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Fort Worth District

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Final Environmental Impact Statement

Lake Ralph Hall Regional Water Supply Reservoir Project

Volume I

FINAL ENVIRONMENTAL IMPACT STATEMENT
LAKE RALPH HALL

Lead Agency:	Department of the Army U.S. Army Corps of Engineers Fort Worth District
Project Location:	Fannin County, Texas
Contact for EIS:	Mr. Chandler Peter, EIS Project Manager U.S. Army Corps of Engineers Fort Worth District 819 Taylor Street, Room 3A37 P.O. Box 17300 Fort Worth, Texas 76102 (817) 886-1736

ABSTRACT

The U.S. Army Corps of Engineers (USACE), Fort Worth District, as lead federal agency, has prepared this Final Environmental Impact Statement (FEIS) to analyze potential impacts from the proposed Lake Ralph Hall project located in Fannin County, Texas. The FEIS is being prepared in compliance with the National Environmental Policy Act of 1969 (NEPA), the Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA (40 Code of Federal Regulations [CFR] 1500-1508), and the USACE Procedures for Implementing NEPA (33 CFR 325 Appendix B and 230).

The project proponent, Upper Trinity Regional Water District (UTRWD), submitted an application to the USACE for a Department of the Army permit under Section 404 of the Clean Water Act (CWA), to discharge dredged and fill material into waters of the United States for the purpose of constructing the proposed Lake Ralph Hall project, including the construction of the dam, reservoir, and a pipeline. Based on a review of the applicant's proposal, the USACE determined that the proposed Lake Ralph Hall project constitutes a major Federal action that has the potential to significantly affect the quality of the human environment and that preparation of an EIS wa required.

The DEIS examined the Proposed Action and the No Action Alternative in detail. The DEIS was issued in October 2018. The DEIS public and agency comment period extended for 45 days and closed on November 21, 2018. During the comment period, the USACE received approximately 550 comments on the DEIS. The comments ranged from questions regarding the technical analysis to questions regarding the NEPA process including development of the proposed action, purpose and need, alternatives, and mitigation, and letters of support and opposition.

Based on the comments received during the DEIS public and agency comment period and new information developed since the release of the DEIS, the USACE has revised the DEIS to complete

this FEIS. In addition, the applicant has prepared a revised draft Mitigation Plan to compensate for impacts associated with the proposed Lake Ralph Hall which has been incorporated into this FEIS.

USACE's decision whether to issue a Section 404 permit will be based on an evaluation of the probable impacts, including cumulative impacts, of the proposed Lake Ralph Hall on the public interest. That decision will reflect the national concern for both protection and utilization of important resources. The benefits that reasonably may be expected to accrue from the proposal must be balanced against the reasonably foreseeable detriments. All factors that may be relevant to the proposal will be considered, including the cumulative effects thereof; among those are conservation, economics, aesthetics, wetlands, fish and wildlife values, flood hazards, floodplain values, land use, navigation, shoreline erosion and accretion, recreation, water supply and conservation, energy needs, safety, food and fiber production, mineral needs, considerations of property ownership and, in general, the needs and welfare of the people. In addition, the evaluation of the impact of the work on the public interest will include application of the guidelines promulgated by the Administrator of the Environmental Protection Agency, under authority of Section 404(b) of the CWA (40 CFR Part 230).

The USACE contact for this FEIS is:

Mr. Chandler Peter, EIS Project Manager
U.S. Army Corps of Engineers
Fort Worth District 819 Taylor Street, Room 3A37
P.O. Box 17300
Fort Worth, Texas 76102
or via email: chandler.j.peter@usace.army.mil

ES1.1 Executive Summary

ES1.1 Introduction and Background

The United States Army Corps of Engineers (USACE) has prepared this Final Environmental Impact Statement (FEIS) to analyze the direct, indirect and cumulative effects for the proposed Lake Ralph Hall project located in Fannin County, Texas (**Figure ES-1**).

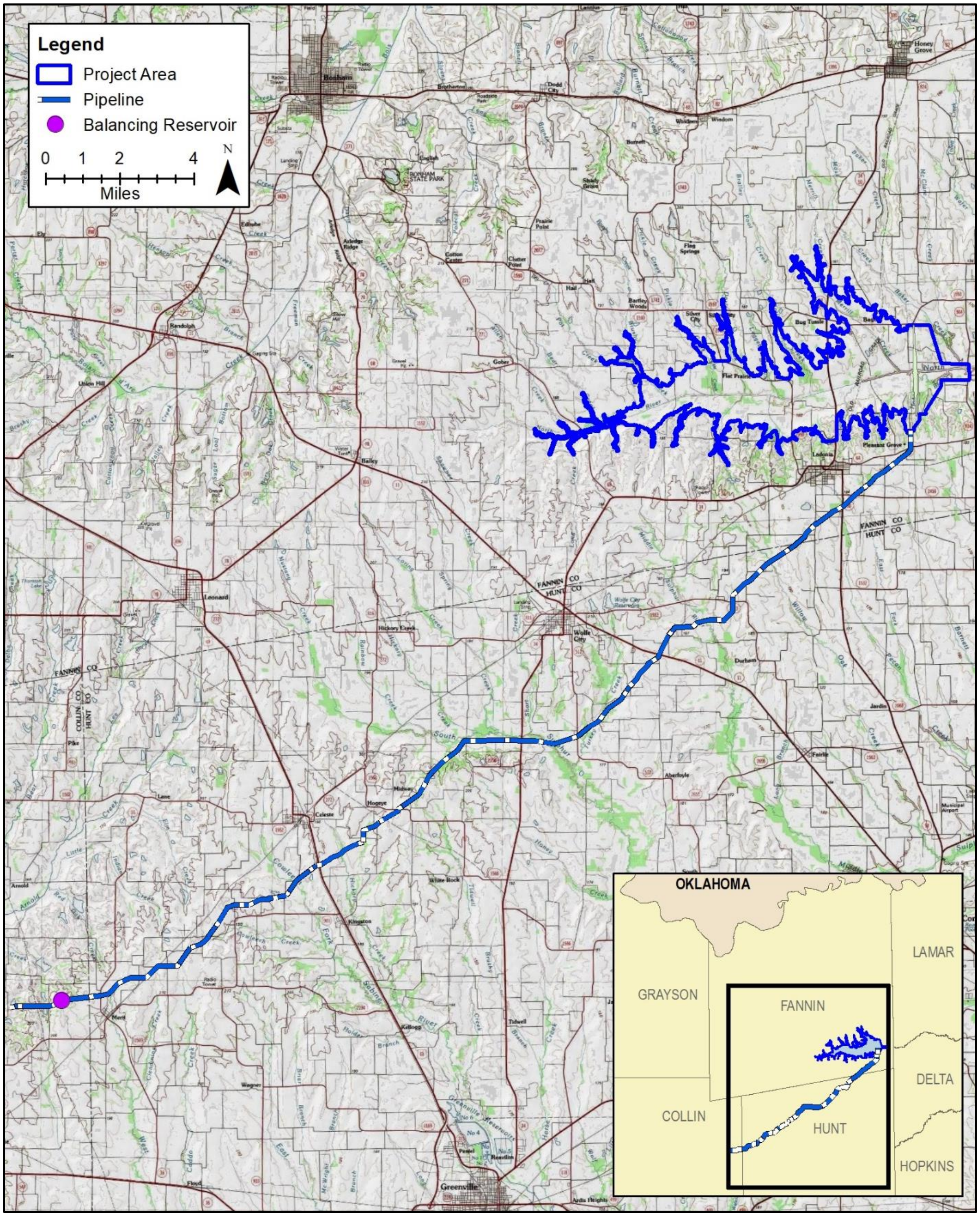
In October 2006, the project proponent, Upper Trinity Regional Water District (UTRWD), submitted an application to the USACE for a Department of the Army permit under Section 404 of the Clean Water Act (CWA), to discharge dredged and fill material into waters of the United States (US) for the purpose of constructing the proposed Lake Ralph Hall project, including the construction of the dam, reservoir, and a pipeline. Based on a review of the applicant's proposal, the USACE determined that the proposed Lake Ralph Hall project constitutes a major Federal action that has the potential to significantly affect the quality of the human environment and that preparation of an EIS is required. A Notice of Intent (NOI) for the Lake Ralph Hall EIS was published in the *Federal Register* on October 17, 2008 (Vol. 73, No. 2028, p. 61827-61828).The USACE is the federal agency that prepared this EIS in compliance with the National Environmental Policy Act (NEPA) of 1969, as amended, the Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of the NEPA (40 Code of Federal Regulations [CFR] 1500-1508) and the USACE Procedures for Implementing NEPA (33 CFR 230). This EIS also addresses the requirements of the US Environmental Protection Agency's (EPA) Section 404(b)(1) guidelines (40 CFR 230) and the USACE's NEPA Implementation Procedures for the Regulatory Program (33 CFR 325 Appendix B) and Public Interest Review at 33 CFR 320.4. The USACE, Fort Worth District, Regulatory Division is the lead agency responsible for preparation of the EIS. As specified at 33 CFR 320.1(a)(4), the USACE is neither a proponent nor opponent of any permit proposal. The instant action is not being funded by the USACE. The USACE has prepared this EIS through the assistance of a third party contractor as described at 40 CFR 1506.6(c) and clarified in 1983 guidance from the CEQ in 48 Fed. Reg. 34263 and will use the Final EIS in rendering a final permit decision.

The USACE also requested that agencies with statutory authority over, or special expertise relative to, the proposed project participate in the NEPA process as cooperating agencies (40 CFR 1501.6 and 1508.5). The EPA, US Fish and Wildlife Service (USFWS), US Forest Service (USFS), Texas Commission on Environmental Quality (TCEQ), Texas Parks and Wildlife Department (TPWD) and the Texas Historical Commission (THC) have engaged as cooperating agencies for this EIS.

ES2.1 Purpose and Need

The purpose of the proposed Lake Ralph Hall is to provide additional raw water supplies to meet the growing demands from UTRWD's wholesale customers and the proposed lake is one strategy to provide that additional water while providing additional security in the event supply from any of its other sources is interrupted. UTRWD identified economic benefits from recreational use, residential and commercial development and protected natural areas as well as environmental benefits due to reductions in soil losses due to erosion.

Figure ES- 1: Project Location



Based on the information provided by UTRWD and the additional needs analysis and its supporting information, USACE defines the overall project purpose as:

> **To provide approximately 34,050 AF of additional, reliable, firm annual yield through a regional project to meet a portion of existing and projected future municipal and industrial water demands by 2024 within UTRWD's defined regional planning area.**

This statement incorporates a number of terms requiring definition. The term "reliable" refers to water supplies having a high degree of certainty as to their amount and long term availability. "Firm annual yield" refers to the hydrologic availability of this water supply including times of drought, as defined by UTRWD and is reflected in hydrologic modeling of the various river basins and UTRWD's water system. "Regional" recognizes the status of UTRWD as a current regional provider which must serve its Members and Customers in accordance with existing agreements and contracts which have been reviewed and accepted by USACE to support the project need. This Overall Project purpose statement will be used to identify, evaluate, and screen alternatives in this EIS.

In summary, the Lake Ralph Hall project is intended to provide UTRWD with additional firm yield to address only a portion of the increasing demands for water from those Members and Customers previously identified. Details about the Purpose and Need are discussed in **Chapter 1.0**.

ES3.1 Alternatives Analyzed in Detail

ES1.3.1 No Action Alternative

The No Action Alternative is a required consideration of NEPA. It also has consideration in the 404(b)(1) guidelines as defined at 40 CFR 230.10(a)(1)(i). A variety of options exist within the No Action alternative and can include permit denial, construction of an alternative that does not involve a regulated discharge under Section 404 of the Clean Water Act, and alternatives that are unavailable to the applicant (even if they require Federal action (permits)). Each of these scenarios result in no permit being issued by USACE.

The No Action Alternative is the most likely alternative to be implemented in the absence of the Proposed Action due to denial of the permit. Unmet water supply needs of UTRWD and its members and customers are projected to begin in 2024. UTRWD and its members and customers would respond to these unmet demands by seeking other water supply and management strategies incrementally, particularly, seeking temporary/emergency water supply contracts, developing local groundwater supplies (by individual UTRWD members and customers only), and implementing mandatory water use restrictions. To achieve mandatory water use restrictions, UTRWD would limit the quantity of water it delivers to its members and customers based on its available supplies. Its members and customers would then be forced to limit the amount of water they deliver to their retail customers by (1) placing demand limits on their customers, (2) imposing a moratorium or otherwise limiting new customer connections to their system, or (3) a combination of both.

ES1.3.2 Lake Ralph Hall – Applicant Preferred Alternative

The proposed Lake Ralph Hall project would include the construction of an earth-filled dam embankment across the valley of the North Sulphur River with a concrete uncontrolled principal spillway located adjacent to the existing channel of the river and an excavated unlined earthen channel emergency spillway located within the embankment on the northern floodplain of the river. The embankment placed would vary between 566 feet and 568 feet North American Vertical Datum of 1988 (NAVD88) to account for anticipated settlement of the embankment thus providing an effective elevation of 566 feet NAVD88 after settlement and would adjoin the existing ground surface on both ends of the structure. Current studies indicate the proposed Lake Ralph Hall reservoir would have a conservation pool storage capacity of approximately 160,235 AF (at an elevation of 551.0 feet above msl), and at that capacity, the surface area of the reservoir would be approximately 7,568 acres. However, it is anticipated that the storage volume is somewhat larger due to continued erosion that has occurred during the permitting and planning period. The maximum depth of the reservoir at the dam would be approximately 90 feet. The firm annual yield of the proposed project would be approximately 34,050 AF/year.

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 the Tom Harpool WTP adjacent to Lewisville Lake and the Tom Taylor WTP through discharge to Lewisville Lake via a proposed raw water transfer pipeline. Through this inter-basin transfer, UTRWD would provide water to towns and cities in Collin, Cooke, Dallas, Denton, Grayson, and Wise Counties within the Trinity River Basin. The proposed Lake Ralph Hall project would divert raw water for municipal, industrial, and agricultural purposes, with ancillary benefits of in-place recreational uses and impeding continued erosion and environmental degradation of the North Sulphur River channel. The proposed Lake Ralph Hall project would also require the relocation and/or abandonment of state and county roads and the reconstruction of the State Highway (SH) 34 Bridge that crosses the North Sulphur River within the proposed project footprint.

ES1.3.3 Alternatives Dismissed from Detailed Consideration

Other alternatives were evaluated but not carried forward for detailed consideration. Alternatives include water supplied from new (undeveloped) reservoirs, including Upper Bois d'Arc Creek Reservoir, Marvin Nichols Reservoir, George Parkhouse Lake South, George Parkhouse Lake North, and Lake Fastrill; securing supplies from Lake Texoma, Toledo Bend Reservoir, Wright Patman Lake, Lake Livingston/Joe Pool Lake/Trinity River Basin, Oklahoma, additional Dallas Water Utilities Supply, the Gulf of Mexico, Cypress Creek Basin, groundwater imports and precipitation enhancement. These potential alternatives were not carried forward for detailed consideration in the EIS because of the inability to meet purpose and need, unacceptable environmental impacts, reliability, cost, and/or institutional constraints including the need to secure agreements with other wholesale water providers. The alternatives analysis, including a description of each of the alternatives dismissed and the justification for their dismissal, is discussed in detail in **Chapter 2.0**.

ES4.1 Summary of Impacts and Proposed Mitigation

Environmental consequences of the preferred alternative were analyzed for each resource area. The primary major impacts of the proposed project are conversion of land to reservoir, impacts to streams and wetlands, impacts to paleontological resources, and changes in visual aesthetics. Primary minor impacts include impacts to the Caddo National Grasslands, noise, air quality, transportation, recreation, habitat, cultural resources, and socioeconomics. **Table ES-2**, included at the end of this **Executive Summary**, summarizes the potential impacts for each resource that would be affected by the implementation of the Proposed Action and No Action Alternative, as well as Applicant- proposed mitigation and monitoring. A detailed discussion of the impacts can be found in **Chapter 4.0,** and details about proposed mitigation can be found in **Chapter 5.0**.

ES5.1 Coordination and Consultation

ES1.5.1 Public Participation and Scoping

Public participation for the EIS began with the scoping process and involved actively soliciting input from the public and interested federal, state, and local agencies about the Proposed Action. On March 14, 2008, the USACE published and distributed a Public Notice to inform interested parties about the proposed Lake Ralph Hall, to solicit comments relevant to the Section 404 permit application, and to inform the public of an upcoming scoping meeting.

The USACE held an informal public scoping meeting on April 15, 2008, at the Fannindel High School in Ladonia, Fannin County, Texas. The purpose of this meeting was to disseminate information about the proposed lake project and its potential effects on the human environment and seek public comment on the applicant's proposal and assist the agency in determining whether the proposed project would significantly affect the quality of the human environment. A total of 255 comments were received from 41 individual commenters. The most common topics of comments concerned effects on properties and displacements of residents, mitigation design, water quality, number of alternatives, visual aesthetics, and sedimentation. A detailed breakdown of the comments received can be found in **Chapter 6.0**.

A public hearing was held Thursday, October 25, 2018 at H.L. Milton Sports Complex, 601 W. Mill Street, Ladonia, TX 75449. An open house was held beginning at 5:30 p.m., and the public hearing was called to order at 6:30 p.m. Speakers were given a period of 5 minutes to present their comments on the Proposed Action and the DEIS as well as identify issues and concerns.

During the 45-day public and agency comment period, approximately 550 comments were received on the DEIS on topics ranging from purpose and need, alternatives, impacts, and mitigation, and letters of opposition and support. Responses to comments received during the DEIS comment period are included in **Appendix P**.

The availability of the FEIS will be announced through public notice, including a Notice of Availability (NOA) in the *Federal Register*.

ES1.5.2 Consultation and Coordination with Federal, State, and Local Government Agencies

Specific regulations require the USACE to coordinate and consult with federal, state, and local agencies concerning the potential for a proposed action and alternatives to affect sensitive environmental and human resources. The USACE Fort Worth District initiated these coordination and consultation activities through the scoping process. In addition, the District invited interested agencies to serve as cooperating agencies for preparation of the EIS. The EPA, USFWS, USFS, THC, TPWD, and TCEQ are serving as cooperating agencies. Coordination meetings held with federal, state, and local agencies are shown in **Table ES-1**. More information about agency coordination can be found in **Chapter 6.0**.

Table ES- 1: Coordination Meetings held with Federal, State, and Local Government Agencies

Date	Agencies	Topics
November 4, 2008	USACE, EPA, USFWS, TPWD, TCEQ, USFS, UTWRD	DEIS scope, alternatives, environmental consequences, mitigation
February 2009	USACE, USFWS, TPWD, TCEQ, UTRWD	Habitat assessment
April 21, 2009	Fannin County Historical Commission	Historic Resources
September 2009	USACE, EPA, USFWS, TPWD, TCEQ, UTRWD	Site visit/review and validation of water impact metrics and scoring for both aquatic and terrestrial resources
March 8, 2011	USACE, EPA, USFWS, TPWD, TCEQ, UTWRD	Mitigation Plan
May 5, 2015	USFWS, USACE, EPA, TPWD, TCEQ	Mitigation Plan
October 1, 2015	USACE, USFWS, TPWD, UTRWD	Site Visit
January 9, 2017	USACE, EPA, USFWS, TWPD, UTRWD	Mitigation Plan
July 3, 2018	USACE, EPA, USFWS, TPWD, TCEQ, USFS, UTRWD	Agency Meeting
August 28, 2018	USACE, EPA, USFWS, TPWD, TCEQ, USFS, UTRWD	Site Visit to Mitigation Area
February 6, 2019	USACE, EPA, USFWS, TPWD, USFS, UTRWD	Agency Meeting

ES1.5.3 Tribal Government-to-Government Consultation

In compliance with NHPA and USACE Policy Guidance Letter No. 57 (Indian Sovereignty and Government-to-Government Relations with Indian Tribes) the USACE is required to establish regular and meaningful consultation and collaboration with Native American tribal governments on development of regulatory policies that could significantly or uniquely affect their communities. The USACE Fort Worth District initiated consultation with Native American tribes by sending letters dated May 2, 2017, to federally recognized tribes (as identified below). The Caddo Nation of Oklahoma and the Choctaw Nation of Oklahoma requested consulting party status by phone. The USACE invited the Caddo Nation of Oklahoma and the Choctaw Nation of Oklahoma to be Consulting Parties to the Programmatic Agreement (PA). The following nations and tribes were consulted:

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

ES6.1 Summary of Impacts

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. A summary of direct and indirect impacts is shown in **Table ES-2**.

Table ES- 2: Summary of Direct and Indirect Impacts by Resource or Impact Issue and Recommended Monitoring and Mitigation

Resource/Impact Issue	No Action Alternative	Proposed Action Alternative	Proposed Mitigation
Land Use	Present trends in land use would continue and remain predominantly rural and undeveloped. UTRWD has purchased a little over half of the project area. There would be no effect on land use.	Effects would be major due to the inundation of more than 7,000 acres including retirement of approximately 1,600 acres of agricultural lands. Land use of lands surrounding the reservoir could change to residential and commercial development. Effects associated with the pipeline would be minor since existing land use could continue after construction. The proposed balancing reservoir would convert approximately 4.5 acres of grassland to a reservoir. Overall land use impacts would be major.	No mitigation is required for this resource.

Resource/Impact Issue	No Action Alternative	Proposed Action Alternative	Proposed Mitigation
Ownership	UTRWD has purchased a little over half of the project area. There would be no effect on ownership.	UTRWD has purchased a little over half of the project area- the remainder (including one residence) would be purchased prior to construction. Impacts would be moderate.	No mitigation is required for this resource.
Public Lands	Impacts to public lands are anticipated to be negligible. Increased water restrictions could result in changes to parklands due to limited watering capabilities.	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 would be major, but would be reduced through compensatory mitigation acreage.	UTRWD is working with the USFS relative to a land exchange to offset these effects.
Physiography	No Effect	No Effect	No mitigation is required for this resource.
Topography	Topography of the proposed project area would be altered by continued erosion in the North Sulphur River and its tributaries. These impacts are considered to be major.	The topography of the proposed project area would be flooded. Area to be modified topographically will be in excess of 8,000 acres for all associated project features. Sediment yield to the reservoir over a 50-year period is between 2,570 ac-ft and 3,700 ac-ft. Flooding a portion of the river basin and some tributaries as well as the development of the dam would occur. Erosion along the proposed shoreline could alter topography. Impacts to topography are considered to be moderate. Impacts to topography from the pipeline are anticipated to be negligible.	No mitigation is required for this resource.
Geology	Geologic formations within the North Sulphur River channel and tributaries would continue to erode. These impacts are considered to be minor.	Construction of the Proposed Action would slow erosion within the North Sulphur River and its tributaries. Along the pipeline alignment, the original characteristics of the surficial material would be permanently altered by construction activities. Impacts would be moderate and beneficial.	No mitigation is required for this resource.
Geologic Hazards	No Effect	No Effect	No mitigation is required for this resource.

Resource/Impact Issue	No Action Alternative	Proposed Action Alternative	Proposed Mitigation
Mineral Resources	No Effect	The proposed pipeline alignment would be precluded from any future surface mineral resource use. Oil and gas could potentially be produced using direction drilling technology. Impacts would be minor.	No mitigation is required for this resource.
Soils	Soils within the proposed project area could be altered by continued erosion in the North Sulphur River. Impacts from the development of groundwater wells and pipelines would be expected to be minimal.	Impacts to soils would include excavation, transport, and compaction during construction. 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 reservoir floodplain. 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 North Sulphur River channel degradation behind the dam. During construction of the Lake Ralph Hall Raw Water Pipeline Alignment approximately 384 acres of existing soils would be disturbed. Impacts would be major.	Sediment and Erosion Control Plan. Construction will be done in accordance with a TPDES Storm Water Permit, which mandates preparation of a Storm Water Pollution Prevention Plan.

Resource/Impact Issue	No Action Alternative	Proposed Action Alternative	Proposed Mitigation
Prime Farmland	Continued erosion in the North Sulphur River and its tributaries, prime farmland could be impacted.	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. The pipeline route would be maintained within a 100-ft ROW. This approximately 384-acre area may 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. If the pipeline alignment ROW is restored to agricultural uses following installation, this would constitute an impact but not a loss of prime farmland areas. Impacts would be major.	Prime Farmland soils found in areas of proposed water supply reservoirs are exempt from restrictions under the Farmland Protection Policy Act (FPPA).
Groundwater	Substantial increases in groundwater usage in the UTRWD service area. Impacts could range from moderate to major.	No impacts to groundwater quantity or quality within the project area are expected. Impacts would be negligible.	No mitigation is required for this resource.
Surface Water – Hydrology	The North Sulphur River and some of its major and minor tributaries would continue to deepen and widen as a result of erosion. Impacts would be major.	Reduced flow of the North Sulphur River would occur immediately downstream of the proposed Lake Ralph Reservoir to Baker Creek. Impacts would be major.	Directional drilling during construction of pipeline at significant stream crossings (those with standing water below the ordinary high water mark (OHWM) at time of construction); restoration of stream contours, stabilization of stream banks; revegetation of disturbed areas after pipeline construction. Whenever practicable, construction within waterbodies will take place during periods when streams or wetlands may be dry. TCEQ Section 401 BMPs will be followed.

Resource/Impact Issue	No Action Alternative	Proposed Action Alternative	Proposed Mitigation
Surface Water – Water Quality	Surface water quality would remain similar to the existing conditions. Impacts would be minor.	Downstream site calculations indicate a slight increase in pollutant concentrations due to decreased flow. Impacts would be minor.	Stormwater Pollution Prevention Plan (SWPPP) and Texas Pollution Discharge Elimination System (TPDES) General Permit During Construction
Surface Water – Floodplains	Floodplains would remain similar to the existing conditions. Impacts would be negligible.	Floodplains would remain similar to the existing conditions in that there are no active floodplains within the project area. The proposed impoundment would restore some floodplain function to the headwaters of the North Sulphur River and tributaries above the proposed conservation pool elevation. Impacts would be negligible.	No mitigation is required for this resource.
Surface Water – 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 is expected to continue. Impacts would be major but would be reduced due to mitigation requirements for future projects.	The proposed reservoir project site would result in impacts including fill and inundation of 447,143 lineal feet of ephemeral stream channel, 62,149 lineal feet of intermittent stream channel, and approximately 56.19 acres of on-channel impoundments. A total of eight acres of lacustrine fringe wetlands would be impacted within the conservation pool, embankment, and spillway area. 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. Impacts are considered to be major but would be reduced through mitigation.	Implement *Mitigation Plan for Impacts to Aquatic Resources – Lake Ralph Hall*

Resource/Impact Issue	No Action Alternative	Proposed Action Alternative	Proposed Mitigation
Air Quality	No substantial changes in air quality within the immediate Lake Ralph Hall study area are anticipated. 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.	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. 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. Minor, temporary impacts to air quality are anticipated during construction.	Implement Best Management Practices (BMP) During Construction
Noise	Slight increase in ambient noise levels caused by the projected population growth and associated development and land use changes.	During the construction, no noise impacts are anticipated for Ladonia residents but single residences located at each end of the dam embankment would be subjected to noise levels in the 55-dbA range. 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 CR 3444 would generate construction noise near four noise receptors located within 1,600 feet of the road/bridge. Increase in noise levels would be expected over the length of the pipeline in the areas where construction is occurring. Impacts associated with the project are considered to be minor.	BMPs would be implemented to reduce potential impacts.

Resource/Impact Issue	No Action Alternative	Proposed Action Alternative	Proposed Mitigation
Recreation	No impacts to recreation in the area.	The Ladonia Fossil Park would no longer be accessible for fossil hunters. Recreational impacts are considered to be minor. No causal recreational benefits have been identified associated with the reservoir, although such development is likely to occur and could represent minor beneficial impacts. Approximately 300 acres of Federal land (Caddo National Grasslands- Ladonia Unit), currently administered by the U.S. Forest Service would be converted as a result of the proposed project and reduce hunting opportunities. USFS also anticipates an increase in visitation and administrative burden. These impacts are considered moderate.	UTRWD will relocate fossil park. UTRWD is currently coordinating with the USFS. No other mitigation is required for this resource.
Visual Resources	No immediate impacts to visual resources.	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. 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. After construction, the visual resource contrast rating for the Build Alternative would be ‘strong’. The form, line, color, and texture of the environment would all change noticeably under the proposed project.	No mitigation is planned for this resource.

Resource/Impact Issue	No Action Alternative	Proposed Action Alternative	Proposed Mitigation
Biological Resources - Habitat	The North Sulphur River and its major tributaries would continue to erode and degrade habitat surrounding these areas.	Minimal loss of moderate quality vegetative resources is anticipated as a result of the proposed project. The reservoir would help stabilize the North Sulphur River watershed by reducing habitat loss and conversion from currently on-going severe erosion. The reservoir would also create and enhance habitat for local and migratory wildlife through the anticipated creation of at least eight acres of fringe wetlands along the proposed reservoir shoreline. Mudflats may also be created in shallow flooded areas, especially in the upstream portion of the reservoir. The potential vegetated impact area includes agricultural production and woody areas. 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 Overall, although the type of vegetation communities to be impacted are common and degraded, because of the large size of the area to be converted to another and more uncommon type, the effects would be considered major.	Implement *Mitigation Plan for Impacts to Aquatic Resources – Lake Ralph Hall;* Re-Vegetate Disturbed Areas After Pipeline Construction

Resource/Impact Issue	No Action Alternative	Proposed Action Alternative	Proposed Mitigation
Biological Resources - Wildlife	Current conditions of the North Sulphur River would continue to exist.	Although some displacement of wildlife would occur with the inundation as a result of the proposed project, the overall current state of degradation of habitat and isolation of remaining moderate quality habitat within the project area indicates that these impacts would be moderate. Increase in noise and presence of workers during construction may cause any wildlife to leave the area temporarily. Wildlife that could occur along the pipeline ROW would potentially experience varying degrees of adverse impacts.	All Requirements Regarding Migratory Birds Would be Met Prior to Construction
Biological Resources – Aquatic Biota	Current conditions of the North Sulphur River would continue to exist.	The existing aquatic biota community would change from intermittent stream species to a community more adapted for a lacustrine habitat. Impacts would be moderate. Impacts to aquatic organisms in pools with decreasing levels would occur between the proposed Lake Ralph Hall dam and the Cooper Gage. Models indicate almost no change to reaches below the Cooper Gage. Impacts would be moderate. Overall impacts from pipeline construction to aquatic biota would be none to minimal.	Implement *Mitigation Plan for Impacts to Aquatic Resources – Lake Ralph Hall*; whenever practicable, construction within waterbodies will take place during periods when streams or wetlands may be dry.
Biological Resources – Invasive Species	Current conditions of the North Sulphur River would continue to exist. Impacts are expected to be minimal.	During the construction phase, invasive terrestrial plant species may invade disturbed areas and continue to inhabit these areas during the long-term operation of the proposed Lake Ralph Hall. Aquatic invasive species known to occur in Texas reservoirs (e.g., zebra mussels) may spread to Lake Ralph Hall if recreational boating is allowed. Impacts would be moderate.	No mitigation is required for this resource.

Resource/Impact Issue	No Action Alternative	Proposed Action Alternative	Proposed Mitigation
Threatened and Endangered Species	No impacts to threatened or endangered species.	Impacts unlikely to any of the federal listed species for Fannin, Hunt, or Collin counties. The state listed timber rattlesnake, as well as the four state listed mollusks, have the potential to be impacted by the construction of Lake Ralph Hall and the Raw Water Pipeline Alignment. Potential impacts to mollusks avoided through proposed use of horizontal directional drilling or tunneling of perennial streams. Impacts would be negligible.	Contractors would be advised of potential occurrence of timber rattlesnake and to avoid harming species. Directional drilling during construction of the pipeline at significant stream crossings (those with standing water below the OHWM at the time of construction).
Traffic and Transportation	Land use changes within the region are expected to occur as a result of long-term population growth and associated development pressure. This growth may result in an increase in traffic on the local and regional transportation network.	During construction of the dam, reservoir, and principal and emergency spillways, congestion would increase in the immediate area due to additional construction vehicles, delays caused by construction activities (i.e., roads temporarily reduced to a single lane), and road closures and detours. In order to successfully implement the proposed Lake Ralph Hall, key roads would require adjustments to alignment and grade while other roads would be partially or completely abandoned. The establishment of the proposed dam, reservoir, and principal and emergency spillways would have noticeable long-term beneficial and adverse effects on transportation resources and traffic. The permanent closure of roadways and rerouting of traffic from some secondary and tertiary roadways in the area would result in adverse effects, while new roads and road improvements would result in beneficial effects. Effects on transportation resources would be minor.	All construction vehicles would be equipped with backup alarms, two-way radios, and 'slow moving vehicle' signs when appropriate. Routing and scheduling construction vehicles to avoid conflicts with other traffic.

Resource/Impact Issue	No Action Alternative	Proposed Action Alternative	Proposed Mitigation
Hazardous Materials	No change to the existing conditions.	One listing in the conservation pool boundary. It is recommended that the property be inspected and potential water quality contaminants removed prior to inundation. One listing outside conservation pool but inside project area not anticipated to be an issue. Three sites identified near the proposed pipeline footprint. The site limits should be verified prior to construction and avoided. Impacts would be minor.	Inspection and Removal of Contaminants at Identified Sites if Needed
Cultural Resources – Historic	Impacts to historic resources, if any, would be minor.	Due to a lack of access, not all properties within the APE were surveyed. None of the resources surveyed were recommended as eligible for the NRHP or recommended for intensive-level study. Additional historic-age properties may be found in the APE at a later date during surveys conducted in accordance with the PA. Impacts are currently anticipated to be minor, but further study is required.	Implement Programmatic Agreement

Resource/Impact Issue	No Action Alternative	Proposed Action Alternative	Proposed Mitigation
Cultural Resources – Archeological	Continued erosion of the North Sulphur River channel and its major tributaries could expose archeological resources. Impacts would be considered minor.	Due to a lack of access, not all properties within the area of potential effects (APE) were surveyed. Survey covered approximately 15 percent of the APE. The remaining 85 percent of the Proposed Action will be considered and surveyed according to the Programmatic Agreement that is yet in progress. Additional sites will likely be encountered, and will need to be assessed for NHRP and SAL eligibility, and eligible sites will need to be evaluated and mitigated for project impacts according to procedures specified in the PA. A total of 17 archeological sites were recorded with five sites recommended for further testing or further definition of the deposit. One site, the Merrill Family Cemetery, was recommended to be avoided. Impacts would be major.	Implement Programmatic Agreement
Paleontological Resources	Continued erosion of the North Sulphur River would continue to expose fossils. The Ladonia Fossil Park would remain in the current location and allow for continued fossil hunting.	Paleontological resources in the inundation footprint would no longer be accessible following completion of the proposed project. The Ladonia Fossil Park would no longer be accessible for fossil hunters, but would be replaced with a similar park downstream. Impacts would be major.	Relocate Fossil Park

Resource/Impact Issue	No Action Alternative	Proposed Action Alternative	Proposed Mitigation
Socioeconomics	The No Action Alternative could displace and/or slow growth in the area. The impacts of displaced growth could be considered major, affecting planning, urban service costs, and public satisfaction with local government.	Impact includes losses in both sales and property tax revenue from the inundation of the land, but gains from increased spending due to construction, and land development. The losses in sales and property taxes revenue would be minor, and would be outweighed by the gains. Increase in property tax revenue from land development would dwarf the losses. Over the whole period, the average annual difference in the wholesale effective rate is 2.9 percent. The wholesale effective rate rises slowly while the lake and pipeline are being constructed; once the lake is in operation, the rate differences are more substantial, until the debt service for the dam is fully repaid. Rate impacts diminish thereafter. Overall impacts would be minor and positive.	Loss of property taxes would be reduced through an arrangement reached between UTRWD and Fannin County.
Environmental Justice and Protection of Children	Current water distribution operations would be expected to have the same effects on populations of concern as the general population, including the potential for water restrictions and higher water costs.	The Proposed Action would not result in environmental justice impacts in the overall ROI. The Proposed Action could create slightly adverse disproportionate impacts relating to noise and/or traffic for Ladonia, for at least a portion of the construction phase, though not during the operational phase. Overall, adverse impacts on environmental justice populations within the study area would be minor. Project benefits, including employment opportunities, increased tax revenue, roadway improvements, and access to a potentially new recreational facility would be shared by all residents in the study area, including environmental justice populations.	Impacts to EJ populations would be reduced through implementations of BMPs for noise and air quality during construction. All construction vehicles would be equipped with backup alarms, two-way radios, and 'slow moving vehicle' signs when appropriate. Routing and scheduling construction vehicles to avoid conflicts with other traffic.

Resource/Impact Issue	No Action Alternative	Proposed Action Alternative	Proposed Mitigation
Climate Change	The No Action Alternative would not have any direct impact on the climate, and would not contribute to climate change.	The proposed project would require energy associated with pumping from the reservoir to the service area, which could be a minor long-term effect on GHG. Long-term slight beneficial effects from augmenting water storage capacity in North Texas would be expected. Although there would be negligible direct effects from the emissions on climate change, the Proposed Action would constitute a more effective approach to water management under future conditions when compared to the No Action Alternative.	No mitigation is required for this resource.

Acronyms and Abbreviations

AAI	All Appropriate Inquiries
AD	Adequate Data
ACS	American Community Survey
AF	Acre-Feet
AF/MO	Acre-Feet Per Month
AF/YR	Acre-Feet Per Year
AHD	American Hospital Directory
ALS	Advanced Life Support
AMSL	Above Mean Sea Level
APA	Applicant's Preferred Alternative
APE	Area of Potential Effects
ASTM	American Society of Testing and Materials
BDC	Bois d'Arc Creek
BDL	Bois d'Arc Lake
BEG	Bureau of Economic Geology
BG	Block Group
BLM	Bureau of Land Management
BMP	Best Management Practice
CA	California
CADSWES	Center for Advanced Decision Support for Water and Environmental Systems
CALF	Closed and Abandoned Landfill Inventory
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cfs	Cubic Feet per Second
CO	Carbon Monoxide
CR	County Roads
CRMWA	Canadian River Municipal Water Authority
CS	Concern for Screening Level
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
dbA	A-Weighted Sound Levels
DEIS	Draft Environmental Impact Statement
DFW	Dallas-Fort Worth International Airport
DHHS	Department of Health and Human Services
DL	Federally Delisted
DO	Dissolved Oxygen
DRMC	Denton Regional Medical Center
DWU	Dallas Water Utilities
E	State Listed Endangered
EA	Environmental Assessment
EIS	Environmental Impact Statement
EJ	Environmental Justice
EMS	Emergency Medical Services
EPA	Environmental Protection Agency

EO	Executive Order
ESA	Endangered Species Act
FCU	Functional Capacity Units
FEIS	Final Environmental Impact Statement
FISD	Fannindel Independent School District
FHWA	Federal Highway Administration
FM	Farm to Market
FONSI	Finding of No Significant Impact
FPPA	Farmland Protection Policy Act
FRSTX	Federal Registry System
FS	Fully Supporting
FTE	Full Time Employee
FWSD	Fresh Water Supply District
GCD	Groundwater Conservation District
GHG	Greenhouse Gas
GIS	Geographic Information System
GMA	Groundwater Management Areas
GPCD	Gallons per Capita per Day
gpm	Gallons per Minute
GTUA	Greater Texoma Utility Authority
HB	House Bill
HE	Harvey Economics
HQ	Habitat Quality
HU	Habitat Units
IH	Interstate Highway
IPP	Initially Prepared Plan
ISD	Independent School District
ISO	Insurance Service Office
LBCR	Lower Bois d'Arc Creek Reservoir
LD	Limited Data
LE	Federally Listed Endangered
LEDPA	Least Environmentally Damaging Practicable Alternative
LRH	Lake Ralph Hall
LT	Federally Listed Threatened
LT/SA	Federally Threatened by Similarity of Appearance
MAG	Modeled Available Groundwater
MBTA	Migratory Bird Treaty Act
MCM	Medical Center of McKinney
mgd	Millions of Gallons per Day
MG/YR	Millions of Gallons per Year
MOA	Memorandum of Agreement
MPH	Miles per Hour
MSL	Mean Sea Level
MSWLF	Municipal Solid Waste Landfill Site
MUA	Municipal Utility Authority
NAAQS	National Ambient Air Quality Standards

NAVD88	North American Vertical Datum of 1988
NC	No Concern
NCTCOG	North Central Texas Council of Governments
NEPA	National Environmental Policy Act of 1969
NETMWD	Northeast Texas Municipal Water District
NGVD	National Geodetic Vertical Datum
NHPA	National Historic Preservation Act
NLCD	National Land Cover Dataset
NOx	Nitrogen Oxides
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NRNWR	Neches River National Wildlife Refuge
NSRCEM	North Sulphur River Channel Evolution Model
NTMWD	North Texas Municipal Water District
NWI	National Wetland Inventory
OH-	Hydroxide Ions
OK	Oklahoma
OTHM	Official Texas Historical Marker
OWRB	Oklahoma Water Resource Board
PA	Programmatic Agreement
PGMA	Priority Groundwater Management Area
PIA	Primary Impact Area
PIR	Public Interest Review
PM	Particulate Matter
RCUs	Resource Capacity Units
RFFA	Reasonably Foreseeable Future Action
ROC	Region of Comparison
ROI	Region of Influence
ROW	Right-of-Way
RRC	Texas Railroad Commission
RWRS	Raw Water Reliability Study
SAAM	Stream Attribute Assessment Methodology
SAL	State Antiquities Landmark
SB	Senate Bill
SH	State Highway
SHPO	State Historic Preservation Office
SIA	Secondary Impact Area
SJRA	San Jacinto River Authority
SMU	Southern Methodist University
SOx	Sulfur Oxides
SRA	Sabine River Authority of Texas
SRBA	Sulphur River Basin Authority
SRMWD	Sulphur River Municipal Water District
SRMVC	Sam Rayburn Memorial Veterans Center
STIP	State Transportation Improvement Program
SU	Standard Units

SUD	Special Utility District
SWAMPIM	Stream Watershed Assessment and Measurement Protocol Interaction Model
SWANCC	Solid Waste Agency of Northern Cook County
SWPPP	Stormwater Pollution Prevention Plan
T	State Listed Threatened
TAC	Texas Administrative Code
TARL	Texas Archeological Research Laboratory
TCEQ	Texas Commission on Environmental Quality
TCOG	Texoma Council of Governments
TDA	Texas Department of Agriculture
TDS	Total Dissolved Solids
TEA	Texas Education Agency
THC	Texas Historical Commission
TMDL	Total Maximum Daily Load
TNRCC	Texas Natural Resource Conservation Commission
TPDES	Texas Pollution Discharge Elimination System
TPWD	Texas Parks and Wildlife Department
TRA	Trinity River Authority
TRWD	Tarrant Regional Water District
TSLA	Texas State Library and Archives
TSS	Total Suspended Solids
TSSWCB	Texas State Soils and Water Conservation Board
TWDB	Texas Water Development Board
TX	Texas
US	United States
USACE	United States Army Corps of Engineers
USC	United States Code
USCB	United States Census Bureau
USDA	United States Department of Agriculture
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGCRP	United States Global Change Research Program
USGS	United States Geological Survey
UTRWD	Upper Trinity Regional Water District
VOCs	Volatile Organic Compounds
WAM	Water Availability Model
WDA	Workforce Development Area
WHAP	Wildlife Habitat Appraisal Procedure
WMA	Wildlife Management Area
WRAP	Water Rights Analysis Package
WSC	Water Supply Corporation
WTP	Water Treatment Plant
°C	Degrees Celsius
µg	Micrograms

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1.0 Purpose and Need

1.1 Introduction

The United States Army Corps of Engineers (USACE) has prepared this Final Environmental Impact Statement (FEIS) to analyze the direct, indirect and cumulative effects for the proposed Lake Ralph Hall project located in Fannin County, Texas. The proposed Lake Ralph Hall project would be located north of the City of Ladonia, Texas (**Figure 1-1**). The site map illustrates the boundaries for the proposed reservoir and the conservation pool within Lake Ralph Hall (**Figure 1-2**). The Proposed Action includes property to be purchased and managed by the applicant adjacent to the proposed conservation pool and also includes the acreage associated with the raw water pipeline and the balancing reservoir. The proposed project lies along the North Sulphur River in the North Sulphur River Watershed of the Sulphur River Basin. The North Sulphur River Basin is bounded on the north by the Red River Basin, the Trinity River Basin to the west, the Sabine and Cypress River Basins to the south, and by the Texas/Arkansas border to the east (**Figure 1-3**). Five lakes are located within Fannin County: 1) Coffee Mill Lake; 2) Lake Crockett; 3) Lake Bonham; 4) Valley Lake; and 5) Lake Fannin. These five lakes are located in the northern portion of the county. Jim Chapman Lake is located south and east of the project area in Hopkins and Delta Counties. **Figure 1-4** depicts the locations of the streams and other waterbodies in the vicinity of the proposed Lake Ralph Hall reservoir project.

The project proponent, Upper Trinity Regional Water District (UTRWD), submitted an application to the USACE for a Department of the Army permit under Section 404 of the Clean Water Act (CWA), to discharge dredged and fill material into waters of the United States (US) for the purpose of constructing the proposed Lake Ralph Hall project, including the construction of the dam, reservoir, balancing reservoir, and a pipeline. Based on a review of the applicant's proposal, the USACE determined that the proposed Lake Ralph Hall project constitutes a major Federal action that has the potential to significantly affect the quality of the human environment and that preparation of an EIS is required.

The USACE is the federal agency that prepared this EIS in compliance with the National Environmental Policy Act (NEPA) of 1969, as amended, the Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of the NEPA (40 Code of Federal Regulations [CFR] 1500-1508) and the USACE Procedures for Implementing NEPA (33 CFR 230). This EIS also addresses the requirements of the US Environmental Protection Agency's (EPA) Section 404(b)(1) guidelines (40 CFR 230) and the USACE's NEPA Implementation Procedures for the Regulatory Program (33 CFR 325 Appendix B) and Public Interest Review at 33 CFR 320.4. The USACE, Fort Worth District, Regulatory Division is the lead agency responsible for preparation of the EIS. As specified at 33 CFR 320.1(a)(4), the USACE is neither a proponent nor opponent of any permit proposal. The instant action is not being funded by the USACE. The USACE has prepared this EIS through the assistance of a third party contractor as described at 40 CFR 1506.6(c) and clarified in 1983 guidance from the CEQ in 48 Fed. Reg. 34263 and will use the Final EIS in rendering a final permit decision.

The USACE also requested that agencies with statutory authority over, or special expertise relative to, the proposed project participate in the NEPA process as cooperating agencies (40 CFR 1501.6 and 1508.5). The EPA, US Fish and Wildlife Service (USFWS), US Forest Service (USFS), Texas Commission on Environmental Quality (TCEQ), Texas Parks and Wildlife Department (TPWD) and the Texas Historical Commission (THC) have engaged as cooperating agencies for this EIS.

Figure 1-1: Project Location Map

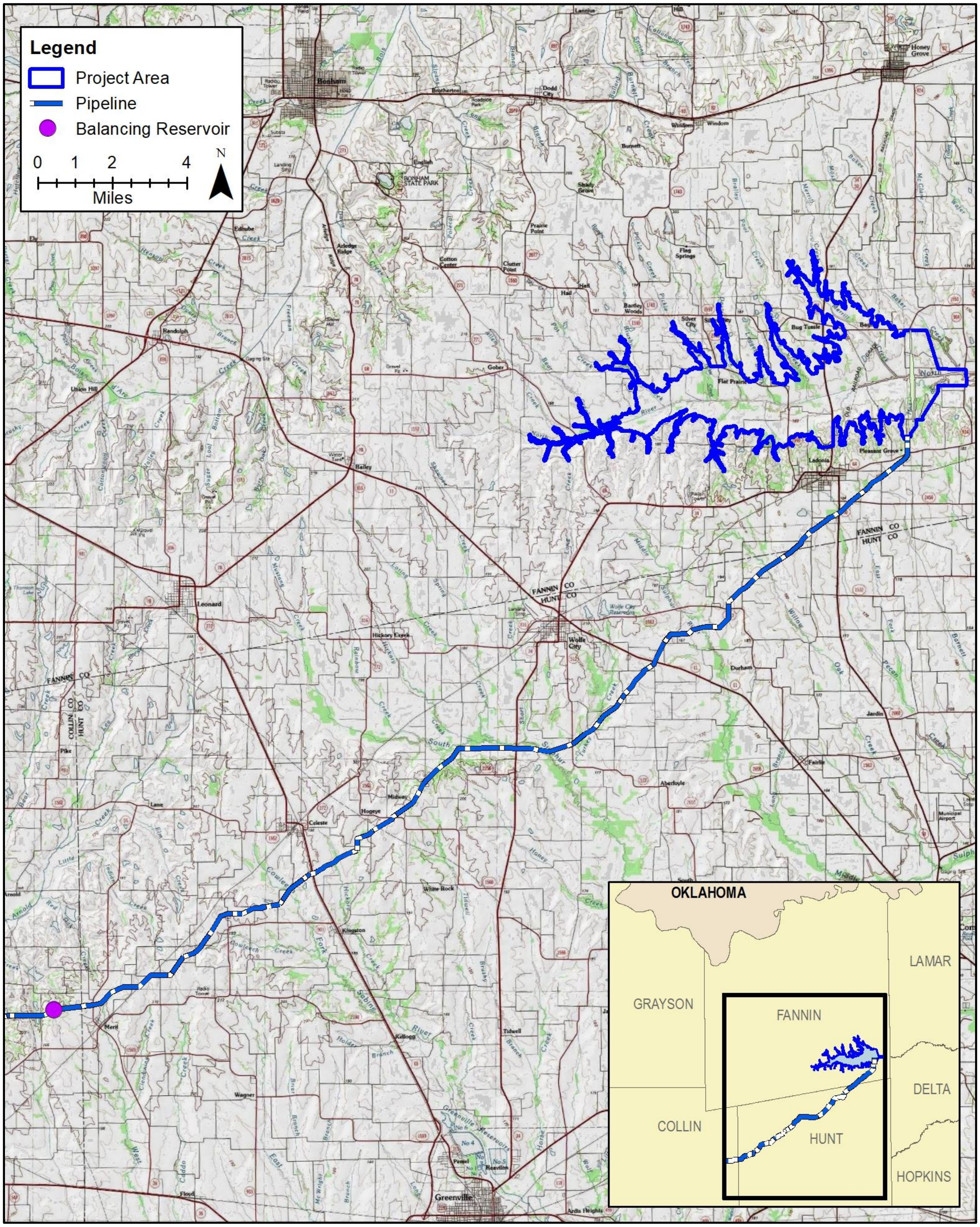


Figure 1-2: Reservoir and Conservation Pool Boundaries

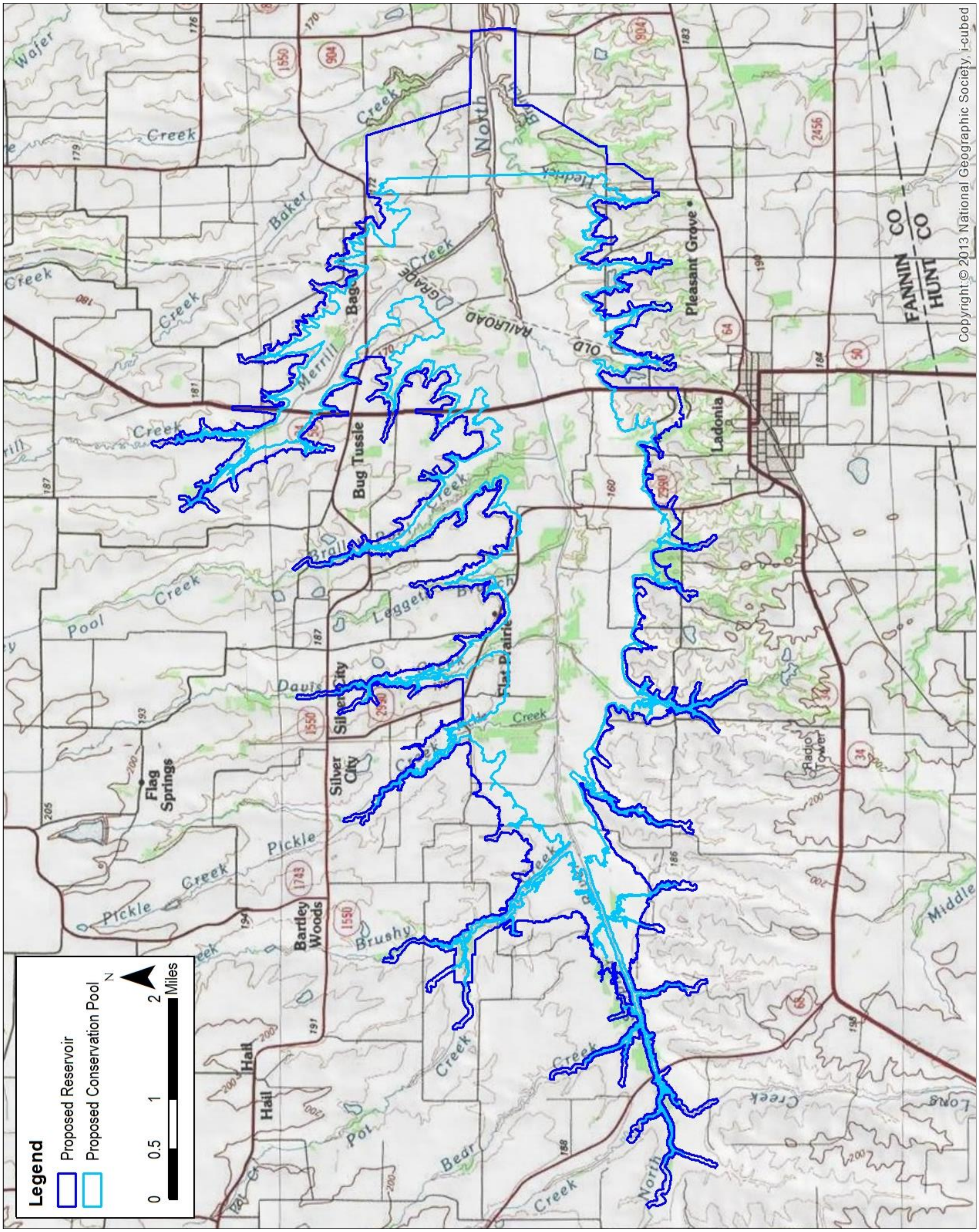
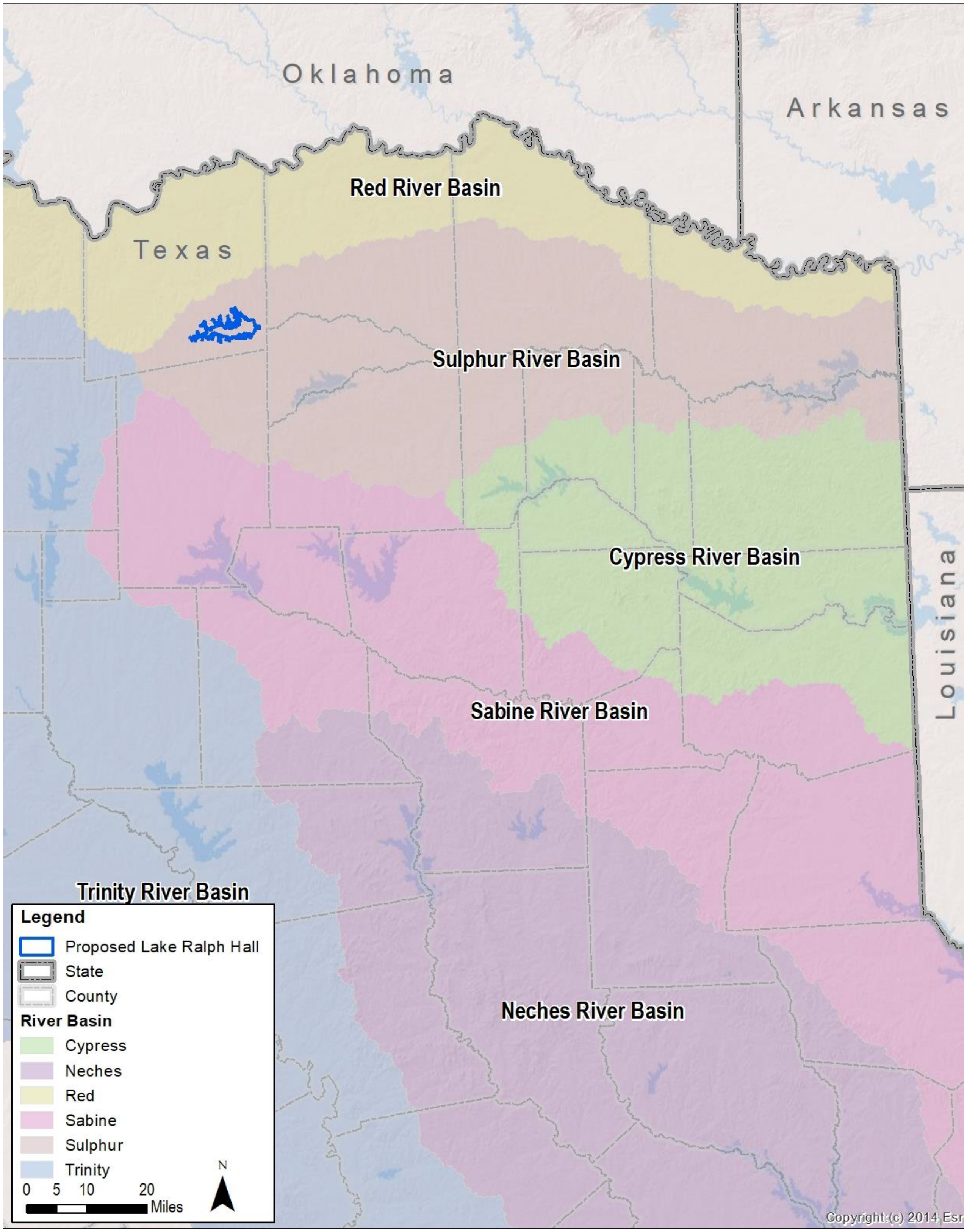
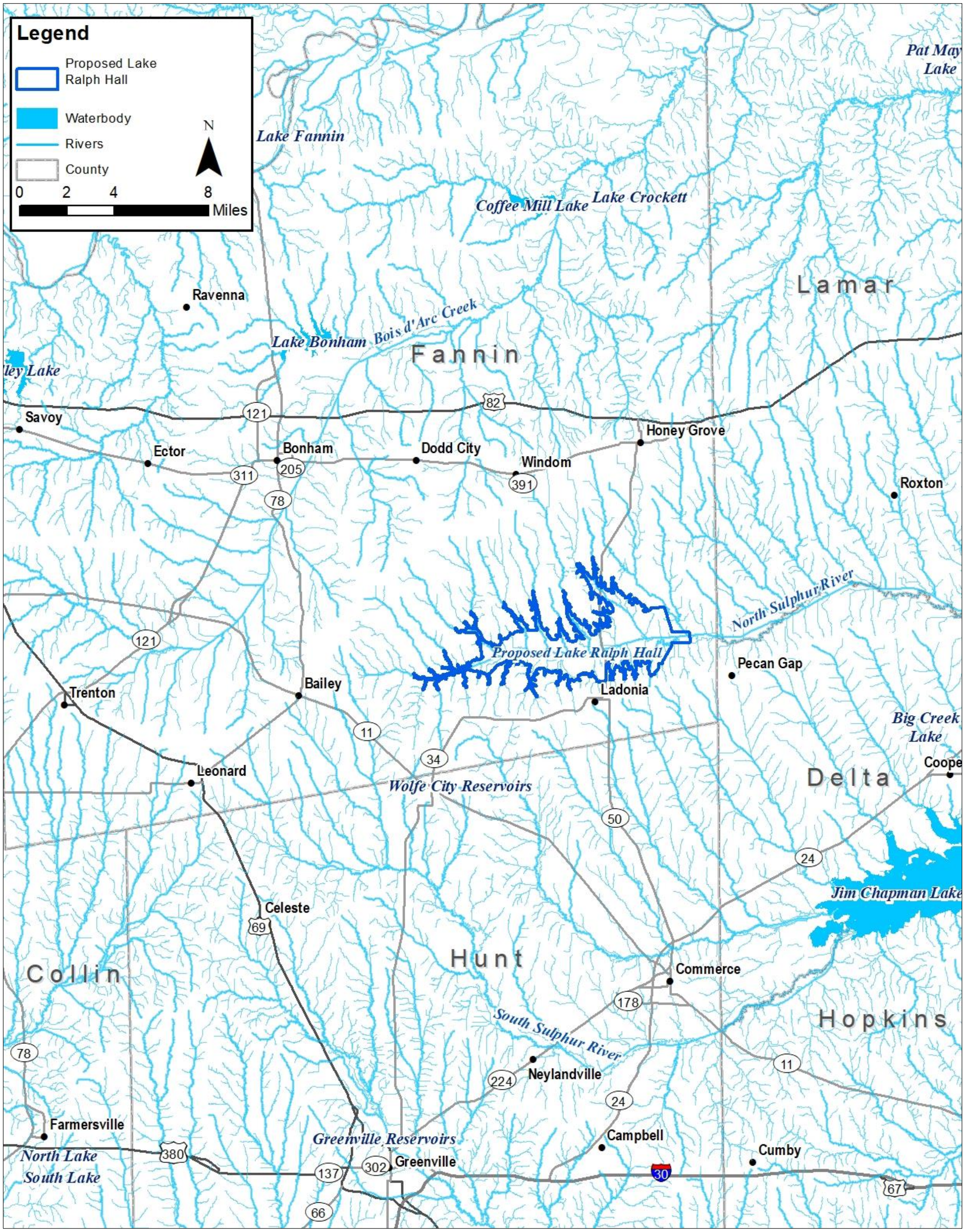


Figure 1-3: River Basins



Source: TWDB

Figure 1-4: Streams and Waterbodies



Source: National Hydrography Dataset

1.2 Authorizing Actions

UTRWD submitted an application to USACE on October 30, 2006, (USACE Project #200300336) for a Department of the Army permit under Section 404 of the CWA. This permit would authorize UTRWD to discharge approximately 650,000 cubic yards of dredged and fill material into approximately 33 acres of waters of the US and inundate approximately 8,500 acres in total with approximately 325 acres of that total being waters of the US associated with the construction and operation of the proposed Lake Ralph Hall project. The proposed Lake Ralph Hall project has obtained a Permit to Appropriate State Water from the TCEQ under Section 11.121 of the Texas Water Code, and Title 30, Chapters 288, 295, 297, and 299 of the Texas Administrative Code (TAC). Federal, State and local permits and approvals required for UTRWD to construct and operate the proposed Lake Ralph Hall project are shown in **Table 1-1** and **Table 1-2**.

Table 1-1: Other Environmental Permits

Federal	
US Army Corps of Engineers	Clean Water Act Section 404 Permit
	Rivers and Harbors Act of 1899 Section 14 (408) Permission (Issued February 15, 2017)
State of Texas	
Texas Commission on Environmental Quality	Permit to Appropriate State Water (Issued December 11, 2013)
	Clean Water Act Section 401 (Surface Water Quality) Certification
	Texas Pollutant Discharge Elimination System Permit – Storm Water Construction Permit

Table 1-2: Other Requirements, Approvals, and Review Authorities

Federal	
US Environmental Protection Agency	EIS Review
US Fish and Wildlife Service	Endangered Species Act Review
	Fish and Wildlife Coordination Act
	Migratory Bird Treaty Act
US Forest Service	Land Exchange
State of Texas	
Texas Department of Transportation	Approval for roadway relocations, abandonment, and bridge reconstruction
Texas Historical Commission	Section 106 of the National Historic Preservation Act
	Native American Graves Protection and Repatriation Act
	Archaeological Resource Protection Act
	American Indian Religious Freedom Act
	Texas Antiquities Code
Texas Parks and Wildlife Department	Habitat
	State Species of Concern
Local	
Fannin County	Approval for county road realignment, abandonment, and conversion
	Approval for stream channel modifications under the National Flood Insurance Program

1.3 Organization of the EIS

This EIS complies with CEQ's EIS requirements (40 CFR 1502.10) and USACE's requirements (33 CFR 325 Appendix B for NEPA). **Chapter 1.0** provides descriptions of the purpose and need for the actions, the role of USACE in the EIS process, and the required regulatory actions for the proposed Lake Ralph Hall project. **Chapter 2.0** describes the alternatives including the proposed Action and the No Action Alternative. **Chapter 3.0** describes the affected environment. **Chapter 4.0** describes the direct, indirect, and cumulative impacts associated with the project alternatives and possible mitigation to minimize or compensate for impacts; and any residual adverse effects following implementation of mitigation. **Chapter 5.0** summarizes public participation and the scoping process, and the consultation and coordination undertaken to prepare the EIS. **Chapter 6.0** presents the list of preparers and reviewers. **Chapter 7.0** provides the list of references. **Chapter 8.0** contains the glossary and **Chapter 9.0** contains the index. For those aspects of the analysis that warrant more substantial disclosure and to provide the reader with important information, appendices are also included. Copies of supporting documents will be available for public review at USACE Fort Worth's District Office located in Fort Worth, Texas and online at the following address: http://www.swf.usace.army.mil/Missions/Regulatory/Permitting/ProposedLakeRalphHall.aspx.

1.4 Project Proponent and Permit Applicant

UTRWD was created by Texas Legislature in 1989 as a non-profit governmental enterprise that provides certain utility services on a wholesale basis. The impetus for UTRWD came from 25 cities and water utilities in Denton County, Texas located immediately north of the City of Dallas. These cities and utilities, with support from the Dallas Water Utilities (DWU), recognized that while Denton County was in the Dallas planning area, they would be best served by creating an independent entity that would provide long term, dependable water supply from surface water sources. UTRWD has 26 Directors on its Board of Directors, made up of 20 from cities and towns, four from special districts, and two from Denton County. It is headquartered in Lewisville within Denton County.

This special district offers the following services to its Members and Customers:

- Wholesale treated water supply planning, development, delivery, conservation and reuse;
- Regional wastewater treatment, water reclamation, and water reuse;
- Non-potable water for irrigation purposes;
- Household hazardous waste collection; and
- Watershed protection.

Members and Customers may voluntarily choose which of these services they wish to avail themselves. UTRWD recoups service costs solely on the basis of services utilized. The focus of this EIS is limited to the UTRWD water services only. Once a Member or Customer chooses to avail themselves of UTRWD's water services, they are obligated to pay their portion for all new sources of supply for the District. UTRWD considers its total water supply to be available to all Members and Customers and individual entities cannot choose the projects that they will or will not pay for as the supply system is developed.

The distinction between Members and Customers relates mostly to the time period when each contract was signed. Members are those entities which entered into participation contracts within the statutory period during the formative stages of UTRWD and Customers are those entities which signed contracts after that time period until the present. Each Member may appoint a representative to the Board of Directors. Customers are represented by a single, at-large representative appointed by Denton County. In terms of treated water service, both Members and Customers have long term contracts with the UTRWD which obligates UTRWD to provide sufficient water to meet that Member's or Customer's future needs. These contracts are renewable by the Member or Customer. UTRWD is legally obligated to provide treated wholesale water to retail water providers within UTRWD's planning area, including Denton County and small portions of Dallas, Collin, Grayson, Wise and Cooke counties to the extent that Denton County Customers' service areas extend outside the County.[1]

UTRWD's current and potential wholesale water Customers are listed in **Table 1-3**. A service area map of UTRWD Members, Customers and Prospective Customers is shown in **Figure 1-5**.

Table 1-3: Upper Trinity Regional Water District Wholesale Water Members, Customers and Prospective Customers

UTRWD Members and Customers	
Argyle WSC • City of Argyle* City of Aubrey* Cross Timbers WSC • Town of Bartonville* • City of Copper Canyon* • Town of Double Oak* City of Celina* City of Corinth* Denton County FWSD No. 1A (Castle Hills)* Denton County FWSD No. 7* Denton County FWSD No. 8A Denton County FWSD No. 9 Denton County FWSD No. 10 Denton County FWSD No. 11A	Town of Flower Mound* City of Highland Village* City of Justin* City of Krum* Lake Cities of Municipal Utility Authority (MUA)* • Town of Hickory Creek • City of Lake Dallas • City of Shady Shores City of Lincoln Park* Mustang Special Utility District (SUD)* • City of Cross Roads • City of Krugerville • City of Oak Point* Northlake City of Sanger*
Prospective Customers	
Ladonia Pilot Point*	Ponder* Prosper*

Notes: (1) * indicates a Member; Indented indicates an indirect Customer, their water is provided by UTRWD through the entity above.
(2) WSC indicates Water Supply Corporation
(3) FWSD indicates Fresh Water Supply District
(4) MUA indicates a Municipal Utility Authority
(5) SUD indicates Special Utility District
(6) The list of Prospective Customers is restricted to those entities that have a contractual relationship with UTRWD for future water service and have an explicit expression to participate. There will likely be other entities that receive water from UTRWD in the future, but they are not included in this EIS.
(7) Ponder, Prosper and Pilot Point are UTRWD Members who currently do not receive any water from UTRWD as they are outside UTRWD's current water delivery area. Once an extension of the water transmission system allows UTRWD to provide service to these Members, they plan to purchase water from UTRWD, therefore they are included as prospective customers.
Source: Upper Trinity Regional Water District, 2015.

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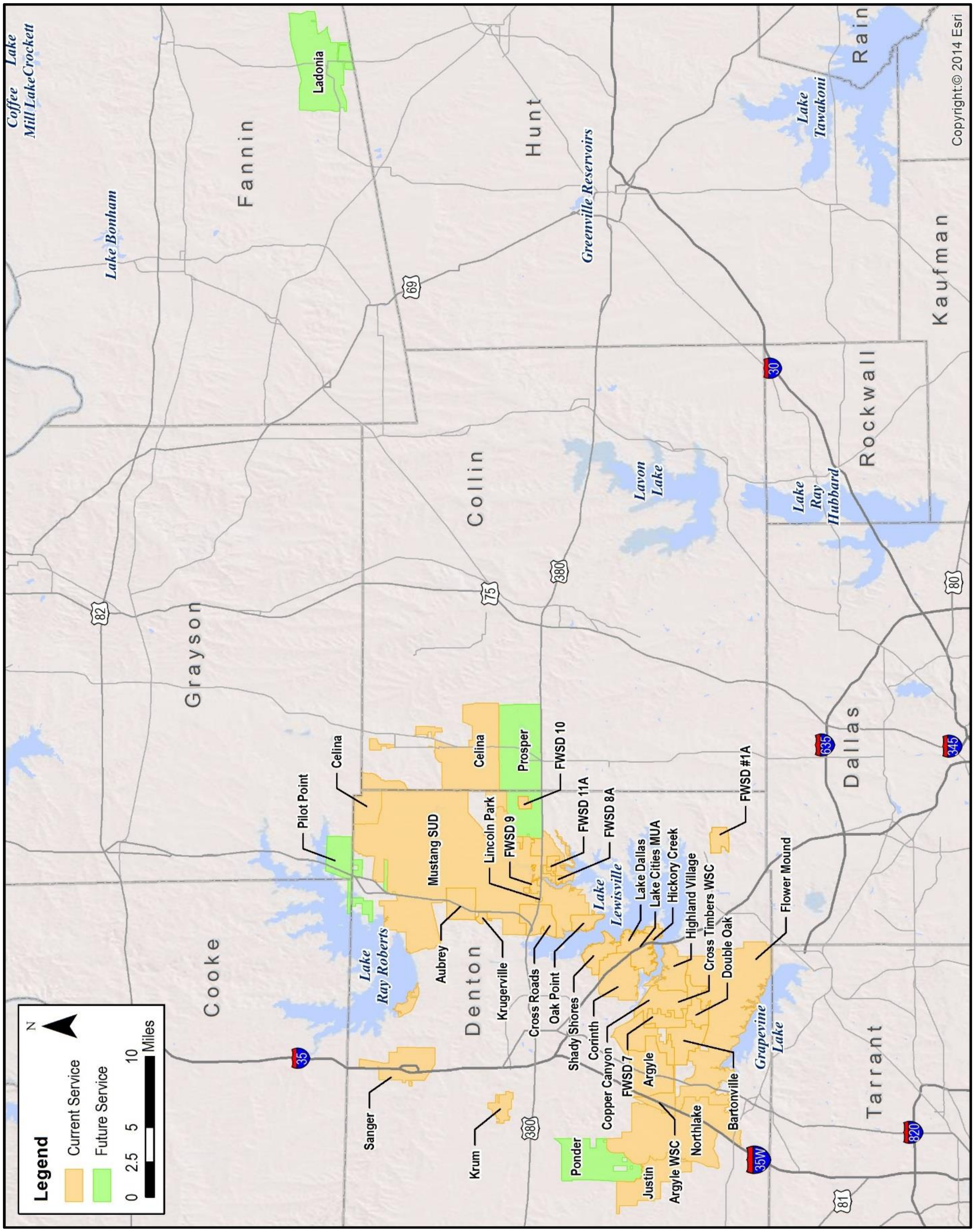
[1] Texas State Bill SB 1657 from legislative session 74(R). The bill was signed on June 12, 1995 and went into effect on September 28, 1995. House Bill No. 3112, codified as Chapter 1053, Regular Session, 71st Legislature (1989), effective June 16, 1989, provides a definition of "Basic Service Area" to mean "the geographic area in the corporate limits of all participating members, all contract members, and all customers and the areas that are served by those members and customers". Section 24 of HB 3112, titled "Rights of Basic Service Area", provides "This Basic Service Area has the primary right to water or wastewater treatment capacity and to water supply in each classification that the District secured under permit from the state agency that has jurisdiction".
Senate Bill No. 1657, codified in Chapter 494, Regular Session, 74th Texas Legislature (1995), effective August 28, 1995, provides "The boundaries of the district are coterminous with the boundaries of the county, plus the entire area in the boundaries of any contract member or participating member, a portion of whose incorporated limits is partially in the boundaries of the county as those boundaries existed on the effective date of this Act, and including the area within the boundaries of the City of Irving, Dallas County, Texas."

Figure 1-5: UTRWD Members, Customers and Prospective Customers



Source: Upper Trinity Regional Water District and Public Utility Commission of Texas, 2015

1.5 UTRWD's Proposed Lake Ralph Hall Reservoir Project

The proposed Lake Ralph Hall project would include the construction of an earth-filled dam embankment across the valley of the North Sulphur River with a concrete uncontrolled principal spillway located adjacent to the existing channel of the river and an excavated unlined earthen channel emergency spillway located within the embankment on the northern floodplain of the river. The embankment placed would vary between 566 feet and 568 feet North American Vertical Datum of 1988 (NAVD88) to account for anticipated settlement of the embankment thus providing an effective elevation of 566 feet NAVD88 after settlement and would adjoin the existing ground surface on both ends of the structure. Current studies indicate the proposed Lake Ralph Hall reservoir would have a conservation pool storage capacity of approximately 160,235 acre-feet (AF) (at an elevation of 551.0 feet above MSL), and at that capacity, the surface area of the reservoir would be approximately 7,568 acres. However, it is anticipated that the storage volume is somewhat larger due to continued erosion that has occurred during the permitting and planning period. The maximum depth of the reservoir at the dam would be approximately 90 feet. The firm annual yield of the proposed project would be approximately 34,050 AF/year.

Water Use Permit No. 5821, the TCEQ-issued state water right permit for Lake Ralph Hall, authorizes UTRWD to impound up to 180,000 AF in the proposed Lake Ralph Hall and authorizes the diversion and use of water supplies with a firm yield of approximately 34,050 AF/year when the proposed project would be operated as part of UTRWD's overall water supply system. Raw water would be conveyed from the proposed Lake Ralph Hall reservoir in the Sulphur River Basin via inter-basin transfer directly to the existing Tom Harpool Water Treatment Plant (WTP) located adjacent to Lewisville Lake in the Trinity River Basin or directly into Lewisville Lake for use at the existing Thomas E. Taylor Regional WTP via a proposed raw water transfer pipeline (see **Figure 1-6**).

The existing Irving Pipeline includes a balancing reservoir (see **Figure 1-6**), located approximately one-mile west of Merit, Texas. The balancing reservoir provides a hydraulic grade break between the Jim Chapman Raw Water Pump Station and the Irving Booster Pump Station (see **Figure 1-6**) located near Princeton, TX. This hydraulic break is necessary for stable operation of the two pump stations.

Although the Lake Ralph Hall Raw Water Pipeline will discharge at the same hydraulic gradient as the Irving Balancing Reservoir, a 4.5-acre balancing reservoir is proposed as part of the project. This reservoir is proposed to be located near the existing Irving Balancing Reservoir (see **Figure 1-6**). The size of the reservoir in terms of surface impacts is unknown until more detailed design is completed, however it is not anticipated to be more than the existing Irving Balancing Reservoir.

The proposed Lake Ralph Hall Raw Water Pipeline will be approximately 60 inches in diameter and, from the lake, it will travel southwest for approximately 32 miles to connect to Irving's Jim

Chapman Pipeline downstream of Irving's existing Balancing Reservoir (see **Figure 1-6**).[2] The connection will be a "tee connection" into the existing pipeline with valves on each branch to allow isolation to facilitate maintenance. The installed capacity of the Irving Jim Chapman Pipeline is 80 million gallons per day (mgd). The proposed Lake Ralph Hall project includes provisions to make improvements to the existing Irving pump station to increase its pumping capabilities. After completion of these improvements it is projected that the Irving pump station and pipeline system will have a capacity of 104 mgd.

With these improvements to Irving's existing pump station there will be adequate capacity to carry all water authorized from proposed Lake Ralph Hall. These improvements will be contained to the interior of the existing pump station thus averting any environmental impacts.

[2] Further details on the Lake Ralph Hall Raw Water Pipeline are presented in Chapter 4.

Figure 1-6: Lake Ralph Hall Raw Water System Location Map

Source: Upper Trinity Regional Water District, 2015

The actual use of water from Lake Ralph Hall will vary from day to day depending on the following factors:

1. The actual water supply usage by UTRWD Members and Customers;
2. The availability of water from Lake Ralph Hall and UTRWD's other water supply sources; and
3. The capability and operational status of water conveyance and treatment infrastructure.

Through this inter-basin transfer, UTRWD would provide water to towns and cities in Collin, Cooke, Dallas, Denton, Grayson, and Wise Counties within the Trinity River Basin. The proposed project would divert and use up to 34,050 AF (on a firm yield basis) of water per year for municipal, industrial, agricultural and recreational purposes of use, as authorized by Water Use Permit No. 5821, and impeding continued erosion and environmental degradation of the North Sulphur River channel.

The proposed Lake Ralph Hall reservoir project would also require roadway adjustments to alignment and grade and/or abandonment of State, county, and local roads within the proposed project footprint (see **Figure 1-7**). State Highway 34 crosses the project boundary near the east/west center of the proposed Lake Ralph Hall. The construction of two bridges over separate portions of the proposed lake will require realignment of the existing highway in order to maintain access during construction. The adjustments made to SH 34 will consist of a new parallel alignment to the west of the existing roadway north and south of the North Sulphur River and north and south of Merrill Creek. The new roadway will consist of two 12-foot wide lanes with two 10-foot wide shoulders. The proposed roadway will connect back to the existing roadway north and south of the project boundaries. All ROW necessary for the construction of the new alignment and the bridge structures will be dedicated to TxDOT by UTRWD prior to construction.

The proposed Lake Ralph Hall Bridge will be approximately 6,000-foot in length with an overall deck width of 46' to accommodate two-12' wide lanes (one lane in each direction) with 10' wide shoulders. The proposed Merrill Creek Bridge will be approximately 625' in length with an overall deck width of 46' to accommodate two-12' wide lanes (one lane in each direction) with 10' wide shoulders.

In order to successfully implement the proposed Lake Ralph Hall, key roads would require adjustments to alignment and grade (**Figure 1-7** and **Table 4-11**). The following State and County Roads would be abandoned or partially abandoned as a result of the impoundment of the proposed Lake Ralph Hall; FM 2990, FM 1550, CR 3365, CR 3370, CR 3380, CR 3600, CR 3605, CR 3610, and CR 3640. SH 34 and CR 3444 would require vertical adjustment. A short segment of CR 3640 would be adjusted vertically and/or horizontally. County Roads 3443 and 3444 would be re-aligned horizontally and vertically and would include new drainage culverts and a 24-foot road surface with drainage swales on both sides.

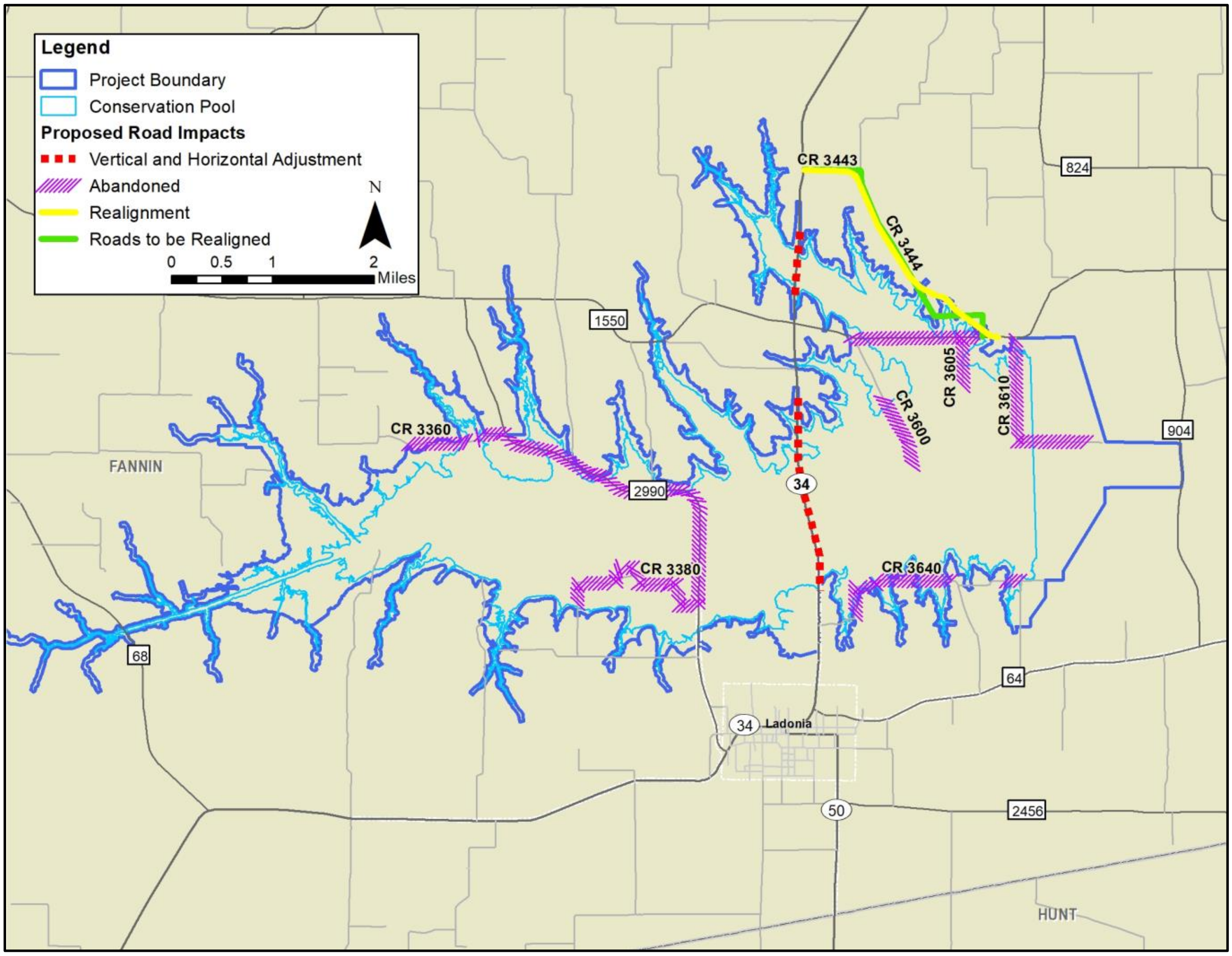
1.5.1 Scope of Federal Control and Responsibility over the Proposed Action and Alternatives

USACE's control and responsibility over actions proposed with the project comprise activities in waters of the US and their associated actions. This "scope of action" includes those activities that result in the fill of waters of the US and other associated activities in waters as well as uplands for construction of the dam and its facilities. The raw water transfer pipeline from Lake Ralph Hall to Lewisville Lake in waters of the US and adjacent upland areas, and waters of the US that would be filled as a result of relocating roads and their adjacent uplands, are included in the defined actions. However, for NEPA disclosure and public interest review purposes, activities beyond the USACE's control and responsibility associated with the listed actions are also included in the EIS to ensure complete consideration of the project and its effects. This EIS describes the proposed construction and operation of the Lake Ralph Hall project, including UTRWD's environmental protection measures; identifies alternatives to the Proposed Action; and describes the direct, indirect and cumulative effects ("scope of effects") resulting from each alternative to the relevant resource factors.

1.6 Need for Action

Understanding the need for a proposal is important in supporting the definition of a project's purpose. It provides the information to allow a determination of the legitimate factors to be included in the project purpose and reflecting the objective(s) of the applicant. UTRWD summarized its need for the proposed Lake Ralph Hall project in its Section 404 permit submittal to the USACE in October 2006. UTRWD's 404 permit application included an analysis of water supplies and future demands. UTRWD stated that population and resulting water demand growth was very rapid in its service area, and a five-fold increase in demands by the year 2060 was expected.

Figure 1-7: Lake Ralph Hall Roadway Impacts



Source: Proposed Modifications to State and County Roads Due to the Effects of the Proposed Lake Ralph Hall Technical Memorandum August 2018.

Based on an assessment of current and anticipated supplies, UTRWD believes that water demands will exceed supplies before the year 2030 and that the shortfall will grow considerably by 2060. The UTRWD also pointed out the need for additional security/reliability in its water supplies in case one or more of the existing supplies become unavailable. UTRWD updated its water supply-demand data in a Raw Water Reliability Study (RWRS) in 2010; this revision of the previous data did not alter the UTRWD's assessment that it would be short of water supply before 2030. The proposed Lake Ralph Hall project was also evaluated as part of the Region C Regional Planning Group under the auspices of the Texas Water Development Board (TWDB) in 2001, updated in 2006 and again in 2011. That state process compared water supplies and projected demands for cities, towns and water user groups and confirmed UTRWD's need for the proposed Lake Ralph Hall project.

The applicant's need for additional water supplies was independently analyzed by USACE through supply and demand evaluations in preparation of this EIS in accordance with 40 CFR 1506.5(a). These analyses and their conclusions are summarized later in this document. Questions which were key factors targeted in the independent analysis of the applicant's need included:

1. What current supplies does UTRWD have available and how dependable are they for meeting long term needs?

2. What are reasonable projections of water demands UTRWD can be expected to meet in the long term future? For the purposes of this EIS, the year 2060 was selected for the forecasting horizon. The year 2060 was selected as a reference because water demand projections, including surface water demand projections and modeled available groundwater are traditionally reported by each groundwater conservation district and the Region C Water Planning Group for each decade up to 2060.

