003 - Project

# ALTUS CITY RESERVOIR EAST BASIN IMPROVEMENTS FOR DROUGHT PREPAREDNESS

## WaterSMART: Drought Resiliency Project Grants for Fiscal Year (FY) 2016

## Funding Opportunity Announcement No. R16-FOA-DO-006


City of Altus &
Altus Municipal Authority

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April 7, 2016

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# 1.0 Technical Proposal

## 1.1 Executive Summary

The City of Altus and the Altus Municipal Authority, herein after called "The City," is located in Jackson County, Oklahoma and desires to increase its level of readiness for the next major drought.

The City is located in a semi-arid region of southwest Oklahoma. Due to the severe impacts inflicted upon the community and its water customers during the recent 2010-15 drought, the City is seeking numerous measures to maximize water reliability for its customers, including Altus Air Force Base, numerous local communities and rural water districts in the area.

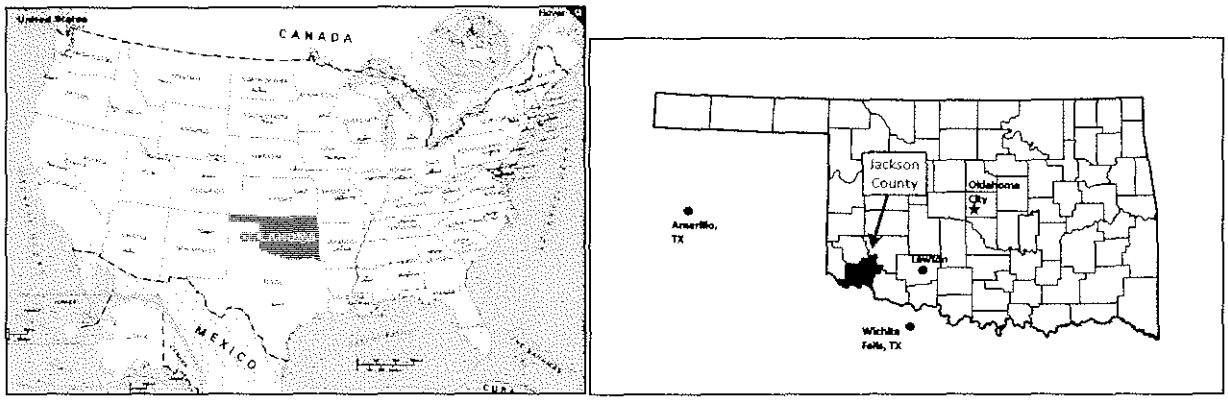
This proposed project would redirect available raw water from Tom Steed Reservoir, a Bureau of Reclamation project and the City's principal source of supply, to Altus City Reservoir, a largely unused municipal supply originally constructed in 1940. This would not only create a convenient and redundant water source, but also alleviate pressure on other regional surface sources, especially Tom Steed Reservoir (which also supplies users in Snyder and Frederick) but also Lugert-Altus Reservoir, another local Reclamation project used by Altus as an emergency water source. This project would provide at least 45 days of backup water supply for Altus and Jackson County users while also allowing managers of Tom Steed to interrupt service, when required, to conduct essential maintenance on its system. This proposed project would also eliminate the need for Lugert-Altus Reservoir, which would free up additional supply for irrigation.

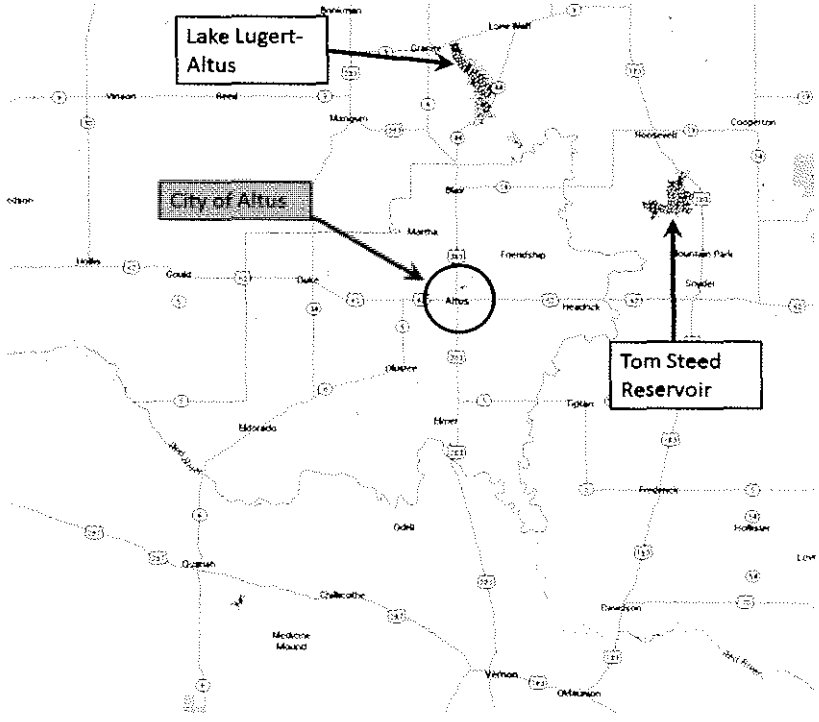
The project would include the installation of sluice gates and weirs and renovation of the original pump station, built almost 80 years ago but currently unused. This project is expected to take 12 months to complete, including design, bidding and construction. The city reservoir and surrounding land is owned by the City of Altus. None of the proposed work on this project would take place on federal land.

## 1.2 Background Data

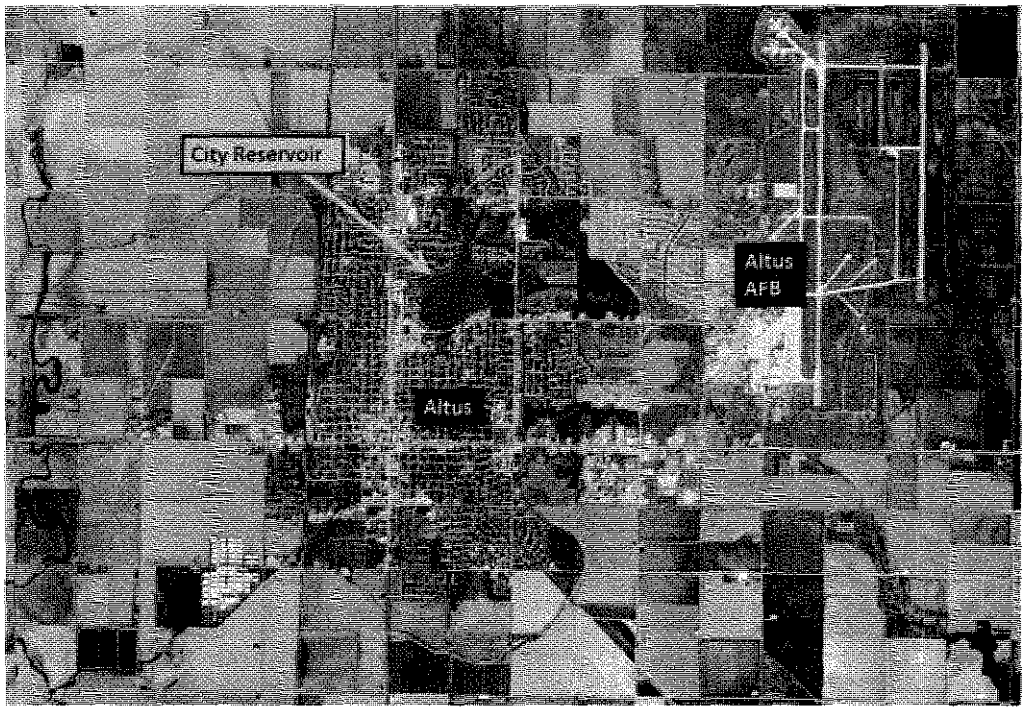
### 1.2.1 Location

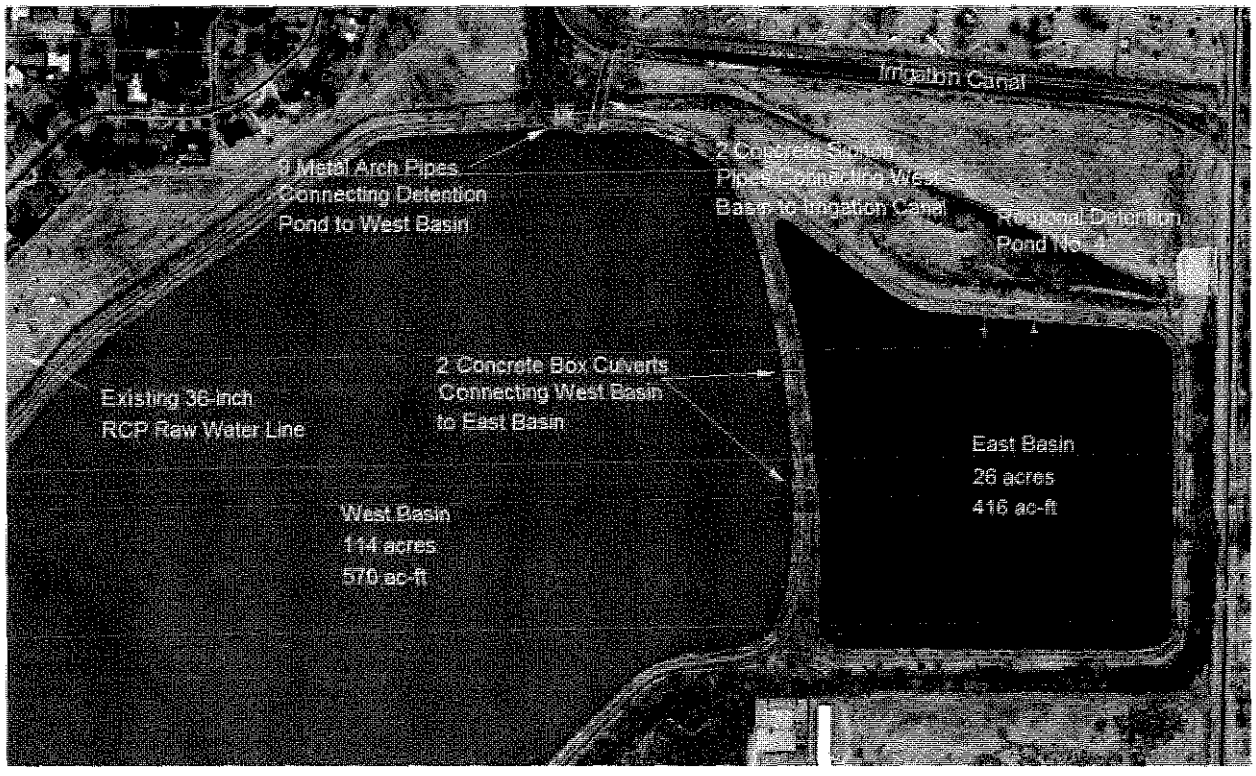
The City of Altus is located in Jackson County in Southwest Oklahoma.




The Altus City Reservoir is located in the northern central portion of the city limits on the North side of Falcon Road between Main Street and Park Lane.




*Existing Conditions*

### 1.2.1 Need for Project

In early 2015, the City came dangerously close to losing its primary water supply when the Tom Steed Reservoir dropped to 19% capacity due to an extreme drought that had plagued southwest Oklahoma since 2010.

The drought prompted a study that resulted in the adoption of a regional drought plan called the Southwest Oklahoma Water Supply Action Plan released in May 2014. One of the projects identified in the plan is the Rehabilitation of the Altus City Reservoir. Excerpts from the plan are found in Appendix B.

The SWAP features a phased, targeted approach to resolving long-term water supply needs in the area. One of the Plan's key recommendations is the project proposed in this application, including dredging and dam improvements to increase the storage capacity of Altus City Lake.

Even after the drought ended, The City's water supply was still vulnerable. In late 2015, there were two power outages at the pump station that draws Tom Steed Water to send to Altus. Even though the Tom Steed Reservoir was full, the City was faced with the temporary loss of access to its primary water supply.

These recent events have underscored the urgent need for the City to renovate the Altus City Reservoir and restore its use as a primary water supply. Doing so will provide the City with an estimated 45 days of water supply in the event that water from the Tom Steed Reservoir is disrupted.

This project meets at least three goals of the Bureau of Reclamation's Drought Resiliency Grant Program. It 1) increases the reliability of water supply and sustainability; 2) improves water management and increases operational flexibility; and 3) implements a system to facilitate the voluntary sale, transfer or exchange of water.

### 1.2.2 History of Altus Water Supply

In 1910, the Altus Reservoir was constructed to serve as a primary source of water. The City built its first Water Treatment Plant that was completed in 1927.

In 1937, the Altus City Reservoir was expanded by the construction of the eastern basin which covers 26 acres.

In 1947, the first irrigation canal brought water from Lake Lugert-Altus, A Bureau of Reclamation Project, to Altus area farms. By 1953 the irrigation system consisted of more than 200 miles of canals and was managed by the Lugert-Altus Irrigation District (LAID). The project today is responsible for some $200 million per year in cotton crop production, supporting a vibrant economy in Altus and surrounding communities.

The main irrigation canal runs within 100 feet of the Altus City Reservoir so connecting

siphon pipes with sluice gate were installed to allow Lugert-Altus water to flow into the reservoir.

Until 1975 the Altus City Reservoir (fed by the Lugert-Altus irrigation canal) served as the primary source of municipal drinking water. However, the irrigation canal is unlined and irrigation water carried significant sediment loads into the City Reservoir. Originally built with an average depth of about 10 feet, the western basin currently has an average depth of about 5 feet. The east basin however, is believed to have had comparatively little siltation due to the manner of flow from west to east and the elevation of connecting culverts.

In 1975, the Tom Steed Reservoir was built by the U.S. Bureau of Land Reclamation in Kiowa County and a 36-inch pipeline (23 miles long) was constructed to bring Tom Steed water directly to the Altus Water Treatment Plant. Since 1975, the Tom Steed Reservoir has been the primary water source, precluding use of the Altus City Reservoir.

Today, the Mountain Park Master Conservancy District (MPMCD) operates the Tom Steed Reservoir including the pump station that conveys raw water to Altus. This water feeds into a 1 million gallon tank at the water plant.

