McLennan County Water Marketing Strategy

Groundwater Replenishment Credits and Groundwater Augmentation Rate

Prepared in cooperation
with the

McLennan County Water Resources Group

Applicant: **McLennan County**
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Application to
US Bureau of Reclamation
WaterSMART: Water Marketing Strategy Grant for Fiscal Year 2019
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1. TECHNICAL PROPOSAL AND EVALUATION CRITERIA

Executive Summary

Date: July 31, 2019

Applicant Name: McLennan County, Texas

Groundwater in McLennan County continues to decline causing serious concerns for the communities that currently rely on it. The Bureau of Reclamation supported and approved the *McLennan County Drought Contingency and Water Supply Resiliency Plan* (McLennan 2017). This study determined that continued heavy pumping of groundwater will result in major depletion of the Trinity Aquifer, the main groundwater supply for McLennan County. The conjunctive use section of the study demonstrated, using Groundwater Availability Modeling (GAM), that implementing in the short-term a conjunctive-use system to replace a significant portion of the groundwater being pumped by the five heaviest groundwater users with surface water would result in preserving groundwater availability throughout the county for the long-term future. The future drawdown of the Trinity Aquifer can be improved (reduced) by 48% based on the GAM. This reduction is the **Groundwater Replenish Goal (GRG)**; the goal set for implementing the water marketing strategy. While the McLennan 2017 report set the GRG, the McLennan County water marketing project will produce the strategy or blueprint for implementing the conjunctive-use system to achieve the goal. New markets for groundwater replenishment must be identified, evaluated, and acceptable methods for the long-term water sales established.

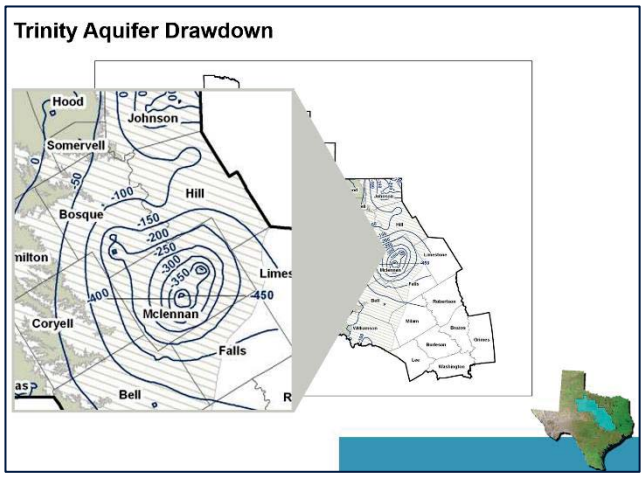
The McLennan water marketing project will adhere to a collaborative approach with Workshops and public meetings and will use the stakeholders' group established for the McLennan 2017. The water marketing project will include tasks to confirm the groundwater availability forecast model and the GRG; however, the main will focus will be on establishing a new water market to achieve the GRG. The surface water (e.g., City of Waco treated water and other potential surface water supplies), reuse supplies (e.g., Flat Creek Reuse Project) and other potential sources such as the Brazos River alluvium used for replacement of or reduced demand for heavily pumped groundwater constitutes a new water market in McLennan County, the **Primary Groundwater Replenishment Market (PGRM)**. This new market can be identified geographically as the five cities currently using the greatest quantities of groundwater in the county. The PGRM cities are identified on the Project Location map below. Economic, legal, and stakeholder outreach tasks will be foundational to establishing the market viability. The market strategy will identify how credits or related tools can incentivize heavy groundwater users to replace up to 50% pumping, the reduction needed to meet the GRG. Subject to refinement with the PESTLE analysis, there are two primary marketing components that will be examined:

1) **Groundwater Replenishment Credits** or similar tool that will incentive the use of surface water by users in the PGRM area; and,
2) **Groundwater Augmentation Rate** or similar tool that will be a county-wide rate applied to the use of groundwater.

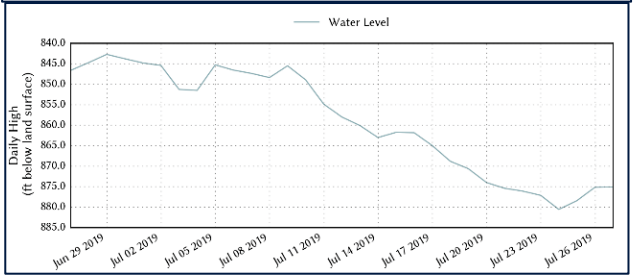
To ensure that the McLennan County water strategy recognizes all major influencing factors, a **PESTLE** analysis will be employed. The PESTLE approach is described in more detail in the Project Component section below.

