

and the causes may vary depending on the natural conditions. Since the pH values were below 6.0 when the highest sulfate values were recorded in 2000 and 2001, the presence of hydrogen sulfide produced by sediments rich in organic matter and/or acid rain may have been a contributing factor. Sulfate is one of the major dissolved constituents in rain and the amount is related to natural and human pollution of the atmosphere.

In the 1999 Basin Summary Report, the screening analyses identified TDS as not supporting the general use criteria at station 10596 (Neches River at FM 279). The historical data indicated that 94% of the samples were exceeding the TDS criteria for this segment. The current data review shows an improvement in the TDS concentrations. The average TDS values for all three stations in the segment are fully supporting the segment-specific criteria (300 mg/L).

Total nitrogen (nitrite+nitrate) was identified as a concern in this segment at station 10596 (Neches River at FM 279). No other concerns were identified for the nutrient parameters in the segment. The data review includes 17 measurements and 58.8% of these measurements exceed the screening level for freshwater streams (2.76 mg/L) established by the TCEQ. Although Texas does not have nutrient stream standards, the screening levels for nutrients are intended to identify secondary concerns for water bodies due to elevated nutrient concentrations. The 24-hour dissolved oxygen measurements collected in

2000 and 2001 at this station were all above the criteria established for the segment. This 24-hour data combined with the routinely collected instantaneous measurements indicate that elevated nutrient levels are not causing a water quality problem. In fact, the trend analysis results show that the oxygen depletion is decreasing significantly, thus the dissolved oxygen values are improving over time. The chlorophyll a measurements are all below the screening level which would indicate that eutrophication is not occurring at this location.

The spatial analysis for the watershed indicates two permitted municipal outfalls and two industrial storm water outfalls less than ten miles upstream from station 10596 on the Neches River. These outfalls discharge to the Prairie Creek subwatershed which is located immediately upstream from the monitoring station. Numerous stormwater outfalls are also located near Tyler and discharge to a tributary of Prairie Creek. An industrial landfill and an unauthorized waste site are also located in the Prairie Creek subwatershed.

The TCEQ's draft 2004 Water Quality Inventory does not identify any impairments in Segment 0606 for toxicity. Ambient toxicity tests were conducted by EPA's Ambient Toxicity Monitoring Program for one station (10596) on the Neches River four (4) times during the assessment period (3/3/98 to 2/10/03). None of the tests indicated any statistically significant level of toxicity on either of the two test organism species.

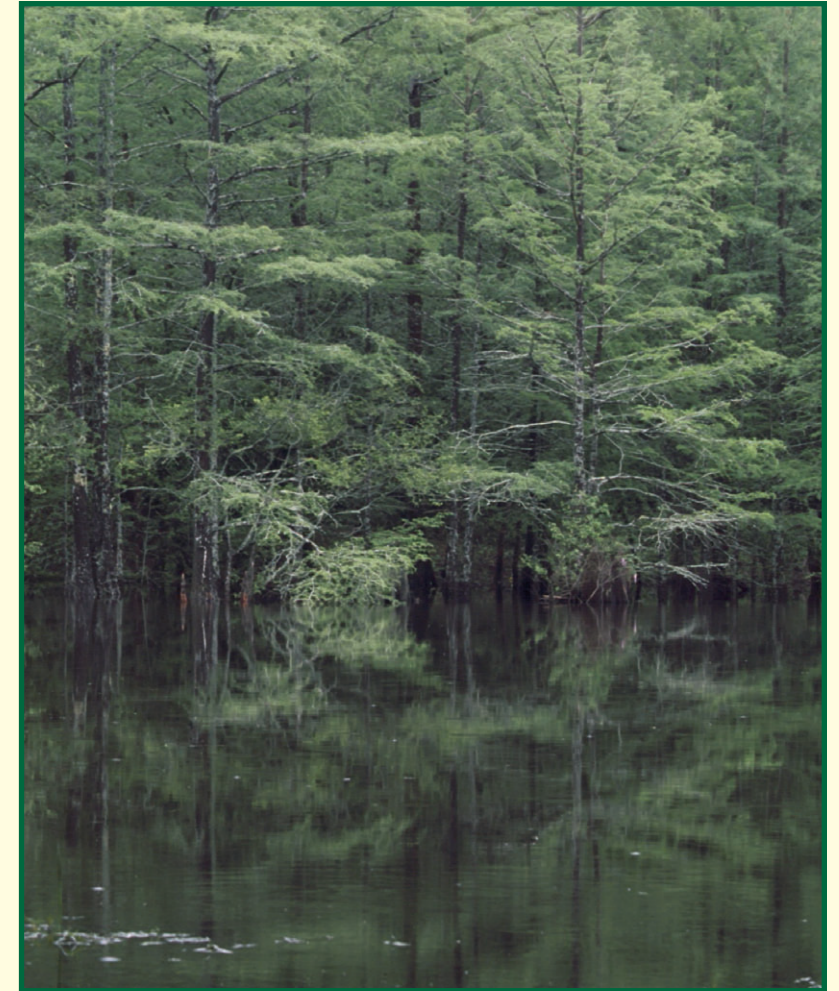
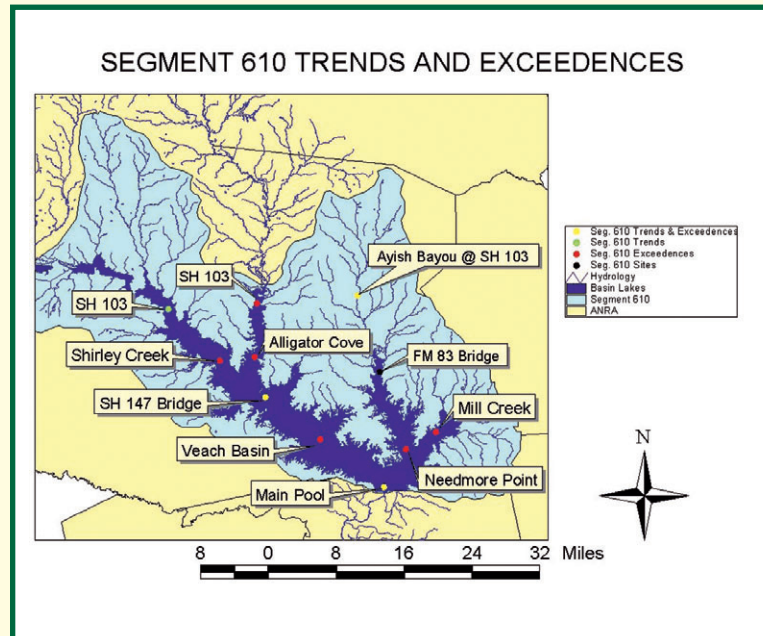


Photo courtesy of Connie Thompson.

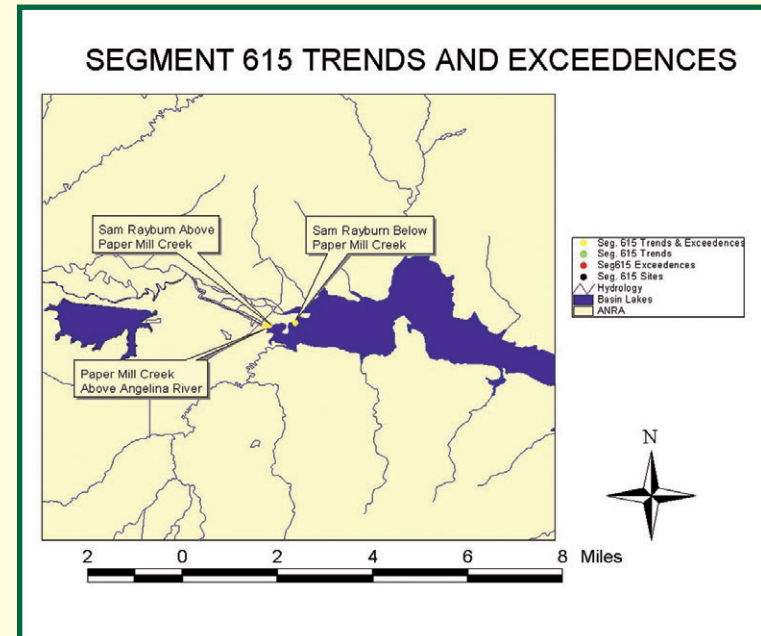
Sam Rayburn Reservoir

Segments 0610 & 0615



Watershed Overview

The Sam Rayburn Reservoir impounds the Angelina River from Sam Rayburn Dam in Jasper County to the aqueduct crossing 0.6 miles upstream of the confluence of Paper Mill Creek on the Angelina River in Angelina/Nacogdoches County and to a point 2.4 miles downstream of Curry Creek on the Attoyac Bayou in Nacogdoches/San Augustine County, up to the normal pool elevation of 164 feet. The segment extends for approximately 79 miles with a surface area of 114,500 acres, making it the largest reservoir completely within the State of Texas. The watershed drains approximately



1,385 square miles and encompasses part of six counties and all or part of nine towns and cities including the northeastern section of the City of Lufkin.