1.6.1 UTRWD's Existing Water Supplies and Water Supply System

Apart from the Lake Ralph Hall water right, UTRWD does not own any water rights; it obtains supplies through contracts with various water rights holders. UTRWD currently obtains its raw water from four sources: 1) a contract with DWU; 2) a contract with the City of Commerce; 3) a contract with the City of Denton and; 4) a reuse permit from the State of Texas related to Jim Chapman Lake (Commerce contract water). UTRWD also has a contract with the City of Irving to purchase their excess water; however, Irving's demand is currently greater than its supply and no water has ever been available to UTRWD through this contract. **Table 1-4** provides a summary of the UTRWD water supply as well as the other supply sources for their Members and Customers through 2060.

Table 1-4: UTRWD Current and Future Water Supply Summary, 2010-2060 (AF)

Source	2010	2020	2030	2040	2050	2060
Dallas Contract	11,200	11,200	11,200	11,200	11,200	11,200
Commerce Contract	16,100	16,100	16,100	16,100	16,100	16,100
Chapman Lake Reuse	9,700	9,700	9,700	9,700	9,700	9,700
Additional Chapman Lake Reuse	6,400	6,400	6,400	6,400	6,400	6,400
Denton Contract	2,200	0	0	0	0	0
UTRWD Total	**45,600**	**43,400**	**43,400**	**43,400**	**43,400**	**43,400**
Non-UTRWD Sources[1]	40,500	42,100	49,000	51,300	53,700	56,200
Total	**86,100**	**85,500**	**92,400**	**94,700**	**97,100**	**99,600**

[1] Includes groundwater, DWU supplies to named entities and others, City of Fort Worth supplies and North Texas Municipal Water District supplies.

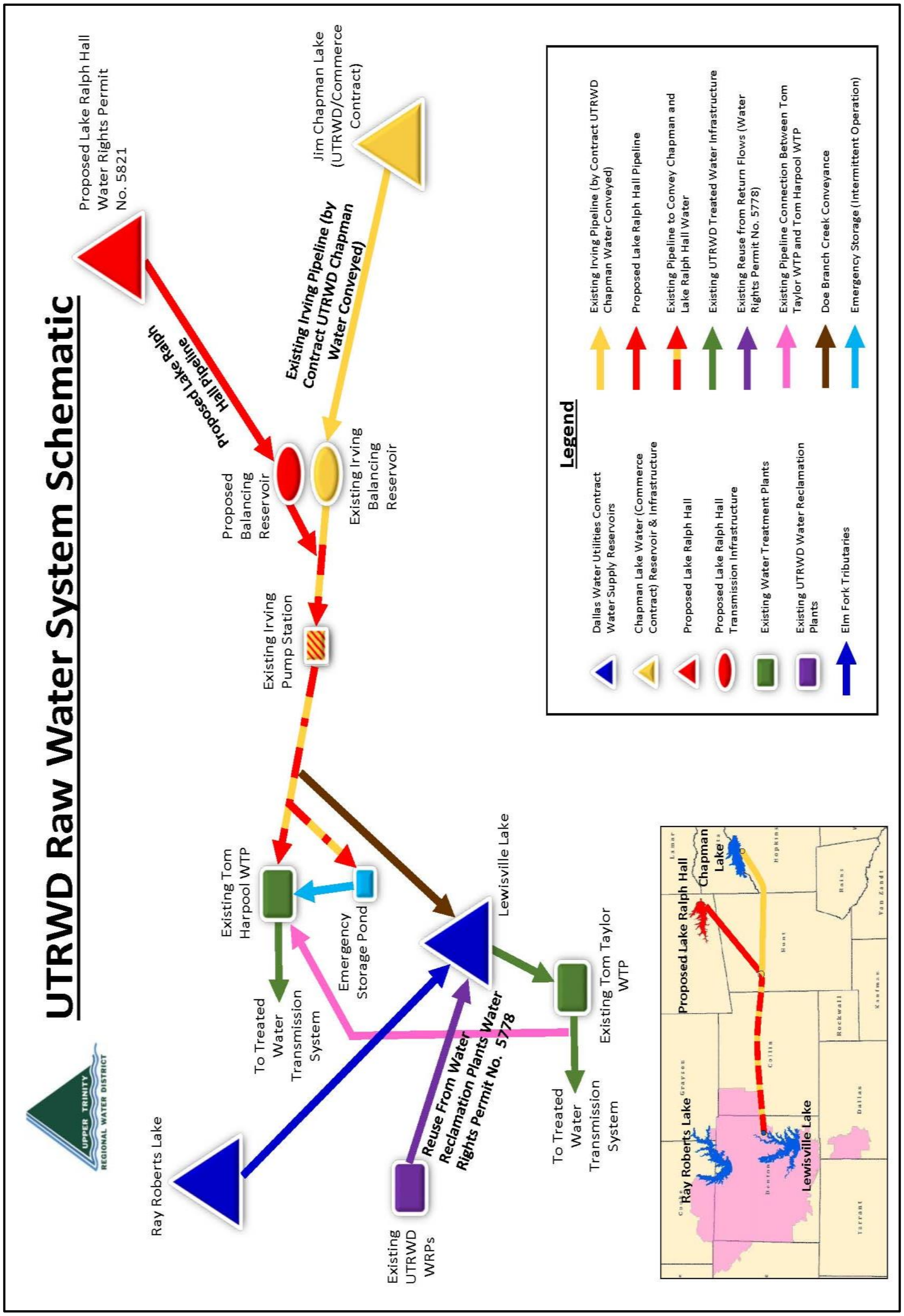
UTRWD withdraws its contract water from Lewisville Lake into its Thomas E. Taylor Regional WTP (**Figure 1-8 and 1-9**). The Tom Harpool WTP obtains its raw water from Jim Chapman Lake via the City of Irving's pipeline. The Jim Chapman Lake has an emergency storage pond located approximately one-third of a mile south-east of the Tom Harpool WTP (see **Figures 1-8 and 1-9**). The capacity of the emergency storage pond is 174 million gallons (or 534.18 AF). When Irving's raw water pipeline is not operational (planned maintenance, breakdown, etc.), the Tom Harpool plant's ability to supply water from Jim Chapman Lake to its Customers is restricted to the treated water provided by a connection to the Thomas E. Taylor Regional WTP and limited on-site raw water emergency storage (see **Figure 1-8 and 1-9**).[3]

Releases from Ray Roberts Lake are controlled by the USACE and primarily relate to environmental releases and flood control. Additional releases are made for Denton and Dallas for diversion at Lewisville Lake. No releases are made for UTRWD and UTRWD has no direct control over these releases. Conveyance losses between Ray Roberts and Lewisville Lake are negligible; but under any circumstance are not caused by UTRWD.

Certain elements of Irving's Jim Chapman Pipeline system will be critical to conveying Lake Ralph Hall water to UTRWD's water treatment plants (the Thomas E. Taylor WTP and the Tom Harpool WTP). Those critical elements are the Irving Booster Pump Station and approximately thirty miles of the Irving Pipeline downstream of the Lake Ralph Hall Pipeline connection point.

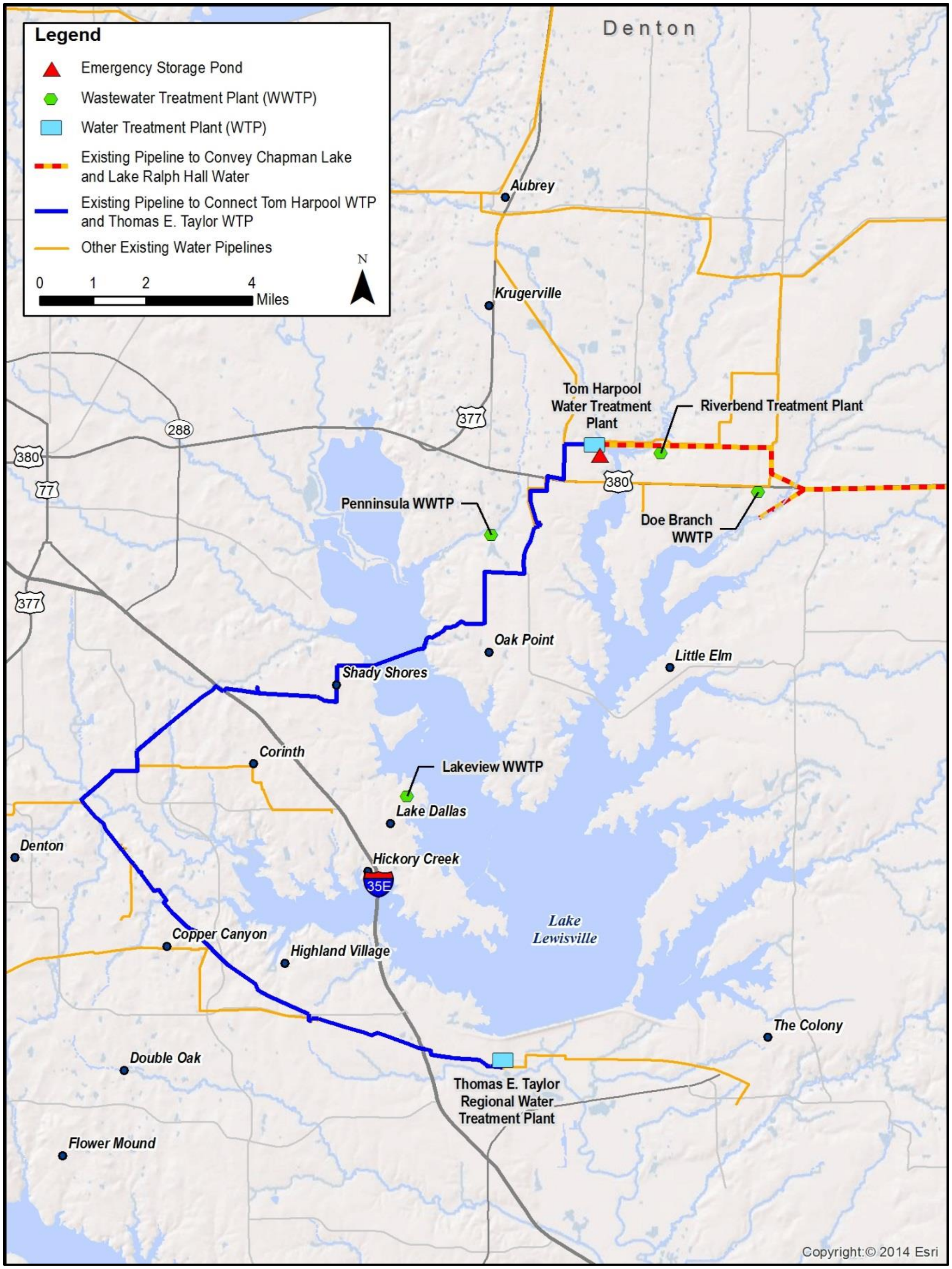
[3] Additionally, the reuse of Chapman Lake water would be available until the Chapman Lake water stored in the Harpool Emergency pond is depleted.

Figure 1-8: UTRWD Raw Water System Schematic



Source: Upper Trinity Regional Water District, 2015.

Figure 1-9: Water Treatment Location Map



Source: Upper Trinity Regional Water District, 2015.

Operational issues with any segment of the Irving Pipeline downstream of the connection point with the Lake Ralph Hall Pipeline would also interrupt transfers of Lake Ralph Hall water to UTRWD's treatment plants.

Likewise, a complete interruption of operation of Irving's pump station would similarly interrupt transfers from Lake Ralph Hall, but Irving's pump station has redundant pumping equipment making full scale interruption highly unlikely. The Irving Pump Station has transferred water for UTRWD for 12 years without interruption. In case of an interruption of transfers from Lake Ralph Hall and Jim Chapman Lake, UTRWD would have to rely on purchasing water from the City of Dallas under the Dallas contract and supplies to the Tom Harpool WTP from the Emergency Storage Pond.

1.6.1.1 City of Dallas Contract (Dallas Water Utilities)

UTRWD's contract with DWU is for withdrawal of water from Lewisville Lake or Ray Roberts Lake. UTRWD currently does not have infrastructure to divert water directly from Ray Roberts Lake; however, they do have the right, under their agreement with the city of Dallas, to construct diversion facilities in Ray Roberts Lake. UTRWD accesses water from Ray Roberts Lake by releases from the lake into Lewisville Lake, diverting the water at its Lewisville Lake Raw Water Intake to the Tom Taylor WTP which can provide water to the Tom Harpool WTP. There is no direct connection between Tom Harpool WTP and Lewisville Lake.

Both lakes are operated by the USACE and are managed in tandem.[4] UTRWD's contract is for 11,200 AF of raw water per year plus a sufficient quantity to meet the present and future needs of the following named entities: Argyle Water Supply Corporation (WSC), Carrollton, Coppell, Denton, Corinth, Lake Cities MUA, Flower Mound, Highland Village, and Lewisville.[5,6] These entities were historically supplied by DWU, but UTRWD took over responsibility of delivering water to them by execution of its 1992 contract with DWU. UTRWD began supplying treated water on a limited basis in 1996.

The DWU contract specifies an annual volume limit only; there is no limit to the daily amount that UTRWD can withdraw. However, the 11,200 AF which UTRWD may withdraw is not a firm yield from Lewisville Lake and Ray Roberts Lake because during periods of water shortage, the available water may be allocated among those entities with water rights in the lakes based on their

[4] The USACE releases water from Lewisville Lake first in order to meet any withdrawal needs and then releases water from Ray Roberts Lake to keep Lewisville Lake at the desired level.

[5] Carrollton, Coppell, Denton and Lewisville are not UTRWD Customers. DWU provides raw water to UTRWD to meet the demands of these entities and UTRWD treats and delivers that DWU water to these entities.

[6] The named entities (excluding Carrollton, Coppell, Denton and Lewisville) are included in the needs analysis because they are UTRWD Members and Customers. Their population and water demand is forecast as UTRWD will require the facilities to handle the total amount of water demanded in the future. When the project need is calculated, the demands of the named entities (excluding Carrollton, Coppell, Denton and Lewisville) are considered to be fully supplied and contribute nothing towards the project need.

proportionate amount of storage in the lakes. UTRWD accesses water from Ray Roberts Lake by releases from the lake into Lewisville Lake and diverting the water at its Lewisville Lake Raw Water Intake which immediately supplies the Tom Taylor WTP. Water must be moved to Tom Harpool WTP via an interconnection with Tom Taylor. To date UTRWD has not been restricted in the quantity of water it procures under the Dallas Contract.

UTRWD's contract with DWU expires in February of 2022 and according to a recent communication, DWU will make no commitment to renew that contract as of January 2015[7]. Even so, DWU makes the assumption that it will continue to supply the base amount of the existing contract plus future demands for the named entities. As embodied in its long range water supply plan, DWU has assumed this relationship will continue at least through 2070[8].

In sum, the DWU water supply is subject to reduction and even curtailment in time of water shortages and contract renewal is subject to some uncertainty, although this uncertainty is perceived to be low. For the purposes of this EIS, although there is some vulnerability associated with UTRWD's water supply from DWU, it is considered a reliable source based on UTRWD's continued provision of water to its current member and customer base as well as their willingness to rely on such a source for future customers.

1.6.1.2 City of Commerce Contract

UTRWD has a contract with the City of Commerce for raw water from Jim Chapman Lake. In turn, the City of Commerce has a contract with the Sulphur River Municipal Water District (SRMWD), who owns 20 percent of the water rights in Chapman Lake.[9] The City of Commerce contracts for half of SRMWD's share of Chapman Lake (10 percent of the lake's total water). UTRWD's contract with the City of Commerce is for a maximum of 16,106 AF/year.[10] In fact, due to water availability in Chapman Lake, UTRWD has only been able to divert a maximum of 13,730 AF in the 11 years it has had this contract, with an average of 11,090 AF. The contract was signed in 1991 and automatically renews every 25 years unless UTRWD provides five years notice prior to termination. After 2066, the City of Commerce can reduce the quantity of water supplied with each subsequent renewal and in 2141 they have the right to cancel the contract if they wish. Included in this contract is an inter-basin transfer permit allowing UTRWD to transfer the water from the Sulphur River Basin to the Trinity River Basin. UTRWD gets raw water via the Irving pipeline which delivers it directly to the Tom Harpool WTP and from an intake in Lewisville Lake that connects to the Thomas E. Taylor WTP.

[7] Letter from Jody Puckett, Director, DWU to Stephen Brooks, USACE, January 28, 2015.
[8] Dallas Water Utilities, 2014 Dallas Long Range Water Supply Plan to 2070 and Beyond (Dec. 2015).

[9] The SRMWD consists of the cities of Sulphur Springs, Commerce and Cooper.

[10] This is the entire amount of the contract between the City of Commerce and SRMWD.

In sum, this supply source depends on the fulfillment of two contracts, but those appear to be secure for at least 60 years. An additional contract with the City of Irving was executed in 1999 that provided space in a pipeline to convey the Chapman Lake raw water to Lewisville Lake. This supply is also subject to shortages of available water in Chapman Lake during drought conditions.

1.6.1.3 City of Denton Contract

Currently the City of Denton owns water rights in Lewisville and Ray Roberts Lakes in excess of their needs. UTRWD has a contract with the City of Denton to purchase this excess raw water. The City of Denton provides this excess raw water to UTRWD via UTRWD's intake in Lewisville Lake. The quantity of water available for purchase by UTRWD is determined by the City of Denton on an annual basis and varies each year. In 2013, UTRWD purchased approximately 6,900 AF from the City of Denton. This contract expired in 2012, but UTRWD has exercised its option to renew for another 10-year period and the negotiations are ongoing. The City of Denton anticipates that its water needs will grow and this UTRWD water supply will diminish to zero by 2022.[11] This supply is excluded from available UTRWD supplies in this EIS after 2022.

1.6.1.4 State of Texas Reuse Permit

UTRWD holds a reuse permit from the State of Texas allowing for the withdrawal of up to 9,664 additional AF/YR of water from Lewisville Lake annually.[12] The specific amount is based on effluent treated by UTRWD but cannot exceed 9,664 AF/YR. The daily allowed withdrawal is equal to 60 percent of the amount of Chapman Lake water deposited into Lewisville Lake for use by UTRWD on the previous day assuming UTRWD brings over the full authorization of 16,106 AF/year from Lake Chapman. The reuse permit takes into account the fact that only a portion of the water that UTRWD takes from Lewisville Lake is fully consumed; the remainder is used in a manner such that it ends up back in Lewisville Lake. Almost all the water reclamation plants serving UTRWD's Customers release treated water back into Lewisville Lake. While the reuse permit makes additional water available for UTRWD Customers, it is dependent on the daily availability of water from Chapman Lake which is considered a reliable source.

1.6.1.5 Permits and Agreements

UTRWD has the following permits and agreements in place in order to operate its water system:

- UTRWD has a pass-through agreement with DWU, the City of Denton and the City of Lewisville allowing them to transfer its water across Lewisville Lake. This agreement

[11] CP & Y, Raw Water Reliability Study, Upper Trinity Regional Water District, 2010b

[12] The permit includes a pass-through clause, which states that the current pass-through agreements UTRWD has negotiated with the Cities of Dallas, Denton and Lewisville apply equally to the reuse water. Additionally, reuse water is not subject to a priority call by senior water rights owners in the Trinity Basin. The permit only applies to water that UTRWD brings over from Chapman Lake and becomes null and void if any of the contracts involved in bringing the water over expire or are terminated.

stipulates daily accounting, so any water UTRWD puts in to Lewisville Lake has to be taken out that day or it becomes unavailable. UTRWD water imported into the Trinity Basin is either diverted directly to the Tom Harpool WTP Emergency Storage Pond or discharged into Lewisville Lake via Doe Branch Creek. Water diverted to Doe Branch Creek is withdrawn at the UTRWD Lewisville Lake raw water intake and treated at the Thomas E. Taylor WTP. As part of this agreement, UTRWD is allowed to purchase additional raw water from DWU. The amount purchased is limited to 40 percent of the Jim Chapman Lake return flows discharged into the Lewisville Lake drainage basin. While the long term water supply plan from Dallas does not assume any additional sales to UTRWD beyond the water for the named entities, to ensure a conservative supply estimate, this possibility is included in the analysis.

- To transfer the raw water associated with the Commerce Contract from Chapman Lake to Lewisville Lake, UTRWD executed a conveyance contract with the City of Irving in 1999 for 23 percent of their pipeline capacity. In 2002 the contract was amended. As amended, the contract provided for the conveyance of 16,106 AF/year from Jim Chapman Lake and any other water UTRWD may obtain the right to divert and use such as Lake Ralph Hall. The contract also provides that UTRWD may use any pipeline capacity not being used by the City of Irving. The contract expires in 2029, but will be automatically renewed for an additional 25 years unless UTRWD provides five years notice. UTRWD has no control over the operation or maintenance of this pipeline.

- UTRWD holds a “bed & banks” permit (Texas Natural Resource Conservation Commission [TNRCC], 2002) which allows them to transfer Chapman Lake water through Doe Branch (see **Figure 1-6**) and Lewisville Lake. UTRWD holds Permit No. 5701 issued by TCEQ which grants UTRWD the right to discharge its Lake Chapman Water at a rate up to 76,389 gallons per minute (gpm) into Doe Branch and transport the water along the bed and banks of Doe Branch and Lewisville Lake to UTRWD’s water treatment plant on the banks of Lewisville Lake (Thomas E. Taylor WTP) for subsequent diversion. This is a perpetual right, as defined under Texas water law, and is considered to meet the reliable requirement of this analysis. This permit allows UTRWD to deposit water into the north end of Lewisville Lake and then withdraw it at their WTP on the south shore. The permit places limits on both the rate of discharge (~ 76,000 gpm) and the annual quantity conveyed through Doe Branch (~16,000 AF/year).

With the exception of the pass-through agreement, which provides up to 6,400 AF/year, these agreements are operational in nature and do not provide UTRWD with any additional water supplies.

1.6.1.6 Water Treatment Facilities

UTRWD currently operates two WTPs (see **Figure 1-9**). The Thomas E. Taylor Regional WTP was expanded to a treatment capacity of 70 mgd in 2001. Its intake is located just north of the Lewisville Lake Dam. The Tom Harpool WTP began operation in 2008 and has a treatment capacity of 20 mgd. Raw water is provided to it from the City of Irving pipeline. A pipeline also connects the Thomas E. Taylor WTP to the Tom Harpool WTP which supplies treated water when the Irving Pipeline is out of service. The two plants operate as a system to meet the needs of the UTRWD's Customers. The two plants are connected by a water transmission pipeline, which has a limited capacity of approximately 8 mgd. This limits UTRWD's ability to serve its Customers from either plant alone. During the peak water demand months, each plant must meet the needs of the Customers in proximity to that plant.

UTRWD's water reclamation program includes three water reclamation plants (see **Figure 1-9**): 1) the 5.5 mgd Lakeview Treatment Plant located in the City of Lake Dallas; 2) the 2.0 mgd Riverbend Treatment Plant; 3) the 0.94 mgd Peninsula Treatment Plant; and 4) the 2.0 mgd Doe Branch Treatment Plant serve Customers in the northeast portion of UTRWD's service area.[13]

1.6.1.7 Emergency Water Supplies to UTRWD Members and Customers

UTRWD also maintains the following interconnections with other water providing entities for emergency purposes: 1) a connection with the DWU that could serve the Denton County Fresh Water Supply District (FWSD) also known as Castle Hills; 2) a connection with the City of Lewisville that could serve the City of Highland Village upon completion of required improvements; 3) a connection with the City of Denton on I-35 E that could serve the Lake Cities MUA, City of Corinth, Argyle WSC, and Cross Timbers WSC and; 4) a connection with the City of Denton on FM 2181 that could serve the City of Lantana, Lake Cities MUA, City of Corinth, Argyle WSC, and Cross Timbers WSC once some minor construction is completed.

1.6.1.8 Additional Water Supplies Available to UTRWD Members and Customers

Certain UTRWD Members and Customers obtain water from other sources:

- The City of Denton treats their own water.
- Flower Mound receives up to 11 mgd of its treated water from DWU, all remaining needs are met by UTRWD.
- The City of Lewisville receives treated and raw water from DWU.

[13] Wastewater treatment plants also function as water reclamation plants.

- Northlake currently receives two thirds of its water from Fort Worth by contract.
- Celina may receive up to 30 percent of its future supplies from the North Texas Municipal Water District.
- Certain existing Members and Customers currently supplement their supplies with groundwater.

These water supplies are accounted for in assessing the future demands upon UTRWD from present and prospective Members and Customers[14].

1.6.1.9 Summary of Available Water Supplies

The above sources provided UTRWD with an estimated total supply of 45,600 AF in 2010 and are expected to provide about 43,400 AF from 2020 through 2060. The total amount of water that UTRWD Members, Customers and Prospective Customers obtain from other sources was about 40,500 AF in 2010 and these are projected to grow to around 56,200 AF by 2060. The total amount of water available to UTRWD's Members, Customers and Prospective Customers from all sources was approximately 86,100 AF in 2010, increasing to just over 99,600 AF in 2060.

1.7 Water Demand

Water demands are a critical element in determining the need for the Lake Ralph Hall project. UTRWD's Members and Customers face future water demands which they expect UTRWD to supply. Future water demands must be projected for comparison with available supplies from UTRWD plus those other supplies available to the Members and Customers to indicate whether or not there are future unmet needs which UTRWD must fill with alternative water supplies. The projection of water demands into the long term is the starting point for this comparison to determine the quantity of new water supplies that will be required in the future and when those needs will occur.

Water demands can be projected through a number of techniques, but the technique most widely utilized by the UTRWD, many other water utilities, and TWDB, is a population/gpcd-based approach. This technique requires the development of population projections and the application of those projections to water use patterns expressed as gallons per capita per day (gpcd). Whereas econometric demand forecasting approaches or sectoral demand projections are respected water demand forecasting techniques as well, the gpcd-based technique is appropriate in this instance.

[14] The list of Prospective Customers is restricted to those entities that have a contractual relationship with UTRWD for future water service and have an explicit expression to participate. There will likely be other entities that receive water from UTRWD in the future, but they are not included in this EIS.

The relatively large number of small entities have limited data, which means that the gpcd approach is the best practicable approach for accomplishing the demand projections.

TWDB has also prepared demand projections as part of the state-wide water planning process; UTRWD is located within Region C, and is thus subject to the Region C Plan. The UTRWD projections are found in the 2010 RWRS. The TWDB has also prepared demand projections as part of the state-wide water planning process; the Region C Plan is the component which includes UTRWD. The population and water use data for these projections were evaluated and utilized to the extent appropriate in the water demand projections for this EIS. Population projections from other entities were also considered. Water use pattern information from a separate survey, conducted specifically for this EIS was utilized in the analyses. The population estimation, projections, and the water use pattern data are described below, leading to the water demand projections adopted for this EIS.

1.7.1 Population

Historically, population estimates are not compiled specifically for the UTRWD since it is not a county, municipality or a Census designated place. The UTRWD service area is comprised of cities and towns designated by the census, but also water user groups, including WSCs, FWSDs and MUAs, which are not estimated by the Bureau of Census or agencies normally responsible for population estimates and projections. This group of small communities and rural areas are situated on the northern outskirts of the Dallas metropolitan area and are continuing to become urbanized. As suburbanization occurs in North Dallas, these areas have evolved into suburban, mostly bedroom communities.

Current UTRWD Members and Customers and those Customers who are expected to join UTRWD in future years are included in the historical population data, the population projections and the water demand projections. Contractual commitments from each existing Member and Customer have been examined to verify the UTRWD supply responsibility. For future customers, this EIS only considers those with a written, clear and explicit request expressing an interest in joining UTRWD, coupled with UTRWD's geographic service responsibility expressed in its authorization documents.[15] In fact, it is possible that UTRWD will have additional customers not accounted for in this EIS. Historical population estimates for UTRWD's Members and Customers establish growth trends and are utilized in calculating gpcd. As set forth in **Table 1-5**, historical population estimates from 1990 through the year 2013 were compiled and estimated from a number of sources, including Bureau of the Census and Customer counts from individual water suppliers. The UTRWD Service area grew by almost four-fold from 1990 through 2013, from about 66,000

[15] UTRWD is governed by a Board of Directors appointed by its members. Members set the policies of UTRWD and establish the programs through their direct representation on the Board of Directors. Consequently, the services provided by UTRWD fit local needs and are in response to the requests of its Members (http://www.utrwd.com/History.html).

persons to 249,000 persons. Average annual growth was 5.9 percent during the 1990-2013 period and 4.5 percent from 2000 through 2013.

Table 1-5: Population Trends for UTRWD Members and Customers, 1990-2013

Members and Customers	1990	2000	2010	2011	2012	2013
Current						
Argyle WSC (total)	4,197	6,232	9,372	9,513	9,760	10,090
Argyle	1,575	2,322	3,282	3,336	3,442	3,561
Argyle WSC	2,622	3,910	6,090	6,177	6,318	6,529
Aubrey	1,138	1,561	2,595	2,677	2,703	2,718
Cross Timbers WSC (total)	4,407	5,684	7,070	7,371	7,521	7,641
Bartonville	849	1,131	1,469	1,604	1,621	1,633
Cross Timbers WSC	916	861	1,400	1,470	1,543	1,620
Copper Canyon	978	1,258	1,334	1,368	1,388	1,393
Double Oak	1,664	2,434	2,867	2,929	2,969	2,995
Celina	1,737	3,060	6,028	6,315	6,537	6,744
Corinth	3,944	11,383	19,935	20,250	20,517	20,618
Denton County FWSD #1A	748	2,400	7,749	8,921	9,720	10,922
Denton County FWSD #7	29	604	6,874	6,960	7,549	8,018
Denton County FWSD #8A	8	15	2,501	3,363	3,567	4,430
Denton County FWSD #9	66	672	4,786	5,230	5,674	6,106
Denton County FWSD #10	0	27	4,307	4,352	4,396	4,834
Denton County FWSD #11A	8	198	2,753	3,237	3,534	4,004
Flower Mound	15,527	50,853	64,669	66,112	67,969	68,609
Highland Village	7,027	12,172	15,056	15,389	15,617	15,747
Justin	1,234	1,894	3,246	3,290	3,322	3,333
Krum	1,542	2,077	4,157	4,339	4,503	4,632
Lake Cities MUA (total)	6,594	9,719	12,964	13,280	13,497	14,065
Hickory Creek	1,893	2,064	3,247	3,362	3,439	3,970
Lake Dallas	3,656	6,101	7,105	7,238	7,315	7,337
Shady Shores	1,045	1,554	2,612	2,680	2,743	2,758
Lincoln Park	287	517	308	311	312	311
Northlake	250	676	1,724	1,860	1,871	1,880
Mustang SUD (Denton Co) (total)	3,645	6,466	12,591	12,482	13,153	13,805
Cross Roads	361	581	1,563	853	862	865
Krugerville	735	1,032	1,662	1,608	1,625	1,637
Mustang SUD	1,904	3,099	6,580	7,095	7,649	8,248
Oak Point	645	1,754	2,786	2,926	3,017	3,055
Sanger	3,508	4,864	6,916	7,072	7,155	7,415
Denton County Unincorporated	10,404	20,062	27,850	29,081	31,385	32,714

Members and Customers	**1990**	**2000**	**2010**	**2011**	**2012**	**2013**
Subtotal:	**66,291**	**141,135**	**223,451**	**231,404**	**240,262**	**248,635**
Prospective Customers						
Ladonia	658	682	612	611	608	605
Pilot Point	2,538	3,550	3,856	3,912	3,989	4,006
Ponder	771	993	2,491	2,545	2,589	2,604
Prosper (Denton County portion only)	-	-	-	-	-	-
Subtotal:	**4,136**	**5,584**	**7,504**	**7,623**	**7,746**	**7,778**
Total:	**70,427**	**146,719**	**230,955**	**239,027**	**248,008**	**256,412**

Note: The list of Prospective Customers is restricted to those entities that have a contractual relationship with UTRWD for future water service and have an explicit expression to participate. There will likely be other entities that receive water from UTRWD in the future, but they are not included in this EIS.

Source: US Census Bureau, 2014; Raw Water Reliability Study, UTRWD, 2010b; 2011 Region C Plan, TWDB, 2011; UTRWD Member/Customer Survey, 2009; Harvey Economics (HE), 2014

Since the UTRWD serves a portion of Denton County and its mission is to continue to serve Denton County jurisdictions which request service, the growth of Denton County and its relationship to the UTRWD is instructive for UTRWD's own population projections. Denton County experienced an average annual growth rate of 4.4 percent from 1990 through 2013 and 4.1 percent from 2000 through 2013. UTRWD Members and Customers represented about 24 percent of total Denton County population in 1990; this percentage rose to 33 percent by 2000 and to 34 percent by 2013. It is clear that both have grown substantially since 1990 and that the relationship of UTRWD service area to Denton County has been relatively consistent from the standpoint of population, with UTRWD growing somewhat faster than Denton County. **Table 1-6** provides alternative population projections for Denton County from the year 2010 through 2060.

Table 1-6: Alternative Population Projections for Denton County, 2010 through 2060

Year	**Texas State Data Center***		**Texas Water Development Board**		**NCTCOG**	
	Population	**Average Annual Growth Rate**	**Population**	**Average Annual Growth Rate**	**Population**	**Average Annual Growth Rate**
2010	662,614	4.35%	674,322	4.53%	643,572	4.16%
2020	827,987	2.25%	889,705	2.81%	862,332	2.97%
2030	1,028,537	2.19%	1,118,010	2.31%	1,085,343	2.33%
2040	1,268,195	2.12%	1,347,185	1.88%	N/A	N/A
2050	1,535,959	1.93%	1,573,994	1.57%	N/A	N/A
2060	N/A	N/A	1,839,507	1.57%	N/A	N/A

* Note: This is the 0.5 scenario. For a description of the scenarios, see text.

Source: The Texas State Data Center, 2012; TWDB, 2011; North Central Texas Council of Governments (NCTCOG), 2009.

The Texas State Data Center (currently the Texas Demographic Center) prepares and publishes population projections for jurisdictions throughout the State of Texas. They employ a cohort survival model and a population migration component with their projections under several scenarios. The different scenarios prepared by the Texas State Data Center refer to the amount of migration which occurred from 1990 to 2000, and the projection of that amount of migration going forward. The 0.5 scenario assumes that half the migration that occurred from 2000 to 2010 will continue through the year 2050. The TWDB also projects population for various water suppliers. The forecasting methodology employed by the TWDB is similar to that of the Texas State Data Center except that migration rates for each county are modified based upon urbanization with a recognition for counties which are near build-out versus more sparsely populated areas likely to be urbanized. This county specific consideration is considered more accurate in the instance of Denton County. The North Central Texas Council of Governments (NCTCOG) projects population for Denton County as well. They employ a land-use based approach.

The RWRS prepared by UTRWD in 2010 updates the population projections from the 2006 TWDB projections and focuses on UTRWD Members and Customers. This report relies upon build-out information for specific jurisdictions as well as population projections, developer plans and other Customer specific aspects of future development. The RWRS relies upon the underlying methodology of the Texas State Data Center and the TWDB, but is more specific to the UTRWD service area.

During the evaluation of data and preparation of the EIS, a top down population forecasting approach was chosen because projecting UTRWD's service area population as a whole is more reliable than projecting each small entity. The Denton County average annual growth rates from TWDB are considered the most appropriate starting point for these service area projections. However, it is believed that the UTRWD service area population will grow more rapidly than Denton County, based on past trends and the RWRS projections. The average annual growth rates adopted for this EIS are shown in **Table 1-7**.

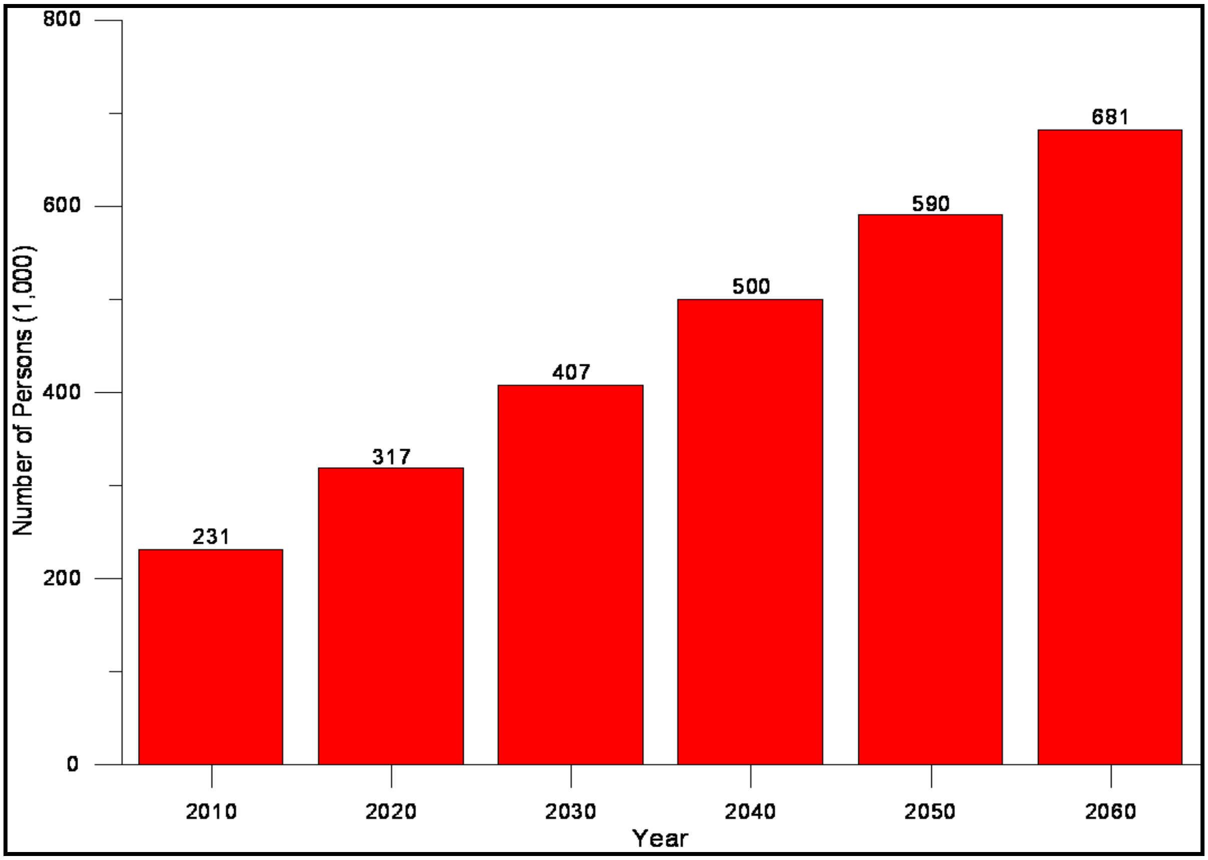
Table 1-7: Projected UTRWD Service Area Population Growth Rates, 2010 through 2060

Years	Denton County Growth Rate	Incremental Growth Rate for UTRWD Service Area	Adopted Annual Growth Rates for UTRWD Service Area
2010 to 2020	2.81%	0.30%	3.11%
2020 to 2030	2.31%	0.20%	2.51%
2030 to 2040	1.88%	0.20%	2.08%
2040 to 2050	1.57%	0.10%	1.67%
2050 to 2060	1.57%	-	1.57%

Source: The Texas Water Development Board, 2011; and HE 2014.

The incremental growth rate assumes a small, declining difference between UTRWD and Denton County growth rates. UTRWD service area population projections from the year 2010 through 2060 are set forth in **Figure 1-10**.

Figure 1-10: Projected UTRWD Service Area Population, 2010 through 2060



Source: HE, 2014. The 2010 population is from the decennial census. The 2020 population was projected from the 2013 population using the 2010 to 2020 adopted annual growth rate for the UTRWD area for seven years. The remaining decades were projected using the appropriate growth rate for ten years. Population is expected to increase from approximately 230,000 persons in 2010 to 681,000 persons by the year 2060 for an average annual growth rate of about 2.2 percent. Although these projections assume a fairly rapid growth rate, they are less than the recent historical experience for Denton County and the UTRWD service area. They are also consistent with the transformation of Denton County from rural agricultural communities to an urbanized area over the next 50 years.

Population projections for individual UTRWD Members and Customers were developed from a share of growth method. That is, the share of growth for each individual Member and Customer from the year 2010 to the year 2020 was applied to the total population change each decade to estimate population by entity. Based on the 2009 UTRWD Member and Customer surveys and the 2010 RWRS, a number of entities will reach build-out before 2060; their populations were held constant, and the growth which would have been allocated to them was re-allocated to the remaining entities who had not reached build-out. **Table 1-8** provides population projections for current and prospective Members and Customers through the year 2060.

Table 1-8: Projected Population for UTRWD Members and Customers, 2010 through 2060

Members and Customers	2010	2020	2030	2040	2050	2060
Current						
Argyle WSC (total)	9,400	12,100	15,100	18,500	22,100	25,800
Argyle	3,300	4,200	6,300	9,700	13,300	17,000
Argyle WSC	6,100	7,900	8,800	8,800	8,800	8,800
Aubrey	2,600	3,300	5,000	7,700	10,500	13,400
Cross Timbers WSC (total)	7,100	8,400	10,700	12,300	12,900	12,900
Bartonville	1,500	1,900	2,800	4,400	5,000	5,000
Cross Timbers WSC	1,400	2,000	2,800	2,800	2,800	2,800
Copper Canyon	1,300	1,500	2,100	2,100	2,100	2,100
Double Oak	2,900	3,000	3,000	3,000	3,000	3,000
Celina	6,000	8,600	12,900	20,000	27,400	35,000
Corinth	19,900	25,400	28,000	28,000	28,000	28,000
Denton County FWSD #1A	7,700	12,200	12,200	12,200	12,200	12,200
Denton County FWSD #7	6,900	11,800	12,500	12,500	12,500	12,500
Denton County FWSD #8A and 11A	5,300	12,700	16,700	16,700	16,700	16,700
Denton County FWSD #9	4,800	8,900	10,300	10,300	10,300	10,300
Denton County FWSD #10	4,300	7,300	10,900	16,900	17,000	17,000
Flower Mound	64,700	77,700	93,000	93,000	93,000	93,000
Highland Village	15,100	17,600	18,000	18,000	18,000	18,000
Justin	3,200	4,100	6,100	9,400	12,900	15,500
Krum	4,200	5,900	7,000	7,000	7,000	7,000
Lake Cities MUA (total)	13,000	16,300	21,300	21,800	21,800	21,800
Hickory Creek	3,200	5,000	7,400	7,900	7,900	7,900
Lake Dallas	7,100	8,000	9,900	9,900	9,900	9,900
Shady Shores	2,600	3,400	3,900	3,900	3,900	3,900
Lincoln Park	300	800	1,000	1,100	1,300	1,500
Northlake	1,700	2,500	3,700	5,800	7,900	10,100
Mustang SUD (Denton Co) (total)	12,600	17,600	26,300	40,700	55,700	71,000
Cross Roads	1,600	1,000	1,500	2,300	3,200	3,800
Krugerville	1,700	1,900	2,900	4,500	6,200	7,900
Mustang SUD	6,600	10,900	16,300	25,200	34,500	44,200
Oak Point	2,800	3,700	5,600	8,600	11,800	15,100
Sanger	6,900	8,700	13,100	20,200	27,700	35,400
Denton County Unincorporated	27,900	39,200	58,700	90,700	124,300	159,000
Subtotal:	**223,500**	**301,200**	**382,700**	**462,900**	**539,300**	**617,200**
Prospective Customers						
Ladonia	600	600	600	600	600	600

Members and Customers	2010	2020	2030	2040	2050	2060
Pilot Point	3,900	4,200	6,300	9,800	13,400	17,200
Ponder	2,500	3,400	5,100	7,900	10,900	13,900
Prosper (Denton County portion only)	-	8,000	12,000	18,500	25,400	32,400
Subtotal:	**7,500**	**16,300**	**24,100**	**36,900**	**50,300**	**64,100**
Total:	**231,000**	**317,500**	**406,700**	**499,800**	**589,600**	**681,300**

Note: The list of Prospective Customers is restricted to those entities that have a contractual relationship with UTRWD for future water service and have an explicit expression to participate. There will likely be other entities that receive water from UTRWD in the future, but they are not included in this EIS.
Source: HE, 2014.

Denton County unincorporated population is included since persons not currently within a Member or Customer boundary are expected to eventually join one of those entities as their boundaries expand and they will then be served by UTRWD. Although population is expected to grow considerably overall, there will continue to be certain Members or Customers who are much larger than others; the Cities of Celina and Sanger, the Towns of Flower Mound and Prosper[16], and the Mustang SUD will likely be the largest Members and Customers by the year 2060. These individual entity population projections are applied to the gpcd estimates to arrive at water demand projections.

1.7.2 Water Use Patterns

An important consideration in water demand forecasting is the historical water use patterns. As part of its efforts to independently evaluate the need for the proposed project and provide full information concerning project need, USACE requested that UTRWD conduct a survey of its Members and Customers to ascertain their historical water use patterns. Total water sales including residential, commercial and public water uses were gathered for the Members and Customers of UTRWD from the years 2000 through 2012. These data were supplemented with information from the RWRS and the 2011 Region C plan from the TWDB. For each Member and Customer, the total water use was divided by the population for that entity in that year to derive a gpcd estimate by year from 2000 through 2012. **Table 1-9** displays the gpcd estimates for UTRWD Members and Customers from 2000 through 2012.

[16] This refers only to the portion of Prosper that is in Denton County and will be served by UTRWD.

Table 1-9: Water Demand Patterns for UTRWD Members and Customers, 2000 through 2012

Members and Customers	Gallons Per Capita Per Day (GPCD)				
	2000	2010	2011	2012	Average 2000 - 2012
Current					
Argyle WSC (total)	224	226	215	223	220
Argyle	274	292	292	292	284
Argyle WSC	194	191	174	185	183
Aubrey	96	104	106	102	106
Cross Timbers WSC (total)	205	164	176	169	170
Bartonville	172	134	136	132	136
Cross Timbers WSC	243	151	161	150	181
Copper Canyon	234	188	204	198	202
Double Oak	191	175	191	185	166
Celina	103	159	155	155	130
Corinth	207	140	163	156	192
Denton County FWSD #1A	146	217	214	187	183
Denton County FWSD #7	227	184	224	199	181
Denton County FWSD #8A and 11A	48	129	120	119	99
Denton County FWSD #9	99	118	120	113	122
Denton County FWSD #10	62	113	155	149	206
Flower Mound	194	207	135	206	199
Highland Village	137	196	212	201	174
Justin	148	120	132	119	132
Krum	111	99	113	126	111
Lake Cities MUA (total)	117	116	127	116	118
Hickory Creek	164	141	152	139	149
Lake Dallas	100	117	128	118	110
Shady Shores	124	84	91	83	103
Lincoln Park	116	129	123	124	114
Northlake	163	141	142	152	139
Mustang SUD (Denton Co) (total)	139	111	138	121	133
Cross Roads	389	224	506	463	324
Krugerville	77	74	95	87	81
Mustang SUD	117	86	98	84	108
Oak Point	131	128	150	135	138
Sanger	264	146	135	130	135

Members and Customers	**Gallons Per Capita Per Day (GPCD)**				
	2000	**2010**	**2011**	**2012**	**Average 2000 - 2012**
Denton County Unincorporated	198	221	217	219	206
Weighted Average Subtotal:	**180**	**177**	**191**	**178**	**177**
Prospective Customers					
Ladonia	321	74	74	74	171
Pilot Point	121	177	182	187	145
Ponder	163	90	91	92	109
Prosper (Denton County portion only)	N/A	N/A	N/A	N/A	N/A
Weighted Average Subtotal:	**122**	**121**	**123**	**125**	**118**
Weighted Average Total:	**175**	**172**	**186**	**174**	**172**

Note: The list of Prospective Customers is restricted to those entities that have a contractual relationship with UTRWD for future water service and have an explicit expression to participate. There will likely be other entities that receive water from UTRWD in the future, but they are not included in this EIS.
Source: UTRWD Survey of Members and Customers; Raw Water Reliability Study, 2010b; 2011 Region C Plan, 2011; HE, 2014.

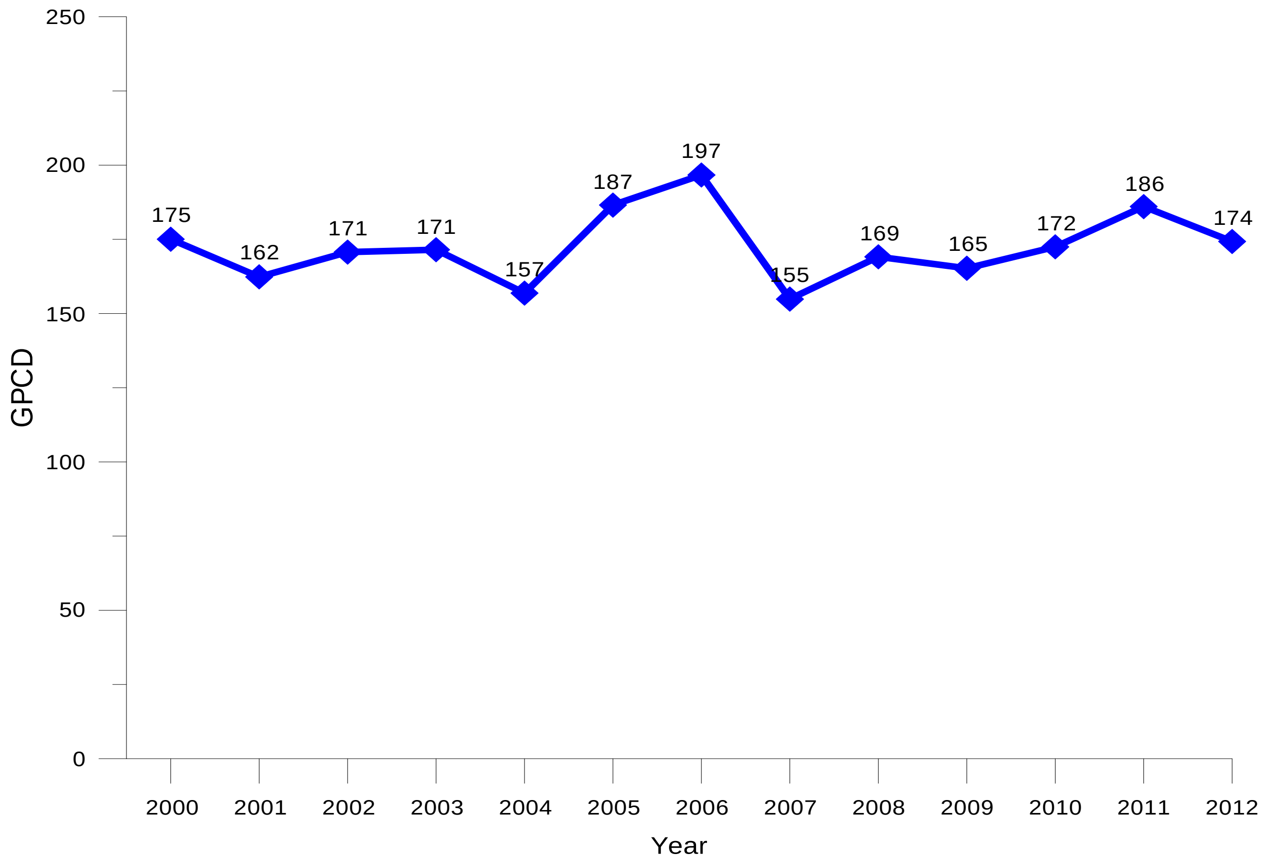
The gpcd varies from year to year for each Member and Customer for a number of reasons, including weather variation, the implementation of conservation programs, and evolving socioeconomic conditions in that particular Member or Customer's jurisdiction. For example, growth in commercial development with urbanization would result in increasing gpcd. Measurement anomalies might exist for certain districts. However, some districts with high gpcd's might exhibit water use practices inconsistent with UTRWD's conservation mandate.

The average gpcd figures for 2000 through 2012 for each Member and Customer provided in **Table 1-9** also shows a very wide variation. Water use pattern differences among Members and Customers, as indicated can be explained by a number of factors including, but not limited to the variation of socioeconomic characteristics from entity to entity, (i.e., income levels, family size, size and mix of dwelling units, etc.); the extent of commercial and public water use, (i.e., shopping, offices, schools, hospitals, etc.); losses; the extent of outdoor watering or landscaping; water use practices; and weather patterns.

A specific analysis of these factors was not conducted[17]. Even recognizing these differences among Members and Customers, the average water use among all the current and prospective Customers of UTRWD present a relatively stable trend from 2000 through 2012, as exhibited in **Figure 1-11**.

[17] Both Argyle and Cross Roads have unusually high gpcds. As they together account for only 3.2 percent of the 2010 overall demand, an in-depth analysis to determine the causes of these high gpcds was deemed not worthwhile.

Figure 1-11: Average GPCD among UTRWD Current and Prospective Customers, 2000 through 2012



Source: HE, 2012. The average gpcd for all the current and prospective UTRWD Members and Customers from 2000 through 2012 is 172. There is no apparent trend in gpcd over time among UTRWD Members and Customers when viewed as a group.

To project water demand at the tap or point of use, a gpcd assumption was developed for each UTRWD Member and Customer:

- For almost half of the Members and Customers, the gpcd assumption was the average gpcd for that entity from 2000 through 2012. This assumption is considered reasonable, since that time period included wet years and dry years and overall gpcd averages indicate no long-term upward or downward trends.[18] By basing gpcd assumptions on the recent historical average, conservation measures that were put in place prior to 2000 are imbedded in the water use patterns. In this manner, existing conservation is accounted for and assumed to continue through the long-term projection period.

- In instances where the historical water use data was lacking or inconsistent, or when gpcd figures appeared to be abnormally high or low, gpcd data and assumptions from other sources, including the UTRWD's Draft RWRS, the 2006 Region C Plan, and the TWDB

[18] Examination of gpcd data from the Statewide water planning effort for Region C, also indicated that these entities generally do not exhibit consistent long-term gpcd trends prior to the year 2000.

historical gpcd data were considered. Further, if an entity was currently undeveloped and expected to grow substantially by 2060, gpcd was increased to reflect the evolving presence of a commercial and public water use base in that particular jurisdiction. Reliable recent historical water use data were not available for the prospective customer group; it was assumed that their future water use patterns would be similar to current UTRWD Members and Customers. The assumed gpcd for each jurisdiction was applied to population projections for that jurisdiction to project water demand at the tap or point of use for Members and Customers through the year 2060, as shown in **Table 1-10**.

Total water demands at the point of use are expected to increase from approximately 14.7 billion gallons in 2010 to 43.5 billion gallons by the year 2060.

Distribution or system loss, treatment plant loss, plus water losses from the master meter of each Member or Customer back to the point of diversion (i.e. the losses occurring between the water's source, conveyance, interim storage, treatment and the customer's delivery point) must be estimated and projected to compare future water demands with the potential yield of the proposed Lake Ralph Hall project or other water resource alternatives. Water loss from the tap, or point of use, back to the master meter for each Member or Customer was gathered through the survey of Members and Customers conducted by UTRWD in 2009 and updated in 2014. Losses varied from year to year, depending upon pipe flushing, public losses, leak detection and remediation. Weighted average losses for those jurisdictions which responded to the survey amounted to 6.6 percent.[19] Conveyance losses from the point of diversion to the master meter have been estimated by UTWRD (and accepted by the TCEQ) to average 2.9 percent per year, from 2009 through 2013.[20]

[19] Loss data was provided by seventeen of the twenty UTRWD Members and Customers, covering over 85 percent of the total water use. No loss data was available for Denton County Unincorporated or any of the prospective customers.

[20] Texas Commission on Environmental Quality, Water Conservation Implementation Report for UTRWD, May, 2014.

Table 1-10: Water Demand Projections for UTRWD Members, Customers and Prospective Customers at Point of Use, 2010 through 2060

Members and Customers	GPCD Assumptions for Projections	Millions of Gallons					
		2010	2020	2030	2040	2050	2060
Current							
Argyle WSC (total)		774	972	1,256	1,617	1,995	2,384
Argyle	291	350	447	667	1,029	1,407	1,795
Argyle WSC	183	424	525	588	588	588	588
Aubrey	121	98	129	200	319	450	593
Cross Timbers WSC (total)		424	499	638	714	745	745
Bartonville	136	72	94	141	218	249	249
Cross Timbers WSC	157	77	115	160	160	160	160
Copper Canyon	202	92	108	154	154	154	154
Double Oak	166	183	182	182	182	182	182
Celina	154	351	487	729	1,127	1,544	1,974
Corinth	151	1,017	1,397	1,542	1,542	1,542	1,542
Denton County FWSD #1A	204	613	911	911	911	911	911
Denton County FWSD #7	181	461	780	824	824	824	824
Denton County FWSD #8A and 11A	122	248	563	744	744	744	744
Denton County FWSD #9	122	207	395	456	456	456	456
Denton County FWSD #10	148	178	395	591	913	917	917
Flower Mound	208	4,889	5,896	7,053	7,053	7,053	7,053
Highland Village	194	1,076	1,245	1,275	1,275	1,275	1,275
Justin	132	142	197	295	456	624	798
Krum	136	150	231	291	310	329	347
Lake Cities MUA (total)		550	701	929	956	956	956
Hickory Creek	141	168	255	382	409	409	409
Lake Dallas	116	303	338	422	422	422	422
Shady Shores	88	80	108	126	126	126	126
Lincoln Park	139	14	40	48	56	65	76
Northlake	140	89	128	191	296	405	518
Mustang SUD (Denton Co) (total)		509	729	1,153	1,875	2,699	3,584
Cross Roads	294	128	109	163	251	344	408
Krugerville	101	45	57	91	149	216	291
Mustang SUD	132	206	377	620	1,044	1,547	2,128
Oak Point	137	130	187	279	432	592	756
Sanger	135	369	429	642	991	1,359	1,737

Members and Customers	GPCD Assumptions for Projections	Millions of Gallons					
		2010	2020	2030	2040	2050	2060
Denton County Unincorporated	206	2,244	2,943	4,407	6,808	9,329	11,929
Subtotal:		**14,403**	**19,067**	**24,175**	**29,245**	**34,223**	**39,364**
Prospective Customers							
Ladonia	74	16	16	16	16	16	16
Pilot Point	177	249	274	410	634	869	1,111
Ponder	177	81	222	332	513	703	899
Prosper (Denton County portion only)	177	-	517	774	1,196	1,639	2,096
Subtotal:		**347**	**1,029**	**1,533**	**2,360**	**3,228**	**4,123**
Weighted Average Total:		**14,479**	**20,096**	**25,708**	**31,605**	**37,451**	**43,487**

Note: The list of Prospective Customers is restricted to those entities that have a contractual relationship with UTRWD for future water service and have an explicit expression to participate. There will likely be other entities that receive water from UTRWD in the future, but they are not included in this EIS.

Source: HE, 2014

1.7.2.1 Safety Factor

Water providers and water supply planners typically include a safety factor in their modeling to provide a buffer in the event of an unanticipated stress on their water delivery systems such as a storage or delivery system failure, forest fire, adverse unexpected court or regulatory rulings, more severe drought than used for planning (including climate change), ineffectiveness of conservation measures or drought restrictions, increased raw water losses in drought years, or higher than expected demand growth. The safety factor goes beyond drought or dry water year planning criteria; it accounts for the myriad of considerations which are simply unaccounted for by water system planners in traditional contingency planning. Some providers use an "increased annual demand" safety factor which increases the anticipated annual demand on their system by a chosen percentage. Others incorporate a "reserve pool" safety factor in their modeling which keeps a quantity of water equal to some percentage of the total annual demand in storage at all times. A third safety factor method employed is a time cushion, e.g. this year's supply will meet demand 10 years in the future. This method allows for a flexible safety factor that will change based on future demand projections. The recently permitted Bois D'Arc Lake incorporated a 10 percent safety factor (USACE 2017c).

The State of Texas and its water providers recognize and encourage the use of safety factors in water system planning. A safety factor must be reported in all regional water planning group plans. The TCEQ mandates a safety factor of 15 percent for water system capacity.[21] The Region C

[21] TAC, Title 30, Part 1, Chapter 290 Subchapter D Rule 290.45, (g2)

Planning Group generally adopts strategies that will develop a total supply of between 20 and 30 percent greater than the projected demands.[22]

In fact, there is no established standard regarding the size of the safety factor, although in recent USACE Regulatory EIS's, the average safety factor was about 10 percent. Examples include the Northern Integrated Supply Project in Colorado which uses a 10 percent safety factor.[23] This water project is sponsored by a wholesale provider which plays a role similar to UTRWD with its many small retail water suppliers. The San Antonio Water System uses a 10-year time cushion (e.g. the 2010 water demand will be available by the year 2000), which calculates to an 8 percent safety factor.[24] In their 2003 Integrated Water Resource Plan, the Metropolitan Water District of Southern California calls for a 10 percent buffer supply.[25] The Halligan Project in northern Colorado, benefitting the City of Fort Collins, uses an increased annual demand safety factor of approximately 15 percent which is derived from a 15 percent reserve pool factor[26]. The safety factor method chosen for this EIS is the percentage of demand. UTRWD does not control its own supply at present, so the additional supply pool was rejected. The number of years ahead of supply requires assumptions about utility planning and additional steps in recalculation.

This EIS adopts a higher than normal safety factor of 15 percent for the Lake Ralph Hall EIS to reflect the unique aspects of UTRWD and its existing supplies. In addition to the standard risks stated above, the UTRWD faces a less common risk of contract risk. Their entire current supply is all contracted and they do not control any sources of their supply. There is also risk that the other parties to the various contracts would be unwilling or unable to deliver the water or provide the transportation facilities that were contracted for. In 2010, DWU only provided 8,290 AF of the contracted 38,815 AF/year due to limited supplies.[27] The DWU contract must be re-negotiated by 2022 and there are no guarantees about terms, water supply reliability (due to failure to provide committed water in the past), etc. Additionally, Harvey Economics (HE) is assuming that UTRWD has access to the total amount of water specified in all of the UTRWD contracts. In practice, this is not always the case. For example, in the 11 years that they have been diverting water from Jim Chapman Lake, the maximum amount of water that UTRWD has ever diverted was about 85 percent of the total contracted amount.

There is also an unusual demand side risk. In addition to serving existing and the few committed Members and Customers, UTRWD is obligated to serve other water providers in Denton County

[22] 2011 Region C Plan, TWDB, 2014

[23] US Army Corps of Engineers Omaha District, Northern Integrated Supply Project Draft Environmental Impact Statement, April 2008.

[24] San Antonio Water System. Long-Range Plan, San Antonio Water System, San Antonio, TX, 1999.

[25] Metropolitan Water District of Southern California. *Draft Integrated Water Resources Plan, 2003 Update*, Metropolitan Water District of Southern California, Los Angeles, CA, 2003.

[26] [Halligan footnote] Not citable until the reports are published.

[27] Table 4E.15, 2011 Region C Plan, TWDB

if they come forward later and request inclusion. Bolivar WSC inclusion would represent a significant increase, for instance.

More specifically, UTRWD's risks include:

1. The water supply contract with DWU must be renegotiated. The terms of that future contract are not guaranteed.

2. The City of Commerce contract involves the performance of a number of parties. This performance over the long term carries the uncertainties common to such multiple party agreements. The reuse water is subject to the same uncertainty as the City of Commerce supplies coming out of Chapman Lake.

3. The amount of water available under UTRWD's contracts may be less than the total amount of water specified. This is applicable to both the DWU and City of Commerce contracts (plus the reuse agreements, as they rely on the amount of water diverted under the City of Commerce Contract).

4. Regardless, the existing contracts carry a concept of "shared shortage." Unlike firm yield which is available in times of drought, UTRWD will share the shortage in its supply with the other participants in each contract. This creates another layer of uncertainty.

5. Members' and Customers' non-UTRWD supplies face a host of uncertainties. Groundwater might decline in productivity or quality, for instance. If these supplies are inadequate, UTRWD would be obligated to increase its support upon request by Members or Customers.

6. Physical risks with the system are always evident (i.e. pipeline failure, source contamination, etc.).

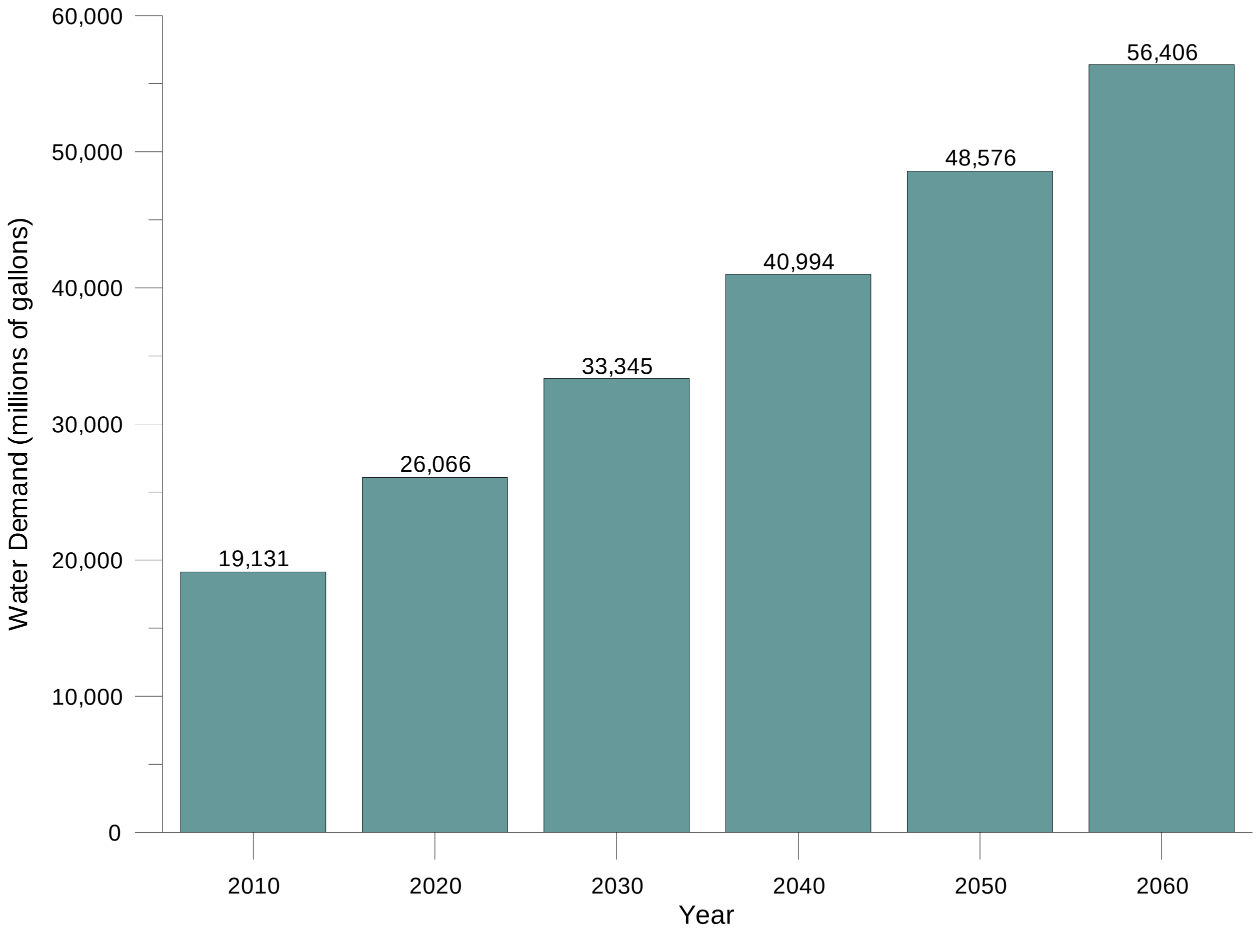
7. Demands might exceed projections.

8. Drought might be worse than planned (i.e. climate change).

Due to the additional risks, beyond those normally faced by a wholesale water supplier, USACE concludes that a 15 percent safety factor is appropriate for the Lake Ralph Hall EIS. Because the project does not meet all needs to 2060, this safety factor does not apply to future potential permit actions UTRWD may pursue (e.g., Marvin Nichols) even though it has been considered here. The values for a 15 percent safety factor are 10,200 AF in 2020 increasing to slightly less than 22,100 AF in 2060.

Figure 1-12 presents UTRWD water demand projections at the point of diversion from the year 2010 through 2060.

Figure 1-12: UTRWD Water Demand Projections at the Point of Diversion (MG/YR)

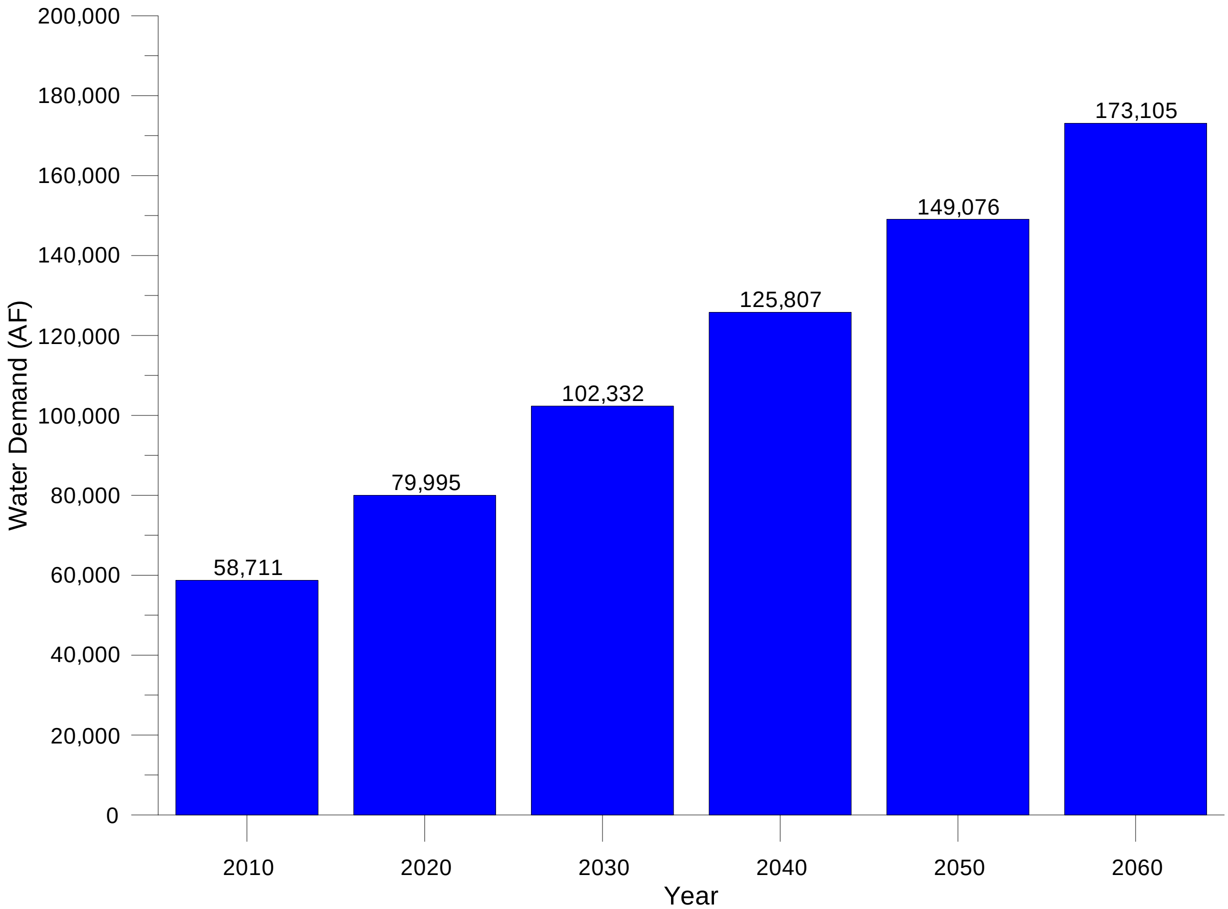


Note: These projections include water demands at the tap plus system losses plus transmission losses from the point of diversion plus a safety factor of 15 percent.

Source: HE, 2014

This graphic is displayed in millions of gallons, and **Figure 1-13** represents the same projections expressed in terms of AF. Whereas UTRWD Members and Customers commonly use millions of gallons in measuring their demand, water resource planning at the point of diversion, such as the yield of Lake Ralph Hall, is typically expressed in AF. UTRWD demand is expected to grow from 60,000 AF in 2010 to 102,000 AF by 2030. By 2060 UTRWD demand at the point of diversion is expected to approximate 173,000 AF.

Figure 1-13: UTRWD Water Demand Projections at the Point of Diversion (AF/YR)



Note: These projections include water demands at the tap plus system losses plus transmission losses from the point of diversion plus a safety factor of 15 percent.

Source: HE, 2014.

1.8 Water Conservation

Water conservation encompasses the policies, strategies and activities to manage fresh water as a sustainable resource, to protect the water environment, and to meet current and future human demand. The goal of water conservation is to allow a given amount of water to serve more people and to ensure water availability for future generations. It requires the efficient use of water resources which involve significant use of water or that significantly affect the availability of water for alternative uses including opportunities to reduce demand and improve efficiency in order to minimize new supply requirements. In the context of this Purpose and Need chapter, conservation is considered to determine if the need for the project can be reduced. The TCEQ requires that all public and wholesale water suppliers have a drought contingency plan and that certain providers have a water conservation plan[28].

[28] Texas Administrative Code Title 30, Chapter 288.

TCEQ requires a water conservation plan from the following entities:

- Entities with 3,300 connections or greater.
- A non-irrigation surface water right greater than 1,000 AF/year.
- An irrigation surface water right greater than 10,000 AF/year.
- Entities applying for a new water right or an amendment to an existing water right.

The TWDB also requires certain water suppliers to have a water conservation plan. There are three instances when a water conservation plan should be submitted to TWDB:

- TWDB rules require that entities that are applying for or receiving financial assistance of more than $500,000, to develop, submit, and implement a water conservation program for the life of the loan and report annually on the progress of the program. More information can be found at http://www.twdb.texas.gov/about/rules/index.asp.
- In 2007, the 80th Texas Legislature amended Section 13.146 of the Texas Water Code to require each retail public utility that provides potable water service to 3,300 or more connections to submit a water conservation plan to the TWDB. The plans were due on May 1, 2009. The code also requires the plan to be reviewed and updated once every five years thereafter and for the entity to report annually on the progress of program implementation. The Water Conservation Rules for entities with 3,300 or more connections can be found at http://www.twdb.texas.gov/conservation/ municipal/plans/doc/TAC363_15.pdf.
- Each entity that is required to submit a water conservation plan with TCEQ should also submit a copy of the plan to the TWDB and report annually to the TWDB on the entity's progress in implementing their plan.

In general, the water conservation plan rules require public water suppliers, such as the UTRWD Members and Customers, to implement conservation strategies such as a water savings goal, a public education program, a conservation rate structure and evidence of enforcement, along with a supplier profile. The TCEQ rules also encourage the adoption of further conservation strategies. The water conservation plan must be updated at least every five years and sent to the TCEQ each time it is revised. The water conservation requirement became Texas law in 2004, compliance was required by January 2008.

Wholesale suppliers, such as UTRWD, have additional requirements such as a leak detection plan and UTRWD must require their Customers to implement a water conservation plan. As per TCEQ rules, the UTRWD water conservation plan includes a description of the service area, a water savings goal, a leak detection, repair and water loss monitoring program, and the requirement that all their Members and Customers have a water conservation plan, as well as all the other requirements. UTRWD has a conservation plan goal of losses less than 10 percent between point of diversion and master meter. Its losses average less than five percent. In addition, UTRWD has developed an outline for its Members and Customers to aid them in the preparation of their own plans. UTRWD also works with its Members and Customers to help them develop their own plans.

In general, the Members and Customers conservation plans follow the outline suggested by the TCEQ and the TWDB. The goals set by the Members and Customers range from reducing system losses to aggressive targets for reducing per capita consumption. The median goals are a five percent reduction in gpcd over five years and a ten percent reduction over ten years. This equates to a reduction of six gpcd over five years and a reduction of thirteen gpcd over ten years. The different sets of water conservation programs that each Member, Customer and Prospective Customer will use to achieve their goals is shown in **Table 1-11**.

Table 1-11: Water Conservation Measures Adopted by UTRWD Members and Customers, 2014

Members and Customers	Water Conservation Plan	Date Plan Implemented	Leak Detection & Repair	Monitoring of Effectiveness and Efficiency	Public Education	Requirement for Water Conservation Plans by Wholesale Customers	Water Conservation Pricing (Rate Structure)	Incentive Programs	Regulatory Measures	Drought Response Plan
Argyle WSC (total) [1]	✓	8/23/2007	✓	✓	✓	✓	✓		✓	✓
Aubrey	✓	6/18/2002	✓		✓		✓			✓
Cross Timbers WSC (total) [2]	✓	2009	✓	✓	✓		✓			✓
Celina	✓	4/1/2009	✓	✓	✓	✓	✓		✓	✓
Corinth	✓	5/21/2009	✓	✓	✓		✓			✓
Denton County FWSD #1A	✓	8/18/2009	✓	✓	✓	✓	✓		✓	✓
Denton County FWSD #7	✓	5/9/2013	✓	✓	✓		✓		✓	✓
Denton County FWSD #8A	✓	6/25/2009	✓	✓	✓	✓	✓		✓	✓
Denton County FWSD #9	✓	7/20/2009	✓	✓	✓		✓		✓	✓
Denton County FWSD #10	✓	7/16/2009	✓	✓	✓		✓		✓	✓
Denton County FWSD #11A	✓	6/25/2009	✓	✓	✓	✓	✓		✓	✓
Flower Mound	✓	4/5/2010	✓	✓	✓	✓	✓	✓	✓	✓
Highland Village	✓	4/14/2014	✓	✓	✓		✓	✓	✓	✓
Justin	✓	9/8/2008	✓	✓	✓	✓	✓		✓	✓
Krum	✓	2003	✓	✓	✓		✓		✓	✓
Lake Cities MUA (total) [3]	✓	4/14/2009	✓	✓	✓	✓	✓			✓
Lincoln Park	✓	3/20/2002			✓		✓		✓	✓
Mustang SUD (Denton Co) (total) [4]	✓	6/1/2013	✓	✓	✓	✓	✓	✓	✓	✓
Sanger	✓	3/18/2014	✓	✓	✓	✓	✓		✓	✓
Ladonia	[5]									✓
Pilot Point	[5]									✓
Ponder	[5]									✓
Prosper (Denton County portion only)	✓	11/1/2007	✓	✓	✓	✓	✓		✓	✓

Notes:

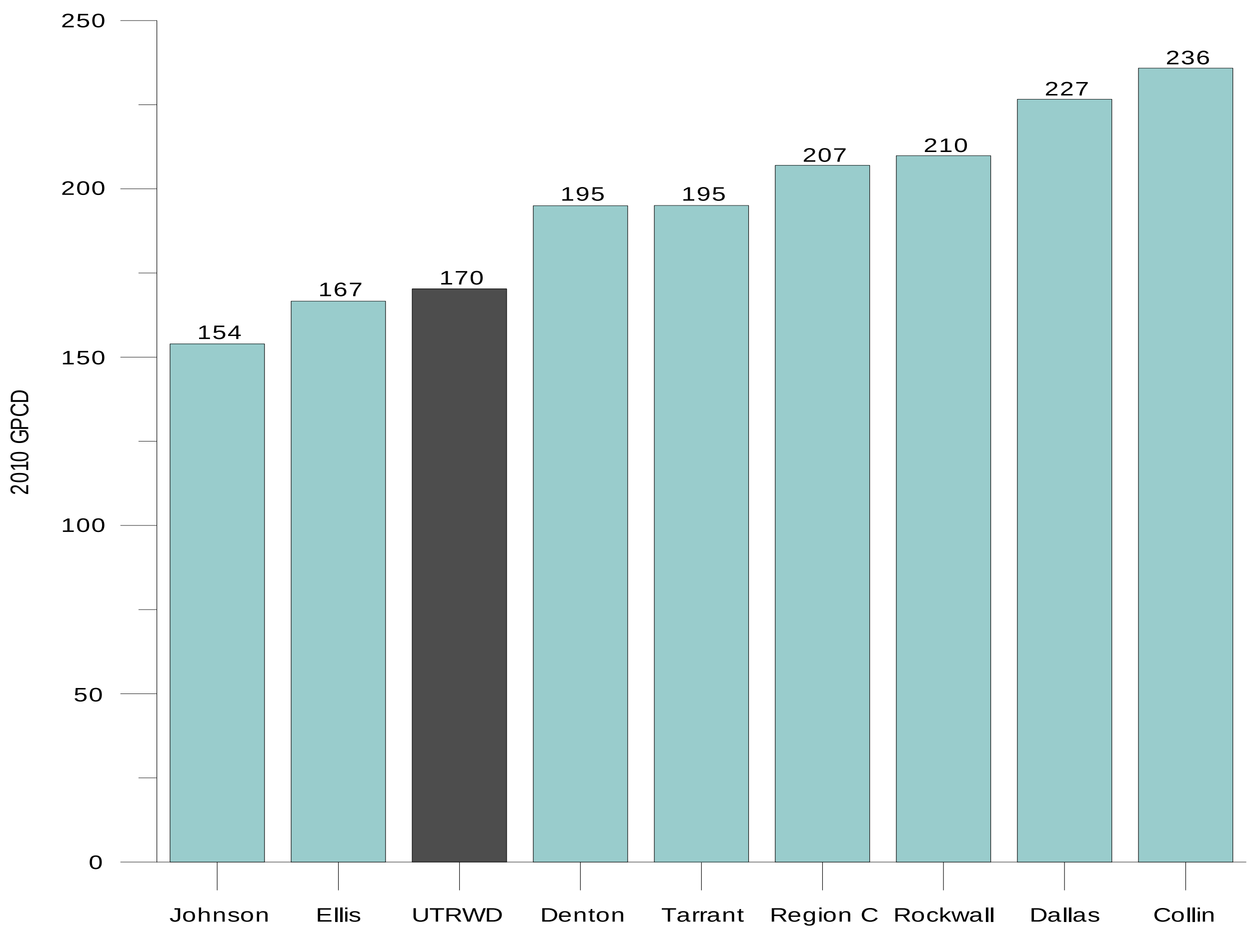
[1] Includes Argyle and Argyle WSC
[2] Includes Bartonville, Bartonville WSC, Copper Canyon and Double Oak.
[3] Includes Hickory Creek, Lake Dallas and Shady Shores.
[4] Includes Cross Roads, Krugerville, Mustang SUD, and Oak Point.
[5] These entities are not currently receiving water service from UTRWD, therefore they are not required by UTRWD to have a conservation plan on file.

Source: UTRWD, 2014.

Overall, the water conservation and drought plans for UTRWD's Members and Customers all meet or exceed the TCEQ Rules and are consistent with the UTRWD's own conservation and drought plans.

Figure 1-14 provides the year 2010 gpcd for UTRWD's Members and Customers that received water from UTRWD in 2010 along with the 2010 gpcd for comparable local counties. This figure demonstrates how UTRWD's gpcd relates to others in the area.

Figure 1-14: UTRWD's and Comparable Counties' 2010 GPCD



Source: 2011 Region C Water Plan. Region C Water Planning Group, 2011
HE, 2014

As can be seen in the chart, UTRWD has one of the lowest gpcds in the region. The overall gpcd for all the areas shown was 207, considerably higher than the UTRWD gpcd of 170.

Figure 1-14 demonstrates that the water use rates for UTRWD customers are already low relative to their peers. Additionally, all current UTRWD Members and Customers have conservation plans and the prospective customers will be required to have a plan as part of their agreement with UTRWD. A small number of UTRWD Customers have gpcd usage higher than these averages, but their use is quite small. All of the UTRWD Members, Customers and Prospective Customers have 2010 gpcds that are below 150 percent of the 2010 Region C average. This indicates the reasonableness of the Member and Customer water use rates and shows that any additional conservation requirements for purposes of USACE review are unnecessary. However, it should be noted that UTRWD continues to strive to improve its water conservation program. In 2012, UTRWD updated its Plan[29] to provide for a more robust conservation program along with a dedicated operation budget to fund its conservation activities. In issuing Water Use Permit No. 5821, TCEQ determined that UTRWD's water conservation plan would result in the "highest practicable levels of water conservation and efficiency achievable within its jurisdiction, as required by section 11.085(1)(2) of the Water Code," for the interbasin transfer authorized for the Lake Ralph Hall project (TCEQ, 2004).

1.9 Basis for Need

The determination of need for the proposed Lake Ralph Hall project supplies is based upon a comparison of projected water demands with available supplies to determine when and how much new supply will be needed. Supply has two components: existing UTRWD supplies as described earlier in this Chapter, plus water supplies available to UTRWD Members and Customers from non-UTRWD sources such as groundwater, DWU, the City of Fort Worth and others. Non-UTRWD water supply information was gathered from the 2009 UTRWD survey of Members and Customers and supplemented by information by UTRWD as found in the RWRS and the 2011 Region C plan.

Table 1-12 compares projected water demands from UTRWD Customers with available supplies through the year 2060.

[29] UTRWD's Water Conservation Plan, 2012.

