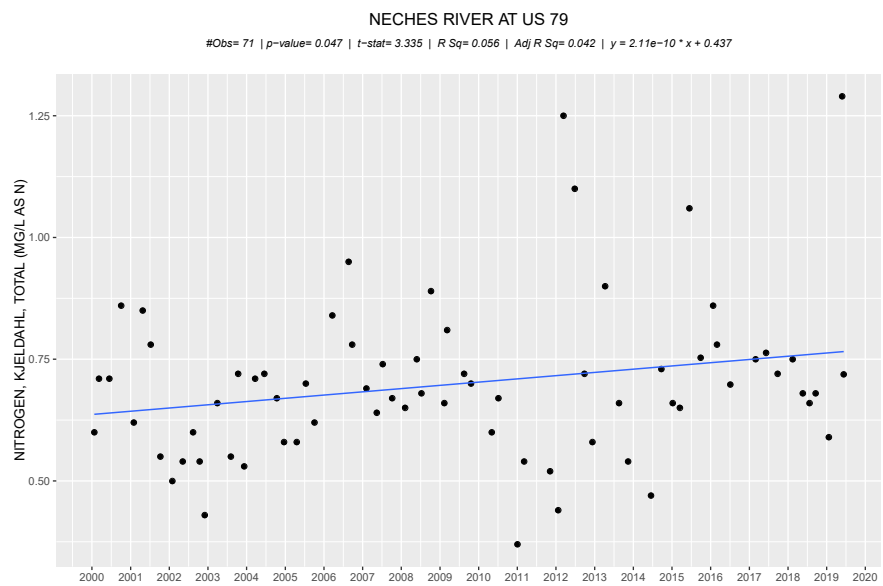
The trend identified for Total Phosphorus is not considered to be statistically significant due to having greater than fifty percent censored values.

This assessment unit is listed in the 2020 Texas Integrated Report with a concern for screening level of Chlorophyll-*a*. There are no other impairments or concerns listed.

Water Quality Monitoring Results for Station 13627

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	74	20	16.00	2400.00	6.77	6.52	0.01	
Water Temperature (C)	114	0	6.20	31.20	20.54	4.38	0.80	
Dissolved Oxygen (mg/L)	111	0	3.40	12.10	7.89	6.78	0.97	
pH (S.U.)	110	2	5.70	8.10	7.04	28.56	0.38	
Specific Conductance (us/cm @ 25C)	111	0	110.00	296.00	194.68	9.09	0.30	
Ammonia-Nitrogen (mg/L as N)	74	0	0.05	0.17	0.06	4.52	0.10	
Chloride (mg/L)	111	0	10.00	39.00	24.14	8.05	0.05	↓
Sulfate (mg/L)	112	0	10.00	47.00	20.95	4.54	0.51	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	71	0	0.37	1.29	0.70	3.34	0.05	↑
Total Phosphorus (mg/L as P)	76	0	0.02	0.11	0.06	5.63	0.03	
Total Suspended Solids (mg/L)	79	0	3.00	44.00	17.89	3.41	0.39	
Nitrate (Total) (mg/L)	8	0	0.06	0.33	0.16	-1.08	0.30	
Nitrite (Total) (mg/L)	8	0	0.05	0.05	0.05	3.45E+14	0.12	
Nitrate + Nitrite (mg/L as N)	86	0	0.04	0.51	0.18	3.52	0.18	
Chlorophyll-*a* (ug/L)	78	35	1.00	36.50	15.24	0.19	0.02	
Pheophytin (ug/L)	25	0	3.92	33.90	8.49	-0.21	0.58	





SEGMENT 0604 - NECHES RIVER BELOW LAKE PALESTINE (UPPER NECHES SUB-BASIN PORTION)

SUMMARY OF WATER QUALITY TRENDS

Trend Analysis Summary for Segment 0604 - Neches River Below Lake Palestine (Upper Neches Sub-Basin Portion)

AU	Station ID	Station Description	*E. coli*	Temp	DO	pH	Spec Cond	NH3	Cl	SO4	TKN	Total P	TSS	NO3	NO2	NO3/ NO2	Chl-*a*	Pheo
0604_04	14794	Neches River at SH 294				↓			↓			↓						
0605_05	10591	Neches River at US 175														↓	↑	
0605_05	13627	Neches River at US 79							↓		↑							

↑ = Statistically significant increasing trend ↓ = Statistically significant decreasing trend

Summary of Water Quality Issues-Segment 0604 - Neches River Below Lake Palestine (Upper Neches Sub-Basin Portion)

Water Quality Issue	Affected Area	Possible Influences/Causes	Possible Effects	Possible Solutions / Actions Taken
Concern for Chlorophyll-*a* Screening Level	AU 0604_05	• Nonpoint sources of pollution • Stormwater runoff • Improper use of fertilizers	• Aesthetic issues • Effect on dissolved oxygen levels	• Continue Monitoring

Neches River at US 59

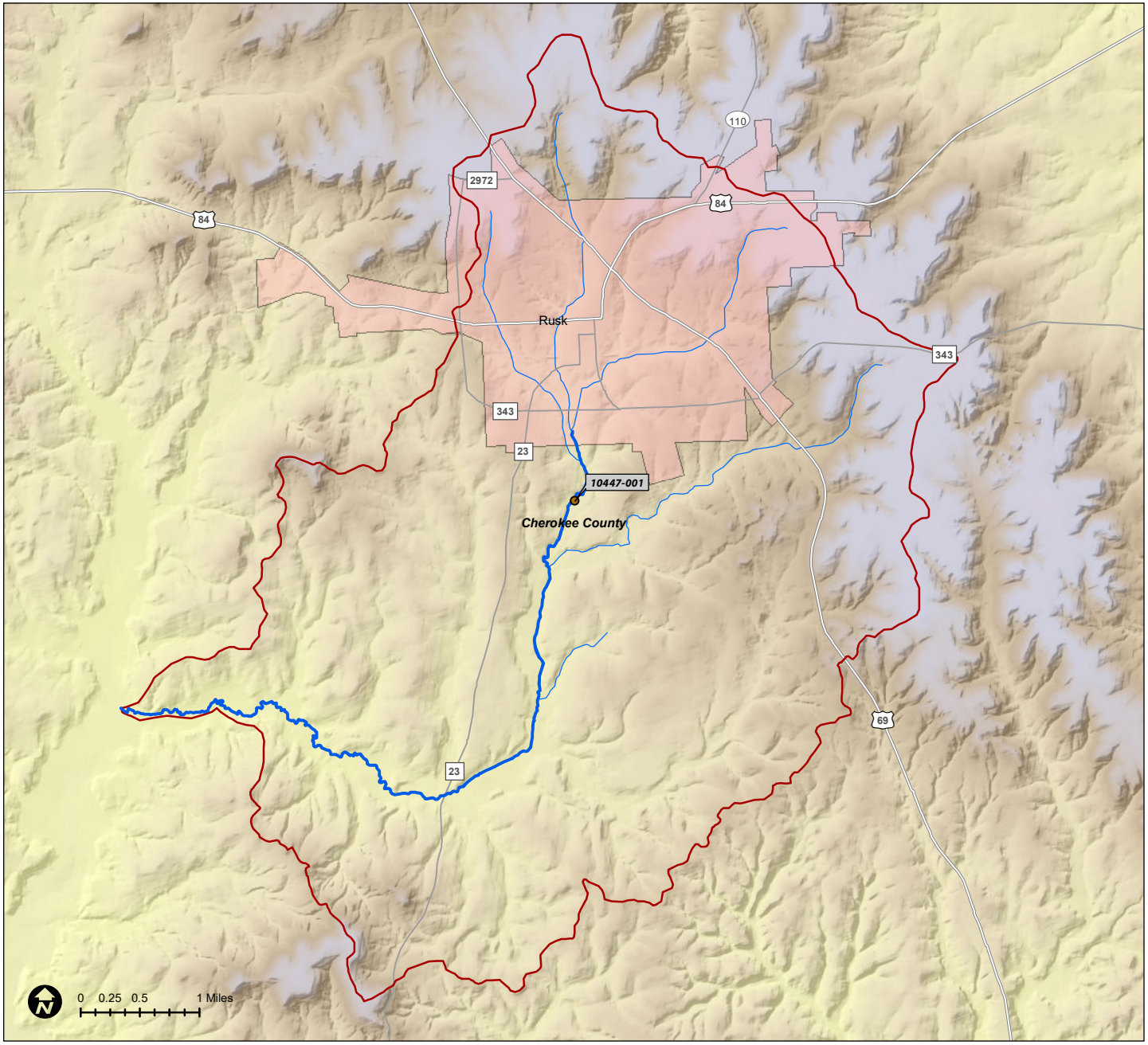
SEGMENT 0604H - ONE-EYE CREEK

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.

The City of Rusk's wastewater treatment facility discharges to One-Eye Creek.

There are no monitoring stations on this unclassified segment and this segment has not been assessed for the 2020 Texas Integrated Report.



- ANRA Monitoring Sites
- TCEQ Monitoring Sites
- Wastewater Outfalls
- Classified Segments
- Other Hydrology
- Segment Watershed
- Counties

SEGMENT 0605 - LAKE PALESTINE

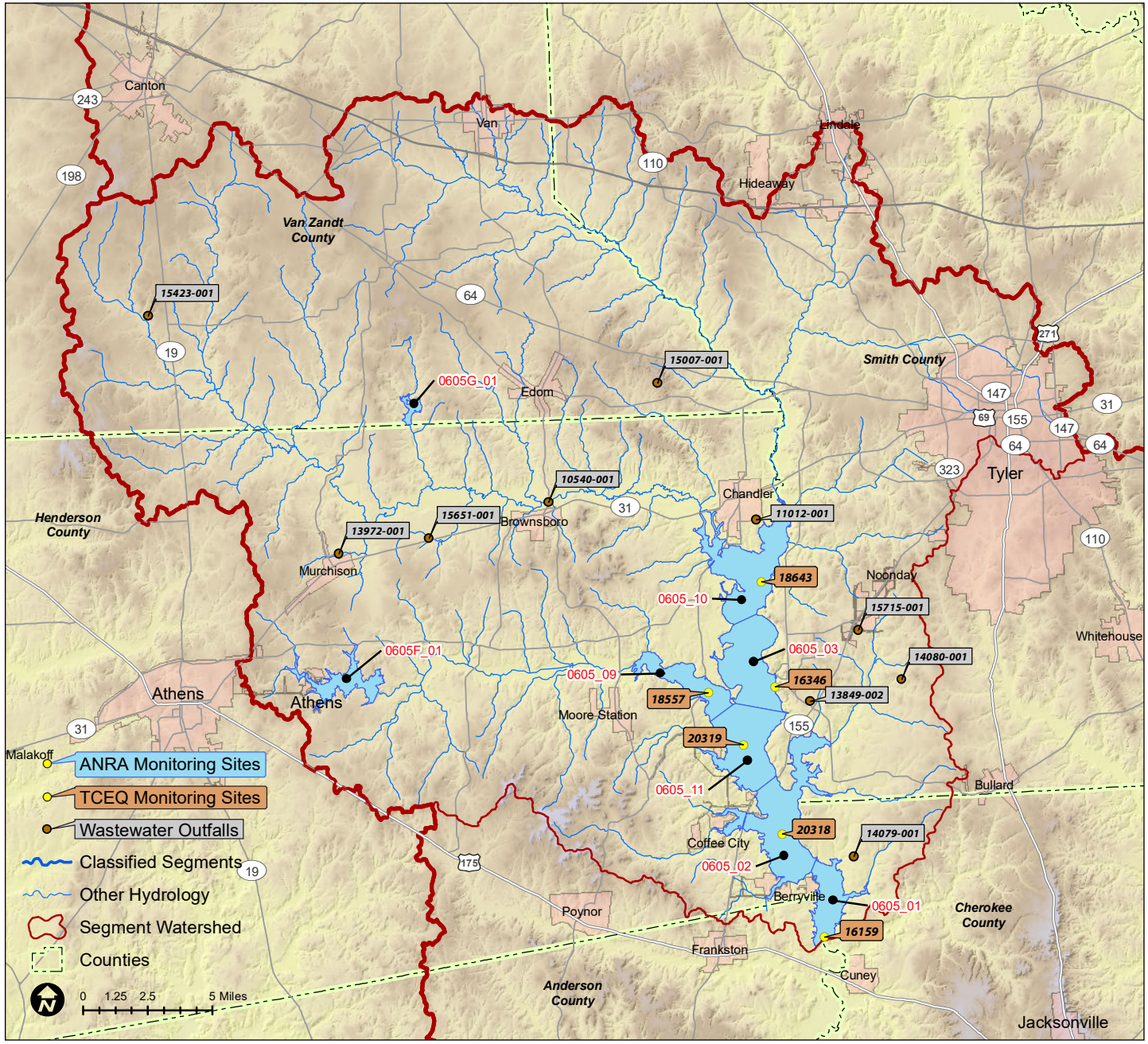
Segment Profile

Lake Palestine is a 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 the upper end and creek arms, especially near Kickapoo Creek. The upper lake is shallow and has heavy aquatic vegetation.

There are statistically significant decreasing trends observed for Specific Conductance, Chloride and Sulfate at multiple stations in this segment. These trends might be influenced by high flow events. It appears that the parameters concentrate over time until a high enough reservoir level is reached and then concentrations significantly decrease suddenly, then begin slowly increasing again afterwards.

There are concerns for Manganese in sediment in all assessment units for this segment. Assessment units 0605_02, 0605_03, 0605_09, and 0605_10 are listed in the 2020 Texas Integrated Report as impaired for elevated pH levels.



SEGMENT 0605 - LAKE PALESTINE

Designated Uses

The designated uses for this classified segment include contact recreation, high aquatic life use, domestic water supply use and general use.

Assessment Units

AU ID	Description
0605_01	Lower portion of reservoir near dam to the first bend in reservoir
0605_02	From the first bend in lower portion of reservoir up to the SH 155 Bridge crossing
0605_03	Upper mid-lake including Tyler Public Water Supply intake
0605_09	Flat Creek Arm
0605_10	Upper Lake
0605_11	From the SH 155 Bridge crossing to the Flat Creek Arm and across the main portion of the lake at the Flat Creek Arm

Monitoring Stations

Station ID	AU ID	Description	Earliest data	Latest data	Notes
16159	0605_01	LAKE PALESTINE AT DAM	1998	2019	Monitored continuously since 1998.
17966	0605_01	LAKE PALESTINE 1.19 KM AND 225 M EAST OF THE DAM RELEASE	2003	2007	Monitored in 2003, 2005 and 2007.
20318	0605_02	LAKE PALESTINE, MIDLAKE, APPROXIMATELY 2.35 MILES DUE SOUTH OF THE NORTH END OF THE SH155 BRIDGE	2008	2019	Monitored continuously since 2008.
16346	0605_03	LAKE PALESTINE AT TYLER INTAKE	1999	2019	Monitored continuously since 1999.
18557	0605_09	LAKE PALESTINE IN FLAT BAY	2005	2019	Monitored continuously since 2005.
18643	0605_10	UPPER LAKE PALESTINE NE	2005	2019	Monitored continuously since 2005.
17550	0605_10	LAKE PALESTINE AT THE NORTHERN MOST CROSSING OF FM 315 760 M NORTH OF SOUTHERN SHORE APPROXIMATELY 7 MILES SOUTH OF CHANDLER	2001	2007	Monitored continuously since 2001.
20319	0605_11	LAKE PALESTINE CWQMN SITE, MID-LAKE, 1.13 KM EAST TO THE END OF CAPE TRANQUILITY DRIVE AND 1.35 KM WEST TO THE END OF REGAL ROW	2008	2019	Monitored continuously since 2008.
10593	0605_11	LAKE PALESTINE MID LAKE AT SH 155 EQUIDISTANT BETWEEN SHORES	1973	2008	Monitored 1973-1979, 1981-1982, 1985-1999 and 2007-2008.

SEGMENT 0605 - LAKE PALESTINE

Assessment Summary *(as reported in the 2020 Texas Integrated Report)*

Parameter	Standard	0605_01 Assessment	0605_02 Assessment	0605_03 Assessment	0605_09 Assessment	0605_10 Assessment	0605_11 Assessment
Chloride (mg/L)	50	FS	FS	FS	FS	FS	FS
Sulfate (mg/L)	50	FS	FS	FS	FS	FS	FS
TDS (mg/L)	200	FS	FS	FS	FS	FS	FS
DO Grab Screening Level (mg/L)	5	NC	NC	NC	NC	NC	NC
DO Grab Minimum (mg/L)	3	FS	FS	FS	FS	FS	FS
24 Hour DO Average	5						
24 Hour DO Minimum	3						
pH (SU)	6.0 - 8.5	FS	NS	NS	NS	NS	FS
Temp (C)	32.2	FS	FS	FS	FS	FS	FS
E. coli geomean (MPN/100mL)	126	FS	FS	FS	FS	FS	FS
Ammonia Nitrogen (mg/L)	0.11	NC	NC	NC	NC	NC	NC
Nitrate Nitrogen (mg/L)	0.37	NC	NC	NC	NC	NC	NC
Total Phosphorus (mg/L)	0.2	NC	NC	NC	NC	NC	NC
Chl-*a* (µg/L)	26.7	NC	NC	NC	NC	NC	NC
Mercury in Edible Tissue							
Dioxin in Edible Tissue							
Manganese in Sediment	1,100	CS	CS	CS	CS	CS	CS

FS = Fully Supporting NC = No Concern CN = Concern for Near Non-Attainment CS = Concern for Screening Level NS = Not Supporting NA = Not Assessed

Lake Palestine drought conditions

SEGMENT 0605 - LAKE PALESTINE

Monitoring Station 16159 - Lake Palestine at Dam

Monitoring Station 16159 is located in AU 0605_01. This station is located at the dam on Lake Palestine equidistant from both shorelines and is monitored quarterly by TCEQ Region 5 (Tyler) personnel for field parameters, conventional parameters, and *E. coli* bacteria.

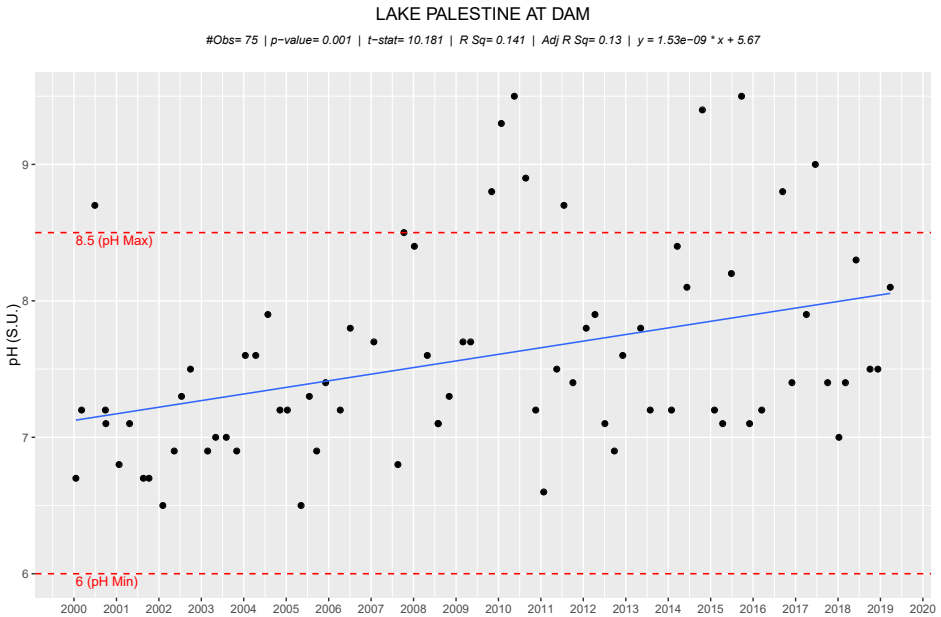
Statistical analysis shows a significant increasing trend for pH, with approximately seven percent of the observations being at or above the max pH standard of 9.0. There is a decreasing trend for Ammonia-Nitrogen; however, this trend is not statistically significant. Most values for this parameter are reported at or below the limit of quantitation, although there are several values which exceed the screening level criteria.

This assessment unit is listed in the 2020 Texas Integrated Report with a concern for manganese in sediment. There are no other impairments or concerns listed.

Water Quality Monitoring Results for Station 16159

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	55	0	1.00	20.00	2.15	0.21	0.51	
Water Temperature (C)	75	1	6.80	32.70	20.79	3.47	0.95	
Dissolved Oxygen (mg/L)	75	4	1.20	13.80	8.22	1.47	0.02	
pH (S.U.)	75	4	6.50	9.50	7.58	10.18	0.00	↑
Specific Conductance (us/cm @ 25C)	75	0	98.00	270.00	188.07	6.45	0.73	
Ammonia-Nitrogen (mg/L as N)	75	9	0.02	0.34	0.07	3.98	0.01	
Chloride (mg/L)	76	0	8.00	37.00	21.40	5.75	0.11	
Sulfate (mg/L)	76	0	9.00	43.00	22.87	3.54	0.69	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	69	0	0.25	1.12	0.75	5.68	0.69	
Total Phosphorus (mg/L as P)	66	0	0.02	0.13	0.05	5.02	0.20	
Total Suspended Solids (mg/L)	72	0	1.00	9.00	5.18	1.60	0.00	
Nitrate (Total) (mg/L)	8	0	0.05	0.46	0.16	-1.02	0.33	
Nitrite (Total) (mg/L)	8	0	0.05	0.05	0.05	3.32+14	0.16	
Nitrate + Nitrite (mg/L as N)	75	5	0.02	0.51	0.12	1.67	0.62	
Chlorophyll-*a* (ug/L)	71	24	1.00	237.00	26.50	0.87	0.78	
Pheophytin (ug/L)	25	0	1.12	237.00	26.44	-0.20	0.73	

Lake Palestine



SEGMENT 0605 - LAKE PALESTINE

Monitoring Station 20318 - Lake Palestine Southeast of the SH 155/FM 3506 Intersection

Monitoring Station 20318 is located in AU 0605_02. This station is located 2.28 km east and 1.95 km south from the intersection of SH 155 and FM 3506 west of Eagles Bluff Country Club. It is monitored quarterly by TCEQ Region 5 (Tyler) personnel for field parameters, conventional parameters, and *E. coli* bacteria.

A trend for *E. coli* was observed but is not considered statistically significant due to more than fifty percent of the data being censored. There is a statistically significant decreasing trend observed for pH. There are also statistically significant decreasing trends observed for Specific Conductance, Chloride and Sulfate. This assessment unit is listed in the 2020 Texas Integrated Report as impaired for elevated pH. There is also a concern for screening level of Manganese in sediment. There are no other impairments or concerns listed for this assessment unit.

Water Quality Monitoring Results for Station 20318

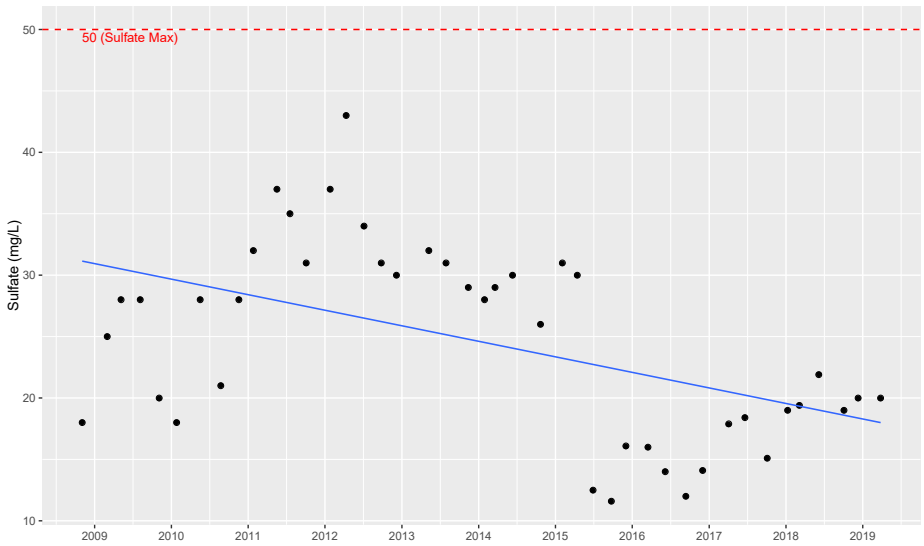
Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	28	0	1.00	12.00	2.25	2.39	0.05	
Water Temperature (C)	41	0	7.80	32.10	20.93	1.59	0.73	
Dissolved Oxygen (mg/L)	41	0	4.70	13.60	9.25	2.48	0.90	
pH (S.U.)	41	4	7.00	9.40	7.95	7.06	0.05	↓
Specific Conductance (us/cm @ 25C)	41	0	109.00	254.00	187.39	4.35	0.04	↓
Ammonia-Nitrogen (mg/L as N)	42	1	0.02	0.13	0.05	1.35	0.98	
Chloride (mg/L)	42	0	8.00	30.00	20.51	4.28	0.01	↓
Sulfate (mg/L)	43	0	11.60	43.00	24.58	5.29	0.00	↓
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	36	0	0.38	1.08	0.76	2.27	0.76	
Total Phosphorus (mg/L as P)	33	1	0.02	1.41	0.09	-0.77	0.36	
Total Suspended Solids (mg/L)	40	0	4.00	10.00	6.22	0.08	0.11	
Nitrate (Total) (mg/L)	parameter not collected for this station							
Nitrite (Total) (mg/L)	parameter not collected for this station							
Nitrate + Nitrite (mg/L as N)	42	0	0.02	0.26	0.08	-0.26	0.42	
Chlorophyll-*a* (ug/L)	39	23	7.59	56.50	28.67	0.46	0.51	
Pheophytin (ug/L)	parameter not collected for this station							

Lake Palestine

SEGMENT 0605 - LAKE PALESTINE

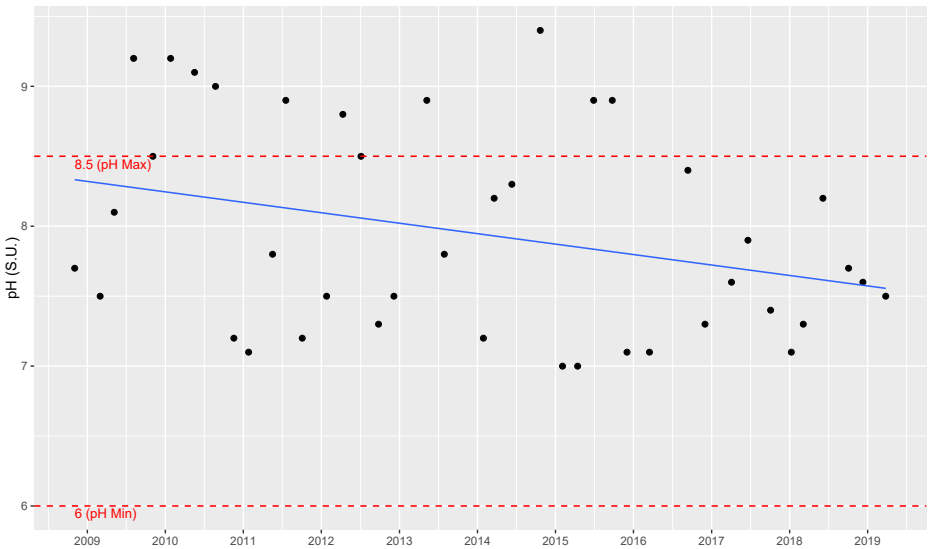
Lake Palestine, midlake, approximately 2.35 miles due south of the north end of the SH155 bridge.

*#Obs= 43 | p−value= 0.001 | t−stat= 5.292 | R Sq= 0.248 | Adj R Sq= 0.23 | y = −4.01e−08 * x + 80.3*



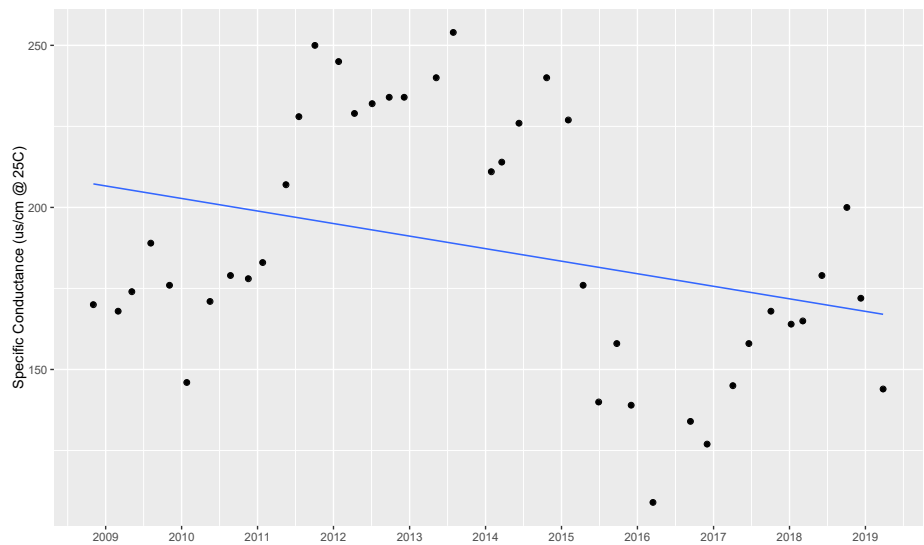
Lake Palestine, midlake, approximately 2.35 miles due south of the north end of the SH155 bridge.

*#Obs= 41 | p−value= 0.045 | t−stat= 7.06 | R Sq= 0.099 | Adj R Sq= 0.076 | y = −2.37e−09 * x + 11.2*



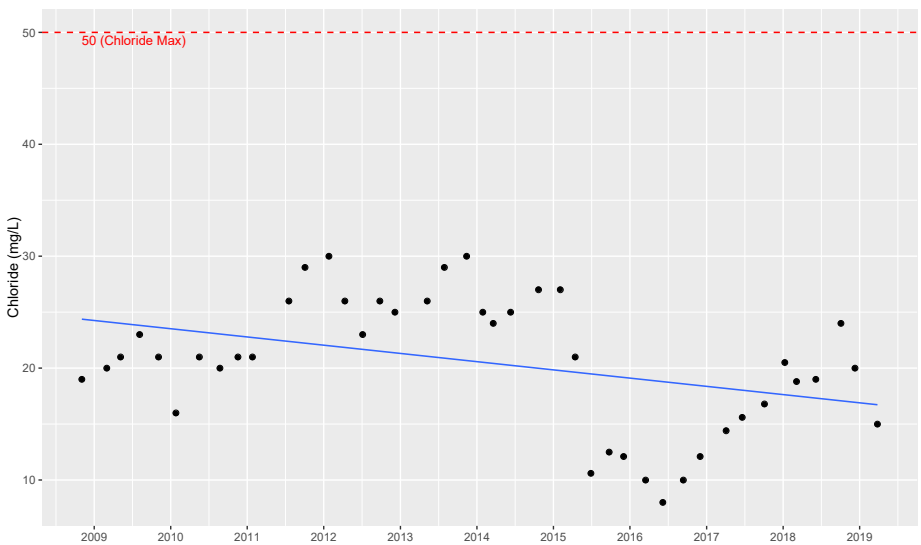
Lake Palestine, midlake, approximately 2.35 miles due south of the north end of the SH155 bridge.

*#Obs= 41 | p−value= 0.045 | t−stat= 4.348 | R Sq= 0.099 | Adj R Sq= 0.076 | y = −1.23e−07 * x + 358*



Lake Palestine, midlake, approximately 2.35 miles due south of the north end of the SH155 bridge.

*#Obs= 42 | p−value= 0.012 | t−stat= 4.283 | R Sq= 0.147 | Adj R Sq= 0.126 | y = −2.33e−08 * x + 52.9*



SEGMENT 0605 - LAKE PALESTINE

Monitoring Station 16346-
Lake Palestine at the City of Tyler Raw Water Intake Structure

Monitoring Station 16346 is located in AU 0605_03. This station is located 0.96 km west of FM 2661 and 2.7 km northwest of the intersection of FM 2661/SH155. It is monitored quarterly by TCEQ Region 5 (Tyler) personnel for field parameters, conventional parameters, and *E. coli* bacteria.

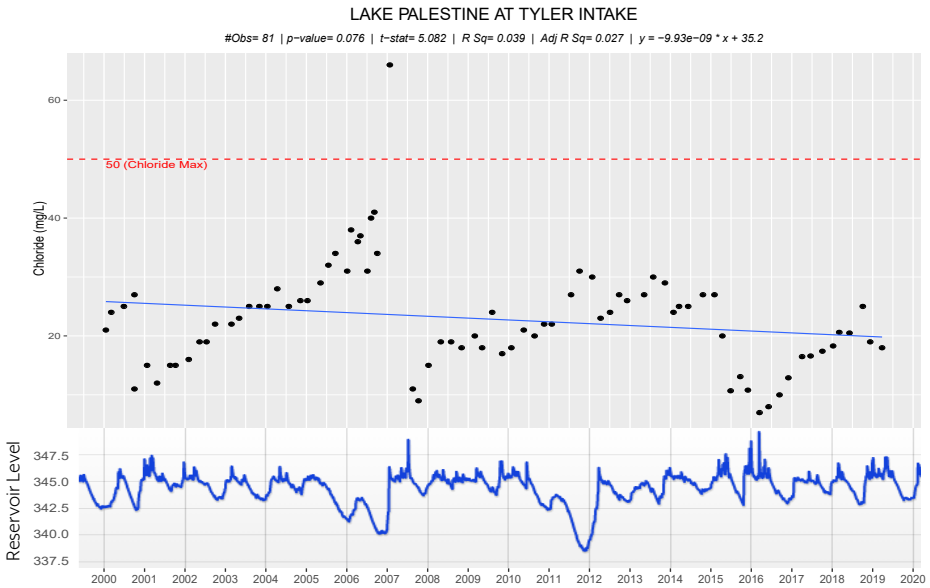
There is a statistically significant decreasing trend identified for Chloride.

This assessment unit is listed in the 2020 Texas Integrated Report with a concern for screening level of Manganese in sediment. There are no other impairments or concerns listed.

Water Quality Monitoring Results for Station 16346

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	59	0	0.00	23.00		-1.72	0.01	
Water Temperature (C)	81	2	6.90	33.00	21.75	4.15	0.65	
Dissolved Oxygen (mg/L)	81	0	4.40	13.20	9.17	6.01	0.50	
pH (S.U.)	81	6	6.60	9.60	7.99	13.57	0.89	
Specific Conductance (us/cm @ 25C)	81	0	85.00	307.00	196.09	6.62	0.32	
Ammonia-Nitrogen (mg/L as N)	80	3	0.02	0.22	0.05	4.12	0.16	
Chloride (mg/L)	81	1	7.00	66.00	22.89	5.08	0.08	↓
Sulfate (mg/L)	82	0	7.00	46.00	24.16	4.09	0.90	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	74	0	0.19	1.56	0.92	5.83	0.26	
Total Phosphorus (mg/L as P)	72	2	0.03	0.34	0.07	2.15	0.72	
Total Suspended Solids (mg/L)	79	0	4.00	23.00	9.03	4.42	0.72	
Nitrate (Total) (mg/L)	8	0	0.05	0.05	0.05	3.32E+14	0.16	
Nitrite (Total) (mg/L)	8	0	0.05	0.05	0.05	3.32E+14	0.16	
Nitrate + Nitrite (mg/L as N)	81	1	0.02	0.40	0.06	1.82	0.76	
Chlorophyll-*a* (ug/L)	77	42	2.14	125.00	34.95	0.66	0.19	
Pheophytin (ug/L)	26	0	1.00	98.00	21.73	0.26	0.98	

Lake Palestine



SEGMENT 0605 - LAKE PALESTINE

Monitoring Station 18557 - Lake Palestine in Flat Bay

Monitoring Station 18557 is located near the mouth of Flat Bay in the Flat Creek Arm of Lake Palestine. This station is located in assessment unit 0605_09. Station 18557 is monitored quarterly by TCEQ Region 5 (Tyler) personnel for field parameters, conventional parameters, and *E. coli* bacteria.

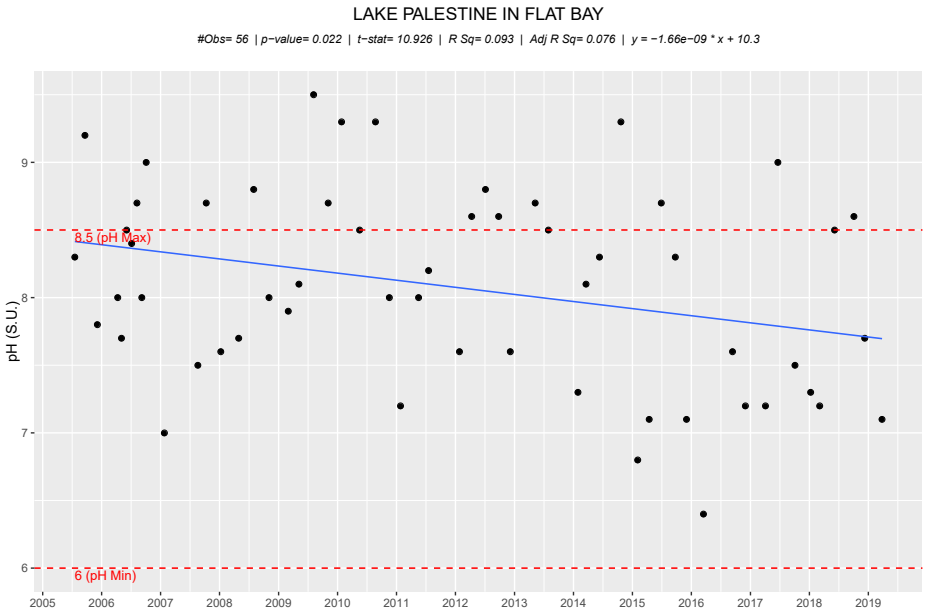
For this station, there are statistically significant decreasing trends observed for Total Phosphorus, pH, TKN, Sulfate and Chloride. Ammonia and Total Phosphorus have decreasing trends that are not considered statistically significant due to more than fifty percent of the data points being at or below the limit of quantitation.

This assessment unit is listed in the 2020 Texas Integrated Report with an impairment for elevated pH. concern for screening level of Manganese in sediment. There are no other impairments or concerns listed.

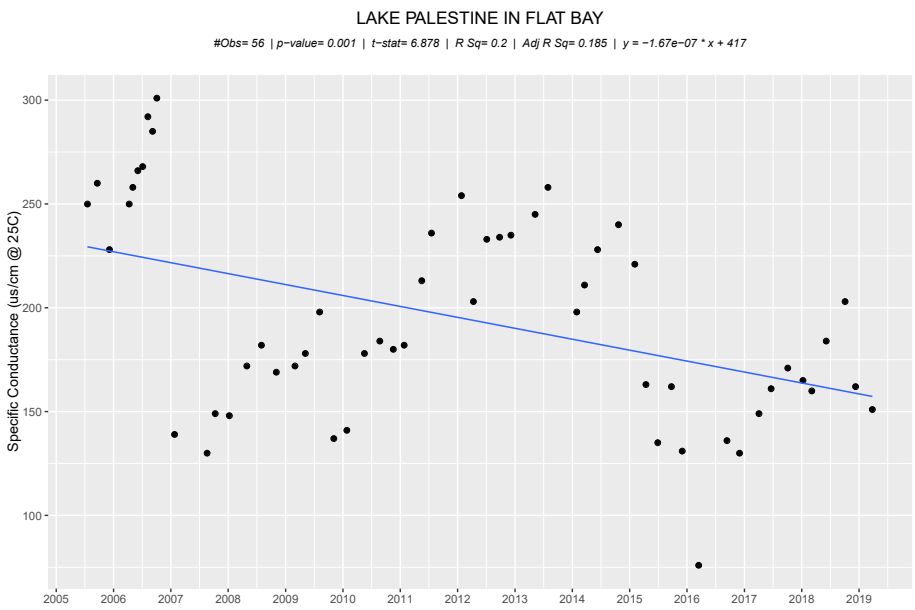
Water Quality Monitoring Results for Station 18557

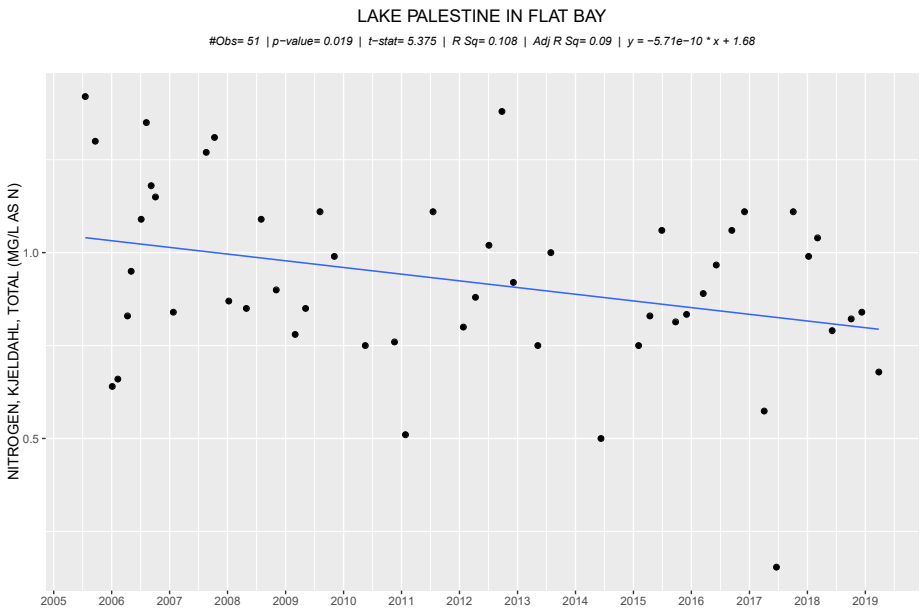
Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	38	0	1.00	16.00	2.62	-0.56	0.25	
Water Temperature (C)	56	3	7.20	33.60	22.17	3.53	0.16	
Dissolved Oxygen (mg/L)	56	0	6.20	13.70	9.14	3.28	0.54	
pH (S.U.)	56	6	6.40	9.50	8.08	10.93	0.02	↓
Specific Conductance (us/cm @ 25C)	56	0	76.00	301.00	195.45	6.88	0.00	↓
Ammonia-Nitrogen (mg/L as N)	55	0	0.02	0.08	0.05	6.69	0.01	
Chloride (mg/L)	57	0	7.00	42.00	22.66	6.43	0.00	↓
Sulfate (mg/L)	58	0	10.00	44.00	24.26	4.57	0.03	↓
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	51	0	0.15	1.42	0.92	5.38	0.02	↓
Total Phosphorus (mg/L as P)	48	0	0.02	0.10	0.06	5.93	0.00	
Total Suspended Solids (mg/L)	56	0	4.44	15.00	8.95	1.71	0.28	
Nitrate (Total) (mg/L)	parameter not collected at this station							
Nitrite (Total) (mg/L)	parameter not collected at this station							
Nitrate + Nitrite (mg/L as N)	58	0	0.02	0.25	0.05	-0.09	0.25	
Chlorophyll-*a* (ug/L)	53	34	6.59	95.60	34.83	2.04	0.49	
Pheophytin (ug/L)	parameter not collected at this station							

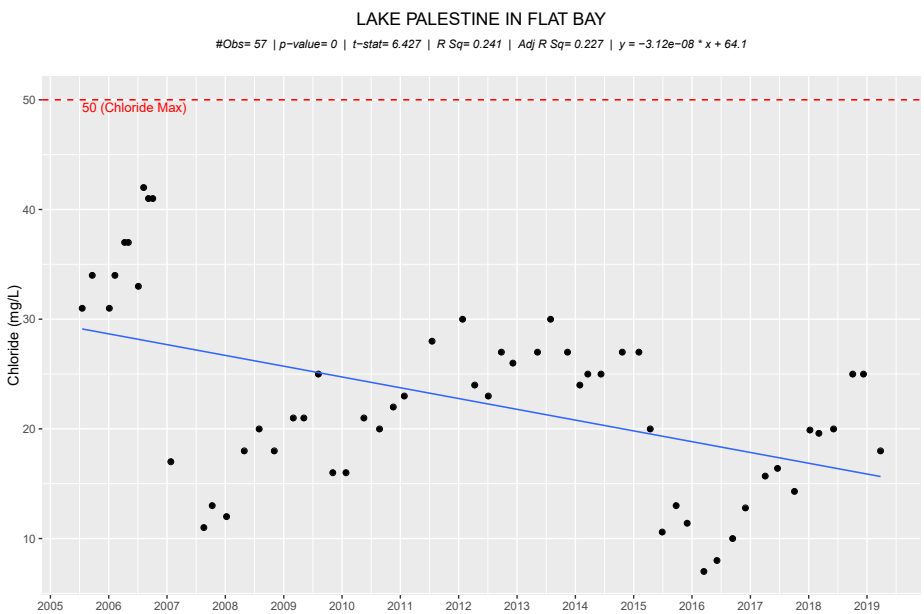
Lake Palestine

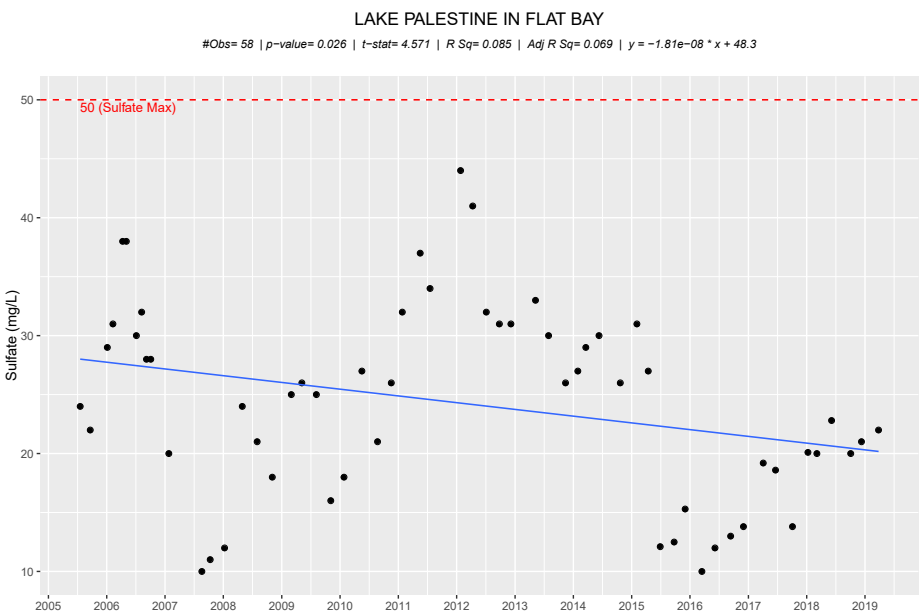


SEGMENT 0605 - LAKE PALESTINE









SEGMENT 0605 - LAKE PALESTINE

Monitoring Station 18643 - Lake Palestine Upper Lake

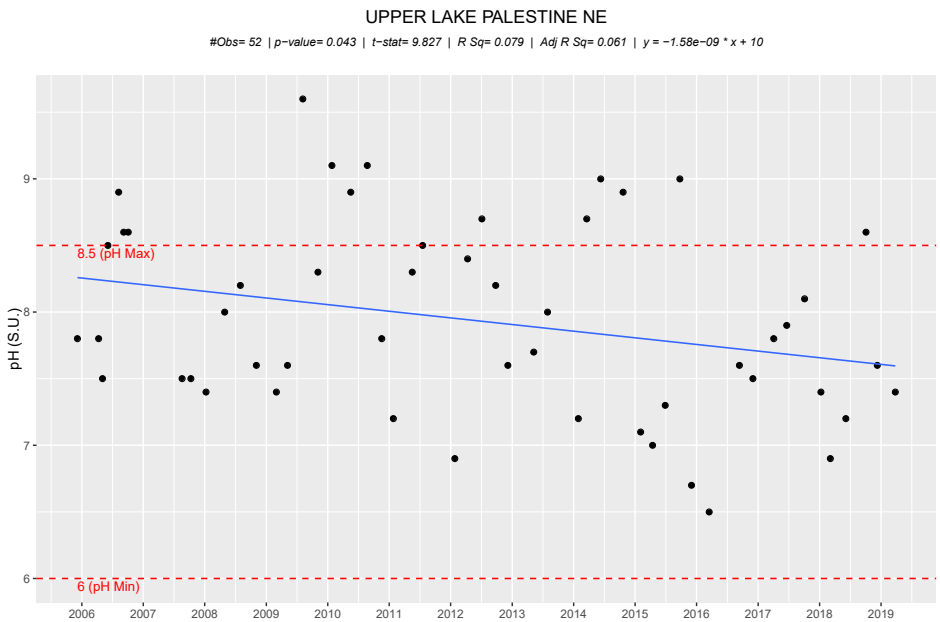
Monitoring Station 18643 is located in the upper portion of Lake Palestine near the east shore and is in AU 0605_10. This station is monitored quarterly by TCEQ Region 5 (Tyler) personnel for field parameters, conventional parameters, and *E. coli* bacteria.

