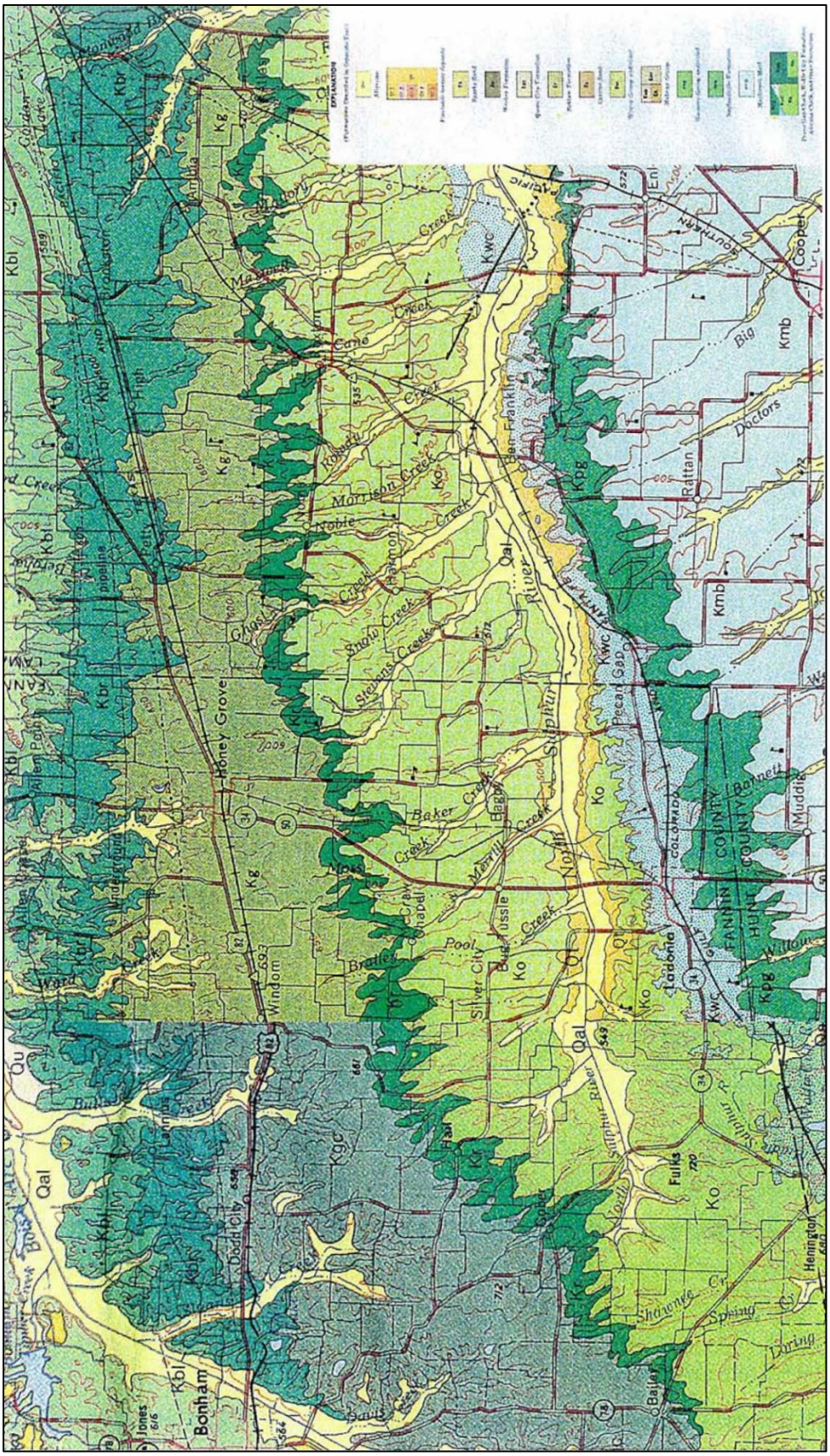


Figure 3-7 Geologic Map of the North Sulphur River Basin

Source: Bureau of Economic Geology, Geologic Atlas of Texas, 1966

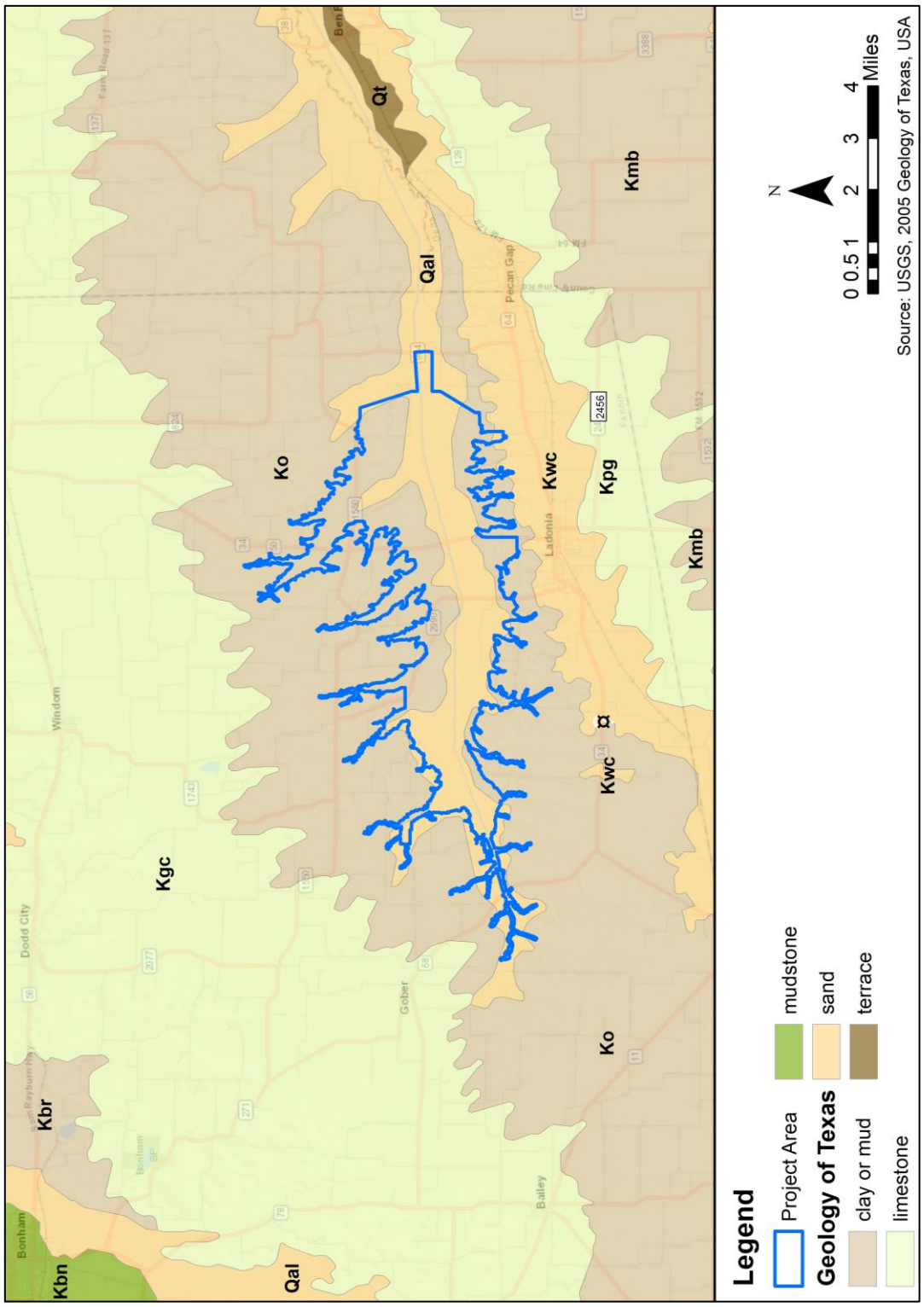


Figure 3-8: Geologic Map of the North Sulphur River Basin and Project Area

Incision of the North Sulphur River and its tributaries has exposed the Ozan Formation in the bed and in the banks where the streams have eroded into the shale. Erosion into the shale takes place as a result of both hydraulic processes (abrasion, plucking, solution) and streambed weathering (slaking) (Howard, 1998; Tinkler and Parish, 1998; Allen et al., 2002). Rates of erosion into the weak shale may ultimately be controlled by the thin layer of sediment over the bedrock rather than the bedrock hardness (Sklar and Dietrich, 1998; Stock et al., 2005). However, Allen et al. (2002) measured wetting-drying cycle-driven slaking rates of up to 4 inches per year in the lower bank regions of channels incised into the Taylor Marl, and rates of up to 2 inches per year in the bed. Tinkler and Parish (1998) have documented channel bed erosion rates into shales on the order of 1 inch per year, and have observed that wetting and drying cycles were primarily responsible for fragmenting the exposed shale to a size that could be transported and removed by frequent and moderate high flows. Similar processes have been observed in the bed of the North Sulphur River and its tributaries (UTRWD, 2006c). **Appendix C** provides a copy of the *Fluvial Geomorphology Study Report*.

The North Sulphur River and its tributaries, within the boundaries of the proposed reservoir, as well as upstream and downstream, are deeply incised and eroding (**Photo 3-1**). Current conditions are the result of channelization and straightening of the sinuous, meandering river and the lower reaches of its tributaries to prevent frequent overbank flooding on the North Sulphur River floodplain in the late 1920s (Williams, 1928; Avery, 1974). Prior to channelization, the North Sulphur River was a sinuous meandering stream with a slope of about 4.3 feet/mile. In the vicinity of the proposed reservoir site, the natural channel was about 48 feet wide and 6 feet deep and had a hydraulic capacity of between 700 and 1,000 cubic feet per second (cfs).

The channelized and straightened channel had a top width of 16 to 30 feet, and a depth of 9 to 12 feet with a slope of 6.5 feet/mile (Avery, 1974) and a hydraulic capacity of about 700 cfs. Currently, at the proposed reservoir site the North Sulphur River is 300 feet wide and about 40 feet deep, the bed and lower portions of the banks of the channel are composed of erodible shale (Ozan Formation), and the channel contains flows well in excess of the 100-year flood peak (38,000 cfs). Based on a comparison of the historical and present-day channel dimensions about 28 million tons of sediment have been eroded from the mainstem North Sulphur River and its tributaries upstream of the proposed reservoir site since the 1920s (UTRWD, 2006c).

Photo 3-1: North Sulphur River deeply incised and eroding channel. Photo taken August 2009.

In the context of the current status of the North Sulphur River, and sediment yield to the reservoir site, it is important to know the evolutionary stage of the incised mainstem and tributaries. In the channelized streams of the humid southeastern U.S., the channel evolution sequence can take about 40 to 50 years to complete (Schumm et al., 1984; Schumm, 1999; Simon, 1989). For the incised streams of the semi-arid southwest the sequence takes about 100 years (Gellis et al., 1995). Therefore, it could be expected that the North Sulphur River, that was channelized about 75 years ago, has completed the evolutionary sequence and might be approaching a new state of equilibrium with the imposed flows and sediment loads. Depending on location, there are indications that this has in fact occurred. However, it is equally apparent that there are sections of the North Sulphur River and its tributaries that are still actively widening, and have very little or no sediment accumulation on the bed, both conditions which are indicative of ongoing disequilibrium. Therefore, it is apparent that the North Sulphur River does not fully fit the previously developed models of incised channel evolution (UTRWD, 2006c).

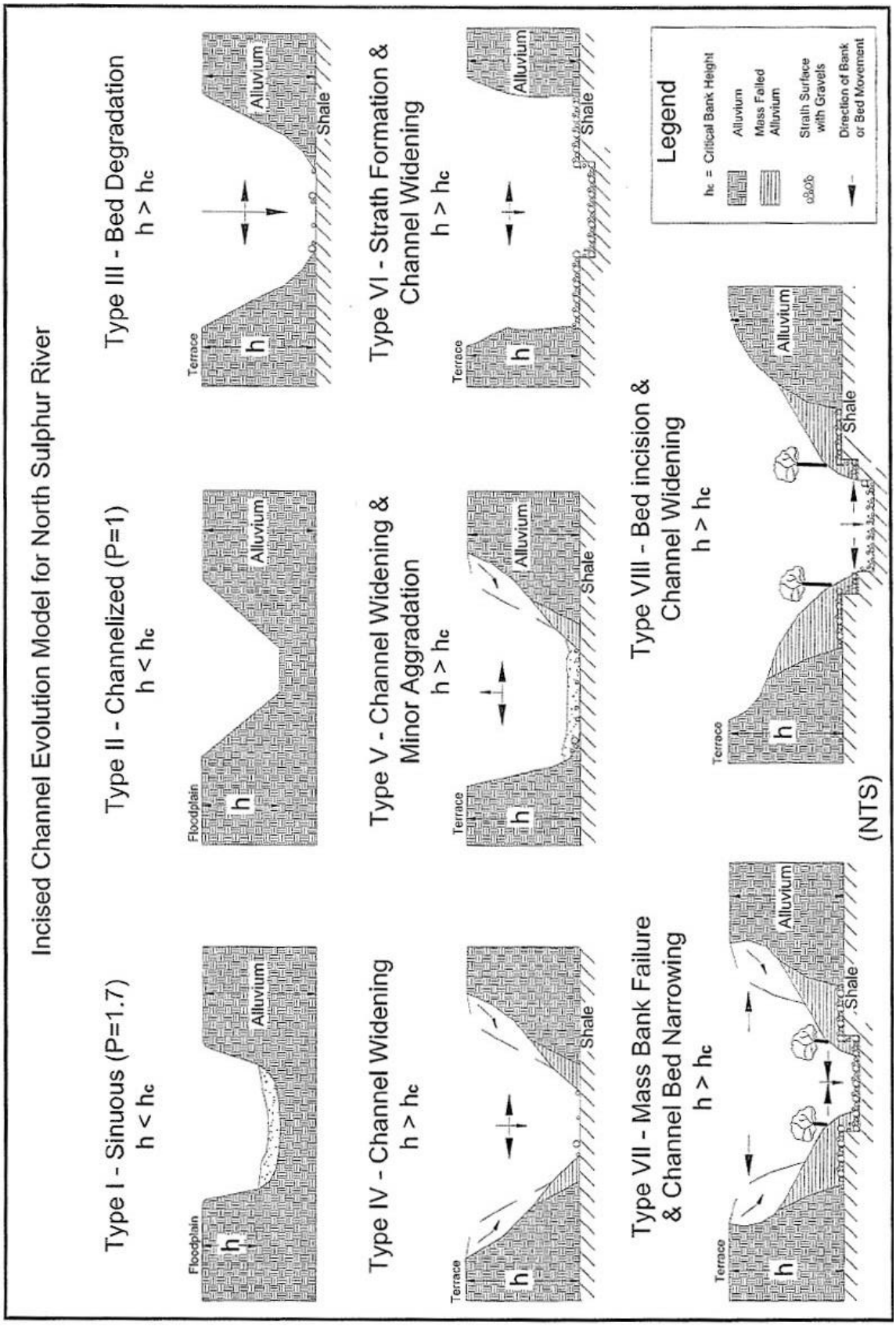
Based on field observations made, a modified version of the incised channel evolution model was developed for the North Sulphur River and its tributaries. Following channelization in the late 1920s the North Sulphur River incised and widened (Avery, 1974) and followed the typical channel evolution sequence while the channel boundary materials were composed of alluvium (**Figure 3-9**, Types I through V).

However, exposure of the shale added a significant complicating factor to the evolution of the channel. Based on the flow record at the U.S. Geological Survey (USGS) gage on the North Sulphur River near Cooper, there are an average of six wetting and drying cycles per year. Since the rates of bedrock erosion are controlled by the number of wetting and drying cycles, and not by hydraulic processes, the upstream dam is unlikely to have any effects on bedrock erosion rates. On an average annual basis, the shale will continue to erode vertically at a rate of about 2 inches per year and laterally at a rate of about 4 inches per year (UTRWD 2006c). Flow events in the channel remove the weathering products and re-initiate vertical and lateral erosion into the shale. As a rule, lateral erosion rates exceed vertical erosion rates in bedrock and result in the formation of gravel-covered strata surfaces that become terraces when vertical erosion of the bed occurs (Leopold et al., 1964; Schumm, 1977) (**Figure 3-9**, Type VI). Deep-seated slump failures of the overlying alluvium bury the strata surfaces (**Figure 3-9**, Type VII) and prevent lateral erosion of the shale.

Resulting channel narrowing may actually accelerate erosion of the shale exposed in the bed, which in turn leads to undercutting of the erosion-resistant, root-reinforced alluvium thereby leading to re-exposure of the shale in the toe of the banks and ongoing lateral retreat of the shale (**Figure 3-9**, Type VIII). Over time the incision into the shale would induce further mass failure of the river bank alluvial valley fill and there would be additional channel widening. It was determined through the incised channel evolution model that the primary sources of channel-derived sediment delivered to the reservoir would be shale outcrops in the bed and lower banks of the channels (UTRWD, 2006c). Furthermore, the model suggested that inundation of the exposed shales within the reservoir would greatly reduce the supply of sediment to the reservoir. The ongoing incised channel evolution exhibited in the North Sulphur River channel applies equally to the larger tributaries that have eroded into the shale.

The bedrock units that are crossed by the Lake Ralph Hall Raw Water Pipeline Alignment begin with the Cretaceous-age Gulf Series Wolfe City Sand which contains a sand and silt layer on top of mudstone. The alignment then crosses the Ozan Formation which consists of dark gray clay with variable amounts of silt. The Lake Ralph Hall Raw Water Pipeline Alignment then passes through Quaternary Alluvium and Quaternary Fluviatile terrace deposits as it crosses the Cowleach Fork of the Sabine River, and the South Sulphur and Middle Sulphur Rivers (UTRWD, 2006c).

Figure 3-9: Channel Evolution Model (NSRCEM) for the North Sulphur River



Source: UTRWD, 2006c

3.4.3 Geologic Hazards

A geologic hazard is a natural geologic event that can endanger human lives and threaten human property. Earthquakes, landslides, and sinkholes are types of geologic hazards that can occur within the proposed Lake Ralph Hall permit area. An earthquake is the result of a sudden release of energy in the Earth's crust that creates seismic waves caused by movement along a fault or by a volcanic eruption. Texas is fortunate to exist in a region low in seismicity. However, earthquakes, of low magnitude have and will occur again in the future in Texas.

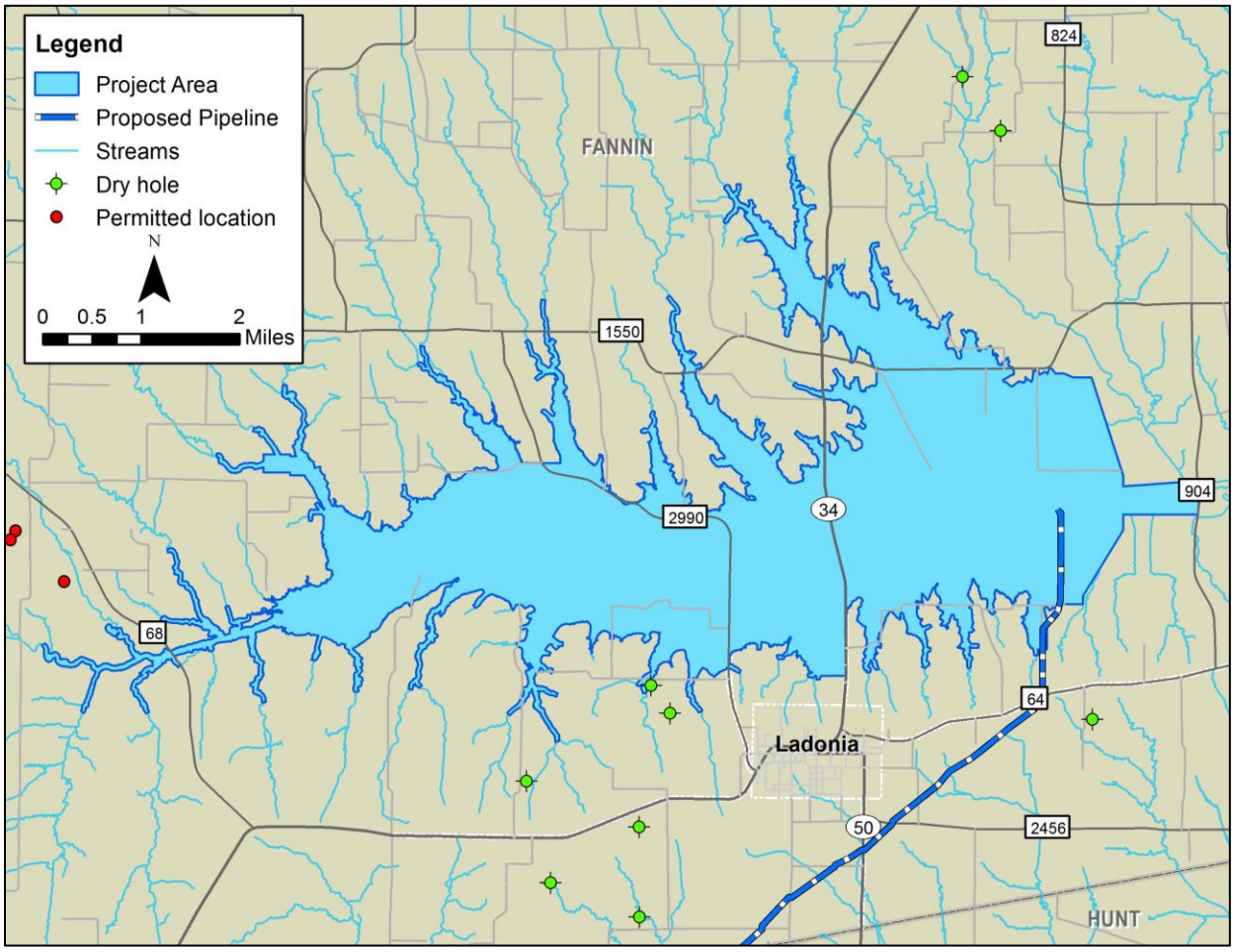
The northeast region of Texas may be at risk from very large, distant earthquakes which might occur in Missouri-Tennessee or Oklahoma; the earthquakes that pose such a hazard are rare, probably occurring only once per 500 years or less. Such distant earthquakes would be most likely to damage large buildings or poorly reinforced masonry structures. Earthquakes with epicenters within northeast Texas region are rare and small; several earthquakes with magnitudes 3 to 4.5 would probably occur each century. These pose little or no risk unless their epicenters are extremely close to poorly built or very sensitive structures (University of Texas Institute for Geophysics, 2012).

A landslide is the movement of soil, rock, or other earth materials, downhill in response to gravity. Landslides include rock falls and topples, debris flows and debris avalanches, earthflows, mudflows, creep, and lateral spread of rock or soil. Frequently landslides occur in areas where the soil is saturated from heavy rains. A landslide occurs when the force that is pulling the slope downward (gravity) exceeds the strength of the earth materials that compose the slope. The proposed Lake Ralph Hall permit area is located in a region low in topographic extremes and therefore low landslide susceptibility and low landslide incidence (Radbruch-Hall et al. 1982). Landslide hazards resulting from natural conditions are not expected. Sinkholes are common where the rock below the land surface is limestone, carbonate rock, salt beds, or rocks that can naturally be dissolved by circulating ground water. As the rock dissolves, spaces and caverns develop underground. There are no known sinkholes within the project area.

3.4.4 Mineral Resources

There are no active oil or gas wells within proposed project area; however, there are several dry oil and gas test wells (Texas Railroad Commission [RRC], 2015). There are three permitted locations northwest of the western portion of the proposed project area. There are no active mines within the proposed project area. Refer to **Figure 3-10** for the locations of mineral resources near the Lake Ralph Hall permit area.

Figure 3-10: Well Locations near Lake Ralph Hall Permit Area



Source: Texas Railroad Commission, 2015

3.4.5 Soils

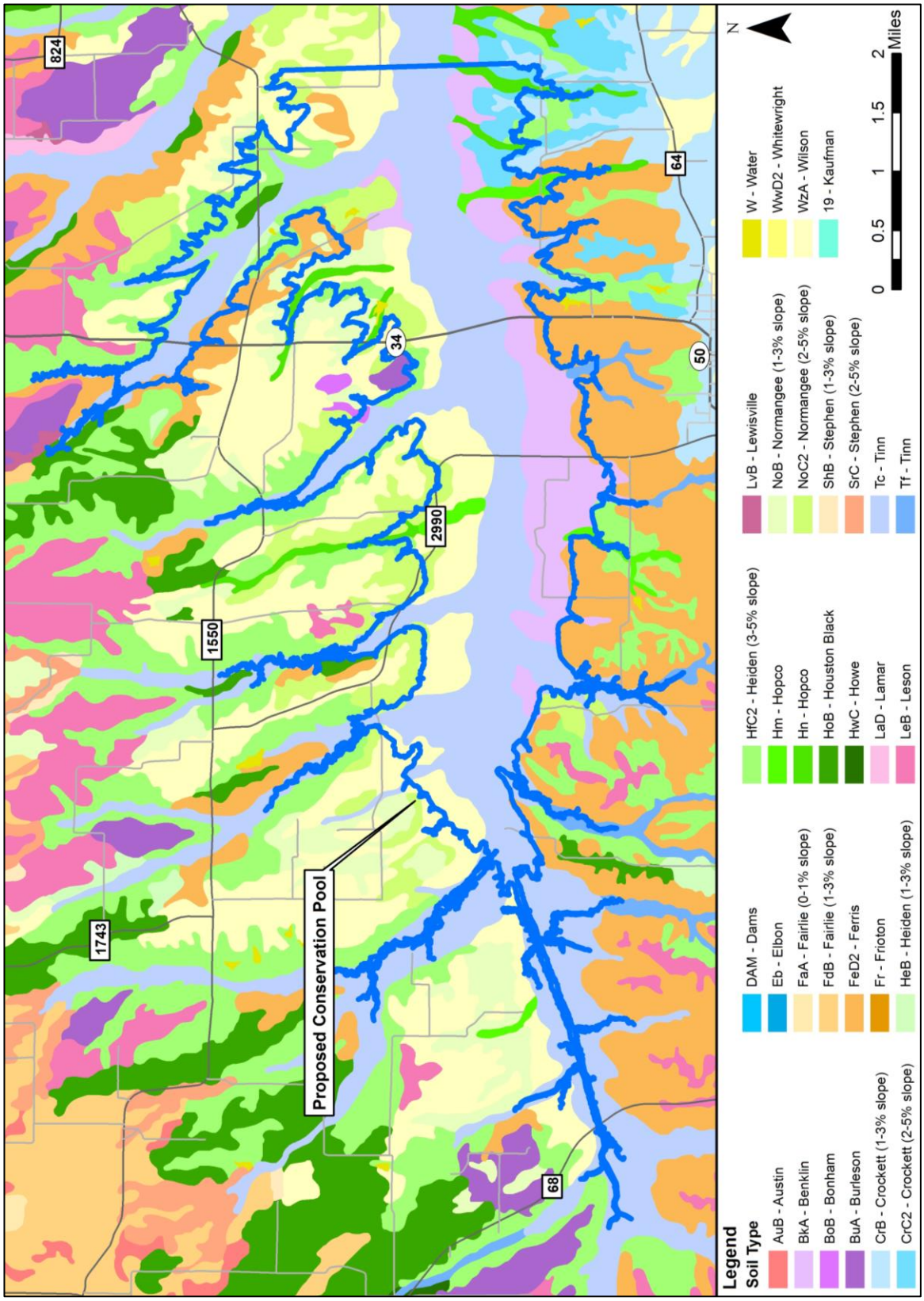
Based on the Natural Resources Conservation Service (NRCS) Soil Survey of Fannin County (a publication sponsored by the United States Department of Agriculture, Soil Conservation Service in cooperation with the Texas Agricultural Experiment Station), a total of 17 surface soils types are located within the proposed Lake Ralph Hall conservation pool footprint and are detailed in **Table 3-2**. **Figure 3-11** shows the surface soils near and within the proposed Lake Ralph Hall. The soils range from somewhat poorly drained soils to well drained soils and vary from loam, silt loam, clay, silty clay, and clay loam. These surface soils consist of soils that are commonly found in river valleys, floodplains, and plains.

Table 3-2: Surface Soils within the Preferred Alternative for Lake Ralph Hall

Map Unit ID	Soil Series	Soil Description
BkA	Benklin	Benklin silt loam, 0 to 1 percent slopes. Moderately well drained and found in stream terraces on river valleys.
BoB	Bonham	Bonham silt loam, 1 to 3 percent slopes. Moderately well drained and found in ridges on plains.
BuA	Burleson	Burleson clay, 0 to 1 percent slopes. Moderately well drained and found in circular gilgai on stream terraces on river valleys and circular gilgai on stream terraces on plains.
CrB	Crockett	Crockett loam, 1 to 3 percent slopes. Moderately well drained and found in ridges on plains.
CrC2	Crockett	Crockett loam, 2 to 5 percent slopes. Moderately well drained and found in ridges on plains.
FeD2	Ferris	Ferris clay, 5 to 12 percent slopes. Well drained soils and found in linear gilgai on ridges on plains.
HeB	Heiden	Heiden clay, 1 to 3 percent slopes. Well drained and found in linear gilgai on ridges on plains and on linear gilgai on plains on plains.
HfC2	Heiden-Ferris	Heiden-Ferris complex, 2 to 6 percent slopes. Well drained and found in linear gilgai on ridges on plains.
Hm	Hopco	Hopco silt loam, occasionally flooded. Somewhat poorly drained soils and found in floodplains on coastal plains.
Hn	Hopco	Hopco silt loam, frequently flooded. Somewhat poorly drained soils and found in floodplains on coastal plains.
HoB	Houston Black	Houston Black clay, 1 to 3 percent slopes. Moderately well drained and found in circular gilgai on ridges on plains.
LvB	Lewisville	Lewisville silty clay, 1 to 3 percent slopes. Well drained and found in stream terraces on river valleys.
NoB	Normangee	Normangee clay loam, 1 to 3 percent slopes. Moderately well drained and found in ridges on coastal plains.
NoC2	Normangee	Normangee clay loam, 2 to 5 percent slopes. Moderately well drained and found in ridges on coastal plains.
Tc	Tinn	Tinn clay, occasionally flooded. Moderately well drained and found in circular gilgai on floodplains on plains and circular gilgai on floodplains on river valleys.
Tf	Tinn	Tinn clay, frequently flooded. Moderately well drained and found in circular gilgai on floodplains on plains and circular gilgai on floodplains on river valleys.
WzA	Wilson	Wilson silt loam, 0 to 1 percent slopes. Moderately well drained and found in stream terraces on plains and in stream terraces on river valleys.

Source: NRCS Soil Survey of Fannin County

Figure 3-11: Soils Near Proposed Lake Ralph Hall, Fannin County



Source: NRCS Soil Survey of Fannin County

The soil types found along the pipeline corridor and proposed balancing reservoir were obtained from the NRCS Soil Surveys for Fannin, Hunt, and Collin counties. **Table 3-3** lists the 24 soil types that are found along the Lake Ralph Hall Raw Water Pipeline Alignment and proposed balancing reservoir.

Table 3-3: Surface Soils Found Along the Lake Ralph Hall Raw Water Pipeline Alignment and Proposed Balancing Reservoir

Map Unit ID	Soil Series	Soil Description
1	Axtell	Axtell loam, 2 to 5 percent slopes. Moderately well drained and found in stream terraces on coastal plains and in stream terraces on river valleys.
AuB	Austin	Austin silty clay loam, 1 to 3 percent slopes. Well drained and found in ridges on plains.
BkA	Benklin	Benklin silt loam, 0 to 1 percent slopes. Moderately well drained and found in stream terraces on river valleys.
CrB	Crockett	Crockett loam, 1 to 3 percent slopes. Moderately well drained and found in ridges on plains.
CrC2	Crockett	Crockett loam, 2 to 5 percent slopes. Moderately well drained and found in ridges on plains.
9	Fairlie-Dalco	Fairlie-Dalco complex, 1 to 4 percent slopes. Moderately well drained and found in ridges on plains.
FdB	Fairlie-Dalco	Fairlie-Dalco complex, 1 to 3 percent slopes. Moderately well drained and found in ridges on plains.
11	Ferris-Heiden	Ferris-Heiden complex, 2 to 5 percent slopes. Well drained and found in linear gilgai on ridges on plains.
HcC2	Heiden	Heiden clay, 3 to 5 percent slopes.
13	Heiden	Heiden clay, 2 to 5 percent slopes. Well drained and found in linear gilgai on ridges on plains.
HfC2	Heiden-Ferris	Heiden-Ferris complex, 2 to 6 percent slopes. Well drained and found in linear gilgai on ridges on plains.
Hn	Hopco	Hopco silt loam, frequently flooded. Somewhat poorly drained soils and found in floodplains on coastal plains.
HoB	Houston Black	Houston Black clay, 1 to 3 percent slopes. Moderately well drained and found in circular gilgai on ridges on plains.
19	Kaufman	Kaufman clay, occasionally flooded. Moderately well drained and found in circular gilgai on floodplains on plains and circular gilgai on floodplains on river valleys.
20	Lamar	Lamar loam, 5 to 12 percent slopes. Well drained and found in stream terraces on plains.
LaC2	Lamar	Lamar clay loam, 3 to 5 percent slopes.
LaD2	Lamar	Lamar clay loam, 5 to 8 percent slopes.

Map Unit ID	Soil Series	Soil Description
LeB	Leson	Leson clay, 1 to 3 percent slopes. Moderately well drained and found in ridges on plains.
25	Nahatche	Nahatche loam, frequently flooded. Somewhat poorly drained and found in floodplains on plains.
28	Stephen	Stephen silty clay, 2 to 5 percent slopes. Well drained and found in ridges on plains.
Tc	Tinn	Tinn clay, occasionally flooded. Moderately well drained and found in circular gilgai on floodplains on plains and circular gilgai on floodplains on river valleys.
Tf	Tinn	Tinn clay, frequently flooded. Moderately well drained and found in circular gilgai on floodplains on plains and circular gilgai on floodplains on river valleys.
WcB	Wilson	Wilson clay loam, 1 to 3 percent slopes.
WzA	Wilson	Wilson silt loam, 0 to 1 percent slopes. Moderately well drained and found in stream terraces on plains and in stream terraces on river valleys.

Source: NRCS Soil Surveys for Fannin, Hunt, and Collin Counties

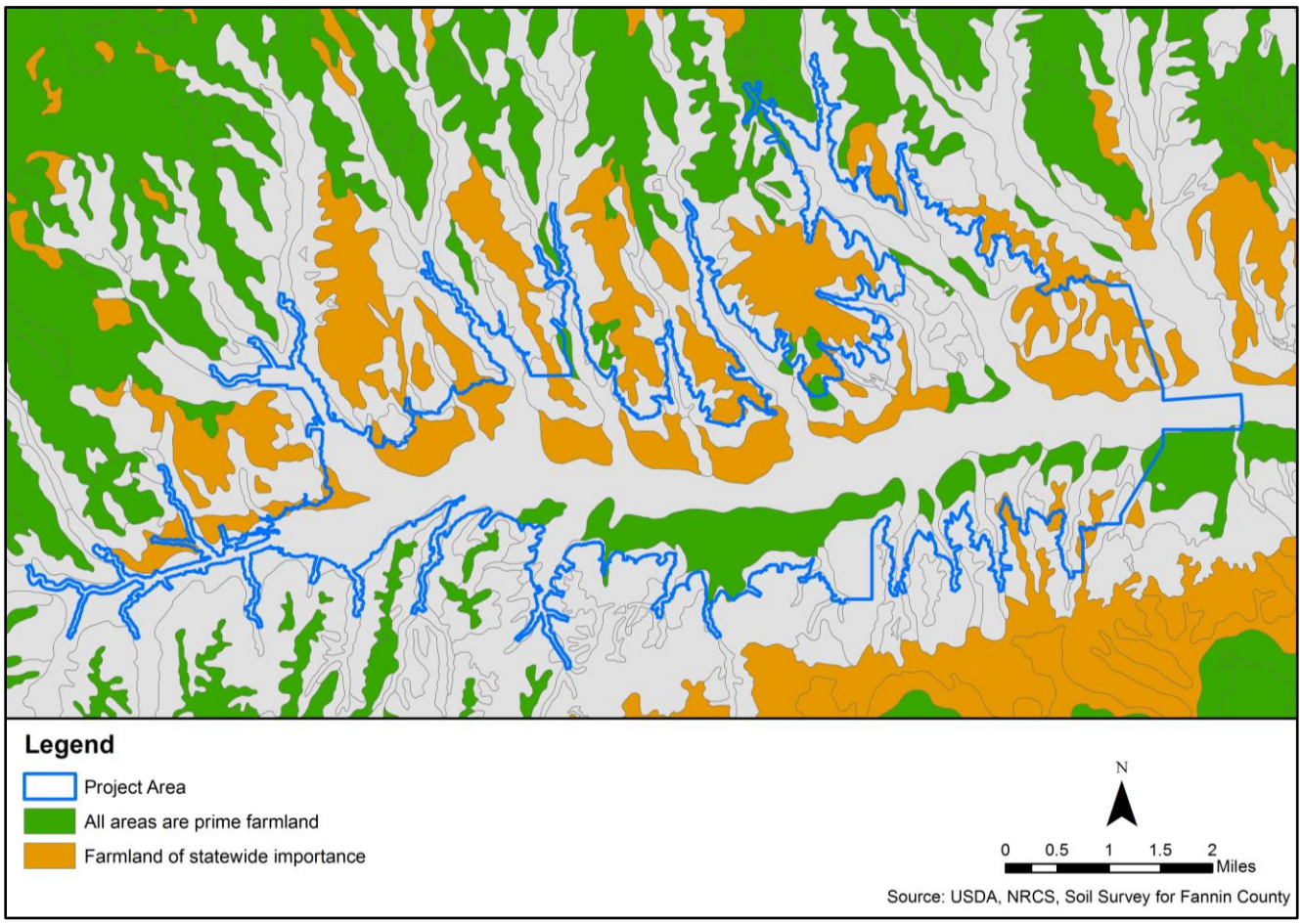
The general soils found along the Lake Ralph Hall Raw Water Pipeline Alignment and proposed balancing reservoir begin on the west end at the proposed balancing reservoir with the Lamar Series, which contains well drained clay loam with 5 to 8 percent slopes. The pipeline continues east into the Crockett Series, which contains loamy moderately well drained upland soils with 1 to 5 percent slopes. The alignment continues into the Leson-Houston Black and Ferris-Heiden Series surrounding the town of Celeste in Hunt County. The Leson-Houston Black Series contains moderately well drained upland soils with 1 to 3 percent slopes. The Ferris-Heiden Series contains well drained soils with 2 to 6 percent slopes (UTRWD, 2006c). As the Lake Ralph Hall Raw Water Pipeline Alignment crosses the South Sulphur River the soil consists of the Kaufman floodplain soil which contains occasionally flooded moderately well drained clay. The alignment then crosses into the Fairlie-Dalco Complex and then back into the Crockett Series heading into and across the city of Ladonia in Fannin County. The Fairlie-Dalco Complex contains moderately well drained soils with 1 to 3 percent slopes.

3.4.6 Prime Farmland

Prime farmland is defined as land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops. The Farmland Protection Policy Act (FPPA) authorizes the NRCS to develop criteria for identifying the effects of federal programs on the conversion of farmland and lands that could be used for farming to non-agricultural uses. Projects considered exempt under the FPPA include those that require no additional right-of-way (ROW), or projects that require additional ROW but that ROW is developed, urbanized or zoned for urban use. Permit actions are exempt and information is included for disclosure purposes. For non-exempt projects impacts are scored using Form NRCS-AD-1006 (Farmland Conversion Impact Rating) and coordination with the NRCS is undertaken as

warranted based on this score. **Figure 3-12** shows the prime farmlands that are found in and near the proposed Lake Ralph Hall.

Figure 3-12: Prime Farmlands Near Proposed Lake Ralph Hall

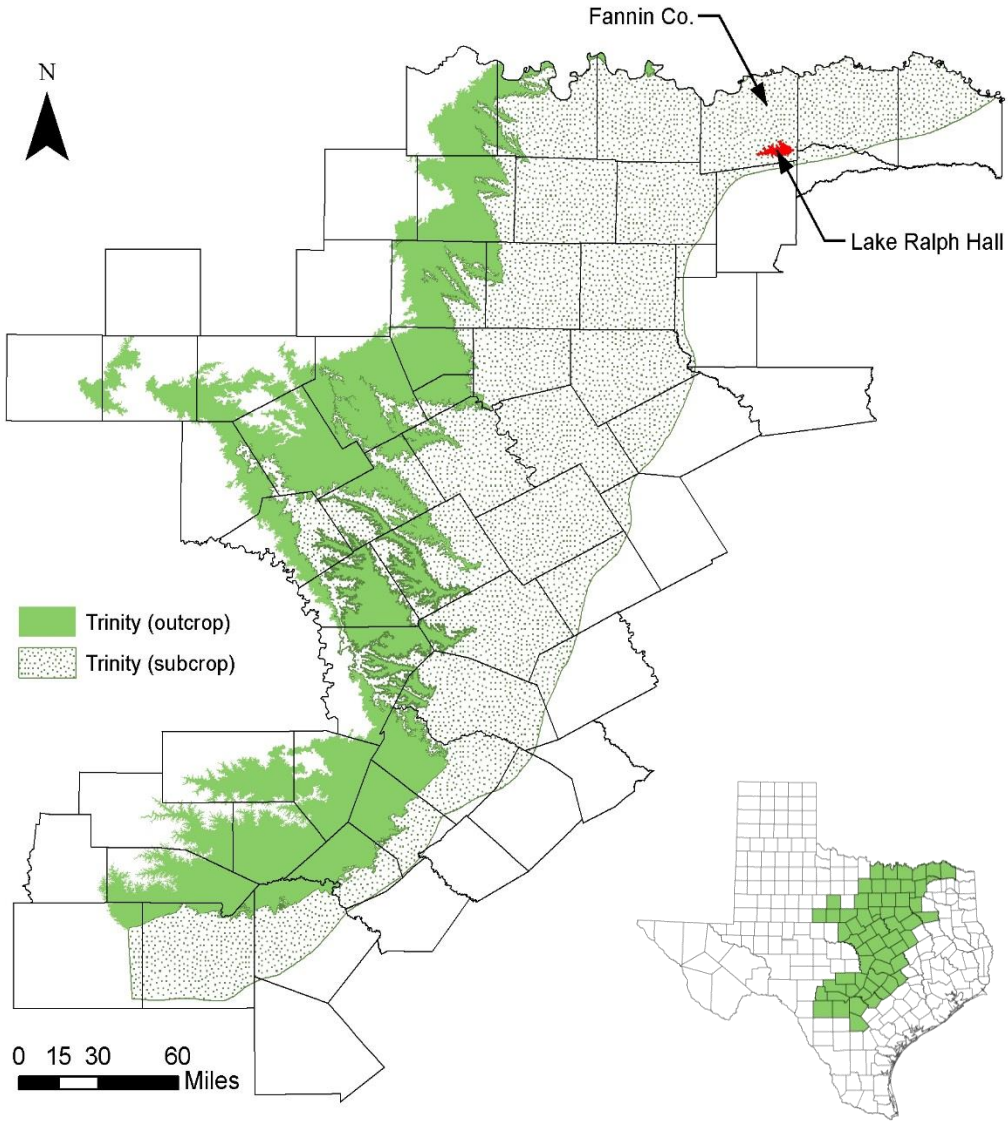


Source: NRCS Soil Survey of Fannin County

3.5 Groundwater

The Trinity and Woodbine aquifers are the two predominant groundwater sources located within the project vicinity (**Figures 3-13 and 3-14)**. The Trinity aquifer, as recognized by the Texas Commission on Environmental Quality (TCEQ) and the Texas Water Development Board, is listed as a major aquifer for Texas. This aquifer consists of limestone, sand, clay, gravel, and conglomerates. The Trinity aquifer is one of the most extensive and highly used groundwater resources in Texas. It is primarily used by municipalities; however, it is also used for irrigation, livestock, and other domestic purposes.

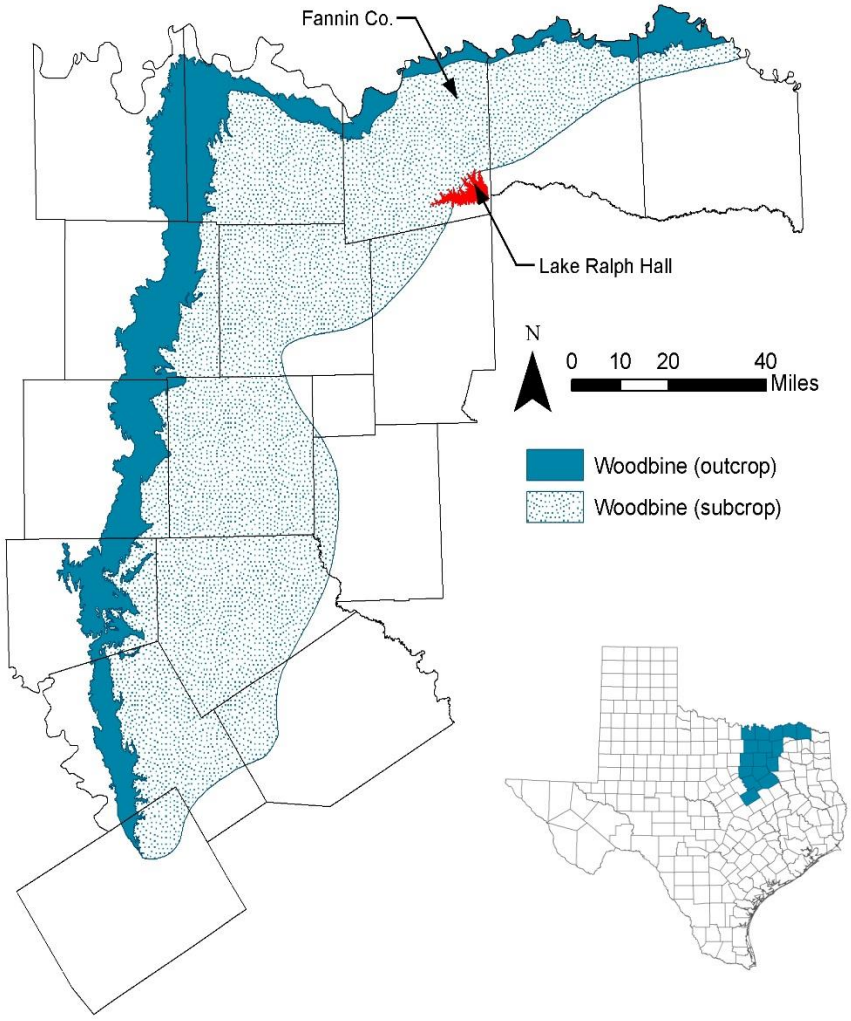
Figure 3-13: Trinity Aquifer



Source: Texas Water Development Board

The Woodbine aquifer is listed as a minor aquifer in Texas. This aquifer overlies the Trinity aquifer and consists of sandstone interbedded with shale and clay. The Woodbine aquifer provides water for municipal, industrial, domestic, livestock, and small irrigation supplies. Both of these aquifers provide water supply for the rural areas of Fannin County.

Figure 3-14: Woodbine Aquifer



Source: Texas Water Development Board

The Trinity and Woodbine formations are more than 2,000 feet below ground surface in this area and are separated from the surface by significant thickness of aquicludes or aquitards. These aquifers recharge very slowly and only approximately 3 percent of water that falls as rain over the outcrop area ends up recharging the aquifer. The amount of recharge to the Trinity and Woodbine aquifers is estimated to be less than one inch per year (Nordstrom, 1982).

Fannin County lies within a Priority Groundwater Management Area (PGMA). A PGMA is an area designated and delineated by TCEQ that is experiencing, or is expected to experience, within 25 years, critical groundwater problems including shortages of surface water or groundwater, land subsidence resulting from groundwater withdrawal, and contamination of groundwater supplies (TCEQ, 2016). The Red River Groundwater Conservation District (GCD) was created to adopt

policies, plans, and rules that can address critical groundwater problems. The Red River GCD includes the counties of Fannin and Grayson. The GCD's goal is to conserve, protect, and preserve groundwater resources.

3.6 Surface Water

3.6.1 Hydrology

The Sulphur River Basin is the major surface watershed where the proposed project would be located. Specifically, the proposed Lake Ralph Hall is located solely within the North Sulphur River Watershed on the North Sulphur River. As shown in **Figure 3-15** major tributaries to the North Sulphur River that could be affected by the proposed reservoir include Allen Creek, Bear Creek, Pot Creek, Brushy Creek, Pickle Creek, Davis Creek, Legget Branch, Bralley Pool Creek, Merrill Creek, Hedrick Branch, Long Creek, Baker Creek, and McClure Creek.