The combined population of the counties located in this watershed have experienced a 0% net increase since April 2000. Only two counties have increasing populations so very little growth is projected for this area. Development is slow in the Lake Sam Rayburn area although recent efforts are encouraging growth and development in the recreation and tourism industry.

The Sam Rayburn Reservoir was constructed by the Ft. Worth District, U.S. Army Corps of Engineers, in cooperation with the Lower Neches Valley Authority. It was designed to control floods, generate hydroelectric power and conserve water for municipal, industrial, agricultural, and recreational uses. Construction began in 1956 and deliberate impoundment of water began in March 1965. The estimated cost, including development for public use, is \$66 million. With a flood control storage of 1,145,000 acre-feet, it is estimated that annual benefits of \$4,958,000 result from the operation of Sam Rayburn Reservoir due to the control of floods, conservation of water for various purposes, generation of power, and the preservation of fish and wildlife.

The watershed is located in the South Central Plains Ecoregion. The vegetation types are Mixed Pine-Hardwood Forest and Longleaf Pine Forest. The soil is characterized by mainly loamy and sandy soils with some clayey areas and nearly level to gently sloping soils that are moderately well drained and well drained. This segment contains mostly moderate and very slowly permeable soils that range from neutral to strongly acidic.

The area is inhabited by thirteen endangered species such as the American Burying Beetle, Red Wolf, Louisiana Black Bear, Shovelnose Sturgeon, and the White Bladderpod. Seven threatened species including the Alligator Snapping Turtle, Bachman's Sparrow, Wood Stork, and Louisiana Pine Snake may also be found in the watershed.



The majority of the 154,245 acre Angelina National Forest is located within the Sam Rayburn Watershed along the northeast and southwest shores of the reservoir. Longleaf pine is the predominant cover type in the southern portion of the forest, while loblolly and shortleaf pine are the dominant types in the rest of the forest. The average annual rainfall is 46 inches and the average midwinter temperature is a mild 52 degrees F. Hundreds of wildlife species exist in the National Forest while the reservoir provides feeding and resting grounds for migratory birds before they proceed south toward the Gulf Coast. The 20,700 acre Bannister Wildlife Management Area and the Turkey Hill Wilderness Area are both located between the Attoyac and Ayish Bayous where the emphasis is wildlife and improving animal populations through multiple resource management.

Numerous recreational opportunities are available in the area with the Sam Rayburn Reservoir at the center providing noted fishing, pleasure boating, and skiing. On or near the shores of the reservoir are three national recreation areas, Caney Creek, Harvey Creek, and Sandy Creek. The U.S. Army Corps of Engineers also operates numerous parks around the reservoir providing camping areas, boat launching ramps, picnic facilities, and fishing docks. Private marinas are also numerous offering lodging and restaurants as well as hosting large bass fishing tournaments.

The segment is classified as water quality limited and the designated water uses are Contact Recreation, High Aquatic Life Use, and Public Water Supply. There are 22 permitted outfalls in this segment (16 municipal, 5 industrial, 1 storm water) with a combined total discharge of approximately 22.54 MGD. The elevations range from 530 feet MSL to 164 feet MSL at the reservoir power pool. The principal tributaries of the segment are Attoyac Bayou (segment 612), Ayish Bayou, Carrizo Bayou, Mill Creek, and Harvey Creek. The land use of the watershed is predominately forested with some land used for agriculture.

Data Review

The data review indicates that the Sam Rayburn Reservoir is fully supporting the aquatic life use for dissolved oxygen, the contact recreation use for bacteria, and the general use water quality criteria. Secondary concerns were identified for the nutrient parameters in the reservoir, primarily total nitrogen (nitrate+nitrite). The reservoir is partially supporting the overall use for the fish consumption advisories issued by the Texas Dept. of Health in 1995 for the mercury in largemouth bass and freshwater drum species. The data review was also conducted on two tributaries of the reservoir which had sufficient data, the Ayish Bayou and Paper Mill Creek. The following table summarizes the results of the data review for the Sam Rayburn Reservoir and its tributaries in the watershed.

Table 3.3-5: Summary of Data Review for the Sam Rayburn Reservoir

Segment	Waterbody	Stations*	Results of ANRA's Data Review
0610	Sam Rayburn Reservoir	10612	Fully Supporting Concern (Nitrate+Nitrite)
		10613	Fully Supporting, No Concerns
		10614	Fully Supporting Concern (Nitrate+Nitrite)
		14906	Fully Supporting Concern (Nitrate+Nitrite)
		14907	Fully Supporting, No Concerns
		15522	Fully Supporting Concern (Ammonia-N, Nitrate+Nitrite)
		15523	Fully Supporting Concern (Ammonia-N, Nitrate+Nitrite, Total Phosphorus)
		15524	Fully Supporting Concern (Ammonia-N, Nitrate+Nitrite, Total Phosphorus)
0610A	Ayish Bayou	15361	Not Supporting (TDS, E. coli) No Concerns
0615	Angelina River/ Sam Rayburn Reservoir	10621	Fully Supporting Concerns (Ammonia-N, Nitrate+Nitrite, Total Phosphorus, Ortho Phosphorus) Primary Concern (E. coli, 24 hr. DO)
		10623	Fully Supporting Concern (Nitrate+Nitrite) Primary Concern (24 hr. DO)
0615A	Paper Mill Creek	10502	Not Supporting (DO, Chloride, Sulfate, TDS) Concerns (Ammonia-N, Total Phosphorus) Primary Concern (E. coli, 24 hr. DO)

The water quality concerns in the Sam Rayburn Reservoir are primarily due to the elevated levels of total nitrogen (nitrate+nitrite). There are also concerns for Ammonia-Nitrogen and Total Phosphorus at selected stations, but 8 out of the 10 stations included in the data review exceeded the screening level for total nitrate+nitrite. The sample exceedance rates range from 30.8% to 79.2% and the stations are spread across all areas of the lake. The trend analysis did not show any significant trends over time. An increasing trend was indicated for Ammonia-Nitrogen and Total Phosphorus at station 10612 (Sam Rayburn at SH 147), but a concern is not listed for either parameter. TCEQ's Historical Data Review for the Sam Rayburn Reservoir TMDL Project prepared in 2003, reviewed nitrate+nitrite data collected at 18 stations from 1990 to 2002. There were 91 samples that exceeded the TCEQ screening levels out of 189 measurements which equals a 48% exceedance rate. The report recommends that consistent nutrient monitoring should continue year-round during dry and wet weather to obtain a better understanding of the sources of nutrients to the reservoir through any seasonal and/or hydrological relationships. ANRA is unsure of the cause of these exceedances at this time, but will continue to monitor nutrients in the reservoir at seven routine monitoring stations nine months out of the year. The TCEQ Regional Office in Beaumont is also monitoring nutrients in the reservoir at additional stations on a quarterly basis.

For a better understanding of nitrogen compounds and their sources in the environment, the following explanation from the book "Environmental Sampling and Analysis for Technicians" by Maria Csuros is provided.

In water supplies, nitrate-nitrogen owes its origin to several possible sources, including the atmosphere, legume plants, plant debris, animal excrement, and sewage, as well as nitrogenous fertilizers and some industrial wastes. Most nitrate is generated by the decay of organic matter and from industrial and agricultural chemicals. Nitrite-nitrogen is an intermediate oxidation state of nitrogen, both in the oxidation of ammonia to nitrate and in the reduction of nitrate. Such oxidation and reduction occurs in wastewater treatment plants, water distribution systems, and natural waters. Ammonia-nitrogen is mostly produced by the decomposition of organic nitrogen containing compounds and by the hydrolysis of urea. Ammonia is naturally present in surface and groundwater.

The 2004 Draft 305b Report lists the Sam Rayburn Reservoir as partially supporting the overall use due to the mercury in fish tissue. The Texas Dept. of Health issued restricted consumption advisories in November 1995 for all waters of Sam Rayburn Reservoir and four other East Texas lakes. The consumption advice says that adults should consume no more than two meals, not to

exceed 8 ounces of fish per meal, per month combined of largemouth bass and freshwater drum, and children should consume no more than two meals, not to exceed 4 ounces of fish per meal, per month for the same two species. The TCEQ has implemented a statewide mercury in fish tissue project through the TMDL process to address these concerns. Because of the ongoing investigation of this concern, no further data analyses was conducted.

The posting of signs at the boat ramps on the reservoir has been discussed as an option to help notify the public about the fish consumption advisories. Current theory attributes much of this problem to a combination of atmospheric deposition, natural sources, and the cycling of mercury once it enters a water body. The resultant contamination of fish across East Texas will likely continue.