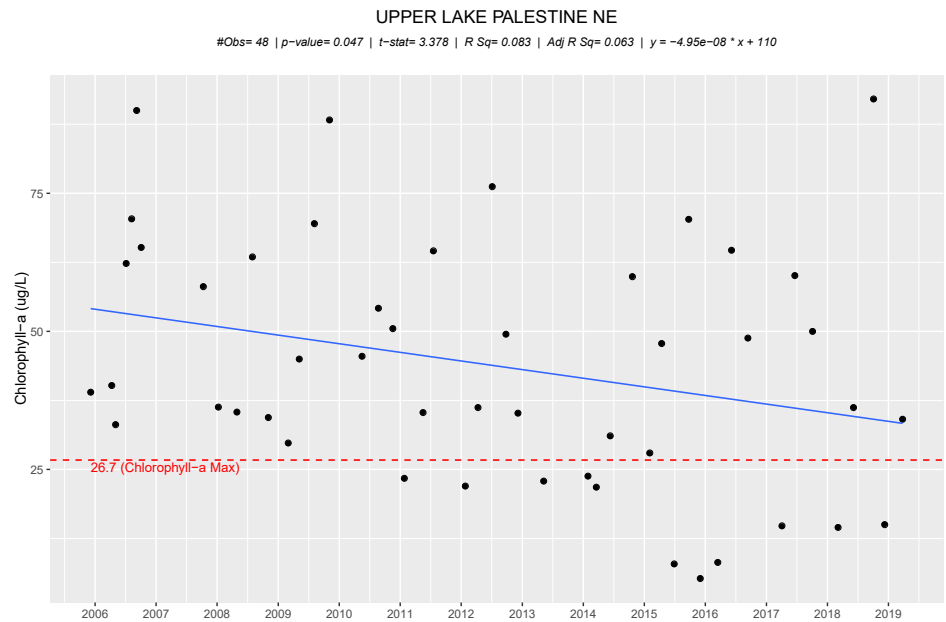
There are significant decreasing trends identified for pH, with approximately five percent of the data points at or above the maximum criteria of 9.0. Analysis shows a significant decreasing trend for Chlorophyll-*a*, with numerous values exceeding the nutrient screening level. Statistically significant decreasing trends are also observed for Specific Conductance, Chloride, Sulfate, and TKN.

This assessment unit is listed in the 2020 Texas Integrated Report with an impairment for elevated pH as well as a concern for screening level of Manganese in sediment. There are no other impairments or concerns listed.

Water Quality Monitoring Results for Station 18643

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	36	1	1.00	230.00	4.11	-1.14	0.19	
Water Temperature (C)	52	2	6.80	33.10	21.88	3.07	0.27	
Dissolved Oxygen (mg/L)	52	0	5.50	12.00	8.89	3.43	0.90	
pH (S.U.)	52	3	6.50	9.60	7.93	9.83	0.04	↓
Specific Conductance (us/cm @ 25C)	52	0	75.00	353.00	209.04	6.72	0.00	↓
Ammonia-Nitrogen (mg/L as N)	52	1	0.02	0.12	0.05	2.59	0.90	
Chloride (mg/L)	53	0	5.00	46.00	23.87	6.58	0.00	↓
Sulfate (mg/L)	54	1	9.00	69.00	26.56	3.93	0.04	↓
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	48	0	0.54	1.94	1.13	6.27	0.00	↓
Total Phosphorus (mg/L as P)	45	3	0.04	0.46	0.11	1.48	0.70	
Total Suspended Solids (mg/L)	52	0	7.00	24.00	13.51	2.70	0.73	
Nitrate (Total) (mg/L)	parameter not collected at this station							
Nitrite (Total) (mg/L)	parameter not collected at this station							
Nitrate + Nitrite (mg/L as N)	54	0	0.02	0.30	0.07	0.87	0.94	
Chlorophyll-*a* (ug/L)	48	37	5.25	92.10	43.97	3.38	0.05	↓
Pheophytin (ug/L)	1	0	not enough data to determine					

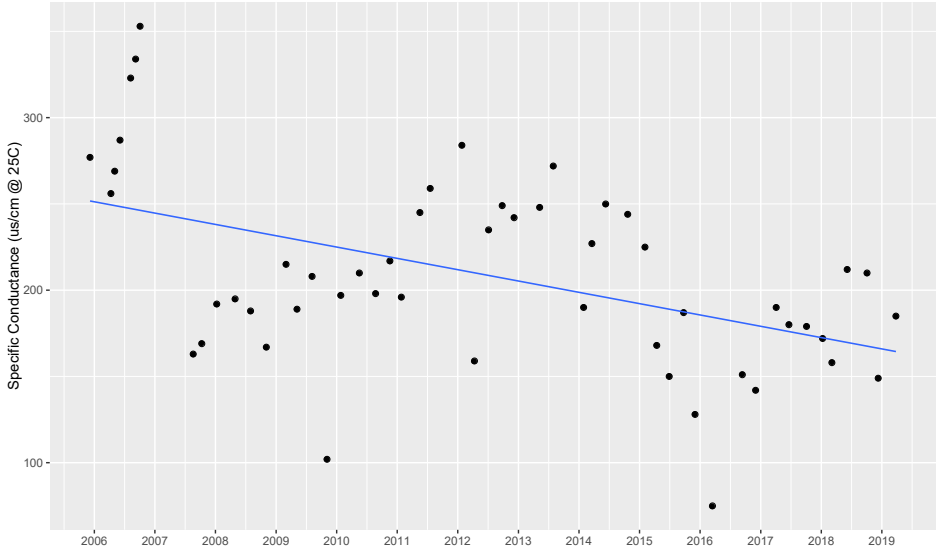




SEGMENT 0605 - LAKE PALESTINE

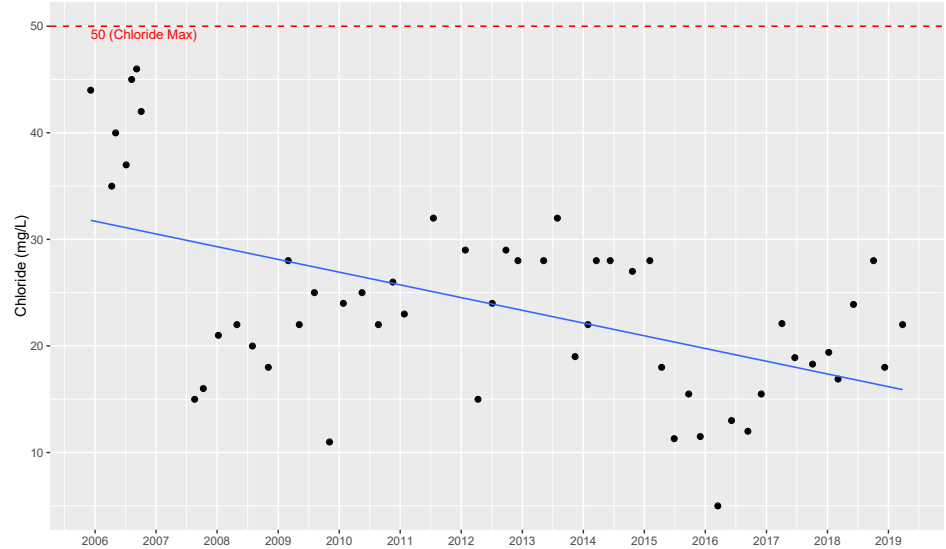
UPPER LAKE PALESTINE NE

*#Obs= 52 | p−value= 0 | t−stat= 6.725 | R Sq= 0.229 | Adj R Sq= 0.214 | y = −2.08e−07 * x + 487*



UPPER LAKE PALESTINE NE

*#Obs= 53 | p−value= 0 | t−stat= 6.579 | R Sq= 0.284 | Adj R Sq= 0.27 | y = −3.78e−08 * x + 74.7*

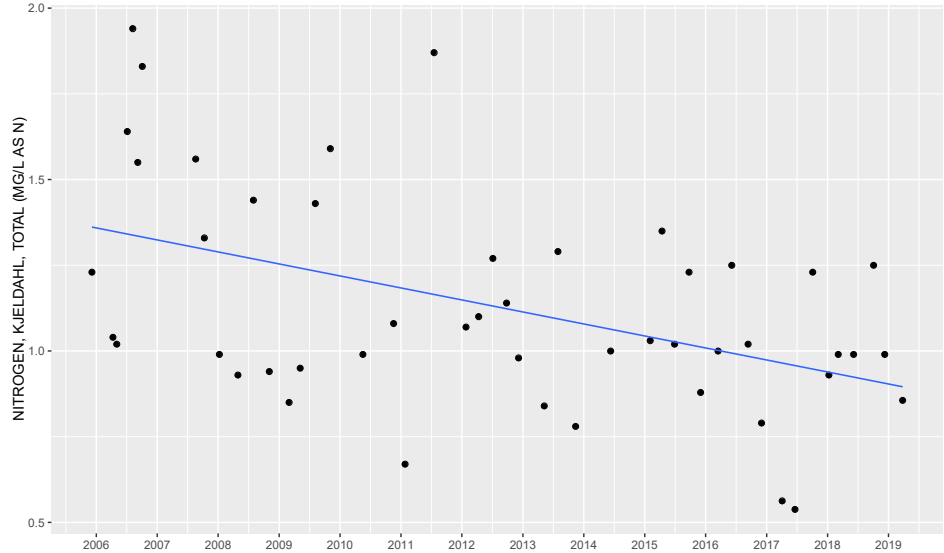


UPPER LAKE PALESTINE NE

*#Obs= 54 | p−value= 0.04 | t−stat= 3.928 | R Sq= 0.078 | Adj R Sq= 0.061 | y = −2.26e−08 * x + 56.9*

UPPER LAKE PALESTINE NE

*#Obs= 48 | p−value= 0.001 | t−stat= 6.271 | R Sq= 0.218 | Adj R Sq= 0.201 | y = −1.11e−09 * x + 2.62*



SEGMENT 0605 - LAKE PALESTINE

Monitoring Station 20319 - Lake Palestine Between Flat Bay and SH 155

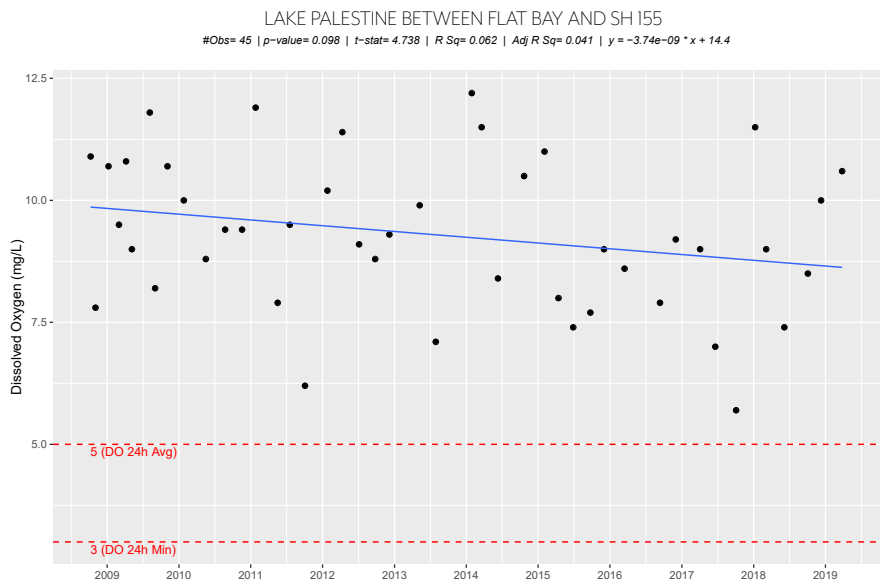
Monitoring Station 20319 was a part of the Continuous Water Quality Monitoring Network (CWQMN). Real-time monitoring began in February of 2008, with the site being deactivated in September of 2009. The station was located in a eutrophic section of the lake, which subjected the multiprobe instrument to biofouling.

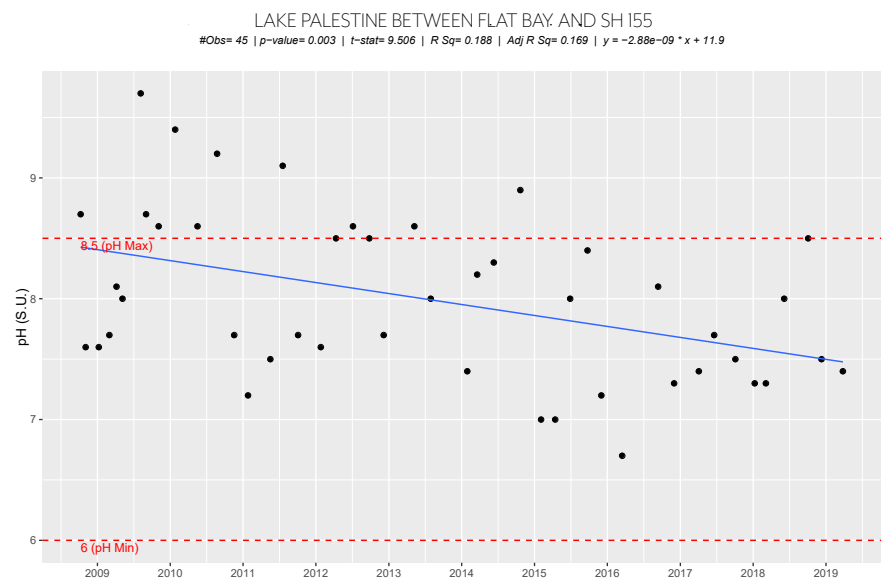
Station 20319 is located mid-lake 1.13 km east of the end of Cape Tranquility Drive and 1.35 km west of the end of Regal Row. This station is in AU 0605_11 and is monitored quarterly for conventional parameters, field parameters, and *E. coli* bacteria.

Statistical analysis shows decreasing trends for Dissolved Oxygen, pH, Specific Conductance, Chloride, and Sulfate.

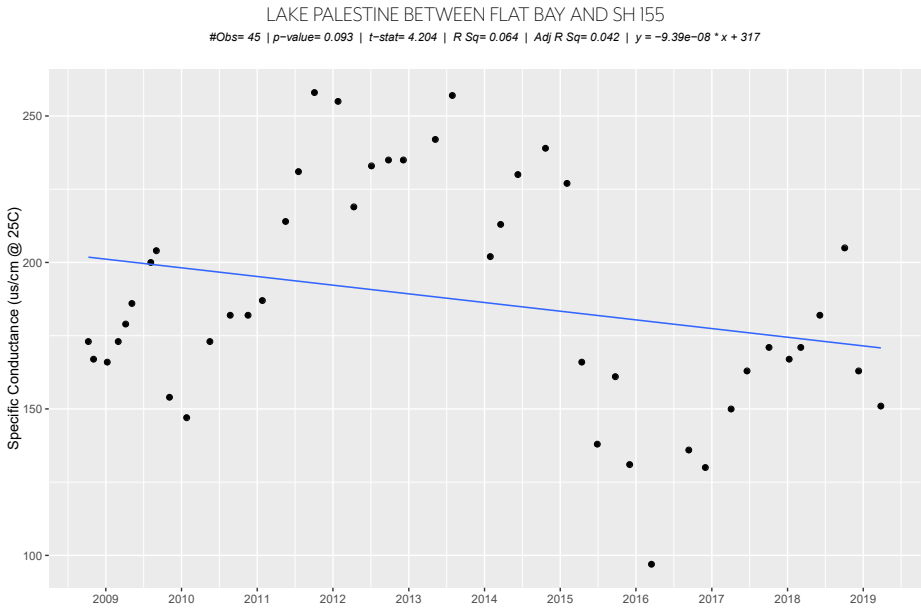
Water Quality Monitoring Results for Station 20319

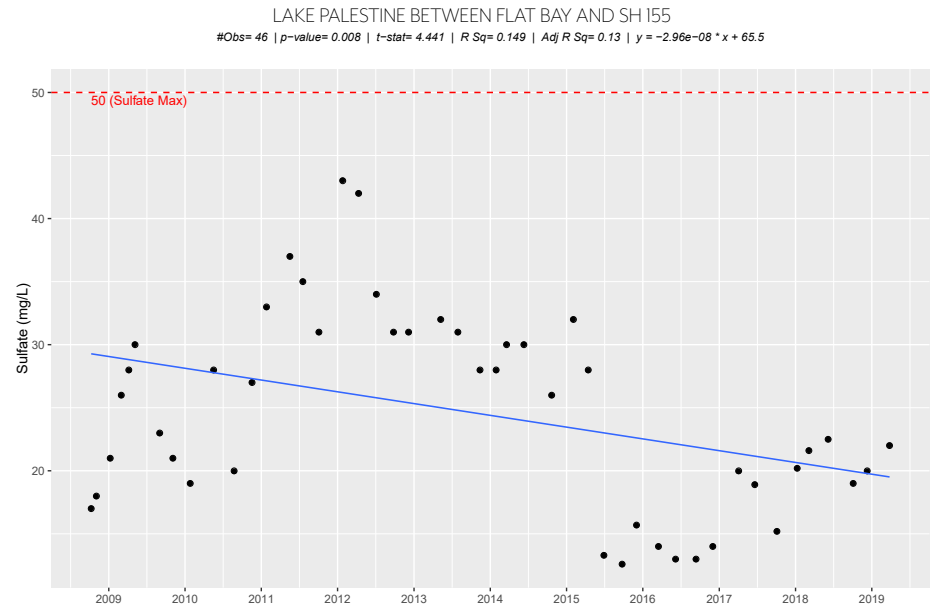
Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	30	0	1.00	75.00	3.51	1.32	0.29	
Water Temperature (C)	45	2	7.30	32.70	20.88	1.62	0.80	
Dissolved Oxygen (mg/L)	45	0	5.70	12.20	9.30	4.74	0.10	↓
pH (S.U.)	45	4	6.70	9.70	7.99	9.51	0.00	↓
Specific Conductance (us/cm @ 25C)	45	0	97.00	258.00	187.67	4.20	0.09	↓
Secchi Transparency (Meters)	46	0	0.50	1.10	0.80	2.46	0.79	
Ammonia-Nitrogen (mg/L as N)	46	0	0.02	0.11	0.05	1.63	0.96	
Chloride (mg/L)	45	0	8.00	31.00	20.84	3.99	0.04	↓
Sulfate (mg/L)	46	0	12.60	43.00	24.67	4.44	0.01	↓
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	39	0	0.16	1.34	0.82	2.36	0.63	
Total Phosphorus (mg/L as P)	38	1	0.02	1.97	0.10	-0.91	0.29	
Total Suspended Solids (mg/L)	44	0	4.00	14.00	7.95	0.90	0.28	
Nitrate (Total) (mg/L)	parameter not collected at this station							
Nitrite (Total) (mg/L)	parameter not collected at this station							
Nitrate + Nitrite (mg/L as N)	46	0	0.02	0.16	0.05	-0.94	0.06	
Chlorophyll-*a* (ug/L)	42	26	12.90	64.60	34.12	1.26	0.82	
Pheophytin (ug/L)	parameter not collected at this station							

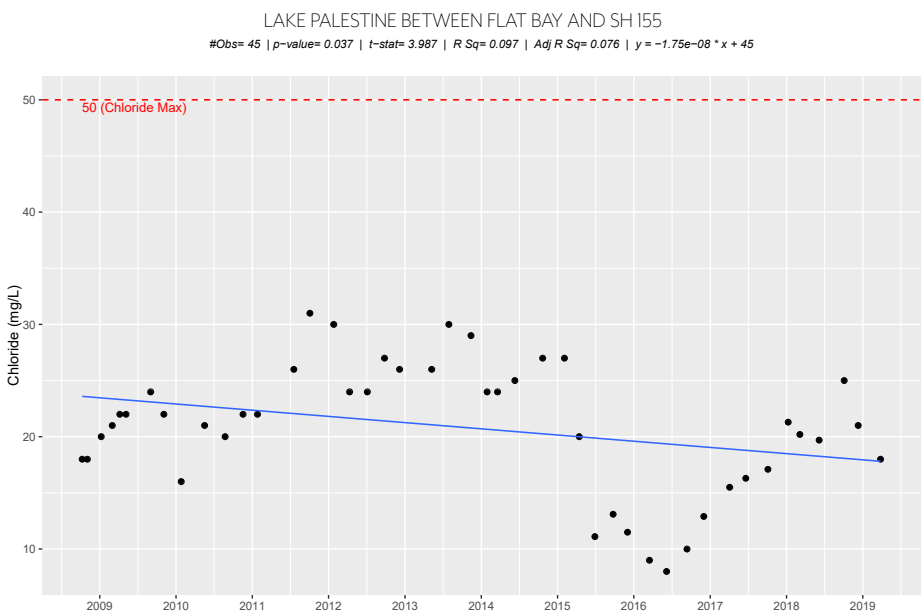




SEGMENT 0605 - LAKE PALESTINE







SEGMENT 0605 - LAKE PALESTINE

SUMMARY OF WATER QUALITY TRENDS

Trend Analysis Summary- Segment 0605 Lake Palestine

AU	Station ID	Station Description	*E. coli*	Temp	DO	pH	Spec Cond	NH3	Cl	SO4	TKN	Total P	TSS	NO3	NO2	NO3/ NO2	Chl-*a*	Pheo
0605_01	16159	Lake Palestine at Dam				↑	↑											
0605_02	20318	Lake Palestine Southeast of SH 155/FM 3506				↓	↓		↓	↓								
0605_03	16346	Lake Palestine at City of Tyler Raw Water Intake Structure							↓									
0605_09	18557	Lake Palestine in Flat Bay				↓	↓		↓	↓	↓	↓						
0605_10	18643	Lake Palestine Upper Lake East Shore				↓	↓		↓	↓	↓						↓	
0605_11	20319	Lake Palestine Between Flat Bay and SH 155			↓	↓	↓		↓	↓								

↑ = Statistically significant increasing trend ↓ = Statistically significant decreasing trend

Water Quality Issues Summary-Segment 0605 Lake Palestine

Water Quality Issue	Affected Area	Possible Influences/Causes	Possible Effects	Possible Solutions / Actions Taken
Elevated pH	0605_02 0605_03 0605_09 0605_10	• Municipal wastewater discharge • Eutrophication • Low alkalinity results in reduced pH buffering capacity	• Detrimental effect on aquatic biological community • Effect on public water supply use	• Continue monitoring
Manganese in sediment (concern)	Entire water body	• Weathering of geological formations • Discharge of surface and groundwater into the lake, followed by sedimentation • Organic and inorganic particulate matter	• Source of manganese in water	• Collect additional data and reevaluate

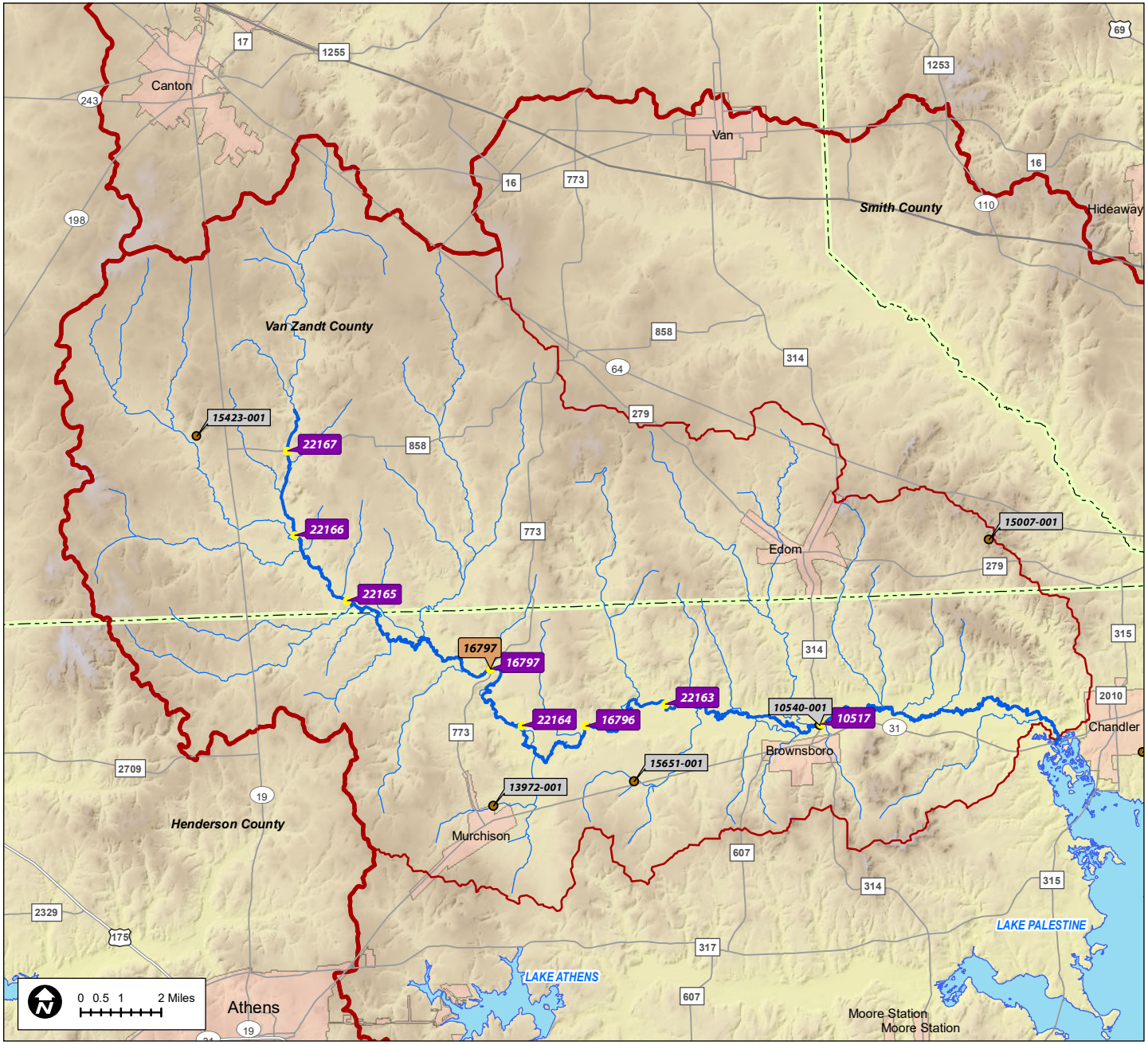
Lake Palestine

SEGMENT 0605A - KICKAPOO CREEK

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.

Assessment unit 0605A_01 is listed in the 2020 Texas Integrated Report with impairments for bacteria and depressed dissolved oxygen. AU 0605A_02 is listed in the 2020 Texas Integrated Report as impaired for bacteria.



- ANRA Monitoring Sites
- SFA Monitoring Sites
- TCEQ Monitoring Sites
- Wastewater Outfalls
- Classified Segments
- Other Hydrology
- Segment Watershed
- Counties

SEGMENT 0605A - KICKAPOO CREEK

Designated Uses

The designated uses for this classified segment include contact recreation, high aquatic life use, domestic water supply use ,and general use.

Assessment Units

AU ID	Description
0605A_01	From the confluence with Lake Palestine (0605) east of Brownsboro in Henderson County to the confluence with Slater Creek (0605E)
0605A_02	From the confluence with Slater Creek (0605E) upstream to confluence with unnamed tributary about 1.62 km north of FM 858 in Van Zandt County at NHD RC 12020001000161

Monitoring Stations

Station ID	AU ID	Description	Earliest Data	Latest Data	Notes
10517	0605A_01	KICKAPOO CREEK AT FM 314	1978	2010	Monitored from 1978-1993 and from 1996-2010.
21618	0605A_01	KICKAPOO CREEK AT CR 3514 APPROXIMATELY 1.4 KM NORTH AND 450 M WEST OF THE INTERSECTION OF SH 31 AND CR 3516 WEST OF THE CITY OF BROWNSBORO	2015	2018	Monitored continuously from 2015-2018.
16797	0605A_02	KICKAPOO CREEK AT FM 773	1999	2019	Monitored 1999-2000 and from 2008-2019.
16796	0605A_02	KICKAPOO CREEK AT FM1803, 1.7MI NORTH OF SH31	1999	2008	Monitored 1999-2001 and from 2005-2008.

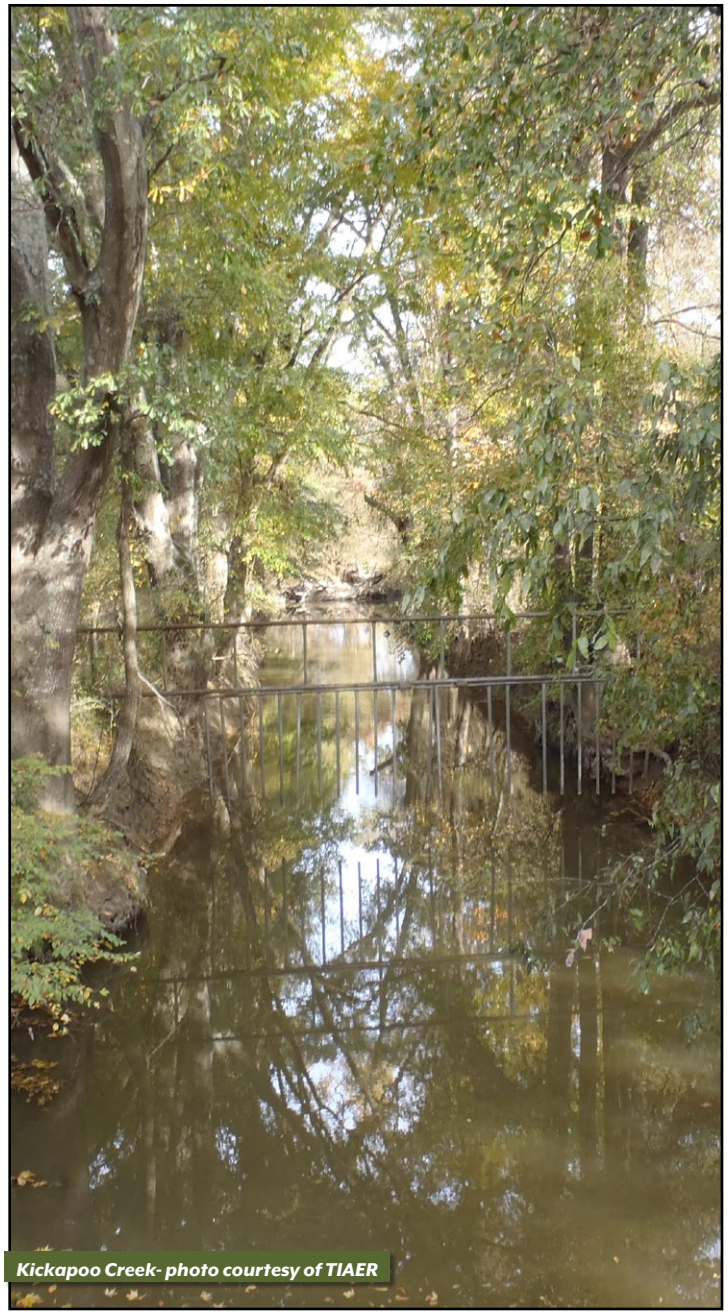
Kickapoo Creek at FM 1803- photo courtesy of TIAER

SEGMENT 0605A - KICKAPOO CREEK

Assessment Summary *(as listed in the 2020 Texas Integrated Report)*

Parameter	Standard	0605A_01 Assessment	0605A_02 Assessment
Chloride (mg/L)	50		
Sulfate (mg/L)	50		
TDS(mg/L)	200		
DO Grab Screening Level (mg/L)	5	NA	NC
DO Grab Minimum (mg/L)	3	NA	FS
24 Hour DO Average	5	NS	
24 Hour DO Minimum	3	NS	
pH (SU)	6.0 - 8.5		
Temp (C)	32.8		
E. coli geomean (MPN/100mL)	126	NS	NS
Ammonia Nitrogen (mg/L)	0.33	NA	NC
Nitrate Nitrogen (mg/L)	1.95	NA	NC
Total Phosphorus (mg/L)	0.69	NA	NC
Chl-*a* (µg/L)	14.1	NA	NC
Mercury in Edible Tissue			
Dioxin in Edible Tissue			

FS = Fully Supporting NC = No Concern CN = Concern for Near Non-Attainment CS = Concern for Screening Level
NS = Not Supporting NA = Not Assessed



Kickapoo Creek- photo courtesy of TIAER

SEGMENT 0605A - KICKAPOO CREEK

Monitoring Station 10517 - Kickapoo Creek at FM 314

Monitoring Station 10517 is no longer monitored, although it has been monitored in the past by TCEQ Region 5 (Tyler) personnel for conventional parameters, field parameters, flow, and *E. coli* bacteria. Monitoring at this station was discontinued in 2010.

Because impairments appear in the 2020 Texas Integrated Report for monitoring conducted at this station, limited data is presented below. ANRA is not presenting the statistical data or considering any trends for this data to be statistically significant since there is no current data at this station.

This assessment unit is listed in the 2020 Texas Integrated Report as impaired for *E. coli* bacteria and Depressed Dissolved Oxygen. There are no other impairments for concerns listed.

Water Quality Monitoring Results for Station 10517

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	30	0	1.00	75.00	3.51	1.32	0.29	
Water Temperature (C)	45	2	7.30	32.70	20.88	1.62	0.80	
Dissolved Oxygen (mg/L)	45	0	5.70	12.20	9.30	4.74	0.10	
pH (S.U.)	45	4	6.70	9.70	7.99	9.51	0.00	
Specific Conductance (us/cm @ 25C)	45	0	97.00	258.00	187.67	4.20	0.09	
Ammonia-Nitrogen (mg/L as N)	46	0	0.02	0.11	0.05	1.63	0.96	
Chloride (mg/L)	45	0	8.00	31.00	20.84	3.99	0.04	
Sulfate (mg/L)	46	0	12.60	43.00	24.67	4.44	0.01	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	39	0	0.16	1.34	0.82	2.36	0.63	
Total Phosphorus (mg/L as P)	38	1	0.02	1.97	0.10	-0.91	0.29	
Total Suspended Solids (mg/L)	44	0	4.00	14.00	7.95	0.90	0.28	
Nitrate (Total) (mg/L)	parameter not collected at this station							
Nitrite (Total) (mg/L)	parameter not collected at this station							
Nitrate + Nitrite (mg/L as N)	46	0	0.02	0.16	0.05	-0.94	0.06	
Chlorophyll-*a* (ug/L)	42	26	12.90	64.60	34.12	1.26	0.82	
Pheophytin (ug/L)	parameter not collected at this station							

Kickapoo Creek at FM 1803- photo courtesy of TIAER

SEGMENT 0605A - KICKAPOO CREEK

Monitoring Station 16797 - Kickapoo Creek at FM 773

Located in Assessment Unit 0605A_02, Monitoring Station 16797 is monitored quarterly by TCEQ Region 5 (Tyler) personnel for field parameters, conventional parameters, flow, and *E. coli* bacteria.

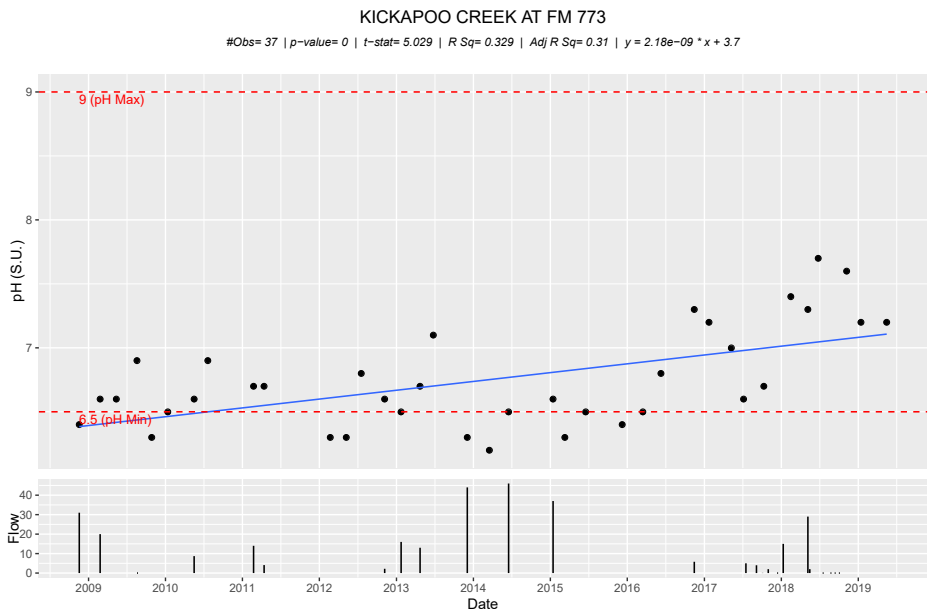
Statistical analysis was performed for this station and a statistically significant increasing trend was observed for pH, with 13 out of the 37 total observations being at or below the 6.5 minimum standard.

This Assessment Unit is listed in the 2020 Texas Integrated Report as impaired for *E. coli* bacteria. There are no other impairments or concerns listed.

Water Quality Monitoring Results for Station 16797

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	46	35	20.00	24000.00	43.82	0.26	0.93	
Water Temperature (C)	37	0	2.90	27.30	17.85	0.89	0.80	
Dissolved Oxygen (mg/L)	37	0	3.40	12.80	6.78	1.51	0.82	
pH (S.U.)	37	8	6.20	7.70	6.75	5.03	0.00	↑
Specific Conductance (us/cm @ 25C)	37	0	85.00	398.00	244.30	2.46	0.39	
Ammonia-Nitrogen (mg/L as N)	37	1	0.02	0.38	0.08	0.86	0.76	
Chloride (mg/L)	35	0	5.80	49.00	27.26	2.82	0.11	
Sulfate (mg/L)	36	14	11.00	98.00	46.61	1.17	0.75	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	31	0	0.50	2.46	1.00	1.04	0.96	
Total Phosphorus (mg/L as P)	33	0	0.04	0.45	0.16	0.82	0.96	
Total Suspended Solids (mg/L)	36	0	6.00	154.00	25.38	0.73	0.73	
Nitrate (Total) (mg/L)	1	0	not enough data to determine					
Nitrite (Total) (mg/L)	1	0	not enough data to determine					
Nitrate + Nitrite (mg/L as N)	37	0	0.04	0.56	0.24	0.38	0.74	
Chlorophyll-*a* (ug/L)	36	4	0.81	29.60	7.04	0.95	0.64	
Pheophytin (ug/L)	parameter not collected at this station							

Kickapoo Creek at CR 3514- photo courtesy of TIAER



SEGMENT 0605A - KICKAPOO CREEK

SUMMARY OF WATER QUALITY TRENDS

Trend Analysis Summary for Segment 0605A- Kickapoo Creek

AU	Station ID	Station Description	*E. coli*	Temp	DO	pH	Spec Cond	NH3	Cl	SO4	TKN	Total P	TSS	NO3	NO2	NO3/ NO2	Chl-*a*	Pheo
0605A_01	10517	Kickapoo Creek at FM 314	*- No trends identified for this Assessment Unit -*															
0605A_01	21618	Kickapoo Creek at FM 3514	*- No trends identified for this Assessment Unit -*															
0605A_02	16797	Kickapoo Creek at FM 773	*- No trends identified for this Assessment Unit -*															
0605A_02	16796	Kickapoo Creek at FM 1803				↑												

↑ = Statistically significant increasing trend ↓ = Statistically significant decreasing trend

Water Quality Issues Summary for Segment 0605A - Kickapoo Creek

Water Quality Issue	Affected Area	Possible Influences/Causes	Possible Effects	Possible Solutions / Actions Taken
Impairment for *E. coli* bacteria	AU 0605A_01 AU 0605A_02	• Municipal wastewater discharge • Non-point source pollution • Domestic animals and wildlife • Storm water runoff	• Water body does not meet the water quality standard for Primary Contact Recreation • Primary Contact Recreation in the water body has an increased risk of gastrointestinal illness	• Continue Monitoring
Depressed Dissolved Oxygen	AU 0605A_01	• Aquatic vegetation • Nutrient loading into the water body • Non-point source pollution	• Detrimental effect on aquatic biological community	• Continue monitoring • Conduct 24-hour DO measurements

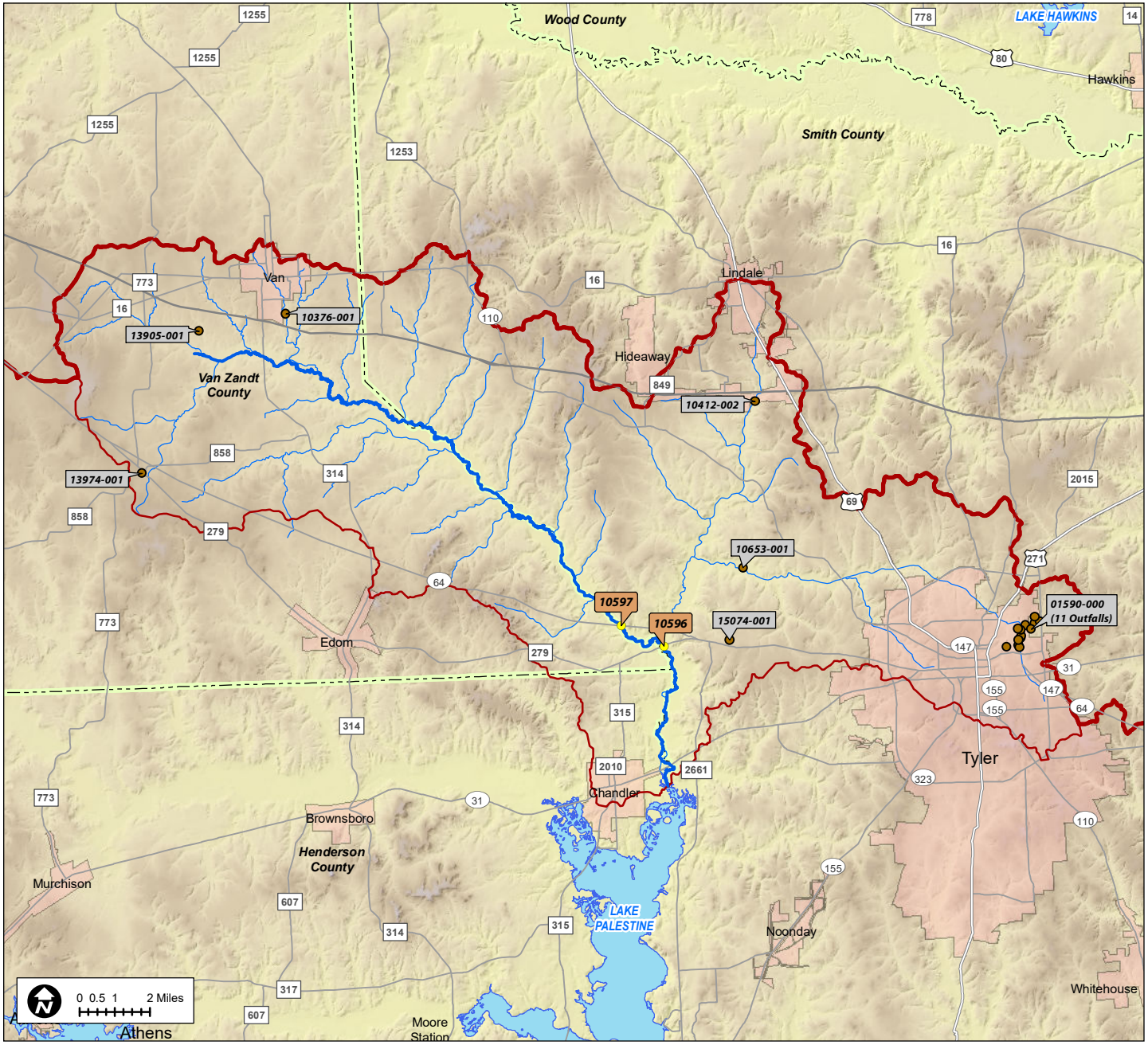
Kickapoo Creek- photo courtesy of TIAER

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.

For the Neches River Above Lake Palestine, assessment unit 0606_01 has an impairment for *E. coli* bacteria listed in the 2020 Texas Integrated Report. Nutrient concerns are also listed for Total Phosphorus and Nitrate+Nitrite. In AU 0606_02, there are impairments for depressed Dissolved Oxygen and *E. coli* as well as a concern for Zinc in water.



ANRA Monitoring Sites
TCEQ Monitoring Sites
Wastewater Outfalls
Classified Segments
Other Hydrology
Segment Watershed
Counties

SEGMENT 0606 - NECHES RIVER ABOVE LAKE PALESTINE

Designated Uses

The designated uses for this classified segment include contact recreation, high aquatic life use, domestic water supply use and general use.

Assessment Units

AU ID	Description
0606_01	From a point approximately 0.06km (0.03 mi) south of St. Louis Southwestern Railroad upstream to the confluence with Prairie Creek (0606A)
0606_02	From the confluence with Prairie Creek (0606A) upstream to the Rhines Lake Dam

Monitoring Stations

Assessment Unit	Monitoring Station ID	Description	Initial Monitoring Event	Latest Monitoring Event	Notes
0606_01	10596	NECHES RIVER AT FM 279 WEST OF TYLER AND NE OF CHANDLER	1975	2019	Monitored from 1975-2010 and again from 2012-2019.
0606_01	10595	LAKE PALESTINE IN NECHES RIVER CHANNEL AT SH 31 NORTHEAST OF CHANDLER	1968	2019	Monitored from 1968-1975, 1982, 1997-2008 and began again in 2019.
0606_02	10597	NECHES RIVER UPSTREAM LAKE PALESTINE AT SH 64 WEST OF TYLER	1978	2019	Monitored from 1978-1993 and 1997-2019.
0606_02	10598	NECHES RIVER UPSTREAM LAKE PALESTINE AT VAN ZANDT CR 4915 6.6 KM SOUTHWEST OF CITY OF MOUNT SYLVAN	1982	2008	Monitored in 1982, 1995-1996, 1999-2002, and 2005-2008.
0606_02	20282	NECHES RIVER AT VAN ZANDT CR 4511 APPROXIMATELY 1.5 KM DOWNSTREAM OF RHINE LAKE SPILLWAY	2008	2015	Monitored continuously from 2008-2015.

