Attoyac Bayou Watershed Location

The Attoyac Bayou Watershed is a predominantly rural watershed situated in deep East Texas. The watershed is located in portions of Nacogdoches, Rusk, San Augustine, and Shelby Counties. Local cities and communities within the watershed include Chireno, Garrison, Martinsville, and Stockmann. The Attoyac Bayou Watershed is situated approximately 180 miles southeast of Dallas, and approximately 150 miles northeast of Houston. Major roads accessing the watershed include US Highways 59 and 84 in the northern portion of the watershed, and State Highways 7 and 21 in the south.

Figure 3.1 – Location of the Attoyac Bayou Watershed.
Source: ESRI
Watershed Boundaries

The Attoyac Bayou Watershed has a drainage area of approximately 554 square miles, or 354,629 acres, and constitutes the northern extent of the Lower Angelina Sub-basin (8-Digit HUC: 12020005). The Lower Angelina Sub-basin is one of seven sub-basins that make up the Neches River Basin (6-Digit HUC: 120200). The headwaters of the Attoyac Bayou begin near the town of Mt. Enterprise in Rusk County. The watershed then extends south and east to the segment boundary near Sam Rayburn Reservoir. The Attoyac Bayou Watershed is further subdivided into 55 smaller sub-watersheds. Figure 3.2 depicts the location of the Attoyac Bayou Watershed within the Neches River Basin.

![Figure 3.2 – Basins of East Texas and Sub-basins of the Neches River Basin.](source: TWDB)

Topography

The majority of the watershed consists of gently to moderately sloping terrain, characterized by hills and ridges which slope down to level floodplains of numerous streams extending throughout the watershed. Slope ranges from 0 to approximately 30 percent depending on
landform throughout the watershed. Elevation ranges from approximately 705 ft above mean sea level (msl) in the upper reaches of the watershed to 165 ft above msl near the watershed outlet point at the segment boundary. Figure 3.3 depicts the elevation of the watershed derived from 10-meter national elevation dataset (NED) images.

![Figure 3.3 - Elevation of Attoyac Bayou Watershed](source: Mosaic of USGS 10-meter National Elevation Dataset images)

**Soils**

Soils throughout the watershed are diverse but generally consist of deep, moderately well drained to well drained, loamy to sandy, acidic soils. For a complete look at the soils of the Attoyac Bayou watershed, see the USDA-NRCS Soil Surveys developed for Nacogdoches, Rusk, San Augustine, and Shelby Counties (USDA 1980, USDA 1992, USDA 2006, and USDA 2002 Respectively).

The Attoyac Bayou Watershed is divided into eight (8) soil associations as seen in Figure 3.4. Briefly, these soil associations generally consist of a variety of well drained loamy soils situated in various upland landscapes and along minor drainage ways and streams within the watershed. Notable exceptions include the Tonkawa-Osier-Darco (s7691) and Tuscosso-Marietta-
Mantachie-Iuka-Hannahatchee (s7453) soil associations. The Tonkawa-Osier-Darco (s7691) soil association is comprised of deep, sandy soils situated on side slopes and narrow drainageways. The Tankawa and Darco soils consist of excessively drained sandy soils situated on side slopes, while the Osier soils consist of poorly drained, wet sandy soils situated on foot slopes and along drainage ways. The Tuscosso-Marietta-Mantachie-Iuka-Hannahatchee (s7453) soils association consists of a variety of frequently flooded bottomland soils situated in floodplains. These soils range from moderately well drained to somewhat poorly drained have textures ranging from clay loam to sandy loam (USDA 1980, USDA 1992, USDA 2006, and USDA 2002).