Ayish Bayou at SH 103 is not supporting the contact recreation use due to the elevated levels of *E. coli* bacteria. The long-term geometric mean is 133 which slightly exceeds the criteria of 126 colonies/100 ml. There are ten samples in the database and only 10% of the samples exceed the single sample criterion of 394 colonies/100 ml. There are two other stations in the watershed which are listed as a primary concern for *E. coli* based on a limited number of samples (4-9). They are both located in segment 615 in the upper portion of the watershed and exceed both the single sample



criterion and long-term geometric mean. The collection of additional *E. coli* data at all three stations will help provide a better understanding of the bacteria concerns. It is unknown what is causing the increased levels of bacteria at this station on the Ayish Bayou, but it is likely generated from non-pointed sources of pollution.

In the 2000 TSWQS, the TCEQ created segment 0615 on the Angelina River which was previously included in the Sam Rayburn Reservoir. The TCEQ adopted standards on July 26, 2000 which established an intermediate aquatic life use for the new segment. The site-specific standards were disapproved by the EPA on July 29, 2001. Therefore, the water quality standards were unchanged and the criteria remains the same as the Sam Rayburn Reservoir.

In segment 0615 (Sam Rayburn Reservoir/Angelina River), there is one station which is not supporting the aquatic life use for dissolved oxygen. Station 10502 (Paper Mill Creek) is an effluent dominated stream which has 18 measurements for dissolved oxygen and five of them (27.8%) are below the absolute minima (3.0 mg/L) in the TSWQS. The 24-hour monitoring data is limited for this station, but four out of six measurements (66.7%) have 24-hour averages that are below the criteria (5.0 mg/L) for the segment. The trend analysis results indicate that a decreasing trend is occurring for oxygen deficit at this station. In addition, the stream is no longer receiving the large volume of

industrial discharge from a large paper mill upstream. The discharge levels have been reduced drastically since the plant is currently not in operation. It is not known whether the plant will re-open or if it will be closed permanently in a few years.

The two other stations in the segment on the Angelina River are fully supporting the criteria for routinely collected instantaneous dissolved oxygen measurements, however several 24-hour measurements are not. They are listed as a primary concern since there is limited data (<10) available. At station 10621, which is below the Paper Mill Creek confluence, 75% of the 24-hour averages are below the criteria and at station 10623, which is at the confluence, 20% of the averages are below the criteria. Continuing the collection of the 24-hour dissolved oxygen measurements will be necessary to fully assess the aquatic life use in the segment.

There is a secondary concern for nutrients at all three stations in segment 615. Station 10621, located on the Angelina River and downstream of the confluence with Paper Mill Creek, has elevated levels of nutrients for all four parameters, whereas at station 10623 located above the confluence with Paper Mill Creek there is a concern for nitrate+nitrite. The nutrient screening levels for freshwater streams were applied to Paper Mill Creek and concerns are indicated for both ammonia-nitrogen and total phosphorus, but if the screening levels for

reservoirs are applied, they are exceeded 60-80% of the time. Paper Mill Creek appears to be a significant source of the nutrients into the Angelina River. Although the trend analysis did not indicate a trend over time for any of the nutrient parameters, it will be expected to decrease with the reduction in wastewater effluent discharged to the river in this area.

The spatial analysis of the watershed includes the identification of on-site sewage facilities (OSSF) around the Sam Rayburn Reservoir using GIS technology. There are concentrated areas of OSSF around the reservoir, which has over 3,900 licensed systems, but there does not appear to be a significant impact to the reservoir from these systems based on additional monitoring by ANRA. This periodic monitoring includes the collection of *E. coli* samples on the reservoir near OSSF problem areas identified by ANRA's environmental staff. The monitoring efforts are part of the inter-local agreement with the LNVA and the data is submitted to them in quarterly program reports. ANRA and LNVA use this information to determine the impacts to the reservoir from OSSFs and other non-point pollution sources which may exist in the area. The permitted wastewater outfalls in the watershed appear to be well dispersed and there has been an overall decrease in the number of outfalls since 2000.



Photo courtesy of Connie Thompson.

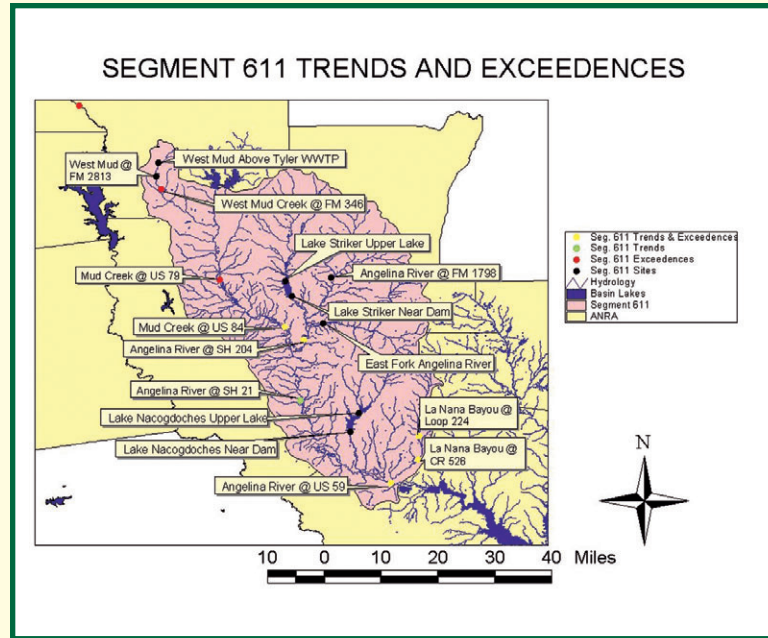
The TCEQ's current Draft 2004 305(b) Water Quality Inventory does not identify any impairments in Segment 0615 for toxicity. Ambient toxicity tests were conducted by EPA's Ambient Toxicity Monitoring Program at the following three stations during the assessment period (3/3/98 to 2/10/03):

- Station 10623, seven (7) tests were performed with no indication of any statistically significant level of toxicity on either of the two test organism species.
- Station 10621, ten (10) tests were performed and one (1) sample did result in a statistically significant level of toxicity, but only one of the two test organisms was affected.
- Station 10502, nine (9) tests were performed. Although two (2) samples resulted in statistically significant levels of toxicity, in each of the cases, only one of the two test organisms were affected. (Based on stakeholder comments, this data is currently being re-reviewed by the TCEQ and may be revised to reflect a concern for toxicity in the final 2004 305(b) Water Quality Inventory.)



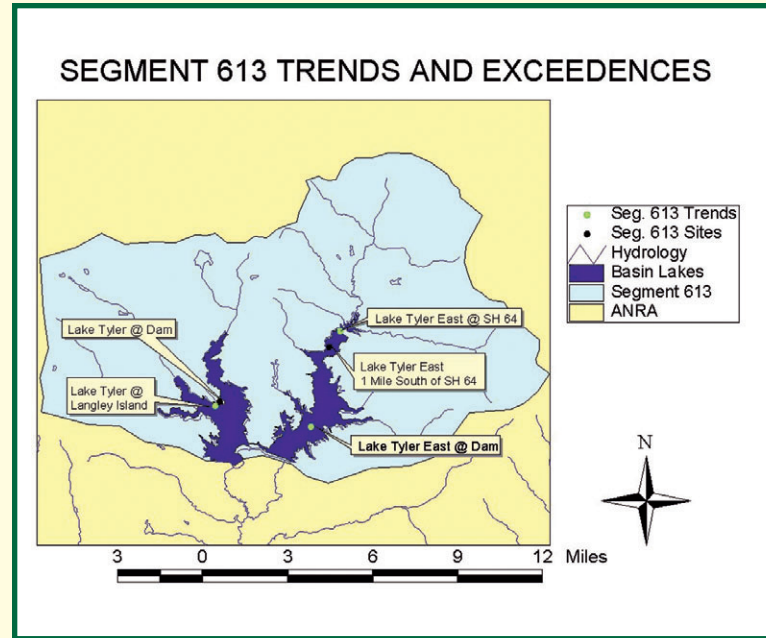
Angelina River above Sam Rayburn Reservoir

Segments 0611 & 0613



Watershed Overview

This watershed includes two classified stream segments, Segments 611 and 613. The Angelina River (Segment 611) extends from the aqueduct crossing 0.6 miles upstream of the confluence of Paper Mill Creek in Angelina/Nacogdoches County to the confluence of Barnhardt Creek and Mill Creek at FM 225 in Rusk County. The segment extends for approximately 104 miles and has a drainage area of 2,008 square miles. Lake Tyler and Lake Tyler East (Segment 613) impound



Prairie Creek and Mud Creek from the Whitehouse Dam and Mud Creek Dam in Smith County up to the normal pool elevation of 375 feet, located southeast of the City of Tyler. The segment extends for approximately 13 miles with a surface area of 4,870 acres.