Table 1-12: A Comparison of Projected Water Demand (AF) from UTRWD Customers with Available Supplies, 2010 through 2060

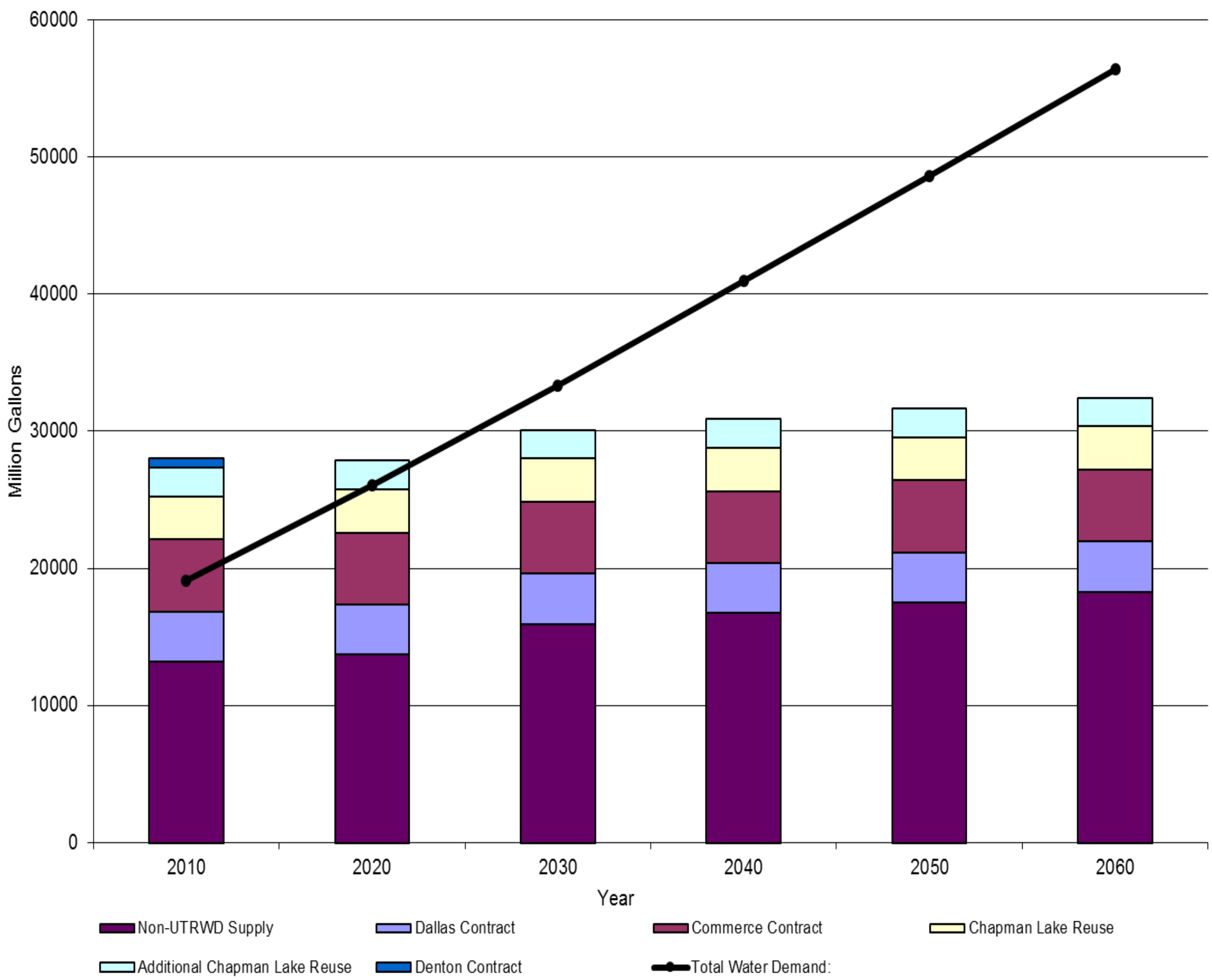
Year	A[1] Total UTRWD Member and Customer (Current and Prospective) Water Demands at Point of Diversion	B[2] UTRWD Existing Supplies	C[3] Water Supplies Available to UTRWD Members and Customers from Non-UTRWD Sources	D Water Supply Surplus/Deficit for UTRWD Members and Customers (A-B-C)
2010	58,711	45,612	40,512	-27,414
2020	79,995	43,413	42,071	-5,490
2030	102,332	43,413	48,953	9,966
2040	125,807	43,413	51,326	31,068
2050	149,076	43,413	53,725	51,938
2060	173,105	43,413	56,190	73,502

Notes: (1) Includes water demands at tap plus losses back to point of diversion and a 15% safety factor.
(2) Includes DWU Contract, City of Commerce Contract, City of Denton Contract, and Reuse Permit.
(3) Includes groundwater, DWU supplies to named entities and others, City of Fort Worth supplies and North Texas Water District supplies.

Source: Raw Water Reliability Study, 2010b; 2011 Region C Plan, 2011; UTRWD, 2014, HE 2014.

In the year 2010, existing UTRWD water supplies plus those available to UTRWD Members and Customers was over 27,000 AF more than demands anticipated in that year. By the year 2020, supplies will also exceed projected demands, but by about 5,000 AF. By the year 2024, water demands will exceed supplies and new water supplies must already be on-line to meet those demands and the growing difference between demand and available supplies out into the future (see **Figure 1-15**). By 2060, water demands will exceed available supplies by approximately 73,502 AF.

Figure 1-15: Demand and Supply for Lake Ralph Hall



Under Column B of **Table 1-12**, UTRWD existing supplies will diminish between 2010 and 2020, because the City of Denton supplies are unlikely to be available as the City of Denton water demands grow to meet its available supplies and the City of Denton no longer markets its excess water to UTRWD.[30] Under Column C, water supplies will increase over time, primarily because certain existing UTRWD members are designated in UTRWD's contract with DWU, wherein their future water demands will be met by water supplied from DWU. Those water supplies are simply passed through to UTRWD for conveyance and treatment. In 2010, the named entities accounted for about 56 percent of total UTRWD demand, by 2060, this percentage is forecast to go down to about 30 percent.

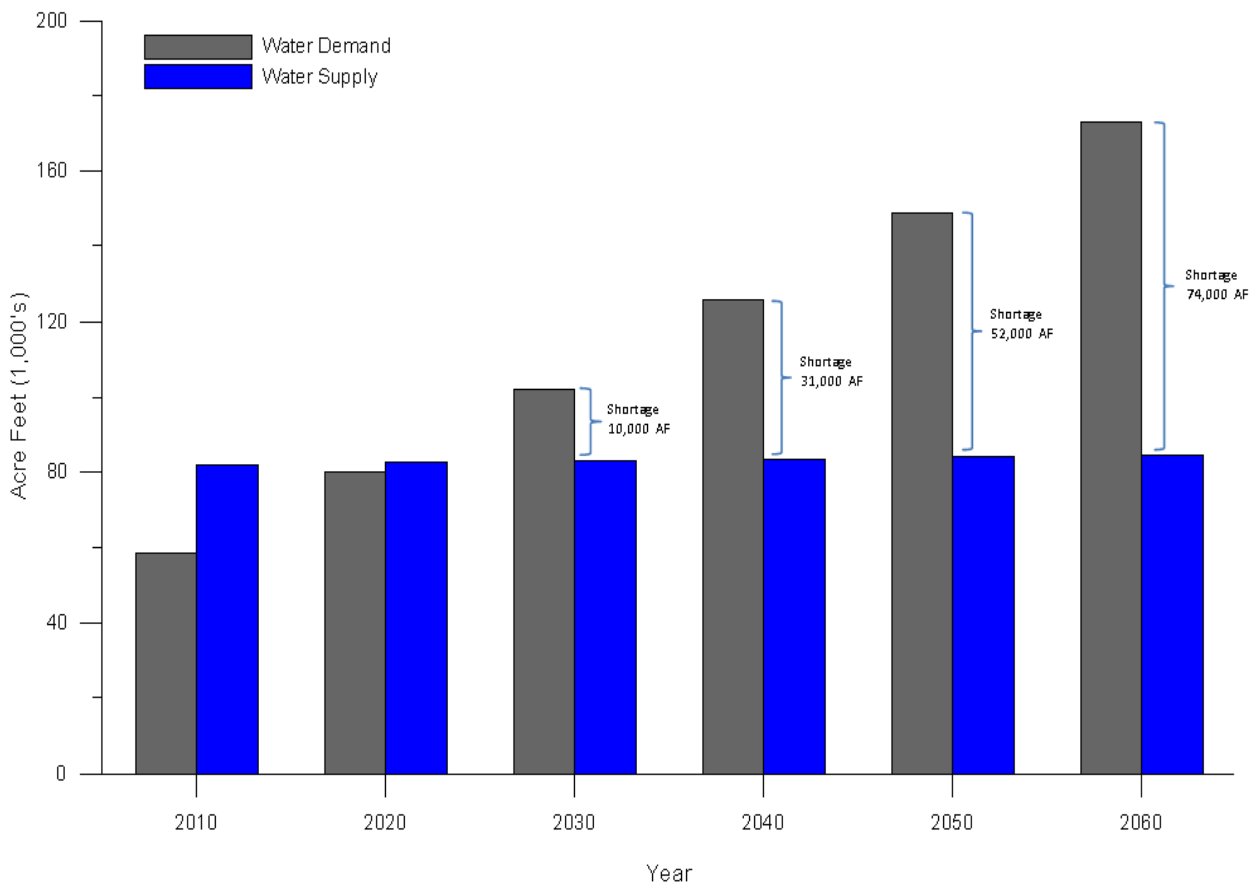
By the year 2030, it is predicted that the UTRWD must have 10,000 AF of additional supply on-line to meet the projected shortage (**Figure 1-16**). This shortage will grow to an estimated 73,502

[30] UTRWD Draft, Raw Water Reliability Study, 2009.

AF by the year 2060. UTRWD has chosen to develop approximately 34,050 AF of new firm yield to address a portion of its needs.

Clearly, UTRWD has an imminent need for water beyond its present supply. The District has identified a project for meeting that need and has additional long terms plans to further supplement its supplies. By 2040, one or more of these additional strategies must be implemented.

Figure 1-16: Projected UTRWD Water Shortages



1.10 Purpose Statement

A definition of the UTRWD overall purpose statement is required to address USACE's and other Federal agency's regulatory responsibilities for NEPA analysis. Additionally, the overall purpose statement is needed for USACE's public interest review as well as compliance with the 404(b)(1) guidelines. USACE also defines a basic project purpose for the 404(b)(1) guidelines to determine whether a proposed action is water (or special aquatic site) dependent.

1.10.1 Basic Project Purpose

In an effort to afford special protection to wetlands and other special aquatic sites (as defined in Subpart E of the 404(b)(1) guidelines), the guidelines establish two rebuttable presumptions for activities which do not require access or proximity to or siting within the special aquatic site to fulfill their basic purpose. Such activities are considered to be non-water dependent and the USACE presumes that practicable alternatives that do not involve special aquatic sites are available and such alternatives are less damaging to the aquatic ecosystem. Whether an activity is water dependent or not is based on the definition of the basic project purpose. Defining the basic project purpose involves the determination of the basic essence of the proposal. For the Lake Ralph Hall project, the basic project purpose is to provide water. The basic purpose of supplying water, whether for municipal, industrial or agricultural uses, does not need to be within a wetland or riffle pool complex (the special aquatic site types to be affected by the proposed actions) for it to be fulfilled. Therefore, the proposed action is not “water dependent” for the purposes of the 404(b)(1) guidelines and the rebuttable presumptions apply. The rigorousness of the alternatives analysis will be adjusted to demonstrate whether these presumptions are overcome.

1.10.2 Overall Project Purpose

The Purpose Statement is intended to provide the basis for defining and evaluating alternatives within the USACE’s decision-making process. It is to be developed from the need analysis and reflect those factors determined by USACE to be legitimate. USACE will, in all cases, exercise independent judgment in defining the purpose and need for a project to be permitted under its regulatory program from both the applicant's and public's perspective (33 CFR Part 325 Appendix B(9)b(4)). The Corps' responsibility for this determination, particularly in relation to the 404(b)(1) guidelines, is furthered in formal counsel and national guidance contained in the findings for "Permit Elevation, Plantation Landing Resort Inc.," dated April 21, 1989 (Plantation Landing 1989). While USACE should consider the views of the applicant regarding the project purpose and the existence (or lack) of practicable alternatives, USACE must determine and evaluate these matters itself, with no control or direction from the applicant, and without undue deference to the applicant's wishes. USACE must be careful not to so narrowly define a project purpose that it unduly restricts a reasonable search of alternatives and at the same time not prescribe a definition that requires such an exhaustive review of alternatives that an analysis cannot reasonably be completed. USACE’s definition is to be formulated in light of the purpose(s) and need(s) identified by the applicant(s).

UTRWD summarized its project’s purpose in the 404 permit application. They stated that the purpose of Lake Ralph Hall is to provide additional raw water supplies to meet the growing demands from its wholesale customers and the proposed lake is one strategy to provide that additional water while providing additional security in the event supply from any of its other sources is interrupted. UTRWD identified economic benefits from recreational use, residential and commercial development and protected natural areas as well as environmental benefits due to reductions in soil losses due to erosion.

Based on the information provided by UTRWD and the additional needs analysis presented within this chapter and its supporting information, USACE defines the overall project purpose as:

> **To provide approximately 34,050 AF of additional, reliable, firm annual yield through a regional project to meet a portion of existing and projected future municipal and industrial water demands by 2024 within UTRWD's defined regional planning area.**

This statement incorporates a number of terms requiring definition. The term "reliable" refers to water supplies having a high degree of certainty as to their amount and long term availability. "Firm annual yield" refers to the hydrologic availability of this water supply including times of drought, as defined by UTRWD and is reflected in hydrologic modeling of the various river basins and UTRWD's water system. "Regional" recognizes the status of UTRWD as a current regional provider which must serve its Members and Customers in accordance with existing agreements and contracts which have been reviewed and accepted by USACE to support the project need. This Overall Project purpose statement will be used to identify, evaluate, and screen alternatives in this EIS.

In summary, the Lake Ralph Hall project is intended to provide UTRWD with additional firm yield to address only a portion of the increasing demands for water from those Members and Customers previously identified.

1.11 Key Scoping Issues

Comments relevant to UTRWD's proposed Lake Ralph Hall received during the Public Scoping Meeting held on April 15, 2008 and the following 45 day commenting period indicate that the following issues are major concerns to interested public and agencies: 1) Property Rights (displacement of residents and need for more accurate mapping of affected properties); 2) Project Design and Management (need for additional project alternatives, lake size and level, and long-term capacity of Lake Ralph Hall); 3) Social and Economic Resources (reallocation of rural water resources to urban areas, potential property tax increases, and the need for water conservation); 4) Water Resources (mitigation design, overall water quality, and geomorphology); 5) Erosion and Sedimentation (sedimentation within conservation pool, effects on downstream sediment transport, and loss of valuable farmland) and; 6) Biological Resources (adverse effects to wildlife and loss of bottomland hardwood forests).[31] This EIS will address these, and other, key scoping issues in the following chapters.

[31] Proposed Lake Ralph Hall Scoping Summary, USACE Fort Worth District, June 2008

2.0 Alternatives

This chapter discusses the identification, screening and description of alternatives that are evaluated in detail in the Final Environmental Impact Statement (FEIS) which are available to the U.S. Army Corps of Engineers (USACE) and to the Upper Trinity Regional Water District (UTRWD), including the No Action Alternative, development of the proposed Lake Ralph Hall project (the Applicant's Proposed Action), and those alternatives that were considered but eliminated from detailed evaluation. As detailed in **Section 2.3**, a wide range of alternatives have been considered by USACE and UTRWD. The analysis of alternatives was accomplished ensuring compliance with the requirements of National Environmental Policy Act (NEPA), the Section 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material (40 CFR 230), and the USACE Public Interest Review (PIR) at 33 CFR 320.4. USACE undertook an independent evaluation and screening process of alternatives initially considered by the applicant as well as developed other options.

The objective of the alternative evaluation process is to identify a reasonable range of alternatives with potential to meet the purpose and need of the proposed Lake Ralph Hall project. NEPA requires that the Lake Ralph Hall EIS evaluate a range of reasonable alternatives including the No Action Alternative. However, NEPA regulations do not specify the number of alternatives that need to be considered in the EIS.

The Council on Environmental Quality (CEQ) defines reasonable alternatives as "those that are practical or feasible from the technical and economic standpoint and using common sense, rather than simply desirable from the standpoint of the applicant*"* (CEQ 1986). CEQ regulations also require that all reasonable alternatives, including no action, are rigorously explored and objectively evaluated and that the reasons for eliminating alternatives are discussed (40 CFR 1502.14).

In addition to satisfying NEPA requirements, projects subject to permitting by USACE under the Clean Water Act also must comply with the Section 404(b)(1) Guidelines (40 CFR, Part 230) for the discharge of dredge and fill material into waters of the U.S. The Section 404(b)(1) Guidelines require that the Corps permit only the least environmentally damaging practicable alternative (LEDPA), unless the LEDPA has other significant adverse environmental consequences. These Guidelines specify "no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences." An alternative is considered practicable if "it is capable of being done after taking into consideration cost, existing technology, and logistics in the light of overall project purposes." Practicable alternatives under the Guidelines assume that "alternatives that do not involve special aquatic sites are available, unless clearly demonstrated otherwise." Guidelines also assume that "all practicable alternatives to the proposed discharge which do not involve a discharge into a special aquatic site are presumed to have less adverse impact on the aquatic ecosystem, unless clearly demonstrated otherwise." The alternatives analysis required for Section 404(b)(1) Guidelines can be conducted either as a separate analysis for 404 permitting or incorporated into the NEPA process. The Corps has integrated NEPA and 404(b)(1) Guidelines into the alternatives analysis. Integration of both NEPA and 404(b)(1) Guidelines ensures that the alternatives selected for evaluation in the EIS provide a reasonable range of alternatives and that the alternatives are practicable.

In addition to NEPA and the 404(b)(1) guidelines, USACE further evaluates alternatives associated with its PIR (33 CFR 320.4(a)(2)(ii)). Where there are unresolved conflicts as to resource use, the practicability of using reasonable alternative locations and methods to accomplish the objective of the proposed structure or work are considered by USACE. Such a consideration can be broader in scope than both NEPA and the Guidelines. While these are separate yet simultaneous evaluations, additional factors to the PIR determination are separate and cannot be used to offset an unfavorable finding under the 404(b)(1) guidelines, including the LEDPA determination.

2.1 Alternatives Available to USACE

There are three decision options available to USACE relative to the Applicant's Preferred Alternative (APA) as identified in their permit application: 1) issue the permit; 2) issue the permit with special conditions; and 3) deny the permit. A permit cannot be issued by the USACE if such issuance is found contrary to the public interest (33 CFR 320.4) and/or if the project does not comply with the Section 404(b)(1) Guidelines at 40 CFR 230.12(a)(1)(i-iii) due to:

- There is a less damaging practicable alternative to the proposed action
- The project results in significant degradation to the aquatic ecosystem
- The mitigation for impacts to the aquatic ecosystem is inadequate

2.2 Alternatives Available to UTRWD

UTRWD considered various alternative water supply strategies during feasibility and planning studies for the proposed Lake Ralph Hall project. These studies included the following:

- Raw Water Reliability Study (UTRWD, 2010b); and
- Summary of Additional Water Supply Strategies (UTRWD, 2009a).

Additionally, the Texas State Water Plan includes identification of various alternatives to address water needs from a statewide perspective. The overall plan is comprised of 16 regional plans of which UTRWD is included within Region C. Alternatives from the State Water Plan were included in the applicant's materials and were considered in the overall range of alternatives evaluated. However, these more broadly developed alternatives were modified by USACE to reflect the specific need of the applicant rather than a larger planning group since UTRWD is the only applicant involved in the proposed permit action. UTRWD undertook an initial development and analysis of alternatives to its proposed action. They evaluated the use of two different water supply strategy alternatives: 1) increasing raw water supply from existing sources; and 2) pursuing and developing other new raw water supply sources. Portions of UTRWD's evaluation of these water supply strategy alternatives and their rationale for eliminating various options is included in **Appendix A-1**. USACE reviewed and independently evaluated the alternatives identified in the applicant's studies, modified some of the alternatives, and developed others based on the issues identified during the scoping and project evaluation processes. USACE's evaluation and modification of the alternatives are provided below or in **Appendix A** which contains summaries of each alternative identified and pertinent correspondence and documentation compiled as part of USACE's evaluation. Modifications to alternatives typically involved changing the size of proposals to be consistent with the specified need and purpose of the proposed project which allowed for uniform evaluations and comparisons. While UTRWD has demonstrated a larger need, they are not pursuing alternatives that provide more yield than approximately 34,050 AF/YR.

2.3 Alternatives Analysis

To be able to identify which alternatives need to be evaluated in detail in the EIS, USACE compiled a listing of potential water sources and infrastructure components that may be viable alone or if paired together to formulate various types of alternatives to address the project purpose. These sources and infrastructure components were evaluated to determine if they were reasonable and practicable, in keeping with the requirements of NEPA and the 404(b)(1) guidelines as well as the PIR. Water sources are defined as those features that can provide new firm yield to the applicant without the need for additional infrastructure components to obtain and utilize such water. Such a consideration is warranted since some water sources may be able to provide new supplies without the need to construct and operate new development features (e.g., obtaining water supplies via contract, modification of existing water rights, new water rights to be accessed with existing infrastructure components, etc.). Water sources can also be provided, with greater and possibly multiplied yields, when combined with new infrastructure components that can capture, hold, treat and move water sources (e.g., dams, pipelines, wells, intakes, etc.). Reasonability and practicability evaluations and determinations can occur individually for sources and infrastructure components as well as in combination to ensure a full and robust alternatives analysis is accomplished. If sources are found to not be viable without the need to evaluate them in conjunction with infrastructure components, then they can be eliminated from further consideration. It must be recognized that not all sources or infrastructure components may be reasonable and/or practicable and they must be considered individually. Sources that may not be reasonable or practicable on their own can quickly become viable options when combined with infrastructure components. It must also be recognized that not all infrastructure components may be reasonable and/or practicable and must also be considered individually. Therefore, reasonability and practicability evaluations and determinations can occur for both sources and infrastructure components individually as well as in combination to ensure a full and robust alternatives analysis is accomplished. A total of 17 sources, infrastructure components and alternatives were identified, including the APA and No Action Alternative, and are listed in **Table 2-1**.

Table 2-1: Alternatives Identified

Alternative	Source	Infrastructure Components
1. No Action		
2. Lake Ralph Hall (APA)	Existing water right	New reservoir, pipelines, pumps
3. Marvin Nichols Reservoir	New inter-basin transfer water right	New reservoir, pipelines, pumps
4. Wright Patman Reservoir	New contract and inter-basin transfer water right	New pipelines, pumps
5. Additional Dallas Water Utilities Supply	New contract	New pipelines, pumps
6. Oklahoma Water	New contract and OK water right	New reservoir, pipelines, pumps
7. Toledo Bend Reservoir	New contract and inter-basin transfer water right	New pipelines, pumps
8. Lake Texoma	New contract and inter-basin transfer water right	New pipelines, pumps
9. George Parkhouse Reservoir (N)	New water right	New reservoir, pipelines, pumps
10. George Parkhouse Reservoir (S)	New water right	New reservoir, pipelines, pumps
11. Gulf of Mexico	New water right	New reservoir, pipelines, pumps, treatment plant
12. Cypress Creek Basin	New contract & inter-basin transfer water right	New pipelines, pumps
13. Precipitation Enhancement		
14. Groundwater Imports	New contract	New wells, pumps, pipelines
15. Bois d’Arc Lake	New water right	Expanded reservoir, new pipelines, pumps
16. Lake Fastrill	New water right	New reservoir, pipelines, pumps
17. Lake Livingston/Joe Pool Lake/Trinity River Basin	New contract	New pipelines, pumps

2.3.1 Alternatives Screening

Screens to determine the viability of alternatives to be carried forward for detailed analysis in the EIS were developed primarily in light of the requirements of the 404(b)(1) guidelines due to their generally more specified and/or substantive nature compared to NEPA. NEPA and PIR considerations also occurred to ensure that a reasonable range of options were evaluated to determine which alternatives need to be in the EIS that meets purpose and need. Screens were divided into two general categories to address the LEDPA requirement at 40 CFR 230.10(a) and reflect NEPA requirements and include:

- Whether the alternative is practicable (practicable is defined as "available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purpose" (40 CFR 230.3(1)), OR

- Whether the alternative is less damaging to the aquatic ecosystem than the APA.

An alternative was eliminated if it failed any one of the defined practicability screens or if it was found to have greater impacts to the aquatic ecosystem than the APA. These are pass/fail determinations because if an alternative cannot pass any of the screens, it cannot be permitted.

2.3.1.1 Screening Criteria

As established in **Section 1.0**, the purpose of the project is to provide the UTRWD planning area with approximately 34,050 acre-feet per year (AF/YR) of additional, reliable, firm annual yield to meet a portion of existing and projected future municipal water demands by 2024. Four practicability screening criteria and one environmental screen were developed to ensure that alternatives advanced for detailed study satisfy the purpose and need and are less damaging to the aquatic ecosystem than the APA. The screens are summarized in **Table 2-2**. While many alternatives include certain risks and uncertainty concerning their viability, the screening criteria and evaluations were conducted to allow firm determinations of practicability. Vague explanations of practicability with terms such as "may" or "could" were avoided or rejected for determining practicability or impacts to aquatic resources. Additionally, similar consideration was also applied to the initial coarse environmental screens developed to determine adverse effects to aquatic resources relative to satisfying LEDPA requirements.

<u>Criterion 1: Provide reliable new firm annual yield.</u>

Criterion 1 is a practicability screen and considers the purpose of providing reliable additional firm annual yield for meeting anticipated future water demands. The term "reliable" refers to water supplies having a high degree of certainty as to their amount and long term availability. In this instance, to be reliable, an alternative must result in a water supply source that the applicant has substantial direct control over (for more information see **Chapter 1.0, Section 1.10.2**). Firm annual yield refers to the hydrologic availability of a water supply including times of drought.

Criterion 2: Add approximately 34,050 AF of new supply.

Criterion 2 is a practicability screen and reflects the approximate amount of water the applicant is pursuing to address their projected demands. While the needs analysis in **Chapter 1.0** documents a need of approximately 73,500 by 2060, which is well in excess of the proposed amount from the proposed action, UTRWD has determined that 34,050 AF of new supply addresses their overall water supply strategy and system management and development goals at this time.

Criterion 3: Add new firm annual yield to UTRWD's supplies by 2024.

Criterion 3 is also a practicability screen and focuses on the temporal aspect of the purpose and need statement that includes a timeline for meeting projected demand by 2024. As detailed in **Section 1.9**, UTRWD's planning area is projected to begin facing a water supply deficit by 2024. UTRWD's 404 permit application included an analysis of water supplies and future demands. UTRWD stated that population and resulting water demand growth was very rapid in its service area, and a five-fold increase in demands by the year 2060 was expected. Based on an assessment of current and anticipated supplies, UTRWD believes that water demands will exceed supplies before the year 2030 and that the shortfall will grow considerably by 2060. USACE evaluation of these projections and concerns were verified through its own additional analysis as described in **Chapter 1.0**, including supply and demand evaluations, and review of population projections, historical water use patterns and data from a survey of Members and Customers. By the year 2024, water demands will exceed supplies and new water supplies must already be on-line to meet those demands and the growing difference between demand and available supplies out into the future.

Criterion 4: Exorbitant Costs.

Criterion 4 is a practicability screen that was developed to determine if sources, infrastructure components and/or alternatives involve costs that are exorbitantly expensive in relation to the project. Cost as a practicability determination screen in relation to the 404(b)(1) guidelines is normally analyzed in the context of the overall scope/cost of the project and consideration of comparable costs for similar actions in the region or analogous markets. Cost considerations are to be based on an objective, industry-neutral inquiry that does not consider an individual applicant's financial standing. The data used for any cost must be current with respect to the time of the alternatives analysis. However, just because one alternative costs more than another does not mean that the more expensive alternative is impracticable. It is important to note that in the context of this definition, cost does not include economics. Economic considerations, such as job loss or creation, effects to the local tax base, or other effects a project is anticipated to have on the local economy are not part of the cost analysis. Development of a cost threshold can be made to determine whether various alternatives are practicable or not. However, if costs of an alternative are clearly exorbitant compared to similar actions that address the project purpose, they can be eliminated without the need to establish a cost threshold for practicability determinations. A cost screen threshold was not established for this EIS although consideration of whether some water supply options were exorbitant did occur.

Criterion 5: Aquatic Resource Direct Impacts (Does not result in greater direct impacts to wetlands/waters of the U.S. than the proposed project.)

This criterion is an environmental impact screen related to consideration of impacts to the aquatic ecosystem and was developed to determine if alternatives resulted in greater direct impacts to aquatic resources and is used rather than undertaking practicability determinations, as applicable (EPA/USACE 1993). Coarse aquatic resource assessments consisting of general off-site and non-data specific or intensive methods and best professional judgment were developed and applied to some alternatives. If the direct effects (fill, inundation, etc.) of the proposed alternative (infrastructure components) to aquatic resources were of greater acreage, linear feet and general quality than the APA, such alternatives were eliminated from further consideration because they could not be permitted under the 404(b)(1) guidelines.[1]

Table 2-2: Alternatives Screening Criteria

Criteria	Parameters
1	Provide reliable new firm annual yield.
2	Provide approximately 34,050 AF of new supply.
3	Add new firm annual yield to UTRWD's supplies by 2024.
4	Exorbitant costs.
5	Aquatic Resources Direct Impacts (Does not result in greater direct impacts to wetlands/waters of the U.S. than the proposed project).

2.4 Screening Results

Screening criteria were applied to the applicant's Proposed Action and other water supply sources, infrastructure components and/or alternatives (**Figure 2-1**). In order for a source, infrastructure component and/or an alternative to be considered practicable and carried forward in the EIS, it must not fail any of the practicability screening criteria. Additionally, if an option can be demonstrated as having greater impacts to aquatic resources than the APA, then it was eliminated from further consideration. The following sections describe the evaluation and discussion of the screening of each option and summary results.

[1] Jurisdiction was not established during the development and application of the screen. All alternatives were treated equally relative to the screen. It is assumed all identified National Wetland Inventory wetlands/waters are jurisdictional. The common standard for the alternative screen ensures that errors are equally applied as well as assumptions.

Figure 2-1: New Supply Sources, Infrastructure Components, or Alternatives

Source: 2016 Region C Water Plan (TWDB, 2015a)

2.4.1 No Action Alternative

The No Action Alternative is a required consideration of NEPA. It also has consideration in the 404(b)(1) guidelines as defined at 40 CFR 230.10(a)(1)(i). A variety of options exist within the No Action alternative and can include permit denial, construction of an alternative that does not involve a regulated discharge under Section 404 of the Clean Water Act, and alternatives that are unavailable to the applicant (even if they require Federal action (permits)). Each of these scenarios result in no permit being issued by USACE. Alternatives that are beyond the capability of the applicant are to be evaluated to the extent necessary to allow a complete and objective evaluation of the public interest and a fully informed decision regarding the permit application. Additionally, predictable actions by others (e.g., UTRWD and its members and customers) as well as other likely uses of a project site are to be discussed as necessary, if the permit is denied. Further, it is recognized that the No Action alternative does not necessarily have to be as fully developed as the action alternatives [2].

An action that addresses the need and purpose and does not involve a regulated discharge was not identified, even though some concepts and alternatives can be accomplished without the need for a regulated discharge. Therefore, the No Action alternative is based on denial of the permit. Recognizing the applicant's responsibility in providing an essential social need of water supply, and to allow a complete evaluation of the public interest as well as disclose the likely consequences of a permit denial, USACE requested the applicant provide information relative to the most likely action(s) that may be taken by them and their members and customers under such a scenario. While the applicant would not receive a permit, they and their participants would continue to operate their systems. They would also seek other sources and/or other water management strategies to meet projected demands and to address existing operation challenges, including minimizing risks inherent in their current water supply portfolios and/or systems. Consistent with the Proposed Action, the No Action Alternative is based on the following assumptions and conditions:

- The water demand projections for the No Action Alternative are the same as those developed for the Proposed Action and assume that UTRWD would continue to have access to water supplies under existing contracts, including the City of Dallas water supply contract that is currently set to expire in 2023.
- Demand projections assume continued implementation of the conservation efforts identified in **Chapter 1.0** of this EIS as well as UTRWD's maximization of reuse of its imported water from Lake Chapman.

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[2] 40 CFR 1502.14(d), 33 CFR 325 Appendix B, Section 9.b(5), 40 CFR 230.10(a)(1)(i), Regulatory Guidance Letter 88-13

- All water system improvements designed to provide additional sources of water supply through approximately 2024 currently planned and underway are developed.

- The No Action Alternative has the same interpretation of water rights, agreements, and permit requirements as the Proposed Action.

The water supply action alternatives that might be available to UTRWD and its members and customers are presented and discussed in subsequent subsections of this chapter. As presented in those discussions, these alternatives either cannot be completed until well after 2024, will fail to provide the needed water as identified in the project purpose, or both. The likely predictable actions by others in the No Action Alternative would involve the use of a combination of strategies to strive to meet the need for additional water supply, including pursuing temporary/emergency water supply contracts, local development of groundwater by individual UTRWD members and customers, and imposing more severe mandatory water use restrictions than the Proposed Action. Even when used in combination, these strategies would result in unmet water demands for UTRWD and its members and customers.

No Action Alternative Strategy 1 – Temporary/Emergency Water Supply Contracts

As part of the No Action Alternative, UTRWD would seek temporary and/or emergency water supplies from the Cities of Denton, Dallas, or a combination of the two. UTRWD temporary/emergency supplies from either Denton or Dallas would be subject to availability of surplus water from these cities. The water plans approved by the Region C Planning Group show that both of these cities project the need to implement their own new water supply strategies during the planning period; therefore, UTRWD has no assurances that these cities will have water available when UTRWD has a need in 2024.

UTRWD members and customers may also individually seek temporary and/or emergency water supply contracts with other entities. While the City of Dallas might provide a small quantity of additional water to its existing customers, documentation presented in other sections of this chapter demonstrates that the City of Dallas does not have the capability to provide significant additional supplies to UTRWD's members and customers beyond what the City of Dallas has already committed via its water supply contracts with UTRWD and some of UTRWD's members and customers.

No Action Alternative Strategy 2 – UTRWD Member/Customer Development of Local Groundwater Supplies

If UTRWD is unable to meet its members' and customers' growing water demands because of limited supplies, those members and customers would be faced with an unmet deficit in their water supplies. The magnitude of the deficit for each member and customer is presented in **Chapter 1.0**. Under the No Action Alternative, those members and customers would have to seek alternative supplies on their own. As discussed, the supplies that can be developed timely are limited to purchasing water from other local water suppliers or developing local groundwater.

Some of UTRWD's members and customers may seek to install additional groundwater capacity by modifying their existing groundwater wells or installing new wells. As presented in other sections of this chapter, groundwater resources in UTRWD's service area have been in decline for a number of years. The information presented also demonstrates that the projected groundwater use is only slightly less than the modeled available groundwater (MAG), hence the reliability and availability of groundwater to meet all of UTRWD's members and customers is not assured.

No Action Alternative Strategy 3 – Mandatory Water Use Restrictions

If the permit is denied and UTRWD pursues another alternative that cannot be completed by 2024, and UTRWD cannot obtain adequate temporary/emergency supplies from the City of Denton, or City of Dallas, UTRWD will have to implement strategies from its drought contingency plan to limit the quantity of water it provides to its members and customers to its available supply capacity. The plans contain multiple stages with the most restrictive measures including:

- Prohibit outdoor irrigation
- Intensify leak detection and repair activities
- Prohibit use of water to wash any motor vehicle, motorbike, boat, trailer or other vehicle not occurring at a commercial vehicle washing facility or commercial service stations
- Increased enforcement activities
- Suspend issuance of permits for new swimming pools, hot tubs, spas and ornamental ponds
- Prohibit the filling, draining and refilling of existing swimming pools, wading pools, Jacuzzis and hot tubs except to maintain structural integrity, proper operation and maintenance or to alleviate a public safety risk

If an individual member or customer of UTRWD is unable to secure sufficient supplies, including purchases from UTRWD, purchases from other entities or developed supplies, to meet its demands, the remaining strategy available is to implement measures from its drought contingency plan to manage its retail customers' demands to the supplies available to that member or customer. UTRWD's members and customers have their own unique drought contingency plans, but those plans are required, by the water sales agreement with UTRWD, to achieve results consistent with UTRWD's drought contingency plan. In addition to implementing water use reduction measures similar to those listed above, UTRWD members and customers may choose to implement a retail rate surcharge to further control usage.

Summary of No Action Alternative Strategies

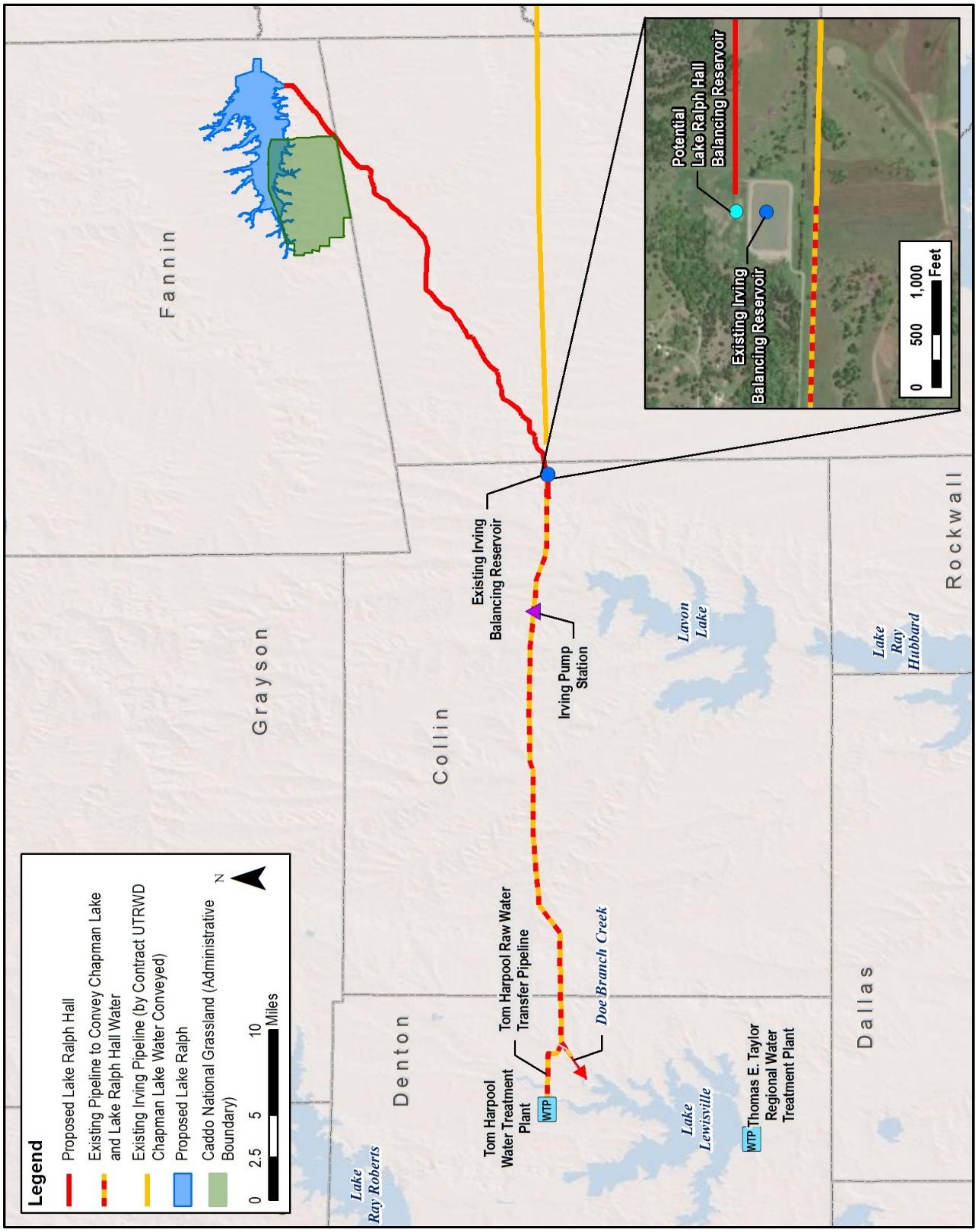
The No Action Alternative is the most likely alternative to be implemented in the absence of the Proposed Action due to denial of the permit. Unmet water supply needs of UTRWD and its members and customers are projected to begin in 2024. UTRWD and its members and customers would respond to these unmet demands by seeking other water supply and management strategies incrementally, particularly, seeking temporary/emergency water supply contracts, developing local groundwater supplies (by individual UTRWD members and customers only), and implementing mandatory water use restrictions. To achieve mandatory water use restrictions, UTRWD would limit the quantity of water it delivers to its members and customers based on its available supplies. Its members and customers would then be forced to limit the amount of water they deliver to their retail customers by (1) placing demand limits on their customers, (2) imposing a moratorium or otherwise limiting new customer connections to their system, or (3) a combination of both.

2.4.2 Lake Ralph Hall – Applicant Preferred Alternative (APA)

The proposed Lake Ralph Hall project would include the construction of an earth-filled dam embankment across the valley of the North Sulphur River (**Figure 2-2**) with a concrete uncontrolled principal spillway located adjacent to the existing channel of the river and an excavated unlined earthen channel emergency spillway located within the embankment on the northern floodplain of the river. The embankment placed would vary between 566 feet and 568 feet North American Vertical Datum of 1988 (NAVD88) to account for anticipated settlement of the embankment thus providing an effective elevation of 566 feet NAVD88 after settlement and would adjoin the existing ground surface on both ends of the structure. Current studies indicate the proposed Lake Ralph Hall reservoir would have a conservation pool storage capacity of approximately 160,235 AF (at an elevation of 551.0 feet above MSL), and at that capacity, the surface area of the reservoir would be approximately 7,568 acres. However, it is anticipated that the storage volume is somewhat larger due to continued erosion that has occurred during the permitting and planning period. The maximum depth of the reservoir at the dam would be approximately 90 feet. The firm annual yield of the proposed project would be approximately 34,050 AF/year.

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 the Tom Harpool WTP adjacent to Lewisville Lake and the Tom Taylor WTP through discharge to Lewisville Lake via a proposed raw water transfer pipeline. Through this inter-basin transfer, UTRWD would provide water to towns and cities in Collin, Cooke, Dallas, Denton, Grayson, and Wise Counties within the Trinity River Basin. UTRWD would also make water available to the City of Ladonia and to those portions of Fannin County that lie in the Sulphur River Basin. The proposed Lake Ralph Hall project would divert raw water for municipal, industrial, and agricultural purposes, with ancillary benefits of in-place recreational uses and impeding continued erosion and environmental degradation of the North Sulphur River channel. The proposed Lake Ralph Hall project would also require the relocation and/or abandonment of state and county roads and the reconstruction of the State Highway (SH) 34 Bridge that crosses the North Sulphur River within the proposed project footprint.

Figure 2-2: Lake Ralph Hall Raw Water System Location Map



Source: Upper Trinity Regional Water District, 2015

2.4.2.1 APA Dam Alignment Options

Variations of the APA have been considered to determine if impacts can be avoided and minimized. Alternative on-site dam alignments and potential conservation pool sizes were considered in the alternatives development and analysis process. UTRWD's consideration of alternative dam sites and conservation pool sizes are provided in UTRWD (2009c) and **Appendix A-2**.

With the proposed Lake Ralph Hall project design, the dam would provide a storage volume at conservation pool of approximately 160,235 AF and would be located between two major tributaries to the North Sulphur River. The project, as proposed, would include waters from the Merrill Creek tributary and would exclude waters from the Baker Creek tributary farther downstream. The following sections include discussion of both upstream and downstream alternatives to this location, as well as alternative pool sizes. **Figures 2-3** through **2-6** illustrate the alternative dam site locations and **Figure 2-7** shows the Proposed Dam Site C.

Upstream Dam Alignments (Dam Sites A and B)

Dam Site A is located upstream of the North Sulphur River's confluence with Merrill Creek and just downstream of the confluence with Bralley Pool Creek, both major tributaries to the North Sulphur River. With the same elevation as the Proposed Action, 551 feet msl, this alternative would have an annual yield of 21,860 AF/YR. This alternative dam location would only provide approximately 61 percent of UTRWD's projected target need of 34,050 AF/YR. Therefore, it does not provide enough raw water to satisfy Criterion 2; further consideration of this alternative was not conducted.

Dam Site B is also located upstream of the confluence with Baker Creek and Merrill Creek, but further downstream from the confluence with Bralley Pool Creek. With the same elevation as the Proposed Action, 551 feet msl, this alternative would have an annual yield of 27,460 AF/YR.

This alternative dam location would only provide approximately 83 percent of UTRWD's projected target need of 34,050 AF/YR. Therefore, it does not provide enough raw water to satisfy Criterion 2; further consideration of this alternative was not conducted.

Downstream Dam Alignment (Dam Site D)

Locating the dam below the proposed location would entail incorporating the Baker Creek drainage, a major drainage of the North Sulphur River. This tributary's headwaters extend almost to Grayson County. Dam Site D would satisfy Criterion 1 and Criterion 2. However, Criterion 5 would not be satisfied.

Benefits of the downstream alternative would include a greater water supply for future populations. Water supply yield with the Dam Site D are estimated to be 47,370 AF/YR, as opposed to the

34,050 AF/YR predicted for the proposed Lake Ralph Hall project. This water supply could support greater economic growth in the region. Additionally, the larger size of the reservoir located above Dam Site D would offer greater recreation opportunities.

Impacts to wetlands/waters of the U.S. for the proposed Lake Ralph Hall project is estimated to include 387 acres of degraded ephemeral and intermittent streams and approximately 10 acres of wetlands (**Appendix E-4**). Potential impacts from Dam Site D (429 acres) would result in greater impacts to wetlands/waters of the U.S. than the proposed Lake Ralph Hall project's impacts to the same resources (387 acres) and therefore this alternative does not meet Criterion 5.

<u>Applicant's Preferred Alternative (Dam Site C)</u>

The proposed Lake Ralph Hall project (Dam Site C) would include the construction of an earth-filled dam embankment across the valley of the North Sulphur River (See **Figure 2-7**). The dam is anticipated to have a concrete uncontrolled principal spillway located adjacent to the existing channel of the river and an excavated unlined earthen channel emergency spillway located within the embankment on the northern floodplain of the river. The top of the dam embankment is anticipated to be at an elevation of between 566 feet and 568 feet msl and would adjoin the existing ground surface on both ends of the structure. The proposed Lake Ralph Hall project would have a conservation pool storage capacity of approximately 160,235 AF (at an elevation of 551.0 feet msl, and at that capacity, the surface area of the reservoir would be approximately 7,568 acres). The maximum depth of the reservoir at the dam would be approximately 90 feet. The firm annual yield of the proposed project would be approximately 34,050 AF/YR. This alternative will impact approximately 387 acres of degraded ephemeral and intermittent streams and 10 acres of wetlands which are waters of the U.S. Details concerning these resources and impacts are contained in **Chapter 3.0** and **Chapter 4.0** of this EIS.

Table 2-3 shows the practicability screening results for the alternative dam sites A, B, and D.

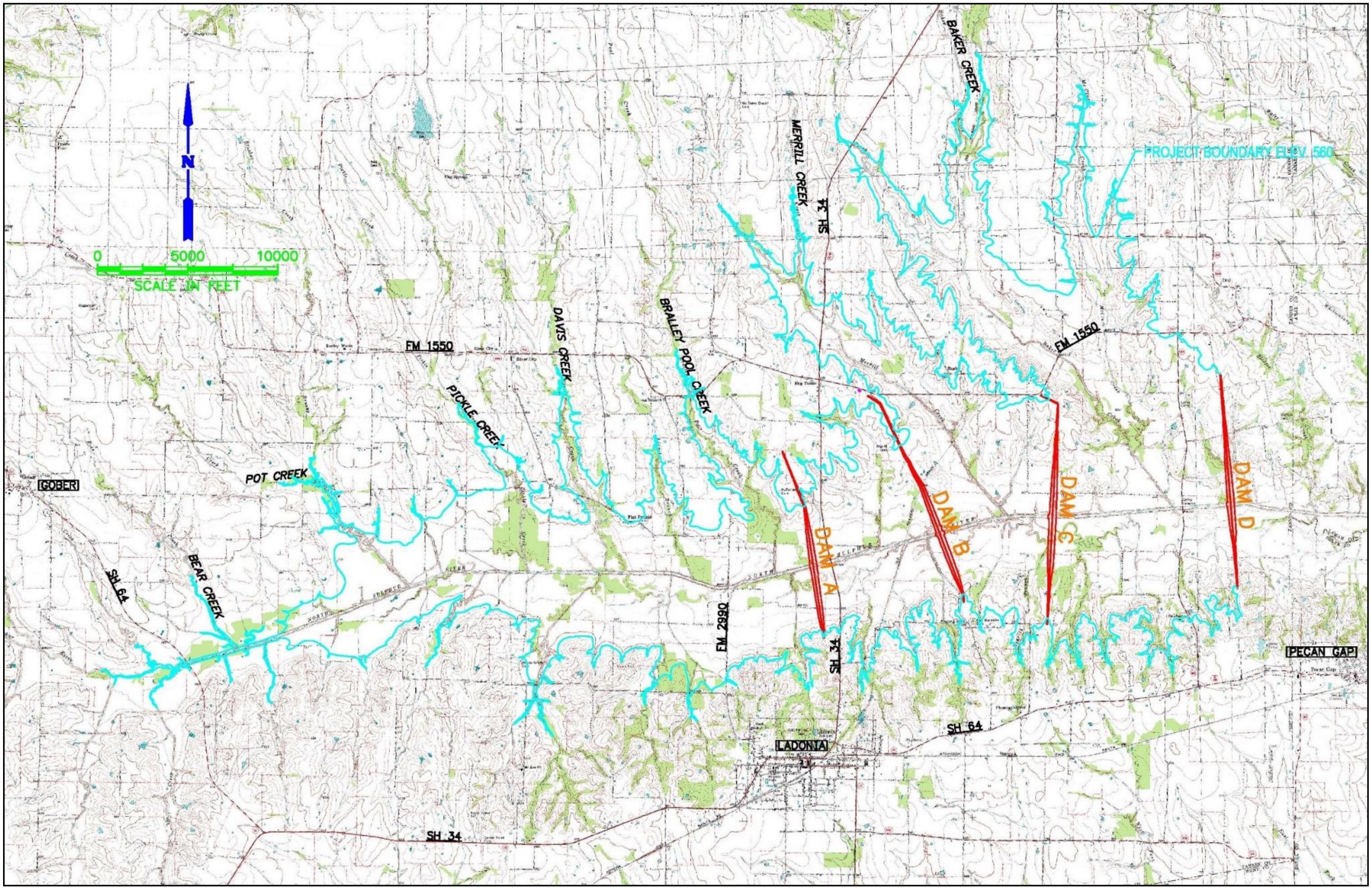
Table 2-3: Alternative Dam Sites Practicability & Impact Screening Results

Alternative	No. 1	No. 2	No. 3	No. 4	No. 5	Advance
Dam Site A - Upstream	-	X	-	-	-	No
Dam Site B - Upstream	-	X	-	-	-	No
Dam Site C - Proposed	-	-	-	-	-	Yes
Dam Site D - Downstream	-	-	-	-	X	No

2.4.2.2 Alternative Conservation Pool Size

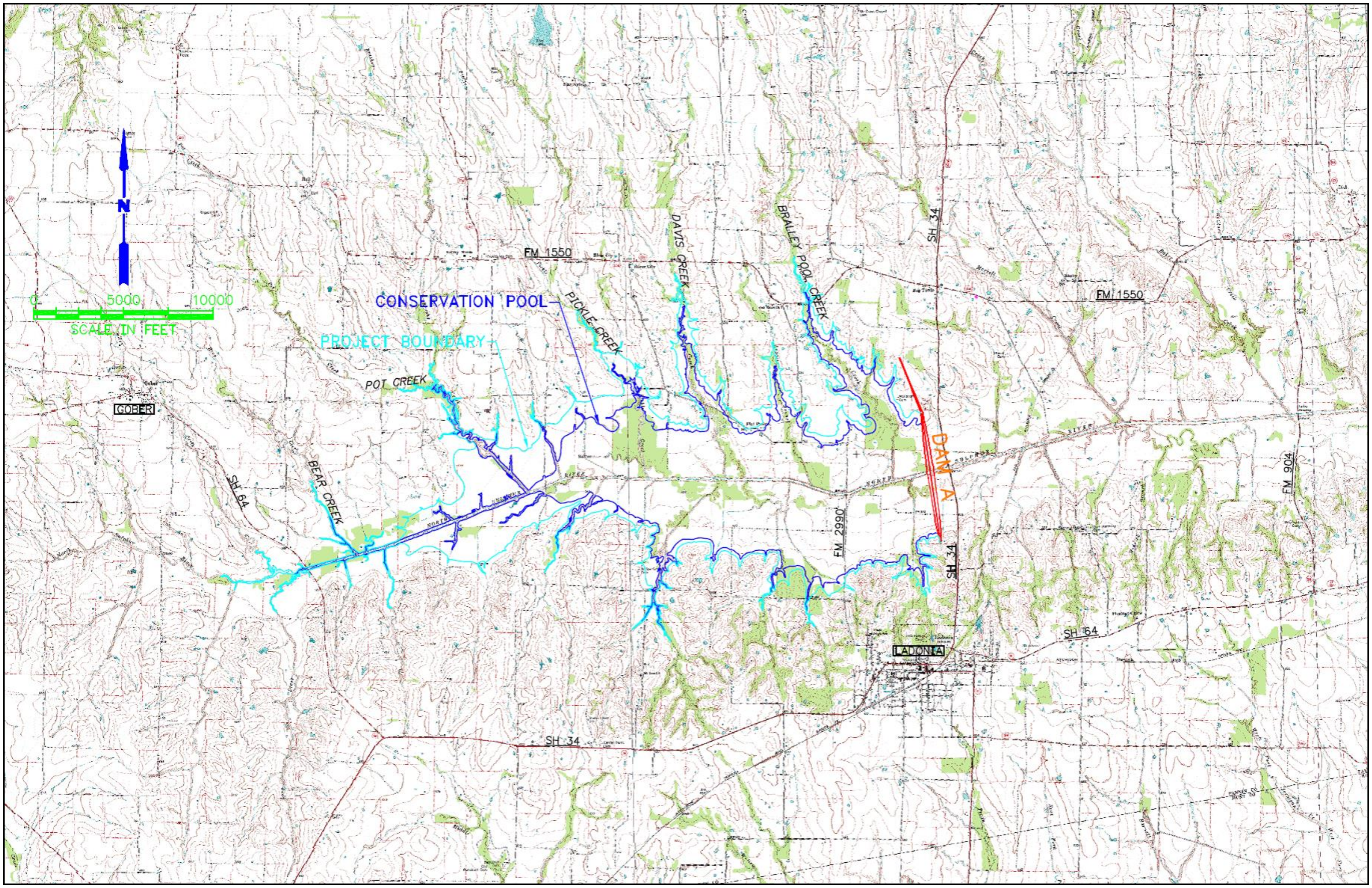
Design of the conservation pool size placed at the Proposed Action location along the river could be larger or smaller than currently proposed. If smaller, it would not meet Criterion 2. A larger pool could be practicable in terms of yield, but the increased size would have more impacts to waters of the U.S and was not considered further. Additional details related to varying elevations of the conservation pool are provided in UTRWD (2009c) and **Appendix A-2**.

Figure 2-3: Dam Sites A, B, C, and D



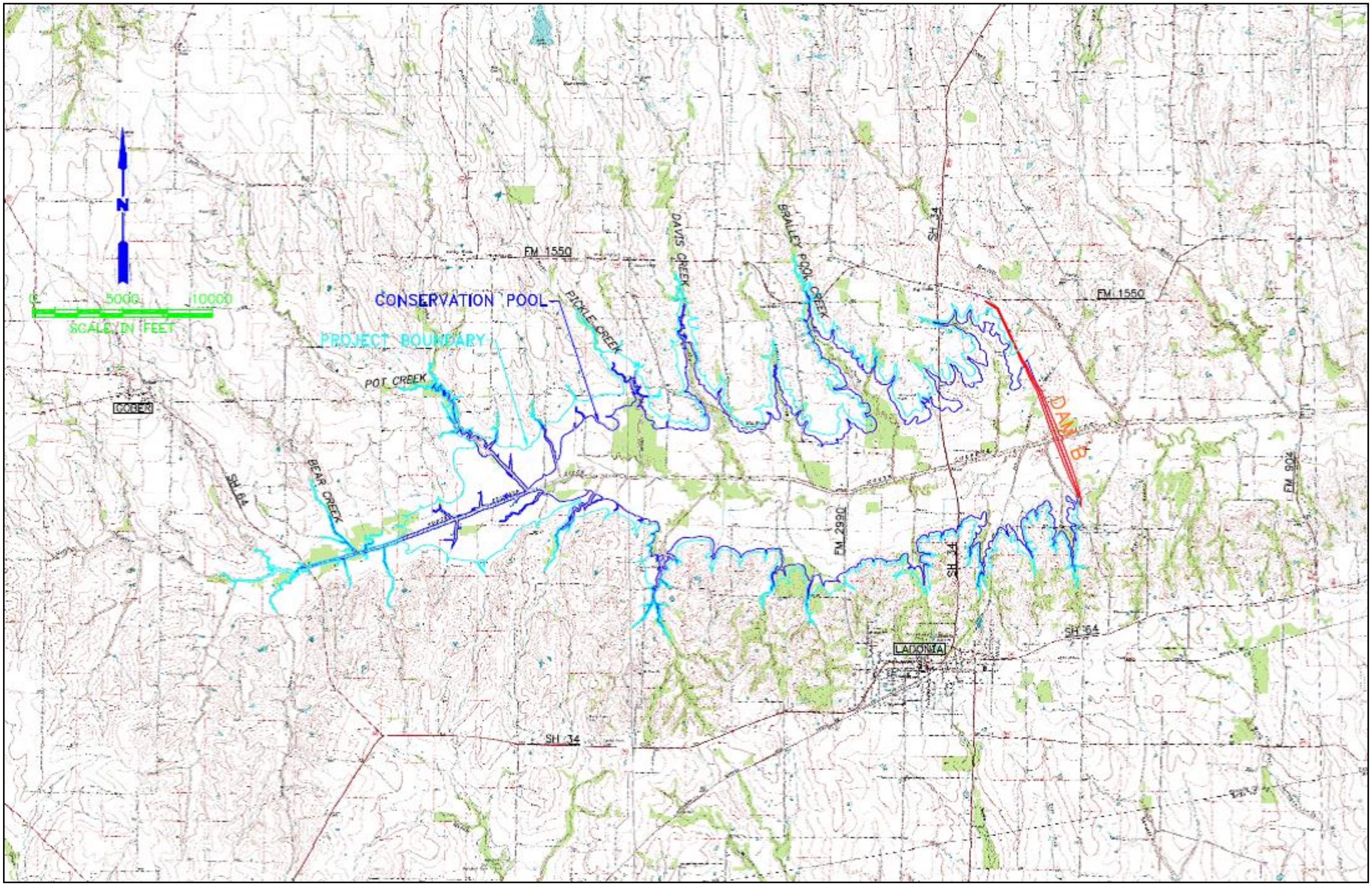
Source: UTRWD, 2009c

Figure 2-4: Dam Site A - Upstream



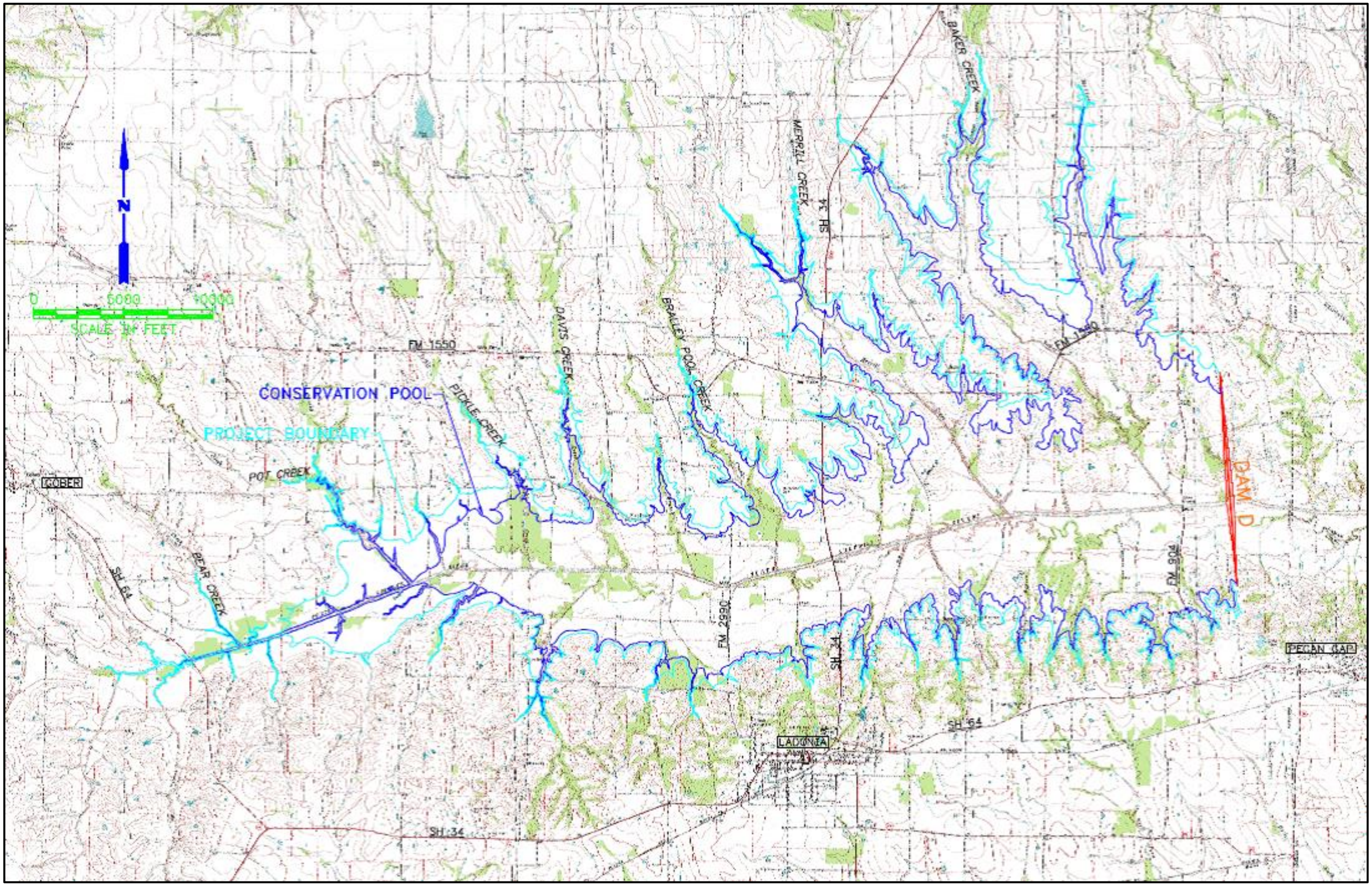
Source: UTRWD, 2009c

Figure 2-5: Dam Site B - Upstream



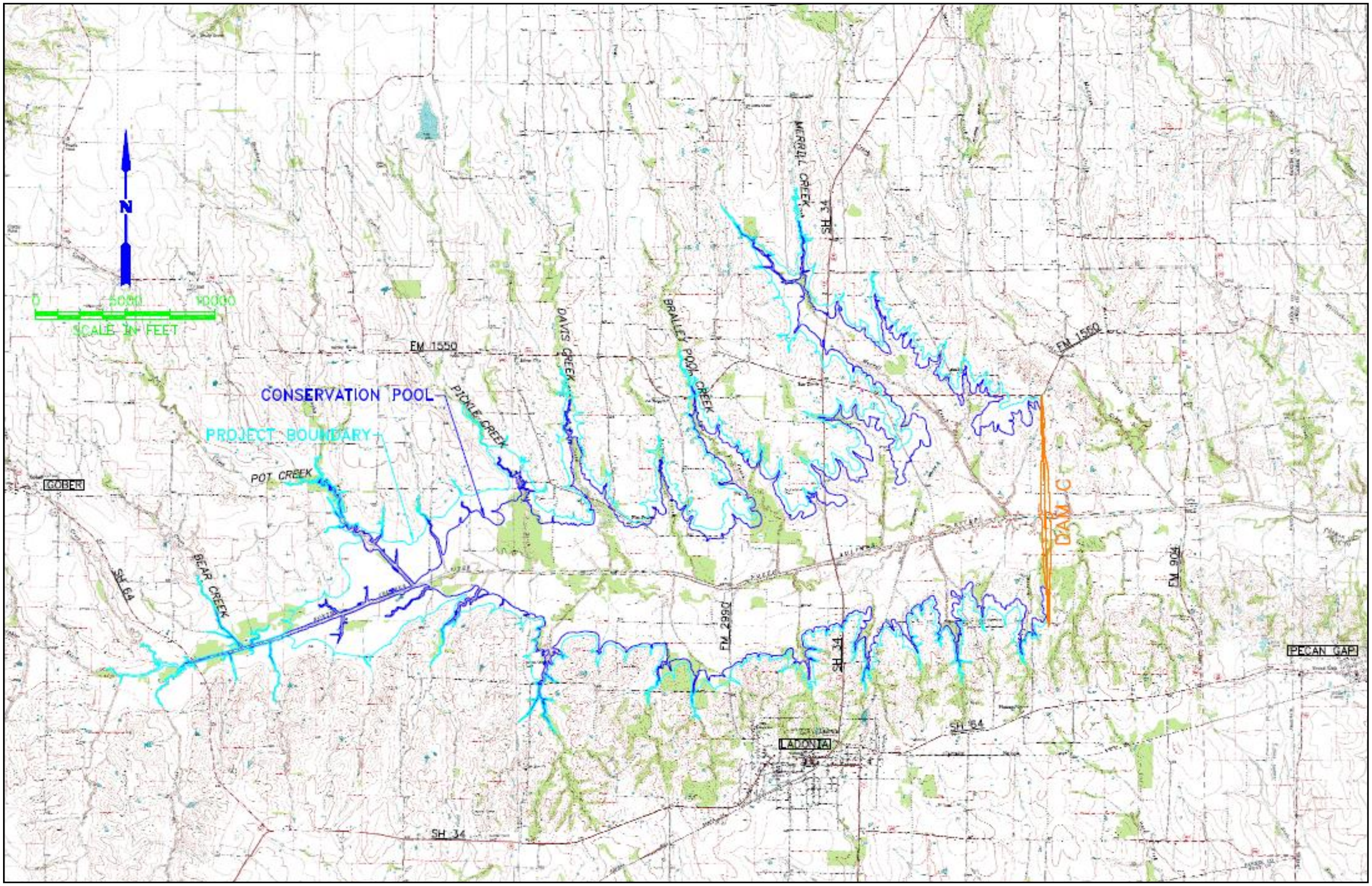
Source: UTRWD, 2009c

Figure 2-6: Dam Site D - Downstream



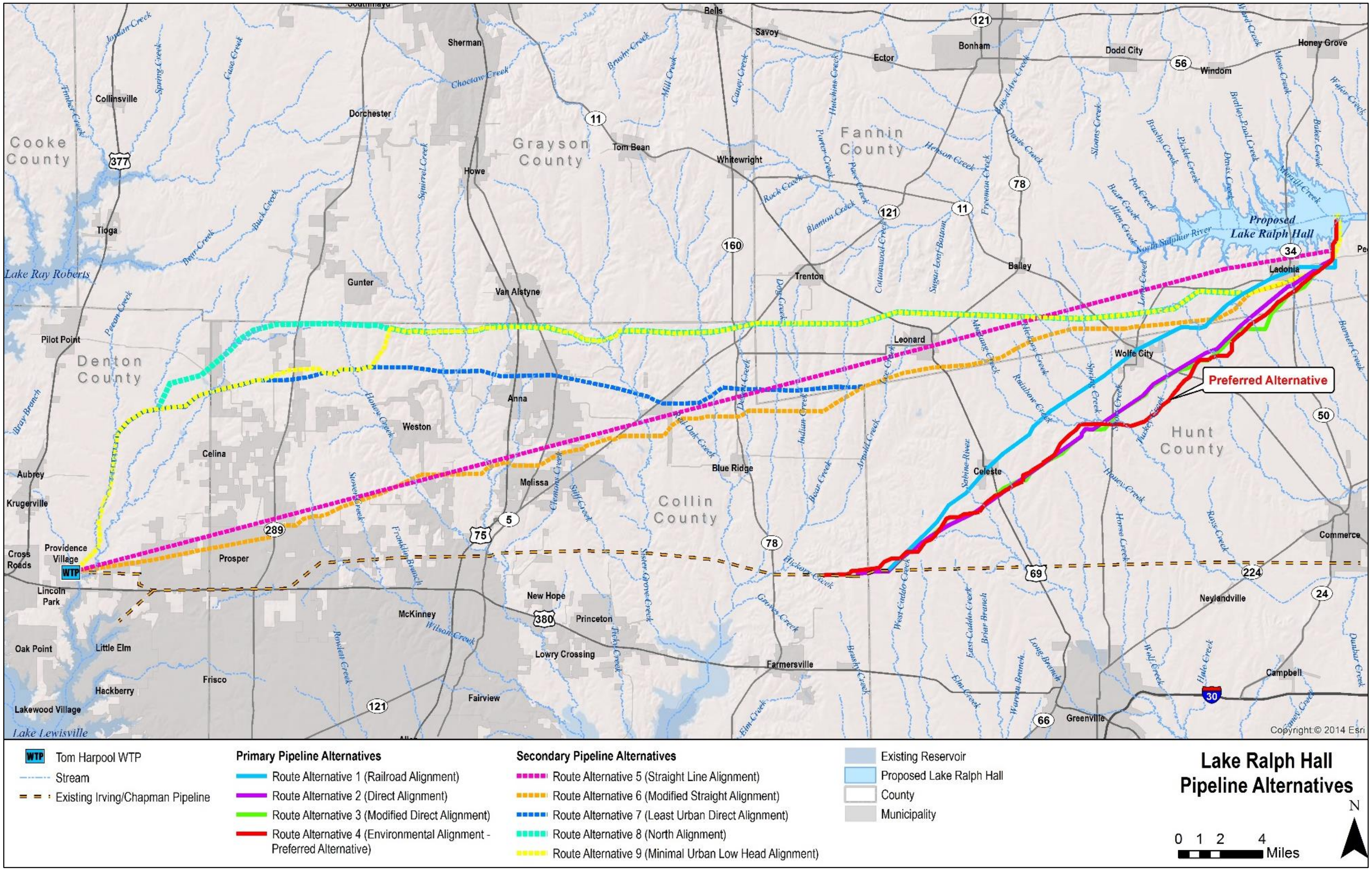
Source: UTRWD, 2009c

Figure 2-7: Dam Site C (Proposed Action)



Source: UTRWD, 2009c

Figure 2-8: Pipeline Alternatives



Source: UTRWD, 2010a

Note: Route Alternative 4 is the preferred pipeline route.

2.4.2.3 Conveyance Alternatives Evaluation

As part of the Dam Sites alternatives evaluation process, nine raw water conveyance alternatives were evaluated since UTRWD would need to be able to move raw water from any of the proposed Lake Ralph Hall dam sites to the Tom Harpool WTP. All nine of the conveyance alternatives evaluated in this EIS consist of a pipeline, each of which varies in terms of the specific alignment. Four primary and five secondary alignments were evaluated for a total of nine conveyance alternatives (see **Figure 2-8**). Primary alignments include those alignments that connect to the existing Irving Pipeline that extends from Chapman Lake to the Tom Harpool WTP. These alignments were considered primary because they are substantially shorter, and therefore less costly and involve less waters of the U.S. crossings, than the secondary alignments. Secondary alignments include those that extend from the Lake Ralph Hall project dam sites directly to the Tom Harpool WTP. The pipeline alignments were analyzed using cost factors including pipeline length and right-of-way impacts and environmental factors including impacts to waters of the U.S., Caddo National Grasslands, and cultural resources. Additional information about the conveyance alternatives can be found in the *Lake Ralph Hall Water Pipeline Alignment Study* (UTRWD, 2010a) portions of which are included in **Appendix A-3**. Route Alternative 4 was selected as the recommended pipeline alternative to carry forward into NEPA analysis because it was one of the shortest (therefore less costly) alternatives with the fewest stream crossings. Other benefits included that it does not cross the Caddo National Grasslands and had the fewest impacts to wooded areas.

2.4.3 Lake Ralph Hall – Other Alternatives Considered

Marvin Nichols Reservoir (at 280 msl)

As described in UTRWD's initial information and the State Water Plan, Marvin Nichols Reservoir would be a much larger alternative than what is needed to address UTRWD's needs as defined in this EIS. The project is a proposed reservoir located on the Sulphur River in the Sulphur River Basin within Region D (North East Texas) in Red River and Titus counties. It has been a recommended strategy in the 2011, 2006, and 2001 Region C Water Plans for the North Texas Municipal Water District (NTMWD), the Tarrant Regional Water District (TRWD), and the UTRWD. In 2015 the Region D Water Planning Group raised an objection to the inclusion of the Marvin Nichols Reservoir (as part of the Sulphur Basin Supplies strategy) in the 2016 Region C Initially Prepared Plan (IPP) (TWDB, 2015a). Based on the resulting mediation agreement, Marvin Nichols Reservoir was modified to begin in 2070 rather than in 2050 (as it was presented in the IPP). The larger configuration of Marvin Nichols Reservoir (at elevation 328 feet, msl) that was included in the previous three Region C Water Plans was retained as an alternative strategy for the 2016 Region C Water Plan.

According to the 2011 Region C Water Plan, Marvin Nichols would provide a large source of additional supply for the Metroplex. The total yield of Marvin Nichols Reservoir is estimated to be approximately 612,300 AF/YR, assuming that Lake Ralph Hall is in place as a senior water right to Marvin Nichols Reservoir and that Marvin Nichols Reservoir is operated as a system with Wright Patman Lake[3]. The division of the 489,840 AF/YR assumed to be available to Region C from the reservoir is:

- 280,000 AF/YR for TRWD
- 174,840 AF/YR for NTMWD
- 35,000 AF/YR for UTRWD.

To ensure a comparable comparison of potential impacts of the Marvin Nichols alternative to the Applicant's proposed Lake Ralph Hall project, the dam location for Marvin Nichols Site 1A was used and the conservation pool elevation was lowered to the point where the annual firm yield of the Marvin Nichols alternative was approximately equal to that of Lake Ralph Hall, 35,000 AF/YR, approximately 280 feet msl. Using ArcGIS software, the surface elevation of 280 feet msl was mapped and overlain on National Wetland Inventory (NWI) mapping for the same area. Based on this analysis, a Marvin Nichols alternative at a 280 feet msl conservation pool elevation with approximately the same yield as the Applicant's proposed Lake Ralph Hall project (~35,000 AF/YR) would result in an inundated surface area of approximately 6,056 acres.

The results of the evaluation of potential impacts to wetlands/waters of the U.S. based NWI maps resulting from a Marvin Nichols alternative at 280 feet msl conservation pool are included in **Table 2-4** below.

Table 2-4: Impacts from Marvin Nichols Alternative - 280 feet msl

NWI Wetland Type	Acreage Inundated
Freshwater Emergent Wetland	674.62
Freshwater Forested/Shrub Wetland	4,560.71
Freshwater Pond	23.53
Riverine	227.73
Total NWI Resources Inundated	5,537.61

Source: NWI GIS (Geographic Information System) Data, 2015

The total impacts to wetlands/water of the U.S. for the proposed Lake Ralph Hall project is estimated to be 387 acres and consists of impacts to degraded ephemeral and intermittent streams and approximately 10 acres of wetlands. Potential impacts from a Marvin Nichols alternative (5,537.61 acres) with approximately the same firm annual yield as Lake Ralph Hall (35,000

[3] 2011 Region C Water Plan, page 4E.2

AF/YR) would result in substantially greater impacts to high quality wetlands/waters of the U.S. The project site contains a portion of the state's Priority 1 bottomland hardwoods. These wetlands are considered high value to key waterfowl species and would require comparable mitigation (TWDB, Report 370, 2008). Since this alternative would result in greater impacts to the aquatic ecosystem, it fails Criterion 5.

Additionally, development of this supply would require a new water rights permit, an interbasin transfer in order to transfer the water from the Sulphur River Basin to the Trinity River Basin, and a 404 permit from USACE involving the development of an EIS. This reservoir site has been studied at the reconnaissance level only; no detailed field studies have been completed, and no permit applications have been filed. Because of the regional conflicts associated with the proposal and additional water rights and Federal permitting requirements, land acquisition for the reservoir and pipeline alignment and pumping stations, development is expected to take a substantial amount of time, well in excess of 2024. A more refined analysis and estimate was not developed to firmly determine if the alternative could be implemented within the time frame of Criterion 3. However, similar options (i.e. the Toledo Bend alternative discussed below) involving such efforts resulted in a timeline that extended well beyond 2024 for many of the issues facing Marvin Nichols without the need to develop an EIS for the construction of a dam and reservoir. Therefore, this option also fails to meet Criterion 3.

Due to failure of Criteria 3 and 5, the Marvin Nichols Reservoir Alternative was not carried forward for detailed evaluation in this EIS.

<u>Wright Patman Lake</u>

Wright Patman Lake is an existing reservoir on the Sulphur River in the Sulphur River Basin, about 150 miles from the Metroplex. It is located in Region D, the North East Texas Region, and owned and operated by USACE. There are three different ways in which water could be made available from Wright Patman Lake for UTRWD.

- Water could be purchased from the City of Texarkana under its existing water right.
- Flood storage in Wright Patman Lake could be converted to conservation storage, and the increased yield could be used by the applicant.
- Wright Patman Lake could be operated as a system with Jim Chapman Lake (formerly Cooper Lake) upstream to further increase yield (2006 Region C Water Plan).

The City of Texarkana has contracted with the USACE for storage in the lake and holds a Texas water right to use up to 180,000 AF/YR from the lake. However, to obtain a reliable supply of this amount, Texarkana would have to activate a contract with the USACE to increase the conservation storage in the lake. Implementation of this contract would require an environmental evaluation of the change in operation of the reservoir as required by NEPA. Additionally, accessing the full 180,000 AF/YR in the Texas water right would require additional modifications to the USACE contract.

For the purchase option, UTRWD would secure 34,050 AF/YR from the City of Texarkana from its currently held water rights. Of their current right, 135,000 AF/YR is allocated to industrial use (more than their projected water demand). For the conversion option, a recent study associated with an ongoing USACE Fort Worth District storage reallocation analysis, reported that increasing the top of conservation storage in Wright Patman Lake to elevation 228.64 feet msl and allowing diversions as low as elevation 215.25 feet msl would increase the yield of the project to about 364,000 AF/YR. In that study, it was assumed that 180,000 AF/YR of the additional supply developed could be made available to water suppliers in the Metroplex, including UTRWD. The yield of Wright Patman Lake could be increased to much more than 364,000 AF/YR by converting additional flood storage to conservation storage and increasing the top of conservation storage. For the system operation option, Wright Patman Lake and Jim Chapman Lake could increase the yield from the two projects by about 108,000 AF/YR. The study assumed that the combination of purchasing water from Texarkana, converting flood storage to conservation storage, and system operation with Jim Chapman Lake could make 390,000 AF/YR available for Region C from Wright Patman Lake (2006 Region C Water Plan), of which UTRWD is party to.

These options involve the same implementation hurdles as the Marvin Nichols alternative relative to being implemented in a timely fashion due to the time required to evaluate and obtain a state water right permit, new land acquisition for pipeline alignment and pump stations as well as utilities, and contract negotiations with Texarkana and/or USACE. While the purchase of water from Texarkana sub-option does not result in additional direct environmental consequence to wetlands and other waters at the reservoir site, the reallocation sub-option sized to meet the UTRWD's need of 34,050 AF/YR apart from other Metroplex players being involved would result in additional inundation to a large area of bottomland hardwoods and streams within the White Oak Creek Mitigation Area. Additionally, reallocation within the reservoir itself could not be accomplished earlier than 2025 (USACE, 2016a – Personal communication to Chandler Peter, USACE, March 2017a). The integrated operations with Chapman sub-option would require contractual changes between the USACE and Texarkana, willing sellers, impacts to the White Oak Creek Mitigation Area, changes to USACE operations of the lake, and conflicts with other potential users (Freese and Nichols, 2008).

All three sub-options would fail to provide the needed water to UTRWD by 2024, similar to the reasons identified in the analysis completed with the Toledo Bend alternative. This is due to water rights permitting, obtaining right of way for pipeline alignment and pumping facility locations, utilities locations, as well as design and construction requirements. While permits would be required from USACE Regulatory program for the pipeline and operations, impacts would be substantially lower allowing use of Nationwide Permits or individual permit evaluation with the development an environmental assessment rather than an EIS due to significantly reduced impacts to aquatic resources without the need for a new or modified dam. The other factors identified result in an estimated time of providing water by 2032, well past the needed time of 2024.

Due to failure of Criteria 3 and 5, the Wright Patman Lake Alternative was not carried forward for detailed evaluation in this EIS.

Additional DWU Supplies

This alternative would entail securing additional contract water supplies above and beyond those already committed. Currently, UTRWD has a contract with DWU with an annual volume limit of 11,200 AF/YR. UTRWD's contract with DWU expires in February of 2022 and DWU will make no commitment to renew that contract as of January 2015[4]. DWU makes the assumption that it will continue to supply the base amount of the existing contract plus future demands for the named entities. As embodied in its long range water supply plan, DWU has assumed this relationship will continue at least through 2070. No additional water is projected to be provided by 2024.

Due to failure of Criterion 3, the Additional DWU Supplies Alternative was not carried forward for detailed evaluation in this EIS.

Oklahoma Water

Importing water from southeastern Oklahoma is a water supply source that is potentially available to the applicant. It is listed as a recommended strategy in the 2016 Region C Water Plan, including an alternative strategy for UTRWD. UTRWD has filed applications with the Oklahoma Water Resource Board (OWRB) to secure such water. Other water suppliers have also filed applications or even entered into agreement in the same basins as UTRWD's applications. However, Oklahoma had imposed a moratorium on any permits or contracts authorizing the sale of water to users outside of the state. A Texas water provider pursued litigation in Federal Court to determine whether this moratorium could be overturned, and the U.S. Supreme Court subsequently ruled in favor of Oklahoma. Before the moratorium expired in 2009 the legislature passed a bill declaring that no out-of-state water permit will impair the ability of the state of Oklahoma to meet its obligations under any interstate stream compact or impair or affect the obligations of the United States and that out-of-state water permits must be approved by the Oklahoma Legislature.

Additionally, the Chickasaw and Choctaw Indian Nations have asserted legal claims to water in southeastern Oklahoma. In August of 2016 a settlement was reached under which Oklahoma would continue to manage the state's natural water supply but acknowledge tribal sovereignty and meet the tribes' conservation guidelines. The agreement also sets up a framework for out-of-state sales or transfers of water from a 22-county region in south-central and southeastern Oklahoma.

[4] See Appendix A-6 Letter from Jody Puckett, Director, DWU to Stephen Brooks, USACE, January 28, 2015.

It creates a five-person commission appointed by the state and tribal governments that will evaluate such proposals and make recommendations to the Legislature. The quantity of water in Oklahoma available to meet the needs of the various applicants and how that water will be allocated is yet to be resolved.

UTRWD has filed three separate applications with the OWRB for the right to withdraw up to a combined total of 115,000 AF/YR from the Kiamichi, Boggy Creek and Texoma basins. UTRWD has requested an extension to two applications which expired in 2016 (Kiamichi extension requested until 3/14/19 and Boggy Creek extension requested until 11/5/19). A response from the OWRB regarding these requests is pending. If ultimately permitted, it is estimated that 115,000 AF/YR would be available from Oklahoma to UTRWD and its partners at some point in the future. UTRWD's share is approximately 45 percent of the 115,000 AF/YR.

If the OWRB were to grant an Oklahoma water rights permit, the UTRWD would still need to obtain a Section 401 water quality certification if Oklahoma water were to be discharged to a Texas stream or lake, and a Section 404 permit for the diversion structure and any dam if needed. Depending upon the source of water and its diversion location, a transmission system would be needed to the UTRWD's service area. Due to the uncertain status of the Oklahoma water rights permit, this strategy would not be able to deliver water in a timely manner to meet the UTRWD's near-term (10-20 year) water needs.

Due to failure of Criterion 3, the Oklahoma Water Alternative was not carried forward for detailed evaluation in this EIS.

Toledo Bend Reservoir

Toledo Bend Reservoir is an existing impoundment located in the Sabine River Basin on the border between Texas and Louisiana. It was built in the 1960s by the Sabine River Authority of Texas (SRA) and the Sabine River Authority of Louisiana. The yield of the project is split equally between the two states, and Texas's share of the yield is slightly over 1,000,000 AF/YR. The SRA holds a Texas water right to divert 750,000 AF/YR from Toledo Bend and is seeking the right to divert an additional 293,300 AF/YR (2006 Region C Water Plan).

The use of water from Toledo Bend Reservoir in East Texas for water supply in North Texas is a recommended strategy for several Metroplex entities, including UTRWD, in the 2016 Region C Water Plan. The Metroplex water suppliers have been investigating the possibility of developing substantial water supplies from Toledo Bend Reservoir, with up to 348,000 AF/YR delivered to Region C. (Toledo Bend Reservoir is located in Region I, the East Texas Region.) The development of this supply would require an agreement among the SRA and Metroplex suppliers, an interbasin transfer permit from the Sabine River Basin to the Trinity River Basin, and development of water transmission facilities including an intake pump station, pipelines, booster pump stations, maintenance access roads and associated utilities.

This alternative was modified to provide the need identified in this EIS of 34,050 AF/YR. Coordination with the SRA confirmed that adequate water supply was available to the applicant to meet the target need. Consideration of costs was also applied to this option. As described in **Section 2.3.1.1**, alternatives may be determined to be not practicable due to costs. An initial cost estimate was developed (**Appendix A-4**) to determine if the option was not practicable from an exorbitant perspective rather than develop a threshold that could be applied to all alternatives. Considerations focused on construction, operation and maintenance costs in present day value since they comprise the bulk of overall costs and allow for a reasonable comparison. The Lake Ralph Hall proposal estimated costs are approximately $330 million while this alternative's costs would be slightly more than $1 billion for the same amount of yield. While a threefold increase in overall costs to address the need is substantial, it was not considered to be exorbitant. Rather than attempt to develop a specific threshold which requires evaluation of regional costs for similar projects and possibly estimate costs for multiple alternatives, other screens were applied to evaluate the alternative.

Development of the infrastructure components and permitting requirements revealed that providing the needed water from this option in a timely manner was problematic. A schedule was developed and refined (**Appendix A-5**) that included water rights permitting, USACE permitting, land acquisition, design and construction. Additionally, consideration of other recent water pipeline projects in the state of Texas was included in the development of the schedule including the Integrated Pipeline project being pursued by the TRWD and City of Dallas Water Utilities, the Mary Rhodes Phase II Pipeline Project by the City of Corpus Christi, and the Lake Texoma Pipeline Project by the NTMWD.

Based on the analysis, it was determined that water from the proposed project would be available starting around 2032, well past the requirement of Criterion 3.

Due to failure of Criterion 3, the Toledo Bend Reservoir Alternative was not carried forward for detailed evaluation in this EIS.

<u>Lake Texoma</u>

Lake Texoma is an existing USACE reservoir on the Red River between Texas and Oklahoma. It provides water supply for the NTMWD and the Greater Texoma Utility Authority (GTUA), the City of Denison, TXU, and the Red River Authority. According to the USACE, the firm yield of Lake Texoma with all hydropower storage reallocated to water supply would be 1,088,500 AF/YR. Under the Red River Compact, water from Lake Texoma is divided between Texas and Oklahoma.

The firm yield of Texas' share of Lake Texoma is 642,608 AF/YR in 2020, decreasing to 640,067 AF/YR by 2070. Based on the 2016 Region C Water Plan, the total Texoma supply available to Region C as of 2070 is 316,550 AF/YR (2,250 AF/YR for Red River Authority; 83,200 AF/YR for GTUA; 24,400 AF/YR for Denison; 197,000 AF/YR for NTMWD; and 16,400 AF/YR for

Luminant). In the case of Texoma, the available supply is limited to the water right amount. This strategy was listed as an alternative water supply strategy for UTRWD in the 2016 Region C Plan.