Beginning in the 1920's, significant portions of the North Sulphur River and several major tributaries including reaches within the proposed reservoir project area, were channelized to increase floodwater drainage within agricultural cropland. Based on newspaper articles from that era (Dallas Morning News, 1928), the channelization project created a straight channel that was approximately 40 feet wide and 10 feet deep along the upper reaches of the North Sulphur River. After decades of erosion, the main channel of the North Sulphur River now varies from 200 to 300 feet wide and 40 to 60 feet deep. At present, head cutting and bank widening continue as a result of constant slaking of the eroding shale within the current channel bottom.

The exceptional erosion exhibited along the river channel and throughout the watershed as a result of the channelization has resulted in significant degradation of hydrologic, biogeochemical, and habitat functions within the proposed project area as well as to downstream reaches of the river basin. Constant erosion exacerbates the continued loss of topsoil, riparian vegetation, stream properties, and stream functions of the North Sulphur River. Furthermore, the tributaries are experiencing similar degradation as the North Sulphur River continues to deepen and widen.

Flows in the North Sulphur River are primarily from runoff, although following rainfall events spring discharges do occur for sustained periods. Conditions of no flow do exist along substantial reaches of the channel during prolonged dry periods of several months (DiNatale Water Consultant, 2016a). **Appendix D-1** provides a copy of the *Evaluation of Hydrologic Modeling in Support of the Lake Ralph Hall EIS*. The only USGS streamflow gage located on the North Sulphur River that can be used to evaluate historical river flow conditions is the North Sulphur River near Cooper, Texas (TX) gage (No. 07343000). This gage is approximately 20 river miles downstream of the proposed Lake Ralph Hall. The total drainage area upstream of the gage is 276 square miles; however the drainage area above the dam site only consists of approximately 100 square miles or 36.6 percent of the total drainage area above the gage (UTRWD, 2004). **Appendix D-2** provides the *Hydrologic and Hydraulic Studies for Lake Ralph Hall*.

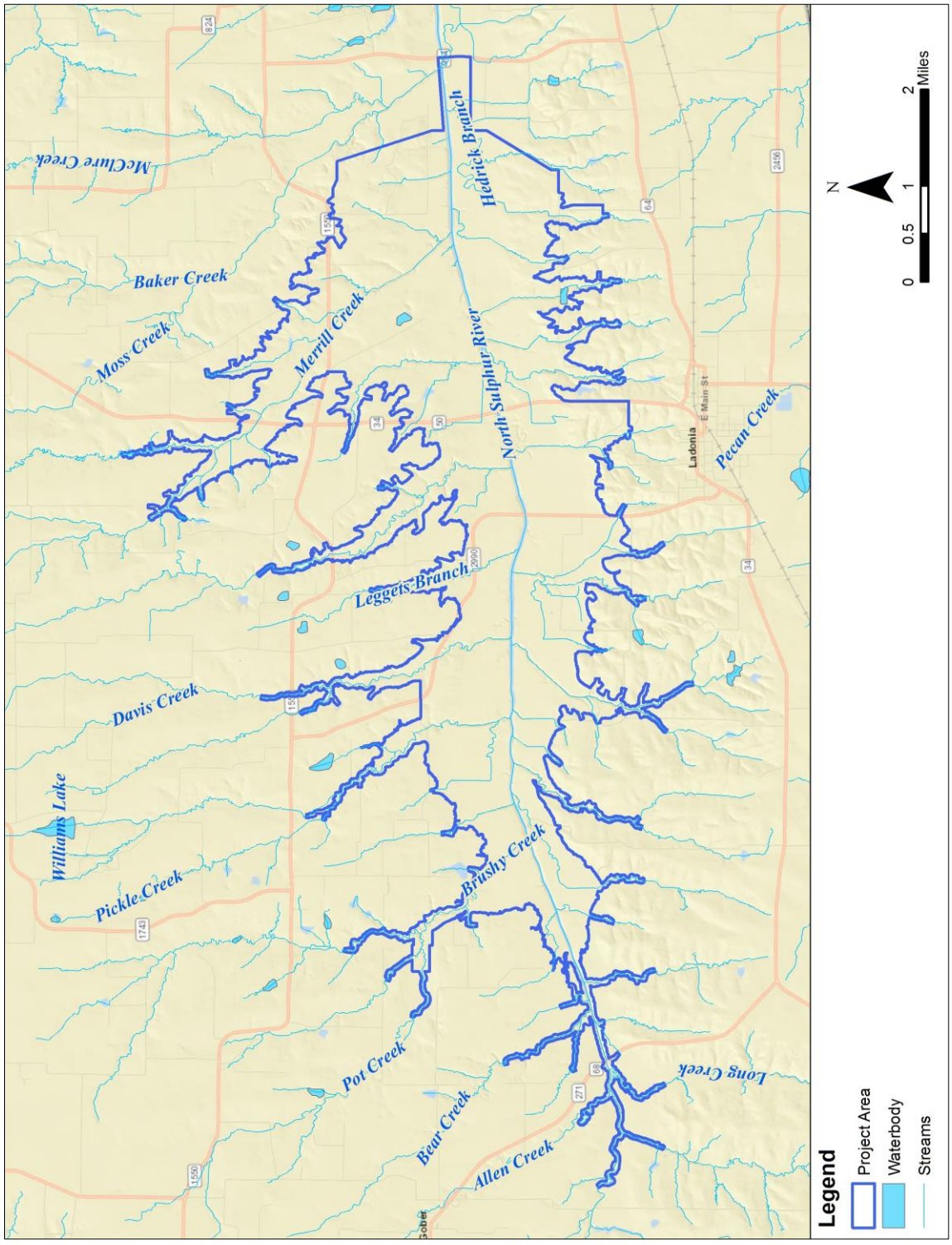


Figure 3-15: Surface Water Resources near the Proposed Lake Ralph Hall

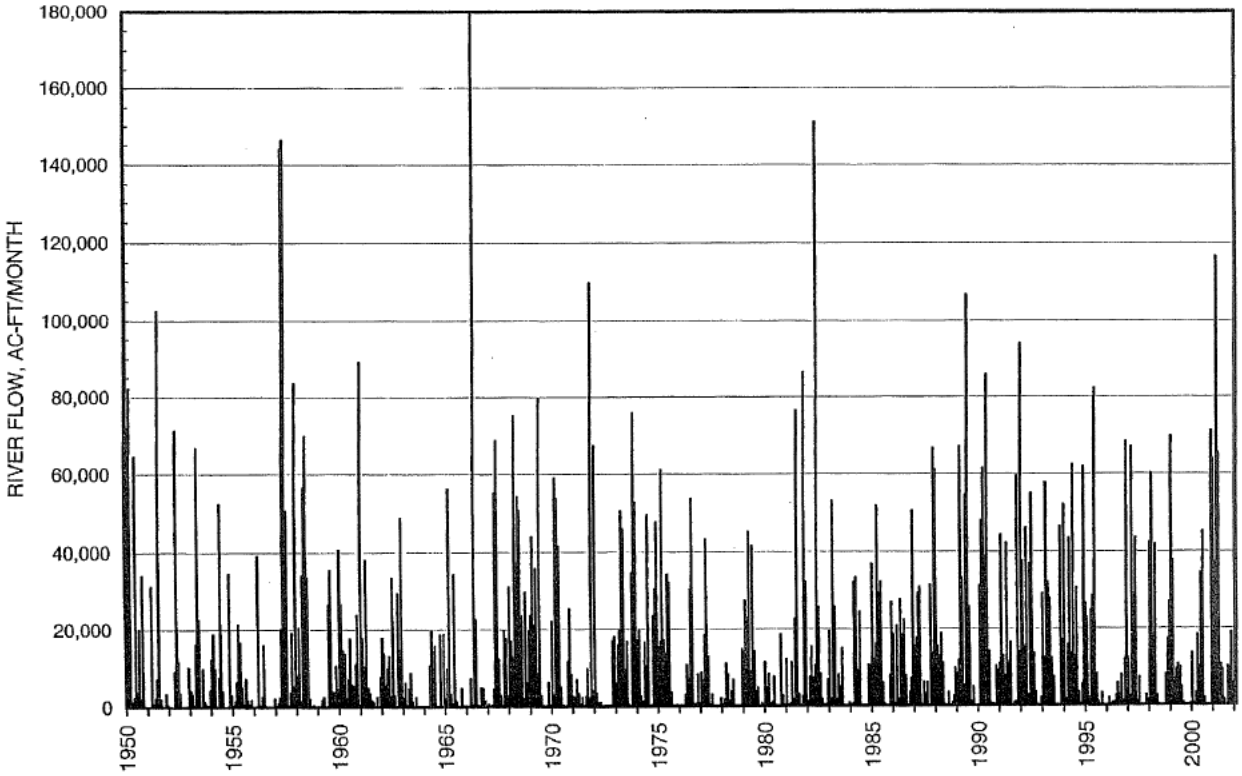
Source: National Hydrography Dataset

The mean daily flow at this gage for the period from October 1950 through September 2001 is 261 cfs or 188,900 acre-feet per year (AF/YR). However, the median flow during that same time period was only 11 cfs. This indicates that the flow had been low much of the time and that significant flood events have occurred periodically and have caused the mean flow of the river to be higher (UTRWD, 2004). As shown in **Figure 3-16**, historical monthly flows measured at the gage on the North Sulphur River have varied considerably in response to rainfall conditions in the basin. This graph shows that some months have had close to zero flows (**Photo 3-2**), while other months have had significant flood flows (**Photo 3-3**).

Photo 3-2: North Sulphur River with zero flow.

Photo 3-3: North Sulphur River with high flow.

Figure 3-16: Historical Monthly North Sulphur River Flows at Gage No. 07343000



Source: UTRWD, 2004

3.6.2 Water Quality

Current water quality conditions of the North Sulphur River and Lewisville Lake are included in this section. Water quality data from TCEQ was used to describe existing conditions. No predictive analysis was conducted to model water quality of the proposed Lake Ralph Hall.

The federal Safe Drinking Water Act Amendments of 1996 protects public health by regulating the nation's public drinking water supply. The law requires many actions to protect drinking water and its sources, including rivers, lakes, reservoirs, and groundwater.

Water quality regulatory programs in Texas are administered by TCEQ with the substantial involvement of local river authorities as well as other state and local groups, and are conducted under the Texas Clean Rivers Program and other relevant legislation. The Texas Administrative Code (TAC), Title 30, Chapter 307 promulgates surface water quality criteria, regulations, and standards. Four typical general categories of water use for each river segment are identified for Texas surface water quality standards: recreation, aquatic life, aquifer protection, and domestic water supply. In addition, TCEQ regulations require certification that a permit allowing the

discharge of dredged or fill material would comply with state water quality standards, under Section 401 of the Clean Water Act (CWA).

The Texas Surface Water Quality Standards establish explicit goals for the quality of streams, rivers, lakes, and bays throughout Texas. Water quality standards are developed to maintain the quality of surface waters in Texas to support public health and enjoyment while protecting aquatic life. Water quality standards identify appropriate uses for surface waters including aquatic life, recreation, and public water supply (drinking water). Criteria for evaluating support of these uses include dissolved oxygen, temperature, pH, dissolved minerals, toxic substances, and bacteria. TCEQ adopted revisions to the standards which became effective in 2014. However, the Environmental Protection Agency (EPA) has not approved all the 2014 standards revisions. In particular, a revision to the North Sulphur River segment stating the benthic macroinvertebrate community should be assessed as limited aquatic life is currently under review by the EPA.

3.6.2.1 North Sulphur River

The 2014 standards for the North Sulphur River are described in **Table 3-4**.

Table 3-4: Site-Specific Uses and Criteria for the North Sulphur River (TCEQ, 2015)

Uses	Recreation	Public Contact Recreation
	Aquatic Life	Intermediate[1]
	Domestic Water Supply	–
	Other	–
Criteria	Cl^{-1} (mg/L)	190
	SO_4^{-2} (mg/L)	475
	TDS (mg/L)	1,320
	Dissolved Oxygen (mg/L)	5.0
	pH Range (SU)	6.0 – 8.5
	Indicator Bacteria[2] (#/100ml)	126
	Temperature (°F)	93

mg/L – milligrams per liter; SU – standard units; °F – degrees Fahrenheit

[1]According to TCEQ, "The intermediate aquatic life use applies only to the fish community. The benthic community is to be assessed using a limited aquatic life use." This language is under EPA review.

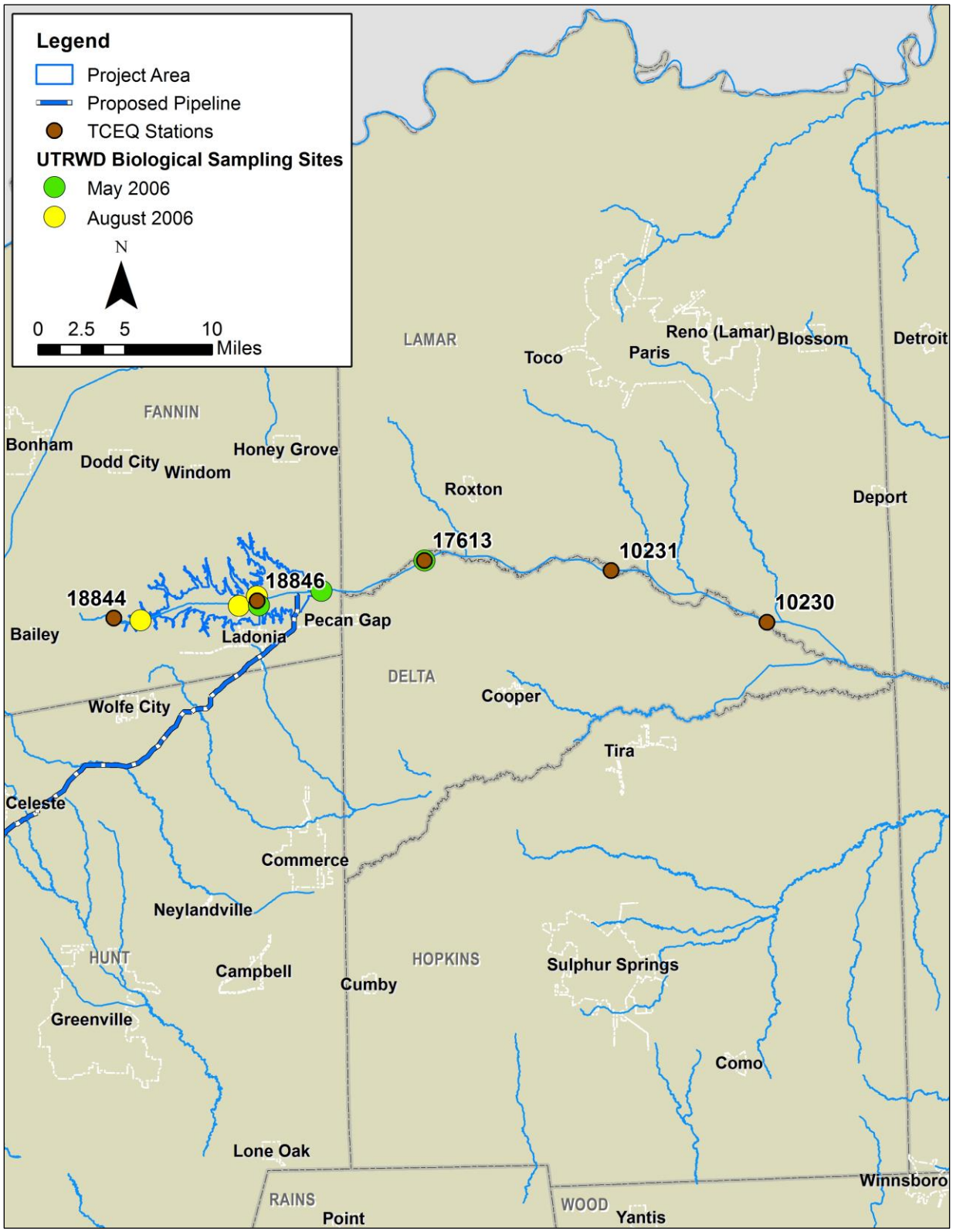
[2]The indicator bacteria for freshwater is *E. coli*.

The Texas Integrated Report of Surface Water Quality describes the status of natural waters based on historical data and assigns water bodies various categories depending on the extent to which they attain standards. In accordance with the federal CWA 305(b) and 303(d), the TCEQ produces an updated report every two years.

According to the 2014 Texas Integrated Report of Surface Water Quality, the North Sulphur River consists of two assessment segments. Segment 0305_01 includes the portion of the river from the confluence with the South Sulphur River upstream approximately 25 miles to Morrison Creek. Segment 0305_02 includes the portion of the river from the confluence with Morrison Creek upstream approximately 23 miles to the headwaters. Stations associated with Segment 0305_01

include 10230 and 10231 (**Figure 3-17**). Stations associated with Segment 0305_02 include 17613, 18844, and 18846 (**Figure 3-17**). Assessment results from TCEQ (2015) are included in **Table 3-5** and **Table 3-6**.

Figure 3-17: UTRWD and TCEQ Water Quality and Biological Sample Stations



Source: TCEQ 2014; UTRWD

Table 3-5: 2014 Texas Integrated Water Quality Assessment Results, Segment 0305_01, December 2005 to November 2012

Parameter	# Samples	Mean of Samples	# of Sample Exceeding Criteria	Mean of Samples Exceeding Criteria	Criteria	Sample Sizes	Level of Support
Aquatic Life Use							
DO-Grab Screening Level (mg/L)	25	–	0	–	5.00	AD	NC
DO-Grab Min (mg/L)	25	–	0	–	3.00	AD	FS
Recreation Use							
Bacteria*	14	52.72	0	–	126.00	LD	NC
General Use							
Water Temp (°C)	25	–	0	–	33.90	AD	FS
High pH (SU)	25	–	1	9.2	8.50	AD	FS
Low pH (SU)	25	–	0	–	6.00	AD	FS
TDS (mg/L)	39	676.32	0	–	1,320.00	AD	FS
Chloride (mg/L)	36	43.77	0	–	190.00	AD	FS
Sulfate (mg/L)	36	306.67	0	–	475.00	AD	FS
Nitrate (mg/L)	25	–	1	3.72	1.95	AD	NC
Ammonia (mg/L)	25	–	0	–	0.33	AD	NC
Total Phosphorus (mg/L)	22	–	0	–	0.69	AD	NC
Chlorophyll-*a* (µg/L)	23	–	7	25.57	14.10	AD	CS

* E. Coli (Colonies/100mL)

DO – Dissolved Oxygen; TDS – Total Dissolved Solids; AD – Adequate Data; LD – Limited Data; NC – No Concern; FS – Fully Supporting; CS – Screening Level Concern; °C – Degrees Celsius; µg - Micrograms

Table 3-6: 2014 Texas Integrated Water Quality Assessment Results, Segment 0305_02, December 2005 to November 2012

Parameter	# Samples	Mean of Samples	# of Sample Exceeding Criteria	Mean of Samples Exceeding Criteria	Criteria	Sample Sizes	Level of Support
Aquatic Life Use							
DO-Grab Screening Level (mg/L)	12	–	0	4.9	4.00	AD	NC
DO-Grab Min (mg/L)	12	–	0	–	3.00	AD	FS
DO-24hr Avg (mg/L)	6	–	0	–	5.00	LD	NC
DO-24hr Min (mg/L)	6	–	0	–	3.00	LD	NC
Habitat	3	19.00	–	–	14.00	AD	NC
Macrobenthic Community	6	22.00	–	–	22.00	AD	FS
Fish Community	6	39.00	–	–	33.00	AD	FS
Recreation Use							
Bacteria	12	9.08	0	–	126.00	LD	NC
General Use							
Water Temp (°C)	12	–	0	–	33.90	AD	FS
High pH (SU)	12	–	0	–	8.50	AD	FS
Low pH (SU)	12	–	0	–	6.00	AD	FS
Sulfate (mg/L)	36	306.67	0	–	475.00	AD	FS
TDS (mg/L)	39	676.32	0	–	1,320.00	AD	FS
Chloride (mg/L)	36	43.77	0	–	190.00	AD	FS
Chlorophyll-*a* (µg/L)	12	–	0	–	14.10	AD	NC
Total Phosphorus (mg/L)	12	–	0	–	0.69	AD	NC
Nitrate (mg/L)	12	–	3	3.06	1.95	AD	NC
Ammonia (mg/L)	12	–	0	–	0.33	AD	NC

* E. Coli

DO – Dissolved Oxygen; TDS – Total Dissolved Solids; AD – Adequate Data; LD – Limited Data; NC – No Concern; FS – Fully Supporting; CS – Screening Level Concern; °C – Degrees Celsius; µg - Micrograms

TCEQ (2015) indicates the majority of parameters assessed fully support the use or are no concern. Chlorophyll-*a* in Segment 0305_01 is the only parameter indicating a concern for water quality based on screening levels from a nonpoint source. Seven out of twenty-three samples exceeded the criteria with a mean exceedance of 25.57 µg/L. Currently, there is no concern for non-attainment of the standard based on numeric criteria.

The Section 303(d) list identifies water bodies in Texas too polluted or otherwise degraded to meet water quality standards. The North Sulphur River is not included in the TCEQ (2015) 303(d) List and is not considered impaired.

3.6.2.2 Lewisville Lake

UTRWD intends to divert raw water from the proposed project reservoir and operate it as part of UTRWD's overall water supply system. Raw water would be conveyed from the proposed Lake Ralph Hall project directly to Lewisville Lake for removal via the Tom Taylor Water Treatment Plant located below the dam as well to the Tom Harpool Water Treatment Plant (WTP) located adjacent to Lewisville Lake via a proposed raw water transfer pipeline.

This 23,280 acre reservoir impounds the Elm Fork Trinity River from Lewisville Dam in Denton County to a point 110 yards upstream of US 380 in Denton County up to normal pool elevation of 515 feet. The 2014 standards for Lewisville Lake are described in **Table 3-7**.

Table 3-7: Site-Specific Uses and Criteria for the Lewisville Lake (TCEQ, 2015)

Uses	Recreation	Public Contact Recreation
	Aquatic Life	High
	Domestic Water Supply	Public Water Supply
	Other	–
Criteria	Cl^{-1} (mg/L)	80
	SO_4^{-2} (mg/L)	60
	TDS (mg/L)	500
	Dissolved Oxygen (mg/L)	5.0
	pH Range (SU)	6.5 – 9.0
	Indicator Bacteria[1] (#/100ml)	126
	Temperature (°F)	90

mg/L – milligrams per liter; SU – standard units; °F – degrees Fahrenheit

According to the 2014 Texas Integrated Report of Surface Water Quality, Lewisville Lake consists of six classified assessment segments. Lewisville Lake water quality stations and assessment results from TCEQ (2014) are included in **Table 3-8** and **Table 3-9**.

Table 3-8: TCEQ Water Quality Station for Lewisville Lake

Segment Identification	Description
0823_01	Lowermost Portion of the Reservoir
0823_02	Stewart Creek Arm
0823_03	Hickory Creek Arm
0823_04	Little Elm Creek Arm
0823_05	Middle Portion of the Reservoir East of Dallas
0823_06	Remainder of Reservoir

Table 3-9: Assessments of Lewisville Lake Water Quality Classified Segments (TCEQ, 2015)

Aquatic Life Use	
0823_01	Not Assessed
0823_02	Fully Supporting
0823_03	Fully Supporting
0823_04	Fully Supporting
0823_05	Fully Supporting
0823_06	Not Assessed
General Use	
0823_01	Fully Supporting
0823_02	Concern
0823_03	Concern
0823_04	Fully Supporting
0823_05	Concern
0823_06	Fully Supporting
Public Contact Recreation Use	
0823_01	Not Assessed
0823_02	Not Assessed
0823_03	Not Assessed
0823_04	Not Assessed
0823_05	Not Assessed
0823_06	Not Assessed
Public Water Supply Use	
0823_01	Fully Supporting
0823_02	Fully Supporting
0823_03	Fully Supporting
0823_04	Fully Supporting
0823_05	Fully Supporting
0823_06	Fully Supporting
Fish Consumption Use	
0823_01x	Fully Supporting
0823_02	Fully Supporting
0823_03	Fully Supporting
0823_04	Fully Supporting
0823_05	Fully Supporting
0823_06	Fully Supporting

Concerns were identified at three segments for General Use. Segment 0823_02 had concerns for ammonia, nitrate, and total phosphorus. Segments 0823_03 and 0823_05 had concerns for chlorophyll-*a.* According to the Trinity River Authority (2015), elevated nutrients do not appear to be causing algal blooms that affect dissolved oxygen levels in the reservoir. In addition, Lewisville Lake is not included in the TCEQ 2014 303(d) List and is not considered impaired

3.6.3 Floodplains

Floodplains include any land area susceptible to being inundated by floodwaters. Floodplains include, at a minimum, areas subject to a one percent or greater chance of flooding in any given year (i.e., the 100-year flood). Floodplains can be considered lowland and relatively flat areas adjacent to inland and coastal waters or flood-prone areas of offshore islands.

The proposed Lake Ralph Hall is situated along the upper reaches of the North Sulphur River. With the current channelized condition of the North Sulphur River, the 100-year floodplain is contained within its channel; therefore, this area does not receive any valley flooding based on the 100-year event. Furthermore, the 100-year floodplains for the major tributaries to the North Sulphur River within the project area are contained within their respective banks. Valley flooding is not associated with any of the major tributaries to the North Sulphur River within the project area (UTRWD, 2004).

3.6.4 Wetland and Waters of the U.S.

Wetlands are transitional areas between terrestrial and aquatic habitats and include elements of both systems. Hydrology is the dominant factor determining the characteristics of wetlands, since the timing, quantity, and duration of water flow strongly influences both abiotic and biotic factors within a wetland (Texas Parks and Wildlife Department [TPWD], 2005). Saturation often determines the nature of soil development and the types of plant and animal communities living in the soil and on its surface (Cowardin et al., 1979). Wetlands vary widely because of regional and local differences in soils, topography, climate, hydrology, water chemistry, vegetation, and other factors, including human disturbance.

Wetlands perform many ecologically important functions. These functions vary from wetland to wetland, but include providing water quality protection and nutrient cycling, flood control, shoreline and sediment stabilization, contributions to groundwater and stream flow, and wildlife and fisheries habitat. Wetlands also are valued as natural areas providing aesthetic, recreational, and educational opportunities. Wetland values are a measurement of the benefit these wetland functions provide to society. For example, wetlands are valued in different degrees for their ability to improve water quality, provide economic benefits for wetland-dependent businesses, help in stabilizing global levels of carbon dioxide, reduce flood damage, and provide recreation opportunities.

Streams located in the Lake Ralph Hall conservation pool area consist of ephemeral and intermittent streams. Sampling within the North Sulphur River indicate biological resources are limited, even within pools of water in the river channel following rainfall events (UTRWD, 2006a). A small variety of freshwater invertebrates were collected with no fish species observed (UTRWD, 2006a). The results of sampling indicate there is no significant existing biological community or

aquatic ecosystem within the river channel that is sustained by ephemeral flows that periodically occur in the river (UTRWD, 2006a).

The U.S. Army Corps of Engineers (USACE) has primary responsibility for regulation of wetlands and jurisdictional waters under the CWA. For many years, wetlands have been regarded as wastelands or idle lands and substantial areas of wetlands have been developed for other purposes such as agriculture and building construction.

The increased awareness in recent years of the importance of wetlands has led to efforts at all levels of government to protect wetland habitats throughout the United States. A variety of federal, state, and local regulations affect construction and other activities in wetlands and adjacent areas, with an overall objective of "no net loss."

For regulatory purposes under the CWA, the term wetlands means "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." The principal federal laws that regulate activities in wetlands are Sections 404 and 401 of the CWA and Section 10 of the River and Harbor Act. Other federal laws include the National Environmental Policy Act of 1969 (NEPA), the Coastal Zone Management Act (CZMA), and a provision of the 1985 Food Security Act known as "Swampbuster."

The Supreme Court handed down a ruling on January 9, 2001 in Solid Waste Agency of Northern Cook County (SWANCC) v. USACE. SWANCC held that the USACE's use of the "migratory bird rule," adopted by the USACE to interpret the extent of its Section 404 authority over "isolated waters" (including isolated wetlands), exceeded the authority granted by law. Wetlands not connected to the network of Waters of the U.S. directly by a surface connection (channel) or within the 100-year floodplain are not subject to Section 404 of the CWA.

A preliminary determination of jurisdictional wetlands and waters of the U.S. was conducted to examine the extent of potential jurisdictional wetlands and other waters of the U.S. within the footprint of the dam, as well as conservation pool for the Proposed Action and the proposed pipeline alignment (**Appendix E-1** and **Appendix E-2**). The results of the initial preliminary assessment were documented in a report dated October 26, 2006 and January 30, 2008 (UTRWD 2006d; 2008). Ephemeral streams have flowing water only during, and for a short duration after, precipitation events in a typical year (**Photo 3-4**). Ephemeral stream beds are located above the water table year-round and groundwater is not a source of water for the stream. Runoff from rainfall is the primary source of water for stream flow. Intermittent streams have flowing water during certain times of the year, when groundwater provides water for stream flow (**Photo 3-5**). During dry periods, intermittent streams may not have flowing water. Runoff from rainfall is a supplemental source of water for stream flow.

Photo 3-4: Ephemeral Stream (Davis Creek) looking upstream from confluence with North Sulphur River. Photo taken September 2005.

Photo 3-5: Intermittent Stream (North Sulphur River) looking downstream from SH 34 Bridge. Photo taken August 2009.

UTRWD requested an Approved Jurisdictional Determination on March 29, 2017. A supplement report was submitted to the USACE on June 21, 2017 with an assessment area including the conservation pool area, embankment structure, spillway system, intake structure and pump station, project boundary representing 560 feet AMSL, and mitigation areas (**Appendix E-3**). This supplement report identified a total of 501,058 lineal feet of ephemeral and intermittent streams, and 56.19 acres of on-channel ponds within the Lake Ralph Hall conservation pool. Review of the supplement report with the 2006 and 2008 information identified small wetland areas located within the 13,000+ acre assessment area. Revisions to the delineation of waters of the United States were accomplished and 10 acres of lacustrine fringe wetlands (**Photo 3-6**) were added within assessment area (UTRWD, 2017d). Utilization of the 1987 USACE Wetland Delineation Manual (USACE, 1987), including the Great Plains Supplement (USACE, 2010), also occurred. The Approved Jurisdictional Determination was issued July 27, 2017 (**Appendix E-4**).

Photo 3-6: Lacustrine fringe wetland along edge of on-channel impoundment on a North Sulphur River Tributary. Photo taken May 2017.

Additionally, 83 acres of non-jurisdictional open water (off channel isolated stock tanks) and 3.80 acres of non-jurisdictional forested wetlands (including isolated remnant channels of the original North Sulphur River and those associated with former tributary channels or tributary meander scars) were also identified within the assessment area (**Photo 3-7**). As described in **Section 3.6.3**, the 100-year floodplain is contained within the main channel and in the tributary channels. Therefore, the abandoned river bends in the former North Sulphur River floodplain have been cut off from hydraulic communication with the river and tributaries. The lack of wetlands along the

North Sulphur River and its tributaries is due primarily to the hydrology and hydraulics of the eroded channels as described with the channel evolution model in **Section 3.4.2**. While such features are not jurisdictional for the purposes of Section 404 of the Clean Water Act, their inclusion in this document is for NEPA disclosure and Public Interest Review considerations.

Photo 3-7: Isolated non-jurisdictional wetland located in former channel scar. Photo taken in May 2017.

Impacts to aquatic resources were quantified into a currency (functional capacity units) using the Stream Watershed Assessment and Measurement Protocol Interaction Model (SWAMPIM). UTRWD developed this functional assessment protocol to support the Section 404 permitting efforts for the proposed Lake Ralph Hall.

In developing SWAMPIM, UTRWD conducted extensive research of existing peer-reviewed stream function assessment protocols employed by federal and state agencies across the United States. UTRWD developed the SWAMPIM model, with review and input from USACE Fort Worth District staff, using field-tested metrics from existing protocols that were applicable to the areas of Texas that are under the jurisdiction of the USACE Fort Worth District, and specifically the North Central Texas area where the proposed Lake Ralph Hall project is located. The metrics utilized in SWAMPIM were primarily from the USACE Norfolk District (2004) Stream Attribute Assessment Methodology (SAAM); EPA (1999) Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates, and Fish, Second Edition (Barbour et al.); Kansas Department of Wildlife and Parks (2000) Guidelines for Assessing Development Project Impacts on Wildlife Habitats and Planning Mitigation Measures for Wildlife

Habitat Losses; TCEQ (2005) Surface Water Quality Monitoring Procedures, Volume 2: Methods for Collecting and Analyzing Biological Community and Habitat Data; and TCEQ (1999) Stream Habitat Assessment Procedures, "Chapter 8 in Surface Water Quality Monitoring Procedures Manual."

In September 2009, the SWAMPIM metrics scores were reviewed and validated in the field with representatives of the USACE, EPA, U.S. Fish and Wildlife Service (USFWS), TPWD, and TCEQ. USACE Fort Worth District, EPA, the USFWS, TPWD, and TCEQ met again in Waco in March 2011 to further review UTRWD's proposed mitigation plan. During that meeting the agencies again agreed to use SWAMPIM as the water resource currency for the Lake Ralph Hall project.

The SWAMPIM protocol accounts for functions and watershed interactions of both streams and impoundments. **Table 3-10** summarizes the results of functional capacities for existing streams and impoundments.

Table 3-10: Functional Capacity Scores for Streams and Impoundments

Streams	**Linear Feet of Stream**	**Functional Capacity**
Within Conservation Pool	501,058	430
Outside of Conservation Pool	189,860	199
Total	**690,918**	**629**
Impoundments	**Area (Acres)**	**Resource Capacity**
Within Conservation Pool	56.19	28.6
Outside of Conservation Pool	13.69	5.5
Total	**69.88**	**34.1**

Based on the SWAMPIM protocol, the functional capacity score for streams is 629 and the resource capacity score for impoundments is 34.1.

3.7 Air Quality

Air quality in Texas varies from region to region. Air pollution is generated from several sources, including industrial processes, motor vehicle emissions (both on and off-road), and area sources (e.g., solvent use, outdoor burning). Substantial levels of air pollution are typically the result of human activities. As a result, poorer air quality is generally correlated with the higher population centers of the state. The federal Clean Air Act of 1970, and its subsequent amendments through 1990, directed the EPA to establish national standards for acceptable levels of outdoor pollutants. The National Ambient Air Quality Standards (NAAQS) were developed for six ambient air pollutants (also known as criteria pollutants): ozone, particulate matter (PM), carbon monoxide (CO), sulfur dioxide, nitrogen dioxide, and lead.

The TCEQ, local air pollution districts, local governments, and private entities all operate continuous air quality monitors in the most populated areas and other rural areas of the state. The

data from the majority of these monitors are reported to the EPA. Areas that exceed the NAAQS can be designated as "nonattainment" by the EPA for not complying with the NAAQS. Both Fannin and Hunt County are in attainment of all NAAQs as of December 2016. Regionally, the Dallas Fort Worth area (Collin, Dallas, Denton, Tarrant, Ellis, Johnson, Kaufman, Parker, Rockwall, and Wise Counties) is classified as moderate ozone nonattainment areas for 8-hour NAAQS and must be in attainment by July 20, 2018 as required by the EPA. In addition, a lead nonattainment area is located within a portion of Collin County.

Although more rural areas of the state may have better air quality overall than the urban centers, they could still experience air quality impacts. Dust and smoke from agricultural and forestry practices in rural areas reduce air quality on a localized short-term basis. Pollutants generated by these processes include sulfur oxides (SOx), PM, CO, nitrogen oxides (NOx), and volatile organic compounds (VOCs). The air quality surrounding the proposed Lake Ralph Hall is generally of higher quality than that of the major cities within the Dallas-Fort Worth Metroplex.

3.8 Noise

Noise may be defined as any sound that is undesirable because it interferes with communication, is intense enough to damage hearing, or is otherwise annoying. Noise can be intermittent or continuous, steady or impulsive, and can involve a number of sources and frequencies. It can be readily identifiable or generally non-descript. Human response to increased sound levels varies according to the source type, characteristics of the sound source, distance between source and receptor, receptor sensitivity, and time of day.

Table 3-11 displays A-weighted sound levels (dbA) for some common noises (within 1 meter):

Table 3-11: dbA Levels for Some Common Noises

Common Noise	dbA
Quiet Residential Area	40
Refrigerator	50
Air Conditioner	50 - 75
Vacuum Cleaner	60 - 85
Hair Dryer	60 - 95
Freeway Traffic	70
Garbage Disposal	70 - 95
Flush Toilet	75 - 85
Doorbell	80
Blender	80 - 90
Backhoe	84 - 93
Front-end Loader	86 - 94
Earthmover	87 - 94
Tractor	90
Earth Tamper	90 - 96
Crane	90 - 96
Bulldozer	93 - 96
Jackhammer	102 - 111
Leaf Blower	110
Car Horn	110
Chain Saw	120
Power Drill	130
Airplane taking off	140

Source: Center for Hearing and Communications, 2010

Current noise conditions within the project area are consistent with activities associated with farming and ranching mechanized equipment. Additional noise is experienced along the rural roads and highways within the project area due to automobile and tractor trailer traffic. No major flyways or military facilities are in the vicinity of the project area; therefore, aeronautical noise is minimal and typically associated with small, private aircraft.

3.9 Recreation

Fannin County is not currently a major destination for recreation, although it does have a number of attractions and recreational amenities:

- Sam Rayburn Library and Museum
- Sam Rayburn House Museum
- Fort Inglish Park and Museum

- Bonham State Park
- Lake Bonham
- Fannin County Museum of History
- Caddo National Grasslands Wildlife Management Area

Economic aspects of the tourism industry are identified in the socioeconomic section of this affected environment chapter. Visitation and other recreational aspects are described below.

Fannin County is part of the Prairies and Lakes Region as defined by the Texas Office of Economic Development and Tourism. However, this region also includes Dallas, Fort Worth, and other populous areas. While detailed visitation statistics are available for the Region, and metropolitan statistical areas within the Region, data for Fannin County or cities within the county are not available.

The rural nature of Fannin County lends itself to recreational activities that take advantage of the outdoors. Three important outdoor recreation areas located in the county are Lake Bonham, Bonham State Park and the Caddo National Grasslands.

Lake Bonham

Owned by the City of Bonham, this 1,282 acre lake offers camping, fishing, swimming, and boating. It is also the City's drinking water supply. No hunting is allowed at the lake. Visitor statistics for the lake are not available.

Bonham State Park

This 261-acre park had about 53,000 total visitors in 2014. (Texas Department of Recreation, 2014). An estimated 43,000 visitors were from out-of-county. The park has a 65-acre lake and features rolling prairies and woodlands. There are about 20 individual campsites and one group campsite. In addition to camping, activities available at the park include swimming, fishing, picnicking, mountain biking, and boating. The economic impacts of the Park on Fannin County include impacts from non-resident spending and from park employee spending. A summary of those impacts for 2014 are provided in **Table 3-12**.

Table 3-12: Economic Impacts of Bonham State Park on Fannin County, 2014

Non-Local Visitors	
Per Person Per Day Expenditures	$12.21
Annual Expenditures	$528,000
Impact on Sales in Fannin County	$278,000
Impact on Employment (jobs)	4.6
Impact on Income	$88,000
Park Employee Spending	
Impact on Sales in Fannin County	$394,000
Impact on Employment	2.6
Impact on Income	$114,000
Total Economic Impact	
Impact on Sales in Fannin County	$672,000
Impact on Employment	7.2
Impact on Income	$202,000
Sales Tax Generated	$17,000

Source: Texas Department of Recreation, Park and Tourism Sciences. The Economic Contributions of Texas State Parks Final Report. Walker, Jamie Rae, Sang Kwan LeeJeong, Ji Youn and John L. Crompton. November, 2014.

Caddo National Grasslands Wildlife Management Area

The Caddo National Grasslands WMA is administered by the US Forest Service and is managed under a cooperative agreement with Texas Parks and Wildlife. The WMA is divided into two units, the 13,360 acre Bois d' Arc Creek Unit and the 2,780 acre Ladonia Unit. The Bois d' Arc Creek Unit comprises six separate land tracts and the Ladonia Unit has twelve land tracts. (TPWD, n.d.-a). The larger Bois d'Arc Unit is located in northern Fannin County, and the smaller Ladonia Unit is located west of Ladonia in the southwest portion of the project area.

Coffee Mill, Lake Crockett and Lake Fannin are located in the Bois d'Arc Unit. About 75 percent of use is related to hunting and fishing. Other activities include horseback riding, hiking, wildflower viewing and wildlife viewing. Use in the Ladonia Unit is limited to hunting as there are no lakes or trails. Estimated annual use for Caddo National Grassland in 2010 is provided in **Table 3-13**.

Table 3-13: Caddo National Grasslands, Estimated Annual Visitation

Caddo National Grasslands Unit	Number of Visitors
Main Bois d'Arc Unit	44,000 to 48,000
Fannin Lake Area (Bois d'Arc)	5,500 to 6,000
Ladonia Unit	5,500 to 6,000
Total	**55,000 to 60,000**

Source: Interview with Jim Crooks, District Ranger, Caddo National Grasslands. August 2010

The Ladonia Unit is the part of the grasslands nearest to the proposed Lake Ralph Hall. Estimated average expenditures within Fannin County related to hunting at the Ladonia Unit are provided in **Table 3-14**.

Table 3-14: Estimated Annual Economic Impact of Ladonia Unit of Caddo National Grasslands

Economic Variable	
Average Expenditure per hunter per day	$176
Estimate of out-of-county hunters	5,300
Annual Expenditures	$934,000
Fannin County Tax Receipts	$4,700

(1) Texas Parks and Wildlife Department. *The 2006 Economic Benefits of Hunting, Fishing and Wildlife Watching in Texas* Southwick Associates, Inc. November 2007 (TPWD, 2007a).
(2) Based on out-of-county visitors and Bonham State Park
(3) Based on County sales tax rate, does not include any city sales tax rate

Ladonia Fossil Park

The Ladonia Fossil Park (aka Pete Patterson Fossil Park) is located two miles north of downtown Ladonia on SH 34 north and west of the bridge spanning the North Sulphur River. The 15-acre park sits on the bank of the river channel and provides an entrance into hunting grounds that have yielded a variety of fossils from the Cretaceous and Pleistocene Periods. Ladonia Fossil Park is located in the footprint of the proposed Lake Ralph Hall.

3.10 Visual Resources

Aesthetic impacts can occur when there is a detrimental effect on the perceived beauty of a place or structure. The proposed Lake Ralph Hall reservoir is located along the North Sulphur River, tributaries, and floodplains. It is approximately one to two miles north of the city of Ladonia, Texas, but there are no major towns within or adjacent to the proposed reservoir. The area is characterized as rural and sparsely populated with a large percentage of the land use consisting of agricultural production. Wooded riparian areas can still be found along the North Sulphur River and its major tributaries, but these areas are isolated and discontinuous. The overall area is relatively flat and slopes towards the North Sulphur River. The North Sulphur River and its tributaries continue to deepen and widen as a result of exceptional erosion and channelization. The viewshed consists of floodplains with surrounding agricultural lands and limited wooded areas. **Photo 3-8** shows a representative view of the project area. Potential changes to the view from the proposed project are discussed in **Chapter 4**.

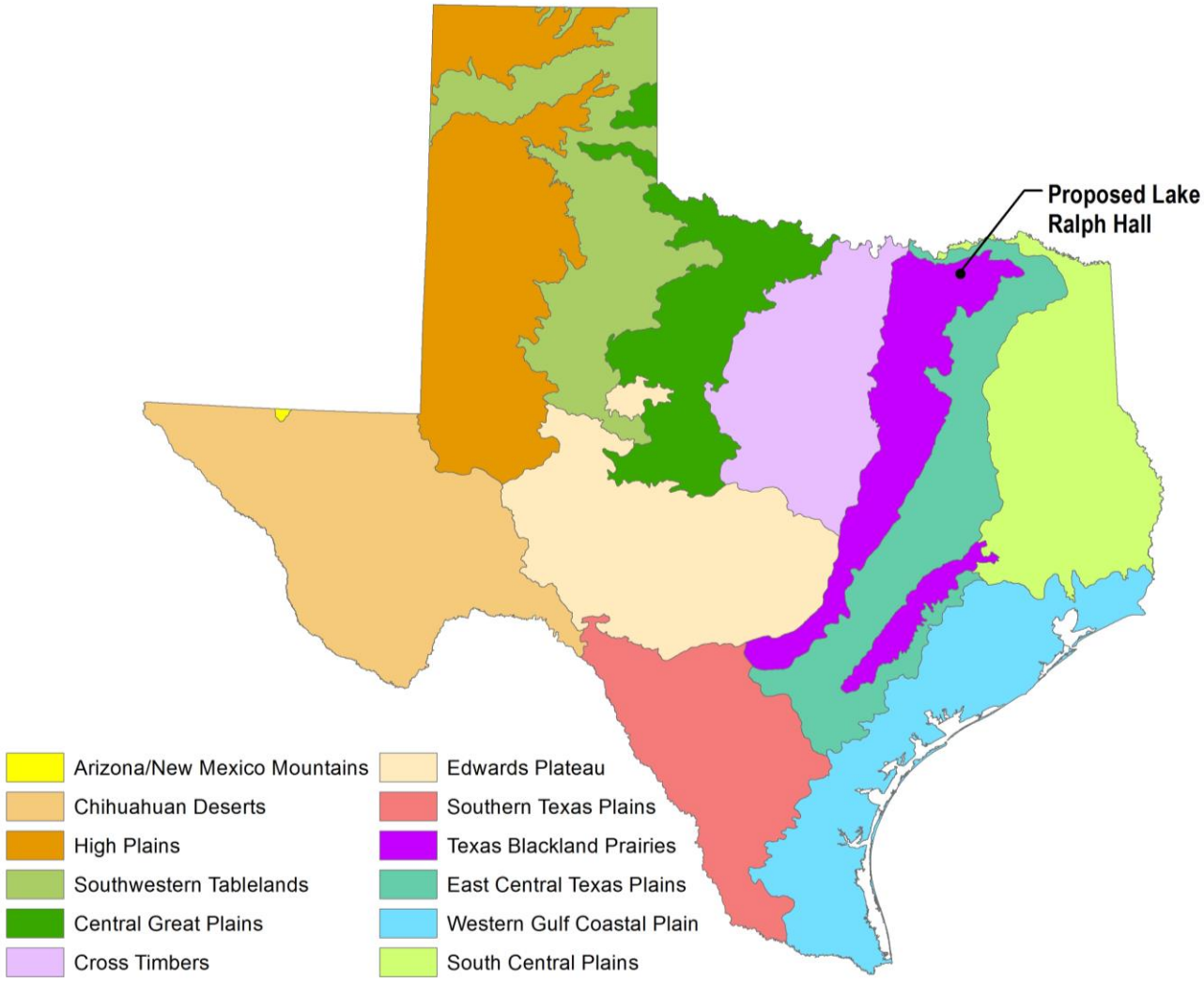
Photo 3-8: Existing view of proposed dam location. View looking southwest from the northeast portion of the project.

3.11 Biological Resources

3.11.1 Habitat

Texas can be divided into twelve distinct ecological regions. These ecological regions of the state represent differences in soils, topography, geology, rainfall, and plant and animal communities (see **Figure 3-18**). The Lake Ralph Hall and Lake Ralph Hall Raw Water Pipeline alignments lie within the Blackland Prairies Vegetation Area in Texas (Griffith et al., 2007). In its natural condition, the Blackland Prairie is an almost treeless rolling prairie of short and bunch grasses. The Texas Parks and Wildlife Department (TPWD) indicates pre-settlement conditions were that of a true prairie grassland community dominated by a diverse assortment of perennial and annual grasses and forbs. Forested or wooded areas were restricted to bottomlands along the North Sulphur River and tributary streams.

Figure 3-18: Ecological Regions of Texas



Source: TPWD, 2014

Early settlers used the Blackland Prairies for grazing livestock, primarily cattle and horses. Farming was also common but did not become a major land use until the 1870's. During this time, the prairies were plowed under and cotton farming replaced ranching as the principle land use. The rich soils of the Blackland Prairie were ideal for growing cotton and in a relatively short time, a majority of the desirable land was cultivated, leaving only small remnants of the original prairie intact (UTRWD, 2005b).

Farming is still a major land use in the Blackland Prairie region today (**Photo 3-9**), but a large portion of the previously farmed land has been converted to pastureland, mostly "improved" grasses such as Bermudagrass and fescue, for grazing livestock. Other important cash crops in the area include wheat, grain sorghum, soybeans, corn, and peanuts. Cotton, once the main cash crop, is now grown on less than 2,000 acres in Fannin County. Crops currently under production within

the general location of Lake Ralph Hall, includes wheat, soybeans, and hay. There are wooded riparian areas still present along the North Sulphur River and its major tributaries; however these areas are isolated, discontinuous tracts and are limited in numbers (UTRWD, 2005b).

Photo 3-9: Agricultural land within the proposed project area.