Background

General Description. McLennan County, located in central Texas, has diversity of water interests and stakeholders, including urban cities, rural communities, public parks and recreational areas, and extensive agricultural areas. It is home to Baylor University, the City of Waco, Lake Waco and the 'Silos.' A diversity of water resources is available: surface water, groundwater, reuse, and water stored in the Brazos River alluvium. However, the reliability of these diverse supplies depends in large measure on sound management. The Trinity Aquifer, which supplies urban, rural and agricultural areas throughout McLennan County continues to rapidly. The smaller, more rural groundwater-based water systems continue to be concerned about reliability of future water supply (see Waco Tribune 2010). The current rapid declines in groundwater availability can be reversed through conjunctive, collaborative use of surface (McLennan 2017). Based the 2017 application of the GAM, it estimated that with implementation of the conjunctive use system groundwater availability increased by as much as 48% through avoidance of 50% the current groundwater pumping by the PGRM users.



Well Serving City of Hewitt _ TWDB Water Data (2019)



Water Demands. Water demand in McLennan County, Texas is projected to grow by approximately 58% over the period 2010 to 2050; water demand growth is coming from a variety of water uses including municipal, manufacturing, electric generation and municipal demands. The public water systems, municipal users, located in McLennan County are numerous as shown in the map insert below; all McLennan County systems, groundwater- and surface water-based were identified and evaluated in detail in McLennan 2017 report and its appendix (**see Appendix**).

Future McLennan County Water Demand

- Projected Water Demand is anticipated to increase by over 58% from 2010 through 2060
  - Average annual increase of just under 1%
- Largest Increases are anticipated in Electric Generation, Municipal Use, and Manufacturing

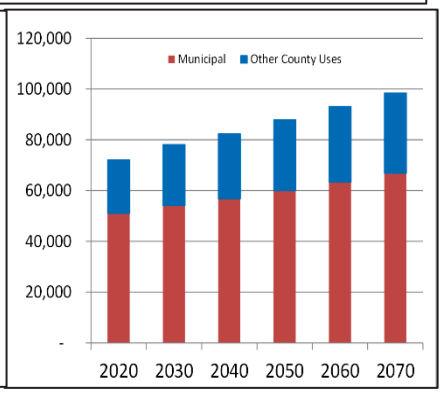
	Total Increase (Ac/Ft)	% of Total
Steam – Electric	15,334	47.15%
Municipal	14,758	45.37%
Manufacturing	2,496	7.67%
Livestock	0	0.00%
Irrigation	(13)	(0.04%)
Mining	(50)	(0.15%)
Total Increase	32,525	

Source: 2012 Texas State Water Plan

Existing water supplies, which include surface and groundwater sources, as well as the development of a significant reuse market supplies, must be conjunctively used to extend the life of current supplies and ensure future availability of groundwater throughout the county. The proposed water marketing strategy is needed to set the stage for the implementation of the conjunctive use plan that was completed in 2017.

McLennan County Water Demands (acre-feet per year), Brazos G

	2040	2070
Waco	35,005	40,887
Hewitt	3,329	4,305
Robinson	3,229	4,418
Bellmead	1,296	1,457
Woodway	3,905	4,594
Lacy-Lakeview	859	1,025
McGregor	820	899
Western Hills	238	274
North Bosque	870	1,233
West	500	538
Other WUGs	3,411	3,958
County-Other	3,306	3,233
Total	**56,768**	**66,821**



Major groundwater pumping is isolated to several urban communities in relatively small geographic areas located near the City of Waco. These areas are shown in ***Figure 1*** (see Project Location below) and are collectively referred to as the **Primary Groundwater Replenish Market (PGRM)** throughout the proposal. If groundwater pumping continues at the current rates in the PGRM, pressures in the Trinity Aquifer that serves McLennan County, will decrease significantly (Brazos G Regional Plan 2016, McLennan 2017, and TWDB Water Data 2019). The 2017 GAM model runs show that by the year 2050 the aquifer pressures will decrease by 543 feet (see ***Table 1***). To maintain the availability of groundwater in all areas of the county several groundwater reduction scenarios were evaluated using a McLennan County-specific GAM. The replacement of a 50% of