Geologic conditions are such that streams in the Lugert-Altus basin are naturally salty with elevated concentrations of chlorides. Tom Steed water is less salty and less expensive to treat than Lugert-Altus water. This is the main reason that the City Reservoir was taken off line as a source of drinking water. This condition has grown worse due to evaporation in the City Reservoir.

Since there is no natural outlet, the water only leaves the reservoir by infiltration or evaporation. As water has evaporated, the concentrations of minerals and organic compounds have increased. Decades of this process has created a reservoir with elevated levels of minerals high enough to promote the growth of golden algae.

From 2010 to 2015, SW Oklahoma suffered from an extreme drought. Lugert-Altus Lake and the Tom Steed Reservoir dropped to alarmingly low rates. The Tom Steed Reservoir dropped to 19% capacity. In 2013, the Altus Water Task Force was created to promote drought resilience and explore additional water sources. The Task Force is a combined effort of the City, the Air Force Base, the Chamber of Commerce and agricultural interests and meets monthly to implement short-, mid- and long-term strategies recommended in the Southwest Oklahoma Water Supply Action Plan (SWAP), published in 2014.

The SWAP was prepared by Duane Smith & Associates, Carollo Engineers and Creative Capital Strategies, LLC and lists several projects for the Altus water system including the rehabilitation of the City Reservoir to include dredging and dam improvements to increase storage capacity.

In May 2015, record rainfalls caused severe flooding throughout much of Oklahoma and Texas. Tom Steed and Lugert-Altus were filled in less than 30 days after what turned out to be the wettest month on record in Oklahoma. This brought welcome relief from the extended drought, but city officials are united in their belief that this reprieve may only be temporary. Climate change reports suggest that droughts may become more common and more severe, increasing the City's vulnerability. It is imperative that Altus plan for a worst-case scenario to effectively mitigate future drought impacts.

In November 2015, the Mountain Park Master Conservancy District (MPMCD) reported and electric failure in the transformer that serves the pump station at Tom Steed and reported that raw water pumps were temporarily inoperable. A frantic search was conducted to find a suitable replacement generator. The City ordered emergency water conservation measures as the wet wells were drawn down and the raw water already in the 23 miles of supply line from Tom Steed was used. It turned out that the transformer did not need to be replaced and was repaired and power restored in about 11 hours. The City did not need to draw water from the City Reservoir.

On December 27, 2015, a winter storm struck Southwest Oklahoma. Accumulating ice and high winds combined to knock down hundreds of utility poles. Once again, the pump station at Tom Steed lost power and emergency water conservation measures were ordered. Even though backup generators at the Altus Water Treatment Plant were operational, there was no generator at the Tom Steed pump station. The MPMCD was able to bring in a generator and restore power about 18 hours later. This storm resulted in Federal Disaster Declaration No. DR-4256.

These recent events have demonstrated how vulnerable the City's water supply can be and the urgent need for projects to reduce vulnerability.

### 1.2.3 Water Quality Considerations

The Altus City Reservoir gets very little inflow from stormwater runoff. The primary means of keeping the reservoir full is a connection to the Lugert-Altus Irrigation District (LAID) irrigation canal that is a couple hundred feet from the north edge or the reservoir.

Lugert-Altus water is highly saline and thus has not been utilized as a drinking water source since the Tom Steed Reservoir was completed in 1975. While the water in the City Reservoir is treatable (especially by reverse osmosis), the associated costs are largely prohibitive. Also, the western basin of the City Reservoir is shallow and highly influenced by solar energy. The warmer, saltier water is prime conditions for the growth of golden algae. Algal blooms have caused two fish-kill events in the last few years including the most recent event in January 2016.

Since high concentrations of algae are difficult to remove by conventional water treatment and can be harmful to the reverse osmosis membranes at the water plant, the Lugert-Altus water that is currently in the City Reservoir is not desirable as a source of drinking water. This project is the first phase in replacing decades-old Lugert-Altus water with Tom Steed water so that the reservoir can be restored as a primary source of

drinking water.

### 1.2.4 Regional Water Supply

The City of Altus provides water to numerous surrounding jurisdictions. The 2014 population of Altus was reported to be 19,531 by the U.S. Census Bureau, however water sales to surrounding water systems increases the customer base to more than 30,000 people served by this project. The City of Altus sells potable water to:

- Jackson County Water Company
- Olustee Public Works Authority
- Blair Public Works Authority
- Duke Municipal Trust Authority
- Creta Water Corporation
- Quartz Mountain Regional Water Authority
- Altus Air Force Base

Thus, increasing the City's drought resilience will increase the economic and social stability of the surrounding area. And by similarly decreasing the water demand on Tom Steed Reservoir, all of southwest Oklahoma benefits as well.

### 1.2.5 Water Use

Average daily water demand is about 4 million gallons per day (MGD) during the winter. However, summer time demands typically run about 8 MGD. This increase includes all outdoor uses but watering of lawns and gardens is thought to be the largest outdoor use. Because of the Lugert-Altus Irrigation District, much of the surrounding farm fields are irrigated with Lugert-Altus water. Therefore, there is little large-scale agricultural use of potable water for crop irrigation. However, small scale farming and home gardens use a significant amount of water from the system.

Commercial and residential meters dedicated to outdoor sprinkler systems used 13.5 million gallons of water during FY2015 which was 0.01% of total water use for the year.

The following table shows a breakdown of water customers served by the City of Altus and water usage for FY2015. The "Master Meter" customer type represents the other water systems that purchase water from Altus.

*Water Customers*

| Type | No. of Meters | FY 2015 Water Use (gallons) | Percent Used |
|---|---|---|---|
| Residential Inside City | 6,630 | 366,370,000 | 36% |
| Residential Outside City | 74 | 4,996,000 | <1% |
| Small Commercial in | 679 | 93,768,000 | 9% |

| | | | |
|---|---|---|---|
| City | | | |
| Small Commercial Outside City | 5 | 3,079,000 | <1% |
| Large Commercial In City | 99 | 51,345,000 | 5% |
| Altus Air Force Base | 1 | 124,778,000 | 12% |
| Bar-S Foods | 1 | 132,655,000 | 13% |
| Master Meters | 7 | 22,6042 | 22% |
| Other | 1 | 16,206 | 3% |

### 1.2.6 Distribution System

The City of Altus has 139.4 miles of water mains that deliver potable water to residents and commercial customers. Water mains range in size from 1.25 inches to 18 inches.

Water Main Size and Quantity

| **Pipe Diameter** | **Miles of Water Main** |
|---|---|
| 2 inches or less | 12.8 |
| 4 inches | 18.2 |
| 6 inches | 42.2 |
| 8 inches | 34.5 |
| 10 inches | 8.5 |
| 12 inches | 15.6 |
| 14 inches | 1.3 |
| 16 inches | 3.8 |
| 18 inches | 2.4 |

Pipe materials include ductile iron, cast iron, galvanized steel, transite cement and PVC. 1,706 water valves are located throughout the system to isolate segments and minimize service disruptions during repairs.

The system has about 462 fire hydrants all of which are dry-barrel hydrants. 90% of hydrants are equipped with isolation valves. There are no booster pumps in the system. The system has about 7800 water meters which are read monthly.

### 1.2.7 Previous Projects with U.S. Bureau of Reclamation

The City of Altus helped fund original construction of Lugert-Altus Dam and the project continues to be an enormous economic benefit to both the City and surrounding region. The Reclamation Safety of Dams Act of 1978 requires that users participate in dam construction and modifications, therefore the City has also contributed to numerous project modifications. The most recent was a $25,000 contribution in October 2015.

The City also helped fund construction of the Lugert-Altus Irrigation System. The City paid the U.S. Bureau of Reclamation $1,080,000 to help underwrite construction of more than 200 miles of irrigation canals.

## 1.3 Technical Project Description

The City wishes to replace the Lugert-Altus water in the Altus City Reservoir with higher-quality Tom Steed water and to establish a configuration where Tom Steed water continually flows through the city reservoir and water is pulled from the basin rather than from the raw water line.

The first phase of this effort will be to isolate the western and eastern basins and restore the eastern basin as a water source. The east basin holds an estimated 115 million gallons and would provide a 45-day backup supply should the supply from Tom Steed be interrupted. The east basin does not have significant siltation problems and is about 10 feet deeper than the west basin.

An intake pump station was installed in 1939 to pull water from the east basin for treatment. This pump station still has the original pump and controls and was taken out of service decades ago. The pump and controls need to be replaced but the intake structure and force main to the treatment plant are considered usable.

The proposed project includes tapping the existing 36-inch raw water line and installing 2,385 feet of 30-inch ductile iron pipe with appurtenances to feed raw water into the northeast corner of the east basin. Appurtenances for this line include a gate valve, magnetic flow meter and various pipe fittings. A 36"x30" Tee and 36-inch gate valve will be installed on the existing raw water line. Sluice gates will be installed in existing pipes to isolate the east basin, west basin and irrigation canal. Weir walls will be installed to allow outflow from the east basin to the west basin and from the west basin to the adjacent detention pond to ensure that the east basin dam does not overtop. A further safety measure will include the installation of a new concrete outlet box to allow overspill from the east basin directly to the detention pond.

The project also includes rehabilitation of the existing pump station at the southwest corner of the east basin. The existing pump and controls will be replaced and other electrical upgrades will be implemented to bring the electric system up to code.

## 1.4 Evaluation Criteria

### 1.4.1 Project Benefits

***Will the project make additional water supplies available? (Provide the estimated quantity of additional supply and how the estimate was calculated.)***

The project will restore the east basin of the City Reservoir to use as the primary drinking water source with Tom Steed water flowing continually through it. The benefit comes from 115 million gallons of Tom Steed water that will be held in reserve in the east basin, providing an estimated 45-day supply of water. This will significantly increase operational flexibility by reducing the pressure on MPMCD to keep water flowing continuously.
The City also operates a well field from which 1 MGD is blended with surface water from Tom Steed. This project will impact only the surface water component which will be at least 75 percent of potable water produced.

***What percentage of the total water supply does the additional water supply represent? How was this estimate calculated?***

The estimated 115-million-gallon reserve represents approximately 7.3 percent of the City's total 4.4 MGD supply (calculated from the City's estimated water supply demand allocation, obtained from the 2012 Update of the Oklahoma Comprehensive Water Plan).

***Provide a brief qualitative description of the degree/significance of the benefits associated with the additional water supplies.***

Establishing an additional 7.3 percent of accessible and reliable surface water supply will provide an essential backup source in the event of a drought or infrastructure-related emergency that interrupts the normal supply from Tom Steed Reservoir. Because Altus City Reservoir has a very small watershed and thus does not benefit from natural inflow/runoff, the gates at the reservoir are occasionally opened to allow water from Lugert-Altus Reservoir, through a nearby canal, to augment storage. However, this water is high in chlorides and algae. While treatable in the City's reverse osmosis facility, the cost is excessive as compared to preferred, higher-quality Tom Steed water.

Another considerable benefit of this additional supply is that it will alleviate pressure on Tom Steed in supplying its other member entities and sub-entities. In short, the entire southwest region benefits from this project, including Altus Air Force Base, which has been actively working with Altus officials to obtain a more secure, long-term water supply.

***How will the project build long-term resilience to drought? How many years will the project continue to provide benefits?***

The City intends to maintain Altus City Reservoir as the primary drinking water source to enhance the community's drought preparedness. With regular maintenance of the reservoir to reduce the impacts of sediment that could reduce the overall storage volume, this source should remain viable for at least the next 50 years.
After this project is completed, the next phase of this drought mitigation effort will be to rehabilitate the reservoir's western basin. This will require a multi-million dollar dredging effort, expected to commence within the next five years. When completed, the City Reservoir will have a total six-month supply of reserve water.

***How will the project improve the management of water supplies? For example, will the project increase efficiency or increase operational flexibility (e.g., improve the ability to deliver water during drought or access other sources of supply)? If so, how will the project increase efficiency or operational flexibility?***

In addition to the City's water management benefits described earlier, this project will allow MPMCD greater flexibility as water levels inevitably drop in Tom Steed Reservoir. As water becomes scarce, the MPMCD could reduce the daily flow to Altus to conserve water or reallocate flow to other areas where the need is more urgent. This emergency supply will also allow MPMCD, which is normally required to maintain a continuous flow of raw water to the Altus Water Treatment Plant, to more easily conduct maintenance that requires a temporary interruption in flow.

Another benefit of this project is that it allows MPMCD managers more flexibility in managing flood storage at Tom Steed Reservoir. Rather than simply releasing floodwaters downstream, these flows can sometimes be diverted to Altus and captured by Altus City Reservoir for water supply purposes.

***Will the project make new information available to water managers? If so, what is that information and how will it improve water management?***

The City does not anticipate new information that will benefit its ability to manage its water supplies.

***Will the project have benefits to fish, wildlife, or the environment? If so, please describe those benefits.***

Replacing saline Lugert-Altus water with higher-quality Tom Steed water will benefit the aquatic ecology of the City Reservoir, eliminating recurring golden algae blooms and preventing future fish kills. And during severe or extreme drought events, this project will serve to reduce short-term demand on Tom Steed Reservoir and thus provide benefits to its fish and other aquatic organisms

Lugert-Altus Reservoir will benefit as well from the reduced discharge. The lake, which frequently experiences rapid level fluctuations, is highly susceptible to fish kills that also impact tourism and recreation (the lake is a key feature of Quartz Mountain State Park). In June 2013, at the height of the recent drought, an estimated 350,000 adult fish died

over a three-month period due to toxic golden algae blooms. The Oklahoma Department of Environmental Quality officially declared the lake to be "dead."

***What is the estimated quantity of water that will be better managed as a result of this project? How was this estimate calculated?***

This 45-day backup supply enhances the City's entire surface and groundwater supply portfolio by reducing drought vulnerability, establishing flexibility in management and improving overall reliability.

When the next major drought comes and Tom Steed dries up, the City of Altus will have a 45-day supply of backup water.

Furthermore, another benefit would be to allow MPMCD some flexibility as water levels get low in the Tom Steed Reservoir. As water becomes scarce, the MPMCD could reduce the daily flow to Altus to conserve water or reallocate flow to other areas where the need is more urgent.