The Caddo National Grasslands WMA is administered by the US Forest Service and is managed under a cooperative agreement with Texas Parks and Wildlife. The WMA is divided into two units, the 13,360 acre Bois d' Arc Creek Unit and the 2,780 acre Ladonia Unit. The Bois d' Arc Creek Unit comprises six separate land tracts and the Ladonia Unit has twelve land tracts. (TPWD, n.d.-a). The larger Bois d'Arc Unit is located in northern Fannin County, and the smaller Ladonia Unit is located west of Ladonia in the southwest portion of the project area.

The Caddo Lyndon B. Johnson National Grasslands are managed for restoration of the land and conservation of soil and watershed resource values. However, since the Ladonia Unit is non-contiguous, management for habitat restoration and public hunting is difficult. Soil erosion continues to affect the grasslands and approximately 93 acres of gullies are reported across seven of the 12 tracts (UTRWD, 2005b).

Along the North Sulphur River in the project vicinity the quality of vegetation is mostly degraded by agricultural usage and the continuing erosion of the channel. The wooded areas that remain provide moderate quality habitat. However, these areas are isolated and fragmented which reduces the ability to support wildlife and none of the riparian forested areas has current hydrology to support classification of bottomland hardwood forest. The Caddo Lyndon B. Johnson National

Grasslands also provide some moderate quality habitat, but these areas are also fragmented. Eastern red cedar, honey locust, cedar elm, and other common woody invasive species are also prevalent throughout the grassland areas (UTRWD, 2005b), further degrading the quality of habitat.

In order to evaluate direct impacts to wildlife resources for 30 of 44 proposed reservoir sites throughout the state of Texas, TPWD and USFWS used Wildlife Habitat Appraisal Procedure (WHAP) methodology to develop a comprehensive documentation during the 1980's. The WHAP measures key components of each cover type, which contribute to ecological condition of the cover type and resulting overall suitability for wildlife. The WHAP was designed to obtain a direct measure of the habitat suitability for wildlife using an assessment of ecological productivity and diversity rather than an evaluation based on the selection of individual wildlife species. Key habitat components which are evaluated include: site potential for woody and herbaceous plant production; age of existing vegetation; relative abundance of the habitat type and its value to wildlife; diversity of occurring woody species; vertical stratification of vegetation canopy cover; relative abundance or the scarcity of dens and refuge sites; and availability of browse and herbaceous material. The various land use areas are divided into the following cover type categories.

- Grasses
- Pasture
- Partially Wooded Areas
- Young Forest
- Cropland
- Stream Channels
- Roads and Houses

The proposed Lake Ralph Hall project site was not included among the 30 sites evaluated in the comprehensive state-wide study. Therefore, in order to assess the project site and provide an opportunity for relative comparison, the site was evaluated using the WHAP protocol during fieldwork conducted during 2005. The *Lake Ralph Hall Preliminary Habitat Assessment* (**Appendix F-1**) was completed in 2005 (UTRWD, 2005b).

The typical vegetation readily observed within the riparian and upland communities identified throughout the project area is identified in **Table 3-15** and **Table 3-16**, respectively.

Table 3-15: Vegetation List for Riparian Communities

Vegetation Type	Common Name	Scientific Name
Canopy	American Elm	*Ulmus Americana*
	Black Willow	*Salix nigra*
	Bois d'Arc	*Maclura pomifera*
	Box Elder	*Acer negundo*
	Cedar Elm	*Ulmus crassifolia*
	Green Ash	*Fraxinus pennsylvanica*
	Honey-Locust	*Gleditsia triacanthos*
	Pecan	*Carya illinoensis*
	Sugar Hackberry	*Celtis laevigata*
	Water Oak	*Quercus nigra*
	Willow Oak	*Quercus phellos*
Sapling/Shrub	American Elm	*Ulmus Americana*
	Bur Oak	*Quercus macrocarpa*
	Cedar Elm	*Ulmus crassifolia*
	Honey-Locust	*Gleditsia triacanthos*
	Deciduous Holly	*Ilex deciduas*
	Redbud	*Cercis canadensis*
	Rough-leaf Dogwood	*Cornus drummondii*
	Sugar Hackberry	*Celtis laevigata*
	Yaupon Holly	*Ilex vomitoria*
Woody Vine	Greenbriar	*Smilax* spp.
	Mustang Grape	*Vitis mustangensis*
	Poison Ivy	*Toxicodendron radicans*
Herbaceous	American Elm	*Ulmus Americana*
	Annual Sumpweed	*Iva annua*
	Butterfly-Pea	*Centrosema virginianum*
	Cedar Elm	*Ulmus crassifolia*
	Frogfruit	*Phyla nodiflora*
	Giant Goldenrod	*Solidago gigantea*
	Giant Ragweed	*Ambrosia trifida*
	Inland Seaoats	*Chasmanthium latifolium*
	Japanese Honeysuckle	*Lonicera japonica*
	Poison Ivy	*Toxicodendron radicans*
	Purple Flatsedge	*Cyperus rotundus*
	Red Mulberry	*Morus rubra*
	Rough-leaf Dogwood	*Cornus drummondii*
	Saw Greenbriar	*Smilax bona-nox*
	Virginia Creeper	*Parthenocissus quinquefolia*
	Virginia Wildrye	*Elymus virginicus*

Source: UTRWD, 2005b

Table 3-16: Vegetation List for Upland Communities

Vegetation Type	Common Name	Scientific Name
Canopy	American Elm	*Ulmus Americana*
	Black Walnut	*Juglans nigra*
	Eastern Red Cedar	*Juniperus virginiana*
	Sugar Hackberry	*Celtis laevigata*
Sapling/Shrub	American Elm	*Ulmus Americana*
	Mexican Plum	*Prunus Mexicana*
	Yaupon Holly	*Ilex vomitoria*
	Redbud	*Cercis canadensis*
Woody Vine	Greenbriar	*Smilax* spp.
	Mustang Grape	*Vitis mustangensis*
	Poison Ivy	*Toxicodendron radicans*
Herbaceous	Annual Ragweed	*Ambrosia artemisiifolia*
	Annual Sumpweed	*Iva annua*
	Balloonvine	*Cardiospermum halicacabum*
	Bermudagrass	*Cynodon dactylon*
	Coralberry	*Symphoricarpos orbiculatus*
	Cocklebur	*Xanthium strumarium*
	Common Sunflower	*Helianthus annus*
	Giant Goldenrod	*Solidago gigantea*
	Giant Reed	*Arundo donax*
	Illinois Bundleflower	*Desmanthus illinoensis*
	Japanese Honeysuckle	*Lonicera japonica*
	Johnsongrass	*Sorghum halepense*
	Partridge Pea	*Chamaecrista fasciculata*
	Poison Ivy	*Toxicodendron radicans*
	Greenbriar	*Smilax bona-nox*
	Southern Dewberry	*Rubus trivialis*

Source: UTRWD, 2005b

The existing vegetation for the alignment alternatives was determined using the 2009 U.S. Department of Agriculture (USDA), National Agricultural Statistics Service Crop Data Layer which is a crop-specific land cover data layer. The vegetation within the alignment corridors consists of cropland (corn, oats, sorghum, soybeans, winter wheat, and fallow/idle), deciduous forest, herbaceous grasslands, pasture/hay, open water, and areas with developed land (roads and residential areas). The majority of the vegetation that lies within the alignment corridors includes cropland, pasture/hay, and herbaceous grasslands.

Cooperating Agencies agreed to the use of WHAP to assess existing habitat in a meeting conducted in February 2009. Cooperating Agencies also requested assessment of additional sampling points within the proposed project area. In September 2009, the Cooperating Agencies participated in a field review of the additional sampling points. During the review, not all habitat cover types listed in the preliminary habitat assessment were reassessed. The review resulted in a less than one percent reduction in score from the preliminary habitat assessment (UTRWD, 2009b). A summary of the additional sampling points in combination with data from the preliminary habitat assessment is included in **Table 3-17**. The *Memorandum Summary of SWAMPIM and WHAP Data Set and Reports for the Proposed Lake Ralph Hall Project Site* is provided in **Appendix F-2**.

Table 3-17: Wildlife Habitat Appraisal Procedure Following September 2009 Cooperating Agency Review Incorporated into the Entire Habitat Assessment

Cover-Type Category	Average Habitat Quality Score (HQ)	Total Area (Acres)	Habitat Units (HQxArea)
Cropland	0.12	1,720	206.4
Grasses*	0.25	1,435	358.75
Pasture	0.19	2,192	416.48
Partially Wooded Grassland*	0.41	516	211.56
Forest	0.53	602	319.06
Young Forest	0.44	1,299	571.56
Total		**7,764**	**2,083.81**

*Represents data used from the preliminary habitat assessment

3.11.2 Wildlife

A variety of mammals are reported to be near and in the Lake Ralph Hall project area. Within these counties the major game species include, mourning dove, waterfowl, and fox squirrel, and some white-tailed deer, bobwhite quail and wild turkey. Other wildlife species that are commonly found include raccoon, striped skunk, armadillo, opossum, cottontail rabbit, jackrabbit, numerous small rodents, and songbird. The most common predators include coyote, fox, and bobcat (NRCS, 2010).

Agricultural activities have influenced the wildlife resources in this area. Large portions of these counties have been farmed for many years and croplands are the dominant vegetation type. Cultivated crops as well as pastures, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines can provide food and cover for wildlife such as quail, mourning doves, pheasant, meadowlark, field sparrow, hawks, cottontail, and red fox. Grassland areas exist throughout the counties and mixed native or introduced grasses and forbs on grasslands are a result of the clearing of woody vegetation. Game species within this vegetation type include quail, mourning dove, fox squirrel, and waterfowl.

Farm ponds as well as creeks, streams, rivers, and other impoundments exist throughout these counties. Farm ponds are usually stocked with largemouth bass, channel catfish, and sunfish. Waterfowl such as northern mallard, teal, pintail, widgeon, gadwall, ring-necked ducks, canvasback ducks, and white pelicans are commonly seen during migration periods on existing water resources. These water areas are commonly used by waterfowl for resting, feeding, and roosting. On the larger impoundments, coot, cormorant, great blue heron, smaller herons, cattle egrets, and other shorebirds are observed and occasionally bald eagles and ospreys. Snow geese and Canada geese are common migrants throughout Fannin, Hunt, and Collin counties. Beaver, nutria, and mink also inhabit various water resources in this area. The most common reptiles and amphibians are cottonmouth, copperhead, bull, and water snakes, green bullfrogs, cricket frogs, snapping turtles, and terrapin.

Wooded areas (deciduous plants or coniferous plants or both and associated grasses and wild herbaceous plants) along streams and rivers provide cover for a variety of wildlife species, including mourning dove, quail, squirrel, and rabbit as well as raccoon, skunk, and opossum (**Photo 3-10**). Other wooded areas throughout the counties provide habitat for wild turkey, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, deer, and bear (NRCS, 2010).

Photo 3-10: Woodlands within project area.

A variety of mammals are reported to be near the Lake Ralph Hall project area. This includes opossum, bat, beaver, nutria, plains pocket gopher, eastern flying squirrel, eastern gray squirrel, fox squirrel, California jackrabbit, eastern cottontail, white-tailed deer, nine-banded armadillo,

raccoon, mink, spotted skunk, red fox, coyote, and bobcat. Many of these species have been able to tolerate urbanization, while species that formerly inhabited the region such as black bear, gray and red wolves, mountain lion, river otter, and bison were extirpated from the area due to hunting, trapping, and /or behavioral intolerance to human activity.

The situation is similar for birds, reptiles, and amphibians. The species more intolerant of human activity have declined, while the more tolerant species have flourished. Common reptile species documented near the project area include lizards and various snakes, such as the copperhead, cottonmouth, bullsnake, and diamondback rattlesnake while amphibians seen occasionally include turtles and frogs. A large number of bird species utilize the stream bottomlands. Species such as the house sparrow, grackle, American crows, and European starling dominate the more urbanized areas in the region.

Aside from the Endangered Species Act (ESA) of 1973 (16 United State Code [USC] 1531-1543) discussed in **Section 3.12** of this document, other regulations also afford protection to wildlife. For example, the Migratory Bird Treaty Act (MBTA) states that it is unlawful to kill, capture, collect, possess, buy, sell, trade, or transport any migratory bird, nest, or egg in part or in whole, without a federal permit issued in accordance within the act's policies and regulations. MBTA provides for the protection of birds classified as migratory by the USFWS. The MBTA prohibits any action or future actions that may harm migratory birds. "Harm" is described as destroying active nests or roosts, or disturbing or interrupting nesting birds. Specific protection for bald and golden eagles is authorized under the Eagle Protection Act (16 USC 668), which provides additional protection to these species from intentional or unintentional harmful conduct.

3.11.3 Aquatic Biota

Flow in the North Sulphur River and its tributaries occur in response to rain events. With the exception of intermittent or ephemeral pools left in the channel after rain events (**Photo 3-11**), the bed of the river remains essentially dry for extended periods of time. Aquatic organisms have been documented in pools in the North Sulphur River within the proposed Lake Ralph Hall footprint and downstream of the proposed Lake Ralph Hall dam.

Photo 3-11: North Sulphur River pools at the existing SH 34 Bridge.

The North Sulphur River Segment 0305_02 was first listed on the 303(d) list in 2006 for impaired habitat, macrobenthic community, and fish community. The impairment for habitat was lowered to a concern for screening level in 2008 and listed as no concern in 2012. The concern for macrobenthic community and fish community was removed from the 303(d) list in 2012 due to a revision in the standard.

The Sulphur River Basin Authority (SRBA) conducted biological monitoring in the North Sulphur River at three sampling stations (SRBA, 2008) in May 2007 and August 2007. According to SRBA (2008), abundant rainfall in the spring and early summer produced flooding conditions that persisted in some areas until later in the summer. Stations sampled included 17613, 18844, and 18846 (**Figure 3-17**). Flow was present at all sites during the early summer while most sites experienced low to no flow during the later summer sample event.

Station 17613 was rated as intermediate for fish community for both events. The macrobenthic community was rated as limited for the May event with ten species and intermediate for the August event due to an increase in the number of species collected. The Habitat Quality Index was rated as high due to the number of riffles, stability of substrate, and amount of available in-stream cover.

Station 18844 was rated as limited for macrobenthic community for both events. The fish community for the May event was rated as high with 11 species and intermediate during the August event with 6 species. The Habitat Quality Index was rated as high due to the number of riffles, stability of substrate, and amount of available in-stream cover.

Station 18846 was rated as limited for macrobenthic community and intermediate for fish community during both events. The number of species collected increased during the August event but was not sufficient to change the rating. The Habitat Quality Index for this site was intermediate due to the instability of banks and channelization.

Table 3-18 and **Table 3-19** summarize the total number of specimens collected at each sampling location.

Table 3-18: Fish Species Identified at Each Sample Location (May and August 2007).

Scientific Name	Common Name	Station 17613		Station 18844		Station 18846	
		May 2007	August 2007	May 2007	August 2007	May 2007	August 2007
Ameiurus melas	Black bullhead	–	–	–	–	–	1
Ameiurus natalis	Yellow bullhead	–	–	1	–	1	–
Campostoma anomalum	Central stoneroller	5	–	–	–	–	1
Cyprinella lutrensis	Red shiner	38	59	139	4	114	17
Fundulus notatus	Blackstripe topminnow	–	–	11	–	–	–
Gambusia affinis	Western mosquitofish	1	4	4	1	-	1
Ictalurus punctatus	Channel catfish	–	–	1	–	–	–
Ictiobus bubalus	Smallmouth buffalo	–	1	–	–	–	–
Lepomis cyanellus	Green sunfish	8	25	74	50	18	60
Lepomis humilis	Orangespotted sunfish	1	–	8	1	–	–
Lepomis macrochirus	Bluegill	–	–	5	8	1	5
Lepomis megalotis	Longear sunfish	–	–	6	2	–	1
Micropterus salmoides	Largemouth bass	2	2	2	–	6	5
Notemigonus Crysoleucas	Golden shiner	–	16	–	–	–	–
Notropis stramineus	Sand Shiner	124	–	–	–	–	–
Pimephales Vigilax	Bullhead minnow	–	5	126	–	43	–

Source: SRBA, 2008

Table 3-19: Aquatic Invertebrates Identified at Each Sample Location (May and August 2007)

Family	Scientific Name	Station 17613		Station 18844		Station 18846	
		May 2007	August 2007	May 2007	August 2007	May 2007	August 2007
Dytiscidae	*Acilius*	1	–	–	–	11	1
Aeshnidae	*Aeshna*	–	–	–	–	–	1
Coenagrionidae	*Argia*	–	2	–	1	–	–
Baetidae	*Baetis*	2	4	–	11	–	–
Belostomatidae	*Belostoma*	–	6	–	1	–	1
Hydrophilidae	*Berosus*	1	2	–	1	–	–
Ceratopogonidae	*Bezzia*	–	1	–	–	–	–
Caenidae	*Caenis*	11	102	–	89	2	73
Corydalidae	*Chauliodes*	–	–	–	–	–	–
Chironomidae	*Chironomidae*	111	17	102	51	132	42
Gammaridae	*Gammarus*	14	15	–	11	–	–
Gerridae	*Gerris*	–	1	–	1	–	1
Planorbidae	*Gyraulus*	–	–	–	–	–	3
Gyrinidae	*Gyrinus*	–	–	–	1	1	–
Calopterygidae	*Hetaerina*	–	1	–	–	–	–
Ephemeridae	*Hexagenia*	–	–	–	–	2	–
Dytiscidae	*Hydaticus*	–	–	3	–	–	–
Dolichopodidae	*Hydrophorus*	7	–	10	1	–	–
Coenagrionidae	*Ischnura*	6	9	–	15	1	2
Hydrophilidae	*Laccobius*	–	–	–	–	2	–
Veliidae	*Microvelia*	–	9	–	–	–	–
Pleidae	*Neoplea*	1	–	–	–	–	–
Physidae	*Physa*	2	3	8	4	1	–
Gerridae	*Rheumatobates*	–	1		–	–	–
Simuliidae	*Simulium*	–	–	69	–	34	–
Heptageniidae	*Stenacron*	–	2	–	–	–	–
Elmidae	*Stenelmis*	–	1	–	–	–	–
Hydrophilidae	*Tropisternus*	–	–	–	–	–	1
Valvatidae	*Valvatidae*	–	2	–	1	–	6

Source: SRBA, 2008

In addition to the TCEQ biological data, biological sampling was conducted by UTRWD in May 2006 and August 2006.

May 2006 Biological Sampling Event

Biological sampling was conducted by UTRWD on the North Sulphur River in May 2006 (UTRWD, 2006a). Within the two weeks prior to the May 2006 sampling event, a total of approximately 1.5 inches of precipitation fell in the vicinity of the proposed Lake Ralph Hall Dam site. Three stations were sampled and included sites upstream of the SH 34 Bridge, downstream of FM 904 Bridge, and downstream of the SH 38 Bridge (**Figure 3-17**). Six pools at each sampling location were identified for collection utilizing a D-frame aquatic dip net for invertebrates, fish,

and amphibians; a Surber Stream Sampler for benthic invertebrates; and a kick net for collecting large and small organisms in open water. The substrate at all three locations consisted of clayey shale with gravel intermixed. No flow or rooted vegetation was observed at any of the three locations. However, detritus and filamentous algae was observed at all three locations. Pools at the SH 34 location averaged approximately 20 meters by 15 meters with a depth ranging from five to ten centimeters. Pools at the FM 904 location averaged approximately 15 meters by 10 meters with depths ranging from five to 22 centimeters. Pools at the SH 38 location averaged approximately 40 meters by 25 meters with depths ranging from five to 15 centimeters. Data collected were compiled into TCEQ's habitat assessment worksheet with each location scoring a limited (poor) habitat quality index.

A variety of freshwater invertebrates were collected from the three sampling locations. **Table 3-20** summarizes the total number of specimens collected at each sampling location. Invertebrates identified during the sampling event are common and abundant throughout the area and normally colonize ephemeral to intermittent pools within the North Sulphur River. These organisms are opportunist and are temporarily sustained by these pools. No fish species were collected at any of the three sample locations.

Table 3-20: Aquatic Invertebrates Identified at Each Sample Location (May 2006)

Scientific Name	Common Name	Hwy 38 Bridge		Hwy 904 Bridge		Hwy 34 Bridge	
		Surber	D-Frame Dip Net	Surber	D-Frame Dip Net	Surber	D-Frame Dip Net
Amphipoda	Scuds	–	1	2	–	–	6
Baetidae	Mayflies	–	6	–	4	1	23
Caenidae	Mayflies	38	361	155	811	41	425
Cambaridae	Crayfish	–	–	–	–	–	1
Ceratopogonidae	Flies and Midges	–	21	2	13	–	22
Chironomidae	Flies and Midges	84	591	92	288	75	934
Cladocera	Water Fleas	–	–	–	–	284	56
Coenagrionidae	Damselflies	–	–	–	2	–	–
Collembula	Spring Tails	–	–	–	–	–	1
Copepoda	Tiny Crustaceans	–	3	–	–	–	7
Corixidae	Aquatic and Semi-Aquatic Bugs	71	136	3	3	4	53
Culicidae	Mosquitoes	2	50	17	19	1	38
Dolichopodidae	Flies and Midges	–	–	–	–	2	3
Gyrinidae	Water Beetles	–	8	–	–	2	5
Haliplidae	Water Beetles	–	–	–	–	–	4
Heptageniidae	Mayflies	–	–	1	1	–	–
Hydracarina	Water Mites	–	2	6	–	–	1
Hydrophilidae	Water Beetles	–	14	5	15	5	25
Libellulidae	Dragonflies	3	12	8	24	3	55
Ostracoda	Seed Shrimp	–	38	–	–	–	48
Planorbidae	Freshwater Snail	–	–	–	–	–	1

The majority of aquatic organisms collected during the sampling event were identified as Chironomidae (41 percent), Caenidae (36 percent) Cladocera (7 percent), and Corixidae (5 percent).

Chironomidae

Chironomidae is the largest family of aquatic insects and inhabits temporary and permanent aquatic habitats. There are 61 common genera found in Texas that are difficult to identify to genus and species. Chironomidae feeding groups include collector-gatherers, filter-collectors, and predators. Species within this family occupy burrows and are tolerant to poor water quality and low dissolved oxygen levels (TCEQ, 2009). Chironomidae was the most abundant family collected and was collected at all sampling locations.

Caenidae

Caenidae species are widespread and common in a variety of lentic and lotic habitats in streams, swamps, spring seeps, marshes, lakes, and ponds. These organisms usually occur in sediment and are often partially covered with silt. Adults live only a few hours and mate shortly after emerging. Caenidae species are collector-gathers and filter-collectors and are considered sprawlers. Caenidae species are tolerant to low dissolved oxygen levels and generally sensitive to moderately tolerant to pollution (TCEQ, 2009). Caenidae species were the second most abundant collected and were collected at all sampling locations.

Cladocera

Cladocera species are widespread and common in freshwater and can be found in most streams with the exception of fast-flowing streams and extremely polluted waters. The majority of species feed on organic detritus, bacteria, and protozoans. Only a few species can handle low oxygen levels (TCEQ, 2009).

Corixidae

Corixidae are abundant to common insects in ponds with some species occurring in streams or brackish pools. Corixidae species are swimmers that spend the majority of time clinging to submerged vegetation and feeding on algae and other small organisms (TCEQ, 2009).

August 2006 Site Investigation

A second on-site investigation was conducted in August of 2006 to quantify existing conditions and observe flows within the North Sulphur River channel. The sample locations included the FM 904 Bridge, FM 2990 Bridge, and the FM 68 Bridge (**Figure 3-17**). No water was observed in the North Sulphur River at any of the sample locations due to the lack of rainfall.

In more permanent water sources such as impoundments, aquatic communities can exist. Several impoundments revealed populations of aquatic vertebrate and invertebrate species. Further, the common fish species previously reported to be in the area include various species of bass, bluegill, drum, gar, sunfish, and shad where permanent water persists. However, some of the less permanent water sources are not suitable habitat for aquatic species due to negative impacts from persistent drought conditions and livestock. **Appendix F-3** provides a copy of the *Biological Assessment of the North Sulphur River*.

3.11.4 Invasive Species

Invasive species are non-native to the ecosystem and are likely to cause economic or environmental harm or harm to human health. Invasive species grow, reproduce, and spread rapidly due to favorable environmental conditions and lack of natural predators, competitors, and disease that normally regulate their population (Texas Invasives, n.d.). The Lake Ralph Hall footprint may include invasive wildlife species and plant species.

Invasive Wildlife Species

Eurasian Collared Dove (*Streptopelia decaocto*) – The Eurasian collared dove was originally native to the Bay of Bengal region and expanded throughout Europe in the 1900s. The Eurasian collared-dove can be found throughout most of the United States, especially along the Gulf Coast and southeastern United States. In Texas, the Eurasian collared-dove is mostly found across the northern edge of the state extending east to Houston and Louisiana (Texas Invasives, n.d).

European Starling (*Sturnus vulgaris*) – The European starling is native to Europe but is known to be present throughout the United States and Texas. The European starling is a fierce competitor with native species taking over nests and expelling the occupants (Texas Invasives, n.d).

Feral Pig (*Sus scrofa*) – The feral pig is native to Europe and is present in several states throughout the United States including Texas. The feral pig is distributed throughout much of Texas especially occurring in the east, south, and central Texas. Feral pigs disturb vegetation and soils through their rooting habits and may cause a shift in plant succession (Texas Invasives, n.d).

Nutria (*Myocastor coypus*) – The nutria is native to South America and has been reported in at least 40 states. Nutria adapt to a wide variety of environmental conditions and inhabit farm ponds, freshwater impoundments, drainage canals with spoil banks, rivers and bayous, freshwater and brackish marshes, swamps, and combinations of various wetland types. Nutria cause significant damage to sugarcane and rice crops (Texas Invasives, n.d).

Zebra mussel (*Dreissena polymorpha*) – The zebra mussel is native to Russia and is widespread in the Great Lakes and throughout the Mississippi River basin. The zebra mussel has infested numerous reservoirs in Texas with larvae detected in additional reservoirs including Fishing Hole (a small lake connected to the Trinity River below Lewisville Lake), Lavon, Livingston, Waco, Worth, Leon River below Belton, Red River below Texoma, and the Elm Fork of the Trinity River. Zebra mussels are known to have cause declines in populations of fish, birds and native mussel species and can disrupt water supply systems by colonizing the insides of pipelines (Texas Invasives, n.d).

The Texas Parks and Wildlife Code §66.0071 prohibits importing, possession, selling, or placing into the public water exotic harmful or potentially harmful fish or shellfish except as authorized by rule or permit issued by the department.

Invasive Plant Species

Aquatic and terrestrial plant species not native to Texas may compete with native plants for nutrients and habitat. Executive Order 13112–Invasive Species directs federal agencies to make efforts to prevent the introduction and spread of invasive plant species, detect and monitor invasive species, and provide for the restoration of native species. The Texas Department of Agriculture (TDA) Code §71.152 prohibit a person from selling, distributing, or importing into Texas the plants listed under this code. The Texas Parks and Wildlife Code also addresses aquatic plants

under §66.0071 (Removal of Harmful Aquatic Plants) and in §66.0072 (Exotic Harmful or Potentially Harmful Aquatic Plants). The list of harmful or potentially harmful exotic plants is found in Texas Administrative Code §57.111.

Table 3-21 lists invasive, noxious, prohibited, and exotic species according to TPWD (TPWD, n.d.-b) and TDA (n.d.) The USDA Plant Database was used to determine if any of the species are known to occur in Fannin County. According to USDA (2017), none of the species listed in **Table 3-21** are known to occur in Fannin County.

Table 3-21: Invasive, Noxious, Prohibited, and Exotic Plant Species

Common Name	Scientific Name
Alligatorweed	*Alternanthera philoxeroides*
Ambulia (Asian Marshweed)	*Limnophila sessiflora*
Balloonvine	*Cardiospermum halicacabum*
Brazilian peppertree	*Schinus terebinthifolius*
Broomrape	*Orobanche ramosa*
Camelthorn	*Alhagi camelorum*
Chinese tallow tree	*Triadica sebifera*
Duck-lettuce	*Ottelia alismoides*
Dotted Duckweed	*Landoltia punctata*
Eurasian watermilfoil	*Myriophyllum spicatum*
Exotic Bur-reed	*Sparganium erectum*
Giant duckweed	*Spirodela oligorrhiza*
Giant reed	*Arundo donax*
Heartshaped False Pickerelweed	*Monochoria vaginalis*
Hedge bindweed	*Calystegia sepium*
Hydrilla	*Hydrilla verticillata*
Itchgrass	*Rottboellia cochinchinensis*
Japanese dodder	*Cuscuta japonica*
Kudzu	*Pueraria montana* var. *lobata*
Lagarosiphon	*Lagarosiphon major*
NarrowleafFalse Pickerelweed	*Monochoria hastata*
Paperbark	*Melaleuca quinquenervia*
Purple loosestrife	*Lythrum salicaria*
Rooted waterhyacinth	*Eichhornia azurea*
Saltcedar	*Tamarix* spp.
Salvinia	*Salvinia* spp.
Serrated tussock	*Nassella trichotoma*
Torpedograss	*Panicum repens*
Tropical soda apple	*Solanum viarum*
Water spinach	*Ipomoea aquatica*
Waterhyacinth	*Eichhornia crassipes*
Waterlettuce	*Pistia stratiotes*

Common Name	Scientific Name
Wetland Nightshade	*Solanum tampicense*

Source: TPWD, n.d.-b TDA, n.d.

3.12 Threatened and Endangered Species

The Endangered Species Act (ESA) declares the intention of Congress to protect federally-listed threatened and endangered species and designate critical habitat of such species. The ESA defines an endangered species as a species that is in danger of becoming extinct throughout all or a significant portion of its range. A threatened species is one that is likely to become endangered in the foreseeable future. Species listed as candidate species are currently being reviewed to determine if they should also be protected under the ESA. The USFWS is the primary regulatory agency responsible for ESA compliance.

The Fish and Wildlife Conservation Act (16 USC 2901-2911) encourages states to develop conservation plans for non-game fish and wildlife of ecological, educational, aesthetic, cultural, recreational, economic, or scientific value. In 1973, TPWD established a list of rare and endangered animals in the state. Laws and regulations pertaining to endangered or threatened animal species are contained in Chapters 67 and 68 of the Texas Parks and Wildlife Code and Sections 65.171 - 65.177 of Title 31 of the TAC. In 1988, the department established a list of threatened and endangered plant species for the state. Laws and regulations pertaining to endangered or threatened plant species are contained in Chapter 88 of the Texas Parks and Wildlife Code and Sections 69.1 - 69.9 of the TAC.

TPWD regulations prohibit the taking, possession, transportation, or sale of any endangered or threatened species without the issuance of a permit. Regulations also prohibit commerce and the collection of threatened and endangered plants from public land without a permit issued by TPWD. Some species listed as threatened or endangered by TPWD are also listed under the USFWS federal regulations and provide additional protection. **Table 3-22** details the federal and state listed endangered and threatened species in Fannin, Hunt, and Collin counties.

Table 3-22: Federal and State Listed Threatened and Endangered Species in Fannin, Hunt, and Collin Counties

Common Name *Scientific Name*	Habitat Association	Status* within County		
		Fannin	Hunt	Collin
Birds				
Bald Eagle *Haliaeetus leucocephalus*	The bald eagle is found primarily near rivers and large lakes and is present year-round throughout Texas as spring and fall migrants, breeders, or winter residents. The bald eagle is known to nest and breed within Fannin County and has wintering range in Hunt and Denton counties. They nest in tall trees or on cliffs near water.	DL, T	DL, T	DL, T
Eskimo Curlew *Numenius borealis*	The Eskimo curlew historically migrated through Texas while traveling between breeding grounds in the arctic tundra of Alaska and Canada and wintering grounds on the pampas grasslands of Argentina. The bird would use native grasslands of Texas as stopover and feeding areas along its migration route. This bird is thought to be extinct today.	LE**, E		
Interior Least Tern *Sterna antillarum athalassos*	The interior least tern traditionally nests along sand and gravel bars within wide, shallow rivers. With the decrease in availability of traditionally preferred habitat, the tern has begun utilizing non-traditional habitats such as sand and gravel pits, dredged islands, dirt roads, and gravel rooftops typically within approximately two miles of a major watercourse. Typical nesting sites are usually absent of vegetation; however, terns are known to utilize sites that have up to 30 percent vegetative cover.	LE, E	LE, E	LE, E
Peregrine Falcon *Falco peregrinus*	Two subspecies of the peregrine falcon migrate across Texas from more northern breeding areas in US and Canada to winter along the coast and farther south. The subspecies, American and Artic peregrine falcons are not easily distinguishable at a distance and reference is generally made only to the species level. The Artic peregrine falcon is no longer listed in Texas, but the American peregrine falcon is still state listed. They nest in tall cliffs and during migration they stop and rest at leading landscape edges such as lake shores, coastlines, and barrier islands. The American peregrine falcon is a year-round resident and breeds in west Texas and occupies a wide range of habitats during migration, including urban concentrations along coast and barrier islands.	DL, T	DL, T	DL, T

Common Name *Scientific Name*	Habitat Association	Status* within County		
		Fannin	Hunt	Collin
Piping Plover *Charadrius melodus*	The piping plover utilizes the beaches of the Texas Gulf Coast as wintering grounds. Preferred habitat includes sandy beaches and shorelines of lakes, where they forage for marine worms, insects and small crustaceans.	LT, T	LT, T	LT, T
Red Knot *Calidris canutus rufa*	Red knots migrate long distances in flocks northward through the contiguous United States mainly April-June, southward July-October. The red knot prefers the shoreline of coast and bays and also uses mudflats during rare inland encounters. Wintering Range includes- Aransas, Brazoria, Calhoun, Cameron, Chambers, Galveston, Jefferson, Kennedy, Kleberg, Matagorda, Nueces, San Patricio, and Willacy. Habitat: Primarily seacoasts on tidal flats and beaches, herbaceous wetland, and tidal flat/shore.	LT	LT	LT
White-faced Ibis *Plegadis chihi*	The white-faced ibis prefers freshwater marshes, sloughs, and irrigated rice fields, but can also be found in brackish and saltwater habitats. They nest in low trees or on the ground in bulrushes or reeds or on floating mats within marshes. The white-faced Ibis has been observed in marshes, swamps, ponds and rivers (TPWD, 2007b). They breed and winter along the Gulf Coast and migrate across Texas towards the Panhandle and West Texas.		T	T
Whooping Crane *Grus americana*	The whooping crane is a potential migrant through the plains throughout most of the state of Texas to the coast. Whooping cranes use a variety of habitats during their long migrations between northern Canada and the Texas coast. Croplands are used for feeding, and large wetland areas are used for feeding and roosting. (TPWD, 2009)	LE**, E	LE**, E	LE, E
Wood Stork *Mycteria americana*	The wood stork forages in prairie ponds, flooded pastures or fields, ditches, and other shallow standing water. They breed in Mexico and following breeding the birds move up into Texas and Louisiana in search of mud flats and other wetlands. The wood stork has formerly nested in Texas, but there have been no recorded breeding sites within Texas since 1960.	T	T	T
Fish				
Blackside darter *Percina maculata*	The blackside darter has habitat within the Red, Sulfur and Cypress River basins. They prefer clear, gravelly streams and pools with some current, or even quiet pools, to swift riffles.	T		
Blue sucker *Cycleptus elongatus*	The blue sucker occurs within larger portions of major rivers in Texas. They are usually found in channels and flowing pools with some exposed	T		

Common Name *Scientific Name*	Habitat Association	Status* within County		
		Fannin	Hunt	Collin
	bedrock on the bottom and with a moderate current. Adults winter in deep pools and move upstream in spring to spawn on riffles.			
Creek chubsucker *Erimyzon oblongus*	The creek chubsucker can be found in tributaries of the Red, Sabine, Neches, Trinity, and San Jacinto rivers. They occupy small rivers and creeks of various types, but rarely are found within impoundments. They prefer headwaters, however the creek chubsucker seldom occurs in springs.	T		
Paddlefish *Polyodon spathula*	The paddlefish prefers large, free-flowing rivers, however these fish would occupy impoundments that have access to spawning sites. The paddlefish spawns in fast, shallow water over gravel bars and its larvae may drift from reservoir to reservoir.	T		
Shovelnose sturgeon *Scaphirhynchus platorynchus*	The shovelnose sturgeon occurs within open, flowing channels with bottoms of sand or gravel. This fish spawns over gravel or rocks in an area with a fast current and can be found in the Red River below the reservoir with a rare occurrence in the Rio Grande.	T		
Insects				
American burying beetle *Nicrophorus americanus*	The American burying beetle is known to inhabit oak-hickory and coniferous forest ridge tops or hillsides to riparian corridors and valley floor pastures.	LE**		
Mammals				
Black bear *Ursus americanus*	The black bear prefers woodlands and forests near water, especially bottomland hardwoods and floodplain forest. The bear is occasionally observed in upland hardwood forests, mixed pine/hardwood forest, wetlands, and agricultural fields. Due to field characteristics that are similar to the threatened Louisiana Black Bear, all east Texas black bears are treated as federal and state listed threatened.	T		
Red wolf *Canis rufus*	The red wolf historically ranged throughout the eastern half of Texas and along the gulf coast. The red wolf is believed to be extirpated in Texas due to land use changes, and the loss of large contiguous tracts of habitat.	L**E, E	LE**, E	LE**, E
Mollusks				
Louisiana pigtoe *Pleurobema riddellii*	The Louisiana pigtoe can be found within streams and moderate-size rivers. These waters are usually flowing water on substrates of mud, sand, and gravel and this species is not generally known to occur in impoundments. The Louisiana pigtoe could occur within the Sabine	T	T	T

Common Name *Scientific Name*	Habitat Association	Status* within County		
		Fannin	Hunt	Collin
	and Neches River basins and was historically found within the Trinity River basin.			
Southern hickorynut *Obovaria jacksoniana*	The southern Hickorynut is found in medium sized gravel substrates with low to moderate current. This mollusk can be found in the Neches, Sabine, and Cypress River basins.	T	T	
Texas heelsplitter *Potamilus amphichaenus*	The Texas heelsplitter is a mollusk that occurs within reservoirs and quiet waters in mud or sand. This mollusk can be found within the Sabine, Neches, and Trinity River basins.		T	T
Texas pigtoe *Fusconaia askewi*	The Texas pigtoe occurs in rivers that have mixed mud, sand, and fine gravel in protected areas associated with fallen trees or other structures. This mollusk occurs within east Texas River basins, Sabine through Trinity Rivers as well as the San Jacinto River.	T	T	T
Reptiles				
Alligator Snapping Turtle *Macrochelys temminckii*	The alligator snapping turtle can be found within a variety of habitats including perennial water bodies; deep water of rivers, canals, lakes, and oxbows; also swamps, bayous, and ponds near deep running water. They can also occasionally be found entering brackish coastal waters. The alligator snapping turtle prefers water with mud bottoms and abundant aquatic vegetation.	T	T	T
Texas horned lizard *Phrynosoma cornutum*	The Texas horned lizard prefers open, arid and semi-arid regions with sparse vegetation. Vegetation includes grass, cactus, scattered brush or scrubby trees and soil may vary in texture from sandy to rocky. When this lizard is inactive they burrow into the soil, enter rodent burrows, or hide under rocks.	T	T	T
Timber/Canebrake Rattlesnake *Crotalus horridus*	The timber/canebrake rattlesnake can be found in a variety of habitats including swamps, floodplains, upland pine and deciduous woodlands, riparian zones, and abandoned farmlands. They prefer dense groundcover in limestone bluffs, sandy soil or black clay.	T	T	T

Source: TPWD, 2018 and USFWS, 2018

* Status Key: LE, LT -Federally Listed Endangered/Threatened;
DL -Federally Delisted;
LT/SA -Federally Threatened by Similarity of Appearance;
E, T -State Listed Endangered/Threatened

**Species listed by TPWD but not listed by USFWS

3.13 Traffic and Transportation

This section provides a discussion of the existing transportation resources near the proposed Lake Ralph Hall, including an overview of the regional and local traffic, airports, and rail resources. The

area can be accessed via many transportation modes, and Fannin County can be easily accessed from all directions except the north, where only one route, State Highway 78, crosses the Red River from Oklahoma into the county.

Transportation in and around the proposed project site is achieved mainly via road and street networks. The closest interstate is approximately 20 miles south: Interstate (I)-30, which runs east-west from Dallas-Fort Worth to Texarkana. I-35 travels north-south approximately 60 miles west of Fannin County and connects the Dallas-Fort Worth area to Oklahoma City. The transportation system serves local and regional traffic consisting of work commuters, general daily travel, and recreationists. Fannin County and its surrounding transportation area is within the Paris District of the Texas Department of Transportation (TxDOT) (TxDOT, n.d).

Because of the rural nature of the area surrounding the proposed reservoir site, the transportation network does not contain major roadways (i.e., interstates). As shown in **Figure 3-19**, a network of state highways and farm-to-market (FM) roads leads to the major interstates; however, there is no direct route to an interstate from the proposed site. The proposed dam development is between SH 34 and FM 904. The closest towns to the proposed site are Ladonia, just south of the proposed reservoir, Pecan Gap, approximately 1.5 miles to the southeast, and Honey Grove, approximately 5 miles to the north. Due to Fannin County's rural location, public transit is unavailable and there is no cohesive network supporting non-motorized and pedestrian transportation.

Roadways located near the Proposed Action include SH 34 and FM 2990, which cross the proposed reservoir site, as well as CR 3360, CR 3370, CR 3380, CR 3395, CR 3342, CR 3343, CR 3344, CR 3600, CR 3605, CR 3610, CR 3640, and FM 1550. Traffic on roadways surrounding the proposed reservoir is free-flowing during both the a.m. and p.m. peak traffic periods.

Jones Field, operated by the City of Bonham, is approximately 13 miles northwest of the proposed reservoir and averages approximately 37 flights per day. Commerce Airport is approximately 10 miles south of proposed reservoir and averages 96 flights per week.

There are many active rail spurs throughout the area. The Fannin Rural Rail Transportation District was developed to preserve railroad service in eastern Grayson, Fannin, and Lamar counties to meet present and future transportation requirements. The closest rail spur runs east to west five miles north of the proposed site near SH 56 but appears to be abandoned. Union Pacific and Texas Northeastern Division Railroad are the primary rail carriers in Fannin County. Amtrak does not provide direct passenger train service to Bonham, and the closest Amtrak passenger station is approximately 60 miles from the proposed reservoir in Gainesville.

Figure 3-19: Transportation in the Project Region

Sources TxDOT 2015

3.14 Hazardous Materials

A hazardous material is a substance capable of posing an unreasonable risk to health, safety, and property. A search for possible hazardous material sites was conducted by reviewing available state and federal records regarding any documentation of pollution control activities, documented incidents, or violations of environmental laws or regulations, and the potential for environmental pollution in the immediate area. A hazmat radius report was obtained from GeoSearch Inc. in August of 2018 and is included in **Appendix G**. The report contains search results of numerous databases from EPA and TCEQ in accordance with the following regulations:

- American Society of Testing and Materials (ASTM) Standard E-1527-05, Standard Practice for Phase I ESAs (2005), and
- Title 40 of the Code of Federal Regulations, Part 312 (40 CFR §312), Standards and Practices for All Appropriate Inquiries (AAI), Final Rule.

The radius report located five sites within the required search distances (**Table 3-23 and Figure 3-20**). Mann Dairy is listed with the Facility Registry System (FRSTX) under the classification of dairy farm, registered as "Wastewater Agriculture Non-Permitted". The property is located along CR 3640 within the proposed conservation pool boundary.

The Greg Morris Property is listed as an FRSTX due to an air quality complaint filed in 2003 relating to smoke from burning wire on the property. The case is listed as closed and no other complaints or reports are listed for the site. No violations were issued. The site is located west of SH 34 on Country Lane, within the project boundary and just outside the conservation pool boundary.

The former Ladonia landfill is listed in the Closed and Abandoned Landfill Inventory (CALF), located on FM 64, approximately 454 feet from the proposed pipeline. It was identified in 1968 and closure was confirmed in 1976. The facility accepted all types of waste, including household, industrial, tires, brush, and agricultural. The CALF notes that the site cannot be verified.

The City of Celeste landfill is listed as a Municipal Solid Waste Landfill Site (MSWLF). The site is located approximately 957 feet from the proposed pipeline, west of CR 1089. The site permit was revoked in 1979 and the facility is listed as closed.

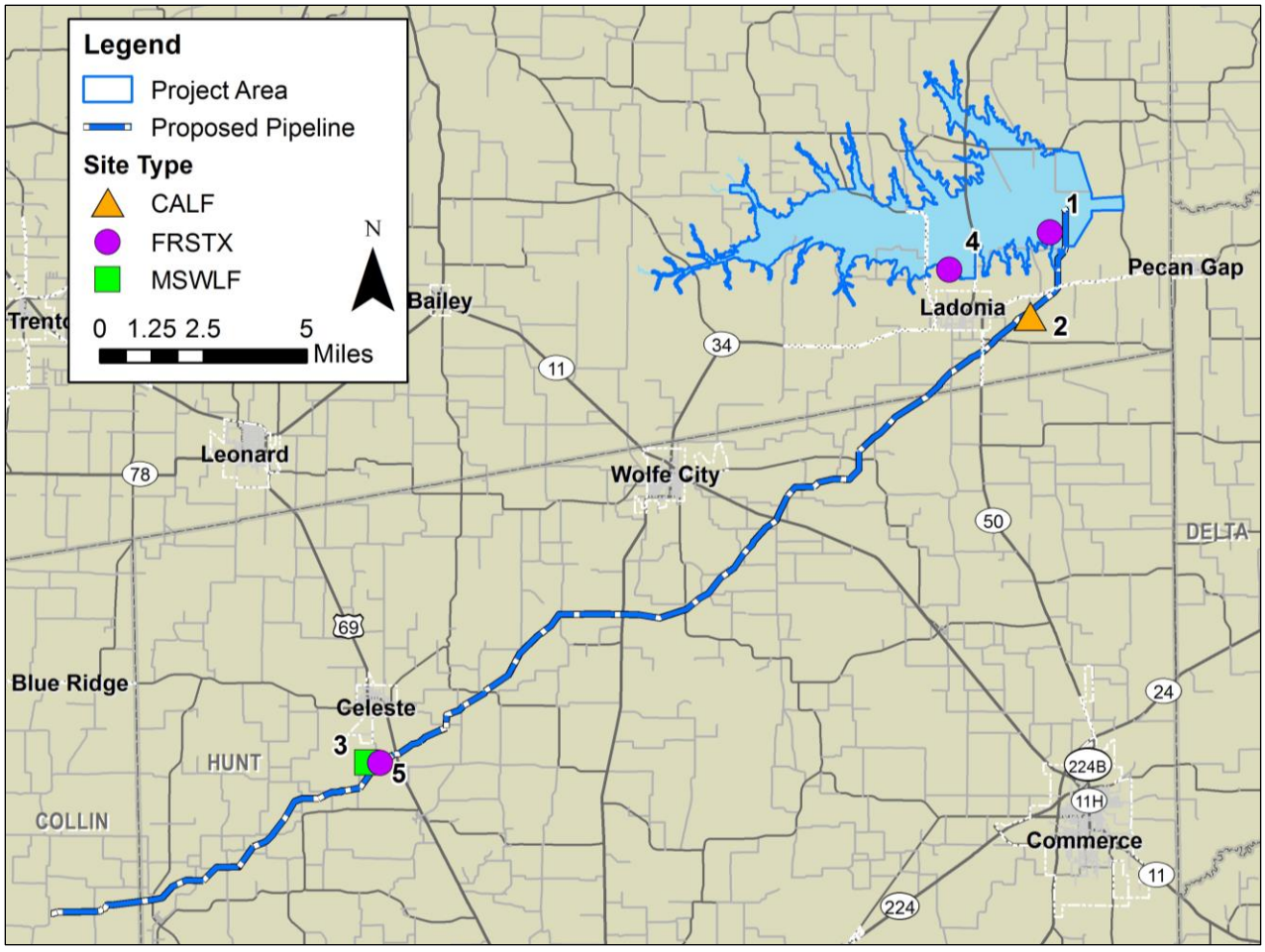
A replacement of a portion of an Atmos Energy pipeline was reported as an FRSTX, Enforcement and Compliance History Information (ECHOR06), and Integrated Compliance Information System National Pollutant Discharge Elimination System (ICISNPDES). The site is listed as a "minor discharger" and has no inspections or violations reported. The site is located approximately 95 feet from the proposed pipeline, west of US 69.