Neches River above Lake Palestine

SEGMENT 0606 - NECHES RIVER ABOVE LAKE PALESTINE

Assessment Summary (as listed in the 2020 Texas Integrated Report)

Parameter	Standard	0606_01 Assessment	0606_02 Assessment
Chloride (mg/L)	100	FS	FS
Sulfate (mg/L)	50	FS	FS
TDS(mg/L)	300	FS	FS
DO Grab Screening Level (mg/L)	4	NC	NA
DO Grab Minimum (mg/L)	3	FS	NS
24 Hour DO Average			CN
24 Hour DO Minimum			
pH (SU)	6.0 - 8.5	FS	FS
Temp (C)	35	FS	FS
E. coli geomean (MPN/100mL)	126	NS	NS
Ammonia Nitrogen (mg/L)	0.33	NC	NC
Nitrate Nitrogen (mg/L)	1.95	CS	NC
Total Phosphorus (mg/L)	0.69	CS	NC
Chl-*a* (µg/L)	14.1	NC	NC
Mercury in Edible Tissue			
Dioxin in Edible Tissue			

FS = Fully Supporting NC = No Concern CN = Concern for Near Non-Attainment CS = Concern for Screening Level NS = Not Supporting NA = Not Assessed

Fish caught in the Neches River- photo courtesy of Brian Sims

Neches River- photo courtesy of Brian Sims

SEGMENT 0606 - NECHES RIVER ABOVE LAKE PALESTINE

Monitoring Station 10596 - Neches River at FM 279

Monitoring Station 10596 is west of Tyler and northeast of Chandler and is located in AU 0606_01. This station is monitored quarterly by TCEQ Region 5 (Tyler) personnel for conventional parameters, field parameters, flow, and *E. coli* bacteria.

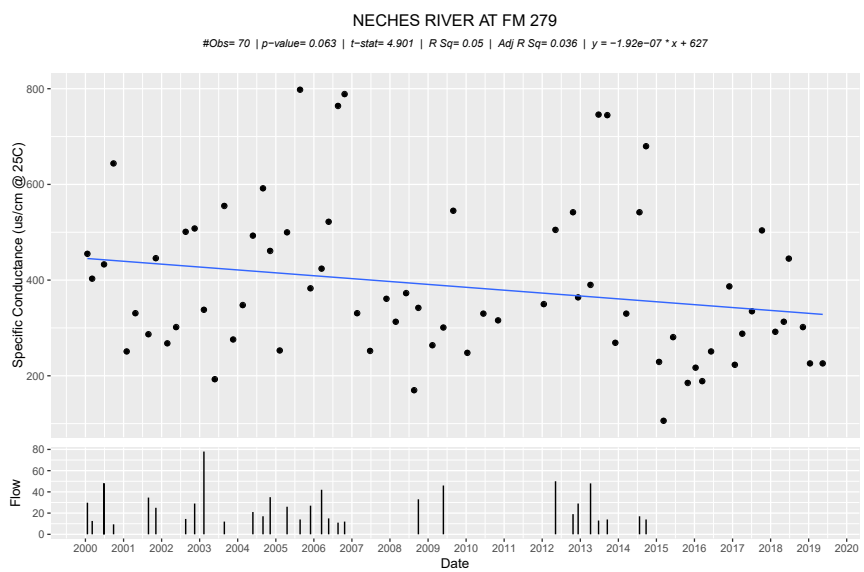
There are statistically significant decreasing trends observed for Specific Conductance and Chloride. A statistically significant increasing trend is observed for pH.

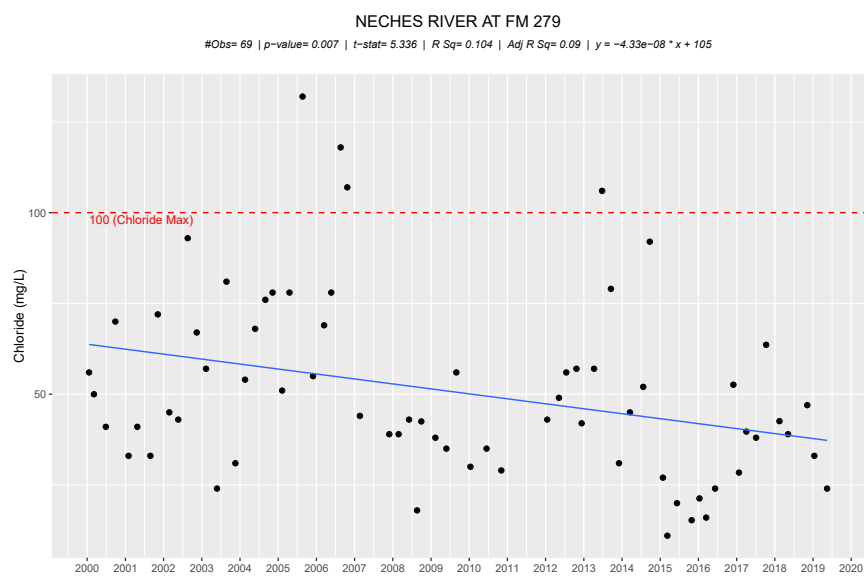
Chlorophyll-*a* shows a decreasing trend but is not considered statistically significant due to greater than fifty-percent of the observations being censored values that resulted from a change in LOQ.

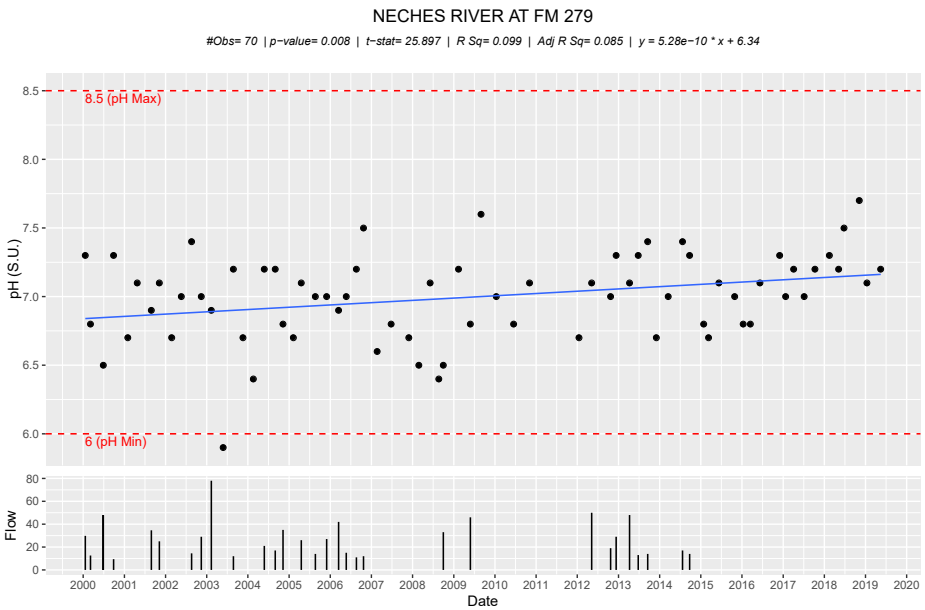
This Assessment Unit is listed in the 2020 Texas Integrated Report as impaired for *E. coli* bacteria. It is also listed with a concern for Nitrate and Total Phosphorus.

Water Quality Monitoring Results for Station 10596

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	51	35	35.00	2400.00	53.08	-0.15	0.39	
Water Temperature (C)	70	0	4.80	29.10	18.64	3.48	0.91	
Dissolved Oxygen (mg/L)	70	0	3.80	11.60	7.46	6.30	0.56	
pH (S.U.)	70	1	5.90	7.70	7.00	25.90	0.01	↑
Specific Conductance (us/cm @ 25C)	70	0	106.00	798.00	387.51	4.90	0.06	↓
Ammonia-Nitrogen (mg/L as N)	70	9	0.05	1.81	0.19	-1.43	0.02	
Chloride (mg/L)	69	4	11.00	132.00	50.74	5.34	0.01	↓
Sulfate (mg/L)	69	15	13.00	83.00	38.29	4.43	0.15	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	65	0	0.55	3.37	1.08	0.54	0.02	
Total Phosphorus (mg/L as P)	65	14	0.06	2.47	0.48	1.09	0.92	
Total Suspended Solids (mg/L)	70	0	4.00	68.00	13.84	0.07	0.11	
Nitrate (Total) (mg/L)	7	0	0.83	13.00	4.57	-0.17	0.84	
Nitrite (Total) (mg/L)	7	0	0.05	0.05	0.05	1.92E+14	0.16	
Nitrate + Nitrite (mg/L as N)	67	40	0.04	16.40	4.02	2.78	0.14	
Chlorophyll-*a* (ug/L)	69	0	0.58	10.00	5.03	11.24	0.00	
Pheophytin (ug/L)	25	0	1.00	14.80	5.37	1.71	0.31	







Neches River

Neches River

SEGMENT 0606 - NECHES RIVER ABOVE LAKE PALESTINE

Monitoring Station 10597 - Neches River at SH 64

Monitoring Station 10597 is west of Tyler at the SH 64 crossing and is located in AU 0606_02. This station is monitored quarterly by TCEQ Region 5 (Tyler) personnel for conventional parameters, field parameters, flow, and *E. coli* bacteria.

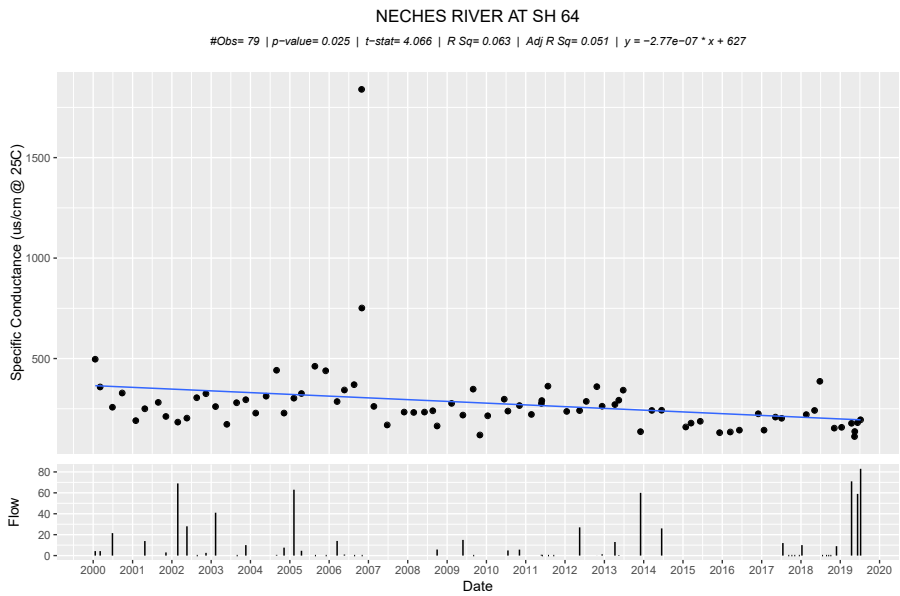
Statistical analysis shows a significant decreasing trends for Specific Conductance, Total Suspended Solids, Chloride and Total Phosphorus. The observed values for Chloride and Total Phosphorus (with the exception of one) are all below the screening level set for each parameter.

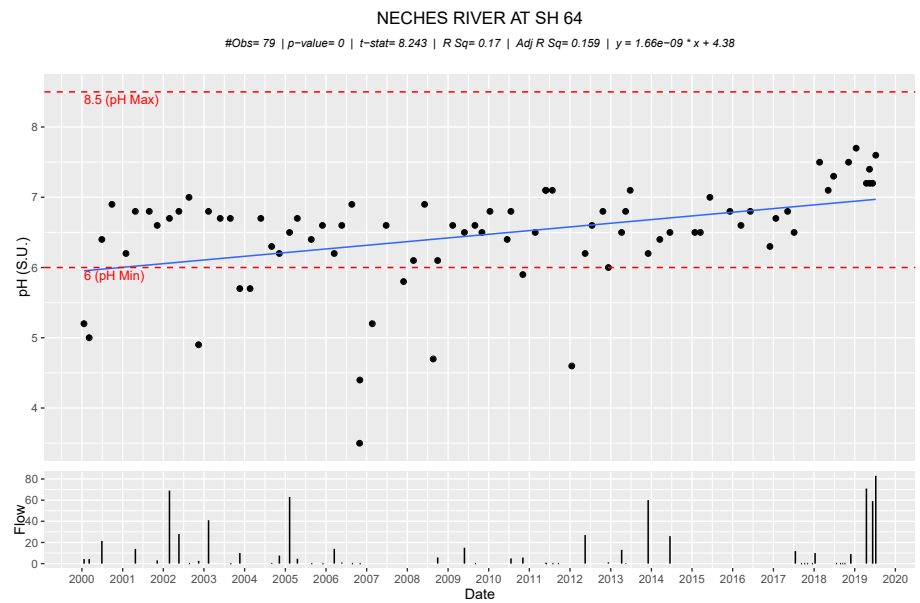
There is a statistically significant increasing trend observed for pH with 13 out of the 79 total observations being at or below the minimum screening level.

This Assessment Unit is listed in the 2020 Texas Integrated Report as impaired for *E. coli* bacteria and depressed dissolved oxygen.

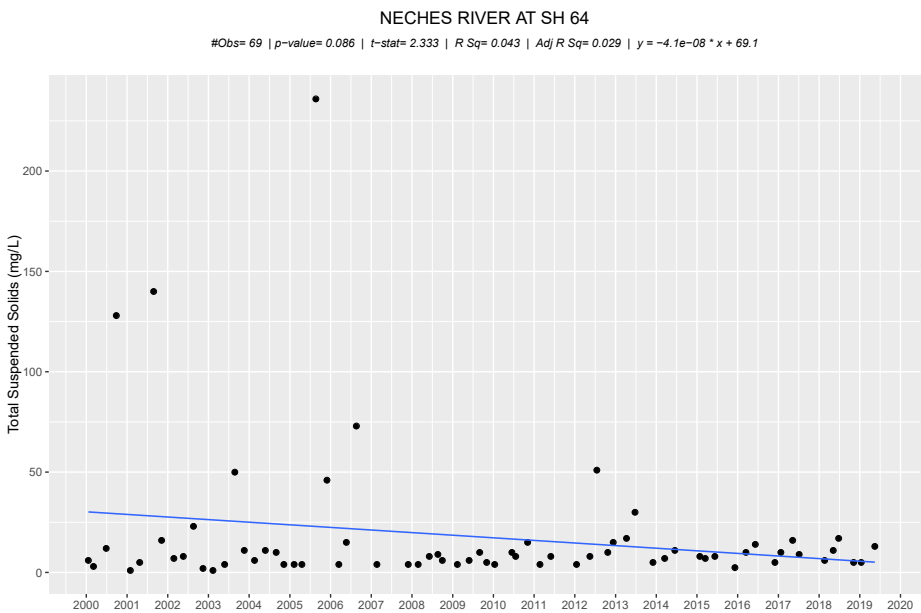
Water Quality Monitoring Results for Station 10597

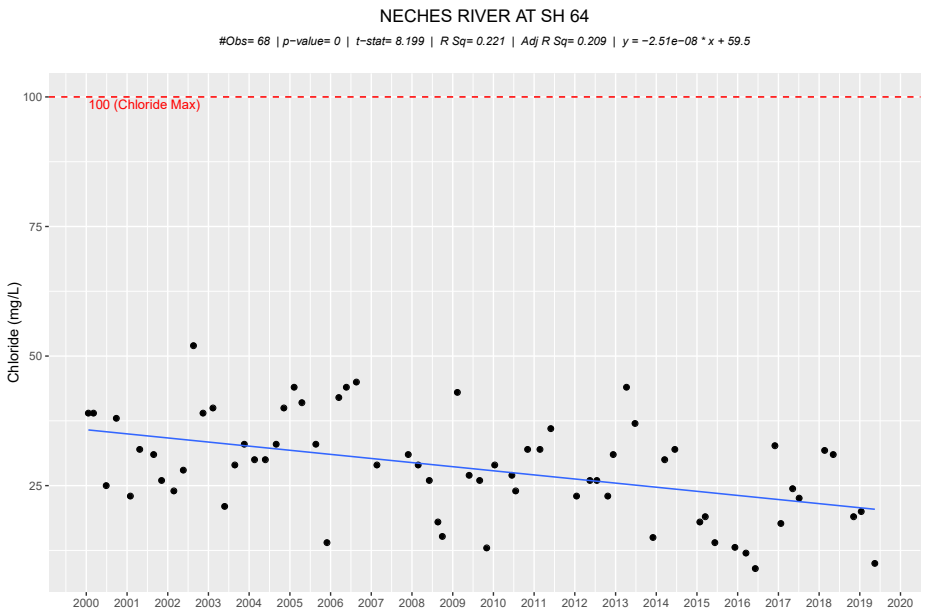
Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	64	40	10.00	2400.00	27.98	-0.61	0.13	
Water Temperature (C)	79	0	2.40	28.00	18.39	2.68	0.32	
Dissolved Oxygen (mg/L)	79	23	0.30	11.60	4.62	0.16	0.03	
pH (S.U.)	79	12	3.50	7.70	6.47	8.24	0.00	↑
Specific Conductance (us/cm @ 25C)	79	0	112.00	1840.00	278.62	4.07	0.03	↓
Ammonia-Nitrogen (mg/L as N)	69	8	0.02	4.59	0.28	1.78	0.19	
Chloride (mg/L)	68	0	9.00	52.00	28.43	8.20	0.00	↓
Sulfate (mg/L)	68	15	1.00	166.00	36.94	2.90	0.10	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	64	0	0.28	6.40	1.20	2.41	0.24	
Total Phosphorus (mg/L as P)	64	1	0.02	0.70	0.14	3.01	0.10	↓
Total Suspended Solids (mg/L)	69	0	1.00	236.00	18.02	2.33	0.09	↓
Nitrate (Total) (mg/L)	7	0	0.05	0.09	0.06	1.08	0.40	
Nitrite (Total) (mg/L)	7	0	0.05	0.05	0.05	1.92E+14	0.16	
Nitrate + Nitrite (mg/L as N)	66	1	0.04	2.69	0.11	0.02	0.72	
Chlorophyll-*a* (ug/L)	66	10	0.85	90.70	10.81	2.15	0.18	
Pheophytin (ug/L)	25	0	1.00	69.70	11.14	-0.28	0.64	

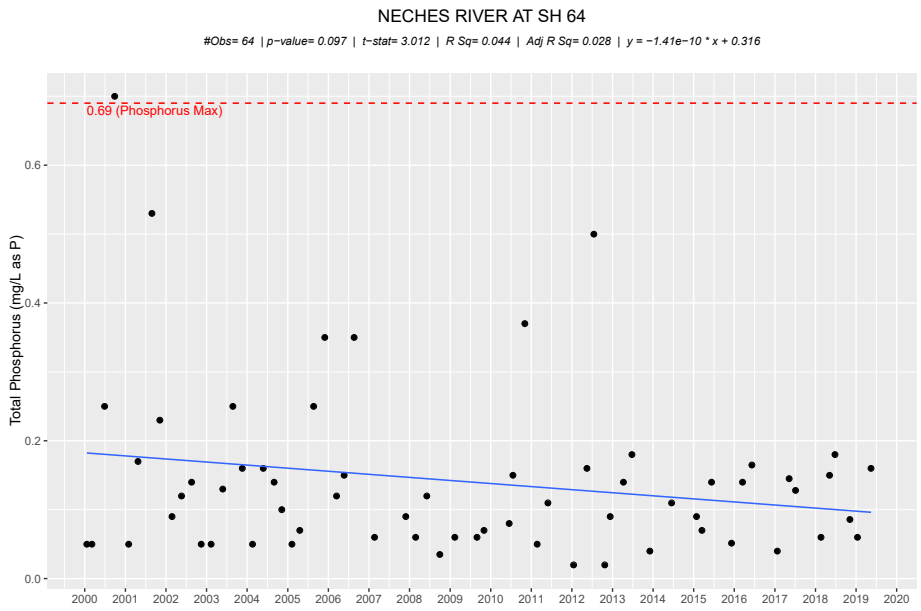




SEGMENT 0606 - NECHES RIVER ABOVE LAKE PALESTINE







SEGMENT 0606 - NECHES RIVER ABOVE LAKE PALESTINE

SUMMARY OF WATER QUALITY TRENDS

Trend Analysis Summary for Segment 0606- Neches River Above Lake Palestine

AU	Station ID	Station Description	*E. coli*	Temp	DO	pH	Spec Cond	NH3	Cl	SO4	TKN	Total P	TSS	NO3	NO2	NO3/ NO2	Chl-*a*	Pheo
0606_01	10596	Neches River at FM 279				↑	↓		↓									
0606_02	10597	Neches River at SH 64				↑	↓		↓			↓	↓					

↑ = Statistically significant increasing trend ↓ = Statistically significant decreasing trend

Water Quality Issues Summary for Segment 0606- Neches River Above Lake Palestine

Water Quality Issue	Affected Area	Possible Influences/Causes	Possible Effects	Possible Solutions / Actions Taken
Impairment for *E. coli* bacteria	0606_01 0606_02	• Failing (and non-existent) septic systems • Wildlife (deer and feral hogs) • Livestock and agricultural operations including cattle and poultry operations	• Water body does not meet the water quality standard for Primary Contact Recreation • Primary Contact Recreation in the water body has an increased risk of gastrointestinal illness	• Continue Monitoring
Depressed Dissolved Oxygen	0606_02	• Municipal wastewater discharge • Aquatic vegetation • Nutrient loading into the water body	• Detrimental effect on aquatic biological community	• Continue Monitoring • Conduct 24-hour DO measurements

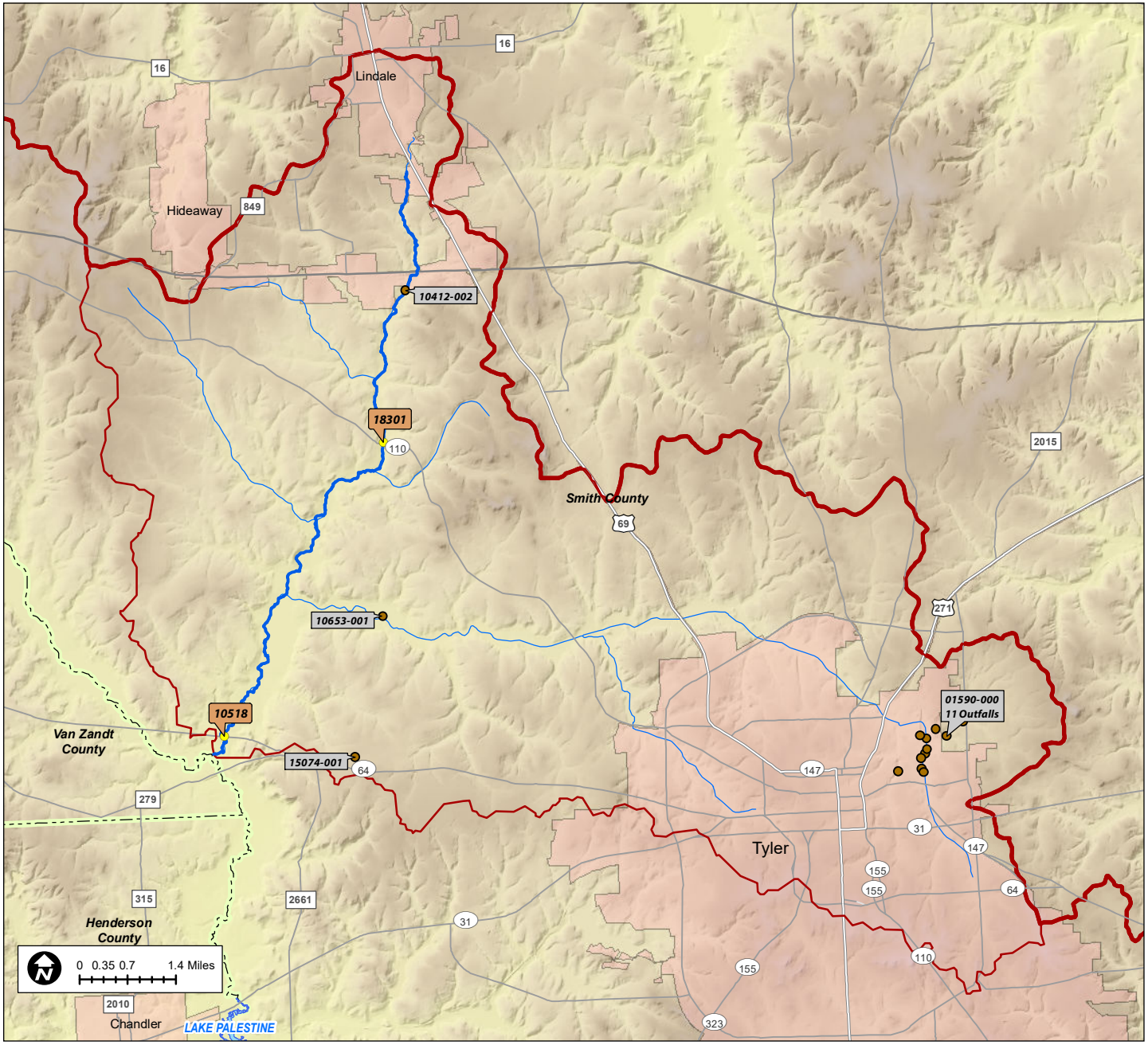
Neches River above Lake Palestine

SEGMENT 0606A - PRAIRIE CREEK

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.

For Prairie Creek, two assessment units (AU 0606A_01 and AU 0606A_03) are listed as impaired for *E. coli* bacteria. For AU 0606A_01, the listing is for a geometric mean of 193.75 MPN/100 mL (based on 25 samples). In AU 0606A_03, the geometric mean is 138.73 MPN/100 mL (based on 27 samples).



- ANRA Monitoring Sites
- TCEQ Monitoring Sites
- Wastewater Outfalls
- Classified Segments
- Other Hydrology
- Segment Watershed
- Counties

SEGMENT 0606A - PRAIRIE CREEK

Designated Uses

The designated uses for this unclassified segment include contact recreation, high aquatic life use, domestic water supply use and general use.

Assessment Units

AU ID	Description
0606A_01	From the confluence with Neches River (0606), per WQS App. D first entry for Prairie Creek at NHD RC 12020001000071 in Smith County upstream to the confluence with Black Fork Creek (0606D) at NHD RC 12020001000071
0606A_02	From the confluence with Black Fork Creek (0606D) upstream to a point immediately upstream of confluence with Caney Creek in Smith County at NHD RC 12020001000074, per WQS App. D first entry for Prairie Creek
0606A_03	From the confluence with Caney Creek upstream to confluence with unnamed tributary appx. 0.6 km downstream of the US 69 bridge crossing, which is located appx. 0.6 km south of the City of Lindale, per App. D second line entry

Monitoring Stations

Station ID	AU ID	Description	Earliest Data	Latest Data	Notes
10518	0606A_01	PRAIRIE CREEK AT SH 64 EAST OF TYLER	1978	2019	Monitored 1978-1993, 1997-1999, 2005-2009 and 2014-2019.
18301	0606A_03	PRAIRIE CREEK AT SH 110 6.5 MI NORTHWEST OF TYLER AND 3.5 MI SOUTHWEST OF LINDALE	2003	2019	Monitored continuously since 2003.

Prairie Creek at CR 842

SEGMENT 0606A - PRAIRIE CREEK

Assessment Summary ***(as listed in the 2020 Texas Integrated Report)***

Parameter	Standard	0606A_01 Assessment	0606A_03 Assessment
Chloride (mg/L)	75		
Sulfate (mg/L)	50		
TDS(mg/L)	200		
DO Grab Screening Level (mg/L)	5	NC	NC
DO Grab Minimum (mg/L)	3	FS	FS
24 Hour DO Average			
24 Hour DO Minimum			
pH (SU)	6.0 - 8.5		
Temp (C)	32.2		
E. coli geomean (MPN/100mL)	126	NS	NS
Ammonia Nitrogen (mg/L)	0.33	CS	NC
Nitrate Nitrogen (mg/L)	1.95	CS	NC
Total Phosphorus (mg/L)	0.69	NC	NC
Chl-*a* (µg/L)	14.1	NC	NC
Mercury in Edible Tissue			
Dioxin in Edible Tissue			

FS = Fully Supporting NC = No Concern CN = Concern for Near Non-Attainment
CS = Concern for Screening Level NS = Not Supporting NA = Not Assessed

Prairie Creek at CR 842

SEGMENT 0606A - PRAIRIE CREEK

Monitoring Station 10518 - Prairie Creek at SH 64

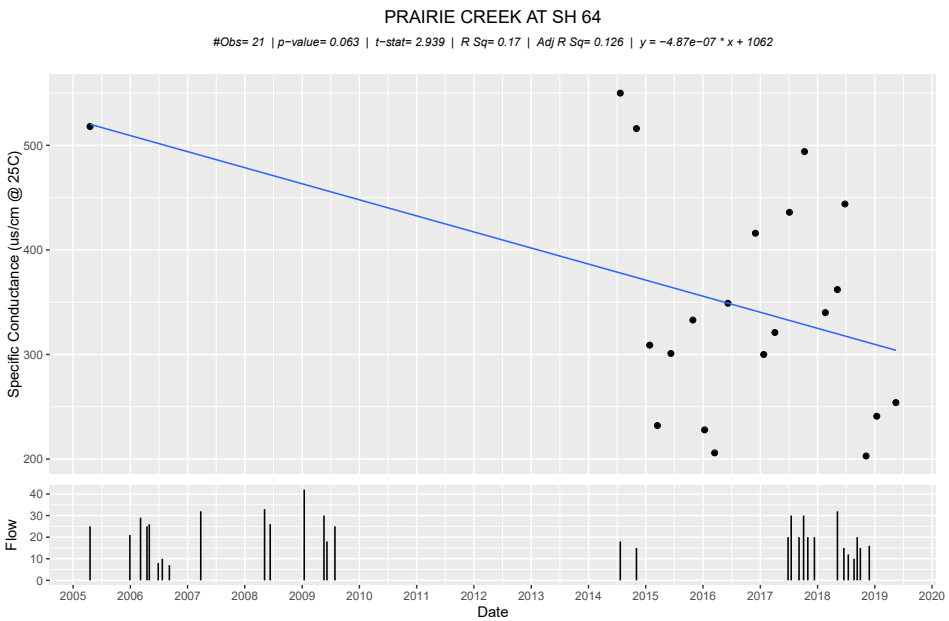
Monitoring Station 10518 is located at SH 64 East of Tyler. This station is monitored quarterly by TCEQ Region 5 personnel for conventional parameters, field parameters, flow, and *E. coli* bacteria.

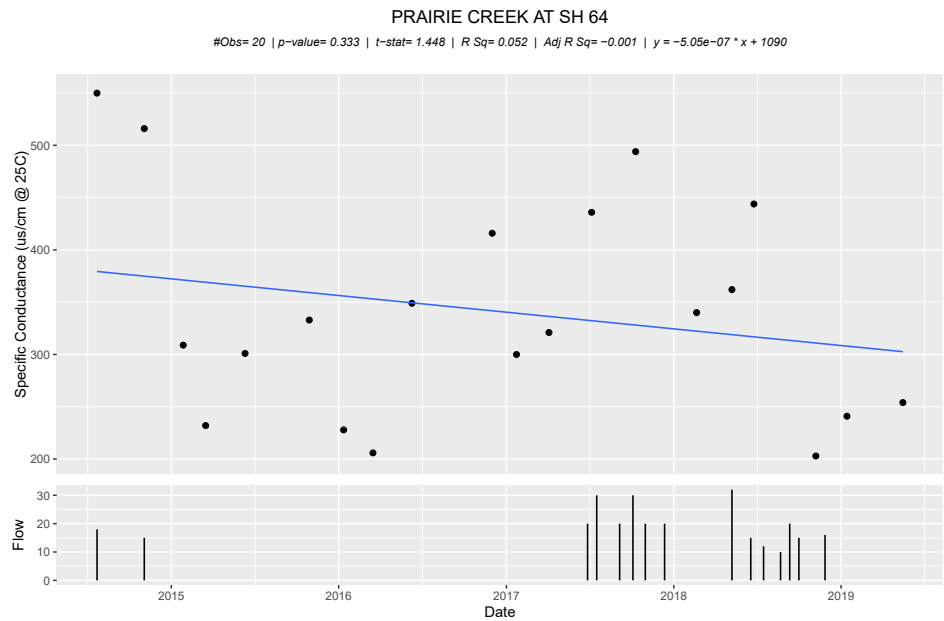
Statistical analysis shows a decreasing trend for Specific Conductance which is not considered to be statistically significant due to a large gap in the data from 2006-2014. After excluding data prior to 2014, the downward trend remains without data gaps, but it still not considered to be statistically significant.

This assessment unit, 0606A_01, is listed in the 2020 Texas Integrated Report as impaired for *E. coli* bacteria. It is also listed with a concern for screening level for Ammonia and Nitrate.

Water Quality Monitoring Results for Station 10518

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	56	38	10.00	7700.00		-0.57	0.34	
Water Temperature (C)	21	0	8.10	29.10	18.90	0.79	0.95	
Dissolved Oxygen (mg/L)	21	0	3.00	10.60	7.38	1.60	0.61	
pH (S.U.)	21	0	6.80	7.70	7.26	7.06	0.24	
Specific Conductance (us/cm @ 25C)	21	0	203.00	550.00	350.14	2.94	0.06	
Ammonia-Nitrogen (mg/L as N)	20	7	0.05	2.50	0.51	1.90	0.09	
Chloride (mg/L)	19	0	18.00	62.20	38.70	0.40	0.99	
Sulfate (mg/L)	19	0	17.00	46.00	30.46	1.75	0.21	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	18	0	0.63	3.67	1.37	1.79	0.13	
Total Phosphorus (mg/L as P)	19	4	0.08	1.11	0.37	0.86	0.48	
Total Suspended Solids (mg/L)	19	0	5.00	54.00	17.07	0.86	0.50	
Nitrate (Total) (mg/L)	parameter not collected for this station							
Nitrite (Total) (mg/L)	parameter not collected for this station							
Nitrate + Nitrite (mg/L as N)	20	10	0.04	11.60	2.78	1.50	0.19	
Chlorophyll-*a* (ug/L)	18	0	0.28	6.72	1.62	0.46	0.74	
Pheophytin (ug/L)	parameter not collected for this station							





SEGMENT 0606A - PRAIRIE CREEK

Monitoring Station 18301 - Prairie Creek at SH 110

Monitoring Station 18301 is located west of Tyler and southwest of Lindale at the SH 100 crossing, and is found in AU 0606A_03. This station is monitored quarterly by TCEQ Region 5 personnel for conventional parameters, field parameters, flow, and *E. coli* bacteria.

There are decreasing trends observed for Chlorophyll-*a* and Pheophytin, but they are not considered statistically significant due to greater than fifty-percent of the observed data points being censored values, resulting from a change in LOQ.

This assessment unit is listed in the 2020 Texas Integrated Report as impaired for *E. coli* bacteria.

Water Quality Monitoring Results for Station 18301

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	66	39	5.00	2400.00	50.5	28.70	0.01	
Water Temperature (C)	54	0	6.60	27.00	17.34	2.42	0.95	
Dissolved Oxygen (mg/L)	54	0	3.80	11.10	7.00	1.21	0.01	
pH (S.U.)	53	0	6.20	8.10	7.11	13.17	0.26	
Specific Conductance (us/cm @ 25C)	54	0	109.00	462.00	149.94	2.06	0.54	
Secchi Transparency (Meters)	53	0	0.10	1.20	0.43	-0.30	0.04	
Ammonia-Nitrogen (mg/L as N)	53	9	0.02	2.30	0.22	2.99	0.02	
Chloride (mg/L)	53	0	5.70	43.00	12.35	2.63	0.51	
Sulfate (mg/L)	53	1	6.97	669.00	28.68	1.84	0.12	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	18	0	0.24	1.18	0.54	0.86	0.61	
Total Phosphorus (mg/L as P)	52	1	0.02	1.08	0.11	2.27	0.10	
Total Suspended Solids (mg/L)	54	0	2.30	49.60	8.09	-0.49	0.18	
Nitrate (Total) (mg/L)	1	0	not enough data to determine					
Nitrite (Total) (mg/L)	1	0	not enough data to determine					
Nitrate + Nitrite (mg/L as N)	54	0	0.04	1.20	0.38	0.11	0.22	
Chlorophyll-*a* (ug/L)	50	1	0.49	15.70	3.51	4.85	0.00	
Pheophytin (ug/L)	24	0	2.00	5.00	2.48	4.63	0.00	

SUMMARY OF WATER QUALITY TRENDS

Trend Analysis Summary for Segment 0606A - Prairie Creek

There are no statistically significant trends identified for this segment.

Water Quality Issues Summary for Segment 0606A - Prairie Creek

Water Quality Issue	Affected Area	Possible Influences/Causes	Possible Effects	Possible Solutions / Actions Taken
Impairment for *E. coli* bacteria	Entire Water Body	• Municipal wastewater discharge • Sanitary sewer overflow (SSO) and Combined sewer overflow (CSO) • Stormwater runoff • Nonpoint sources of pollution • Domestic animals and wildlife	• Water body does not meet the water quality standard for Primary Contact Recreation • Primary Contact Recreation in the water body has an increased risk of gastrointestinal illness	• Continue Monitoring
Concern for Nitrate-Nitrogen	0606A_01	• Municipal wastewater discharge • Nonpoint sources of pollution • Stormwater runoff	• Detrimental effect on aquatic biological community	• Continue monitoring • Evaluate wastewater effluent permit limits
Concern for Ammonia-Nitrogen	0606A_01	• Municipal wastewater discharge • Nonpoint source pollution, such as failing septic systems • Stormwater runoff • Domestic animals and wildlife • Improper fertilizer use	• Detrimental effect on aquatic biological community	• Continue monitoring

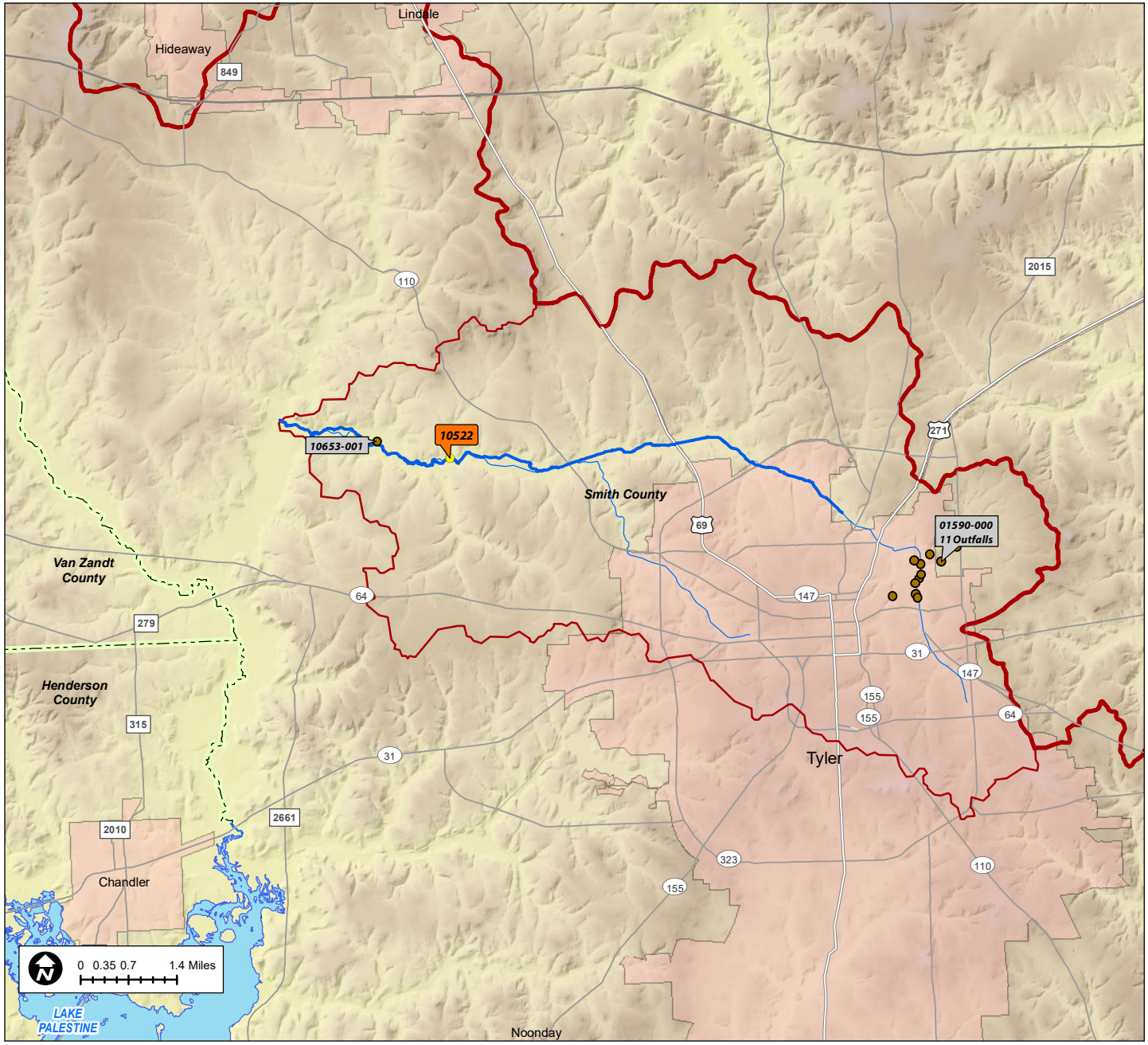
SEGMENT 0606D - BLACK FORK CREEK

Segment Profile

This freshwater stream begins at the confluence of an unnamed tributary west of Tyler in Smith County and continues upstream to a point 0.4 km downstream of FM 14 in Tyler. Designated uses for this segment are general, contact recreation, and high aquatic life use.

Assessment unit 0606D_02 is listed in the 2020 Texas Integrated Report with and impairment for *E. coli* bacteria.

An RUAA is currently being conducted on Black Fork Creek and a draft report will be released by TCEQ for public comment in 2021.



UT Tyler Monitoring Sites
Wastewater Outfalls
Classified Segments
Other Hydrology
Segment Watershed
Counties

SEGMENT 0606D - BLACK FORK CREEK

Designated Uses

The designated uses for this unclassified segment include contact recreation, intermediate aquatic life use, domestic water supply use and general use.

Assessment Units

AU ID	Description
0606D_02	From the confluence with unnamed tributary at NHD RC 12020001000072 upstream to a point 0.4km downstream of FM 14 in Tyler.

Monitoring Stations

Station ID	AU ID	Description	Earliest Data	Latest Data	Notes
10522	0606D_02	BLACK FORK CREEK AT SMITH CR 46 2.3 KM UPSTREAM OF TYLER-WESTSIDE WWTP 4.5 KM DOWNSTREAM OF PRAIRIE CREEK	1982	2019	Monitored 1982, 1986-1989, 2003-2012, and began again in 2017..

Assessment Summary *(as listed in the 2020 Texas Integrated Report)*

Parameter	Standard	0606D_02 Assessment
Chloride (mg/L)	75	
Sulfate (mg/L)	50	
TDS(mg/L)	200	
DO Grab Screening Level (mg/L)	5	NA
DO Grab Minimum (mg/L)	3	NA
24 Hour DO Average		
24 Hour DO Minimum		
pH (SU)	6.0 - 8.5	
Temp (C)	32.2	
E. coli geomean (MPN/100mL)	126	NS
Ammonia Nitrogen (mg/L)	0.33	NA
Nitrate Nitrogen (mg/L)	1.95	NA
Total Phosphorus (mg/L)	0.69	NA
Chl-a (µg/L)	14.1	NA
Mercury in Edible Tissue		
Dioxin in Edible Tissue		

FS = Fully Supporting NC = No Concern CN = Concern for Near Non-Attainment
CS = Concern for Screening Level NS = Not Supporting NA = Not Assessed

Flowers in bloom

SEGMENT 0606D - BLACK FORK CREEK

Monitoring Station 10522 - Black Fork Creek at CR 46

Monitoring Station 10522 is located at CR 46 East of Tyler. This station is monitored quarterly by UT Tyler personnel for TMDL bacteria monitoring.

Although trends at this station are not considered to be statistically significant due to a large gap in data,there were increasing trends identified for pH, and decreasing trends identified for ammonia and chloride. Decreasing trends for Chlorophyll-a and Pheophytin were also not considered statistically significant because the trends resulted from a change in LOQ.

This assessment unit, 0606D_02, is listed in the 2020 Texas Integrated Report as impaired for *E. coli* bacteria.

Water Quality Monitoring Results for Station 10522

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	59	38	12.20	29000.00	94.10	-1.04	0.20	
Water Temperature (C)	42	0	7.20	27.80	18.66	0.59	0.04	
Dissolved Oxygen (mg/L)	41	0	4.40	10.15	6.42	3.19	0.63	
pH (S.U.)	41	0	6.40	8.20	7.17	15.35	0.01	
Specific Conductance (us/cm @ 25C)	42	0	23.00	363.00	244.55	3.58	0.95	
Ammonia-Nitrogen (mg/L as N)	33	16	0.10	1.50	0.38	2.36	0.07	
Chloride (mg/L)	34	0	10.00	69.00	27.11	3.17	0.03	
Sulfate (mg/L)	33	1	14.70	751.00	44.18	1.64	0.14	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	parameter not collected for this station							
Total Phosphorus (mg/L as P)	34	0	0.06	0.49	0.12	0.83	0.70	
Total Suspended Solids (mg/L)	34	0	1.00	75.30	8.52	-0.58	0.42	
Nitrate (Total) (mg/L)	parameter not collected for this station							
Nitrite (Total) (mg/L)	parameter not collected for this station							
Nitrate + Nitrite (mg/L as N)	34	0	0.06	1.53	0.44	1.96	0.20	
Chlorophyll-a (ug/L)	32	1	2.00	104.10	6.80	2.22	0.05	
Pheophytin (ug/L)	24	0	2.00	5.00	2.52	4.20	0.00	

SUMMARY OF WATER QUALITY TRENDS

Trend Analysis Summary for Segment 0606D - Black Fork Creek

There are no statistically significant trends identified for this segment.