Figure 3.4 – Soil associations within the Attoyac Bayou Watershed. Source: USGS STATSGO Soils

Landuse/Landcover

Castilaw Environmental Services, LLC (CES) classified the landuse and landcover (LULC) types within the Attoyac Bayou Watershed in 2009 – 2010. The watershed was divided into thirteen (13) LULC classes. A more detailed description of these classes as well as the methods used to classify these features can be found in Appendix B.
CES utilized a variety of sources in order to delineate the individual LULC classes found throughout the watershed. The primary method used to delineate these classes was to hand-digitize, often referred to as “heads-up digitizing”, individual areas within the watershed exhibiting a significantly different cover types or landuse from the surrounding areas. Each area was classified according to the different LULC classes presented in Table 3.1. Delineated areas were generally 2-acres in size and larger. Areas exhibiting a separate LULC class but smaller than 2-acres in size were considered a minor component to a larger LULC class and not delineated. Imagery used for the delineation of LULC classes consisted of 2008, leaf-off, 1-meter, National Agricultural Imagery Program (NAIP) county mosaics for each county within the watershed. In order to ensure the accuracy and completeness of the LULC data, CES personnel conducted initial field surveys to characterize dominant LULC types within the watershed and to relate on-the-ground observations with aerial photographic signatures associated with different LULC classes. These classifications were verified utilizing 2001 National Land Cover Dataset classifications and ground truthed data thus providing an accurate and up-to-date description of LULC in the watershed.

As seen in Table 3.1, the Attoyac Bayou Watershed is a predominantly rural watershed with roughly 70% consisting of forested LULC classes, 26% consisting of managed pasture or rangeland, and only approximately 3% consisting of classes of developed land. The remaining classes consisted of open water, barren land, and cultivated crops.

<table>
<thead>
<tr>
<th>LULC Class</th>
<th>Acreage</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Watershed</td>
<td>354,629</td>
<td></td>
</tr>
<tr>
<td>Forested Land</td>
<td>133,193</td>
<td>37.56%</td>
</tr>
<tr>
<td>Managed Pasture</td>
<td>69,662</td>
<td>19.64%</td>
</tr>
<tr>
<td>Pine Plantation</td>
<td>67,891</td>
<td>19.14%</td>
</tr>
<tr>
<td>Near Riparian Forested Land</td>
<td>43,193</td>
<td>12.18%</td>
</tr>
<tr>
<td>Rangeland</td>
<td>23,049</td>
<td>6.50%</td>
</tr>
<tr>
<td>Developed (Low Intensity)</td>
<td>6,618</td>
<td>1.87%</td>
</tr>
<tr>
<td>Developed (Open Space)</td>
<td>3,394</td>
<td>0.96%</td>
</tr>
<tr>
<td>Open Water</td>
<td>2,681</td>
<td>0.76%</td>
</tr>
<tr>
<td>Mixed Forest</td>
<td>2,561</td>
<td>0.72%</td>
</tr>
<tr>
<td>Barren Land</td>
<td>1,546</td>
<td>0.44%</td>
</tr>
<tr>
<td>Developed (Medium Intensity)</td>
<td>771</td>
<td>0.22%</td>
</tr>
<tr>
<td>Cultivated Crops</td>
<td>57</td>
<td>0.02%</td>
</tr>
<tr>
<td>Developed (High Intensity)</td>
<td>13</td>
<td>0.004%</td>
</tr>
</tbody>
</table>
Ecoregions

The watershed is located in the South Central Plains (35) ecoregion, commonly referred to as the “Piney Woods”. Once dominated by a mix of pine and hardwood forest, much of this ecoregion has now been converted to pine plantations. Soils in the South Central Plains ecoregion are generally acidic and sand to sandy loam textures. The Attoyac Bayou Watershed is further subdivided into two level IV ecoregions identified as the Tertiary Uplands (35a), which comprises the northern 3/4ths of the watershed, and the Southern Tertiary Uplands (35e), comprising the southern 1/4th of the watershed.

The Tertiary Uplands (35a) consists of a large area encompassing portions of east Texas, southern Arkansas and North Louisiana. The landscape in this area consists of gently to moderately sloping rolling terrain with numerous stream channels that support a wide variety of habitats and species. The soils in this area are mostly well drained with sandy to sandy loam surface horizons. The natural vegetative communities within the Tertiary Uplands exhibit a lower pine component when compared to the Southern Tertiary Uplands (35e). Much of the
forested land has been converted to pine plantations for timber production. Additional land uses consist of livestock grazing, poultry production, as well as oil & natural gas production (Griffith, et al, 2007).