Table 3-23: Radius Report Results

Map ID	Type	ID	Name	Site Location	Distance from Site
1	FRSTX	110034713594	Mann Dairy	CR 3640	Within conservation pool boundary
2	CALF	1012	Ladonia Landfill	FM 64	454 ft from pipeline
3	MSWLF	1320	City of Celeste Landfill	1 mile south of Celeste city limits	957 ft from pipeline
4	FRSTX	110033919446	Greg Morris Property	681 Country Ln, Ladonia, TX 75449	Within project area boundary, just outside conservation pool boundary
5	ECHOR06	110070051243	Line O21 STA. 406+84 to 439+54 Replacement	CR 1089 West of HWY 69, Celeste, TX 75423	95 ft from pipeline
5	FRSTX	110070051243			
5	ICISNPDES	TXR10F4A3INPDES			

Source: Geosearch, August 28, 2018

Figure 3-20: Radius Report Site Locations



Source: GeoSearch, August 28, 2018

3.15 Cultural Resources

The Lake Ralph Hall and associated pipeline have the potential to disturb and affect cultural resources. Cultural Resources may include locations of past human activity, occupation, or use, such as prehistoric and historic archeological sites and historic structures and districts.

The USACE, in consultation with the Texas State Historic Preservation Officer (SHPO), considered the potential effects of the Project as provided in 36 CFR 800 and 33 CFR 325 and established an Area of Potential Effects (APE) for direct and indirect effects that encompasses the 8,500-acre area comprising the flood pool (elevation 560.0 amsl), all areas ancillary facilities, all areas of the mitigation plan, all roads, and pipeline rights-of-way; associated ancillary facilities such as pump stations, pipelines and associated workspace and facilities for pipelines, areas determined as mitigation land for the Project's impacts to waters of the U.S., public roads to be impacted, new roads to be built as a result of the Project, and public roads that require expansion or upgrades as a result of the Project.

The USACE must ensure compliance with Section 106 of the National Historic Preservation Act (NHPA) in considering the Section 404 permit application from the UTRWD for the proposed Lake Ralph Hall. The USACE and the State Historic Preservation Office (SHPO) are two of the signatories in a Programmatic Agreement (PA) for conducting a cultural resources survey. Other implementing regulations include 33 CFR 325 (Appendix C) and 36 CFR 800.

Section 106 of the NHPA requires consideration of impacts on historic properties as part of the USACE permit process. A historic property is defined as any district, archeological site, building, structure, or object that is listed, or eligible for listing, in the National Register of Historic Places (NRHP). The criteria to evaluate the significance of a cultural resource is the quality of significance in American history, architecture, archeology, engineering, and culture present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and:

A. That are associated with events that have made a significant contribution to the broad patterns of our history; or

B. That are associated with the lives of significant persons in our past; or

C. That embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

D. That have yielded or may be likely to yield, information important in history or prehistory.

The intent of Section 106 is that federal agencies take into account the impacts of a proposed undertaking on historic properties and to consult with SHPOs, federally recognized tribes, local governments, and other interested parties regarding potential impacts on historic properties. Under the USACE's procedures and guidelines, the District Engineer is responsible for making the final decision regarding compliance with the NHPA.

3.15.1 Historic Resources

3.15.1.1 Historical Overview of the Project Area

The Caddo Indians occupied what is now Fannin County when Anglo explorers first visited the region in 1687. By the time settlers, predominantly from Tennessee, arrived in 1836, the Caddo had joined the Cherokees and their Twelve Associated Bands (Pigott, 2008). These first white settlements were along the Red River and Bois d'Arc Creek, where fertile soils, timber and water were plentiful (Strickland, 1930). Native Americans were attacked by the settlers in 1837, and tension continued as white settlers interfered with well-established hunting patterns (UTRWD 2006b).

In 1839, the Congress of the Republic of Texas defined the boundaries of Fannin County (originally to be named Independence), with Bonham, then known as Bois d'Arc, named as the county seat in 1843. This same year, the Treaty of Bird's Fort was signed and helped to quell the hostilities between the natives and the new-comers (Pigott, 2008). Agriculture took the form of small self-sufficient farms cultivating corn, vegetables, wheat, cotton and hay, and cattle, hogs and horses were raised in the forest and prairie lands. Land sold for $1.50 an acre in 1845 (Bureau of Business Research, 1949), and current county boundaries were established in 1846.

Bonham was a thriving community in the 1850s with north Texas's then-largest flour mill (Bureau of Business Research, 1949). The 1860 census listed 9,217 residents county-wide. During these years before the Civil War, livestock production was an economic mainstay, with 25,000 beef cattle raised in the county. Fannin County supported secession and contributed manpower to the war effort, as well as hosting a commissary, military headquarters and confederate hospital in Bonham (Pigott, 2008).

Until the turn of the 20th century, Fannin County's population continued to increase, and with it came more farms and increased agricultural production. By 1870, the county had 54 factories and supported five newspapers (Pigott, 2008). The arrival of the Texas and Pacific Railway through the area in 1873 spurred on greater development. Produce was able to be shipped to a much larger market and Fannin County residents could now receive a wider variety of goods. Lumber production increased and a cash-crop model for cotton production replaced the self-sufficient farming and cattle ranching of the earlier era. Honey Grove to the east and Ladonia to the southeast of Bonham developed along the additional rail lines which came to serve the county during this period: the Gulf, Colorado and Santa Fe's Honey Grove branch, the Cotton Belt's Texarkana and

Sherman branch and the main line and Denison and Bonham branch of the Missouri, Kansas and Texas. Shortly thereafter, Texas &Pacific and Denison, Bonham &New Orleans also built rail lines through the county (Leshner, 1911). Also during this period, Fannin County demonstrated its interest in education with the opening of several schools, colleges and institutes (Pigott, 2008).

Fannin County reached nearly 35,000 inhabitants by 1885 and agriculture was by far the biggest industry. Ranchers had improved the quality of their cattle, horses, sheep and hogs with the importation of better stock and a wide variety of crops were being produced, thanks to the climate and soil of the region, at a high yield per acre. Fruits, including apples, grapes and melons, were produced along with cotton, corn, wheat, oats and sorghum (History of Fannin County Texas, 1885).

Fannin County's population had risen to 51,793 by 1900 (Texas Almanac and State Industrial Guide, 1904). A record number of hogs and swine were raised that year, and corn production peaked as well at 3,059,430 bushels (Pigott, 2008). The county had 7,202 farms and agriculture remained the economic focus. While unimproved sandy timber land could still be purchased for about five dollars an acre in other parts of the county, improved blackland farms, like those located near the North Sulphur River were valued at up to 75 dollars per acre (Texas Almanac and State Industrial Guide, 1904). Seventy-five percent of county land (432,000 acres) was in use for cultivation (Texas Almanac and State Industrial Guide, 1910). The Fannin County Purebred Livestock and Poultry association was organized in 1919, and in its first five years nearly tripled the number of show animals, as well as broadened the scope of agricultural products it featured (Richardson, 1925). Cotton production reached its highest level 1920, the year in which Fannin County counted 14,665 dairy cows, confirming the region's continuance of the commitment to agricultural pursuits. The county's peak number of businesses also occurred at the turn of the century, which included eight national banks (Texas Almanac and State Industrial Guide, 1904), but both business and agricultural concerns were soon to become victim to the Great Depression.

Nationally, after the stock market crash in 1929, 14 million wage-earners found themselves unable to support their families and 33 million farmers and ranchers were forced to sell their products for less than it cost them to produce it. U.S. Congressman Sam Rayburn from Bonham, in a speech to the Congress in 1936, spoke of this situation as, "the most serious, far-reaching and dangerous crisis that ever threatened this country. . ." (Rayburn, 1936). Programs intended to provide relief, recovery and reform under Roosevelt's New Deal were implemented quickly and enthusiastically by the citizens of Fannin County. With two-thirds of the county's vast cropland dedicated to over-produced and under-valued cotton, 4,269 Fannin County farmers signed contracts to destroy their crops for a federal payout. Similar programs were carried out to rid the market of surplus pigs and cows. While some benefits were reaped, complications resulted when trying to keep a balanced supply and demand not only nationally, but in the foreign market as well (Weddle, 1992).

During the 1920s and 1930s, Fannin County's population held steady at around 41,000. It was during this period that land reclamation efforts were proposed and undertaken along the North

Sulphur River (Dallas Morning News, 1923, 1928). Established in February 1928, the Fannin-Lamar-Delta County Levee Improvement District No. 3 began a systematic channelization of the river and many of its tributaries in an effort to control the frequent flooding in the area (von Rosenberg, 1928). Although channel improvements and drainage work were outside the scope of levee district law, the extensive plans were approved and work began in April of 1928 (Williams, 1928). Inspection reports from the files of the state reclamation engineer show the work progressed quickly (von Rosenberg, 1928).

The dairy industry suffered during this time as did other agricultural ventures, but was bolstered by the arrival of the Kraft-Phoenix Cheese Company in Bonham in 1934. The number of milk cows rose to 10,279 by 1940. While this was an improvement from Depression levels, the count was still not as high as in 1920, and the number began to decline again later in the 1940s. The agricultural focus shifted back toward beef cattle with a considerable increase in the 1930s, a trend that continued through the end of the century (Pigott, 2008).

Population in Fannin County fell in the 1940s to 31,253. In 1947, there were 15 manufacturing concerns employing 630 residents (Pigott, 2008). Only 234,911 acres of cropland was being harvested in 1949 (Texas Almanac and State Industrial Guide, 1954-1955). During the 1950s, as the population decreased, so did the production of cotton and corn, but the number of manufacturers rose to 29 by 1958. Lumber and other wood products were the primary commodities during this time, and the number of banking and other service-oriented business increased, albeit slowly. The county's population continued to decline slowly throughout the 1960s and 70s, eventually falling below 1880s levels (Pigott, 2008).

The properties remaining in the project area reflect the strong agricultural focus of these rural areas in Fannin County. Lots tend to be large with only a few buildings each, if any – those necessary for dwelling, animal enclosure and agricultural storage, most built in the first half of the 20th century. By far the greatest number of dwellings was built in Fannin County between 1900 and 1920, and the houses were almost exclusively wood construction (Bureau of Business Research, 1949).

3.15.1.2 Historic Resources Survey

A reconnaissance-level *Historic Resources Survey* (Michael Baker International, 2010) was conducted in 2009-2010. The study team, in consultation with the THC, determined that the area of potential effect (APE) for the historic resources survey effort was to extend 300 feet beyond the proposed Lake Ralph Hall project area boundaries. The effort included a field survey of the APE and included inspection of the parcels that fall partially within the APE to identify and assess all historic-age built resources and rural historic landscapes therein.

A preliminary research/literature review was performed including online sources such as the Texas Historic Sites Atlas, Handbook of Texas online, and Fannin County Appraisal District and in

person review of archives at the THC History Programs Division, Center for American History at the University of Texas at Austin, Texas State Library and Archives (TSLA), Bonham Public Library, Fannin County Museum of History, and Bertha Voyer Memorial Library, as well as meeting with the Fannin County Historical Commission.

The preliminary research/literature review did not identify any previously-designated historic resources within the project's APE. However, it revealed that the general study area contains one official Texas historical marker (OTHM), which is entitled the "Central National Road." This OTHM marks the route of the Central National Road, which was built in 1844 to connect the Republic of Texas with the United States. The THC Historic Sites Atlas also revealed the presence of six historic-age cemeteries within the APE including:

- The New Harmony Cemetery (THC # FN-C004)
- The Pleasant Grove Cemetery (THC # FN-C234)
- The Merrill Cemetery (THC # FN-C007)
- McFarland Cemetery (THC # FN-C008)
- The Oakridge Cemetery (THC # FN-C212)
- The Willow Grove Cemetery (THC # FN-C010)

A team consisting of a senior professional historian, a cultural resource analyst and a research assistant undertook a reconnaissance-level survey during April and May of 2009. This survey was performed in accordance with the standards of the THC. The entirety of each land parcel that intersects the APE underwent a reconnaissance-level survey to identify and document all resources constructed by 1965.

The April and May 2009 field surveys identified 75 properties within the project's APE that include 114 resources. A summary of the historic resources surveyed is listed in **Table 3-24.** Separated into distinct property types, the resources include 56 domestic property types, 46 agricultural property types, six transportation property types, two commercial property types, two religious property types, one commemorative property type and one landscape property type. None of the resources were recommended as eligible for the National Register of Historic Places (NRHP). No properties identified during the initial phase of the survey were recommended for intensive-level study.

Table 3-24: Historic Resources Summary Table

Resource #	Property Type/Subtype	Date	PA* APE OUT	Eligibility (Criteria)
1	Agriculture/Animal facility	Ca. 1960	OUT	No
2	Domestic/Single dwelling	Ca. 1925	PA	No
3	Domestic/Single dwelling	Ca. 1950	OUT	No

Resource #	Property Type/Subtype	Date	PA* APE OUT	Eligibility (Criteria)
4	Commerce/Department store	Ca. 1910	OUT	No
5a	Agriculture/Animal facility	Ca. 1940	OUT	No
5b	Agriculture/Storage	Ca. 1940	OUT	No
6	Domestic/Single dwelling	Ca. 1960	APE	No
7a	Domestic/Single dwelling	1940	APE	No
7b	Agriculture/Animal facility	Ca. 1950	APE	No
7c	Agriculture/Animal facility	Ca. 1940	APE	No
7d	Domestic/secondary structure	Ca. 1940	APE	No
7 e	Domestic/secondary structure	Ca. 1940	APE	No
7f	Domestic/Secondary structure	Ca. 1940	APE	No
7g	Domestic/Secondary structure	Ca. 1940	APE	No
7h	Agriculture/Outbuilding	Ca. 1940	APE	No
8	Transportation/Road-related	1960	PA	No
9a	Domestic/Single dwelling	1925	PA	No
9b	Agriculture/Animal facility	Ca. 1950	PA	No
9c	Agriculture/Animal facility	Ca. 1960	PA	No
10	Agriculture/Animal facility	Ca. 1965	PA	No
11	Transportation/Road-related	Ca. 1965	PA	No
12	Domestic/Single dwelling	1930	APE	No
13	Agriculture/Animal facility	Ca. 1930	PA	No
14	Agriculture/Animal facility	Ca. 1940	APE	No
15	Agriculture/Animal facility	Ca. 1965	APE	No
16	Domestic/Single dwelling	Ca. 1925	PA	No
17a	Domestic/Single dwelling	1942	OUT	No
17b	Agriculture/Animal facility	Ca. 1940	OUT	No
18a	Domestic/Single dwelling	Ca. 1930	OUT	No
18b	Domestic/Secondary structure	Ca. 1930	OUT	No
19	Domestic/Single dwelling	1872	OUT	No
20a	Domestic/Single dwelling	Ca. 1930	OUT	No
20b	Domestic/Secondary structure	Ca. 1930	OUT	No
21a	Domestic/Single dwelling	1940	OUT	No
21b	Domestic/Secondary structure	Ca. 1940	OUT	No
22	Agriculture/Animal facility	Ca. 1965	APE	No
23	Transportation/Road related	Ca. 1950	OUT	No
24	Domestic/Single dwelling	Ca. 1925	OUT	No
25	Agriculture/Animal facility	Ca. 1950	OUT	No
26	Agriculture/Animal facility	Ca. 1950	OUT	No
27a	Agriculture/Animal facility	Ca. 1950	OUT	No
27b	Agriculture/Animal facility	Ca. 1950	OUT	No
28	Agriculture/Storage	Ca. 1940	OUT	No
29a	Domestic/Single dwelling	Ca. 1910	APE	No
29b	Agriculture/Storage	Ca.1930	APE	No
29c	Domestic/Secondary structure	Ca. 1930	APE	No
29d	Agriculture/Animal facility	Ca.1930	APE	No
30	Transportation/Road-related	Ca. 1950	APE	No
31	Domestic/Single dwelling	Ca. 1930	APE	No
32	Domestic/Single dwelling	Ca. 1950	OUT	No
33	Domestic/Single dwelling	Ca.1925	PA	No
34a	Domestic/Single dwelling	Ca. 1920	PA	No
34b	Domestic/Secondary structure	Ca. 1920	PA	No
34c	Commerce/Department store	Ca. 1920	PA	No

Resource #	Property Type/Subtype	Date	PA* APE OUT	Eligibility (Criteria)
34d	Recreation and Culture/Monument	1994	PA	No
35a	Agriculture/Animal facility	Ca. 1940	PA	No
35b	Agriculture/Storage	Ca. 1940	PA	No
36	Agriculture/Animal facility	Ca. 1940	PA	No
37	Agriculture/Animal facility	Ca. 1940	PA	No
38	Domestic/Single dwelling	N/A	APE	No
39a	Domestic/Single dwelling	Ca.1935	APE	No
39b	Agriculture/Animal facility	Ca.1935	APE	No
40	Agriculture/Storage	Ca. 1950	OUT	No
41	Funerary/Cemetery	Ca. 1850	PA	No
42	Funerary/Cemetery	Ca. 1865	PA	No
43	Agriculture/Animal facility	Ca. 1930	PA	No
44	Agriculture/Animal facility	Ca. 1920	PA	No
45a	Domestic/Single dwelling	Ca. 1930	PA	No
45b	Domestic/Secondary structure	Ca. 1930	PA	No
45c	Domestic/Secondary structure	Ca. 1930	PA	No
46	Agriculture/Animal facility	Ca. 1940	APE	No
47	Agriculture/Animal facility	N/A	OUT	No
48	Agriculture/Animal facility	Ca. 1930	OUT	No
49a	Domestic/Single dwelling	1923	OUT	No
49b	Domestic/Secondary Structure	Ca. 1940	OUT	No
50a	Domestic/Single dwelling	Ca. 1940	OUT	No
50b	Domestic/Secondary structure	Ca. 1940	OUT	No
50c	Domestic/Secondary structure	Ca. 1940	OUT	No
50d	Domestic/Single dwelling	Ca. 1940	OUT	No
51	Agriculture/Animal facility	Ca. 1930	OUT	No
52	Agriculture/Animal facility	Ca. 1945	OUT	No
53a	Domestic/Single dwelling	Ca. 1920	APE	No
53b	Domestic/Secondary structure	Ca. 1935	APE	No
53c	Agriculture/Animal facility	Ca. 1930	APE	No
54	Domestic/Single dwelling	Ca. 1960	PA	No
55	Agriculture/Animal facility	Ca. 1955	OUT	No
56a	Domestic/Single dwelling	Ca. 1915	OUT	No
56b	Domestic/Secondary structure	Ca. 1930	OUT	No
56c	Domestic/Secondary structure	Ca. 1950	OUT	No
57a	Domestic/Single dwelling	Ca. 1950	OUT	No
57b	Agriculture/Animal facility	Ca. 1945	OUT	No
57c	Agriculture/Animal facility	Ca. 1945	OUT	No
58	Domestic/Secondary structure	Ca. 1940	OUT	No
59a	Domestic/Single dwelling	Ca. 1930	PA	No
59b	Domestic/Secondary structure	Ca. 1930	PA	No
60	Agriculture/Animal facility	Ca. 1940	PA	No
61	Domestic/Secondary structure	Ca. 1940	PA	No
62	Domestic/Single dwelling	Ca. 1920	PA	No
63	Agriculture/Animal facility	Ca. 1960	PA	No
64a	Agriculture/Animal facility	Ca. 1940	APE	No
64b	Agriculture/Animal facility	Ca. 1950	APE	No
65	Agriculture/Animal facility	Ca. 1940	OUT	No
66	Domestic/Single dwelling	Ca. 1950	OUT	No
67a	Domestic/Single dwelling	Ca. 1965	OUT	No

Resource #	Property Type/Subtype	Date	PA* APE OUT	Eligibility (Criteria)
67b	Agriculture/Storage	Ca. 1965	OUT	No
68	Agriculture/Animal facility	Ca. 1915	OUT	No
69	Transportation/Road-related	1943/1978	PA	No
70	Domestic/Single dwelling	Ca. 1880/Ca. 1910	OUT	No
71	Domestic/Single dwelling	1912	OUT	No
72a	Domestic/Single dwelling	Ca. 1930	OUT	No
72b	Agriculture/Animal facility	Ca. 1940	OUT	No
73	Domestic/Single dwelling	Ca. 1900	OUT	No
74	Landscape/Natural feature	1928	PA	No
75	Transportation/Rail-related	1886	PA	No
76a	Domestic/Single dwelling	Ca. 1940	PA	No
76b	Domestic/Secondary structure	Ca. 1965	PA	No
77	Funerary/Graves	1866	OUT	No

Source: Lake Ralph Hall Historic Survey Report (Michael Baker International, 2010)
*PA= Project Area; APE= Area of Potential Effect (300 ft buffer of Project Area); OUT= outside APE

Additional historic-age properties may be found in the APE at a later date. Not all resources were able to be seen from the right of way. Lack of right of entry, heavy rains on unpaved roads and heavy vegetation all hindered the survey process. Using a 1964 topographic map, current aerial photographs and previous archeological survey, the properties that appear to have historic-age resources present have been identified in the *Historic Resources Survey* (Michael Baker International, 2010). While the project may be permitted before verification of the presence of these resources is undertaken, the proposed project may not proceed until these resources have been identified, documented and determined eligible or ineligible for NRHP listing.

To assess the impacts to historic resources from the pipeline alignment, a desktop survey of the pipeline alignment was conducted and is included in the *Lake Ralph Hall Raw Water Pipeline Alignment Study*. The desktop survey consisted of a literature review and records search to identify sites in the project area. In addition to the desktop survey, a field reconnaissance (windshield survey) was conducted along major roadways near the proposed pipeline alignment.

A records review of recorded cultural resources within the alignment, historic maps of the counties, and cultural resource management reports for the four counties demonstrated that although few recorded cultural resources are within an 800-foot corridor of the alignment, there is potential for cultural resources to be located within the route. Further investigations should include survey of the high potential areas, as well as micrositing the alignment and survey of cemetery locations to confirm avoidance of these locations.

3.15.2 Archeological Resources

3.15.2.1 Background and Previous Investigations

Background

The North Sulphur River valley has preserved geological and archeological evidence of Native American occupation from at least 10,000 BC and possibly earlier. The presence of Late Pleistocene fossils and Clovis and Folsom dart points attest to this early occupation. It is possible that the North Sulphur River valley is an area in northeast Texas where the potential of finding Paleoindian sites in-place is high. The watershed is well watered (Brune, 1981) and is relatively narrow and contains buried sediments that are 10,000 years old or older (Bureau of Economic Geology 1966, 1992). No sediments dating from this early period were investigated at Cooper Lake but they have been described in the valleys of the North and Sulphur Rivers and possibly in association with prehistoric artifacts (Slaughter and Hoover, 1965). Preserved and buried early sites, the Aubrey site (Ferring, 2001) and the Lewisville site (Crook and Harris, 1957), were discovered along the Elm Fork of the Trinity River. It is possible that the North Sulphur River valley was a natural avenue from the High Plains into the Eastern Woodlands since it is an eastward extension of the upland ridge that is between the Red River and the Elm Fork of the Trinity River.

Occupation continued from the end of the Late Paleoindian period into the Archaic period and up to the historic period, except for a hiatus that may have occurred in response to a major drying period soon after AD 1,000 or to the subsequent sweep of illness brought to North America by European explorers. The earliest occupation at Cooper Lake was reported from the Finley Fan site and dated 4500 to 3000 BC.

Previous Investigations

Few cultural investigations in the Ladonia area have been done due to the absence of any large-scale land modifying activities in the area. Although the Ladonia Unit of the Caddo National Grasslands is nearby, very little archeological survey has been done on these lands which are controlled by the U.S. Forest Service (Jurney, Winchell, and Moir, 1989) and the only other investigations in the area have been in conjunction with the construction of roads, pipelines, flood-water retarding structures and similarly small-scale projects. The only major archeological site survey in Fannin County was conducted in 1968 (Hsu, 1968) in anticipation of the construction of Timber Creek Reservoir which is now known as Lake Bonham and at LBCR. No excavation was conducted at Lake Bonham and LBCR has not been built. This single survey resulted in locating more than a quarter of the 50 archeological sites recorded for the entire county at the Texas Archeological Research Laboratory (TARL, 2002). In 1994, four archeological sites were recorded on the Ladonia Unit of the National Grasslands (Servello, 1994) and these included two prehistoric and two historic sites (**Table 3-25**). No sites have been recorded in the floodplain of the North Sulphur River within Fannin County although hundreds of prehistoric projectiles and numerous Late Pleistocene fossils have been recovered by artifact collectors. These artifacts are most likely

derived from campsites that were dissected or otherwise have been exposed since the North Sulphur River floodplain and its tributaries were channelized. Channelization also resulted in headward erosion of the tributaries which has also increased exposure of formerly buried archeological sites.

Table 3-25: Recorded archeological sites in the immediate vicinity

Site No.	Description
41FN47	Very light scatter of chipped stone including flakes, a core and tested cobble of locally available quartzite. No tools were recovered from the surface of the heavily eroded surface of this ridge where artifacts covered an area 15 by 20 m.
41FN48	Chipped stone artifacts and some historic artifacts were recorded scattered over a crescent-shaped area with a maximum width of 40 m and a length of up to 140 m. The chipped stone artifacts include quartzite and chert along with petrified wood. No dating of the prehistoric occupation period was provided. A single piece of ground stone was also found. Historic artifacts include handmade bricks along with a few pieces of ceramics and glass which date this occupation between 1870 and 1900.
41FN49	An old road bed is adjacent to the west side of this house site where a cistern/well, house foundation, storm cellar and several artifact scatters were recorded. Artifacts include ceramics, glass, metal, building materials and bone. The house is tentatively dated between 1880 and 1940, but possibly earlier.
41FN50	This is the site of a historical residence that tentatively dates between 1880 and 1940. A corral and a cistern are the only features present. Artifacts on the surface include ceramics, bricks, glass, wire nails, cast iron stove parts, an iron harness, bolts, wire and coal/charcoal.

Source: Lake Ralph Hall Archeological Survey (UTRWD, 2005a)

For years, a large number of surface collectors, including members of Surface Hunters of Texas have recovered prehistoric Native American artifacts from the North Sulphur River and its tributaries. The majority of artifacts are actually found in the shallow waters of the river channel and the numerous smaller drainages which flow into it. The number of artifacts gathered seems to be evenly divided between these two settings. However, some have been found eroding out of the steep banks of both the river and tributary channels. When exposed in the eroded banks, artifacts are usually found between 20 and 200 centimeters below the present ground surface.

Dart points are the most commonly found artifacts with significantly fewer arrow points being found, and very little prehistoric pottery. Nearly all of the dart or arrow point types that are found throughout Texas have also been collected within the North Sulphur River Basin. These include the following Paleoindian and Archaic dart points: Clovis, Folsom, Plainview, Meserve, Scottsbluff, Pelican, Calf Creek, Darl, Fairland, Edgewood, Ellis, Gary, Trinity and Dallas. Arrow points include Scallorn and Perdiz. In addition to projectile points, other chipped stone tools include bifaces, scrapers, corner-tang knives, cores and an abundance of lithic debris. A variety of local and exotic stone types were used in making various stone tools. These include local and central Texas cherts and quartzites as well as Alibates chert from the Texas Panhandle. Ground stone tools such as manos, metates, axes and pipes have been found. Exotic artifacts such as drilled

bear teeth, small clay effigies, stone gorgets and decorated clay pipes have also been found. Animal bones, mussel shells and charcoal have been observed in the banks and eroded into the water.

3.15.2.2 Archeological Survey

During 2005, an intensive pedestrian archeological survey was conducted along with trench testing of selected areas within the project area. The scope of the archeological survey included a records review, a field survey, the recording of sites, and the preparation of a summary report. The *Cultural Resources Survey Report* was submitted to and reviewed by the THC, the State Historic Preservation Office (SHPO) for Texas. A copy of the correspondence from the THC is included in the *Cultural Resources Survey Report* (UTRWD, 2006b). On April 17, 2006, the State Historic Preservation Office concurred with the findings of the report.

The survey covered approximately 15 percent of the Proposed Action project area with the primary focus on the dam site. A total of more than 1,700 acres was surveyed for sites. The largest continuous area surveyed is the dam site and second area is adjacent to the FM 1550 crossing of Merrill Creek. The banks and channels of the river scar and the old river were inspected for buried site deposits and other evidence of occupation. A total of 17 archeological sites were recorded, which includes 7 prehistoric sites and 10 historic sites. The study found that sediment in the North Sulphur River floodplain was first deposited about 15,000 BC and continued to be deposited up to the present. Two bridges, several turn of the century residences, a family cemetery, and a trash accumulation were recorded. An abandoned train stop that was at the rural community of Bagby is also within the lake area and was also recorded. **Table 3-26** lists the archeological site numbers, descriptions, and eligibility recommendations for the surveyed sites.

Table 3-26: Archeological Site Recommendations

Site No.	Description	Recommendation
41FN60	Plowed and deflated prehistoric lithic scatter, no subsurface deposit or surface integrity	Ineligible for NRHP or as SAL*
41FN61	Plowed and deflated prehistoric lithic scatter, no subsurface deposit or surface integrity	Ineligible for NRHP or as SAL
41FN62	Plowed and deflated prehistoric lithic scatter and artifact scatter with no subsurface deposit	Ineligible for NRHP or as SAL
41FN63	Late 19th century trash accumulation	Ineligible for NRHP or as SAL
41FN64	20th century house site, house was moved away and only feature is a trash-filled cistern	Ineligible for NRHP or as SAL
41FN65	20th century artifact scatter, possibly a house	Ineligible for NRHP or as SAL
41FN66	Deeply buried Middle Archaic campsite with an abundance of mussel shells, animal bones, charcoal and stone tools	Needs further definition of deposit to determine NRHP eligibility
41FN67	20th century house site with cistern, footings, and scattered trash	Ineligible for NRHP or as SAL
41FN68	Small shallow Middle/Late Archaic campsite situation overlooking the river	Further testing is needed to determine NRHP eligibility
41FN69	Concrete and wood bridge piers, not in primary context	Ineligible for NRHP or as SAL
41FN70	Wooden pilings, earthen berm, and collapsed iron-sheathed railroad bridge piers from Gulf, Colorado and Santa Fe Railroad across floodplain	Ineligible for NRHP or as SAL due to abandonment and degradation
41FN71	Collapsing 3-room frame house built in early 20th century and lived in until 1950s	Ineligible for NRHP or as SAL due to abandonment and degradation
41FN72	Merrill Family Cemetery	Avoid
41FN73	A cobble core/chopper form Profile 1 may be from a buried deposit below a radiocarbon date of 10,860±40BP	Further testing is needed to determine artifact association and NRHP eligibility
41FN74	Bagby railroad stop on the Gulf, Colorado and Santa Fe Railroad and associated rural community	Further testing is needed to determine NRHP eligibility
41FN75	Limestone hearth slab, rock footings and possible cistern of a possible 1800s log cabin	Further testing is needed to determine NRHP eligibility
41FN76	Plowed and deflated prehistoric lithic scatter, no subsurface deposit or surface integrity	Ineligible for NRHP or as SAL

Source: Lake Ralph Hall Archeological Survey (UTRWD 2005a)
*State Antiquities Landmark (SAL)

To assess the impacts to archeological resources from the pipeline alignment, a desktop survey of the pipeline alignment was conducted and is included in the *Lake Ralph Hall Raw Water Pipeline Alignment Study* found in **Appendix A-3**. The desktop survey consisted of a literature review and records search to identify sites in the project. A records review of recorded cultural resources within the alignment, historic maps of the counties, and cultural resource management reports for the four counties demonstrated that although few recorded cultural resources are within an 800-foot corridor of the alignment, there is potential for cultural resources to be located within the route. The report recommends that additional archival research should be conducted to identify areas that have high potential for cultural resources. These high potential areas will include where

the pipeline route crosses the Elm Fork Watershed and the East Fork of the Trinity River, as well as other permanent drainages.

3.15.2.3 Tribal Consultation

The USACE is working with the SHPO and permit applicant (UTRWD) to develop a research design for future cultural resource investigations across the project. While the proposed reservoir lies in an area with no known tribal lands or trust lands, there are five tribes historically associated with the area. In May of 2017, letters (**Appendix H**) were sent out to the tribes in the Area of Interest inviting them to consult on the project and requesting their participation in the consultation and development of a PA to guide future work (testing and mitigation) on the identified sites, and to notify the USACE of any cultural or religious significance they might attach to this site or this area. Tribes in the Area of Interest that were notified included:

- Caddo Nation of Oklahoma
- Choctaw Nation of Oklahoma
- Comanche Nation of Oklahoma
- Tonkawa Tribe of Oklahoma
- Wichita and Affiliated Tribes

3.16 Paleontological Resources

The North Sulphur River area had abundant life in the Later Cretaceous time, including Planktonic (floating) such as microscopic algae and nannoplankton, Nektonic (swimming) such as fish, turtles, ammonites, baculites, sharks, mosasaurs, and Benthonic (bottom-dwelling) such as clams, oysters, rudists, snails. The North Sulphur River is a good location for fossil finds due to a variety of reasons including, but not limited to (Tom Dill, n.d.):

- The area has a wide variety of preservation types, including molds, casts, tracks, trails, and hard parts such as bones, teeth and shells that contribute to the diversity of fossil finds.
- Fossils in the area were entombed in clay and silt, which becomes mudstone or shale when compacted. Shale is ideal for preservation and extraction because it weathers easily, releasing fossils.
- During the Late Cretaceous time, the area was likely shallow seas, about 200-500 feet deep. When the seal level began to drop, waves washed away the clay and silt from the sea bottom and fossils accumulated on the sea floor.
- The North Sulphur River flows between the Pecan Gap Chalk and Wolfe City Sand ridges on the easily-eroded Ozan Formation. The uplift, tilting, and faulting of the Ozan

Formation allowed older layers to be exposed through erosion at the edge of the basin. Straightening of the Sulphur River enhanced erosion, exposing more fossils.

- Accessibility, with multiple bridges that cross channels, allowing access to the ROW. (Tom Dill, n.d.)

The Ladonia Fossil Park (aka Pete Patterson Fossil Park) is located two miles north of downtown Ladonia on SH 34 north and west of the bridge spanning the North Sulphur River. The 15-acre park sits on the bank of the river channel and provides an entrance into hunting grounds that have yielded a variety of fossils from the Cretaceous and Pleistocene Periods. Ladonia Fossil Park is located in the footprint of the proposed Lake Ralph Hall.

On January 21, 2011, the USACE held a meeting in Ladonia to educate the public on the role of the USACE in evaluating the historic and prehistoric resources that could be affected by construction of the lake. Two speakers provided overviews of the historic resources in the proposed lake area. The first speaker discussed the prehistoric and historic-age sites that have been identified in the area. The second speaker provided information on the fossils that are commonly found in the Sulphur River and have made the area well-known to paleontologists. Notices advertising the meeting invited the public to bring fossils and artifacts, photographs, or documents. Some of the less common fossils discussed at the meeting included a fossilized fish estimated to be 79-80 million years old found in the Upper North Sulphur River Valley, and a pod of four prehistoric turtles. Over 60 people attended the meeting, including several members of the Dallas Paleontological Society.

On March 22, 2011, the USACE held a meeting at Southern Methodist University (SMU) to provide an overview of the proposed project and the EIS process and discuss potential mitigation opportunities. Meeting attendees included members of the Dallas Paleontological Society, paleontologists from SMU, a staff member from the Museum of Nature & Science, and representatives from the USACE and UTRWD. Topics included potential project impacts, best management practices, education/museum outreach, and standards for collaboration between consulting parties.

A discussion of potential impacts to paleontological resources from the proposed Lake Ralph Hall project is included in **Chapter 4**.

3.17 Socioeconomics

In this report, the Lake Ralph Hall Project Team has defined a primary impact area (PIA) and a secondary impact area (SIA) for each of the project components based upon an understanding of the potential socioeconomic effects which might result from each project component. The socioeconomic PIA is defined as that geographic area in which the immediate and direct socioeconomic effects of the project component are likely to incur. This would include the inundation area and the immediately affected jurisdiction, namely Fannin County. For pipelines,

the PIA will be the political jurisdictions immediately affected by the corridors where the construction will occur.

For each alternative, the socioeconomic SIA has been determined to include that area in which indirect or linked socioeconomic effects might occur from the alternative development or operation. Examples of these indirect or linked socioeconomic effects follow:

- The region from which workers might be drawn or where they in-migrate to and commute from.
- Political jurisdictions which are likely to serve construction workers, operational employees or directly affected residents or businesses.
- Other public facility and service providers that might be indirectly affected by, for example the diversion of water associated with the project component.
- Those public jurisdictions that might incur financial effects or fiscal impacts associated with the construction or operation of a component.

Secondary impact areas are defined mostly by counties but also by incorporated communities. To avoid repetition, each political jurisdiction which represents all or part of the alternative's SIA are described only once in this report. For example, Fannin County is only described once, although it appears as a PIA for the lake and an SIA for the pipeline. **Table 3-27** provides the composition of socioeconomic PIAs and SIAs for the project alternative and its components.

Table 3-27: Socioeconomic Primary and Secondary Impact Areas for Lake Ralph Hall Alternatives and Components

Alternative	PIA	SIA
Lake Ralph Hall	Fannin County	City of Paris and Hunt County
Pipeline	Pipeline Footprint	Collin, Fannin, and Hunt Counties

Source: Harvey Economics, 2015

Within the descriptions of each socioeconomic PIA and SIA, this section addresses the range of socioeconomic resources which might be affected by the various alternatives:

- Demographic characteristics – population levels, commuting patterns, age and ethnicity of the residents, income patterns, household size, vacancy rates, the number of seasonal homes and housing values. Demographic conditions are relevant in this EIS because the nature and significance of socioeconomic impacts are in part determined by the characteristics of the affected population.
- Economic characteristics – employment, unemployment, employment by industry and occupation, businesses and gross sales. The economic conditions of each PIA and SIA

are relevant since the construction and operation of these alternatives represent economic stimuli to the respective geographic areas. Agricultural conditions are pertinent because the lake would inundate farms and ranches, and the pipelines would temporarily disturb farm or ranch land.

- Public facilities and services – protection services (police and fire), health services, municipal services (water, wastewater and solid waste), education, and library services. Public facilities and services are relevant in the Lake Ralph Hall EIS because (1) certain services may be called upon during the construction phase of the project, i.e. protection services; (2) some municipal services, such as water and wastewater, might be affected by the project component operations; (3) population changes might affect service levels or demands upon certain public facilities and services; (4) fiscal impacts, either positive or negative, might affect the funding levels for public facilities and service levels in certain jurisdictions.
- Fiscal resources – revenues, expenditures and capital outlays for potentially affected jurisdictions. A change in population levels, economic activity or expenditure patterns from the construction and operation of the project can increase a jurisdiction's revenues and/or increase its expenditures.

Socioeconomic information presented here are from secondary and primary sources. U.S. Bureau of Census decennial demographic and economic information is the basis for PIA and to a lesser extent, SIA descriptions, since this source is consistent across areas and considered to be the most accurate information available. Other federal information sources were the U.S. Bureau of Labor Statistics regarding employment data and U.S. Bureau of Economic Analysis related to income. County and metropolitan planning agencies such as the Texoma Council of Governments provided information as well. In addition, Team representatives interviewed individuals responsible for public facilities and services within each PIA and SIA. Fiscal information was obtained from State of Texas regulatory agencies, coupled with budgets from various jurisdictions. This affected socioeconomic environment is based upon the most recent information available as of early 2015.

Values are adjusted for inflation where appropriate. Time series dollar information is expressed in consistent, constant 2014 dollar values, reflecting the most recent year of dollar data available.

This section is structured to discuss the dam site first, followed by the pipeline alternative.

3.17.1 Definition of Lake Ralph Hall Dam Sites Socioeconomic Impact Areas

Lake Ralph Hall would be located in the southeast corner of Fannin County, Texas (**Figure 3-21**). The town of Ladonia is located immediately to the south, the city of Pecan Gap is to the southeast and Wolfe City is southwest of the lake. State highway 34 runs north south through the proposed lake footprint, bisecting it almost at the centerline. Bug Tussle is situated immediately north of the lake and Bailey is located to the west.

The PIA for Lake Ralph Hall is Fannin County. While the county would encompass the bulk of the impacts, Lake Ralph Hall socioeconomic effects would differ across the county. Special emphasis would be put on the description of the footprints of the lake and the surrounding unincorporated areas, as well as the town of Ladonia and the city of Bonham, the county seat. Census data is available at many different geographical levels. Block Group Census data, the second smallest geographic designation, are used to describe the Lake Ralph Hall PIA, where available. Note that block group-level data is only available for certain topics.

The SIA area for Lake Ralph Hall is Hunt County and the city of Paris. These two jurisdictions make up the majority of the proximal population that is not already in Fannin County. Workers coming from outside Fannin County would be drawn from Greenville (Hunt County) and Paris as the two largest cities near Lake Ralph Hall. The SIA impacts would mostly be felt at the municipal level, which is why Paris was chosen instead of Lamar County. However, in the case of Hunt County, the pipeline route goes through a large portion of northern Hunt County, so the entire county was chosen. Special emphasis would be placed on Greenville when discussing Hunt County.

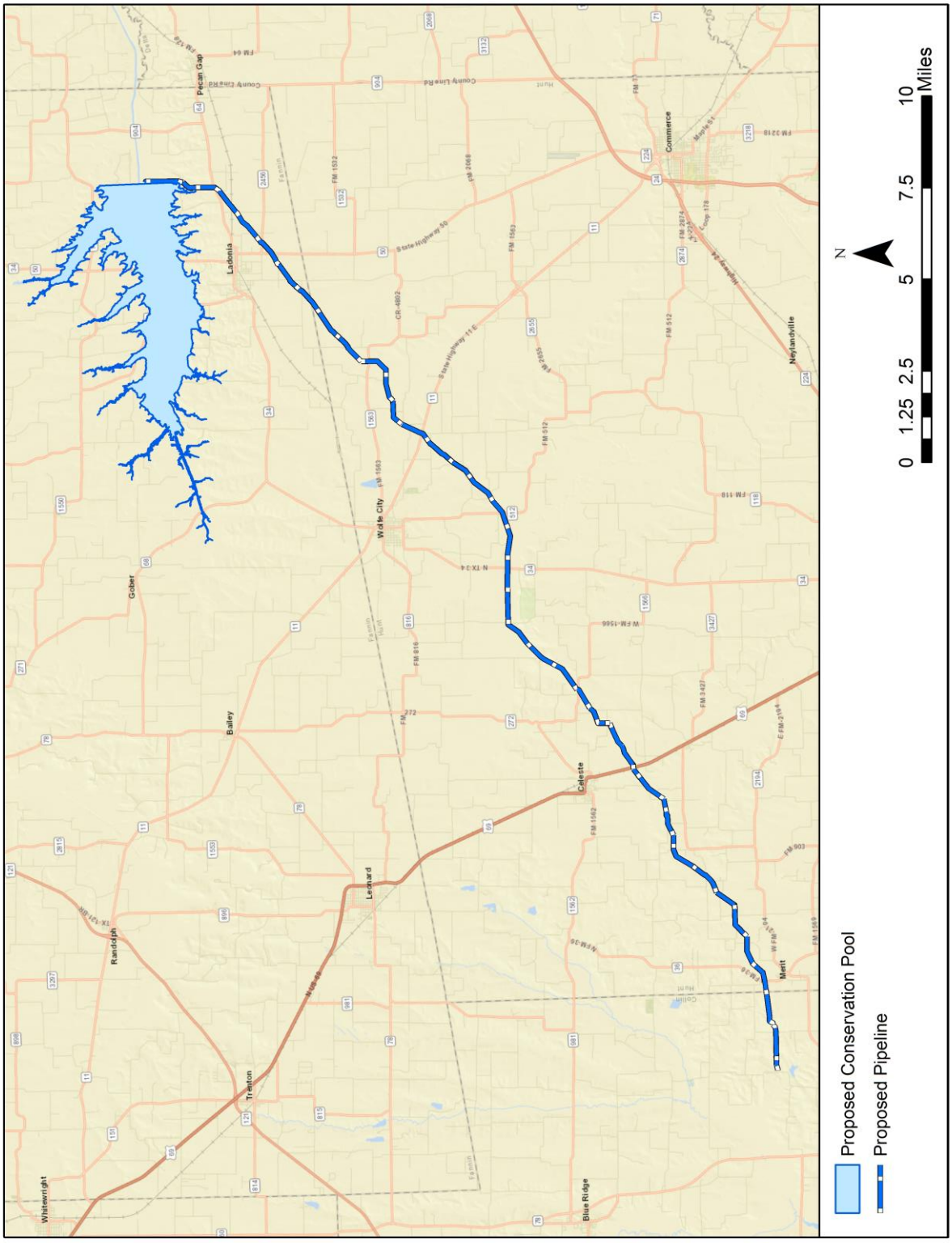


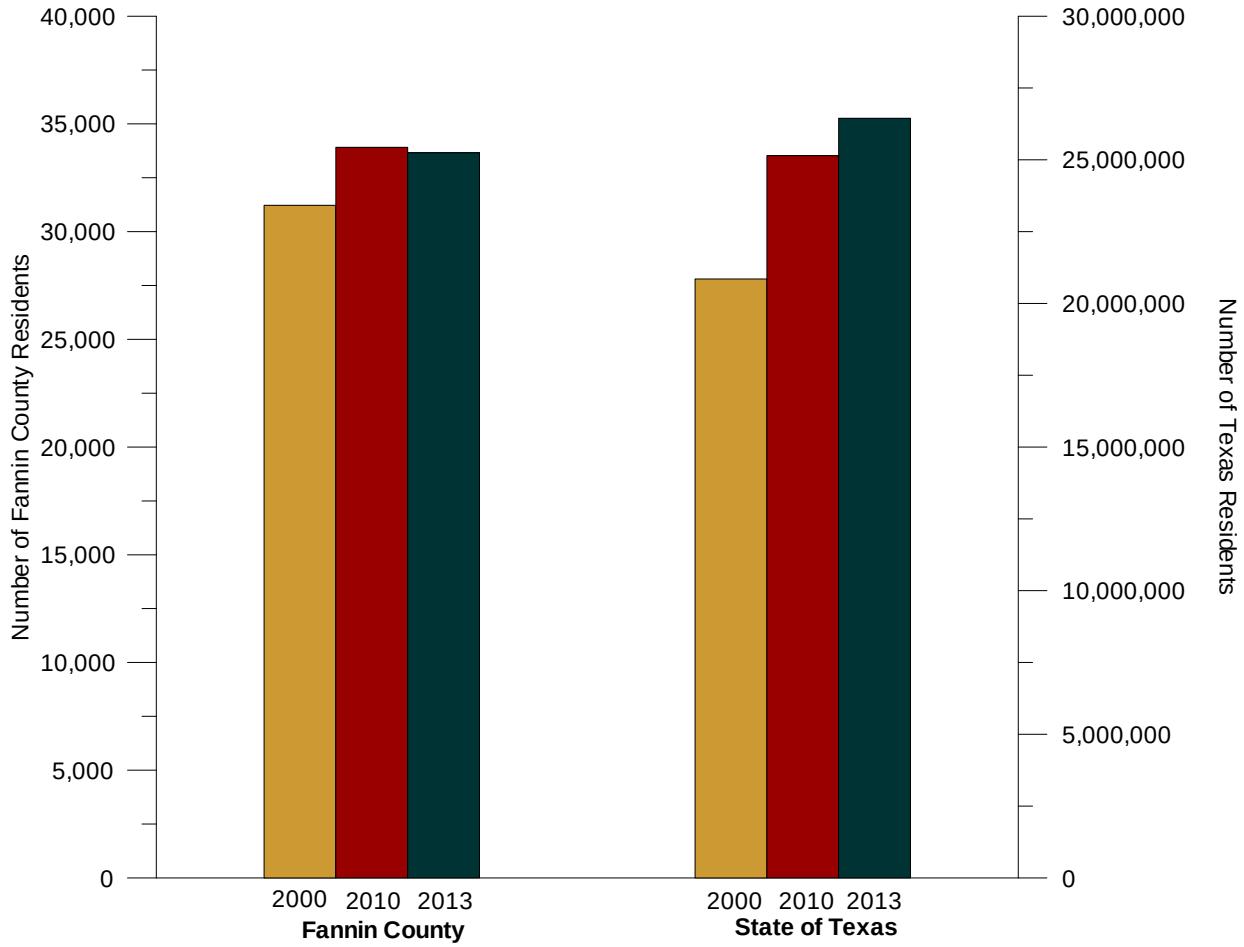
Figure 3-21: Lake Ralph Hall Conservation Pool and the Preferred Pipeline Alternative

3.17.2 Demographic and Economic Conditions for Dam Site PIA and SIA

Population

Figure 3-22 illustrates population growth for Texas and Fannin County for 2000, 2010, and 2013. Both were clearly growing during this nearly 20 year period but, like many rural areas, growth in Fannin County was less than the State from 2000 to 2013.

Figure 3-22: Population of Texas and Fannin County, 2000, 2010, & 2013



Source: US Census Bureau; Census 2000, Summary File 1, Table P1. Population Estimates Program, Table T1. www.census.gov, (accessed January, 2015). American Community Survey, 2009-2013 American Community Survey 5-Year Estimates, Table B01003. www.census.gov, (accessed January, 2015).

Table 3-28 provides population figures for Texas, Fannin County, Bonham, Ladonia, and Lake Ralph Hall for 2000, 2010, and 2013. From 2000 to 2013, Fannin County, Bonham and Ladonia grew at a slower rate than the State of Texas.