Thus the long-term drought resilience benefits from this project extend beyond the limits of Altus. Water consumers in Jackson County and other parts of southwest Oklahoma would also benefit.

The City intends to maintain the reservoir as the primary drinking water source to sustain drought readiness for the next 50 years or longer. After this project is completed, the next phase of this effort will be to rehabilitate the western basin. This will require a mutli-million dollar dredging effort. This project may commence in the next 5 years. When completed, the City Reservoir will have a six month supply of water. Work on the west basin is not included in the work proposed for this grant.

#### *1.4.4.2 Environmental Benefits*

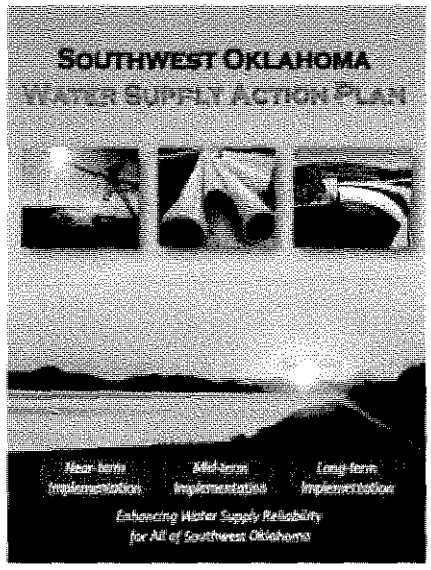
Replacing high salinity Lugert-Altus water with cleaner Tom Steed water will benefit the aquatic ecology of the City Reservoir. This effort will eliminate the golden algae and prevent future fish kills.

The project will also serve to reduce short term demand on the Tom Steed Reservoir when severe drought returns. This could be beneficial to the fish and other aquatic organisms that live in Tom Steed.

### 1.4.2 Drought Planning and Preparedness

***Explain how the applicable plan addresses drought. (Explain multiple stakeholder involvement and the collaborative process. Explain how the drought plan includes consideration of climate change impacts to water resources or drought.)***

***Describe how your proposed drought resiliency project is supported by an existing drought plan. (Explain how the plan identifies the proposed project as a potential mitigation or response action. Describe how the proposed project is prioritized in the drought plan.)***




The Southwest Oklahoma Water Supply Action Plan (SWAP), completed in May 2014, features a phased, targeted approach to resolving long-term water supply needs in this region of Oklahoma. Spearheading development of the plan and regular updates are the City of Altus and MPMCD who, along with key stakeholders in the region, remain committed to maximizing water reliability while minimizing drought vulnerability for area citizens.

Technical information and planning strategies for SWAP were compiled by experienced state water consultants, including Duane Smith & Associates, which has been engaged indefinitely to help the new SWAP Water Task Force implement the plan's recommendations. A copy of the SWAP as well as the updated plan (completed in July 2015) is included in the Appendix of this grant application.
Key to the plan was the involvement of regional stakeholders—including Altus Air Force Base, Lugert-Altus Irrigation District, area rural water districts and citizens without access to a public water system—who collaborated for almost a year to identify projects aimed at "drought-proofing" and enhancing the economic prosperity of Jackson, Tillman, Harmon, Kiowa and Greer Counties as well as surrounding areas.

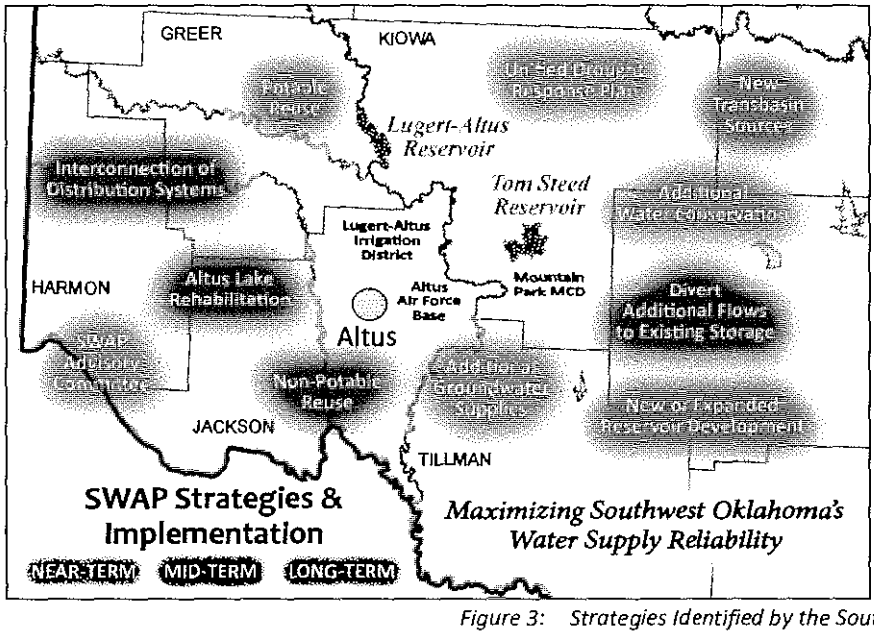



*Figure 3: Strategies Identified by the Southwest Oklahoma Water Supply Action Plan*

The SWAP identifies realistic and implementable options recognizing the inevitability of future—perhaps even more severe and frequent—drought events in the region. These well-vetted strategies are presented in near-, mid- and long-term actions over at least the next 15 years. Some, such as the pursuit of additional groundwater supplies and wells to supplement public surface supplies, are already underway as Altus has begun an $8 million project

to reinstate wells in its well field, install a new water main to connect the well field to the city and rehabilitate its reverse osmosis treatment plant. The SWAP also contemplates the construction and rehabilitation of reservoirs, extension and interconnection of distribution systems, expanded conservation, water reuse and improved drought response. Figure 3 summarizes SWAP action strategies and their implementation priorities.

The SWAP, which was essentially founded to address the potential and anticipated impacts associated with regional climate change, was also used to help prioritize activities associated with the Bureau of Reclamation's ongoing Upper Red River Basin Study. This collaborative investigation is addressing how climate change may affect future water supply, demand and operations in the basin and, when complete, it will identify adaptation strategies to address imbalances in water supply and demand.

Among the drought resiliency projects recommended by SWAP action strategies is this proposed project: rehabilitation of Altus City Reservoir, including dredging and dam modifications to increase storage capacity. The project is prioritized by SWAP as a "mid-term" (2- to 5-year) Action Item as the initial phase of an extended effort to restore the reservoir as drinking water source.

### 1.4.3 Severity of Actual or Potential Drought Impacts of the Project

Drought is common in southwest Oklahoma, where the climate is somewhat typical of the southwest U.S. This most recent drought was a particular threat to public water supply. During the spring of 2015, the height of the drought, Tom Steed Reservoir dropped to 19 percent capacity and almost 17 feet below its normal elevation. Similar impacts were experienced at Lugert-Altus Reservoir as the lake dropped more than 31 feet during 2015. Figure 4 displays the evolution of level declines at both lakes during the 2010-15 drought as well as the consistent severity of drought (via Drought Monitor categories) throughout the episode.

***What are the ongoing or potential drought impacts to specific sectors in the project area if no action is taken (e.g., impacts to agriculture, environment, hydropower, recreation and tourism, forestry), and how severe are those impacts?***

In addition to municipal supply vulnerabilities that will continue to exist should this project not be implemented, Altus Air Force Base supply vulnerabilities will also continue unheeded, contributing to reduced security for the AFB and its inhabitants. The U.S. Air Force is currently conducting a new Installation Complex Encroachment Management Action Plan (ICEMAP) study of the Altus water system and its ability to provide a secure, long-term water source that enables the AFB to fulfill its federal mission. The most recent ICEMAP report identified several quantity and quality concerns with the Altus water supply. Through the SWAP and recent efforts to upgrade its water supply—including the proposed Altus City Reservoir project—City officials are aggressively addressing these concerns.

It is imperative to the economic future of Altus that the City does everything in its power to maintain this crucially important defense facility as competition increases from other regional markets with arguably more reliable water supplies.

***Are there public health concerns or social concerns (e.g., water quality concerns including past or potential violations of drinking water standards, increased risk of wildfire, or past or potential shortages of drinking water supplies)? Does the community have another water source available to them if their water service is interrupted?***

During the 2010-15 drought, the unprecedented reduction in inflow at Tom Steed Reservoir had a serious impact on water quality due to abnormally elevated concentrations of organic compounds. Chlorine by-products in the water system rose to an all-time high and resulted in multiple drinking water standards violation notices from the Oklahoma Department of Environmental Quality. Future public health concerns would be decreased through implementation of this project and the resulting alleviation of pressure on Tom Steed.

***Are there ongoing, past or potential, local, or economic losses associated with current drought conditions (e.g., business, agriculture, reduced real estate values)?***

LAID's irrigated agriculture supports a vibrant economy in Altus and surrounding communities. Numerous cotton gins and related production facilities and the citizens they employ depend wholly upon the District and the success or failure of each year's crop. In a typically good year, one gin might employ dozens working 24-hour shifts; in a dry year with little or no irrigation water, there is limited work for only a handful of employees, and no work at all for many. During this recent drought, for the first time in more than half a century history, LAID farmers were unable to irrigate due to lack of water supply. Decreased crop production had a significant economic impact on Altus, which reduced tax receipts, property taxes (irrigated land is taxed at a higher rate) and related maintenance and improvements to roads, hospitals, schools and retail businesses.

Similarly, Altus Air Force Base is dependent upon a reliable water supply and requisite quality of life for its military and civilian population. 2009 data from the Altus Economic Development Corporation reveal that the AFB provides 4,250 jobs—about 60 percent of total employment in Altus. Like citizens in Altus, AFB residents were also impacted by the recent, long-term drought.

Also during the 2010-15 drought, thousands of rural citizens in the Altus area, especially vulnerable because they lack access to a water system, were forced to search for additional household supply, abandon surface sources or drill new or deeper water wells, which can often be an economic hardship.

### *Are there other drought-related impacts, such as water-related conflicts?*


There have been few drought-related water conflicts. This is due, in large part, to the ongoing regional SWAP planning effort, which has unified southwest Oklahoma water providers and stakeholders alike. Monthly meetings of the SWAP Task Force also serve as a forum to address looming water problems and potential conflicts over short- and long-term water use.

### *Describe existing or potential drought conditions in the project area.*

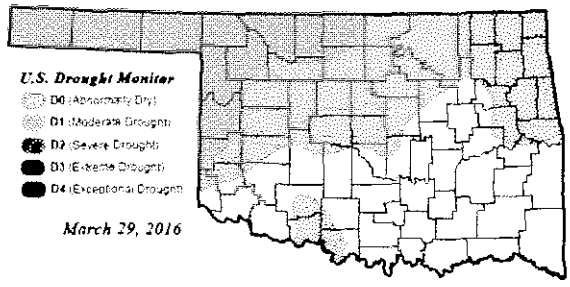



*Figure 5: Latest Drought Monitor for Oklahoma*

The record precipitation event that occurred about one year ago largely erased drought from southwest Oklahoma, giving way to more seasonable climatic conditions in the area.
More recently, however, it appears that drought conditions may once again be creeping into the region, primarily from the north and west (Figure 5).

### *Describe any projected increases to the severity or duration of drought in the project area resulting from climate change.*

The South Central Climate Science Center commissioned a study to look at the potential impacts of climate change on the hydrology of the Red River Basin (the upper Red River Basin includes the proposed project area). Participating scientists from the University of Oklahoma and the Choctaw and Chickasaw Nations expect future temperatures to increase in the region, the magnitude of which corresponds quite closely to the future emission scenario chosen. Precipitation is less certain, but is generally expected to decrease in the upper basin. While scientists point out considerable uncertainty with this and similar climate change and hydrology studies, the City of Altus and southwest Oklahoma water user groups are unified in their efforts to recognize and respond to the future potential dangers posed by a drier climate and resulting impacts to water availability and reliability. The rehabilitation of Altus City Reservoir, as well as other action strategies recommended by the SWAP, represents such a response.

The recent extreme drought of 2011-2015 threatened the public water supply. The Tom Steed Reservoir dropped to 19% capacity. Furthermore, the quality of water decreased significantly due to high concentrations of organic compounds. Chlorine

byproducts in the water system rose to an all-time high and resulted in multiple notices of violation from the Oklahoma Department of Environmental Quality.

Not only was the Tom Steed water less safe, it came dangerously close to drying up completely. This record drought presented a threat of the highest severity. Aside from the considerable economic and agricultural impacts, the drought threatened the health and welfare of the people of Altus and southwest Oklahoma. Now is the time to get ready for the next severe drought.

While it is uncertain when a severe drought will return, climate studies suggest that droughts are becoming more frequent and more severe. One of the lessons learned during the last drought was that the best time to prepare is before the drought. For these reasons, the City of Altus wishes to expedite the rehabilitation of the city reservoir. The recent winter storm taught us that the water supply can be interrupted by power failures as well.

This project will increase the City's resilience to any water supply interruptions regardless of the cause.

### 1.4.4 Project Implementation

This project is scheduled to be included in the FY2017 budget that begins July 1, 2016. While the budget has not yet been approved by the City Council, the intention of City Staff is to include $346,529.08 in the budget for the rehabilitation of the east basin of the City Reservoir. The enclosed letter of commitment and resolution should be sufficient to demonstrate that this project has the support of the City Council.

#### *1.4.4.1 Estimated Project Schedule*

The major phases of implementation will include environmental studies, design, bidding, permits, contract award and construction. The proposed schedule of implementation is as follows:

| Description | Begin Date | Duration | End Date |
|---|---|---|---|
| Environmental Study | July 2016 | 60 days | Sep 2016 |
| Design & Specifications | July 2016 | 120 days | Oct 2016 |
| Bidding | Nov 2016 | 45 days | Jan 2017 |
| Submit PCN for 404 review | Nov 2016 | 45 days | Jan 2017 |
| Award of Contract | Jan 2017 | 30 days | Feb 2017 |
| Other Permitting | Jan 2017 | 30 days | Feb 2017 |
| Construction | Feb 2017 | 180 days | Sep 2017 |
| Project Closeout | Sep 2017 | 30 days | Oct 2017 |

#### *1.4.4.2 Required Permits*

A. Water System Permit

A Permit to Construct will be required by the Oklahoma Department of Environmental Quality. This is standard for any capital project that involves an expansion or

modification of a permitted water system.