The Southern Tertiary Uplands (35e) consist of the northern extent of the longleaf pine range in Texas and Louisiana. The landscape in this area is gently sloping, rolling terrain dissected with low to moderate gradient stream channels. In general, this area has less topographic relief than the Tertiary Uplands, but has more relief than the Flatwoods (35f) ecoregion situated to the south. Soils are diverse in this area and range from well-drained sands, to poorly drained clays. Historically, the vegetative community within this ecoregion consisted of longleaf pine forest with other forest types containing hardwoods present at a lower frequency. Large portions of the Southern Tertiary Uplands are public national forest land consisting of the Angelina, Davy Crockett, Sabine, and Sam Houston National Forests. Other land uses consists of pine plantations for timber production, pastureland for livestock grazing, recreation, wildlife, and oil & natural gas production (Griffith, et al, 2007).

**Climate**

The climate within the watershed can be characterized as humid subtropical, with warm humid summers, and humid, mild winters. Average high temperatures during the summer months range from the low to mid 90’s with average low temperatures ranging from the low to mid 70’s. Average high temperatures during the winter months range from the mid to high 50’s with low temperatures in the upper 30’s (Southern Regional Climate Center 2012). Average rainfall within the watershed varies from 45 to 49 inches per year, with an average of 45 inches occurring in the western portion of the watershed and increasing to 49 inches per year in the eastern portion of the watershed. Rainfall is distributed fairly evenly throughout the cooler months of the year. The months of July and August generally receive the least amount of rain in a year. East Texas is characterized as a portion of Texas that experiences a summer drought climatic pattern, with peak precipitation occurring in the spring and fall months. When rainfall is below normal during the cooler months, especially during the peak rainfall periods before and after the typical summer drought conditions, significant drought periods can result (Carr 1967).

**Groundwater**

The Carrizo-Wilcox, Sparta and Queen City aquifer are present within the Attoyac Bayou Watershed. The Carrizo-Wilcox is identified by the Texas Water Development Board (TWDB) as a major aquifer, while the Sparta and Queen City are identified as minor aquifers.

**Carrizo-Wilcox Aquifer**

The Carrizo-Wilcox aquifer is situated in a narrow band that parallels the Gulf Coast and extends from the Rio Grande in South Texas northeast into Arkansas and Louisiana. This aquifer provides water to all or portions of 60 counties in Texas. Municipal pumpage accounts for roughly 35 percent of total withdraws; with the largest metropolitan areas including Bryan-
College Station, Lufkin-Nacogdoches, and Tyler. Pumpage for irrigation accounts for roughly 51 percent of total, and is the predominant use in the Winter Garden region of South Texas. Well yields are generally around 500 gal/min, although some wells may reach 3,000 gal/min in the downdip (subcrop) areas where the water bearing geologic formation is overlain by another formation creating artesian conditions for the aquifer. The Carrizo-Wilcox aquifer produces water that is fresh to slightly saline. In the outcrop, the water is usually hard and low in dissolved solids. In the subcrop, water is softer, but contains more dissolved solids. Water level declines have occurred in the aquifer, with the Lufkin-Nacogdoches area experiencing declines in excess of 400 ft since the 1940’s. Water level declines in the aquifer are slowing, largely due to increasing use of surface water instead of groundwater (Ashworth and Hopkins 1995).

**Sparta**

The Sparta Aquifer is situated in a narrow band that runs from Frio County in South Texas, northeasterly to Sabine County along the Louisiana border. The Sparta aquifer passes through portions of twenty-six (26) Texas Counties. Individual water well yields are generally around 100 gal/min, with some high capacity wells averaging 400 to 500 gal/min. Water quality is generally good within the outcrop and in shallower portions of the subcrop. Water quality deteriorates with depth in the subcrop (Ashworth and Hopkins 1995).