The watershed includes part of five counties and all or part of sixteen towns and cities including the City of Nacogdoches and the southern half of the City of Tyler. The populations of the counties located in the

watershed have increased slightly since April 2000. Smith County has seen the largest population increase. The City of Tyler currently has a population of 88,300. There will continue to be significant development and growth in the Lake Tyler and south Tyler regions.

The watershed is located in the South Central Plains Ecoregion. The major vegetation types include Pine-Hardwood Forest, Willow Oak-Water Oak-Blackgum Forest, Young Forest/Grassland, and other Native/Introduced Grasses. There are nine endangered species of wildlife and seven threatened species that inhabit the area including the Rafinesque's big-eared bat.

The soils are dominated by loamy and sandy soils with portions of clay soils that are gently sloping to moderately steep. This segment is characterized by well and moderately well drained soils that show moderate and moderately slow permeability. Finally, these soils are slightly to moderately acidic.

Segment 611 and 613 are classified as water quality limited and the designated water uses are Contact Recreation, High Quality Aquatic Life Use, and Public Water Supply. There are 36 permitted outfalls in the watershed (18 municipal, 7 industrial, 11 storm water) with a combined total discharge of 26.60 MGD. The elevation ranges from 630 feet MSL to 194 feet MSL and



Table 3.3-6: Summary of Data Review for the Angelina River above Sam Rayburn Reservoir

Segment	Waterbody	Stations*	Results of ANRA's Data Review
0611	Angelina River	10627	Fully Supporting Primary Concern (E. coli)
		10630	Fully Supporting, No Concerns
		10633	Not Supporting (E. coli) Partially Supporting (pH) Primary Concern (24 Hr. DO)
		10635	Fully Supporting, No Concerns
0611A	East Fork Angelina River	10552	Fully Supporting, No Concerns
0611B	La Nana Bayou	10474	Not Supporting (E. coli) Partially Supporting (DO) Concerns (Ammonia-N, Total Phosphorus, Ortho Phosphorus)
		10475	Not Supporting (E. coli) No Concerns
0611C	Mud Creek	14477	Fully Supporting Concern (Total Phosphorus) Primary Concern (24 hr. DO)
		10532	Not Supporting (E. coli) No Concerns
0611D	West Mud Creek	10540	Fully Supporting Concerns (Ammonia-N, Nitrate+Nitrite, Total Phosphorus, Ortho Phosphorus)
0613	Lake Tyler/ Lake Tyler East	10637	Fully Supporting, No Concerns
		10638	Fully Supporting, No Concerns
		14235	Fully Supporting, No Concerns
		15210	Fully Supporting, No Concerns

*Note: Station Descriptions/ Locations are included in the Data Review Tables in Appendix B

the major tributaries are Mud Creek, West Mud Creek, East Fork Angelina River, Striker Creek, Loco Bayou, and La Nana Bayou. Lake Nacogdoches, Lake Striker, Lake Tyler and Lake Tyler East (Segment 613) are also located in the watershed. The land use of the watershed is forested with agricultural and urban development.

Data Review

The data review for the Angelina River indicates the water quality is fully supporting the aquatic life use, not supporting the contact recreation use, and partially supporting the general use criteria. There are no secondary concerns for nutrients in the segment. Lake Tyler and Lake Tyler East are fully supporting all designated uses and no secondary concerns were identified. The East Fork Angelina River is fully supporting the aquatic life use and there are no secondary concerns. TCEQ's Draft 2004 Water Quality Inventory indicates the contact recreation use is not supported. The contact recreation use is also not supported in the La Nana Bayou and Mud Creek. The La Nana Bayou is partially supporting the aquatic life use for dissolved oxygen and there are secondary concerns for nutrients. There are also secondary concerns for nutrients in West Mud Creek. The following table shows the results of the data review for each station in the watershed.

The contact recreation use is not supported at station 10633 on the Angelina River at SH 204 due to the elevated levels of *E. coli* bacteria. The long-term geometric mean slightly exceeds the criteria and 18% of the samples exceed the single sample criterion. The trend analysis results indicate that a decreasing trend is occurring for bacteria at this station. The upstream and downstream monitoring stations on the Angelina River are both fully supporting the criteria for *E. coli*. The problem appears to be attributable to non-point sources in the vicinity of the station since there is no widespread impairment of the river due to bacteria. ANRA will continue to monitor bacteria and 24-hour DO measurements at this station.

The data review also identified the Angelina River as partially supporting the general use criteria for low pH at one station. Two measurements out of 17 were below the pH criteria (6.0-8.5) on the Angelina River at SH 204. The values reported were 5.5 and 5.6 and they were collected in November 1998 and January 1999 respectively. All pH values reported since this period have an average of 7.0. These values may be outliers and continued monitoring at this location is recommended.

Two major tributaries of the Angelina River are not supporting the contact recreation use due to the levels of *E. coli*. Both monitoring stations on the La Nana Bayou



have long-term geometric mean values that are above the criteria. The upstream station which is located at Loop 224 in Nacogdoches, has the highest geometric mean and 75% of the samples exceed the single sample criterion. The trend analysis results show that the downstream station located at Nacogdoches CR 526 has a decreasing trend for bacteria and currently 25% of the samples exceed the single sample criterion. Mud Creek at SH 84 has a long-term geometric mean which is exceeding the criteria but the trend analysis also indicates there is a decreasing trend for bacteria at this location. ANRA will continue to monitor *E. coli* at these routine monitoring stations. The likely source of the bacteria is from non-point sources in the watershed including urban and agricultural runoff, faulty wastewater collection systems, and improperly treated sewage.

There are also secondary concerns for several of the nutrient parameters in the La Nana Bayou and West Mud Creek tributaries. The La Nana Bayou at CR 526 (10474) is the station which has concerns for nutrients and they include ammonia-nitrogen, total phosphorus, and ortho-phosphorus. The screening levels are exceeded over 47% of the time on all samples collected for these parameters. West Mud Creek at FM 346 (10540) has concerns for ammonia-nitrogen, nitrate+nitrite, total phosphorus, and ortho-phosphorus. The screening levels are exceeded by an average of 58% on all samples collected. The trend analysis does not show a significant trend over time for any of the

nutrient parameters at either station. The spatial analysis indicates that both stations are below municipal wastewater outfalls and urban areas. Continued monitoring at these stations for the nutrient parameters is recommended.

The East Fork Angelina River is not supporting the contact recreation use at the confluence with the Grassy Lake area according to the Draft 2004 Texas Water Quality Inventory. This area includes station 10551 which is located at the lowermost county road crossing near the Angelina River confluence. The non-support designation is based on historical fecal coliform data which was collected from 1996 to 2000. Based on this dataset, which includes 20 fecal coliform samples, the long-term geometric mean (271) exceeds the criteria for fecal coliform (200) and 20% of the samples exceed the single grab criteria criterion (400 cfu/100ml). The fecal coliform values have decreased significantly over time. Since July 1997, the long-term geomean is only 156 and there were no measurements above 400 compared to the period from Sept. 1996 to June 1997 when the geomean was 698 and 4 out of 7 measurements or 57% of the samples were above 400 cfu/100 ml.

Station 10551 was not included in ANRA's data review since there is insufficient data available during the assessment period (Sept. 98 to August 03). There has been no *E. coli* data collected at this location. Station 10552, which is located immediately upstream at FM 225, was included in ANRA's data review. There are

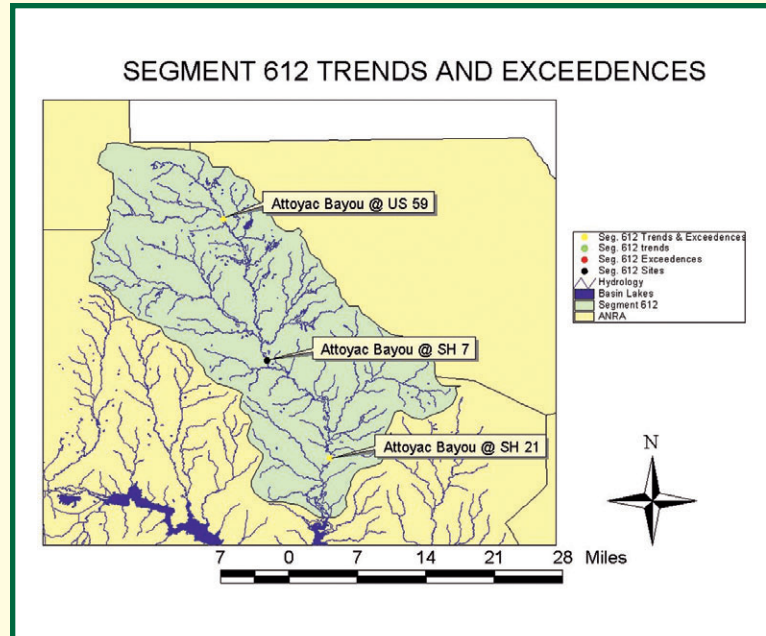
ten samples available in the database. The geomean is 94 and only one sample (10%) exceeds the single sample criterion, thus it is fully supporting the contact recreation use for *E. coli*.