Water Quality Issues Summary for Segment 0606D - Black Fork Creek

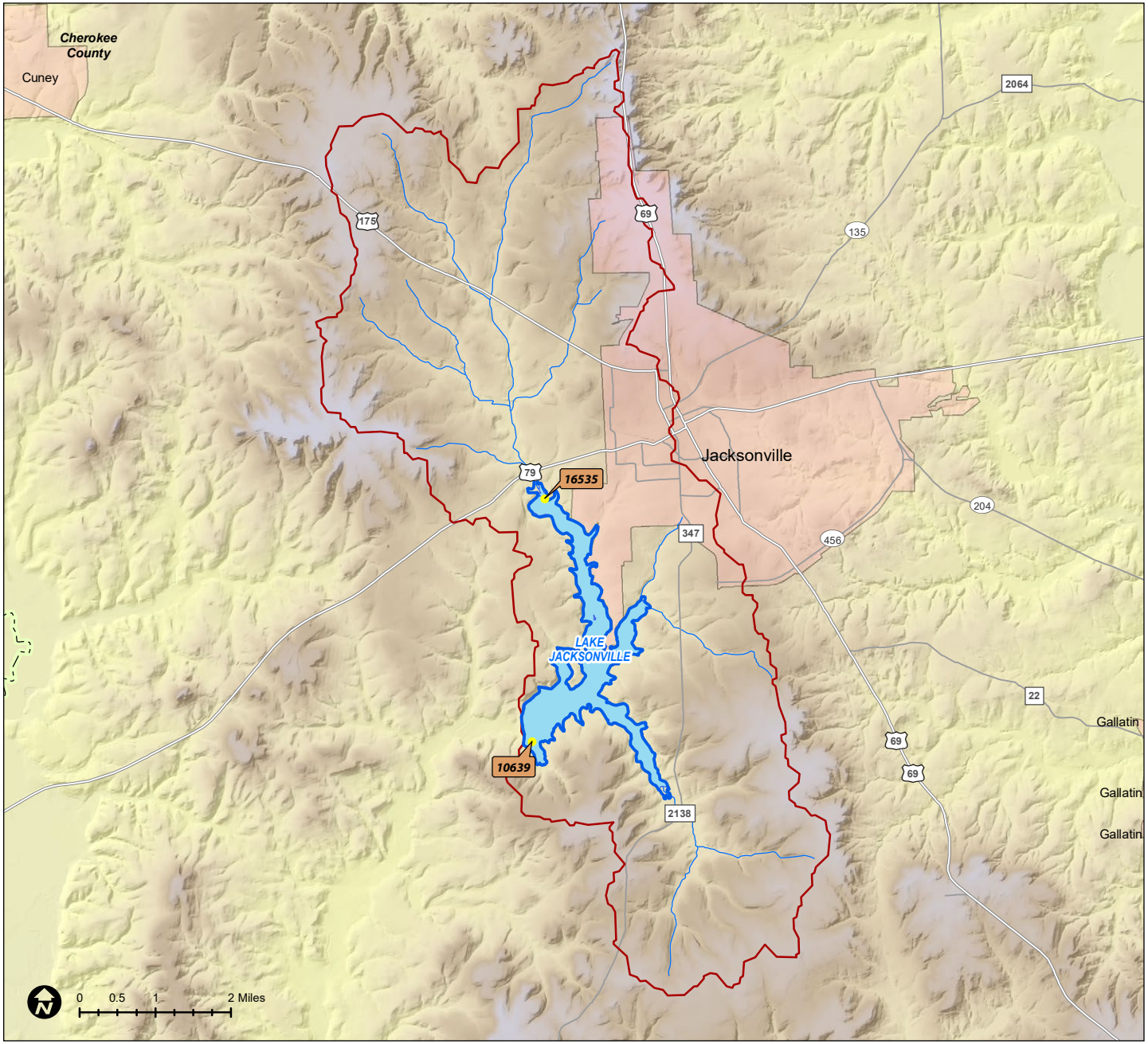
Water Quality Issue	Affected Area	Possible Influences/Causes	Possible Effects	Possible Solutions / Actions Taken
Impairment for *E. coli* bacteria	Entire Water Body	• Municipal wastewater discharge • Sanitary sewer overflow (SSO) and Combined sewer overflow (CSO) • Stormwater runoff • Nonpoint sources of pollution • Domestic animals and wildlife	• Water body does not meet the water quality standard for Primary Contact Recreation • Primary Contact Recreation in the water body has an increased risk of gastrointestinal illness	• Continue Monitoring

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.

There are no impairments or concerns listed for Segment 0614 (Lake Jacksonville) in the 2020 Texas Integrated Report.



- ANRA Monitoring Sites
- TCEQ Monitoring Sites
- Wastewater Outfalls
- Classified Segments
- Other Hydrology
- Segment Watershed
- Counties

SEGMENT 0614 - LAKE JACKSONVILLE

Designated Uses

The designated uses for this classified segment include contact recreation, high aquatic life use, domestic water supply use and general use.

Assessment Units

AU ID	Description
0614_01	Lower reservoir
0614_02	Upper reservoir

Monitoring Stations

Station ID	AU ID	Description	Earliest Data	Latest Data	Notes
10639	0614_01	LAKE JACKSONVILLE AT DAM	1973	2019	Monitored 1973-1979, 1981-1982, 1985-1994 and 1999- present.
16535	0614_02	LAKE JACKSONVILLE UPPER LAKE	1999	2017	Monitored continuously from 1999-2017.

Assessment Summary *(as listed in the 2020 Texas Integrated Report)*

Parameter	Standard	0614_01 Assessment	0614_02 Assessment
Chloride (mg/L)	50	FS	FS
Sulfate (mg/L)	75	FS	FS
TDS(mg/L)	750	FS	FS
DO Grab Screening Level (mg/L)	5	NC	NC
DO Grab Minimum (mg/L)	3	FS	FS
24 Hour DO Average			
24 Hour DO Minimum			
pH (SU)	6.0-9.0	FS	FS
Temp (C)	33.9	FS	FS
E. coli geomean (MPN/100mL)	126	FS	FS
Ammonia Nitrogen (mg/L)	0.11	FS	FS
Nitrate Nitrogen (mg/L)	0.37	FS	FS
Total Phosphorus (mg/L)	0.2	FS	FS
Chl-*a* (µg/L)	26.7	FS	FS
Mercury in Edible Tissue			
Dioxin in Edible Tissue			

FS = Fully Supporting NC = No Concern CN = Concern for Near Non-Attainment CS = Concern for Screening Level NS = Not Supporting NA = Not Assessed

SEGMENT 0614 - LAKE JACKSONVILLE

Monitoring Station 10639 - Lake Jacksonville at Dam

Monitoring Station 10639 is located in AU 0614_01 in the southwest corner of the lake approximately 100 m upstream of the dam and equidistant to both shorelines. This station is monitored quarterly by TCEQ Region 5 personnel for conventional parameters, field parameters, and *E. coli* bacteria.

Trends observed at this station for Chlorophyll-*a*, Chloride, TSS, and Total Phosphorus are not considered statistically significant due to grater than fifty-percent of the observed data points for each parameter being censored values resulting from changes in LOQ.

There are no impairments or concerns identified in the 2020 Texas Integrated Report for this AU.

Water Quality Monitoring Results for Station 10639

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	51	1	1.00	180.00	2.59	-1.45	0.08	
Water Temperature (C)	76	0	7.90	31.80	21.71	3.68	0.96	
Dissolved Oxygen (mg/L)	76	0	6.10	10.80	8.42	7.87	0.40	
pH (S.U.)	76	0	6.60	8.00	7.34	25.55	0.20	
Specific Conductance (us/cm @ 25C)	76	0	66.00	116.00	83.29	11.40	0.52	
Ammonia-Nitrogen (mg/L as N)	72	1	0.02	0.20	0.06	3.60	0.61	
Chloride (mg/L)	75	0	5.00	20.00	7.87	2.15	0.01	
Sulfate (mg/L)	75	0	4.00	11.00	6.54	1.98	0.00	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	68	0	0.13	0.54	0.31	3.34	0.27	
Total Phosphorus (mg/L as P)	68	0	0.02	0.06	0.04	13.54	0.00	
Total Suspended Solids (mg/L)	72	0	1.00	5.00	3.58	-4.01	0.00	
Nitrate (Total) (mg/L)	8	0	0.05	0.08	0.05	2.11	0.12	
Nitrite (Total) (mg/L)	6	0	0.05	0.05	0.05	3.36E+14	0.19	
Nitrate + Nitrite (mg/L as N)	71	0	0.02	0.27	0.07	1.57	0.89	
Chlorophyll-*a* (ug/L)	69	0	1.00	17.80	5.88	7.41	0.00	
Pheophytin (ug/L)	23	0	4.20	14.00	5.53	0.61	0.92	

Flowers in bloom

SEGMENT 0614 - LAKE JACKSONVILLE

Monitoring Station 16535
Lake Jacksonville Upper Lake

Monitoring Station 16535 is located in AU 0614_02 and in the upper lake near the raw water intake structure. This station is monitored quarterly by TCEQ Region 5 personnel for conventional parameters, field parameters, and *E. coli* bacteria.

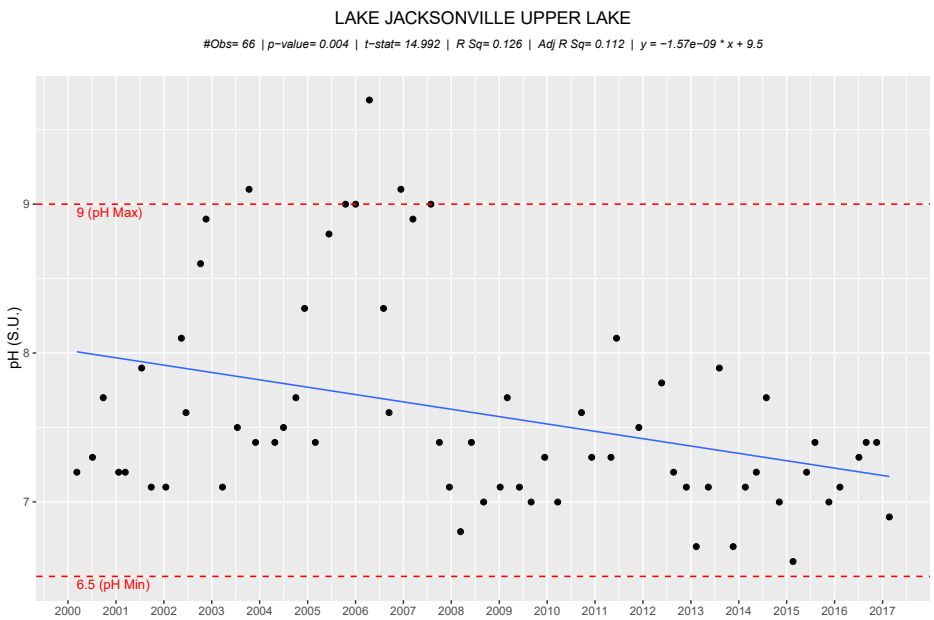
There is a statistically significant decreasing trend observed for pH, with 6 of the 66 total observed data points being at or above the maximum pH screening level.

There is a decreasing trend for Chlorophyll-*a* that is not considered statistically significant because the trend is resulting form a change in LOQ.

There are no impairments or concerns identified in the 2020 Texas Integrated Report for this AU.

Water Quality Monitoring Results for Station 16535

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	46	3	1.00	410.00	3.26	8.46	0.02	
Water Temperature (C)	66	0	7.40	32.50	22.00	3.20	0.92	
Dissolved Oxygen (mg/L)	66	0	6.00	11.90	8.64	6.99	0.76	
pH (S.U.)	66	3	6.60	9.70	7.59	14.99	0.00	↓
Specific Conductance (us/cm @ 25C)	66	0	69.00	110.00	85.79	8.91	0.85	
Ammonia-Nitrogen (mg/L as N)	60	1	0.02	0.14	0.05	5.06	0.17	
Chloride (mg/L)	66	1	5.00	69.00	8.75	0.26	0.36	
Sulfate (mg/L)	66	0	4.00	15.00	6.89	-0.13	0.00	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	57	0	0.11	0.71	0.34	4.50	0.22	
Total Phosphorus (mg/L as P)	58	1	0.02	1.28	0.07	-0.74	0.26	
Total Suspended Solids (mg/L)	66	0	1.00	7.00	3.74	-1.37	0.00	
Nitrate (Total) (mg/L)	8	0	0.05	0.05	0.05	3.51E+14	0.12	
Nitrite (Total) (mg/L)	6	0	0.05	0.05	0.05	3.362E+14	0.19	
Nitrate + Nitrite (mg/L as N)	63	0	0.02	0.17	0.06	2.91	0.32	
Chlorophyll-*a* (ug/L)	60	1	1.30	46.40	7.62	3.79	0.01	
Pheophytin (ug/L)	23	0	1.00	19.00	6.36	0.35	0.95	



SUMMARY OF WATER QUALITY TRENDS

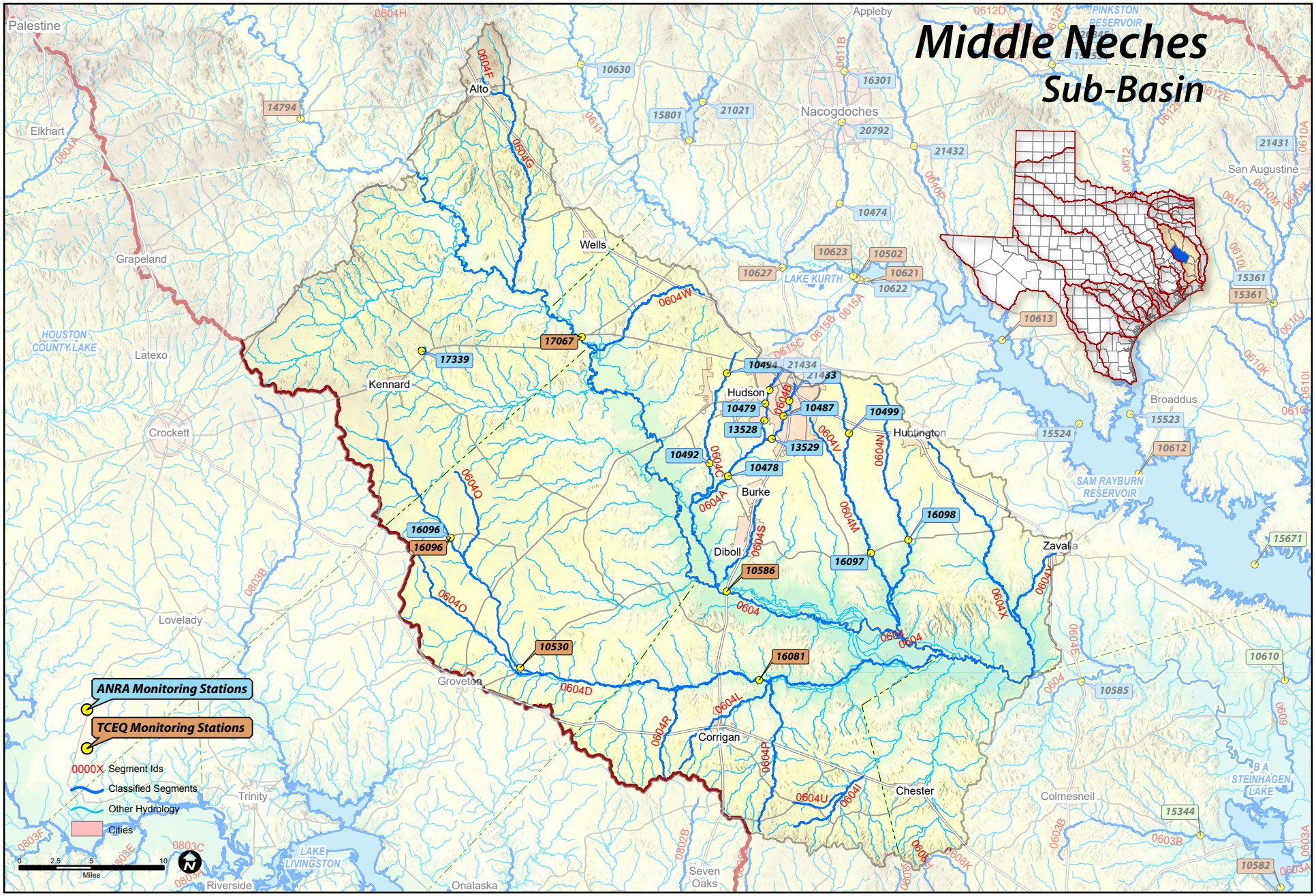
Trend Analysis Summary for Segment 0614 - Lake Jacksonville

There was a statistically significant decreasing trend identified for pH in AU 0614_02. There were no other trends identified for this segment.

Water Quality Issues Summary for Segment 0614 - Lake Jacksonville

There are no concerns or impairments listed for this segment in the Draft 2020 Draft Integrated Report.

MIDDLE NECHES OVERVIEW MAP-



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 follows: Lufkin, Hudson, Burke, Diboll, Huntington, Zavalla, Chester, Corrigan, Wells, Alto, Kennard, and Groveton. As of the 2010 census, there are an estimated 33,243 households, including 79,176 individuals residing within the sub-basin.

Land Characteristics and Use

There are numerous farms within this sub-basin, with the poultry industry being particularly prevalent.

The South Central Plains ecoregion includes floodplains, tertiary uplands, and southern tertiary uplands. Carrizo-Wilcox, Yegua Jackson, and Gulf Coast are the aquifers supplying this region.

Segments in the Middle Neches Sub-Basin

Segment ID	Segment Name
0604	Neches River Below Lake Palestine
0604A	Cedar Creek (unclassified water body)
0604B	Hurricane Creek (unclassified water body)
0604C	Jack Creek (unclassified water body)
0604D	Piney Creek (unclassified water body)
0604M	Biloxi Creek (unclassified water body)
0604N	Buck Creek (unclassified water body)
0604T	Lake Ratcliff (unclassified water body)

Snake at Hurricane Creek below Kiwanis Park

PROFILE OF THE MIDDLE NECHES SUB-BASIN

Permitted Discharges in the Middle Neches Sub-Basin

A total of twenty-nine permitted discharges are within the Middle Neches sub-basin.

First Segment in Drainage Path	Segment ID as identified in Permit	Permit Number	Outfall Number	NPDES Number	Permittee	County	TCEQ Region
0604C	0604	WQ0011826001	001	TX0068985	CITY OF HUDSON	ANGELINA	10-Beaumont
0604	0604	WQ0001153000	001	TX0001201	GEORGIA-PACIFIC PANEL PRODUCTS & GEORGIA-PACIFIC WOOD PRODUCTS SOUTH	ANGELINA	10-Beaumont
0604	0604	WQ0001153000	003	TX0001201	GEORGIA-PACIFIC PANEL PRODUCTS & GEORGIA-PACIFIC WOOD PRODUCTS SOUTH	ANGELINA	10-Beaumont
0604	0604	WQ0001153000	004	TX0001201	GEORGIA-PACIFIC PANEL PRODUCTS & GEORGIA-PACIFIC WOOD PRODUCTS SOUTH	ANGELINA	10-Beaumont
0604	0604	WQ0001153000	006	TX0001201	GEORGIA-PACIFIC PANEL PRODUCTS & GEORGIA-PACIFIC WOOD PRODUCTS SOUTH	ANGELINA	10-Beaumont
0604	0604	WQ0013871001	001	TX0118991	CITY OF ZAVALLA	ANGELINA	10-Beaumont
0604L	0604	WQ0001902000	001	TX0064491	GEORGIA-PACIFIC WOOD PRODUCTS SOUTH LLC	POLK	10-Beaumont
0604L	0604	WQ0001902000	002	TX0064491	GEORGIA-PACIFIC WOOD PRODUCTS SOUTH LLC	POLK	10-Beaumont
0604S	0604	WQ0010288001	001	TX0024872	CITY OF DIBOLL	ANGELINA	10-Beaumont
0604B	0604	WQ0010214001	001	TX0024309	CITY OF LUFKIN	ANGELINA	10-Beaumont
0604	0604	WQ0010191001	001	TX0053422	CITY OF HUNTINGTON	ANGELINA	10-Beaumont
0604	0604	WQ0001153000	001	TX0001201	GEORGIA-PACIFIC PANEL PRODUCTS & GEORGIA-PACIFIC WOOD PRODUCTS SOUTH	ANGELINA	10-Beaumont
0604	0604	WQ0011474001	001	TX0056596	CITY OF KENNARD	HOUSTON	10-Beaumont
0604L	0604	WQ0015057001	001	TX0133787	CITY OF CORRIGAN	POLK	10-Beaumont
0604N	0604	WQ0014128001	001	TX0119679	ANGELINA WSC	ANGELINA	10-Beaumont
0604G	0604	WQ0010546001	001	TX0025020	CITY OF ALTO	CHEROKEE	5-Tyler
0604	0604	WQ0015234001	001	TX0135267	FOREST WSC	CHEROKEE	5-Tyler
0604B	0604	WQ0001737000	001	TX0082261	GEORGIA-PACIFIC CHEMICALS LLC	ANGELINA	10-Beaumont
0604	0604	WQ0014086001	001	TX0118966	APPLE SPRINGS ISD	TRINITY	10-Beaumont
0604W	0604	WQ0011196001	001	TX0071021	CITY OF WELLS	CHEROKEE	5-Tyler
0604U	0604	WQ0001598000	005	TX0006076	GEORGIA-PACIFIC WOOD PRODUCTS LLC	POLK	10-Tyler
0604U	0604	WQ0001598000	006	TX0006076	GEORGIA-PACIFIC WOOD PRODUCTS LLC	POLK	10-Tyler
0604U	0604	WQ0001598000	001	TX0006076	GEORGIA-PACIFIC WOOD PRODUCTS LLC	POLK	10-Tyler
0604U	0604	WQ0001598000	002	TX0006076	GEORGIA-PACIFIC WOOD PRODUCTS LLC	POLK	10-Tyler
0604U	0604	WQ0001598000	004	TX0006076	GEORGIA-PACIFIC WOOD PRODUCTS LLC	POLK	10-Tyler
0604U	0604	WQ0001598000	007	TX0006076	GEORGIA-PACIFIC WOOD PRODUCTS LLC	POLK	10-Tyler
0604U	0604	WQ0001598000	008	TX0006076	GEORGIA-PACIFIC WOOD PRODUCTS LLC	POLK	10-Tyler
0604U	0604	WQ0001598000	009	TX0006076	GEORGIA-PACIFIC WOOD PRODUCTS LLC	POLK	10-Tyler
0604U	0604	WQ0001598000	010	TX0006076	GEORGIA-PACIFIC WOOD PRODUCTS LLC	POLK	10-Tyler

PROFILE OF THE MIDDLE NECHES SUB-BASIN

Texas Surface Water Quality Standards for the Middle Neches Sub-Basin

Site-Specific Uses and Numeric Criteria for Classified Segments in the Middle Neches Sub-Basin

Segment ID	Segment Name	Recreation Use	Aquatic Life Use	Domestic Water Supply Use	Other Use	Chloride (mg/L)	Sulfate (mg/L)	TDS (mg/L)	Dissolved Oxygen (mg/L	pH Range (S.U.)	*E. coli* Bacteria #/100 mL	Temp (°F)
0604	Neches River Below Lake Palestine	PCR	H	PS		50	50	200	5.0	6.0 - 8.5	126	91

PCR = Primary Contact Recreation SCR1 = Secondary Contact Recreation 1 SCR2 = Secondary Contact Recreation 2 NCR = Noncontact Recreation
H = High Aquatic Life Use I = Intermediate Aquatic Life Use PS = Public Supply
* The criteria for Chloride, Sulfate, and TDS are listed as the maximum annual averages for the segment. Dissolved Oxygen criteria are listed as minimum 24-hour means at any site within the segment. The pH criteria are listed as minimum and maximum values expressed in standard units at any site within the segment. The criteria for Temperature are listed as maximum values at any site within the segment.

Neches River at US 59

SEGMENT 0604 - NECHES RIVER BELOW LAKE PALESTINE (MIDDLE NECHES SUB-BASIN PORTION)

Segment Profile

This freshwater segment is 231 miles long and 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.

Assessment units 0604_01, 0604_02 and 0604_03 are listed in the 2020 Texas Integrated Report as impaired for Dioxin in edible tissue and Mercury in edible tissue.

An ADV-51 Fish Consumption Advisory has been issued for this water body. See page 305 for more further details.

There is a concern listed for Chlorophyll-*a* in assessment unit 0604_05.

No other impairments or concerns have been identified for this portion of the segment.

ANRA Monitoring Sites
TCEQ Monitoring Sites
Wastewater Outfalls
Classified Segments
Other Hydrology
Segment Watershed
Counties

SEGMENT 0604 - NECHES RIVER BELOW LAKE PALESTINE (MIDDLE NECHES SUB-BASIN PORTION)

Designated Uses

The designated uses for this classified segment include contact recreation, high aquatic life use, fish consumption use, public water supply use, and general use.

Assessment Units

AU ID	Description
0604_02	From the confluence of Biloxi Creek (0604M) upstream to the upper confluence of Old River at NHD RC 12020002000037
0604_03	From the upper confluence of Old River upstream to the confluence with Cedar Creek in Cherokee County at NHD RC 12020002000085 near Hargrove Lake

Monitoring Stations

Station ID	AU ID	Description	Earliest Data	Latest Data	Notes
10586	0604_02	NECHES RIVER AT US 59	1972	2019	Monitored continuously since 1972.
17067	0604_03	NECHES RIVER AT SH 7	2000	2019	Monitored continuously since 2000.

Assessment Summary *(as listed in the 2020 Texas Integrated Report)*

Parameter	Standard	0604_02 Assessment	0604_03 Assessment
Chloride (mg/L)	50	FS	FS
Sulfate (mg/L)	50	FS	FS
TDS (mg/L)	200	FS	FS
DO Grab Screening Level (mg/L)	5.00	NC	NC
DO Grab Minimum (mg/L)	3.00	FS	FS
24 Hour DO Average (mg/L)			
24 Hour DO Minimum (mg/L)			
pH(SU)	6.0 - 8.5	FS	FS
Temp (C)	32.8	FS	FS
E. coli geomean (MPN/100L)	126	FS	FS
Ammonia Nitrogen (mg/L)	0.33	NC	NC
Nitrate Nitrogen (mg/L)	1.95	NC	NC
Total Phosphorus (mg/L)	0.69	NC	NC
Chl-*a* (µg/L)	14.1	NC	NC
Mercury in Edible Tissue		NS	NS
Dioxin in Edible Tissue		NS	NS

FS = Fully Supporting NC = No Concern CN = Concern for Near Non-Attainment CS = Concern for Screening Level
NS = Not Supporting NA = Not Assessed

SEGMENT 0604 - NECHES RIVER BELOW LAKE PALESTINE (MIDDLE NECHES SUB-BASIN PORTION)

Monitoring Station 10586- Neches River at US 59

Located in AU 0604_02, Monitoring Station ID 10586 is monitored quarterly for field and conventional parameters, flow, and *E. coli* bacteria. This monitoring station is located 6.3 km south of Diboll in Angelina County. It is the southernmost monitoring station on the Neches River in the Middle Neches Sub-Basin.

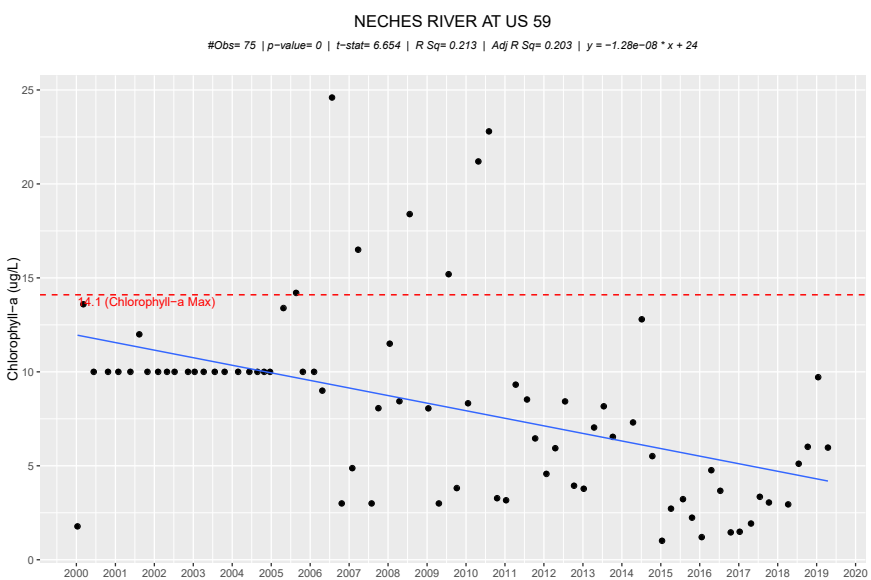
Statistical analysis shows a significant decreasing trend for pH, however, all observed values remain between the 6.0-8.5 screening level.

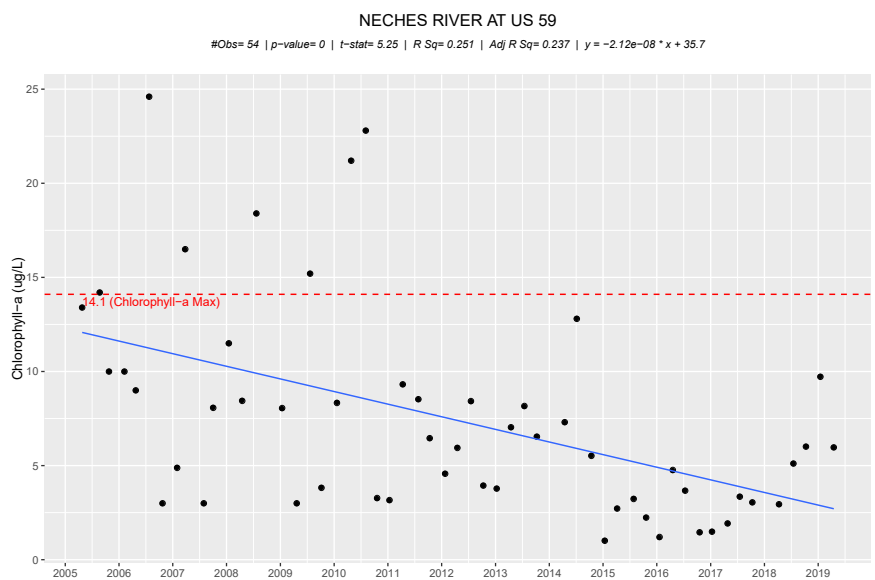
Chlorophyll-*a* showed a significant decreasing trend from the year 2000-2020, with possible influence by the large number of censored values from 2000-2006. Included below are the graphed values from 2005-2020, excluding the censored values, in which the trend is still considered to be significant.

This assessment unit is listed in the 2020 Texas Integrated Reports as impaired for Dioxin in edible tissue and Mercury in edible tissue. No other impairments or concerns have been identified for this assessment unit.

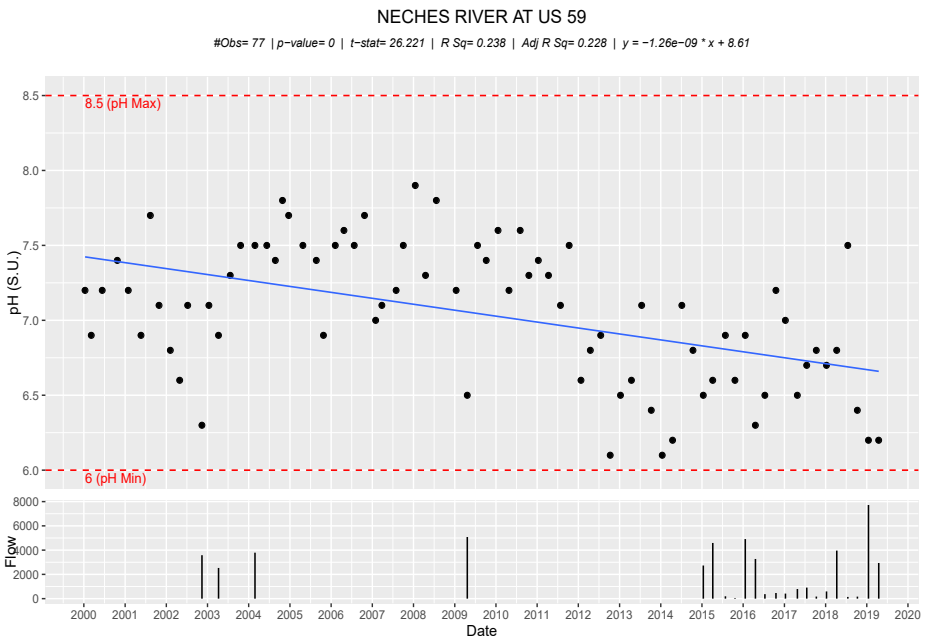
Water Quality Monitoring Results for Station 10586

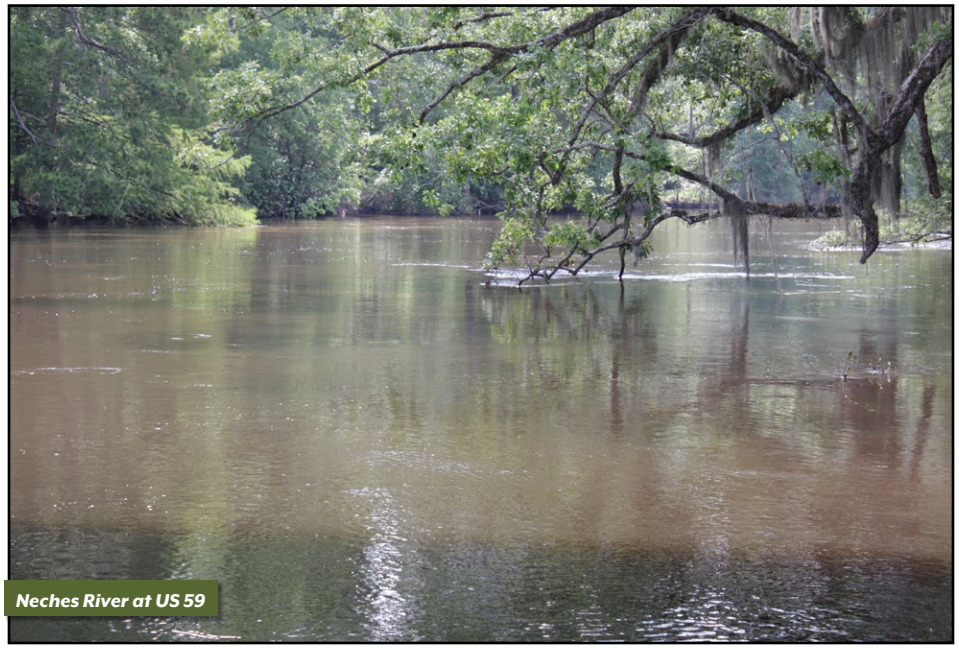
Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	46	3	1.00	410.00	3.26	8.46	0.02	
Water Temperature (C)	66	0	7.40	32.50	22.00	3.20	0.92	
Dissolved Oxygen (mg/L)	66	0	6.00	11.90	8.64	6.99	0.76	
pH (S.U.)	66	3	6.60	9.70	7.59	14.99	0.00	↓
Specific Conductance (us/cm @ 25C)	66	0	69.00	110.00	85.79	8.91	0.85	
Ammonia-Nitrogen (mg/L as N)	60	1	0.02	0.14	0.05	5.06	0.17	
Chloride (mg/L)	66	1	5.00	69.00	8.75	0.26	0.36	
Sulfate (mg/L)	66	0	4.00	15.00	6.89	-0.13	0.00	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	57	0	0.11	0.71	0.34	4.50	0.22	
Total Phosphorus (mg/L as P)	58	1	0.02	1.28	0.07	-0.74	0.26	
Total Suspended Solids (mg/L)	66	0	1.00	7.00	3.74	-1.37	0.00	
Nitrate (Total) (mg/L)	8	0	0.05	0.05	0.05	3.51E+14	0.12	
Nitrite (Total) (mg/L)	6	0	0.05	0.05	0.05	3.36E+14	0.19	
Nitrate + Nitrite (mg/L as N)	63	0	0.02	0.17	0.06	2.91	0.32	
Chlorophyll-*a* (ug/L)	60	1	1.30	46.40	7.62	3.79	0.01	↓
Pheophytin (ug/L)	23	0	1.00	19.00	6.36	0.35	0.95	





SEGMENT 0604 - NECHES RIVER BELOW LAKE PALESTINE (MIDDLE NECHES SUB-BASIN PORTION)





Neches River at US 59

Neches River in flood stage at US 59

SEGMENT 0604 - NECHES RIVER BELOW LAKE PALESTINE (MIDDLE NECHES SUB-BASIN PORTION)

Monitoring Station 17067- Neches River at SH 7

Monitoring Station 17067, located at the SH 7 bridge crossing, is the northernmost monitoring station on the Neches River in the Middle Neches Sub-Basin, and the only station in assessment unit 0604_03. This station is monitored quarterly by TCEQ Region 10 personnel for field parameters, conventional parameters, flow, and *E. coli* bacteria.

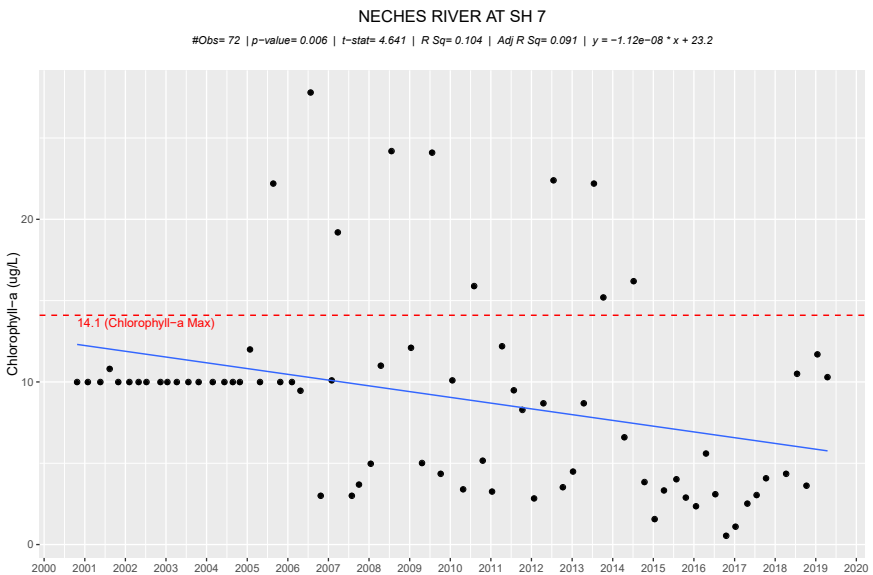
Statistical analysis shows a significant decreasing trend for pH, with all values within the 6.0-8.5 screening criteria.

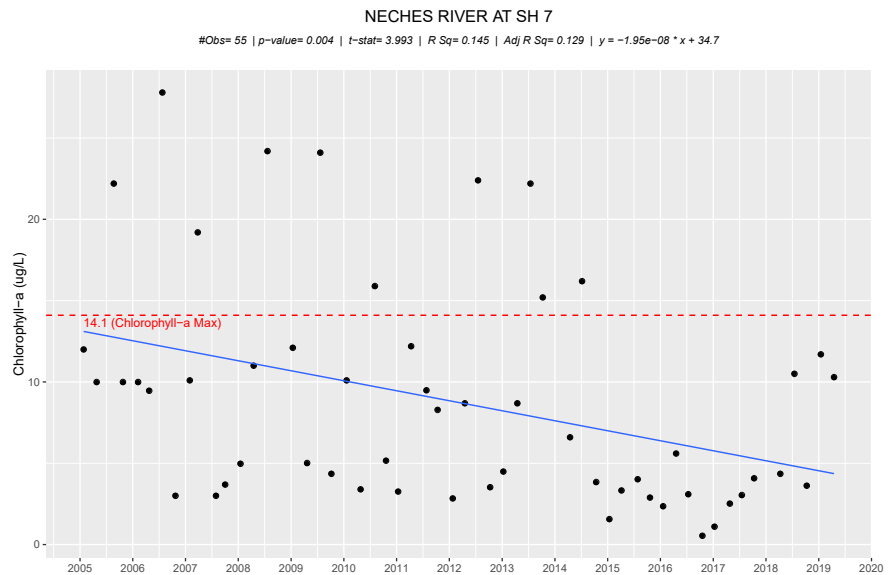
Chlorophyll-*a* showed a significant decreasing trend from the year 2000-2020, with possible influence by the large number of censored values from 2000-2006. Included below are the graphed values from 2005-2020, excluding the censored values, in which the trend is still considered to be significant.

This assessment unit is listed as impaired for Dioxin in edible tissue and Mercury in edible tissue. No other impairments or concerns have been identified for this assessment unit.

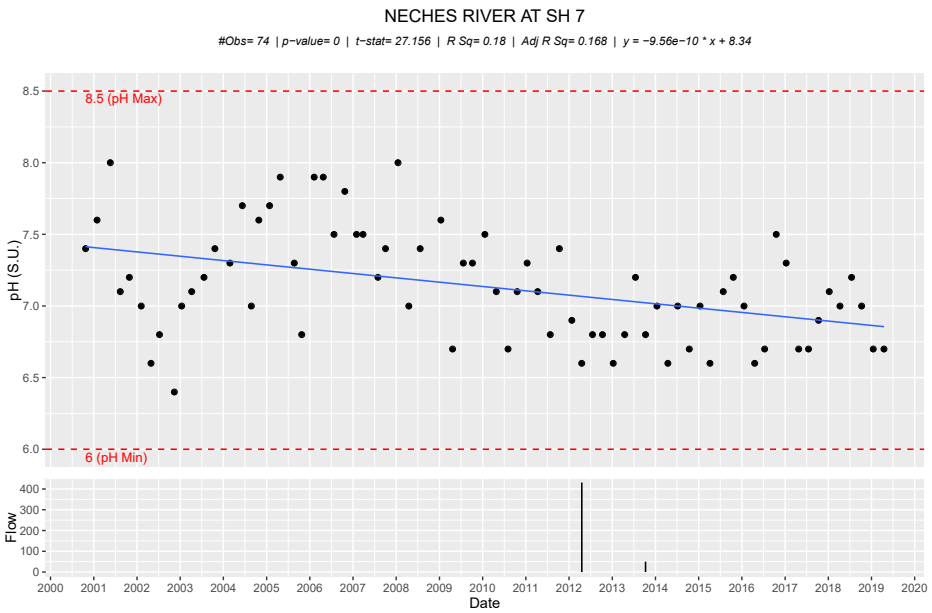
Water Quality Monitoring Results for Station 17067

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	62	17	10.00	4800.00	73.46	0.77	0.67	
Water Temperature (C)	74	0	6.60	31.80	20.02	2.76	0.81	
Dissolved Oxygen (mg/L)	74	0	4.70	12.80	8.03	4.21	0.62	
pH (S.U.)	74	0	6.40	8.00	7.13	27.16	0.00	↓
Specific Conductance (us/cm @ 25C)	73	0	114.00	267.00	183.14	6.13	0.45	
Ammonia-Nitrogen (mg/L as N)	72	0	0.02	0.12	0.05	4.78	0.38	
Chloride (mg/L)	74	0	8.00	31.00	20.69	5.48	0.48	
Sulfate (mg/L)	74	1	9.00	65.30	21.88	1.88	0.30	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	66	0	0.30	1.19	0.63	3.02	0.37	
Total Phosphorus (mg/L as P)	67	1	0.02	1.01	0.10	0.10	0.41	
Total Suspended Solids (mg/L)	71	0	4.00	82.00	29.05	3.14	0.22	
Nitrate (Total) (mg/L)	8	0	0.11	0.25	0.17	1.96	0.13	
Nitrite (Total) (mg/L)	8	0	0.05	0.05	0.05	3.73E+14	0.14	
Nitrate + Nitrite (mg/L as N)	74	0	0.04	0.62	0.21	0.79	0.20	
Chlorophyll-*a* (ug/L)	72	10	0.54	27.80	9.08	4.64	0.01	↓
Pheophytin (ug/L)	22	0	5.00	42.40	9.13	0.87	0.51	





SEGMENT 0604 - NECHES RIVER BELOW LAKE PALESTINE (MIDDLE NECHES SUB-BASIN PORTION)



Neches River in flood stage at SH 7

SEGMENT 0604 - NECHES RIVER BELOW LAKE PALESTINE (MIDDLE NECHES SUB-BASIN PORTION)

SUMMARY OF WATER QUALITY TRENDS

Trend Analysis Summary for Segment 0604 - Neches River Below Lake Palestine (Middle Neches Sub-Basin Portion)

AU	Station ID	Station Description	*E. coli*	Temp	DO	pH	Spec Cond	NH3	Cl	SO4	TKN	Total P	TSS	NO3	NO2	NO3/ NO2	Chl-*a*	Pheo
0604_02	10586	Neches River at US 59				↓											↓	
0604_03	17067	Neches River at SH 7				↓											↓	

↑ = Statistically significant increasing trend ↓ = Statistically significant decreasing trend

Water Quality Issues Summary for Segment 0604 - Neches River Below Lake Palestine (Middle Neches Sub-Basin Portion)

Water Quality Issue	Affected Area	Possible Influences/Causes	Possible Effects	Possible Solutions / Actions Taken
Mercury in Edible Tissue	The Neches River (Segment 0604) and all contiguous waters from the SH 7 bridge west of Lufkin, TX downstream to the US 96 bridge near Evadale, TX including B.A. Steinhagen Reservoir and Sam Rayburn Reservoir	• Pulp and paper bleaching processes	• The Texas DSHS has concluded that consuming fish from this water body poses an apparent hazard to public health	• A comprehensive Fish Consumption Advisory issued by the Texas DSHS recommends consumption advice for six species of fish • ADV-51 issued on January 24, 2014
Dioxin in Edible Tissue	The Neches River (Segment 0604) and all contiguous waters from the SH 7 bridge west of Lufkin, TX downstream to the US 96 bridge near Evadale, TX including B.A. Steinhagen Reservoir and Sam Rayburn Reservoir	• Atmospheric deposition from coal-fired power plants, large boilers and heaters, steel production, and incinerators	• The Texas DSHS has concluded that consuming fish from this water body poses an apparent hazard to public health	• A comprehensive Fish Consumption Advisory issued by the Texas DSHS recommends consumption advice for six species of fish • ADV-51 issued on January 24, 2014

Neches River at US 59

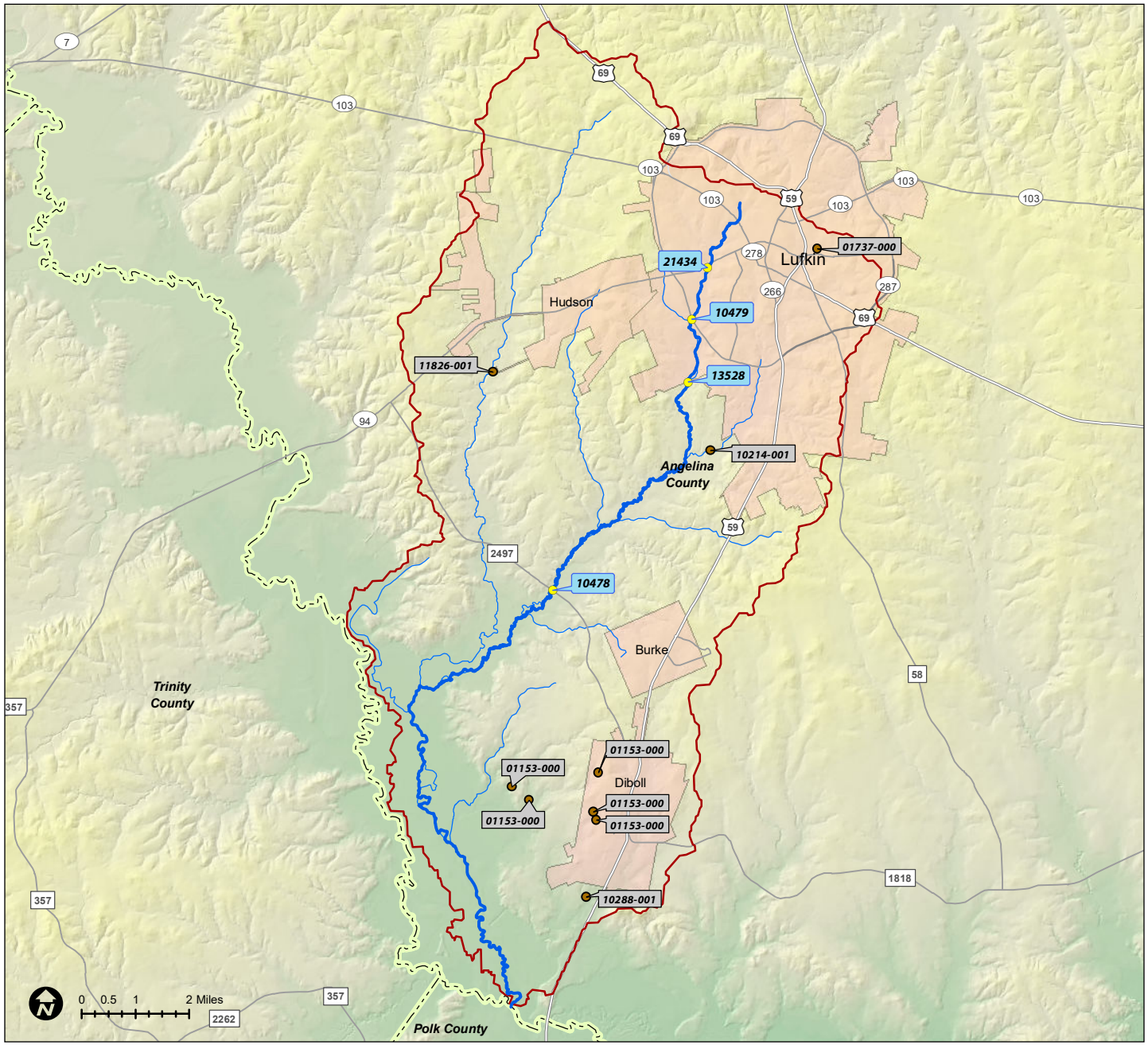
SEGMENT 0604A - CEDAR CREEK

Segment Profile

Cedar Creek is a 24-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.