Table 3-28: Population of Texas, Fannin County, Bonham, Ladonia, and Lake Ralph Hall for 2000, 2010, and 2013

Year(s)	Texas	Fannin County	Bonham	Ladonia	Lake Ralph Hall
2000	20,851,028	31,225	10,004	682	4,225
2010	25,145,561	33,915	10,127	612	4,798
2013	26,448,193	33,659	10,005	605	4,081
% Change 2000-2010	21%	9%	1%	-10%	14%
% Change 2000-2013	27%	8%	0%	-11%	-3%
% Change 2010-2013	5%	-1%	-1%	-1%	-15%

Source: US Census Bureau; Census 2000, Summary File 1, Table P1. Population Estimates Program, Table T1. www.census.gov, (accessed January, 2015). American Community Survey, 2009-2013 American Community Survey 5-Year Estimates, Table B01003. www.census.gov, (accessed January, 2015).

Table 3-29 shows the 2000 to 2013 population estimates for Hunt County, Greenville, and Paris, compared with the State. The 2000 to 2013 growth rate of the SIA is considerably lower than the overall Texas rate.

Table 3-29: Population of Texas, Hunt County, Greenville, and Paris for 2000, 2010, and 2013

Year(s)	Texas	Hunt County	Greenville	Paris
2000	20,851,028	76,562	24,056	25,832
2010	25,145,561	86,129	25,557	25,171
2013	26,448,193	87,048	25,917	24,912
% Change 2000-2010	21%	12%	6%	-3%
% Change 2000-2013	27%	14%	8%	-4%
% Change 2010-2013	5%	1%	1%	-1%

Source: US Census Bureau; Census 2000, Summary File 1, Table P1. Population Estimates Program, Table T1. www.census.gov, (accessed January, 2015). American Community Survey, 2009-2013 American Community Survey 5-Year Estimates, Table B01003. www.census.gov, (accessed January, 2015).

Age

Table 3-30 depicts the age characteristics for Texas and the PIA. The median age in the PIA is moderately higher than the overall Texas median, and the proportion of the population over 60 is eight percent higher in the PIA as compared to Texas.

Table 3-30: Age Characteristics for Fannin County, Bonham, Ladonia, Lake Ralph Hall, and Texas, 2009-2013

Age Range (Years)	Texas		Fannin County		Bonham		Ladonia		Lake Ralph Hall	
	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total
> 10	3,889,720	15%	4,090	12%	1,334	13%	116	18%	352	9%
10 - 19	3,790,622	15%	4,166	12%	915	9%	80	13%	488	12%
20 - 29	3,751,413	15%	3,989	12%	1,590	16%	94	15%	453	11%
30 - 39	3,589,159	14%	4,383	13%	1,604	16%	37	6%	351	9%
40 - 49	3,474,870	14%	4,345	13%	1,067	11%	32	5%	623	15%
50 - 59	3,169,259	12%	4,888	14%	1,550	15%	85	13%	610	15%
60 - 69	2,153,141	8%	3,980	12%	790	8%	116	18%	656	16%
70 - 79	1,143,307	4%	2,385	7%	648	6%	55	9%	376	9%
80 +	677,882	3%	1,593	5%	585	6%	24	4%	172	4%
Total	**25,639,373**	**100%**	**33,819**	**100%**	**10,083**	**100%**	**639**	**100%**	**4,081**	**100%**
Median Age	**34**		**41**		**38**		**36**		**48**	

Note: Beginning in 2009, a 1-year, a 3-year and a 5-year estimate are available. The 5-year estimate is used because it has data for smaller areas. It is based on the average characteristics over the five year range. For more information see: http://factfinder.census.gov/jsp/saff/SAFFInfo.jsp?_content=acs_guidance_2008.html.
Source: US Census Bureau; American Community Survey, 2009-2013 American Community Survey 5-Year Estimates, Tables B01001 & B01002. www.census.gov, (accessed January, 2015).

The median age for Hunt County in 2009-2013 was 38. This is the same as Paris and four years older than the median age for Greenville and Texas. The median ages for Hunt County and Paris were slightly higher than that for Texas, but Greenville's median age was the same as that of the state. As with the PIA, the proportion of the population over 60 is higher in the SIA than in Texas. **Table 3-31** indicates the age characteristics for the SIA.

Table 3-31: Age Characteristics for Hunt County, Greenville, Paris and Texas, 2009-2013

Age Range (Years)	Texas		Hunt County		Greenville		Paris	
	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total
>10	3,889,720	15%	11,745	14%	4,587	18%	3,418	14%
10-19	3,790,622	15%	12,008	14%	2,963	12%	3,443	14%
20-29	3,751,413	15%	11,314	13%	4,170	16%	3,643	15%
30-39	3,589,159	14%	10,456	12%	3,326	13%	2,705	11%
40-49	3,474,870	14%	11,417	13%	2,874	11%	3,177	13%
50-59	3,169,259	12%	11,765	14%	2,841	11%	3,069	12%
60-69	2,153,141	8%	9,347	11%	2,226	9%	2,514	10%
70-79	1,143,307	4%	5,301	6%	1,418	6%	1,917	8%
80+	677,882	3%	3,102	4%	1,324	5%	1,233	5%
Total	**25,639,373**	**100%**	**86,455**	**100%**	**25,729**	**100%**	**25,119**	**100%**
Median Age	**34**		**38**		**34**		**38**	

Source: US Census Bureau; American Community Survey, 2009-2013 American Community Survey 5-Year Estimates, Tables B01001 & B01002. www.census.gov, (accessed January, 2015).

Housing Characteristics

Table 3-32 and **Table 3-33** provide the housing characteristics for Texas and the Lake Ralph Hall PIA.

Table 3-32: Housing Statistics for Texas, Fannin County, Bonham, Ladonia, and the Lake Ralph Hall PIA, 2009-2013

Housing	Texas	Fannin County	Bonham	Ladonia	Lake Ralph Hall
Total Housing Units	10,070,703	14,159	3,563	373	2,184
Vacant Housing Units	1,184,232	2,345	512	126	567
Housing Vacancy Rates	12%	17%	14%	34%	13%
Seasonal/Vacation Homes	236,330	448	0	10	119
Average Household Size	2.8	2.6	2.5	2.6	2.5

Source: American Community Survey 2009-2013, Tables B25002, B25004 & B25010. www.census.gov, (accessed January 2015).

In 2009-2013, the vacancy rate for Texas (12 percent) was lower than for the PIA (Fannin was 17 percent). The Lake Ralph Hall footprint has a slightly higher proportion of vacant seasonal houses than Texas or Fannin County and considerably more than Bonham or Ladonia. The household size is slightly smaller for the PIA (Fannin was 2.6 in 2009-2013) compared to Texas (2.8 in 2009-2013) as a whole. This is unsurprising given the higher percentage of people over 60 in the PIA.

Table 3-33: Median Housing Values for Texas, Fannin County, Bonham, Ladonia, and the Lake Ralph Hall PIA, 2000, 2010 and 2009-2013

Year(s)	Texas	Fannin County	Bonham	Ladonia	Lake Ralph Hall
2000	$110,553	$82,701	$66,928	$52,150	$52,318
2010	$134,080	$88,482	$67,746	$61,232	n/a
2009-2013	$130,991	$94,102	$86,684	$49,592	$107,338
% Change 2000-2010	21.3%	7%	1%	17%	n/a
% Change 2000 to 2009-2013	18%	13.8%	29.5%	-4.9%	105.2%
% Change 2010 to 2009-2013	-2%	6.4%	28.0%	-19.0%	n/a

Note: Median housing value is in 2014 dollars.

Source: US Census Bureau;. Census 2000, Summary File 3, Tables H84 & H85. American Community Survey 2006-2010, Tables B25075 & B25077. American Community Survey 2009-2013, Tables B25075 & B25077.www.census.gov, (accessed January, 2015).

The 2010 median housing value for Texas was higher than the PIA housing values. However, according to the 2009-2013 data, the housing value for the Lake Ralph Hall footprint was higher than the housing values for Fannin County, Ladonia and Bonham. From 2000 to 2009-2013, the Lake Ralph Hall footprint housing values grew considerably faster than housing values for Fannin County or Texas. Notably, almost all of Bonham's growth occurred after 2010.

Table 3-34 and **Table 3-35** present the housing characteristics for Texas and the Lake Ralph Hall SIA. The vacancy rate for the SIA is slightly higher than that for Texas. Hunt County and Texas has more than double the proportion of seasonal / vacation homes than Greenville and Paris. Most likely this reflects the fact that these types of homes are more often located in rural rather than urban areas.

The median housing value for Texas is considerably higher than for the SIA. All of the growth in the median SIA housing value took place between 2000 and 2010; all the regions experienced negative growth in median housing value between 2010 and 2009-2013.

Table 3-34: Housing Statistics for Texas, Hunt County, Greenville, and Paris, 2009-2013

Housing	Texas	Hunt County	Greenville	Paris
Total Housing Units	10,070,703	36,630	10,787	12,067
Vacant Housing Units	1,184,232	5,874	1,561	1,787
Housing Vacancy Rates	12%	16%	14%	15%
Seasonal/Vacation Homes	236,330	1,261	135	165
Average Household Size	2.8	2.7	2.7	2.4

Source: American Community Survey 2009-2013, Tables B25002, B25004 & B25010. www.census.gov, (accessed January 2015).

Table 3-35: Median Housing Values for Texas, Hunt County, Greenville, and Paris 2000, 2010, and 2009-2013

Year(s)	Texas	Hunt County	Greenville	Paris
2000	$110,553	$87,106	$82,275	$73,607
2010	$134,080	$98,470	$85,985	$79,254
2009-2013	$130,991	$95,017	$83,330	$76,623
% Change 2000-2010	21.3%	13%	4.5%	8%
% Change 2000 to 2009-2013	18%	9.1%	1%	4%
% Change 2010 to 2009-2013	-2%	-3.5%	-3%	-3%

Note: Median housing value is in 2014 dollars.

Source: US Census Bureau; Census 2000, Summary File 3, Tables H84 & H85. American Community Survey 2006-2010, Tables B25075 & B25077. American Community Survey 2009-2013, Tables B25075 & B25077.www.census.gov, (accessed January, 2015).

Income

Per capita income is higher for Texas, than for the PIA, although only barely for the lake footprint in 2009-2013. The Lake Ralph Hall footprint is the only region that had positive per capita income growth over the 2000 to 2009-2013 period. Median family incomes were much lower in Ladonia and Bonham than in Fannin County throughout the entire period. Just over 17 percent of the Texas and Fannin County population had incomes below the poverty level while that figure was about 22 percent for Ladonia and over 26 percent for Bonham.

Table 3-36 points out the median household and per capita income for Fannin County, Bonham, Ladonia, Lake Ralph Hall and Texas for 2000, 2010 and 2009-2013. **Table 3-37** shows the median household and per capita incomes for Texas, Hunt County, Greenville and Paris for the SIA.

Table 3-36: Median Household and Per Capita Income for Fannin County, Bonham, Ladonia, the Lake Ralph Hall PIA, and Texas, 2000, 2010 and 2009-2013

Year(s)	Texas		Fannin County		Bonham		Ladonia		Lake Ralph Hall	
	Median Income	Per Capita Income	Median Income	Per Capita Income	Median Income	Per Capita Income	Median Income	Per Capita Income	Median Income	Per Capita Income
2000	$56,736	$25,676	$49,025	$21,028	$37,132	$15,497	$37,498	$18,129	$52,318	$21,532
2010	$53,899	$24,870	$48,368	$20,221	$29,614	$16,301	$32,872	$21,894	n/a	n/a
2009-2013	$52,742	$24,355	$45,075	$19,036	$35,738	$14,684	$31,440	$16,417	$46,294	$24,184
% Change 2000-2010	-5.0%	-3.1%	-1.3%	-3.8%	-20.2%	5.2%	-12.3%	20.8%	n/a	n/a
% Change 2000 to 2009-2013	-7.0%	-5.1%	-8.1%	-9.5%	-3.8%	-5.2%	-16.2%	-9.4%	-11.5%	12.3%
% Change 2010 to 2009-2013	-2.1%	-2.1%	-6.8%	-5.9%	20.7%	-9.9%	-4.4%	-25.0%	n/a	n/a

Note: Median and Per Capita Income are in 2014 dollars.

Source: Census 2000, Summary File 3, Table P082 & P053. American Community Survey 2006-2010, Table B19301 & B19013. American Community Survey 2009-2013, Table B19301 & B19013. www.census.gov, (accessed January, 2015).

Table 3-37: Median Household Income and Per Capita Income for Hunt County, Greenville and Paris, 2000, 2010 and 2009-2013

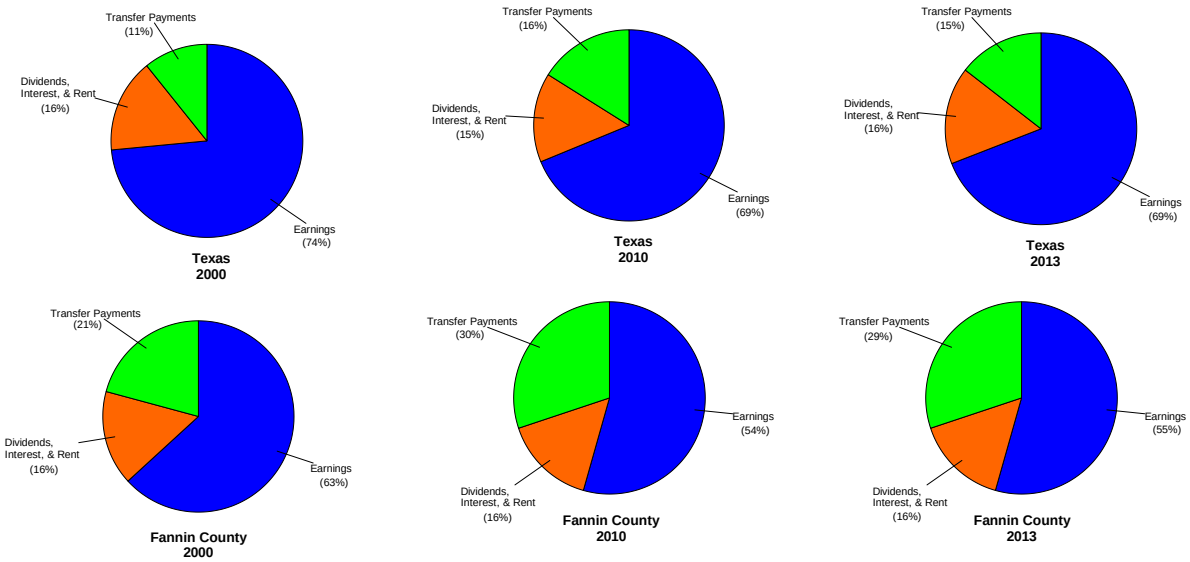
Year(s)	Texas		Hunt County		Greenville		Paris	
	Median Income	Per Capita Income	Median Income	Per Capita Income	Median Income	Per Capita Income	Median Income	Per Capita Income
2000	$56,736	$27,875	$52,224	$24,944	$49,175	$24,485	$38,989	$24,351
2010	$53,899	$27,001	$46,793	$23,500	$39,327	$20,925	$33,541	$19,609
2009-2013	$52,742	$26,441	$45,586	$22,703	$37,696	$19,530	$32,203	$19,381
Change 2000-2010	-5.0%	-3.1%	-10.4%	-5.8%	-20.0%	-14.5%	-14.0%	-19.5%
Change 2000 to 2009-2013	-7.0%	-5.1%	-12.7%	-9.0%	-23.3%	-20.2%	-17.4%	-20.4%
Change 2010 to 2009-2013	-2.1%	-2.1%	-2.6%	-3.4%	-4.1%	-6.7%	-4.0%	-1.2%

Source: US Census Bureau; Census 1990, Summary File 3, Tables P080, P080A, P114A & P117. Census 2000, Summary File 3, Tables P52, P53, P82 & P87. American Community Survey 2006-2008, Tables B17001, B19001, B19013 & B19301. www.census.gov, (accessed January, 2015).

Consistent with many rural areas, the SIA experienced a considerable drop in constant dollar income from 2000 to 2009-2013. As of the 2009-2013 American Community Survey, Fannin, Hunt and Lamar (home to Paris) counties are considered economically distressed areas. Designation as an economically distressed area is based on having a higher unemployment rate or lower per capita income than the national average.

Personal income by source for Texas and Fannin County in 2000, 2010, and 2013 is provided in **Figure 3-23**.

Figure 3-23: Personal Income by Source for Texas and Fannin County, 2000, 2010, and 2013

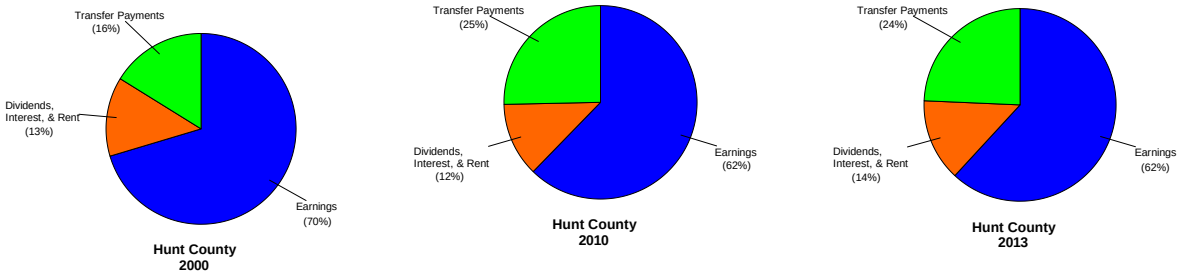


Source: Regional Economic Information System, Bureau of Economic Analysis, US Department of Commerce

Sources of Texas income changed moderately between 2000 and 2010, with increasing transfer payments, but hardly changed between 2010 and 2013. Transfer payments include retirement and disability insurance benefits, Medicare and Medicaid payments, unemployment insurance benefits, veterans' benefits, and federal grants and loans to students. Fannin County has a relatively larger share of personal income from transfer payments than the State, which is consistent with an older and lower income population. As with the State, between 2000 and 2010, Fannin County transfer payments as a percent of total personal income grew while other income sources fell modestly. Again, there was very little change in the sources of income between 2010 and 2013.

Personal income by source for Hunt County in 2000, 2010, and 2013 is provided in **Figure 3-24**.

Figure 3-24: Personal Income by Source for Hunt County, 2000, 2010, and 2013



Source: Regional Economic Information System, Bureau of Economic Analysis, US Department of Commerce

The percentage of Hunt County income from earnings was slightly smaller than the State as a whole in 2000, but dropped almost twice as fast as the State between 2000 and 2010; both remained

almost constant between 2010 and 2013. Transfer payments rose by 8 percent points between 2000 and 2013 in Hunt County, which would suggest declining income and an aging population.

Compensation by Industry

Table 3-38 demonstrates the percentage of total compensation or earnings from economic sectors in Fannin County and Texas in 2013. For Fannin County, government was by far the largest source of earnings income, comprising more than 45 percent of the county total. Health Care and retail trade also were relatively large sources of county income.

Table 3-38: Compensation by Industry for Fannin County and Texas, 2013

Industry	Percent of Total Compensation	
	Fannin County	Texas
Farm compensation	1.5%	0.2%
Forestry, fishing, and related activities	0.7%	0.1%
Mining	0.3%	5.5%
Utilities	1.8%	0.9%
Construction	3.2%	5.8%
Manufacturing	7.9%	10.3%
Wholesale trade	5.1%	6.7%
Retail trade	8.8%	5.9%
Transportation and warehousing	1.8%	4.2%
Information	0.4%	2.6%
Finance and insurance	4.2%	6.3%
Real estate, rental, and leasing	0.5%	1.7%
Professional, scientific, and technical services	1.5%	8.8%
Management of companies and enterprises	0.0%	1.7%
Administrative and waste services	1.3%	4.6%
Educational services	0.1%	1.1%
Health care and social assistance	9.8%	9.4%
Arts, entertainment, and recreation	0.2%	0.6%
Accommodation and food services	2.1%	3.2%
Other services, except public administration	3.8%	2.9%
Government and government enterprises	45.1%	17.6%
Total	**100%**	**100%**

Source: Bureau of Economic Analysis Regional Economic Information System. www.bea.gov. Accessed March, 2015.

The disproportionate contribution of government to the Fannin County economy is largely attributable to the Sam Rayburn Memorial Veterans Center (SRMVC). With over 600 employees, it has the largest payroll in Fannin County. The SRMVC is a regional facility, serving veterans in

Northern Texas and Southern Oklahoma. In addition, the Clyde W. Cosper Texas State Veterans Home is located adjacent to the SRMVC.

Table 3-39 shows the percentage of total compensation paid by industry in Hunt County and Texas in 2013. Manufacturing and government are the two largest sources of wage income for both Hunt County and Texas.

Table 3-39: Compensation by Industry for Hunt County and Texas, 2013

Industry	Percent of Total Compensation	
	Hunt County	Texas
Farm compensation	0.3%	0.2%
Forestry, fishing, and related activities	0.2%	0.1%
Mining	0.0%	5.5%
Utilities	1.0%	0.9%
Construction	3.0%	5.8%
Manufacturing	41.4%	10.3%
Wholesale trade	3.5%	6.7%
Retail trade	6.4%	5.9%
Transportation and warehousing	1.9%	4.2%
Information	0.5%	2.6%
Finance and insurance	2.2%	6.3%
Real estate, rental, and leasing	0.4%	1.7%
Professional, scientific, and technical services	2.0%	8.8%
Management of companies and enterprises	(D)	1.7%
Administrative and waste services	(D)	4.6%
Educational services	0.5%	1.1%
Health care and social assistance	6.2%	9.4%
Arts, entertainment, and recreation	0.1%	0.6%
Accommodation and food services	2.5%	3.2%
Other services, except public administration	2.4%	2.9%
Government and government enterprises	23.3%	17.6%
Total	**100%**	**100%**

Note: (D) indicates data not shown to avoid disclosure of confidential information, but the estimates for this item are included in the total.
Source: Bureau of Economic Analysis Regional Economic Information System. www.bea.gov. Accessed March, 2015.

The large proportion of manufacturing compensation in Hunt County is explained by the presence of L-3 Integrated Systems, accounting for two thirds of the manufacturing jobs, and almost half of the total jobs in Hunt County. With 4,700 employees, this avionics producer is the largest employer in Hunt County. Other large manufacturers include Aramark and Newell.

Employment

Table 3-40 shows the employment statistics for Texas, Fannin County, Bonham, and Ladonia for 2000, 2010 and 2009-2013.

Table 3-40: Employment Summary for Texas, Fannin County, Bonham, Ladonia, and the Lake Ralph Hall PIA, 2000, 2010, and 2009-2013

Geography	Year	Civilian Labor Force	Employed	Unemployed	Unemployment Rate
Texas	2000	9,830,559	9,234,372	596,187	6.1%
	2010	12,179,035	11,288,597	890,438	7.3%
	2009-2013	12,589,173	11,569,041	1,020,132	8.1%
Fannin County	2000	13,010	12,327	683	5.2%
	2010	14,758	13,648	1,110	7.5%
	2009-2013	14,808	13,627	1,181	8.0%
Bonham	2000	3,111	2,860	251	8.1%
	2010	3,480	3,200	280	8.0%
	2009-2013	3,431	3,052	379	11.0%
Ladonia	2000	276	267	9	3.3%
	2010	298	268	30	10.1%
	2009-2013	249	224	25	10.0%
Lake Ralph Hall	2000	2,327	2,157	170	7.3%
	2010	n/a	n/a	n/a	n/a
	2009-2013	1,849	1,704	145	7.8%

Source: US Census Bureau; Census 2000, Summary File 3, Table P43. American Community Survey 2007-2011, Table B23025. American Community Survey 2009-2013, Table B23025.www.census.gov, (accessed January, 2015).

Fannin County and Texas unemployment trends rose moderately between 2000 and 2009-2013 while the lake footprint area unemployment (by place of residence) was mostly flat during that period. Unemployment rates were lower in Fannin County compared with the State in 2000, but were higher by 2010, but lower again in 2009-2013. **Table 3-41** shows the employment statistics for Texas, Hunt County, Greenville, and Paris. In 2010, the unemployment rate for the SIA was higher than the rate for Texas. However, this was not always the case; Hunt County, Greenville had a lower unemployment rate in 2000, compared with the State.

Table 3-41: Status of Employment for Hunt County, Greenville, and Paris, 2000, 2010, and 2009-2013

Geography	Years	Civilian Labor Force	Employed	Unemployed	Unemployment Rate
Texas	2000	9,830,559	9,234,372	596,187	6.1%
	2010	12,179,035	11,288,597	890,438	7.3%
	2009-2013	12,589,173	11,569,041	1,020,132	8.1%
Hunt County	2000	36,679	34,539	2,140	5.8%
	2010	40,424	36,625	3,799	9.4%
	2009-2013	40,614	35,473	5,141	12.7%
Greenville	2000	11,118	10,501	617	5.5%
	2010	10,919	10,064	855	7.8%
	2009-2013	11,219	9,792	1,427	12.7%
Paris	2000	11,062	9,976	1,086	9.8%
	2010	11,494	10,566	928	8.1%
	2009-2013	11,532	10,354	1,178	10.2%

Source: US Census Bureau; Census 2000, Summary File 3, Table P43. American Community Survey 2007-2011, Table B23025. American Community Survey 2009-2013, Table B23025.www.census.gov, (accessed January, 2015).

Employment by Industry

Table 3-42 shows the employment by industry for Texas and Fannin County.

Government is the largest employer for both Fannin County and Texas, but that sector is relatively more important in Fannin County. This sector has traditionally been more stable in terms of employment than other sectors. Agriculture is also relatively more important for Fannin County and mineral employment, such as oil and gas, is less important. Fannin County also has a relatively smaller service economy than the state.

Table 3-42: Employment by Industry for Texas and Fannin County, 2013

Industry	Percent of Total Employment 2013	
	Fannin County	Texas
Farm employment	14.8%	1.7%
Forestry, fishing, and related activities	1.2%	0.4%
Mining	1.1%	3.4%
Utilities	0.6%	0.3%
Construction	7.0%	6.4%
Manufacturing	5.1%	6.1%
Wholesale trade	2.3%	4.0%
Retail trade	9.5%	9.7%
Transportation and warehousing	2.4%	3.7%
Information	0.5%	1.6%
Finance and insurance	4.5%	6.0%
Real estate, rental, and leasing	3.8%	4.3%
Professional, scientific, and technical services	3.2%	6.4%
Management of companies and enterprises	0.8%	0.8%
Administrative and waste services	3.7%	6.7%
Educational services	0.4%	1.5%
Health care and social assistance	8.2%	9.7%
Arts, entertainment, and recreation	1.2%	1.6%
Accommodation and food services	4.0%	7.2%
Other services, except public administration	6.4%	5.8%
Government and government enterprises	19.2%	12.7%
Total	**100%**	**100%**

Source: Regional Economic Information System, Bureau of Economic Analysis, US Department of Commerce

Government is also the largest employer for Hunt County. Agricultural employment in Hunt County is relatively more important than in Texas. **Table 3-43** depicts employment by industry for Hunt County and Texas.

Table 3-43: Employment by Industry for Hunt County and Texas, 2013

Industry	Percent of Total Employment 2013	
	Hunt County	Texas
Farm employment	6.9%	1.7%
Forestry, fishing, and related activities	0.5%	0.4%
Mining	0.7%	3.4%
Utilities	0.5%	0.3%
Construction	6.2%	6.4%
Manufacturing	16.7%	6.1%
Wholesale trade	2.7%	4.0%
Retail trade	10.7%	9.7%
Transportation and warehousing	2.3%	3.7%
Information	0.6%	1.6%
Finance and insurance	3.4%	6.0%
Real estate, rental, and leasing	2.7%	4.3%
Professional, scientific, and technical services	3.4%	6.4%
Management of companies and enterprises	(D)	0.8%
Administrative and waste services	(D)	6.7%
Educational services	1.0%	1.5%
Health care and social assistance	7.6%	9.7%
Arts, entertainment, and recreation	1.2%	1.6%
Accommodation and food services	5.9%	7.2%
Other services, except public administration	6.0%	5.8%
Government and government enterprises	17.3%	12.7%
Total	**100%**	**100%**

Note: (D) Not shown to avoid disclosure of confidential information, but estimates for these sectors are included in the total.
Source: Regional Economic Information System, Bureau of Economic Analysis, US Department of Commerce

Commuting Patterns

Over 40 percent of the Fannin County employment base commutes to work outside the county. Given Ladonia and Lake Ralph Hall's location (four other counties within 15 miles), it is not surprising that a relatively high proportion of the population leave the county to go to work. Bonham, which is both the largest city in the county and located near the center of the county, has a lower percentage of people leaving the county to work than the rest of the PIA. **Table 3-44** demonstrates the commuting patterns for Texas, Fannin County, Bonham, Ladonia, and Lake Ralph Hall.

Table 3-44: Commuting Patterns for Texas, Fannin County, Ladonia, and the Lake Ralph Hall PIA, 2000, 2010, and 2009-2013

	Texas		Fannin County		Bonham		Ladonia		Lake Ralph Hall	
	No. of Workers	**%**	**No. of Workers**	**%**	**No. of Workers**	**%**	**No. of Workers**	**%**	**No. of Workers**	**%**
2000										
Total Workers	**9,157,875**		**12,146**		**2,818**		**261**		**1,808**	
Worked in state of residence	9,067,659	99.0%	12,063	99.3%	2,810	99.7%	258	98.9%	1,801	99.6%
Worked in county of residence	7,202,239	78.6%	7,266	59.8%	2,074	73.6%	114	43.7%	913	50.5%
Worked outside county of residence	1,865,420	20.4%	4,797	39.5%	736	26.1%	144	55.2%	888	49.1%
Worked outside of state of residence	90,216	1.0%	83	0.7%	8	0.3%	3	1.1%	7	0.4%
2010										
Total Workers	**11,199,863**		**13,762**		**n/a**		**n/a**		**n/a**	
Worked in state of residence:	11,074,332	98.9%	13,530	98.3%	n/a	n/a	n/a	n/a	n/a	n/a
Worked in county of residence	8,695,791	77.6%	7,460	54.2%	n/a	n/a	n/a	n/a	n/a	n/a
Worked outside county of residence	2,378,541	21.2%	6,070	44.1%	n/a	n/a	n/a	n/a	n/a	n/a
Worked outside of state of residence	125,531	1.1%	232	1.7%	n/a	n/a	n/a	n/a	n/a	n/a
2009-2013										
Total Workers	**11,445,014**		**13,205**		**2,991**		**219**		**1,645**	
Worked in state of residence	11,319,672	98.9%	12,957	98.1%	2,892	96.7%	219	100.0%	1,617	98.3%
Worked in county of residence	8,870,931	77.5%	7,131	54.0%	2,198	73.5%	112	51.1%	830	50.5%
Worked outside county of residence	2,448,741	21.4%	5,826	44.1%	694	23.2%	107	48.9%	787	47.8%
Worked outside of state of residence	125,342	1.1%	248	1.9%	99	3.3%	0	0.0%	28	1.7%

Source: US Census Bureau; Census 2000, Summary File 3, Table P26. American Community Survey 2008-2010, Table B08007. American Community Survey 2009-2013, Table B08007. www.census.gov, (accessed January, 2015).

Table 3-45 shows the commuting patterns for Texas, Hunt County, Greenville, and Paris. A considerable portion of the workers in Hunt County and, to a lesser extent, Greenville leave the county to go to work, compared to Paris.

Table 3-45: Commuting Patterns for Texas, Hunt County, Greenville, and Paris, 2000, 2010 and 2009-2013

	Texas		Hunt County		Greenville		Paris	
	No. of Workers	**%**	**No. of Workers**	**%**	**No. of Workers**	**%**	**No. of Workers**	**%**
2000								
Total Workers	**9,157,875**		**34,010**		**10,380**		**10,135**	
Worked in state of residence	9,067,659	99.0%	33,706	99.1%	10,283	99.1%	10,005	98.7%
Worked in county of residence	7,202,239	78.6%	21,070	62.0%	8,226	79.2%	9,237	91.1%
Worked outside county of residence	1,865,420	20.4%	12,636	37.2%	2,057	19.8%	768	7.6%
Worked outside of state of residence	90,216	1.0%	304	0.9%	97	0.9%	130	1.3%
2010								
Total Workers	**11,199,863**		**35,551**		**9,335**		**10,306**	
Worked in state of residence	11,074,332	98.9%	35,399	99.6%	9,249	99.1%	10,118	98.2%
Worked in county of residence	8,695,791	77.6%	21,252	59.8%	7,717	82.7%	9,336	90.6%
Worked outside county of residence	2,378,541	21.2%	14,147	39.8%	1,532	16.4%	782	7.6%
Worked outside of state of residence	125,531	1.1%	152	0.4%	86	0.9%	188	1.8%
2009-2013								
Total Workers	**11,445,014**		**34,836**		**9,749**		**10,029**	
Worked in state of residence	11,319,672	98.9%	34,642	99.4%	9,683	99.3%	9,829	98.0%
Worked in county of residence	8,870,931	77.5%	21,644	62.1%	8,025	82.3%	9,026	90.0%
Worked outside county of residence	2,448,741	21.4%	12,998	37.3%	1,658	17.0%	803	8.0%
Worked outside of state of residence	125,342	1.1%	194	0.6%	66	0.7%	200	2.0%

Source: US Census Bureau; Census 2000, Summary File 3, Table P26. American Community Survey 2008-2010, Table B08007. American Community Survey 2009-2013, Table B08007. www.census.gov, (accessed January, 2015).

3.17.2.1 Key Economic Sectors in the Dam Site PIA

Agriculture is an important economic sector in this region and would be impacted by the inundated acres from Lake Ralph Hall. However, no bottomland hardwood or timbering industry is evident

in the dam site PIA; therefore, no industry data are reported. Recreation and tourism would also be impacted by recreational opportunities created by the Lake. These sectors are discussed below.

Agricultural Economy

Table 3-46 provides agricultural statistics for Fannin County and Texas.

Table 3-46: Agricultural Economy in Fannin County and Texas, 2007 and 2012

	Fannin County			Texas		
	2007	**2012**	**Change**	**2007**	**2012**	**Change**
No. of Farms	2,110	2,515	19%	247,437	248,809	1%
Land in Farms (ac)	473,853	513,651	8%	130,398,753	130,153,438	0%
Irrigated Acres	5,264	1,172	-78%	5,010,416	4,489,163	-10%
Market Value of Products Sold (millions)						
Total	**$48.7**	**$71.1**	**46%**	**$21,001**	**$25,376**	**21%**
Crops	$24.0	$39.8	66%	$6,566	$7,367	12%
Livestock	$24.8	$31.3	27%	$14,435	$18,009	25%

Source: 2012 Census of Agriculture, County Profile, Fannin County; 2007 Census of Agriculture, County Profile, Fannin County; 2012 Census of Agriculture, State Profile, Texas; 2007 Census of Agriculture, State Profile, Texas; 2012 Census of Agriculture, Texas County Data, Table 10.

Fannin County contains almost 514,000 acres of agricultural land, less than 0.04 percent of the State of Texas. Almost half of Fannin County agricultural land is pastureland, mostly for cattle, as compared to almost 70 percent for Texas. Cropland, almost all dryland, accounts for almost 39 percent of all agricultural lands in Fannin County, compared with about 22 percent in the State. Just over 0.2 percent of Fannin County agricultural land is irrigated compared to 3.4 percent for Texas. Both total agricultural lands and the number of farms in Fannin County increased between 2007 and 2012, while the number of irrigated acres dropped dramatically.

In 2012, the Fannin County agricultural sector reported about $71 million in total sales, up 46 percent from five years earlier; this trend more than doubled the increase for the State of Texas which experienced an increase of 21 percent. Total agricultural product sales for Fannin County equates to about 0.3 percent of the total for Texas. The top three agricultural products by sales from Fannin County were cattle and calves ($29 million); grains, oilseeds, dry beans and dry peas ($21 million); and hay and related crops ($12 million).

Travel and Tourism

Fannin County does not currently have a large, well developed tourism economy. However, it does have a number of attractions that bring tourists to the county.

Fannin County tourism attractions which include:

- Sam Rayburn Library and Museum;
- Sam Rayburn House Museum;
- Fort Inglish Park and Museum;
- Bonham State Park;
- Lake Bonham;
- Fannin County Museum of History; and
- Caddo National Grasslands Wildlife Management Area

Visitation and other recreational aspects are described in the recreational and land use section of this affected environment chapter. Economic aspects of the industry are identified below.

Retail trade, accommodation and food services, and arts, entertainment and recreation provide about 15 percent of employment in Fannin County. In 2014, sales tax revenues were projected to provide about 5 percent of total county revenues. **Table 3-47** shows the retail and tourism sector sales for Fannin County.

Table 3-47: Retail and Tourism Sector Sales for Fannin County, 2005 through 2014

Year	Retail Sales	Arts and Entertainment	Accommodations and Food Services
2005	$59,540,927	$1,093,240	$13,967,044
2006	$61,846,640	$1,287,419	$14,676,992
2007	$64,331,738	$1,057,530	$15,595,660
2008	$67,025, 239	$998,516	$16,172,943
2009	$65,887,341	$959,694	$16,237,316
2010	$66,069,872	$1,034,587	$15,713,454
2011	$67,201,535	$940,427	$15,946,781
2012	$71,334,267	$932,967	$17,210,705
2013	$74,537,186	$975,287	$17,794,192
2014	$79,111,827	$942,505	$18,748,303

Note: Figures shown are for taxable receipts only
Source: Texas Comptroller of Public Accounts. 2015. Quarterly Sales Tax Historical Data, Window on State Government. https://ourcpa.cpa.state.tx.us/allocation/HistSales.jsp

As of 2014, there were about 50 hotel rooms available at 6 facilities in Fannin County. All were located in Bonham. The occupancy rate for 2014 was about 50 percent and the average room rate was about $50.00. In 2009, taxable receipts from lodging were about 3 percent of the total receipts for accommodations and food services. Expenditures at Bonham State Park in 2014, by non-local visitors were more than $500,000. Those expenditures generated $17,000 in sales tax revenue,

seven jobs and about $700,000 in total economic output. The Ladonia Unit of the Caddo National Grasslands generates about $200,000 in Fannin County sales each year. Annual data about the economic impact of travel for Fannin County is provided in **Table 3-48**.

Table 3-48: Direct Travel Impacts for Fannin County, 2005 through 2014

Year	Visitor Spending ($000)	Earnings ($000)	Employment (jobs)	Fannin County Tax Impacts	
				Local ($000)	State ($000)
2014	12,800	1,860	90	90	660
2013	13,100	1,880	90	100	670
2012	12,600	1,760	90	80	630
2011	12,400	1,720	90	80	620
2010	11,300	1,650	90	80	630
2009	10,600	1,730	90	80	620
2008	12,300	1,610	90	80	630
2007	11,500	1,620	90	80	630
2006	10,700	1,540	90	70	610
2005	9,800	1,500	90	70	580
Change 2005-2014	31%	24%	0%	29%	14%

Source: The Economic Impact of Travel on Texas, Dean Runyan Associates. Annual reports for years 2005 through 2014, and Harvey Economics, 2015.

Between 2008 and 2009, visitor spending declined about 17 percent and employment declined about 10 percent, likely due to the nationwide economic downturn at that time. Since 2009, visitor spending has rebounded, increasing about 13 percent between 2010 and 2014. The county also experienced modest gains in earning and tax receipts during that period. While the State of Texas charges a 6 percent occupancy tax for hotel rooms, Fannin County does not levy an additional tax, although it is allowed by law.

3.17.2.2 Public Facilities and Services for the Dam Components

Public facilities and services can be impacted by Lake Ralph Hall if population levels or other activities change service demands or if public fiscal conditions change.

Police and Sheriff Services PIA

The Fannin County Sheriff's Department serves a population of about 35,000 people in unincorporated Fannin County and small municipalities in the county including Ladonia. This service area includes the Lake Ralph Hall footprint. The Department employs 20 sworn officers, 7 dispatchers and 2 administrative workers. As of 2016, the department was short three officers. The department has 11 marked vehicles and 5 unmarked vehicles.

In January 2016, the Department responded to about 1,000 calls, which is typical for any given month. The department provides dispatch services for the entire county and this number includes calls that are relayed to other municipalities as well as emergency medical services (EMS) and fire departments. The Department's detention center is located in Bonham and has a capacity of about 400. The facility is privately run and federal prisoners are also held there. The private operator also handles the annex which houses mostly county inmates and has 112 beds (Fannin County Sheriff's Department, 2016).

The Bonham Police Department serves a population of about 10,000 in the City, which encompasses about 9.4 square miles. The Department has 29 employees, 5 SUVs, 2 pickups and 5 patrol cars. In 2014, the Department responded to more than 9,500 calls and averaged about 800 calls to 911 each month. The Bonham Police Department has one holding jail facility with 3 cells (Bonham Police Department, 2015).

Police and Sheriff Services SIA

The Paris Police Department serves a 42 square mile area within the city limits. If mutual aid is requested, the Department will respond outside the city limits. The Department has 60 full-time officers and 10 front-line police vehicles. On average, the Department responds to 30,000 to 40,000 calls each year. The Department also operates a 17 cell detention center (Paris Police Department, 2015).

The City of Greenville Police Department has 57 officers and 20 civilian employees operating out of a single location. In 2014 the Department responded to more than 31,000 calls (Greenville Police Department, 2014). The municipal jail is located at the Greenville Police and Courts Building. The Hunt County Detention Center is also located in Greenville.

Fire Departments PIA

The Bonham Fire Department serves the city and parts of rural Fannin County across an area of about 100 square miles, serving more than 35,000 residents. It is the only paid fire department in Fannin County, which has a total of 13 fire departments. The Department operates out of two stations and has 2 engines, 2 rescue/brush trucks, 5 advanced life support (ALS) ambulances, 1 command vehicle, and 1 boat. It employs 38 career and eight volunteer fire fighters and 3 paid-per-call firefighters. The Department provides emergency medical services, firefighting, vehicle

rescue and search and rescue services. In 2012, the Department responded to 4,208 EMS calls and 719 fire calls (Bonham Fire Department, 2015).

The Lake footprint is currently served primarily by the Ladonia volunteer fire department (north of Farm Road 1550). The remainder of the footprint is served by the Honey Grove volunteer fire department (south of Farm Road 1550).

There are also several volunteer fire departments in the county, including North Fannin County, Dodd City, Leonard, Randolph, and Ravenna (Fire Departments.net, 2015).

Fire Departments SIA

The Paris Fire Department operates out of three stations with 51 firefighters, three engines, a rescue truck, and command vehicle. Other equipment is available as needed including an aerial device, HazMat Unit, brush truck, boats and a reserve engine. All vehicles are radio equipped. The Department has an insurance service office (ISO) rating of 3. In 2014, the department responded to about 1,500 fire and about 1,000 EMS calls. Paris EMS works out of four locations and employs 21 full-time paramedics and 10 part-time EMTs. Ambulance services are available 24 hours a day (Paris Fire Department, 2015).

The Greenville Fire Department is a fully paid department with a service area of 33 square miles and population of about 27,000. The Department has a total of 52 employees, one administrative office and four fire stations. Department vehicles include three front-line pumpers, two reserve pumpers, one aerial (75-foot) quint, one (95-foot) platform, two booster trucks, one command vehicle, and one reserve rescue vehicle. The Department responds to about 3,000 emergency and non-emergency calls each year and has an ISO rating of 3 (Greenville Fire Department, 2015).

Health Services PIA

TMC Bonham Hospital, formerly Red River Community Hospital, is a 25 bed facility with 10 physicians, located in Bonham and offering inpatient, outpatient and emergency services. Sam Rayburn Memorial Veterans Center (SRMVC) is also located in Bonham and offers services to eligible veterans. These services include primary health care, nursing home care and long-term rehabilitative services. SRMVC has more than 600 employees and is the largest employer in the county (U.S. Department of Veteran Affairs, 2015).

Health Services SIA

Hunt Regional Medical Center is located in Greenville, in Hunt County. This facility has a total of 181 beds, including 29 special care beds. This hospital offers a full range of inpatient, outpatient and emergency services. Hunt Regional Emergency Medical Center at Commerce is associated with the Regional Medical Center and has 24 beds, 4 active staff and provides 24-hour emergency services (American Hospital Directory, 2015).

Paris Regional Medical Center provides a full range of services on two campuses with more than 300 beds. The Medical Center serves Paris, Lamar County and residents from nearby Texas and Oklahoma communities.

Education PIA

The Fannindel Independent School District (FISD) serves the City of Ladonia, Pecan Gap, northeast Hunt County and a small area of Lamar County. Fannindel High School is located in Ladonia and serves grades six through twelve. Pre-K to grade five students attend Fannindel Elementary School in Pecan Gap. In 2014, total enrollment at Fannindel ISD was 200, with an average class size of about 10 students. More than 80 percent of the students are economically disadvantaged (Texas Education Agency [TEA], 2014).

Dodd City ISD serves an area northwest of the proposed lake site. The District has one K-12 school serving the 400 person community and surrounding area. The District had about 30 teachers and 20 support staff and enrollment of 360 in 2014. The average student teacher ratio was about 12. In 2014, almost 45 percent of the students were economically disadvantaged (TEA, 2014).

Honey Grove ISD provides services in the area directly to the north of the Lake Ralph Hall site. The District has one elementary school, a middle school and high school that serve almost 600 students with about 44 teachers, for an average class size of about 13 students. About 63 percent of the students are economically disadvantaged (TEA, 2014).

Bonham ISD serves an area to the east and northeast of the proposed lake site. The district has one high school, one middle school, two elementary schools, as well an alternative education center. Total enrollment in the District is about 2,000, with about 13 students for every full-time equivalent teacher. Almost 70 percent of students are economically disadvantaged (TEA, 2014).

3.17.2.3 Fiscal Conditions in the Dam Site PIA and SIA

Tax revenues and expenditures would be impacted by the lake development. Existing conditions are described below.

In fiscal year 2014-2015 (October 2014 through September 2015), Fannin County received $13.5 million in total revenue, a 4.1 percent decrease from 2013-2014. The revenue sources for Fannin are concentrated in property taxes which amount to about 66 percent of total revenue. Fannin County had a total mill levy of 5.95 in 2014-2015, unchanged from the previous year. The next largest source of county revenue was other taxes, comprised mostly of sales tax revenues, which, in 2014, amounted to $656,000 or 4.7 percent of 2014 total revenue. Fannin County has a 0.5 percent sales tax rate. The total revenue for Ladonia, in fiscal year 2015 was about $415,000. Water sales are the largest source of total revenue, at 36 percent. In 2015, the Water and Sewer Fund transferred over $11,000 into the General Fund, the fourth largest source of revenue for that fund. Property taxes, the second largest source of total revenue, make up 16 percent of the total Ladonia

budget revenue. Sales taxes amounted to $25,000 in 2015 or 6.0 percent of the Town's total. Ladonia charges a one percent sales tax fee.

Tax revenue (including property, sales and others) make up 72 percent of Bonham's revenue. Bonham received $2.0 million in property tax revenue in 2015 from a tax rate of .067 mills, or 32 percent of its total revenue. The only noteworthy source of revenue that is not a tax is from solid waste collection (14 percent of total revenue).

Hunt County's revenue is also based mostly on property taxes, accounting for 67 percent of total revenue. The one half cent county sales tax and other taxes account for almost 9 percent and 10 percent of total revenue respectively, while no other category is above 3 percent.

Greenville's revenue is fairly diversified among the different options. Property tax accounts for about 28 percent of overall revenue; sales and income taxes account for almost 28 percent while transfers make up 14 percent. The next two categories, intergovernmental revenues and other are about 8 percent each. Paris' revenue is also diversified. It comes from four major sources: water and sewer sales (33 percent); property taxes (16 percent); sales tax (16 percent); and fees (13 percent).

3.17.3 Definition of Lake Ralph Hall Pipeline Site SIA

In addition to the lake, a pipeline has been proposed to deliver water from Lake Ralph Hall to Upper Trinity Regional Water District's existing infrastructure. The pipeline runs for approximately 32.9 miles southwest from Lake Ralph Hall in an almost straight line, to Merit, TX. Just northeast of Merit, the pipeline turns due west for about 1.5 miles, where it joins the existing Chapman pipeline.

The PIA for the pipeline is the actual pipeline footprint. Due to the minimal amount of land used and the transitory nature of pipeline construction, most of the impacts would be localized to the pipeline footprint. The SIA for the pipeline is Fannin, Hunt, and Collin counties, largely related to tax effects. These are the three counties that the pipeline passes through. While the majority of the pipeline goes through Hunt County, portions go through Fannin and Collin counties. Since Fannin and Hunt counties have already been described in the dam site section, only Collin County is described below.

3.17.4 Demographic and Economic Conditions of the Pipeline Site PIA and SIA

The Census was the primary source of demographic and economic data for the pipeline alignment impact area. As the PIA is so localized, only data at the census block group level was available to describe them. Block group data from the 2010 census is only available for certain topics. The pipeline footprint area covers portions of 8 census block groups.

Population

Table 3-49 shows the population for Texas, Collin County, and the Pipeline.