TCEQ's Draft 2004 Water Quality Inventory also lists lead (chronic) in water as previously identified parameters at four locations on the East Fork Angelina River. There are fourteen values in the database for total and dissolved lead and all values except one are below the detection limit which is either 5, 2, or 1 ug/L. These detection limits are above the criteria established for lead in water based on the basin hardness values. The criteria for chronic lead in water is normally less than 1.0 ug/L, so a detection limit significantly less than the criterion is necessary to properly assess the waterbody. Additional data needs to be collected and analyzed using much lower detection limits (i.e. 0.1 ug/L).

The TCEQ's current Draft 2004 305(b) Water Quality Inventory does not identify any impairments in Segment 0611 for toxicity. Ambient toxicity tests were conducted by EPA's Ambient Toxicity Monitoring Program for one station (10627) eight (8) times during the assessment period (3/3/98 to 2/10/03). Tests identified two events that indicated statistically significant levels of toxicity. In each case, only one of the two test organisms was affected. (Based on stakeholder comments, this data is currently being re-reviewed by the TCEQ and may be revised to reflect a concern for toxicity in the final 2004 305(b) Water Quality Inventory.)

Attoyac Bayou

Segment 0612



Watershed Overview

The Attoyac Bayou (Segment 612) begins at a point 2.4 miles downstream of Curry Creek in Nacogdoches/San Augustine County to FM 95 in Rusk County. The segment extends for approximately 121 miles and has a drainage area of 667 square miles. The watershed encompasses parts of four counties and all or part of two towns and cities.

The populations in the counties located in the watershed have increased slightly since 2000. Shelby County has the highest increase at 2.6%. Very little growth and development is projected for this area. Nine endangered species and six threatened species may be found in the

watershed. The watershed is located in the South Central Plains Ecoregion. The vegetation types include Pine-Hardwood Forest, Young Forest/Grassland, and Willow Oak-Water Oak-Blackgum Forest.

This segment is characterized by dominantly loamy soils with sandy and clayey portions that are gently sloping to moderately steep. These soils are well to moderately well drained with moderate to moderately slow permeability. This segment is dominated by moderately to strongly acidic soils.

The segment is classified as effluent limited and the designated water uses are Contact Recreation, High Quality Aquatic Life Use, and Public Water Supply. There are six permitted outfalls in this segment (4 municipal and 2 industrial) with a combined total discharge of 0.29 MGD. The elevation ranges from 550 feet MSL to 170 feet MSL and the main tributaries are Naconiche Creek, West Creek, and Arenosa Creek. Pinkston Reservoir is also located within the watershed. The land use of the watershed is forested with some agricultural use including concentrated areas of poultry operations in the Waffelow and Terrapin Creek watersheds.

Data Review

The data review for the Attoyac Bayou indicates that it is fully supporting the aquatic life use and general use support criteria but it is not supporting the contact

recreation use. There are also no secondary concerns for the nutrient parameters. Both stations on the Attoyac Bayou which are located at the State Hwy. 21 and US Hwy. 59 crossings have elevated levels of *E. coli* bacteria. The values exceed both the long-term geometric mean and the single sample criterion for the segment. There are no trends at either station and they are located in both the upper reaches and lower portions of the watershed. The cause of the impairment is most likely from non-point sources in the watershed such as inadequately treated sewage, improperly managed animal waste from livestock and poultry, aquatic birds and mammals, or failing septic systems. ANRA will continue to monitor *E. coli* bacteria in the Attoyac Bayou but additional monitoring in the tributaries will help to determine the magnitude of the problem and identify the source(s) of the bacteria. Efforts will be made to increase stakeholder involvement in the watershed to assist in the development of action plans and best management practices, and identify funding sources to expand the monitoring and data collection activities.

Table 3.3-7: Summary of Data Review for the Attoyac Bayou

Segment	Waterbody	Stations	Results of ANRA's Data Review
0612	Attoyac Bayou	10636	Not supporting (<i>E. coli</i>) No Concerns
		16076	Not Supporting (<i>E. coli</i>) No Concerns

*Note: Station Descriptions/ Locations are included in the Data Review Tables in Appendix B

4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1 Conclusions

The 2004 Basin Summary Report shows that significant progress has been made in the collection and analysis of water quality data in the basin. This was the intent of the Texas Clean Rivers Act in 1991 and it is occurring in the Upper Neches Basin through the efforts of ANRA. Since the Upper Neches surface water quality monitoring program began in September 1996, ANRA has compiled over 27,000 records from 1,637 monitoring events. The data collection effort has included monitoring in all areas of the basin, including numerous subwatersheds and receiving streams to support discharge permits. The types of data collected have included routine water quality parameters, in-stream flows, metals in water and sediment, priority pollutants (pesticides, herbicides, etc.), biological assessments, and receiving water assessments. In addition, ANRA has collected geographical data in the basin using GPS technology and maintains an inventory of events and issues that impact water quality in the basin.

In the Upper Neches Basin, the majority of the classified segments support the designated uses as defined by the Texas Surface Water Quality Standards. There are water quality impairments and concerns that have been identified in this report, especially in the unclassified segments, which will focus efforts in the basin and may initiate the development of special projects. If special projects are developed in the basin it would further increase the cooperation and coordination of basin entities and may identify additional funding sources.

In response to a metals in water issue in the Upper Neches Basin, ANRA implemented an intensive 18 month dissolved metals in water study in June 2002 to address the possible concerns. In preparing the Draft 2002 305b Assessment, TCEQ and ANRA officials determined there were quality assurance issues with the metals in water data collected during 1998 and 1999. Based on ANRA's recommendation, the metals data from this time period was not included in the state's 2002 assessment and the dissolved metals in water study was initiated.

Additional funds were received through the Clean Rivers Program and quarterly metals in water sampling was conducted at 15 high priority monitoring stations over a two year period. Since the total hardness values in East Texas are relatively low, the metals in water criteria is significantly lower than other parts of Texas. To address the low detection limits that would be required to accurately assess the metals data, ANRA utilized an ultra-clean sample collection and laboratory analysis technique developed by Albion Environmental in College Station, TX to accurately determine trace metals at the parts per billion (ppb) to parts per trillion (ppt) level. The analytical results from this study determined that basin-wide metals in water contamination is not occurring since all values were reported below the water quality criteria established in the TSWQS. ANRA has continued to monitor dissolved metals in water using this technique on an annual or semi-annual basis since the initial study was completed.



4.2 Recommendations and Comments

The following recommendations are provided to continue the progress that has been made with the data collection efforts and focus on problem areas that may require more intensive actions. Special studies that are recommended should determine the extent of a problem and formulate a justification for standards revisions, recommended actions, and/or determine designated uses. The data review has indicated that additional data will aid in many cases to determine whether concerns are justified. Stream standards may need to be re-evaluated to determine if segment specific criteria support naturally occurring water quality conditions in the region. Additional monitoring in areas where a general use is not supported would help to determine the cause and potential sources if not attributed to natural conditions.

- Continue *E. coli* monitoring in segment 0604 on Cedar Creek, Jack Creek, Hurricane Creek, and Biloxi Creek and encourage stakeholders in these watersheds to address the potential sources of pollution.
- General use criteria be established for the unclassified segments. ANRA's data review included these parameters and applied the segment-specific criteria to the unclassified water bodies for screening purposes only.
- Collect additional 24-hour dissolved oxygen measurements on Piney Creek, and if necessary add monitoring stations upstream and downstream to

locate the extent of the potential problem area. If the depressed levels continue, a Use Attainability Analysis (UAA) may need to be completed in order to ensure that the high aquatic life use criteria is appropriate for this unclassified water body in segment 0604.

- Implement intensive monitoring in the upper portion of Lake Palestine to determine the severity of the nutrients problem and the potential sources.
- Continue monitoring at Kickapoo Creek near Brownsboro and consider monitoring additional stations upstream to address on-going water quality issues.
- Continue monitoring dissolved metals in water on the Neches River at SH 64, including the collection of hardness data, to identify potential concerns for zinc in water.
- Collect additional *E. coli* data at the Ayish Bayou in segment 0610, and the Angelina River and Paper Mill Creek in segment 0615 to provide a better understanding of bacteria concerns.
- Continue the collection of the 24-hour dissolved oxygen measurements in segment 0615 to fully assess the aquatic life use in the segment.
- Continue to monitor bacteria, pH and 24-hour DO measurements on the Angelina River at SH 204 in segment 0611.
- Continue to monitor *E. coli* and nutrients at La Nana

Bayou, Mud Creek and West Mud Creek monitoring stations in segment 0611.