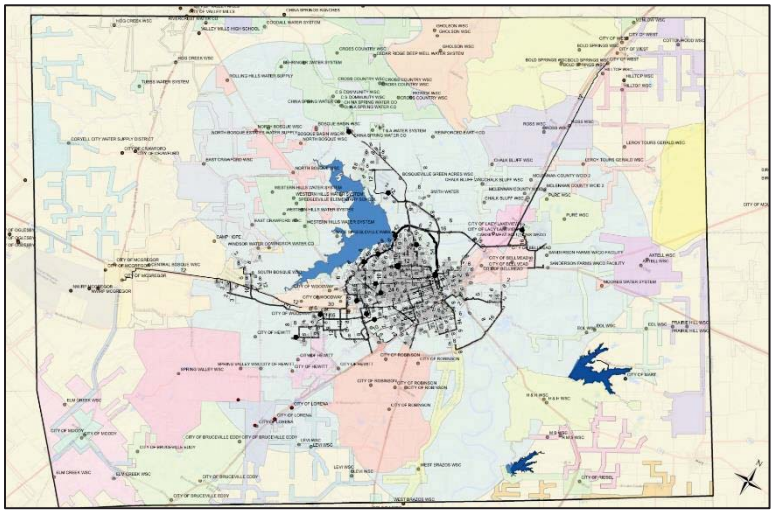


Table 1 - GAM Runs (McLennan 2017) with & without GW replenishment

Run	Description	GW Pumped by User (cf/day)								Total GW Used (cf/day)	Total Drawdown	Drawdown Reduced %
		Hewitt	Woodway	Robinson	Lorena	Bellmead	Sanderson	Waco	Other			
10	Base, no change	372,056	269,969	226,879	8,649	194,909	179,464	4,633	645,357	**1,901,915**	543	N/A
10.1	Reduce all by 30%	260,439	188,978	158,815	6,054	136,436	125,625	3,243	451,750	**1,331,340**	320	48
10.2	Reduce 4 South users by 50%	186,028	134,984	113,439	4,324	194,909	179,464	4,633	645,357	**1,463,139**	353	43
10.3	Reduce Top 10 by 30%	260,439	188,978	158,815	6,054	136,436	125,625	3,243	645,357	**1,524,947**	393	37
10.4	Reduce 4 South users + Bellmead by 50%	186,028	134,984	113,439	4,324	97,454	179,464	4,633	645,357	**1,365,684**	320	48
10.5	Reduce Top 10 by 25%	279,042	202,477	170,159	6,487	146,182	134,598	3,475	645,357	**1,587,775**	414	33
10.6	Reduce Top 10 by 50%	186,028	134,984	113,439	4,324	97,454	89,732	2,317	645,357	**1,273,636**	285	54
10.7	Reduce Top 10 by 75%	93,014	67,492	56,720	2,162	48,727	44,866	1,158	645,357	**959,496**	158	75

groundwater pumping by PGRM cities resulted in a 48% increase in future availability of groundwater. Based on the economics (estimated cost of conveyance for Waco treated water supplies plus Waco water cost), surface replacement for the PGRM was more cost effective than reducing all major groundwater users by 30%. Approximately 18,000 gallons of surface water replacement are needed per foot of Trinity Aquifer pressure saved (McLennan 2017).

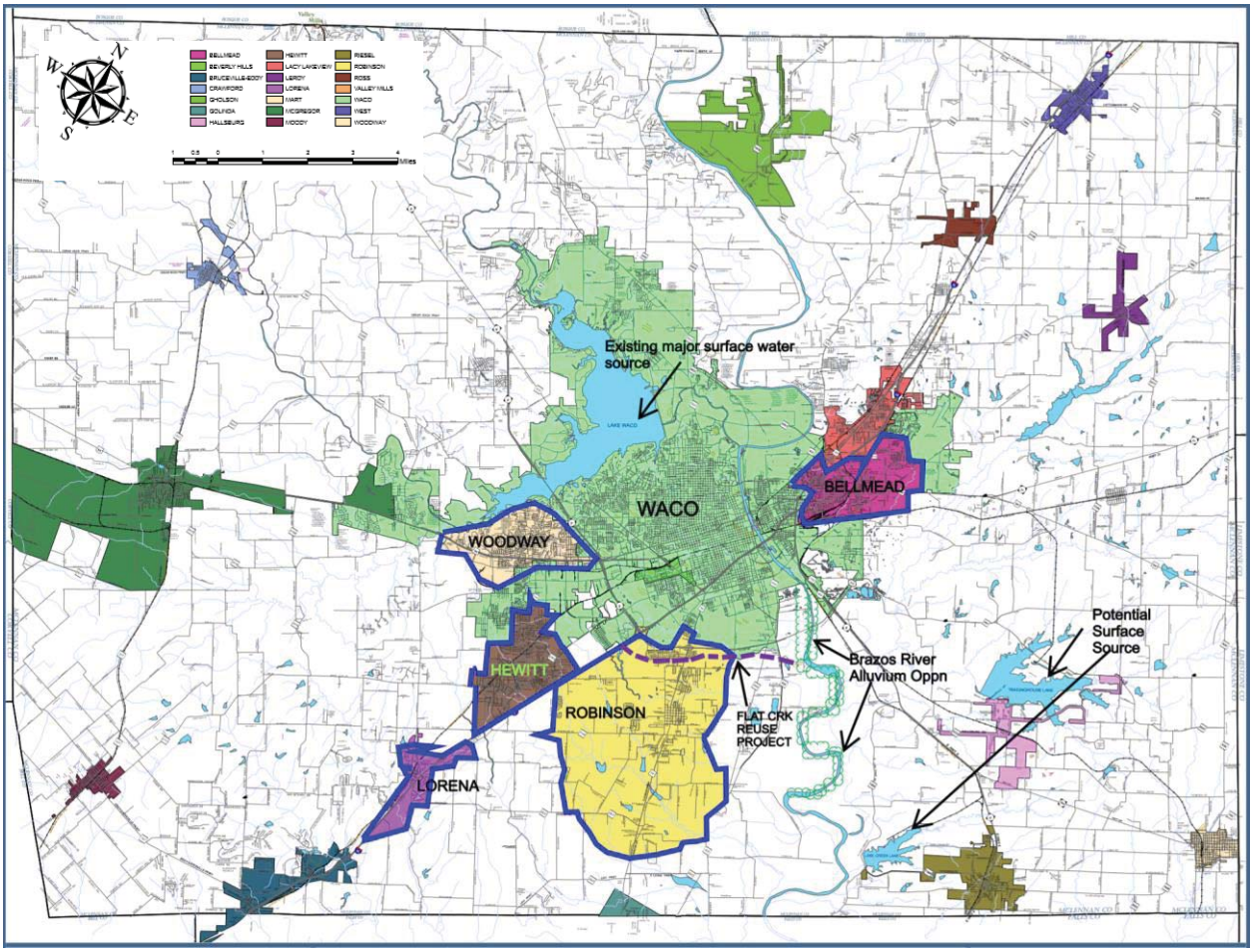
The surface water or non-impacting supplies (e.g., Brazos River alluvium or other supplies that will not impact future pressures in the outlying areas of the Trinity Aquifer in the county) required for this conjunctive use scenario constitutes a new water supply market in McLennan County. Those who utilize groundwater must be economically incentivized to convert to new surface water or non-impacting sources. The productive use of reclaimed or recycled water must also be encouraged via this new market to further sustain both the reliability of both ground and surface water supplies. To effectively implement this situation, a careful study must be made to determine potential transactions, determining the legal parameters of water sales under a conjunctive use scenario, exploring water rights for some potential new surface water supplies and finding the appropriate approaches to establishing prices within the market, recognizing both the tangible and intangible benefits of extending the life of available supplies.