Cedar Creek is listed in the 2020 Texas Integrated Report with impairments for *E. coli* bacteria and depressed Dissolved oxygen. AU 0604A_02 is listed with a geometric mean of 291.49 MPN/100 mL , for *E. coli*, based on 40 samples assessed from 12/1/2011 to 11/30/2018.

Nutrient concerns are also present in Cedar Creek, with the segment listed as having concerns for screening levels of Nitrate, Total Phosphorus, depressed Dissolved Oxygen, and bacteria in water.



ANRA Monitoring Sites
Wastewater Outfalls
Classified Segments
Other Hydrology
Segment Watershed
Counties

SEGMENT 0604A - CEDAR CREEK

Designated Uses

The designated uses for this unclassified segment include contact recreation, high aquatic life use, fish consumption use, public water supply use, and general use.

Assessment Units

AU ID	Description
0604A_01	From the confluence with the Neches River upstream to the confluence with Jack Creek (0604C)
0604A_02	From the confluence with Jack Creek (0604C) upstream to confluence with unnamed tributary adjacent to State Loop 287, per App. D in WQS, at NHD RC 12020002000436

Monitoring Stations

Assessment Unit	Monitoring Station ID	Description	Earliest Data	Latest Data	Notes
0604A_01	-	There are no monitoring stations in this AU	-	-	
0604A_02	13528	CEDAR CREEK AT FM 1336	2002	2019	Monitored continuously since 2002.
0604A_02	10478	CEDAR CREEK AT FM 2497	1972	2019	Monitored 1972-1989 and began again in 1911.
0604A_03	21434	CEDAR CREEK AT ELLIS AVENUE IN LUFKIN	2013	2019	Monitored continuously since 2013.
0604A_03	10479	CEDAR CREEK AT LOOP 287	1977	2019	Monitored 1977, 1979-1980, 1996-1997 and began again in 2013.

Assessment Summary *(as listed in the 2020 Texas Integrated Report)*

Parameter	Standard	0604A_02 Assessment	0604A_03 Assessment
Chloride (mg/L)	50		
Sulfate (mg/L)	50		
TDS (mg/L)	200		
DO Grab Screening Level (mg/L)	4	NC	CS
DO Grab Minimum (mg/L)	3	FS	NS
24 Hour DO Average (mg/L)			
24 Hour DO Minimum (mg/L)			
pH(SU)	6.0 - 8.5		
Temp (C)	32.8		
E. coli geomean (MPN/100L)	126	NS	CN
Ammonia Nitrogen (mg/L)	0.33	NC	NC
Nitrate Nitrogen (mg/L)	1.95	CS	NC
Total Phosphorus (mg/L)	0.69	CS	NC
Chl-*a* (µg/L)	14.1	NC	NC
Mercury in Edible Tissue			
Dioxin in Edible Tissue			

FS = Fully Supporting NC = No Concern CN = Concern for Near Non-Attainment
CS = Concern for Screening Level NS = Not Supporting NA = Not Assessed

Cedar Creek at Loop 287

SEGMENT 0604A - CEDAR CREEK

Monitoring Station 13528 - Cedar Creek at FM 1336

Monitoring Station 13528 is located at the FM 1336 crossing of Cedar Creek in southwest Lufkin and is in assessment unit 0604A_02 This station is monitored quarterly by ANRA personnel for field parameters, conventional parameters, flow, and *E. coli* bacteria.

Statistical analysis shows no significant trends for this station.

This assessment unit is listed in the 2020 Texas Integrated Report as impaired for bacteria as well as a concern for screening levels for nitrate and total phosphorus. No other impairments or concerns have been identified for this assessment unit.

Water Quality Monitoring Results for Station 13528

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	50	28	3.00	2400.00	194.75	-1.65	0.04	
Water Temperature (C)	48	0	2.80	28.80	18.07	3.30	0.10	
Dissolved Oxygen (mg/L)	47	4	1.30	12.80	6.03	-1.10	0.02	
pH (S.U.)	48	0	6.60	8.00	7.49	16.37	0.63	
Specific Conductance (us/cm @ 25C)	50	0	254.00	1030.00	579.08	2.38	0.52	
Ammonia-Nitrogen (mg/L as N)	50	2	0.10	1.60	0.16	1.28	0.40	
Chloride (mg/L)	50	23	12.80	120.00	48.53	1.95	0.47	
Sulfate (mg/L)	50	41	5.00	240.00	95.16	1.60	0.67	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	parameter not collected for this station							
Total Phosphorus (mg/L as P)	49	0	0.06	0.56	0.21	0.93	0.76	
Total Suspended Solids (mg/L)	50	0	1.30	65.00	11.40	0.61	0.98	
Nitrate (Total) (mg/L)	16	0	0.05	0.26	0.10	0.33	0.86	
Nitrite (Total) (mg/L)	16	0	0.05	0.05	0.05	NA	NA	
Nitrate + Nitrite (mg/L as N)	50	0	0.04	1.28	0.17	1.05	0.56	
Chlorophyll-*a* (ug/L)	45	1	2.00	28.50	4.89	1.31	0.43	
Pheophytin (ug/L)	44	0	2.00	8.38	2.75	0.84	0.99	

Station 13528-Cedar Creek at FM 1336

SEGMENT 0604A - CEDAR CREEK

Monitoring Station 10478 - Cedar Creek at FM 2497

Monitoring Station 10478 is located on Cedar Creek at the FM 2497 crossing. This station is monitored quarterly by ANRA personnel for field parameters, conventional parameters, flow, and *E. coli* bacteria. This station is located in Assessment Unit 0604A_02.

Statistical analysis shows no significant trends for this station.

This assessment unit is listed in the 2020 Texas Integrated Report as impaired for bacteria as well as a concern for screening levels for nitrate and total phosphorus. No other impairments or concerns have been identified for this assessment unit.

Water Quality Monitoring Results for Station 10478

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	21	14	34.00	2400.00	263.90	-1.43	0.13	
Water Temperature (C)	19	0	4.10	26.90	17.32	-0.13	0.64	
Dissolved Oxygen (mg/L)	21	3	1.20	11.20	6.20	0.08	0.80	
pH (S.U.)	20	0	7.20	8.00	7.65	4.90	0.12	
Specific Conductance (us/cm @ 25C)	21	0	359.00	1110.00	664.71	0.07	0.62	
Ammonia-Nitrogen (mg/L as N)	21	3	0.10	0.82	0.16	0.16	1.00	
Chloride (mg/L)	21	10	22.00	100.00	54.14	0.46	0.95	
Sulfate (mg/L)	21	19	34.50	230.00	112.79	0.07	0.76	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	parameter not collected for this station							
Total Phosphorus (mg/L as P)	20	1	0.06	0.73	0.24	-0.11	0.72	
Total Suspended Solids (mg/L)	21	0	2.50	13.60	5.96	0.99	0.51	
Nitrate (Total) (mg/L)	13	0	0.05	0.55	0.15	-0.73	0.42	
Nitrite (Total) (mg/L)	13	0	0.05	0.05	0.05	1.59E+15	0.07	
Nitrate + Nitrite (mg/L as N)	21	0	0.02	0.60	0.17	-0.80	0.32	
Chlorophyll-*a* (ug/L)	17	1	2.00	29.70	5.19	2.90	0.01	
Pheophytin (ug/L)	17	0	2.00	9.90	2.84	2.53	0.03	

Station 10478-Cedar Creek at FM 2497

SEGMENT 0604A - CEDAR CREEK

Monitoring Station 21434- Cedar Creek at Ellis Avenue

Monitoring Station 21434 is located at the Ellis Avenue crossing in Lufkin. ANRA monitors this station quarterly for conventional parameters, field parameters, flow, and *E. coli* bacteria. This station was added in 2014 to help identify possible sources of *E. coli* bacteria and nutrient concerns in Cedar Creek. This station is located in Assessment Unit 0604A_03.

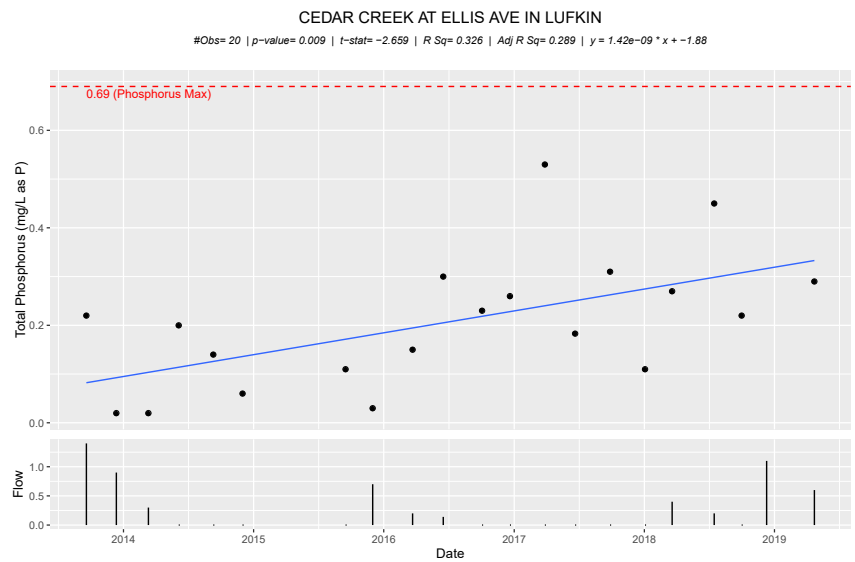
Statistical analysis shows an increasing trend for Total Phosphorus but it is not considered to be statistically significant due to having less than 10 years of observed data.

This assessment unit is listed in the 2020 Texas Integrated Report as impaired and a concern for screening level for depressed dissolved oxygen in water. This assessment unit is also listed as a concern for near non-attainment for bacteria.

Water Quality Monitoring Results for Station 21434

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	21	11	6.00	1700.00	128.95	-1.57	0.11	
Water Temperature (C)	19	0	4.50	26.90	17.76	-0.18	0.60	
Dissolved Oxygen (mg/L)	21	3	2.00	10.60	5.74	0.16	0.84	
pH (S.U.)	21	0	7.00	8.00	7.43	4.81	0.85	
Specific Conductance (us/cm @ 25C)	21	0	317.00	1420.00	831.71	1.28	0.41	
Ammonia-Nitrogen (mg/L as N)	21	0	0.10	0.28	0.11	-0.16	0.54	
Chloride (mg/L)	21	14	20.00	170.00	74.94	1.73	0.17	
Sulfate (mg/L)	21	19	7.78	210.00	132.37	0.15	0.81	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	parameter not collected for this station							
Total Phosphorus (mg/L as P)	20	0	0.02	0.53	0.21	-2.66	0.01	
Total Suspended Solids (mg/L)	21	0	3.50	40.00	11.59	-0.18	0.73	
Nitrate (Total) (mg/L)	13	0	0.05	0.10	0.07	-0.92	0.25	
Nitrite (Total) (mg/L)	13	0	0.05	0.19	0.06	0.70	0.59	
Nitrate + Nitrite (mg/L as N)	21	0	0.04	0.46	0.13	-0.76	0.33	
Chlorophyll-*a* (ug/L)	17	3	2.00	26.50	7.36	0.38	0.80	
Pheophytin (ug/L)	17	0	2.00	8.32	3.05	0.78	0.56	

Cedar Creek at Ellis Avenue



SEGMENT 0604A - CEDAR CREEK

Monitoring Station 10479- Cedar Creek at South Loop 287

Monitoring station 10479 is located at the South Loop 287 crossing. ANRA monitors both stations quarterly for conventional parameters, field parameters, flow, and *E. coli* bacteria. This station was added in 2014 to help identify possible sources of *E. coli* bacteria and nutrient concerns in Cedar Creek. This station is located in Assessment Unit 0604A_03.

There are no statistically significant trends identified for this station.

This assessment unit is listed in the 2020 Texas Integrated Report as impaired and a concern for screening level for depressed dissolved oxygen in water. This assessment unit is also listed as a concern for near non-attainment for bacteria.

Water Quality Monitoring Results for Station 10479

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	21	14	34.00	2400.00	263.9	-1.43	0.13	
Water Temperature (C)	19	0	4.10	26.90	17.32	-0.13	0.64	
Dissolved Oxygen (mg/L)	21	3	1.20	11.20	6.20	0.08	0.80	
pH (S.U.)	20	0	7.20	8.00	7.65	4.90	0.12	
Specific Conductance (us/cm @ 25C)	21	0	359.00	1110.00	664.71	0.07	0.62	
Ammonia-Nitrogen (mg/L as N)	21	3	0.10	0.82	0.16	0.16	1.00	
Chloride (mg/L)	21	10	22.00	100.00	54.14	0.46	0.95	
Sulfate (mg/L)	21	19	34.50	230.00	112.79	0.07	0.76	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	parameter not collected for this station							
Total Phosphorus (mg/L as P)	20	1	0.06	0.73	0.24	-0.11	0.72	
Total Suspended Solids (mg/L)	21	0	2.50	13.60	5.96	0.99	0.51	
Nitrate (Total) (mg/L)	13	0	0.05	0.55	0.15	-0.73	0.42	
Nitrite (Total) (mg/L)	13	0	0.05	0.05	0.05	1.59E+15	0.07	
Nitrate + Nitrite (mg/L as N)	21	0	0.02	0.60	0.17	-0.80	0.32	
Chlorophyll-*a* (ug/L)	17	1	2.00	29.70	5.19	2.90	0.01	
Pheophytin (ug/L)	17	0	2.00	9.90	2.84	2.53	0.03	

Cedar Creek at Loop 287- Trash

SEGMENT 0604A - CEDAR CREEK

SUMMARY OF WATER QUALITY TRENDS

Trend Analysis Summary for Segment 0604A-Cedar Creek

There are no statistically significant trends identified for this segment.

Water Quality Issues Summary for Segment 0604A - Cedar Creek

Water Quality Issue	Affected Area	Possible Influences/Causes	Possible Effects	Possible Solutions / Actions Taken
Impairment/concern for *E. coli* bacteria	Entire water body	• Urbanization in upper portion of segment • Point-source pollution from wastewater discharges, sewer line breaks, overflows, etc. • Municipal wastewater discharge • Nonpoint sources of pollution • Domestic animals and wildlife • Stormwater runoff • Illegal dumping	• Water body does not meet the water quality standard for Primary Contact Recreation • Primary Contact Recreation in the water body has an increased risk of gastrointestinal illness	• Continue monitoring • Additional monitoring stations added in FY 2014 within the city limits of Lufkin to help identify sources
Impairment/concern for Depressed Dissolved Oxygen	AU 0604A_03	• Nonpoint source pollution • Aquatic vegetation • Nutrient loading into the water body	• Detrimental effect of aquatic biologiccal community	• Continue monitoring • Conduct 24-hour DO measurements • Conduct Aquatic Life UAA
Concern for Nitrate-Nitrogen	AU 0604A_02	• Urbanization in upper portion of segment • Point-source pollution from wastewater discharges, sewer line breaks, overflows, etc. • Municipal wastewater discharge • Nonpoint sources of pollution • Domestic animals and wildlife • Stormwater runoff • Illegal dumping	• Detrimental effect on aquatic biological community	• Continue monitoring • Additional monitoring stations added in FY 2014 within the city limits of Lufkin to help identify sources
Concern for Total Phosphorus	AU 0604A_02	• Urbanization in upper portion of segment • Point-source pollution from wastewater discharges, sewer line breaks, overflows, etc. • Municipal wastewater discharge • Nonpoint sources of pollution • Domestic animals and wildlife • Stormwater runoff • Illegal dumping	• Can increase production of algae • Algae production can cause swings in dissolved oxygen, which can be detrimental to the aquatic biological community	• Continued monitoring • Additional monitoring stations added in FY 2014 within the city limits of Lufkin to help identify sources

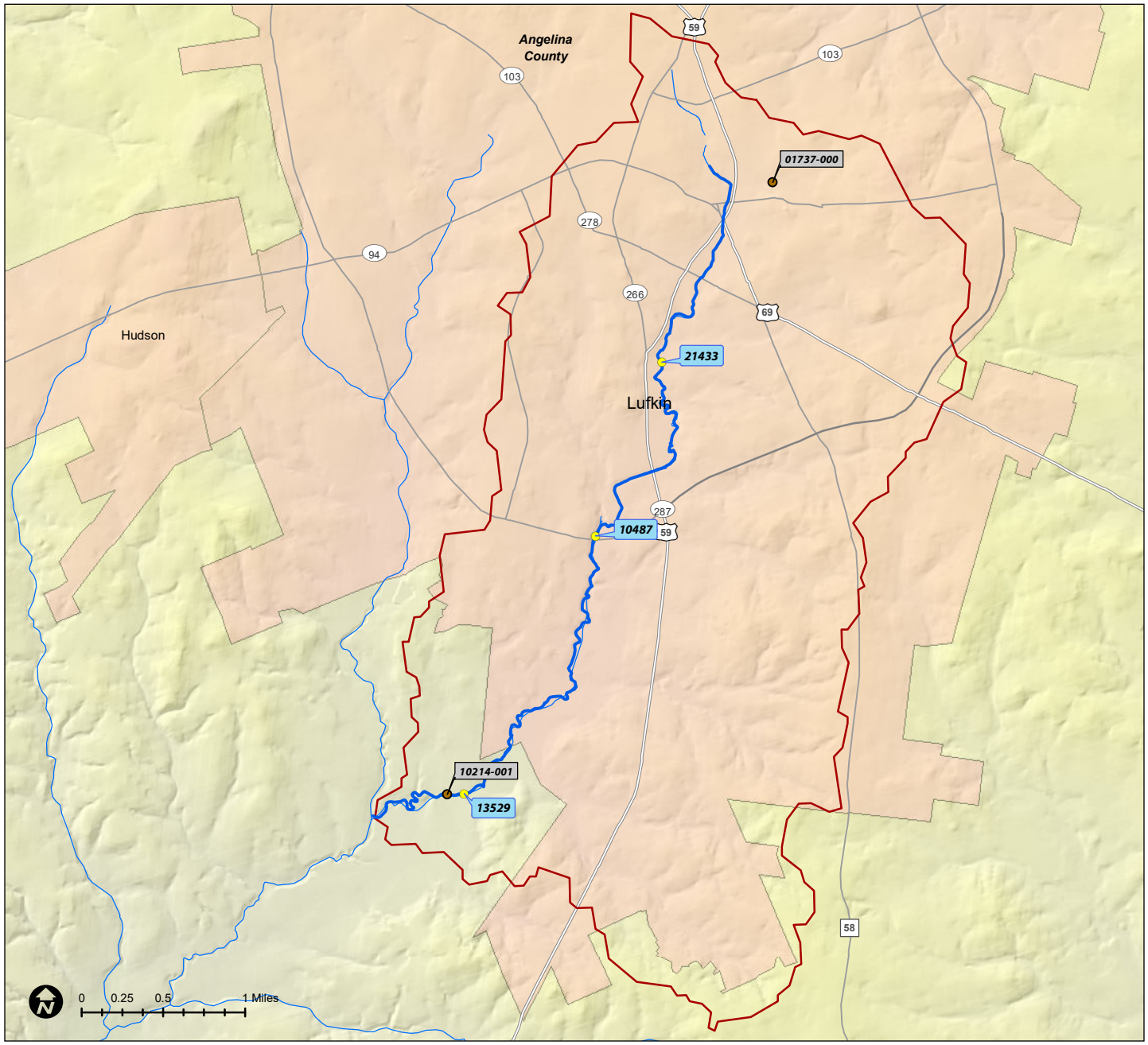
SEGMENT 0604B - HURRICANE CREEK

Segment Profile

Covering a length of 3.3 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.

The City of Lufkin's wastewater treatment facility discharges to Hurricane Creek.

Hurricane Creek, AU 0604B_01, is listed in the 2020 Texas Integrated Report as impaired due to *E. coli* bacteria there is also a concern listed for *E. coli* bacteria levels in AU 0604B_02.



ANRA Monitoring Sites
Wastewater Outfalls
Classified Segments
Other Hydrology
Segment Watershed
Counties

SEGMENT 0604B - HURRICANE CREEK

Designated Uses

The designated uses for this unclassified segment include contact recreation, high aquatic life use, fish consumption use, public water supply use, and general use.

Assessment Units

AU ID	Description
0604B_01	From the confluence with Cedar Creek (0604A) upstream to confluence with unnamed tributary 100m above State Loop 287 in Lufkin, per WQS App. D, at NHD RC 12020002000043
0604B_02	From the confluence with unnamed tributary 100 meters upstream of SH Loop 287 in the City of Lufkin upstream to headwaters near Groesbeck Ave in Lufkin

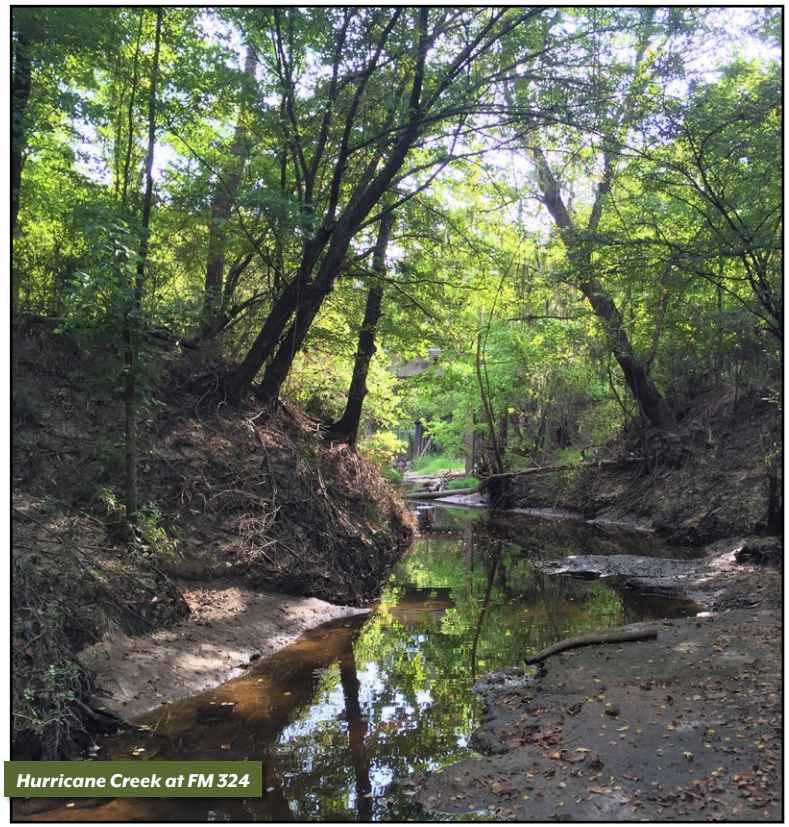
Monitoring Station

Station ID	AU ID	Description	Earliest Data	Latest Data	Notes
13529	0604B_01	HURRICANE CREEK AT FM 324	1997	2019	Monitored continuously since 1997.
10487	0604B_01	HURRICANE CREEK AT LOOP 287	1977	2019	Monitored 1977, 1979-1980, 1996-1997, 2013- present.
21433	0604B_02	HURRICANE CREEK 38 METERS DOWNSTREAM OF KIWANIS PARK DRIVE	2013	2019	Monitored continuously since 2013.

Assessment Summary *(as listed in the 2020 Texas Integrated Report)*

Parameter	Standard	0604B_01 Assessment	0604B_02 Assessment
Chloride (mg/L)	50		
Sulfate (mg/L)	50		
TDS (mg/L)	200		
DO Grab Screening Level (mg/L)	4	NC	NC
DO Grab Minimum (mg/L)	3	FS	NC
24 Hour DO Average (mg/L)			
24 Hour DO Minimum (mg/L)			
pH(SU)	6.0 - 8.5		
Temp (C)	32.8		
E. coli geomean (MPN/100L)	126	NS	CN
Ammonia Nitrogen (mg/L)	0.33	NC	NC
Nitrate Nitrogen (mg/L)	1.95	NC	NC
Total Phosphorus (mg/L)	0.69	NC	NC
Chl-*a* (µg/L)	14.1	NC	NC
Mercury in Edible Tissue			
Dioxin in Edible Tissue			

FS = Fully Supporting NC = No Concern CN = Concern for Near Non-Attainment
CS = Concern for Screening Level NS = Not Supporting NA = Not Assessed



Hurricane Creek at FM 324

SEGMENT 0604B - HURRICANE CREEK

Monitoring Station 13529 - Hurricane Creek at FM 324

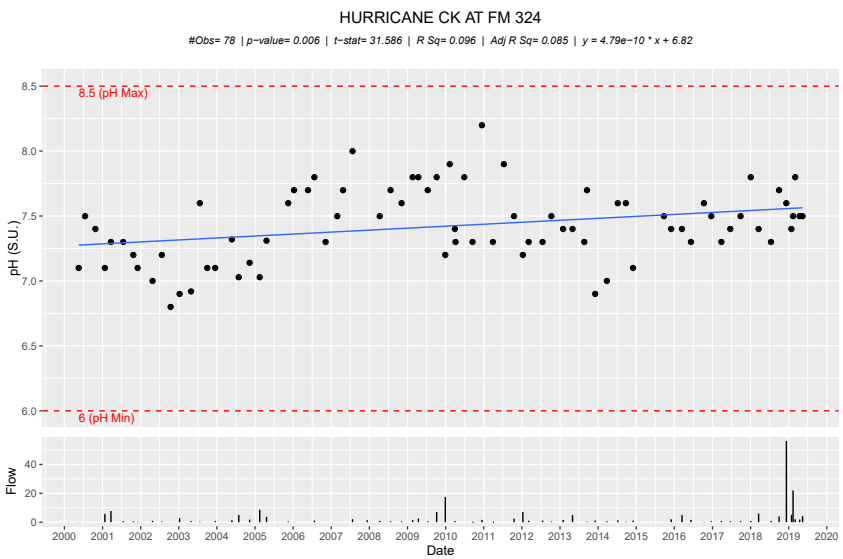
Monitoring Station 13529 is located on Hurricane Creek at the FM 324 crossing in assessment unit 0604B_01. It is upstream of the City of Lufkin wastewater treatment plant discharge. This station is monitored quarterly by ANRA personnel for field parameters, conventional parameters, flow, and *E. coli* bacteria.

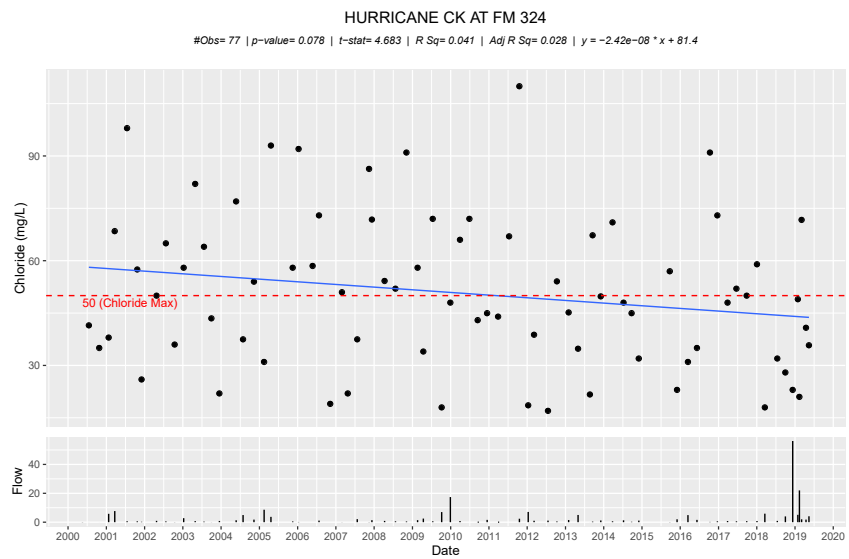
Statistical analysis shows a significant increasing trend for pH. Significant decreasing trends are shown for Chloride, Total Phosphorus and Chlorophyll-*a*. These trends could be partially attributable to improvements that the City of Lufkin has made to it's wastewater collection system over time. Trends observed for Ammonia-Nitrogen and Nitrate+Nitrite are not considered statistically significant due to greater than 50% of the observed values for each parameter being censored values.

This assessment unit is listed in the 2020 Texas Integrated Report as impaired for bacteria. There are no other impairments or concerns listed.

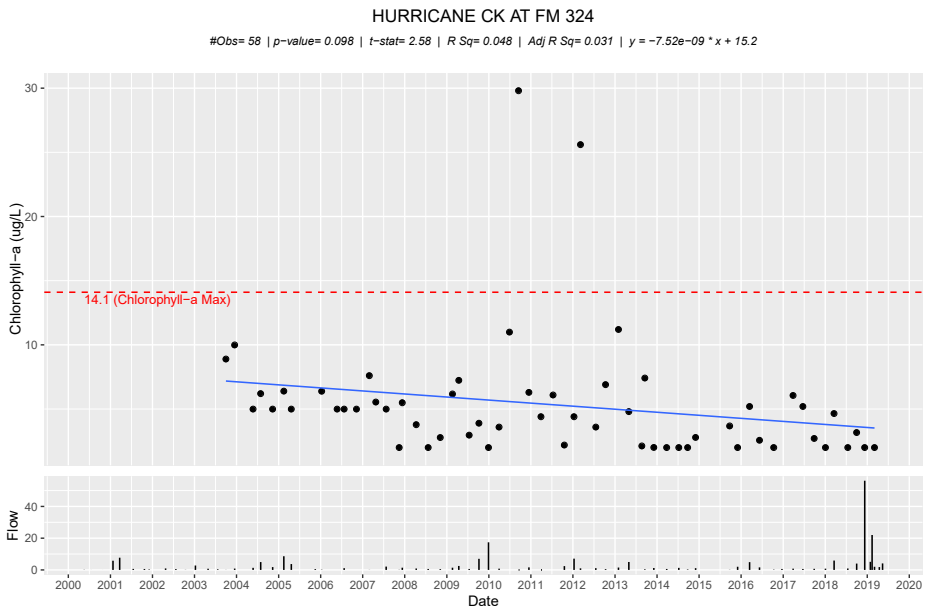
Water Quality Monitoring Results for Station 13529

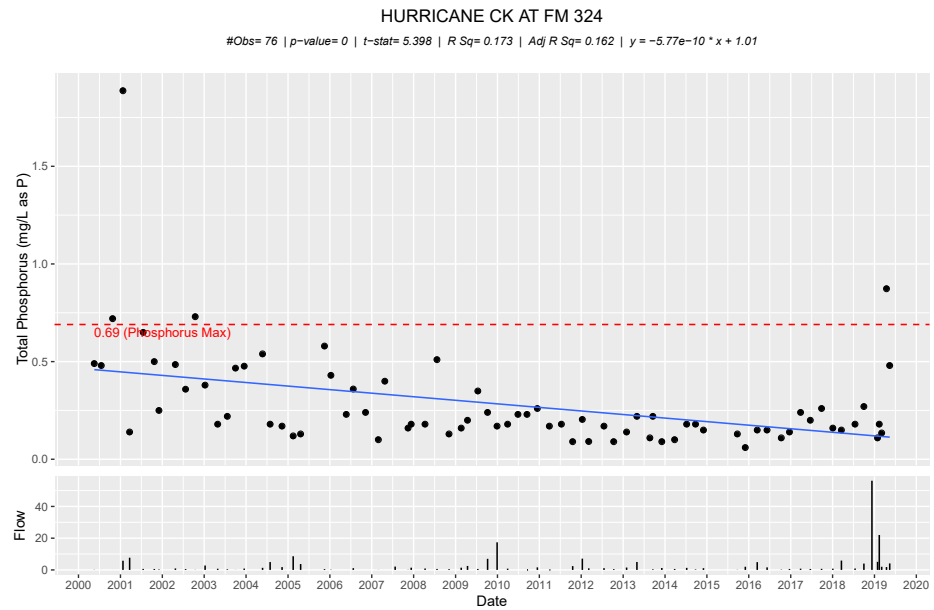
Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	76	55	19.00	3972.60	259.43	1.33	0.69	
Water Temperature (C)	78	0	2.10	29.60	18.59	4.74	0.23	
Dissolved Oxygen (mg/L)	77	1	1.30	12.30	6.96	2.40	0.17	
pH (S.U.)	78	0	6.80	8.20	7.43	31.59	0.01	↑
Specific Conductance (us/cm @ 25C)	79	0	255.00	1170.00	605.25	4.08	0.36	
Ammonia-Nitrogen (mg/L as N)	78	16	0.01	1.50	0.24	3.14	0.04	
Chloride (mg/L)	77	35	17.00	110.00	50.68	4.68	0.08	↓
Sulfate (mg/L)	78	68	5.00	2600.00	134.33	0.68	0.93	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	parameter not collected for this station							
Total Phosphorus (mg/L as P)	76	4	0.06	1.89	0.28	5.40	0.00	↓
Total Suspended Solids (mg/L)	78	0	1.33	152.40	17.19	2.19	0.16	
Nitrate (Total) (mg/L)	16	0	0.05	0.18	0.09	-1.94	0.04	
Nitrite (Total) (mg/L)	16	0	0.05	0.05	0.05	NA	NA	
Nitrate + Nitrite (mg/L as N)	78	1	0.04	2.49	0.29	5.76	0.00	
Chlorophyll-*a* (ug/L)	58	2	2.00	29.80	5.34	2.58	0.10	↓
Pheophytin (ug/L)	51	0	2.00	6.50	2.67	3.11	0.11	





SEGMENT 0604B - HURRICANE CREEK





Hurricane Creek at FM 324

SEGMENT 0604B - HURRICANE CREEK

Monitoring Station 10487 - Hurricane Creek at South Loop 287

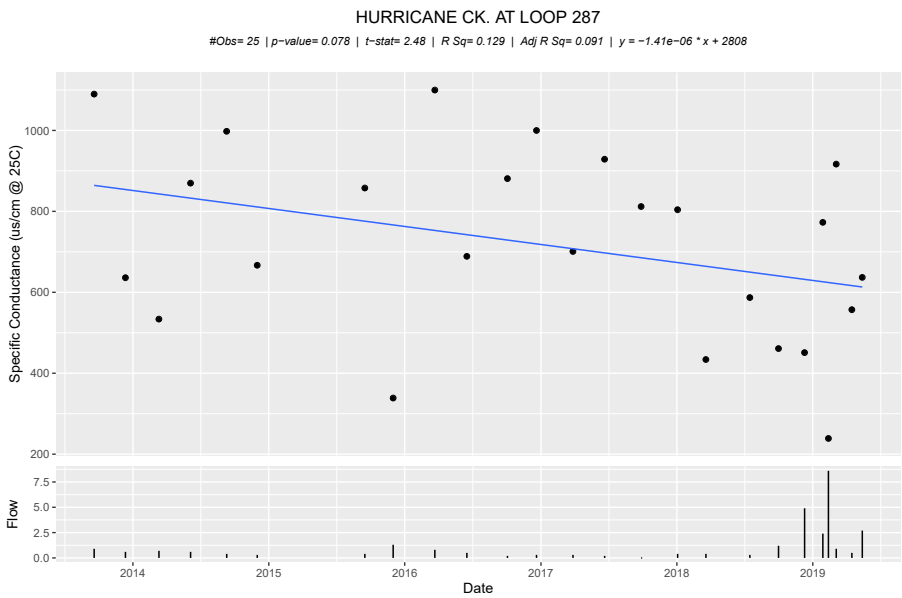
Monitoring Station 10487 is located at the South Loop 287 crossing. ANRA monitors both stations quarterly for conventional parameters, field parameters, flow, and *E. coli* bacteria. This station was added in 2014 to help identify possible sources of the *E. coli* bacteria in Hurricane Creek.

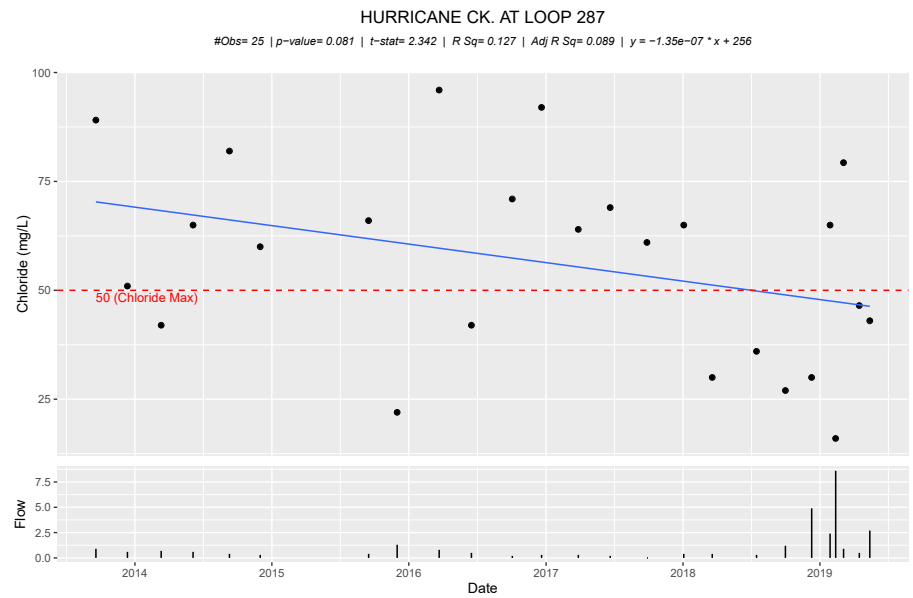
Although not considered significant due to having less than 10 years of data, decreasing trends were identified for specific conductance and chloride. An increasing trend was also identified for nitrate plus nitrite.

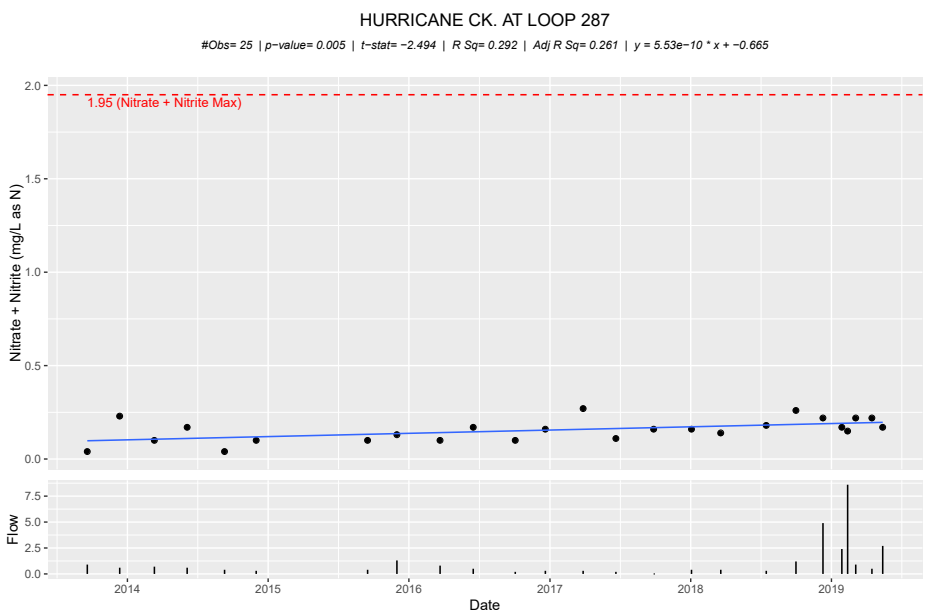
This assessment unit is listed in the 2020 Texas Integrated Report as impaired for bacteria. There are no other impairments or concerns listed.

Water Quality Monitoring Results for Station 10487

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	25	23	24.00	2400.00	381.02	-1.31	0.15	
Water Temperature (C)	23	0	3.30	26.80	16.35	0.69	0.76	
Dissolved Oxygen (mg/L)	25	0	3.10	12.50	7.65	-1.39	0.05	
pH (S.U.)	25	0	7.00	8.00	7.61	6.47	0.78	
Specific Conductance (us/cm @ 25C)	25	0	239.00	1100.00	718.56	2.48	0.08	
Ammonia-Nitrogen (mg/L as N)	25	2	0.10	3.00	0.24	1.83	0.09	
Chloride (mg/L)	25	15	16.00	96.00	56.40	2.34	0.08	
Sulfate (mg/L)	25	23	29.00	270.00	130.28	1.44	0.33	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	parameter not collected for this station							
Total Phosphorus (mg/L as P)	24	2	0.07	6.25	0.51	-1.35	0.17	
Total Suspended Solids (mg/L)	25	0	2.50	58.00	10.80	-0.15	0.74	
Nitrate (Total) (mg/L)	16	0	0.05	0.21	0.10	-3.27	0.00	
Nitrite (Total) (mg/L)	16	0	0.05	0.05	0.05	NA	NA	
Nitrate + Nitrite (mg/L as N)	25	0	0.04	0.27	0.15	-2.49	0.01	
Chlorophyll-*a* (ug/L)	17	2	2.00	17.80	4.38	-0.07	0.85	
Pheophytin (ug/L)	17	0	2.00	3.78	2.17	1.57	0.34	







Water samples being collected upstream of bridge crossing (Station 10487)

Downstream of bridge crossing (Station 10487)

SEGMENT 0604B - HURRICANE CREEK

Monitoring Station 21433- Hurricane Creek at Kiwani's Park

Monitoring Station 21433 is located downstream of Kiwanis Park Drive in assessment unit 0604B_02. ANRA monitors this station quarterly for conventional parameters, field parameters, flow, and *E. coli* bacteria. This station was added in 2014 to help identify possible sources of *E. coli* bacteria in Hurricane Creek.

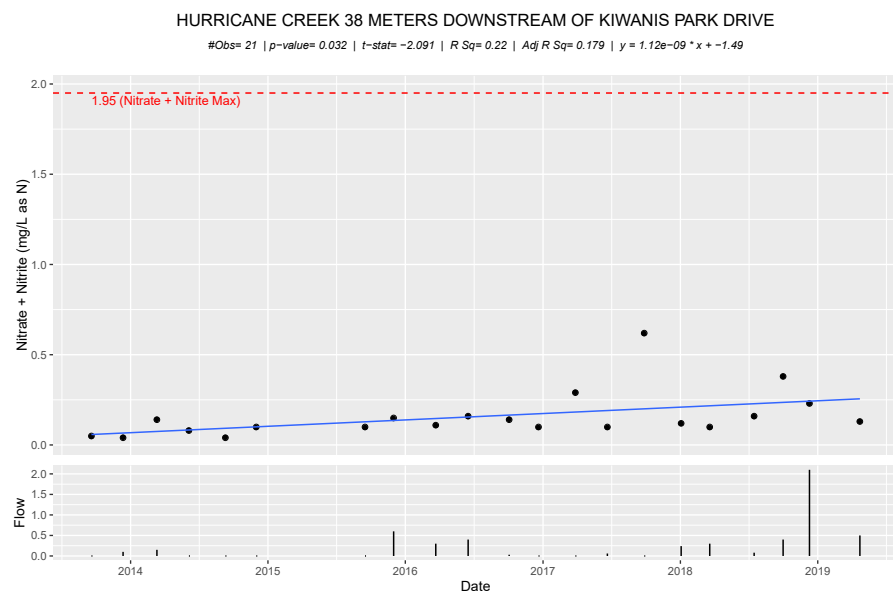
Although not considered statistically significant due to having less than 10 years worth of data, an increasing trend was identified for Nitrate+Nitrite.

This assessment unit is listed in the 2020 Texas Integrated Report with a concern for near non-attainment for bacteria. There are no other impairments or concerns listed.

Flow measurement being conducted at Station 21433

Water Quality Monitoring Results for Station 21433

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	21	17	42.00	2400.00	372.97	-1.51	0.11	
Water Temperature (C)	19	0	2.50	27.40	17.14	-0.21	0.59	
Dissolved Oxygen (mg/L)	21	1	1.90	11.80	6.98	0.51	0.96	
pH (S.U.)	21	1	4.40	8.10	7.35	-0.22	0.06	
Specific Conductance (us/cm @ 25C)	21	0	6.00	1100.00	584.76	-0.09	0.63	
Ammonia-Nitrogen (mg/L as N)	21	1	0.10	0.41	0.13	-0.31	0.56	
Chloride (mg/L)	21	6	15.00	82.00	43.30	1.66	0.22	
Sulfate (mg/L)	21	19	36.00	250.00	97.22	0.44	0.91	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	parameter not collected for this station							
Total Phosphorus (mg/L as P)	20	0	0.03	0.54	0.24	0.19	0.98	
Total Suspended Solids (mg/L)	21	0	2.50	34.00	8.95	1.85	0.11	
Nitrate (Total) (mg/L)	14	0	0.05	0.42	0.12	-1.64	0.11	
Nitrite (Total) (mg/L)	14	0	0.05	0.20	0.06	-0.31	0.66	
Nitrate + Nitrite (mg/L as N)	21	0	0.04	0.62	0.16	-2.09	0.03	
Chlorophyll-*a* (ug/L)	17	2	2.00	19.70	4.42	-0.44	0.59	
Pheophytin (ug/L)	17	0	2.00	18.30	3.17	-0.57	0.51	



SEGMENT 0604B - HURRICANE CREEK

SUMMARY OF WATER QUALITY TRENDS

Trend Analysis Summary for Segment 0604B- Hurricane Creek

There are no statistically significant trends identified for this segment.