In 2010, an additional 150,000 AF out of the Texas share was reallocated for Texas water supplies. These supplies were fully subscribed by NTMWD and GTUA. That reallocation required 12 years to complete.

Water from Lake Texoma is brackish and unable to be used without blending it with higher quality water or using a desalination process. The city of Sherman, which receives raw water from GTUA, operates a desalination and treatment plant. GTUA along with NTMWD also blends water with higher quality and upstream source to make water from Lake Texoma potable. The Red River Authority is also sponsoring the Red River Chloride Control Project to improve water quality and desalinate prior to the brackish water reaching Lake Texoma. It is anticipated that UTRWD can implement similar treatment trains relative to Lake Texoma water. These conditions and requirements did not allow for a determination that this option is not practicable.

Further reallocation of hydropower storage to water supply in Lake Texoma would provide additional yield. Texas' share would be 544,250 AF/YR, leaving about 220,000 AF/YR of additional supply available to Texas by the reallocation of more hydropower storage to municipal use (beyond the supplies already contracted for and the currently authorized reallocation). The Lake Texoma waters available to Texas municipal water users have been spoken for or are lined up by the historical constituent utilities of the Lake, NTMWD and GTUA. NTMWD is projected to have water shortages, as evidenced by its starting negotiations with GTUA and the city of Sherman for receiving unused water. Reallocation of water from hydropower, would require an act of Congress.

UTRWD would need to establish a water right and an engineering plan for getting the water to its service area and rendering it potable first before applying to the USACE for the reallocation. The USACE would then need to initiate a process for reallocation, including a study to assess the reallocation. Hydropower interests and other Texas water interests would have an opportunity to comment and contest such a reallocation and water grant to UTRWD. Costs for this effort would be borne by UTRWD.

As previously identified, UTRWD has filed for a water rights permit from Lake Texoma from the OWRB to utilize a portion of Oklahoma's Lake Texoma water. The OWRB is not ruling on this and other out of state permits pending the outcome of related lawsuits. As discussed previously, the Supreme Court ruled in favor of Oklahoma, but additional lawsuits by Chickasaw and Choctaw Indian Nations have resulted in agreements that set up a framework for out-of-state sales, still only when authorized by the legislature.

It took UTRWD more than a decade to obtain a water right permit for its preferred alternative which was followed by litigation from 2012 up until the final ruling from the First District of Texas

Court of Appeals on June 9th, 2017. This ruling ended litigation making the water right permit for Lake Ralph Hall final and legally unappealable (**Appendix J**). Additionally, the USACE permit evaluation of the proposed Lake Ralph Hall project has taken over nine years to develop and release a Final EIS. Due to the contentiousness of a reallocation effort, based on documented comments and concerns associated with the previous reallocation effort, the time associated with the state of Texas water right permit process and Congressional authorization, it is concluded that developing water from this potential alternative cannot occur within the timeframe screen established in Criterion 3 which is 2024.

Due to failure of Criterion 3, the Lake Texoma Alternative was not carried forward for detailed evaluation in this EIS.

George Parkhouse Reservoir (North)

George Parkhouse Reservoir (North), also referred to as Parkhouse II Lake, is a potential reservoir on the North Sulphur River located downstream of the proposed Lake Ralph Hall project in Lamar and Delta Counties (Region D). The 2016 Region C Water Plan estimates that the reservoir yield would be 148,700 AF/YR, based on a conservation pool level of 410 feet, 118,960 AF/YR of which is assumed to be available for Region C, with 35,000 AF/YR of that amount allocated to UTRWD. Therefore this alternative would meet Criterion 2.

The previous TWDB Report 370 estimates the firm yield of the proposed reservoir at 144,300 AF/YR, and estimates that this would be reduced by 2,500 AF/YR for environmental flow requirements and by an additional 26,900 AF/YR if the proposed Lake Ralph Hall project is in place as a senior water right (if this is an alternative to Lake Ralph Hall then the Lake Ralph Hall right could possibly be transferred downstream if the existing Lake Ralph Hall water right was cancelled). According to the report, the firm yield of George Parkhouse Reservoir (North) would decrease if one or more of the proposed reservoirs in the Sulphur Basin (Ralph Hall, George Parkhouse Reservoir (South), and/or Marvin Nichols IA) are built and the George Parkhouse Reservoir (North) has a junior priority to any of these reservoirs. Yield analysis conducted in 2008 for the TWDB Report 370, determined that Lake Ralph Hall would reduce the firm yield of George Parkhouse Reservoir (North) by 26,900 AF/YR, which is 18 percent of the stand-alone yield. If all of the other planned reservoirs in the Sulphur Basin were in place the yield from George Parkhouse Reservoir (North) is estimated to be only 32,100 AF/YR, which is 112,200 AF/YR less than the stand-alone yield (or a reduction of 78 percent).

George Parkhouse Reservoir (North) site is located upstream of a Priority 1 bottomland hardwood preservation site identified as Sulphur River Bottoms West (TWDB, 2008). George Parkhouse Reservoir (North) would inundate approximately 14,400 acres of land at conservation storage capacity. **Table 2-5** summarizes existing landcover for the George Parkhouse Reservoir (North) site as determined by the Texas Parks and Wildlife Department (TWDB, 2008).

Table 2-5: Acreage and Percent Landcover for George Parkhouse Reservoir (North)

Landcover Classification	Acreage[a]	Percent
Bottomland hardwood forest	208	1.4%
Seasonally flooded shrubland	170	1.1%
Swamp	31	0.2%
Evergreen forest	9	0.0%
Upland deciduous forest	4,003	26.0%
Grassland	7,605	49.5%
Shrubland	672	4.4%
Agricultural land	2,424	15.8%
Urban/developed land	45	0.3%
Open water	200	1.3%
Total	**15,367**	**100.0%**

Source: Texas Water Development Board Report 370, 2008
Notes: [a]Acreage based on approximate GIS coverage rather than calculated elevation-area-capacity relationship.

Development of George Parkhouse Reservoir (North) would require a water right permit and an interbasin transfer permit. Detailed studies of water needs in the receiving and the source basins would be required as part of the permitting process for new interbasin transfers. The typical reservoir development schedule (**Appendix A-5**) indicates that due to the need for detailed engineering and environmental studies, new water rights and IBTs, it appeared unlikely that George Parkhouse Reservoir (North) could be developed in time to meet Criterion 3. Therefore, additional analysis was required.

Using Arc GIS software, the surface elevation of 375 feet msl was mapped and overlain on NWI mapping for the George Parkhouse II (North) reservoir site. A scaled down conservation pool elevation resulting in firm annual yield similar to that of Lake Ralph Hall (approximately 35,000 AF) was not available so the closest available yield (~30,000 acre-feet [AF]) elevation of 375 msl was selected for comparison.

Based on this analysis, a George Parkhouse II (North) alternative at a 375 feet msl conservation pool elevation with slightly less yield as the Applicant's proposed Lake Ralph Hall project would result in an inundated surface area of approximately 3,532 acres (TWDB, 2008). The results of the screening of potential impacts to wetlands/waters of the U.S. based on NWI maps and a George Parkhouse II (North) alternative at a 375 feet msl conservation pool are included in **Table 2-6**.

Table 2-6: Impacts from George Parkhouse Reservoir (North) Alternative - 375 feet msl

NWI Wetland Type	Acreage Inundated
Freshwater Emergent Wetland	2.81
Freshwater Forested/Shrub Wetland	776.96
Freshwater Pond	10.50
Riverine	101.27
Total NWI Resources Inundated	**891.54**

The total impacts to wetlands/water of the U.S. for the proposed Lake Ralph Hall project is estimated to be less than 387 acres and consists of impacts to degraded ephemeral and intermittent streams and approximately 10 acres of wetlands. Potential impacts from a scaled down George Parkhouse II (North) alternative (891.54 acres) with a slightly lower firm annual yield as Lake Ralph Hall would result in more than two times the amount of impacts to wetlands/waters of the U.S. than the proposed Lake Ralph Hall project's impacts to the same resources (387 acres). The George Parkhouse II (North) alternative would not meet Criterion 5 because it would result in greater impacts to wetlands/waters of the U.S. than the proposed Lake Ralph Hall project's impacts to the same resources.

Due to failure of Criteria 3 and 5, the George Parkhouse Reservoir (North) Alternative was not carried forward for detailed evaluation in this EIS.

George Parkhouse Reservoir (South)

George Parkhouse Reservoir (South), also referred to as Parkhouse I Lake, is a potential reservoir located downstream from Jim Chapman Lake on the South Sulphur River in Hopkins and Delta Counties (Region D). According to the 2016 Region C Water Plan, George Parkhouse Reservoir (South) could supply 135,600 AF/YR based on a conservation pool level of 410 feet. Assumed to be available for Region C are 108,480 AF/YR, with 35,000 AF/YR of that amount assumed to be allocated to UTRWD.

The 2008 TWDB Report 370 estimated the firm yield to be 122,000 AF/YR based on a conservation pool elevation of 401 feet. The lower conservation pool elevation was used in this study based on concerns of operational and cost impacts if it were set at a higher level. TWDB Report 370 also estimates that environmental flow requirements would be 2,400 AF/YR, and notes that the yield would decrease if the proposed Lake Ralph Hall project is in place as a senior water right. George Parkhouse Reservoir (South) is not a recommended water management strategy for any Region C water supplier. It is an alternative strategy for the NTMWD and the UTRWD.

According to the report, the yield of George Parkhouse Reservoir (South) would decrease if one or more of the proposed reservoirs in the Sulphur Basin (Ralph Hall, Parkhouse II, and/or Marvin Nichols IA) are built, and George Parkhouse Reservoir (South) has a junior priority to any of these reservoirs. The scenario that produces the lowest yield assumes that George Parkhouse Reservoir (South) is built after all of the other proposed reservoirs in the Sulphur Basin. Under this scenario, the yield of George Parkhouse Reservoir (South) would be 48,400 AF/YR, or 73,600 AF/YR less than if the reservoir is senior to any other proposed reservoir. Lake Ralph Hall is senior to George Parkhouse Reservoir (South), as well as to George Parkhouse Reservoir (North) and Marvin Nichols Reservoir IA.

Development of George Parkhouse Reservoir (South) would require a water right permit and an interbasin transfer permit. Detailed studies of water needs in the receiving and the source basins would be required as part of the permitting process for new interbasin transfers. The typical reservoir development schedule (**Appendix A-5**) indicates that due to the need for detailed engineering and environmental studies, new water rights and IBTs, it is unlikely that George Parkhouse Reservoir (South) could be developed in time to meet Criterion 3. Therefore, as with George Parkhouse (North), additional analysis was required to determine practicability or greater environmental consequences to the aquatic ecosystem.

Texas Parks and Wildlife Department completed a study titled, An Analysis of Bottomland Hardwood Areas at Three Proposed Reservoir Sites in Northeast Texas. The results of the study are presented in the Final Report to Texas Water Development Board for the fulfillment of interagency agreement No. 97-483-211 (Changxiang Liu, Ph.D., Alison L. Baird, Craig Scofield, and A. Kim Ludeke, Ph.D.). As indicated in **Table 2-7**, the proposed George Parkhouse Reservoir (South) at a normal (mean) conservation pool (elevation 401 feet msl) would impact land use cover types including bottom land hardwoods (e.g. wetlands) as would a scaled down version sized for UTRWD’s needed yield of 35,000 AF.

Table 2-7: Acreage of Land Use for George Parkhouse Reservoir (South)

Land Use Cover Type*	Normal Conservation Pool (Acres)	Reduced Conservation Pool (Acres)**
Water	830	216
Bottomland Hardwood	9,434	2,453
Secondary Bottomland Hardwood	1,959	509
Oak-Hickory	2,284	594
Cedar-Hardwood/Pine-Hardwood	161	42
Pure Cedar/Pine	7	2
Grassland	11,734	3,051
Crop/Managed Grassland	2,654	690
Bare Soil/Ground	118	31
Total	**29,181**	**7,588**

Notes: * https://tpwd.texas.gov/publications/pwdpubs/pwd_rp_t3200_1057a/index.phtml for land use cover type methods.
** Reduced conservation pool acreages were calculated by multiplying the normal conservation pool acreages by 0.26 since 35,000 AF is approximately 26% of 135,000 AF.

The total impacts to wetlands/water of the U.S. for the proposed Lake Ralph Hall project is estimated to be 387 acres and consists of impacts to degraded ephemeral and intermittent streams and approximately 10 acres of wetlands. Potential impacts from a George Parkhouse Reservoir (South) alternative (2,453 acres) with approximately the same firm annual yield as Lake Ralph Hall (35,000 AF/YR) would result in greater impacts to wetlands/waters of the U.S. than the proposed Lake Ralph Hall project's impacts to the same resources (387 acres) and therefore this alternative does not meet Criterion 5.

Due to failure of Criteria 3 and 5, the George Parkhouse Reservoir (South) Alternative was not carried forward for detailed evaluation in this EIS

<u>Gulf of Mexico</u>

The State of Texas has sponsored initial studies of potential seawater desalination projects, and this is seen as a potential future supply source for the state. This option has been mentioned through public input during the planning process, and it was evaluated in the 2016 Region C Water Plan in response to that input. While the cost of desalination has been decreasing in recent years, and some municipalities in Florida and California have been developing it as a supply source, the distance to the Gulf of Mexico and elevation change of more than 500 feet makes this option not a particularly promising source of supply for Region C, including the applicant. The energy required for desalination and the conveyance of raw water from this source to the applicant would be substantial. Similar to the Toledo Bend alternative, a cost estimate was developed for this option to address UTRWD's need and purpose (**Appendix A-4**) and compared to the proposed action. Considerations focused on construction, operation and maintenance costs in present day value since they comprise the bulk of overall costs and allow for a reasonable comparison. The Lake Ralph Hall proposal estimated costs are $330 million while the Gulf of Mexico option costs would be slightly less than $2.4 billion for the same amount of yield. Such a stark contrast in costs, approximately eight times what is the least costly build option, allows for a determination that this alternative's costs are exorbitantly expensive.

Due to failure of Criterion 4, the Gulf of Mexico Alternative was not carried forward for detailed evaluation in this EIS.

<u>Cypress Creek Basin – Lake O' the Pines</u>

Lake O' the Pines is an existing USACE reservoir, with Texas water rights held by the Northeast Texas Municipal Water District (NETMWD). The lake is on Cypress Creek in the Cypress Basin in Senate Bill One water planning Region D, the North East Texas Region. Lake O' the Pines is about 120 miles from the Metroplex. The distance and limited supply make this a potentially expensive water management strategy. Obtaining water from the Cypress River Basin is not a recommended strategy in the 2016 Region C Water Plan for any Region C supplier. Some Metroplex water suppliers have explored the possibility of purchasing supplies in excess of local needs from the Cypress Basin for use in the Metroplex. There could be as much as 89,600 AF/YR available for export from the basin. Development of this source would require contracts with the NETMWD and other Cypress River Basin suppliers with excess supplies and an interbasin transfer permit. Since this water management strategy obtains water from an existing source, the environmental impacts are expected to be low.

Coordination with NETMWD (**Appendix A-6**) revealed that approximately 26,000 AF/YR of reliable water could be provided to a customer. NETMWD also stated they are not interested in selling any of its water rights. Because development of this source would not generate the required amount of water under Criterion 2, this is not considered a practicable alternative and was eliminated from further consideration in the EIS. Additionally, in light of other alternatives that were evaluated which involved the need to develop contracts with a water provider in another basin with available supplies, required a new interbasin transfer permit from the TCEQ, and also required authorization under a Section 404 permit from the USACE, this option would also not meet Criterion 3.

Due to failure of Criteria 2 and 3, the Cypress Creek Basin Alternative was not carried forward for detailed evaluation in this EIS.

Precipitation Enhancement

Precipitation enhancement involves seeding clouds with silver iodide to promote rainfall. Such programs are generally located within areas where the rainfall is lower than in Region C. Given that Region C has adequate rainfall, and that there are no studies showing what impact precipitation enhancement would have on streamflow and reservoirs in Region C, precipitation enhancement is not recommended as a potentially feasible water management strategy for Region C in the State Water Plan. However, there may be localized areas in Region C who might benefit from such a management strategy. The 2016 Region C Water Plan decision summary states "Do not include precipitation enhancement as a potentially feasible strategy for the development of additional water supplies. Allow for studies and localized pilot projects to further investigate precipitation enhancement" (2016 Region C Water Plan, 5A.9).

Since additional studies are required to ascertain the potential for use a water supply strategy and no development of precipitation enhancement is projected to occur by 2024, it would not meet Criteria 1, 2, or 3 and therefore is not considered a practicable alternative to the proposed Lake Ralph Hall project.

Due to failure of Criteria 1, 2, and 3, the Precipitation Enhancement Alternative was not carried forward for detailed evaluation in this EIS.

Groundwater Imports

In Region C, only six percent of the water used comes from groundwater. Groundwater is sometimes used to meet peak demands in systems that have both groundwater and surface water supplies. This does not, however, increase total supply on an annual basis. Therefore, from a state perspective, conjunctive use is not considered as a potentially feasible water management strategy to provide additional supplies for Region C. The 2016 Region C Water Plan decision summary states "Do not include the conjunctive use of groundwater and surface water as a source of additional supplies for Region C. Conjunctive use to meet peak needs is appropriate and should continue" (2016 Region C Water Plan, 5A.5). USACE evaluated groundwater as a possible supply to address the project need. It is recognized that some UTRWD members and customers currently rely upon groundwater for portions of their supplies and there are numerous other entities that do as well.

Ogallala Groundwater (Roberts County)

In the 2006 Region C Water Plan, and covered in **Appendix A-1**, Mesa Water, Incorporated, was interested in selling groundwater from the Ogallala aquifer in Roberts County to water suppliers in Region C. (Roberts County is in Region A, the Panhandle Region.) Mesa Water controlled rights to 150,000 AF/YR of groundwater in Roberts County with options for additional supply and had permits from the local groundwater conservation district (GCD) to export groundwater. Mesa Water had indicated they could develop a reliable supply of 200,000 AF/YR for water suppliers in

Region C through 2060 and beyond. The groundwater in Roberts County is about 250 miles from the Metroplex. Since this is a groundwater supply, no interbasin transfer permit would have been required. However, these water rights were sold to the Canadian River Municipal Water Authority (CRMWA) in 2011 (CRMWA, 2017). Ogallala groundwater from Roberts County is not a recommended strategy for any Region C supplier. It was an alternative strategy for DWU and the NTMWD in the 2006 Plan. This strategy is not included in the 2016 Plan.

Carrizo-Wilcox Aquifer Groundwater (Brazos County and Vicinity)
The Carrizo-Wilcox aquifer covers a large area of east, central, and south Texas. Organizations and individuals have been studying the development of water supplies in Brazos County and surrounding counties for export. Metroplex water suppliers have been approached as possible customers for the water. (The supplies under discussion are located in Region G, called the Brazos G Region, and these supplies have also been studied for use by communities in that region.) Brazos County is about 150 miles from the Metroplex. Since this is a groundwater supply, no interbasin transfer permit would be required. Carrizo-Wilcox groundwater from Brazos County and vicinity is not a recommended strategy for any Region C supplier. It was an alternative strategy for the NTMWD in the 2006 Plan. This strategy is not included in the 2016 Plan.

Carrizo-Wilcox Aquifer Groundwater in Wood, Upshur, and Smith Counties (Regions D and I)
The Carrizo-Wilcox aquifer covers a large area of east, central, and south Texas. In Dallas' recent Long Range Plan, groundwater from the Carrizo-Wilcox aquifer in Wood, Upshur, and Smith Counties was identified as a potential water supply. Since this is a groundwater supply, no interbasin transfer permit would be required. Carrizo-Wilcox groundwater from Wood, Upshur, and Smith counties in Regions C and I is an alternative strategy for DWU in the 2016 Region C Water Plan.

Carrizo-Wilcox Aquifer Groundwater in Freestone and Anderson Counties (Region I)
Organizations (including Forestar) and individuals have been studying the development of water supplies in Freestone and Anderson Counties and surrounding counties for export. Metroplex water suppliers have been approached as possible customers for the water. Since this is a groundwater supply, no interbasin transfer permit would be required. Carrizo-Wilcox groundwater in Freestone/Anderson Counties is an alternative strategy for NTMWD in the 2016 Region C Water Plan.

In addition to reviewing groundwater sources evaluated in Region C Water Plans, potential groundwater sources from several GCDs and the Canadian River Municipal Water Authority (CRMWA) were evaluated. In addition to the CRMWA, the following GCDs were reviewed:

- Mid-East Texas
- Neches & Trinity Valleys
- Northern Trinity

- Upper Trinity
- Prairielands
- North Texas
- Red River
- Brazos Valley

According to the *Supplemental Evaluation of CH2M Hill's Groundwater Alternatives Analysis* (UTRWD, 2016), none of the GCDs or the CRMWA possess adequate groundwater supplies to provide the project yield of 34,050 AF/YR. In addition, two permits would be required to access groundwater supplies; a withdrawal permit and a permit to transfer the water beyond the boundaries of the GCD. Permits are generally issued for a period of one to five years and are subject to non-renewal or early termination. GCDs manage groundwater through the issuance of permits but actual ownership of the groundwater is the property owner(s). Individual land owners would need to sign leases to allow for the transfer of groundwater which has historically been met with considerable opposition and/or several years of litigation. Obtaining and maintaining the necessary groundwater permits do not qualify as "reliable" as defined in Criterion 1 and therefore do not meet the proposed project's purpose and need. Additionally, none of the above groundwater import strategies are projected to occur by 2024. Therefore, groundwater imports would not meet Criterion 3 and therefore is not considered a practicable alternative to the proposed Lake Ralph Hall project.

These potential groundwater alternatives were determined to not be practicable since they do not provide a reliable, long-term source of water available to meet the stated project purpose and need nor in a timely manner.

Due to failure of Criteria 1 and 3, the Groundwater Imports Alternative was not carried forward for detailed evaluation in this EIS.

<u>Bois d'Arc Lake</u>

The proposed Bois d'Arc Lake (BDL) is to be located on Bois d'Arc Creek (BDC) in Fannin County, upstream from the Caddo National Grasslands. The BDL project consists of a regional water supply project intended to provide up to 175,000 AF/YR of new water, with an estimated firm yield of 120,665 AF/YR, for NTMWD member cities and direct customers in all or portions of nine counties in northern Texas. A dam approximately 10,400 feet (about two miles) long and up to 90 feet high would be constructed, and much of the reservoir footprint would be cleared of trees and built structures. The total "footprint" of the proposed project site, including the dam, is 17,068 acres, and the reservoir would have a total storage capacity of approximately 367,609 AF. The proposed action would eventually result in the transfer of approximately 120,665 AF of water annually from the Red River basin to the Trinity and Sulphur River basins. (The appropriation request to TCEQ is for a maximum projected use of 175,000 AF/YR, but the firm yield would be 120,665 AF/YR.)

Approximately 38 percent of the reservoir footprint is cropland and 37 percent consists of bottomland hardwoods and riparian woodlands, with the remaining 25 percent mostly upland deciduous forest. Construction of the reservoir and related facilities would result in permanent impacts to approximately 6,180 acres of wetlands and 651,024 linear feet of streams (USACE, 2017b).

The NTMWD submitted an application June 4, 2008, to the USACE Tulsa District to discharge dredged and fill material into BDC in Fannin County, Texas for the construction of a dam to impound the flow of the creek to provide a new water supply reservoir at the designed conservation pool of 534.0 msl. This reservoir would provide water to numerous towns, cities, and utility districts in portions of Collin, Dallas, Denton, Fannin, Hopkins, Hunt, Kaufman, Rains and Rockwall Counties in north central Texas. At conservation pool the proposed reservoir would store 367,609 AF and provide a firm yield of 120,665 AF/YR. A FEIS was released for the proposed action in November of 2017 and a Record of Decisions (ROD) was approved January 29, 2018. Note that the name has been changed to Bois d'Arc Lake from Lower Bois D'Arc Creek Reservoir, but this EIS will reference Bois d'Arc Lake.

Potential accommodation of UTRWD's need of 34,050 AF at an expanded BDL was considered as an alternative. An increase in the conservation pool of the currently proposed reservoir by NTMWD of 8.75 feet would be required to generate the additional yield for UTRWD. Such an expansion would result in the direct loss of 230 acres of emergent, scrub shrub and forested wetlands, some open water ponds, and an undetermined amount of intermittent and ephemeral streams (**Appendix A-7**). The Lake Ralph Hall site would result in the loss of approximately 387 acres of degraded ephemeral and intermittent streams, some open water pond, and approximately 10 acres of wetlands. Consideration of the quality of aquatic resources between the BDL aquatic resources as described in the November FEIS and Ralph Hall resources as described in this EIS allows for the conclusion that, while the BDL expansion may result in less acreage loss, greater functional loss would occur.

Therefore, this alternative would result in comparable and/or greater impacts to the aquatic ecosystem and is not less damaging than the proposed action.

Due to failure of Criterion 5, the BDL Alternative not carried forward for detailed evaluation in this EIS.

<u>Lake Fastrill</u>

The State of Texas first identified a site along the Upper Neches River in Anderson and Cherokee Counties as a potential reservoir to serve the growing Dallas/Ft. Worth Metroplex in 1961. The

Fastrill Reservoir site was included in a state water plan in 1984, and in the 1997 and 2001 Texas Water Development Board (TWDB) regional water plans. Dallas and TWDB's plan included constructing the reservoir in 2050 so that supply would be available in 2060.

According to the TWDB’s Reservoir Site Protection Study (2008), Fastrill Reservoir would be constructed with a conservation pool elevation of 274 feet msl with a conservation pool surface area of 24,948 acres. The proposed reservoir would impound 503,563 AF of water. The firm yield of the proposed Fastrill Reservoir was estimated at 137,843 AF/YR at a conservation elevation of 274 feet.

After preparing an Environmental Assessment (“EA”) of the proposed Neches Wildlife Refuge in East Texas, the U.S. Fish and Wildlife Service (USFWS) announced its Finding of No Significant Impact (“FONSI”), obviating the need to prepare an Environmental Impact Statement (“EIS”). USFWS then set an acquisition boundary for the refuge and accepted a conservation easement within that boundary. These actions precluded the Fastrill Reservoir proposed for the same site.

Dallas and TWDB sued in federal district court claiming that the EA that USFWS prepared was flawed, that under the National Environmental Policy Act (“NEPA”) the agency was required to prepare an EIS, and that the establishment of the refuge violated the Tenth Amendment. The district court dismissed several of the Appellants' claims and granted USFWS' motion for summary judgment on others.

The 5th Circuit Court (City of Dallas Texas v. Hall, No. 08-10890, March 12, 2009) affirmed the District Court’s decision. In 2010, Dallas and TWDB requested that the U.S. Supreme Court hear an appeal of a lower court's decision that favored Fish and Wildlife's plan. A decision of the United States Supreme Court on February 22, 2010 not to hear the appeals of the State of Texas and Dallas has effectively supported the creation of the Neches River National Wildlife Refuge (NRNWR) and rendered the development of Lake Fastrill not feasible. Since the existence of the refuge precludes the development of the reservoir this alternative cannot meet the yield, time, or reliability criteria.

Due to failure of Criteria 1, 2, and 3, the Lake Fastrill Alternative was not carried forward for detailed evaluation in this EIS.

Lake Livingston/Joe Pool Lake/Trinity River Basin

Evaluation of alternative water supplies potentially available from the Trinity River basin was conducted and included consideration of Lake Livingston as well as Joe Pool Reservoir. The largest single-purpose reservoir in Texas at 83,000 surface acres, Lake Livingston was completed in 1971 as the result of a contract between the Trinity River Authority (TRA) of Texas and the city of Houston. TRA financed and constructed the lake, along with Lake Livingston Dam, and continues to own and operate both. Lake Livingston has a normal pool elevation of 131 feet msl, impounds 1.8 million AF of water, and supplies water to four surrounding counties, plus the city of Houston.

Lake Livingston is an existing reservoir on the Trinity River in Region H. The TRA and the City of Houston hold the water rights for Lake Livingston. The TRA has indicated that as much as 200,000 AF/YR might be available to water suppliers in Region C from the lake.

Since Lake Livingston is in the Trinity River Basin, no interbasin transfer permit would be needed, but a transmission system would be required for UTRWD to receive water from it. Livingston is not a recommended strategy for any Region C supplier, but it was an alternative strategy for DWU, the NTMWD, and the TRWD in the 2011 Region C Water Plan. It is not a recommended or alternative strategy for any suppliers in the 2016 Plan.

Lake Livingston is operated by the TRA to meet the service demands of the City of Houston and other local users in the Trinity Basin and in the Neches-Trinity Coastal Basin. Region H may be considering other potential uses of the supply from Lake Livingston. Lake Livingston is about 180 miles from the Metroplex.

Livingston is used primarily to store water and the Wallisville Saltwater Barrier is to control the migration of salt water from Trinity Bay. Lake Livingston and Wallisville permitted yields are 1,255,500 AF/YR and 89,700 AF/YR respectively. The sum of these permitted yields is the combined yield of the system (1,345,200 AF/YR). Additional permitted run-of-the-river water supplies downstream of Lake Livingston total 220,230 AF/YR. These supplies are associated with the water rights agreements established at the time of Lake Livingston permitting.

Lake Livingston is dependent upon return flows from upstream Region C in the upper Trinity Basin. As a result of its downstream location, Lake Livingston indirectly benefits from growth in the Dallas–Fort Worth Metroplex. As upstream demands increase in Region C, it is anticipated that the importation of out-of-basin supplies will increase, providing additional return flows to the lower basin. Although return flows will likely increase over time, the timing of developing reuse supplies may have an adverse effect on the Lake Livingston water rights, temporarily reducing the in-basin return flows.

The firm yield of the Lake Livingston water rights is expected to decrease from the full permitted yield of 1,344,000 AF/YR year in the year 2010 to 1,265,000 AF/YR in the year 2030. The decrease in firm yield is the result of increasing amounts of reuse projected in the upper basin, reducing the amount of return flows available to Region H.

The firm yield is then projected to increase after 2030 as Region C begins to import water supplies to meet growing demands. By the year 2050 the permitted yield of Lake Livingston is projected to be firm. The results of the study are summarized below:

- Minimum upper basin net return flows of 253,055 AF/YR projected in 2030
- Minimum return flows available to Region H in 2030 of approximately 185,500 AF/YR
- Firm yield of Lake Livingston water rights are reduced in decades 2020, 2030 and 2040
- Minimum firm yield of Lake Livingston water rights is approximately 1,265,000 AF/YR in 2030
- Minimum level of return flows required to make Lake Livingston water rights firm is approximately 285,000 AF/YR in 2060

The firm yield of Lake Livingston is reduced in the decades 2020, 2030 and 2040 due to insufficient return flows from the upper Trinity Basin, as shown in **Table 2-8**.

Table 2-8: Lake Livingston Firm Yield (AF/YR)

Return Flows	2010	2020	2030	2040	2050	2060
Firm Yield	1,344,000	1,289,000	1,265,000	1,294,000	1,344,000	1,344,000
Reduction in Yield	0	-55,000	-79,000	-50,000	0	0

By 2020, increased reuse diversions in Region C are projected to reduce return flows available to Region H and consequently to reduce the firm yield of Lake Livingston during a drought-of-record by 55,000 AF/YR. By 2030, projected in-basin return flows are projected to be reduced to 253,055 AF/YR, which is the minimum level expected during the planning period. Under these assumed conditions, the firm yield of Lake Livingston in 2030 is projected to be 1,265,000 AF/YR, approximately 79,000 AF/YR less than the currently permitted diversion under the existing water rights permit.

The minimum level of return flows required to make the permitted yield of the Lake Livingston water rights 100% reliable during drought-of-record is approximately:

- 280,000 AF/YR required in 2010 – 2040 to maintain permitted diversions.
- 280,500 AF/YR required in 2050 and 2060

The City of Houston has a permit to divert 902,800 AF/YR from Lake Livingston and 38,000 AF/YR from the Wallisville Saltwater Barrier. The TRA has a permit to divert 351,600 AF/YR from Lake Livingston and 51,600 AF/YR from the Wallisville Saltwater Barrier. Not all of this water would be available to Region H. Of the amount that is owned by the TRA, approximately 26,900 AF/YR is committed outside of Region H.

Reuse within Region C in the Trinity Basin would impact the yield of Lake Livingston. Thus significant reuse of these flows may affect the water rights of San Jacinto River Authority (SJRA), TRA, and City of Houston. Indirect reuse permits are increasingly being requested within the state, allowing the use of the bed and banks of the receiving stream to carry treated effluent to a downstream diversion point. Unlike direct reuse, this practice is considered a separate diversion and requires a separate water right permit. These permits typically allow the rediversion of a percentage of the discharged volume, with the difference being allocated to meet carriage losses and instream flow requirements.

Water from Lake Livingston was not a recommended strategy for any Region C supplier in the 2016 Region C Water Plan, but was an alternative strategy for DWU, the NTMWD, and the TRWD in the 2011 Region C Water Plan (p 4D.12). This alternative would require a contract with TRA. TRA was contacted to discuss this alternative and TRA stated that they do not intend to, nor will they take steps to, permit the sale of firm-yield Lake Livingston water in the upper Trinity River basin. Correspondence with TRA is included in **Appendix A-6**. In addition, the TRA's reuse water entitlement associated with Lake Livingston is not sufficient to make a sale of that water to UTRWD a practicable alternative.

Due to failure of Criterion 2, the Lake Livingston Alternative was not carried forward for detailed evaluation in this EIS.

Joe Pool Lake is a 7,400-acre impoundment located in the south part of the Dallas-Fort Worth Metroplex. The lake is located partially in Grand Prairie, Dallas, Cedar Hill, Mansfield, and Midlothian and encompasses part of Dallas, Ellis, and Tarrant Counties. The main body of the lake in located in-between SH 360 and FM 1382 about one mile south of Interstate Highway (IH) 20. Joe Pool Lake is mostly fed by Mountain Creek and Walnut Creek and drains north into Mountain Creek leading into Mountain Creek Lake. The Mountain Creek Water Shed is in the Upper Trinity River Basin and has a length of 37 miles and a total drainage area of 304 square miles. There are 64 miles of shoreline at normal conservation pool of 522 feet msl. Impoundment began in January 1986.

Currently Joe Pool Lake serves as a reservoir for the City of Midlothian for their public water supply. Several other entities have water interests in Joe Pool Lake, but are not currently using the water resources. The City of Midlothian has a water intake structure in the southeast leg of the lake. They pull anywhere from 1.0 million gallons per day of water in the winter months to 9.0 million gallons per day in the summer months. The Trinity River Authority of Texas also has a water intake structure in Cedar Hill State Park, but it currently not in use.

According to *Reallocation of Storage in Federal Reservoirs for Future Water Supp*ly (TWDB, 2006b), Joe Pool had a dependable yield of 26,450 AF, and with USACE maximum reallocation authority the dependable yield could reach 30,548 AF.

Due to failure of Criterion 2, the Joe Pool Lake Alternative was not carried forward for detailed evaluation in this EIS.

Summary

Table 2-9 provides the results of the initial screening of the alternatives discussed above. All of the 15 off-site alternatives failed at least one of the five criteria and therefore none were advanced for further study.

Table 2-9: Summary of Alternatives Screening

Optional Source, Infrastructure Component or Alternative	Criteria					Advance
	No. 1	No. 2	No. 3	No. 4	No. 5	
No Action						Yes
Lake Ralph Hall - APA						Yes
Marvin Nichols Reservoir	-	-	No	-	No	No
Wright Patman Lake	-	-	No	-	No	No
Additional DWU Supplies	-	-	No	-	-	No
Oklahoma Water	-	-	No	-	-	No
Toledo Bend Reservoir	-	-	No	-	-	No
Lake Texoma	-	-	No	-	-	No
George Parkhouse Reservoir (N)	-	-	No	-	No	No
George Parkhouse Reservoir (S)	-	-	No	-	No	No
Gulf of Mexico	-	-	-	No	-	No
Cypress Creek Basin	-	No	No	-	-	No
Precipitation Enhancement	No	No	No	-	-	No
Groundwater Imports	No	-	No	-	-	No
Bois d'Arc Lake	-	-	-	-	No	No
Lake Fastrill	No	No	No	-	-	No
Lake Livingston/Joe Pool Lake/Trinity River Basin	-	No	-	-	-	No

2.4.4 Alternatives Carried Forward for Detailed Analysis

A broad and varied range of alternatives were identified and evaluated in light of the overall project purpose defined in **Chapter 1.0** of the EIS. Thorough consideration and evaluation of the factors that surround the proposed action and definition of the project purpose and development of alternatives screens have yielded the narrow results. Development of the screens are based on valid logistical reasons as well as impacts to aquatic resources. Inclusion of alternatives that may have greater impacts to waters of the U.S. in the EIS to maintain a broader range can occur but would imply that such options are viable. In light of the requirements of 40 CFR 230.10 and 230.12(a)(3), carrying forward such options would be confusing and an unnecessary expenditure of funds and effort. Consideration was given to whether the project purpose statement was written too narrowly as detailed in **Section 1.10** and concluded to be appropriate. Additionally, screening criteria derived from the purpose statement were also concluded to be appropriate for the type of project and applicable to practicability and reasonability analysis. The practicability screening process detailed in **Section 2.3** revealed that only one alternative was practicable and that several other alternatives would be more damaging than the proposed action.

3.0 Affected Environment

This chapter describes the environment that would be affected by the construction and operation of the Proposed Action and the No Action Alternatives. The environmental baseline information summarized in this chapter was obtained from field studies conducted in the project area, published sources, unpublished materials, and communication with relevant government agencies and private individuals with knowledge of the area. The affected environment for individual resources was defined based on the area of potential direct and indirect environmental impacts of the Proposed Action. Direct effects are caused by the action and occur at the same time and place. Indirect effects are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. For some resources, such as geology and soils, land use, ownership, public lands, cultural resources, hazardous materials, biological resources, visual, noise, paleontology, and recreation, the affected area was determined to be the physical location and immediate vicinity of the areas to be disturbed by the project as pertinent to the project component. For other resources, such as water resources, groundwater, air quality, climate change, environmental justice, and socioeconomics, the affected environment comprised a larger area (i.e. watershed, airshed, Fannin County, etc.). The terms "effects" and "impacts" as used in this Environmental Impact Statement (EIS) are synonymous.

This chapter is organized by environmental resource. **Sections 3.1** through **3.19** describe the existing conditions associated with each resource. Numerous technical reports were prepared as support documents to this Final EIS and are located in the **Appendices**. Copies of these technical reports are available for review at the following locations:

1. Ladonia City Hall, 100 Center Plaza, Ladonia, TX 75449.
2. Wolfe City Public Library, 102 TX-11, Wolfe City, TX 75496.
3. Commerce Public Library, 1210 Park Street, Commerce, TX 75428.
4. Honey Grove Library, 500 N 6th Street, Honey Grove, TX 75466.
5. Bonham Public Library, 305 E 5th Street, Bonham, TX 75418.
6. Greenville Public Library, 1 Lou Finney Lane, Greenville, TX 75401
7. Upper Trinity River Water District, 900 North Kealy Street, Lewisville, TX 75067.
8. U.S. Army Corps of Engineers, Fort Worth Regulatory Office, 819 Taylor Street, Fort Worth, TX 76102.

3.1 Land Use and Ownership

Fannin County, Texas is a rural county located in north Texas near the Texas-Oklahoma border. The county is a lightly populated agricultural area with Bonham being the seat and the main source of employment. The county's land use includes residential, light industrial and commercial but is predominantly agricultural with vast hay and pasture land. Row crops can be found more prominently in the eastern half of the county and deciduous trees are found near the lakes, creeks, streams, and residential areas. According to the USDA's 2012 Census of Agriculture Fannin County increased the number of farms from 1,252 in 2007 to 1,445 farms in 2012 (Texoma Council of Governments [TCOG], 2015).

Historical Land Use

Fannin County grew steadily from the Civil War to the turn of the 20th Century. Agriculture was the main source of income with cotton and corn being the leading crops. In 1900 the county had a population of 51,793. After the turn of the century the population slowly decreased. The depression brought a loss of farm values of over 40 percent and pushed a decline in the number of farms. Cotton and corn production dropped sharply during the 1950s and took with it a large part of the population. The population and number of farms continually declined until only 22,705 people resided in the county in 1970. During this period corn and cotton farms were changing to cattle ranches. The population slowly started to rebound in the 1970s with an increase in manufacturing, banking, retail, and cattle farms (TCOG, 2015). In 2002 the county had 1,976 farms and ranches covering 483,446 acres, 59 percent of which were devoted to crops, 32 percent to pasture, and 8 percent to woodland (Handbook of Texas Online, 2010).

Existing Land Use

Approximately 30.1 percent of the project area is pasture, 22.3 percent forest, 21.7 percent cropland, and 14.3 percent young trees (UTRWD, 2019a). The remainder consists of road/buildings, stream channels, grasses, parklike, stock tanks, and on-channel ponds. **Table 3-1** and **Figure 3-1** shows the existing land uses within the project area. The data for this table and figure were developed from aerial imagery obtained from Texas Natural Resources Information Systems; National Agriculture Imagery Program 1 Meter Resolution Natural Color – 2016 Aerial Imagery for Collin, Hunt, and Fannin Counties.

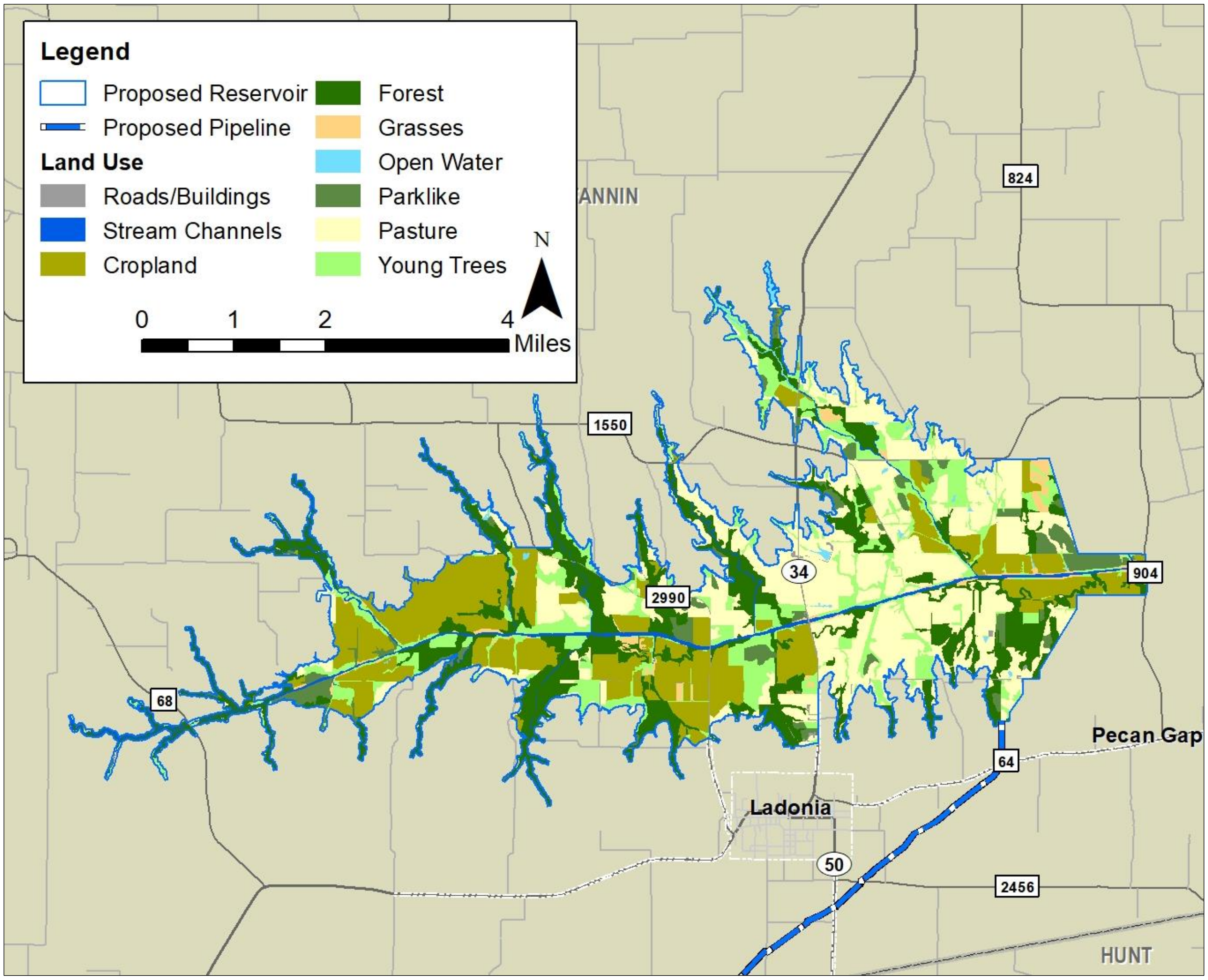
Table 3-1: Existing Land Use within the Project Area

Land Use	Acres*	Percentage
Roads/Buildings	102	0.8%
Stream Channels	379	3.1%
Cropland	2,618	21.7%
Forest	2,701	22.3%
Grasses	193	1.6%
Parklike	601	5.0%
Pasture	3,634	30.1%
Young Trees	1,730	14.3%
Open Water (Stock Tanks & On-Channel Ponds)	134	1.1%
Total	12,092	100.00%

Source: UTRWD, 2019a

*Area includes the land use assessed for conservation pool extending to the project boundary, and the proposed State Highway 34 re-alignment work zones.

Figure 3-1: Existing Land Use within the Proposed Reservoir Boundary



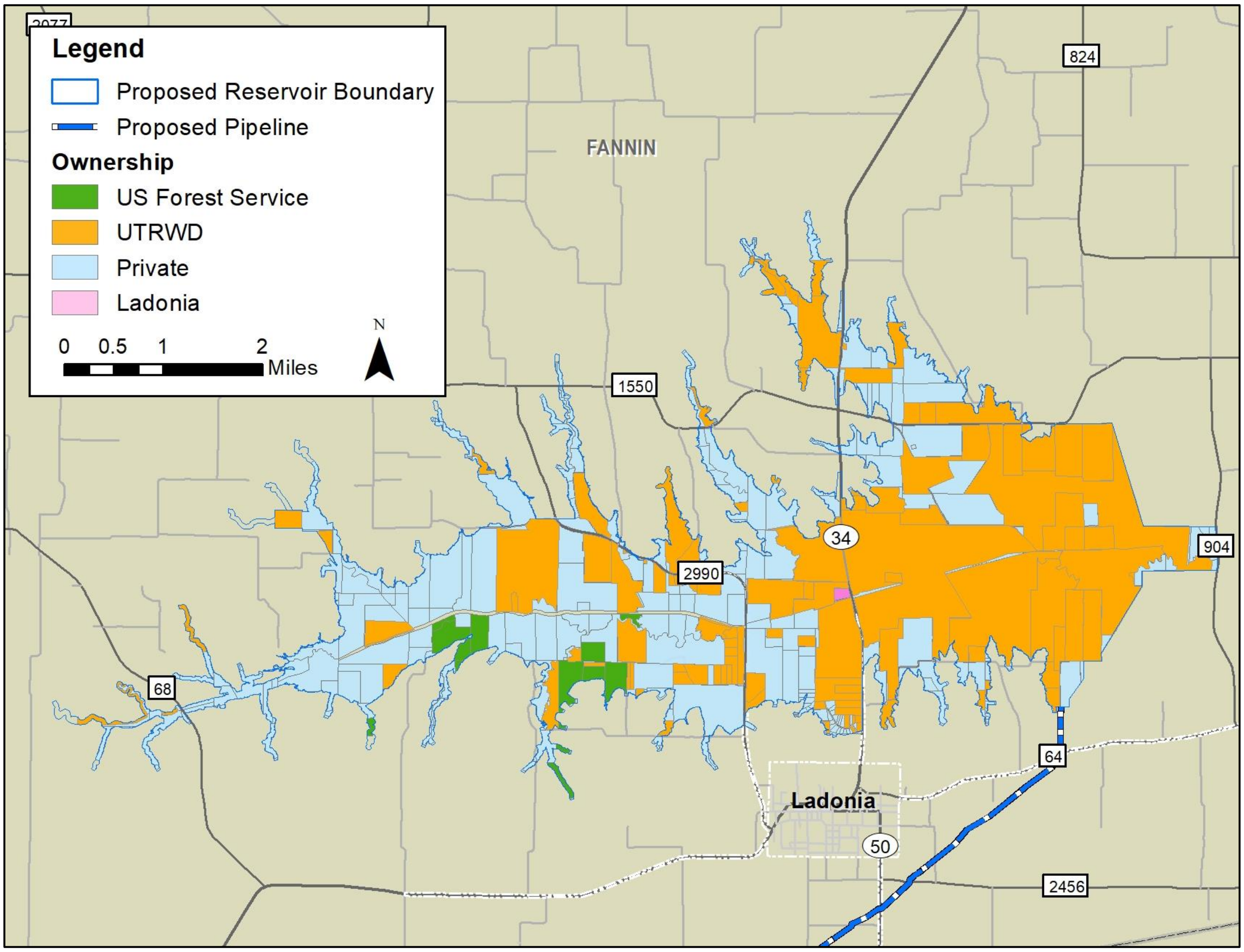
The approximately 384-acre pipeline footprint consists primarily of pasture (180 acres), cropland (80 acres) and forested areas (74 acres). The remainder consists of roads and buildings, stream channels, grasses, park-like areas, and young trees.

The 4.5-acre footprint of the proposed balancing reservoir consists primarily of grassland. The balancing reservoir would be constructed adjacent to the north side of the existing Irving balancing reservoir.

Ownership

All lands within the project area will be acquired by the applicant during the planning and pre-construction phases. The applicant continues to take ownership of all project lands through either voluntary sale or through governmental processes as stated in law, regulation or policy, e.g. acquisition of the Caddo National Grasslands through land exchange. As of May 2017, UTRWD has purchased a little over half of the project area. All land purchases have been made from willing sellers. UTRWD has purchased all but one of the homes within the project boundary. The remainder is primarily private land, with the exception of a few parcels owned by the City of Ladonia and the U.S. Forest Service. **Figure 3-2** shows the ownership of parcels within the project area. As with other lands within the project area, the applicant intends to take ownership of these Federal lands in the planning and pre-construction phases of this project.

Figure 3-2: Ownership within the Proposed Reservoir Boundary



Source: UTRWD, 2018b

The pipeline footprint consists of private land other than the tracts where the pipeline footprint overlaps the proposed project already owned by UTRWD as shown in **Figure 3-2**.

3.2 Public Lands

Federal Lands

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, partially within the reservoir footprint.

There are no Indian reservations, military bases, national parks or wildlife refuges in Fannin County. There are no national forests, military bases, national parks, Indian reservations, or wildlife refuges in the areas potentially affected by the dam inundation or the pipelines (Federal Highway Administration [FHWA], 2017).

There are no federal lands in the pipeline footprint.

State Lands

Bonham State Park is the largest state-owned property in Fannin County (**Figure 3-3**). The park is located to the southeast of Bonham in the Blackland Prairie Region, approximately seven miles northwest of the project area. The terrain features rolling prairies and woodlands composed of Texas Oak, eastern red cedar, bois d'arc and eve's necklace. The park also has a 65-acre man-made lake, which was completed in 1936. The shoreline provides habitat for beaver, raccoon, opossum and songbirds.

Lake Tawakoni State Park is a 376.3-acre park located in Hunt County. However, it is in the southeast corner of the county, far from the pipeline footprint. There are no state parks in Collin County.

There are no state public lands within the proposed dam, reservoir, spillways, pump station, pipeline footprint, or balancing reservoir.

County Lands

There are no county lands within the proposed dam, reservoir, spillways, pump station, pipeline footprint, or balancing reservoir.

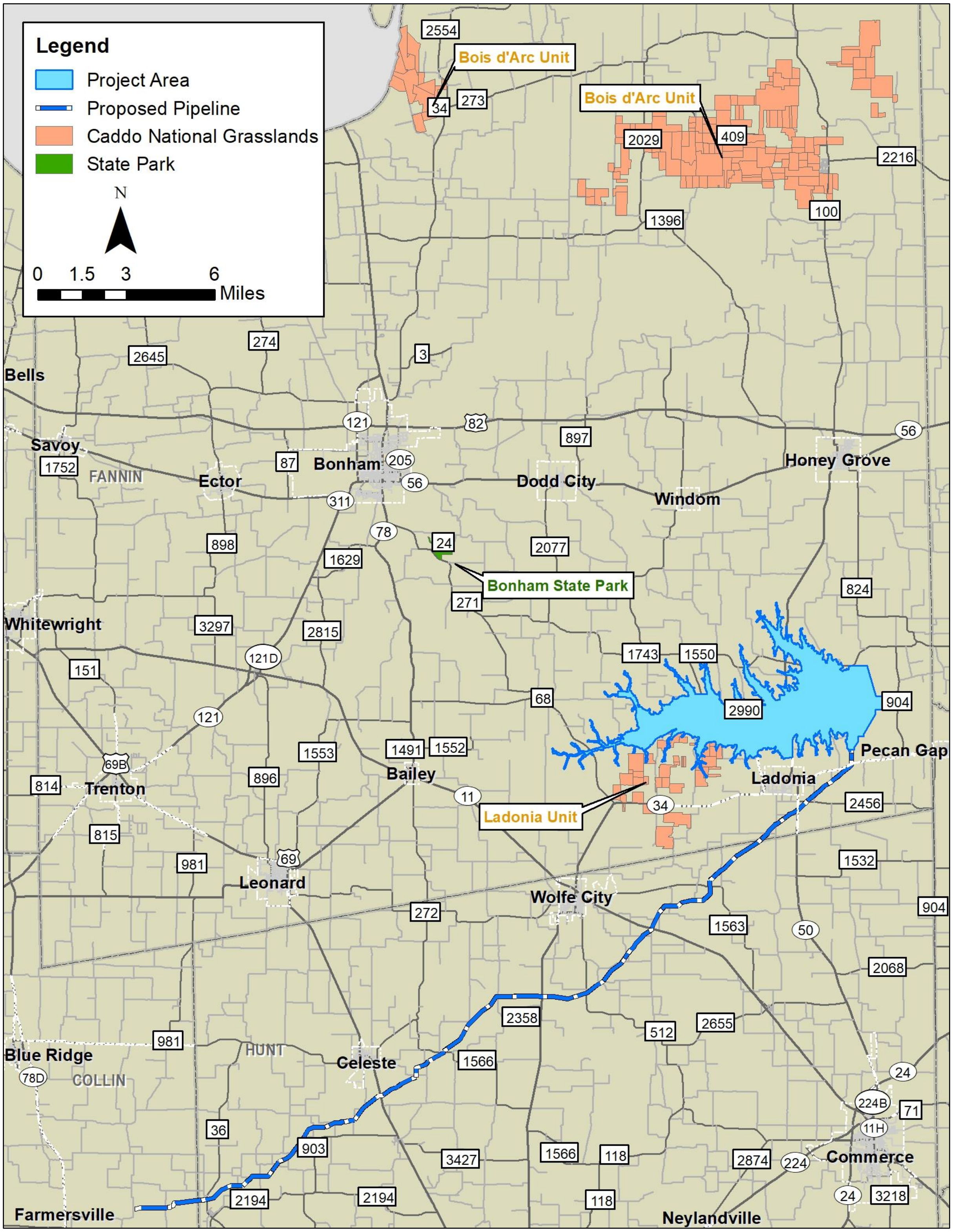
City Lands

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. This feature is discussed more in **Section 3.16**.

Other Public Lands

In addition, the North Texas Municipal Water District (NTMWD) owns land associated with the future BDL reservoir, currently under construction.

Figure 3-3: Public Lands

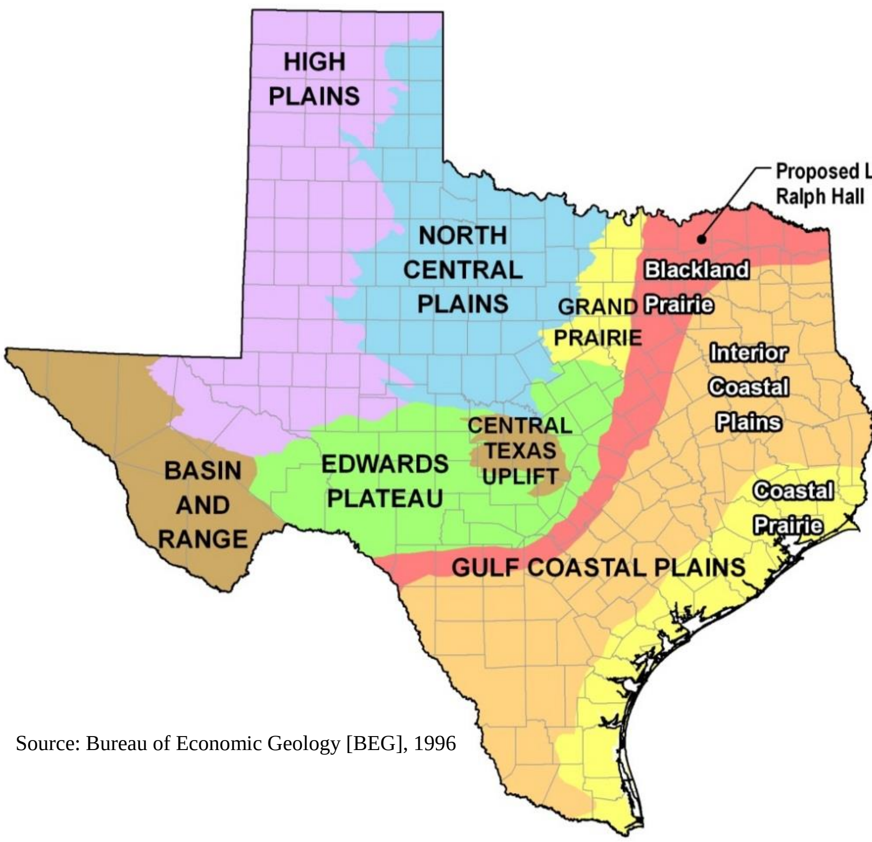


Sources: USFS; TPWD

3.3 Physiography and Topography

Physiography is the study of physical patterns and processes of the Earth, such as the forces that produce and change rocks, oceans, weather, and global flora and fauna patterns. Geologists have studied the landforms of Texas and divided it into distinctive physiographic provinces. Each province consists of an integrated geological history of depositional and erosional processes that are distinguished by characteristic geologic structure, rock and soil types, vegetation, and climate. The elevations and shapes of its landforms contrast significantly with those of landforms in adjacent regions (Bureau of Economic Geology [BEG], 1996). The proposed Lake Ralph Hall and Lake Ralph Hall Raw Water Pipeline Alignment lie within the Gulf Coastal Plains physiographic province. The Gulf Coastal Plains include three subprovinces named the Coastal Prairies, the Interior Coastal Plains, and the Blackland Prairies (**Figure 3-4**).

Figure 3-4: Physiographic Provinces of Texas



Source: Bureau of Economic Geology [BEG], 1996

The Blackland Prairies are bounded on the southeast by the Interior Coastal Plains and by the Grand Prairie to the west. The Blackland Prairies consist of deep, black, fertile clay soils, in contrast with the thin red and tan sandy and clay soils of the Interior Gulf Coastal Plains. The Blackland Prairies have a gentle undulating surface that is cleared of most natural vegetation and cultivated for crops (BEG, 1996). The Lake Ralph Hall project boundary is located wholly within the Blackland Prairie region.

The Lake Ralph Hall Raw Water Pipeline Alignment lies within the Blackland Prairie region and runs from southeast Fannin County through northwest Hunt County ending in eastern Collin County. Throughout this area stream valleys are shallow and drainages divide well rounded surfaces. The northwestern part of Hunt County drains into the Trinity River (East Fork) and northeastern Hunt County and southeastern Fannin County both drain into tributaries of the Sulphur River. Southeastern Fannin County drains to the North Sulphur River and South Sulphur River. Northeastern Hunt County drains to the South Sulphur River. Bottomlands in these areas are not usually farmed because of seasonal flooding (UTRWD, 2006b).

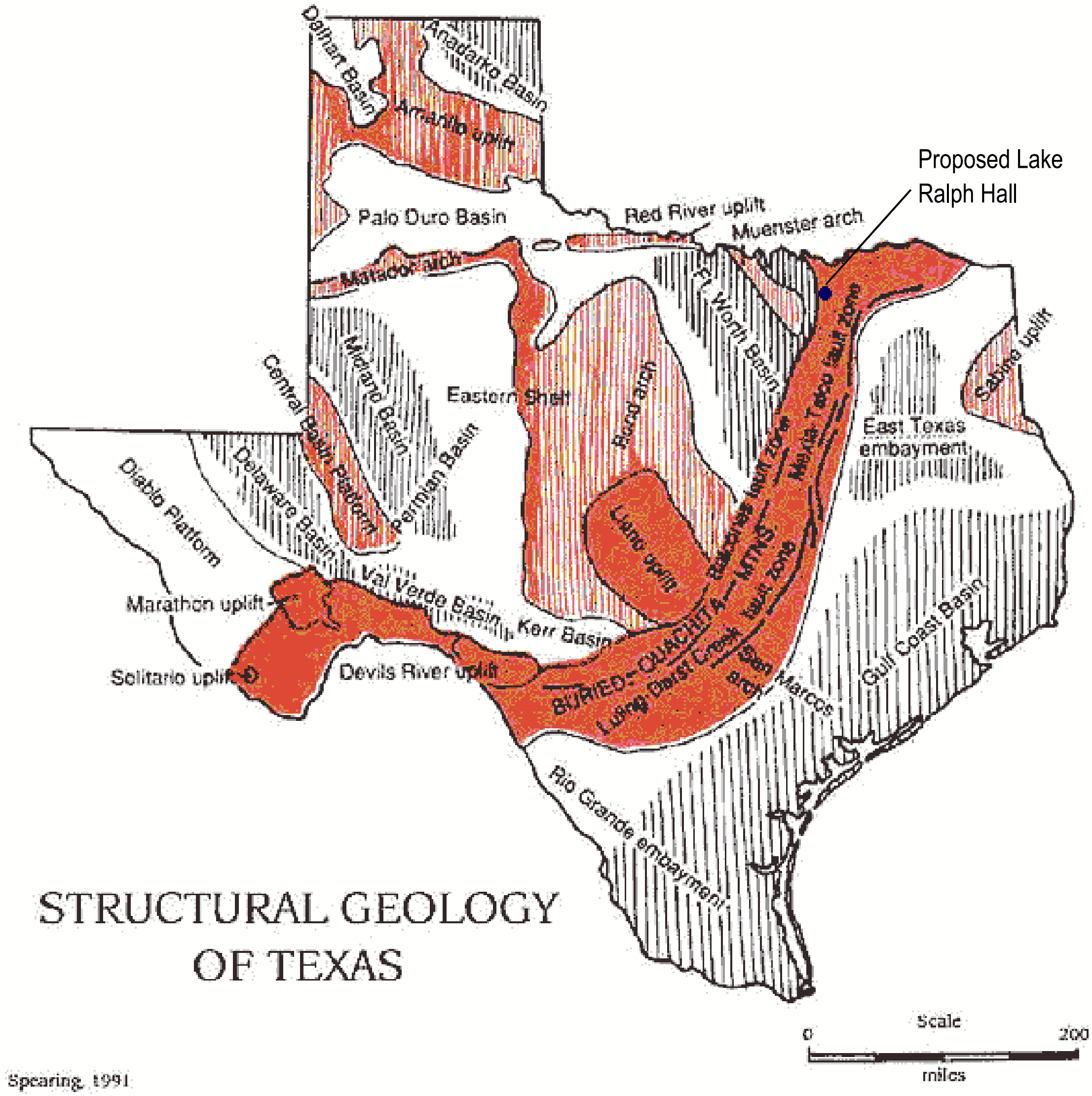
Elevations within the Proposed Lake Ralph Hall Alternatives range from 170 to 185 feet national geodetic vertical datum (NGVD) or from approximately 470 to 620 feet above mean sea level (AMSL), and the area is characterized by flat prairie lands that are cut by the major east/west trending North Sulphur River and by minor north/south trending tributaries to the North Sulphur River. Elevations along the Lake Ralph Hall Raw Water Pipeline Alignment range from approximately 500 to 730 feet AMSL.

3.4 Geology and Soils

3.4.1 Regional Geologic Setting

The proposed Lake Ralph Hall project area lies within the Ouachita Fold Belt, a buried mountain range that extends from southeast Oklahoma to the Big Bend area of West Texas (**Figure 3-5**). Other major structural elements in East-Central Texas include several major fault zones and basins. Coincident with the buried Ouchita Fold Belt is a hingeline along which parallel fault zones occur (Davis et al. 1989). These fault zones are the Balcones Fault Zone, Luling Fault Zone, and Mexia Fault Zone. In addition to these fault zones, other major structural elements in the East-Central Texas area are the East Texas Embayment, Sabine Uplift, and the Gulf Coast Basin.

Figure 3-5: Structural Geology of Texas



The Ouachita Fold Belt marks the edge of the North American continent at the end of the Jurassic and beginning of Cretaceous periods 144 million years ago (Spearing, 1991). During the Jurassic and lower Cretaceous periods, clastic and carbonate rocks were deposited along the fringes of this shallow sea. Carbonate rocks (limestone and dolomite) in this area are composed primarily of calcium and magnesium carbonate. The carbonate rocks, which were derived from the shells of various living organisms, developed in a complex of patch reefs, barrier reefs, and lagoonal environments. In upper Cretaceous time, shale, chalk, marl, and limestone were deposited, which are represented by the Eagle Ford, Austin, Taylor, and Navarro Groups (Worrall and Snelson, 1989). The maximum aggregate thickness of these units in the area is approximately 1,900 feet (Proctor et al., 1974).

At the close of the Cretaceous period, approximately 60 million years ago, uplift of the Rocky Mountains began and the deposition of carbonates ceased. Large river systems began carrying sediment eroded from the Rocky Mountains as they were uplifted. These river systems generally trended from northwest to southeast, and delta complexes were built over the Cretaceous deposits.

The geologic units relevant to the proposed Lake Ralph Hall project area are Cretaceous-age deposits of the Taylor and Austin Groups. The geologic units generally thicken toward the southeast and dip slightly toward the Gulf of Mexico (**Figure 3-6**). The underlying geological formations of the Lake Ralph Hall Raw Water Pipeline Alignment consists mostly of late Cretaceous-age deposits as well as some Pleistocene and Holocene-age deposits.

3.4.2 Site Geology

The bedrock units that crop out in the North Sulphur River basin are from the Cretaceous-age Gulf Series. Both the land surface and the rock units dip slightly to the southeast, which results in successively younger formations being exposed as the North Sulphur River flows east and southeast. From west to east, exposed in ascending order are the Austin and Taylor Groups. The Roxton Limestone and the Gober Chalk are the two uppermost units of the Austin Group that crop out along the north side of the North Sulphur River Basin. Although the geologic map (**Figure 3-7 and Figure 3-8**) shows a narrow band of Roxton Limestone on the north side of the North Sulphur River, field observation and mapping, and the respective lithologic descriptions of the Roxton Limestone and Gober Chalk (BEG, 1966), suggest that it is the Gober Chalk that is actually observed in the beds of the headwaters of the North Sulphur River and the south flowing tributaries (Allen, Bear, Pot, Brushy, Pickle, Davis, Bralley Pool, Merrill, and Baker Creeks).

The downstream limit of the Roxton/Gober Chalk outcrop limits the upstream extent of the induced incision of the tributaries. Erosion of the Roxton/Gober Chalk is primarily due to surficial weathering, but the rate of erosion is low. The uppermost unit of the Taylor Group is the Ozan Formation, a 425-foot thick dark gray calcareous, poorly bedded clay (shale) with varying amounts of silt and glauconite and some thin siltstone and limestone beds. The rock is compact, highly jointed, and highly erodible and travels when exposed to weathering (Kleinfelder, 2005).

A geotechnical site investigation (**Appendix B**) was conducted to identify and characterize the soils and rock materials at the project site (UTRWD, 2017c). The site investigation included the collection borings at five locations along the dam alignment and five locations within the borrow area. Boring maximum depths along the dam alignment ranged from 60 feet to 100 feet and consisted of fat clay, marl, fat clay with sand, fat clay with gravel, and lean clay with sand. Borings in the borrow area were collected to a maximum depth of 25 feet and consisted of sandy lean clay, fat clay, and lean clay.

Figure 3-6: Geology of Texas

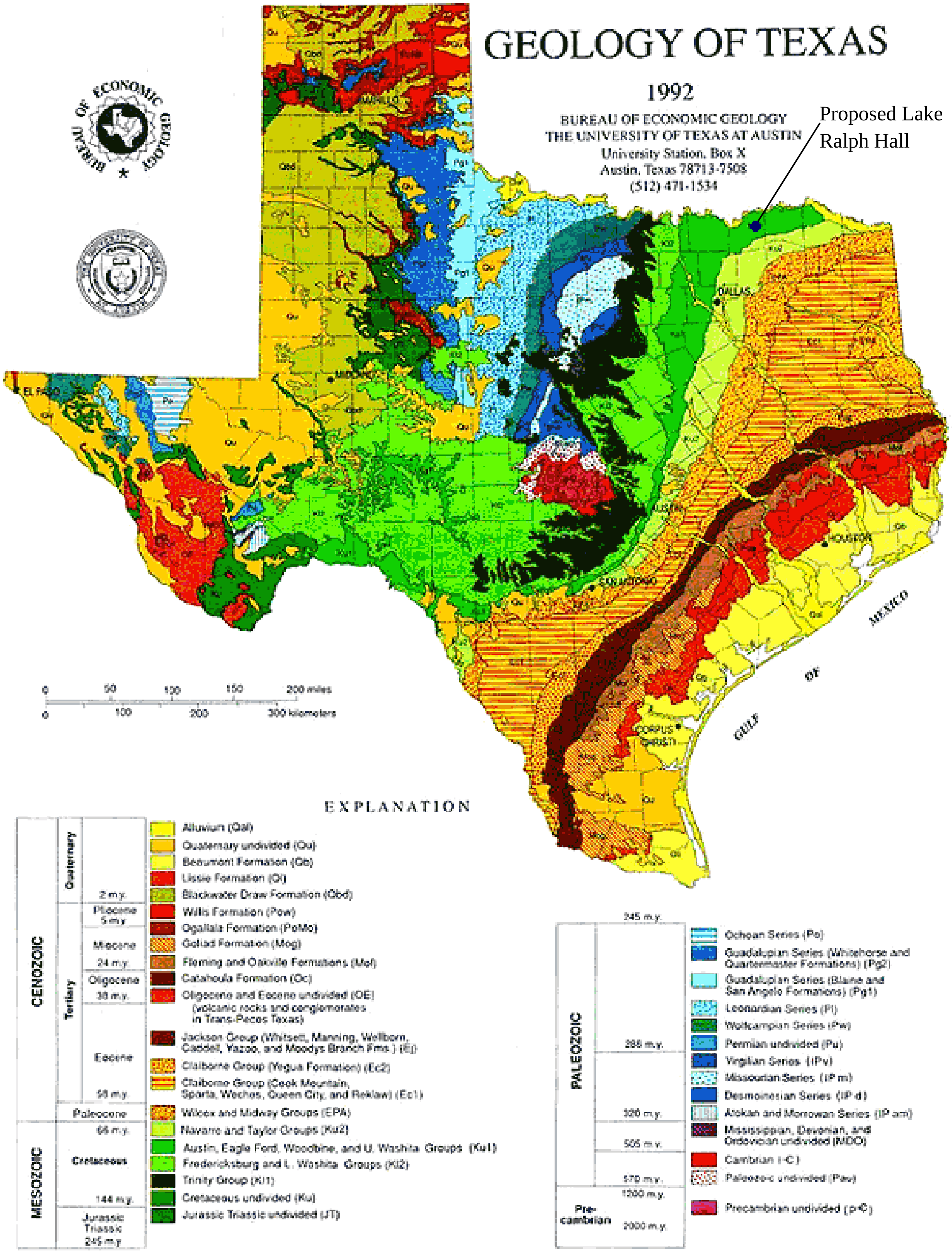
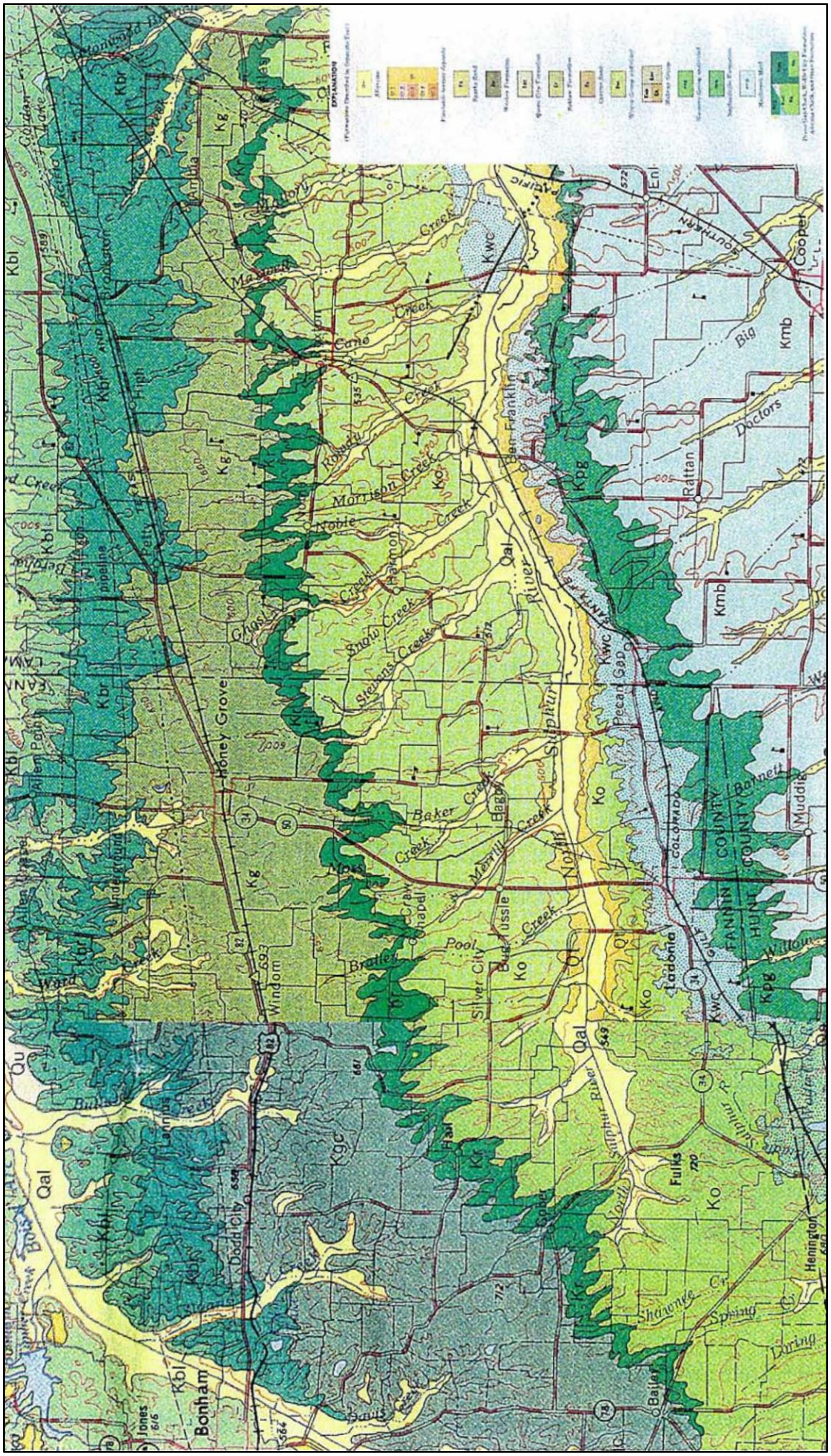
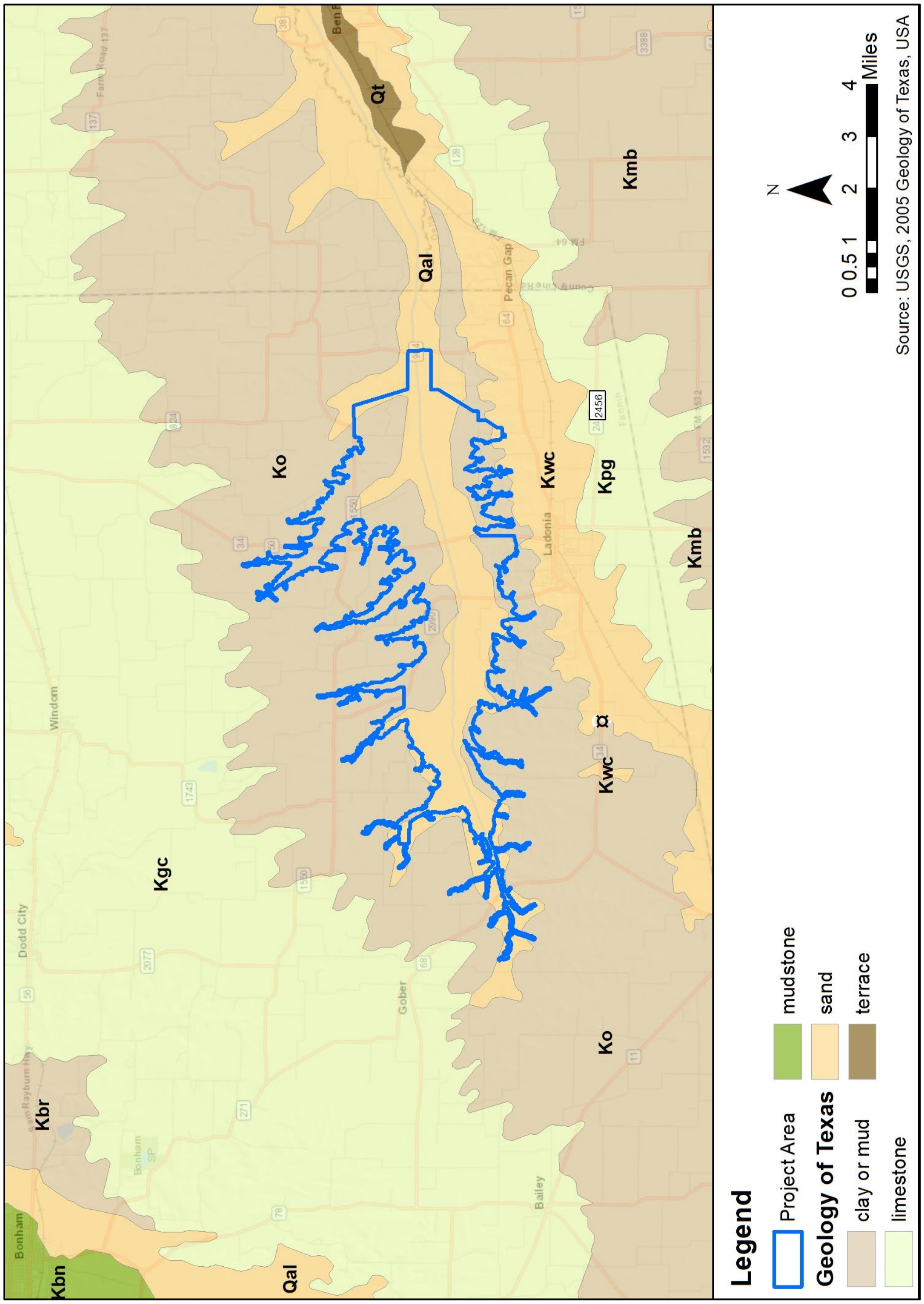


Figure 3-7 Geologic Map of the North Sulphur River Basin



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).

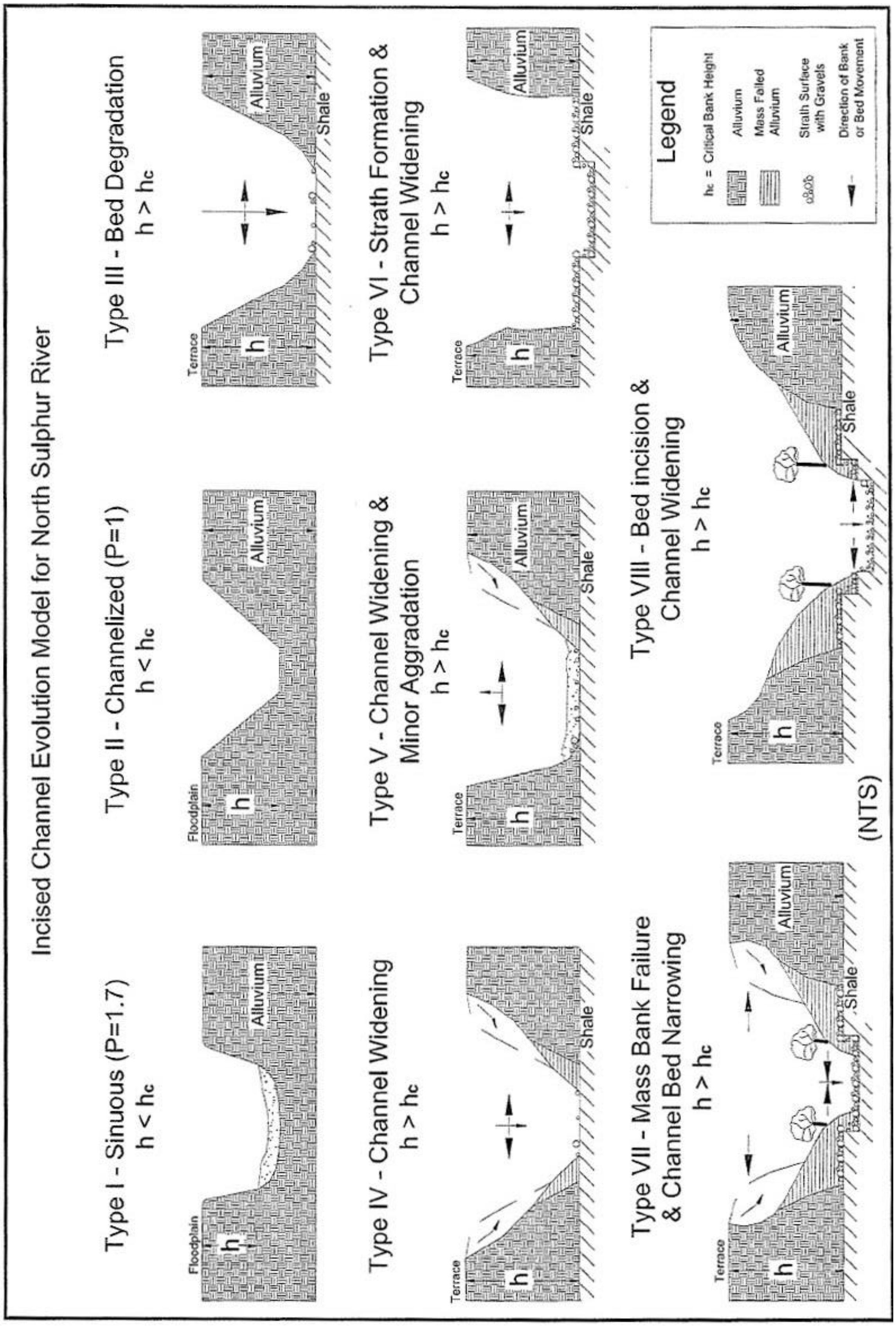
Based on field observations made, a modified version of the incised channel evolution model was developed for the North Sulphur River and its tributaries. Following channelization in the late 1920s the North Sulphur River incised and widened (Avery, 1974) and followed the typical channel evolution sequence 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.