Collaborative Input & Established Partnership. In recent years, McLennan County has led a voluntary alliance of the various water managers in considering how the county's water resources managed to ensure future water supply. The **McLennan County Water Resources Group** (McLennan WRGroup) was established in 2014 and functions to both disseminate water resources information as well as receive input on all water resources matters pertinent to McLennan County. A copy of the McLennan WRGroup *Purpose Statement* is provided in the Appendix. The McLennan WRGroup was the "Task Force" for the 2015 WaterSMART grant project. The McLennan WRGroup agreed with the findings that showed groundwater and surface water could be used conjunctively to preserve up to 20,000 acre-feet per year of groundwater for the future. As a result, and as evidenced by the support letters included in this submittal, the group supports and recognizes the need for the proposed water marketing strategy. Importantly, members of the Group will contribute to the collaborative effort in building of a McLennan County strategy through discussions at McLennan WRGroup meetings, participation in various Workshops, and provide opportunity for public (water user) input and responses.

Project Location

The project area is shown in ***Figure 1*** below. This exhibit shows the boundaries of McLennan County, which correspond to the project boundaries, the major cities and the several urban areas comprised the PGWR Market. Other pertinent features shown included the potential Brazos River alluvium supplies, the additional surface water supplies that have not yet been developed for municipal use, and one of the prominent reuse projects, the Flat Creek Reuse Project. The Bureau of Reclamation approved a Title XVI Feasibility Study for the Flat Creek project in 2008. This is not only another connection to the Bureau of Reclamation in McLennan County but also a project that could provide offsets for the PGRM users to claim Groundwater Replenishment credits.

Figure 1. Project Location & Pertinent Features



Project Description & Milestones

Overview of Project Tasks and Supporting Workshops & Outreach

The McLennan County project will undertake the various tasks needed to achieve the GRG. The product will be a collaboratively driven, primarily through the McLennan WRGroup but with outreach through Workshops and public meetings, water marketing strategy built on a foundation of sound economic analysis of the costs of replenishment versus the future benefit to water users, particularly groundwater users, throughout McLennan County. The major tasks that will bring McLennan County closer to implementation of its conjunctive use plan and achieving its GRG include:

- Estimates of the benefits of preserving/conserving groundwater for future use;
- Methods to develop Groundwater Replenishment credits that will trigger the sale of surface water or other non-impacting supplies to the PGRM users;
- Method to balance the replenishment credits cost with a groundwater augmentation rate or other method applied to the use of groundwater after the conjunctive use system is implemented;

- Review and any necessary updates to the input data/information from the McLennan 2017 report, including GAM updates or engineering cost estimates;
- Cost estimates for future conveyance of surface water to rural groundwater system that would be vulnerable to loss of groundwater availability (to measure cost avoidance);
- Conducting a PESTLE evaluation as a guide for input and structuring a strategy;
- Exploring through Workshops the legal issues associated with groundwater replenishment sales, including recognizing and adhering to water rights; and,
- Meeting the challenge of public outreach (to the typical McLennan County groundwater user) to recognize the cost disparity between existing groundwater use and purchase and use of surface water.