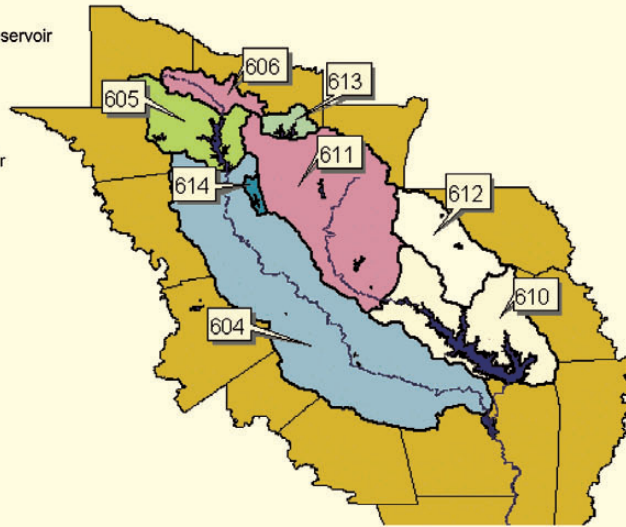
- Additional metals (lead) in water data needs to be collected and analyzed using much lower detection limits (i.e. 0.1 ug/L) in the East Fork Angelina River.
- Continue to monitor *E. coli* bacteria in the Attoyac Bayou. Additional monitoring in the tributaries will help to determine the magnitude of the problem and may identify the source(s) of the bacteria.

The majority of the recommendations are to continue the routine and intensive monitoring that is currently being conducted and incorporate additional monitoring stations in some areas. A special study is recommended for the Sam Rayburn Reservoir and Lake Palestine to identify the sources of nutrients in the watersheds. Additional targeted monitoring in conjunction with current routine monitoring efforts may establish target areas to implement Best Management Practices (BMPs) and/or develop implementation plans. The input and cooperation of stakeholders in the watersheds to develop project proposals is important to obtain additional funding for the projects. Local matching funds would likely be required to obtain additional funding through sources such as the Texas Nonpoint Source Pollution Management Program which utilizes federal CWA section 319(h) funds allocated to Texas.

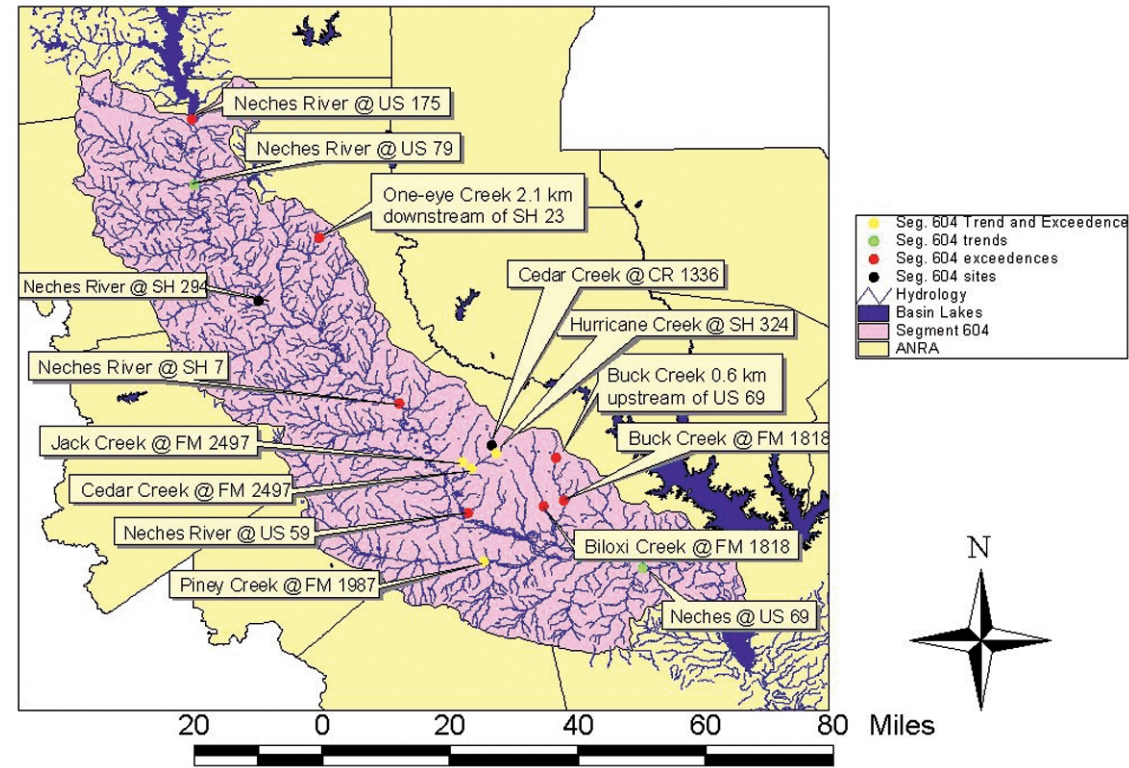


Segment Maps of the Upper Neches River Basin

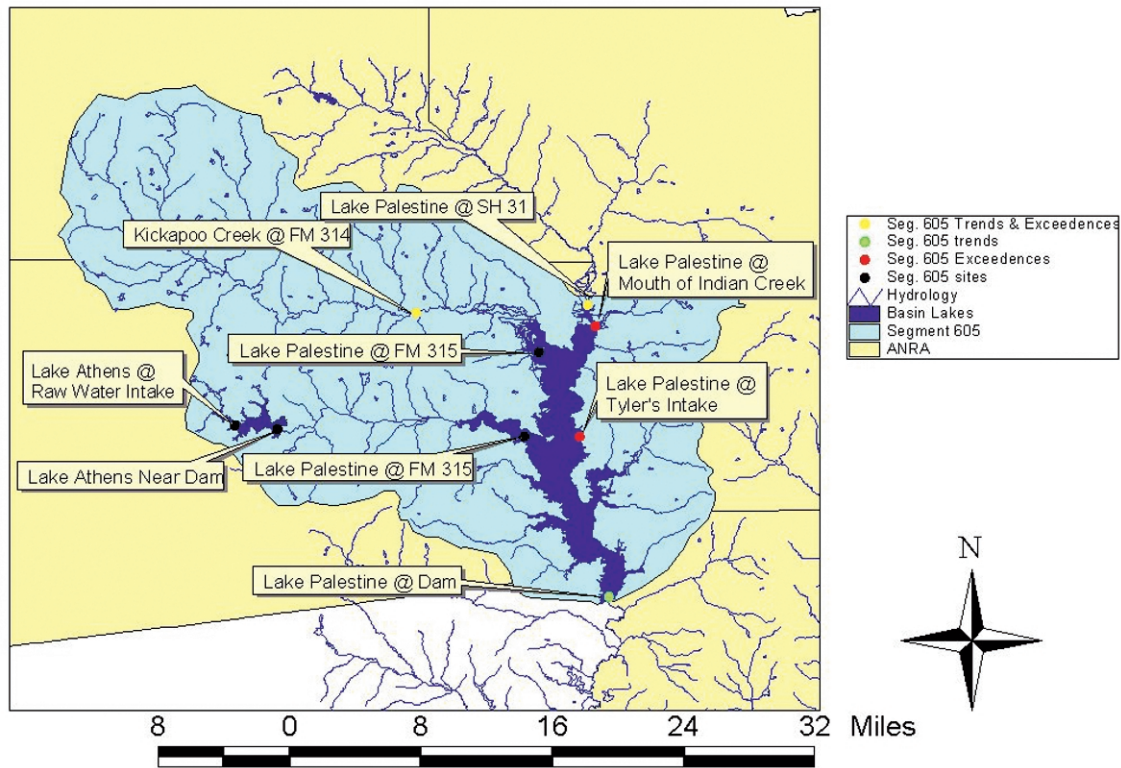
- Segment 604 – Neches River below Lake Palestine
- Segment 605 – Lake Palestine
- Segment 606 – Neches River above Lake Palestine
- Segment 610 – Sam Rayburn Reservoir
- Segment 611 – Angelina River above Sam Rayburn Reservoir
- Segment 612 – Attoyac Bayou
- Segment 613 – Lake Tyler/ Lake Tyler East
- Segment 614 – Lake Jacksonville
- Segment 615 – Angelina River/ Sam Rayburn Reservoir