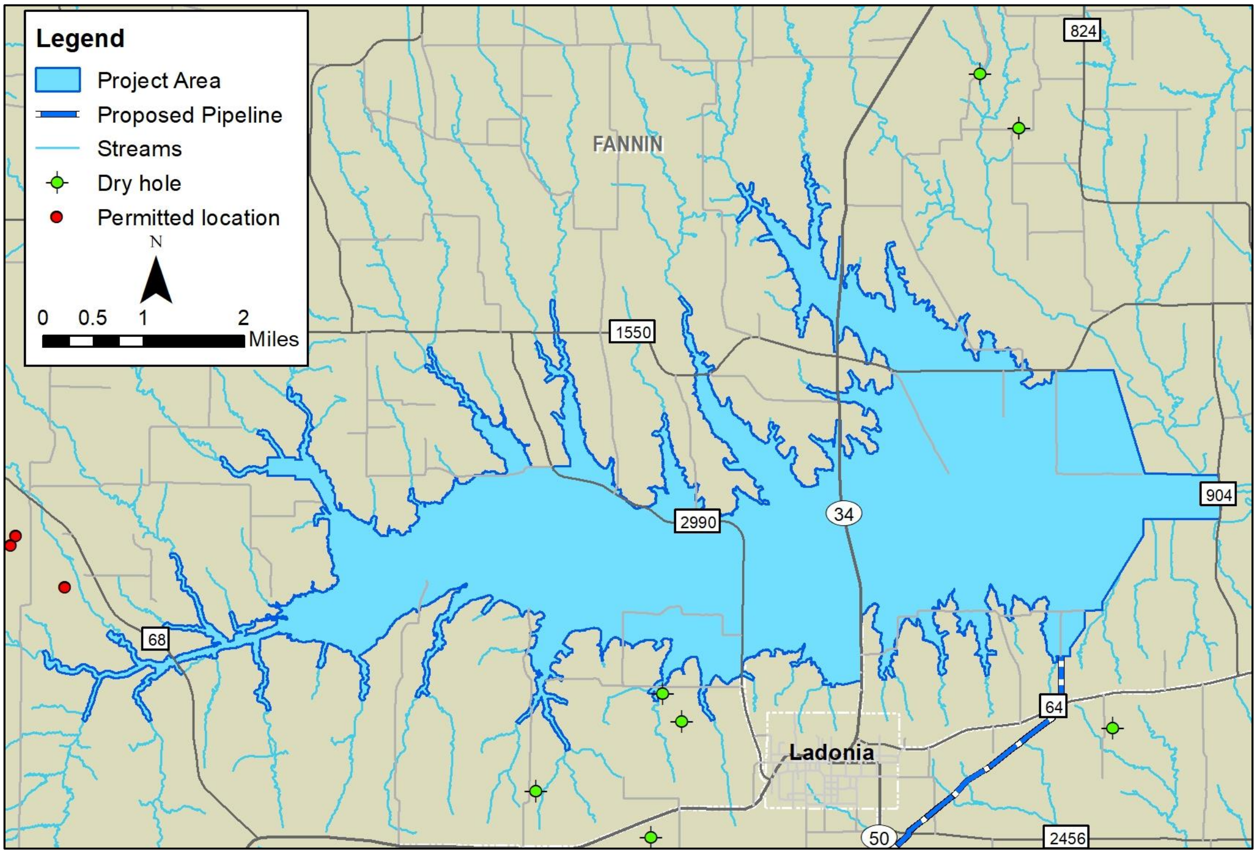
The northeast region of Texas may be at risk from very large, distant earthquakes which might occur in Missouri-Tennessee or Oklahoma; the earthquakes that pose such a hazard are rare, probably occurring only once per 500 years or less. Such distant earthquakes would be most likely to damage large buildings 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

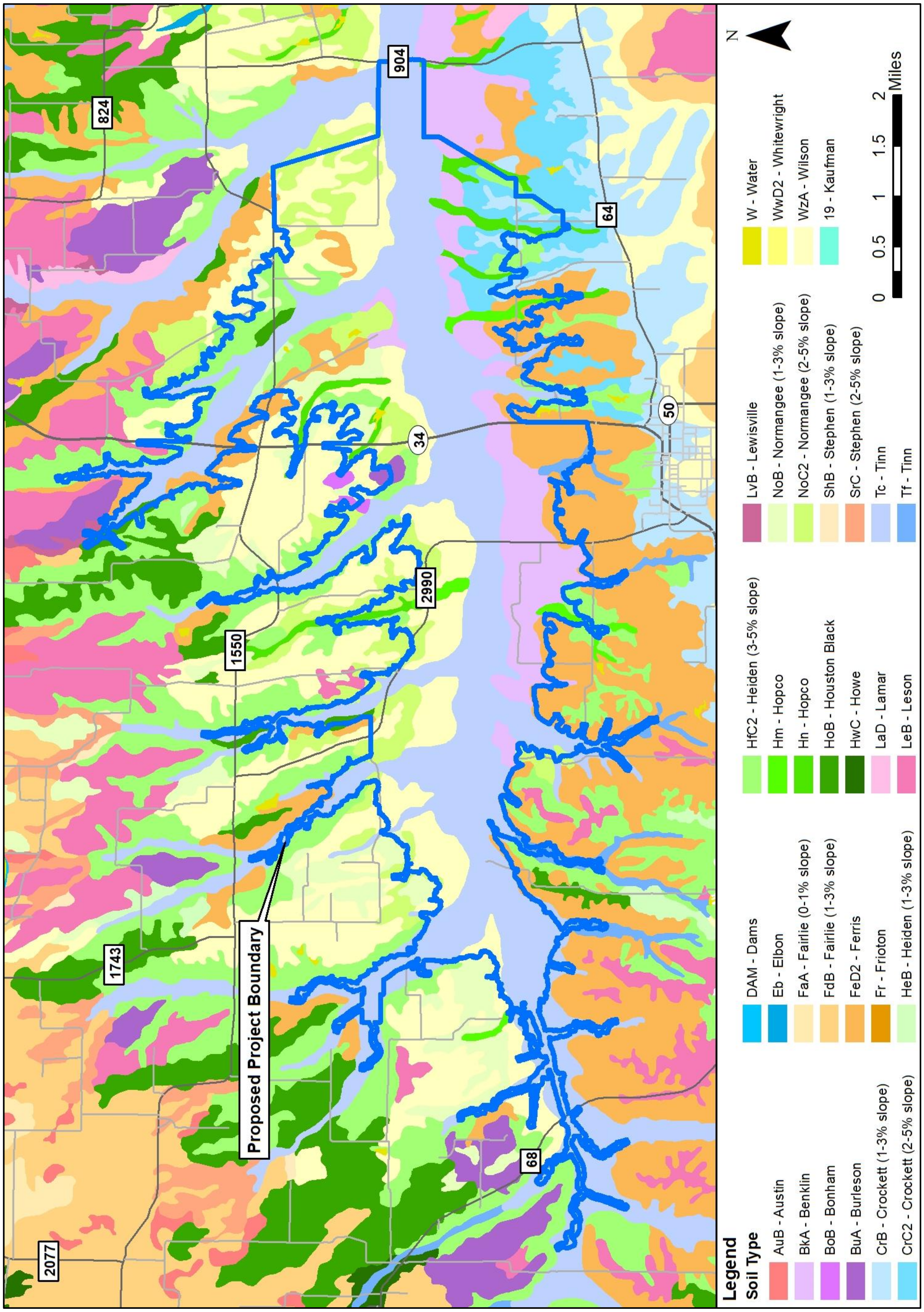
Based on the Natural Resources Conservation Service (NRCS) Soil Survey of Fannin County (a publication sponsored by the United States Department of Agriculture, Soil Conservation Service in cooperation with the Texas Agricultural Experiment Station), a total of 17 surface soils types are located within 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.

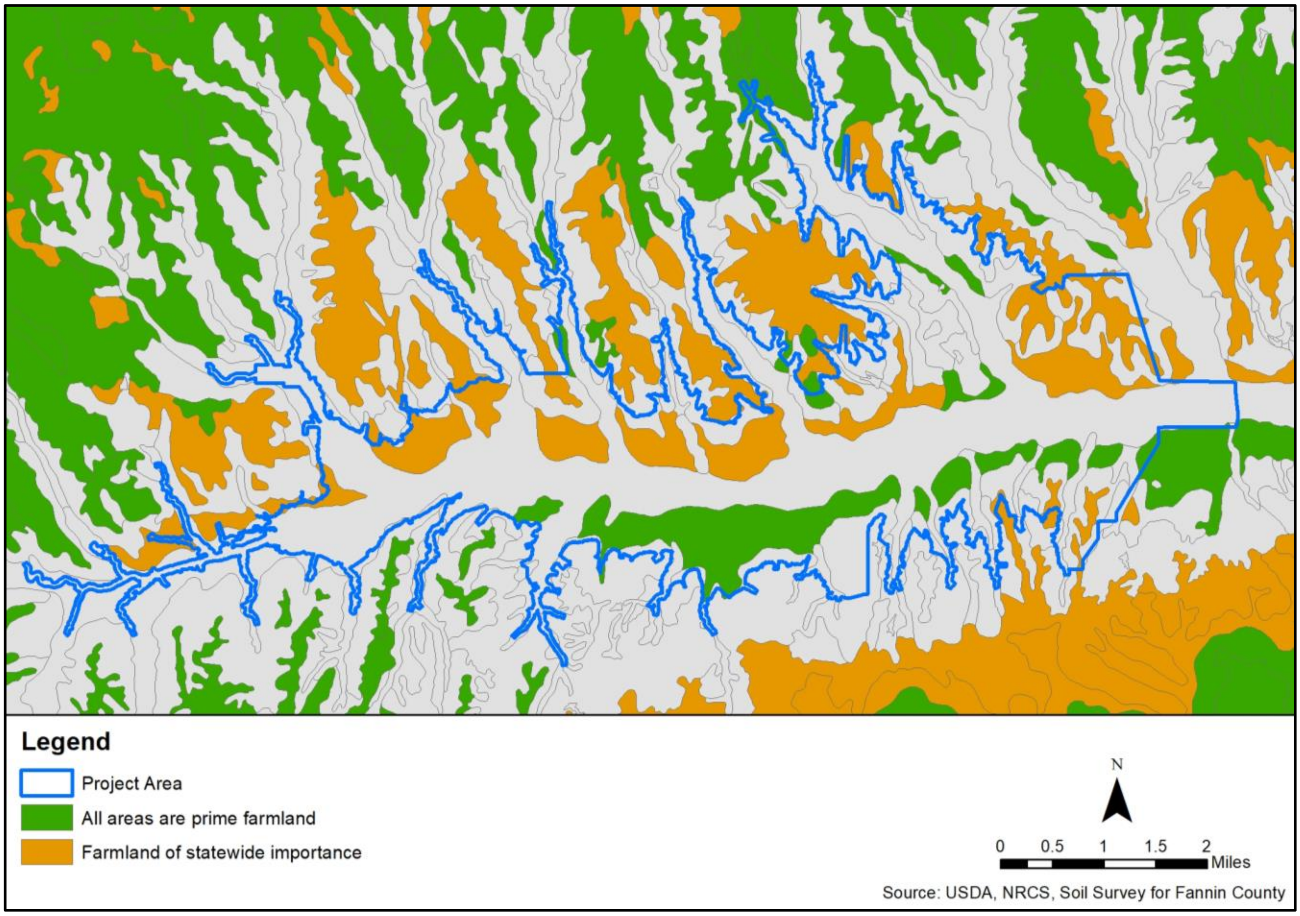
Source: NRCS Soil Surveys for Fannin, Hunt, and Collin Counties

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

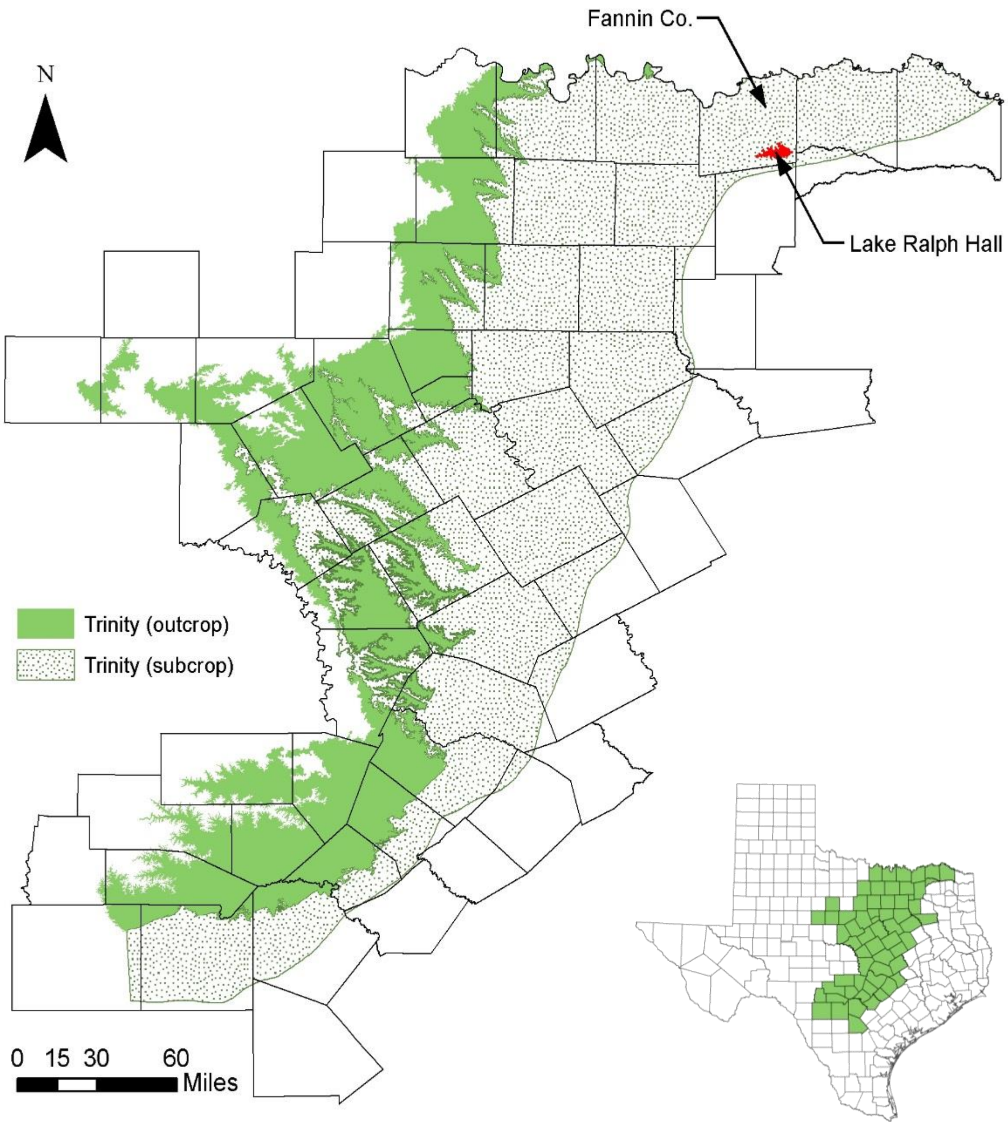


Source: NRCS Soil Survey of Fannin County

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.

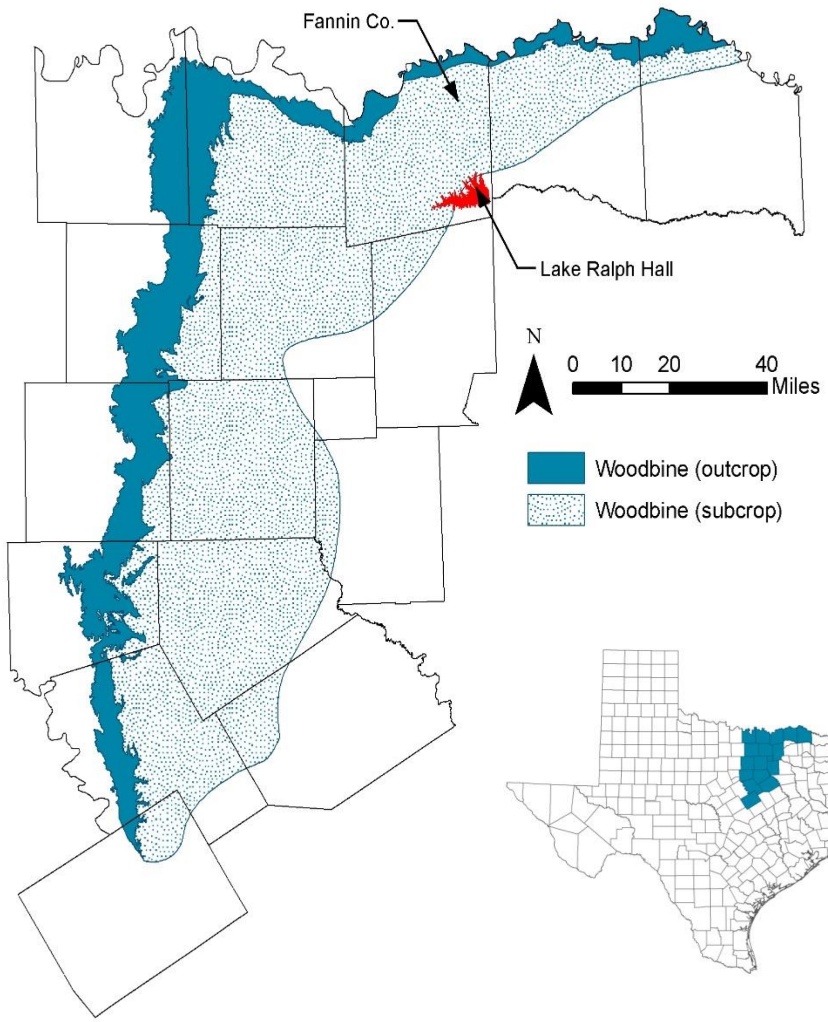
Figure 3-13: Trinity Aquifer



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

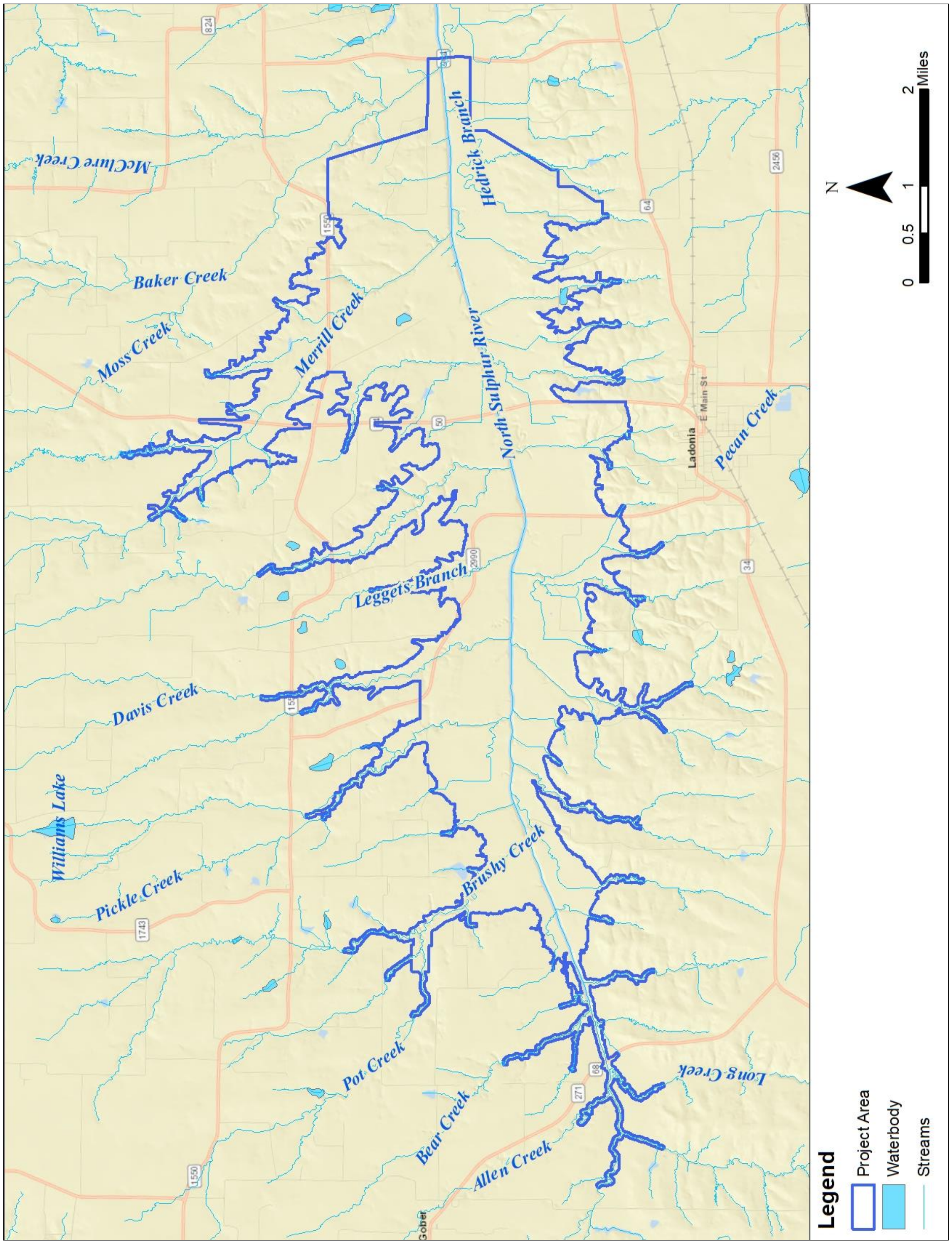
The Sulphur River Basin is the major surface watershed where the proposed project would be located. Specifically, the proposed Lake Ralph Hall is located solely within the North Sulphur River Watershed on the North Sulphur River. As shown in **Figure 3-15** major tributaries to the North Sulphur River 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



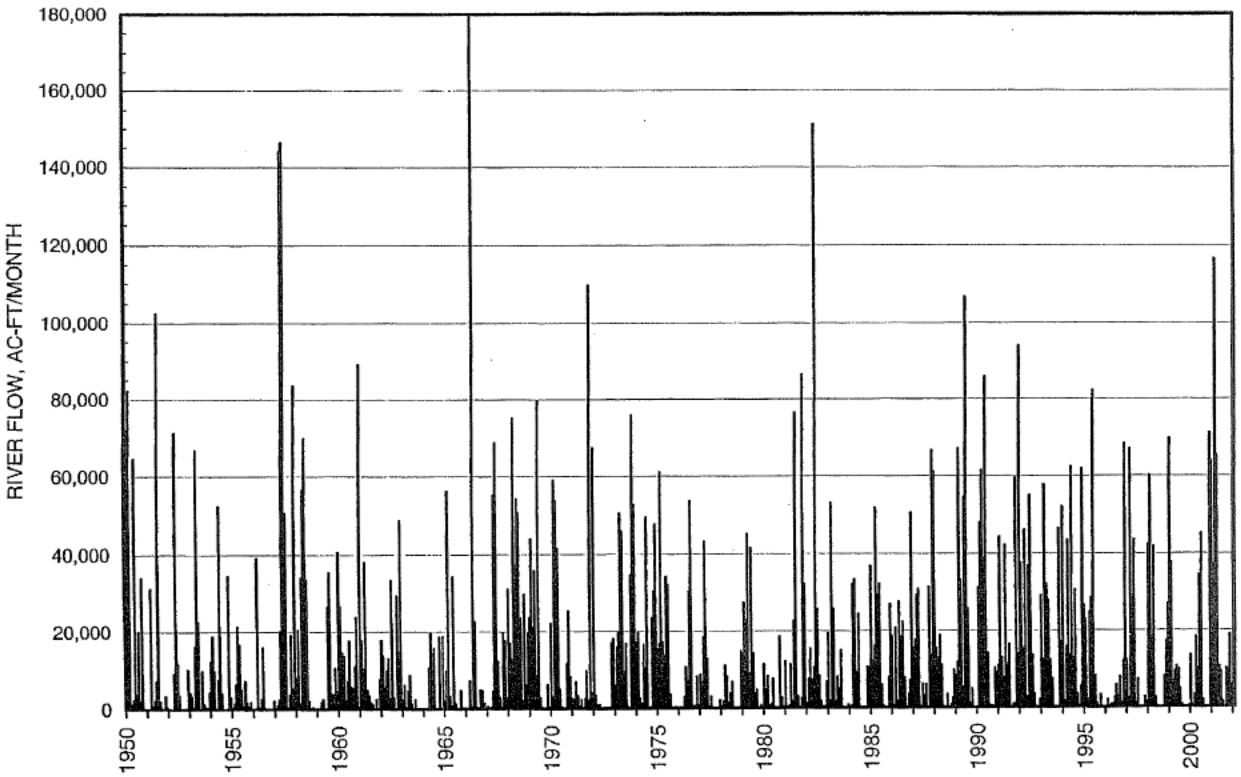
Source: National Hydrography Dataset

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	Primary 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

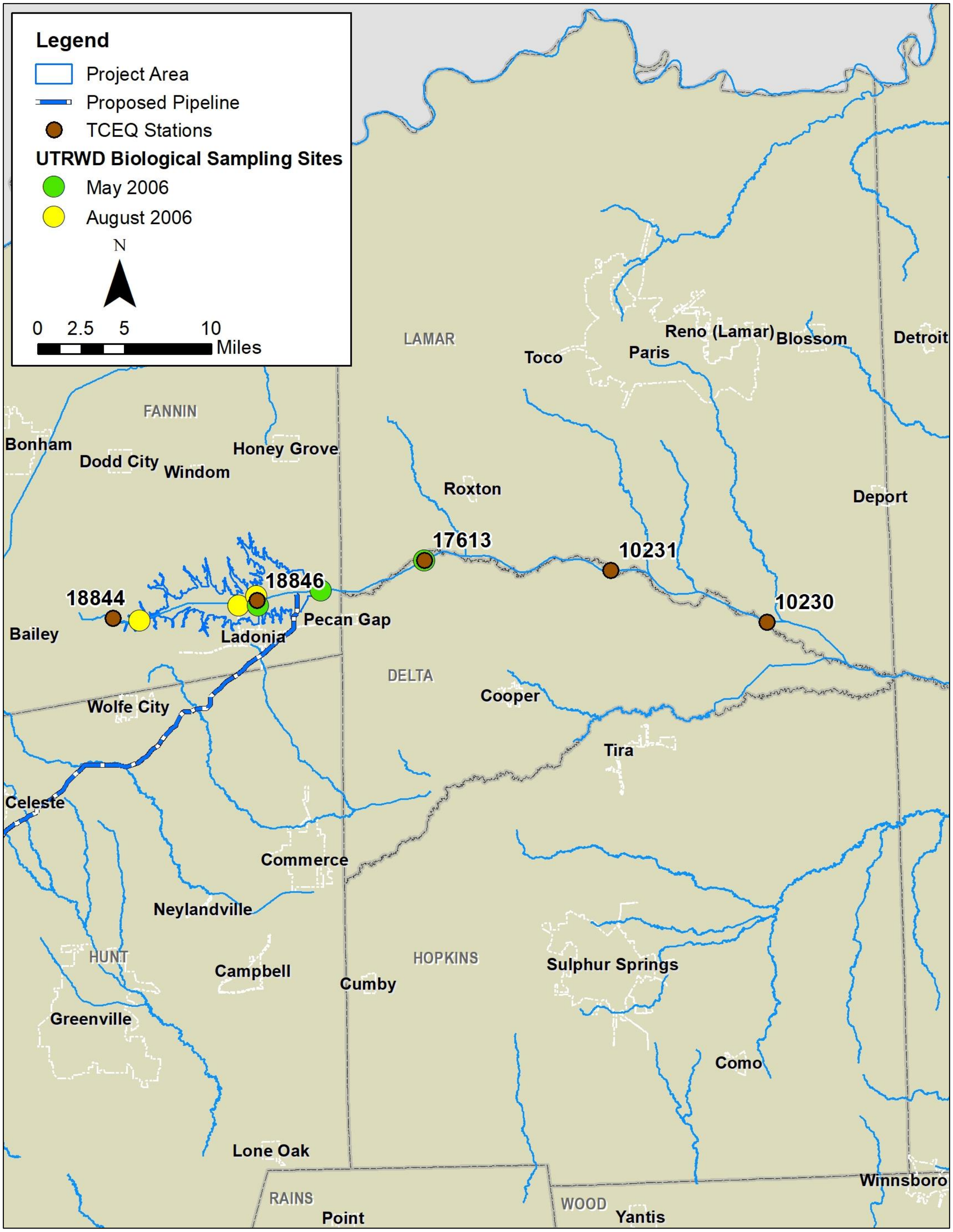
[1]According to TCEQ, "The intermediate aquatic life use applies only to the fish community. The benthic community is to be assessed using a limited aquatic life use." This language is under EPA review.

[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 2015; 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	Primary 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

[1]The appropriate indicator criteria for Lewisville Lake is *E. coli*
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
Primary 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 Wetlands 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. Like wetlands, these streams provide ecologically important functions and are critical to the health of river systems. They provide connectivity to larger streams and rivers, help transport and retain sediment, help regulate water quality, recharge underground aquifers, and provide unique habitat for plants and wildlife. They also help support economically important industries, such as fishing and hunting, and provide opportunities for recreation and education (USEPA, 2013).

The U.S. Army Corps of Engineers (USACE) has primary responsibility for regulation of wetlands and jurisdictional waters under the CWA. 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. Based on the supplement report, 10 acres of lacustrine fringe wetlands (**Photo 3-6**) were identified within the assessment area (UTRWD, 2017d). The delineation of aquatic resources was conducted utilizing the 1987 USACE Wetland Delineation Manual (USACE, 1987), including the Great Plains Supplement (USACE, 2010). The Approved Jurisdictional Determination was issued July 27, 2017 (**Appendix E-4**). Revisions to these impact areas were included in the *Mitigation Plan for Impacts to Aquatic Resources – Lake Ralph Hall* (**UTRWD, 2019b; Appendix L**) as the design progressed. This mitigation plan revised the length of impacted ephemeral and intermittent streams to 509,292 lineal feet.

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

Waterbody Type	Length / Area	Functional Capacity
Stream	509,292 (Lineal Feet)	440
Impoundments	56.19 (Acres)	28.6

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 a marginal ozone nonattainment area for 9-hour NAAQS and must be in attainment by August 3, 2021. In addition, a lead maintenance 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 historic 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**.

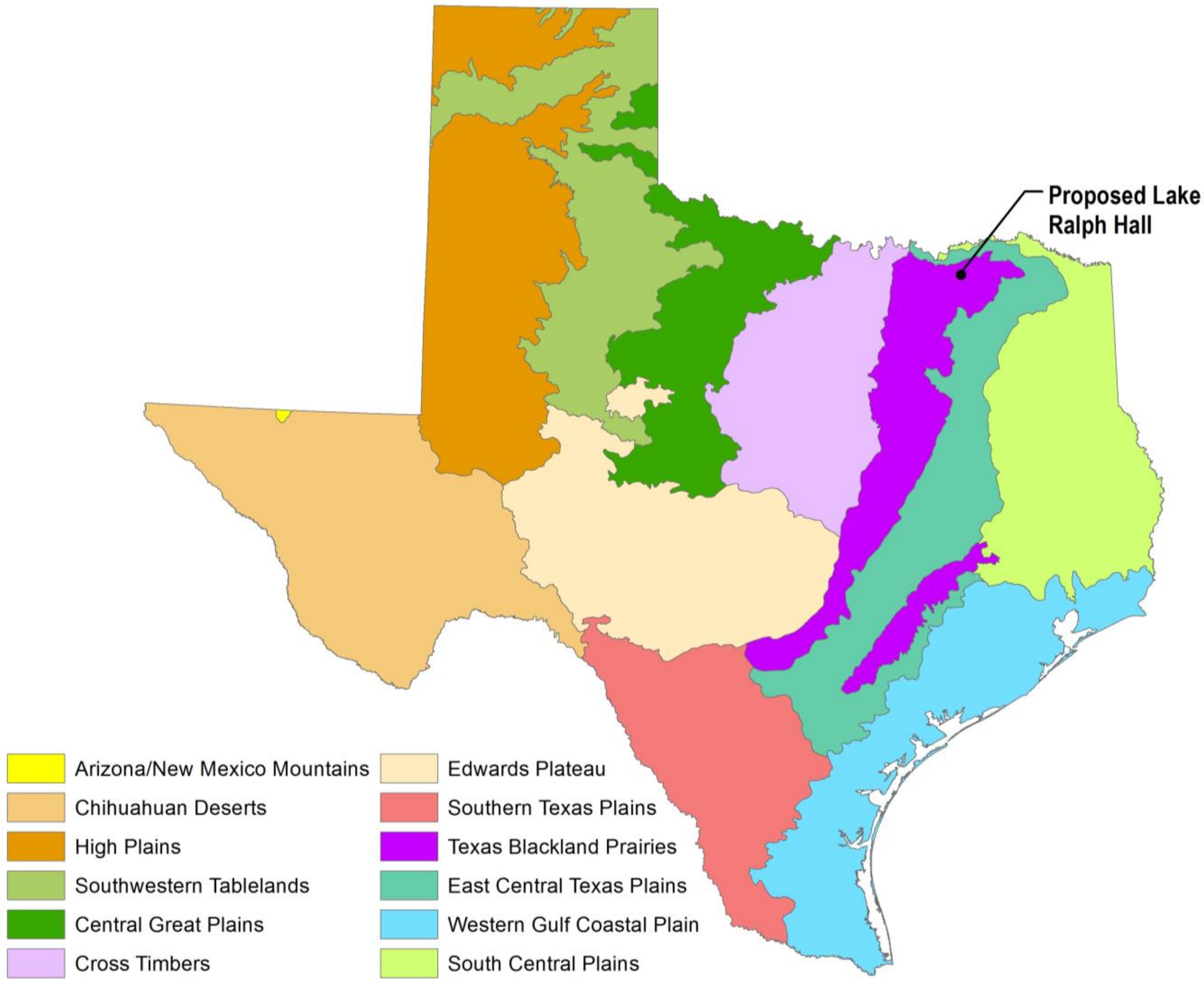
Photo 3-8: Existing view of proposed dam location. View looking southwest from the northeast portion of the project.

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.

Texas Parks and Wildlife tracks species of greatest conservation need (SGCN) and actively promotes their conservation. SGCN that range within Fannin, Collin, and Hunt Counties include the southern crawfish frog, the cerulean warbler, Henslow's sparrow, Sprague's pipit, the western burrowing owl, a crayfish, the goldeye, the orangebelly darter, the ironcolor shiner, the taillight shiner, the western sand darter, the American burying beetle, the sage sphinx moth, the plains spotted skunk, the Texas garter snake, the Topeka purple-coneflower, and Hall's prairie clover (TPWD, 2019).

Aside from the Endangered Species Act (ESA) of 1973 (16 United States 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 May 2007	Station 17613 August 2007	Station 18844 May 2007	Station 18844 August 2007	Station 18846 May 2007	Station 18846 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 §66.007 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

3.12.1 Federally-Listed 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 Title 31 of the TAC. **Table 3-22** details the federal listed endangered and threatened species in Fannin, Hunt, and Collin counties.

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

Common Name *Scientific Name*	**Habitat Association**	**Status* within County**		
		Fannin	**Hunt**	**Collin**
Birds				
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		

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	LT	LT
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
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

Source: USFWS, 2019

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

3.12.2 State-Listed Threatened and Endangered Species

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 3-23** details the state listed endangered and threatened species in Fannin, Hunt, and Collin counties.

Table 3-23: State Listed Threatened and Endangered Species in Fannin, Hunt, and Collin Counties

Common Name *Scientific Name*	Habitat Association	Status* within County		
		Fannin	Hunt	Collin
Amphibians				
Southern Crawfish Frog *Lithobates areolatus areolatus*	The Southern Crawfish Frog can be found in abandoned crawfish holes and small mammal burrows. This species inhabits moist meadows, pasturelands, pine scrub, and river flood plains. This species spends nearly all of its time in burrows and only leaves the burrow area to breed. Although this species can be difficult to detect due to its reclusive nature, the call of breeding males can be heard over great distances. Eggs are laid and larvae develop in temporary water such as flooded fields, ditches, farm ponds and small lakes. Habitat: Shallow water, Herbaceous Wetland, Riparian, Temporary Pool, Cropland/hedgerow, Grassland/herbaceous, Suburban/orchard, Woodland – Conifer.	SGCN	SGCN	
Strecker's Chorus Frog *Pseudacris streckeri*	Wooded floodplains and flats, prairies, cultivated fields and marshes. Likes sandy substrates.	SGCN	SGCN	
Woodhouse's toad *Anaxyrus woodhousii*	Extremely catholic up to 5,000 feet, does very well (except for traffic) in association with man.	SGCN	SGCN	
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.	T	T	T
Black Rail *Laterallus jamaicensis*	Found primarily near rivers and large lakes; nests in tall trees or on cliffs near water; communally roosts, especially in winter; hunts live prey, scavenges, and pirates food from other birds.	SGCN	SGCN	SGCN
Franklin's Gull *Leucophaeus pipixcan*	Prairies, inland marshes; in winter, coasts, ocean. Nests on prairie marshes where habitat is extensive and water is fairly deep; forages during summer and migration over agricultural fields, prairie, flooded pasture, marshes, estuaries. In winter mostly along coast, in protected bays, estuaries; sometimes far offshore or on lakes well inland.	SGCN	SGCN	SGCN
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	E	E	E

Common Name *Scientific Name*	**Habitat Association**	**Status[*] within County**		
		Fannin	**Hunt**	**Collin**
	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.			
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.	T	T	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.	SGCN	SGCN	SGCN
Western Burrowing Owl *Athene cunicularia hypugaea*	The western burrowing owl is found in open grasslands, especially prairie, plains, and savanna, sometimes in open areas such as vacant lots near human habitation or airports; nests and roosts in abandoned burrows.	SGCN	SGCN	SGCN
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	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)			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	T	T	T

Common Name *Scientific Name*	Habitat Association	Status* within County		
		Fannin	Hunt	Collin
	wetlands. The wood stork has formerly nested in Texas, but there have been no recorded breeding sites within Texas since 1960.			
Crustaceans				
No Common Name *Procambarus regalis*	This species is a burrower usually found near or within stands of prairie lands, but in some places, burrows completely cover fields. Burrow areas may be far from places where rain would regularly produce pools of temporary water and tunnel depth may exceed six feet. Excavation around the hole is more often seen as a plume or low hill than a chimney.	SGCN		
Parkhill Prairie Crayfish *Procambarus steigmani*	This crayfish is a burrower in long-grass prairie; all animals were collected with traps, thus there is no knowledge of depths of burrows; herbivore; crepuscular; nocturnal.		SGCN	SGCN
Fish				
Goldeye *Hiodon alosoides*	Goldeye are found in the Red River basin below reservoir; spawns spring to July in shallow firm-bottomed backwaters or gravel shoals in tributaries, eggs semibuoyant drift downstream or to quiet water; adults in quiet turbid water of medium to large lowland rivers, small lakes, marshes and muddy shallows connected to them; young feed on microcrustaceans and other inverts; adults on surface water insects, also frogs, fishes, and small mammals.	SGCN		
Orangebelly Darter *Etheostoma radiosum*	The orangebelly darter is found in the Red through the Angelina River basins; just headwaters ranging from high gradient streams to more sluggish lowland streams, gravel and rubble riffles preferred; eggs buried in gravel and riffle raceways, post-larvae live in quiet water, move into progressively faster water as they mature, young feed mostly on copepods and cladocerans, adults on mayfly and fly larvae, spawn late February through mid-April in eastern Texas.	SGCN		
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				

Common Name *Scientific Name*	Habitat Association	Status* within County		
		Fannin	Hunt	Collin
American Bumblebee *Bombus pensylvanicus*	Species nests in or on the ground in open, grassy areas, under grass thatch or in abandoned rodent burrows. Compost piles, abandoned bird houses, and brush piles may be used.	SGCN	SGCN	SGCN
Sage Sphinx Moth *Lintneria eremitoides*	The sage sphinx moth is found in the desert, grassland; sandy prairie or desert with sage; caterpillars feed on leaves of sage; adults emerge late spring or summer, but little information available; immatures develop directly to the pupal stage probably in 5-7 weeks, and pupae overwinter underground.		SGCN	
Mammals				
American Badger *Taxidea taxus*	Badgers live in a variety of habitats, but they most commonly are found in open country such as prairies and plains. They avoid heavily wooded areas and habitats with rocky soils.	SGCN	SGCN	SGCN
Big Brown Bat *Eptesicus fuscus*	Any wooded areas or woodlands except south Texas. Riparian areas in west Texas.	SGCN	SGCN	SGCN
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	T	
Eastern Red Bat *Lasiurus borealis*	Found in a variety of habitats in Texas. Usually associated with wooded areas. Found in towns especially during migration.	SGCN	SGCN	SGCN
Eastern Spotted Skunk *Spilogale putorius*	Catholic; open fields prairies, croplands, fence rows, farmyards, forest edges; woodlands. Prefer wooded, brushy areas; tallgrass prairies. S.p. ssp. *interrupta* found in wooded areas and tallgrass prairies, preferring rocky canyons and outcrops when such sites are available.	SGCN	SGCN	SGCN
Hoary Bat *Lasiurus cinereus*	Known from montane and riparian woodland in Trans-Pecos, forests and woods in east and central Texas.	SGCN	SGCN	SGCN
Long-Tailed Weasel *Mustela frenata*	Includes brushlands, fence rows, upland woods and bottomland hardwoods, forest edges & rocky desert scrub. Usually live close to water.	SGCN	SGCN	SGCN
Mexican Free-Tailed Bat *Tadarida brasiliensis*	Roosts in buildings in east Texas. Largest maternity roosts are in limestone caves on the Edwards Plateau. Found in all habitats, forest to desert.	SGCN	SGCN	SGCN
Mink *Neovision vison*	Intimately associated with water; coastal swamps & marshes, wooded riparian zones, edges of lakes. Prefer floodplains.	SGCN	SGCN	SGCN

Common Name *Scientific Name*	**Habitat Association**	**Status[*] within County**		
		Fannin	**Hunt**	**Collin**
Mountain Lion *Puma concolor*	Rugged mountains & riparian zones.	SGCN	SGCN	SGCN
Southeastern Myotis Bat *Myotis austroriparius*	Caves are rare in Texas portion of range; buildings, hollow trees are probably important. Historically, lowland pine and hardwood forests with large hollow trees; associated with ecological communities near water. Roosts in cavity trees of bottomland hardwoods, concrete culverts, and abandoned man-made structures.		SGCN	
Southern Short-Tailed Shrew *Blarina carolinensis*	Various upland and wetland habitats, including moist deciduous woods, brushy areas, pine woodland and forest, mixed oak-pine-juniper woods, grassy situations, densely wooded floodplains. May favor areas with abundant leaf litter and fallen logs. Nest sites are probably under logs, stumps and other debris.	SGCN	SGCN	SGCN
Swamp Rabbit *Sylvilagus aquaticus*	Prefers swampy lowlands, floodplains, cypress swamps, and edges of rivers and creeks. Often found near water and in the cover of thickets, stumps, or fallen trees. Inhabits poorly drained river bottoms and coastal marshes.	SGCN	SGCN	SGCN
Thirteen-Lined Ground Squirrel *Ictidomys tridecemlineatus*	Restricted to dry and sandy (and "tighter") soils of open areas, such as grasslands, cultivated fields, meadows, roadsides, airfields, shrublands, and suburb lawns. Beaches and dry pine barrens also used. Rests, gives birth, and hibernates in underground burrow.	SGCN	SGCN	SGCN
Tricolored Bat *Perimyotis subflavus*	Forest, woodland and riparian areas are important. Caves are very important to this species.	SGCN	SGCN	SGCN
Western Hog-Nosed Skunk *Conepatus leuconotus*	Habitats include woodlands, grasslands & deserts, to 7,200 feet, most common in rugged, rocky canyon country; little is known about the habitat of the ssp. *telmalestes*.			SGCN
Woodland Vole *Microtus pinetorum*	Include grassy marshes, swamp edges, old-field/pine woodland ecotones, tallgrass fields; generally sandy soils.	SGCN	SGCN	SGCN
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 and Neches River basins and was historically found within the Trinity River basin.		T	T
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	

Common Name *Scientific Name*	Habitat Association	Status* within County		
		Fannin	Hunt	Collin
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	
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
Eastern Box Turtle *Terrapene Carolina*	Eastern box turtles inhabit forests, fields, forest-brush, and forest-field ecotones. In some areas they move seasonally from fields in spring to forest in summer. They commonly enter pools of shallow water in summer. For shelter, they burrow into loose soil, debris, mud, old stump holes, or under leaf litter. They can successfully hibernate in sites that may experience subfreezing temperatures. Also attracted to farms, old fields and cut-over woodlands, as well as creek bottoms and dense woodlands. Egg laying sites often are sandy or loamy soils in open areas; females may move from bottomlands to warmer and drier sites to nest.	SGCN	SGCN	SGCN
Northern Scarlet Snake *Cemophora coccinea copei*	Along Gulf Coast, known from mixed hardwood scrub on sandy soils. Mixed hardwood scrub on sandy soils; feeds on reptile eggs; semi-fossorial; active April-September.		T	
Slender Glass Lizard *Ophisaurus attenuatus*	Prefers relatively dry microhabitats, usually associated with grassy areas. Habitats include open grassland, prairie, woodland edge, open woodland, oak savannas, longleaf pine flatwoods, scrubby areas, fallow fields, and areas near streams and ponds, often in habitats with sandy soil. This species often appears on roads in spring. During inactivity, it occurs in underground burrows. Eggs are laid underground, under cover, or under grass clumps; in cavities beneath flat rocks or in abandoned tunnels of small mammals (Scalopus, Microtus).	SGCN	SGCN	SGCN

Common Name *Scientific Name*	Habitat Association	Status* within County		
		Fannin	Hunt	Collin
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
Western Box Turtle *Terrapene ornata*	Ornate or western box turtles inhabit prairie grassland, pasture, fields, sandhills, and open woodland. They are essentially terrestrial but sometimes enter slow, shallow streams and creek pools. For shelter, they burrow into soil (e.g., under plants such as yucca) or enter burrows made by other species. Eggs are laid in nests dug in soft well-drained soil in open area. Very partial to sandy soil.	SGCN	SGCN	SGCN
Plants				
Engelmann's Bladderpod *Physaria engelmannii*	Shrublands on dry limestone slopes; Perennial; Flowering April-May; Fruiting May-June			SGCN
Glandular Gay-Feather *Liatris glandulosa*	Occurs in herbaceous vegetation on limestone outcrops			SGCN
Hall's Prairie Clover *Dalea hallii*	Global Rank: G3; found in grasslands on eroded limestone or chalk and in oak scrub on rocky hillsides; Perennial; Flowering May-Sept; Fruiting June-Sept	SGCN		
Oklahoma Grass Pink *Calopogon oklahomensis*	Prefers mesic, acidic, sandy to loamy soils; avoids the wetter habitats preferred by most of the other species in the genus. Found in tallgrass and coastal prairies (including prairie remnants such as those beside railroads as well as prairie-haymeadows and other mowed meadows), savannas (such as longleaf pine savannas) and wetland savanna borders, moderately open woodlands (such as post oak-blackjack oak woodlands), hillside seepage bogs and edges of bogs; occasionally in pine plantations, acidic wet barrens, or claypan savannas. Appears to thrive under relatively frequent fires (every 1-3 years, particularly dormant-season burns), late-season haymeadow mowing (where most or all of the above-ground vegetation is effectively removed once every 1-2 years, with thatch not left behind), and perhaps light grazing.		SGCN	

Common Name *Scientific Name*	Habitat Association	Status* within County		
		Fannin	Hunt	Collin
Red Yucca *Hesperaloe parviflora*	Shrublands on dry limestone slopes; Perennial; Flowering April-May; Fruiting May-June			SGCN
Topeka Purple-Coneflower *Echinacea atrorubens*	Global Rank: G3; Occurring mostly in tallgrass prairie of the southern Great Plains, in blackland prairies but also in a variety of other sites like limestone hillsides; Perennial; Flowering Jan-June; Fruiting Jan-May.	SGCN	SGCN	

Source: TPWD, 2019
* Status Key: E, T -State Listed Endangered/Threatened
SGCN – State Species of Greatest Conservation Need

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 3365, CR 3370, CR 3380, 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 inactive rail spurs throughout the area and one active spur. 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 active rail spur, the Dallas, Garland and Northeastern RR (DGNO), runs from Sherman, in Grayson County thru the towns of Trenton and Leonard in Fannin County to Greenville in Hunt 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 3-24 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.

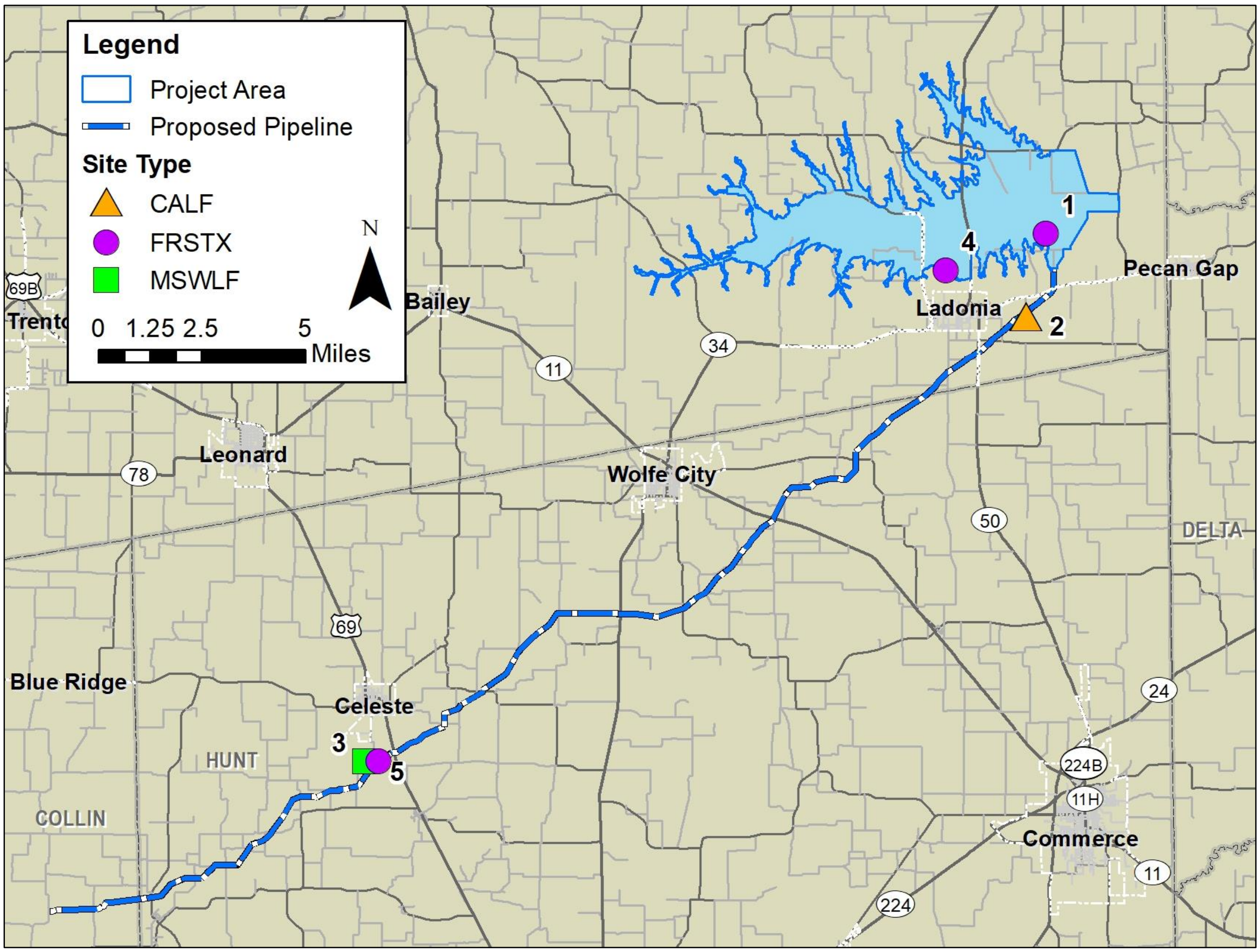
A replacement of a portion of an Atmos Energy pipeline was reported as an FRSTX, Enforcement and Compliance History Information (ECHOR06), and Integrated Compliance Information System National Pollutant Discharge Elimination System (ICISNPDES). The site is listed as a "minor discharger" and has no inspections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

Table 3-24: 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 of the proposed Lake Ralph Hall (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 before 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 3-25.** 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 3-25: 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 Sulphur River and South Sulphur River 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 BDL. No excavation was conducted at Lake Bonham and BDL 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 3-26**). 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 3-26: 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 reservoir footprint 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 3-27** lists the archeological site numbers, descriptions, and eligibility recommendations for the surveyed sites.

Table 3-27: 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 APE 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 sea 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 3-28** provides the composition of socioeconomic PIAs and SIAs for the project alternative and its components.

Table 3-28: 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.

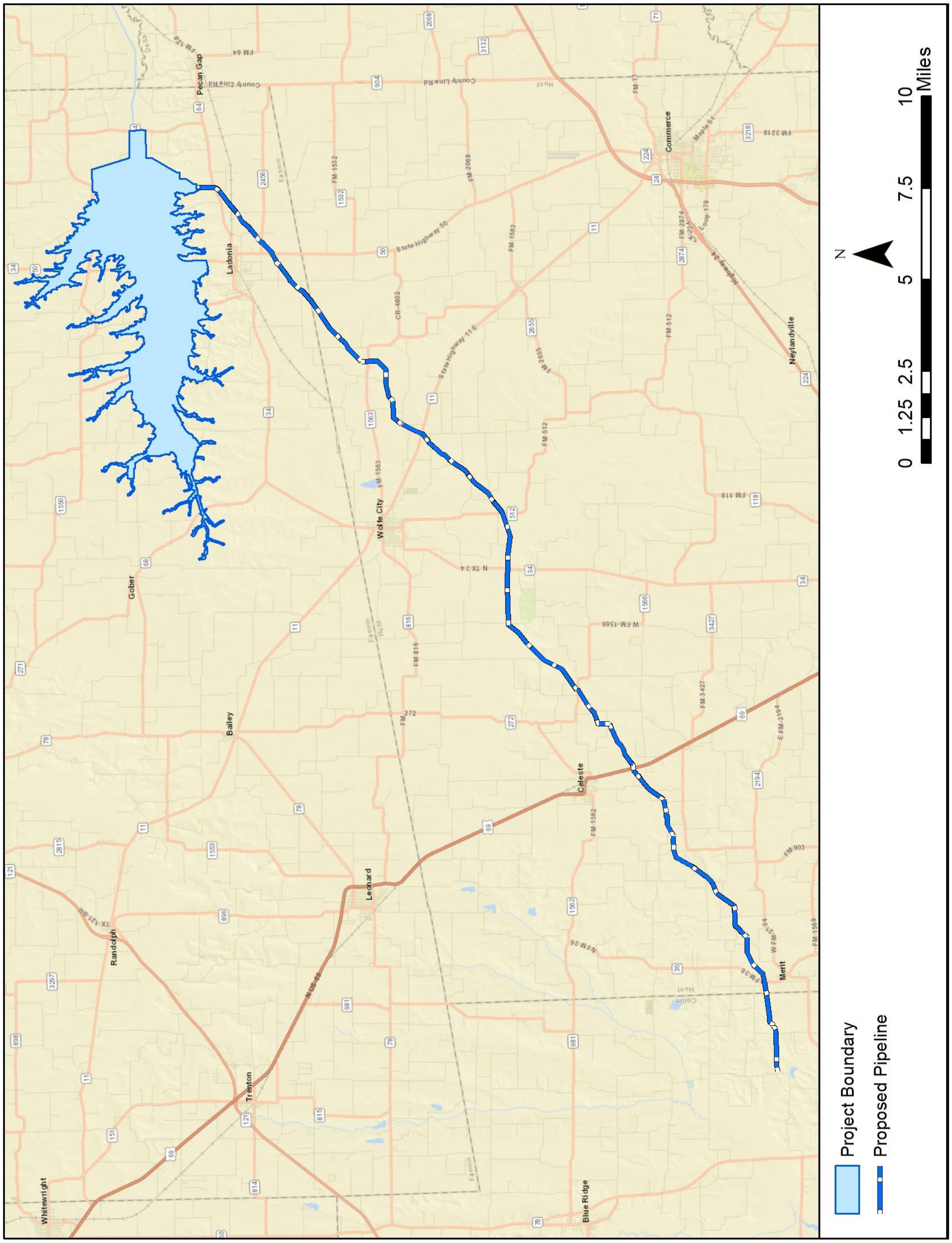
3.17.1 Definition of Lake Ralph Hall Dam Sites Socioeconomic Impact Areas

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 Project Boundary and the Preferred Pipeline Alternative

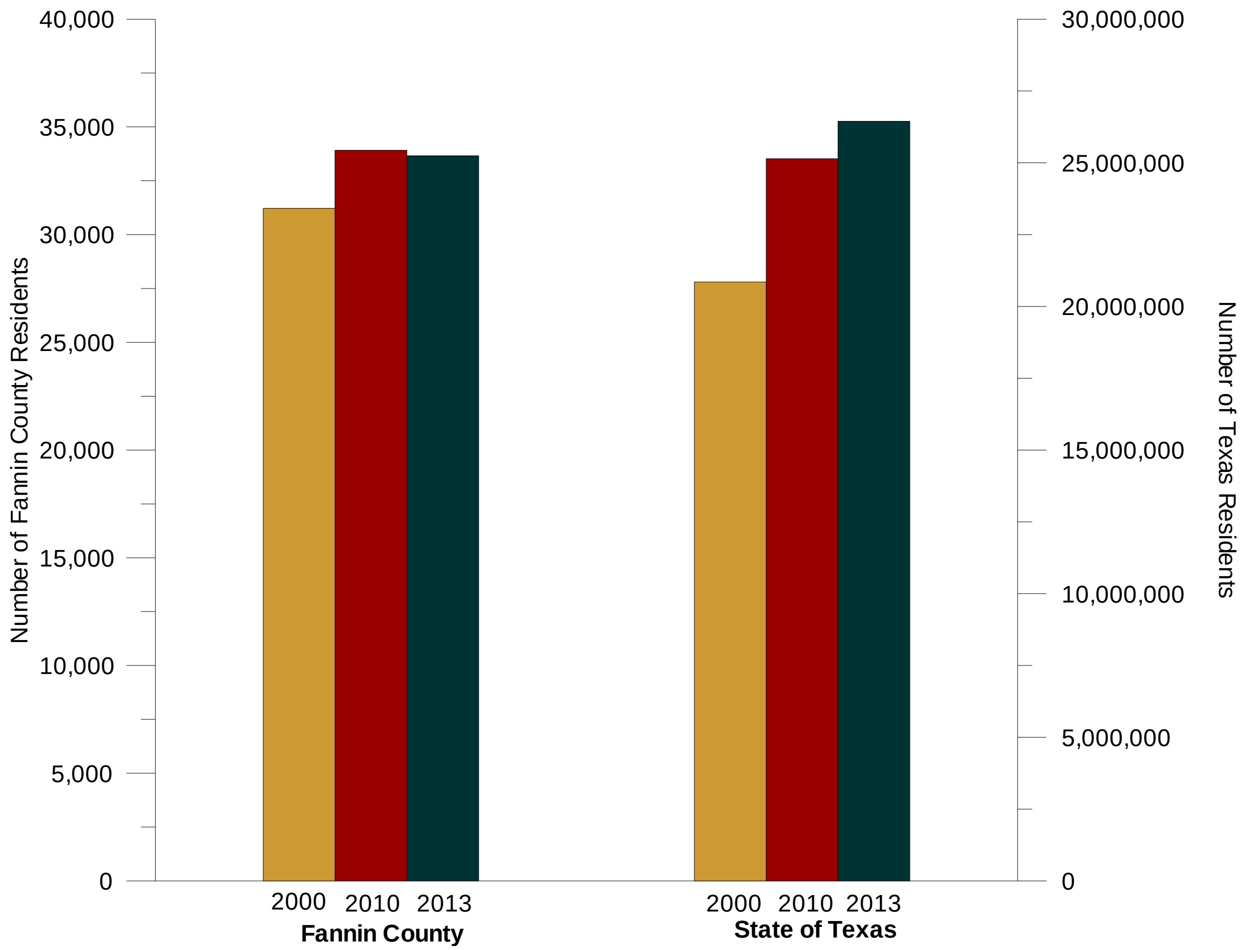


3.17.2 Demographic and Economic Conditions for Dam Site PIA and SIA

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 3-29 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 3-29: Population of Texas, Fannin County, Bonham, Ladonia, and Lake Ralph Hall PIA for 2000, 2010, and 2013

Year(s)	Texas	Fannin County	Bonham	Ladonia	Lake Ralph Hall PIA
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 3-30 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 3-30: 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 3-31 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 14 percent higher in the PIA (29%) as compared to Texas (15%).

Table 3-31: Age Characteristics for Fannin County, Bonham, Ladonia, Lake Ralph Hall PIA, and Texas, 2009-2013

Age Range (Years)	Texas		Fannin County		Bonham		Ladonia		Lake Ralph Hall PIA	
	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 3-32** indicates the age characteristics for the SIA.

Table 3-32: 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 3-33 and **Table 3-34** provide the housing characteristics for Texas and the Lake Ralph Hall PIA.

Table 3-33: 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 PIA
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 3-34: 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 PIA
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 3-35 and **Table 3-36** 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 3-35: 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 3-36: 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 3-37 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 3-38** shows the median household and per capita incomes for Texas, Hunt County, Greenville and Paris for the SIA.

Table 3-37: 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 PIA	
	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 3-38: Median Household Income and Per Capita Income for Hunt County, Greenville and Paris, 2000, 2010 and 2009-2013

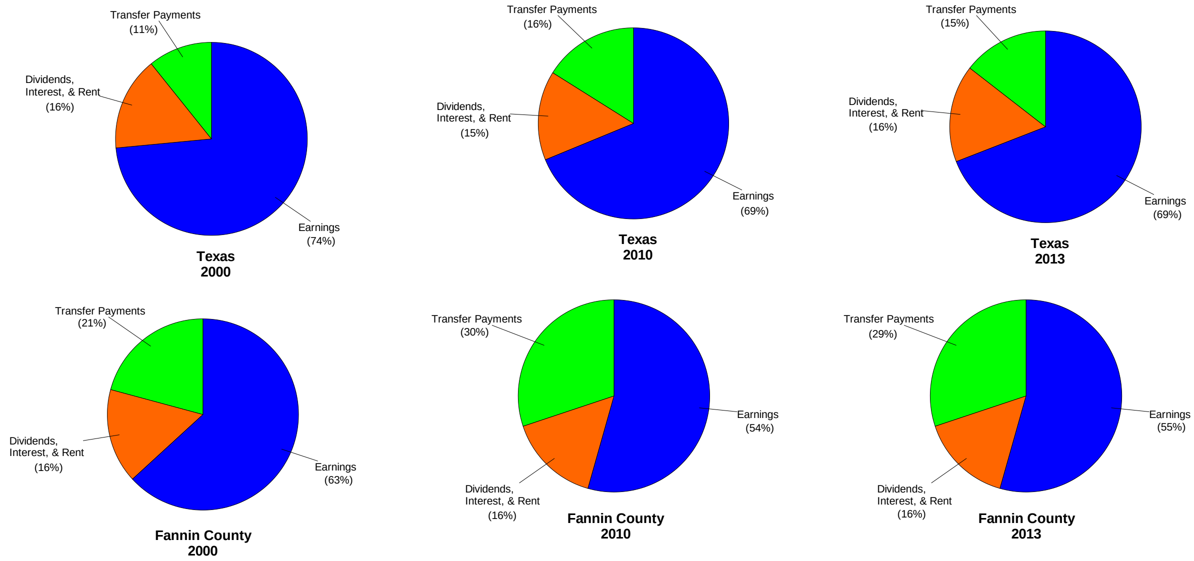
Year(s)	Texas		Hunt County		Greenville		Paris	
	Median Income	Per Capita Income	Median Income	Per Capita Income	Median Income	Per Capita Income	Median Income	Per Capita Income
2000	$56,736	$27,875	$52,224	$24,944	$49,175	$24,485	$38,989	$24,351
2010	$53,899	$27,001	$46,793	$23,500	$39,327	$20,925	$33,541	$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

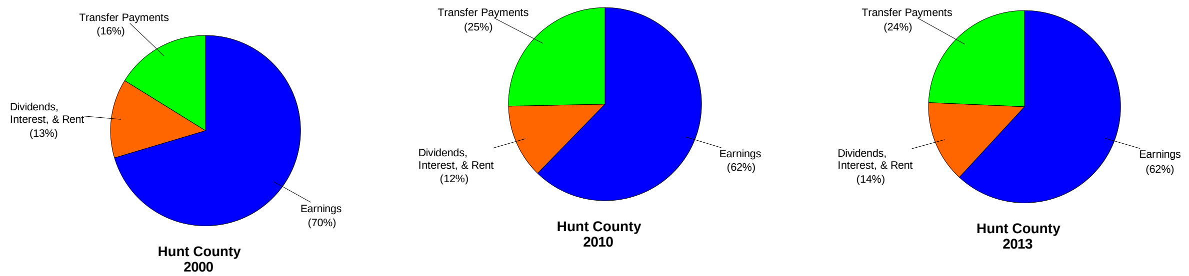


Source: Regional Economic Information System, Bureau of Economic Analysis, US Department of Commerce

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 3-39 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 3-39: 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 3-40 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 3-40: 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 3-41 shows the employment statistics for Texas, Fannin County, Bonham, and Ladonia for 2000, 2010 and 2009-2013.

Table 3-41: 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 3-42** 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 3-42: 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 3-43 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 3-43: 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 3-44** depicts employment by industry for Hunt County and Texas.

Table 3-44: 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 3-45** demonstrates the commuting patterns for Texas, Fannin County, Bonham, Ladonia, and Lake Ralph Hall.

Table 3-45: 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 PIA	
	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 3-46 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 3-46: 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 3-47 provides agricultural statistics for Fannin County and Texas.

Table 3-47: 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 3-48** shows the retail and tourism sector sales for Fannin County.

Table 3-48: 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 3-49**.

Table 3-49: 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).

Education SIA

No increase or decrease to student populations or school district finances are anticipated in the SIA.

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 31.9 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 3-50 shows the population for Texas, Collin County, and the Pipeline.

Table 3-50: 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 15 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 3-51).**

Table 3-51: 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 3-52 shows the housing data for the Lake Ralph Hall Pipeline, 2009-2013.

Table 3-52: 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 3-53** shows the median home value for Texas, Collin County, and the Pipeline.

Table 3-53: 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 3-54 shows the median household and per capita income for Texas, Collin County, and the Pipeline.

Table 3-54: Median Household Income and Per Capita Income for Texas, Collin County, and the Lake Ralph Hall Pipeline PIA, 2000, 2010, and 2009-2013

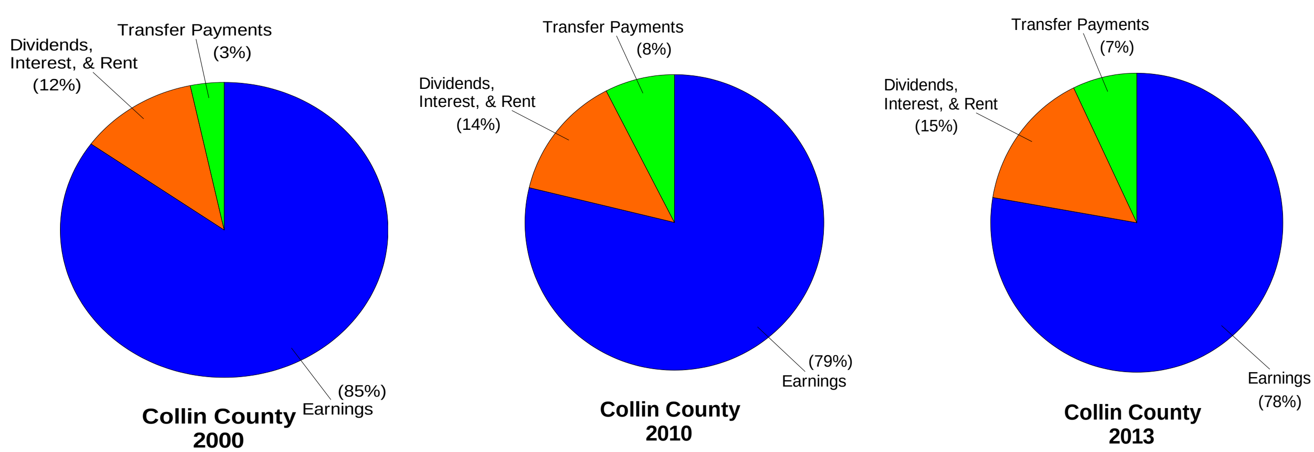
Year(s)	Texas		Collin County		Pipeline	
	Median Income	Per Capita Income	Median Income	Per Capita Income	Median Income	Per Capita Income
2000	$56,736	$27,875	$100,655	$47,383	$54,558	$25,120
2010	$53,899	$27,001	$87,400	$40,563	n/a	n/a
2009-2013	$52,742	$26,441	$84,105	$38,453	$46,441	$23,532
% Change 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 3-55 depicts the percentage of total compensation by industry in Collin County and Texas in 2009.

Table 3-55: 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 3-56 shows the employment statistics for Texas, Collin County, and the Pipeline footprint.

Table 3-56: 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 3-57 shows the employment by industry for Texas and Collin County.

Table 3-57: 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 3-58 presents the commuting patterns for Texas, Collin County and the Pipeline Footprint.

Table 3-58: 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 3-59 offers agricultural statistics for Collin and Hunt counties.

Table 3-59: 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 31.9-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 3-60** 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 3-60 summarizes minority population groups in Fannin, Collin, Delta, Hunt, Grayson, and Lamar counties as well as the state of Texas.

Table 3-60: 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 3-60** 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 3-61 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 3-61: Percent Minority by Block Group within the EJ Study Area Block Groups

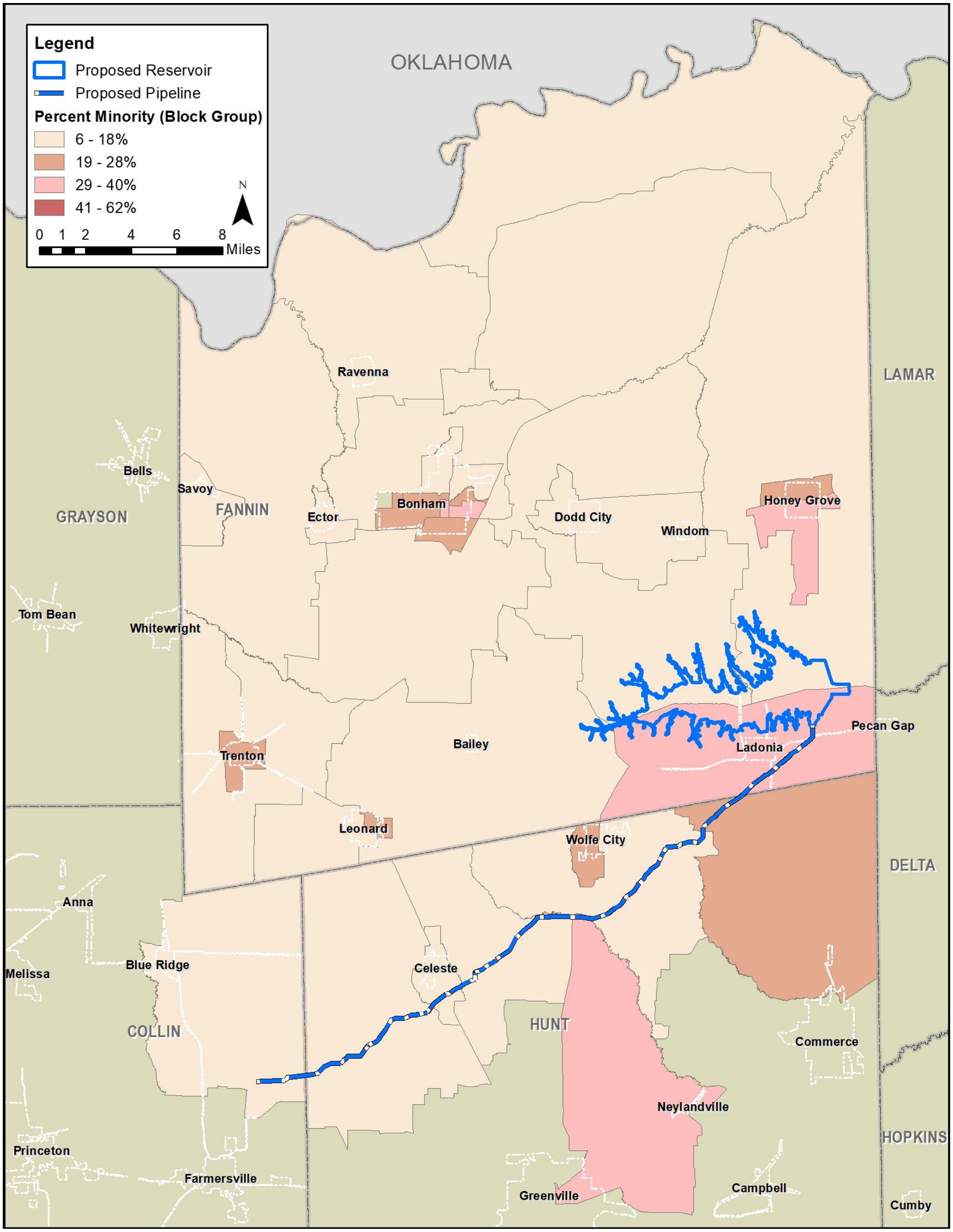
County	Census Tract	Block Group	Percent Minority
Collin	301	3	12.7
Fannin	9501	1	9.7
Fannin	9501	2	18.8
Fannin	9501	3	**39.2**
Fannin	9503	1	9.6
Fannin	9503	2	6.7
Fannin	9503	3	8.0
Fannin	9504.01	1	27.7
Fannin	9504.01	2	**36.3**
Fannin	9504.01	3	**62.3**
Fannin	9504.01	4	26.8
Fannin	9504.02	1	11.4
Fannin	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 3-62**, 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 3-62: 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 3-63** 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.

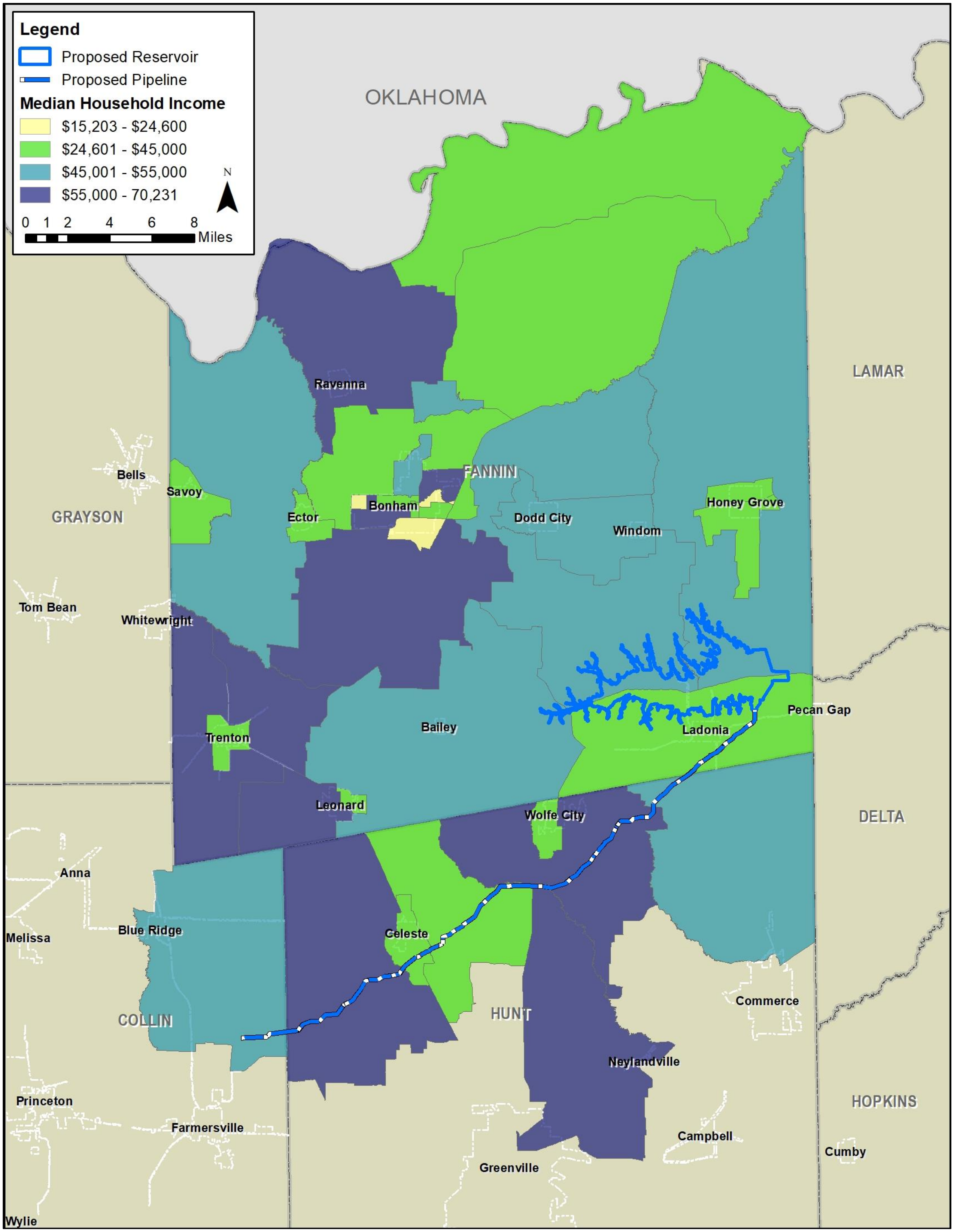
Table 3-63: Median Household Income and Poverty Status within the EJ Study Area Block Groups

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

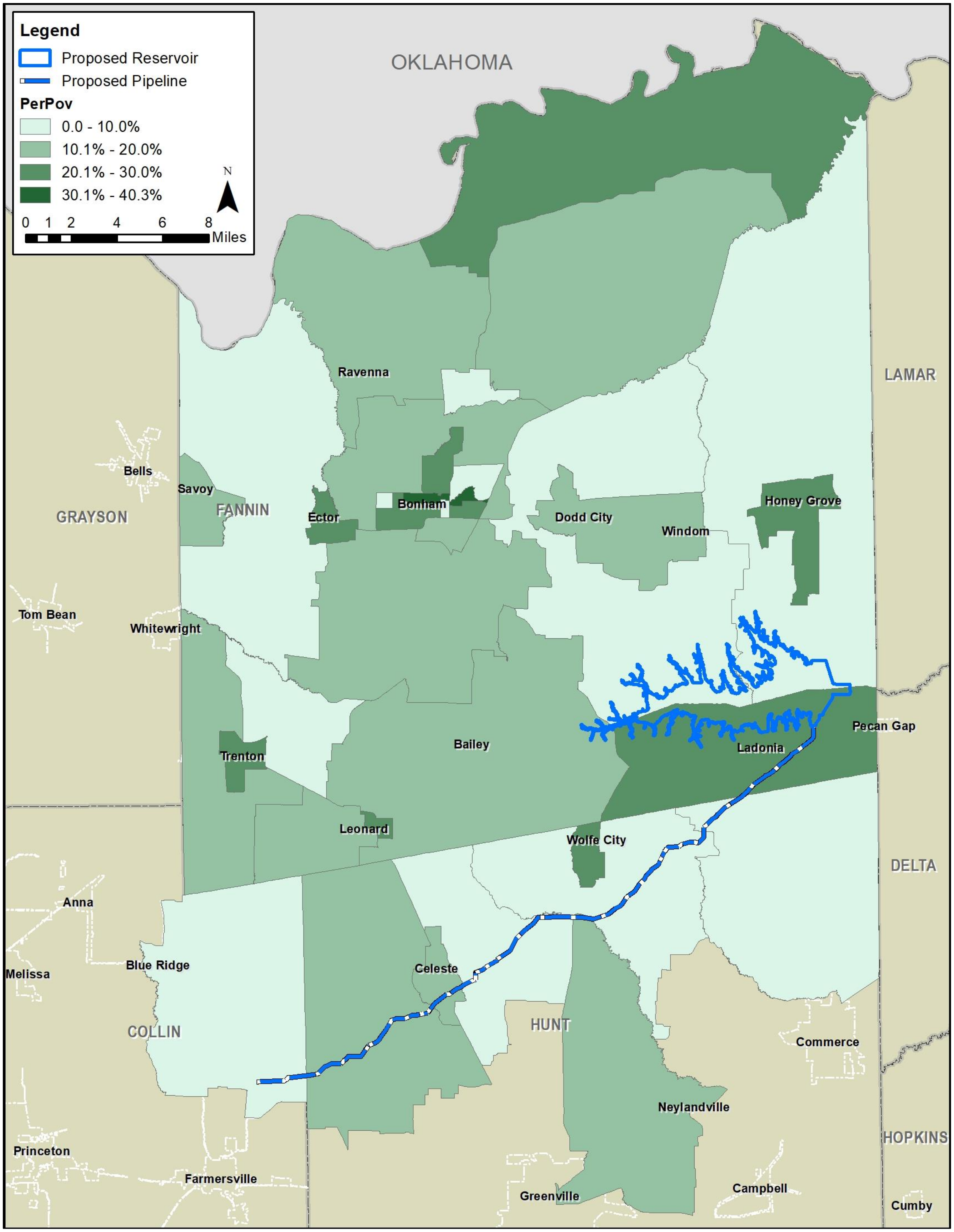
Source: U.S. Census Bureau. 2011-2015 ACS 5-Year Estimates, Tables B17021, B19001, and B19013.

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 Final 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 3-64**). **Figure 3-29** shows the ranges of populations under five by BG.

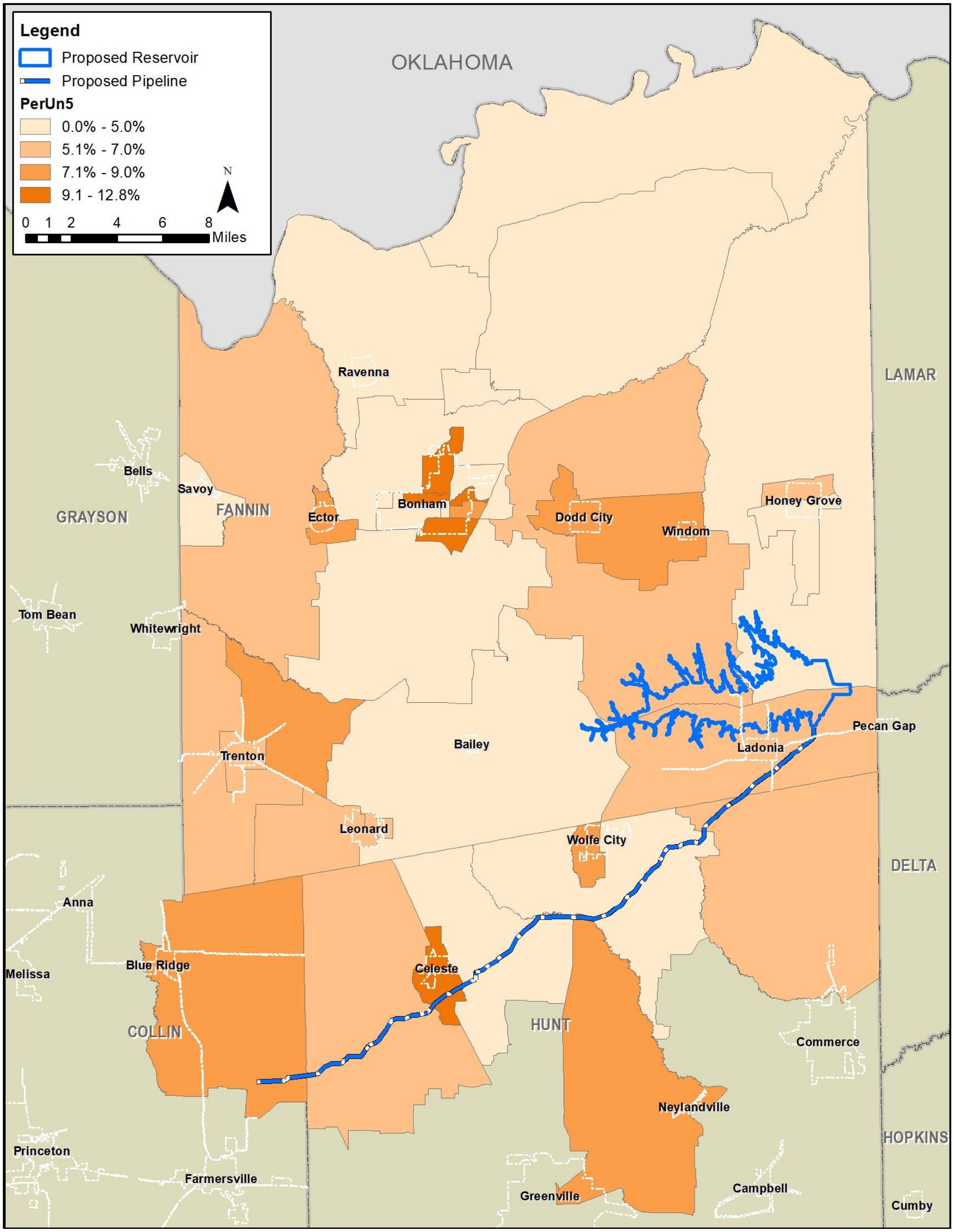
This BG data is compared with previously defined "pockets" of minority or low-income populations; as EO 13045 recognizes that children of environmental justice populations are more likely to be exposed to, and have increased health and safety risks from, environmental contamination than the general population. 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 3-64: 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 Final Environmental Impact Statement (EIS) and are located in the **Appendices**.

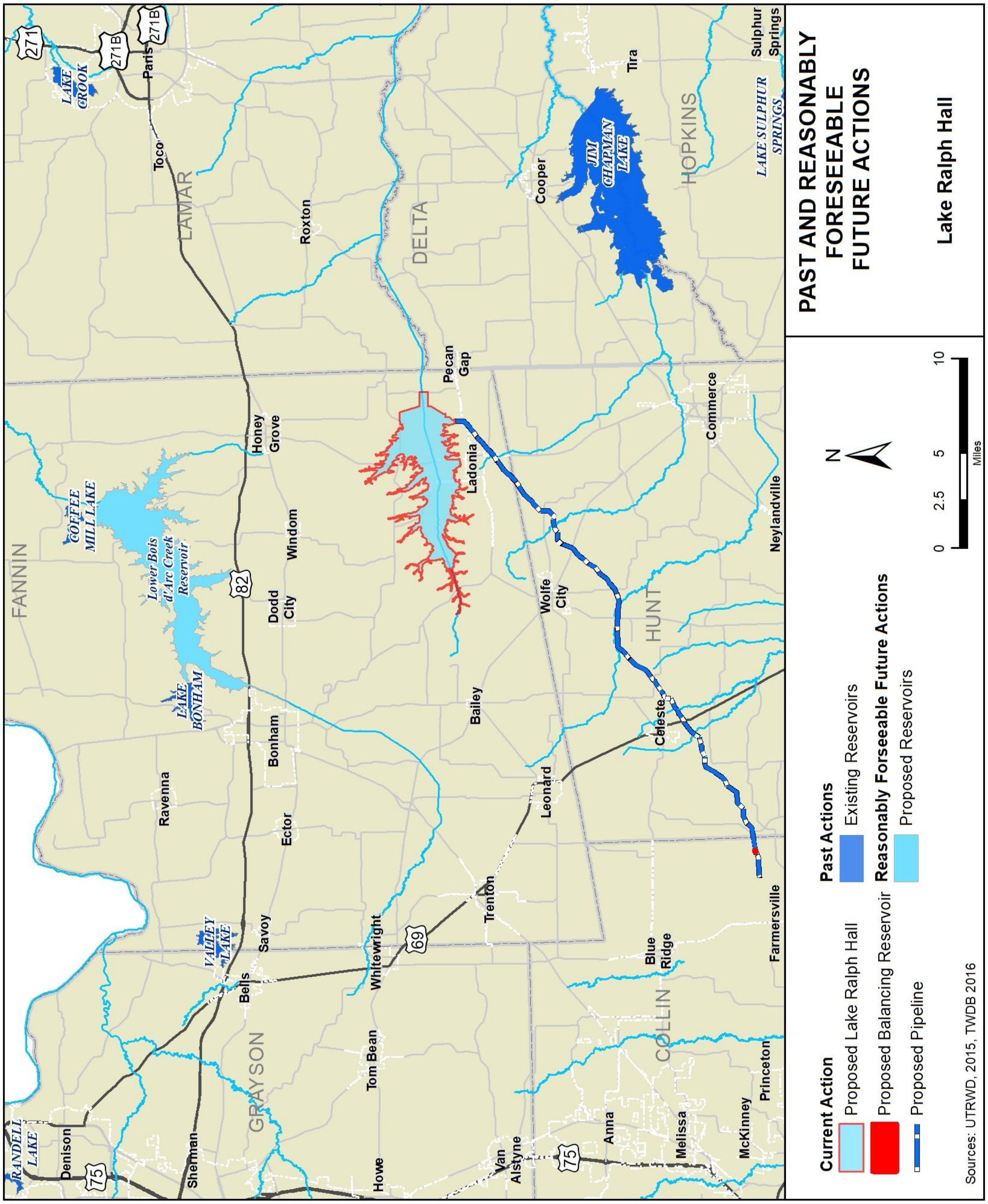
For the purposes of analysis for this project, the intensity of impacts was described using the following terms:

- 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 2.0** 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 12,092 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 August 2018, one residence remained in the project boundary that would need to be acquired prior to construction. 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 leased to the prior property owner, and, if the No Action Alternative were selected, the lands would continue to be leased back or eventually put on the open market. Already planned future action in the area includes the proposed BDL, which would inundate 17,068 acres of bottomland and adjacent upland habitat along Lower Bois d'Arc Creek in Fannin County, and would represent a substantial change in land use for Fannin County.