B. Federal Permit

A permit will also be required from the Mountain Park Master Conservancy District and/or U.S. Bureau of Reclamation to tap their raw water line and install fittings and valves within the easement.

C. Environmental Permits

There is no net loss of wetlands or aquatic habitat involved in this project. It is not anticipated that state or federal permits will be required. The only potential for environmental impacts comes from draining the reservoir into Stinking Creek. Care must be taken not to harm downstream aquatic ecology.

The City intends to submit a Pre-Construction Notification (PCN) to the U.S. Army Corps of Engineers to prompt a review by federal and state agencies and give them a chance to comment on the project as set forth in Section 404 of the Clean Water Act.

### 1.4.5 Nexus to Reclamation

The City of Altus currently receives its water supply from Tom Steed Reservoir and supplemental/emergency supply from Lugert-Altus Reservoir. Both are Reclamation projects that provide the basis for economic development in the City of Altus and surrounding communities. The City is a member of Mountain Park Master Conservancy District as it receives project water. The City also originally underwrote a portion of Lugert-Altus Dam and Irrigation System construction in the 1940s.

Altus City Reservoir has no inflowing stream and has been filled by Lugert-Altus water by means of two siphons that connect the main irrigation canal with the west basin. This project proposes to replace Lugert-Altus with Tom Steed water and involves placing sluice gates in the siphons from the irrigation canal and tapping the 36-inch raw water line. The Altus City Reservoir project provides benefits to both Reclamation projects by alleviating pressure on municipal supply at Tom Steed and agricultural supply at Lugert-Altus. The City of Altus and both projects reside in the Upper Red River Basin, which is currently under a Bureau of Reclamation water resource investigation.

The project involves placing sluice gates on the downstream end of siphon pipes from the irrigation canal and tapping the 36-inch raw water line. Otherwise, there is no work proposed on reclamation property or infrastructure.

## 1.5 Performance Measures

The ultimate success of this project will be measured through the number of instances in which Altus customers experienced interruption of water service.
The new magnetic meter will measure and record flows into the east basin from the raw water line. Surface water will be drawn from the east basin. Flows from the new meter will be compared to flow data through the treatment plant and flows from the well field.

The City will maintain the east basin water level between an elevation of 1395 and 1396 feet, which will maximize the storage capacity while still providing a minimum of 2 feet of freeboard on the lowest part of the dam. Weekly inspection and prompt servicing of pumps and valves will keep infrastructure operational.

# 2.0 Environmental & Cultural Compliance Questions

*2.1 Will the proposed project impact the surrounding environment (e.g., soil [dust], air, water [quality and quantity], animal habitat)?*

The proposed project is expected to have a long term benefit to the aquatic ecology of the city reservoir. The current water has high salinity because Lake Lugert-Altus has high salinity water which has been concentrated by decades of evaporation. A recent bloom of Golden Algae in January 2016 killed thousands of fish. Replacing this water with lower salinity Tom Steed water is expected to increase the water quality in the city reservoir.

Potential harmful impacts may result during construction. The installation of a new 30-inch water line will create a potential for sediment discharges into nearby streams. The new pipeline will cross an ephemeral drainage channel and then run parallel to a perennial stream that flows through the existing regional detention pond. Erosion, sediment and pollution control practices will be designed and implemented to minimize pollutant discharges during construction.

A further potential for ecologic impact will be the draining of the City Reservoir into an unnamed perennial tributary of Stinking Creek. Even though Stinking Creek has naturally elevated concentrations of chlorides, care must be taken not to flood the creek with higher concentrations of minerals that could harm the aquatic organisms. The City will perform chemical tests to monitor water quality and will seek the guidance of state and federal agencies regarding ways to minimize this impact.

No other potential impacts are anticipated.

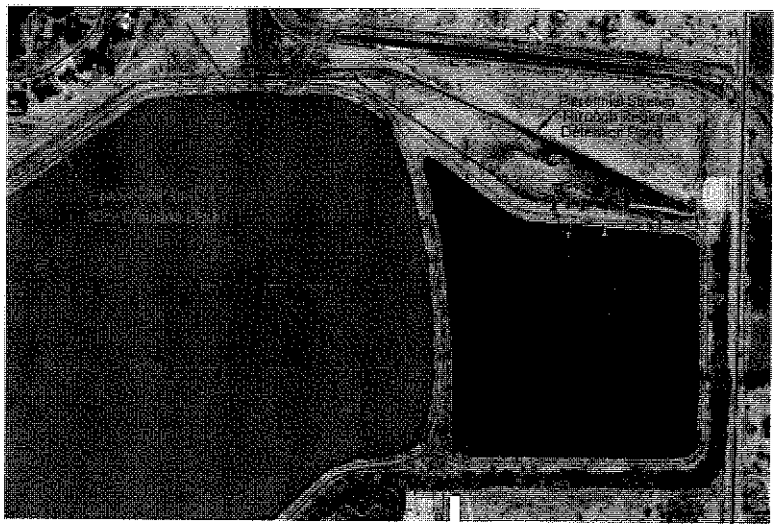
*2.2 Are you aware of any species listed or proposed to be listed as a Federal threatened or endangered species, or designated critical habitat in the project area?*

No – No known threatened or endangered species should be impacted by this project and there should be no permanent loss of critical habitat.

*2.3 Are there wetlands or other surface waters inside the project boundaries that potentially fall under CWA jurisdiction as "Waters of the United States?"*

Yes – the unnamed perennial stream that flows through the regional detention pond meets the definition of Water of the United States. The pipe route has been designed

so as not to cross this stream but the new pipeline will run parallel to the stream.



While the pipeline is located as far from the stream as possible, there is a portion of the new pipeline that will be installed within 20 feet of the streambank.

Potential wetlands beyond stream banks were observed within the detention pond. These are not believed to be jurisdictional wetlands. However, a formal wetland delineation will be conducted and submitted for review by the U.S. Army Corps of Engineers along with a Preconstruction Notification for this project.

*2.4 When was the water delivery system constructed?*

The west basin of the Altus City Reservoir was constructed in 1910. The first water treatment plant was built in 1927 on the west bank of the reservoir. The eastern basin was constructed in 1937 and a new water intake was installed in 1939. In 1947, the irrigation canal was constructed and connecting siphons installed to divert irrigation water into the western basin. Current water treatment plant was built in 1975. A reverse osmosis treatment facility was constructed in 2005. The earliest portions of the water distribution system were installed before 1920 and has been expanding ever since.

*2.5 Will the proposed project result in any modification of or effects to, individual features of an irrigation system (e.g., headgates, canals, or flumes)?*

The project will affect the main irrigation canal as the City will install sluice gates on the downstream ends of siphon pipes that allow canal water to enter the reservoir. The irrigation district operates sluice gates on the upstream ends of the siphons pipes. There used to be sluice gates on the downstream ends as well to keep reservoir water from backfilling into the siphon pipes but they fell into disrepair and were removed. This project includes work to replace the sluice gates at the downstream ends of the siphon pipes at the edge of the city reservoir.

The project is not expected to have any adverse impact on the irrigation canal and there will not be any disturbance or trespass needed to complete the work. On the contrary, the irrigation district will benefit from the project by the reduced need for irrigation water to keep the city reservoir full and a reduced labor burden by responding to requests to

# 4.0 Letters of Support

J. D. STRONG
EXECUTIVE DIRECTOR

MARY FALLIN
GOVERNOR

**STATE OF OKLAHOMA**
**WATER RESOURCES BOARD**
www.owrb.ok.gov

March 31, 2016

Mr. Michael Dieterich
U.S. Bureau of Reclamation Acquisition Operations Branch
Mail Code: 84-27852
P.O. Box 25007
Denver, CO 80225

*RE: Letter of Support for WaterSMART DRP Grant application by the City of Altus, Oklahoma*

Dear Mr. Dieterich:

The Oklahoma Water Resources Board supports the proposal of the City of Altus to upgrade the east basin of the Altus City Lake. These improvements will both protect the integrity of the basin and add 115 million gallons of continuous flow through, resulting in a 45-day supply to buffer the region from potential interruptions from its raw water source.

At least seven other entities will benefit from this project, mitigating somewhat, the effects of long standing droughts that regularly occur in far southwest Oklahoma. The City of Altus is not simply a water provider, but an active regional partner working with the surrounding communities, setting goals, and developing a strategy against devastating drought as demonstrated in the region's Southwest Water Supply Water Action Plan.

Altus's system of water resources also plays a role in the national defense and local economy as the primary provider of Altus Air Force Base.

Through Oklahoma's State Revolving Fund programs and *Water for 2060 Drought Grant* program, Altus enjoys a long history of improving its system with over $26 million in loans. Altus is an excellent borrower today with less than a million dollars outstanding loan balance. Over the years, the City has improved both water and sewer plants, as well as its drainage, supply, and distribution systems. With this new project, Altus will continue its tradition as a forward thinking community.

Such efforts are all directly in line with the water efficiency goals of both Oklahoma's Water for 2060 initiative and Reclamation's WaterSMART grant program. If the OWRB can assist you in any way, please call Mr. Owen Mills, OWRB's Director of Water Planning, at (405) 530-8800.

Sincerely,

J.D. Strong
Executive Director

OWRB
the water agency

3800 N. CLASSEN BOULEVARD • OKLAHOMA CITY, OKLAHOMA 73118
TELEPHONE (405) 530-8800 • FAX (405) 530-8900

Stephen B. Allen • Tom Buchanan • Bob Drake • F Ford Drummond
Marilyn Feaver • Ed Fite • Jason W Hitch • Linda P. Lambert • Richard C Sevenoaks

WATER FOR 2060

ALTUS CHAMBER
COMMERCE

April 6, 2016

Mr. Michael Dieterich
U.S. Bureau of Reclamation Acquisition Operations Branch
Mail Code: 84-27852
P.O. Box 25007
Denver, CO 80225

RE: Letter of Support for WaterSMART DRP Grant application by the City of Altus, Oklahoma

Dear Mr. Dieterich:

The Altus Chamber of Commerce and its Southwest Oklahoma Water Task Force support the proposal of the City of Altus to improve the east basin of the Altus City Lake. These efforts will improve both the quality and the quantity of the water available to our community while improving water security through the establishment of a 45-day supply to help prevent potential interruptions in our water supply.

This project is a key part of our Southwest Water Supply Water Action Plan, which has been enacted to ensure safe, reliable water is available for thousands of Oklahomans in this region, and it is critical to maintaining the ability of Altus Air Force Base to continue to perform its important mission at a high level.

We are proud of the efforts the City of Altus has undertaken to not only respond to the recent drought we experienced but to also better position our community for future water shortages, and this project is a major step in the right direction. It will allow us better provide for our current residents and businesses, while also helping ensure adequate water supply for economic development and future growth.

If you have any further questions, or if my staff or I can be of assistance in any way, please do not hesitate to contact us. We sincerely appreciate your consideration of this important request. You can be confident that Altus will be excellent stewards of these financial resources and that funding this request will positively impact thousands of lives

Sincerely,

Brian Bush
President & CEO

*Better. Stronger. Together.*
301 West Commerce, P.O. Box 518 – Altus, OK 73522 – Phone: (580) 482-0210, Fax: (580) 482-0223
www.altuschamber.com

# 5.0 Official Resolutions

Two resolutions were executed for this application from the following governing bodies.

- Council of the City of Altus
- Board of Trustees of the Altus Municipal Authority

The city council is comprised as the same persons who are also the trustees of the authority. The Mayor is also Chairman of the Board of Trustees.

The non-federal match will be included in the AMA portion of the City Budget and materials will be purchased under the name of the City.

RESOLUTION NO. 2016 - 08

A RESOLUTION DECLARING THE COMMITMENT OF THE ALTUS MUNICIPAL AUTHORITY TO REHABILITATE THE EAST BASIN OF THE ALTUS CITY RESERVOIR AND AUTHORIZE THE CITY'S APPLICATION FOR A WATERSMART DROUGHT RESILIENCY PROJECT GRANT FOR FISCAL YEAR 2016 (FUNDING OPPORTUNITY ANNOUNCEMENT NO. R16-FOA-DO-006)

WHEREAS, the Altus Municipal Authority was established to facilitate the operation of public utilities including a public water system; and

WHEREAS, the Altus City Reservoir was constructed in 1910 to serve as a primary source of drinking water for the public water system and constructed a water treatment plant in 1927 to treat water from the City Reservoir to generate potable water; and

WHEREAS, the Lake Lugert-Altus dam and pipeline was constructed in 1927 to convey Lugert-Altus water to the City Reservoir and expanded the City Reservoir in 1937 by constructing the east basin and pump station to draw water out of the City Reservoir for treatment at the water treatment plant; and

WHEREAS, the Authority discontinued use of the City Reservoir as a primary drinking water source when the Tom Steed Reservoir was completed in 1975 using Lugert-Altus water periodically to refill the basin after evaporation of water; and

WHEREAS, decades of water sitting and evaporating has concentrated levels of chlorides and organic compounds that promote the growth of golden algae which has caused fish kills in the reservoir to the extent that the City Reservoir is no longer desirable as a source of drinking water; and

WHEREAS, the City of Altus experienced an extreme drought from 2011-2015 which reduced the Tom Steed Reservoir to 19% capacity and threatened the City's water supply; and

WHEREAS, power outages in November and December 2016 interrupted the flow of raw water from the Tom Steed Reservoir and underscored the need to have a back-up water supply since the City's well field does not have the capacity to serve as a sole source of water, even on a short term basis; and

WHEREAS, the Authority has less than 24 hours supply of treated water on hand in clear wells and storage tanks making the Authority dependent on the continuous flow of raw water from the Tom Steed Reservoir; and

WHEREAS, the Authority has access to Tom Steed Water that can be used to replace the existing water in the City Reservoir in an effort to restore the City Reservoir as a primary source of drinking water; and

WHEREAS, the City Engineer, has recommended that the first phase of said restoration to be the rehabilitation of the east basin of the reservoir to remove the old Lugert-Altus water, rehabilitate the pump station, and install a new pipeline to feed Tom Steed water continuously through the east basin and draw water from this basin for treatment which project would provide a 45-day back-up supply of high quality Tom Steed water should there ever be an interruption in the flow from the Tom Steed Reservoir for a total project cost of $646,529.08; and

WHEREAS, the Authority desires to devote resources to increase its readiness for the next major drought; and

WHEREAS, the U.S. Bureau of Reclamation has announced WaterSMART: Drought Resiliency Project Grants for Fiscal Year 2016 (Funding Opportunity Announcement No. R16-FOA-DO-006) which can provide 50% of project costs up to $300,000 for projects to increase the drought resiliency of water systems and the Authority desires to pursue a grant to leverage its public funds; and

WHEREAS, the U.S. Bureau of Reclamation requires a formal resolution from the applicant's governing body to be submitted with the grant application.