Anticipated Workshops

- Legal Workshops: with Waco City Legal regarding sales contracts/Waco water rights, PGRM cities legal staff; BRA legal on additional surface water /water rights
- Marketing Workshops: with PGRM city managers/utility staff; STGCD management; County Judge and staff to present & receive input on water sales approach; discussion of cost avoidance, groundwater replenishment credits and groundwater augmentation rates
- Technical Review Workshop: with engineering consultants representing groundwater systems; STGCD technical staff and consultants; McLennan County technical staff and consultants to review the 2017 report and identify needed updates, costing and engineering review.
- Public/Stakeholder Mtg or Workshops: with McLennan County project manager, STGCD manager, economic consultants and others to present & receive input on each stage or milestone of the water marketing strategy development

Project Components

The following is a break-out of the anticipated tasks and subtasks to prepare a comprehensive McLennan County Water Marketing Strategy that meets the goals and objectives of the FOA. This proposal is for consideration in **Funding Group I.**

Component 1. Outreach & Partnership Building

Proposed Tasks	Task Description and Subtasks
Informing and obtaining input	*Reliance on and direction from on the established and well-functioning McLennan WRGroup as stipulated in the following tasks:*
Task 1.1. Outreach Conducting outreach to potential partners, participants, and interested or affected stakeholders	*Recognizing that some McLennan WRGroup members are Primary Groundwater Replenishment Marker (PGRM) users and all are McLennan County stakeholders, this group will both oversee and be an integral part of the outreach effort.* *Subtasks:* *a) An Outreach Blueprint will be developed and approved by the McLennan WRGroup* *b) Outreach will be conducted via public meetings and Workshops to the public, particularly rural areas dependent on groundwater, with the assistance of Farm Bureau;* *c) Each McLennan WRGroup member will reach out to its respective Board or Council members*

Task 1.2. Workshops Hosting workshops to gather input and feedback	*Workshops are more focused, discussion/input oriented than public meetings.* *Subtasks:* *The anticipated Workshops, including the general purpose of each Workshop, are shown in the project Overview section above.* *a) Workshops will be identified and included in the Outreach Blueprint.*
Task 1.3. Public Review Make available draft strategy document for public review and comment	*The draft strategy will be developed in steps or phases, each will be presented to the McLennan WRGroup for review and comment. After the draft strategy document is considered by the McLennan County WRGroup, it will be presented for public/stakeholders for comment.* *Subtasks:* *a) Public meeting(s) for review and comment on the strategy will be scheduled* *b) The Outreach Blueprint will include and schedule this public meeting(s)*
Task 1.5. PGRM Collaboration	*The PGRM collaboration is critical to establishing this new market in McLennan County.* *Subtasks:* *a) Workshops and meetings will be scheduled with the PGRM users* *b) A PGRM Subcommittee of the McLennan WRGroup will be recommended*

Component 2. Scoping & Planning Activities

Proposed Tasks	Task Description and Subtasks
Exploring the development of a new water market (PGRM) & related activities	*The following will be conducted to provide the basis for developing a McLennan County water marketing strategy:* *1. Workshops and public outreach input;* *2. Policy conclusions/impacts considered and defined;* *3. Assumptions for transition market (groundwater replacement) strategies;* *4. Defining "Influencing Factors" (use of the PESTLE evaluation);* *5. McLennan WRGroup to provide review and oversight*
Task 2.1 Influencing Factors Early in the project, an evaluation will be conducted to identify the various factors, opinions, conflicts, etc. that will relate to building the water market strategy.	*A PESTLE analysis will be employed in the development of the McLennan County Water Marketing Strategy, which will identify* ***influencing factors*** *for consideration. The elements of the PESTLE analysis are defined as follows:* *Description and Subtasks Involved:* *P The political environment within which water suppliers exist and operate will be defined. The best communication methods will be incorporated into the Outreach Blueprint (Task 1.1)* *E The influence of the economic impact of water pricing on potential water transactions will be considered early in the project. Setting expectations for pricing and cost is a major influencing factor to follow throughout the project.* *S The social element will consider the influences of market changes such as urbanization, changes in labor markets, tourism, etc.* *T Technology advancements will influence how water markets are implemented. These influences on the McLennan County water market development will be identified and their impacts quantified.* *L Legal impediments and requirements influence the viability and development of water market. Supporting and constraining legal impacts on conjunctive use development will be identified.*