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 Bois d'Arc Lake (BDL) 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 12,092 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 BDL, which would inundate 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 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, a covered pavilion and stairway access to the North Sulphur River Channel. A location map (subject to change) and conceptual renderings of the relocated park are included in **Appendix Q**. 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 BDL 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 BDL 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

The topography of the balancing reservoir would be altered by excavating earth and creating an embankment to create the reservoir. The height of the embankment will vary with the existing grades and is anticipated to be between 20 to 25 feet above the existing grade.

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 BDL (ROD signed 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. Details of this analysis can be found in **Appendix C**. Transport of the shale results in a temporal and spatial transformation of initially gravel-sized material, which is transported as bed material, to silt-clay-sized wash load that has little or no morphological significance. 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 approximately 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 approximately 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 BDL 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 total 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 total amount of groundwater available from the Woodbine Aquifer is 10,086 AF/YR, but approximately 86 percent of this available groundwater is utilized by current water users, leaving approximately 5,357 AF/YR from the Trinity Aquifer and 1,412 AF/YR from the Woodbine Aquifer for use by UTRWD, its members and customers (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.

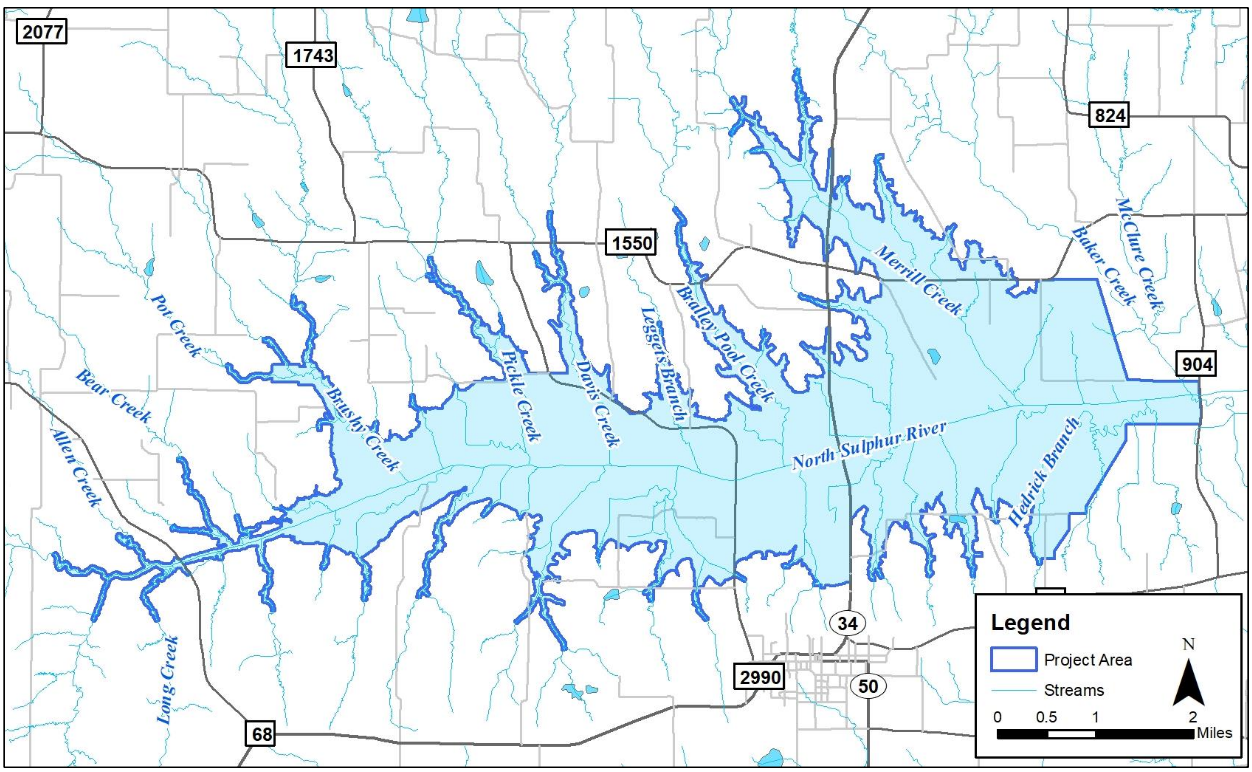
4.6.1.2 Proposed Action

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

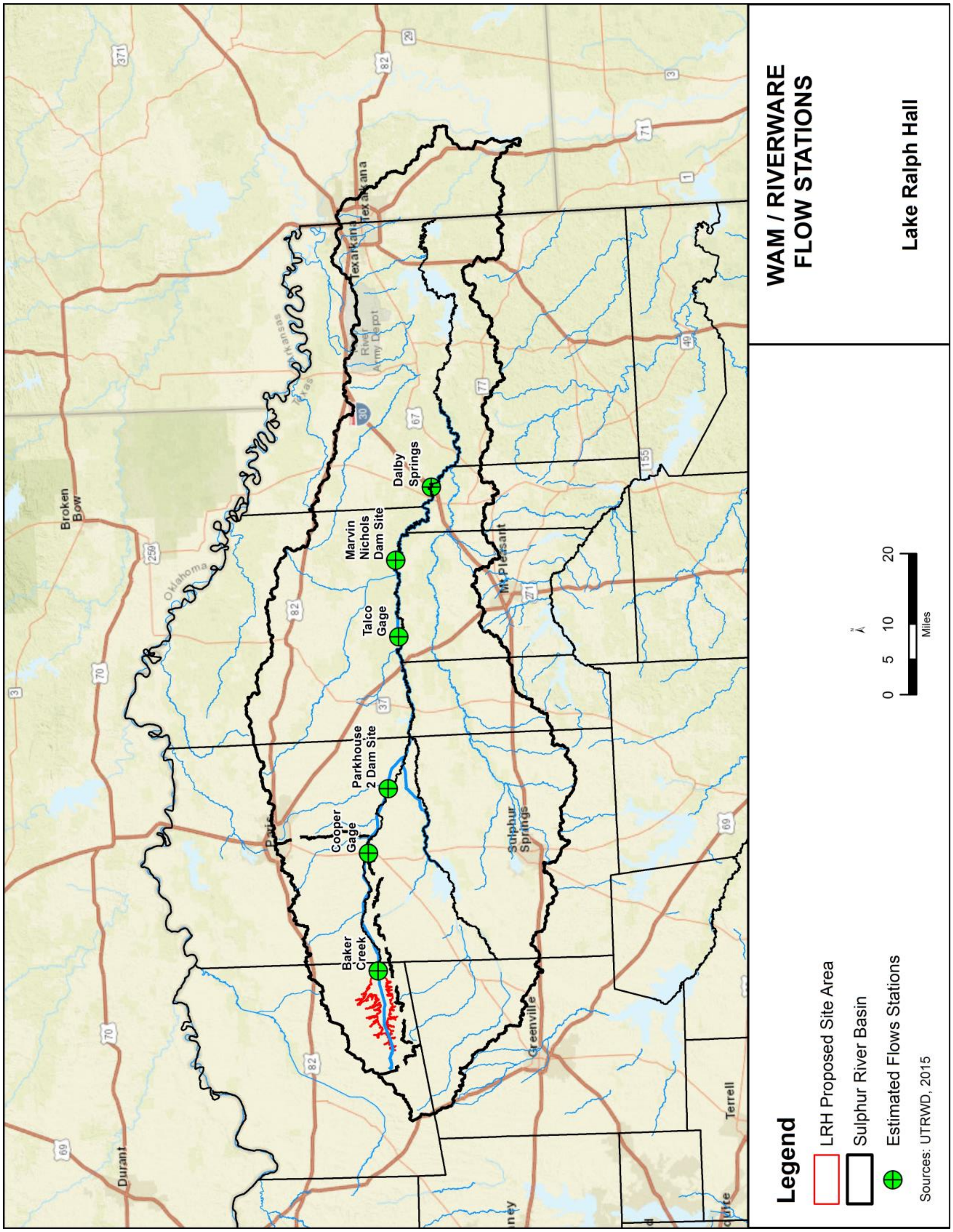


Table 4-1: Statistical Analysis of Flows from WAM with and Without Lake Ralph Hall (LRH) (AF/MO)

		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.

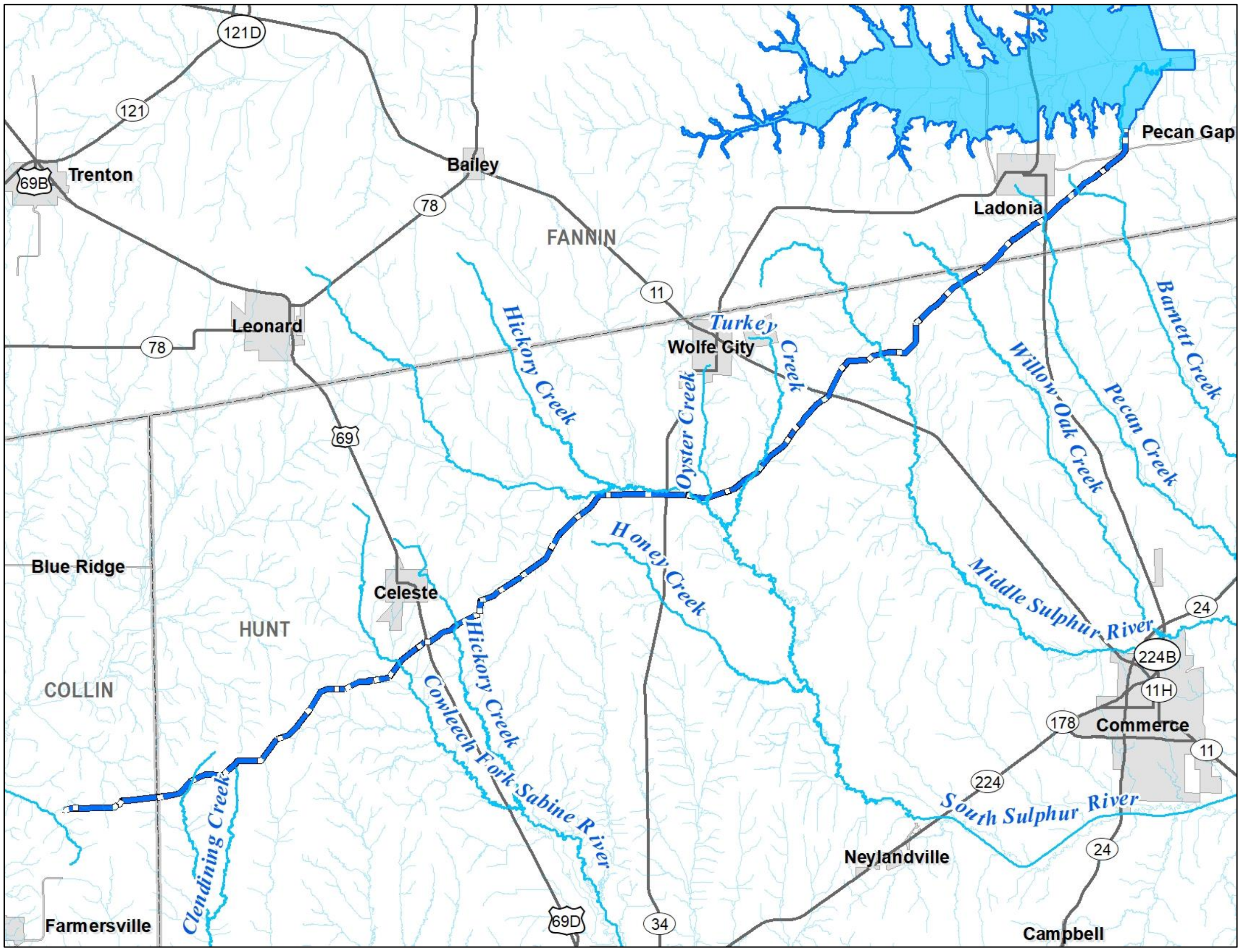
Based on the WAM simulation period of 1940-1997, when the proposed Lake Ralph Hall is operated under firm annual yield conditions with a demand of 34,050 acre-feet/year the anticipated lake level ranges are:

- 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. A stream is considered significant if, at the time of construction, there is standing water below the ordinary high water mark (OHWM). If a stream does not have standing water below the OHWM at the time of construction, then the pipeline crossing would be constructed using open trench construction methods. Upon completion, temporary fill for cofferdams or other construction materials will be removed from the stream, the bed and bank contours below the ordinary high water mark will be restored, and the stream will be stabilized using appropriate post-construction best management practices in accordance with U.S. Army Corps of Engineers section 404 permit and Texas Commission on Environmental Quality section 401 Water Quality Certification and Stormwater Construction General Permit conditions. 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 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

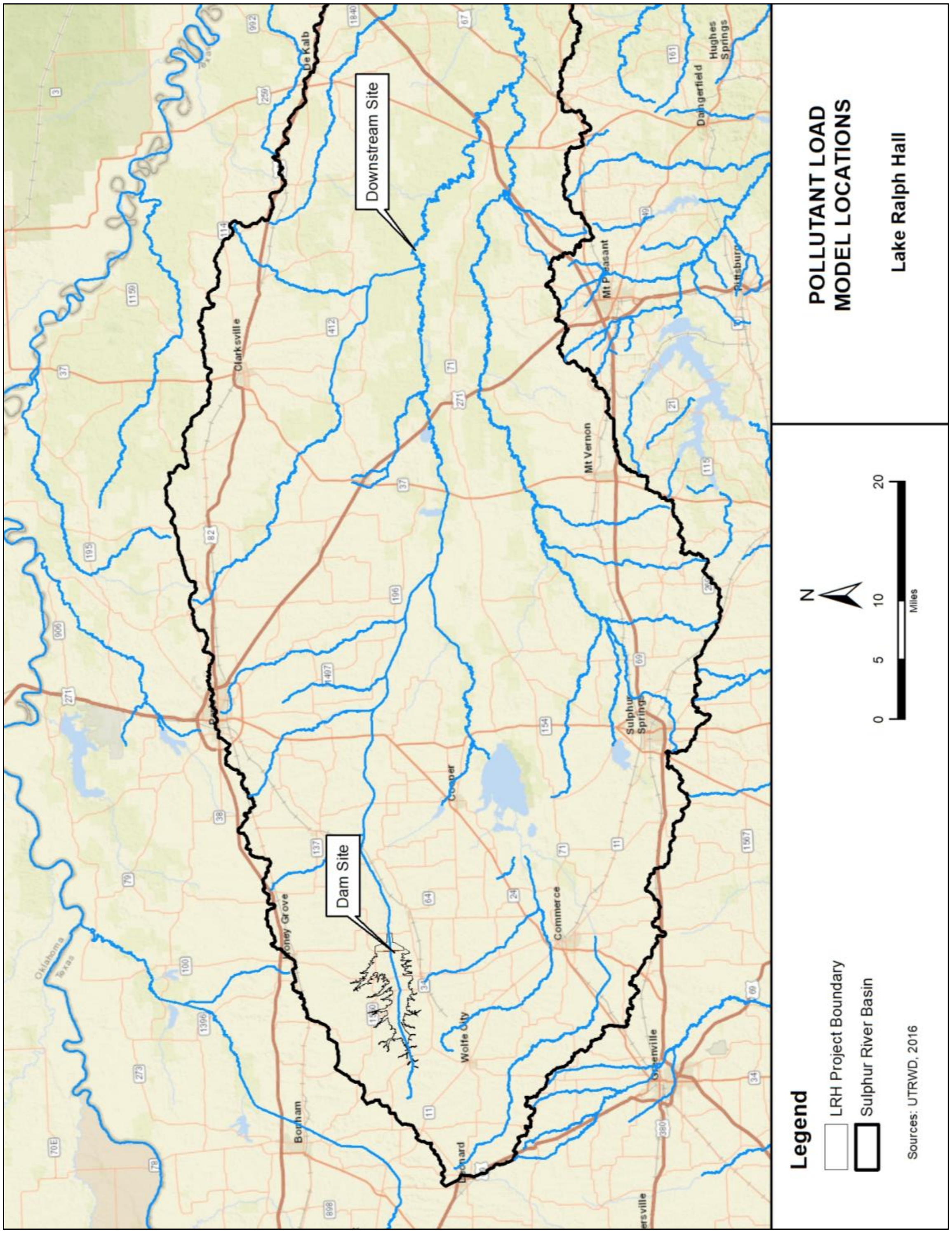


Table 4-4: Loading and Concentration at River Site Post-Project

	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. If, at the time of construction, the South Sulphur River has standing water below the OHWM, it will be crossed using horizontal directional drilling.

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 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 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 historic 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 historic 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**). A draft mitigation plan was completed in July 2019 (**Appendix L**). Based on these investigations, the proposed reservoir project site would result in impacts including fill (dam embankment) and inundation of 447,143 lineal feet of ephemeral stream channel, 62,149 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 designed to propose compensatory mitigation that replaces aquatic ecosystem functions lost or impaired as a result of the proposed activity. Based on the SWAMPIM protocol, these impacts equate to 383 Functional Capacity Units (FCU) of ephemeral streams, 57 FCU of intermittent streams, and a Resource Capacity of 28.6 for on-channel impoundments (UTRWD, 2019b). 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**.

A total of eight acres of lacustrine fringe wetlands would be impacted within the conservation pool, embankment, and spillway area. The mitigation plan provides for a targeted location to address the eight-acre loss, and inadvertent development of some fringe wetland may occur along the lake shoreline. In addition, the upgrade of CR 3444 includes the addition of two minor crossings of waters of the U.S. and would result in negligible impacts.

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). The HEC-RAS model evaluated the river stage at several locations using historical gaged flows and basin geometry (cross-sections) of existing reservoirs. **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. In addition, the upgrade of CR 3444 includes the addition of two minor crossings of waters of the U.S. which would result in negligible impacts.

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 drilling installation techniques. Directional drilling will be used at streams with standing water below the OHWM at the time of construction. 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 BDL 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 as well as all other diffuse sources of pollutants from the watershed. 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. Fannin County possesses the legal authority to regulate zoning around the proposed Lake in order to implement such water quality controls. 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. UTRWD's state water right, Water Use Permit No. 5821, requires UTRWD to 'establish and maintain a riparian buffer zone of permanent vegetation around the perimeter of the reservoir averaging at least 50 feet in width with the exception of reasonable access areas and the area of the dam and spillway.' In doing so, minimal contributions to water quality would occur. 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. As described in Section 4.6.1.2, analysis showed impacts to downstream floodplain resources due to Lake Ralph Hall are negligible.

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 BDL would impact 5,874 acres of wetlands and 651,140 linear feet of stream channel, which are being mitigated 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

Emissions Analysis

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 maintenance area is located within a portion of Collin County. The general conformity process applies to NAAQS nonattainment or maintenance areas and requires evaluation of project emissions within these areas to determine the potential for negative air quality impacts. In order to determine if the proposed project would cause new violations of the NAAQS, increase the frequency or severity of NAAQS violations, or delay timely attainment of the NAAQS or any interim milestone, a comparison of project emissions in Collin County for ozone precursors (nitrogen oxides (NOx) and volatile organic compounds (VOCs)), and lead against the de minimis emissions levels for ozone and lead nonattainment and maintenance areas specified in 40 CFR § 93.153 (Applicability) was performed.

The emissions analysis was limited to the activities that will be conducted in Collin County. Proposed activities associated with the LRH that will have potential for direct and indirect emissions in Collin County include construction of a 2.5-mile pipeline and construction of a balancing reservoir. The calculation of emission inventory for targeted pollutants was completed using a combination of the EPA Motor Vehicle Emissions Simulator (MOVES) 2014b model and assumptions of vehicle activity for the Collin County portion of the project, which includes equipment type and horsepower, and hours of operation required for construction of the pipeline and balancing reservoir. Specific details regarding the model inputs are included in the complete emissions analysis in **Appendix O**.

The results for projected ozone precursors (VOC and NOx) and lead emissions for the Collin County portion of the LRH project are shown in **Table 4-7**. Also shown are the emissions levels above which a conformity determination is required in ozone non-attainment areas and lead maintenance areas, as indicated in CFR §95.153(a) (or below which a *de minimis* determination is made).

Table 4-7: Total emissions for Ozone precursors and Lead for Collin County portion of Lake Ralph Hall

Criteria Pollutant or Precursor	Emissions from Lake Ralph Hall Activities in Collin County (tons/yr)	*de minimis* Emissions Levels in Ozone Non-Attainment and Lead Maintenance Areas (tons/yr)
NOx	0.8	50
VOC	0.07	50
Lead	0	25

As shown by the results, both ozone and lead emissions levels are well below the *de minimis* threshold for these pollutants in the Collin County non-attainment and lead maintenance area. Also as indicated, no lead-based fuels are anticipated to be used in the any of the vehicles or activities of construction of the pipeline or balancing reservoir; therefore, no lead emissions are projected.

The LRH project will cause a *de minimis* increase in direct and indirect emissions in Collin County and therefore no conformity determination for LRH will be required.

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. 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 BDL, 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 BDL 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 BDL 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 BDL.

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 stairway access to the North Sulphur River Channel (**Appendix Q**). 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 to recreational resources include the effects of the Proposed Action, other reservoirs in the county as well as changes at Caddo National Grasslands and Bonham State Park, specifically potential future increases in visitation of the Caddo National Grasslands and Bonham State Park as a result of future population growth with Fannin County. Other reasonably foreseeable future actions include the BDL, 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 BDL 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.

Photo 4-2: Landscape with Proposed Lake Ralph Hall at elevation of 541 ft msl with mudline.

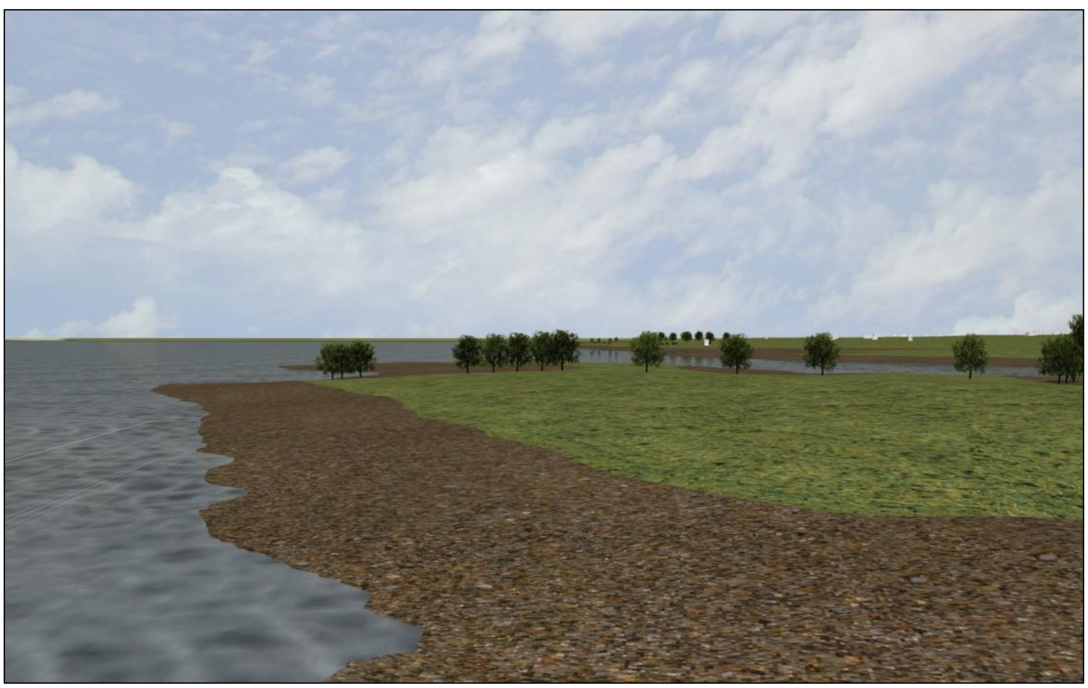


Photo 4-3: Simulated view of Proposed Lake Ralph Hall shoreline

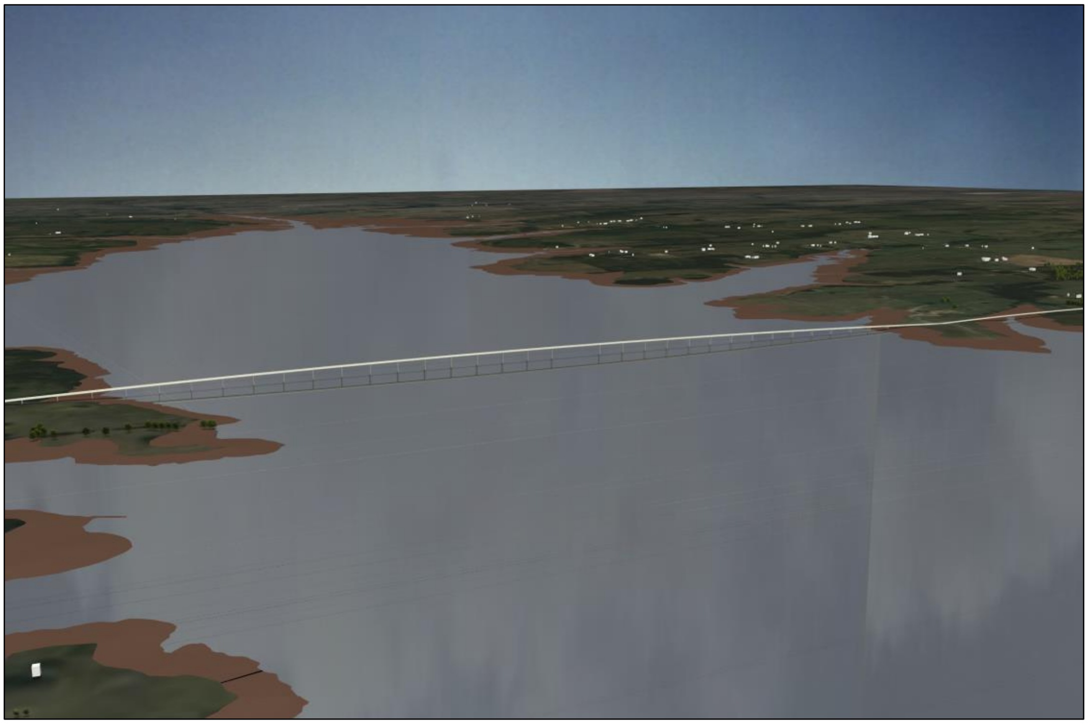
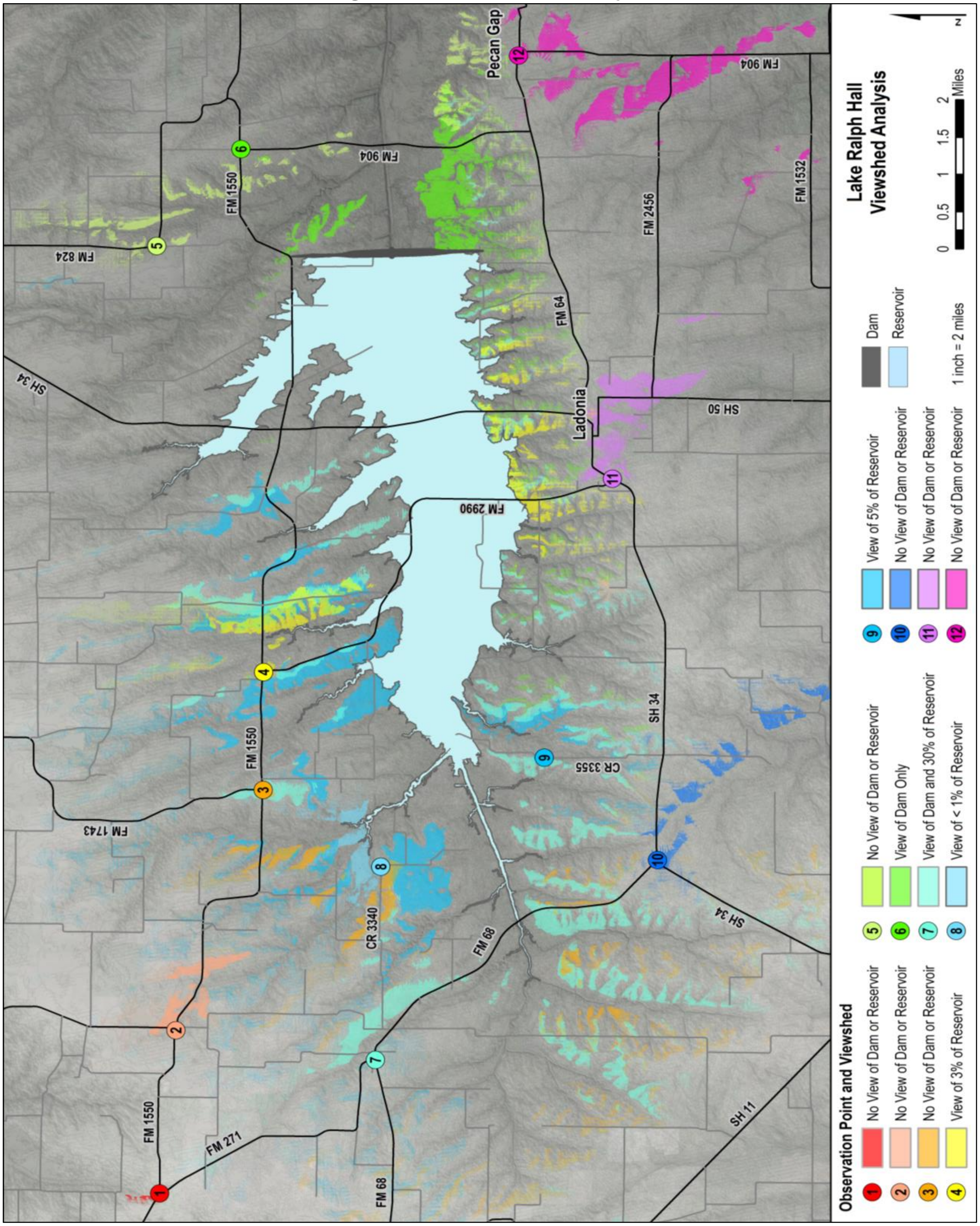


Photo 4-4: Simulated view of Proposed Lake Ralph Hall looking at the SH 34 Bridge

Figure 4-6: Viewshed Analysis



Source: Michael Baker International

4.10.2 Cumulative Effects

4.10.2.1 No Action Alternative

The No Action Alternative would not change the appearance of the North Sulphur River or the surrounding area. Cumulatively, over the long run, by not developing a lake with a protected green perimeter, the No Action Alternative may be considered more or less attractive to observers than the proposed project depending on what types of development occur within the area instead of the proposed project. Continued erosion of the river and its tributaries along with additional bank failures would be consistent with the current condition.

4.10.2.2 Proposed Action

The proposed Lake Ralph Hall would cause a large change to the existing visual appearance of a part of Fannin County, which is now largely rural and agricultural. This change of more than 7,000 acres, coupled with the visual changes to more than 17,000 acres resulting from the BDL, can be considered substantial to Fannin County, although both projects do not share a common viewshed. Over time, as the population of the county increases, its rural appearance would gradually fade as it becomes more developed and populous. In this scenario, the open space and "natural areas" represented by both lakes and their adjacent areas could become a valued asset of the county.

4.11 Biological Resources

4.11.1 Environmental Consequences

4.11.1.1 No Action Alternative

Habitat

Under the No Action Alternative, the project area would not be flooded. However, the North Sulphur River and its major tributaries would continue to erode and degrade habitat surrounding these areas.

Wildlife

Current conditions of the North Sulphur River would exist under the No Action Alternative. The wildlife species more intolerant of human activity have declined, while the more tolerant species have flourished in this area. The area could continue to experience changes primarily related to agriculture and local recreation related to hunting and fishing.

Aquatic Biota

Current conditions of the North Sulphur River would exist under the No Action Alternative. The aquatic organisms inhabiting the North Sulphur River and its tributaries would continue to experience limited habitat due to continued erosion.

Invasive Species

Current conditions of the North Sulphur River would exist under the No Action Alternative. Increased urbanization and development could cause surface disturbances through construction activities facilitating the establishment and spread of invasive noxious weeds. During construction, aggressive non-native species could become established if ground disturbance is extensive and lengthy. Invasive species could be transported to other areas by construction equipment (U.S. Federal Highway Administration [FHWA], 1999). In general, invasive species can harm native flora and fauna in a number of ways, such as by preying on them, out-competing them for food and other resources (e.g., sunlight), preventing them from reproducing, changing food webs, and modifying ecosystem conditions. Overall effects of invasive species under the No Action Alternative are expected to be minimal.

4.11.1.2 Proposed Action

Habitat

The Wildlife Habitat Appraisal Procedure (WHAP) was used to quantify land use cover type acreages to be eliminated within the lake area including the conservation pool, dam embankment, and spillway areas (**Table 4-8**). 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 4-8: Habitat Area Lost by Cover Type for the Proposed Action

Land Use Cover Type	Area (acres)
Grasses	1,435
Pasture	2,192
Partially Wooded Areas	516
Young Forest	1,299
Forest	602
Cropland	1,720
Total Assessment Area	**7,764**

Source: UTRWD, 2009b.

Since the overall quality of vegetative resources within the proposed project area has been substantially degraded by agricultural usage and the significant continuing erosion problems experienced as a result of historical channelization projects along the river, minimal loss of moderate quality vegetative resources is anticipated as a result of the proposed project. Beneficial opportunities exist with the development of the proposed Lake Ralph Hall. The reservoir would help stabilize the North Sulphur River watershed by reducing habitat loss and conversion from currently on-going severe erosion. The reservoir would also create and enhance habitat for local and migratory wildlife through the anticipated creation of at least eight acres of fringe wetlands along the proposed reservoir shoreline (UTRWD, 2019b). Mudflats may also be created in shallow flooded areas, especially in the upstream portion of the reservoir.

Approximately 69 percent of the potential vegetated impact area for the proposed reservoir is currently under agricultural production (cropland, grasses, and pasture). Land use area identified as partially wooded areas, representing another 6.6 percent, is also used for grazing livestock. Acreage with woody vegetation (forest, young forest, and partially wooded areas) represents approximately 31 percent of the proposed project area, but over half of this acreage is in young regrowth forest with areas classified as partially wooded areas, characterized as grassland with scattered trees, representing about one-quarter of the wooded vegetation area. The remaining wooded vegetation area is characterized as more mature re-growth following historical clearing of the area for cotton growing in the late 1800s and early 1900s. These wooded areas provide some moderate quality habitat, but these areas are fragmented reducing their overall ability to support wildlife populations.

Approximately 300 acres of Federal land (within the Caddo National grasslands – Ladonia Tract representing the Caddo Wildlife Management Area (WMA) – 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. These native grassland areas are being managed to preserve and enhance native prairie habitat and currently provide moderate quality habitat. Due to the discontinuity of the managed lands (the Ladonia Unit of the Caddo National Grassland WMA consists of separate, non-contiguous land tracts) effectiveness of management plans as well as wildlife and public utilization of these areas are reduced. Woody invaders such as eastern red cedar, honey locust, and cedar elm currently dominate substantial areas being managed as native grassland. Overall, although the type of vegetation communities to be impacted are common and degraded, because of the large size of the area to be converted to another and more uncommon type, the effects would be considered major.

The Lake Ralph Hall Raw Water Pipeline Alignment is within the Blackland Prairie Ecoregion which consists of agricultural lands and grasslands with isolated forested or wooded areas. During construction of the Lake Ralph Hall Raw Water Pipeline Alignment existing vegetation would be disturbed. The pipeline route would be maintained within a 100-ft ROW. The majority of vegetation within this pipeline corridor consists of cropland, pasture/hay, and herbaceous grasslands. This area would be re-vegetated and certain non-structural uses such as agriculture and rangeland could be used along the alignment. The pipeline does not impact the Caddo National Grasslands, however it does impact some wooded areas.

The proposed project would convert approximately 4.5-acres of disturbed grassland to a balancing reservoir. Construction of the proposed balancing reservoir would not affect habitat.

Wildlife

Although some displacement of wildlife would occur with the inundation as a result of the proposed project, the overall current state of degradation of habitat and isolation of remaining moderate quality habitat within the project area indicates that these impacts would be moderate. In some cases, animal burrows may be inundated if they are located within the conservation pool of the reservoir. This would impact individuals of a particular species but would not constitute population level effects. Some ground nesting bird species could be accidentally displaced, injured or killed as a result of inundation. Similarly, birds nesting and/or foraging in this area could also be disturbed. All required permits would be obtained prior to construction. Nesting birds, wildlife in burrows, and less- mobile wildlife would also be impacted by vegetation clearing and ground disturbance within the lake footprint and construction of the dam and State Highway (SH) 34 bridge. Construction can result in temporary increases in noise due to the presence of workers and equipment needed to perform construction. Increase in noise and presence of workers may cause any wildlife to leave the area temporarily. Typically, wildlife would return after construction is completed and the heavy equipment vacates the area.

Wildlife that could occur along the pipeline ROW would potentially experience varying degrees of adverse impacts. The majority of the vegetation within this pipeline corridor consists of cropland, pasture/hay, and herbaceous grasslands. Wildlife species that inhabit this vegetation type include quail, mourning doves, meadowlark, field sparrow, hawks, cottontail, and red fox. Game species within this vegetation type include quail, mourning dove, fox squirrel, and waterfowl.

There are also 105 acres of wooded areas that would be impacted by the Lake Ralph Hall Raw Water Pipeline Alignment. Wildlife within wooded areas could include mourning dove, quail, squirrel, rabbit, raccoon, skunk, opossum, wild turkey, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, deer, and bear. In some cases, animal burrows may need to be removed or filled when they are located in close proximity to the pipeline alignment. Such activities would impact individuals of a particular species but would not constitute population level effects. Construction can result in temporary increases in noise which may cause any wildlife to leave the area temporarily. Wildlife would typically return after construction is completed and the heavy equipment vacates the area.

Several species of greatest conservation need (SGCN) as identified by TPWD have the potential to be impacted or disturbed by project activities based on the presence of potentially suitable habitat, the species' mobility, and the species' life history requirements. These SGCN include the southern crawfish frog, the western burrowing owl, the plains spotted skunk, the Texas garter snake, a crayfish, the Topeka purple-coneflower, and Hall's prairie clover.

In Texas, pursuant to a U.S. Court of the Appeals for the Fifth Circuit 2015 decision, and pursuant to a legal memo issued by the Department of Interior dated December 22, 2017, the MBTA prohibits intentional acts (not omissions) that directly (not indirectly or accidentally) kill migratory birds. Consequently, UTRWD is only required to comply with the MBTA in a way to avoid intentional takings of migratory birds.

Construction activities would have minimal effects on migratory birds, their nests, or eggs. Some ground nesting species could be accidentally displaced, injured or killed as a result of construction activities but personnel would be trained to avoid disturbing birds and nests when present within a work area. Similarly, birds nesting and/or foraging in this area could also be disturbed during construction activities.

The proposed project would convert approximately 4.5-acres of disturbed grassland to a balancing reservoir. Impacts to wildlife from construction of the proposed balancing reservoir would be negligible.

Aquatic Biota

As described in **Section 3.11.3**, aquatic organisms occupy pools within the North Sulphur River in the proposed Lake Ralph Hall footprint. The North Sulphur River within the proposed Lake Ralph footprint is an intermittent stream that normally experiences periods of no flow. Fish species sampled in the North Sulphur River within the proposed Lake Ralph Hall footprint are included in **Table 4-9**.

Table 4-9: Fish Species Sampled in the North Sulphur River within the Proposed Lake Ralph Hall Footprint

Scientific Name	Common Name
Ameiurus melas	Black bullhead
Ameiurus natalis	Yellow bullhead
Campostoma anomalum	Central stoneroller
Cyprinella lutrensis	Red shiner
Fundulus notatus	Blackstripe topminnow
Gambusia affinis	Western mosquitofish
Ictalurus punctatus	Channel catfish
Lepomis cyanellus	Green sunfish
Lepomis humilis	Orangespotted sunfish
Lepomis macrochirus	Bluegill
Lepomis megalotis	Longear sunfish
Micropterus salmoides	Largemouth bass
Pimephales vigilax	Bullhead minnow

Source: SRBA, 2008

The limited aquatic habitat in the North Sulphur River would be converted to open water and a more stable lacustrine environment. With the exception of the central stoneroller, all the species in **Table 4-9** occupy lacustrine environments and are found in other Texas reservoirs. Additional species that normally occur in Texas reservoirs could also be abundant in the proposed Lake Ralph Hall once constructed.

Invertebrates occupying the North Sulphur River within the Lake Ralph Hall footprint consist of those that typically inhabit intermittent streams. However, due to the limited available habitat within the existing stream, impacts to these species is expected to be minimal. The aquatic habitat available for invertebrates would be converted from an intermittent stream habitat to a lacustrine habitat. Therefore, the invertebrate species community would change from riverine species to a community more adapted for a lacustrine habitat.

As previously described, aquatic organisms occupy pools within the North Sulphur River channel downstream from the proposed Lake Ralph Hall Dam location. The aquatic biological community within these pools is dependent on water quality conditions and available habitat within each pool. Changes in water levels within stream pools can lead to changes in water quality including changes in pH, dissolved oxygen, conductivity, siltation level, and concentrations of ions, toxins, or pollutants (Williams, 1987; Stanley et al., 1994; Lake, 2000). These changes affect the composition and interactions of the macroinvertebrate communities within stream pools. Taxa can vary seasonally within pools as flow velocities and water levels change in intermittent streams. In addition, water quality in adjacent pools within the same reach can vary substantially in nutrient concentrations and dissolved oxygen levels as water levels decrease. As water quality within stream pools change, the macroinvertebrate community changes and adapts to conditions within the pool. In addition, other factors such as species competition, and predators such as fish, amphibians, and birds can affect the abundance, density, and taxonomic composition of the macroinvertebrate community (Xerces Society for Invertebrate Conservation, n.d.).

In order to provide a conservative estimate of impacts to aquatic organisms within North Sulphur River pools, model calculations for pools >75 full were used. This method assumes aquatic organisms are impacted in pools experiencing decreasing levels from 100 percent full to 75 percent full.

Sampling conducted by the applicant and Sulphur River Basin Authority (SRBA) indicated the presence of opportunistic invertebrates sustained by pools within the river channel. These pools ranged in depth from five centimeters to 22 centimeters. The majority of organisms sampled are tolerant to poor water quality and low dissolved oxygen levels. Based on the biological sampling efforts conducted, comparable habitat for opportunistic invertebrates also exists downstream of the proposed Lake Ralph Hall Dam location. Therefore, similar aquatic organisms would be impacted in downstream pools experiencing decreasing flows and water levels.

According to the DiNatale Water Consultant (2016b) Daily Model, the majority of impacts to pools >75 percent full in the North Sulphur River would occur between the Lake Ralph Hall Dam site and Baker Creek (**Figure 4-7** and **Table 4-10**). This reach of the North Sulphur River will also be filled with earthen fill consisting of native clay soils excavated from the project area, eliminating this pool area. Pools in reaches below Baker Creek would experience lower levels of change ranging from 0.0 percent to 6.0 percent. It is anticipated impacts to aquatic organisms in pools with decreasing levels would occur between the proposed Lake Ralph Hall dam and the

Cooper Gage. These effects would be minor. Both the RiverWare Model and WAM Model indicated almost no change to reaches below the Cooper Gage. Impacts to aquatic biota would be moderate.

Figure 4-7: Percent Change to Pools Greater Than 75 Percent Full

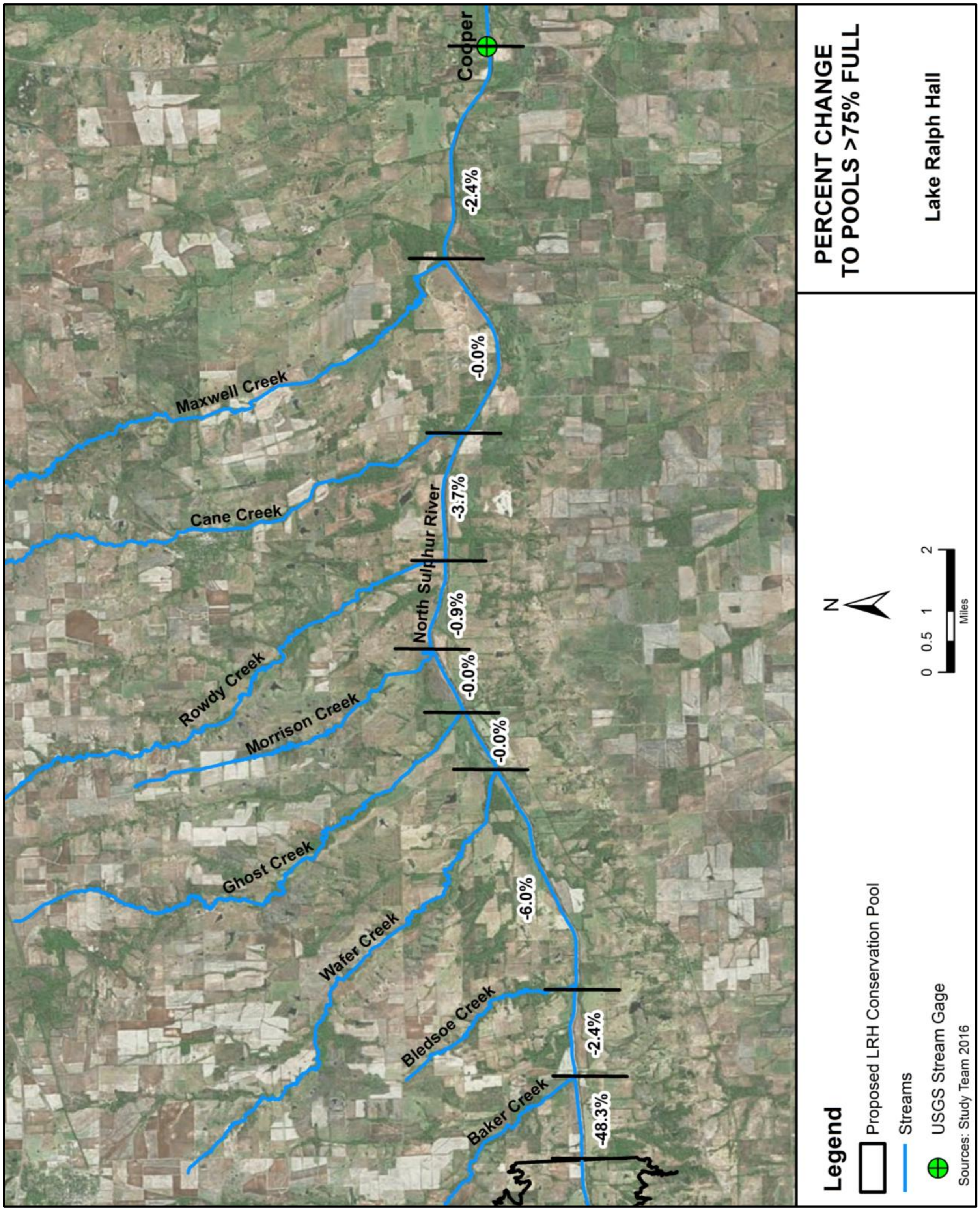


Table 4-10: Percent of Time Pools are > 75 Percent Full (1994 to 2014 Study Period)

Reach	Without LRH	With LRH	Difference
Downstream of Lake Ralph Hall Dam Site	81.9%	33.6%	-48.3%
Downstream of mouth of Baker Creek	80.2%	77.8%	-2.4%
Downstream of mouth of Bledsoe Creek	76.6%	70.5%	-6.0%
Downstream of mouth of Wafer Creek	77.2%	77.2%	0.0%
Downstream of mouth of Ghost Creek	80.3%	80.3%	0.0%
Downstream of mouth of Morrison Creek	73.5%	72.6%	-0.9%
Downstream of mouth of Rowdy Creek	71.9%	68.2%	-3.7%
Downstream of mouth of Cane Creek	74.2%	74.2%	0.0%
Downstream of mouth of Maxwell Creek*	68.3%	65.9%	-2.4%

Source: DiNatale Water Consultant, 2016b
*Reach Ends at Cooper Gage

Temporary impacts to aquatic biota would be avoided by using horizontal directional drilling to install the pipeline at significant stream crossings and staging areas would be located within uplands. Significant streams are those which, at the time of construction, have standing water below the OHWM. When open trench crossings are used, associated impacts will be temporary in nature. Upon completion, temporary fill for cofferdams or other construction materials will be removed from the stream, the bed and bank contours below the OHWM will be restored, and the stream will be stabilized using appropriate post-construction best management practices in accordance with U.S. Army Corps of Engineers section 404 permit and Texas Commission on Environmental Quality section 401 Water Quality Certification and Stormwater Construction General Permit conditions. These include methods for erosion control, post-construction total suspended solids control, and sedimentation control. If contaminated dredge material that was not anticipated is encountered, operations shall cease immediately. 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 aquatic biota would be none to negligible.

The proposed project would convert approximately 4.5-acres of disturbed grassland to a balancing reservoir. Construction of the proposed balancing reservoir would have no effect on aquatic biota.

Invasive Species

The spread of invasive plant species is often attributed to disturbed soils. During the construction phase, invasive terrestrial plant species may invade disturbed areas and continue to inhabit these areas during the long-term operation of the proposed Lake Ralph Hall.

Aquatic invasive species known to occur in Texas reservoirs (e.g., Zebra mussels) may spread to Lake Ralph Hall if recreational boating is allowed. Aquatic invasive species are known to be transported from reservoir to reservoir via watercraft and/or trailers.

Impacts from invasive species would be moderate.

4.11.2 Cumulative Effects

4.11.2.1 No Action Alternative

Under the No Action Alternative, the continued erosion of the North Sulphur River downstream of the proposed project and degradation of habitat surrounding these areas would continue. In addition, this trend would also continue to degrade habitat and impact aquatic biota in the North Sulphur River. While urbanization will also occur in Fannin County and likely include the North Sulphur watershed, no adverse cumulative impacts to wildlife are anticipated from the No Action Alternative. Additionally, the No Action Alternative would not increase or reduce the spread of invasive species within the study area.

4.11.2.2 Proposed Action

Past and present actions that contribute to the cumulative effect on vegetation, wildlife and aquatic biota within the North Sulphur River Watershed includes approximately 19,070 acres of urban areas and roadways (0.6 percent of the North Sulphur River Watershed). Past and present development of cities and roadways within the watershed can cause a decrease in natural habitat vegetation, wildlife utilization as well as indirect effects to the aquatic environment. These impacts are local and the development of urban areas and roadways has had a low relative contribution to cumulative effects on these factors in the North Sulphur River Watershed.

Minimal to no production from oil and gas wells that have been drilled has occurred within the North Sulphur River Watershed. The land area required for drilling and production of a well is approximately two acres. Since there is minimal to no production from wells within the watershed and with more stringent environmental regulations and requirements for wells, impacts to vegetation and wildlife within the North Sulphur River Watershed are minimal. Well placement does not normally occur within major streams and rivers but may include some actions within wetlands. Due to these factors, the relative contributions of oil and gas production to effects on vegetation, wildlife and aquatic biology in the North Sulphur River Watershed have been low.

Logging operations cause a decrease in vegetation type and associated wildlife utilization; 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. Nonpoint source pollution can impact water quality and also aquatic species. The amount of forest land within the North Sulphur Watershed is relatively low and timber production via logging operations has had a low relative contribution to cumulative effects on water quality and aquatic species.

Local land uses in the vicinity of Lake Ralph Hall predominantly consist of agricultural uses. Decreases in diversity of vegetation have occurred as well as associated wildlife utilization. However, such conditions are not major departures from initial conditions. Channelization of the North Sulphur River also was an action related to agricultural land use which has greatly modified the conditions of the river and its tributaries. Non-point source contributions to the aquatic ecosystem have also occurred from such uses and contribute to the conditions that exist. No additional agricultural reasonable foreseeable future actions (RFFA) have been identified that would contribute to cumulative effects to vegetation, wildlife or aquatic biota resources. Trends in land use as described in **Section 4.1** would involve positive and negative contributions to these resource categories.

There is also a small portion of the Caddo National Grasslands, scattered residential associated with the agricultural land, and timbering operations on forested areas. Local wildlife related recreational activities such as hunting and fishing within the project footprint would also be affected. Hunting activities that occur on the Caddo National Grasslands within the project footprint would cease upon construction and operation of Lake Ralph Hall. Past and present hunting and fishing within the project area have had low contributed effects on wildlife and are expected to continue. However, fishing opportunities may be provided by Lake Ralph Hall and hunting would still occur on the remaining portion of the Caddo National Grasslands.

If recreational activities are allowed in Lake Ralph Hall, they would contribute positively to cumulative effects on aquatic species in the vicinity of Lake Ralph Hall. These relative contributions in relation to aquatic species due the creation of a large waterbody, associated habitats and possible stocking for recreational use would be considered moderate.

Overall, the above factors indicate limited past and present actions that contribute to cumulative effects. Those, coupled with no identification of any major RFFAs or expected changes in the watershed lead to the conclusion that cumulative effects to vegetation, wildlife and aquatic biota will be minor.

The local land use within the 100-ft corridor for the pipeline primarily consists of agricultural land. Once the pipelines are in place and the disturbed lands are properly reclaimed, previous land uses and associated vegetation with the exception of forested communities can be restored within the pipeline corridors. Contribution of the pipeline activities to cumulative effects is considered negligible.

4.12 Threatened and Endangered Species

4.12.1 Environmental Consequences

4.12.1.1 No Action Alternative

No impacts to threatened or endangered species would result from the No Action Alternative.

4.12.1.2 Proposed Action

The proposed Lake Ralph Hall would be located in Fannin County. As mentioned in **Section 3.12**, the U.S. Fish and Wildlife Service (USFWS) lists the least tern (*Sterna antillarum*) as an endangered species occurring or potentially occurring in Fannin County. In addition, the USFWS lists the piping plover (*Charadrius melodus*) and red knot (*Calidris canutus rufa*) as threatened species occurring or potentially occurring in Fannin County (USFWS, 2019). However, the USFWS has directed that, for planning purposes, the piping plover and red knot only need to be considered for wind energy projects.

Impacts to the interior least tern nesting habitat would not result from the project because traditional habitats such as sand and gravel bars are not present within the project area. Due to the eroded and channelized state of the North Sulphur River riparian zone, preferred habitat for the red knot and piping plover does not occur in the project area. Additionally, the USFWS has directed that, for planning purposes, the piping plover and red knot only need to be considered for wind energy projects. Therefore, impacts to these species would not result from the construction of the Proposed Action. Designated critical habitat is not present for any of the federal-listed endangered or threatened species in this area, and none of the species were observed during the on-site investigations.

The Texas Parks and Wildlife Department (TPWD) also lists species that have a high potential to be federally listed in the future if conservation actions are not implemented. No species are state listed as endangered within Fannin County. The following species are state listed as threatened within Fannin County: bald eagle, white-faced ibis, wood stork, paddlefish, shovelnose sturgeon, black bear, and Texas horned lizard.

Based on observations during the on-site investigations and evaluations of preferred habitat for the federal and state listed protected species, the Proposed Action would not impact any listed species. Inundation due to the Proposed Action could potentially provide feeding and stopover habitat for the piping plover and red knot. Also, species such as the bald eagle and interior least tern may occur near surface-water reservoirs.

The Lake Ralph Hall Raw Water Pipeline Alignment crosses through Fannin, Hunt, and Collin counties. The USFWS lists the endangered least tern as potentially occurring in Fannin County and the endangered whooping crane as potentially occurring in Collin County. In addition, USFWS lists the piping plover and red knot as threatened species occurring or potentially occurring in Fannin, Hunt, and Collin counties.

TPWD does not list any endangered species occurring within Fannin, Hunt, or Collin counties. However, TPWD lists the following species as threatened within Fannin, Hunt, or Collin counties: white faced ibis, wood stork, bald eagle, shovelnose sturgeon, paddlefish, black bear, alligator snapping turtle, northern scarlet snake, Texas horned lizard, timber rattlesnake, Texas pigtoe, southern hickorynut, Louisiana pigtoe, and Texas heelsplitter.

The pipeline alignment crosses habitat that mainly consists of agricultural lands and grasslands with isolated forested or wooded areas. Cropland, pasture/hay, and herbaceous grasslands make up the majority of the vegetation within the 100-ft ROW pipeline corridor. The timber rattlesnake has been known to occur in forested riparian zones. The pipeline crosses several streams and riparian areas. This species could be potentially impacted by the construction of the pipeline if the snake is present within riparian zones.

There is no suitable habitat for the least tern, piping plover, red knot, bald eagle, alligator snapping turtle, northern scarlet snake, or the Texas horned lizard. Therefore, impacts to these species would not result from the construction of the Lake Ralph Hall Raw Water Pipeline Alignment. The white-faced ibis, whooping crane, and wood stork could possibly be seen migrating through the area, but would not be impacted by construction.

There are also 74 acres discontinuous forest that would be impacted by the Lake Ralph Hall Raw Water Pipeline Alignment. The black bear is currently listed within Fannin and Hunt counties and there are no bottomland hardwood forests and only limited upland hardwood forest in discontinuous forested tracts, therefore the black bear is unlikely to occur within the project area.

Four mollusks that can be found within the Sabine and Sulphur River basins include the Louisiana pigtoe, southern hickorynut, Texas heelsplitter, and the Texas pigtoe. The Lake Ralph Hall Raw Water Pipeline Alignment crosses the Sabine and Sulphur River Basins and has 59 stream crossings with 11,893 linear feet of stream impacts and 0.4 acres of stock tanks located within the 100-ft ROW. If the mollusks occur within the creeks that the alignment crosses, they have the potential to be impacted. Impacts would be minimized and avoided at perennial stream crossings, where mollusks would be most likely to occur, through the use of horizontal directional drilling as the pipeline installation method. The paddlefish and shovelnose sturgeon are listed only within Fannin County and the pipeline does not cross any water resources that would have suitable habitat for these species. Therefore, it is unlikely they would be impacted by the construction of the Lake Ralph Hall Raw Water Pipeline Alignment.

Based on species research and evaluations of preferred habitat for the federal and state listed protected species, it is unlikely there would be impacts to any of the federal listed species for Fannin, Hunt, or Collin counties. The state listed timber rattlesnake, as well as the four state listed mollusks, have the potential to be impacted by the construction of Lake Ralph Hall and the Raw Water Pipeline Alignment.

Impacts to threatened and endangered species would be minor.

4.12.2 Cumulative Effects

4.12.2.1 No Action Alternative

No adverse cumulative impacts to threatened and endangered species are anticipated under the No Action Alternative.

4.12.2.2 Proposed Action

As described above there are 24 federal and/or state listed species within Fannin, Hunt, and Collin counties. There are two species federally listed as endangered species within Fannin, Hunt, and Collin counties (least tern and whooping crane) and two federally listed threatened species (piping plover and red knot). Within those same counties, TPWD state listed eight birds (bald eagle, Eskimo curlew, least tern, peregrine falcon, piping plover, white-faced ibis, whooping crane, and wood stork); five fish (blackside darter, blue sucker, creek chubsucker, paddlefish, and shovelnose sturgeon); two mammals (black bear and red wolf); four mollusks (Louisiana pigtoe, southern hickorynut, Texas heelsplitter, Texas pigtoe); and three reptiles (alligator snapping turtle, Texas horned lizard, and timber rattlesnake) as either threatened or endangered (see **Table 3-23**). Adverse effects to the federally listed threatened or endangered species are not expected to occur as a result of the construction and operation of the Proposed Action. Therefore, no examination of cumulative effects associated with other past, present, and future actions was performed.

4.13 Traffic and Transportation

4.13.1 Environmental Consequence

4.13.1.1 No Action Alternative

Under the No Action Alternative, land use changes within the region are expected to occur as a result of long-term population growth and associated development pressure. This growth may result in an increase in traffic on the local and regional transportation network. The existing roadway network is expected to be able to accommodate increases in traffic resulting from this long-term growth. However, as discussed later in **Section 4.17**, the actions to be taken due to the issues associated with developing groundwater and other actions under the No Action Alternative could influence growth patterns within the UTRWD service area as well as elsewhere in the Dallas metropolitan area.

4.13.1.2 Proposed Action

During construction of the dam, reservoir, and principal and emergency spillways congestion would increase in the immediate area due to additional construction vehicles, delays caused by construction activities (i.e., roads temporarily reduced to a single lane), and road closures and detours. As discussed later in **Section 4.17**, an estimated 290 workers per year are anticipated to be needed to construct Lake Ralph Hall, with the majority of them driving from Bonham, Paris, and Greenville. While the existing transportation infrastructure not directly affected (e.g., road eliminations and reconstruction) or associated with construction of the dam, reservoir, and principal and emergency spillways would be sufficient to support the increase in vehicle traffic resulting from the construction activities described above and because some roadways would be relocated, moderate impacts on traffic and transportation resources would occur.

State Highway 34 crosses the project boundary near the east/west center of the proposed Lake Ralph Hall. The construction of two bridges over separate portions of the proposed lake will require realignment of the existing highway in order to maintain access during construction. The adjustments made to SH 34 will consist of a new parallel alignment to the west of the existing roadway north and south of the North Sulphur River and north and south of Merrill Creek. The new roadway will consist of two 12-foot wide lanes with two 10-foot wide shoulders. The proposed roadway will connect back to the existing roadway north and south of the project boundaries. All ROW necessary for the construction of the new alignment and the bridge structures will be dedicated to TxDOT by UTRWD prior to construction.

The proposed Lake Ralph Hall Bridge will be approximately 6,000 foot in length with an overall deck width of 46’ to accommodate two-12’ wide lanes (one lane in each direction) with 10’ wide shoulders. The proposed Merrill Creek Bridge will be approximately 625’ in length with an overall deck width of 46’ to accommodate two-12’ wide lanes (one lane in each direction) with 10’ wide shoulders.

In order to successfully implement the proposed Lake Ralph Hall, key roads would require adjustments to alignment and grade (**Figure 4-8** and **Table 4-11**). The following County Roads would be abandoned or partially abandoned as a result of the impoundment of the proposed Lake Ralph Hall; FM 2990, CR 1550, CR 3360, CR 3365, CR 3370, CR 3380, CR 3600, CR 3605, CR 3610, and CR 3640. SH 34 and CR 3444 would require vertical adjustment. A short segment of CR 3640 would be adjusted vertically and/or horizontally. County Roads 3443 and 3444 would be re-aligned horizontally and vertically and would include new drainage culverts and a 24-foot road surface with drainage swales on both sides.

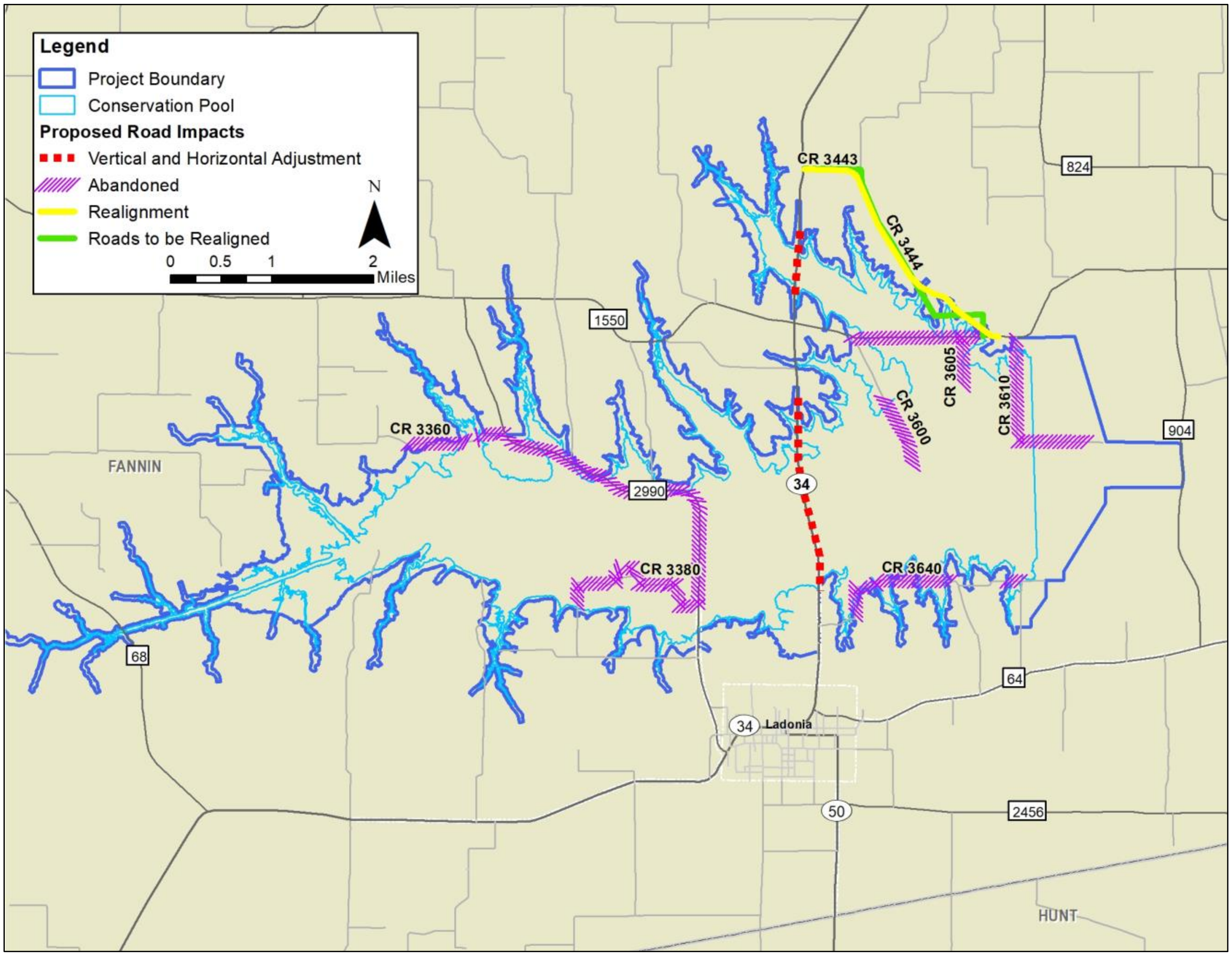
The establishment of the proposed dam, reservoir, and principal and emergency spillways would have noticeable long-term beneficial and adverse effects on transportation resources and traffic. The permanent closure of roadways and rerouting of traffic from some secondary and tertiary roadways in the area would result in adverse effects, while new roads and road improvements would result in beneficial effects.

Table 4-11: Lake Ralph Hall Roadway Impacts

Impacted Roadway	Length of Abandoned Roadway (linear feet)	Length of Horizontal and Vertical Adjustments (linear feet)	Length of Roadway Upgrades (linear feet)	Length of Culvert Improvements (linear feet)
SH 34	0	6,625	12,000	0
FM 2990	19,100	0	0	0
FM 1550	7,000	0	0	0
CR 3360	5,500	0	0	0
CR 3365	500	0	0	0
CR 3370	2,100	0	0	0
CR 3380	7,710	0	0	0
CR 3443	0	0	3,000	50
CR 3444	0	1,600	12,540	400
CR 3600	3,800	0	0	0
CR 3605	2,500	0	0	0
CR 3610	9,000	0	0	0
CR 3640	7,015	0	200	200
Total	**64,225**	**8,225**	**27,740**	**650**

Source: *Proposed Modifications to State and County Roads Due to the Effects of the Proposed Lake Ralph Hall Technical Memorandum*. August 2018.

Figure 4-8: Lake Ralph Hall Roadway Impacts



Source: Proposed Modifications to State and County Roads Due to the Effects of the Proposed Lake Ralph Hall Technical Memorandum August 2018.

Construction of the proposed raw water pipeline would have short-term negligible effects to transportation resources primarily due to construction of pipeline road crossings, additional traffic because of workers' commutes, and additional traffic associated with delivery of equipment and supplies to the proposed sites. When appropriate, use of existing roads and trails to facilitate construction activities would occur.

Operation of the proposed pipeline would not conflict with any existing roadway or interfere with traffic. There would be some very small increases in traffic due to maintenance activities around the pipeline and pump stations; however, overall conditions would remain comparable to existing conditions. Effects on transportation resources would be negligible.

Overall impacts to traffic and transportation would be minor.

4.13.2 Cumulative Effects

4.13.2.1 No Action Alternative

The No Action Alternative would have no direct or indirect effects on transportation in Fannin County; however, land use changes within the region are expected to occur as a result of long-term population growth and associated development pressure, independent of the proposed project. With population growth and correspondingly increased vehicle miles traveled in the future, Fannin and Hunt Counties will need to add capacity to its ground transportation network as do all areas in the process of growth and development. Maintenance and repair of roads will continue.

4.13.2.2 Proposed Action

The study area for the transportation cumulative effects assessment consists of Fannin County and northern Hunt County (to encompass the pipeline footprint). This area was selected as the study area because the roadways affected by the project are local transportation routes and not part of a broader region or statewide transportation network.

The proposed reservoir footprint is traversed by a number of roads and bridges and several of these would be impacted by Lake Ralph Hall, as shown in **Table 4-11** and **Figure 4-8**. The past, present, and reasonably foreseeable actions anticipated to cumulatively impact transportation within the study area include past reservoir projects in the county, the proposed BDL, and the growth of Fannin County.

Based on current proposed construction schedules, the construction phases of Lake Ralph Hall and the BDL 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 transportation facilities and traffic.

4.14 Hazardous Materials

4.14.1 Environmental Consequences

4.14.1.1 No Action Alternative

Under the No Action Alternative, the construction of the dam, reservoir, and pipeline would not occur. No further action is expected to be necessary to address concerns over toxic/hazardous substances or contaminants. There would be no change to the existing conditions discussed in **Section 3.14**.

4.14.1.2 Proposed Action

As described in **Section 3.14**, the August 2018 radius report **(Appendix G**) contained one listing in the conservation pool boundary, one within the project area, and three near the proposed pipeline footprint. 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 inundation area. The property has already been acquired by UTRWD. A search of TCEQ records indicated a violation in 2004 stating "The facility failed to construct and operate waste control facilities and land application areas to protect surface and groundwater in accordance with the technical requirements of 321.38-321.40 of Subchapter B" and was noted as resolved in 2008 when "The operator submitted a Water Quality Plan from the Texas State Soils and Water Conservation Board (TSSWCB)." As the original violation noted dead animals buried onsite and improperly stockpiled manure, it is recommended that the property be inspected and potential water quality contaminants removed prior to inundation.

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. Since no violation was issued and the case was closed, no issues are anticipated due to this listing.

The former Ladonia landfill is listed in the Closed and Abandoned Landfill Inventory (CALF), located on FM 64, approximately 530 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 site limits should be verified prior to construction and avoided.

The City of Celeste landfill is listed as a Municipal Solid Waste Landfill Site (MSWLF). The site is located approximately 740 feet from the proposed pipeline. The site permit was revoked in 1979 and the facility is listed as closed. The site limits should be verified prior to construction and avoided.

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. Coordination with Atmos Energy would need to occur prior to construction of the raw water pipeline.

4.14.2 Cumulative Effects

4.14.2.1 No Action Alternative

Under the No Action Alternative, the construction of the dam, reservoir, and pipeline would not occur. There would be no change to the existing conditions discussed in **Section 3.14.** Therefore, there would be no cumulative impacts relating to hazardous materials for the No Action Alternative.

4.14.2.2 Proposed Action

No impacts related to hazardous materials are anticipated from the proposed action, or from the proposed BDL. Therefore, no cumulative impacts relating to hazardous materials are anticipated.

4.15 Cultural Resources

4.15.1 Environmental Consequences

4.15.1.1 No Action Alternative

<u>Historic Resources</u>
Although the proposed project would not be built under the No Action Alternative, historic surveys have been completed for 75 properties. Many of the sites that have been surveyed are no longer on private property as they have been purchased by UTRWD. It is unknown what would happen to these sites under the No Action Alterative. However, none of the sites surveyed at this time were recommended as eligible for the National Register of Historic Places (NRHP), therefore it is anticipated that impacts to historic resources, if any, from the No Action Alternative would be minor.

<u>Archeological Resources</u>
Although the proposed project would not be built under the No Action Alternative, archeological survey has already been conducted along with cultural resources survey for approximately 15 percent of the project area. Many of the sites that have been surveyed and tested are no longer on private property as they have been purchased by UTRWD. Under the No Action Alternative, the impacts from investigations already conducted for the proposed project could be considered as minor impacts to archeological resources, in addition to those experienced periodically under existing conditions. Under existing conditions, erosion of the North Sulphur River channel and its major tributaries could expose cultural resources.

4.15.1.2 Proposed Action

Historic Resources

National Register Properties

The Proposed Action would have no effect on properties currently listed on the NRHP because none are present on-site.

Historical Markers

There is one historic marker near the proposed pipeline footprint, Marker Number 7822, Texas Sites Atlas 5231007822, representing the “Old National Road Crossing”. No impacts to the marker are anticipated, but if it is determined that the marker needs to be removed during construction it would be reinstalled after construction.

Historic Cemeteries

Two cemeteries were surveyed as part of the 2010 *Historic Resources Survey*. Pleasant Grove and New Harmony Center cemeteries are both located outside the project area, but within the area of potential effects (APE), and not recommended as eligible for the NRHP. The *Historic Survey* contains a list of properties within the APE that were not surveyed due to lack of access. This list includes McFarland Cemetery, Merrill Cemetery, Henslee Cemetery, and Willow Grove Cemetery. However, Merrill Cemetery was included in the archeological survey, as discussed below.

Historic Buildings and Structures

As discussed in **Section 3.15.1.2**, the 2009 field surveys identified 75 properties within the surveyed portions of the APE that include 114 resources. A summary of the historic resources surveyed is listed in **Table 3-25**. None of the resources were recommended as eligible for the NRHP. No properties identified during the initial phase of the survey were recommended for intensive-level study.

Additional historic-age properties may be found in the APE at a later date. Not all resources were able to be seen from the ROW. 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*. 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.

All future cultural resource survey will be done in accordance with the Programmatic Agreement (PA) (**Appendix M**). The PA states that the USACE will determine the NRHP eligibility of all archeological and historical resources identified within the APE in consultation with the State Historic Preservation Office (SHPO) and the Tribes. For all resources determined eligible for inclusion in the NRHP, the USACE will apply the Criteria of Effect to assess whether or not adverse effects will occur to historic properties as a result of the project. In consultation with the SHPO and Tribes, the USACE shall make a determination of effect. For all historic properties that will be adversely affected, an avoidance plan or mitigation plan will be developed in consultation with all consulting parties.

Impacts to historic resources are currently anticipated to be minor, but further study is required.

Archeological Resources

As described in **Section 3.15.2**, an intensive pedestrian archeological survey was conducted along with trench testing of selected areas within the project area in 2005. The *Cultural Resources Survey Report* was submitted to and reviewed by the Texas Historical Commission (THC), the 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 SHPO concurred with the findings of the report.

The survey covered approximately 15 percent of the Proposed Action with the primary focus on the dam site. A total of 17 archeological sites were recorded, which includes seven prehistoric sites and 10 historic sites. **Table 3-26** lists the archeological site numbers, descriptions, and eligibility recommendations for the surveyed sites. Eleven sites were recommended as ineligible for the NRHP or as a State Antiquities Landmark (SAL). Five sites were recommended for further testing or further definition of the deposit. One site, the Merrill Family Cemetery, was recommended to be avoided.

Based upon the results of the survey, the report included recommendations for additional survey of the first terrace surfaces, the lake margin, and deep testing in the proposed borrow pit areas and along the old river and creek channels to search for deeply buried sites. The report concluded that excavation of several prehistoric sites may be required to mitigate the loss of select significant resources and several historic sites warrant preservation.

All future cultural resources survey will be done in accordance with the PA. The PA states that the USACE will determine the NRHP eligibility of all archeological and historical resources identified within the APE in consultation with the SHPO and the Tribes. In consultation with the SHPO and Tribes, the USACE shall make a determination of effect. For archeological sites, the mitigation plan will specify the areas to be excavated, the methods to be used, special samples to be collected, the specialists who will conduct specialized analyses, the problems set forth in the research design that can be addressed by data from the site being excavated, and include reporting methods and curation of artifacts and records.

Impacts to archeological resources would be major.

4.15.2 Cumulative Effects

4.15.2.1 No Action Alternative

Historic and Archeological Resources

There is a continuing, cumulative loss of heritage resources in the area and elsewhere as a result of development, destruction, neglect, and natural processes such as weathering, erosion, and decay. However, construction projects in Fannin County that would impact cultural resources would need to reduce those impacts to below the threshold of significance in order to comply with federal and state laws, though not all construction projects are subject to federal and state historic preservation laws. Therefore, the cumulative impacts from the No Action Alternative would be minimal and primarily associated with the existing conditions including destruction, neglect, and natural processes such as weathering, erosion, and decay.

4.15.2.2 Proposed Action

Historic and Archeological Resources

There is a continuing, cumulative loss of heritage resources in the area and elsewhere as a result of development, destruction, neglect, and natural processes such as weathering, erosion, and decay. In addition, both large reservoir projects (Lake Ralph Hall and the BDL) and other construction projects in Fannin County would impact cultural resources, although both would need to reduce those impacts to below the threshold of significance in order to comply with federal and state laws. It should be noted, not all construction projects are subject to federal and state historic preservation laws.

The PA guides all cultural resources investigations and analysis related to this project. The PA serves as a guidance document that will be relied upon by all parties to ensure that Section 106 requirements are met throughout the life of the project. The PA will be in place for a period of ten years from signing, and is renewable by amendment. For all significant cultural resources that will be adversely affected, an avoidance plan or mitigation plan will be developed by USACE in consultation with the consulting parties. The BDL project has a separate PA that guides the cultural resource investigations and analysis for that project. According to the FEIS, although there would be impacts to cultural resources from the BDL, primarily archeological resources, implementing mitigation measures, as appropriate, would reduce the level of impact on cultural resources in general to below the threshold of significance (USACE, 2017b). Therefore, overall, it is anticipated that there is minimal potential for cumulative effects to cultural resources.

Both the Proposed Action and the proposed BDL would also cause benefits related to cultural resources. The Lake Ralph Hall and BDL projects have triggered intensive research leading to the discovery of previously unknown cultural information that otherwise might have remained unknown and been ultimately lost due to the natural processes associated with weathering and decay.

4.16 Paleontological Resources

4.16.1 Environmental Consequences

4.16.1.1 No Action Alternative

Under the No Action Alternative, no reservoir would be constructed. As discussed in **Section 3.16**, the channelization of the Sulphur River enhanced erosion, which exposes fossils. Under the No Action Alternative, the Ladonia Fossil Park (aka Pete Patterson Fossil Park) would remain in the current location and allow for continued fossil hunting.

4.16.1.2 Proposed Action

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, a covered pavilion and stairway access to the North Sulphur River Channel (**Appendix Q**). 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.

4.16.2 Cumulative Effects

4.16.2.1 No Action Alternative

The No Action Alternative would not change existing paleontological processes or access to the Ladonia Fossil Park (aka Pete Patterson Fossil Park) and therefore would not contribute to cumulative impacts to recreation.

4.16.2.2 Proposed Action

The cumulative impacts study area is the Sulphur River Basin. Past projects include the channelization of the Sulphur River. Reasonably foreseeable future actions include growth in Fannin County, which could lead to development in the Sulphur River Basin that could cause loss of paleontological resources. Cumulative impacts would include the possible loss of scientific data and education value associated with potential fossil resource in the region.

4.17 Socioeconomics

This section describes the socioeconomic impacts of the No Action and Action Alternative associated with Lake Ralph Hall. For each alternative, the following socioeconomic issues are addressed:

- Construction workers and related expenditures
- Inundation or pipeline ROW effects
- Economic effects of recreation
- Economic effects of land use changes, including land development
- Effects on public facilities and services
- Fiscal impacts
- Financial impacts of water costs for UTRWD members and customers

For each of the above socioeconomic issues, this section presents impacts within the primary impact area (PIA) which consists of Fannin County for the Dam Site Alternative and the footprint of the pipeline for the Preferred Pipeline Alternative. The secondary impact area (SIA) includes the surrounding counties where the work force would be drawn from and construction expenditures would occur, and counties the pipeline would pass through. Effects for the State of Texas are also provided as a basis of comparison; little, if any, socioeconomic effects, would take place outside the State of Texas.

4.17.1 Environmental Consequences

4.17.1.1 No Action Alternative

The socioeconomic impacts of the No Action Alternative are examined in this section. Under the No Action Alternative, the USACE would deny UTRWD's application for an individual Section 404 permit. As a result, the proposed Lake Ralph Hall project would not be developed. One of three events would then have to occur:

1) UTRWD would find an alternative source of water;
2) UTRWD's members and customers would find alternative sources of water other than Lake Ralph Hall, including:
    a. Purchasing additional Dallas Water Utilities (DWU) water;
    b. A substitute non-UTRWD water supply project;
    c. Increased groundwater use by members and customers;
    d. Use of agricultural irrigation water.
3) Neither UTRWD nor their members or customers would be able to find sufficient alternative water resources and chronic shortages would occur among UTRWD members and customers.

Under the No Action Alternative, UTRWD would not be able to provide alternate supplies to its members and customers in a timely fashion. **Section 2.0** of this EIS describes alternatives UTRWD might pursue in lieu of Lake Ralph Hall, but in sum, these alternatives will not meet expected demands in a timely fashion. Members and customers would need to identify alternate supplies on their own. It is anticipated that modest amounts of groundwater and the DWU supplies to certain members under the UTRWD/DWU contract would be fully utilized and/or provided. Given that 86 percent of the groundwater resources in Region C are currently being used to meet existing demand, less than 6,800 acre-feet per year would be available to meet the needs of the Applicant's members and customers. If the growth in the UTRWD service area was somehow redirected to those members and customers relying on DWU supplies, those members would reach build out more quickly.

As water becomes less available, UTRWD's members and customers would have to implement more severe and possibly permanent water use restrictions until additional water supplies were secured. These restrictions would have economic effects on those water supply areas, one of which could be to limit and discourage growth in those areas. Dallas is still contractually obliged to provide water for the named entities in the UTRWD/DWU contract. However, as discussed in **Section 2.4.1**, UTRWD has no assurances that these cities will have water available when UTRWD has a need in 2024. This would change the pattern of growth in the UTRWD service area; the named entities would be able to grow more rapidly than currently expected as they absorb growth that would have gone to the parts of the UTRWD service area that can no longer accommodate growth, until they develop additional supplies. The named entities would reach build out sooner than currently expected. Eventually, growth and development would slow within portions of the UTRWD service area until UTRWD or customers and members secure additional water supplies. Some growth that would have gone to the UTRWD service area could be displaced to other areas in and around the Dallas/Fort Worth metropolitan area.

However, according to the Region C and Region G Water Plans, the counties in or surrounding the Dallas/Fort Worth area already have to develop new water supplies to meet currently anticipated future growth. Any redirected growth from UTRWD would accelerate and possibly expand the need for new water supplies and development in those areas. Growth in the UTRWD service area region would be slowed or become more expensive until and unless other longer-term future water projects can be completed.

The socioeconomic impacts of the No Action Alternative would be propelled by UTRWD's commitment to provide water to its members and customers and by the members and customer's commitment to provide water to their service areas. Without Lake Ralph Hall, UTRWD and its members and customers would be forced to deplete their available groundwater resources, impose various levels of water use restrictions, reduce any supply margins of protection such as safety factors, and eventually develop other, non-UTRWD water supplies. Some members and customers might attempt to aggressively acquire additional supplies through markets or trans-basin transfers, and these efforts might forestall shortages. The lack of Lake Ralph Hall or other new supply could cause some municipalities within the UTRWD service area to lower their build out population if they had trouble obtaining additional water supplies. In sum, the actions that would be taken by UTRWD's members and customers are unknown, but it must be recognized that this region will face shortfalls in water supply until another large water supply project is developed.

The socioeconomic impacts of the No Action Alternative would occur as a result of:

1. Slower or lower growth and lower build out population among the non-named entities,
2. Faster growth among the named entities, reaching build out earlier than planned,
3. Additional growth diverted to other areas in the Dallas Metroplex, and
4. Groundwater withdrawals would increase at least to the maximum allowable amount.
5. Members and customers would pursue their own, likely more expensive, water supply opportunities. This could include pursuing their own contracts from others, requiring development entities to bring their own supplies, or other water acquisition strategies, i.e. agricultural water.

Non-Named Entities

As discussed previously, without Lake Ralph Hall, the non-named entities (from the UTRWD/DWU contract) might not be able to identify sufficient alternate supplies on their own, except for a modest amount of groundwater. This could slow their growth, or cause their build out to arrive sooner than planned and at a lower population as water becomes harder or more expensive to obtain. A smaller population would generate fewer tax revenues and lower public sector facility and service costs. However, many of the typical municipal obligations are reliant on fixed costs, i.e., equipment, or other capital outlay. It is generally more efficient to spread these costs out over a larger number of people. Having to pay for large infrastructure projects from a smaller tax base could create financial issues, especially for smaller entities.

Municipal planning efforts would also be negatively impacted. Long-term growth plans lead to capital investment plans, transportation plans and other municipal commitments. If the water supply is unreliable, these plans would be jeopardized, and the municipality's financial commitments become imperiled.

A lack of water also limits the attraction of businesses to an area and the type of businesses that can be accommodated within the municipality. Only businesses with minimal water use (e.g. office or administrative businesses) would be attractive to these water-short municipalities, limiting the commercial base, tax base, as well as the employment opportunities in the area. The inability to meet service and facility demands would lead to public dissatisfaction.

While a lack of growth in the area due to an absence of water is a worst case outcome, a slowdown in, or irregular, growth would still cause harm to the non-named entities as discussed above. The likelihood of the impacts are inversely related with their severity. It is quite likely that with a lack of water growth will slow and/or become more expensive and that water-reliant businesses would choose other locations. However, it is less likely that all growth would cease unless there was no water available at any price.

Named Entities

While the named entities in the UTRWD/DWU contract would still receive all the water they need from DWU, the shortage of water in the surrounding communities would cause issues for these named entities as well. When it is no longer possible in the non-named entities, growth would tend to concentrate within the named entities, causing a higher than planned growth rate and a more rapid build out. Orderly planning could be disrupted. The need for infrastructure could occur sooner than planned. Infrastructure hastily developed would lead to unnecessarily higher costs and further risks of inadequate planning. The result is likely to be inefficient, inadequate planning leading to higher costs and public dissatisfaction.

Other Areas in the Dallas Metroplex

Other areas in the Dallas Metroplex could experience a moderated version of the issues described above for the named entities but on a reduced scale: somewhat higher levels of growth, and build out sooner than planned. While this impact would be noticeable over the long term if another large water supply project is not developed, it would be less concentrated throughout the Dallas Metroplex than in the named entities because the Dallas Metroplex has a greater capacity to absorb the displaced growth. This assumes that the other areas in the Dallas Metroplex continue their water development progress. If their water development stalls, they would quickly be subject to the same type of growth limitations and lower build out issues as the non-named entities described above, at a much greater scale.

Groundwater Withdrawals

Without Lake Ralph Hall, UTRWD's members and customers would be forced to increase groundwater pumping over and above their planned levels in an attempt to maintain their water supply. Given that 86 percent of the groundwater resources in Region C are currently being used to meet existing demand, less than 6,800 acre-feet per year would be available to meet the needs of the Applicant's members and customers.