Table 3-49: Population of Texas, Collin County, and the Pipeline for 2000, 2010, and 2013

Year(s)	Texas	Collin County	Pipeline
2000	20,851,028	491,272	6,465
2010	25,145,561	782,341	12,485
2013	26,448,193	854,778	12,581
% Change 2000-2010	21%	59%	93%
% Change 2010-2013	5%	9%	1%
% Change 2000-2013	27%	74%	95%

Note: The data for Hunt County and Fannin County are presented in the Lake footprint PIA, Section 3.17.2.
Source: US Census Bureau; Census 2000, Summary File 1, Table P1. Population Estimates Program, Table T1. www.census.gov, (accessed January, 2015). American Community Survey, 2009-2013 American Community Survey 5-Year Estimates, Table B01003. www.census.gov, (accessed January, 2015).

The State's population grew at an average annual rate of just under 2 percent between 2000 and 2013. Over the same time period, Collin County grew at an annual average rate of over 4 percent, while the Pipeline footprint grew at a rate of over 5 percent.

Age

The median ages are similar for Texas and Collin County; however, the Pipeline footprint has considerably higher median age. The proportion of the population over sixty in the county is 13 percent compared to Texas at 16 percent. Despite the fact that the county has a lower proportion of seniors, the Pipeline footprint (21 percent) has a higher proportion of people over 60 than Texas **(Table 3-50).**

Table 3-50: Age Characteristics for Texas, Collin County, and the Lake Ralph Hall Pipeline PIA, 2009-2013

	Texas		Collin County		Pipeline	
Age Range (Years)	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total
<10	3,889,720	15%	126,230	16%	1,851	15%
10-19	3,790,622	15%	121,632	15%	1,703	14%
20-29	3,751,413	15%	92,632	11%	1,335	11%
30-39	3,589,159	14%	127,655	16%	1,440	11%
40-49	3,474,870	14%	137,698	17%	1,702	14%
50-59	3,169,259	12%	102,719	13%	1,950	15%
60-69	2,153,141	8%	62,178	8%	1,483	12%
70-79	1,143,307	4%	26,663	3%	751	6%
80+	677,882	3%	13,901	2%	366	3%
Total	**25,639,373**	**100%**	**811,308**	**100%**	**12,581**	**100%**
Median Age	**34**		**35**		**41**	

Note: The data for Hunt County and Fannin County are presented in the Lake footprint PIA, Section 3.17.2.
Source: US Census Bureau; American Community Survey, 2009-2013 American Community Survey 5-Year Estimates, Tables B01001 & B01002. www.census.gov, (accessed January, 2015).

Housing Characteristics

Table 3-51 shows the housing data for the Lake Ralph Hall Pipeline, 2009-2013.

Table 3-51: Housing Data for Texas, Collin County and the Lake Ralph Hall Pipeline PIA, 2009-2013

Housing	Texas	Collin County	Pipeline
Total Housing Units	10,070,703	306,978	5,227
Vacant Housing Units	1,184,232	17,226	817
Housing Vacancy Rates	12%	6%	16%
Seasonal/Vacation Homes	236,330	775	276
Average Household Size	2.8	2.8	2.8

Note: The data for Hunt County and Fannin County are presented in the Lake footprint PIA, Section 3.17.2.
Source: U.S. Census Bureau, 2009-2013 5-Year American Community Survey Tables B25002, B25004 & B25010. (Accessed January, 2015).

Both the proportion of seasonal or vacation homes and the vacancy rate are considerably lower in Collin County and substantially higher in the Pipeline footprint when compared to Texas. **Table 3-52** shows the median home value for Texas, Collin County, and the Pipeline.

Table 3-52: Median Home Value for the Lake Ralph Hall Pipeline PIA, 2000, 2010, and 2009-2013

Year(s)	Texas	Collin County	Pipeline
2000	$110,553	$215,421	$96,307
2010	$134,080	$216,048	n/a
2009-2013	$130,991	$209,443	$96,287
% Change 2000-2010	21.3%	0%	n/a
% Change 2000 to 2009-2013	18%	-2.8%	0.0%
% Change 2010 to 2010-2013	-2%	-3.1%	n/a

Note: All housing values are in 2014 constant dollars.
The data for Hunt County and Fannin County are presented in the Lake footprint PIA, Section 3.17.2.
Source: US Census Bureau; Census 2000, Summary File 3, Tables H84 & H85. American Community Survey 2006-2010, Tables B25075 & B25077. American Community Survey 2009-2013, Tables B25075 & B25077.www.census.gov, (accessed January, 2015).

Home values in Collin County are considerably higher than the State, on average. However, median home values are less in the pipeline PIA than the county average. Interestingly, while the home values went up between 2000 and 2010 and then declined between 2010 and 2013, the overall change between 2000 and 2013 was positive for Texas, negative for Collin County and essentially flat for the Pipeline footprint.

Income

Table 3-53 shows the median household and per capita income for Texas, Collin County, and the Pipeline.

Table 3-53: Median Household Income and Per Capita Income for Texas, Collin County, and the Lake Ralph Hall Pipeline PIA, 2000, 2010, and 2009-2013

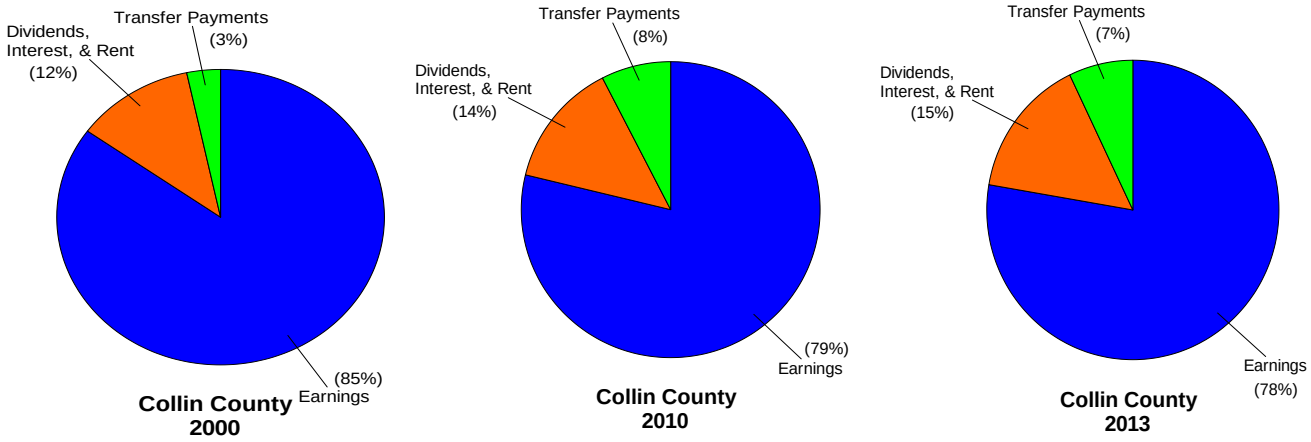
Year(s)	Texas		Collin County		Pipeline	
	Median Income	Per Capita Income	Median Income	Per Capita Income	Median Income	Per Capita Income
2000	$56,736	$27,875	$100,655	$47,383	$54,558	$25,120
2010	$53,899	$27,001	$87,400	$40,563	n/a	n/a
2009-2013	$52,742	$26,441	$84,105	$38,453	$46,441	$23,532
% Change 2000-2010	-5.0%	-3.1%	-13.2%	-14.4%	n/a	n/a
% Change 2000 to 2009-2013	-7.0%	-5.1%	-16.4%	-18.8%	-14.9%	-6.3%
% Change 2010 to 2010-2013	-2.1%	-2.1%	-3.8%	-5.2%	n/a	n/a

Note: Median and per capita income are shown in 2014 dollars.
The data for Hunt County and Fannin County are presented in the Lake footprint PIA, Section 3.17.2.
Source: Census 2000, Summary File 3, Table P082 & P053. American Community Survey 2006-2010, Table B19301 & B19013.
American Community *Survey 2009-2013, Table B19301 & B19013. www.census.gov, (accessed January, 2015).*

Collin County has a substantially higher income level than the state, but the Pipeline appears to be passing through areas with income levels approximately the same as the State. In all cases, the incomes dropped between 2000 and 2013.

Figure 3-25 shows the income by source for Collin County.

Figure 3-25: Personal Income by Source for Collin County, 2000, 2010, and 2013



The data for Hunt County and Fannin County are presented in the Lake footprint PIA, Section 3.17.2.
Source: Regional Economic Information System, Bureau of Economic Analysis, US Department of Commerce

Compared with the State, dividends, interest, and rent are lower than the State, and transfer payments are much lower than the State, suggesting that earnings make up a higher percent of income for this county than the State.

Compensation by Industry

Table 3-54 depicts the percentage of total compensation by industry in Collin County and Texas in 2009.

Table 3-54: Compensation by Industry for Collin County and Texas, 2013

Industry	Percent of Total Compensation	
	Collin County	Texas
Farm compensation	0.0%	0.2%
Forestry, fishing, and related activities	0.0%	0.1%
Mining	0.9%	5.5%
Utilities	0.3%	0.9%
Construction	4.2%	5.8%
Manufacturing	10.4%	10.3%
Wholesale trade	6.2%	6.7%
Retail trade	6.5%	5.9%
Transportation and warehousing	0.6%	4.2%
Information	7.9%	2.6%
Finance and insurance	11.3%	6.3%
Real estate, rental, and leasing	1.7%	1.7%
Professional, scientific, and technical services	12.7%	8.8%
Management of companies and enterprises	5.0%	1.7%
Administrative and waste services	5.2%	4.6%
Educational services	0.6%	1.1%
Health care and social assistance	8.7%	9.4%
Arts, entertainment, and recreation	0.9%	0.6%
Accommodation and food services	3.2%	3.2%
Other services, except public administration	2.7%	2.9%
Government and government enterprises	11.0%	17.6%
Total	**100%**	**100%**

Note: The data for Hunt County and Fannin County are presented in the Lake footprint PIA, Section 3.17.2,
Due to rounding, any value less than 0.05 percent is reported as 0.0 percent.
Source: Bureau of Economic Analysis Regional Economic Information System. www.bea.gov. Accessed March, 2015.

Collin County relies more heavily on the professional, scientific, and technical services and the finance and insurance sectors than Texas.

Employment

Table 3-55 shows the employment statistics for Texas, Collin County, and the Pipeline footprint.

Table 3-55: Employment Statistics for Texas, Collin County, and the Pipeline Footprint, 2000, 2010, and 2009-2013

Location	Year(s)	Civilian Labor Force	Employed	Unemployed	Unemployment Rate
Texas	2000	9,830,559	9,234,372	596,187	6.1%
	2010	12,179,035	11,288,597	890,438	7.3%
	2009-2013	12,589,173	11,569,041	1,020,132	8.1%
Collin	2000	275,187	266,999	8,188	3.0%
	2010	417,275	394,850	22,425	5.4%
	2009-2013	440,783	415,734	25,049	5.7%
Pipeline	2000	5,355	5,131	224	4.2%
	2010	n/a	n/a	n/a	n/a
	2009-2013	5,889	5,343	546	9.3%

Note: The data for Hunt County and Fannin County are presented in the Lake footprint PIA, Section 3.17.2.
Source: US Census Bureau; Census 2000, Summary File 3, Table P43. American Community Survey 2007-2011, Table B23025. American Community Survey 2009-2013, Table B23025.www.census.gov, (accessed January, 2015).

Unemployment increased moderately from 2000 to 2013 for Texas and Collin County, but increased much more for the pipeline footprint. Despite this increase in unemployment, Collin County managed to add 149,000 new jobs; the Pipeline footprint added 212 jobs over the same period.

Employment by Industry

Table 3-56 shows the employment by industry for Texas and Collin County.

Table 3-56: Employment by Industry for Texas and Collin County, 2013

Industry	Percent of Total Employment 2013	
	Collin County	Texas
Farm employment	0.4%	1.7%
Forestry, fishing, and related activities	0.1%	0.4%
Mining	1.9%	3.4%
Utilities	0.2%	0.3%
Construction	4.6%	6.4%
Manufacturing	5.0%	6.1%
Wholesale trade	3.2%	4.0%
Retail trade	10.8%	9.7%
Transportation and warehousing	1.1%	3.7%
Information	3.4%	1.6%
Finance and insurance	10.4%	6.0%
Real estate, rental, and leasing	6.5%	4.3%
Professional, scientific, and technical services	10.3%	6.4%
Management of companies and enterprises	1.7%	0.8%
Administrative and waste services	6.7%	6.7%
Educational services	1.5%	1.5%
Health care and social assistance	8.6%	9.7%
Arts, entertainment, and recreation	2.3%	1.6%
Accommodation and food services	6.9%	7.2%
Other services, except public administration	5.6%	5.8%
Government and government enterprises	8.8%	12.7%
Total	**100%**	**100%**

Note: The data for Hunt County and Fannin County are presented in the Lake footprint PIA, Section 3.17.2.
Source: Regional Economic Information System, Bureau of Economic Analysis, US Department of Commerce, Table CA25N.

Government and government services is the largest employment sector for Texas while retail trade is the largest for Collin County. Collin County is well diversified and compares closely with the state overall.

Commuting Patterns

Table 3-57 presents the commuting patterns for Texas, Collin County and the Pipeline Footprint.

Table 3-57: Commuting Patterns for Texas, Collin County, and the Pipeline Footprint, 2000, 2010, and 2009-2013

	Texas		Collin County		Pipeline	
	No. of Workers	**%**	**No. of Workers**	**%**	**No. of Workers**	**%**
2000						
Total Workers	**9,157,875**		**263,601**		**2,832**	
Worked in state of residence	9,067,659	99.0%	260,881	99.0%	2,815	99.4%
Worked in county of residence	7,202,239	78.6%	128,271	48.7%	1,581	55.8%
Worked outside county of residence	1,865,420	20.4%	132,610	50.3%	1,234	43.6%
Worked outside of state of residence	90,216	1.0%	2,720	1.0%	17	0.6%
2010						
Total Workers	**11,199,863**		**389,191**		**n/a**	
Worked in state of residence:	11,074,332	98.9%	385,651	99.1%	n/a	n/a
Worked in county of residence	8,695,791	77.6%	218,705	56.2%	n/a	n/a
Worked outside county of residence	2,378,541	21.2%	166,946	42.9%	n/a	n/a
Worked outside of state of residence	125,531	1.1%	3,540	0.9%	n/a	n/a
2009-2013						
Total Workers	**11,445,014**		**410,021**		**5,138**	
Worked in state of residence	11,319,672	98.9%	405,872	99.0%	5,090	99.1%
Worked in county of residence	8,870,931	77.5%	232,297	56.7%	3,409	66.3%
Worked outside county of residence	2,448,741	21.4%	173,575	42.3%	1,681	32.7%
Worked outside of state of residence	125,342	1.1%	4,149	1.0%	48	0.9%

Note: The data for Hunt County and Fannin County are presented in the Lake footprint PIA, Section 3.17.2.
Source: US Census Bureau; Census 2000, Summary File 3, Table P26. American Community Survey 2008-2010, Table B08007. American Community Survey 2009-2013, Table B08007. www.census.gov, (accessed January, 2015)

More than twice the percentage of people work outside their county of residence for Collin County compared to the Texas average. This is not surprising as both counties are directly north of Dallas and are within easy commuting distance. However, the percentage of people in the Pipeline footprint who leave the county to work, while still high for Texas, is lower than Collin County.

Agricultural Sector

Table 3-58 offers agricultural statistics for Collin and Hunt counties.

Table 3-58: Agricultural Indicators for Collin and Hunt Counties, 2007 and 2012

	Collin County			Hunt County		
	2007	**2012**	**Change**	**2007**	**2012**	**Change**
No. of Farms	2,235	2,264	1%	3,139	4,206	34%
Land in Farms (ac)	290,831	312,806	8%	388,422	454,539	17%
Irrigated Acres	708	6,186	774%	2,056	5,488	167%
Market Value of Products Sold (millions)						
Total	**$61.2**	**$77.8**	**27%**	**$40.5**	**$69.3**	**71%**
Crops	$34.9	$50.8	46%	$22.6	$44.8	98%
Livestock	$26.2	$27.0	3%	$17.9	$24.6	37%

Source: 2012 Census of Agriculture, County Profile, Collin County; 2007 Census of Agriculture, County Profile, Collin County; 2012 Census of Agriculture, County Profile, Hunt County; 2007 Census of Agriculture, County Profile, Hunt County; 2012 Census of Agriculture, Texas County Data, Table 10.

In Hunt County, the number of farms increased sharply from 2007 to 2012, whereas the same statistic was stable for Collin County over that period. About 44 percent of Collin County and 40 percent of Hunt County is pastureland, less than the 69 percent for Texas. Less than 2 percent of either of the counties' agricultural land is irrigated compared to 3 percent for Texas.

Both counties saw their total agricultural sales increase considerably since 2007; both increased more than the Texas average. Collin County increased slightly more than Texas and Hunt County over three times more than Texas. However, together, both counties account for less than one percent of the total market value of products sold in Texas. Grains, oilseeds, dry beans and dry peas are the top products by value for Hunt County, while cattle and calves is the top product for Collin County.

3.17.5 Public Facilities and Services in the Pipeline SIA

As rural areas, the pipeline PIA are served by the counties or SIA.

Sheriff Services SIA

The Collin County Sheriff's Department serves the unincorporated areas of the county. The department has about 500 total employees. In 2015, the department responded to more than 140,000 requests for service. The Sheriff's Department also operates the county detention center which can house up to 1,600 inmates. In 2015, the average daily population was 829.

Fire Department SIA

Collin County has 23 fire departments (Collin County, 2016). Large professional departments are located in Frisco, McKinney, and Plano. Some departments have both professional and volunteer

fire fighters. Collin County also has an appointed fire marshal whose job it is to oversee codes and state statutes.

Health Services SIA

The Medical Center of McKinney (MCM) is one of several hospitals that serve Collin County. This 260-bed hospital provides emergency care and recently opened an off-campus, level III trauma center (MCM, 2016). Texas Health Presbyterian Hospital at Allen is a full-service 73-bed community hospital (Texas Health Resources, 2016a). Texas Health Presbyterian Hospital at Plano is a short term acute care facility. The hospital has 366 beds and in early 2016 broke ground on an additional $25 million expansion. The facility also includes an Advanced Level III Trauma center (Texas Health Resources, 2016c). The Medical Center of Plano is an acute-care facility with more than 1,600 employees and 493 beds, including an emergency trauma center (Medical Center of Plano, 2016). Methodist McKinney Hospital provides in-patient, outpatient and emergency care, with 19 beds and 6 operating rooms (Methodist McKinney Hospital, 2016). Baylor Scott & White Medical Center at Plano serves patients in a 160-bed acute care facility (Baylor Scott & White Health North Texas at Plano, 2016).

Denton Regional Medical Center (DRMC) is a full service hospital with 208 beds, 850 employees and 300 physicians providing care (DRMC, 2016). DRMC has the only Trauma Center in the area, which treats more than 40,000 patients each year. Medical Center of Lewisville is a short-term acute care facility serving southern Denton County with 186 beds and a newly expanded emergency room and provides Level IV Trauma care (Medical Center of Lewisville, 2016). Texas Health Presbyterian Hospital at Denton is a 255-bed hospital with more than 300 doctors (Texas Health Resources, 2016b). Baylor Medical Center at Carrollton is a 216-bed acute care facility with more than 600 employees and almost 500 physicians. The hospital offers a 24 hour emergency room and 16-bed intensive care unit (Baylor Scott & White Health North Texas at Carrollton, 2016).

3.17.6 Public Sector Finances in the Pipeline SIA's

In fiscal year 2016, Collin County expects to raise over $310 million in revenues, a slight increase from the 2015 budgeted amount. The county relies heavily on property assessments as 69 percent of its revenue is from this source. The next largest revenue source is charges for services / fees with 13 percent of total revenue.

Denton County's projected revenues for fiscal year 2015-16 will be about $255 million. About 71 percent of Denton County revenue comes from property taxes. Fees bring the next most revenue, but only accounts for 8 percent of the total.

3.18 Environmental Justice and Protection of Children

Executive Order (EO) 12898 "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" (The White House, February 11, 1994), requires that federal agencies consider as a part of their action, any disproportionately high and adverse human health or environmental effects to minority and low income populations. Agencies are required to ensure that these potential effects are identified and addressed.

EO 13045 "Protection of Children from Environmental Health Risks and Safety Risks" (The White House, April 21, 1997), places a high priority on the identification and assessment of environmental health and safety risks that may disproportionately affect children. The EO requires that each agency "shall ensure that its policies, programs, activities, and standards address disproportionate risks to children." It considers that physiological and social development of children makes them more sensitive than adults to adverse health and safety risks and recognizes that children in minority and low-income populations are more likely to be exposed to and have increased health and safety risks from environmental contamination than the general population.

3.18.1 Environmental Justice

The EPA defines environmental justice as "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies." The goal of "fair treatment" is not to shift risks among populations, but to identify potential disproportionately high adverse impacts on minority and low-income communities and identify steps to mitigate any adverse impacts. For purposes of assessing environmental justice under NEPA, the Council on Environmental Quality (CEQ) defines a minority population as one in which the percentage of minorities exceeds 50 percent or is substantially higher than the percentage of minorities in the general population or other appropriate unit of geographic analysis (CEQ, 1997).

Lake Ralph Hall would include the construction of a 7,568-acre reservoir and a 32.9-mile pipeline from the proposed reservoir site to Irving's existing Chapman Lake Raw Water Pipeline System. The study area for environmental justice and protection of children (Environmental Justice [EJ] Study Area) includes Fannin County, where the proposed reservoir is located, as well as the block groups in Hunt and Collin counties that intersect the proposed pipeline footprint. For purposes of this analysis, the five counties surrounding the reservoir site – Collin, Hunt, Lamar, Delta, and Grayson – are defined as the region of comparison (ROC), or appropriate units of geographic analyses and the general population. For additional context, data is also provided for the state of Texas.

Due to the site-specific nature of the proposed project, United States Census Bureau (USCB) block group (BG) data were used to identify high concentration "pockets" of environmental justice populations in the EJ Study Area. **Figures 3-26**, **3-27**, **3-28, and 3-29** help show the distribution of minorities, low-income populations, and children within the EJ Study Area.

Minority Populations

The CEQ defines "minority" as including the following population groups: American Indian or Alaskan Native; Asian or Pacific Islander; Black, not of Hispanic Origin; or Hispanic (CEQ, 1997). Data presented in **Table 3-59** were based on the USCB's 2010 decennial census. BG and county level census data are used where appropriate throughout the section.

The CEQ defines a minority population in one of two ways:

1. "…If the percentage of minorities exceeds 50 percent..." (CEQ, 1997). In this more straightforward scenario, if more than 50 percent of the Fannin County population consists of minorities (the sum of minority groups), this would qualify the county as comprising an environmental justice population.
2. "…[If the percentage of minorities] is substantially higher than the percentage of minorities in the general population or other appropriate unit of geographic analysis" (CEQ, 1997). For purposes of the analysis, a discrepancy of 10 percent or more between minorities (the sum of all minority groups) in Fannin County as compared to the surrounding five counties (Collin, Grayson, Hunt, Lamar, Delta) or the state of Texas would be considered "substantially" higher. Any discrepancy higher than 10 percent would categorize Fannin County as an environmental justice population.

Table 3-59 summarizes minority population groups in Fannin, Collin, Delta, Hunt, Grayson, and Lamar counties as well as the state of Texas.

Table 3-59: Summary of Minority and Minority Groups in the EJ Study Area and ROC

County	Total Population	Minority *(%)*	American Indian and Alaska Native *(%)*	Black or African American *(%)*	Asian *(%)*	Native Hawaiian and Other Pacific Islander *(%)*	Hispanic or Latino *(%)*
Fannin	33,915	6,039 *(17.8%)*	369 *(1.1%)*	2,312 *(6.8%)*	125 *(0.4%)*	7 *(0.0%)*	3,226 *(9.5%)*
Collin	782,341	274,389 *(35.1%)*	4,448 *(0.6%)*	66,387 *(8.5%)*	87,752 *(11.2%)*	448 *(0.1%)*	115,354 *(14.7%)*
Lamar	49,793	10,947 *(22.0%)*	700 *(1.4%)*	6,703 *(13.5%)*	311 *(0.6%)*	10 *(0.0%)*	3,223 *(6.5%)*
Delta	5,231	770 *(14.7%)*	72 *(1.4%)*	380 *(7.3%)*	30 *(0.6%)*	0 *(0.0%)*	288 *(5.5%)*

Hunt	86,129	20,751 *(24.1%)*	804 *(0.9%)*	7,133 *(8.3%)*	916 *(1.1%)*	147 *(0.2%)*	11,751 *(13.6%)*
Grayson	120,877	23,691 *(19.6%)*	1,835 *(1.5%)*	7,081 *(5.9%)*	1,046 *(0.9%)*	41 *(0.0%)*	13,688 *(11.3%)*
Texas	25,145,561	13,597,743 *(54.1%)*	170,972 *(0.7%)*	2,979,598 *(11.8%)*	964,596 *(3.8%)*	21,656 *(0.1%)*	9,460,921 *(37.6%)*

Source: USCB 2010 *Profile of General Population and Housing Characteristics: (DP-1)*

As **Table 3-59** indicates, Fannin County does not meet the regulatory definition of a minority population. Fannin County's population consists of approximately 18 percent minorities, compared to Collin County's 35 percent; Lamar County's 22 percent; Grayson County's 20 percent; Hunt County's 24 percent; and Delta County's 15 percent. The percentage of minorities in Fannin County is higher than the percentage of minorities in Delta County; less than the percentage of minorities Collin, Lamar, Grayson, and Hunt counties; and less than the state's 54 percent. The discrepancy in the percentage of minorities between Fannin and Delta counties is about three percent. The minority populations in Fannin and Grayson counties also represent less than half of their total county populations, respectively. Minorities in Fannin County are neither greater than 50 percent of the total county population nor are they substantially higher than the percentage of minorities in the five surrounding counties (Collin, Lamar, Grayson, Hunt, Delta) or the state of Texas as a whole.

Minority Populations by Block Groups

The discussion of environmental justice up until this point describes the existing minority population on the county level. Due to the site-specific nature of the proposed project, in addition to describing the proportion of minorities on the county level, BG data are used to describe the distribution of minorities in EJ Study Area. A BG is a statistical subdivision of a census tract, generally defined to contain between 600 and 3,000 people and 240 and 1,200 housing units. It is the smallest geographic unit for which the USCB tabulates sample data, i.e. data which are only collected from a fraction of households. BGs are statistical areas bounded by visible features such as roads, streams, and railroad tracks, and by nonvisible boundaries such as property lines, city, township, school district, county limits and short line-of-sight extensions of roads. The EJ Study Area is made up of 38 BGs, including all the BGs in Fannin County, and the eight BGs in Hunt and Collin Counties that intersect the proposed pipeline footprint.

Minority data for BGs in the EJ Study Area were evaluated. Applying the CEQ definition(s) from above, BGs (and associated towns) are identified as having an environmental justice population if:

- More than 50 percent of a BG consists of minorities.
- The percentage of minorities in a BG is substantially higher than the percentage of minorities in Fannin County. For purposes of this analysis, a discrepancy of ten percent or more between minorities (the sum of all minority groups) in a BG and Fannin County would be considered "substantially" higher, and would categorize that BG as an environmental justice population.

Table 3-60 shows the percent minority by block group within the EJ study area. **Figure 3-26** shows the distribution of minority populations within the EJ Study Area, color-coding the proportion of minorities using ranges. The data indicates that there are five BGs within the EJ Study Area with minority populations substantially higher (10 percent or greater) than Fannin County as a whole that would therefore be defined as environmental justice populations. This includes three BGs in Bonham, which is approximately 10 miles away northwest of the proposed reservoir site, one BG in Honey Grove, which is approximately 4.5 miles northeast of the proposed reservoir site, one BG that covers Ladonia, which is immediately south of the proposed reservoir site, and one BG in Hunt County along the pipeline footprint. For purposes of this analysis Bonham, Honey Grove, and Ladonia constitute minority populations, or an environmental justice population.

Table 3-60: Percent Minority by Block Group within the EJ Study Area Block Groups

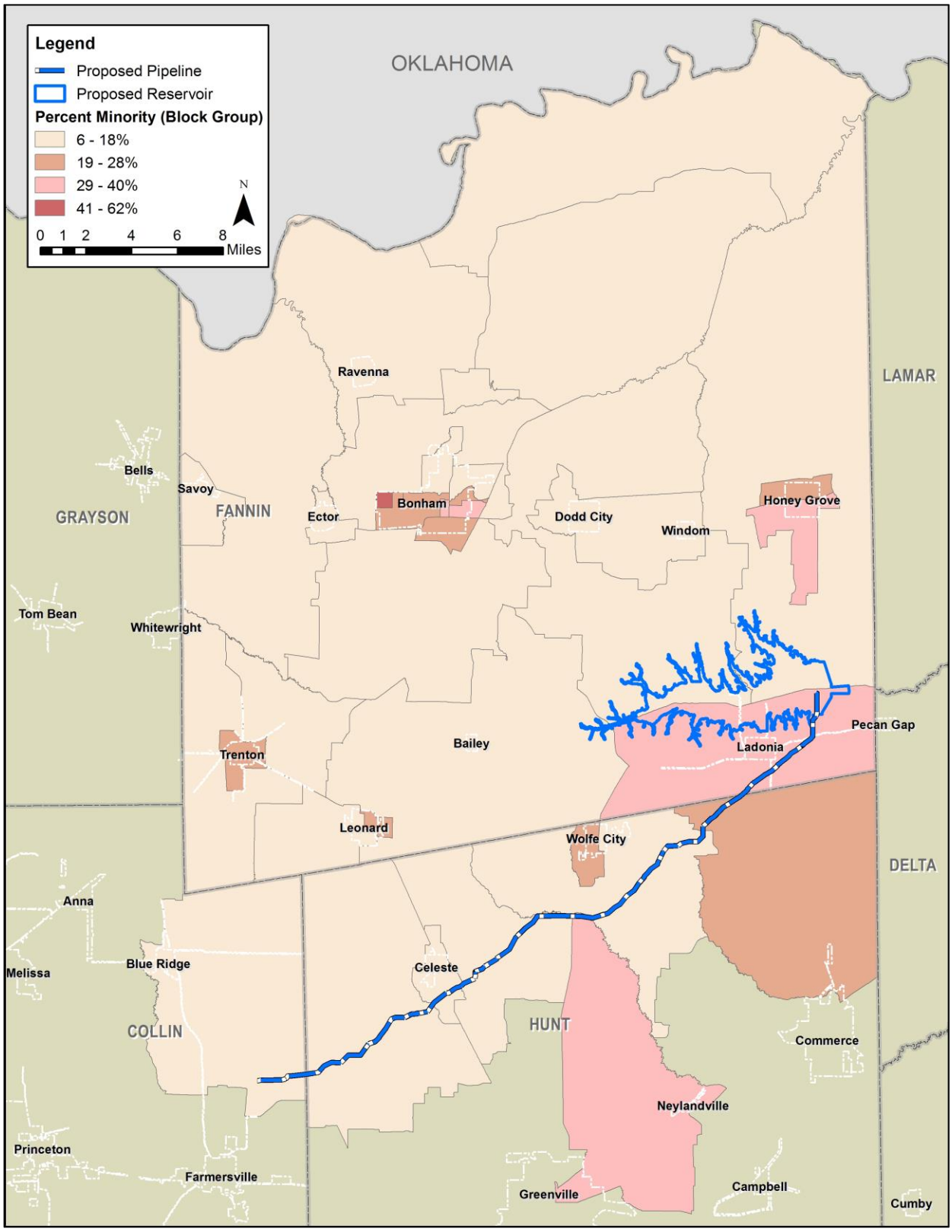
County	Census Tract	Block Group	Percent Minority
Collin	301	3	12.7
Fannin	9501	1	9.7
Fannin	9501	2	18.8
Fannin	9501	3	**39.2**
Fannin	9503	1	9.6
Fannin	9503	2	6.7
Fannin	9503	3	8.0
Fannin	9504.01	1	27.7
Fannin	9504.01	2	**36.3**
Fannin	9504.01	3	**62.3**
Fannin	9504.01	4	26.8
Fannin	9504.02	1	11.4
Fannin	9504.02	2	33.2
Fannin	9504.02	3	14.8
Fannin	9504.02	4	15.3
Fannin	9504.02	5	24.4
Fannin	9505	1	8.7
Fannin	9505	2	7.6
Fannin	9505	3	**31.2**
Fannin	9506	1	23.1
Fannin	9506	2	9.0
Fannin	9507.01	1	14.9
Fannin	9507.01	2	20.7
Fannin	9507.01	3	12.8
Fannin	9507.02	1	21.5
Fannin	9507.02	2	14.3
Fannin	9507.02	3	8.4

County	Census Tract	Block Group	Percent Minority
Fannin	9508	1	9.2
Fannin	9508	2	9.8
Fannin	9508	3	10.6
Fannin	9508	4	6.5
Hunt	9601	1	20.7
Hunt	9602	1	15.2
Hunt	9602	2	24.3
Hunt	9603	1	8.4
Hunt	9603	2	13.2
Hunt	9603	3	10.7
Hunt	9604	1	**34.3**

Source: US Census 2010. Table P9.

Note: For purposes of identifying EJ populations, "minority" includes both persons of Latino and Hispanic Origin and persons of races other than "white alone".

Figure 3-26: Distribution of Minorities within the EJ Study Area



Source: US Census 2010

Low-Income Populations

Low-income is defined as a household income at or below the Department of Health and Human Services (DHHS) poverty guidelines. In 2017, the DHHS poverty guideline for a four-person family is $24,600.

The 2011-2015 American Community Survey data for "Household income in the past 12 months (in 2015 inflation-adjusted Dollars)" and the "Percent of population with income in the past 12 months below poverty level" was used to determine if there are low-income populations present in the EJ Study Area. At the county level, the median household income for Fannin County as well as the income for the ROC counties is above the DHHS poverty guidelines. The median household income for Fannin County is greater than that for Lamar and Delta, but lower than Hunt, Grayson, Collin, and the State of Texas. The percent below poverty level was 17.2 for Fannin County, which is lower than Lamar, Delta, and Hunt and almost the same as Texas as a whole. As shown in **Table 3-61**, the difference between the percent poverty in Fannin County and the ROC counties is less than 10 percent; therefore Fannin County does not qualify as an environmental justice community.

Table 3-61: Median Household Income and Poverty Status within the EJ Study Area and the ROC

County	Households	Median household income	Population for whom poverty status is determined	Percent Population with Income in the past 12 months below poverty level
Fannin	11,974	44,071	30,810	17.2
Collin	305,827	84,735	857,655	7.6
Lamar	19,026	40,748	48,762	18.6
Delta	1,928	42,432	5,152	22.8
Hunt	30,832	45,197	85,135	18.9
Grayson	47,215	47,952	119,943	16.2
Texas	9,149,196	53,207	25,923,852	17.3

Source: U.S. Census Bureau. 2011-2015 American Community Survey (ACS) 5-Year Estimates, Tables B17021, B19001, and B19013.

Low-Income Populations by Block Groups

As with minority populations, BGs were then used to identify high concentrations of low-income populations within the EJ Study Area. The data indicates that two BGs in the EJ Study Area had a median household income less than the 2017 poverty guidelines, both located in Bonham. **Table 3-62** shows the number of households, median household income, and poverty status for EJ Study Area BGs. **Figures 3-27** and **3-28** shows the median household income and percent below poverty. There are four BGs that have a percent below poverty level greater than 10 percent of that for Fannin County. Three are part of Bonham and the fourth is part of Wolfe City. For purposes

of this analysis Bonham and Wolfe City therefore constitute low-income populations, or an environmental justice population.

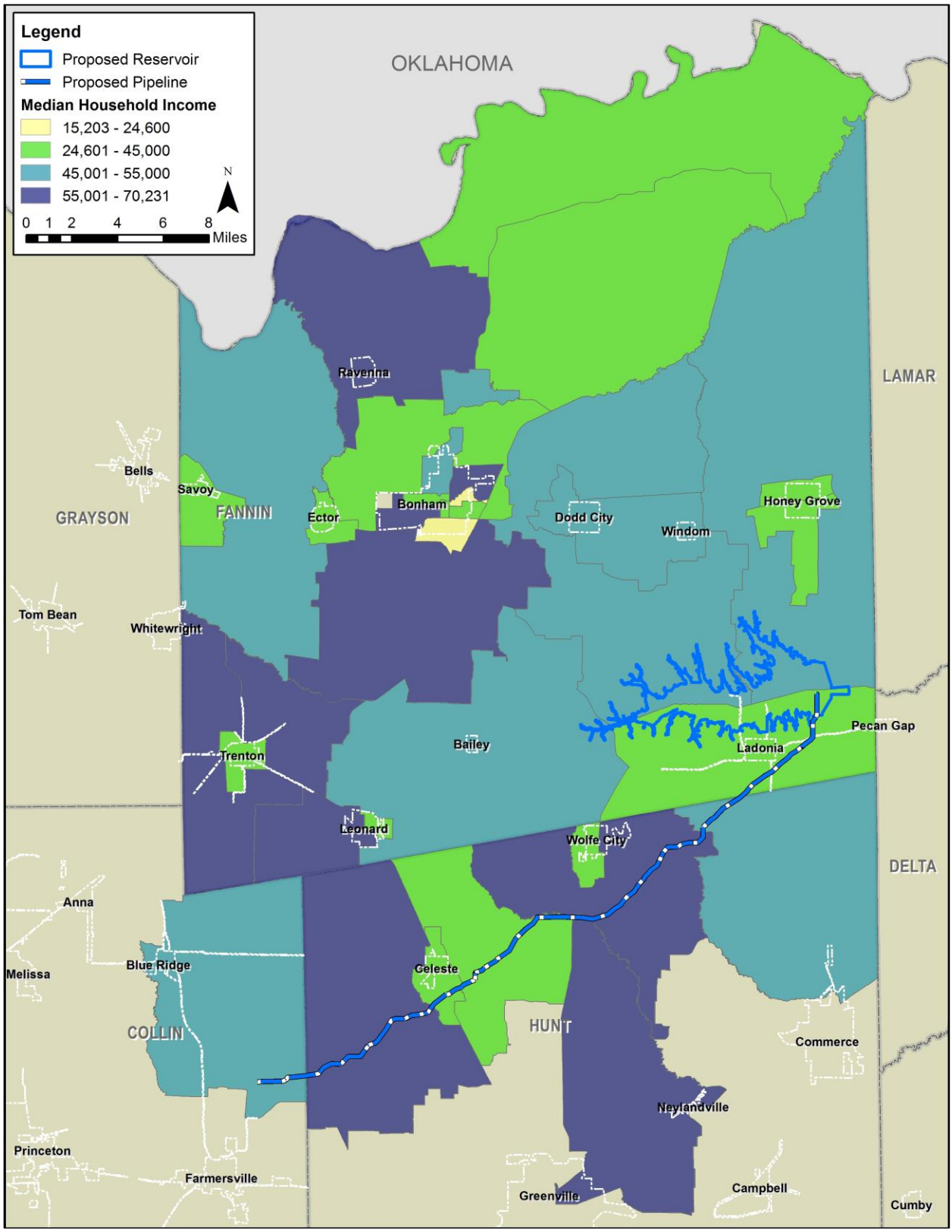
Table 3-62: Median Household Income and Poverty Status within the EJ Study Area Block Groups

County	Census Tract	Block Group	Households	Median Household Income	Population for whom poverty status is determined	Percent Population with Income in the past 12 months below poverty level
Collin	301	3	1,010	50,486	3,056	8.0
Fannin	9501	1	352	52,273	843	7.0
Fannin	9501	2	423	29,663	1,123	22.0
Fannin	9501	3	334	36,500	940	26.7
Fannin	9503	1	343	41,467	732	16.8
Fannin	9503	2	478	51,042	1,326	8.4
Fannin	9503	3	315	34,712	833	22.3
Fannin	9504.01	1	547	30,284	1,167	**40.3**
Fannin	9504.01	2	212	36,563	465	9.7
Fannin	9504.01	3	-	-	-	-
Fannin	9504.01	4	259	55,927	732	22.7
Fannin	9504.02	1	569	39,215	1,259	10.7
Fannin	9504.02	2	377	27,131	1,045	**27.8**
Fannin	9504.02	3	449	67,370	1,040	3.1
Fannin	9504.02	4	561	45,114	1,444	20.8
Fannin	9504.02	5	307	**15,203**	981	**39.9**
Fannin	9505	1	258	52,222	730	11.9
Fannin	9505	2	383	51,699	958	9.8
Fannin	9505	3	380	31,806	917	27.0
Fannin	9506	1	286	**24,375**	678	19.0
Fannin	9506	2	613	57,788	1,707	11.7
Fannin	9507.01	1	554	64,167	1,753	10.8
Fannin	9507.01	2	433	37,538	1,199	20.6
Fannin	9507.01	3	633	52,841	1,504	13.5
Fannin	9507.02	1	343	37,031	863	23.6
Fannin	9507.02	2	609	70,231	1,849	15.1
Fannin	9507.02	3	274	63,250	652	6.4
Fannin	9508	1	538	35,625	1,290	15.4
Fannin	9508	2	335	43,633	939	21.4
Fannin	9508	3	578	58,790	1,348	11.3
Fannin	9508	4	231	53,542	493	4.7

County	Census Tract	Block Group	Households	Median Household Income	Population for whom poverty status is determined	Percent Population with Income in the past 12 months below poverty level
Hunt	9601	1	406	52,143	1,239	6.4
Hunt	9602	1	405	62,708	1,144	8.7
Hunt	9602	2	496	28,214	1,232	**28.2**
Hunt	9603	1	362	42,422	807	4.6
Hunt	9603	2	780	58,182	2,199	15.6
Hunt	9603	3	282	42,500	856	19.7
Hunt	9604	1	732	57,763	2,137	11.6

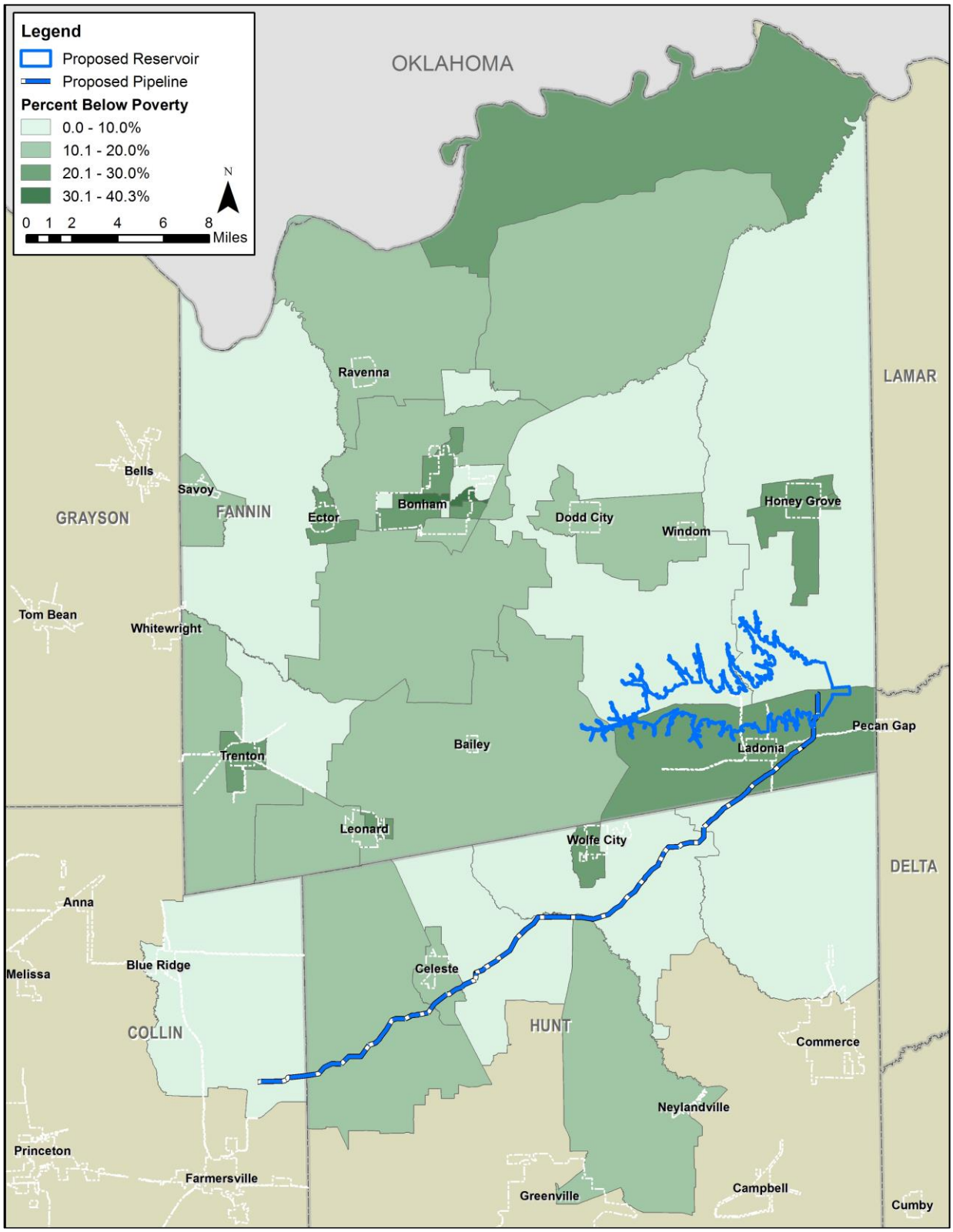
Source: U.S. Census Bureau. 2011-2015 ACS 5-Year Estimates, Tables B17021, B19001, and B19013.

Figure 3-27: Median Household Income by Block Group within the EJ Study Area



Source: U.S. Census Bureau. 2011-2015 American Community Survey (ACS) 5-Year Estimates

Figure 3-28: Percent Below Poverty by Block Group within the EJ Study Area



Source: U.S. Census Bureau. 2011-2015 American Community Survey (ACS) 5-Year Estimates

3.18.2 Protection of Children

EO 13045 *Protection of Children from Environmental Health Risks and Safety Risks* was prompted by the recognition that children are more sensitive than adults to adverse environmental health and safety risks because they are still undergoing physiological growth and development. EO 13045 defines "environmental health risks and safety risks [to] mean risks to health or to safety that are attributable to products or substances that the child is likely to come in contact with or ingest (such as the air we breathe, the food we eat, the water we drink or use for recreation, the soil we live on, and the products we use or are exposed to)." Children may have a higher exposure level to contaminants because they generally have higher inhalation rates relative to their size. Children also exhibit behaviors such as spending extensive amounts of time in contact with the ground and frequently putting their hands and objects in their mouths that can lead to much higher exposure levels to environmental contaminants. It is well documented that children are more susceptible to exposure to mobile source air pollution, such as particulate matter from construction or diesel emissions (EPA, 2012).

The Memorandum Addressing Children's Health through Reviews Conducted Pursuant to the National Environmental Policy Act and Section 309 of the Clean Air Act recommends that a Draft EIS "describe the relevant demographics of affected neighborhoods, populations, and/or communities and focus centers, parks, and residential areas in close proximity to the proposed project area, and other areas of apparent frequent and/or prolonged exposure" (EPA, 2012).

According to the American Community Survey 2011-2015 estimates, approximately 5.4 percent of the population in Fannin County is under the age of five. At the BG level, the population under five ranges between 0.0 percent and 12.8 percent (**Table 3-63**). **Figure 3-29** shows the ranges of populations under five by BG.