NOW, THEREFORE, BE IT RESOLVED by the Board of Trustees of the Altus Municipal Authority:

Section 1. That the Mayor of Altus and the City Manager are authorized to sign documents on behalf of the Authority to enter into any agreements required by the U.S. Bureau of Reclamation as required by the WaterSMART Grant Program; and

Section 2. That the Board supports the submittal of an application for a WaterSMART Drought Resiliency Project Grant FY2016 to rehabilitate the east basin of the Altus City Reservoir; and

Section 3. That the Board acknowledges that the project is estimated to cost $646,529.08 with 50% non-federal match required. The Board commits to including the non-federal match of $346,529.08 in the FY 2017 annual budget which will be available July 1, 2016; and

Section 4. That the Authority will cooperate with the U.S. Bureau of Reclamation to meet established deadlines for entering into a cooperative agreement and otherwise comply with WaterSMART Program requirements.

PASSED AND APPROVED this 5th day of April, 2016 by the Altus Municipal Authority.

JACK SMILEY, CHAIRMAN

(SEAL)

ALTUS MUNICIPAL AUTHORITY SEAL OKLAHOMA

ATTEST:

DEBBIE DAVIS: CITY CLERK/TREASURER

Approved as to form and legality this 5th day of April, 2016.

CATHERINE J. COKE, CITY ATTORNEY

K:\RESOLUT\WaterSMART Grant Application AMA

RESOLUTION NO. 2016 - 09

A RESOLUTION DECLARING THE COMMITMENT OF THE CITY OF ALTUS TO REHABILITATE THE EAST BASIN OF THE ALTUS CITY RESERVOIR AND AUTHORIZE THE CITY'S APPLICATION FOR A WATERSMART DROUGHT RESILIENCY PROJECT GRANT FOR FISCAL YEAR 2016 (FUNDING OPPORTUNITY ANNOUNCEMENT NO. R16-FOA-DO-006).

WHEREAS, the City of Altus constructed the Altus City Reservoir in 1910 to serve as a primary source of drinking water for the public water system and constructed a water treatment plant in 1927 to treat water from the city reservoir to generate potable water; and

WHEREAS, the City participated in the construction of the Lake Lugert-Altus dam and pipeline in 1927 to run Lugert-Altus water to the City Reservoir and expanded the City Reservoir in 1937 by constructing the east basin and pump station to draw water out of the city reservoir for treatment at the water treatment plant; and

WHEREAS, the City discontinued use of the City Reservoir as a primary drinking water source when the Tom Steed Reservoir was completed in 1975 using Lugert-Altus water periodically to refill the basin after evaporation of water; and

WHEREAS, decades of water sitting and evaporating has concentrated levels of chlorides and organic compounds that promote the growth of golden algae which has caused fish kills in the reservoir to the extent that the City Reservoir is no longer desirable as a source of drinking water; and

WHEREAS, the City of Altus experienced an extreme drought from 2011-2015 which reduced the Tom Steed Reservoir to 19% capacity and threatened the City's water supply; and

WHEREAS, power outages in November and December 2016 interrupted the flow of raw water from the Tom Steed Reservoir and underscored the need to have a back-up water supply since the City's well field does not have the capacity to serve as a sole source of water, even on a short term basis; and

WHEREAS, the City has less than 24 hours supply of treated water on hand in clear wells and storage tanks making the City dependent on the continuous flow of raw water from the Tom Steed Reservoir; and

WHEREAS, the City has a supply Tom Steed Water that can be used to replace the existing water in the City Reservoir in an effort to restore the City Reservoir as a primary source of drinking water; and

WHEREAS, the City Engineer, has recommended that the first phase of said restoration to be the rehabilitation of the east basin of the reservoir to remove the old Lugert-Altus water, rehabilitate the pump station, and install a new pipeline to feed Tom Steed water continuously through the east basin and draw water from this basin for treatment which project would provide a 45-day back-up supply of high quality Tom Steed water should there ever be an interruption in the flow from the Tom Steed Reservoir for a total project cost of $646,529.08; and

WHEREAS, the City desires to devote resources to increase its readiness for the next major drought; and

WHEREAS, the U.S. Bureau of Reclamation has announced WaterSMART: Drought Resiliency Project Grants for Fiscal Year 2016 (Funding Opportunity Announcement No. R16-FOA-DO-006) which can provide 50% of project costs up to $300,000 for projects to increase the drought resiliency of water systems and the City desires to pursue a grant to leverage its public funds; and

WHEREAS, the U.S. Bureau of Reclamation requires a formal resolution from the applicant's governing body to be submitted with the grant application.

NOW, THEREFORE, BE IT RESOLVED by the Council of the City of Altus:

Section 1. That the Mayor of Altus and the City Manager are authorized to sign documents on behalf of the City to enter into any agreements required by the U.S. Bureau of Reclamation as required by the WaterSMART Grant Program; and

Section 2. That the Council supports the submittal of an application for a WaterSMART Drought Resiliency Project Grant FY2016 to rehabilitate the east basin of the Altus City Reservoir; and

Section 3. That the Council acknowledges that the project is estimated to cost $646,529.08 with 50% non-federal match required. The Council commits to including the non-federal match of $346,529.08 in the FY2017 annual budget which will be available July 1, 2016; and

Section 4. That the City will cooperate with the U.S. Bureau of Reclamation to meet established deadlines for entering into a cooperative agreement and otherwise comply with WaterSMART Program requirements.

PASSED AND APPROVED this 5th day of April, 2016 by the City of Altus, Oklahoma.

JACK SMILEY, MAYOR

(SEAL)

CITY OF ALTUS SEAL ALTUS OKLAHOMA

ATTEST:

DEBBIE DAVIS: CITY CLERK/TREASURER

Approved as to form and legality this 5th day of April, 2016.

CATHERINE J. COKE, CITY ATTORNEY

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# Appendix A

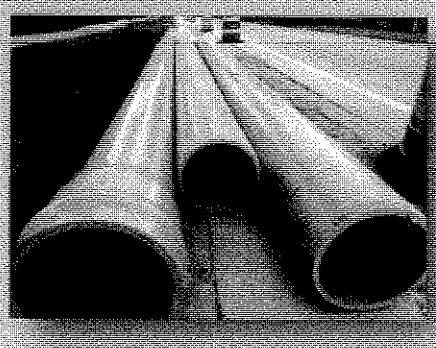
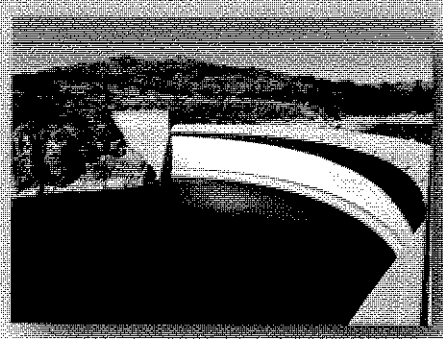
## SF-424 Application for Federal Assistance

## SF-424D Assurances - Construction Programs

# Appendix B

## Regional Drought Plan

# SOUTHWEST OKLAHOMA
# WATER SUPPLY ACTION PLAN

*Near-term Implementation* | *Mid-term Implementation* | *Long-term Implementation*

***Enhancing Water Supply Reliability for All of Southwest Oklahoma***

REPORT | May 2014

Creative Capitol Strategies, LLC **Duane Smith & Associates** Carollo Engineers...Working Wonders With Water

Creative Capitol Strategies, LLC  **Duane Smith & Associates**  carollo


5/30/14

# SOUTHWEST OKLAHOMA

# WATER SUPPLY ACTION PLAN

**FINAL**
May 2014

100 N.E. 5TH STREET • OKLAHOMA CITY, OKLAHOMA 73104 • P. 405.840.7785

**SOUTHWEST OKLAHOMA**

**WATER SUPPLY ACTION PLAN**

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# 1.0 ACTION PLAN PURPOSE AND GOALS

Scarcity of water resources has been a part of life in Southwest Oklahoma since before statehood. Residents and farmers in this part of the state have always had to be diligent and creative in working to capture as much water as possible during the wet years to get them through the dry years that are prevalent in Southwest Oklahoma.

The Territorial Legislature recognized the difficult situation facing Western Oklahoma farmers. In 1897, the Legislature provided tax incentives to individuals who constructed and maintained irrigation systems. A tax deduction of eight dollars for the first acre, four dollars for the second, and one dollar for each additional acre was allowed for impounded water.

The history of this region is peppered with stories and examples of early day residents attempting develop the water resources of the region. These include W.H. Fullerton's 1890 Turkey Creek reservoir and irrigation system, primitive dams across the North Fork of the Red River, and a number of wells in the region. These efforts culminated in the development of the Lugert-Altus irrigation project, which was completed in 1947.

As population in the region continued to grow, providing drinking water for Altus and the surrounding communities was becoming more and more challenging. In 1960, communities in the area began working with the Bureau of Reclamation to develop additional water resources near Mountain Park. With the much help from U.S. Representative Tom Steed, a dam was completed on Otter Creek in 1975. Since then, the Tom Steed Reservoir and Mountain Park Master Conservancy District (MPMCD) has been providing municipal water to Altus, Snyder, Frederick and Mountain Park.

The area has continued to experience growth, and with it, the challenges of providing a reliable source of good quality water. The goal of the Southwest Oklahoma Water Supply Action Plan is to bring the communities in the region together to work collectively toward securing the future of the region for decades to come. This Southwest Oklahoma Water Supply Action Plan (referred to below as the SWAP, or Action Plan) identifies steps to be taken to move Southwest Oklahoma forward in the face of increasing drought and securing a sustainable economy for generations to come.

# 2.0 REGIONAL WATER SUPPLY OVERVIEW

## 2.1 Regional Water Supply Sources

Southwest Oklahoma relies on a combination of surface water (streams, rivers, and reservoirs) and groundwater aquifer supplies (including shallow alluvial wells and deep bedrock groundwater wells). The 2012 Oklahoma Comprehensive Water Plan (OCWP) reported that surface water supplies 38 percent of demand in the region, with alluvial and bedrock groundwater supplying the remaining 28 percent and 34 percent of demand, respectively.

As documented in the OCWP, the following are the major water supply sources in Southwest Oklahoma:

- Surface water: The region is supplied by three major rivers: the North Fork of the Red River, the Elm Fork of the Red River, and the Salt Fork of the Red River.
- Alluvial groundwater: The majority of currently allocated alluvial groundwater withdrawals in the region are from the North Fork of the Red River aquifer, Tillman Terrace aquifer, and from non-delineated minor aquifers.
- Bedrock groundwater: Currently allocated and projected withdrawals are primarily from the Blaine and Ogallala major bedrock aquifers, and to a lesser extent, the Elk City and minor aquifers.

Water supply availability and water quality present significant challenges for surface water and groundwater alike. Surface water resources can be vulnerable to extended drought conditions, even with significant reservoir storage, and surface water permits are fully allocated in portions of the region. Surface water quality issues include elevated levels of total dissolved solids (TDS) and sulfates, posing issues for public water suppliers and crop irrigators alike. Decreasing water levels in storage in both the Lugert-Altus project and Tom Steed Reservoir has shown a direct correlation to water quality impacts as well. The OCWP noted that the Area VI chloride control project on the Elm Fork of the Red River has been studied for many years by the U.S. Army Corps of Engineers, and may be a potential viable source of additional water through diversion to existing infrastructure or pumped directly into Lugert-Altus Reservoir.

The OCWP projected that the continued use of alluvial groundwater in Southwest Oklahoma could cause withdrawals to exceed recharge rates in some areas, particularly in summer. However, there are significant quantities of groundwater in storage. The OCWP also forecasts that bedrock groundwater withdrawals will exceed recharge rates in many parts of the region, but again referenced the seasonality of those impacts and the large volumes of water in the region's deep aquifers. However, water quality constraints do affect the use of the region's groundwater supplies. High mineral content, TDS, and nitrates and other parameters across the region can affect the ability to use groundwater supplies for potable water supply or irrigation or drive a need to treat or blend those supplies before use.

## 2.2 Projected Water Demands

The SWAP was initiated by a proactive group of water interests, comprised largely of Public Water Suppliers, AAFB representatives, agricultural producers, and involved members of the public and local economies. The intent of the SWAP is to provide an implementable plan to firm up the reliability of supplies for all water users in the region.

The OCWP projected water demands from a 2010 baseline estimate of water use out to 2060 in 10-year increments, aggregating demands for each water use sector on a county level and on a watershed or "basin" level. Appendix A presents the OCWP county-level demand projections for Jackson, Tillman, Harmon, and Greer Counties, the four counties most directly driving the SWAP. The OCWP's defined water use sectors include Public

Water Supply (including municipalities and rural water districts), self-supplied residential (e.g., domestic well users), crop irrigation, livestock, oil and gas, thermoelectric power, and self-supplied industrial (not on a public water supply system). Of these seven water use sectors, crop irrigation comprises about 93 percent of the four-county demand. Public water supply represents 5 percent of the demand, with lesser use but important economic contributions coming from all remaining sectors.

### 2.3 Water Supply Issues and Ongoing Actions

The extended drought from late 2010 through the present has directly impacted all of Southwest Oklahoma. As such, reliability of supplies is at the forefront of public attention and a daily challenge for water providers and users across Southwest Oklahoma. As noted above, water quality challenges are exacerbated by decreased reservoir levels under drought conditions. Southwest Oklahomans have responded positively, however, with significant curtailment of water use to help manage limited supplies through these times of drought. MPMCD staff report that its customers have reduced use some 40 percent in response to the low lake levels and continued drought. In addition, several water suppliers are actively pursuing additional groundwater supplies to increase supply reliability, as further detailed in the Action Plan below. Furthermore, conservation programs and drought management actions are being employed more than at any time in the region's history to address supply limitations now and into the future.