Water Quality Issues Summary for Segment 0604B - Hurricane Creek

Water Quality Issue	Affected Area	Possible Influences/Causes	Possible Effects	Possible Solutions / Actions Taken
Impairment/concern for *E. coli* bacteria	0604B_01 (impairment) 0604B_02 (concern)	• Failing (and non-existent) septic systems • Wildlife (deer and feral hogs) • Livestock and agricultural operations including cattle and poultry operations	• Water body does not meet the water quality standard for Primary Contact Recreation • Primary Contact Recreation in the water body has an increased risk of gastrointestinal illness	• Continue Monitoring

Hurricane Creek at FM 324

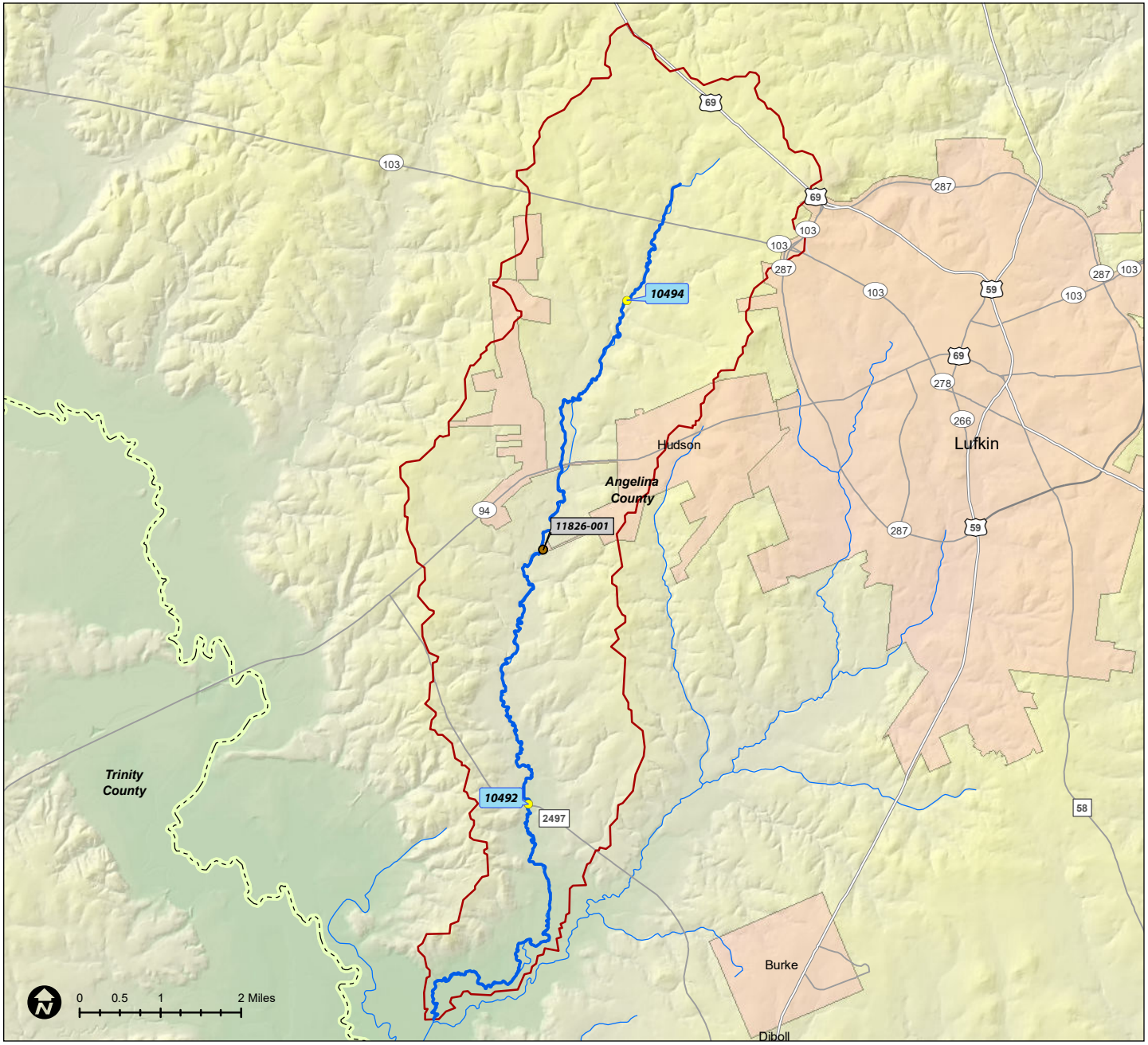
SEGMENT 0604C - JACK CREEK

Segment Profile

This freshwater stream extends 16 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.

The City of Hudson's wastewater treatment facility discharges to Jack Creek.

Jack Creek is listed in the 2020 Texas Integrated Report as impaired for *E. coli* bacteria and it is also listed with a concern for Total Phosphorus in water.



ANRA Monitoring Sites
Wastewater Outfalls
Classified Segments
Other Hydrology
Segment Watershed
Counties

SEGMENT 0604C - JACK CREEK

Designated Uses

The designated uses for this unclassified segment include contact recreation, high aquatic life use, fish consumption use, public water supply use, and general use.

Assessment Units

AU ID	Description
0604C_01	From the confluence with Cedar Creek (0604A) upstream to confluence with unnamed tributary 1.6km SW of US Hwy 69 NW of Lufkin at NHD RC 12020002012470

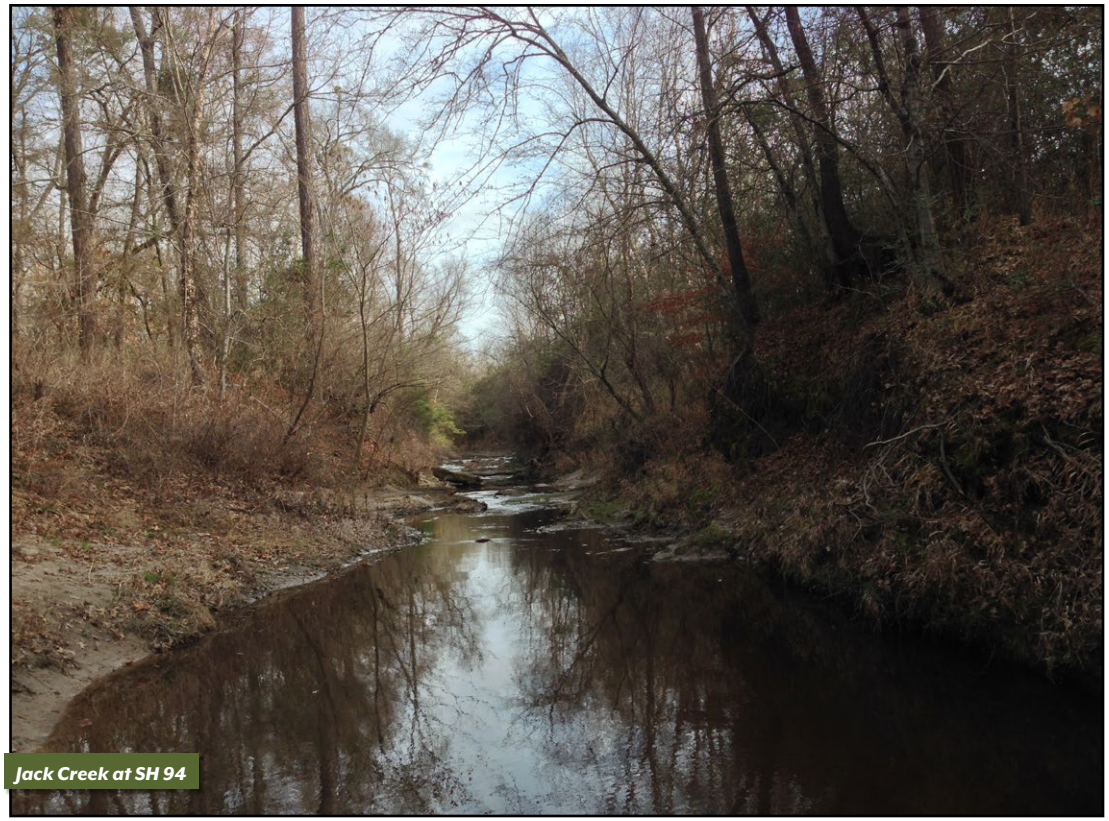
Monitoring Stations

Assessment Unit	Monitoring Station ID	Description	Initial Monitoring Event	Latest Monitoring Event	Notes
0604C_01	10492	JACK CREEK AT FM 2497	1977	2019	Monitored 1977, 1979-1980 and began again in 1996
0604C_01	10493	JACK CREEK AT SH 94	1977	2018	Monitored 1977, 1979-1980, 1996-2000 and 2013-2018.
0604C_01	10494	JACK CREEK AT FM 3150	1977	2019	Monitored 1977, 1979-1980 and began again in 2013.

Assessment Summary *(as listed in the 2020 Texas Integrated Report)*

Parameter	Standard	0604C_01 Assessment
Chloride (mg/L)	50	
Sulfate (mg/L)	50	
TDS(mg/L)	200	
DO Grab Screening Level (mg/L)	5	NC
DO Grab Minimum (mg/L)	3	FS
24 Hour DO Average		
24 Hour DO Minimum		
pH (SU)	6.0-8.5	
Temp (C)	32.8	
E. coli geomean (MPN/100mL)	126	NS
Ammonia Nitrogen (mg/L)	0.33	NC
Nitrate Nitrogen (mg/L)	1.95	NC
Total Phosphorus (mg/L)	0.69	CS
Chl-*a* (µg/L)	14.1	NC
Mercury in Edible Tissue		
Dioxin in Edible Tissue		

FS = Fully Supporting NC = No Concern CN = Concern for Near Non-Attainment
CS = Concern for Screening Level NS = Not Supporting NA = Not Assessed



Jack Creek at SH 94

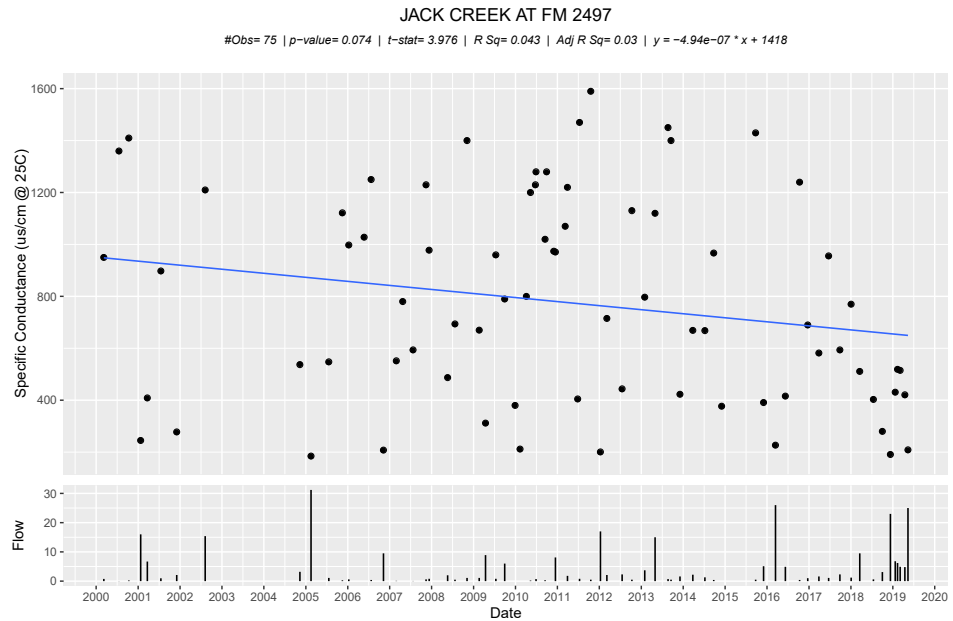
SEGMENT 0604C - JACK CREEK

Monitoring Station 10492 - Jack Creek at FM 2497

Monitoring Station 10492 is located on Jack Creek at the FM 2497 crossing. This station is located downstream of the City of Hudson wastewater treatment plant effluent discharge. This station is monitored quarterly by ANRA personnel for field parameters, conventional parameters, flow, and *E. coli* bacteria. This station is located in Assessment Unit 0604C_01.

Statistical analysis identifies significant decreasing trends for Specific Conductance, Chloride, and Nitrate+Nitrite. Chloride and Nitrate+Nitrite have many values exceeding the screening level set for each parameter.

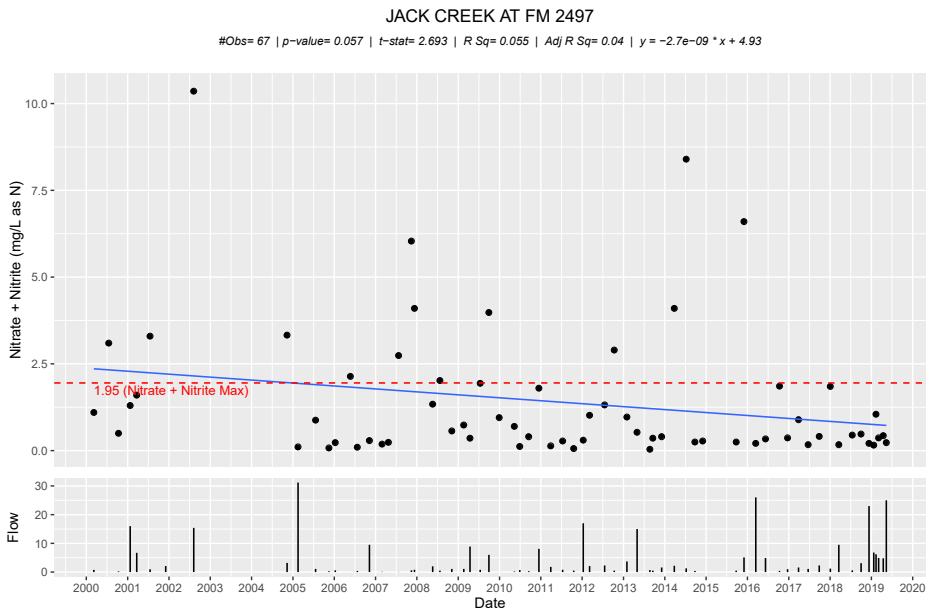
This assessment unit is listed in the 2020 Texas Integrated Report as impaired for bacteria. There is also a concern for screening level listed for total phosphorus. There are no other impairments or concerns listed.

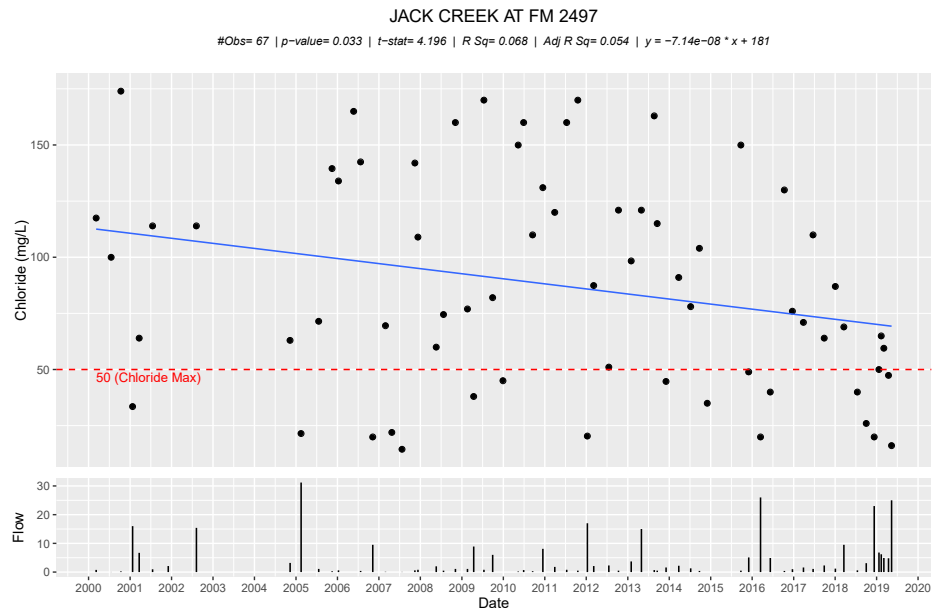


Water Quality Monitoring Results for Station 10492

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	25	23	24.00	2400.00	381.02	-1.31	0.15	
Water Temperature (C)	23	0	3.30	26.80	16.35	0.69	0.76	
Dissolved Oxygen (mg/L)	25	0	3.10	12.50	7.65	-1.39	0.05	
pH (S.U.)	25	0	7.00	8.00	7.61	6.47	0.78	
Specific Conductance (us/cm @ 25C)	25	0	239.00	1100.00	718.56	2.48	0.08	↓
Ammonia-Nitrogen (mg/L as N)	25	2	0.10	3.00	0.24	1.83	0.09	
Chloride (mg/L)	25	15	16.00	96.00	56.40	2.34	0.08	↓
Sulfate (mg/L)	25	23	29.00	270.00	130.28	1.44	0.33	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	parameter not collected for this station							
Total Phosphorus (mg/L as P)	24	2	0.07	6.25	0.51	-1.35	0.17	
Total Suspended Solids (mg/L)	25	0	2.50	58.00	10.80	-0.15	0.74	
Nitrate (Total) (mg/L)	16	0	0.05	0.21	0.10	-3.27	0.00	
Nitrite (Total) (mg/L)	16	0	All values were below the detection limit					
Nitrate + Nitrite (mg/L as N)	25	0	0.04	0.27	0.15	-2.49	0.01	↓
Chlorophyll-*a* (ug/L)	17	2	2.00	17.80	4.38	-0.07	0.85	
Pheophytin (ug/L)	17	0	2.00	3.78	2.17	1.57	0.34	

10492 - Jack Creek at FM 2497


JACK CREEK AT FM 2497
#Obs= 67 | p−value= 0.057 | t−stat= 2.693 | R Sq= 0.055 | Adj R Sq= 0.04 | y = −2.7e−09 * x + 4.93
Nitrate + Nitrite (mg/L as N)
1.95 (Nitrate + Nitrite Max)
Flow
Date


JACK CREEK AT FM 2497
#Obs= 67 | p−value= 0.033 | t−stat= 4.196 | R Sq= 0.068 | Adj R Sq= 0.054 | y = −7.14e−08 * x + 181
Chloride (mg/L)
50 (Chloride Max)
Flow
Date

10492 - Jack Creek at FM 2497

SEGMENT 0604C - JACK CREEK

Monitoring Station 10493 - Jack Creek at SH 94

Monitoring Station 10493 is located on Jack Creek at the SH 94 crossing. ANRA monitors this station quarterly for conventional parameters, field parameters, flow, and *E. coli* bacteria. This station was previously monitored and added back in 2014 to try and track potential sources of pollution. Monitoring was stopped in 2018 because the results were similar to Jack at 3150, which is in the same assessment unit (0604C_01).

Decreasing trends identified for Total Phosphorus and Nitrate+Nitrite are not considered statistically significant due to the large gap in observation. Ammonia-Nitrogen has a decreasing trend observed that is not considered statistically significant due to the large gap in observation and also having greater than fifty-percent censored values.

This assessment unit is listed in the 2020 Texas Integrated Report as impaired for bacteria. There is also a concern for screening level listed for total phosphorus. There are no other impairments or concerns listed.

Water Quality Monitoring Results for Station 10493

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	18	11	50.00	650.00	106.56	1.37	0.25	
Water Temperature (C)	18	0	8.00	26.30	18.76	2.69	0.25	
Dissolved Oxygen (mg/L)	20	1	2.50	12.00	8.34	0.39	0.10	
pH (S.U.)	20	0	6.50	7.50	7.18	14.56	0.89	
Specific Conductance (us/cm @ 25C)	20	0	155.00	358.00	275.10	3.32	0.39	
Ammonia-Nitrogen (mg/L as N)	20	0	0.10	0.20	0.11	20.68	0.00	
Chloride (mg/L)	20	1	13.00	59.00	36.05	2.38	0.47	
Sulfate (mg/L)	20	0	13.00	50.00	26.95	1.90	0.57	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	parameter not collected for this station							
Total Phosphorus (mg/L as P)	20	1	0.02	1.21	0.24	7.37	0.00	
Total Suspended Solids (mg/L)	20	0	1.00	24.00	7.80	-0.20	0.40	
Nitrate (Total) (mg/L)	13	0	0.05	0.16	0.09	-0.20	0.72	
Nitrite (Total) (mg/L)	12	0	0.05	0.12	0.06	-1.43	0.13	
Nitrate + Nitrite (mg/L as N)	20	0	0.04	1.00	0.18	5.11	0.00	
Chlorophyll-*a* (ug/L)	17	0	2.00	14.10	4.51	-0.56	0.47	
Pheophytin (ug/L)	17	0	2.00	4.03	2.26	0.58	0.88	

10493 - Jack Creek at SH 94

SEGMENT 0604C - JACK CREEK

Monitoring Station 10494 - Jack Creek at FM 3150

Monitoring Station 10494 is located at the FM 3150 crossing. ANRA monitors both stations quarterly for conventional parameters, field parameters, flow, and *E. coli* bacteria. This station was previously monitored but was added back in 2014 as an effort to track potential sources of pollution. It is located in Assessment Unit 0604C_01.

Although not considered statistically significant due to having less than 10 years of data, there was a decreasing trend identified for Sulfate and increasing trends for Total Phosphorus and *E. coli* bacteria.

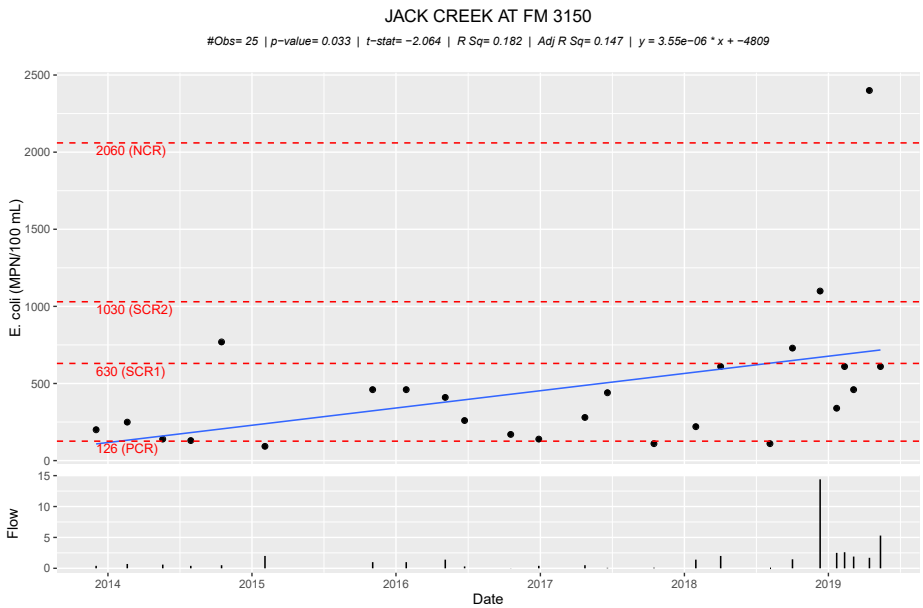
This assessment unit is listed in the 2020 Texas Integrated Report as impaired for bacteria. There is also a concern for screening level listed for total phosphorus. There are no other impairments or concerns listed.

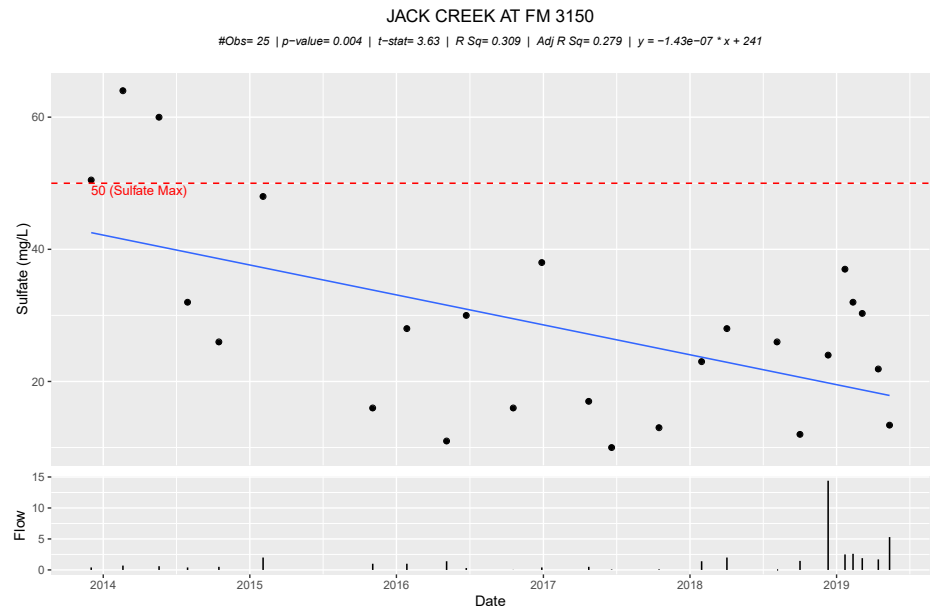
Water Quality Monitoring Results for Station 10493

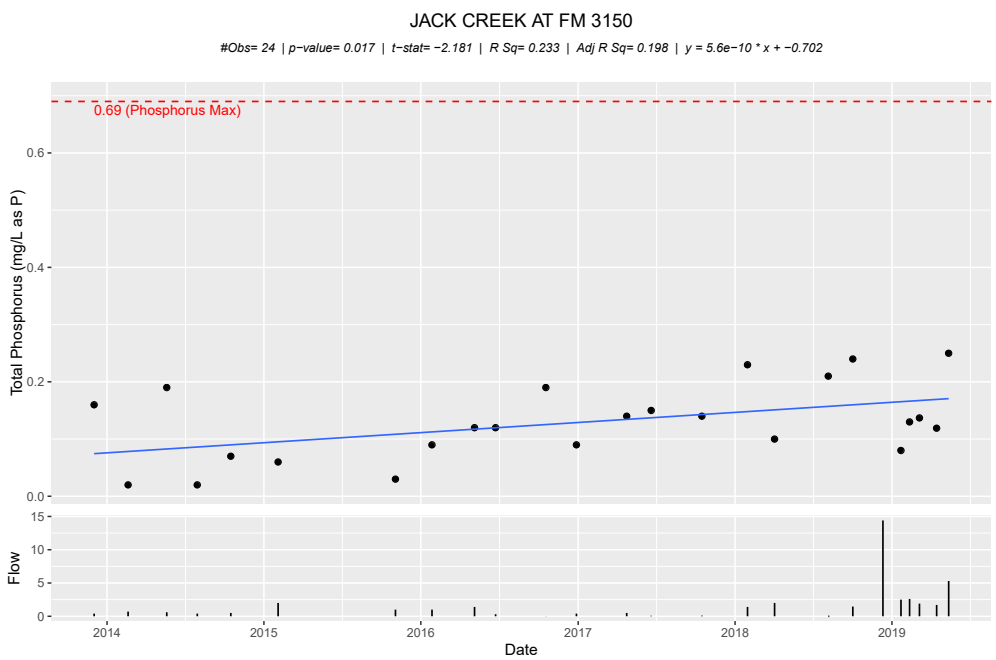
Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	25	22	93.00	2400.00	327.94	-2.06	0.03	
Water Temperature (C)	23	0	6.10	25.80	15.93	0.44	0.99	
Dissolved Oxygen (mg/L)	25	1	1.80	12.80	8.10	-0.38	0.34	
pH (S.U.)	25	0	6.10	8.10	7.22	0.17	0.00	
Specific Conductance (us/cm @ 25C)	25	0	166.00	399.00	275.84	2.37	0.13	
Ammonia-Nitrogen (mg/L as N)	25	0	0.10	0.15	0.10	1.75	0.89	
Chloride (mg/L)	25	2	12.00	64.00	34.12	1.88	0.18	
Sulfate (mg/L)	25	3	10.00	64.00	28.28	3.63	0.00	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	parameter not collected for this station							
Total Phosphorus (mg/L as P)	24	0	0.02	0.25	0.13	-2.18	0.02	
Total Suspended Solids (mg/L)	25	0	3.00	22.00	9.60	-1.73	0.05	
Nitrate (Total) (mg/L)	16	0	0.05	0.14	0.08	0.76	0.61	
Nitrite (Total) (mg/L)	15	0	0.05	0.12	0.05	-0.69	0.35	
Nitrate + Nitrite (mg/L as N)	25	0	0.04	0.21	0.12	-0.87	0.19	
Chlorophyll-*a* (ug/L)	21	0	2.00	12.80	3.31	0.43	0.79	
Pheophytin (ug/L)	21	0	2.00	5.06	2.18	1.54	0.32	

10494 - Jack Creek at FM 3150

SEGMENT 0604C - JACK CREEK







Jack Creek at FM 3150

SEGMENT 0604C - JACK CREEK

SUMMARY OF WATER QUALITY TRENDS

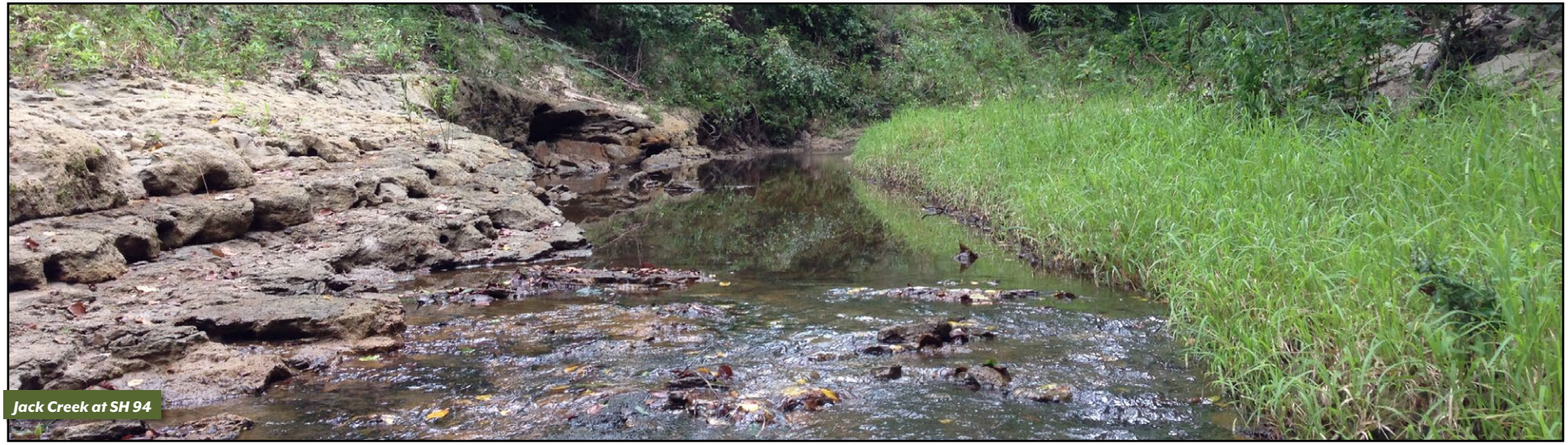
Trend Analysis Summary for Segment 0604C - Jack Creek

AU	Station ID	Station Description	*E. coli*	Temp	DO	pH	Spec Cond	NH3	Cl	SO4	TKN	Total P	TSS	NO3	NO2	NO3/ NO2	Chl-*a*	Pheo
0604C_01	10492	Jack Creek at FM 2497					↓		↓							↓		
0604C_01	10493	Jack Creek at SH 94	*- No trends identified for this Assessment Unit -*															
0604C_01	10494	Jack Creek at FM 3150	*- No trends identified for this Assessment Unit -*															

↑ = Statistically significant increasing trend ↓ = Statistically significant decreasing trend

Water Quality Issues Summary for Segment 0604C - Jack Creek

Water Quality Issue	Affected Area	Possible Influences/Causes	Possible Effects	Possible Solutions / Actions Taken
E. coli bacteria	Entire water body	• Jack Creek was previously listed as impaired for *E. coli* bacteria, but was de-listed in the Draft 2014 Integrated Report	• The water body now meets the standard for Primary Contact Recreation and has been de-listed	• Continue monitoring • A RUAA is being conducted by TCEQ on this water body to determine if the most appropriate contact recreation standard is being applied
Concern for Total Phosphorus	Entire water body	• Municipal wastewater discharge • Nonpoint sources of pollution • Domestic animals and wildlife • Stormwater runoff	• Can increase production of algae • Algae production can cause swings in dissolved oxygen, which can be detrimental to the aquatic biological community	• Continue monitoring • Additional monitoring stations added in FY 2014 to help identify sources



Jack Creek at SH 94

SEGMENT 0604D - PINEY CREEK

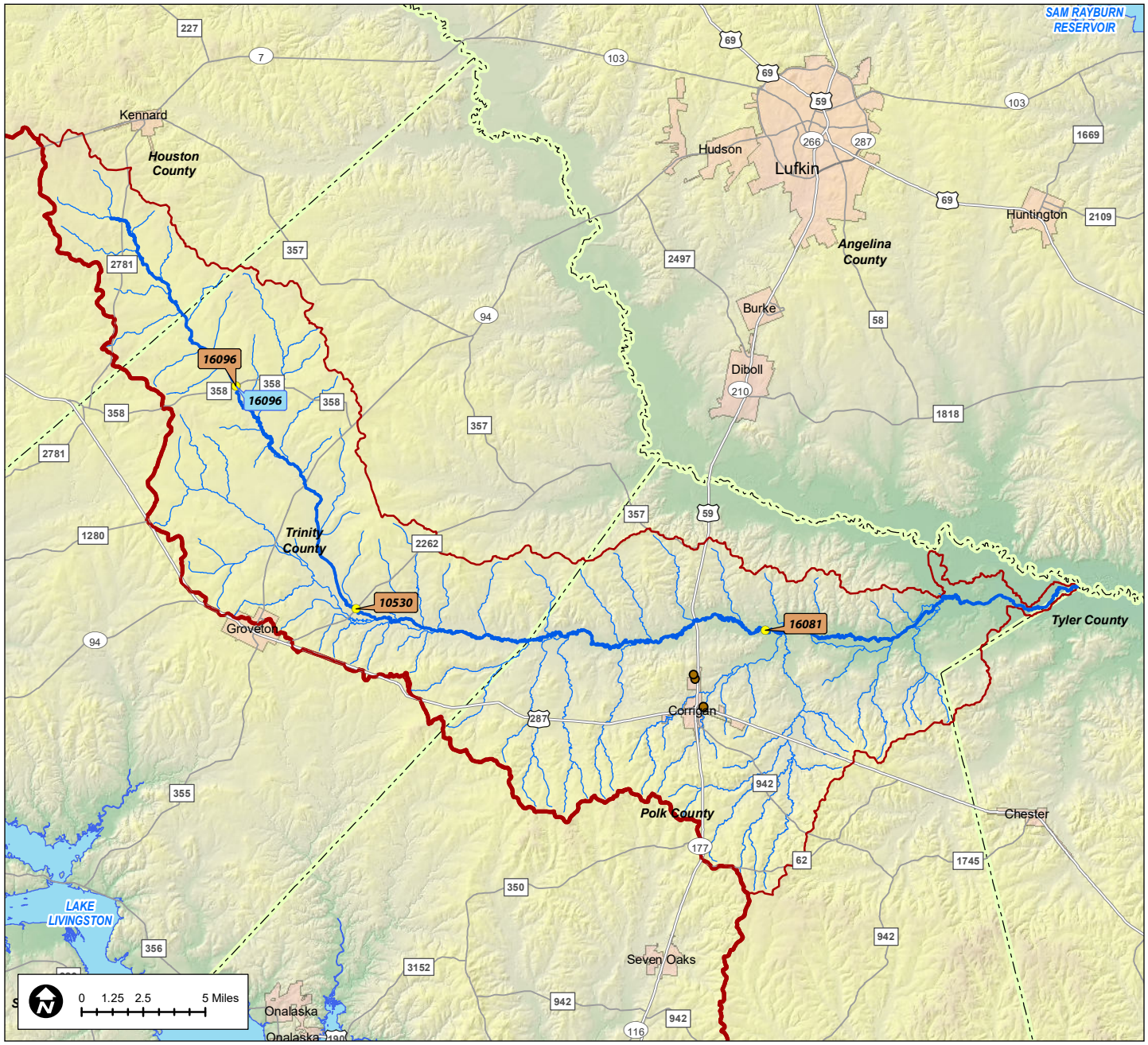
Segment Profile

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 is listed in the 2020 Texas Integrated Report as impaired due to depressed Dissolved Oxygen. Assessment Unit 0604D_01 has a listing of not supporting due to the 24-hour average and 24-hour minimum measurements, while Assessment Unit 0604D_02 is shown to be fully supporting for this parameter. 0604D_02 has a concern listed for depressed Dissolved Oxygen.

Assessment Unit 0604D_02 is listed in the 2020 Texas Integrated Report as impaired for *E. coli* bacteria.

There are nutrient concerns in Piney Creek as well, with AU 0604D_01 having a concern for Ammonia-Nitrogen.



ANRA Monitoring Sites
TCEQ Monitoring Sites
Wastewater Outfalls
Classified Segments
Other Hydrology
Segment Watershed
Counties

SEGMENT 0604D - PINEY CREEK

Designated Uses

The designated uses for this unclassified segment include contact recreation, high aquatic life use, fish consumption use, public water supply use, and general use.

Assessment Units

AU ID	Description
0604D_01	Middle portion of the stream from the confluence with Bear Creek (0604L) in Polk County upstream to the confluence with Caney Creek (0604O) in Trinity County at NHD RC 12020002000163
0604D_02	Upper portion of stream from the confluence with Caney Creek (0604O) in Trinity County upstream to confluence with unnamed tributary at NHD RC 12020002000181 in Houston County 0.75km west of FM 2781
0604D_03	Lower portion of stream from the confluence with the Neches River (0604) upstream to the confluence with Bear Creek (0604L) in Polk County at NHD RC 12020002000145

Monitoring Stations

Station ID	AU ID	Description	Earliest Data	Latest Data	Notes
16081	0604D_01	PINEY CREEK AT FM 1987	1997	2019	Monitored from 1997-2012, 2017- present.
16096	0604D_02	PINEY CREEK AT FM 358 EAST OF PENNINGTON	1997	2019	Monitored from 1997-1998 , 2007- present.

Assessment Summary (as listed in the Draft 220 Texas Integrated Report)

Parameter	Standard	0604D_01 Assessment	0604D_02 Assessment
Chloride (mg/L)	50		
Sulfate (mg/L)	50		
TDS(mg/L)	200		
DO Grab Screening Level (mg/L)	5	NA	CS
DO Grab Minimum (mg/L)	3	NA	FS
24 Hour DO Average	5	NS	
24 Hour DO Minimum	3	NS	
pH (SU)	6.0-8.5		
Temp (C)	32.8		
E. coli geomean (MPN/100mL)	126		NS
Ammonia Nitrogen (mg/L)	0.33	CS	NC
Nitrate Nitrogen (mg/L)	1.95		NC
Total Phosphorus (mg/L)	0.69		NC
Chl-*a* (µg/L)	14.1		NC
Mercury in Edible Tissue			
Dioxin in Edible Tissue			

FS = Fully Supporting NC = No Concern CN = Concern for Near Non-Attainment CS = Concern for Screening Level
NS = Not Supporting NA = Not Assessed

Piney Creek at FM 2781

SEGMENT 0604D - PINEY CREEK

Monitoring Station 16081 - Piney Creek at FM 1987

Monitoring Station 16081 is located at the FM 1987 crossing of Piney Creek. This station is no longer monitored due to difficulty obtaining samples during the drought, when this portion of the stream would frequently go dry. The depressed Dissolved Oxygen impairments and Ammonia-Nitrogen concern for this segment are based upon the data collected at station 16081, which is located in AU 0604D_01.

Because of the lack of recent data, ANRA is not considering the trends at this station to be statistically significant, as they may not represent current water quality conditions. However, there were increasing trends identified for pH and Ammonia-Nitrogen and a decreasing trend identified for Nitrate+Nitrite.

This assessment unit is listed in the 2020 Texas Integrated Report as impaired for depressed dissolved oxygen in water. There is also a concern for screening level of ammonia listed.

Water Quality Monitoring Results for Station 16081

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	29	13	6.00	1990.00	114.42	0.92	0.47	
Water Temperature (C)	40	0	2.60	28.70	18.51	1.98	0.72	
Dissolved Oxygen (mg/L)	40	11	0.70	11.10	5.49	0.87	0.80	
pH (S.U.)	40	5	5.40	7.70	6.66	5.13	0.03	
Specific Conductance (us/cm @ 25C)	40	0	68.00	475.00	237.33	-0.10	0.16	
Ammonia-Nitrogen (mg/L as N)	31	15	0.01	1.98	0.63	-4.32	0.00	
Chloride (mg/L)	31	4	8.50	143.00	30.57	-0.97	0.15	
Sulfate (mg/L)	31	17	10.00	140.50	57.35	-0.58	0.19	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	parameter not collected for this station							
Total Phosphorus (mg/L as P)	31	5	0.07	3.95	0.42	1.52	0.21	
Total Suspended Solids (mg/L)	31	0	4.67	26.30	12.92	0.04	0.48	
Nitrate (Total) (mg/L)	parameter not collected for this station							
Nitrite (Total) (mg/L)	parameter not collected for this station							
Nitrate + Nitrite (mg/L as N)	31	1	0.04	2.00	0.53	4.52	0.00	
Chlorophyll-*a* (ug/L)	16	2	2.00	44.60	9.16	0.21	0.95	
Pheophytin (ug/L)	8	0	2.00	11.00	4.13	1.27	0.30	

Piney Creek at FM 1987- Station 16081

SEGMENT 0604D - PINEY CREEK

Piney Creek at FM 358

Monitoring Station 16096 - Piney Creek at FM 358

Monitoring Station 16096 is located on Piney Creek at the FM 358 crossing in assessment unit 0604D_02. This station is monitored quarterly by ANRA personnel for field parameters, conventional parameters, flow and *E. coli* bacteria.

Statistical analysis shows significant decreasing trends for Dissolved Oxygen and Sulfate.

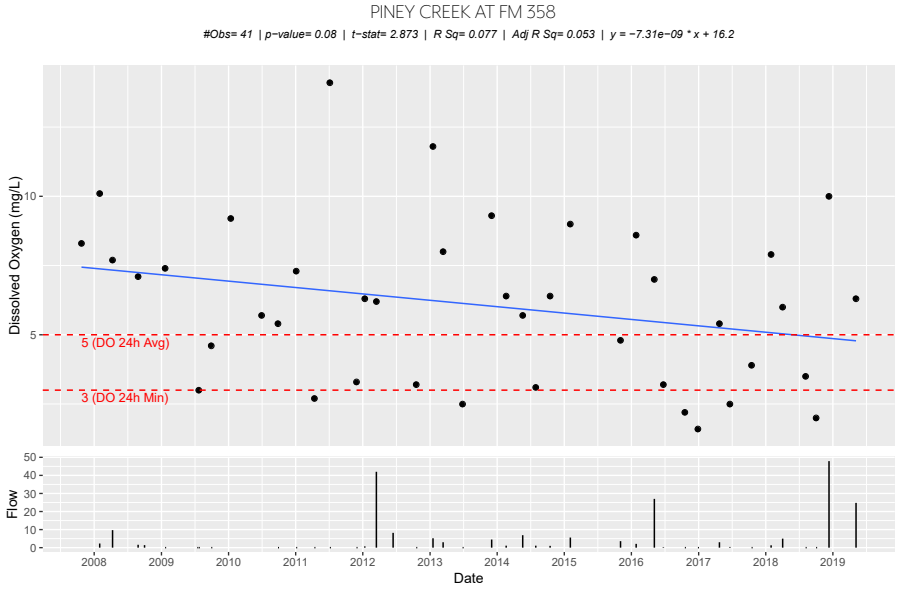
This assessment unit is listed in the 2020 Texas Integrated Report as impaired for *E. coli* bacteria. There is also a concern for screening level listed for depressed Dissolved Oxygen in water.

Water Quality Monitoring Results for Station 16096

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	44	26	2.00	2000.00	96.44	-0.77	0.26	
Water Temperature (C)	43	0	4.60	29.00	17.43	0.63	0.50	
Dissolved Oxygen (mg/L)	41	6	1.60	14.10	6.07	2.87	0.08	↓
pH (S.U.)	43	4	5.60	9.00	6.73	5.65	0.51	
Specific Conductance (us/cm @ 25C)	45	0	65.00	824.00	193.20	1.83	0.31	
Ammonia-Nitrogen (mg/L as N)	45	1	0.10	0.36	0.12	2.51	0.26	
Chloride (mg/L)	45	3	5.00	71.00	21.77	-0.34	0.26	
Sulfate (mg/L)	45	2	5.00	86.90	18.73	2.95	0.03	↓
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	parameter not collected for this station							
Total Phosphorus (mg/L as P)	42	1	0.02	0.87	0.24	0.97	0.78	
Total Suspended Solids (mg/L)	45	0	3.20	72.00	19.25	0.38	0.76	
Nitrate (Total) (mg/L)	14	0	0.05	0.13	0.07	-0.43	0.53	
Nitrite (Total) (mg/L)	13	0	0.05	0.05	0.05	1.41E+15	0.03	
Nitrate + Nitrite (mg/L as N)	45	0	0.04	0.54	0.09	-1.49	0.04	
Chlorophyll-*a* (ug/L)	44	10	2.00	727.00	29.56	0.87	0.47	
Pheophytin (ug/L)	44	0	1.20	122.00	8.48	0.81	0.56	

Flowers at Piney Creek at FM 358

SEGMENT 0604D - PINEY CREEK



Beaver Dam-Piney Creek at FM 358

SEGMENT 0604D - PINEY CREEK

SUMMARY OF WATER QUALITY TRENDS

Trend Analysis Summary for Segment 0604D - Piney Creek

AU	Station ID	Station Description	*E. coli*	Temp	DO	pH	Spec Cond	NH3	Cl	SO4	TKN	Total P	TSS	NO3	NO2	NO3/ NO2	Chl-*a*	Pheo
0604D_01	16081	Piney Creek at FM 1987	*- No trends identified for this Assessment Unit -*															
0604D_02	16096	Piney Creek at FM 358 East Of Pennington			↓					↓								

↑ = Statistically significant increasing trend ↓ = Statistically significant decreasing trend

Water Quality Issues Summary for Segment 0604D - Piney Creek

Water Quality Issue	Affected Area	Possible Influences/Causes	Possible Effects	Possible Solutions / Actions Taken
Depressed Dissolved Oxygen	0604D_01- Impairment 0604D_02- Concern	• Municipal wastewater discharge • Nonpoint sources of pollution • Aquatic vegetation • Nutrient loading into the water body • Low flow • Intermittent nature of water body	• Detrimental effect on aquatic biological community	• Continue monitoring • Conduct 24-hour DO measurements
Impairment for *E. coli* bacteria	0604D_02	• Municipal wastewater discharge • Nonpoint source pollution • Domestic animals and wildlife • Stormwater runoff	• Water body does not meet the water quality standard for Primary Contact Recreation • Primary Contact Recreation in the water body has an increased risk of gastrointestinal illness	• Continue monitoring
Concern for Ammonia-Nitrogen	0604D_01	• Municipal wastewater discharges • Nonpoint sources of pollution • Stormwater runoff • Domestic animals and wildlife • Improper use of fertilizers	• Detrimental effect on aquatic biological community	• Continue monitoring
Concern for Chlorophyll-*a*	0604D_02	• Nonpoint sources of pollution • Stormwater runoff • Improper use of fertilizers	• Aesthetic issues • Effect on dissolved oxygen levels	• Continue monitoring

SEGMENT 0604M - BILOXI CREEK

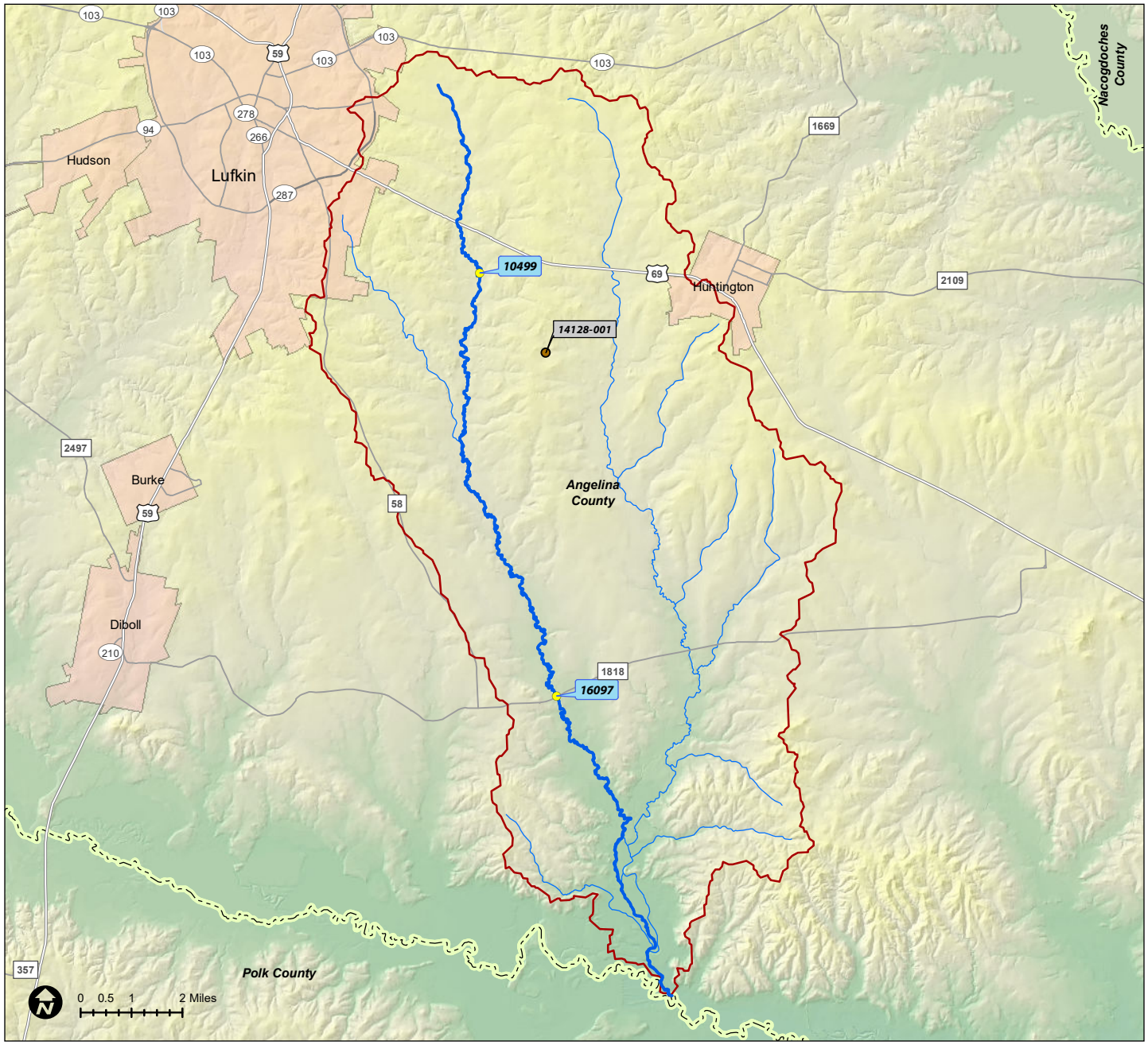
Segment Profile

Biloxi Creek is 28.3 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.