**Queen City**

The Queen City Aquifer is situated in a narrow band that runs from Frio County in South Texas, northeasterly into Northeast Texas and Louisiana. Yields of individual water wells are generally low, with only a few exceeding 400 gal/min. Water quality is generally good within the outcrop and in shallower portions of the subcrop. Water quality deteriorates with depth in the subcrop (Ashworth and Hopkins 1995).
Surface Water

Surface water in the Attoyac Bayou Watershed is abundant. As delineated by the USGS National Hydrography Dataset (NHD), there are over 1,930 stream miles within the Attoyac Bayou Watershed. The majority of these streams consist of unnamed ephemeral and intermittent tributaries of the Attoyac Bayou, however there are approximately 584 stream miles of named streams, generally intermittent or perennial, within the Attoyac Bayou Watershed. The Attoyac Bayou begins in Rusk County in the northern portion of the watershed, and flows in a southerly direction, meandering approximately 97 miles to the segment boundary near Sam Rayburn Reservoir. Major tributaries of the Attoyac Bayou include Big Iron Ore, Naconiche, Terrapin, Waffelow, and West Creeks.

Man-made reservoirs and stock ponds of various sizes are numerous throughout the watershed. Open-water habitats account for 2,680 acres or 0.76% of the land surface within the watershed. Smaller ponds and lakes within the watershed appear to have been built for agriculture or recreational uses by private individuals. There are 13 impoundments within the watershed that
Lake Naconiche

Lake Naconiche is a recently constructed impoundment of Naconiche Creek located in Nacogdoches County. Construction of the dam was completed in 2006; however recreational facilities are in various stages of engineering and construction. The lake is not yet open to the public, and is expected to be open for limited recreational access in mid to late 2012. Funding for the approximately $6.5 million project was provided by Nacogdoches County as well as NRCS (Anderson 2008). The primary function of Lake Naconiche is for flood control with recreation as a secondary use. Utilizing Lake Naconiche as a source for municipal water supply was also mentioned in the 2011 East Texas Water Plan; however a primary sponsor for a new water supply system has not been confirmed (ETRWPG 2010). The lake has a conservation pool surface area 692 acres and a total project area of 1,254 acres. The lake can be accessed from Farm to Market Road 2435, off U.S. Highway 59, approximately 13 miles north of Nacogdoches (ANRA 2011).

Lake Pinkston

Lake Pinkston is located in southwest Shelby County and is an impoundment of Spring Creek. The lake is owned and operated by the City of Center and construction of the lake was completed in 1978. The primary purpose of Lake Pinkston is for municipal water supply for the city of Center with recreation as a secondary use. The lake has a conservation pool area of 447 acres, roughly four miles of shoreline, and an average depth of approximately 20 ft. From State Highway 7, County Road 1510 accesses the dam and western portion of the lake and County Road 1211 accesses the eastern portion of the lake (ANRA 2011).

Lake Timpson

Lake Timpson is located in northwest Shelby County, and is an impoundment of Blackwater Creek. Lake Timpson was constructed in 1956 and the controlling authority is the Shelby County Freshwater Supply District. The primary purposes of this lake are water supply for the city of Timpson and recreation. This lake has a surface area of approximately 223 acres, roughly eight miles of shoreline, and an average depth of 8 ft. The lake can be accessed from Farm to Market Road 2667, off U.S. Highway 59, approximately five miles southwest of Timpson (ANRA 2011).
Population

2010 census data was obtained for individual census tracts present within the Attoyac Bayou Watershed. Census tracts are areas within a county that generally have between 2500 – 8000 people and relatively homogenous population characteristics. These tracts were clipped to only include the area within the watershed, and the population was adjusted based on the amount of land area still present from the original tract. According to 2010 census data, the population for the Attoyac Bayou Watershed is approximately 13,275 people. These people are spread throughout the watershed, but are generally concentrated around towns, communities, and along major road corridors. Based on 911 address data, there are approximately 6,670 structures within the watershed. The majority of these structures are housing units; however this does include churches, businesses, shops, and other large structures. Figure 3.8 depicts the density (structure per square mile) within the watershed.
Figure 3.8 – Structure Point Density for Attoyac Bayou Watershed
Source: ETCOG & DETCOG