If UTRWD's members and customers are forced to rely on groundwater as their main source of new water, there would be increased pressure on the limited groundwater resources contained in the local aquifers. TWDB has modeled the aquifers in the North Texas area and developed values for the Modeled Available Ground Water (MAG) for those aquifers. MAG is the value for annual pumping from Ground Water Management Areas (GMA) to achieve the Desired Future Conditions (DFC) for the aquifer. Given the current groundwater pumping rates from the North Texas aquifers, the quantity of local groundwater available to UTRWD members and customers is much less than their need. Increasing pumping beyond the MAG limits would draw down the aquifer beyond what is able to be replenished, causing interference with other groundwater users in the area. Users would no longer be able to practice prudent use of groundwater, as a backup supply during droughts and replenished from surface water during wet years. Users would rely on groundwater every year and as the aquifer gets drawn down, shortages would be exacerbated and occur more often. This level of pumping may not be allowed if the North Texas Groundwater Conservation District's final management plan includes production limitations based on the MAG, as expected. It is possible that members and customers will seek water supplies in other regions, but the costs would be sufficiently high that scale economies would be required. This suggests that UTRWD would be the logical entity to pursue that option; this alternative was rejected in **Chapter 2.0** but might be re-considered under more dire circumstances.

Agricultural Water

The 2016 Region C plan has about 8,700 AF of irrigation supply and about 15,500 AF of livestock supply listed in Region C, for a total of around 24,200 AF. While this total amount would cover the excess demand for UTRWD until almost 2040, it would also require the complete cessation of irrigated agriculture in the 16 Region C counties. The willingness of all irrigators to give up all their water is highly uncertain, but selected opportunities might become evident for agricultural transfers, forestalling shortages for a period of time. Some of this water may be available for municipal use, but it would be expensive and the sources would be very spread out and difficult to aggregate and deliver to a municipality.

Water Restrictions

UTRWD members and customers could resort to more severe and permanent water use restrictions to extend their existing supplies further. However, as noted in the conservation analyses in **Section 1.8**, water use in the UTRWD is reasonably efficient, which suggests that these restrictions would cut into landscaping efforts, and other mostly outdoor uses currently viewed as necessary. Under these circumstances, a negative public response is anticipated.

Recognizing substantial uncertainties, the No Action Alternative could cause moderate to major socioeconomic impacts on UTRWD's members and customers, especially the non-named entities from the Dallas/DWU contract. The difficulties involved in obtaining other water supplies could displace and/or slow growth in the area. The impacts of displaced growth could be considered major, affecting planning, urban service costs, and public satisfaction with local government.

4.17.1.2 Proposed Action

Construction Impacts of the Dam

This section details the direct and indirect impacts of Lake Ralph Hall during construction on the key economic sectors in the PIA, SIA and Texas. All the indirect effects are calculated using the RIMS II from the Bureau of Economic Analysis (n.d.) multipliers for the appropriate region and industry.

In general, the socioeconomic impacts of construction are short-term, i.e., the economic stimulus only occurs during the construction period and ceases when construction is completed. The construction of Lake Ralph Hall is scheduled to commence in late 2019 and take five years to complete. **Table 4-12** breaks down the total costs of the project into the relevant categories to calculate the direct and indirect economic effects of building Lake Ralph Hall.

Table 4-12: Construction Costs for Lake Ralph Hall, 2015 dollars

Project Costs	Cost (millions of dollars)
Materials	$93.8
Labor	$53.6
Supplies	$21.4
Engineering	$47.3
Land Acquisition and Mitigation	$31.1
Total Project Costs	**$247.2**

Note: The engineering and contingency costs (35 percent of the net construction costs) were split into engineering costs (10 percent of the net construction costs) and contingency costs (25 percent of the net construction costs). The contingency costs were then allocated among materials, labor and supplies based on the relative share of each category.

Source: UTRWD, "RFI#3 Response Letter and Attachments", 2010c; HE, 2015

Materials and supplies account for almost half the total project costs and labor accounts for just under one quarter. Spending on these three items would account for the bulk of the benefits to the local area from the project.

The dam-site construction workforce is assumed to be evenly spread over a three-year period; the remainder of the construction activity occurs from the pipeline. To determine the number of workers required for Lake Ralph Hall, the total annual labor costs for the dam were divided by the weighted mean construction wage for the region. The weighting is done to reflect that the workers would come from the PIA, the SIA and the rest of the region. Lake Ralph Hall would require an estimated 290 workers per year to complete. Construction would require various trades, including operators, laborers, carpenters, ironworkers, surveyors, electricians and plumbers. These workers would be drawn from the local and regional workforce. **Table 4-13** shows the mean annual wages and number of employed construction workers for all the PIAs and SIAs, plus Dallas.

Table 4-13: Mean Construction Wages and Number of Workers Employed for Selected Areas, 2nd Quarter 2015

Area	Mean Construction Wages (Annual)	Workers Employed
Fannin County	$30,888	50
Hunt County	$37,752	108
Lamar County	$47,632	373
Collin County	$66,508	3,145
Denton County	$59,592	3,747
Dallas County	$61,880	10,693

Note: The wages are for workers in the Heavy Civil and Engineering Construction industry.

Source: Quarterly Employment and Wages, Texas Workforce Commission Website www.tracer2.com. Accessed November 2015.

There are not enough construction workers in Fannin County to supply the workforce for the dam. However, from the table above, the total number of construction workers in the region is more than adequate to supply the needed workers. There are likely enough workers in the SIA to provide the entire workforce. Some of the specialized skills or less common trade workers may have to come from the Dallas area.

It is assumed that all the workers would commute from their homes daily. There are no hotels and very few transient dwellings in Ladonia for the workers to reside. Most of the construction workers for Lake Ralph Hall would come from the main population centers for the PIA (Bonham) and the SIA (Paris and Greenville), both within 30 miles of the Lake. From the center of Dallas, it is an 80-mile drive to the lake, taking approximately one and a half hours. It is assumed that 10 percent of the workers would come from the PIA and 75 percent from the SIA. The remaining 15 percent would come from elsewhere in Texas, most likely the Dallas area.

The construction of the Lake Ralph Hall Dam would add about $5.4 million in payroll to Fannin County households, $40.2 million to the SIA and a total of $53.6 million in Texas.

Spending on materials and supplies makes up almost half the total spending on Lake Ralph Hall construction. As such, it would have an impact on the regional economy. **Table 4-14** depicts the total materials and supplies costs and where they would be purchased.

Table 4-14: Sales Location of Goods and Services Purchased for Lake Ralph Hall Construction (millions of dollars)

	Total Materials &Supplies Costs	Amount Purchased in:			
		PIA	SIA	Texas	Out of State
LRH	$115.2	$11.5	$28.8	$63.4	$11.5

Source: UTRWD, "RFI#3 Response Letter and Attachments", 2010c; HE, 2015

It is assumed that 10 percent of the materials and supplies would be purchased in the PIA. A further 25 percent would be obtained in the SIA, with 55 percent purchased elsewhere in Texas, and the remaining 10 percent sourced from out of state. While the PIA and the SIA do not have the capacity to provide all the materials required to construct the dam, their proximity to the construction site means that what is available and competitively priced in the area would be purchased there. Texas has a large diversified economy that would be able to provide almost everything required to construct the dam. However, in large construction jobs, there are typically specialty products that are only available from out of state.

Summary of Construction Impacts

In addition to the direct impacts of spending on labor and materials and supplies for Lake Ralph Hall, there would be indirect or induced benefits from the money circulating in the local economies. For example, the 290 new construction workers would spend their wages and increase the incomes of local merchants or the purchase of materials would cause a local supplier to hire new workers to complete the order. These indirect benefits, along with the total benefits, are summarized in **Table 4-15**.

Table 4-15: Summary of Employment, Income and Total Expenditures for the Construction of Lake Ralph Hall

	Direct	Indirect	Total
Employment			
PIA	29	127	156
SIA	217	228	445
Rest of Texas	43	1,353	1,396
Total (Texas)	**290**	**1,708**	**1,998**
Income (millions of dollars)			
PIA	$5.4	$7.4	$12.7
SIA	$40.2	$41.9	$82.1
Rest of Texas	$8.0	$61.6	$69.6
Total (Texas)	**$53.6**	**$110.8**	**$164.4**
Total Expenditures for Goods and Services (millions of dollars)			
PIA	$16.9	$19.3	$36.2
SIA	$69.0	$81.9	$150.9
Rest of Texas	$71.4	$171.6	$243.0
Total (Texas)	**$157.3**	**$272.9**	**$430.2**

Note: Out-of-state impacts are excluded from this table. An estimated 9.5 percent of additional economic effects would occur outside Texas as a result of the project.
Source: HE 2015.

The large indirect effects of the project on the remainder of Texas are attributable to the purchase of construction materials and supplies. The Texas economy is sufficiently diverse to provide almost all construction materials. The total increase in employment would have a small effect in the PIA and the SIA (about a one percent increase in each area). Adding two thousand jobs to the Texas economy, while still a positive impact, would have a negligible relative effect.

Adding $13 million of income to Fannin County (the PIA) would increase total income in that area by about two percent. Aggregate income in the SIA would increase by almost four percent, while the overall impact to Texas is again, positive but negligible.

The increase to the overall economy, as measured by sales of goods and services, follows a similar pattern. The impacts to the PIA and SIA are nine percent and two percent respectively, whereas the overall impacts to Texas are small, but still beneficial.

Overall, the construction phase of Lake Ralph Hall would have temporary but positive economic effects on the local area (PIA and SIA). Employment, income and the size of the local economy would all increase slightly. The construction of Lake Ralph Hall would provide very small short-term benefits to Texas.

Inundation Impacts at Lake Ralph Hall

This section details the direct and indirect impacts on the physical footprint of Lake Ralph Hall. As opposed to the impacts of construction, the inundation impacts are generally long-term in nature. The Lake Ralph Hall project area, the land UTRWD would acquire and retire from current use, would amount to 12,092 acres. The area inundated by Lake Ralph Hall reservoir water would amount to approximately 7,568 acres. The various land types included in the project area and inundation area are provided in **Table 4-16.**

Table 4-16: Lake Ralph Hall Dam Project Area by Land Use Type (acres)

Land Use Type	Conservation Pool	Project Boundary	Approved Jurisdictional Determination Assessment Area
Roads and Buildings	78	102	132
Stream Channels	325	379	387
Cropland	1,654	2,618	2,928
Forest	1,584	2,701	3,065
Grasses	100	193	183
Park Like	229	601	730
Pasture	2,344	3,634	3,732
Young Trees	1,146	1,730	1,784
Open Water (Stock Tanks and On-Channel Ponds	108	134	153
Total	**7,568**	**12,092**	**13,094**

Source: UTRWD email, April 2011 and confirmed in July 2017, Project Boundary Land Use updated as per RFI June 2019a.

The Lake Ralph Hall project area accounts for about two percent of the land area of Fannin County. About half the land affected by Lake Ralph Hall is productive agricultural land, cropland or pasture. This makes up slightly more than one percent of the agricultural land in Fannin County. Forests, grasses and park-like land make up slightly less than half the affected area and account for around six percent of that type of land in Fannin County. As stated in **Section 3.11.1**, there is no bottomland hardwood in the Lake Ralph Hall project area, so that land use type would not be impacted.

Economic Output of Agriculture

Although Lake Ralph Hall would inundate only a small portion of the agricultural land in Fannin County, there would still be economic impacts from this loss of production. The total loss of agricultural production revenues and government payments for the agricultural land taken by Lake Ralph Hall amount to an estimated $837,000 per year (U.S. Department of Agriculture [USDA] 2012, UTRWD 2010c). Total lost agricultural revenue is approximately two percent of the total market value of agricultural products from Fannin County as of 2012.

Households and Population

In addition to agricultural land, Lake Ralph Hall would require some houses and residents to relocate. UTRWD has purchased from willing sellers a little over half of the project area. As of

August 2018, one residence remained in the project boundary and would need to be acquired prior to construction (UTRWD, 2018b).

The number of persons and houses within the project area is negligible relative to the County total, but the project would have an important effect on those required to relocate. From 2009 to 2013, Fannin County had over 250 vacant houses for sale. While this would be more than enough to house the people whose homes would be inundated by Lake Ralph Hall, it is assumed that half the people affected would leave the county, because of Lake Ralph Hall's location in the very southeast end of the county and the immediate proximity to three other counties. House prices in the portions of these three counties closest to Fannin are similar to those in the Lake Ralph Hall area, whereas house prices elsewhere in Fannin County are higher (Shannon, 2011). Lake Ralph Hall would have a minimal impact on the population and number of houses in Fannin County.

Summary of Inundation and Project Area Impacts

The UTRWD acquisition and retirement of project area lands, including inundation, would have a negligible socioeconomic impact in Fannin County. Agriculture-related losses are expected to be $837,000. The loss of agricultural production due to Lake Ralph Hall would cause a loss of 17 jobs in Fannin County, about one tenth of one percent of total employment in the county. The loss of agricultural land also causes a loss of $247,000 in aggregate income to the whole county, a loss of less than one half of one percent of total income for the county. Finally, the overall impact to the economy is a loss of $3.1 million, approximately three quarters of one percent of the local economy. One house occupied as of August 2018 would need to be acquired prior to construction.

Land Development near Lake Ralph Hall

As described in **Section 3.1**, current land use in the project area of the proposed Lake Ralph Hall dam sites is primarily rural and agricultural, similar to unincorporated Fannin County. The Lake Ralph Hall project area includes a conservation pool of about 7,568 acres and a total project area of 12,092 acres. This land would be lost to its current use but could be available for water-based recreation, as discussed as a reasonably foreseeable future action, in the cumulative impacts section.

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, a covered pavilion and stairway access to the North Sulphur River Channel (**Appendix Q**). 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. Because the fossil park would be replaced in kind, it is anticipated that economic impacts associated with tourism to the fossil park would be minimal.

Changes in land use would arise from the inundation and from the change in character for lands surrounding Lake Ralph Hall. Land around the lake would become lake view property. New residential developments are also 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, as discussed in the cumulative impacts section.

Local Governance

The City of Ladonia is adjacent to the southern edge of the lake footprint and the local government is interested and supportive of the lake. It is likely that Ladonia would annex the lake and surrounding acres in the future (Strickland, 2011). City officials see the potential for the lake to bring commerce and jobs to the city. The City has a development plan that anticipates development of Lake Ralph Hall that includes infrastructure improvement recommendations (City of Ladonia, 2007). The development plan found that:

- Almost 80 percent of the City's streets are in poor condition;
- About 67 percent of the City's drainage system were found to be blocked, crushed, or overgrown with vegetation; and
- The water and wastewater systems need to be upgraded

These improvements and possibly other infrastructure upgrades may be necessary to support residential development related to Lake Ralph Hall if the lake is annexed by the City. However, Ladonia has a small tax base which will limit the funds available for needed improvements, and it is unknown if the city will have the funds to make those improvements. The city might eventually bond for facility improvements and institute new customer fees. No tangible planning, zoning or infrastructure improvements or commitments have occurred to date. Fannin County possesses the legal authority to regulate zoning around the proposed lake.

Despite the infrastructure challenges, Lake Ralph Hall's proximity to one of the fastest growing metropolitan areas in the country and the lower cost of housing compared with nearby metropolitan counties suggest conditions that will be favorable for residential development. Nearby Collin and Denton counties have seen substantial growth over the past decade and rapid growth is projected to continue. Lake Ralph Hall is suitable for development for a wide range of uses including primary residences, weekend or second homes, and retirement properties.

Public Facilities and Services

The construction of Lake Ralph Hall may create new demands on government facilities and services including police and emergency services (fire departments), health services and schools. The existing conditions for these services were described in **Section 3.17.5**. Temporary impacts would be related to lake construction and from other potential construction activities such as home and commercial building. Long term impacts to these services related to Lake Ralph Hall would come from changes in population related to land development and from visitor impacts from recreation, as discussed in the cumulative impacts section.

Lake Ralph Hall Law Enforcement

Construction Impacts

During the three year Lake Ralph Hall dam-site construction period almost 300 workers would be engaged in building the lake, annually. Most of these workers would commute from outside the PIA, primarily from the SIA. This influx of workers along with transportation of construction materials and heavy equipment would increase traffic in the area which may lead to more accidents or may increase the need for patrols to monitor speeds on access routes. However, these demands are likely to be minor, and temporary. The Fannin County Sherriff's Department should be able to accommodate these additional demands in the PIA. Impacts from construction on law enforcement within the SIA would be related to traffic impacts and would be temporary, negligible, but negative.

Land Development Impacts

The resulting population growth due to land development near Lake Ralph Hall is projected to occur over many years and at a modest rate. After 20 years, Lake Ralph Hall land development induced population would account for about one percent of total county population. By year 50, this figure would increase to about four percent. The demands created from the new population would require Ladonia to employ its own police force or to increase coverage by the Fannin County Sheriff. Either of these options would create an additional expense for the City and would create a long-term, negative impact for the city. There would be almost no impacts to law enforcement in the SIA as a result of land development around Lake Ralph Hall.

Emergency services

Construction Impacts

Construction work is statistically more dangerous than most occupations. For every 100 employees engaged in the construction of heavy and civil engineering construction, there are 1.1 injuries that result in days away from work each year (U.S. Bureau of Labor Statistics, 2014c). In addition, in 2014 there were 105 fatalities in Texas in the construction industry (U.S. Bureau of Labor Statistics, 2014a). This suggests that additional calls for emergency medical technicians (EMTs) might occur during lake construction. The lake footprint is currently served by the Ladonia and Honey Grove volunteer fire departments. Additional emergency medical calls related to lake construction may strain these small, volunteer agencies. Arrangements for assistance from other agencies, such as the Bonham Fire Department, may be required. This would be a temporary and negative impact. It is unlikely that there would be any impacts to emergency services within the SIA.

Land Development Impacts

The projected population growth around the lake would create a modest increase to the demand for emergency services in the PIA, especially in the area of Lake Ralph Hall. The impacts would be permanent and negative. Impacts to emergency services in the SIA would be negligible.

Health services

Construction Impacts

In the event of construction or traffic related accidents, TMC Bonham (formerly Red River Community Hospital) provides emergency services. In the event of serious or multiple injuries, there are several large medical centers in the SIA that provide a full range of emergency services and that are well-equipped to handle increased demand resulting from Lake Ralph Hall construction activities. Impacts to health services in the PIA and SIA during Lake Ralph Hall construction would be temporary, negative and negligible.

Land Development Impacts

Extensive and well-developed services are available at nearby facilities within the SIA. Any additional demands for health services from the new population would be served by existing facilities and impacts within the PIA and SIA would be negligible.

Education

Construction Impacts

Construction workers are expected to commute to the Lake Ralph Hall site and are not expected to relocate. As a result there would be no increase in population and no impacts to area school districts.

Land Development Impacts

New residential development in the Lake Ralph Hall area would create additional demands on the local school districts. Impacts would occur primarily in the Fannindel Independent School District (ISD), however Honey Grove ISD and Bonham ISD would also be affected. After 30 years, it is projected that there would be about 900 new, full-time residents in developments around the lake. Based on current age distribution in Fannin County, this would suggest a new school age population of around 230. These impacts would occur over a number of years but would require planning for space and personnel by the districts. There would be negligible impacts to education in the SIA.

Inundation Impacts

Some roads surrounding Lake Ralph Hall would be re-routed, others would dead-end at the lake, and some roads would be inundated. Law enforcement and emergency service vehicles may need to adopt new routes and devise the best way to traverse the area around the lake. Certain area residents would also need to alter their travel patterns around the area. While the changes from inundation would be permanent, residents and other drivers would adjust to the change over time.

The inundation of Lake Ralph Hall lands would have little direct impact on other public facilities and services. As of 2011, there are no public facilities within the proposed footprint.

Summary of Public Facilities and Services Impacts

In general, all the impacts to the public facilities and services from the construction phase would be minor and temporary. Any impacts would disappear once the construction is completed. The impacts from land development and inundation would all be long-term and range from minor to moderate.

Fiscal Impacts Related to Lake Ralph Hall

Building and operating Lake Ralph Hall would also have impacts upon local and state government revenues. Both sales and property tax revenues would be affected and different aspects of the project would have positive or negative impacts to government revenues. For example, sales of materials to construct the dam would increase sales tax revenues, while inundating the land would remove it from the property tax rolls, lowering property tax revenue. Fiscal impacts of Lake Ralph Hall are identified below.

Sales Tax

The construction of the dam and future land development would all have a positive effect on sales tax revenues while the inundation would have a negative effect. The net effect overall would be positive.

Construction

The construction phase of Lake Ralph Hall would increase sales tax revenue for the PIA, SIA and the State of Texas. Both a portion of the construction workers wages and the induced income would be spent on taxable items and some of the spending on materials and supplies would be subject to sales tax. **Table 4-17** shows the Lake Ralph Hall sales tax revenue impact on affected jurisdictions.

Table 4-17: Total Sales Tax Generated from the Construction of Lake Ralph Hall

	Area	Employee Spending	Sales of Materials and Supplies	Total
Amount Subject to Sales Tax		$18,383,000	$56,053,000	$74,436,000
Percentage Spent in Region	Fannin	15%	10%	
	SIA	72%	25%	
	Texas	100%	100%	
Sales Tax Rates	Fannin	0.5%	0.5%	
	SIA	0.5%	0.5%	
	Texas	6.25%	6.25%	
Sales Tax Collected	Fannin	$13,000	$28,000	$41,000
	SIA	$66,000	$70,000	$136,000
	Texas	$1,149,000	$3,503,000	$4,652,000

Note: (1) Assumes that the workers from the SIA and Texas spend a small amount (5 percent) of money in the PIA, but that most of the spending subject to sales tax is done in the workers' home region.
(2) All the sales subject to the local taxes are also subject to Texas state sales tax.
(3) Assumes half the materials and supplies costs are subject to sales tax.
(4) Includes direct and indirect effects.

Source: Texas Window on State Government Local Sales and Use Tax, http://www.window.state.tx.us/taxinfo/local/city.html Accessed December 2015; Consumer Expenditure Survey, U.S. Bureau of Labor Statistics, October, 2014b; HE, 2015

For all jurisdictions, the spending on materials and supplies has the most impact on sales tax revenues. An increase of $41,000 corresponds to a six percent increase in sales tax revenue for Fannin County. The increase to the SIA is just over one percent and the relative impact to Texas is negligible. These impacts would be short-term; once construction is completed, this increase in sales tax revenue would cease.

Inundation

The inundation of property would have a negligible impact upon sales tax revenue in Fannin County and no impact to either the SIA or Texas. As previously discussed, two homes would be displaced by the inundation and half of their residents are expected to leave the county. This represents a loss of less than $300 annually in lost sales tax revenue, less than one tenth of one percent of the total.

Land Development

Sales tax impacts from land development would come from two sources, home construction and expenditures by residents in those new homes. The purchase of goods and services for construction, as described earlier in this section, would result in sales tax revenue within the PIA, SIA and Texas. Sales tax projections related to the purchase of materials for home construction at Lake Ralph Hall are provided in **Table 4-18**.

Table 4-18: Sales Tax Revenue Related to Residential Land Development at Lake Ralph Hall, for the PIA, SIA and Texas, Year 1 through Year 50

Area		Year 1	Year 10	Year 20	Year 30	Year 40	Year 50
PIA	Ladonia	$300	$1,520	$3,000	$5,700	$8,300	$12,300
	Honey Grove	$150	$800	$1,520	$2,800	$4,200	$6,200
	Fannin County	$200	$1,010	$2,000	$3,800	$5,600	$8,200
SIA		$1,400	$6,800	$13,700	$17,100	$18,800	$22,200
Texas		$35,400	$177,000	$353,900	$438,800	$478,600	$551,000

Note: All amounts in 2015 dollars.
Source: Harvey Economics, 2016.

The new residents who purchase homes in the developments around Lake Ralph Hall would make expenditures within the local economy. For the purposes of the analysis, it is assumed that in the early years of development, both full and part-time residents would make most of their purchases in the SIA due to a lack of retail outlets in the PIA. Over time, it is assumed that more purchases would be made in the PIA as commercial development occurs. **Table 4-19** provides projected sales tax revenue from expenditures by new full and part-time Fannin County residents, year 1 through year 50.

Table 4-19: Sales Tax Revenue from Expenditures by New Fannin County Residents, for the PIA, SIA and Texas, Year 1 through Year 50

Area		Year 1	Year 10	Year 20	Year 30	Year 40	Year 50
PIA	Ladonia	$20	$1,600	$5,800	$14,500	$27,400	$45,900
	Honey Grove	$20	$2,400	$8,700	$21,700	$41,100	$68,800
	Fannin County	$20	$1,600	$5,800	$14,500	$27,400	$45,900
SIA		$150	$5,300	$15,500	$25,800	$34,100	$40,400
Texas		$2,400	$99,100	$305,500	$579,100	$882,800	$1,239,600

Note: All amounts in 2015 dollars.
Source: Harvey Economics, 2015

The Fannin County 2016 adopted budget projected receipts of about $652,000 in sales tax revenue. The long-term impacts to Fannin County would be positive, increasing revenues about seven percent.

In 2015, the City of Ladonia collected about $24,000 in sales tax revenue. By year 20 of Lake Ralph Hall operations, land development sales tax revenue would have a major, positive impact on the City. By year 50, revenues are projected to increase almost 200 percent over 2015 receipts. Honey Grove would also experience long-term, major, positive impacts from land development sales taxes. Within the much larger economies of the SIA and Texas, sales tax revenue impacts would be long-term, positive, but negligible.

Property Tax

Lake Ralph Hall would affect property tax revenue in Fannin County, but have no impact on property tax revenues in the SIA. The State of Texas does not levy property taxes.

Construction

For the purposes of this analysis it is assumed that the entire project area would be owned by UTRWD and completely vacated when dam construction begins. The impacts to the project area will be discussed in the inundation section.

Inundation

Since UTRWD is a tax-exempt entity, Lake Ralph Hall would remove 12,092 acres from the Fannin County property tax rolls. The assessed value of the affected parcels is totaled in **Table 4-20.**

Table 4-20: Total Property Value for Lake Ralph Hall Inundated Parcels (millions of dollars)

	Value of Buildings	Value of Land	Agricultural Land Valuation	Total Market Value
LRH	$1.4	$3.7	$20.0	$25.1

Note: The total Timber Market Valuation for the LRH affected parcels was zero. Therefore it was not included.
Source: 2016 Update Dam C Land Value Spreadsheet – June 20, 2016.xls, UTRWD, 2016.

The Fannin County Appraisal District appraises the value of land and buildings at market value, but has two special categories for agricultural and timber land. These are assessed based on the best use as agricultural (or timber) land, not the market value for other uses (e.g. potential housing developments). The total property value for the affected area is 0.8 percent of the total assessed value for Fannin County. About eighty percent of the total value of property affected by Lake Ralph Hall is for agricultural value, again showing the importance of agriculture to the area.

The annual loss in property taxes to Fannin County, Ladonia and the three local school districts due to the inundation of Lake Ralph Hall is presented in **Table 4-21**.

Table 4-21: Lost Property Taxes Due to Lake Ralph Hall

2016 Project Area Assessed Value	Lost Property Taxes			
	Fannin County	School Districts	Ladonia	Total
$7,095,000	$16,000	$30,000	$700	**$46,700**

Note: The project area of LRH covers portions of three school districts. Most of the project area is in Fannindel ISD, with parts in Honey Grove ISD and Bonham ISD.
Source: 2016 Update Dam C Land Value Spreadsheet – June 20, 2016.xls, UTRWD, 2016.

The lost property taxes for Fannin County, the school districts and Ladonia are less than one percent of the total property taxes collected by each jurisdiction. Additionally, the loss of property taxes would be reduced through an arrangement reached between UTRWD and Fannin County.

Once UTRWD acquired 5,000 acres of land for the development of the lake, it began making payments to Fannin County to help offset the loss. The first payment occurred in October of 2015. Fannin County will apportion the payments amongst the various local government agencies. The schedule of payments is shown in **Table 4-22**.

Table 4-22: Schedule of UTRWD Payments to Offset Fannin County's Property Tax Loss

Year	Payments
1	$58,000
2	$58,000
3	$58,000
4	$50,500
5	$43,500
6	$36,000
7	$29,000
8	$21,500
9	$14,500
10	$7,000
Total	**$376,000**

Source: Upper Trinity Regional Water District and Fannin County, Texas Agreement Concerning the Development of Proposed Lake Ralph Hall in Fannin County. UTRWD, 2010d.

As seen in **Table 4-22**, the payments start off at approximately the estimated loss to Fannin County and then after three years they begin to decline, until after ten years, the payments cease. However, as the payments are triggered when UTRWD acquired 5,000 acres (44 percent of the total project area), Fannin would still receive property tax revenue from the remainder of the project area. Similarly, by the tenth year, the lake should be completely constructed and development should have started to occur around it. This development would increase the taxable value of the area surrounding the lake and potentially offset the lost revenue from the inundated land. UTRWD acquired the necessary amount of land in 2015, with the first payment occurring in October of that year.

Land Development

The residential land development around Lake Ralph Hall would also generate property tax revenue for the cities, county and school districts, as shown in **Table 4-23**.

Table 4-23: Projected Property Tax Revenue Related to Residential Land Development at Lake Ralph Hall, for the PIA, Year 1 though Year 50

PIA	Year 1	Year 10	Year 20	Year 30	Year 40	Year 50
Ladonia	$2,000	$83,300	$257,000	$487,200	$742,700	$1,042,800
Honey Grove	$1,100	$45,100	$139,100	$263,600	$401,900	$564,300
Fannindel ISD	$6,000	$251,500	$775,600	$1,470,300	$2,241,500	$3,147,300
Honey Grove ISD	$400	$18,800	$57,900	$109,700	$167,300	$234,900
Bonham ISD	$200	$9,700	$29,800	$56,500	$91,700	$128,700
Fannin County	$3,100	$131,100	$404,300	$766,400	$1,168,400	$1,640,600

Note: All amounts in 2015 dollars.
Source: Fannin County Appraisal District http://www.fannincad.org/ and Harvey Economics, 2016b.

In the early years of development, property tax revenue would be quite small and would have little impact on fiscal conditions within the PIA. Over time, these revenues would grow and would have a major, positive impact on the Ladonia, Honey Grove and school districts. For Fannin County, these projected revenues would be moderate and positive. There would be no property tax impacts in the SIA.

As discussed above, it is likely that visitors at Lake Ralph Hall would necessitate additional law enforcement and emergency medical services, either at the county or city level. Additional law enforcement and emergency services are projected to cost about $100,000 beginning in year 1 and reaching about $500,000 by year 50 (Fannin County, 2016a). The increased law enforcement and emergency services expenditures required by the additional land development at Lake Ralph Hall are assumed to be adequate to handle any new demands created by the increased population.

Summary of Fiscal Impacts

The fiscal impacts of Lake Ralph Hall are twofold; there would be losses in both sales and property tax revenue from the inundation of the land, but gains from increased spending due to construction, and land development. The losses in sales tax revenue would be minor, and would be outweighed by the gains. The losses in property tax revenue would similarly be minor and UTRWD is providing money to Fannin County to offset this loss, and the increase in property tax revenue from land development would dwarf the losses.

Lake Ralph Hall Water Pipeline Alignment

The impacts (direct and indirect) of the Lake Ralph Hall pipeline are addressed in this section. The Lake Ralph Hall pipeline travels in a southwesterly direction from the Lake through Fannin and Hunt counties until it reaches Collin County. There, it turns west and connects to the City of Irving pipeline.

The pipeline is a smaller project than the lake (about 30 percent of the total costs), and the effects are spread over multiple counties, rather than at one location, so the benefits are anticipated to be smaller and more spread out. For the pipeline, the PIA is defined as the actual footprint of the pipeline so the impacts to the PIA are expected to be minimal; almost all of the impacts would affect the SIA and the remainder of Texas. The pipeline easement has a 100-ft ROW.

Construction Impacts

The economic effects of construction are short-term in nature; once construction ceases, the benefits cease. These benefits are enumerated in this section. The construction of the Lake Ralph Hall pipeline is expected to take three years to complete and is scheduled to commence in 2021. **Table 4-24** provides a categorization of the total costs to install the Lake Ralph Hall pipeline.

Table 4-24: Construction Costs for the Lake Ralph Hall Pipeline

Project Costs	Cost (millions of dollars)
Materials	$45.5
Labor	$17.4
Supplies	$7.2
Engineering	$5.6
Right-of-Way Easements	$0.6
Total Project Costs	**$76.3**

Note: As with the dam, the contingency costs were allocated amongst the other costs.

Source: UTRWD, "RFI#3 Response Letter and Attachments", 2010c; HE, 2015

About 70 percent of the Lake Ralph Hall pipeline costs are for materials and supplies. Labor makes up almost a quarter of the costs. Much like the lake, spending on these three items would account for the majority of the economic impact to the local areas.

Construction Workforce

The construction workforce is assumed to be evenly spread over the entire period. The Lake Ralph Hall pipeline would require 94 workers per year to install. Unlike the construction of the dam alternatives, no workers would be drawn from the PIA. The SIA is assumed to provide almost all (85 percent) of the workers, with some specialized skills or less common trades workers coming from the Dallas area. Again, all the workers are assumed to commute daily to the job site. Compensation per worker was shown earlier in **Table 4-13** and is assumed to be the same for the pipeline construction workers.

Construction Worker Income

The Lake Ralph Hall pipeline would add $15 million in payroll to the SIA for a total of over $17 million in Texas.

Construction Materials and Supplies

Table 4-24 shows that spending on construction materials and supplies makes up the majority of the spending on the Lake Ralph Hall pipeline. Therefore it would have the greatest impacts on the regional economy. **Table 4-25** displays the total materials and supplies costs for the Lake Ralph Hall pipeline and where they would be sourced from.

Table 4-25: Sales Location of Materials and Supplies Purchased for the Lake Ralph Hall Pipeline (millions of dollars)

	Total Materials &Supplies Costs	Amount Purchased in:			
		PIA	SIA	Texas	Out of State
LRH Pipeline	$52.8	$0.0	$5.3	$42.2	$5.3

Source: UTRWD "RFI#3 Response Letter and Attachments", 2010c; HE, 2015

As most of the costs for materials and supplies would be spent on pipe, which is assumed to be available in Texas, an estimated 80 percent of the purchases would occur in the state (outside the SIA). Both the SIA and out of state vendors would likely each supply 10 percent of the materials and supplies.

Summary of Construction Impacts

The indirect or induced benefits of construction arise from the direct spending being re-circulated through the economy. **Table 4-26** depicts the direct, indirect and total benefits arising from the construction of the Lake Ralph Hall pipeline.

Table 4-26: Summary of Employment, Income and Total Expenditure for the Construction of the Lake Ralph Hall Pipeline

	Direct	Indirect	Total
Employment			
PIA	0	0	0
SIA	80	124	203
Rest of Texas	14	933	947
Total (Texas)	**94**	**1,057**	**1,150**
Income (millions of dollars)			
PIA	-	-	-
SIA	$14.7	$13.0	$27.7
Rest of Texas	$2.6	$37.9	$40.5
Total (Texas)	**$17.4**	**$50.9**	**$68.2**
Total Expenditures for Goods and Services (millions of dollars)			
PIA	-	-	-
SIA	$20.0	$20.3	$40.4
Rest of Texas	$44.8	$111.2	$156.0
Total (Texas)	**$64.9**	**$131.5**	**$196.3**

Note: Out-of-state impacts are excluded from this table. An estimated 9 percent of additional economic effects would occur outside Texas as a result of the project.

Source: HE, 2015.

For reasons discussed previously, there are no economic benefits accruing to the PIA. Any temporary impacts that occur to the PIA during the construction phase are addressed in the Right-of-Way Aspects section below.

Adding 200 new jobs to the SIA, or 900 jobs to Texas is a positive but negligible impact in terms of the overall jobs market in those areas. The addition of about $28 million in income would result in a 0.1 percent increase in total income for the SIA. The impact to Texas would also be positive, but negligible. There is projected to be a 0.1 percent increase to the overall economy in the SIA from the sales of goods and services, while the impacts to Texas are small, but favorable. Overall the construction of the Lake Ralph Hall pipeline would have a small benefit to the SIA and negligible benefits to Texas, but the impacts would be positive.

Right-of-Way Aspects

This section outlines the ROW impacts of the Lake Ralph Hall pipeline. UTRWD would purchase ROW easements that would allow the land user to return the land to its prior use once construction is finished. The future land is mostly unaffected as long as UTRWD can access the pipeline should that be necessary. **Table 4-27** shows the acreage affected by the Lake Ralph Hall pipeline ROW broken down by land use type.

Table 4-27: Lake Ralph Hall Pipeline Right-of-Way by Land Use Type (acres)

Land Use Type	Right-of-Way
Roads & Buildings	6
Stream Channels	2
Cropland	80
Forest	74
Grasses	11
Park Like	15
Pasture	180
Young Trees	17
Stock tanks	0
On-Channel Ponds	0
Total	**384**

Note: Rows may not sum due to rounding
Source: UTRWD "June 2018 RFI Response #2, Attachment 1", 2018

The majority of the land use on the pipeline route is agricultural or wooded areas. This will minimize the disruption during installation.

Overall, the disruptions to the ROW would be minor (during the construction phase) and would only impact a portion of the ROW at a time. Also, they would be spread over a number of land owners, so the impact to any particular land owner would be minimal. At worst, farmers would lose a small portion of their cropland for one growing season or pasture land for a few weeks. The disruption would not last for the whole season, but trench digging for a pipeline would mean that a crop would not be grown on that land that season. The permanent impacts would be negligible as the land could be returned to it prior use once installation was completed.

Public Facility and Services Impacts

Since the PIA is the pipeline footprint only, there would be no impacts to public facilities and services related to the Lake Ralph Hall pipeline. SIA impacts are described below.

Law Enforcement

Potential impacts to law enforcement arising from pipeline construction would likely be related to increased traffic from commuting workers and transportation of construction equipment. Temporary road closures may also be necessary, which would create a need for traffic control officers. These effects should be quite small and easily handled by the existing law enforcement agencies within the SIA. These negative impacts would be negligible and temporary.

Emergency Services

Workers engaged in the construction of the Lake Ralph Hall pipeline might be injured or become ill while on the job. Commuting workers might be involved in traffic accidents. The number of such incidents from 94 construction workers is likely to be low and can be handled by the existing emergency services available in the SIA. These negative impacts would be negligible and temporary.

Health Services

A full range of health services are available at several area hospitals and medical centers in the SIA. These existing facilities would be sufficient to handle any additional demand due to construction of the Lake Ralph Hall pipeline. These negative impacts would be negligible and temporary.

Education

There would be no population impacts resulting from construction of the Lake Ralph Hall pipeline and as a result, no impacts to education in the SIA.

Overall, the impacts to public facilities and services from the construction of the Lake Ralph Hall pipeline would be negligible and temporary. The impacts from the operation of the pipeline would be even smaller, but long-term.

Fiscal Impacts Related to the Lake Ralph Hall Pipeline

Building and operating the Lake Ralph Hall pipeline would affect sales tax revenues in the affected regions, but it is not expected to impact property tax revenues. The Lake Ralph Hall pipeline is not expected to significantly change the assessed value of any of the properties that it passes through and consequently, would not change the property taxes collected by the various jurisdictions.

Sales Tax

The impact of the Lake Ralph Hall pipeline on sales tax revenues would be from sales of goods and services and employee spending. These impacts would be temporary and positive.

Construction

The increased spending in the economy, both by workers and for materials and supplies would increase the sales tax revenues to the SIA and Texas. **Table 4-28** shows the sales tax revenue collected by the various jurisdictions from the construction of the Lake Ralph Hall pipeline.

Table 4-28: Total Sales Tax Collected from the Construction of the Lake Ralph Hall Pipeline

	Area	Employee Spending	Sales of Materials and Supplies	Total
Amount Subject to Sales Tax		$7,627,616	$27,567,134	$35,194,760
Percentage Spent in Region	PIA	0%	0%	
	SIA	86%	10%	
	Texas	100%	100%	
Sales Tax Rates	PIA	0.0%	0.0%	
	SIA*	0.5%	0.5%	
	Texas	6.25%	6.25%	
Sales Tax Collected	PIA	$0	$0	$0
	SIA*	$21,802	$9,189	$30,991
	Texas	$476,727	$1,722,946	$2,199,672

Note: (1) Assumes that the workers from Texas spend a small amount (5 percent) of money in the SIA, but that most of the spending subject to sales tax is done in the workers' home region.
(2) All the sales subject to the local taxes are also subject to Texas state sales tax.
(3) Assumes half the materials and supplies costs are subject to sales tax.
(4) Includes direct and indirect effects.
(5) Purchases are assumed to be spread evenly over the three counties making up the SIA. However, Collin County does not levy a county sales tax, so no county taxes are collected on sales in Collin County

Source: Texas Window on State Government Local Sales and Use Tax, http://www.window.state.tx.us/taxinfo/local/city.html Accessed April, 2016; Consumer Expenditure Survey, U.S. Bureau of Labor Statistics, http://www.bls.gov/cex/ Accessed April, 2016; HE, 2016

For the SIA, employee spending has the most impact on sales tax revenues. The increase in sales tax collected due to spending on the Lake Ralph Hall pipeline would be very modest (less than one percent) in all the jurisdictions affected. Also, these impacts are short term, once construction ceases, the revenue ceases.

Right-of-Way

There would be no sales tax impacts to the Lake Ralph Hall pipeline ROW because it is not a taxing entity and there would be no increase (or decrease) of sales to that area.

The fiscal impacts of the Lake Ralph Hall pipeline are limited to a small sales tax increase from the purchase of materials during construction. No other fiscal impact is expected.

Operational Impacts for Lake Ralph Hall

Once the dam and pipeline are completed, UTRWD plans to employ eight full-time and two part-time workers in the Ladonia area. The full-time workers would include a reservoir manager, a senior operator, a senior mechanic, an electronic technician, three operator/maintenance workers and a mechanic. The expected salaries for these positions range from just over $46 thousand per year to about $80 thousand, all of which are higher than the median earnings in Fannin County, which was $25,894 for 2011-2015 (USCB 2011-2015 American Community Survey [ACS]). The two part-time employees would be a special assistant for property services and a property management assistant. They would be employed for up to twenty hours per week at annualized salaries ranging from about $53 thousand to around $80 thousand per year. The electronic technician, the three operator/maintenance workers and the mechanic would only spend 50 percent of their time in the Ladonia area, while the others would be there all the time. While the sales and property taxes paid by these employees would have a positive effect on the area, it would be negligible compared to the land development impacts. Similarly, their impacts on the public facilities and services would be negligible.

Rate Impacts on UTRWD Members and Customers

In addition to the impacts from construction, inundation, and future development, the Lake Ralph Hall project would also impact the rates and fees charged by UTRWD to its members and customers, since project capital and operating costs must be repaid. This section estimates the incremental change to UTRWD's rates and fees caused by the Lake Ralph Hall project (both the lake and pipeline together). UTRWD sells water only to its members and customers, all of whom are resellers of this water to various other entities and traditional water customers (municipal, industrial, etc.). UTRWD does not sell to individual water consumers. This rate impact examines the impact on UTRWD rates and fees charged to members and customers. The charges to ratepayers served by each Member and Customer would be different and depend on the individual cost recovery techniques and policy decisions of each Member and Customer.

UTRWD Charges and Fees

UTRWD levies three charges and fees for water services: the Demand Charge, the Volume Charge, and the Flat Rate. Members and customers are levied one or more of these charges and fees depending on their individual circumstances; none pay all three charges at once. The most commonly applicable charges are the Demand Charge and the Volume Charge.

The Demand Charge is calculated to cover the fixed costs of providing water. UTRWD calculates the expected fixed costs for the upcoming year and divides those by the subscribed amounts to calculate the demand charge. This charge is based on the subscribed or contracted water demand. For Fiscal Year (FY) 2017, the Demand Charge was $411,500 per subscribed million of gallons delivered daily (mgd).

The Volume Charge recovers all variable costs, i.e., any cost that can be related back to the volume of water delivered. It is billed on a monthly basis for water supplied to the Member's or Customer's master meter. This charge is set by dividing the expected variable costs by the expected amount of water to be delivered. Each member or customer has a minimum actual take requirement to ensure that the water treatment plant is kept running, but that minimum is rarely an issue since they have historically taken more than the minimum. Customers pay a seven percent surcharge on the Volume Charge that Members do not. In 2016, the Volume Charge was $1.11 ($1.19 for Customers) per thousand gallons.

The Flat Rate ($4.33/1,000 gal in 2016) is used in place of a demand plus volume charge for smaller customers and for other irregular sales such as construction water. The Flat Rate is seldom applied.

Generally, a Member or Customer would only pay the Demand Charge and Volume Charge once their water distribution system is connected to the UTRWD system and they are being supplied water. These two charges would be impacted by the construction and operation of Lake Ralph Hall.

Cost Recovery Calculations

As discussed previously, the Demand and Volume Charges are the total fixed and variable costs, respectively, divided by the subscribed and expected amounts of water to be delivered.

To calculate the Demand Charge, the fixed costs of Lake Ralph Hall dam and pipeline construction costs plus the fixed costs of running the lake and pipeline are totaled for the year in which they are spent. For capital construction costs, UTRWD would employ various methods of financing to spread the costs over time, so the annual costs would be the costs for debt service. Annual debt service is divided by the amount of water (mgd) delivered by UTRWD that year to derive the Lake Ralph Hall capital expenses per mgd in that year. The annual charges in this calculation, compared with the 2016 Demand Charge, represent the percentage change in the Demand Charge each year. Fixed annual operation and maintenance costs are added to the capital costs to calculate the total Demand Change per mgd.

The variable costs of getting water from Lake Ralph Hall to the members and customers, including variable lake operating costs, pumping costs for conveying the water and water treatment costs are calculated on a per 1,000 gallon basis to determine the Volume Charge for Lake Ralph Hall. The overall Volume Charge levied by UTRWD is based on a blended cost of acquiring water from multiple sources, then treating and delivering it to the members and customers. The variable costs of Lake Ralph Hall water would be incorporated into this blended cost.

Rate Impacts

For the purposes of the rate impact analysis, the Demand Charge and the Volume Charge have been combined into one wholesale effective rate per 1,000 gallons (NewGen Strategies and

Solutions, 2016). This allows the overall rate impacts of the lake and the pipeline to be calculated and presented in a simplified manner. In 2016, the effective wholesale rate was $4.33 per 1,000 gallons. These rate impacts are projections since actual financial conditions and borrowing strategies would be addressed prior to project commencement. All impacts are presented in 2016 constant dollars.

Over the whole period, the average annual difference in the wholesale effective rate is 5.5 percent (or about 24 cents per 1,000 gallons in any year). However, these increases are not consistent. Generally, the wholesale effective rate rises slowly while the lake and pipeline are being constructed; once the lake is in operation, the rate differences are more substantial, until the debt service for the dam is fully repaid. Rate impacts diminish thereafter.

From 2016 until 2024, when the project is expected to be completed, the average annual rate difference is 2 percent (about 9 cents per 1,000 gallons) per year. Between 2025 and 2035, the annual rate differences attributable to Lake Ralph Hall are fairly consistent, an average of 9.2 percent (40 cents per 1000 gallons), a high of 11.6 percent and a low of 6.2 percent. After 2035, the annual rate differences fall off every year, from 11 percent in 2035 down to 0.8 percent in 2060. The average change in the wholesale effective rate in this period is 5.3 percent.

Socioeconomic Impact Summary for the Proposed Alternative

A summary of the net socioeconomic effects of the Proposed Alternative is provided below. This summary consolidates all of the individual socioeconomic issues and related impacts discussed earlier in this section. The dam site and pipeline alternatives are addressed separately. The water rate and fee impacts on UTRWD customers are presented earlier in this section and reflect the dam site and pipeline combined.

Table 4-29 provides the short-term socioeconomic impact summary for Lake Ralph Hall, which covers the three-year dam construction period, beginning in the year 2019.

Table 4-29: Short-Term Socioeconomic Impact Summary for Lake Ralph Hall

	PIA	SIA	Rest of Texas	Total (Texas)
Sales of Goods and Services (000s)	$36,230	$150,932	$242,992	$430,154
Personal Income (000s)	$12,726	$82,060	$69,615	$164,401
Annual Employed Persons (FTE)*	156	445	1,396	1,998

Note: Includes direct and indirect impacts.
*Full Time Employee (FTE)

The net effects on sales of goods and services from Lake Ralph Hall amounts to almost $430 million, with about $36 million expended in Fannin County, the PIA for Lake Ralph Hall. Fannin County personal income would increase by $12.7 million during the three-year dam construction period, although the largest part of the income benefits would accrue to the SIA because of construction related expenditures in those areas. Total short-term employment effects for each of the three construction years would amount to 156 in the PIA and about 2,000 throughout the State of Texas.

Lake Ralph Hall would inundate about 7,600 acres and retire a total of about 12,092 acres of land in Fannin County representing about two percent of the total County land. Agricultural revenue losses from land retirement are estimated to be about $0.8 million or two percent of the County total. An estimated one home would be lost and their residents would be displaced from the project footprint.

Table 4-30 presents the summary of long-term net socioeconomic impacts for Lake Ralph Hall, which account for losses from inundated agriculture (not accounting for UTRWD land purchases and payments to Fannin County) which are more than offset by gains from land development after the project is completed.

Table 4-30: Long-Term Socioeconomic Impact Summary for Lake Ralph Hall

	Area	Year 10	Year 20	Year 30	Year 40	Year 50
Sales of Goods and Services (000s)	PIA	$(2,561.5)	$(1,468.6)	$723.7	$3,830.3	$8,308.8
	SIA	$2,824.8	$7,224.8	$10,876.3	$13,508.0	$16,009.1
	Rest of Texas	$1,696.3	$3,908.4	$5,833.4	$7,597.9	$9,426.9
	Total (Texas)	**$1,959.6**	**$9,664.5**	**$17,433.5**	**$24,936.2**	**$33,744.7**
Personal Income	PIA	$639.8	$1,677.6	$2,572.5	$3,509.8	$4,967.4
	SIA	$584.7	$1,510.9	$2,348.1	$2,983.0	$3,535.1
	Rest of Texas	$229.2	$602.7	$1,018.6	$1,451.0	$1,978.7
	Total (Texas)	**$1,453.7**	**$3,791.2**	**$5,939.2**	**$7,943.7**	**$10,481.1**
Employed Persons	PIA	8	37	64	93	139
	SIA	17	41	64	90	106
	Rest of Texas	6	17	29	42	58
	Total (Texas)	**31**	**95**	**157**	**226**	**303**

Note: Includes net positive direct, indirect and induced effects from lost agricultural revenue and lakeside land development.

Once completed, the net positive effects from Lake Ralph Hall would be modest in the early years, but grow steadily to make a substantial contribution after year 30, following the initial reservoir fill. Total spending on goods and services in the PIA would amount to $0.7 million by year 30 and approximately $17.4 million total by that year throughout the state. PIA income levels would reach almost $2.6 million by year 30 and an increase of 64 employed persons. A summary of the tax revenues generated from Lake Ralph Hall is shown in **Table 4-31**.

Table 4-31: Summary of Long-Term Net Tax Revenues Generated by Lake Ralph Hall (Thousands of dollars)

Area		Year 10	Year 20	Year 30	Year 40	Year 50
PIA	Ladonia	$81.8	$228.6	$433.6	$660.9	$928.7
	Honey Grove	$41.1	$126.0	$238.9	$364.0	$511.4
	School Districts	$433.5	$678.1	$1,321.3	$2,045.1	$2,887.8
	Fannin County	$229.5	$352.2	$684.6	$1,053.4	$1,487.1
PIA Total		$786.0	$786.0	$1,384.8	$2,678.4	$4,123.4
SIA Total		$6.8	$6.8	$13.7	$17.1	$18.8
Rest of Texas Total		$155.8	$155.8	$311.7	$386.4	$421.5
Total (Texas)		$948.7	$948.7	$1,710.2	$3,081.9	$4,563.8

Notes: (1) All Amounts are in 2016 dollars.
(2) UTRWD has an arrangement with Fannin County to help offset the loss of property taxes due to Lake Ralph Hall. The amount shown above is the total amount paid over a ten-year period. See Exhibit 4-x for details. Honey Grove would not lose any property taxes due to the inundation of LRH. It is also not a beneficiary of the UTRWD payments.
(3) The School districts do not receive any sales tax.

The net tax revenues reflect property taxes from land development, sales taxes from visitors and land development, and payment in lieu of property tax by UTRWD, which together more than offset lost property taxes from the Lake Ralph Hall inundation and land retirement. The City of Ladonia would experience net increases of more than $400,000 per year by year 30 and more than $900,000 per year by year 50. Fannin County is projected to experience net positive increases in revenues of $685,000 by year 30. The total net revenues generated by Lake Ralph Hall in the State of Texas are projected to exceed $1.7 million by year 30 and $4.6 million by year 50.

With Lake Ralph Hall, the local jurisdictions would experience an increase in law enforcement and emergency service demands during construction and operation. School enrollment and related demands would also increase. Project related revenues should more than offset these impacts.

The water rate increases for Lake Ralph Hall, expressed through the wholesale effective rate per 1,000 gallons, would be an average of 5.5 percent higher in each year between 2016 and 2060, as compared to without Lake Ralph Hall. However, wholesale rates will be an average of 6.3 percent higher than without Lake Ralph Hall once Lake Ralph Hall is filled, for an extended period

The socioeconomic impact summary for the Lake Ralph Hall pipeline is shown in **Table 4-32**.

Table 4-32: Short-Term Socioeconomic Impact Summary for the Lake Ralph Hall Pipeline

	PIA	SIA	Rest of Texas	Total (Texas)
Sales of Goods and Services (000s)	-	$30,641	$47,801	$78,441
Personal Income (000s)	-	$27,734	$40,479	$68,213
Employed Persons (FTE)	0	203	947	1,150

Note: Includes direct and indirect impacts.

The pipeline would result in an increase of about $78 million in purchases for goods and services in the State of Texas over the three-year pipeline construction period. None of the benefits would occur in the PIA, which is the footprint of the pipeline. The pipeline would generate total employment in the state of Texas of about 1,100 persons per year for the three-year pipeline construction period, including direct, indirect and induced workers. Personal income would amount to about $68 million over this three-year period.

Affected lands disturbed by the ROW for the pipeline would amount to almost 400 acres. These lands would be disturbed temporarily; farmers might lose a portion of their crop during one growing season for affected pasture lands. Public facilities and services would not be affected by the construction of the pipeline.

The sales tax benefits from the construction of the pipeline are indicated in **Table 4-33**.

Table 4-33: Total Sales Tax Collected from the Construction Phase of Lake Ralph Hall Pipeline

Jurisdiction	Total
PIA	$0
SIA	$30,991
Texas	$2,199,672

Note: Assumes half the materials and supplies costs are subject to sales tax and none of it is subject to property tax. Purchases are assumed to be spread evenly over the three counties making up the SIA. However, Collin County does not levy a county sales tax, so no county taxes are collected on sales in Collin County

Source: HE, 2010

In total, approximately $2.1 million in state taxes would be generated from the construction of this pipeline, of which only $31,000 would be generated in the SIA.

4.17.2 Cumulative Effects

4.17.2.1 No Action Alternative

Under the No Action Alternative, growth patterns could differ from that of the Proposed Action, as discussed in **Section 4.17.1.1**, because growth would be displaced outside the UTRWD service area. In addition, impacts to current residents within the UTRWD service area would potentially be impacted by water restrictions and higher water costs.

4.17.2.2 Proposed Action

There are two large reservoirs that are currently proposed to be built in Fannin County; Lake Ralph Hall and the BDL. Lake Ralph Hall is described extensively in other sections of this report. The BDL will be located a little north of the center of Fannin County and about 30 miles north-west of Lake Ralph Hall's proposed location. Under the applicant's proposed action, the project area for the BDL will cover about 17,000 acres and the reservoir would have a storage capacity of over 367,000 acre-feet. This is over 40 percent larger than Lake Ralph Hall by project area. The cumulative impact of the construction and operation of these two reservoirs is discussed in this section.

Bois d'Arc Lake

The BDL will impound up to about 367,600 acre-feet of water and divert up to 175,000 acre-feet per year, with an estimated firm yield of 120,665 acre-feet per year, into an approximately 16,600-acre lake. The raw water from the reservoir would then be transported by approximately 35 miles of new pipeline to a proposed new terminal storage reservoir and water treatment plant – the "North Water Treatment Plant" – just west of the City of Leonard in southwest Fannin County.

The BDL will have about a 17,000-acre footprint, on largely rural countryside, with some residences. Approximately 38 percent is cropland and 37 percent consists of bottomland hardwoods and riparian woodlands, with the remaining 25 percent consisting of mostly upland deciduous forest.

The NTMWD webpage on the BDL states that final permitting and construction is scheduled for early 2018 with completion by 2022 (NTMWD, 2017). The ROD was signed in January 2018. The LBCR FEIS states that construction of the BDL dam, pipeline and associated infrastructure will create over 5,000 person years of employment. Averaging this workforce over the four-year construction period yields about 1,250 workers required per year. Overall, the entire project is estimated to cost just under $600 million for construction, with just over $51 million in annual costs to operate.

Existing recreation activities in BDL footprint would cease once the construction phase begins, and last the duration of the three- to four-year construction phase and beyond. The size or physical extent of such adverse impacts would be small (localized), given the relatively few number of people that would be affected. These activities will cease once the creek becomes inundated by the reservoir. However, the reservoir would serve as a major new outdoor recreation asset for Fannin County and the region. At this stage, no specific recreational facilities, activities, designs or locations have been chosen. However, Fannin County's Comprehensive Plan for the LBCR, adopted October 18, 2016, includes plans for public access points, opportunities for both passive and active recreation, and trail connections. Additionally, residential homes (e.g., single family, two-family, manufactured home) are also planned for development around the lake, the majority on larger properties (i.e., one acre) in an effort to maintain the rural character of the area (Fannin County, 2016b). At least 2,100 new dwellings would be constructed in the area surrounding the reservoir as weekend/vacation homes and investment properties.

Construction Impacts

The LBCR Revised FEIS states "At the time the LBCR EIS began and even at the time of the March 2012 meeting to discuss cumulative impacts of BDL and LRH, it appeared that their construction schedules could overlap, which would cause short-term cumulative impacts. However, this situation has changed and the current construction timeframe for LRH is estimated to occur between 2025 and 2030. This would be subsequent to the proposed construction of BDL. It is thus likely that both projects would not be built concurrently." However, as noted in the **Section 4.17.1.2**, the construction of Lake Ralph Hall and the pipeline is expected to begin in 2019 and finish in 2023. Hence, for four years (2019 through 2022), both projects may be under construction concurrently. As discussed in **Section 4.17.1.2**, Lake Ralph Hall will require approximately 300 workers per year for construction of the dam and about 100 persons per year for the pipeline (these workers will be needed consecutively, pipeline work will not commence until the dam is finished). And, as noted above, the BDL will require about 1,250 workers per year from 2018 to 2022. Combining these workers with the maximum number of workers required for Lake Ralph Hall indicates about 1,550 workers per year for a couple of the years where construction overlaps.

While this is many more construction workers than are available in Fannin County, **Table 4-13** indicates that there are more than enough workers in the SIA and in Dallas to meet this need. And given the proximity of Dallas, it is reasonable to expect workers to commute to Fannin County to work on either project.

Despite the potential competition for construction workers, the cumulative impacts of the construction phases of the two reservoirs are similar. Both lakes cause some short-term adverse impacts, mostly due to inundation of agricultural land and protection services. Regarding loss of associated property tax receipts, both proposing entities also have agreements where they make payments to offset some of these tax losses. These short-term adverse impacts are also weighed against the short-term economic stimulus provided by the construction of the projects.

Operational Impacts

While the main cumulative impacts of the two lakes will be recreational (the recreational impacts are discussed in the Recreation section below), there will be operational socioeconomic impacts that derive from this anticipated increased recreation. These impacts include the income and employment for permanent residents and the local tax impacts to Fannin County.

The socioeconomic impacts sections for Lake Ralph Hall described in **Section 4.17.1.2** project that, 50 years after lake completion, Fannin County will have over 1,000 new houses. The BDL combines the impact of permanent and weekend residents for a total of 2,100 new houses. Additionally, the new permanent residents will provide the population base and demand for goods and services leading to increased employment, and income in the area. This will also lead to an increase in sales and property tax revenues for the county and the other taxing entities. These impacts are detailed in the socioeconomic sections of the LRH FEIS and LBCR FEIS.

However, with the two lakes, there may be some competition between them for new lake-oriented visitors and residents and therefore some sharing of the benefits. People are unlikely to buy two lake-view properties just because two new lakes are being built, and they will choose which lake to visit on a given weekend. Overall, this will cause a modest reduction in the overall effects (i.e.

the total impacts of the two lakes will be somewhat less than the sum of the impacts projected for each lake) due to this competition.

As mentioned above, the inundation of the two reservoirs will remove land from Fannin's tax rolls. However, both proposing entities have agreements to help make up the temporary loss of property taxes until the construction of new houses can increase the total taxable value for the County. In both cases the total taxable amount from the new house construction is expected to substantially outweigh the loss due to inundation. Additionally, these new residents will increase the sales tax revenue with their local purchases. Again, there will be competition between the two lakes and people are likely to choose one or the other, leading to a modest reduction in the overall tax impacts to the County.

The Fannin County Planning Commission is working to develop a zoning plan that will improve prospects for quality development at Lake Ralph Hall. Developers will be required to go through the Fannin County Subdivision committee before getting a permit. Effective zoning laws should have a positive impact on the quality of development around Lake Ralph Hall. Some lakes in Texas have developed without the benefit of zoning and in those cases the quality of lake properties are often uneven and of lower value. In addition to zoning, developments could require site-built homes, adopt deed restrictions and put in place a homeowners association. These restrictions would improve the quality of development around the lake, but may tend to slow the rate of growth. This EIS assumes that effective zoning would be enacted and that deed restrictions would be put in place to ensure quality, long-term development.

Growth Projections

Employment forecasts are not available for Fannin County, but are available for the Texoma Workforce Development Area (WDA), which is comprised of Cooke, Fannin and Grayson Counties. The Texas Workforce Commission projects the average annual employment in the Texoma WDA to be about 92,350 in 2024, up about 13 percent from the 81,790 people who worked there in 2014. This equates to an average annual growth rate of about 1.2 percent.

The Texas Demographic Center expects Fannin County to grow to about 40,500 people by 2050, from their 2010 base of 33,915. This represents an average annual growth rate of 0.45 percent. However, the growth rate starts out around 0.6 percent per year in the early years and drops to about 0.25 percent in the later years.

Neither the employment projections for the three-county WDA nor the population projections for Fannin County specifically address the impact of either Lake Ralph Hall or BDL. While neither show any sudden increase due to the construction or later housing and recreation development, of Lake Ralph Hall or the BDL, this is more likely due to the forecasting methodology and timing than to the lack of impact of the two projects.

With the moderate to slow growth projected in the employment and population forecasts, along with the slow rate of recreation and housing development forecast in the Lake Ralph Hall EIS and LBCR FEIS, the marketplace and Fannin County should have sufficient time to respond to demands for the necessary housing, infrastructure and services necessary to meet this growth.

Recreation Impacts

Although there is no specific recreational plan for Lake Ralph Hall, it is a reasonably foreseeable future action that recreation will occur on the lake and that the associated recreational amenities will be developed. While Fannin County does have a number of tourist attractions, its rural nature lends itself to recreational activities that take advantage of the outdoors. During the construction phase, each lake would cause some minor negative impacts upon recreation mostly due to the activity in the area. Once the lakes are operational, there will be an overall increase in the recreational amenities in Fannin County, but this increase will not be evident across all recreation types. Both the LRH EIS and LBCR FEIS project a large increase in recreational activity once their reservoirs are finished. While the county's water-based recreation (fishing, boating, swimming, etc.) will increase, it is likely that the hunting opportunities would decrease because hunting is not generally compatible with the higher levels of people the lakes are expected to attract due to safety concerns and potentially less game.

The primary purpose of Lake Ralph Hall is to provide a water supply for the UTRWD service area and secondarily for the City of Ladonia. The reservoir could also become a recreational resource for the area. This analysis assumes that basic recreational facilities would be constructed at the time the lake is built and that these facilities would be ready for use when the North Sulphur River is impounded. UTRWD is assumed to construct basic amenities such as boat ramps, docks and parking areas, however, no assumptions have been made about the locations of these facilities. UTRWD would not manage these recreational facilities on an ongoing basis. Thus, future operation and maintenance of these facilities would need to be taken over by another entity, most likely the City of Ladonia.

The physical characteristics of Lake Ralph Hall would impact recreational use and development of the lake. At its deepest point, Lake Ralph Hall would be slightly more than 90 feet deep and is expected to be an excellent fishing lake. At about 7,000 surface acres, Lake Ralph Hall is relatively small, as compared to other area lakes, which may limit boating activity. Other characteristics that would impact development and visitor numbers, such as water clarity, are not known at this time.

The water levels in Lake Ralph Hall will vary by season. However, about 95 percent of the time, the annual water level fluctuations are projected to be less than eight feet per year. This compares to an average annual fluctuation of 12.9 feet for five of Texas' more popular recreational lakes (Lewisville Lake, 8.7 feet; Lake Grapevine, 13.1 feet; Eagle Mountain Lake, 5.9 feet; Lake Texoma, 10.8 feet; and Lake Travis, 26.2 feet) for the 2000 to 2017 period. Only Eagle Mountain Lake has an average fluctuation of less than eight feet per year and Lake Travis has fluctuated more than 10 feet per year for 17 of the previous 18 years. This indicates that the projected water level fluctuations in Lake Ralph will not deter recreational activity on the lake.

Visitor projections
Average annual visitation for four comparable lakes was used to project Lake Ralph Hall visitation at year 30 of operation. Year 1, defined as the year in which the reservoir is completely filled and fully operational, was assumed to be 10 percent of year 30 attendance. After year 30, it is assumed that the bulk of development would have been achieved and growth would slow to about one percent a year. After 30 years, when Lake Ralph Hall would likely have amenities completed that are similar to the comparable lakes and a substantial amount of residential and commercial development has occurred, total visitation is projected to reach over 330,000 persons for Lake Ralph Hall. By the 50th year of operation, visitation is projected to be more than 400,000. Recreational visitation is not reported for the BDL.

Purchases of goods and services
Recreational users of Lake Ralph Hall would purchase goods and services associated with travel and activities at the lake. These expenditures would include food, fuel, equipment rentals, bait, sporting equipment, etc. Over time, it is assumed that the majority of these expenditures would take place in close proximity of the lake, such as in Ladonia or Honey Grove. It should be noted that as of 2016, Ladonia has very limited commercial development. It is assumed that during lake construction some additional commercial outlets would open and as the lake attracts more visitors, further commercial development would occur.

In addition, people traveling to Lake Ralph Hall would make purchases such as gasoline and food en route. These expenditures would accrue benefits to the SIA and Texas. Expenditures related to lake recreation are estimated to be $32.31 per person, per day (USACE, 2016). These direct visitor expenditures would be re-spent within the economy leading to additional or indirect effects. **Table 4-34** provides projected expenditures for goods and services related to recreation at Lake Ralph Hall.

Table 4-34: Direct and Indirect Impacts of the Sales of Goods and Services Related to Lake Ralph Hall Recreation, Year 1 through Year 50 (thousands of dollars)

Area	Effect	Year 1	Year 10	Year 20	Year 30	Year 40	Year 50
PIA	Direct Effects	$803.8	$1,642.5	$3,633.6	$8,038.3	$8,879.3	$9,808.3
	Indirect Effects	$327.9	$669.9	$1,482.0	$3,278.6	$3,621.6	$4,000.5
	Total	**$1,131.7**	**$2,312.4**	**$5,11.6**	**$11,316.9**	**$12,500.9**	**$13,808.7**
SIA	Direct Effects	$214.4	$438.0	$969.0	$2,143.5	$2,367.8	$2,615.5
	Indirect Effects	$160.3	$327.5	$724.5	$1,602.7	$1,770.4	$1,955.6
	Total	**$374.6**	**$765.5**	**$1,693.5**	**$3,746.3**	**$4,138.2**	**$4,571.2**

Area	Effect	Year 1	Year 10	Year 20	Year 30	Year 40	Year 50
Remainder of Texas	Direct Effects	$53.6	$109.5	$242.2	$535.9	$592.0	$653.9
	Indirect Effects	$65.9	$134.6	$297.8	$658.8	$727.7	$803.8
	Total	**$119.5**	**$244.1**	**$540.0**	**$1,194.7**	**$1,319.6**	**$1,457.7**
Total (Texas)		**$1,625.8**	**$3,322.1**	**$7,349.1**	**$16,257.8**	**$17,958.7**	**$19,837.6**

Note: All amounts are in 2015 dollars.
Source: Value to the Nation, Fast Facts. http://www.corpsresults.us/recreation/recfastfacts.cfm, Bureau of Economic Analysis, RIMS II Multipliers, and HE, 2016b.

By year 30, total economic impacts from recreation related spending within the PIA for Lake Ralph Hall are projected to be $11.3 million. In 2014, retail sales in Fannin County subject to sales tax were $79.1 million. The projected increase of about 14 percent would provide a moderate, positive impact to the PIA. By year 50, sales rise to about $13.8 million or 17 percent of 2014 total county retail sales. This is in addition to the $17 million to $22 million in economic activity that BDL recreational visitors are expected to contribute to the area. The sum of these recreational visitor sales for lakes could increase Fannin County sales by about 44 percent. However, similarly to the socioeconomic impacts, there will be an element of competition between the two lakes. The recreational amenities and visitation in Fannin County will increase dramatically, but not quite additive for the individual impacts. These recreation expenditures would be a moderate to major, long-term benefit to the PIA. Impacts to the SIA and to Texas, which have much larger economies, would be long-term and positive, but negligible to minor.

Employment

As described above, recreational use of Lake Ralph Hall would likely start out at a relatively low level and grow as the recreation aspects become established and as facilities are further developed. Employment opportunities from recreational activities at Lake Ralph Hall are likely to be somewhat seasonal. Although most lakes in the region remain open year-round, almost all Lake Ralph Hall activity is expected in the spring through the fall, with the heaviest usage taking place in the summer months. Direct employment created by recreation at Lake Ralph Hall is likely to be primarily in retail trade, food and other services sectors. As of 2014, almost 14 percent of Fannin County employment was in the retail sector and about five percent was in accommodation and food services sectors. Employment in these sectors is typically relatively low paying. As wages of these direct employees are spent in the local economies, additional jobs, or indirect employment would be created in other economic sectors in the PIA and SIA.

In the early years of operation, employment impacts from recreation would be minimal. By year 30 of operation, total Lake Ralph Hall employment is projected to be 213, with 160 direct and indirect jobs within the PIA, 38 total jobs in the SIA and 15 total jobs for the remainder of the state. BDL is projected to support between 300 and 400 jobs. Within the PIA, these impacts would be minor and positive. Within the SIA and Texas, impacts would be negligible and positive.

Income

Income from recreational activities at Lake Ralph Hall would also be relatively low in the early years of operation. Direct employment, which is projected to be somewhat seasonal, would supply income to area residents. As this income is spent in the local economy, more jobs and resulting income would be generated. **Table 4-35** provides projected income from recreation related employment at Lake Ralph Hall in year 1 of operation through year 50.

Table 4-35: Direct and Indirect Income Related to Lake Ralph Hall Recreation for the PIA, SIA and Texas, Year 1 through Year 50 (thousands of dollars)

Area	Effect	Year 1	Year 10	Year 20	Year 30	Year 40	Year 50
PIA	Direct Effects	$275.1	$562.2	$1,243.8	$2,751.5	$3,039.3	$3,357.3
	Indirect Effects	$58.6	$119.7	$264.8	$585.8	$647.1	$714.8
	Total	**$333.7**	**$681.9**	**$1,508.5**	**$3,337.2**	**$3,686.4**	**$4,072.1**
SIA	Direct Effects	$63.0	$128.7	$284.6	$629.6	$695.5	$768.3
	Indirect Effects	$22.9	$46.8	$103.5	$228.9	$252.8	$279.3
	Total	**$85.8**	**$175.4**	**$388.1**	**$858.5**	**$948.3**	**$1,047.5**
Remainder of Texas	Direct Effects	$22.8	$46.5	$102.9	$227.7	$251.6	$277.9
	Indirect Effects	$12.9	$26.4	$58.4	$129.1	$142.6	$157.5
	Total	**$35.7**	**$72.9**	**$161.3**	**$356.9**	**$394.2**	**$435.4**
Total (Texas)		**$455.2**	**$930.2**	**$2,057.9**	**$4,552.6**	**$5,028.9**	**$5,555.0**

Source: Value to the Nation, Fast Facts http://www.corpsresults.us/recreation/recfastfacts.cfm Bureau of Economic Analysis, RIMS II Multipliers, and HE, 2016b.

By year 50, direct and indirect income within the PIA would reach almost $4.1 million. This represents 0.4 percent of total 2014 personal income in Fannin County and about two percent of earnings. The income from recreational activities at BDL would be between $6.2 million and $8.3 million, an additional 0.8 percent of income and 4 percent of earnings, at the high end. Thus, the long-term impacts from recreation related income within the PIA would be positive but modest. Long-term impacts within the SIA and Texas would also be positive, but negligible.

Conclusion

As discussed in **Section 4.17.1.2,** the socioeconomic and recreational impacts of Lake Ralph Hall will be minor, and positive, in the long-term. Similarly, the LBCR FEIS concluded that the recreational opportunities from Alternatives 1 and 2 are likely to be moderately beneficial and long-term. Overall, the cumulative impacts on recreation from both lakes would be generally beneficial. The BDL is expected to have a larger socioeconomic impact than Lake Ralph Hall, but, in the long-term, the beneficial impacts from recreational revenue and land development would be additive and considerable for Fannin County.

4.18 Environmental Justice and Protection of Children

4.18.1 Environmental Consequences

4.18.1.1 No Action Alternative

Under the No Action Alternative, growth patterns could differ from that of the Proposed Action, as discussed in **Section 4.17.1.1**, because growth would be displaced outside the UTRWD service area. Current water distribution operations would be expected to have the same effects on populations of concern as the general population, discussed in **Section 4.17.1.1**, including the potential for water restrictions and higher water costs.

4.18.1.2 Proposed Action

Minority Populations

Fannin County does not constitute an environmental justice population because the percentage of minority population neither exceeds 50 percent nor is substantially higher than the percentage of minorities in the five surrounding counties. As such, there would be no disproportionate environmental justice impacts to Fannin County minority populations overall.

However, a closer look at the distribution of minority populations within Fannin County using block group (BG) data reveals that Honey Grove, Ladonia, and Bonham consist of environmental justice populations, as established in **Section 3.18.1** and shown in **Figure 3-27**. Potential impacts to these environmental justice populations resulting from the construction and operation phases are evaluated below.

Construction Phase

The construction phase of the Proposed Action could have minor adverse impacts on minority populations in Ladonia during construction. The types of impacts from the construction equipment, vehicles, and activities that were evaluated include:

1. Noise Disturbances: As discussed in **Section 4.8**, the primary noise disturbance during construction would occur within 1,600 feet of the dam. No noise impacts to Ladonia residents from dam construction are anticipated. Disturbances could occur from an increased level of noise created by construction equipment and vehicles moving throughout the area. No noise impacts would occur in Honey Grove or Bonham.
2. Congestion: Congestion would increase in the immediate area due to additional vehicles and traffic delays near the pipeline, affecting environmental justice populations in Ladonia.
3. Community Cohesion: An increase in travel time or miles traveled during the construction of the pipeline could reduce access to community centers, neighborhood parks, and recreation areas for Ladonia residents.

4. Human Health and Safety: Construction workers are inherently exposed to safety risks such as injury by unguarded machinery and dust inhalation by operating heavy machinery and working on construction sites.
5. Job opportunities: Beneficial impacts could include the availability of short-term construction jobs for area residents, including minority populations in Bonham, Ladonia, and Honey Grove.

During at least a portion of the construction phase, the Proposed Action could result in adverse impacts on Ladonia residents. As discussed in **Section 4.8**, the primary noise impact would be from dam construction and locations more than 1,600 feet from use of heavy equipment would seldom experience appreciable levels of construction noise. Noise from the construction of pipeline to the WTP would not be fixed in one location but would progress along the pipeline as construction progresses; and the pipeline would not traverse any of the minority populations. Some nearby Ladonia residents may experience annoying levels of noise; however, given the distance to the pipeline, impacts would be indirect. Such indirect impacts would be temporary and intermittent, and last for the duration of pipeline-related construction activities but not for the full duration of the construction phase. To minimize the effects of noise impacts, construction would primarily occur during normal weekday business hours in areas adjacent to noise sensitive land uses such as residential and recreation areas; and construction equipment mufflers would be properly maintained and in good working order.

As discussed in **Section 4.13**, congestion would increase in the immediate area due to additional construction vehicles, delays caused by construction activities (i.e., roads temporarily reduced to a single lane), and road closures and detours. Contractors would route and schedule construction vehicles to avoid conflicts with other traffic, and strategically locate staging areas to minimize traffic impacts.

As discussed in **Section 4.17.1**, short-term job opportunities would be a beneficial impact to local and regional workforce and could beneficially impact the minority populations within Fannin County. Construction of the proposed project would also create a number of indirect or induced jobs from project-related spending and the spending decisions of workers.

Operation Phase

The operation phase of the Proposed Action would not have adverse impacts on minority populations. Some roads in the project area would be upgraded to higher speed standards which would benefit all users, including minority populations. The proximity of Honey Grove, Ladonia, and Bonham to the reservoir might be advantageous for local recreationists and job-seekers. The proposed reservoir would introduce the potential for a new recreational resource in the county, which would be beneficial impact for all residents, including minority populations.

Low-Income Populations

As established in **Section 3.18.1**, Fannin County does not meet the regulatory definition of a low-income population, but block group level analysis showed that Bonham and Wolfe City are low-income compared with the county and are therefore considered environmental justice communities (**Figure 3-28**).

Construction Phase

The construction phase of the Proposed Action is not anticipated to have adverse impacts on low-income populations in Bonham due to the distance from the proposed project. Beneficial impacts could include the availability of short-term construction jobs available to the entire population, including low-income populations. All construction workers – low-income or otherwise – could inherently be exposed to safety and health risks due to operating heavy machinery and working on-site. Any health and safety risks associated with construction activities would not disproportionately affect low-income construction workers. The construction of the pipeline could have minor, temporary traffic impacts for residents of Wolfe City.

Operation Phase

The operation phase of the Proposed Action would not disproportionately impact low-income populations. Some roads in the project area would be upgraded to higher speed standards which would benefit all users, including low-income populations. The proximity of Bonham and Wolfe City to the reservoir might be advantageous for local recreationists and job-seekers. The proposed reservoir would introduce the potential for new recreational resource in the county, which would be beneficial impact for all residents, including low-income populations.

Protection of Children

In compliance with Executive Order (EO) 13045, *Protection of Children From Environmental Health Risks and Safety Risks*, this analysis examines local, regional, and national demographic data; evaluates the number and distribution of children in the area; and discerns whether these children could be exposed to environmental health and safety risks from the Proposed Action. The analysis considers that physiological and social development of children makes them more sensitive to health and safety risks than adults. It also 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. Activities that result in air emissions, water discharges, and noise emissions are considered to have severe environmental health and safety risks if they were to generate disproportionately high environmental effects on youth populations within the study area. Potential effects include health and safety concerns such as respiratory issues, hearing loss, and interruption of communication or attention in nearby residences and schools with children present.

Fannin County overall does not meet the regulatory definition of a minority or low-income population, or an environmental justice population. Analysis at the BG-level identified high concentration “pockets” of minority populations in Ladonia, Bonham, and Honey Grove, and high concentration “pockets” of low-income populations in Bonham and Wolfe City. However, because the safety risks are higher in the vicinity of the proposed project, places where children “learn, live, and play” in Ladonia are the focus of this analysis for disproportionate impacts as it relates to their health and safety.

Construction Phase

The construction phase of the Proposed Action could have disproportionate impacts on children in the vicinity of Ladonia. This analysis considers that the following types of adverse impacts on children from the construction equipment, vehicles, and activities could include:

1. Noise Disturbances: Increased level of noise created by construction equipment and vehicles could affect children’s learning, especially near homes, schools, and recreational areas.
2. School Funding: Decreased tax revenue from a decrease in taxable land that would be impounded could affect funding for teachers, classroom materials, or maintenance and improvement projects in the Fannindel ISD. As discussed in **Section 4.17.1**, UTRWD is making payments to Fannin County to offset decreases in property tax revenue.
3. Mobile Source Air Pollutant Emissions (including traffic): Children living, learning, or playing in close proximity to the project area could be impacted by construction activities and vehicles. Children are believed to be especially vulnerable due to higher relative doses of air pollution, smaller diameter airways, and more active time spent outdoors and closer to ground-level sources of vehicle exhaust.
4. Congestion and Obesity Factors: Increased congestion in the immediate area due to additional vehicles and traffic delays near the site could reduce opportunities for children to exercise outdoors and the accessibility of neighborhood parks, green spaces, and recreation areas.
5. Safety: Children living, learning, and playing in close proximity to the project area are inherently at a higher risk of accident or incident that could result in bodily harm.

Possible impacts under the Proposed Action to youth community and recreational facilities such as childcare centers, places of worship, schools, recreation facilities, hospitals, public health facilities, and social welfare facilities located Ladonia would determine the characterization of impacts as posing a concern to the protection of children. Potential impacts to children at relevant youth community and recreational facilities in Ladonia are discussed below, and are included based on their location and proximity relative to the project area. The types of potential adverse impacts listed above in combination with impact factors (size, duration, likelihood, severity) are used to qualify the magnitude of impacts.

Fannindel High School is located in Ladonia and serves grades sixth through twelfth, including students from both Ladonia and Pecan Gap. Traffic and time delays during the construction phase could adversely impact families commuting in the area. Given the distance of the school to the project area, any increase in noise levels created by construction equipment and vehicles would not affect learning. Similarly, it is unlikely that increased congestion and mobile source air pollutant emissions from construction vehicles in the project area would reduce opportunities for children to exercise or play outdoors or increase the risk of dust inhalation or other pollutants at Fannindel High School.

As discussed in **Section 4.17.1**, tax revenues could initially decrease due to taxable land that would be impounded. However, the UTRWD has committed to offsetting tax losses by making payments to Fannin County as shown in **Table 4-21**. As such, impacts to Fannindel ISD from lost tax revenues would be minimal. Beneficial tax impacts from ancillary development (i.e., real estate and businesses) discussed in **Section 4.17.1** could occur during and extend after the construction phase.

Operation Phase

The availability of water and recreational opportunities at the reservoir could potentially influence land uses in the greater vicinity to become more industrialized and/or developed, creating both adverse and beneficial impacts to children.

As the population grows with economic development during the operation phase of the dam and reservoir, the tax base would also expand, eventually boosting property tax revenues in local taxing jurisdictions. This net increase in tax revenue would enable the cities and county to increase the number of schools and teachers and provide community services for the increased population. It should, however, be noted that it is unclear whether the increased revenue would be in fact used to address these needs. Those decisions are a function of the political process of local government and may also depend on other outstanding needs.

As discussed in **Section 4.17**, revenue related to residential land development at Lake Ralph Hall is projected to generate over $3 million for Fannindel ISD.

Although recreation is not considered a direct result of the proposed project, if Lake Ralph Hall becomes a recreational facility close to Ladonia and Honey Grove it could potentially offer boating, fishing, swimming, and other outdoor activities would represent a benefit for all area youth. The visual and aesthetic value of the reservoir and the green space around it would also be considered by many as beneficial in the long-term.

Conclusion

The Proposed Action would not result in environmental justice impacts in the overall Region of Influence (ROI). Census BG data identified Honey Grove, Ladonia, and Bonham as “pockets” of minority populations and Bonham and Wolfe City as “pockets” of low-income populations. The Proposed Action could create slightly adverse disproportionate impacts relating to noise and/or traffic for Ladonia, for at least a portion of the construction phase, though not during the operational phase. The likelihood of all noise and air-quality related adverse impacts on environmental justice populations outside of Ladonia would be low given their distance(s) to the project area. Overall, adverse impacts on environmental justice populations within the study area would be minor. Project benefits, including employment opportunities, increased tax revenue, roadway improvements, and access to a potentially new recreational facility would be shared by all residents in the study area, including environmental justice populations.

4.18.2 Cumulative Effects

4.18.2.1 No Action Alternative

The No Action Alternative would not result in any cumulative impacts on environmental justice.

4.18.2.2 Proposed Action

As previously discussed, adverse impacts from the Proposed Action on environmental justice populations would be minor and primarily short term. Other future actions include the BDL, which also would have negligible adverse impacts on environmental justice populations. Any long-term cumulative effects from the Proposed Action and the BDL on environmental justice populations would be slight but likely beneficial (from increased economic and recreational opportunities). No cumulative effects on environmental justice populations are expected from the other reasonably foreseeable actions.

4.19 Climate Change

4.19.1 Environmental Consequences

4.19.1.1 No Action Alternative

Under the No Action Alternative, there would be no raw water pipeline, or reservoir to affect greenhouse gas (GHG) emissions. This alternative would not have any direct impact on the climate, and would not contribute to climate change. As discussed in **Section 3.19**, the National Climate Assessment (U.S. Global Change Research Program [USGCRP], 2014) 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. The report also indicates that a 25-50 percent increase in water withdrawals is projected in the project region with climate change effects. The No Action Alternative, by foregoing the development of greater water storage capacity that could be drawn upon during dry periods and droughts, would constitute a riskier approach to water management under future climatic conditions compared to the Proposed Action.

4.19.1.2 Proposed Action

The proposed project would require energy associated with pumping from the reservoir to the service area, which could be a minor long-term effect on GHG. Long-term slight beneficial effects from augmenting water storage capacity in North Texas would be expected. Although there would be negligible direct effects from the emissions on climate change, the Proposed Action would constitute a more effective approach to water management under future conditions when compared to the No Action Alternative. As noted above, it is predicted that the region will be at a high risk for water supply sustainability with climate change effects, and a 25-50 percent increase in water withdrawals is projected in the project region. Maintaining adequate water storage capacity is an important strategy in adapting to predicted climate change in Texas.

4.20 Unavoidable Adverse Impacts

Sec. 102(C)(ii) of NEPA [42 USC § 4332] requires an EIS to list “any adverse environmental effects which cannot be avoided should the proposal be implemented.” The following section lists the anticipated adverse environmental effects for each resource. Some of the adverse effects of the proposed project could be mitigated to some extent as described in **Chapter 5.0**. **Table 4-36** includes a summary of impacts from the No Action Alternative and the Proposed Action Alternative.

Land Use

The proposed project would result in long term conversion of existing land use to water supply use. The project may indirectly cause additional changes in land use in adjacent areas. These changes could be regarded as adverse by residents who value the rural landscape.