	E Environmental constraints such as water quality, water disinfection process, and federal and state environmental regulations will be identified and included. *At the conclusion of the PESTLE analysis, a report will be developed which sets forth the PESTLE analysis findings, conclusions and recommended. The findings will be presented to and discussed with the McLennan WRGroup.*
Task 2.2 Tools Analysis of decision support tools, including software databases, registries, dashboards or models that would help facilitate water marketing.	*Several tools are available based on State and local planning. This task will be conducted early in the project, to identify what tools are available and prepare those tools for use in subsequent tasks.* *Subtasks:* *a) INPUT TOOLS: Evaluate the currently available tools will include the following:* • *Infrastructure costing tool (based on the TWDB tool used for Texas' regional water planning);* • *Preliminary engineering – sizing of pipes, pumps & other conveyance infrastructure (spreadsheet-based tools used for prior plan)* • *McLennan Co GAM model – to show future condition of aquifer* • *Economic costing tool – capital, O&M, and life-cycle costing)* • *Environmental checklist (to identify both positive, additional flows, etc.)* *b) OUTPUT TOOLS: Evaluate the currently available tools will include the following:* • *Graphics/Tables and other exhibits* • *Database linked to the McLennan County GAM tool to show real-time benefits* *c) INPUT-OUTPUT DECISION TOOL – very conceptual at this point but envisioned as a tool available on-line for PGWR market users and GW beneficiaries:* • *This tool is envisioned as a "Dashboard" to show cost and credits* • *The Dashboard would include links to cost, economic analyses, engineering estimates, water rights, and legal constraints* *The Dashboard could be electronically transmitted to stakeholders and posted on the McLennan County website*
Task 2.3 Marketing Approaches Researching different water marketing approaches	*Marketing approaches pertinent to McLennan County and the groundwater replacement marketing would be developed by economic and water marketing consultants and presented to McLennan WRGroup. The following are potential approaches that would be evaluated because of potential to support a conjunctive use system and to provide water supply for the PGRM users:* *Subtask (evaluations):* *a) Blended Cost* *b) The production cost of groundwater and surface water are blended to achieve a uniform rate throughout the county.* *c) Use of Groundwater for Peaking Requirements* *d) Groundwater supplies would base load off surface water treatment plants and utilize well fields to peak during summer months* *e) SWAPS* *f) Surface water would be provided at the groundwater supplies avoided cost plus the incremental cost of treated surface water* *g) Groundwater Replenishment Credit in Surface Cost* *h) The PGRM groundwater users receive credits for groundwater production costs*

<table>
<tr><td></td><td>
<table>
<tr><th>Groundwater Replenishment Credits</th><th>Groundwater Augmentation Rate</th></tr>
<tr><td>Apply to GWRM users that replace GW use with SW
Based on SW delta and recognizing GW benefits
For use of SW today</td><td>Apply to systems that continue to use (baseload) GW
Applies county-wide
Based on benefits accruing to avoided cost of future required SW conveyance
For avoiding cost of using SW in the future</td></tr>
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The initial proposal is for a two-tier marketing strategy to implement the SW/GW transition:
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<tr><td>Task 2.4 Water Rights/Legal Reviews
Analyzing water rights issues or legal requirements</td><td>
Subtasks:
a) Evaluating Texas water rights constraints
i. Recognizing that all surface water in Texas is subject to Water Rights administered by the Public Utilities Commission, the potential use of any surface water as replacement supply will be evaluated for requirements and constraints (diversion location, type of use, availability, bed & banks constraints, etc.).
ii. Water Rights with respect to Brazos River alluvium supplies will assessed.
b) Legal reviews, approaches for transfers and long-term sales, special terms required
i. Existing surface water (treated) sales contract terms will be reviewed and pertinent provisions identified
ii. Workshops meeting(s) will be held to present approaches evaluated in Task 2.1 and legal constraint input solicited (from water right holders, City of Waco, Brazos River Authority (BRA), the Southern Trinity Groundwater Conservation District [STGCD], and others as identified)
iii. Identify pertinent State and local agencies policies, statutes, ordinances, etc.
iv. Evaluating other legal issues as the PESTLE evaluation identifies as needed
v. Generate water marketing (sales contract) terms as a discussion draft
The Legal Workshop for input on these tasks will include but not be limited to City of Waco, PGRM attorneys, STGCD (on groundwater legal issues), and the BRA.
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<tr><td>Task 2.5 Quantifying Available Supplies
Determine how much water is available for marketing</td><td>
Water consumption (groundwater pumping, water demand, environmental flows impacts) would be available from STGCD pumping & permit records; questionnaires sent to PGRM users and their consultants;
Subtasks:
a) Review and confirm replacement supply amounts needed for the PGRM
b) Identify all possible sources to serve the PGRM, including Lake Waco (confirming costs), reuse and alluvium
c) With input from Task 2.2 (water rights/legal constraints), determine quantities of potential replacement supply sources that are available for the PGRM
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<tr><td>Task 2.6 Socio-economic Impacts
Analyzing economic, social, community, and environmental impacts</td><td>
Economic consultant to develop McLennan County economic and pertinent demographic information to include as baseline information for at the public meeting (Public Meeting #1). This presentation would include discussion of economic impacts, benefits of the transition (to preserve GW pressures), marketing approaches that will be considered
Subtasks:
a) Desktop (level 1) review of environmental (endangered species, wetlands, habitat resources) and cultural resources (historical, economic)
b) Estimate the social and community impacts of groundwater/surface water uses and the impacts that could accrue to transition of groundwater market
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	c) Estimate the economic (Task 2.8 input), social, community and environmental impacts of a future significant loss of groundwater availability
Task 2.7 Hydrogeologic & Engineering Conducting related hydrologic or engineering studies and updates to replacement quantities, interconnections and unit costs	*Recognizing that basic engineering cost estimates are available in the McLennan 2017 Report, including quantities needed for the PGRM users, existing interconnections, and layout for new conveyance infrastructure this task will update and confirm. The 2017 report includes the groundwater availability model results and discussion, which constitute the GRG:* *Subtasks:* *a) Infrastructure requirements – confirm quantities and cost of conveyance will be updated, as needed based on the outcome of PGWR Workshop and McLennan WRGroup input (including updates to existing system interconnections)* *b) Groundwater benefits – quantify economic values* *i. Hydrogeologic model review & updates as needed* *ii. In cooperation with the STGCD, hydrologist will review the Trinity GAM model used in the prior study and update, refine as needed* *iii. Avoided Cost Analyses for future loss of groundwater availability* *iv. Engineering and economic consultants estimate the avoided cost if the groundwater transition markets are implemented* *c) Evaluation of potential (new) surface water supplies - In cooperation with BRA, any new sources of water supply (e.g., upstream Brazos system supplies, development of local surface water supply – Tradinghouse Lake or other, etc.)* *d) Evaluation of potential reuse supplies – In cooperation with the City of Waco and the regional sewerage system, identify and quantify the amount and estimated cost of reuse supplies (e.g., Flat Creek Reuse Project, with a Reclamation approved Title XVI Feasibility Study and high priority for implementation)*
Task 2.8 Economic Analysis Conducting financial or economic analyses to identify potential buyers and sellers	*Economic analyses will focus on the cost and rate impacts of delivering surface water (sources to affect less groundwater pumping) to the PGRM. Note, the PESTLE evaluation could identify other markets or market incentives.* *Subtasks:* *a) Review and update as needed capital and O&M (annual costs) of conveyance (from the McLennan 2017 Report)* *b) Estimate the future cost of delivering alternative supply to peripherally located groundwater systems (avoided cost) in the future* *c) Identify the range of Groundwater Replenishment Credits needed to incentivize the PGRM users (iterative tasks based on Workshop/PGRM discussions)* *Estimate range of Groundwater Augmentation Water Rate to generate enough revenues to reliably provide incentive credits to the PGRM users*