The City of Altus is actively working to bring its existing reverse osmosis (RO) water treatment facility back online, to provide greater flexibility in the City's ability to treat water from Lake Altus when necessary, address disinfection byproduct water quality concerns, and provide for possible future treatment of groundwater supplies if/as needed. The RO facility was shut down in 2011 due to significant water losses (low treated water recovery rates), high operating costs, and operational issues. The facility will use different pretreatment technology (conventional treatment instead of ultrafiltration) to address those issues.

## 3.0 WATER SUPPLY ACTION PLAN

### 3.1 Overview of the Action Plan

The Southwest Oklahoma Water Supply Action Plan ("SWAP" or "Action Plan," for short) was developed through a detailed review of past studies and reports, coupled with a series of meetings with key water stakeholders in the region that represent a diverse set of water interests and uses. A summary of key information from past reports is provided in Appendix B, and a list of referenced reports is included as Appendix C.

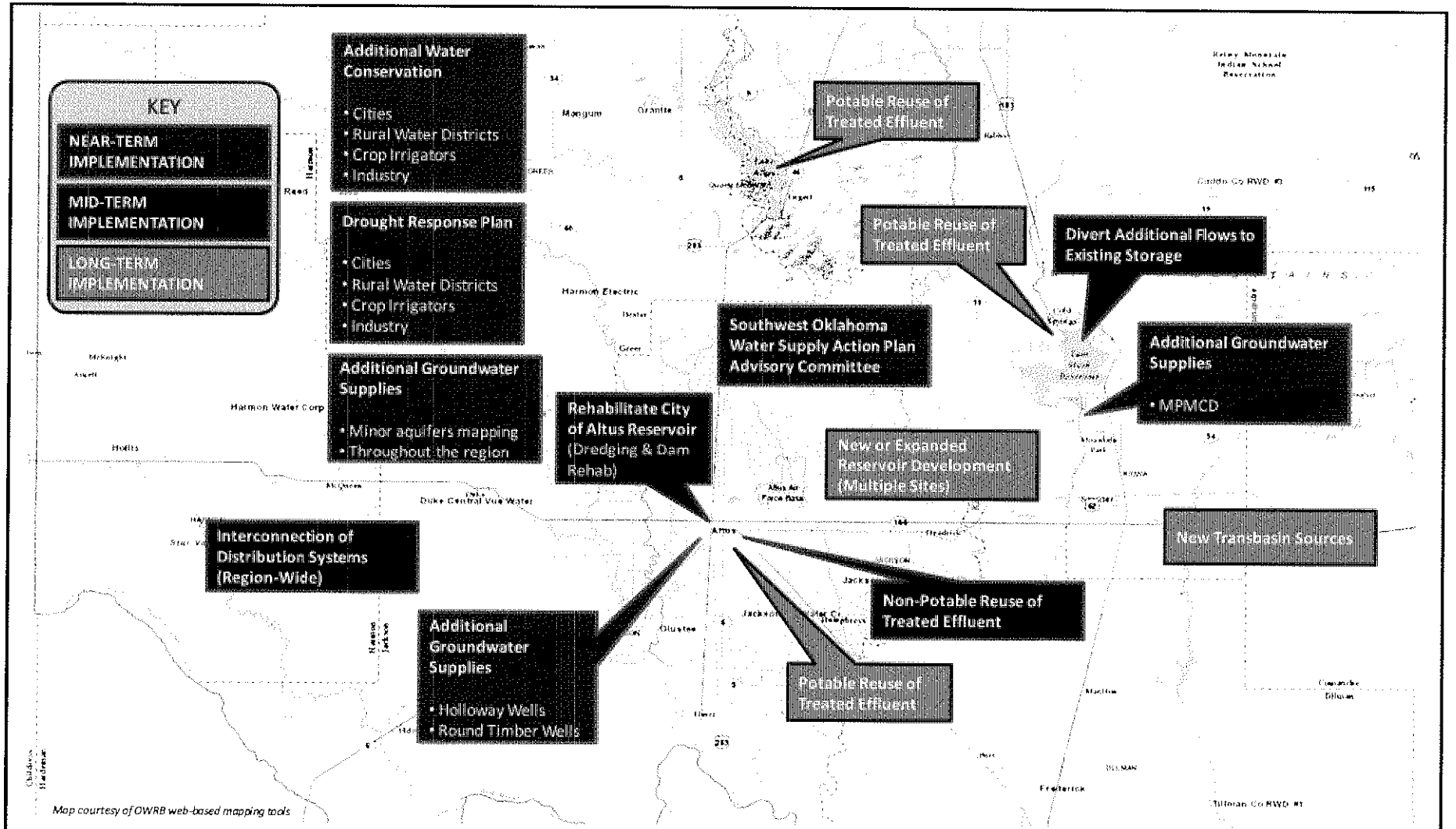
The Action Plan (Table 1) provides a phased, targeted approach to addressing near and long-term water supply improvements, driven largely by the amount of time needed to implement each water supply strategy. Phased implementation of the major Action Plan components is also depicted on Figure 1.

| Table 1 Water Supply Strategies and Actions | | | | |
|---|---|---|---|---|
| **Water Supply Strategies** | **Components** | **0- to 2-Year Action Plan** | **2- to 5-Year Action Plan** | **5+ Year Action Plan** |
| **Near-Term Implementation: Increase Efficiency / Local Supplies** | | | | |
| **Additional Water Conservation** | • Additional efficiency measures for Public Water Supply systems, including Altus AFB, and Crop Irrigation | • Inventory and document existing conservation measures and practices (PWS and Crop Irrigation)<br>• Identify and share best practices (PWS and Crop Irrigation)<br>• Assess potential costs and water savings of lining LAID canals<br>• Evaluate Oklahoma Comprehensive Water Plan savings by county and determine applicability of OCWP measures<br>• Develop/update conservation plans and programs (PWS and Crop Irrigation)<br>• Identify crop irrigation research project and submit for USDA's National Integrated Water Quality Program (NIWQP) grant | • Consider implementation of additional more aggressive conservation measures<br>• Monitor and adjust conservation plans<br>• Potentially implement initial phase of LAID canal lining | • Monitor and adjust conservation plans<br>• Potentially implement remaining phases of LAID canal lining |
| **Drought Response Plan** | • Specific actions to be taken at specific supply trigger points<br>• Consistency between users of shared surface water resources<br>• Phased response plan to reflect stages of supply shortages | • Inventory and document existing drought response triggers and measures (PWS and Crop Irrigation)<br>• Identify and share best practices<br>• Consider Unified Drought Response Plan for users of shared surface water supplies | • Monitor and adjust drought response triggers and plans | • Monitor and adjust drought response triggers and plans |
| **Additional Groundwater Supplies** | • Augmentation of Tom Steed supplies in transmission with new alluvial wells<br>• Additional groundwater wells to augment existing supplies (Public Water Supply systems, including Altus AFB, and Crop Irrigation)<br>• Reinstate Altus Round Timber wells and transmission line<br>• Red River Chloride Control Project (local implementation and Bureau of Reclamation Upper Red River Basin Study) | • Evaluate groundwater/surface water quality compatibility for transmission lines (Tom Steed and other blended supplies)<br>• Evaluate groundwater/surface water flow interaction in North Fork Red River<br>• Map regional groundwater resources based on known wells yield and quality<br>• Identify most viable well sites (potential yield, water quality and treatment requirements, volume in storage, recharge rates, proximity to users)<br>• Identify additional groundwater sources for Mountain Park MCD customers to take additional pressure off Tom Steed Reservoir<br>• Monitor/participate in Bureau of Reclamation Basin study | • Investigate potential use of Tillman Terrace aquifer for City of Altus or others<br>• Confirm permit availability for additional targeted groundwater wells<br>• Funding/financing plan<br>• Ongoing groundwater monitoring (levels and quality)<br>• Update North Fork Red River maximum annual yield study/hydrologic survey<br>• Implement recommendations of Bureau of Reclamation Basin study | • Consider need for additional groundwater wells<br>• Ongoing groundwater monitoring (levels and quality) |

**Table 1 Water Supply Strategies and Actions**

| Water Supply Strategies | Components | 0- to 2-Year Action Plan | 2- to 5-Year Action Plan | 5+ Year Action Plan |
|---|---|---|---|---|
| **Southwest Oklahoma Water Supply Action Plan Advisory Committee** | • Cooperative committee to monitor and steer implementation of Action Plan | • Form committee to drive joint accountability and implementation of Southwest Oklahoma Water Supply Action Plan<br>• Provide single source for relevant studies and data<br>• Coordinate, advocate for, and monitor Action Plan implementation<br>• Develop an integrated capital improvements plan | • Continued monitoring and adaptive management of Action Plan; update Action Plan (and CIP) as needed | • Continued monitoring and adaptive management of Action Plan; update Action Plan (and CIP) as needed |
| **Mid-Term Implementation: Enhance Existing Supplies** | | | | |
| **Non-Potable Reuse of Treated Effluent** | • Irrigation, industrial, and other non-potable reuse applications consistent with ODEQ non-potable water reuse regulations | • Develop Altus and AFB Reuse Plan (inventory supply availability from water reclamation facilities, compare effluent quality to ODEQ regulatory requirements, identify large water use sites/customers and screen for potential non-potable uses)<br>• Customer and public outreach | • Consider applicability of reuse for smaller communities<br>• Develop funding/financing plan<br>• Design initial phase of Altus/AFB non-potable reuse plan | • Implement initial phase of Altus/AFB non-potable reuse plan<br>• Implement non-potable reuse system expansion |
| **Rehabilitate City of Altus Reservoir** | • Dredging to recuperate capacity<br>• Rehabilitation of dam | • Evaluate benefits and costs of dredging and dam rehabilitation to maintain capacity and asset longevity | • Preliminary planning and design of improvements, as appropriate based on evaluation of costs and benefits | • Implementation of improvements, as appropriate based on evaluation of costs and benefits |
| **Divert Additional Flows to Existing Storage** | • Additional creek diversions to Tom Steed Reservoir<br>• Other diversion opportunities | • Inventory previous work on additional diversions and identify/prioritize potential opportunities<br>• Estimate additional yield and cost for widening Elm Creek Diversion Channel into Tom Steed | • Develop funding/financing plan<br>• Widen Elm Creek Diversion Channel to increase capacity and flows into Tom Steed<br>• Assess potential sizing/yield/cost for new diversion into Tom Steed | • Design, construct, and implement new diversion from creek(s) into Tom Steed<br>• Monitor yield of additional diversions |
| **Interconnection of Distribution Systems** | • Add piping interconnections for emergency and/or regular supply sharing between systems (municipal, rural and military water systems) | • Compile mapping of existing transmission and distribution systems<br>• Identify and cost options for redundant Altus AFB connections<br>• Estimate costs and prioritize system interconnections<br>• Identify funding/financing vehicles | • Develop interlocal agreements<br>• Planning, design, and construction of priority interconnections<br>• Evaluate connecting Cache to Lawton to take additional pressure off Tom Steed during drought | • Continued operation of interconnected systems<br>• Identification of additional cost-effective interconnection opportunities |

| Table 1 Water Supply Strategies and Actions | | | | |
|---|---|---|---|---|
| **Water Supply Strategies** | **Components** | **0- to 2-Year Action Plan** | **2- to 5-Year Action Plan** | **5+ Year Action Plan** |
| **Long-Term Implementation: Implement New Sources of Supply** | | | | |
| **New or Expanded Reservoir Development** | • Additional NRCS dams<br>• Reassess feasibility of raising Lugert and/or Tom Steed dams<br>• Consider new surface water reservoir | • Inventory potential NRCS sites<br>• Integrate analyses of new reservoir sites and/or raising existing dams, yields, and costs into Bureau of Reclamation Basin study | • Prioritize one or more reservoir sites for permitting and funding/financing plan | • Implement reservoir project, contingent on 0-5 year Action Plan results |
| **Potable Reuse of Treated Effluent** | • Consider augmentation of existing surface water supplies with treated effluent (indirect potable reuse)<br>• Consider direct potable reuse (water reclamation plant followed by advanced water treatment and distribution) | • Initial public outreach<br>• Monitor ODEQ regulatory process<br>• Coordinate availability of treated effluent with non-potable reuse plans | • Continue public outreach<br>• Define treatment and infrastructure requirements for indirect or direct potable water reuse; develop conceptual infrastructure schematic; develop planning-level costs<br>• Determine role of potable reuse in light of other mid-term and long-term supplies<br>• Develop potable water reuse implementation plan (if applicable) | • Continue public outreach<br>• Implement potable water reuse projects (indirect or direct potable reuse) |
| **New Transbasin Sources** | • Evaluate feasibility of new transbasin supplies | • Monitor and evaluate regional/state processes evaluating major transbasin supply projects<br>• Compare costs, benefits, and implementation challenges to alternate approaches | • Continue to monitor regional/state processes<br>• Initiate detailed study if/as appropriate | • Initiate implementation if/as appropriate |




# PHASED IMPLEMENTATION PLAN

FIGURE 1

SOUTHWEST OKLAHOMA
*WATER SUPPLY ACTION PLAN*

**Creative Capitol Strategies, LLC** **Duane Smith & Associates** **carollo**

pw://Carollo/Documents/Client/OK/Altus/9501A00/Deliverables/Figure 1

Strategies are outlined in three groups:

- **Near-term implementation strategies** expand on the region's successes in making efficient use of existing supplies, and also includes measures that can increase water supply or enhance water supply planning starting immediately.
- **Mid-term implementation strategies** are designed to supplement or enhance existing supplies in the region. These strategies require more time for implementation, but do not have significant institutional, regulatory, or technical hurdles to overcome.
- **Long-term implementation strategies** focus on implementation of new water supply sources. Long-term strategies have the longest implementation time because of the regulatory, financing, and/or technical challenges associated with developing new water supply sources.

Near-term strategies are first and foremost intended to reduce drought vulnerabilities in the region. These actions are strongly recommended – even if normal precipitation returns to the region in the near future – to increase the number and types of supply sources available to Southwest Oklahoma water users. These actions will not only help increase supply reliability under the current drought conditions, but equally importantly, will strengthen the ability of Southwest Oklahoma water users to prepare for and mitigate the effects of the inevitable next drought.