Physiography and Topography

Topography of the proposed project area would be permanently altered by inundation due to construction of the proposed Lake Ralph Hall and project dam. The modified area would total more than 8,000 acres for all associated project features. The proposed reservoir is anticipated to accumulate between 2,570 ac-ft and 3,700 ac-ft of sediment over a 50-year period. The proposed project would not alter physiography.

Geology and Soils

Original characteristics of the surficial material, such as existing stratification, would be permanently altered by construction activities including excavating soils to construct the proposed pipeline. Impacts to soils would include excavation, transport, and compaction of soils to construct several project elements (impoundment dam, SH 34 roadway embankment, and fill required for the North Sulphur River downstream of the dam). Other impacts would include inundation of soils within the reservoir footprint.

Water Resources (Groundwater and Surface Water)

The proposed project would alter hydrology of the North Sulphur River and major tributaries including Allen Creek, Bear Creek, Pot Creek, Brushy Creek, Pickle Creek, Davis Creek, Leggets Branch, Bralley Pool Creek, Merrill Creek, Hedrick Branch, and Long Creek. Details on impacts to surface water hydrology are provided in **Section 4.6.1.2**. The proposed project would result in impacts including fill (dam embankment) and inundation of 447,143 lineal feet of ephemeral stream channel, 62,149 lineal feet of intermittent stream channel, and approximately 56.19 acres of on-channel impoundments. Flows from ephemeral and intermittent streams inundated from the construction of the reservoir would be converted from flowing (lotic) to a still (lentic) state. No impacts to groundwater are anticipated.

Air Quality

The proposed project would result in up to five years of construction-related emissions, and long-term emissions from pumping-related energy use.

Noise

The proposed project would result in a short-term increase in noise during the five-year construction period and minor long-term increases due to potential cumulative impacts from recreation.

Recreation/Public Lands

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 and would no longer be available to the public.

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, a covered pavilion and stairway access to the North Sulphur River Channel (**Appendix Q**). 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.

Visual Resources

The proposed project would result in long-term changes to the visual environment by changing the rural landscape to a reservoir and dam, which could be viewed as an adverse impact by viewers who value the rural, agricultural landscape.

Biological Resources/Threatened and Endangered Species

The proposed project would result in the loss of habitat including grasses, pastures, partially wooded areas, young forest, forest, and cropland. Approximately 69 percent of the potential vegetated impact area for the proposed project is currently under agricultural production (cropland, grasses, and pasture). 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 limited aquatic habitat in the North Sulphur River would be converted to open water and a more stable lacustrine environment. The spread of invasive plant species is often attributed to disturbed soils. During the construction phase, invasive terrestrial plant species may invade disturbed areas and continue to inhabit these areas during the long-term operation of the proposed Lake Ralph Hall.

Aquatic invasive species known to occur in Texas reservoirs (e.g., Zebra mussels) may spread to Lake Ralph Hall if recreational boating is allowed. Aquatic invasive species are known to be transported from reservoir to reservoir via watercraft and/or trailers.

Based on species research and evaluations of preferred habitat for the federal and state listed protected species, it is unlikely there would be impacts to any of the federal listed species for Fannin, Hunt, or Collin counties. The state listed timber rattlesnake, as well as the four state listed mollusks, have the potential to be impacted by the construction of Lake Ralph Hall and the Raw Water Pipeline Alignment.

Transportation

The proposed project would require partial or complete abandonment of some FM Roads and CRs and the constructions of two new bridges.

Historic Resources

Inundation would result in the loss of existing structures including any historic property or NRHP-eligible site located within the reservoir footprint. The adverse impacts would be mitigated in accordance with the PA.

Archeological Resources

Inundation would result in the loss of existing archeological resources within the reservoir footprint. The adverse impacts would be mitigated in accordance with the PA.

Paleontological Resources

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, a covered pavilion and stairway access to the North Sulphur River Channel (**Appendix Q**). 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.

Socioeconomics

The proposed project would permanently remove some agricultural land from production and require sale of parcels in the project area to UTRWD. As of August 2018, one residence remained in the project boundary that would need to be acquired prior to construction.

Environmental Justice and Protection of Children

The proposed project could result in minor adverse impacts to environmental justice populations such as increased noise and air emissions during construction. Children could be adversely impacted by increased noise and potential safety concerns during construction.

Table 4-36: Summary of Impacts from the No Action Alternative and Proposed Action Alternative

Resource/Impact Issue	No Action Alternative	Proposed Action Alternative
Land Use	Present trends in land use would continue and remain predominantly rural and undeveloped. UTRWD has purchased a little over half of the project area. There would be no effect on land use.	Effects would be major due to the inundation of more than 7,000 acres including retirement of approximately 1,600 acres of agricultural lands. Land use of lands surrounding the reservoir could change to residential and commercial development. Effects associated with the pipeline would be minor since existing land use could continue after construction. The proposed balancing reservoir would convert approximately 4.5 acres of grassland to a reservoir. Overall land use impacts would be major.
Ownership	UTRWD has purchased a little over half of the project area. There would be no effect on ownership.	UTRWD has purchased a little over half of the project area- the remainder (including one residence) would be purchased prior to construction. Impacts would be moderate.
Public Lands	Impacts to public lands are anticipated to be negligible. Increased water restrictions could result in changes to parklands due to limited watering capabilities.	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 would be major, but would be reduced through compensatory mitigation acreage.
Physiography	No Effect	No Effect
Topography	Topography of the proposed project area would be altered by continued erosion in the North Sulphur River and its tributaries. These impacts are considered to be major.	The topography of the proposed project area would be flooded. Area to be modified topographically will be in excess of 8,000 acres for all associated project features. Sediment yield to the reservoir over a 50-year period is between 2,570 ac-ft and 3,700 ac-ft. Flooding a portion of the river basin and some tributaries as well as the development of the dam would occur. Erosion along the proposed shoreline could alter topography. Impacts to topography are

Resource/Impact Issue	No Action Alternative	Proposed Action Alternative
		considered to be moderate. Impacts to topography from the pipeline are anticipated to be negligible.
Geology	Geologic formations within the North Sulphur River channel and tributaries would continue to erode. These impacts are considered to be minor.	Construction of the Proposed Action would slow erosion within the North Sulphur River and its tributaries. Along the pipeline alignment, the original characteristics of the surficial material would be permanently altered by construction activities. Impacts would be moderate and beneficial.
Geologic Hazards	No Effect	No Effect
Mineral Resources	No Effect	The proposed pipeline alignment would be precluded from any future surface mineral resource use. Oil and gas could potentially be produced using direction drilling technology. Impacts would be minor.
Soils	Soils within the proposed project area could be altered by continued erosion in the North Sulphur River. Impacts from the development of groundwater wells and pipelines would be expected to be minimal.	Impacts to soils would include excavation, transport, and compaction during construction. 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 reservoir floodplain. 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 North Sulphur River channel degradation behind the dam. During construction of the Lake Ralph Hall Raw Water Pipeline Alignment approximately 384 acres of existing soils would be disturbed. Impacts would be major.
Prime Farmland	Continued erosion in the North Sulphur River and its tributaries, prime farmland could be impacted.	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. The pipeline route would be maintained within a 100-ft ROW. This approximately 384-acre area may 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. If the pipeline alignment ROW is restored to agricultural uses following installation, this would constitute an impact but not a loss of prime farmland areas. Impacts would be major.
Groundwater	Substantial increases in groundwater usage in the UTRWD service area. Impacts could range from moderate to major.	No impacts to groundwater quantity or quality within the project area are expected. Impacts would be negligible.

Resource/Impact Issue	No Action Alternative	Proposed Action Alternative
Surface Water – Hydrology	The North Sulphur River and some of its major and minor tributaries would continue to deepen and widen as a result of erosion. Impacts would be major.	Reduced flow of the North Sulphur River would occur immediately downstream of the proposed Lake Ralph Reservoir to Baker Creek. Impacts would be major.
Surface Water – Water Quality	Surface water quality would remain similar to the existing conditions. Impacts would be minor.	Downstream site calculations indicate a slight increase in pollutant concentrations due to decreased flow. Impacts would be minor.
Surface Water – Floodplains	Floodplains would remain similar to the existing conditions. Impacts would be negligible.	Floodplains would remain similar to the existing conditions in that there are no active floodplains within the project area. The proposed impoundment would restore some floodplain function to the headwaters of the North Sulphur River and tributaries above the proposed conservation pool elevation. Impacts would be negligible.
Surface Water – 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 is expected to continue. Impacts would be major but would be reduced due to mitigation requirements for future projects.	The proposed reservoir project site would result in impacts including fill and inundation of 447,143 lineal feet of ephemeral stream channel, 62,149 lineal feet of intermittent stream channel, and approximately 56.19 acres of on-channel impoundments. A total of eight acres of lacustrine fringe wetlands would be impacted within the conservation pool, embankment, and spillway area. 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. Impacts are considered to be major but would be reduced through mitigation.
Air Quality	No substantial changes in air quality within the immediate Lake Ralph Hall study area are anticipated. 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.	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. 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. Minor, temporary impacts to air quality are anticipated during construction.
Noise	Slight increase in ambient noise levels caused by the projected population growth and associated development and land use changes.	During the construction, no noise impacts are anticipated for Ladonia residents but single residences located at each end of the dam embankment would be subjected to noise levels in the 55-dbA range. 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.

Resource/Impact Issue	No Action Alternative	Proposed Action Alternative
		Construction of the bridge for SH 34 and improvement of portions of CR 3444 would generate construction noise near four noise receptors located within 1,600 feet of the road/bridge. Increase in noise levels would be expected over the length of the pipeline in the areas where construction is occurring. Impacts associated with the project are considered to be minor.
Recreation	No impacts to recreation in the area.	The Ladonia Fossil Park would no longer be accessible for fossil hunters. Recreational impacts are considered to be minor. No causal recreational benefits have been identified associated with the reservoir, although such development is likely to occur and could represent minor beneficial impacts. Approximately 300 acres of Federal land (Caddo National Grasslands- Ladonia Unit), currently administered by the U.S. Forest Service would be converted as a result of the proposed project and reduce hunting opportunities. USFS also anticipates an increase in visitation and administrative burden. These impacts are considered moderate.
Visual Resources	No immediate impacts to visual resources.	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. 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. After construction, the visual resource contrast rating for the Build Alternative would be 'strong'. The form, line, color, and texture of the environment would all change noticeably under the proposed project.
Biological Resources – Habitat	The North Sulphur River and its major tributaries would continue to erode and degrade habitat surrounding these areas.	Minimal loss of moderate quality vegetative resources is anticipated as a result of the proposed project. The reservoir would help stabilize the North Sulphur River watershed by reducing habitat loss and conversion from currently on-going severe erosion. The reservoir would also create and enhance habitat for local and migratory wildlife through the anticipated creation of at least eight acres of fringe wetlands along the proposed reservoir shoreline. Mudflats may also be created in shallow flooded areas, especially in the upstream portion of the reservoir. The potential vegetated impact area includes agricultural production and woody areas. Approximately 300 acres of Federal land (Caddo

Resource/Impact Issue	No Action Alternative	Proposed Action Alternative
		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 Overall, although the type of vegetation communities to be impacted are common and degraded, because of the large size of the area to be converted to another and more uncommon type, the effects would be considered major.
Biological Resources – Wildlife	Current conditions of the North Sulphur River would continue to exist.	Although some displacement of wildlife would occur with the inundation as a result of the proposed project, the overall current state of degradation of habitat and isolation of remaining moderate quality habitat within the project area indicates that these impacts would be moderate. Increase in noise and presence of workers during construction may cause any wildlife to leave the area temporarily. Wildlife that could occur along the pipeline ROW would potentially experience varying degrees of adverse impacts.
Biological Resources – Aquatic Biota	Current conditions of the North Sulphur River would continue to exist.	The existing aquatic biota community would change from intermittent stream species to a community more adapted for a lacustrine habitat. Impacts would be moderate. Impacts to aquatic organisms in pools with decreasing levels would occur between the proposed Lake Ralph Hall dam and the Cooper Gage. Models indicate almost no change to reaches below the Cooper Gage. Impacts would be moderate. Overall impacts from pipeline construction to aquatic biota would be none to minimal.
Biological Resources – Invasive Species	Current conditions of the North Sulphur River would continue to exist. Impacts are expected to be minimal.	During the construction phase, invasive terrestrial plant species may invade disturbed areas and continue to inhabit these areas during the long-term operation of the proposed Lake Ralph Hall. Aquatic invasive species known to occur in Texas reservoirs (e.g., zebra mussels) may spread to Lake Ralph Hall if recreational boating is allowed. Impacts would be moderate.
Threatened and Endangered Species	No impacts to threatened or endangered species.	Impacts unlikely to any of the federal listed species for Fannin, Hunt, or Collin counties. The state listed timber rattlesnake, as well as the four state listed mollusks, have the potential to be impacted by the construction of Lake Ralph Hall and the Raw Water Pipeline Alignment. Potential impacts to mollusks avoided through proposed use of horizontal directional drilling or tunneling of perennial streams. Impacts would be negligible.

Resource/Impact Issue	No Action Alternative	Proposed Action Alternative
Traffic and Transportation	Land use changes within the region are expected to occur as a result of long-term population growth and associated development pressure. This growth may result in an increase in traffic on the local and regional transportation network.	During construction of the dam, reservoir, and principal and emergency spillways, congestion would increase in the immediate area due to additional construction vehicles, delays caused by construction activities (i.e., roads temporarily reduced to a single lane), and road closures and detours. In order to successfully implement the proposed Lake Ralph Hall, key roads would require adjustments to alignment and grade while other roads would be partially or completely abandoned. The establishment of the proposed dam, reservoir, and principal and emergency spillways would have noticeable long-term beneficial and adverse effects on transportation resources and traffic. The permanent closure of roadways and rerouting of traffic from some secondary and tertiary roadways in the area would result in adverse effects, while new roads and road improvements would result in beneficial effects. Effects on transportation resources would be minor.
Hazardous Materials	No change to the existing conditions.	One listing in the conservation pool boundary. It is recommended that the property be inspected and potential water quality contaminants removed prior to inundation. One listing outside conservation pool but inside project area not anticipated to be an issue. Three sites identified near the proposed pipeline footprint. The site limits should be verified prior to construction and avoided. Impacts would be minor.
Cultural Resources – Historic	Impacts to historic resources, if any, would be minor.	Due to a lack of access, not all properties within the APE were surveyed. None of the resources surveyed were recommended as eligible for the NRHP or recommended for intensive-level study. Additional historic-age properties may be found in the APE at a later date during surveys conducted in accordance with the PA. Impacts are currently anticipated to be minor, but further study is required.
Cultural Resources – Archeological	Continued erosion of the North Sulphur River channel and its major tributaries could expose archeological resources. Impacts would be considered minor.	Due to a lack of access, not all properties within the area of potential effects (APE) were surveyed. Survey covered approximately 15 percent of the APE. The remaining 85 percent of the Proposed Action will be considered and surveyed according to the Programmatic Agreement that is yet in progress. Additional sites will likely be encountered, and will need to be assessed for NHRP and SAL eligibility, and eligible sites will need to be evaluated and mitigated for project impacts according to procedures specified in the PA. A total of 17 archeological sites were recorded with five sites recommended for further

Resource/Impact Issue	No Action Alternative	Proposed Action Alternative
		testing or further definition of the deposit. One site, the Merrill Family Cemetery, was recommended to be avoided. Impacts would be major.
Paleontological Resources	Continued erosion of the North Sulphur River would continue to expose fossils. The Ladonia Fossil Park would remain in the current location and allow for continued fossil hunting.	Paleontological resources in the inundation footprint would no longer be accessible following completion of the proposed project. The Ladonia Fossil Park would no longer be accessible for fossil hunters, but would be replaced with a similar park downstream. Impacts would be major.
Socioeconomics	The No Action Alternative could displace and/or slow growth in the area. The impacts of displaced growth could be considered major, affecting planning, urban service costs, and public satisfaction with local government.	Impact includes losses in both sales and property tax revenue from the inundation of the land, but gains from increased spending due to construction, and land development. The losses in sales and property taxes revenue would be minor, and would be outweighed by the gains. Increase in property tax revenue from land development would dwarf the losses. Over the whole period, the average annual difference in the wholesale effective rate is 5.5 percent. The wholesale effective rate rises slowly while the lake and pipeline are being constructed; once the lake is in operation, the rate differences are more substantial, until the debt service for the dam is fully repaid. Rate impacts diminish thereafter. Overall impacts would be minor and positive.
Environmental Justice and Protection of Children	Current water distribution operations would be expected to have the same effects on populations of concern as the general population, including the potential for water restrictions and higher water costs.	The Proposed Action would not result in environmental justice impacts in the overall ROI. The Proposed Action could create slightly adverse disproportionate impacts relating to noise and/or traffic for Ladonia, for at least a portion of the construction phase, though not during the operational phase. Overall, adverse impacts on environmental justice populations within the study area would be minor. Project benefits, including employment opportunities, increased tax revenue, roadway improvements, and access to a potentially new recreational facility would be shared by all residents in the study area, including environmental justice populations.
Climate Change	The No Action Alternative would not have any direct impact on the climate, and would not contribute to climate change.	The proposed project would require energy associated with pumping from the reservoir to the service area, which could be a minor long-term effect on GHG. Long-term slight beneficial effects from augmenting water storage capacity in North Texas would be expected. Although there would be negligible direct effects from the emissions on climate change, the Proposed Action would constitute a more effective

Resource/Impact Issue	No Action Alternative	Proposed Action Alternative
		approach to water management under future conditions when compared to the No Action Alternative.

4.21 Relationship between Short-term Uses of the Environment and the Maintenance and Enhancement of Long-Term Productivity

Sec. 102(C)(iv) of NEPA [42 USC § 4332] and 40 CFR 1502.16 require an EIS to address "the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity." This involves the consideration of whether a Proposed Action is sacrificing a resource value that might benefit the environment in the long term, for some short-term value to the project proponent or the public.

The purpose of the Proposed Action is to capture, conserve, manage, and use a vital natural resource, water, in a manner that would benefit society. Hypothetically, Lake Ralph Hall could help meet water needs for North Texas municipalities for a period of time measuring a century or more, which would qualify as long-term. Therefore, the Proposed Action would not be sacrificing long-term productivity for short-term use or gain.

The USACE acknowledges that there are tradeoffs inherent in any allocation of natural resources. In the present instance, implementation of Lake Ralph Hall would necessitate the permanent loss of Waters of the U.S. on site. Prime Farmland Soils in certain upland areas, some of which are currently used as agricultural land (cropland and pasture) and all of which could be used as such would also be permanently lost. Effects on Waters of the U.S., in any case, as mandated by Section 404 of the Clean Water Act, would require compensatory mitigation.

4.22 Irreversible and Irretrievable Commitment of Resources

Sec. 102(C)(v) of NEPA [42 USC § 4332] requires an EIS to address "any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented." Irreversible and irretrievable commitments of resources mean losses to or impacts on natural resources that cannot be recovered or reversed.

More specifically, "irreversible" implies the loss of future options. Irreversible commitments of resources are those that cannot be regained, such as permanent conversion of wetlands and loss of cultural resources, soils, wildlife, agricultural, and socioeconomic conditions. The losses are permanent, incapable of being reversed. "Irreversible" applies mainly to the effects from use or depletion of nonrenewable resources, such as fossil fuels or cultural resources, or to those factors, such as soil productivity, that are renewable only over long periods of time.

“Irretrievable” commitments are those that are lost for a period of time, such as the temporary loss of timber productivity in forested areas that are kept clear for use as a ROW, road, or winter sports site. The lost forest production is irretrievable, but the action is not irreversible. If the use changes back again, it is possible to resume timber production.

4.22.1 Irreversible Commitments of Resources

Under the construction and operations of the Proposed Action, the following irreversible commitments of resources would occur:

• Consumption of fossil fuels (primarily diesel) and lubricants used during construction of dam, pipeline, balancing reservoir, and bridges as well as for road relocations, and to clear the reservoir footprint.

• Materials used to construct the dam and all other facilities, including cement/concrete, soil cement, slurry material, clay, sand, gravel, steel, iron, and other metallic alloys, copper wiring, PVC pipe, plastic, and so forth.

• Energy, supplied by fossil fuels or some other source of electricity, used over the operational life of the dam/reservoir to pump water from the intake/pump station at Lake Ralph Hall.

• Portions of the North Sulphur River and its tributaries permanently inundated at the site of the reservoir footprint.

• Prime Farmland Soils inundated at the site of the reservoir footprint permanently removing potential agricultural production.

• Existing wildlife habitat inundated within the reservoir footprint.

• Possible undiscovered archeological resources within the reservoir footprint, which would be permanently inundated by the reservoir and eventually buried under layers of sediments over the coming century and beyond, likely moving them beyond the reach of future investigations.

• One remaining home and associated structures that have to be purchased, demolished, and removed prior to impoundment.

4.22.2 Irretrievable Commitments of Resources

As noted above, “irretrievable” commitments of resources are those that are lost for a period of time, but not permanently. The Proposed Action would cause short-term loss of agricultural production during construction along the raw water pipeline ROW.

5.0 Mitigation

This chapter summarizes the anticipated impacts of the Lake Ralph Hall and Lake Ralph Hall Raw Water Pipeline Proposed Action Alternatives and identifies proposed mitigations measures. Potential monitoring and mitigation measures for identified impacts are identified by the U.S. Army Corps of Engineers (USACE) for individual resources. Mitigation measures described are intended to address the requirements of the National Environmental Policy Act (NEPA), USACE's Public Interest Review and the 404(b)(1) guidelines, and the USACE Regulatory Guidance Letter 02-2. The project application was submitted prior to the establishment of the USACE Compensatory Mitigation Regulations (April 2008) and is not subject to those requirements, but is instead subject to the 2002 Compensatory Mitigation Regulatory Guidance Letter 02-2. The mitigation measures are not part of Upper Trinity Regional Water District's (UTRWD) proposed project but could be added as special conditions to any Section 404 permit that may be issued by USACE or as stipulations of approval or authorizations of regulatory agencies. **Table 5-1** includes a summary of Proposed Mitigation Measures.

Table 5-1: Summary of Proposed Mitigation Measures

Resource/Impact Issue	Impacts from the Proposed Action Alternative	Proposed Mitigation for the Proposed Action Alternative
Land Use	Effects would be major due to the inundation of more than 7,000 acres including retirement of approximately 1,600 acres of agricultural lands. Land use of lands surrounding the reservoir could change to residential and commercial development. Effects associated with the pipeline would be minor since existing land use could continue after construction. The proposed balancing reservoir would convert approximately 4.5 acres of grassland to a reservoir. Overall land use impacts would be major.	No mitigation is required for this resource.
Ownership	UTRWD has purchased a little over half of the project area- the remainder (including one residence) would be purchased prior to construction. Impacts would be moderate.	No mitigation is required for this resource.
Public Lands	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 would be major, but would be reduced through compensatory mitigation acreage.	UTRWD is working with the USFS relative to a land exchange to offset these effects.

Resource/Impact Issue	Impacts from the Proposed Action Alternative	Proposed Mitigation for the Proposed Action Alternative
Physiography	No Effect	No mitigation is required for this resource.
Topography	The topography of the proposed project area would be flooded. Area to be modified topographically will be in excess of 8,000 acres for all associated project features. Sediment yield to the reservoir over a 50-year period is between 2,570 ac-ft and 3,700 ac-ft. Flooding a portion of the river basin and some tributaries as well as the development of the dam would occur. Erosion along the proposed shoreline could alter topography. Impacts to topography are considered to be moderate. Impacts to topography from the pipeline are anticipated to be negligible.	No mitigation is required for this resource.
Geology	Construction of the Proposed Action would slow erosion within the North Sulphur River and its tributaries. Along the pipeline alignment, the original characteristics of the surficial material would be permanently altered by construction activities. Impacts would be moderate and beneficial.	No mitigation is required for this resource.
Geologic Hazards	No Effect	No mitigation is required for this resource.
Mineral Resources	The proposed pipeline alignment would be precluded from any future surface mineral resource use. Oil and gas could potentially be produced using direction drilling technology. Impacts would be minor.	No mitigation is required for this resource.
Soils	Impacts to soils would include excavation, transport, and compaction during construction. 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 reservoir floodplain. 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 North Sulphur River channel degradation behind the dam. During construction of the Lake Ralph Hall Raw Water Pipeline Alignment approximately 384 acres of existing soils would be disturbed. Impacts would be major.	Sediment and Erosion Control Plan. Construction will be done in accordance with a TPDES Storm Water Permit, which mandates preparation of a Storm Water Pollution Prevention Plan.

Resource/Impact Issue	Impacts from the Proposed Action Alternative	Proposed Mitigation for the Proposed Action Alternative
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. The pipeline route would be maintained within a 100-ft ROW. This approximately 384-acre area may 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. If the pipeline alignment ROW is restored to agricultural uses following installation, this would constitute an impact but not a loss of prime farmland areas. Impacts would be major.	Prime Farmland soils found in areas of proposed water supply reservoirs are exempt from restrictions under the Farmland Protection Policy Act (FPPA).
Groundwater	No impacts to groundwater quantity or quality within the project area are expected. Impacts would be negligible.	No mitigation is required for this resource.
Surface Water – Hydrology	Reduced flow of the North Sulphur River would occur immediately downstream of the proposed Lake Ralph Reservoir to Baker Creek. Impacts would be major.	Directional drilling during construction of pipeline at significant stream crossings (those with standing water below the ordinary high water mark (OHWM) at time of construction); restoration of stream contours, stabilization of stream banks; revegetation of disturbed areas after pipeline construction. Whenever practicable, construction within waterbodies will take place during periods when streams or wetlands may be dry. TCEQ Section 401 BMPs will be followed.
Surface Water – Water Quality	Downstream site calculations indicate a slight increase in pollutant concentrations due to decreased flow. Impacts would be minor.	Stormwater Pollution Prevention Plan (SWPPP) and Texas Pollution Discharge Elimination System (TPDES) General Permit During Construction
Surface Water – Floodplains	Floodplains would remain similar to the existing conditions in that there are no active floodplains within the project area. The proposed impoundment would restore some floodplain function to the headwaters of the North Sulphur River and tributaries above the proposed conservation pool elevation. Impacts would be negligible.	No mitigation is required for this resource.

Resource/Impact Issue	Impacts from the Proposed Action Alternative	Proposed Mitigation for the Proposed Action Alternative
Surface Water – Wetlands and Other Waters of the U.S.	The proposed reservoir project site would result in impacts including fill and inundation of 447,143 lineal feet of ephemeral stream channel, 62,149 lineal feet of intermittent stream channel, and approximately 56.19 acres of on-channel impoundments. A total of eight acres of lacustrine fringe wetlands would be impacted within the conservation pool, embankment, and spillway area. 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. Impacts are considered to be major but would be reduced through mitigation.	Implement *Mitigation Plan for Impacts to Aquatic Resources – Lake Ralph Hall*
Air Quality	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. 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. Minor, temporary impacts to air quality are anticipated during construction.	Implement Best Management Practices (BMP) During Construction
Noise	During the construction, no noise impacts are anticipated for Ladonia residents but single residences located at each end of the dam embankment would be subjected to noise levels in the 55-dbA range. 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 CR 3444 would generate construction noise near four noise receptors located within 1,600 feet of the road/bridge. Increase in noise levels would be expected over the length of the pipeline in the areas where construction is occurring. Impacts associated with the project are considered to be minor.	BMPs would be implemented to reduce potential impacts.

Resource/Impact Issue	Impacts from the Proposed Action Alternative	Proposed Mitigation for the Proposed Action Alternative
Recreation	The Ladonia Fossil Park would no longer be accessible for fossil hunters. Recreational impacts are considered to be minor. No causal recreational benefits have been identified associated with the reservoir, although such development is likely to occur and could represent minor beneficial impacts. Approximately 300 acres of Federal land (Caddo National Grasslands- Ladonia Unit), currently administered by the U.S. Forest Service would be converted as a result of the proposed project and reduce hunting opportunities. USFS also anticipates an increase in visitation and administrative burden. These impacts are considered moderate.	UTRWD will relocate fossil park. UTRWD is currently coordinating with the USFS. No other mitigation is required for this resource.
Visual Resources	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. 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. After construction, the visual resource contrast rating for the Build Alternative would be ‘strong’. The form, line, color, and texture of the environment would all change noticeably under the proposed project.	No mitigation is planned for this resource.

Resource/Impact Issue	Impacts from the Proposed Action Alternative	Proposed Mitigation for the Proposed Action Alternative
Biological Resources - Habitat	Minimal loss of moderate quality vegetative resources is anticipated as a result of the proposed project. The reservoir would help stabilize the North Sulphur River watershed by reducing habitat loss and conversion from currently on-going severe erosion. The reservoir would also create and enhance habitat for local and migratory wildlife through the anticipated creation of at least eight acres of fringe wetlands along the proposed reservoir shoreline. Mudflats may also be created in shallow flooded areas, especially in the upstream portion of the reservoir. The potential vegetated impact area includes agricultural production and woody areas. 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 Overall, although the type of vegetation communities to be impacted are common and degraded, because of the large size of the area to be converted to another and more uncommon type, the effects would be considered major.	Implement *Mitigation Plan for Impacts to Aquatic Resources – Lake Ralph Hall;* Re-Vegetate Disturbed Areas After Pipeline Construction
Biological Resources - Wildlife	Although some displacement of wildlife would occur with the inundation as a result of the proposed project, the overall current state of degradation of habitat and isolation of remaining moderate quality habitat within the project area indicates that these impacts would be moderate. Increase in noise and presence of workers during construction may cause any wildlife to leave the area temporarily. Wildlife that could occur along the pipeline ROW would potentially experience varying degrees of adverse impacts.	All Requirements Regarding Migratory Birds, as applicable in Texas, will be Met Prior to Construction.

Resource/Impact Issue	Impacts from the Proposed Action Alternative	Proposed Mitigation for the Proposed Action Alternative
Biological Resources – Aquatic Biota	The existing aquatic biota community would change from intermittent stream species to a community more adapted for a lacustrine habitat. Impacts would be moderate. Impacts to aquatic organisms in pools with decreasing levels would occur between the proposed Lake Ralph Hall dam and the Cooper Gage. Models indicate almost no change to reaches below the Cooper Gage. Impacts would be moderate. Overall impacts from pipeline construction to aquatic biota would be none to minimal.	Implement *Mitigation Plan for Impacts to Aquatic Resources – Lake Ralph Hall*; whenever practicable, construction within waterbodies will take place during periods when streams or wetlands may be dry.
Biological Resources – Invasive Species	During the construction phase, invasive terrestrial plant species may invade disturbed areas and continue to inhabit these areas during the long-term operation of the proposed Lake Ralph Hall. Aquatic invasive species known to occur in Texas reservoirs (e.g., zebra mussels) may spread to Lake Ralph Hall if recreational boating is allowed. Impacts would be moderate.	No mitigation is required for this resource.
Threatened and Endangered Species	Impacts unlikely to any of the federal listed species for Fannin, Hunt, or Collin counties. The state listed timber rattlesnake, as well as the four state listed mollusks, have the potential to be impacted by the construction of Lake Ralph Hall and the Raw Water Pipeline Alignment. Potential impacts to mollusks avoided through proposed use of horizontal directional drilling or tunneling of perennial streams. Impacts would be negligible.	Contractors would be advised of potential occurrence of timber rattlesnake and to avoid harming species. Directional drilling during construction of the pipeline at significant stream crossings (those with standing water below the OHWM at the time of construction).

Resource/Impact Issue	Impacts from the Proposed Action Alternative	Proposed Mitigation for the Proposed Action Alternative
Traffic and Transportation	During construction of the dam, reservoir, and principal and emergency spillways, congestion would increase in the immediate area due to additional construction vehicles, delays caused by construction activities (i.e., roads temporarily reduced to a single lane), and road closures and detours. In order to successfully implement the proposed Lake Ralph Hall, key roads would require adjustments to alignment and grade while other roads would be partially or completely abandoned. The establishment of the proposed dam, reservoir, and principal and emergency spillways would have noticeable long-term beneficial and adverse effects on transportation resources and traffic. The permanent closure of roadways and rerouting of traffic from some secondary and tertiary roadways in the area would result in adverse effects, while new roads and road improvements would result in beneficial effects. Effects on transportation resources would be minor.	All construction vehicles would be equipped with backup alarms, two-way radios, and 'slow moving vehicle' signs when appropriate. Routing and scheduling construction vehicles to avoid conflicts with other traffic.
Hazardous Materials	One listing in the conservation pool boundary. It is recommended that the property be inspected and potential water quality contaminants removed prior to inundation. One listing outside conservation pool but inside project area not anticipated to be an issue. Three sites identified near the proposed pipeline footprint. The site limits should be verified prior to construction and avoided. Impacts would be minor.	Inspection and Removal of Contaminants at Identified Sites if Needed
Cultural Resources - Historic	Due to a lack of access, not all properties within the APE were surveyed. None of the resources surveyed were recommended as eligible for the NRHP or recommended for intensive-level study. Additional historic-age properties may be found in the APE at a later date during surveys conducted in accordance with the PA. Impacts are currently anticipated to be minor, but further study is required.	Implement Programmatic Agreement

Resource/Impact Issue	Impacts from the Proposed Action Alternative	Proposed Mitigation for the Proposed Action Alternative
Cultural Resources – Archeological	Due to a lack of access, not all properties within the area of potential effects (APE) were surveyed. Survey covered approximately 15 percent of the APE. The remaining 85 percent of the Proposed Action will be considered and surveyed according to the Programmatic Agreement that is yet in progress. Additional sites will likely be encountered, and will need to be assessed for NHRP and SAL eligibility, and eligible sites will need to be evaluated and mitigated for project impacts according to procedures specified in the PA. A total of 17 archeological sites were recorded with five sites recommended for further testing or further definition of the deposit. One site, the Merrill Family Cemetery, was recommended to be avoided. Impacts would be major.	Implement Programmatic Agreement
Paleontological Resources	Paleontological resources in the inundation footprint would no longer be accessible following completion of the proposed project. The Ladonia Fossil Park would no longer be accessible for fossil hunters, but would be replaced with a similar park downstream. Impacts would be major.	Relocate Fossil Park
Socioeconomics	Impact includes losses in both sales and property tax revenue from the inundation of the land, but gains from increased spending due to construction, and land development. The losses in sales and property taxes revenue would be minor, and would be outweighed by the gains. Increase in property tax revenue from land development would dwarf the losses. Over the whole period, the average annual difference in the wholesale effective rate is 2.9 percent. The wholesale effective rate rises slowly while the lake and pipeline are being constructed; once the lake is in operation, the rate differences are more substantial, until the debt service for the dam is fully repaid. Rate impacts diminish thereafter. Overall impacts would be minor and positive.	Loss of property taxes would be reduced through an arrangement reached between UTRWD and Fannin County.

Resource/Impact Issue	Impacts from the Proposed Action Alternative	Proposed Mitigation for the Proposed Action Alternative
Environmental Justice and Protection of Children	The Proposed Action would not result in environmental justice impacts in the overall ROI. The Proposed Action could create slightly adverse disproportionate impacts relating to noise and/or traffic for Ladonia, for at least a portion of the construction phase, though not during the operational phase. Overall, adverse impacts on environmental justice populations within the study area would be minor. Project benefits, including employment opportunities, increased tax revenue, roadway improvements, and access to a potentially new recreational facility would be shared by all residents in the study area, including environmental justice populations.	Impacts to EJ populations would be reduced through implementations of BMPs for noise and air quality during construction. All construction vehicles would be equipped with backup alarms, two-way radios, and 'slow moving vehicle' signs when appropriate. Routing and scheduling construction vehicles to avoid conflicts with other traffic.
Climate Change	The proposed project would require energy associated with pumping from the reservoir to the service area, which could be a minor long-term effect on GHG. Long-term slight beneficial effects from augmenting water storage capacity in North Texas would be expected. Although there would be negligible direct effects from the emissions on climate change, the Proposed Action would constitute a more effective approach to water management under future conditions when compared to the No Action Alternative.	No mitigation is required for this resource.

5.1 Land Use and Ownership

The proposed Lake Ralph Hall dam and reservoir would take an estimated five years to construct and would impact approximately 12,092 acres of forest, crop, grasslands, and ranch land. As of August 2018, one residence remains within the project area and would need to be purchased prior to construction. 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. The effects of the pipeline and balancing reservoir associated with the proposed action on land use and ownership would be minor. No mitigation is being proposed for impacts to land use and ownership.

5.2 Public Lands

The Ladonia Unit of the Caddo National Grasslands is located in the southwest portion of the project area. 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 are considered major but would be reduced by compensatory mitigation acreage. UTRWD is undertaking efforts and coordinating with the USFS regarding the Caddo National Grassland relative to mitigation in the form of a land exchange. Lands to be offered to the Caddo National Grassland by UTRWD are not identified at this time and will be addressed in the USFS separate NEPA analysis concerning that action.

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, a covered pavilion and stairway access to the North Sulphur River Channel (**Appendix Q**). 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.

5.3 Physiography and Topography

The topography of the proposed project area would be altered 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. Impacts to topography are considered to be moderate. Physiography under the Proposed Action would not be altered. Since the pipeline would be buried, impacts to the topography are transitory and do not represent long term alteration. No monitoring or mitigation is being considered for impacts to physiography or topography.

5.4 Geology and Soils

Construction of the Proposed Action would reduce the rate of erosion of the Ozan Formation and terrace deposits within the North Sulphur River and its tributaries. No adverse downstream impacts on channel morphology or capacity are expected as a result of the Proposed Action (**Appendix C**). 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 right-of-way (ROW) along the pipeline alignment.

The Proposed Action is not expected to magnify effects from geologic hazards or effect mineral resources in the project area.

Several project elements 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. 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 North Sulphur River channel degradation behind the dam.

During construction of the Lake Ralph Hall Raw Water Pipeline Alignment approximately 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.

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 FPPA.

The pipeline route would be maintained within a 100-ft ROW. This approximately 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. No additional monitoring or mitigation is being considered for geology and soils.

5.5 Groundwater

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 are expected. No mitigation for groundwater is anticipated.

5.6 Surface Water

Hydrology

Under the Proposed Action, the North Sulphur River and major tributaries would be affected by the construction and operation of the reservoir. 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. Impacts to the flow regime would be major.

The Lake Ralph Hall Raw Water Pipeline Alignment crosses several streams. Temporary impacts to hydrology would be avoided by using horizontal directional drilling to install the pipeline at perennial stream crossings, which are considered significant, and staging areas would be located within uplands.

In streams that are not perennial, the pipeline crossing would be constructed using open trench construction methods. Any impacts associated with open trench crossings would be temporary in nature. Upon completion, temporary fill for cofferdams or other construction materials will be removed from the stream, the bed and bank contours below the ordinary high-water mark will be restored, and the stream will be stabilized using appropriate post-construction best management practices in accordance with U.S. Army Corps of Engineers section 404 permit, the Texas Commission on Environmental Quality section 401 Water Quality Certification, and Stormwater Construction General Permit conditions. Overall impacts from pipeline construction to hydrology would be negligible to minor.

Water Quality

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. The reduction in pollutant concentrations is attributed to decrease of overland runoff area as a result of the construction of Lake Ralph Hall. Downstream site calculations indicate a slight increase in pollutant concentrations due to decreased flow as a result of Lake Ralph Hall.

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. A Texas Pollution Discharge Elimination System (TPDES) general permit exists for construction activities. The SWPPP is a requirement of the general permit. The Texas Commission on Environmental Quality (TCEQ) would review the SWPPP to determine that potential threats to water quality are addressed, and would inspect the implementation and maintenance of measures to control erosion during the construction process. Construction best management practices (BMPs) would be used to minimize erosion during construction. Erosion and sedimentation controls typically used include but are not limited to the following:

- Re-establishment of vegetative cover as soon as practicable to any areas of exposed soil within the construction areas outside the footprint of the proposed reservoir. Erosion control mats or comparable protection would be required for stream banks to provide protection until vegetation is reestablished.

- Sprinkling with water on exposed soil in traffic areas at appropriate intervals to minimize wind erosion.

- Implementation of temporary sediment control measures on slopes with exposed soils. These measures may include silt fencing, rock-check dams, and/or hay bales.

- Management of stockpiles formed from excavations located near streams, gullies or steep slopes by silt fences, rock berms, or geotextiles at the contractor's discretion to prevent direct discharge of sediments to streams.

- Grading of construction areas to a finished smooth condition at the conclusion of construction to discourage the formation of gullies and to facilitate reestablishment of vegetative cover.

- Construction of sediment detention ponds below large areas of excavation, stockpiles, or filling in order to collect sedimentation on site rather than allow it to be carried to the area streams.

Implementation of the above measures would limit adverse effects due to siltation and sedimentation during construction.

Floodplains

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 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. Ground elevations would return to pre-construction elevations once construction of the Lake Ralph Hall Raw Water Pipeline Alignment is complete.

Wetlands and Waters of the U.S.

The proposed reservoir project site would result in impacts including fill (dam embankment) and inundation of 447,143 lineal feet of ephemeral stream channel, 62,149 lineal feet of intermittent stream channel, and approximately 56.19 acres of on-channel impoundments (33 in number). Based on the Stream Watershed Assessment and Measurement Protocol Interaction Model (SWAMPIM) protocol, these impacts equate to 383 Functional Capacity Units (FCU) of ephemeral streams and 57 FCU of intermittent streams for a total of 440 FCU. Impacts to on-channel impoundments equate to a Resource Capacity of 28.6 (UTRWD, 2019b). A total of eight acres of lacustrine fringe wetlands would be impacted within the conservation pool, embankment, and spillway area.

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.

Projects subject to Clean Water Act (CWA) regulations must comply with CWA Section 404(b)(1) Guidelines (40 CFR, Part 230) for the discharge of dredge and fill material into waters of the U.S.

The Section 404(b)(1) Guidelines require that the USACE permit only the least environmentally damaging practicable alternative (LEDPA), unless the LEDPA has other significant adverse environmental consequences. The USACE's evaluation typically includes a determination of whether the applicant has taken sufficient measures to mitigate the project's likely adverse impact on the aquatic ecosystem.

In a Memorandum of Agreement (MOA) signed February 6, 1990 between the USACE and the Environmental Protection Agency (EPA), mitigation was clarified as required under the 404(b)(1) guidelines as a sequential process of avoiding, minimizing, and compensating for adverse impacts to the aquatic ecosystem:

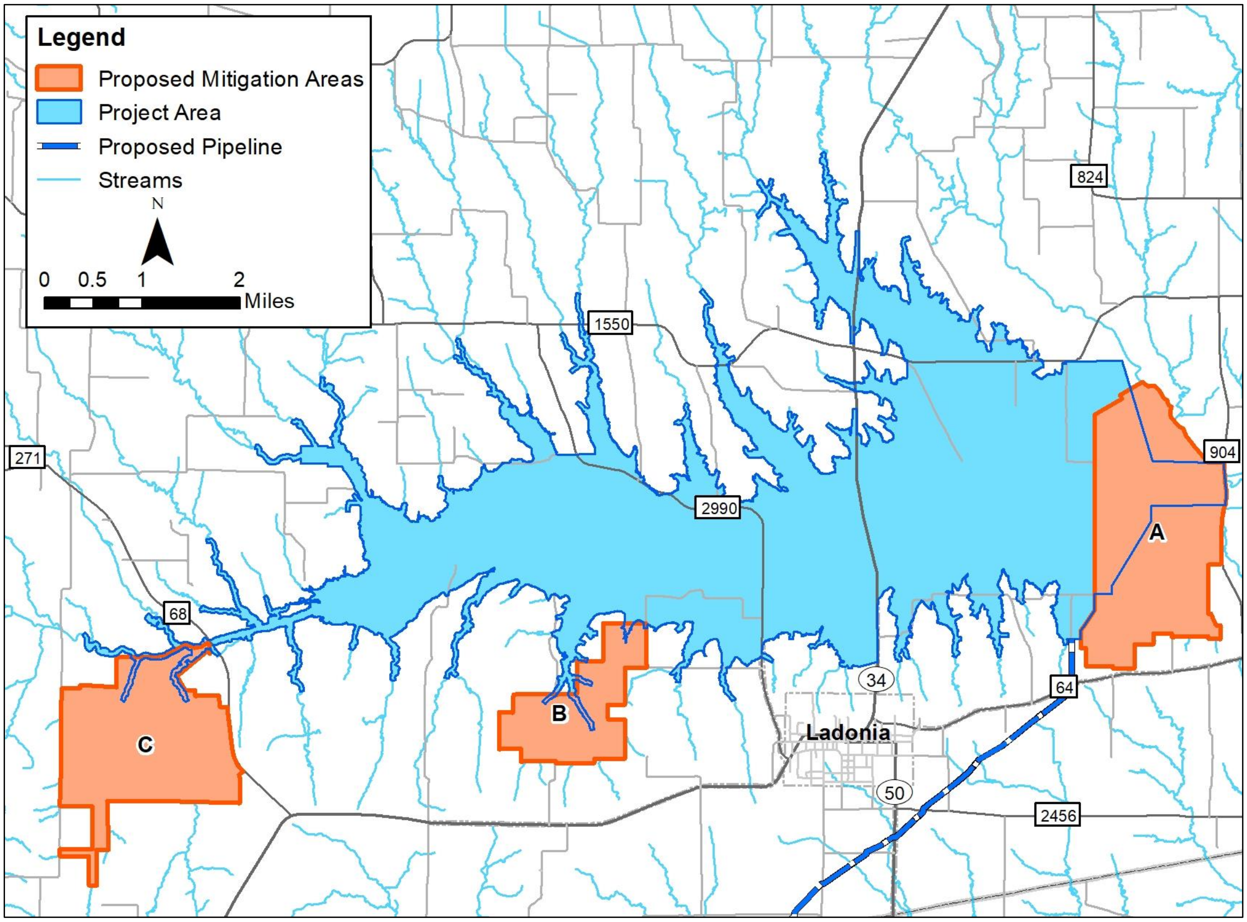
> Avoid: Take all appropriate and practicable measures to avoid adverse impacts to the aquatic ecosystem that are not necessary.
>
> Minimize: Take all appropriate and practicable measures to minimize adverse impacts to the aquatic ecosystem that cannot reasonably be avoided.
>
> Compensate: Implement appropriate and practicable measures to compensate for adverse project impacts to the aquatic ecosystem that cannot reasonably be avoided or further minimized. This step is also referred to as compensatory mitigation. The purpose of compensatory mitigation is to replace aquatic ecosystem functions that would be lost or impaired as a result of a USACE-authorized activity.

Goals of the proposed *Mitigation Plan for Impacts to Aquatic Resources – Lake Ralph Hall (***Appendix L**) include:

- Avoid and minimize impacts to waters of the U. S. associated with the Lake Ralph Hall project to the maximum practicable extent.
- Provide for the replacement of the chemical, physical and biological functions of the waters of the U.S. that will be lost because of the project.
- Restore and support self-sustaining stream systems that support functions appropriate for the landscape setting and watershed.

Figure 5-1 shows the proposed mitigation areas relative to the proposed reservoir.

Figure 5-1: Proposed Mitigation Area



The proposed mitigation includes qualitative and quantitative objectives. Qualitative objectives include improvements to support the plan's goals associated with hydrologic, hydraulic, geomorphologic, physiochemical, and biological functions.

Quantitative objectives include the following measurable outcomes to achieve the goals of the mitigation plan (UTRWD, 2019b):

- Provide a minimum functional uplift of 56.84 FCUs for intermittent streams located within Mitigation Zone A (**Figure 5-1**). The functional uplift will be generated by restoring degraded streams and improving the hydrologic, hydraulic, geomorphologic, physiochemical, and biological function of those streams.

- Provide a minimum functional uplift of 382.74 FCUs for ephemeral streams in Mitigation Zones A, B and/or C (**Figure 5-1**). The functional uplift will be generated through enhancement, restoration and re-establishment of streams, improving the hydrologic, hydraulic, geomorphologic, physiochemical and biological function of those streams.

- Establish a minimum of 8 acres of emergent wetland.

Based on the activities described in the mitigation plan, loss of 56.84 intermittent stream FCUs and 382.74 ephemeral stream FCUs within the impact area will be offset by an uplift of 439.58 FCUs within Mitigation Zones A, B and/or C. Of the 439.58 FCUs, a minimum of 56.84 FCUs will result from intermittent stream mitigation activities.

Table 5-2 includes a summary of stream type and FCU generation by mitigation zone. Detailed information regarding mitigation credits for the mitigation activities are provided in **Appendix L.**

Table 5-2: Summary of Functional Capacity of Streams Within Mitigation Zones A, B, and C at Maturity

Mitigation Zone	Stream Type	Proposed Total Stream Functional Capacity Units (FCU) at Maturity
Mitigation Zone A Subtotal	Intermittent / Perennial Pools	130.65
Mitigation Zones A, B, & C Subtotal	Ephemeral	510.59
Total FCUs	–	640.95
Less Baseline FCUs	–	182.92
Projected Uplift FCUs	–	458.03
Less Impacted FCUs	–	439.58
Adaptive Management / Contingency FCUs	–	18.45

In addition, approximately 8 acres of emergent wetlands would be established to compensate for loss of lacustrine fringe emergent wetlands within the impact area. Therefore, the mitigation plan would provide the required acre for acre compensation to offset unavoidable losses to emergent wetland from the project.

Pipeline installation would 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.

5.7 Air Quality

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. Although some air quality impacts inevitably would occur during construction, they would be transitory and limited in duration.

Once project construction is complete air quality should return to its current conditions. 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.

BMPs would be implemented and all provisions of state laws governing the maintenance and operations of construction equipment and regulations governing fugitive dust would be complied with. Emissions due to construction operations would be mitigated by implementing BMP measures such as fugitive dust control. Strategies to control fugitive dust may include wetting or watering, chemical stabilizations, planting vegetative cover, providing synthetic cover, wind breaks, or other equivalent approved methods or techniques. Other emissions controls could include reducing idling, adhering to burning restrictions, and minimizing hauling.

5.8 Noise

During the construction phase, heavy equipment on the site would include dump trucks, scrapers, dozers, loaders, backhoes, and other heavy construction equipment. No noise impacts are anticipated for residents in the City of Ladonia. Single residences located at each end of the dam embankment would be subjected to noise levels tolerable for day time activity, but may be of bother at night if night time operations are conducted. Four noise receptors would be subjected to increased noise levels from construction of bridges and roadways. Increased noise levels would also be expected over the length of the pipeline 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 to the extent that visitation to the area is increased and boats are operated for fishing and other recreation could occur. However, local authorities such as lake operators, cities, or counties can set noise regulations to reduce noise levels.

BMPs to reduce noise could include limiting construction to normal weekday business hours in areas adjacent to noise sensitive land uses such as residential areas and recreational areas when possible, and ensuring that construction equipment mufflers are properly maintained.

5.9 Recreation

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. Recreation within this portion of the grasslands is limited to hunting as there are no lakes or trails. Therefore, there would be 300 fewer acres of land available for recreational hunting due to the Proposed Action, which is considered minimal.

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 stairway access to the North Sulphur River Channel (**Appendix**

Q). 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.

The reservoir has the ability to provide the potential benefit as a recreational resource for the area. However, no development plans or specific use of the proposed project for recreational purposes has been identified. Therefore, no causal recreational benefits have been identified associated with the reservoir, although such development is likely to occur independently and was addressed in the cumulative section.

5.10 Visual Resources

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. Overall, the impacts to visual resources related to construction of the proposed dam and reservoir would be moderate and end once construction activities are completed.

Based on the large size of the proposed reservoir, dam, and change in land use that would occur under the proposed project, the visual resource contrast rating for the Build Alternative would be ‘strong’. The form, line, color, and texture of the environment would all change noticeably under the proposed project. However, whether this impact would be regarded as adverse or beneficial would depend on the values of each individual observer. No mitigation for visual resources is anticipated.

5.11 Biological Resources

Habitat

Since the overall quality of vegetative resources within the proposed project area has been substantially degraded by agricultural usage and the significant continuing erosion problems experienced as a result of historical channelization projects along the river, minimal loss of moderate quality vegetative resources is anticipated as a result of the proposed project. The reservoir would help stabilize the North Sulphur River watershed by reducing habitat loss and conversion from currently on-going severe erosion. The reservoir would also create and enhance habitat for local and migratory wildlife through the anticipated creation of eight acres of wetlands at a targeted location as outlined in the mitigation plan. There may also be inadvertent development of some fringe wetlands along the lake shoreline that could provide benefits to wildlife. Mudflats may also be created in shallow flooded areas, especially in the upstream portion of the reservoir.

To facilitate evaluation of potential impacts to these habitats, Texas Parks and Wildlife Department’s (TPWD) Wildlife Habitat Appraisal Procedure (WHAP) was selected to assess the terrestrial habitat within the proposed project area. The habitat assessment included classification of land cover within the proposed conservation pool area and evaluation of habitat quality using the WHAP (UTRWD, 2011a). In the documentation of its Decision Order, the TCEQ listed

Findings of Fact including many which detailed the impacts of the historical North Sulphur Channelization Project, the existing conditions of the North Sulphur River watershed, and its evaluation of the habitats within the proposed project area. The final Water Use Permit No. 5821 (dated December 11, 2013) includes several Special Conditions (**Appendix N**). Special Conditions related to aquatic resources are met with the proposed mitigation activities described in the mitigation plan. Special Condition M related to terrestrial resources mitigation is included below:

Special Condition Excerpted from Water Use Permit No. 5821:

M. Permittee shall establish and maintain a riparian buffer zone of permanent vegetation around the perimeter of the reservoir averaging at least 50 feet in width with the exception of reasonable access areas and the area of the dam and spillway. Permittee shall also establish and maintain riparian buffer zones 25 to 50 feet wide at or below elevation 560 feet msl along Bear Creek, Brushy Creek, Pickle Creek, Davis Creek, Leggets Branch, Bralley Pool Creek, Merrill Creek, the North Sulphur River, and along unnamed tributaries within the area of the reservoir project. The buffer zones shall be planted with native vegetation as necessary to ensure complete coverage at maturity.

During construction of the Lake Ralph Hall Raw Water Pipeline Alignment existing vegetation would be disturbed. The pipeline route would be maintained with a 100-ft ROW. The majority of vegetation within this pipeline corridor consists of cropland, pasture/hay, and herbaceous grasslands. This area would be re-vegetated and certain non-structural uses such as agriculture and rangeland could be used along the alignment.

<u>Wildlife</u>

Although some displacement of wildlife would occur with the inundation as a result of the proposed project, the overall current state of degradation of habitat and isolation of remaining moderate quality habitat within the project area indicates that these impacts would be moderate. Wildlife that could occur along the pipeline ROW would potentially experience varying degrees of adverse impacts. In some cases, animal burrows may need to be removed or filled when they are located in close proximity to the pipeline alignment. Such activities would impact individuals of a particular species but would not constitute population level effects. Increase in noise and presence of workers during construction may cause wildlife to leave the area temporarily. Typically, wildlife would return after construction is completed and heavy equipment vacates the area. During construction, contractors would be notified of the potential presence of species of greatest conservation need (SGCN) in the area and encouraged to avoid or minimize impacts to SGCN if encountered during project activities.

Construction activities would have minimal effects on migratory birds, their nests, or eggs. Some ground nesting species could be accidentally displaced, injured or killed as a result of construction activities but personnel would be trained to avoid disturbing birds and nests when present within a work area. Similarly, birds nesting and/or foraging in this area could also be disturbed during construction activities. In accordance with the Migratory Bird Treaty Act (MBTA), UTRWD would avoid intentional takings of migratory birds. In addition, BMPs would be put into place that minimizes and avoids disturbance to migratory birds by:

- Not disturbing, destroying, or removing active nests during the nesting season;
- Avoiding the removal of unoccupied, inactive nests, as practicable; and
- Not collecting, capturing, relocating, or transporting birds, eggs, young, or active nests.

Aquatic Biota

The limited aquatic habitat in the North Sulphur River would be converted to open water and a more stable lacustrine environment. With the exception of the central stoneroller, all species sampled in the North Sulphur River occupy lacustrine environments and are found in other Texas reservoirs. Additional species that normally occur in Texas reservoirs could also be abundant in the proposed Lake Ralph Hall once constructed.

Due to the limited available habitat for invertebrates within the existing stream, impacts to these species is expected to be minimal. The aquatic habitat available for invertebrates would be converted from an intermittent stream habitat to a lacustrine habitat. Therefore, the invertebrate species community would change from riverine species to a community more adapted for a lacustrine habitat.

Aquatic organisms occupy pools within the North Sulphur River channel downstream from the proposed Lake Ralph Hall Dam location. The majority of impacts to pools >75 percent full in the North Sulphur River would occur between the Lake Ralph Hall Dam site and Baker Creek. This reach of the North Sulphur River will also be filled with earthen fill consisting of native clay soils excavated from the project area materials eliminating this pool area. Pools in reaches below Baker Creek would experience lower levels of change ranging from 0.0 percent to 6.0 percent. It is anticipated impacts to aquatic organisms in pools with decreasing levels would occur between the proposed Lake Ralph Hall dam and the Cooper Gage. These effects would be minor. Both the RiverWare Model and Water Availability Model (WAM) Model indicated almost no change to reaches below the Cooper Gage.

Temporary impacts to aquatic biota would be avoided by using horizontal directional drilling to install the pipeline at significant stream crossings and staging areas would be located within uplands. Significant streams are those which, at the time of construction, have standing water below the OHWM. If a stream does not have standing water below the OHWM at the time of construction, open trench crossing methods will be used. When open trench crossings are used, associated impacts will be temporary in nature. Once construction activities are complete for each crossing, the area will be returned to grade. Appropriate erosion control best management practices will be implemented and monitored in accordance with a Storm Water Pollution

Prevention Plan and the TCEQ Section 401 Water Quality Certification conditions issued for the USACE 404 permit. These include methods for erosion control, post-construction total suspended solids control, and sedimentation control. If contaminated dredge material that was not anticipated is encountered, operations shall cease immediately. 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 aquatic biota would be none to minimal.

Invasive Species

The spread of invasive plant species is often attributed to disturbed soils. During the construction phase, invasive terrestrial plant species may invade disturbed areas and continue to inhabit these areas during the long-term operation of the proposed Lake Ralph Hall.

Aquatic invasive species known to occur in Texas reservoirs (e.g., Zebra mussels) may spread to Lake Ralph Hall, particularly if recreational boating is allowed. Aquatic invasive species are known to be transported from reservoir to reservoir via watercraft and/or trailers. The control of these species is often very difficult once they become established. The Texas Parks and Wildlife Department (TPWD) has increased public awareness and education for these species and provides information on prevention of introduction. Any USACE permit has the ability to require additional actions be taken as appropriate if such new conditions occur.

5.12 Threatened and Endangered Species

Based on species research and evaluations of preferred habitat for the federal and state listed protected species, it is unlikely there would be impacts to any of the federal listed species for Fannin, Hunt, or Collin counties. The state listed timber rattlesnake, as well as the four state listed mollusks, have the potential to be impacted by the construction of Lake Ralph Hall Raw and the Water Pipeline Alignment. No mitigation is proposed.

5.13 Traffic and Transportation

During construction of the dam and reservoir, congestion would increase in the immediate area due to additional construction vehicles, delays caused by construction activities (i.e., roads temporarily reduced to a single lane), and road closures and detours.

The establishment of the proposed dam and reservoir would have noticeable long-term beneficial and adverse effects on transportation resources and traffic. The permanent closure of roadways and rerouting of traffic from some secondary and tertiary roadways in the area would result in adverse effects, while new roads and road improvements would result in beneficial effects.

Construction of the proposed raw water pipeline would have short-term negligible effects to transportation resources. Operation of the proposed pipeline would not conflict with any existing roadway or interfere with traffic.

Planning, development, and implementation of the proposed roadway improvements would be coordinated through TxDOT planners and engineers as well as Fannin County authorities. Potential construction BMPs could include requiring construction vehicles to be equipped with backup alarms, two-way radios, and 'slow moving vehicle' signs when appropriate. In addition, construction vehicles would be routed to avoid conflicts with other traffic when possible.

5.14 Hazardous Materials

As described in **Section 3.14**, the August 2018 radius report **(Appendix G**) contained one listing in the conservation pool, one outside conservation pool but within the project area and three near the proposed pipeline footprint. The listing located within the inundation areas is registered as "Wastewater Agriculture Non-Permitted". The property has been acquired by UTRWD and will be inspected and potential water quality contaminants will be removed prior to inundation. Limits of the two landfill listings near the proposed pipeline footprint will be verified prior to construction and avoided. Coordination with Atmos Energy would need to occur prior to construction of the raw water pipeline.

5.15 Cultural Resources

Historic Resources

The Proposed Action would have no effect on properties currently listed on the National Register of Historic Places. One historic marker is located near the proposed pipeline footprint. No impacts to the marker are anticipated, but if it is determined that the marker needs to be removed during construction it would be reinstalled after construction. Two cemeteries were surveyed as part of the 2010 *Historic Resources Survey*. Both cemeteries are located outside the project area, but within the APE, and are not recommended as eligible for the NRHP. Other historic cemeteries are located within the APE but were not surveyed due to lack of access. Field surveys of historic buildings and structures identified 75 properties within the APE including 114 resources. None of the resources were recommended as eligible for the NRHP or recommended for intensive-level study. Not all potential resources were surveyed due to lack of right of entry, heavy rains on unpaved roads, and heavy vegetation. 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*. 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.

A future cultural resource survey will be done in accordance with the Programmatic Agreement (PA) (**Appendix M**). The PA states that the USACE will determine the NRHP eligibility of all archeological and historical resources identified within the APE in consultation with the State Historic Preservation Office (SHPO) and the Tribes. For all resources determined eligible for inclusion in the NRHP, the USACE will apply the Criteria of Effect to assess whether or not adverse effects will occur to historic properties as a result of the project. In consultation with the SHPO and Tribes, the USACE shall make a determination of effect. For all historic properties that will be adversely affected, an avoidance plan or mitigation plan will be developed in consultation with all consulting parties.

Archeological Resources

An intensive pedestrian archeological survey was conducted along with trench testing of selected areas within the project area in 2005. The *Cultural Resources Survey Report* was submitted to and approved by the Texas Historical Commission (THC) in April 2006.

The survey covered approximately 15 percent of the Proposed Action with the primary focus on the dam site. A total of 17 archeological sites were recorded, which includes seven prehistoric sites and 10 historic sites. Eleven sites were recommended as ineligible for the NRHP or as a State Antiquities Landmark (SAL). Five sites were recommended for further testing or further definition of the deposit. One site, the Merrill Family Cemetery, was recommended to be avoided.

Based upon the results of the survey, the report included recommendations for additional survey of the first terrace surfaces, the lake margin, and deep testing in the proposed borrow pit areas and along the old river and creek channels to search for deeply buried sites. The report concluded that excavation of several prehistoric sites may be required to mitigate the loss of select significant resources and several historic sites warrant preservation.

A future cultural resources survey will be done in accordance with the PA. The PA states that the USACE will determine the NRHP eligibility of all archeological and historical resources identified within the APE in consultation with the SHPO and the Tribes. In consultation with the SHPO and Tribes, the USACE shall make a determination of effect. For archeological sites, the mitigation plan will specify the areas to be excavated, the methods to be used, special samples to be collected, the specialists who will conduct specialized analyses, the problems set forth in the research design that can be addressed by data from the site being excavated, and include reporting methods and curation of artifacts and records.

5.16 Paleontological Resources

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 due to the proposed project. However, proposed mitigation includes involving an equivalent or better park downstream of the proposed reservoir, including parking, signage, and a covered pavilion.

5.17 Socioeconomics

As discussed in **Section 4.17.1.2,** the socioeconomic and recreational impacts of Lake Ralph Hall will be minimal, and positive, in the long-term. As discussed previously, the loss of property taxes would be reduced through an arrangement reached between UTRWD and Fannin County. Once UTRWD acquired 5,000 acres of land for the development of the lake, it began making payments to Fannin County to help offset the loss. The first payment occurred in October of 2015. Fannin County will apportion the payments amongst the various local government agencies. No other mitigation is planned for this resource.

5.18 Environmental Justice and Protection of Children

The Proposed Action would not result in environmental justice impacts in the overall Region of Influence (ROI). Overall, adverse impacts on environmental justice populations within the study area would be minor, primarily relating to noise, air, and safety. Impacts to EJ populations would be reduced through implementations of BMPs for noise and air quality during construction. Safety concerns would be reduced through by ensuring that all construction vehicles would be equipped with backup alarms, two-way radios, and ‘slow moving vehicle’ signs when appropriate, and routing and scheduling construction vehicles to avoid conflicts with other traffic. Project benefits, including employment opportunities, increased tax revenue, roadway improvements, and access to a potentially new recreational facility would be shared by all residents in the study area, including environmental justice populations.

5.19 Climate Change

The proposed project would require energy associated with pumping from the reservoir to the service area, which could be a minor long-term effect on GHG. Although there would be negligible direct effects from the emissions on climate change, the Proposed Action would constitute a more effective approach to water management under future conditions. No mitigation for climate change is anticipated.

6.0 Consultation and Coordination

6.1 Public Participation and Scoping

Public participation for the FEIS began with the scoping process and involved actively soliciting input from the public and interested federal, state, and local agencies about the Proposed Action. The process provides a mechanism to identify and analyze potential environmental impacts and alternatives to be addressed in detail and disclosed to the public through the preparation of an EA or EIS. The USACE Fort Worth District's overall scoping goal for the FEIS was to engage a diverse group of public, tribal, and agency participants in the NEPA process, solicit relevant input, and provide timely information during the FEIS process.

On March 14, 2008, the USACE published and distributed a Public Notice to parties on the USACE Regulatory Branch mailing list for projects located in Fannin, Delta, and Lamar Counties, Texas, adjacent landowners, and other interested parties. The purpose of the Public Notice was to inform interested parties about the proposed Lake Ralph Hall, to solicit comments relevant to the Section 404 permit application, and to inform the public of an April 15, 2008, scoping meeting, proposed to be held at the Fannindel High School Gymnasium, in Ladonia, Texas. To further publicize the meeting, a notice providing information on the meeting was published in several local newspapers.

On Tuesday April 15, 2008, the USACE held an informal public scoping meeting from 4:00 to 8:30 pm at the Fannindel High School, located at 601 West Main Street, Ladonia, Fannin County, Texas. The purpose of this meeting was to disseminate information about the proposed lake project and its potential effects to the human environment. The USACE held this meeting to seek public comment on the applicant's proposal and assist the agency in determining whether the proposed project would significantly affect the quality of the human environment. Meeting participants were offered two options to provide comments, either in written form or through verbal comment recorded by a stenographer.

The formal 45-day comment period for the Public Notice and scoping process closed on April 28, 2008. The USACE did not receive any requests to extend the 45-day comment period. As the Public Notice comments and scoping comments were received, the USACE cataloged and recorded each comment with a unique number. All original copies, including transcript of verbal comments have been incorporated into the administrative record for this project. The comments were identified relative to environmental/human resource type and by specific issue within each resource to identify public and agency concerns related to the proposed project.

This summary of scoping comments presents a preliminary identification of those issues that appear to be relevant to the NEPA process and the USACE's decision whether to prepare an EA or EIS for this project. A number of comments were received regarding issues unrelated to the proposed action or for which the relationship appears to be weak or poorly defined. The USACE determined such comments to be outside the scope of the Section 404 and NEPA evaluations. As such, these comments were purposely omitted from this analysis.

The scoping phase of the NEPA process is designed to encourage public input to the environmental analysis and document preparation process. As such, the number of comments received at this point in the process provides an indication of the level of public interest and participation in the proposed project.

The following tables **(Table 6-1** through **Table 6-13)** provide a general overview of the number of comments by resource and by issue. Some comments concern more than one subject; therefore, some comments have been included in more than one table, although they were counted only once for the total comments in **Table 6-1**. Although all reasonable efforts were put forth to provide the most accurate information, the numbers provided in **Table 6-1** represent an approximate, not absolute accounting of comments.

Table 6-1: Total Written and Verbal Comments Transcribed

Number of Submission (Letter/transcript)	49
Number of Comments	255
Number of Individual Commenters	41

Table 6-2: Number of Comments Concerning Water Resources

Subject	Number of Comments
Effects to stream receiving inter basin transfer	2
Concern regarding accuracy of Jurisdictional Determination	4
Need to increase riparian and shoreline buffers	3
Need for performance bonds (mitigation)	1
Concerns regarding mitigation design	13
Impacts to aquatic resources associated with water transmission lines	2
Need for additional mitigation	2
Effects to downstream areas losing water due to interbasin transfer	1
Effects of altered flow regime (downstream)	3
Effects to downstream channel geomorphology	4
Effects to floodplain and need for map revisions	1
Need for review by Floodplain Administrator	1
Effects to water quality associated with receiving waters and source waters	5
Effects to water quality associated with lakeshore development-recreation	4
Effects to isolated wetlands and other isolated waters	2
Effects to overall water quality	6
Effects associated with increased flooding	2
Need to prohibit clearing/grazing within shoreline buffer	1
Effects associated with leakage of underground gas reserves into lake water	2

Table 6-3: Number of Comments Concerning Loss of Soils Erosion-Sedimentation

Subject	Number of Comments
Loss of valuable farmland	3
Sedimentation within conservation pool	6
Effects to downstream sediment transport	4
Need to control erosion without construction of a lake	1
General concerns regarding erosion	4

Table 6-4: Number of Comments Concerning Biological Resources (Vegetation and Wildlife)

Subject	Number of Comments
Loss of bottomland hardwood forests	2
Adverse effects to wildlife	3
Concern regarding aquatic life movement	1
Lack of data on effects (adverse) to fish and wildlife	1

Table 6-5: Number of Comments Concerning Cultural and Paleontological Resources

Subject	Number of Comments
Effects to paleontological resources	2
Effects to cultural resources subject to the National Historic Preservation Act	3
Effects to cemeteries	1

Table 6-6: Number of Comments Concerning Air Quality

Subject	Number of Comments
Effects to air quality (development, traffic, recreational boats)	2

Table 6-7: Number of Comments Concerning Property Rights

Subject	Number of Comments
Loss of mineral rights	3
Loss of private property	5
Need for more accurate mapping of affected properties	13
Affects to property/displacement of residents	24

Table 6-8: Number of Comments Concerning Social and Economic Resources

Subject	Number of Comments
Lack of an economic development plan	1
Lake not needed for water supply	3
Reallocation of rural water resources to urban areas	5
Concerns relating to anticipated future water shortages	3
Effects associated with increased land values	1
Effects associated with increases in property taxes	3
Need for zoning to regulate lakeshore development	3
Need for overall water conservation	3
Effects to local economy (beneficial)	2
Effects to local economy (adverse)	2
Effects (adverse) associated with loss of tax base (lake no longer on tax rolls)	3

Table 6-9: Number of Comments Concerning Noise and Visual Resources

Subject	Number of Comments
Adverse aesthetics effects due to significant fluctuations of lake levels	5
Adverse effects to rural nature of Fannin County	2

Table 6-10: Number of Comments Concerning Transportation

Subject	Number of Comments
Effects associated with road closures	2

Table 6-11: Number of Comments Concerning Recreation

Subject	Number of Comments
Concerns about excessive public access	1
Need for adequate public access	2

Table 6-12: Number of Comments Concerning Project Design and Management

Subject	Number of Comments
Overall project design concerns	1
Underestimated project costs	2
Water transmission method	2
High cost of water to be sold Lake Ralph Hall	2
Concerns regarding long-term capacity of reservoir	6
Accuracy of firm yield estimates	2
Responsibility for shoreline maintenance	1
Dam design, construction, and safety	2
Availability of water for local use	1
Need for additional project alternatives	10

Concerns regarding high cost of project	4
Purchase of water from Oklahoma as possible alternative	2
Concerns regarding lake size	3
Concerns regarding lake levels	8
Lake not needed for local water supply	4
Concerns regarding water allocation	1
Project timing	4

Table 6-13: Number of Comments Concerning the Regulatory Process

Subject	Number of Comments
Lack of agency coordination	1
Overall lack of data	4
Requests for an EIS	6
Requests for a formal Public Hearing	5

The USACE determined that the project could result in significant effects to the human and natural environment requiring the preparation of an EIS. A Notice of Intent (NOI) for the Lake Ralph Hall EIS was published in the *Federal Register* on October 17, 2008 (Vol. 73, No. 2028, p. 61827-61828).

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, prehistoric, and paleontological resources that could be affected by construction of the lake. 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.

6.2 Consultation and Coordination with Federal, State, and Local Government Agencies

Specific regulations require the USACE to coordinate and consult with federal, state, and local agencies concerning the potential for a proposed action and alternatives to affect sensitive environmental and human resources. The USACE Fort Worth District initiated these coordination and consultation activities through the scoping process. In addition, the District invited interested agencies to serve as cooperating agencies for preparation of the EIS. The EPA, USFWS, USFS, THC, TPWD, and TCEQ are serving as cooperating agencies. Numerous site visits have occurred with EPA, USFWS, and TPWD. Coordination meetings held with federal, state, and local agencies are shown in **Table 6-14**.

Table 6-14: Coordination Meetings held with Federal, State, and Local Government Agencies

Date	Agencies	Topics
November 4, 2008	USACE, EPA, USFWS, TPWD, TCEQ, USFS, UTWRD	DEIS scope, alternatives, environmental consequences, mitigation
February 2009	USACE, USFWS, TPWD, TCEQ, UTRWD	Habitat assessment
April 21, 2009	Fannin County Historical Commission	Historic Resources
September 2009	USACE, EPA, USFWS, TPWD, TCEQ, UTRWD	Site visit/review and validation of water impact metrics and scoring for both aquatic and terrestrial resources
March 8, 2011	USACE, EPA, USFWS, TPWD, TCEQ, UTWRD	Mitigation Plan
May 5, 2015	USFWS, USACE, EPA, TCEQ, TPWD	Mitigation Plan
October 1, 2015	USACE, USFWS, TPWD, UTRWD	Site Visit
January 9, 2017	USACE, EPA, USFWS, TWPD, UTRWD	Mitigation Plan
July 3, 2018	USACE, EPA, USFWS, TWPD, UTRWD	Mitigation Plan
August 28, 2018	USACE, EPA, USFWS, TWPD, UTRWD	Mitigation Plan
February 6, 2019	USACE, EPA, USFWS, TWPD, UTRWD	Mitigation Plan
March 28, 2018	USACE, EPA, USFWS, TWPD, UTRWD	Mitigation Plan

6.3 Tribal Government-to-Government Consultation

In compliance with NHPA and USACE Policy Guidance Letter No. 57 (Indian Sovereignty and Government-to-Government Relations with Indian Tribes) the USACE is required to establish regular and meaningful consultation and collaboration with Native American tribal governments on development of regulatory policies that could significantly or uniquely affect their communities. The USACE Fort Worth District initiated consultation with Native American tribes by sending letters dated May 2, 2017, to federally recognized tribes (as identified below). The Caddo Nation of Oklahoma and the Choctaw Nation of Oklahoma requested consulting party status by phone. The USACE invited the Caddo Nation of Oklahoma and the Choctaw Nation of Oklahoma to be Consulting Parties to the PA. The following nations and tribes were consulted:

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

6.4 Distribution of Notifications or Copies of the DEIS

The Notice of Availability (NOA) for the DEIS was issued on October 5, 2018. The DEIS public and agency comment period extended for 45 days and closed on November 21, 2018. The DEIS was distributed by hard copy to the EPA, USFWS, THC, TPWD, TCEQ, and USFS. In addition, copies of the DEIS were made available for review at the following locations:

1. Ladonia City Hall, 100 Center Plaza, Ladonia, TX 75449.
2. Wolfe City Public Library, 102 TX-11, Wolfe City, TX 75496.
3. Commerce Public Library, 1210 Park Street, Commerce, TX 75428.
4. Honey Grove Library, 500 N 6th Street, Honey Grove, TX 75466.
5. Bonham Public Library, 305 E 5th Street, Bonham, TX 75418.
6. Greenville Public Library, 1 Lou Finney Lane, Greenville, TX 75401
7. Upper Trinity River Water District, 900 North Kealy Street, Lewisville, TX 75067.
8. U.S. Army Corps of Engineers, Fort Worth Regulatory Office, 819 Taylor Street, Fort Worth, TX 76102.

6.5 Public Hearing

A public hearing was held Thursday, October 25, 2018 at H.L. Milton Sports Complex, 601 W. Mill Street, Ladonia, TX 75449. An open house was held beginning at 5:30 p.m., and the public hearing was called to order at 6:30 p.m. Speakers were given a period of 5 minutes to present their comments on the Proposed Action and the DEIS as well as identify issues and concerns.

During the 45-day public and agency comment period, approximately 550 comments were received on the DEIS on topics ranging from purpose and need, alternatives, impacts, and mitigation, and letters of opposition and support. Responses to comments received during the DEIS comment period are included in **Appendix P**.

7.0 EIS Preparers and Reviewers

Responsibility	Affiliation / Name	Degree and Experience
U.S. Army Corps of Engineers EIS Team		
Chief, Evaluation Branch, Regulatory Division	Jennifer Walker	BS Environmental Science/Biology 32 Years Experience
Planning Division	Mary Verwers	MS Wildlife Science 19 Years Experience
Regulatory Division	Brent Jasper	BS Forest Resource Management 31 Years Experience
Regulatory Division	Chandler Peter	BS Biology 31 Years Experience
Michael Baker International (MBI) EIS Team		
Project Manager	Tim Smith MBI Round Rock, TX	MS Wildlife Biology BS Forest Biology 25 Years Experience
Project Manager	Matt Barkley MBI Round Rock, TX	MA Organizational Management BS Environmental Resource Management 20 Years Experience
Deputy Project Manager	Michael Weeks MBI Round Rock, TX	BS Aquatic Biology 20 Years Experience
Document Manager	Rain Nox MBI Round Rock, TX	MS Applied Geography, GIS PhD Environmental Geography 12 Years Experience
Document Preparation	Erin Graham MBI Round Rock, TX	B.S. Environmental Geoscience 4 Years Experience
Document Preparation	Alexandra Austin MBI Round Rock, TX	B.S. Biology M.S. Environmental Science 5 Years Experience
Socioeconomics	Edward Harvey Harvey Economics Denver, CO	MS Economics 29 Years Experience
Hydrology	Matt Bliss DiNatale Water Consultants Denver, CO	MS Civil Engineering BS Mathematics 12 Years Experience
CH2M Hill (Ed Motley now with UTRWD)		
Mitigation Plan	Ed Motley Dallas, TX	MS Civil Engineering 38 Years Experience
obert J Brandes Consulting		
Hydrology	Robert Brandes Austin, TX	PhD 34 Years Experience

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9.0 Glossary

Abiotic: Of or characterized by the absence of life or living organisms.

Alluvial: Of or relating to the sedimentary matter deposited within recent times, especially within valleys of large rivers.

Alluvium: The sedimentary matter deposited within recent times, especially within valleys of large rivers.

Ancillary: Providing necessary support to the primary activities operation of an organization, institution, industry, or system.

Annual (firm) yield: Maximum water volume a reservoir can provide each year under a repeat of the drought of record.

Aquiclude: Any geological formation that absorbs and hold water but does not transmit it at sufficient rate to supply springs, wells, etc.

Aquitard: A geologic formation or stratum that lies adjacent to an aquifer and that allows only a small amount of liquid to pass.

Benthic: Of, pertaining to, or occurring at the bottom of a body of water.

Benthic macroinvertebrate: Organisms without backbones that inhabit the bottom substrates for at least part of their lifecycle.

Biogeochemical: Of or pertaining to the science dealing with the relationship between the geochemistry of a given region and its flora and fauna, including the circulation of such elements as carbon and nitrogen between the environment and the cells of living organisms.

Biotic: Of, relating to, or caused by living organisms.

Brackish: Water or briny water with higher salinity than fresh water but less than seawater, such as the mixture of river water and seawater in estuaries.

Calcareous: Consisting of or containing calcium carbonate.

Channelization: The act of straightening a stream, typically widening and deepening the stream as well as to improve the flow of water.

Channel Morphology: Form and structure that describes the shape of a stream or river bed.

Collector-gatherers: Macroinvertebrate functional feeding group which collect fine particulate organic matter from the stream bottom.

Conservation pool: Water in a reservoir that lies above the dead pool (water in a reservoir that cannot be drained by gravity through a dam's outlet works) and below the normal maximum operating level. When a reservoir's conservation pool is full, the reservoir is considered full.

Conservation storage: The amount of water present within a reservoir's conservation pool; if the reservoir is shared with another state or country then conservation storage refers only to the portion that belongs to Texas.

Conveyance: The action or process of transporting something from one place to another.

Cumulative effects: Changes to the environment that are caused by an action in combination with other past, present and future actions.

Deciduous: Referring to a plant (usually a tree or shrub) that sheds its leaves at the end of the growing season.

Desalination: The process of removing salt from sea water, typically to make it drinkable.

Detritus: Rock in small particles or other material worn or broken away to form a mass, as by the action of water or glacial ice.

Easement: The right of a person, government, agency, or public utility company to use or restrict public or private land owned by another for a specific purpose.

Effluent: Treated waste material (such as smoke, liquid industrial refuse, or sewage) discharged into the environment especially when serving as a pollutant.

Ephemeral stream: An ephemeral stream has flowing water only during, and for a short duration after, precipitation events in a typical year. Ephemeral stream beds are located above the water table year-round. Groundwater is not a source of water for the stream. Runoff from rainfall is the primary source of water for stream flow.

Emergent wetlands: Wetlands characterized by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. These wetlands are usually dominated by perennial plants.

Emissions: Substances discharged into the air (as by a smokestack or an automobile engine).

Erosion: The removal of sediment or rock from a point in the landscape.

Expenditures: The act of expending something, especially funds; disbursement; consumption.

Extirpated: Something which has been wiped out or destroyed completely.

Firm Yield: The maximum amount of water that can be diverted from a reservoir on an annual basis during a repeat of the historical drought of record without shortage, assuming that all of the water in the reservoir is available for use.

Forb: Any herbaceous plant that is not a grass.

Functional capacity: The rate or magnitude at which a wetland ecosystem performs a function. Functional capacity is dictated by characteristics of the wetland ecosystem and the surrounding landscape, and interaction between the two.

Functional capacity units (FCU): The value derived by multiplying the functional capacity index for a wetland unit area by the size of the wetland area.

Geomorphology: The scientific study of the formation, alteration, and configuration of landforms and their relationship with underlying structures.

Herbaceous: Designating or relating to plants or plant parts that are fleshy as opposed to woody.

Hydraulic gradient: A line joining the points of highest elevation of water in a series of vertical open pipes rising from a pipeline in which water flows under pressure.

Hydrology: The science dealing with the occurrence, circulation, distribution, and properties of the waters of the earth and its atmosphere.

Impoundment: A body of water confined within an enclosure, as a reservoir.

Interbasin transfer: The taking or diverting of state water from a river basin and transferring such water to any other river basin.

Intermittent stream: An intermittent stream has flowing water during certain times of the year, when groundwater provides water for stream flow. During dry periods, intermittent streams may not have flowing water. Runoff from rainfall is a supplemental source of water for stream flow.

Inundation area: Areas that would be flooded as a result of the dam and reservoir construction.

Invertebrates: Any animal lacking a backbone or spinal column, including all species not classified as vertebrates.

Lacustrine: Any large body of water that is greater than 8 hectares. Found in a topographic depression or is a dammed river channel.

Lithic Scatter: A scatter on the ground surface of cultural artifacts and debris consisting entirely of lithic (rock), tools and chipped stone debris.

Macrobenthic community: The relatively large organisms living on or in the bottom of bodies of water.

Mainstem: The primary, and generally largest, branch of a river.

Marl: A loose or crumbling earthy deposit (as of sand, silt, or clay) that contains a substantial amount of calcium carbonate.

Maximum available groundwater: The amount of groundwater that can be pumped while maintaining desired future conditions in an aquifer.

Mitigation: The act of lessening the force or intensity of condition or impact less severe.

Moratorium: A legally authorized period of delay in the performance of a legal obligation or the payment of a debt.

Nonpoint source pollution: A source of pollution (such as runoff from farmland) that is not confined to a single point or does not arise from a single identifiable source.

Noxious: Harmful or injurious to health or physical well-being.

Nektonic: The aggregate of actively swimming aquatic organisms in a body of water, able to move independently of water currents.

Oxbow: A bow-shaped bend in a river, or the land embraced by it. Also applicable as oxbow lake, when a bow-shaped lake is formed in a former channel of a river.

Per capita income: The measurement of the average income earned per person in a given area (city, region, country, etc.) in a specified year.

Perennial: A stream that normally has water in its channel at all times.

Permitted diversion: The amount of water that can be legally withdrawn from a water source in accordance with a Texas water right.

Photosynthesis: Process by which green plants and some other organisms use sunlight to make food from carbon dioxide and water.

Physiography: The study of physical patterns and processes of the Earth, such as the forces that produce and change rocks, oceans, weather, and global flora and fauna patterns.

Prime Farmland Soils: land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and that is available for these uses.

Reliable Supply: Amount of water that is considered available 100 percent of the time during a repeat of the historical drought of record. This is commonly based on the firm yield of the water source and may differ from permitted diversions or contract amounts.

Reuse: To use again especially in a different way or after reclaiming or reprocessing.

Right-of-way: The legal right, established by usage or grant, to pass along a specific route through grounds or property belonging to another.

Riparian: Areas adjacent to rivers and streams. These areas often have a high density, diversity, and productivity of plants and animal species relative to nearby uplands.

Riverine: Of, like, relating to, or produced by a river.

Run and riffle habitats: Runs refer to an area where the water is flowing rapidly, generally located downstream from riffles. Riffle is an area of a stream where the water breaks over cobbles, boulders and ravel or where the water surface is visibly broken. Runs are typically deeper than riffles.

Sedimentation: The deposition or accumulation of mineral or organic matter by water, air, or ice.

Slaking: The disintegration of lime in which it reacts with water or moist air to produce calcium hydroxide.

Socioeconomic: Of, relating to, or signifying the combination or interaction of social and economic factors.

Stratification: When water forms layers because of differences in salinity, oxygen levels, density, or temperature. These layers often act as a barrier to water mixing.

Swale: A low place in a tract of land, usually moister and often having ranker vegetation than the adjacent higher land.

Tax Roll: A breakdown of all taxable property that can be taxed within a given jurisdiction, such as a city or county. The tax roll lists each property separately in addition to its assessed value, and is usually created by the taxing assessor or other authority within the jurisdiction.

Texas water right (Certificate of Adjudication or Permit): Legal instrument issued by the State of Texas to divert, use and/or store waters of the state.

Topography: The three-dimensional arrangement of physical attributes (such as shape, height, and depth) of a land surface in a place or region. Physical features that make up the topography of an area include mountains, valleys, plains, and bodies of water. Human-made features such as roads, railroads, and landfills are also often considered part of a region's topography.

Tributary: Stream or river that flows into a larger stream or main stem river or a lake.

Undulating: To move with a sinuous or wavelike motion; display a smooth rising-and-falling or side-to-side alternation of movement.

Upland: Land or an area of land lying above the level where water flows or where flooding occurs.

Urbanization: The process by which a predominantly rural area or city becomes more industrialized and increases in population size and density.

Viewshed: The natural environment that is visible from one or more viewing points.

10.0 Index

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