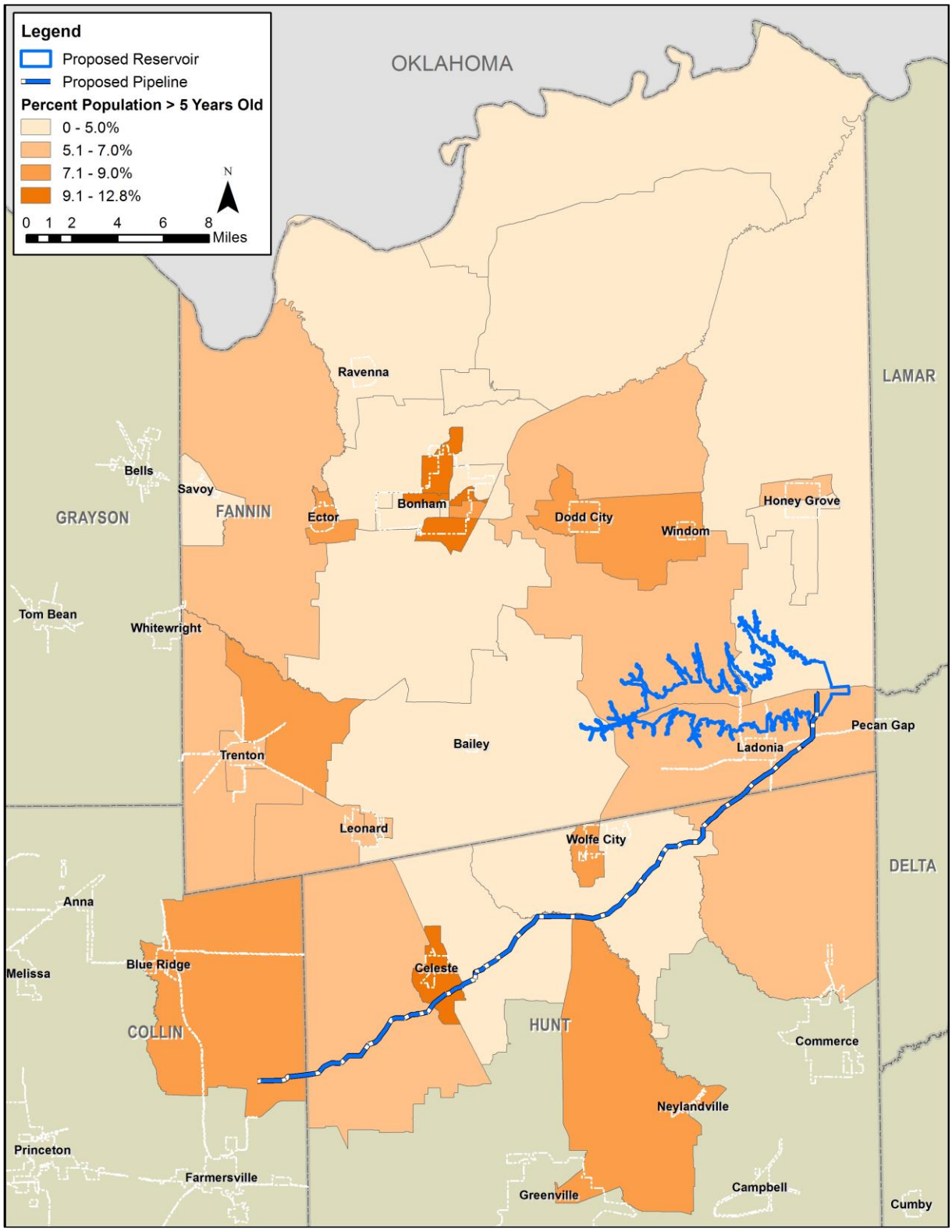
This BG data is compared with previously defined "pockets" of minority or low-income populations; as EO 13045 recognizes that children of environmental justice populations are more likely to be exposed to, and have increased health and safety risks from, environmental contamination than the general population. Under the Proposed Action, children in areas defined as minority or low-income environmental justice populations (i.e., Bonham, Ladonia, Wolfe City, and Honey Grove) will be evaluated for disproportionate impacts as it relates to a child's health and safety.

Table 3-63: Populations Under 5 by Block Group within the EJ Study Area

County	Census Tract	Block Group	Total	Population Under 5	Percent Population Under 5
Collin	301	3	3,056	221	7.2
Fannin	9501	1	843	17	2.0
Fannin	9501	2	1,204	70	5.8
Fannin	9501	3	940	37	3.9
Fannin	9503	1	845	26	3.1
Fannin	9503	2	1,326	74	5.6
Fannin	9503	3	833	69	8.3
Fannin	9504.01	1	1,189	118	9.9
Fannin	9504.01	2	465	11	2.4
Fannin	9504.01	3	1,832	0	0.0
Fannin	9504.01	4	1,211	32	2.6
Fannin	9504.02	1	1,259	43	3.4
Fannin	9504.02	2	1,336	97	7.3
Fannin	9504.02	3	1,040	47	4.5
Fannin	9504.02	4	1,444	186	12.9
Fannin	9504.02	5	1,030	120	11.7
Fannin	9505	1	730	58	7.9
Fannin	9505	2	958	53	5.5
Fannin	9505	3	917	54	5.9
Fannin	9506	1	678	64	9.4
Fannin	9506	2	1,720	76	4.4
Fannin	9507.01	1	1,753	121	6.9
Fannin	9507.01	2	1,235	71	5.7
Fannin	9507.01	3	1,508	53	3.5
Fannin	9507.02	1	870	56	6.4
Fannin	9507.02	2	1,849	93	5.0
Fannin	9507.02	3	652	48	7.4
Fannin	9508	1	1,301	49	3.8
Fannin	9508	2	939	21	2.2
Fannin	9508	3	1,348	45	3.3
Fannin	9508	4	493	18	3.7
Hunt	9601	1	1,239	82	6.6
Hunt	9602	1	1,144	56	4.9
Hunt	9602	2	1,278	114	8.9
Hunt	9603	1	807	36	4.5
Hunt	9603	2	2,199	152	6.9
Hunt	9603	3	856	95	11.1
Hunt	9604	1	2,137	153	7.2

Source: U.S. Census Bureau. 2011-2015 ACS 5-Year Estimates, Tables B01001

Figure 3-29: Percent Population Under 5 by Block Group



Source: U.S. Census Bureau. 2011-2015 American Community Survey (ACS) 5-Year Estimates

3.19 Climate Change

According to the National Climate Assessment (U.S. Global Change Research Program [USGCRP], 2014), climate change in the Great Plains Region, which includes Texas, is anticipated to result in increases in the number of days with the hottest temperature and increases in the number of consecutive dry days. The trend toward more dry days and higher temperatures across the south will increase evaporation, decrease water supplies, reduce electricity transmission capacity, and increase cooling demands. These changes will add stress to limited water resources and affect management choices related to irrigation, municipal use, and energy generation. The report predicts that the project region would be at moderate to high risk for water supply sustainability (shortages) with no climate change effects and high to extreme risk with climate change effects. In addition, the report indicates that a 25-50 percent increase in water withdrawals is projected in the project region with climate change effects.

4.0 Environmental Consequences

This chapter describes the anticipated direct, indirect, and cumulative impacts of the Lake Ralph Hall and Lake Ralph Hall Raw Water Pipeline Alternatives. This chapter also identifies residual adverse effects, that is, the effects that would remain after the recommended mitigation measures have been implemented.

The proposed project may result in impacts interrelated with other past, present and reasonably foreseeable future actions in the area. For resources where project-specific impacts are identified, the cumulative impacts associated with the proposed project were evaluated together with other interrelated projects.

This chapter is organized by environmental resource. **Sections 4.1** through **4.22** describe the potential environmental impacts associated with each resource. Numerous technical reports were prepared as support documents to this Draft Environmental Impact Statement (DEIS) and are located in the **Appendices**.

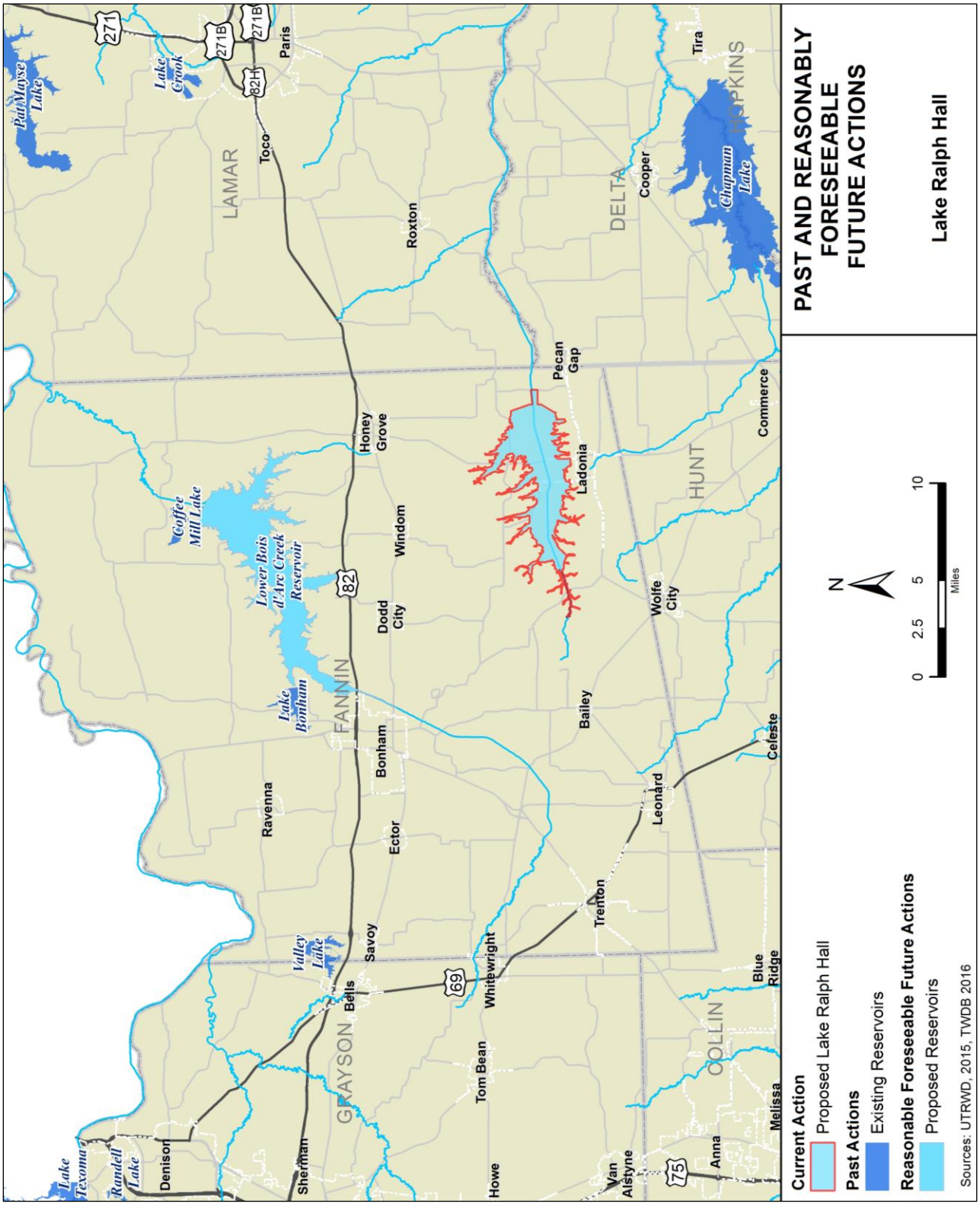
For the purposes of analysis for this project, the intensity of impacts was described using the following terms:

- No effect: No discernable or measurable effect.
- Negligible: Effects would be at the lowest levels of detection, barely measurable, with no perceptible consequences.
- Minor: Effects result in a detectable change, but the change would be slight.
- Moderate: Effects would result in a clearly detectable change, with measurable effects.
- Major: Effects would be readily apparent with substantial consequences.

These terms are utilized specifically in relation to each resource unless otherwise noted. Additionally, all effects are considered adverse unless otherwise stated as beneficial.

For cumulative impacts analysis, the resource study area for most resources is Fannin County, but specific study areas for biological and water resources are described in their respective resource subsections. The temporal boundary for analysis is a 50-year growth period to coincide with the planning timeframe for water supply in the region. Since identification of reasonably foreseeable future actions can become speculative this far in the future, the focus is on trends that may occur during this time period. In addition, the inclusion of past and future actions is focused on water-resource related projects, but general trends relating to non-water resource actions are acknowledged when appropriate for that resource. Past and reasonably foreseeable water-resource related actions are shown in **Figure 4-1**.

Figure 4-1: Past and Reasonably Foreseeable Future Actions



Source: UTRWD 2015; TWDB 2016

4.1 Land Use and Ownership

4.1.1 Environmental Consequences

4.1.1.1 No Action Alternative

Under the No Action Alternative, the proposed Lake Ralph Hall would not be constructed. The present trends in land use in the project area would continue. UTRWD has purchased a little over half of the project area from willing sellers. This land is currently being leased back to the property owners. In the case that the No Action Alternative was selected, this land would either continue to be leased back or would eventually be put on the open market. Therefore, the land use in the project area would be expected to remain predominantly rural and undeveloped for the foreseeable future. Some increased urbanization in nearby cities and towns would be expected as the population of Fannin County increases over the decades. Fannin County urbanization would be at a slower pace than what would occur in the remainder of the state as a whole due to projected slower population growth and associated land use changes. However, some agricultural lands may convert to grasslands or undeveloped lands as family farms are passed down to future generations or sold. This would decrease demand for agricultural products and/or pastures. Actions that may be taken by the Applicant and their participants under the No Action Alternative as described in **Chapter 2** are not anticipated to have any effects to land use or ownership in Fannin County. However, development of groundwater wells and associated infrastructure could require securing easements and minor areas of property in the member's and participant's areas of responsibility and jurisdictions.

4.1.1.2 Proposed Action

This section discusses the environmental consequences on land use during both the construction and operation phases of the proposed dam, reservoir, and pipeline. Impacts of this alternative are expected to be moderate to major in magnitude. Whether these long-term changes in land use of moderate to major magnitude are considered adverse or beneficial – or both – depends on the particular interests and values of the observer.

Dam, Reservoir, and Principal and Emergency Spillways

The proposed Lake Ralph Hall dam, reservoir and principal and emergency spillways would take an estimated five years to construct and would impact approximately 11,915 acres of forest, crop, grasslands, and ranch land (See **Section 4.17.1.2**). All of the project area would be rendered unusable for current or future agricultural use. As of May 2017, there are two residences remaining within the project area that would need to be purchased before construction could begin. All other residences have been acquired by the Upper Trinity Regional Water District (UTRWD) from willing sellers (UTRWD, 2017b). These residential areas are only a minor portion of the proposed reservoir site. Overall, the effects of the Proposed Action on land use would be major due to the

inundation of more than 7,000 acres, including retirement of approximately 1,600 acres of agricultural lands.

Changes in land use would also arise from the change in character for lands surrounding Lake Ralph Hall. Land around the lake would become lake view property. New residential developments are likely, although the timing of such development is uncertain. Other land use impacts due to the creation of Lake Ralph Hall would come from commercial development to support new residents and potential recreational activities at the lake. Potential for residential and commercial development due to the Proposed Action is discussed in detail in **Section 4.17.1.2.** At this time, there are no specific plans to develop recreational features at the proposed project. However, it is assumed that recreational use of the reservoir will occur sometime in the future. Adjacent project lands are to be open space and available to the public, which is considered to be a moderate benefit to this factor. Overall, impacts to land use from the operational phase of the Proposed Action are expected to be major.

Pipeline

Pipelines associated with the proposed raw water transmission facilities would parallel county and farm-to-market roads and existing electrical transmission line easements to minimize environmental and infrastructural disturbances. While future construction would be limited within the right-of-way (ROW) easement, land uses such as farming could continue directly above the buried pipeline. Overall, the effects of the pipeline associated with the Proposed Action on land use would be minor.

Balancing Reservoir

The proposed project would convert approximately 4.5-acres of grassland to a balancing reservoir. The balancing reservoir would be constructed adjacent to the north side of the existing Irving balancing reservoir. Overall, impacts to land use from the balancing reservoir of the Proposed Action are expected to be major.

4.1.2 Cumulative Effects

Fannin County does not have any county-wide land use planning or zoning. Land use planning and zoning within the county is limited to incorporated municipalities, with the exception of the Lower Bois d'Arc Creek Comprehensive Plan.

The City of Ladonia has a *Zoning Map* and *Future Land Use Map* that includes the proposed Lake Ralph Hall (City of Ladonia, 2015). The zoning map shows Ladonia as primarily single family residential and commercial with a small area of manufacturing/industrial on the northeast side and small area zoned as agricultural in the southeast corner. The future land use map shows the addition of some public/semi-public lands and some medium density residential. The area outside of downtown Ladonia up to the proposed Lake Ralph Hall boundary is shown as single family residential.

Fannin County's Comprehensive Plan for the Lower Bois d'Arc Creek Reservoir, adopted October 18, 2016, includes future land use planning for the land within a 5,000-foot buffer of the shoreline of the proposed reservoir (Fannin County, 2016b). The future land use map shows the majority of land within the buffer as agricultural/open space, with areas of large-lot residential closer to the reservoir, two areas of small-lot residential, a few areas of office/retail/commercial, and North Texas Municipal Water District (NTMWD)-owned property.

The City of Bonham has a *Zoning Map* that shows downtown Bonham as local business, surrounded by single-family residential, with industrial towards the city limits (City of Bonham, n.d.).

4.1.2.1 No Action Alternative

The study area for assessing cumulative effects on land use consists of Fannin County. Fannin County was selected as the area of effect for the cumulative impact analysis because land use classifications are made at the county-level and the direct land use impacts attributable to the project are located almost entirely within Fannin County. The No Action Alternative would not contribute to any cumulative changes in land use over the long term because the lands are currently being leased back to the property owner and if the No Action Alternative was selected the lands would continue to be leased back or eventually put on the open market.

4.1.2.2 Proposed Action

The analysis considers the footprint of the Proposed Action in combination with other actions and projects located in Fannin County. Past water resources projects within Fannin County include the channelization of the North Sulphur River, Lake Bonham, Valley Lake, Coffee Mill Lake, and Lake Davy Crockett. Reasonably foreseeable future actions include the Lower Bois d'Arc Creek Reservoir (LBCR) and population growth of Fannin County. Other past actions relating to land use include conversion of land to other uses, such as development or agriculture. According to the National Land Cover Dataset, approximately 5,000 acres of Fannin County have been developed, and approximately 192,000 acres have been cultivated for agriculture.

The proposed Lake Ralph Hall project area would change the land use of approximately 11,915 acres within Fannin County. As previously discussed, land use within the pipeline footprint would generally remain the same. The balancing reservoir would also convert approximately 4.5-acres of grassland. Other future actions include the proposed LBCR, which would cover up to 17,068 acres of bottomland and adjacent upland habitat along Lower Bois d'Arc Creek in Fannin County. This land is predominantly undeveloped with scattered rural residences. In combination, the two reservoirs represent a substantial change in land use for Fannin County. Over time, as the population of the county grows, its rural, largely agrarian landscape would gradually decline as it becomes more developed and residential, commercial, and institutional land use increases. The

two reservoirs and associated project lands would permanently remain as open space and "parkland" as the county transitions away from agriculture and rural land uses.

4.2 Public Lands

4.2.1 Environmental Consequences

4.2.1.1 No Action Alternative

As discussed in **Section 3.2**, the only public lands found within the project area are the Caddo National Grasslands and Ladonia Fossil Park. Under the No Action Alternative, the proposed Lake Ralph Hall would not be constructed and therefore would not impact the Caddo National Grasslands or the Ladonia Fossil Park. Impacts to public lands are anticipated to be negligible.

4.2.1.2 Proposed Action

Dam, Reservoir, and Principal and Emergency Spillways

The Ladonia Unit of the Caddo National Grasslands is located in the southwest portion of the project area. The grasslands are made up of non-contiguous parcels. Approximately 300 acres of Federal land (Caddo National Grasslands- Ladonia Unit), currently administered by the U.S. Forest Service, would be acquired by the applicant and converted to open water as a result of the proposed project. The impact to public lands with the project is considered to be major but would be reduced by compensatory mitigation acreage. Construction of Lake Ralph Hall could provide deterrent to current erosive forces degrading stream channels on USFS tracts and may provide a be considered a benefit. Impacts associated with recreational use of the Caddo National Grasslands are discussed in **Section 4.9.1**.

Under the Proposed Action, the Ladonia Fossil Park (aka Pete Patterson Fossil Park) would no longer be accessible for fossil hunters. UTRWD anticipates mitigating the impact to the existing Pete Patterson Fossil Park by providing a similar park near the intersection of FM 904 and the North Sulphur River. The relocated park is anticipated to be comprised of a gravel parking area, signage, a covered pavilion and a path accessing the North Sulphur River Channel. The access to the North Sulphur River Channel is anticipated to be provided by a series of steps leading from the upper bank of the channel to the channel bottom.

No impacts to any state or county lands would occur due to the proposed project.

Pipeline and Balancing Reservoir

No impacts to any public lands would occur from the proposed pipeline or balancing reservoir.

4.2.2 Cumulative Effects

4.2.2.1 No Action Alternative

The No Action Alternative would not contribute to any cumulative changes in public lands over the long term.

4.2.2.2 Proposed Action

The study area for assessing cumulative effects of the action on public lands consists of Fannin County. Fannin County was selected as the area of effect for the cumulative impact analysis because as previously discussed, land use classifications are made at the county-level and the direct land use impacts attributable to the project alternatives are located almost entirely within Fannin County. Land use within the pipeline footprint would generally remain the same.

The analysis considers the footprint of the Proposed Action in combination with other projects located in Fannin County. Past projects within Fannin County include Lake Bonham, Valley Lake, Coffee Mill Lake, and Lake Davy Crockett. Reasonably foreseeable future actions include the LBCR and the growth of Fannin County. As discussed in **Section 3.2**, the primary public lands within Fannin County are the Caddo National Grasslands and Bonham State Park. No proposed future actions are known that would further affect these National Grasslands. The LBCR would not directly impact public lands. Growth of Fannin County would accelerate conversion of rural, agricultural land to developed uses, but would not directly impact public lands. Therefore, there are no cumulative effects anticipated to public lands.

4.3 Physiography and Topography

4.3.1 Environmental Consequences

4.3.1.1 No Action Alternative

Under the No Action Alternative, the physiography and topography of the proposed project area would be altered by continued erosion in the North Sulphur River and its tributaries. Where shale is exposed in the bed and banks, the channel depth could increase approximately eight feet and the channel bottom widths could increase approximately 16 feet over a 50-year period. Increased channel depths are also likely to cause further mass failure of the alluvial portions of the banks, thereby increasing channel top widths (UTRWD, 2006c). These impacts are considered to be major.

4.3.1.2 Proposed Action

Dam, Reservoir, and Principal and Emergency Spillways

The physiography and topography of the proposed project area would be altered in regard to being flooded due to the construction of the Lake Ralph Hall reservoir as well as the project dam. Area to be modified topographically will be in excess of 8,000 acres for all associated project features. Sediment yield (accumulation) to the reservoir over a 50-year period is between 2,570 ac-ft and 3,700 ac-ft depending on a conservative or worst-case scenario (UTRWD, 2006c). Physiography under the Proposed Action would not be altered. The proposed Lake Ralph Hall project would also impact area topography by flooding a portion of the river basin and some tributaries as well as the development of the dam. Erosion along the shoreline of the proposed Lake Ralph Hall reservoir could, over time, alter topography but this impact would be limited in areal extent and less than the topographic alterations occurring as a result of the No Action Alternative where the river channel and tributaries would continue to erode at current rates. Impacts to physiography and topography are considered to be moderate.

Pipeline

Since the pipeline would be buried, impacts to the topography are transitory and do not represent long term alteration. Once the pipeline is in place, the topography would return to its previous elevation. Impacts to physiography and topography from the pipeline are anticipated to be negligible.

Balancing Reservoir

Minor alteration to the topography would occur to accommodate the balancing reservoir.

4.3.2 Cumulative Effects

4.3.2.1 No Action Alternative

The No Action Alternative will not contribute to cumulative effects to the topography of the proposed project area. The topography of the area has been and would continue to be impacted by the lateral and vertical erosion of the North Sulphur River channel.

4.3.2.2 Proposed Action

The topography of the area has been and would continue to be impacted by the lateral and vertical erosion of the North Sulphur River channel. This erosion, and associated topographic modifications associated with it, would continue to alter the terrain within the river basin and tributaries, primarily downstream of the proposed action. Reasonably foreseeable future actions in the assessment area, specifically the LBCR (404 permit issued January of 2018), also include features that will have some impact to the area's topography due to inundation and construction of the dam and embankment.

4.4 Geology and Soils

4.4.1 Environmental Consequences

4.4.1.1 No Action Alternative

Geology

Under the No Action Alternative the geologic formations within the North Sulphur River channel and tributaries would continue to erode. The rates of bedrock erosion are controlled by the number of wetting and drying cycles (Allen et al., 2002), and not by hydraulic processes. On an average annual basis, the shale will continue to erode vertically at a rate of about two inches per year and laterally at a rate of about four inches per year in the North Sulphur River channel (UTRWD, 2006c). **Appendix C** provides a copy of the *Fluvial Geomorphology Study Report* which further describes potential conditions to occur with the channel and tributaries. Geology and soils may experience minor effects if development of groundwater supplies occurs associated with a permit denial.

Geologic Hazards

Earthquakes, landslides, and sinkholes are types of geologic hazards that can occur within this area. Texas lies in a region low in seismicity, but earthquakes, of low magnitude, have occurred and will occur again in the future in Texas. There are no known sinkholes in the area. The project is located in a region with low topographic extremes and therefore low landslide susceptibility and low landslide incidence. Landslide hazards resulting from natural conditions are not expected. Geologic hazards would not be affected by the No Action Alternative.

Mineral Resources

There are no active oil or gas wells within this area; however, there are several dry oil and gas test wells (Texas Railroad Commission, 2015). There are no active mines within this area. Mineral resources would not be affected by the No Action Alternative.

Soils

Under the No Action Alternative, current influences and conditions will continue to occur. Development of groundwater wells and pipelines in member and participant jurisdictions would be expected to be minimal.

Prime Farmland

Under the No Action Alternative, current influences and conditions will continue to occur. Farmland in this area is used mainly as cropland for corn, grain sorghum, soybeans, and wheat. Alfalfa and forage sorghum are grown for hay in some areas.

4.4.1.2 Proposed Action

Geology

In the proposed project area, the original topography would be flooded. There are no mines within the project area and therefore any geologic resources would not be permanently altered by the construction of the Proposed Action. However, in regard to the geologic formations within the project area, construction of the Proposed Action would slow the erosion of the Ozan Formation and terrace deposits within the North Sulphur River and its tributaries. Hydration of the exposed shale within the inundation area of the reservoir footprint would stabilize the shale and reduce further delamination in areas consistently inundated. Impacts would be moderate and beneficial.

No adverse downstream impacts on channel morphology or capacity are expected as a result of the Proposed Action (**Appendix C**). Rates of bedrock erosion are controlled by the number of wetting and drying cycles and not hydraulic processes. On an average annual basis, the shale will continue to erode vertically at a rate of about 2 inches per year and laterally at a rate of about 4 inches per year based on studies of the erosion of the shale (Allen et al., 2002; Crawford, in prep) and the results of analysis of stage-discharge rating curves for the Cooper gage and comparative bridge profiles. Therefore, construction of the proposed dam is unlikely to affect bedrock erosion rates. Total sediment yield to the dam site is about 174,000 tons, but only 25 percent is composed of bed material with the remaining amount composed of wash load. Construction of the dam would reduce the morphologically-significant sediment yield to the channel downstream by about 25 percent, which will have an insignificant effect on the channel morphology (**Appendix C**). Sediment accumulation in the bed of the channel could result since operation of the reservoir will affect the magnitude and frequency of flows in the downstream channel but will not affect sediment supply from the watershed, tributary and channel sources below the dam. Watershed sediment yields would be reduced by implementation of best soil conservation management practices, reduction in the area under cultivation and re-establishment of riparian buffer areas along the channel margins where they have been cleared.

Along the Lake Ralph Hall Raw Water Pipeline Alignment the original characteristics of the surficial material, such as existing stratification, would be permanently altered by construction activities, which includes excavating soils to lay the pipeline into place. Construction activities would occur within the 100-ft ROW along the pipeline alignment.

Geologic Hazards

Even though Texas is a region low in seismicity, earthquakes of low magnitude, have occurred and will occur in northeast Texas. Earthquakes with epicenters within counties surrounding Fannin County where the Lake Ralph Hall project area is located are rare and small. A few earthquakes with magnitudes 3.0 to 4.2 have been recorded within the last 73 years within surrounding counties (University of Texas Institute for Geophysics, 2012).

The project area is located in a region with low landslide susceptibility due to the generally flat topography. Landslide hazards resulting from natural conditions are not expected to affect the Proposed Action. There are no known sinkholes within the project area.

Mineral Resources

There are no active oil or gas wells within proposed project area; however, there are several dry oil and gas test wells (Texas Railroad Commission, 2015). There are no active mines within the proposed project area. The Proposed Action would not affect the mineral resources of the area.

The construction of the Lake Ralph Hall Raw Water Pipeline Alignment would not affect any existing mineral resources along the pipeline route. However, this surface area along the Lake Ralph Hall Raw Water Pipeline Alignment would be precluded from any future surface mineral resource use establishment within the ROW. Oil and gas could potentially be produced in the pipeline alignment if directional drilling technology was employed.

Soils

Since several project elements (impoundment dam, State Highway [SH] 34 roadway embankment and fill required for the North Sulphur River downstream of the dam) would be constructed from local soils, impacts to soils would include excavation, transport, and compaction during construction of these elements. Borrow areas are to occur within the project area. The approximate amount of borrow for each element is 3.7 million cubic yards for the dam, 750,000 cubic yards for the SH 34 roadway embankment and 470,000 cubic yards for the North Sulphur River downstream of the dam. Other impacts within the proposed reservoir footprint would include inundation of the soils within the conservation pool and periodic flooding of the soils within the littoral zone. Tributaries and contributing watersheds above the reservoir are anticipated to experience some decrease in erosion rates due to lowering of channel gradients from the halting of the North Sulphur River channel degradation behind the dam due to inundation.

During construction of the Lake Ralph Hall Raw Water Pipeline Alignment at least 384 acres of existing soils would be disturbed. A sedimentation and erosion control plan would be prepared and implemented to mitigate potential impacts during construction, such as an increase in erosion.

Prime Farmland

Impacts to prime farmland would include inundation of approximately 1,168 acres of prime farmland and 1,131 acres of farmland of statewide importance within the conservation pool of the proposed reservoir. However, the Natural Resources Conservation Service (NRCS) considers Prime Farmland soils found in areas of proposed water supply reservoirs to be exempt from restrictions under the Farmland Protection Policy Act (FPPA). Impacts to prime farmland would be major.

The pipeline route would be maintained within a 100-ft ROW. This 384-acre area would be precluded from other uses, with the possible exception of certain non-structural uses such as

agriculture and rangeland. There may be a potential loss of prime farmlands if the pipeline is constructed in such areas.

Overall, impacts to geology and soils are expected to be moderate due to the amount of loss due to conversion to open water and the dam but buffered by the benefits of reduced erosion rates. Impacts associated with the proposed pipeline would be negligible. Impacts to prime farmland would be major.

4.4.2 Cumulative Effects

4.4.2.1 No Action Alternative

The No Action Alternative would not contribute to any changes relating to geology, geologic hazards, mineral resources or soils. Under the No Action Alternative, prime farmland would be converted as projected development occurs within Fannin County. However, as discussed in detail later in **Section 4.17.1** associated with the applicant's service areas, potential shortages of water under the No Action Alternative would likely involve changes in timing of development patterns and locations in members and customers areas of responsibilities that could influence growth which may have impacts to geology and soils. Landowners are expected to continue to develop upland stock tanks as well as undertake actions to limit and halt soil erosion within the assessment area through the development of on-channel ponds and drop structures. Development of more than 150 ponds occurred in or near the project study area between 2006 and 2017. This trend is expected to continue, although potentially at a lower rate, in areas downstream of the proposed project due to reduced but continued increases in channel gradient from ongoing erosion.

4.4.2.2 Proposed Action

The study area for assessing cumulative effects on geology and soils for the proposed action consists of Fannin County. Fannin County was selected as the area of effect for the cumulative impact analysis because as previously discussed, land use classifications are made at the county-level and the prime farmland impacts attributable to the project alternatives are located almost entirely within Fannin County. As discussed, the primary direct impact under geology and soils would be conversion of prime farmlands to development. The Proposed Action would directly impact approximately 1,168 acres of prime farmland and 1,131 acres of farmland of statewide importance within the conservation pool of the proposed reservoir. Reasonably foreseeable future actions include the LBCR and the growth of Fannin County. All of these actions would contribute to further conversion of prime farmlands to development. Landowners are expected to continue to develop upland stock tanks as well as undertake actions to limit and halt soil erosion within the assessment area through the development of on-channel ponds and drop structures. Development of more than 150 ponds occurred in or near the project study area between 2006 and 2017. This trend is expected to continue, although potentially at a lower rate, in areas downstream of the proposed project due to reduced but continued increases in channel gradient from ongoing erosion.

4.5 Groundwater

4.5.1 Environmental Consequences

4.5.1.1 No Action Alternative

The No Action Alternative could lead to substantial increases in groundwater usage in the UTRWD service area. The amount of groundwater available from the Trinity Aquifer to the counties within the UTRWD service area is 38,269 acre-feet per year (AF/YR) and groundwater available from the Woodbine Aquifer is 10,086 AF/YR (Texas Water Development Board [TWDB], 2015a). Even with an increase in groundwater use, future water supply needs would not be met. The 2010 water demand for the UTRWD service area counties (Fannin, Collin, Denton, Wise, and Cooke) is 443,521 AF/YR and the 2060 water demand is 1,061,089 AF/YR. Under the No Action Alternative there would likely be an increase in pumping of groundwater in the members and customers respective jurisdictions and/or other areas pursued for development, which could result in additional drawdowns in areas that are already stressed. This could result in reduced well production and even shortages, as well as decreased water quality as deeper and poorer quality of water is withdrawn. The need for additional water supplies is discussed in more detail in **Section 1.6**. Impacts to groundwater from the No Action Alternative could range from moderate to major.

4.5.1.2 Proposed Action

There are no significant groundwater sources in the immediate project area and no major or minor aquifer outcrops. No impacts to groundwater quantity or quality within the project area (including the dam, reservoir, and spillways) are expected. Water well records from near Ladonia and vicinity indicate the supply source for groundwater comes from the Trinity and Woodbine Aquifers. These are greater than 2,000 feet below ground surface and the interval between the surface and the shallowest aquifer (Woodbine) is comprised of geologic formations that act as aquicludes or aquitards. No impacts to groundwater are anticipated and the lake would not serve as a recharge for the Woodbine and Trinity aquifers. According to TWDB (2016) no known private wells used for domestic purposes are located within the proposed action area.

No groundwater impacts would be expected to occur as a result of construction of the pipeline or balancing reservoir. Impacts would be negligible.

4.5.2 Cumulative Effects

4.5.2.1 No Action Alternative

There will be no cumulative effects to groundwater resources associated with the No Action Alternative in the project area. However, any planned or ongoing development of groundwater

resources adjacent to UTRWD's Customers and Members service areas would continue and water users will put greater stress on those portions of the aquifers. The Trinity and Woodbine aquifers are the two predominant groundwater sources located within the project vicinity and within the UTRWD Service Area. A host of members and customers rely upon groundwater to some extent. Current groundwater use in a number of areas exceeds the projected long-term water supply availability. Supplies from other sources would be needed in these areas so groundwater use can be reduced to sustainable levels. Local drawdowns and quality concerns could be exacerbated if a substantial increase in groundwater demand occurs.

4.5.2.2 Proposed Action

The Proposed Action Alternative would provide a primary source for meeting a portion of future water supplies. The availability of this new water supply from Lake Ralph Hall could cause decreases in groundwater demand and usage in UTRWD service area counties. However, the past, present, and continued usage of the Trinity and Woodbine aquifers could result in contributions to effects on both groundwater hydrology and quality. The construction and operation of Lake Ralph Hall would cause no impacts to local groundwater within the Trinity and Woodbine aquifers.

The Proposed Action Alternative is located within the North-Central Texas Trinity and Woodbine Aquifers Priority Groundwater Management Area (PGMA). This PGMA includes the Red River and North Texas groundwater conservation districts. The construction and operation of Lake Ralph Hall would provide additional surface water supplies and would cause no impacts to groundwater within the PGMA or associated GCDs.

4.6 Surface Water

4.6.1 Environmental Consequences

4.6.1.1 No Action Alternative

Hydrology

Under the No Action Alternative, the North Sulphur River and some of its major and minor tributaries would continue to deepen and widen as a result of erosion. Erosion and channel degradation is exhibited along the North Sulphur River channel and throughout the watershed as a result of the channelization of significant portions of the North Sulphur River and several major tributaries, including reaches within the proposed reservoir project area. Impacts would be major.

Water Quality

The North Sulphur River from the confluence with the South Sulphur River in Lamar County to a point 6.7 km (4.2 miles) upstream of Farm to Market (FM) 68 in Fannin County was first listed as an impaired water body on the Texas Commission on Environmental Quality (TCEQ) 2006 303(d) list for an impaired fish community and an impaired macrobenthic community. The North Sulphur

River was still listed on the 2008 and 2010 303(d) list, but was not included in the 2012 list. The removal of the North Sulphur River from the 2012 list was due to a revision in standards in 2010. The 2014 303(d) list demonstrates that water quality within the North Sulphur River meets the required standards. Surface water quality would remain similar to the existing conditions under the No Action Alternative. Impacts would be minor.

Floodplains

With the current channelized condition of the North Sulphur River, the 100-year floodplain is contained within its channel and as a result, there is no valley flooding based on the 100-year event (UTRWD, 2004). The 100-year floodplains for the major tributaries to the North Sulphur River within the project area are also contained within their respective banks. Floodplains would remain similar to the existing conditions under the No Action Alternative. Impacts would be negligible.

Wetlands and Other Waters of the U.S.

Development of on channel stock ponds as well as actions taken to halt soil erosion and tributary degradation and headcuts (e.g., drop structures) within the assessment area is expected to continue to occur. As previously identified, development of more than 150 ponds occurred in or near the project study area between 2006 and 2017 and similar trends are expected to occur. Minor urbanization and population growth in Fannin County may contribute to losses of wetlands and waters of the U.S. in the project area. UTRWD service areas will continue to see changes to existing wetlands and other waters through an increase in agricultural land use or an increase in residential and/or commercial development. In addition, associated residential/commercial infrastructure including roads and bridges will impact wetlands and other waters of the U.S. A review of the U.S. Army Corps of Engineers (USACE) ORM Database identified more than twenty regulatory actions and reviews in the watershed that contribute to the proposed Lake Ralph Hall and the watershed below the dam site upstream of the confluence with the South Sulphur River. Historic actions have involved primarily pipeline installation which results in temporary impacts to waters of the U.S. Some road rehabilitation and improvement has occurred as well as minor gravel extraction. Impacts to waters of the U.S. historically have been minimal. In addition, non-regulated activities (i.e., exempt from the need of a permit) have also occurred in the assessment area relative to the construction of stock tanks which have impacted waters of the U.S. Future actions anticipated to occur in the assessment area are expected to be similar to historic actions except for potential development related to housing and growth that may occur with the reservoir. Such actions would require authorization from USACE in accordance with permit requirements. Impacts to waters of the U.S. exceeding 0.1 acres per activity would require mitigation (USACE, 2017a). Impacts would be major but would be reduced due to USACE permit and mitigation requirements for future projects.

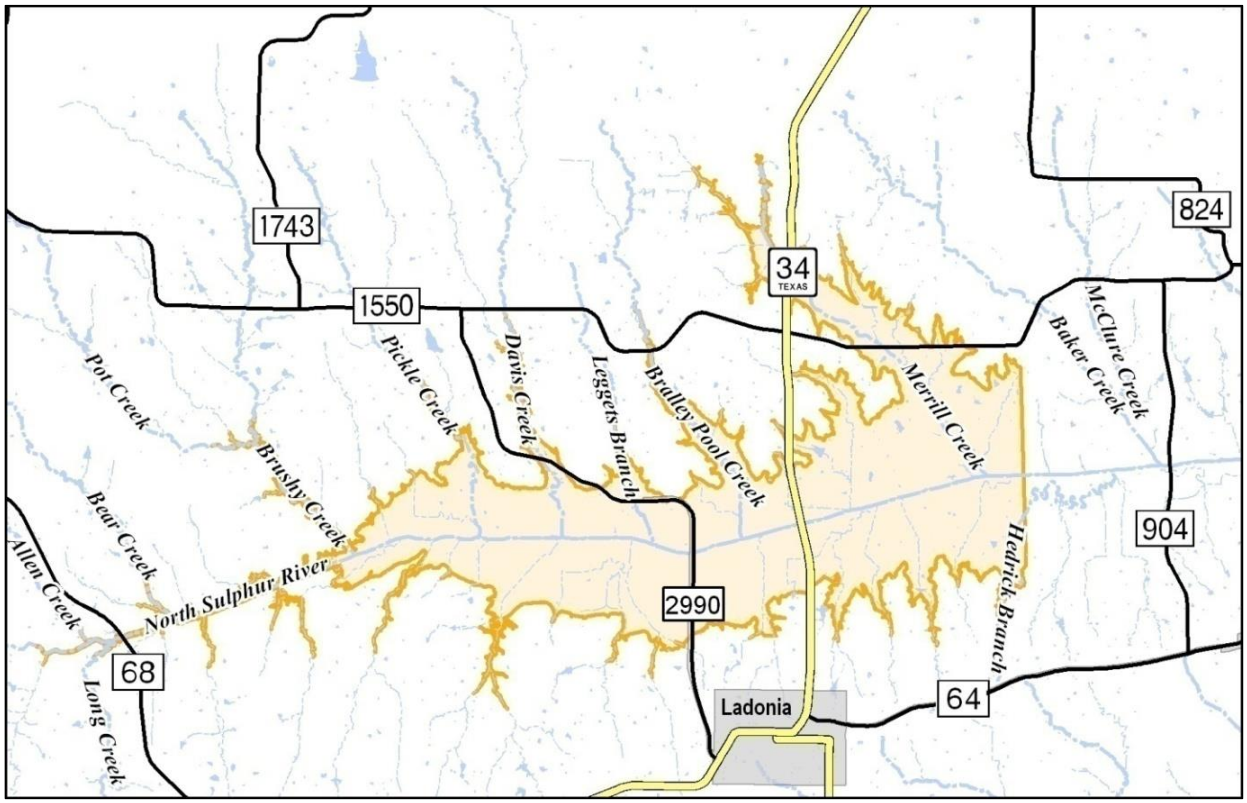
4.6.1.2 Proposed Action

Hydrology

Dam, Reservoir, and Principal and Emergency Spillways

Under the Proposed Action, the North Sulphur River and major tributaries would be affected by the construction and operation of the reservoir which include Allen Creek, Bear Creek, Pot Creek, Brushy Creek, Pickle Creek, Davis Creek, Leggets Branch, Bralley Pool Creek, Merrill Creek, Hedrick Branch, and Long Creek. See **Figure 4-2** for the surface water that would be affected by the Proposed Action.

Figure 4-2: Surface Water Affected by the Proposed Action



Source: National Hydrography Dataset

The drainage area from the U.S. Geological Survey (USGS) gage near Cooper, Texas (TX) (No. 07343000) on the North Sulphur River consists of 276 square miles **(Figure 4-3)**. This gage is approximately 20 river miles downstream of the proposed Lake Ralph Hall and the drainage area above the dam site only consists of approximately 100 square miles. The mean daily flow at this gage for the period from October 1950 through September 2001 is 261 cfs and the median flow was only 11 cfs indicating low flow during much of the time with periodic flood events. Data from this gage also indicate zero flow for 10 percent of the time and flow above 306 cfs approximately 10 percent of the time (UTRWD, 2004). Historical monthly flows show variable flows with periods of no flow and other periods indicating significant flood flows (UTRWD, 2004). During

rain events flows increase rapidly in the North Sulphur River Watershed but recede within a day or two to nearly no flow. Small pools and puddles typically form within the river channel (**Appendix D-2**).

Two different models were used to evaluate estimated flows below the proposed dam after construction of Lake Ralph Hall. The first is the State of Texas' Water Availability Model that uses the Water Rights Analysis Package modeling platform (WAM/WRAP) developed for the Sulphur River basin. The second is a RiverWare model developed by the USACE for a larger Red River Basin modeling effort (the Sulphur River is a tributary to the Red River).

The TCEQ has developed several hydrologic water availability models for different river basins throughout Texas. The Water Rights Analysis Package (WRAP) is the computer program or modeling platform. Each river basin's model has its own set of input files that describe the hydrology, water rights, demands and other features of the basin. These inputs files are referred to as the Water Availability Model (WAM).

The water availability models are used by the TCEQ to evaluate whether water will be available to a proposed use under various assumptions. The Sulphur River WAM model simulates the North Sulphur River, South Sulphur River, Sulphur River mainstem, White Oak Creek and the watershed above Wright Patman Lake. The simulation utilizes historical hydrology as flow inputs, but can be configured to include current demands, or can include full authorization of all water rights in the basin. The simulation allocates flow to the various water rights according to demand for water and priority of the water right. TCEQ uses information from the full authorization model run to evaluate the reliability of a proposed water right under future conditions with other conservative assumptions about return flows and water reuse. This model run is useful in determining the future reliability of a water right, but is not necessarily representative of how stream flows will be affected under current water uses.

The USACE developed a river network model for the Red River Basin using the RiverWare modeling platform. RiverWare is a modeling platform developed at the Center for Advanced Decision Support for Water and Environmental Systems (CADSWES), located at the University of Colorado, Boulder, and funded primarily by the United States Bureau of Reclamation, Tennessee Valley Authority and the USACE. RiverWare models are able to simulate complex river and reservoir networks. One of RiverWare's most useful features is its user-developed policy rules. These rules allow nearly unlimited flexibility to develop and simulate different operating policies and protocols.

The USACE Red River Basin RiverWare model includes the Sulphur River and North Sulphur River because these rivers are tributaries to Lake Wright Patman (a USACE reservoir), and ultimately, tributaries to the Red River. The model was developed to evaluate different operations for the USACE, including flood control in the Red River Basin. The model is a daily model that includes Lake Ralph Hall, but does not include any simulated diversions to Upper Trinity from the

reservoir and simply spills any water over an uncontrolled spillway when full. While RiverWare is capable of simulating water rights priority, the USACE model did not include this feature in its Red River model, and Lake Ralph Hall does not pass water to downstream senior water rights as currently configured in the RiverWare model.

This model was modified to include the Upper Trinity diversions at Lake Ralph Hall in order to produce a with-project RiverWare model. Also developed was a without-project model that disabled Lake Ralph Hall rather than keeping the uncontrolled spillway used in the USACE version. Using the modified RiverWare models, evaluation of the effects of the reservoir on the flows at the Cooper and Talco gages was accomplished. See **Appendix D-3** for the *Lake Ralph Hall RiverWare Modeling Memorandum*.

The RiverWare and WAM results provide the upper and lower ends of the range of flows expected below Lake Ralph Hall at specified locations along the North Sulphur River and Sulphur River (**Figure 4-3**). The RiverWare model tends to have less flow because no water is passed for downstream water rights. The WAM modeling tends to have higher flows because of its strict adherence to downstream water rights and other conservative modeling assumptions. When both models are used on a monthly basis as in UTRWD (2015), the actual impact based on the monthly flow analysis is between the impact predicted by WAM and by RiverWare. The most significant effects on the flow regime of the North Sulphur River occur immediately downstream of the proposed Lake Ralph Reservoir to Baker Creek (**Figure 4-3** and **Tables 4-1 and 4-2**).

Figure 4-3: WAM / RiverWare Flow Stations

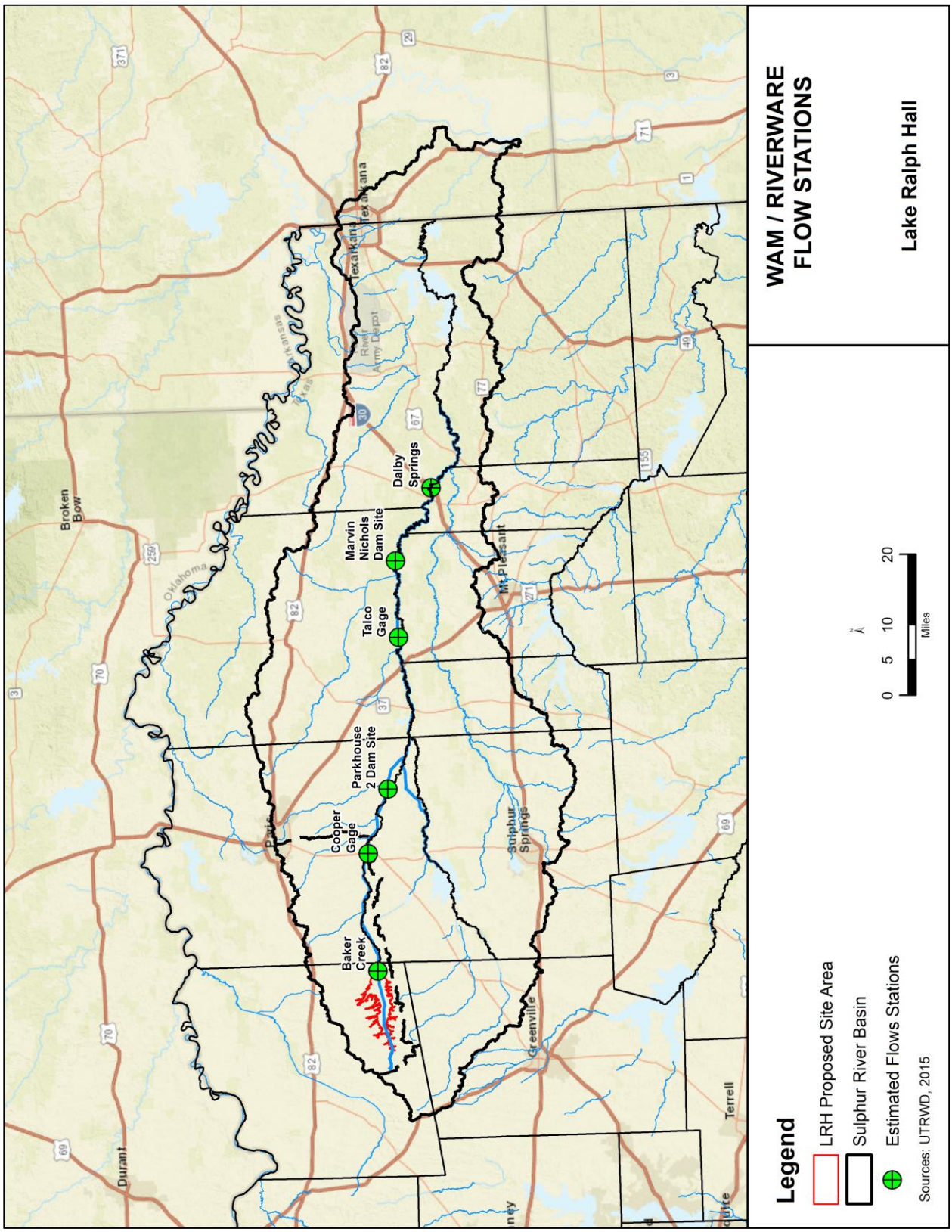


Table 4-1: Statistical Analysis of Flows from WAM with and Without Lake Ralph Hall (LRH) (AF/MO)

		Percentile				
		Minimum	**25-Percent**	**50-Percent**	**75-Percent**	**Maximum**
Flow at Baker Creek	With LRH	0	148	703	1,824	30,362
	Without LRH	0	226	1,953	7,529	71,901
Flow at Cooper Gage	With LRH	2	531	3,686	12,991	119,938
	Without LRH	2	560	4,819	18,597	177,515
Flow at Parkhouse 2 Dam Site	With LRH	3	1,057	9,206	29,924	211,279
	Without LRH	3	1,068	10,683	35,918	260,229
Flow at Talco Gage	With LRH	208	2,708	18,267	79,181	673,524
	Without LRH	208	2,907	20,578	87,441	722,475
Flow at Marvin Nichols Dam Site	With LRH	284	5,251	32,715	127,491	877,480
	Without LRH	284	5,462	33,876	132,052	925,058

Source: UTRWD, 2015.