Component 3. Development of a Water Marketing Strategy Document

Proposed Tasks	Task Description and Subtasks
Water marketing document is a written document that describes that describes a	*Based on the PESTLE evaluation, Output Tools, Workshop input and direction of the McLennan WRGroup (input from Task 1.0 and 2.0), the McLennan County Marketing Strategy document will define how Groundwater Credits and the Groundwater Augmentation Rate will be established, linked and monitored. This is the 'roll-up' effort to collect what has been learned and structure a McLennan County Water Marketing Strategy based on it. The outcome will be a written document describing in detail the marketing strategy. The report will consist of the following sections:*

proposed approach to establish the PGRM	*Subtasks:* *a) Implementation Planning Section* *i. Identify the Market suppliers and users by system* • *Those systems that would be eligible for Groundwater Credits;* • *Those systems that would provide surface water replacement supplies (including new sources of supply as identified in tasks above); and,* • *Those systems that will continue to use groundwater supplies* *ii. Define the institutional responsibilities for implementing the conjunctive use system and the PGRM. The anticipated roles of the major stakeholders are provided in the Appendix.* *iii. Define, in clear terms, how the new market (PGRM) will operate and be managed* *iv. Define the administrative structure with the authorities and capabilities to provide long-term management, monitoring and financial backing* *v. Ensure that the legal requirements and constraints identified in 2.3 are recognized and followed* *vi. Establish responsibility for budget control and real-time accounting of payments and credits* *vii. A method to help reduce or resolve conflicts, confusion and concerns will be identified and included in this section of the report* *viii. Incorporate the Output Tool developed in Task 2.1 and disperse electronically; this tool will provide ready access to pertinent data* *b) Legal Framework Section* *i. Identify how the PGRM activity and the conjunctive use system complies with existing Texas water rights and applicable State regulations* *ii. Include 'go-by' legal agreements based on Legal Workshop efforts in Task 2.3 proposed for water sales* *iii. Include provisions for implementing the Water Augmentation Rate* *iv. Identify legal issues that will require resolution or further attention prior to implementation* *c) Monitoring and Matrices Section* *i. The means and requirements for metering the delivery of groundwater replacement supply will be standardized, both the PGRM user and the provider of replacement supply will receive receipts of delivery* *ii. Replacement quantities delivered will be recorded and audited routinely* *iii. Working with STGCD, performance metrics will be defined and a database or other means for monitoring aquifer (groundwater supply) benefits over time will be established* *d) Stakeholder Support and Input* *i. Commitment for the ongoing leadership of the McLennan WRGroup during the implementation* *ii. Input from the McLennan County stakeholders will be identified in the final report, recognizing the stakeholders' comments and how those were resolved* *e) Prepare the draft report for review by the McLennan WRGroup and presentation for input from McLennan County stakeholders per the Outreach Blueprint*

Project Schedule & Milestones

The major project milestones are shown in the graphic below. A more detailed, task-by-task schedule is provided in the Appendix.