Assessment Unit 0604M_02 is listed in the 2020 Texas Integrated Report with a concern for near non-attainment for *E. coli* bacteria.

Assessment Unit 0604M_03 is listed with impairments for depressed dissolved oxygen and *E. coli* bacteria.

Nutrient concerns are also present in AU 0604M_03, with a concern for Total Phosphorus and for Ammonia-Nitrogen.



ANRA Monitoring Sites
Wastewater Outfalls
Classified Segments
Other Hydrology
Segment Watershed
Counties

SEGMENT 0604M - BILOXI CREEK

Designated Uses

The designated uses for this unclassified segment include contact recreation, high aquatic life use, fish consumption use, public water supply use, and general use.

Assessment Units

AU ID	Description
0604M_02	From the confluence with Neches River (0604) upstream to confluence with One Eye Creek in Angelina County SE of Lufkin
0604M_03	From the confluence with One Eye Creek in Angelina County SE of Lufkin upstream to FM 325 east of Lufkin

Monitoring Stations

Station ID	AU ID	Description	Earliest Data	Latest Data	Notes
16097	0604M_02	BILOXI CREEK AT FM 1818	1997	2019	Monitored continuously since 1997.
10499	0604M_03	BILOXI CREEK AT ANGELINA CR 216	1977	2019	Monitored continuously since 1977.

Assessment Summary *(as listed in the 2020 Texas Integrated Report)*

Parameter	Standard	0604M_02 Assessment	0604M_03 Assessment
Chloride (mg/L)	50		
Sulfate (mg/L)	50		
TDS(mg/L)	200		
DO Grab Screening Level (mg/L)	3	NC	NA
DO Grab Minimum (mg/L)	2	FS	NA
24 Hour DO Average	3		NS
24 Hour DO Minimum	2		NS
pH (SU)	6.0-8.5		
Temp (C)	32.8		
E. coli geomean (MPN/100mL)	126	CN	NS
Ammonia Nitrogen (mg/L)	0.33	NC	CS
Nitrate Nitrogen (mg/L)	1.95	NC	NA
Total Phosphorus (mg/L)	0.69	NC	CS
Chl-*a* (µg/L)	14.1	NC	
Mercury in Edible Tissue			
Dioxin in Edible Tissue			

FS = Fully Supporting NC = No Concern CN = Concern for Near Non-Attainment
CS = Concern for Screening Level NS = Not Supporting NA = Not Assessed

Rattlesnake- Biloxi at Cotton Thompson Rd

SEGMENT 0604M - BILOXI CREEK

Monitoring Station 16097 - Biloxi Creek at FM 1818

Monitoring Station 16097 is located on Biloxi Creek at the FM 1818 crossing. This station is in Assessment Unit 0604M_02. Prior to 2018, this station was monitored 6 times yearly for field parameters, flow and *E. coli* bacteria. Station 16097 is currently monitored quarterly by ANRA personnel for those same parameters in addition to conventional parameters. This station is also monitored for 24 Hour Dissolved Oxygen averages, with 10 planned monitoring events over a two-year span.

Statistical Analysis shows a significant decreasing trend for Total Phosphorus. A statistically significant decreasing trend is also observed for *E. coli* bacteria. There is a significant increasing trend for pH with all observations still between the screening level criteria set for this parameter.

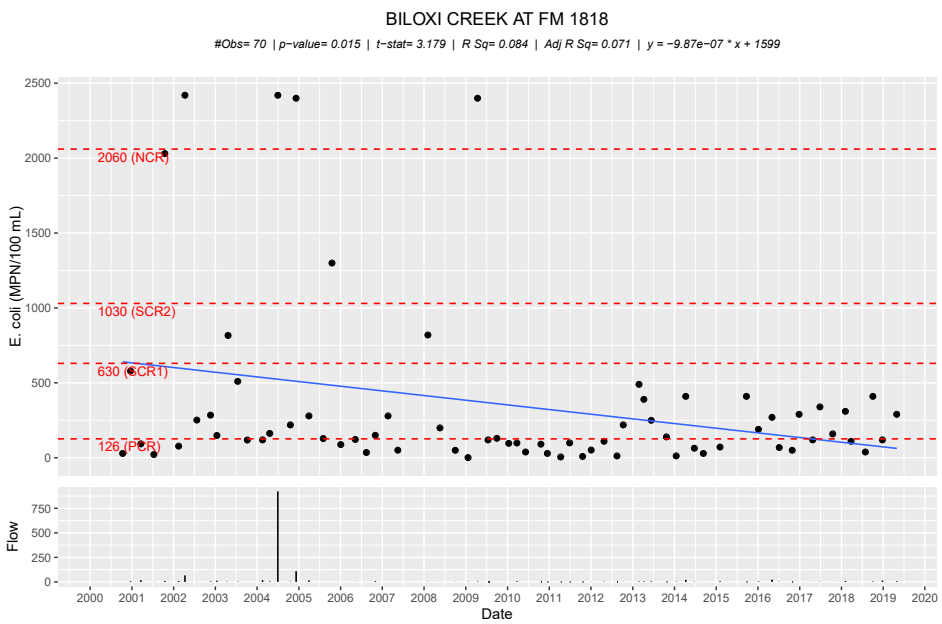
Ammonia-Nitrogen and Nitrate plus Nitrite both have decreasing trends that are not considered significant due to having greater than fifty percent censored data.

This assessment unit is listed in the 2020 Texas Integrated Report with a concern for near non-attainment for bacteria, with 1 out of the 26 total observations exceeding the screening level having a value of 127.69 MPN/100mL. There are no other impairments or concerns listed.

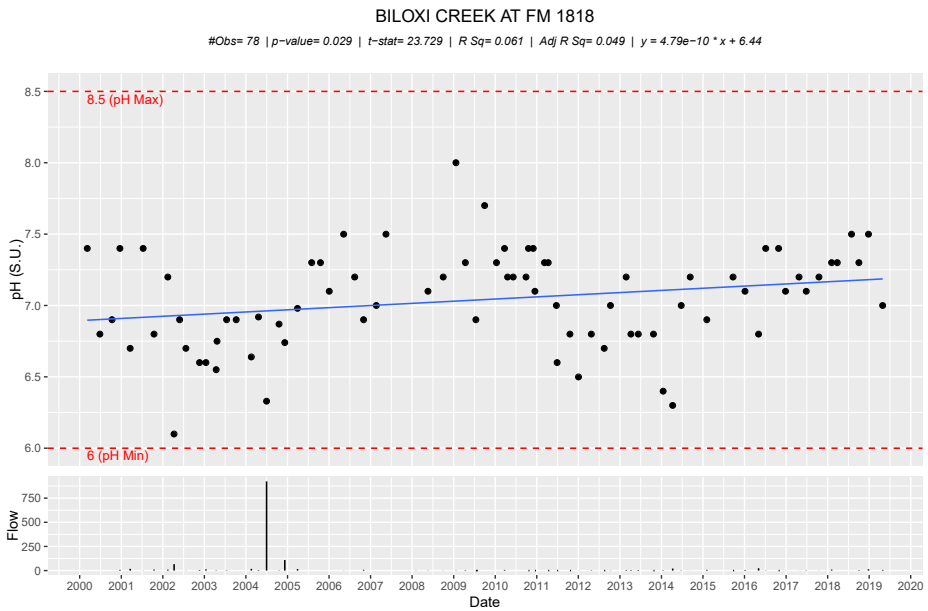
Water Quality Monitoring Results for Station 16097

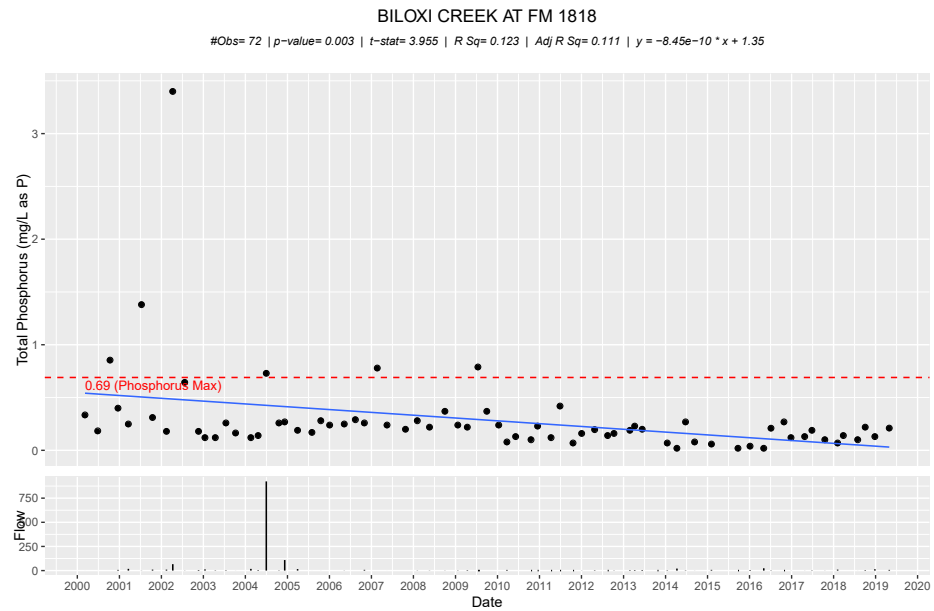
Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	70	36	1.00	2420.00	107.49	3.18	0.01	↓
Water Temperature (C)	78	0	2.40	28.40	17.84	3.07	0.74	
Dissolved Oxygen (mg/L)	77	1	2.10	12.20	7.56	3.17	0.44	
pH (S.U.)	78	0	6.10	8.00	7.04	23.73	0.03	↑
Specific Conductance (us/cm @ 25C)	80	0	101.00	902.00	461.96	2.76	0.88	
Ammonia-Nitrogen (mg/L as N)	72	15	0.01	1.24	0.25	3.47	0.01	
Chloride (mg/L)	73	29	10.00	120.00	50.21	2.83	0.49	
Sulfate (mg/L)	73	65	22.00	260.00	98.18	2.82	0.72	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	parameter not collected for this station							
Total Phosphorus (mg/L as P)	72	6	0.02	3.40	0.29	3.96	0.00	↓
Total Suspended Solids (mg/L)	73	0	2.00	314.00	22.20	1.78	0.25	
Nitrate (Total) (mg/L)	15	0	0.05	0.13	0.07	1.46	0.23	
Nitrite (Total) (mg/L)	15	0	0.05	0.05	0.05	8.07E+14	0.05	
Nitrate + Nitrite (mg/L as N)	73	0	0.04	1.69	0.25	7.17	0.00	
Chlorophyll-*a* (ug/L)	58	5	2.00	54.30	6.90	2.19	0.12	
Pheophytin (ug/L)	50	0	2.00	12.80	3.11	1.99	0.24	

Mussels- Biloxi Creek at FM 1818



SEGMENT 0604M - BILOXI CREEK





SEGMENT 0604M - BILOXI CREEK

Monitoring Station 10499 - Biloxi Creek at CR 216

Monitoring Station 10499 (Biloxi Creek at CR 216) is located in the uppermost assessment unit (AU 0604M_03) of Biloxi Creek. This monitoring station was monitored 6 times per year for field parameters, *E. coli* bacteria, and flow, but is now monitored quarterly by ANRA personnel for field parameters, conventional parameters, flow, and *E. coli* bacteria, as well as being monitored for 24-hour dissolved oxygen levels.

There are no observed trends at this station.

This assessment unit is listed in the 2020 Texas Integrated Report as impaired for bacteria and depressed dissolved oxygen in water. There are also listed concern for screening levels for total phosphorus and ammonia.

Pollution is a significant issue at this station, with numerous discarded tires present. During hunting season, animal carcasses are commonly found by water quality monitoring staff.

10499- Flow measurement, Biloxi at CR 216

Water Quality Monitoring Results for Station 10499

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	65	43	10.00	2500.00	210.10	1.47	0.31	
Water Temperature (C)	48	0	1.80	27.30	16.49	1.97	0.43	
Dissolved Oxygen (mg/L)	51	9	0.30	11.90	5.91	-0.59	0.13	
pH (S.U.)	51	0	6.10	8.20	7.06	7.26	0.15	
Specific Conductance (us/cm @ 25C)	51	0	189.00	1520.00	550.41	1.60	0.49	
Ammonia-Nitrogen (mg/L as N)	8	1	0.10	0.71	0.18	56.89	0.00	
Chloride (mg/L)	8	4	18.00	89.70	49.61	-0.06	0.68	
Sulfate (mg/L)	8	6	30.00	209.00	109.14	0.03	0.77	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	parameter not collected for this station							
Total Phosphorus (mg/L as P)	8	2	0.14	2.70	0.81	-0.31	0.66	
Total Suspended Solids (mg/L)	8	0	5.30	35.00	14.32	-0.44	0.49	
Nitrate (Total) (mg/L)	4	0	0.05	0.33	0.13	4.94	0.04	
Nitrite (Total) (mg/L)	4	0	0.05	0.05	0.05	NA	NA	
Nitrate + Nitrite (mg/L as N)	8	0	0.04	0.38	0.16	-0.80	0.29	
Chlorophyll-*a* (ug/L)	1	0	not enough data to determine					
Pheophytin (ug/L)	1	0	not enough data to determine					

SEGMENT 0604M - BILOXI CREEK

SUMMARY OF WATER QUALITY TRENDS

Trend Analysis Summary for Segment 0604M - Biloxi Creek

AU	Station ID	Station Description	*E. coli*	Temp	DO	pH	Spec Cond	NH3	Cl	SO4	TKN	Total P	TSS	NO3	NO2	NO3/ NO2	Chl-*a*	Pheo
0604M_02	16097	Biloxi Creek at FM 1818	↓			↑						↓						
0604M_03	10499	Biloxi Creek at Angelina CR 216	*- No trends identified for this Assessment Unit -*															

↑ = Statistically significant increasing trend ↓ = Statistically significant decreasing trend

Water Quality Issues Summary for Segment 0604M - Biloxi Creek

Water Quality Issue	Affected Area	Possible Influences/Causes	Possible Effects	Possible Solutions / Actions Taken
Impairment for *E. coli* bacteria	0604M_02- Concern 0604M_03- Impairment	• Nonpoint sources of pollution • Stormwater runoff • Domestic animals and wildlife • Illegal dumping	• Water body does not meet the water quality standard for Primary Contact Recreation • Primary Contact Recreation in the water body has an increased risk of gastrointestinal illness	• Continue monitoring
Depressed dissolved oxygen	0604M_03	• Nonpoint sources of pollution • Aquatic vegetation • Nutrient loading into the water body • Low flow	• Detrimental effect on aquatic biological community	• Continue monitoring • Conduct 24-hour DO measurements
Concern for Ammonia-Nitrogen	0604M_03	• Nonpoint sources of pollution • Stormwater runoff • Domestic animals and wildlife • Improper use of fertilizers • Illegal dumping	• Detrimental effect on aquatic biological community	• Continue monitoring
Concern for Total Phosphorus	0604M_03	• Nonpoint sources of pollution • Stormwater runoff • Domestic animals and wildlife • Improper use of fertilizers • Illegal dumping	• Aesthetic issues • Effect on dissolved oxygen levels	• Continue monitoring

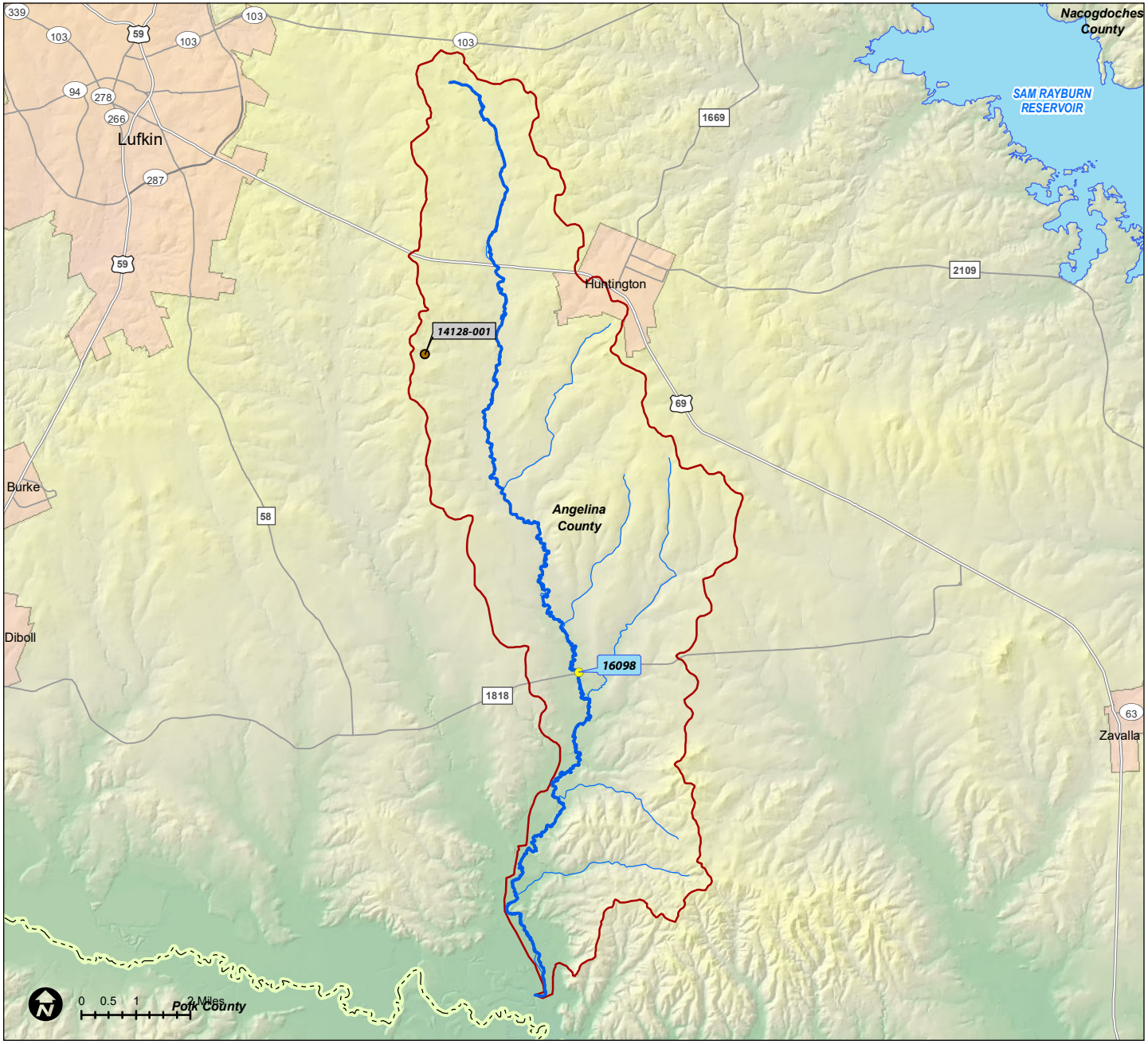
SEGMENT 0604N - BUCK CREEK

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.

The City of Huntington's wastewater treatment facility discharges to Buck Creek. There is also an industrial wastewater treatment facility that discharges to this segment.

There are no impairments or concerns listed for Buck Creek in the 2020 Texas Integrated Report.



ANRA Monitoring Sites
Wastewater Outfalls
Classified Segments
Other Hydrology
Segment Watershed
Counties

SEGMENT 0604N - BUCK CREEK

Designated Uses

The designated uses for this unclassified segment include contact recreation, high aquatic life use, fish consumption use, public water supply use, and general use.

Assessment Units

AU ID	Description
0604N_01	From the confluence with Biloxi Creek (0604M) upstream to the confluence with Graham Creek (0604E) SW of City of Huntington at NHD RC 12020002000417
0604N_02	From the confluence with Graham Creek (0604E) SW of City of Huntington upstream to 0.23km south of Old Ewing Rd east of Lufkin at NHD RC 12020002000418

Monitoring Stations

Station ID	AU ID	Description	Earliest Data	Latest Data	Notes
16098	0604N_01	BUCK CREEK AT FM 1818	1997	2019	Monitored continuously since 1997.

Assessment Summary *(as listed in the 2020 Texas Integrated Report)*

Parameter	Standard	0604N_01 Assessment
Chloride (mg/L)	50	
Sulfate (mg/L)	50	
TDS(mg/L)	200	
DO Grab Screening Level (mg/L)	5	
DO Grab Minimum (mg/L)	3	
24 Hour DO Average		
24 Hour DO Minimum		
pH (SU)	6.0-8.5	
Temp (C)	32.8	
E. coli geomean (MPN/100mL)	126	FS
Ammonia Nitrogen (mg/L)	0.33	NC
Nitrate Nitrogen (mg/L)	1.95	NC
Total Phosphorus (mg/L)	0.69	NC
Chl-*a* (µg/L)	14.1	NC
Mercury in Edible Tissue		
Dioxin in Edible Tissue		

FS = Fully Supporting NC = No Concern CN = Concern for Near Non-Attainment
CS = Concern for Screening Level NS = Not Supporting NA = Not Assessed

Buck Creek at FM 1818

SEGMENT 0604N - BUCK CREEK

Monitoring Station 16098 - Buck Creek at FM 1818

Monitoring Station 16098 is located on Buck Creek at the FM 1818 crossing. Sampling at this station is conducted quarterly by ANRA personnel, who monitor for field parameters, conventional parameters, flow, and *E. coli* bacteria. It is located in assessment unit 0604N_01.

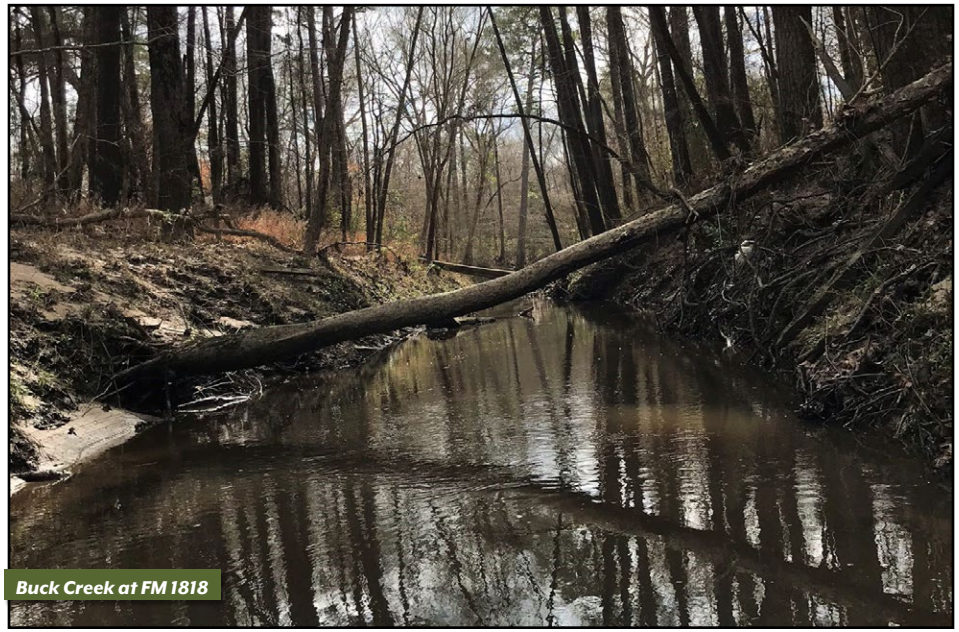
This site on Buck Creek at FM 1818 is used frequently for illegal dumping.

Analysis shows a significant decreasing trend for Total Phosphorus. Decreasing trends for Ammonia-Nitrogen and Nitrate plus Nitrite were identified; however, these trends are not considered to be statistically significant due to having greater than fifty-percent censored data. Pheophytin, and Chlorophyll-*a* also show decreasing trends that are not considered statistically significant because they are influenced by a change in LOQ.

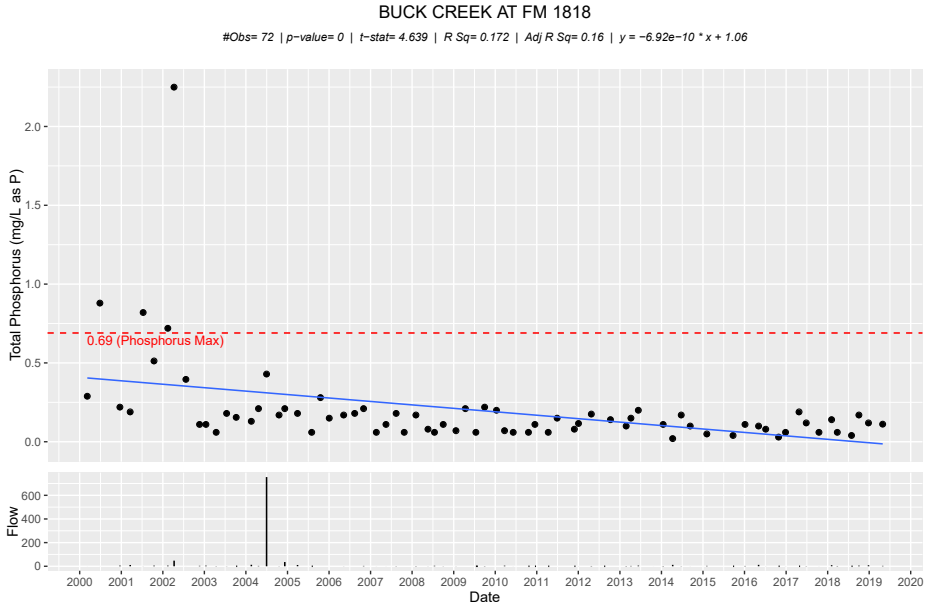
There are no impairments or concerns listed for this assessment unit in the 2020 Texas Integrated Report.

Water Quality Monitoring Results for Station 16098

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	70	28	1.00	2419.60	71.77	1.32	0.44	
Water Temperature (C)	78	0	1.50	28.30	17.71	3.34	0.91	
Dissolved Oxygen (mg/L)	78	3	0.80	13.00	7.67	3.45	0.76	
pH (S.U.)	78	3	4.70	7.80	6.92	16.42	0.82	
Specific Conductance (us/cm @ 25C)	80	0	104.00	4660.00	682.73	-0.32	0.13	
Ammonia-Nitrogen (mg/L as N)	73	14	0.01	1.29	0.24	3.45	0.01	
Chloride (mg/L)	73	36	10.00	440.00	70.91	-0.36	0.11	
Sulfate (mg/L)	73	60	13.00	1060.00	157.98	-0.68	0.08	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	parameter not collected for this station							
Total Phosphorus (mg/L as P)	72	4	0.02	2.25	0.20	4.64	0.00	↓
Total Suspended Solids (mg/L)	73	0	1.00	172.00	18.35	2.24	0.12	
Nitrate (Total) (mg/L)	15	0	0.05	0.17	0.07	0.89	0.47	
Nitrite (Total) (mg/L)	15	0	0.05	0.05	0.05	8.07E+14	0.05	
Nitrate + Nitrite (mg/L as N)	73	1	0.04	2.59	0.24	5.30	0.00	
Chlorophyll-*a* (ug/L)	59	1	2.00	16.20	4.35	5.36	0.00	
Pheophytin (ug/L)	51	0	2.00	5.45	2.46	3.84	0.06	



Buck Creek at FM 1818



SEGMENT 0604N - BUCK CREEK

SUMMARY OF WATER QUALITY TRENDS

Trend Analysis Summary for Segment 0604N - Buck Creek

AU	Station ID	Station Description	*E. coli*	Temp	DO	pH	Spec Cond	NH3	Cl	SO4	TKN	Total P	TSS	NO3	NO2	NO3/ NO2	Chl-*a*	Pheo
0604N_01	16098	Buck Creek at FM 1818										↓						

↑ = Statistically significant increasing trend ↓ = Statistically significant decreasing trend

Summary of Water Quality Issues for Segment 0604N- Buck Creek

There are no water quality impairments or concerns listed for segment 0604N- Buck Creek in the 2020 Texas Integrated Report.

Buck Creek at FM 1818

SEGMENT 0604T - LAKE RATCLIFF

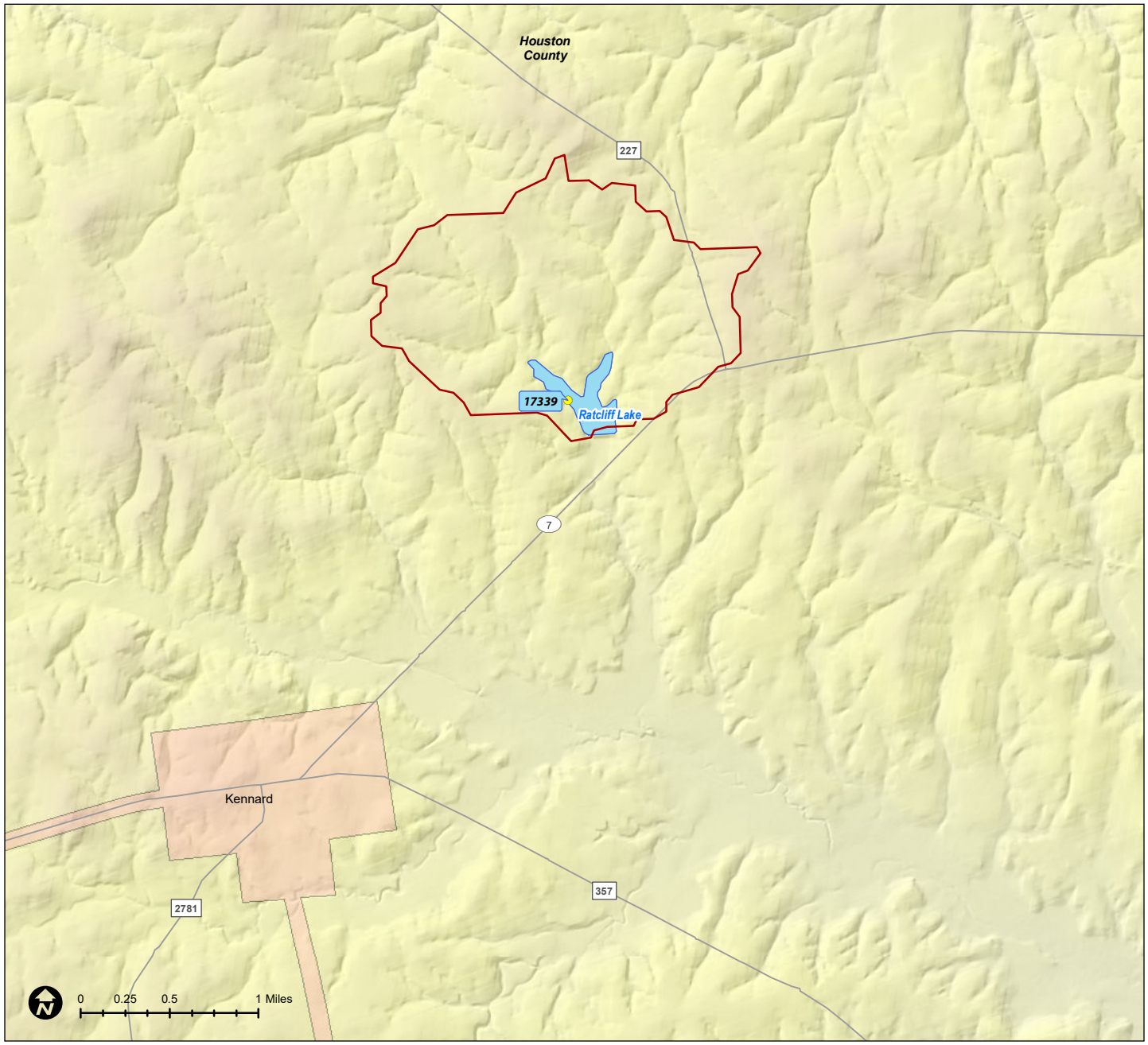
Segment Profile

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.

Lake Ratcliff is listed in the 2020 Texas Integrated Report with an impairment for Mercury in edible tissue.

A Fish Consumption Advisory (ADV-23) was issued for this water body by the Texas Department of Health and Safety (DSHS) in May of 2002. See page 306 for further details.

No other impairments or concerns were identified for this water body.



- ANRA Monitoring Sites
- Wastewater Outfalls
- Classified Segments
- Other Hydrology
- Segment Watershed
- Counties

SEGMENT 0604T - LAKE RATCLIFF

Designated Uses

The designated uses for this unclassified segment include contact recreation, high aquatic life use, fish consumption use, public water supply use, and general use.

Assessment Units

AU ID	Description
0604T_01	Entire lake

Monitoring Stations

Station ID	AU ID	Description	Earliest Data	Latest Data	Notes
17339	0604T_01	LAKE RATCLIFF NORTHWEST ARM	2010	2019	Monitored in 2000 and began again in 2009.

Assessment Summary *(as listed in the 2020 Texas Integrated Report)*

Parameter	Standard	0604T_01 Assessment
Chloride (mg/L)	50	
Sulfate (mg/L)	50	
TDS(mg/L)	200	
DO Grab Screening Level (mg/L)	5	NC
DO Grab Minimum (mg/L)	3	FS
24 Hour DO Average		
24 Hour DO Minimum		
pH (SU)	6.0-8.5	
Temp (C)	32.8	
E. coli geomean (MPN/100mL)	126	FS
Ammonia Nitrogen (mg/L)	0.11	NA
Nitrate Nitrogen (mg/L)	0.37	NA
Total Phosphorus (mg/L)	0.2	NA
Chl-*a* (µg/L)	26.7	NA
Mercury in Edible Tissue		NS
Dioxin in Edible Tissue		

FS = Fully Supporting NC = No Concern CN = Concern for Near Non-Attainment
CS = Concern for Screening Level NS = Not Supporting NA = Not Assessed

Lake Ratcliff

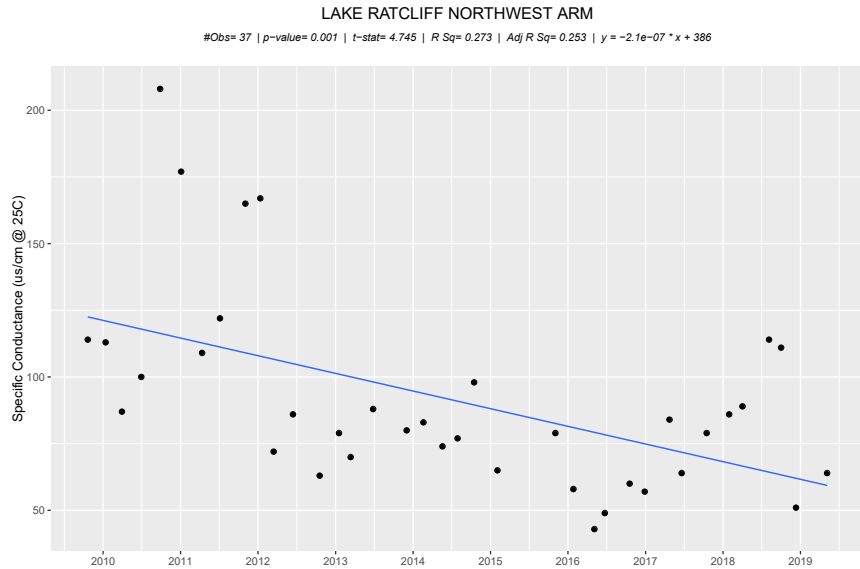
SEGMENT 0604T - LAKE RATCLIFF

Monitoring Station 17339 - Lake Ratcliff Northwest Arm

Monitoring Station 17339 is located on Lake Ratcliff where the northwest arm joins the main body of the lake. This station is monitored quarterly by ANRA for conventional parameters, field parameters and *E. coli* bacteria. This monitoring station was added in FY 2010 in assessment unit 0604T_01.

Analysis shows significant decreasing trends for Specific Conductance and Sulfate and a significant increasing trend for Total Suspended Solids. The decreasing trend identified for Ammonia-Nitrogen is not considered statistically significant due to having greater than fifty-percent censored values.

This assessment unit is listed on the 2020 Texas Integrated Report as impaired for Mercury in edible tissue. There are no other impairments or concerns listed.

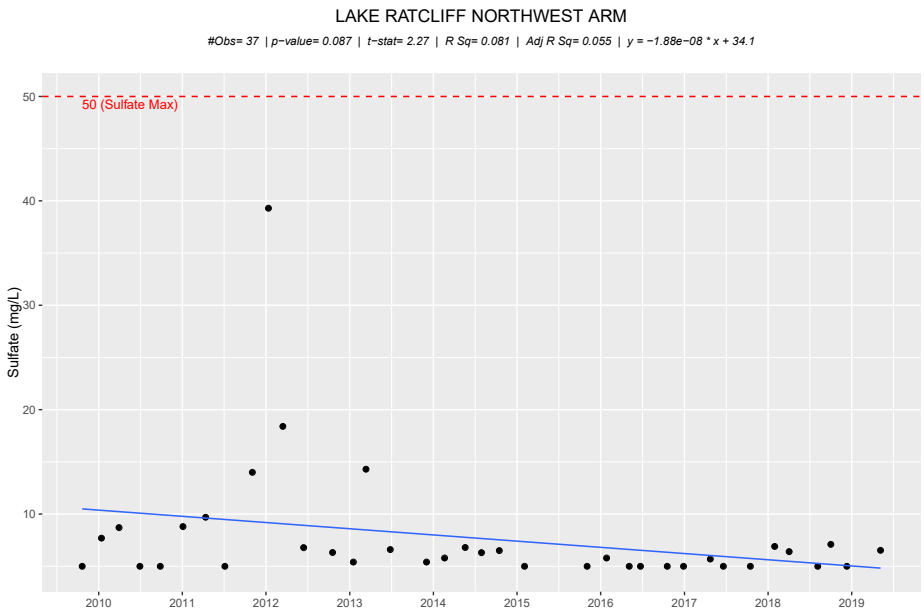


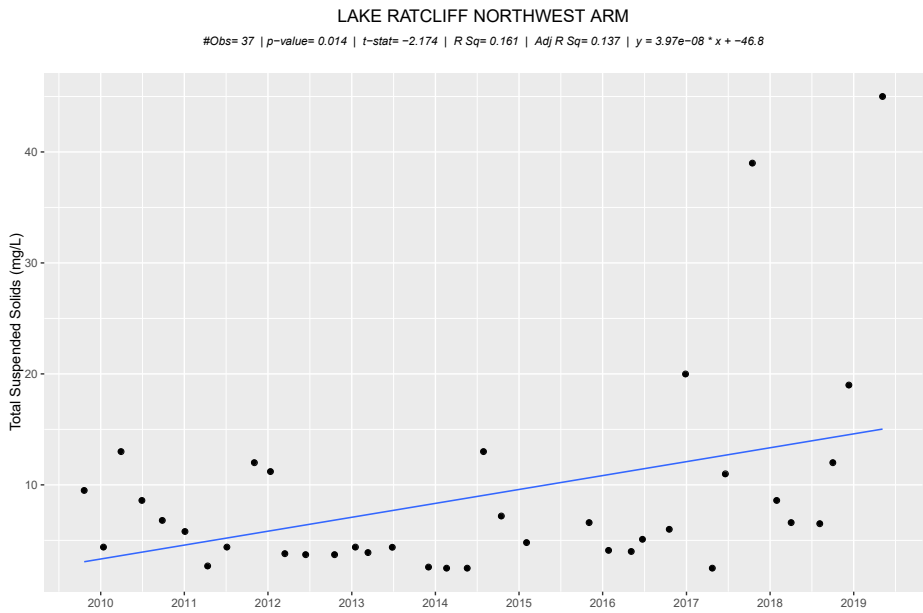
Lake Ratcliff

Water Quality Monitoring Results for Station 17339

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	37	2	1.00	2400.00	5.06	-1.75	0.07	
Water Temperature (C)	35	0	8.20	32.50	21.15	0.00	0.26	
Dissolved Oxygen (mg/L)	35	0	3.60	13.40	7.81	1.64	0.81	
pH (S.U.)	37	1	5.90	8.10	7.16	4.76	0.93	
Specific Conductance (us/cm @ 25C)	37	0	43.00	208.00	91.49	4.75	0.00	↓
Ammonia-Nitrogen (mg/L as N)	37	3	0.10	0.32	0.11	2.92	0.08	
Chloride (mg/L)	37	0	4.25	18.00	8.25	1.95	0.33	
Sulfate (mg/L)	37	0	5.00	39.30	7.71	2.27	0.09	↓
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	parameter not collected for this station							
Total Phosphorus (mg/L as P)	34	0	0.02	0.20	0.06	-0.18	0.41	
Total Suspended Solids (mg/L)	37	0	2.50	45.00	8.94	-2.17	0.01	↑
Nitrate (Total) (mg/L)	14	0	0.05	0.14	0.06	3.22	0.01	
Nitrite (Total) (mg/L)	13	0	0.05	0.05	0.05	1.41E+15	0.03	
Nitrate + Nitrite (mg/L as N)	37	0	0.03	0.19	0.08	-0.91	0.10	
Chlorophyll-*a* (ug/L)	37	5	2.00	44.80	13.19	1.52	0.30	
Pheophytin (ug/L)	37	0	2.00	19.00	4.19	-0.22	0.50	

SEGMENT 0604T - LAKE RATCLIFF





SUMMARY OF WATER QUALITY TRENDS

Trend Analysis Summary for Segment 0604T - Lake Ratcliff

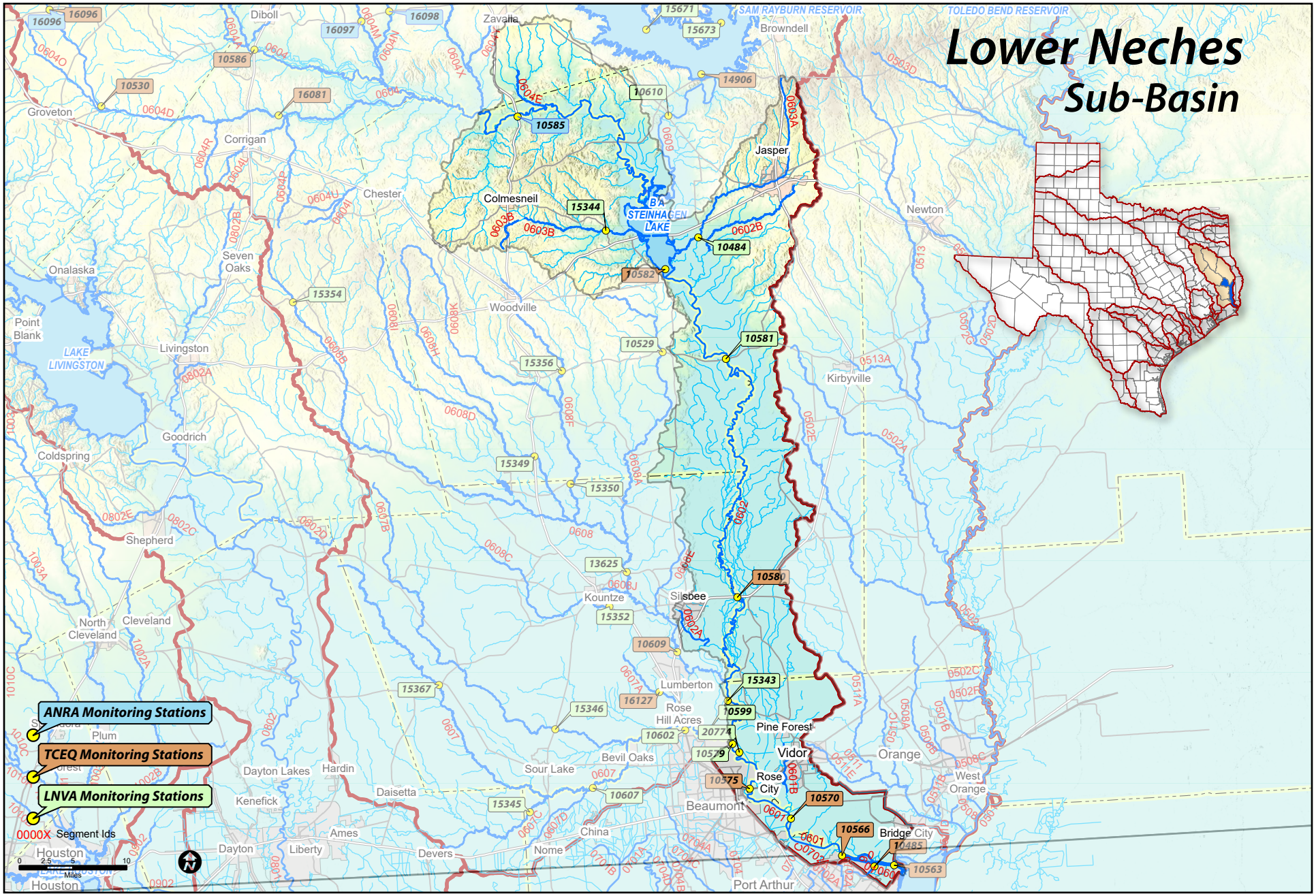
AU	Station ID	Station Description	*E. coli*	Temp	DO	pH	Spec Cond	NH3	Cl	SO4	TKN	Total P	TSS	NO3	NO2	NO3/ NO2	Chl-*a*	Pheo
0604T_01	17339	Lake Ratcliff Northwest Arm					↓			↓			↑					

↑ = Statistically significant increasing trend ↓ = Statistically significant decreasing trend

Water Quality Issues Summary for Segment 0604T - Lake Ratcliff

Water Quality Issue	Affected Area	Possible Influences/Causes	Possible Effects	Possible Solutions / Actions Taken
Mercury in Edible Tissue	Entire Lake	• Atmospheric deposition from coal-fired power plants, large boilers and heaters, steel production, and incinerators	• The Texas DSHS has concluded that consuming fish from this water body poses an apparent hazard to public health	• A comprehensive Fish Consumption Advisory issued by the Texas DSHS recommends consumption advice for largemouth bass • ADV-23 issued on May 10, 2002

LOWER NECHES OVERVIEW MAP



PROFILE OF THE LOWER NECHES SUB-BASIN

Clean Rivers Program 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.