Table 4-2: Statistical Analysis of Flows from RiverWare with and Without Lake Ralph Hall (AF/MO)

		Percentile				
		Minimum	**25-Percent**	**50-Percent**	**75-Percent**	**Maximum**
Flow at Baker Creek	With LRH	0	46	464	2,217	68,143
	Without LRH	0	283	2,748	10,144	78,816
Flow at Cooper Gage	With LRH	0	385	3,858	14,846	141,161
	Without LRH	0	637	6,103	22,106	175,146
Flow at Parkhouse 2 Dam Site	With LRH	1	985	8,023	28,116	208,524
	Without LRH	1	1,297	10,317	35,934	240,444
Flow at Talco Gage	With LRH	308	3,086	26,824	98,188	606,742
	Without LRH	308	3,486	29,881	106,032	654,534
Flow at Marvin Nichols Dam Site	With LRH	308	5,774	40,908	130,400	733,092
	Without LRH	308	6,486	41,964	140,059	770,216

Source: UTRWD, 2015.

The 2017 *Lake Ralph Hall Draft Operations Plan* (**Appendix K**) presents a strategy for operating the proposed Lake Ralph Hall in conjunction with UTRWD's other water resources to meet the water supply needs of its current and potential future members and customers (UTRWD, 2017a). The actual daily operations will vary and focus on maximizing the total quantity of water available from UTRWD's water resource portfolio, given the contractual and permit limits. Lake Ralph Hall would be constructed with an uncontrolled overflow spillway allowing the lake to capture and store inflows into the lake up to the conservation pool elevation. Once the lake reaches conservation pool elevation, inflows would "spill" uncontrolled over the spillway and flow into the North Sulphur River downstream of the dam. Lake Ralph Hall would have facilities that allow UTRWD to release inflows to the lake to fulfill "calls" from senior downstream water right holders. Consistent with Texas Water Law, UTRWD would pass inflows through these facilities when such calls are made. Consistent with Texas Water Law, no flows would be released from Lake Ralph Hall water stored prior to the call from senior water right holders. Lake Ralph Hall would have one or more diversion pump station(s) to divert water supply needs as follows:

- The total annual water supply diversions shall not exceed 45,000 AF.
- The total daily diversion shall include water supplied to Fannin County and water conveyed to UTRWD's water supply system.

- The actual quantity of water diverted to Fannin County from Lake Ralph Hall shall equal the needs of those portions of Fannin County that lie in the North Sulphur River Basin (less any supplies from other sources) up to the limits stated in the contract between UTRWD and the City of Ladonia.
- The actual quantity diverted from Lake Ralph Hall to the UTRWD water supply system shall be equal to the needs of the UTRWD system less any supplies from other sources.

Water diverted from Lake Ralph Hall would be used by UTRWD in the following priority:

- Raw water demands of those portions of Fannin County that lie in the North Sulphur River basin up to contract amounts.
- Raw water demands to supply the Tom Harpool Water Treatment Plant and/or to fill Tom Harpool Water Treatment Plant (WTP) raw water storage. The Tom Harpool WTP has a current capacity of 20 million gallons per day (mgd) with a future maximum capacity of 160 mgd.
- Diverted into the Trinity River Basin (Lewisville Lake) for UTRWD's use within the same day (no Lake Ralph Hall water will be stored in the Trinity River Basin on-channel water supply reservoirs) to supply the Taylor Plant or other water treatment plants operated by UTRWD.
- Diverted into the Trinity River Basin (Lewisville Lake) for UTRWD's use to satisfy the raw water demands of its members or customers on an interim or emergency basis as available.

Overdraw of Lake Ralph Hall may occur in a manner that maximizes the quantity of water available to enhance the available supply from the system. Potential situations when overdraft may occur include making up for the unavailability of another supply on a short-term basis, or withdrawing additional water from Lake Ralph Hall in a wetter than normal year when such increased withdrawals would enhance the yield of the system as a whole to meet demand.

Based on the WAM simulation period of 1940-1997, when the proposed Lake Ralph Hall is operated under firm annual yield conditions with a demand of 34,050 acre-feet/year the anticipated lake level ranges are:

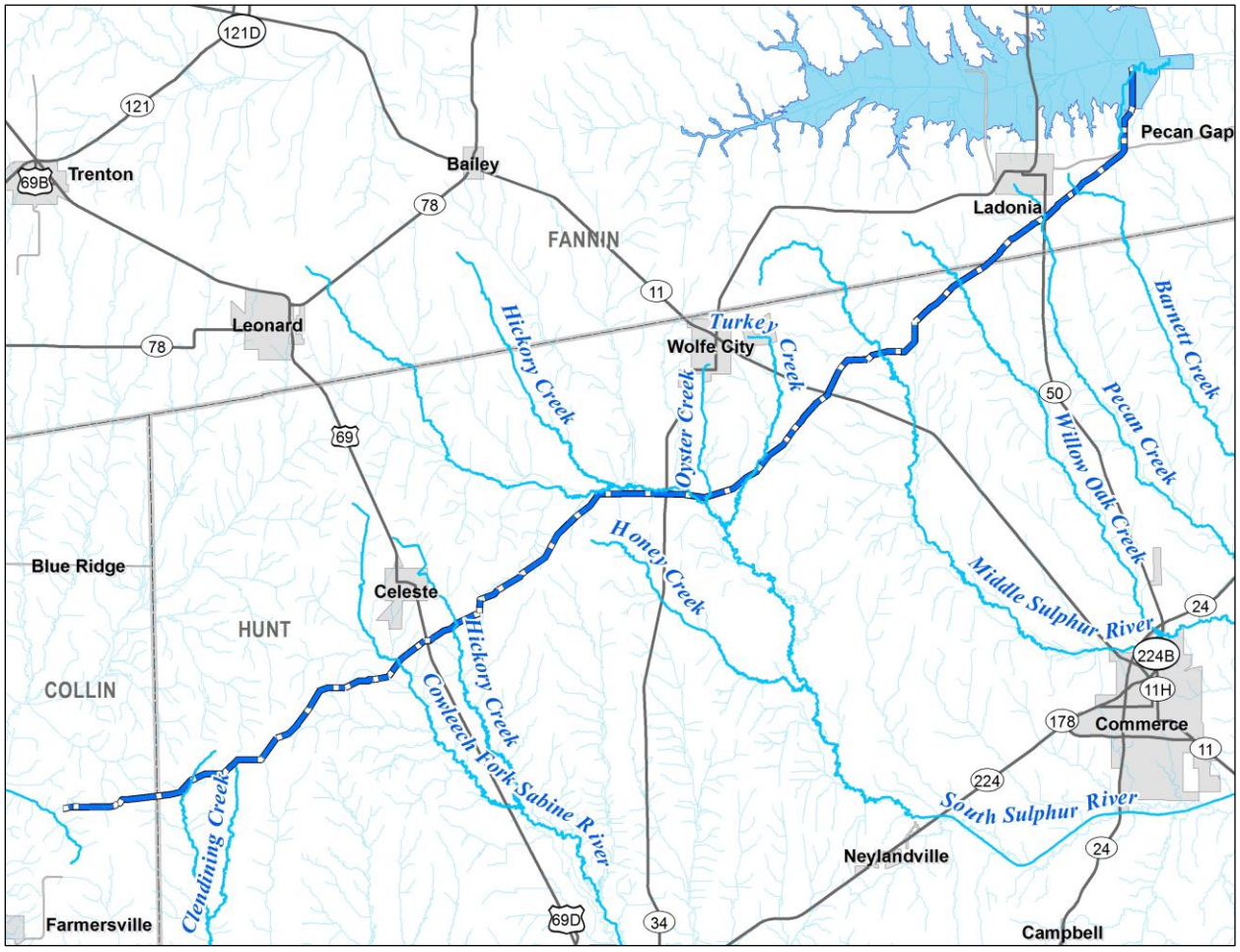
- At or above elevation 541' msl: 76.54 percent of the time
- At or above elevation 546' mls: 45.94 percent of the time
- At or above elevation 551' mls: 8.0 percent of the time

Pipeline

The Lake Ralph Hall Raw Water Pipeline Alignment crosses several intermittent streams which includes Willow Oak Creek, Middle Sulphur River, South Sulphur River, Cowleech Fork of the Sabine River, Barnett Creek, Clendining Creek, Hickory Creek, Honey Creek, Pecan Creek,

Turkey Creek, and West Caddo Creek (**Figure 4-4**). Temporary impacts to hydrology would be avoided by using horizontal directional drilling to install the pipeline at significant stream crossings and staging areas would be located within uplands. Once the pipeline is constructed, all pre-construction contours would be restored, exposed slopes and stream banks would be stabilized, and disturbed areas would be revegetated. Overall impacts from pipeline construction to hydrology would be negligible to minor.

Figure 4-4: Surface Water Affected by the Lake Ralph Hall Raw Water Pipeline Alignment



Source: UTRWD, 2010a

Balancing Reservoir

No impacts to hydrology are anticipated from the balancing reservoir.

Water Quality

Dam, Reservoir, and Principal and Emergency Spillways

According to the 2014 303(d) list, there are no impaired water bodies within the reservoir project area. However, as the construction of the proposed dam would involve excavation in and near streams, surface water quality may be temporarily impacted due to the potential for sedimentation and siltation. A Stormwater Pollution Prevention Plan (SWPPP) would be prepared and

implemented to protect against loss of soil due to erosion from the construction sites during rainfall events. Potential threats to water quality would be addressed and approved engineering and construction best management practices (BMPs) would be used to minimize erosion during construction.

The Environmental Protection Agency (EPA) (1983) provides median concentrations for various pollutants of concern for various land use categories including residential, mixed, commercial, and nonurban. Current and post-project pollutant loading and water quality conditions were assessed for the Lake Ralph Hall drainage area above the proposed dam. The NRCS Curve Number Method was used to calculate runoff from 1-year and 2-year storm events. In addition, average annual runoff was calculated using the Simple Method to Calculate Urban Stormwater Loads (Stormwater Manager's Resource Center, n.d.). Calculation methods are included in the *Lake Ralph Hall Water Resources Technical Report (***Appendix I***)*.

Pollutant loading at the proposed dam location was calculated and indicates lower pollutant concentrations at the proposed Lake Ralph Hall dam compared to existing conditions (**Table 4-3**). The reduction in pollutant concentrations is attributed to decrease of overland runoff area as a result of the construction of Lake Ralph Hall (Michael Baker International, 2017).

Table 4-3: Loading and Concentrations at Dam Site Post-Project

	Load (Pounds)			Concentration (mg/L)	
Pollutant	**1-Year Storm**	**2-Year Storm**	**Annual Rainfall**	**With LRH**	**Without LRH**
TSS*	1,533,567	1,909,624	6,041,414	118.37	133.50
Lead	657	818	2,589	0.05	0.06
Zinc	4,272	5,320	16,830	0.33	0.37
Kjeldahl Nitrogen	21,141	26,326	83,285	1.63	1.84
Nitrite / Nitrate	11,896	14,813	46,864	0.92	1.04
Total Phosphorus	2,651	3,301	10,443	0.20	0.23
Soluble Phosphorus	570	709	2,244	0.04	0.05

Source: Michael Baker International (2017)

*Total Suspended Solids (TSS)

Post-project estimated pollutant loads were calculated downstream of Lake Ralph Hall using similar methods described previously (Michael Baker International, 2017). The downstream site represents the furthest point downstream where simulated monthly flows from the WAM were modeled in UTRWD (2015) as mapped on **Figure 4-5**. In addition, estimated 50-percentile flows from the WAM model were used to calculate estimated pollutant concentrations (**Table 4-4**). Downstream site calculations indicate a slight increase in pollutant concentrations due to decreased flow as a result of Lake Ralph Hall. The WAM model calculated average monthly flows at the downstream site with and without Lake Ralph Hall. Flows at the downstream site without Lake Ralph Hall are estimated to be 33,876 AF/month while flows with Lake Ralph Hall decrease to 32,715 AF/month (UTRWD, 2015).

Figure 4-5: Pollutant Load Model Locations

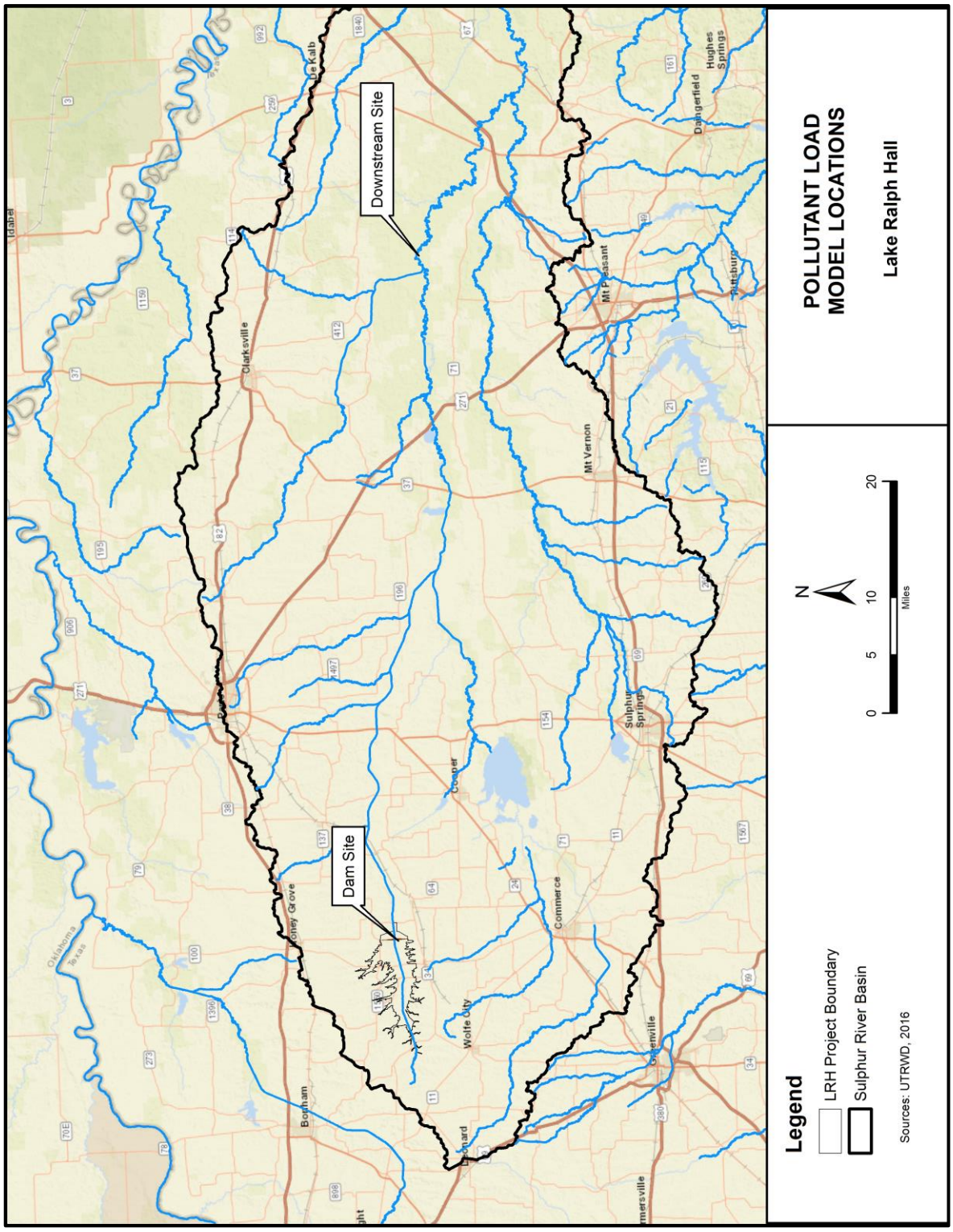


Table 4-4: Loading and Concentration at River Site Post-Project

	Load (Pounds)			Concentration (mg/L)	
Pollutant	**1-Year Storm**	**2-Year Storm**	**Annual Rainfall**	**With LRH**	**Without LRH**
TSS	24,131,018	30,450,258	110,317,189	103.34	100.49
Lead	10,342	13,050	47,279	0.04	0.04
Zinc	67,222	84,826	307,312	0.29	0.28
Kjeldahl Nitrogen	332,663	419,779	1,520,801	1.42	1.39
Nitrite / Nitrate	187,188	236,207	855,746	0.80	0.78
Total Phosphorus	41,712	52,635	190,691	0.18	0.17
Soluble Phosphorus	8,963	11,310	40,975	0.04	0.04

Pipeline

The Lake Ralph Hall Raw Water Pipeline Alignment crosses the South Sulphur River which is an impaired water body under the 2014 303(d) list. It was first listed in 2008 for high pH levels under category 5b which means a review of the water quality standards for this water body would be conducted before a Total Maximum Daily Load (TMDL) is scheduled. A high pH level means that there is an increase in the amount of hydroxide ions (OH-) and the water is becoming more alkaline. The further these levels rise, the more alkaline the water becomes. As the pH rises it increases the toxicity of chemicals such as ammonia. Changes in pH level in the water can prove harmful or even fatal to fish and other aquatic organisms. Pipeline installation, either if directionally placed or trenched and backfilled, is not anticipated to contribute to this condition.

Negligible impacts to water quality are anticipated from the construction of the pipeline. A SWPPP would be required to protect against loss of soil due to erosion from the construction sites during rainfall events. Potential threats to water quality would be addressed and approved engineering and construction BMPs would be used to minimize erosion during construction.

Balancing Reservoir

Negligible impacts to water quality are anticipated from the construction of the balancing reservoir. A SWPPP would be required to protect against loss of soil due to erosion from the construction sites during rainfall events. Potential threats to water quality would be addressed and approved engineering and construction BMPs would be used to minimize erosion during construction.

Floodplains

Dam, Reservoir, and Principal and Emergency Spillways

The erosional effects that were brought about by the channelizing of the North Sulphur River in the 1920's have brought about major changes to the floodplain. Currently the hydraulic analysis of the reach within the river that is to be inundated by the project demonstrates that the 100-year flood is wholly contained within the channel (UTRWD, 2004). The same is true of the tributaries within those reaches that lie within the project boundaries. The tributary channels within the area affected by impoundment all can carry the 100-year flood within their channels. Thus existing

areas alongside the river and tributaries are remnant floodplains and serve no function as floodplains in the present dynamic river environment. Therefore, no loss of existing floodplain function would occur since there is no overbank storage or filtration of floodwaters in the present setting. However, the proposed impoundment would restore some floodplain function to the headwaters of the North Sulphur River and tributaries above the proposed conservation pool elevation.

The remnant floodplains have been used to support livestock. Swales and oxbow-like features exist as remnants of the pre-channelized trace of the North Sulphur River. Woody vegetation (i.e., trees and shrubs) exist in isolated, non-contiguous areas along the banks of the North Sulphur River and tributary channels. These features would be submerged once inundation occurs.

Therefore; minor impacts would occur from restoration of some floodplain function and from inundation of remnant floodplains.

Pipeline

The Lake Ralph Hall Raw Water Pipeline Alignment would be designed so that it would not increase the base flood elevations of any floodplains that the pipeline may cross. This alignment crosses several streams and their associated floodplains, including Pecan Creek, Willow Oak Creek, Sulphur River, Turkey Creek, South Sulphur River, Oyster Creek, Hickory Creek, Sabine River Cowleech Fork, and West Caddo Creek. Ground elevations would return to pre-construction elevations once construction of the Lake Ralph Hall Raw Water Pipeline Alignment is complete. Therefore, impacts from the pipeline would be negligible.

Balancing Reservoir

The proposed balancing reservoir is not located in a floodplain; therefore, no impacts to floodplains from the balancing reservoir are anticipated.

Wetlands and Other Waters of the U.S.

Dam, Reservoir, and Principal and Emergency Spillways

The applicant conducted on-site investigations during August 2005, September 2005, and June 2017 for the proposed project to identify potential jurisdictional waters of the U.S. and adjacent wetlands (**Appendix E-1, Appendix E-2, and Appendix E-3**). The jurisdictional determination was approved July 27, 2017 (**Appendix E-4**). Based on these investigations, the proposed reservoir project site would result in impacts including fill (dam embankment) and inundation of 445,488 lineal feet of ephemeral stream channel, 55,570 lineal feet of intermittent stream channel, and approximately 56.19 acres of on-channel impoundments (33 in number). Impacts to aquatic resources were quantified into a currency (functional capacity units) using the Stream Watershed Assessment and Measurement Protocol Interaction Model (SWAMPIM). A functional assessment approach was desired to propose compensatory mitigation that replaces aquatic ecosystem functions lost or impaired as a result of the USACE authorized activity. Based on the SWAMPIM protocol, these impacts equate to 381 Functional Capacity Units (FCU) of ephemeral streams, 49

FCU of intermittent streams, and a Resource Capacity of 28.6 for on-channel impoundments (UTRWD, 2018a). Approximately 325.11 acres of stream channel would be excavated, inundated, or filled within the conservation pool, embankment/dam, and spillway area. Flows from ephemeral and intermittent streams inundated from the construction of the reservoir would be converted from flowing (lotic) to a still (lentic) state. Eroding streams inundated from construction of the project would likely experience sedimentation and siltation as described in **Section 4.3.1.2**. The limited aquatic habitat in the North Sulphur River would be converted to a more stable lacustrine environment as described in **Section 4.11.1.2**.

The on-site investigations also determined approximately 10 acres of lacustrine fringe wetlands are located within the 13,000+ acre assessment area (UTRWD, 2017d). A total of eight acres of lacustrine fringe wetlands would be impacted within the conservation pool, embankment, and spillway area. According to UTRWD (2018a), the substantial increase in shallow lake edge along the shoreline of the proposed Lake Ralph Hall is anticipated to develop substantially more than eight acres of lacustrine fringe wetland area.

Approximately 3.8 acres of isolated forested wetlands were identified within the assessment area. However, these wetlands do not contribute to the chemical, physical, and biological integrity of waters of the U.S. Consequently, the wetlands identified within the 13,094-acre assessment area, aside from those associated with on-channel lacustrine fringe wetlands, should be considered "isolated" and not subject to Section 404 of the Clean Water Act.

The Sulphur River immediately downstream of the confluence between the North Sulphur River and South Sulphur River is not as channelized as the upper portions of the North Sulphur River. The lower portion of the North Sulphur River contains riparian habitats and meandering channels typical of riverine systems. Detailed hydrology for floodplain resources at downstream locations was evaluated using a USACE HEC-RAS model for the Sulphur River Basin (DiNatale Water Consultant, 2016a). **Appendix D-1** provides a copy of the *Evaluation of Hydrologic Modeling in Support of the Lake Ralph Hall EIS.* Historical gaged flows from the Cooper Gage, Talco Gage, and Dalby Springs Gage were used in the analysis (**Figure 4-3**). Flows were adjusted to assume Lake Ralph Hall stored the entire inflow to the lake during various flow events to determine the river stage decline due to Lake Ralph Hall (DiNatale Water Consultant, 2016a). This conservative approach assumes maximum impact at Lake Ralph Hall. Four separate rainfall events were selected to evaluate Lake Ralph Hall's impacts to floodplain resources. The events were chosen based on frequency of the flow event, with the lowest flow expected to occur several times per year, the next highest flow expected to occur about once a year, the next highest expected once every few years, and the highest flow event expected to occur about once every 20 years. **Table 4-5** shows the events, the gaged peak daily flow, the total flow volume of the event and the adjustments made for the without Lake Ralph Hall scenario. **Table 4-6** shows the changes in river stage at the peak daily flow rates. The results indicate minor differences between the scenarios with and without the Lake Ralph Hall project due to the increasing contributing drainage area and

flow to the river further downstream of the site. The analysis showed the impacts to floodplain resources due to Lake Ralph Hall are negligible downstream of the channelized portion of the river.

Table 4-5: Rain Events Used to Evaluate Floodplain Resources Impacts of Lake Ralph Hall

Date	Frequency	Without Lake Ralph Hall Flow (AF)			With Lake Ralph Hall Flow (AF)		
		Cooper	Talco	Dalby Springs	Cooper	Talco	Dalby Springs
January 8, 2012	Several Times per Year	5,109	17,302	26,452	3,406	15,599	24,748
December 23, 2009	Few Times per Year	10,850	72,774	109,864	7,233	69,157	106,248
March 19, 2012	Once Every Few Years	56,450	186,684	242,162	37,633	167,868	223,345
November 27, 2015	Once Every 20 Years	140,945	294,803	585,183	93,964	247,821	538,202

Table 4-6: Water Surface Elevation (Feet) With and Without Lake Ralph Hall

Date	Frequency	Without Lake Ralph Hall Elevation (Feet)			With Lake Ralph Hall Elevation (Feet)		
		Cooper	Talco	Dalby Springs	Cooper	Talco	Dalby Springs
January 8, 2012	Several Times per Year	376.84	294.16	244.50	376.22	293.98	244.30
December 23, 2009	Few Times per Year	381.97	301.14	253.98	379.78	301.02	253.88
March 19, 2012	Once Every Few Years	396.56	303.76	257.00	392.26	303.64	256.89
November 27, 2015	Once Every 20 Years	401.18	305.20	259.45	398.78	305.04	259.33

Necessary measures and BMPs would be incorporated into the engineering design and construction to minimize impacts to water of the U.S. associated with fill activities. Impacts to occur to surface water from the proposed reservoir are considered to be major.

Pipeline

The Lake Ralph Hall Raw Water Pipeline Alignment has 59 stream crossings with 11,893 linear feet of stream impacts and 0.4 acres of stock tanks potentially impacted within the 100-ft ROW. As previously described, installation will include open trenching and backfilling as well as

directional installation techniques. Necessary measures and BMPs would be incorporated into the engineering design and construction to minimize impacts to waters of the U.S. associated with construction activities. Impacts are considered to be negligible to minor.

Balancing Reservoir
No impacts to wetlands and other waters of the U.S. are anticipate from the balancing reservoir.

4.6.2 Cumulative Effects

4.6.2.1 No Action Alternative

The No Action Alternative would not contribute to cumulative impacts on surface water. Under the No Action Alternative, the North Sulphur River and its major and minor tributaries would continue to deepen and widen as a result of erosion. Some losses are anticipated from continued actions by landowners to halt these processes through pond and drop structure construction. The LBCR would impact 5,874 acres of wetlands, which would require mitigation in accordance with USACE requirements and the LBCR Revised Mitigation Plan (USACE 2017c).

4.6.2.2 Proposed Action

Nonpoint source pollution includes agricultural lands and timber production via logging. Agricultural land within the North Sulphur River Watershed totaled 165,000 acres or 52 percent of the Watershed. Agricultural land use can result in soil erosion and runoff and can contribute to an increase in suspended sediments and chemicals from fertilizers containing nitrogen and phosphorus, as well as pesticides, in nearby water resources. Moderate relative contributions to surface-water quality are expected to be associated with runoff from agricultural lands. However, BMPs are being implemented for controlling agricultural runoff and impacts to these resources are declining.

Logging operations cause a decrease in vegetation; an increase in soil erosion, which results in an increase in suspended sediments in surface water; and an increase in runoff from the areas that have been logged. The amount of forest land within the North Sulphur Watershed is relatively low and timber production via logging operations is identified as having a low relative contribution to cumulative effects on water quality. Also, with the implementation of various BMPs for controlling runoff, related impacts to water quality are declining.

Past and present development of cities and roadways within the project watershed have caused some flow changes in surface water resources and potential declines in downstream water quality. These impacts are local and the development of urban areas and roadways has had a low relative contribution to cumulative effects on these resources in the North Sulphur River Watershed. The proposed Lake Ralph Hall reservoir project would require the relocation and/or abandonment of state and county roads and the reconstruction of the SH 34 bridge. There are currently no

significant projects on the Statewide Transportation Improvement Program (STIP) within the North Sulphur River Watershed. Therefore, the construction of the bridge for SH 34 and relocating other roads would have a low relative contribution to cumulative effects on local surface water hydrology and water quality.

The proposed Lake Ralph Hall will have approximately 110 miles of shoreline. Any shoreline development that may occur around the proposed Lake is likely to have a minimal contribution to declines in water quality. Lake view developments within the contributing watershed are also expected to be minimal. Regulations regarding water quality, including erosion control, septic tank restrictions, and nonpoint source pollution on and surrounding the proposed Lake Ralph Hall, would need to be developed and enforced at the local level to minimize potential adverse effects. Similar requirements for recreational and commercial activities would facilitate the mitigation of cumulative effects on water quality.

Floodplains

Currently the 100-year flood is wholly contained within the North Sulphur River and associated tributaries. Therefore, no cumulative loss of existing floodplain function would occur since there is no overbank storage or filtration of floodwaters in the present setting.

Wetlands and Waters of the U.S.

Past, present, and reasonably foreseeable actions anticipated to cumulatively impact the study area's waters and wetlands include the North Sulphur River channelization, other reservoir and pipeline projects, climate change, and the growth of Fannin County. The LBCR would impact 5,874 acres of wetlands, which would require mitigation in accordance with USACE requirements and the LBCR Revised Mitigation Plan (USACE 2017c). Historic losses of wetlands and other waters have included more than twenty regulatory actions and reviews in the watershed that contribute to the proposed Lake Ralph Hall and the watershed below the dam site upstream of the confluence with the South Sulphur River (USACE, 2017a). Similar losses are anticipated in the future but most with required compensatory mitigation as is required under USACE's Regulatory program. Under the Proposed Action with mitigation, little or no contribution to cumulative adverse impacts on waters and wetlands is anticipated.

4.7 Air Quality

4.7.1 Environmental Consequences

4.7.1.1 No Action Alternative

Under the No Action Alternative it is not anticipated that there would be substantial changes in air quality within the immediate Lake Ralph Hall study area. There could be a slight decrease in air quality within the region due to minor projected population growth and associated development and land use changes.

4.7.1.2 Proposed Action

Dam, Reservoir, and Principal and Emergency Spillways

During the construction phase of the project, temporary impacts to air quality would increase due to local fugitive dust levels and diesel powered heavy construction equipment. The principal source of fugitive dust would include land clearing, earth moving, scraping, hauling, and materials storage and handling; truck loading operations; and wind erosion from stockpiles. At the same time vehicle exhaust emissions would be generated; however, such emissions would be small in comparison to fugitive emissions from construction and operation activity. Although some air quality impacts inevitably would occur during construction, they would be transitory and limited in duration.

Once the project is complete air quality should return to its current conditions. The lake could be used to support water-based recreation. To the extent that visitation to the area is increased and boats are operated for fishing and other recreation, there would be a corresponding increase in emissions.

Construction of the bridge for SH 34 and relocating other roads would produce increased fugitive dust emissions. During the construction of the pipeline alignment, temporary air quality impacts could occur. Air quality impacts can originate from site preparation, diesel powered heavy construction equipment; and vehicle exhaust emission. If the bridge, relocation of the roads, pipeline alignment, and Lake Ralph Hall were all constructed simultaneously this could have a short-term cumulative effect with the increased emissions. It is unlikely that all of these projects would be constructed simultaneously. BMPs would be implemented to minimize any impacts to air quality. These air quality impacts would be transitory and temporary and once the projects are complete air quality should return to its current conditions. Overall, air quality impacts are considered to be minor.

Pipeline

The pipeline crosses Fannin, Hunt, and Collin Counties. As discussed in **Section 3.7**, both Fannin and Hunt counties are in attainment of all National Ambient Air Quality Standards (NAAQS) as of December 2016. Regionally, the Dallas Fort Worth area (Collin, Dallas, Denton, Tarrant, Ellis, Johnson, Kaufman, Parker, Rockwall, and Wise counties) is classified as moderate ozone nonattainment areas for 8-hour NAAQS and must be in attainment by July 20, 2018 as required by the EPA. In addition, a lead nonattainment area is located within a portion of Collin County.

BMPs would be implemented to minimize any affects to air quality. Temporary air quality impacts would occur during the construction of the Lake Ralph Hall Raw Water Pipeline Alignment. Once construction is complete air quality should return to its current condition. Construction activities can have a short-term impact on local air quality during periods of site preparation, the use of diesel powered heavy construction equipment; and vehicle exhaust emission, with particulate matter from fugitive dust having the greatest impact. This impact may occur in association with

excavation and earth moving, heavy equipment operation, and wind erosion of exposed areas. The effect of fugitive dust would be temporary and would vary in scale depending on local weather conditions, the degree of construction activity, and the nature of the construction activity.

Balancing Reservoir

Negligible impacts to air quality are anticipated from construction of the balancing reservoir due to the limited duration and size.

4.7.2 Cumulative Effects

4.7.2.1 No Action Alternative

The No Action Alternative would not directly contribute to any cumulative impacts on air quality in the region. Development of groundwater may involve temporary construction activities in members and customers jurisdictions for development of wells and pipeline installation. As the Dallas – Fort Worth Metroplex expands into Fannin County over the next 50 years, the increase in the number of vehicles and vehicle-miles-traveled will increase emissions of criteria air pollutants, which would tend to degrade air quality within the county. However, continuing improvements in fuel efficiency standards and ever more stringent tailpipe emissions requirements would likely offset or even slightly reverse this trend. Overall, while there would likely be adverse effects on air quality, that is, lower average air quality in the future, the effects would likely not be significant, and the area is likely to stay in attainment for all criteria air pollutants.

4.7.2.2 Proposed Action

A review of the past and present actions that could impact air quality did not reveal any substantial contributing actions to cumulative effects. There are currently no significant projects on the STIP within the North Sulphur River Watershed.

Reasonably foreseeable future actions include the LBCR, the growth of Fannin County, and growth of the Dallas-Fort Worth Metroplex. Lake Ralph Hall would require an estimated 290 workers per year to complete, bringing additional traffic to the area from within Fannin County, as well as adjacent counties. According to the FEIS, the LBCR would contribute to short-term, slight adverse impacts on air quality during the construction phase, from the use of heavy construction equipment, deliveries to the site, fugitive dust, and burning of cleared vegetation material from the reservoir footprint. Based on current proposed construction schedules, the construction phases of Lake Ralph Hall and the LBCR would overlap for four years. The LBCR FEIS indicates that local economic construction impacts would include 5,000 jobs, with some workers commuting from Collin, Delta, Lamar, Grayson, and Hunt Counties. The two projects combined would cause an additive, short-term moderate effect on air quality within Fannin County relating to increased traffic.

Additional minor air quality impacts could occur from commuting by recreational visitors during the operational phase to both Lake Ralph Hall and the LBCR.

The main contributor to cumulative impacts on air quality in the region would be the growth of the Dallas-Fort Worth Metroplex and associated increase in vehicular traffic and other emissions sources. However, at the same time, ongoing improvements in air pollution control technology with regard to vehicular emissions could offset or even slightly reverse this trend, in spite of the increasing number of pollutant sources.

Once Lake Ralph Hall is operational it is reasonable to project that boat traffic would be allowed on the lake, although no formal plan has been proposed. Associated vehicular traffic would increase in and near the project footprint, some limited shoreline development may occur for access and a boat ramp, and other nearby developments for properties near the lake are expected to occur. There would be a corresponding increase in emissions to the extent that visitation to the area is increased and boats are operated for fishing and other recreation and developments. However, effects on air quality would be anticipated to be negligible to minor due to the small size of these additional sources, balanced by the elimination of existing sources of air emissions within the footprint such as agricultural operations and burning.

4.8 Noise

4.8.1 Environmental Consequences

4.8.1.1 No Action Alternative

Under the No Action Alternative there would be a slight increase in ambient noise levels caused by the projected population growth and associated development and land use changes.

4.8.1.2 Proposed Action

During the construction phase heavy equipment on the site would include dump trucks, scrapers, dozers, loaders, backhoes, and other heavy construction equipment. Typically these are rated about 85 dbA at 50 feet. A level of 45 to 50 dbA at 50-feet is considered suitable for residential areas. Noise attenuates with distance, although it is affected by other influences, such as wind. Typically noise attenuates about six dbA for each doubling of distance from the source (in the case of point sources). Therefore, for construction noise on the dam embankment to be tolerable it should be at least 1,600 feet from noise sensitive receptors. The city of Ladonia is closest to the dam site and is greater than 1,600 feet away; therefore, no noise impacts are anticipated for Ladonia residents. Single residences exist at each end of the dam embankment. Those residents would be subjected to noise levels in the 55-dbA range, which is tolerable for day time activity, but may be of bother at night if night time operations are conducted.

Once the reservoir is completed any allowed boat traffic on the lake would generate noise that does not currently exist. Currently in Texas boat mufflers are required, but there are not any standards for noise levels from motor boats. However, local authorities such as lake operators, cities, or counties can set noise regulations. There would be a corresponding increase in noise levels to the extent that visitation to the area is increased and boats are operated for fishing and other recreation.

Construction of the bridge for SH 34 and improvement of portions of County Road (CR) 3444 would also generate construction noise. There are currently four noise receptors identified (not located on property acquired by UTRWD or in the inundation area) that are closer than 1,600 feet to the proposed road construction and would be subjected to noise from the construction of the bridge and roadways. Noise produced from these activities would result from operating heavy construction and earth-moving equipment, including trucks, cranes, dozers, scrapers, backhoes, and concrete mixers. Noise would remain similar to existing conditions after the completion of the proposed SH 34 bridge.

An increase in noise levels would be expected over the length of the pipeline in the areas where construction is occurring. Once construction is completed, noise levels would return to existing conditions. Impacts associated with the project are considered to be minor.

An increase in noise levels would be expected during the construction of the balancing reservoir. There are no sensitive receivers under 1,000 feet from the balancing reservoir; therefore, noise impacts would be negligible.

4.8.2 Cumulative Effects

4.8.2.1 No Action Alternative

The No Action Alternative would not contribute to the expected cumulative increase in future ambient noise levels in Fannin County. Temporary short-term effects could occur associated with well construction and pipeline installation in Member and Customer locales.

4.8.2.2 Proposed Action

The cumulative study area for noise consists of the proposed project area and adjacent area that would be affected by noise generated from the proposed project. Existing noise levels in the project area are typical of rural areas and locations near rural highways. During the construction phase for the Proposed Action noise levels would be typical of construction sites.

Reasonably foreseeable future actions include the growth of Fannin County. Fannin County and the study area will become somewhat of a noisier place in the future primarily as a result of projected growth and development and the associated increased presence and use of noise-generating machinery, from autos and light trucks to air conditioners, lawn mowers, and

generators. Overall, the project is expected to contribute to cumulative noise conditions to a negligible degree.

4.9 Recreation

4.9.1 Environmental Consequences

4.9.1.1 No Action Alternative

The No Action Alternative would not include construction activities in or adjacent to the North Sulphur River or convert land from the Caddo National Grasslands and therefore would not cause any impacts to recreation in the area. Any groundwater development is expected to have no effect.

4.9.1.2 Proposed Action

The proposed Lake Ralph project is intended to provide a water supply for the UTRWD service area. The reservoir has the potential to provide a benefit as a recreational resource for the area. However, no development plans or specific use of the proposed project for recreational purposes have been identified. Therefore, no casual recreational benefits have been identified associated with the reservoir, although such development is likely to occur independently and is therefore addressed in the cumulative section below and in the cumulative socioeconomic section. Additionally, no conflicts of use relative to reservoir levels and operations are anticipated.

As discussed in **Section 4.2.1**, 300 acres of Federal land, currently administered by the U.S. Forest Service, would be acquired by the applicant and converted to open water as a result of the proposed project. Recreation within this portion of the grasslands is limited to hunting as there are no lakes or trails. UTRWD is undertaking efforts and coordinating with the Caddo National Grassland relative to mitigation in the form of a land exchange. Lands to be offered to the Caddo National Grasslands by UTRWD are not identified at this time and will be addressed in the USFS separate NEPA analysis concerning that action. Project impacts would be major, but would be reduced through the compensatory acreage. USFS has indicated that the Caddo National Grasslands in the vicinity of the project are likely to experience increased use and impacts as recreational use and residential development occurs in the future on lands in proximity to the project area and may result in an increased administrative burden to provide for and manage recreational use and to effectively administer the boundary between private and public lands.

Under the Proposed Action paleontological resources in the inundation footprint would no longer be accessible following completion of the proposed project. During construction a paleontologist would be available to identify and manage potentially significant fossil finds. The Ladonia Fossil Park (aka Pete Patterson Fossil Park) would no longer be accessible for fossil hunters. UTRWD anticipates mitigating the impact to the existing Pete Patterson Fossil Park by providing a similar park near the intersection of FM 904 and the North Sulphur River. The relocated park is

anticipated to be comprised of a gravel parking area, signage, a covered pavilion and a path accessing the North Sulphur River Channel. The access to the North Sulphur River Channel is anticipated to be provided by a series of steps leading from the upper bank of the channel to the channel bottom.

No changes in recreational opportunities would be associated with the pipeline footprint or the balancing reservoir.

4.9.2 Cumulative Effects

4.9.2.1 No Action Alternative

The No Action Alternative would not change existing recreational opportunities and therefore would not contribute to cumulative impacts to recreation.

4.9.2.2 Proposed Action

Cumulative effects include the effects of the Proposed Action, other reservoirs in the county as well as changes at Caddo National Grasslands and Bonham State Park. Other reasonably foreseeable future actions include the LBCR, the growth of Fannin County, and growth of the Dallas-Fort Worth Metroplex.

Even though no specific recreational plan has been developed, it is reasonable to foresee and project that recreational features will be developed at the reservoir for such use, especially since UTRWD has not precluded development or recreational use of the lake. The physical characteristics of the proposed reservoir would influence recreational use and development of the lake. At about 7,000 surface acres, Lake Ralph Hall is relatively small, as compared to other area lakes, which may limit boating activity somewhat. At its deepest point, Lake Ralph Hall would be slightly more than 90 feet deep which could allow for the development of a recreational fishery. As discussed in the socioeconomics section, lake levels are likely to vary, but within ranges and at frequencies similar to other recreational lakes in Texas. Other characteristics that would impact development and use, such as water clarity, are not known at this time. While assumptions have been made relative to development features for future recreational use of the lake including the construction of a ramp, dock and support parking area that would allow regular access, no assumptions have been made about the locations of these facilities, other than potential locations for park roads which are shown in **Section 4.13**. Details about projected number of visitors associated with such assumptions and the economic aspects of recreation are included in **Section 4.17.1.2**.

Long-term cumulative impacts of these recreational features and reservoir use would likely occur because of the project and the LBCR operating in relatively close proximity, with both providing similar recreational opportunities such as fishing and boating. No predictions whether they are

likely to compete with or complement one another have been made. In general, even if the two lakes compete with each other for recreational users at first, subsequent increases in demand for lake-based outdoor recreation that occurs as population in the region grows over time could eventually reduce or eliminate competition. At some point, the proximity of the two facilities could become advantageous as a draw to visitors particularly given their proximity to the Dallas-Fort Worth Metroplex.

While the county's fishing and boating and other water recreation-related opportunities would be increased by the presence of two new lakes, it is likely that hunting opportunities in Fannin County would decrease, because hunting is not generally compatible with higher human population densities due to safety concerns, and possibly, less game. Overall cumulative impacts from the project to recreation are considered to be beneficial to a moderate to major degree.

4.10 Visual Resources

Analysis of visual resources included consideration of the degree of contrast between existing and new elements in the landscape. In this method, used by the Bureau of Land Management (BLM), there are four degrees of visual contrast:

- **None:** The element contrast is not visible or perceived.
- **Weak:** The element contrast can be seen but does not attract attention.
- **Moderate:** The element contrast begins to attract attention and begins to dominate the characteristic landscape.
- **Strong:** The element contrast demands attention, will not be overlooked, and is dominant in the landscape.

In addition, the BLM method considers the following items:

- **Form:** The mass or shape of an object or of objects which appear unified.
- **Line:** The path that the eye follows when perceiving abrupt differences in form, color, or texture.
- **Color:** The property of reflecting light of a particular intensity and wavelength to which the eye is sensitive.
- **Texture:** The aggregation of small forms or color mixtures into a continuous surface pattern.

4.10.1 Environmental Consequences

4.10.1.1 No Action Alternative

Under the No Action Alternative, the reservoir and dam would not be constructed. Therefore, the visual environment at the proposed site would remain unchanged, at least in the short term. The No Action Alternative would have no immediate impacts to visual resources. Over the long term, it is difficult to predict how land use changes may incrementally and cumulatively affect visual resources in the region. However, if the population in the region grows, accompanied by various types of development, the area may lose some of its existing rural appearance.

4.10.1.2 Proposed Action

Construction

During construction of the proposed dam and embankment the viewshed of travelers along FM 1550, FM 904, and SH 34 would be affected as the construction would be visible from the roadway. Construction would include mining soils from an area adjacent from the dam for use in the embankment and construction of an emergency spillway and principal spillway. Some tree clearing activities would occur in selected areas. The visual resource contrast rating of reservoir clearing and dam construction activities would be 'moderate' (begins to attract attention and begins to dominate the characteristic landscape). Overall, the impacts to visual resources related to construction of the proposed dam, reservoir, and principal and emergency spillways would be moderate and end once construction activities are completed.

Operation

Based on the large size of the proposed reservoir (7,568 acres), the large size of the proposed dam, and the complete change in land use that would occur under the proposed project, the visual resource contrast rating for the Build Alternative would be 'strong' (demands attention, will not be overlooked, and is dominant in the landscape). The form, line, color, and texture of the environment would all change noticeably under the proposed project.

As shown in **Photo 4-1** through **Photo 4-4**, the visual landscape would change from rural, agricultural scenery to one with the lake as the dominant feature. As shown in **Photo 4-4**, the visual contrast of the lake would be 'strong' (the element contrast demands attention, will not be overlooked, and is dominant in the landscape). Any viewer would notice the new lake environment, whether a local resident looking out a window or a commuter on a nearby road. The proposed SH 34 bridge would also be a prominent feature on the landscape.

A viewshed analysis was conducted using ArcGIS. Eighteen observation points were created near the project in surrounding roadways and municipalities. The resulting viewshed analysis (**Figure 4-6**) shows how much of the lake would be seen by a viewer at each of the eighteen locations. According to the analysis, the view from the observation points in Ladonia and Pecan Gap would

remain unchanged from existing. The view from points west of the reservoir would be able to see a portion of the reservoir. This viewshed only accounts for topography and does not take into account tree or building obstruction. Actual visibility of the reservoir from a given site would depend on the presence or absence of obstructions.

Due to its size and prominence, the Proposed Alternative would have a major, long-term impact on visual resources; however, whether this impact would be regarded as adverse or beneficial would depend on the values of each individual observer. Some individuals would regard the permanent elimination of rural, grassland scenery along the North Sulphur River as a loss outweighing any gain provided by a lake setting, while other individuals would regard the permanent addition of a lake on the landscape as an aesthetic asset to the community. Other members of the public would appreciate both the aesthetic loss and the aesthetic gain.

Photo 4-1: Existing Landscape within the Proposed Lake Ralph Hall footprint.