For each near-term, mid-term, and long-term water supply strategy, the Action Plan identifies one or more components with specific actions on an implementation timeline. The timeline organizes the implementation actions for each supply strategy into the following time frames:

- 0- to 2-Year Action Plan.
- 2- to 5-Year Action Plan.
- 5-Year and Beyond ("5+ Year") Action Plan.

The timeline provides sequential steps for implementation of the recommended strategy so that the resulting water supply can be available when it is needed. For example, while a new reservoir is a long-term strategy, there are activities that need to be completed sooner (e.g., site identification and permitting) that can take years – or even a decade or more for some projects – to complete.

## 3.2 Near-Term Strategies

The SWAP identifies four near-term strategies:

- Additional water conservation,
- Develop drought response plan,
- Additional groundwater supplies, and
- SWAP Advisory Committee.

Table 1 provides 0- to 2-Year, 2- to 5-Year, and 5+ Year actions for each of these strategies, as described below.

### 3.2.1 Additional Water Conservation

Increasing water use efficiency through additional conservation measures and programs is a key component of managing supplies for reliability and cost-effective use. Conservation is a vital strategy for public water suppliers (for example, the Town of Snyder, City of Altus, Jackson County Water Corporation), and military users (Altus Air Force Base, or AAFB) and crop irrigators. There may be opportunities for industrial water users and other water use sectors to increase efficiencies as well.

Conservation measures and programs are activities that water users engage in everyday, regardless of whether the region is in drought, and represent consistent water savings. Everyday conservation actions can directly translate into drought preparation and mitigation, by reducing water use that in turn alleviates demand on surface water reservoirs and other existing supplies, and maintains greater supplies in storage for use in times of drought.

The Action Plan calls for developing and updating conservation plans, implementing the programs, and monitoring and adjusting conservation plans and programs to maintain or improve efficiency.

During the 0- to 2-year period, stakeholders will build upon existing programs that are already in place. They will review previous studies and accepted best practices to determine which additional conservation activities are most likely to be embraced by their customers (and thus result in the most efficient use of local supplies). Conservation activities may include increased metering, increasing tiered rate structure, community education, or others. The City of Altus is also investigating potential grants to start replacing meters in its distribution system with smart meters that can provide more direct feedback to users and aid in conservation efforts.

This includes assessing the costs and potential water savings of Lugert-Altus Irrigation District (LAID) canal lining, validating the potential savings identified in the Oklahoma Comprehensive Water Plan (OCWP) conservation analyses for public water supply and crop irrigation systems in Southwest Oklahoma counties, and developing or updating conservation plans for each public water supply system using Tom Steed Reservoir, AAFB, and irrigation districts. The 0- to 2-Year Action Plan also calls for identifying crop irrigation research needs and applying for a USDA grant to support the research.

Implementation of additional conservation programs stemming from those plans is shown in the 2- to 5-Year Action Plan period. During this time (and continuing through the future), the effectiveness of the conservation programs is evaluated and adjustments are made to continue activities that improve water use efficiency and modify or eliminate programs that do not have a positive impact on water savings. Additionally, large-scale conservation projects, like lining irrigation canals or widespread implementation of efficient landscape or crop irrigation technologies, can be phased to better match available capital funds.

Appendix B provides information on potential conservation savings from two past reports. The *Appraisal Report for Water Supply Augmentation of W.C. Austin Project, Oklahoma* estimated approximately 14,000 acre-feet per year (AFY) of water savings through the replacement and installation of new measurement structures, additional remote monitoring, and new regulating reservoirs within the LAID canals. The *2012 Update to the Oklahoma Comprehensive Water Plan* (2012 OCWP) evaluated how moderate and substantially expanded conservation activities affects water demand projections. Projected water savings for the Southwest Oklahoma counties from 2012 OCWP conservation activities are summarized in Appendix B. The 2012 OCWP estimated approximately 3,000 AFY of water savings in Southwest Oklahoma by implementing a moderate level of additional conservation for public water suppliers and approximately 32,000 AFY of water savings for a moderate level of additional conservation activities for irrigated agriculture.

### 3.2.2 Drought Response Plan

A drought response plan describes activities that are used temporarily during water supply shortages. Unlike conservation measures, drought response measures are not employed under normal supply conditions. An example of a drought response measure is limiting outdoor watering in communities when lake levels reach a pre-determined low level. Users of Tom Steed Reservoir supplies have already shown significant temporary reductions in their use by employing drought management measures during the current extended drought.

The intent of this strategy is to:

- Share best practices in drought management.
- Document drought management "trigger points" and phased drought response actions for major water users throughout Southwest Oklahoma, tailored to local systems and needs.
- Provide additional consistency in how demands are managed during regional droughts, particularly where there are multiple users of a single surface water supply source.

The first activities, shown in the 0- to 2-year period, are to determine what drought response measures are being used within the region currently, then use the best practices to consider implementation of a unified drought response plan. The unified plan would provide specific actions to be taken at specific water supply trigger points and be applicable to all users of a shared water supply. Following implementation of the drought response plan, the effectiveness of the program should be monitored and adjusted as necessary, as shown in the 2 to 5 and greater than 5-year periods.

### 3.2.3 Additional Groundwater Supplies

This strategy reinstates existing unused groundwater wells and adds new groundwater wells to increase local water supply. Having a "balanced portfolio" of surface water and groundwater supplies will help users throughout the region better manage supplies and

increase supply reliability. This includes taking advantage of surface water in wetter years, and reducing surface water use by increasing groundwater use in dry times.

To implement this strategy, the Action Plan calls for investigation of groundwater quantity and quality, assessing the compatibility of blending groundwater and surface water, and identifying the most viable well sites in the 0- to 2-year timeframe. Later activities focus on acquiring permits, funding, and implementing recommendations (new wells, rehabilitating existing wells, treatment, etc.) along with continuing monitoring of groundwater supplies. Key elements of this strategy include:

- Reinstating the City of Altus Round Timber and Holloway wells in north Texas.
- Investigating new well sites and implementing wells in rural water districts and other outlying areas.
- Addition of wells by the Mountain Park Master Conservancy District (MPMCD) to augment Tom Steed Reservoir supplies and increase water delivery capacity to MPMCD customers.

The City of Altus is actively working to bring the Round Timber and Holloway well fields back online, supported in part by an Oklahoma Emergency Drought Relief Commission grant awarded in early 2014. The wellfield ceased operation years ago due to high operating costs and treatment requirements during times of high surface water availability. Bringing the wells back online is intended to extend the yield of Tom Steed Reservoir and improve water quality through blending the groundwater and surface water supplies.

Engineering analyses and permitting work are underway to bring the wellfields back online as soon as practical. This includes rehabilitating existing wells and a pump station, and drilling two new wells. Altus anticipates having about 700,000 gallons per day of Holloway well capacity online by late 2014 and an ultimate delivery capacity of about 2 million gallons per day (mgd). In a second phase of the project, Altus will be developing a new 12-inch diameter pipeline (parallel to the existing 18-inch pipeline) for transmission of the water to Altus, and is evaluating treatment needs and approaches to meet potable water quality standards. Initial phases of the reinstated well water could be online later in 2014. Altus may also consider adding groundwater from the Tillman Terrace aquifer in the future.

Similarly, adding new groundwater supplies throughout the region will be beneficial in mitigating regional drought vulnerabilities. However, the minor aquifers in rural areas of the Southwest region have not been mapped or studied in detail, leaving significant questions about the potential well yields, available supplies in aquifer storage, water quality, and treatment needs associated with their use. Many wells in the region are reported to exhibit high salinity levels and/or elevated concentrations of nitrates, making them unusable for potable supply without advanced treatment or blending. Consequently, upfront studies to better map the availability and quality of minor aquifers and identification of favorable well sites is among the early (0- to 2-year) actions in support of this strategy. Identifying additional local groundwater sources as part of MPMCD customers' supply portfolios will also help alleviate pressure on Tom Steed Reservoir supplies.

The MPMCD has initiated work with the Bureau of Reclamation to investigate the implementation of new groundwater wells in areas downstream (south) of the Mountain Park Dam. MPMCD is evaluating siting options for new wells that would pump groundwater into the existing raw water transmission lines to Altus and/or Snyder. Existing agricultural wells downstream of the dam, drilled to a depth of about 100 feet, exhibit significant well yields and good water quality. As part of its investigations, water quality, well yields, and the chemical compatibility of the new groundwater sources with raw water from Tom Steed Reservoir should be investigated to ensure no precipitative reactions or other incompatibilities will arise when blending these sources in the pipelines. Once implemented, the MPMCD wells will augment the reservoir's deliveries to MPMCD's customers and bolster supplies, particularly during drought.

Stakeholders should coordinate with the OWRB to obtain relevant groundwater data from the OWRB's recently-initiated Groundwater Monitoring and Assessment Program (GMAP) as those data become available. For example, the North Fork of the Red River and the Salt Fork of the Red River alluvial aquifers will both have data collected under GMAP in 2014, with Blaine aquifer data to be collected in 2015.

In related work, stakeholders in the region should evaluate groundwater/surface water flow interactions in the North Fork of the Red River in order to identify potential interferences with uses. Currently, the U.S. Bureau of Reclamation is conducting a study of water supplies in the Upper Red River Basin. Stakeholders should monitor and participate in this study as it may result in recommendations that, if implemented, could increase available local water supplies.

In the 2- to 5-year time frame, this strategy includes confirming permit availability for the targeted groundwater well additions, developing a funding/financing plan for the new infrastructure, monitoring groundwater levels and quality on an ongoing basis, working with OWRB to update the North Fork Red River maximum annual yield study and hydrologic survey, and working with the Bureau of Reclamation to implement recommendations from the Upper Red River Basin study. Beyond 5 years, water providers and users should monitor and consider the need for additional groundwater wells and participate in ongoing groundwater monitoring for water levels and water quality trends.

Two previous studies are summarized in Appendix B. One describes reinstating the City of Altus Round Timber Well Field, which is estimated to have a long-term yield of 1.2 mgd and peak supply of 2.5 mgd. This preliminary study indicated that existing wells and transmission pump station would need to be rehabilitated as well as treatment provided to address nitrates, coliform, and iron. As noted above, additional investigations and engineering work are now underway to finalize plans and implementation schedules. A separate study evaluated aquifer recharge to the Blaine Aquifer. It indicated that an average recharge rate of 70 AFY per well could be achieved, thus increasing groundwater supply availability for users in the region.

### 3.2.4 Southwest Oklahoma Water Supply Action Plan Advisory Committee

This strategy recommends formalizing the membership and roles of an advisory committee to monitor and drive the implementation of the SWAP. Users throughout the region have

already informally organized an ad-hoc committee in recognition of the importance of having an adequate water supply. Through this project, that group has reinforced a regional approach to water supply planning that benefits all users. The SWAP Advisory Committee would formalize the committee and would be responsible for coordinating ongoing updates to the Action Plan while monitoring implementation of the water supply strategies.

The Advisory Committee will develop more specific action items for each strategy, including accountability of specific entities responsible for each strategy with specific schedule milestones to be tracked by the Advisory Committee. The Advisory Committee will also develop a common repository for relevant water supply and water quality data, including the studies compiled during development of this Action Plan. Coordination with the Oklahoma Water Survey will also be an important part of making relevant data accessible to water planners and users.

The Advisory Committee will also be responsible for developing an integrated capital improvements plan (CIP). The purpose of this CIP is to provide stakeholders with a comprehensive planning level cost (not just the cost for individual programs like conservation or interconnection between systems that would be developed as part of the individual evaluations). Since it is unlikely that there is a single water strategy (especially in the near and mid-terms) that can meet the region's water demands, a combination of strategies will be used to meet water needs. The integrated CIP provides a format for packaging supply options and reflecting on combined costs. Initially the CIP projects would be general and have conservative costs, but, as the projects are refined, the CIP would be updated to reflect the selected alternatives and better cost estimates.

The Advisory Committee is not responsible for actual implementation of strategies, as this is the responsibility of the individual stakeholders. However, the Committee serves as an accountability partner so that strategies for managing and developing existing and new supplies are coordinated with one another and progressing toward execution in a timely manner. The Advisory Committee also serves as a forum for discussing adjustments and updates to the SWAP.

## 3.3 Mid-Term Strategies

The SWAP identifies three mid-term strategies:

- Non-potable reuse of treated effluent,
- Rehabilitate Lake Altus (City of Altus Reservoir)
- Divert additional flows to existing storage, and
- Interconnection of distribution systems.

Table 1 provides 0- to 2-Year, 2- to 5-Year, and 5+ Year actions for each of these strategies, as described below.

### 3.3.1 Non-potable Reuse of Treated Effluent

Non-potable reuse provides a way to beneficially use treated wastewater effluent from water reclamation facilities while offsetting the use of potable supplies for applications that

do not require potable-quality water. An example of non-potable reuse is irrigation of a golf course by pumping treated water meeting Oklahoma Department of Environmental Quality (ODEQ) standards from the treatment facility to the golf course.

The first steps in the Action Plan are to inventory available supplies from water reclamation facilities in the region and evaluate compatibility with potential non-potable uses for larger irrigation and industrial water use sites. Facilities with surface water discharges and those with mechanical treatment facilities (e.g., City of Altus, rather than non-discharging systems and lagoons) are more likely to meet ODEQ treatment and water quality requirements. Development of non-potable water reuse plans are included in the first phase of implementation for the City of Altus and the AAFB.

Lessons learned from initial efforts in larger communities can be extended to smaller communities in later periods. Design of the first phase of non-potable reuse for larger stakeholders is shown in the 2- to 5-Year Action Plan, with implementation occurring in the greater than 5-Year Action Plan. There may also be opportunities for intergovernmental cooperation on water reuse, such as the potential to supply reclaimed water from the City of Altus' facility to the AAFB for use in nonpotable irrigation and industrial applications on the base.

The 0- to 2-Year Action Plan also recommends beginning customer and public outreach and education. Open communication and consistently addressing public concerns about reuse are effective at cultivating support and changing preconceived perceptions about reuse. The key is to begin education and outreach soon, so when the water provider is ready to implement a reuse project, the public is not surprised. There is a wealth of public outreach guidance material available from industry organizations such as the WateReuse Association.