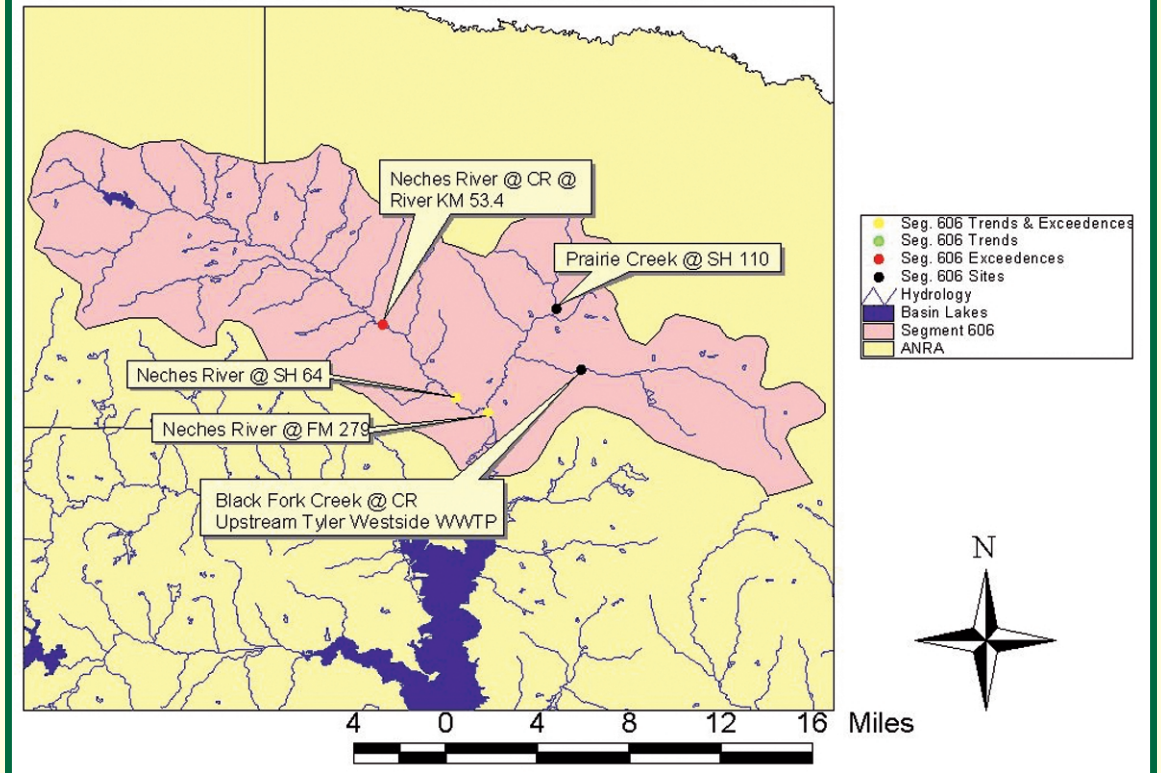
SEGMENT 604 TRENDS AND EXCEEDENCES



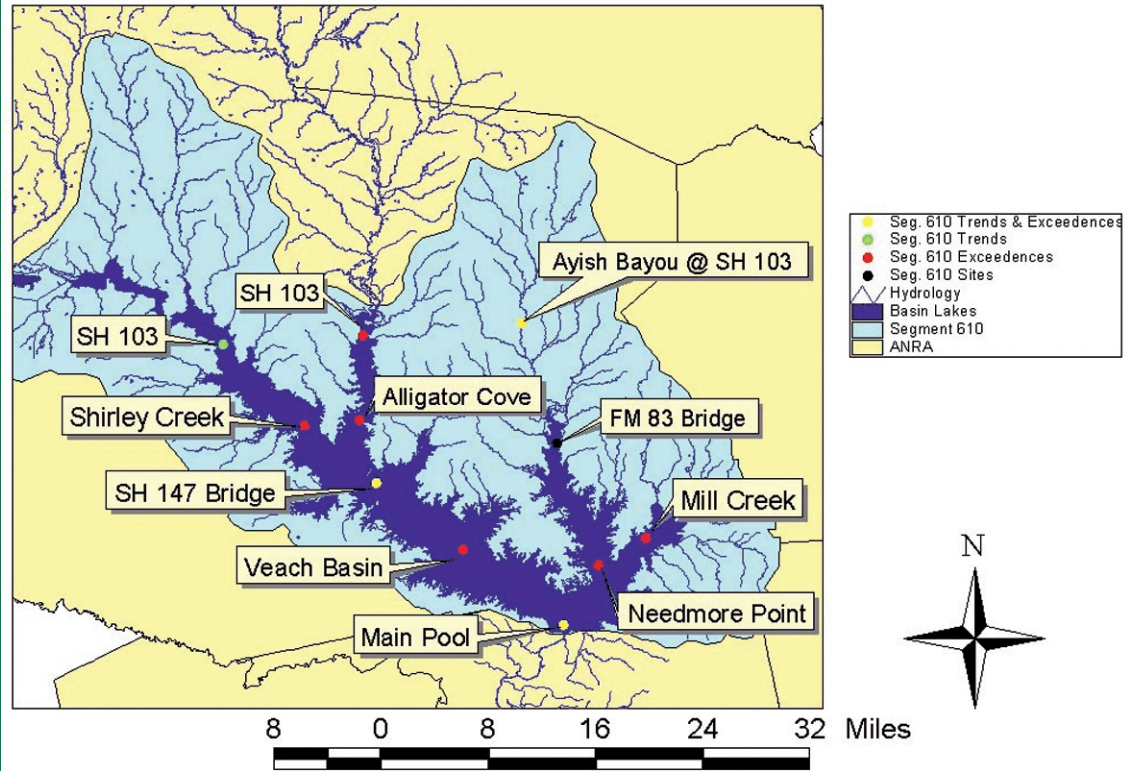
SEGMENT 605 TRENDS AND EXCEEDENCES



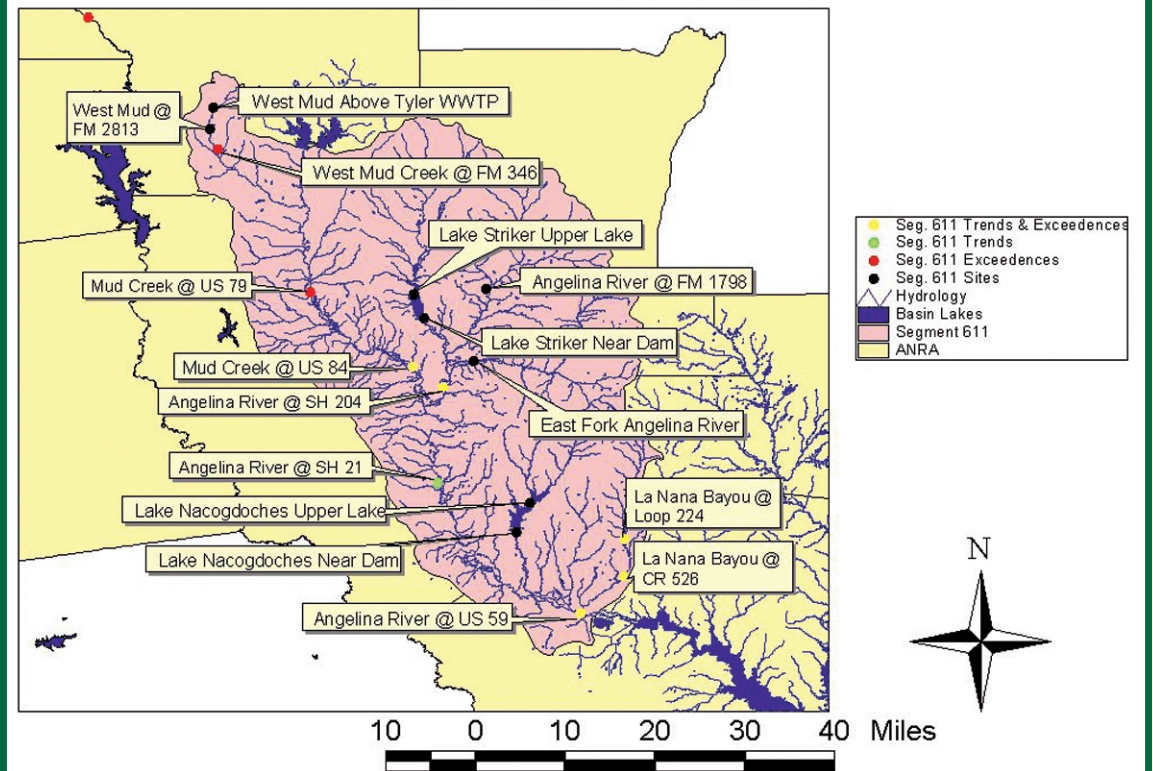
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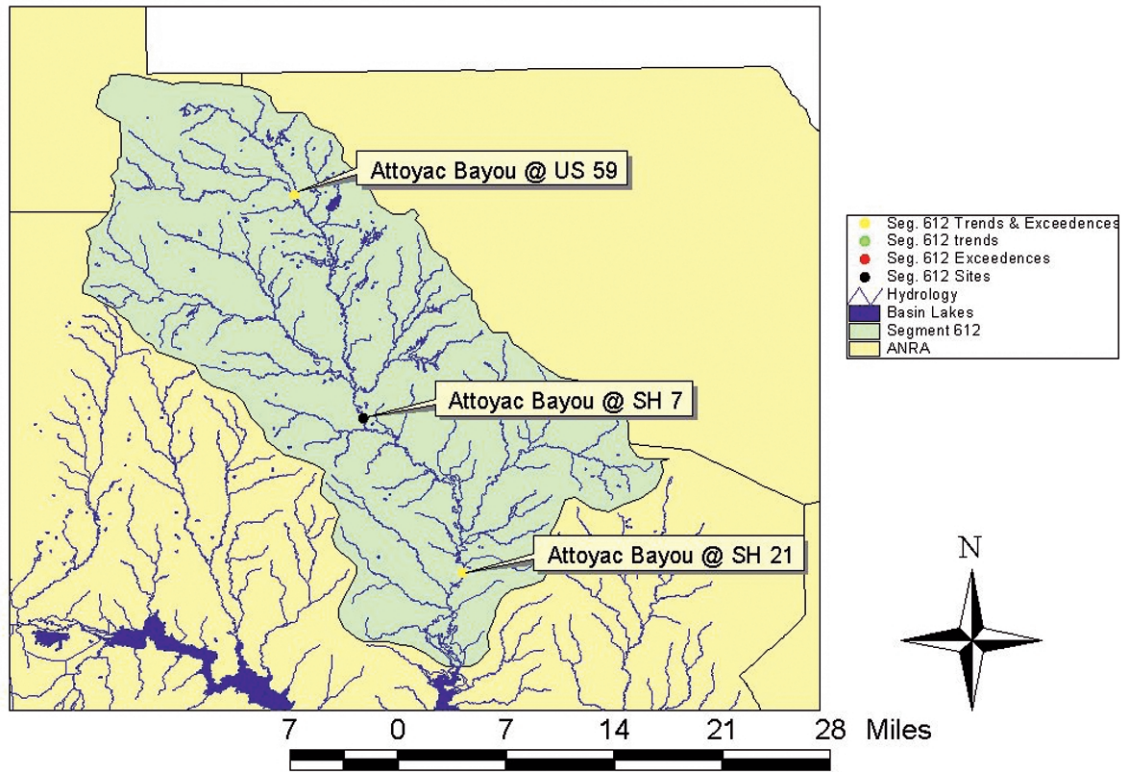
SEGMENT 610 TRENDS AND EXCEEDENCES