Neches River at US 69

Segments in the Lower Neches Sub-Basin

Segment ID	Segment Name
0604	Neches River Below Lake Palestine

Permitted Discharges in the Lower Neches Sub-Basin

A total of eighty-five permitted discharges are within the Lower Neches sub-basin, but only one in the area of interest for this report. See LNVA's Basin Summary Report for details about others.

Permitted Discharges in the Lower Neches Sub-Basin

First Segment in Drainage Path	Segment ID as identified in Permit	Permit Number	Outfall Number	NPDES Number	Permittee	County	TCEQ Region
0604	0604	11295-001	001	100692	CITY OF COLMESNEIL	Tyler	10 - Beaumont

Texas Surface Water Quality Standards for the Lower Neches Sub-Basin

Site-Specific Uses and Numeric Criteria for Classified Segments in the Lower Neches Sub-Basin

Segment ID	Segment Name	Recreation	Aquatic Life	Domestic Water Supply	Other	Chloride (mg/L)	Sulfate (mg/L)	TDS (mg/L)	Dissolved Oxygen (mg/L	pH Range (S.U.)	*E. coli* Bacteria #/100 mL	Temp (°F)
0604	Neches River Below Lake Palestine	PCR	H	PS		50	50	200	5.0	6.0 - 8.5	126	91

PCR = Primary Contact Recreation SCR1 = Secondary Contact Recreation 1 SCR2 = Secondary Contact Recreation 2 NCR = Noncontact Recreation

H = High Aquatic Life Use I = Intermediate Aquatic Life Use PS = Public Supply

* The criteria for Chloride, Sulfate, and TDS are listed as the maximum annual averages for the segment. Dissolved Oxygen criteria are listed as minimum 24-hour means at any site within the segment. The pH criteria are listed as minimum and maximum values expressed in standard units at any site within the segment. The criteria for Temperature are listed as maximum values at any site within the segment

SEGMENT 0604 - NECHES RIVER BELOW LAKE PALESTINE (LOWER NECHES SUB-BASIN PORTION)

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.

Assessment unit 0604_01 is listed in the 2020 Texas Integrated Report as impaired for Dioxin in edible tissue and Mercury in edible tissue.

An ADV-51 Fish Consumption Advisory has been issued for this water body. See page 305 for more further details.

No other impairments or concerns have been identified for this portion of the segment.

ANRA Monitoring Sites
Wastewater Outfalls
Classified Segments
Other Hydrology
Segment Watershed
Counties

SEGMENT 0604 - NECHES RIVER BELOW LAKE PALESTINE (LOWER NECHES SUB-BASIN PORTION)

Designated Uses

The designated uses for this segment include contact recreation, high aquatic life use, fish consumption use, public water supply use, and general use.

Assessment Units

AU ID	Description
0604_01	Lower boundary to a point immediately upstream of confluence of Biloxi Creek 0604M at NHD RC 12020002001061

Monitoring Stations

Station ID	AU ID	Description	Earliest Data	Latest Data	Notes
10585	0604_01	NECHES RIVER AT US 69	1969	2019	Monitored 1969-1978, 1981- present.

Assessment Summary *(as listed in the 2020 Texas Integrated Report)*

Parameter	Standard	0604_01 Assessment
Chloride (mg/L)	50	
Sulfate (mg/L)	50	
TDS (mg/L)	200	
DO Grab Screening Level (mg/L)	5	NC
DO Grab Minimum (mg/L)	3	FS
24 Hour DO Average (mg/L)		
24 Hour DO Minimum (mg/L)		
pH(SU)	6.0 - 8.5	FS
Temp (C)	32.8	FS
E. coli geomean (MPN/100L)	126	FS
Ammonia Nitrogen (mg/L)	0.33	NC
Nitrate Nitrogen (mg/L)	1.95	NC
Total Phosphorus (mg/L)	0.69	NC
Chl-*a* (µg/L)	14.1	NC
Mercury in Edible Tissue		NS
Dioxin in Edible Tissue		NS

FS = Fully Supporting NC = No Concern CN = Concern for Near Non-Attainment
CS = Concern for Screening Level NS = Not Supporting NA = Not Assessed

Neches River at US 69

SEGMENT 0604 - NECHES RIVER BELOW LAKE PALESTINE (LOWER NECHES SUB-BASIN PORTION)

Monitoring Station 10585- Neches River at US 69

Located in AU 0604_01, Monitoring Station ID 10585 is monitored quarterly for field and conventional parameters, flow, and *E. coli* bacteria. This monitoring station is the only station monitored by ANRA in the Lower Neches Sub-Basin.

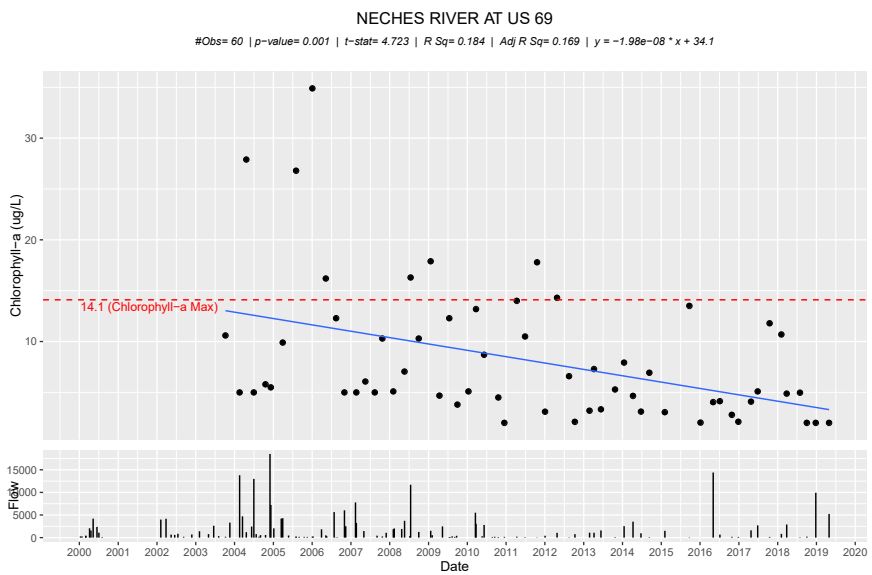
There is a decreasing trend for Ammonia-Nitrogen observed at this monitoring station. Numerous elevated values were reported prior to 2008, but since that time, most results are at or below the limit of quantitation. This trend is not considered statistically significant due to greater than 50% of observed values being censored values.

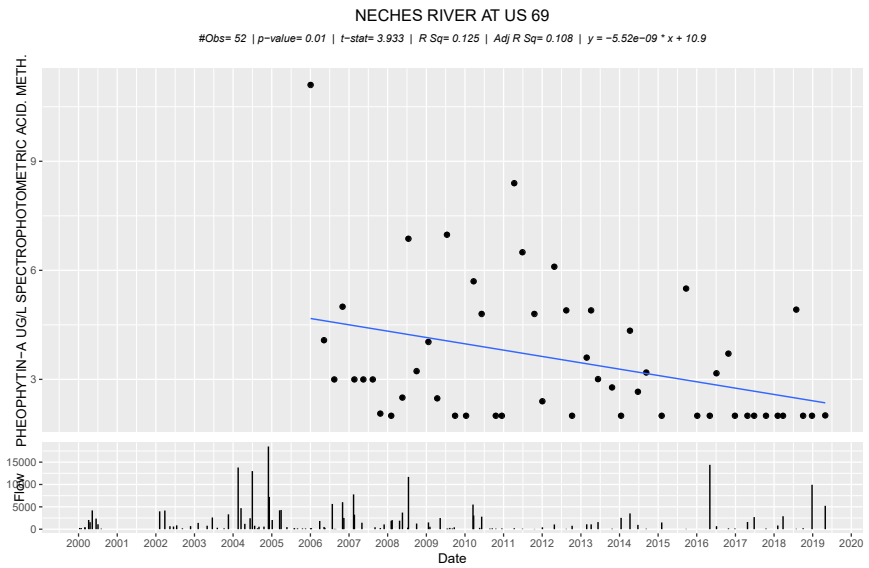
There are statistically significant decreasing trends for Chlorophyll-*a* and Pheophytin at this station.

This assessment unit is listed in the 2020 Texas Integrated Report as impaired for Dioxin in edible tissue and Mercury in edible tissue. No other impairments or concerns have been identified for this assessment unit.

Water Quality Monitoring Results for Station 10585

Parameter	Number of Samples	Number of Exceedances	MIN	MAX	Mean/ Geomean	t_stat	p_value	Trend
E. coli (MPN/100 mL)	60	14	2.00	2400.00	6.98	1.51	0.25	
Water Temperature (C)	115	0	5.00	32.20	21.17	4.62	0.63	
Dissolved Oxygen (mg/L)	109	0	4.60	12.90	7.57	6.82	0.84	
pH (S.U.)	111	3	5.86	8.70	7.09	17.02	0.23	
Specific Conductance (us/cm @ 25C)	104	0	5.00	356.00	209.13	4.50	0.93	
Ammonia-Nitrogen (mg/L as N)	61	15	0.10	1.58	0.28	6.99	0.00	
Chloride (mg/L)	99	1	2.19	54.50	25.38	3.63	0.93	
Sulfate (mg/L)	99	2	1.63	87.50	28.79	2.54	0.46	
TKN (Total Kjeldahl Nitrogen) (mg/L as N)	parameter not collected for this station							
Total Phosphorus (mg/L as P)	59	2	0.02	1.90	0.18	1.88	0.18	
Total Suspended Solids (mg/L)	72	0	6.00	118.00	30.15	2.43	0.50	
Nitrate (Total) (mg/L)	15	0	0.05	0.54	0.16	0.78	0.51	
Nitrite (Total) (mg/L)	15	0	0.05	0.05	0.05	8.07+14	0.05	
Nitrate + Nitrite (mg/L as N)	70	0	0.04	0.59	0.17	0.87	0.71	
Chlorophyll-*a* (ug/L)	60	8	2.00	34.90	8.19	4.72	0.00	↓
Pheophytin (ug/L)	52	0	2.00	11.10	3.53	3.93	0.01	↓





SEGMENT 0604 - NECHES RIVER BELOW LAKE PALESTINE (LOWER NECHES SUB-BASIN PORTION)

SUMMARY OF WATER QUALITY TRENDS

Trend Analysis Summary for Segment 0604 - Neches River Below Lake Palestine (Lower Neches Sub-Basin Portion)

AU	Station ID	Station Description	*E. coli*	Temp	DO	pH	Spec Cond	NH3	Cl	SO4	TKN	Total P	TSS	NO3	NO2	NO3/ NO2	Chl-*a*	Pheo
0604_01	10585	Neches River at US 69															↓	↓

↑ = Statistically significant increasing trend ↓ = Statistically significant decreasing trend

Water Quality Issues Summary for Segment 0604 - Neches River Below Lake Palestine (Lower Neches Sub-Basin Portion)

Water Quality Issue	Affected Area	Possible Influences/Causes	Possible Effects	Possible Solutions / Actions Taken
Dioxin in Edible Tissue	The Neches River (Segment 0604) and all contiguous waters from the SH 7 bridge west of Lufkin, TX downstream to the US 96 bridge near Evadale, TX including B.A. Steinhagen Reservoir and Sam Rayburn Reservoir	• Pulp and paper bleaching processes	• The Texas DSHS has concluded that consuming fish from this water body poses an apparent hazard to public health	• A comprehensive Fish Consumption Advisory issued by the Texas DSHS recommends consumption advice for six species of fish • ADV-51 issued on January 24, 2014
Mercury in Edible Tissue	The Neches River (Segment 0604) and all contiguous waters from the SH 7 bridge west of Lufkin, TX downstream to the US 96 bridge near Evadale, TX including B.A. Steinhagen Reservoir and Sam Rayburn Reservoir	• Atmospheric deposition from coal-fired power plants, large boilers and heaters, steel production, and incinerators	• The Texas DSHS has concluded that consuming fish from this water body poses an apparent hazard to public health	• A comprehensive Fish Consumption Advisory issued by the Texas DSHS recommends consumption advice for six species of fish • ADV-51 issued on January 24, 2014

Neches River at US 69

RECOMMENDATIONS & CONCLUSIONS

Mussels- Biloxi Creek FM 1818

BASIN-WIDE WATER QUALITY FINDINGS

Impairments and Concerns

Bacterial Impairments

Bacterial impairments are the most common reason for water bodies in the upper and middle portions of the Neches River Basin to be listed on the 303(d) List. Three classified segments (Neches River Above Lake Palestine, Angelina River Above Sam Rayburn Reservoir, and Attoyac Bayou) have a bacterial impairment listed in the 2020 Texas Integrated Report. Additionally, fourteen unclassified segments have impairments or concerns for *E. coli* bacteria.

Depressed Dissolved Oxygen

Depressed Dissolved Oxygen levels were common in the basin, apparent in two of the classified segments and five of the unclassified segments These impairments and concerns are most likely due to a combination of low flows and elevated nutrient levels

Concerns for Nutrient Levels

Numerous segments had concerns for nutrients, particularly Ammonia, Nitrate and Total Phosphorus. Classified segments had concerns for Chlorophyll-a (0604), Nitrate (0606) and Total Phosphorus (0606 and 0611)

Mercury and Dioxin in Edible Fish Tissue

Fish advisories issued by the Texas Department of State Health Services (DSHS) cover several water bodies in the Neches Basin. Lake Ratcliff has a fish consumption advisory due to mercury, while an advisory for mercury and dioxin covers the Neches River Below Lake Palestine, Sam Rayburn Reservoir, and B.A. Steinhagen. On connected water bodies not explicitly mentioned in the advisory, but where fish could be reasonably expected to travel from listed areas, we recommend following the recommendations in the advisory.

Impairments and Concerns in the Upper Neches Basin

(as listed in the 2020 Texas Integrated Report)

Segment ID	Segment Name	Impairment(s)	Concern(s)
0604	**Neches River Below Lake Palestine**	Mercury in Edible Tissue, Dioxin in Edible Tissue	Chlorophyll-a
0604A	Cedar Creek	Bacteria (recreation use), Depressed dissolved oxygen	Bacteria (recreation use),Depressed dissolved oxygen, Nitrate, Total Phosphorus
0604B	Hurricane Creek	Bacteria (recreation use)	Bacteria (recreation use)
0604C	Jack Creek	Bacteria (recreation use)	Total Phosphorus
0604D	Piney Creek	Bacteria (recreation use), Depressed dissolved oxygen	Ammonia, Depressed dissolved oxygen
0604M	Biloxi Creek	Bacteria (recreation use), Depressed dissolved oxygen	Ammonia, Bacteria (recreation use), Total Phosphorus
0604N	Buck Creek	No impairments	No concerns
0604T	Lake Ratcliff	Mercury in edible tissue	No Concerns
0605	**Lake Palestine**	pH	Manganese in sediment
0605A	Kickapoo Creek	Bacteria (recreation use), Depressed dissolved oxygen	No Concerns
0605F	Lake Athens	No Impairments	No Concerns
0606	**Neches River Above Lake Palestine**	Bacteria (recreation use), Depressed dissolved oxygen	Depressed dissolved oxygen, Nitrate, Total Phosphorus, Zinc in water
0606A	Prairie Creek	Bacteria (recreation use)	Ammonia, Nitrate
0606D	Black Fork Creek	Bacteria (recreation use)	No concerns
0609	**Angelina River Below Sam Rayburn Reservoir**	Mercury in Edible Tissue, Dioxin in Edible Tissue	No Concerns
0610	**Sam Rayburn Reservoir**	Mercury in Edible Tissue, Dioxin in Edible Tissue	Iron in sediment, Manganese in sediment, Mercury in edible tissue
0610A	Ayish Bayou	Bacteria (recreation use)	No Concerns

BASIN-WIDE WATER QUALITY FINDINGS

Segment ID	Segment Name	Impairment(s)	Concern(s)
0610P	Bayou Carrizo	No Impairments	Bacteria (recreation use)
0611	**Angelina River Above Sam Rayburn Reservoir**	Bacteria (recreation use)	Bacteria (recreation use), Total Phosphorus
0611A	East Fork Angelina River	Bacteria (recreation use)	No concerns
0611B	La Nana Bayou	Bacteria (recreation use)	Nitrate, Total Phosphorus
0611C	Mud Creek	Bacteria (recreation use)	No concerns
0611D	West Mud Creek	Bacteria (recreation use)	Ammonia Nitrate
0611Q	Lake Nacogdoches	No Impairments	No concerns
0611R	Lake Striker	No Impairments	No concerns
0611V	Bowles Creek	No Impairments	Depressed dissolved oxygen
0611W	Johnson Creek	No Impairments	No Concerns
0612	**Attoyac Bayou**	Bacteria (recreation use)	No concerns
0613	**Lake Tyler/ Lake Tyler East**	No Impairments	No concerns
0615	**Angelina River/Sam Rayburn Reservoir**	Bacteria (recreation use)	No concerns
0615A	Paper Mill Creek	*E. coli*, Aluminum in Water	No Concerns

Dorr Creek at FM 1275 (located within the Neches River Basin)

BASIN-WIDE WATER QUALITY FINDINGS

Water Quality Trends

Nutrient Trends

Throughout the basin, statistically significant decreasing trends were observed for nutrient parameters. For Total Phosphorus, decreasing trends were observed in 11 assessment units. Chlorophyll-*a* trends were decreasing in 4 assessment units and increasing in 1 assessment unit.

Bacterial Trends

There is only one decreasing trend identified for *E. coli* bacteria in the 2020 Basin Summary Report.

Other Trends

Other trends in the basin include pH, Chloride, and Sulfate . There were 13 assessment units with decreasing trends and 11 assessment units with increasing trends identified for pH. There were decreasing trends observed for Chloride in 21 assessment units and for Sulfate in 16 assessment units.

Summary of Statistically Significant Trends in the Upper Neches River Basin

Segment ID	Segment Name	AU	*E. coli*	Temp	DO	pH	Spec Cond	NH3	Cl	SO4	TKN	Total P	TSS	NO3	NO2	NO3/ NO2	Chl-*a*	Pheo
0604	Neches River below Lake Palestine	0604_01															↓	↓
0604	Neches River below Lake Palestine	0604_02				↓											↓	
0604	Neches River below Lake Palestine	0604_03				↓											↓	
0604	Neches River below Lake Palestine	0604_04				↓			↓			↓						
0604	Neches River below Lake Palestine	0604_05							↓		↑					↓	↑	
0604A	Cedar Creek	0604A_01	*- No trends identified for this Assessment Unit -*															
0604A	Cedar Creek	0604A_02	*- No trends identified for this Assessment Unit -*															
0604A	Cedar Creek	0604A_03	*- No trends identified for this Assessment Unit -*															
0604B	Hurricane Creek	0604B_01	*- No trends identified for this Assessment Unit -*															
0604B	Hurricane Creek	0604B_02	*- No trends identified for this Assessment Unit -*															
0604C	Jack Creek	0604C_01					↓		↓							↓		
0604D	Piney Creek	0604D_01	*- No trends identified for this Assessment Unit -*															
0604D	Piney Creek	0604D_02			↓					↓								
0604M	Biloxi Creek	0604M_02	↓			↓						↓						
0604M	Biloxi Creek	0604M_03	*- No trends identified for this Assessment Unit -*															
0604N	Buck Creek	0604N_01										↓						
0604T	Lake Ratcliff	0604T_01					↓			↓			↓					
0605	Lake Palestine	0605_01				↑	↑											
0605	Lake Palestine	0605_02				↓	↓		↓	↓								

Segment ID	Segment Name	AU	*E. coli*	Temp	DO	pH	Spec Cond	NH3	Cl	SO4	TKN	Total P	TSS	NO3	NO2	NO3/ NO2	Chl-*a*	Pheo
0605	Lake Palestine	0605_03							↓									
0605	Lake Palestine	0605_09				↓			↓	↓	↓	↓						
0605	Lake Palestine	0605_10				↓			↓	↓	↓						↓	
0605	Lake Palestine	0605_11	*- No trends identified for this Assessment Unit -*															
0605A	Kickapoo Creek	0605A_01	*- No trends identified for this Assessment Unit -*															
0605A	Kickapoo Creek	0605A_02				↑												
0606	Neches River above Lake Palestine	0606_01				↑	↓		↓									
0606	Neches River above Lake Palestine	0606_02				↑	↓		↓			↓	↓					
0606A	Prairie Creek	0606A_01	*- No trends identified for this Assessment Unit -*															
0606A	Prairie Creek	0606A_02	*- No trends identified for this Assessment Unit -*															
0606A	Prairie Creek	0606A_03	*- No trends identified for this Assessment Unit -*															
0606D	Black Fork Creek	0606D_02	*- No trends identified for this Assessment Unit -*															
0609	Angelina River below Sam Rayburn Reservoir		*-Please refer to LNVA's report for information on this Assessment Unit-*															
0610	Sam Rayburn Reservoir	0610_01				↓			↓	↓								
0610	Sam Rayburn Reservoir	0610_02	*- No trends identified for this Assessment Unit -*															
0610	Sam Rayburn Reservoir	0610_03				↓			↓	↓								
0610	Sam Rayburn Reservoir	0610_04			↑	↑	↑		↓	↓								
0610	Sam Rayburn Reservoir	0610_05	*- No trends identified for this Assessment Unit -*															
0610	Sam Rayburn Reservoir	0610_06					↑									↓		
0610	Sam Rayburn Reservoir	0610_07					↓		↓	↓			↓					
0610	Sam Rayburn Reservoir	0610_08	*- No trends identified for this Assessment Unit -*															
0610	Sam Rayburn Reservoir	0610_09							↓									
0610	Sam Rayburn Reservoir	0610_10				↑												
0610A	Ayish Bayou	0610A_01				↓						↓						
0610A	Ayish Bayou	0611A_02	*- No trends identified for this Assessment Unit -*															
0610P	Bayou Carrizo	0610P_01	*- No trends identified for this Assessment Unit -*															
0611	Angelina River above Sam Rayburn	0611_01														↓		
0611	Angelina River above Sam Rayburn	0611_02				↑												

Segment ID	Segment Name	AU	*E. coli*	Temp	DO	pH	Spec Cond	NH3	Cl	SO4	TKN	Total P	TSS	NO3	NO2	NO3/ NO2	Chl-*a*	Pheo
0611	Angelina River above Sam Rayburn	0611_03				↑			↓			↓				↓		
0611	Angelina River above Sam Rayburn	0611_04				↑												
0611A	East Fork Angelina River	0611A_01				↑										↓		
0611A	East Fork Angelina River	0611A_02				↑	↓		↓									
0611B	La Nana Bayou	0611B_01	*- No trends identified for this Assessment Unit -*															
0611B	La Nana Bayou	0611B_02	*- No trends identified for this Assessment Unit -*															
0611B	La Nana Bayou	0611B_03	*- No trends identified for this Assessment Unit -*															
0611C	Mud Creek	0611C_01							↓	↓		↓				↓		
0611C	Mud Creek	0611C_02								↓		↓				↓		
0611D	West Mud Creek	0611D_01	*- No trends identified for this Assessment Unit -*															
0611D	West Mud Creek	0611D_02	*- No trends identified for this Assessment Unit -*															
0611Q	Lake Nacogdoches	0611Q_01							↓									
0611R	Lake Striker	0611R_01							↓								↓	
0611V	Bowles Creek	0611V_01	*- No trends identified for this Assessment Unit -*															
0611W	Johnson Creek	0611W_01	*- No trends identified for this Assessment Unit -*															
0612	Attoyac Bayou	0612_01	*- No trends identified for this Assessment Unit -*															
0612	Attoyac Bayou	0612_02										↓						
0612	Attoyac Bayou	0612_03								↓						↓		
0612F	West Creek	0612F_01								↓						↓		
0612G	Lake Naconiche	0612G_01	*- No trends identified for this Assessment Unit -*															
0613	Lake Tyler/Lake Tyler East	0613_01											↑					
0613	Lake Tyler/Lake Tyler East	0613_02					↑		↑									
0613	Lake Tyler/Lake Tyler East	0613_03	*- No trends identified for this Assessment Unit -*															
0613	Lake Tyler/Lake Tyler East	0613_04	*- No trends identified for this Assessment Unit -*															
0614	Lake Jacksonville	0614_01	*- No trends identified for this Assessment Unit -*															
0614	Lake Jacksonville	0614_02				↓												
0615	Angelina River/Sam Rayburn Reservoir	0615_01				↓			↓	↓	↓							
0615A	Paper Mill Creek	0615A_01				↓	↓		↓	↓	↓	↓				↓		

↑ = Statistically significant increasing trend ↓ = Statistically significant decreasing trend

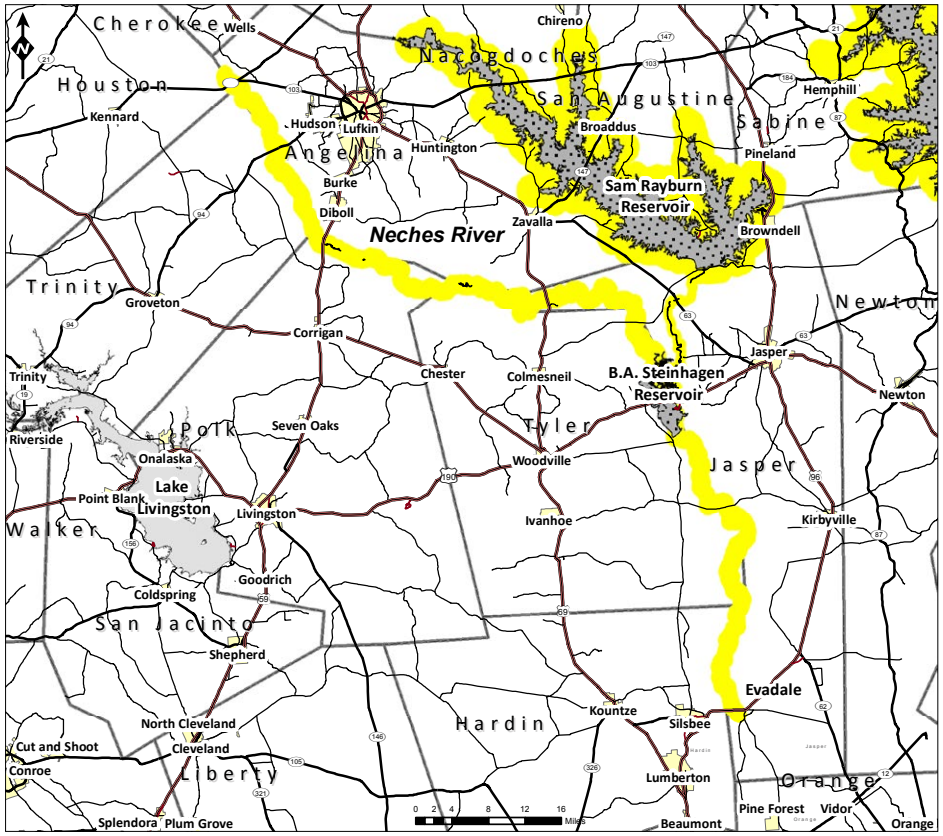
TDSHS FISH CONSUMPTION BANS AND ADVISORIES

The Texas Department of State Health Services (TDSHS) monitors fish for the presence of environmental contaminants within edible tissue and issues fish advisories for water bodies when a threat to human health may occur from contaminated fish consumption. A consumption advisory is a recommendation to limit consumption to specified quantities dependent on the species and size of the fish.

Neches River Fish Consumption Advisory

On January 27, 2014, a Fish Consumption Advisory was issued for portions of the Neches River Basin. The area covered by the advisory begins at the State Highway 7 bridge west of Lufkin and continues downstream near Evadale to the U.S. Highway 96 bridge. The advisory area also encompasses Sam Rayburn Reservoir and B. A. Steinhagen Reservoir.

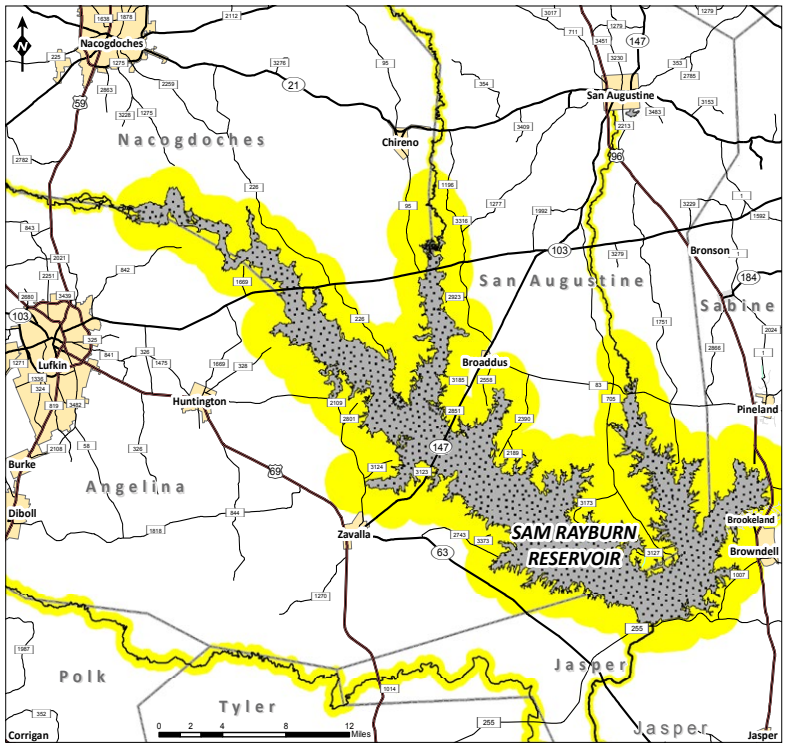
Contaminants of concern are Mercury (Hg) and Dioxins. Because consumption of contaminated fish can be a health hazard, TDSHS has made recommendations for consumption, located in the table to the right. Elevated levels of Dioxins and Mercury in edible fish tissues do not pose a health risk for people conducting recreational activities in which there is a significant risk of ingestion of water, including swimming ,wading, diving, etc. On connected water bodies that are not explicitly mentioned in the advisory but where fish could reasonably be expected to travel from listed areas, ANRA recommends following the recommendations in the advisory.



Consumption Recommendations

Blue catfish > 30 in.	Two 8 oz. meals/month
Flathead catfish	One 8 oz. meal/month
Gar (All species)	One 8 oz. meal/month
Largemouth bass > 16 in.	Two 8 oz. meals/month
Smallmouth buffalo	**DO NOT EAT**
Spotted bass > 16 in.	Two 8 oz. meals/month

***It is recommended that women of childbearing age and children under 12 years of age should NOT CONSUME any amount of the affected species listed above.**



TDSHS FISH CONSUMPTION BANS AND ADVISORIES

Lake Ratcliff Fish Consumption Advisory

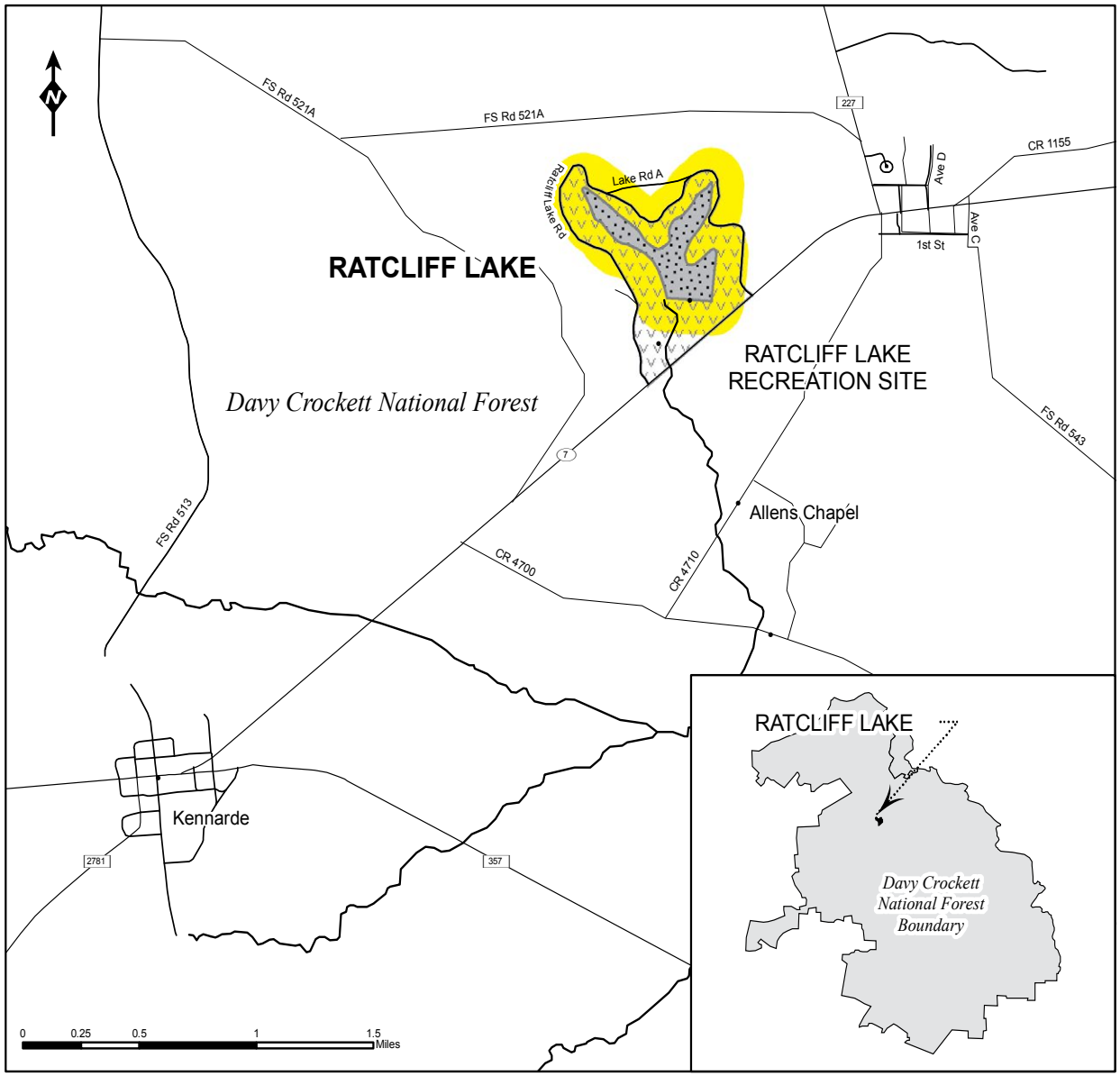
On May 10, 2002, a Fish Consumption Advisory was issued for Lake Ratcliff, located within Davey Crockett National Forest.

The contaminant of concern in Lake Ratcliff is Mercury (Hg) and the affected species is Largemouth bass (all sizes). Because consumption of contaminated fish can be a health hazard, TDSHS has made the following recommendations for consumption:

- Adults should limit consumption of largemouth bass to no more than two 8 ounce meals per month
- Children under 12 years old should limit consumption of largemouth bass to no more than two 4 ounce meals per month.

Elevated levels of Mercury in edible fish tissues do not pose a health risk for people conducting recreational activities in which there is a significant risk of ingestion of water, including swimming, wading, diving, etc.

Lake Ratcliff



RECOMMENDATIONS

Addressing Water Quality in the Neches Basin

Water quality issues in the Neches basin are generally not attributable to a single point source, and addressing them requires a community focused approach that includes partnerships with individuals as well as organizations all working together to identify and implement solutions. With that in mind, based upon the evaluation of water quality presented in this Basin Summary Report, as well as recommendations from stakeholders and Steering Committee members, we believe the following recommendations present the best path forward.

Continued Routine Surface Water Quality Monitoring

Routine surface water quality monitoring is critical in order to conduct accurate evaluations of the overall health of an aquatic system. The Texas Clean Rivers Program (CRP) monitors water quality in relation to human health concerns, ecological condition, and designated uses. CRP partners across the State of Texas coordinate and conduct monitoring and assessments based on data collected from approximately 1800 monitoring stations state-wide, as well as encouraging stakeholder participation as an effort to improve surface water quality.

An Increased Focus on Stakeholder Education & Involvement

Over the past year, ANRA has focused on the importance of educating communities and building partnerships within the Neches River Basin. It is vital to provide education and outreach opportunities to stakeholders in order to increase the understanding of the importance of water quality, provide to them the different alternatives that can be used to address water quality issues, and promote environmental stewardship. Building partnerships within the Basin allows for a greater potential impact on water quality due to the combination of resources from different organizations state-wide.

With ninety-five percent of the lands of the State of Texas being privately owned, public involvement is crucial when it comes to addressing water quality issues. ANRA encourages the public's involvement through the Texas Stream Team, Major Rivers curriculum, and other education and outreach efforts. The Texas Stream Team, serving as a voluntary group of citizen scientists, is a great way for stakeholders to be directly engaged in their watersheds, in which monitoring efforts can be taken into their own hands by conducting research and contributing to water quality data through a database maintained by the Town of Flower Mound and The Meadows Center for Water and the Environment at Texas State University. The Major Rivers curriculum is a water education program that teaches school-aged children about the importance of water resources and how to properly care for those resources. ANRA, in partnership with TCEQ, is in the process of developing its own education and outreach materials to be distributed to school-aged children that teaches them the importance of the CRP program and it's role in improving water quality.

ANRA encourages landowners and stakeholders to incorporate Best Management Practices (BMPs) to ensure that operations are environmentally friendly and take into consideration the potential impacts that agricultural operations can have on water quality. BMPs are conservation practices available to landowners that can help protect and improve overall water quality and quantity, maintain and improve wildlife and fish habitat, as well as a host of other potential benefits. For more information on the Natural Resources Conservation Service's (NRCS) conservation practices, contact your local USDA Service Center or Soil and Water Conservation District or visit the Texas Water Development Board's (TWDB) suggested Water Conservation Best Management Practices at:

https://www.twdb.texas.gov/conservation/BMPs/index.asp

In the future, ANRA would like to participate in additional training opportunities, expand volunteer monitoring programs to other areas of the basin, as well as build relationships with other water quality partners. For more information on Texas Stream Team involvement, or the Major Rivers Curriculum, please visit:

https://www.meadowscenter.txstate.edu/Leadership/TexasStreamTeam.html

https://www.twdb.texas.gov/conservation/education/kids/MajorRivers/index.asp

Continue to seek grant funding for Watershed-Specific Supplemental Projects

ANRA is already actively participating in several special projects basin-wide to maintain and improve water quality and address impairments and concerns. These projects focus on bringing stakeholders in diverse watersheds together to address water quality issues. They can include data collection and interpretation, education and outreach, implementation of best management practices, assistance for low income households, and more. We believe these projects can be powerful tools to address existing water quality concerns as well as provide education that will foster understanding and appreciation for our natural resources that will help prevent future issues. We should continue to work with partners to seek out opportunities for these types of projects where possible.

Riverine portion of Sam Rayburn Reservoir

CONCLUSIONS

The Angelina and Neches River Authority's jurisdictional service area consists of approximately 8,500 square miles that lie wholly or in part of 17 counties. ANRA has a robust surface water quality monitoring program in the basin, monitoring 37 stations on a quarterly basis for the Clean Rivers Program, as well as additional monitoring for other grant projects. 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 paper mill in Lufkin. There are several listed concerns for nutrients throughout the basin, and routine monitoring activities should be continued in order to better to assess these areas, as well as the incorporation of other water quality monitoring techniques including recommended best management practices (BMPs). 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.

Mud Creek at US 84

APPENDICES

Mud Creek at US 69

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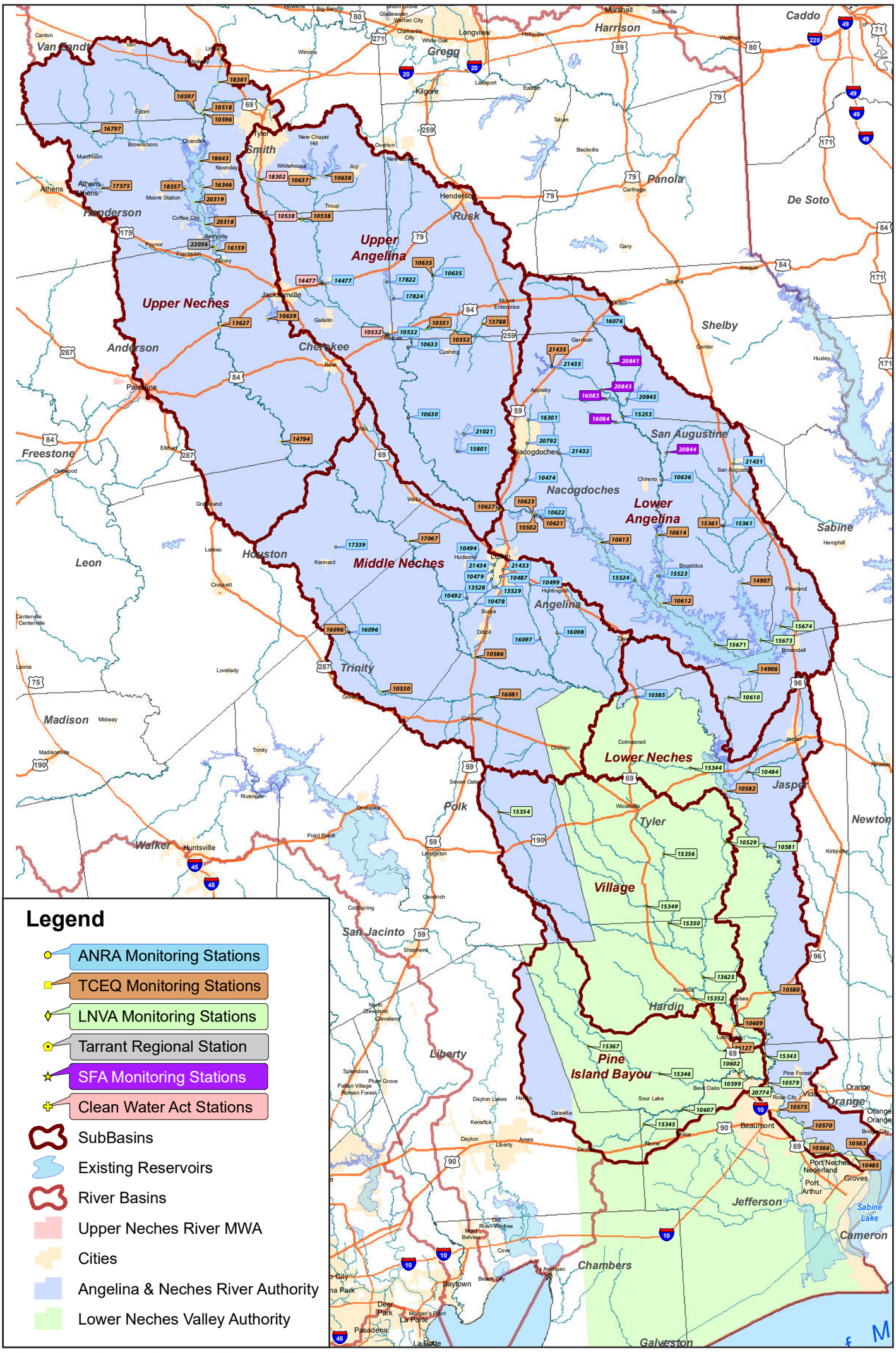
LIST OF ACRONYMS

ALU	Aquatic Life Use
ANRA	Angelina and Neches River Authority
AU	Assessment Unit
Ave	Avenue
Avg	Average
BMP	Best Management Practice
C	Celsius
cfs	cubic feet per second
Chl-*a*	Chlorophyll-*a*
Cl	Chloride
CMS	Coordinated Monitoring Schedule
CR	County Road
CRP	Clean Rivers Program
CS	Concern for Screening
CWA	Clean Water Act
CZR	Control Zone Rayburn
DO	Dissolved Oxygen
DSHS	Department of State Health Services
EPA	Environmental Protection Agency
F	Fahrenheit
FM	Farm-to-Market Road
FS	Fully Supporting
FWSD	Freshwater Supply District
FY	Fiscal Year
GIS	Geographical Information System
hr	Hour
HUC	Hydrologic Unit Code
HWY	Highway
ISD	Independent School District
km	Kilometer
LNVA	Lower Neches Valley Authority
m	Meter
MAX	Maximum
mg/L	milligrams per liter
mi	Mile
MIN	Minimum
MPN	most probable number
MSW	Municipal Solid Waste
MUD	Municipal Utility District
N	Nitrogen
NA	Not Assessed
NCR	Non-Contact Recreation
NELAP	National Environmental Laboratory Accreditation Program
NH3	Ammonia-Nitrogen
NHD	National Hydrography Dataset
NO3/NO2	Nitrate+Nitrite-Nitrogen
NPDES	National Pollution Discharge Elimination System
NPS	Nonpoint Source
NRCS	Natural Resources Conservation Service
NS	Not Supporting
OSSF	On-Site Sewage Facility
P	Total Phosphorus
PCR	Primary Contact Recreation
PWS	Public Water System
QAPP	Quality Assurance Project Plan
RC	Reach Code
RUAA	Recreational Use Attainability Analysis
RWA	Receiving Water Assessment
SCR1	Secondary Contact Recreation 1
SCR2	Secondary Contact Recreation 2
SFASU	Stephen F. Austin State University
SH	State Highway
SO4	Sulfate
Spec Cond	Specific Conductance

LIST OF ACRONYMS

SU	Standard Units
SWQM	Surface Water Quality Monitoring
SWQMIS	Surface Water Quality Monitoring Information System
TAC	Texas Administrative Code
TCEQ	Texas Commission on Environmental Quality
TDS	Total Dissolved Solids
TIAER	Texas Institute for Applied Environmental Research
TMDL	Total Maximum Daily Load
TPDES	Texas Pollution Discharge Elimination System
TPWD	Texas Parks and Wildlife Department
TSS	Total Suspended Solids
TSSWCB	Texas State Soil and Water Conservation Board
TSWQS	Texas Surface Water Quality Standards
TWDB	Texas Water Development Board
TWRI	Texas Water Resources Institute
UAA	Use Attainability Analysis
µg/L	micrograms per liter
US	United States Highway
µs/cm	microseiemens per centimeter
USACE	United States Army Corps of Engineers
USGS	United States Geological Survey
WAP	Watershed Action Planning
WCID	Water Control and Improvement District
WLE	Wasteload Evaluation
WPP	Watershed Protection Plan
WQS	Water Quality Standards
WSC	Water Supply Corporation
WWTF	Wastewater Treatment Facility
WWTP	Wastewater Treatment Plant

BASIN SAMPLING MAP FY 2020



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2020 Upper Neches Basin Summary Report

The 2020 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.