### 3.3.2 Rehabilitate City of Altus Reservoir

Maintaining existing water storage and delivery assets is of critical importance for their continued use as part of the region's water infrastructure and reliable water resources portfolio. This action calls for maintaining the City of Altus' existing reservoir. In the initial two-year action period, the costs and benefits of dredging the reservoir to recover storage capacity lost to sedimentation will be investigated. At the same time, an assessment of dam rehabilitation needs and costs will be conducted for this reservoir. Subsequent activities in the 2-to-5 year planning period and the longer-term planning period include detailed planning, design, and implementation of the dredging and dam improvements as appropriate, based on the findings of the initial investigations.

### 3.3.3 Divert Additional Flows to Existing Storage

During times of drought, low lake levels at Lake Altus and Tom Steed Reservoir provide clear visual evidence of supply limitations. However, in times of higher precipitation and runoff, there are significant stream flows in the vicinity of these reservoirs that go uncaptured due to infrastructure limitations. This water supply strategy proposes assessing additional creek diversions to Tom Steed Reservoir as well as other potential diversion opportunities. In the 0- to 2-Year Action Plan, evaluation and costing of potential diversions

are conducted, This will start with an inventory of the evaluations that have already been completed, and prioritizing among the potential diversion opportunities.

One concept that shows significant potential is widening the existing Bretch Diversion Canal that is used to convey flows diverted from Elm Creek to Tom Steed Reservoir. Preliminary assessments by the MPMCD indicate that the diversion structure has excess capacity, such that the constraint on the ability to divert flows is associated with the capacity of the canal. Building on this initial assessment, the 0- to 2-Year Action Plan calls for estimating the cost and additional yield for widening the canal.

In the 2- to 5-Year Action Plan, a funding/financing plan and design and construction for the canal widening should be completed. If technically and economically feasible, this strategy can provide additional water supply to the region within 5 years. The 2- to 5-Year Action Plan also calls for assessing diversion of additional creek flows into Tom Steed, including a creek east of the reservoir that could potentially have flow diverted by gravity into the reservoir. If feasible, new diversions into Tom Steed Reservoir would likely be implemented in the greater than 5-year timeframe.

### 3.3.4 Interconnection of Distribution Systems

This water supply strategy builds upon existing interconnections between public water supply systems and adds additional interconnections. Interconnections can be operated on an ongoing basis or on an emergency-only basis, and can be used to share untreated water supplies or potable-quality water between neighboring systems. The 2012 update of the Oklahoma Comprehensive Water Plan included an inventory of existing public water supply system interconnections in Southwest Oklahoma in the Southwest Watershed Planning Region Report.

The purpose of the interconnections is to provide diversity in supply sources and strengthen reliability. For example, during a drought when surface water supplies are low, it is helpful to have groundwater as an alternate supply. Alternatively, when an individual supply source (e.g., a groundwater pump) is temporarily out of service, access to alternate supplies helps reduce impacts to the system's customers. In addition, the AAFB has expressed interest in increasing its water supply redundancy, which could be achieved in whole or in part by increasing regional supply interconnections.

Increasing the connectivity between public water supply systems increases access to a diversity of supply sources for all connected systems. In the 0- to 2-Year Action Plan, compiling and reviewing transmission and distribution system maps is proposed to confirm existing system interconnections and their use, and to determine where new interconnections make sense in terms of supply redundancy and capital costs. In the 2- to 5-Year Action plan, interagency agreements can be made along with design and construction of the priority connections. Other potential connections, such as connecting Cache to Lawton's supply for use in times when Tom Steed Reservoir is low but Lawton's lakes are less impacted (such as in 2014) could be explored during this timeframe. If the connections are phased, the second phase could be completed in the greater than 5-year timeframe.

## 3.4 Long-Term Strategies

The SWAP identifies three long-term strategies:

- New or expanded reservoir development,
- Potable reuse of treated effluent, and
- New transbasin sources.

Table 1 provides 0- to 2-Year, 2- to 5-Year, and 5+ Year actions for each of these strategies, as described below.

### 3.4.1 New or Expanded Reservoir Development

This supply strategy evaluates increasing water supply using a new reservoir or modifications to existing reservoirs to expand capacity. These options require significant study, regulatory permitting, and funding/financing strategies, and tend to have longer design and construction periods. In the 0- to 2-year period, the focus is on critically evaluating previously-studied projects in terms of firm yield and cost so that one or more sites can be selected for further refinement (and possible initiation of permitting) in the 2- to 5-year period. Included in this evaluation will be raising existing dams at Lake Altus and/or Tom Steed Reservoir, new major reservoir sites, and investigation of potential new or expanded Natural Resources Conservation Service (NRCS) dams.

The 2012 OCWP compiled a list of reservoir sites across the state. Fifteen reservoir sites are located within the region and key attributes are summarized in Appendix B. These sites have varying levels of known information, meaning that some sites have been studied more, like Cookietown Reservoir, while others have virtually no information available, like Coopertown. Other examples of new reservoirs that have been previously studied in the region include a new reservoir upstream of Lake Altus (Trico Reservoir) and a new reservoir downstream of Lake Altus to supplement irrigation water supplies (Cable Mountain Reservoir). All reservoirs require additional technical evaluation and funding/financing analyses before design and permitting can begin. All reservoir analyses should be coordinated with the Bureau of Reclamation's ongoing Basin Study in the area, which is considering multiple long-range supply options.

Implementation is shown in the greater than 5-ear Action Plan, as it is anticipated that 20 years or more may be needed to develop a new reservoir from beginning of studies through construction of dam and infrastructure.

### 3.4.2 Potable Reuse of Treated Effluent

This supply strategy proposes the use of highly-treated effluent (or reclaimed water) from water reclamation facilities for drinking water supply purposes. Potable reuse offers an opportunity to make full or nearly-full use of the reclaimed water resource year-round, as opposed to non-potable reuse which often has significant seasonality to its demand due to nonpotable irrigation applications.

Direct potable reuse (DPR) is distinguished from indirect potable reuse (IPR) in that there is no environmental buffer between water reclamation plants and potable treatment plants with DPR. Although numerous IPR projects have been implemented across the southwest part of the U.S. in the past decade, DPR has quickly become the focus of much of the water community's research efforts. Drought conditions and severe supply limitations in some parts of the country – such as the unprecedented supply shortages in California and parts of Oklahoma and Texas – have quickly escalated the role of potable reuse, to the point where some communities are bypassing IPR in favor of DPR. Communities like Big Spring, Texas, Cloudcroft, New Mexico, and Wichita Falls, Texas have all begun implementation or operation of DPR systems in light of significant limitations in local availability of alternate water supplies.

In Southwest Oklahoma, potable reuse could be accomplished through indirect methods (like augmentation of Tom Steed Reservoir or Lake Altus with reclaimed water) or direct methods (water reclamation plant followed by blending of reclaimed and traditional source waters feeding an advanced water treatment before distribution to customers). Recharging groundwater with reclaimed water before using it for potable supply is another IPR strategy that could be considered.

ODEQ is currently developing rules for indirect potable reuse via surface water augmentation. In the 0- to 2-Year Action Plan, the SWAP proposes public outreach (could be done in conjunction with outreach for non-potable reuse), monitoring ODEQ regulatory development, and coordinating an assessment of treated effluent availability based on non-potable reuse plans. When ODEQ issues IPR regulations, potential potable reuse projects can be developed as part of an overall long-term water supply plan and, if appropriate, implemented during later planning periods.

### 3.4.3 New Transbasin Sources

Over the years, several major transbasin water supply projects have been considered at a conceptual planning level of detail. One example is a major transmission pipeline from southeastern Oklahoma to western parts of the state (including Southwest Oklahoma), first analyzed generally in the 1980 Oklahoma Comprehensive Water Plan. Costs for that conceptual transmission system were updated in the 2012 update of the Oklahoma Comprehensive Water Plan. While technically possible, significant challenges to implementing such a project remain in institutional considerations and in the costs of implementing such a major infrastructure project. Other trans-basin opportunities may also be possible, but will have similar types of challenges due to the distance from Southwest Oklahoma to other reliable sources of supply.

Before new basin transfers are considered, it is incumbent upon all water users to evaluate all options within their areas and be the most efficient water users that they can be. From a cursory, conceptual cost review of transporting water from major trans-basin water projects, it appears that these types of projects are not feasible in the foreseeable future, considering the local options. The cost of constructing a large pipeline, power costs of pumping water, operation and maintenance, environmental studies and reviews, and potential mitigation of environmental impacts, coupled with the fact that the federal government is no longer subsidizing the cost of major construction projects, makes these major trans-basin water

projects difficult to implement. Nevertheless, ongoing activities should continue to evaluate and develop more cost-effective projects that can bring a reliable supply to Southwest Oklahoma.

The 0- to 2-Year Action Plan calls for monitoring and evaluating ongoing regional and state processes as they continue to investigate the feasibility of such projects. It also calls for comparing costs, benefits, and implementation challenges to alternate projects with supply sources located in or closer to Southwest Oklahoma. These efforts should continue to be monitored through active participation by Southwest Oklahoma representatives, and if appropriate, detailed studies may be initiated in the 2- to 5-year or greater than 5-year timeframes.

## 3.5 Next Steps

From a review of the population projections published in the OCWP, it appears that the strategies discussed in this report, if implemented expeditiously, will have the impact of providing a reliable water supply to all water needs with the exception of irrigated agriculture for the foreseeable future. This includes meeting the future needs of the MPWCD, AAFB, and rural water suppliers. Irrigated agriculture will, however, benefit from the continued implementation of efficient water use technologies and practices, and from the implementation of additional water supplies and conservation practices in the public water supply sector, which will in turn reduce pressure on existing supplies for all users.

Even within the 0- to 2-year period, there are numerous actions in the SWAP that can and should be taken to increase supply reliability. A logical first step is to form the SWAP Advisory Committee. This Advisory Committee can help determine which of the SWAP activities to pursue first – that is, which of the SWAP strategies offer the most benefits to the region or are most likely to be accepted by stakeholders. Some activities, like monitoring ODEQ regulatory development on potable water reuse, are an on-going activity without a specific start and end date. Some activities, like conservation and drought response plans, make sense to pursue as a region so that there is consistency between suppliers. Others, like reinstating the Round Timber wells, should be pursued by individual stakeholders (with reporting on progress, lessons learned, etc. benefiting all). As projects are developed, the Advisory Committee can and should update the SWAP to reflect the latest information and refine next steps.

# APPENDIX A – SUMMARY OF COUNTY LEVEL DEMAND PROJECTIONS

**APPENDIX A**

SUMMARY OF COUNTY LEVEL DEMAND PROJECTIONS (ALL VALUES IN ACRE-FEET PER YEAR) FROM OKLAHOMA COMPREHENSIVE WATER PLAN 2012 UPDATE

| JACKSON COUNTY | 2010 | 2020 | 2030 | 2040 | 2050 | 2060 |
|---|---|---|---|---|---|---|
| Public Water Supply | 4,619 | 4,899 | 5,129 | 5,314 | 5,467 | 5,590 |
| Self-Supplied Residential | 112 | 119 | 124 | 129 | 133 | 135 |
| Crop Irrigation | 101,716 | 103,765 | 105,813 | 107,862 | 109,434 | 111,960 |
| Livestock | 592 | 646 | 701 | 755 | 809 | 864 |
| Oil and Gas | 29 | 60 | 100 | 151 | 211 | 280 |
| Thermoelectric Power | 0 | 0 | 0 | 0 | 0 | 0 |
| Self-Supplied Industrial | 601 | 586 | 614 | 636 | 654 | 669 |
| **Total Demand** | **107,669** | **110,075** | **112,482** | **114,846** | **116,708** | **119,498** |

| TILLMAN COUNTY | 2010 | 2020 | 2030 | 2040 | 2050 | 2060 |
|---|---|---|---|---|---|---|
| Public Water Supply | 1,345 | 1,388 | 1,418 | 1,447 | 1,477 | 1,521 |
| Self-Supplied Residential | 80 | 81 | 83 | 85 | 87 | 89 |
| Crop Irrigation | 18,163 | 18,412 | 18,661 | 18,910 | 19,101 | 19,408 |
| Livestock | 889 | 895 | 900 | 905 | 911 | 916 |
| Oil and Gas | 41 | 75 | 121 | 177 | 243 | 319 |
| Thermoelectric Power | 0 | 0 | 0 | 0 | 0 | 0 |
| Self-Supplied Industrial | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total Demand** | **20,518** | **20,852** | **21,183** | **21,524** | **21,818** | **22,254** |

| HARMON COUNTY | 2010 | 2020 | 2030 | 2040 | 2050 | 2060 |
|---|---|---|---|---|---|---|
| Public Water Supply | 789 | 797 | 821 | 845 | 870 | 894 |
| Self-Supplied Residential | 0 | 0 | 0 | 0 | 0 | 0 |
| Crop Irrigation | 26,455 | 27,191 | 27,927 | 28,664 | 29,229 | 30,137 |
| Livestock | 565 | 577 | 589 | 602 | 614 | 626 |
| Oil and Gas | 3 | 4 | 5 | 6 | 8 | 9 |
| Thermoelectric Power | 0 | 0 | 0 | 0 | 0 | 0 |
| Self-Supplied Industrial | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total Demand** | **27,812** | **28,569** | **29,343** | **30,117** | **30,720** | **31,665** |

| GREER COUNTY | 2010 | 2020 | 2030 | 2040 | 2050 | 2060 |
|---|---|---|---|---|---|---|
| Public Water Supply | 1,037 | 1,049 | 1,049 | 1,067 | 1,085 | 1,103 |
| Self-Supplied Residential | 0 | 0 | 0 | 0 | 0 | 0 |
| Crop Irrigation | 6,064 | 8,255 | 10,445 | 12,636 | 14,317 | 17,016 |
| Livestock | 442 | 442 | 443 | 443 | 444 | 444 |
| Oil and Gas | 6 | 8 | 10 | 13 | 16 | 19 |
| Thermoelectric Power | 0 | 0 | 0 | 0 | 0 | 0 |
| Self-Supplied Industrial | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total Demand** | **7,548** | **9,754** | **11,947** | **14,159** | **15,861** | **18,582** |

# APPENDIX B – SUMMARY OF PREVIOUS REPORTS