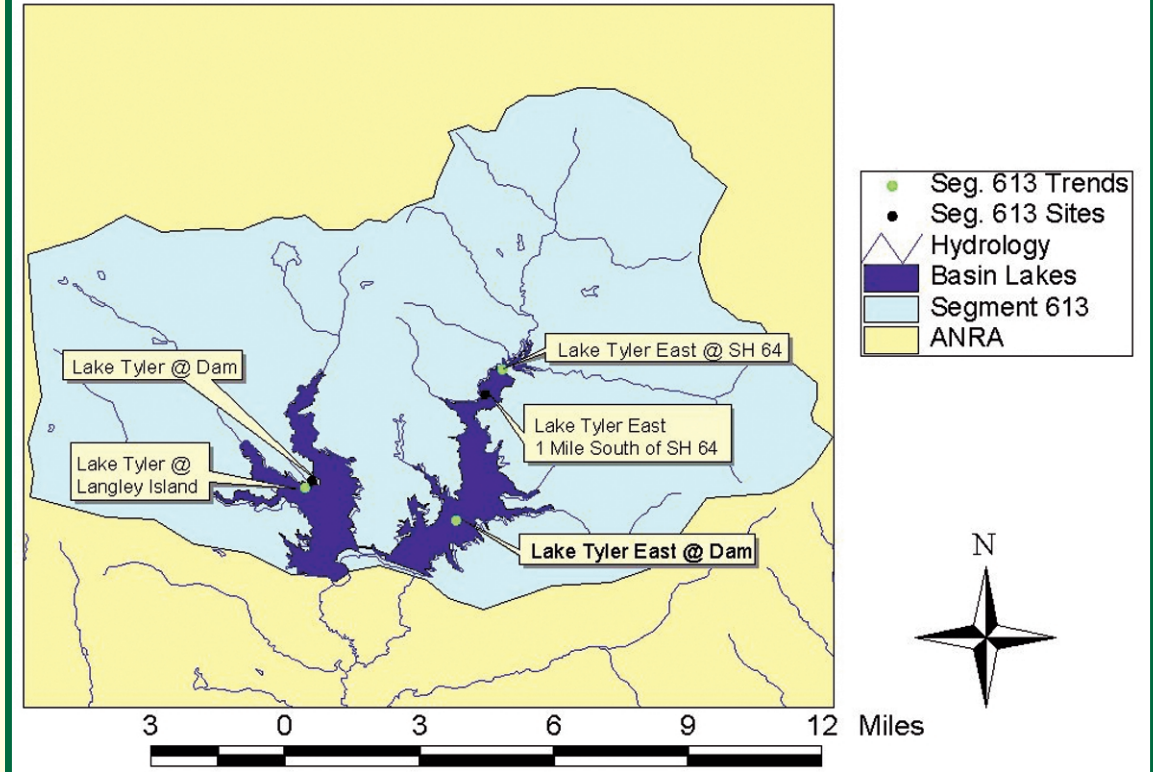
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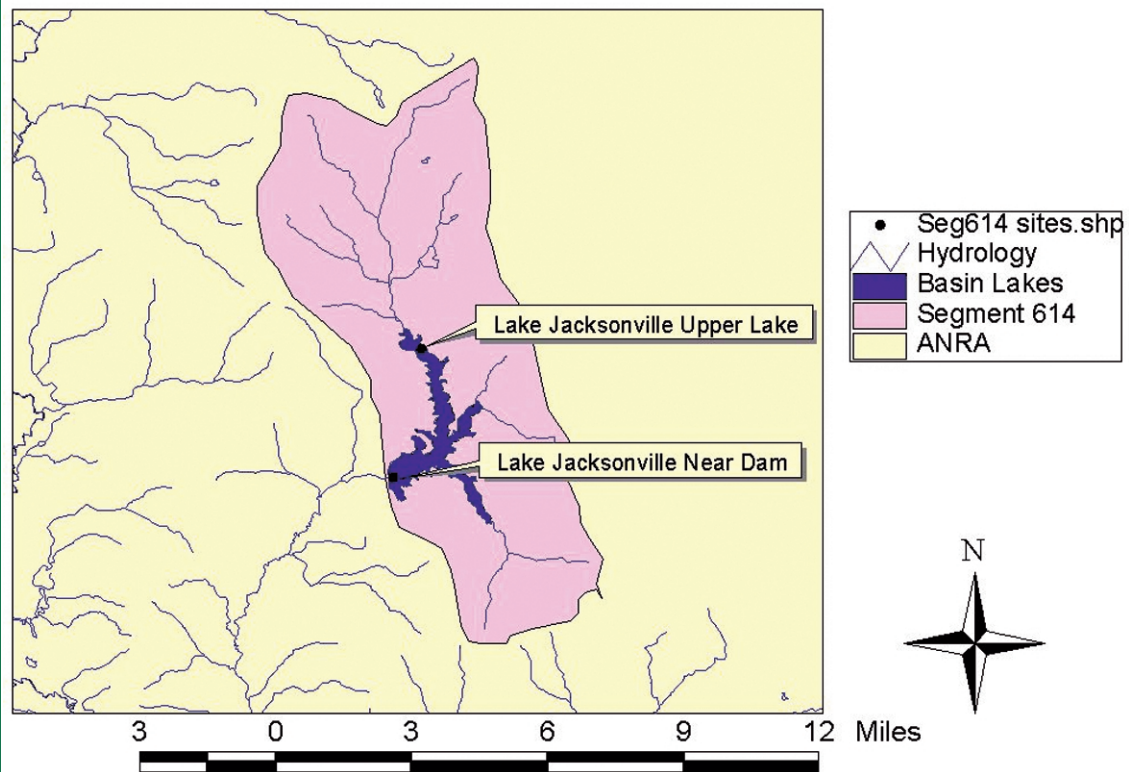
SEGMENT 612 TRENDS AND EXCEEDENCES



SEGMENT 613 TRENDS AND EXCEEDENCES



SEGMENT 614 TRENDS AND EXCEEDENCES



SEGMENT 615 TRENDS AND EXCEEDENCES