Evaluation Criteria

A. Water Marketing Benefits

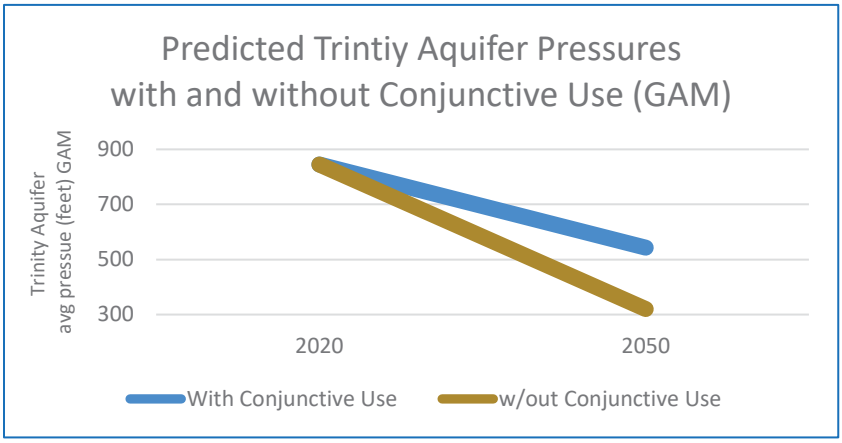
- Explain whether the water market/water marketing strategy project will address a specific water supply shortfall and describe the extent of benefits of different sectors, including agricultural, municipal/industrial, tribal and environmental.
- Will the water marketing strategy project address a specific water supply shortfall?

The Water Marketing Strategy will address the declining Trinity Aquifer supplies in McLennan County. The specific amount of groundwater that is currently vulnerable to permanent shortfall is approximately 18,000 acre-feet/year (see STGCD pumping records and McLennan 2017 Report).

- What is the nature and severity of the shortfall, and which sectors are affected? Please provide support for your response.

Using the Texas Water Development Board authorized GAM showed a future (2050) pressure decline of 543 feet in the Trinity Aquifer (see Table 1 above and McLennan 2017 Report). This shortfall will result have severe impacts on groundwater systems in McLennan County. In 2010 it was estimated that nearly half of McLennan County population, approximately 125,000 people, in those communities heavily dependent on groundwater were vulnerable to loss or reduced water supply (Southern Trinity GCD estimates). The rural communities reliant on groundwater, particularly in the peripheral areas of the county, and agriculture use will be most impacted. Future replacement with surface water or imported groundwater will be cost prohibitive for rural, agriculture-based systems (this estimated cost will be quantified in Task 2.6(b) but considering the conjunctive use cost estimates in McLennan 2017 Report and the conveyance distances involved in reaching peripheral systems, these costs will be substantial and prohibitive for small system users). Urban groundwater uses will likely be impacted by poor water quality as lower levels of the Trinity Aquifer are more vulnerable to high mineral conditions (communication City of Hewitt).

– How and to what extent will the water market/water marketing strategy activities, once implemented, address the shortfall? Please describe the expected benefits (e.g., how water users will benefit) and provide support for your response.



*The primary benefit of the McLennan County Water Marketing Strategy is advancing the **implementation** of the groundwater/surface water conjunctive use plan (McLennan 2017 Report). As documented in the 2017 Report (also to be confirmed in Task 2.6(b), Task 2.5 and others) the replacement of 50% of the heavy groundwater pumping in urban areas (the PGRM discussed above) will result in a 48% improvement in the Trinity Aquifer pressures in 2050 based on GAM modeling. As a result, groundwater availability throughout McLennan County will be more **reliable** and outlying small systems will avoid a future cost of alternative supply sources.*

1) **Will the water market/water marketing strategy activities benefit multiple sectors (e.g., agricultural, municipal, tribal, and environmental) and/or types of water uses? If so, to what extent, and which sectors and water user will benefit? Provide support for your response.**

Benefits to multiple sectors, anticipated include the following:

- ***Municipal – for urban groundwater using areas** (1) additional source of supply; (2) avoids potential for water quality problems from lowering or over-pumping existing wells; (3) avoids cost of new wells; (4) expands existing interconnections with Waco water system; (5) pumping reduction will improve groundwater reliability over long-term; (6) replacement source (Waco water) much closer, some with existing interconnects*
- ***Municipal – rural areas** (1) ability to maintain reliable groundwater supply and continued use of wells; (2) contribute to the incentives for urban groundwater cities (PGRM) to convert portion of use to alternative supply; (3) help maintain rural communities and socio-economic conditions; (4) avoid the future but much higher cost of extending services (from Waco) to peripheral areas of county*
- ***Agriculture** (1) secondary benefit of helping to maintain rural communities that use groundwater; (2) groundwater reliability for irrigation use is maintained; (3) helps avoid lowering wells in the future to meet irrigation demands.*
- ***Environmental** (1) avoids environmental impacts associated with a future need to extend conveyance pipelines to peripheral areas of the County; (2) helps preserve groundwater recharge and tributary base-flow contributions from groundwater*

2) Explain how and to what extent the proposed water market/water marketing strategy activities will improve water supply reliability:

– Reducing the likelihood of conflicts over water.

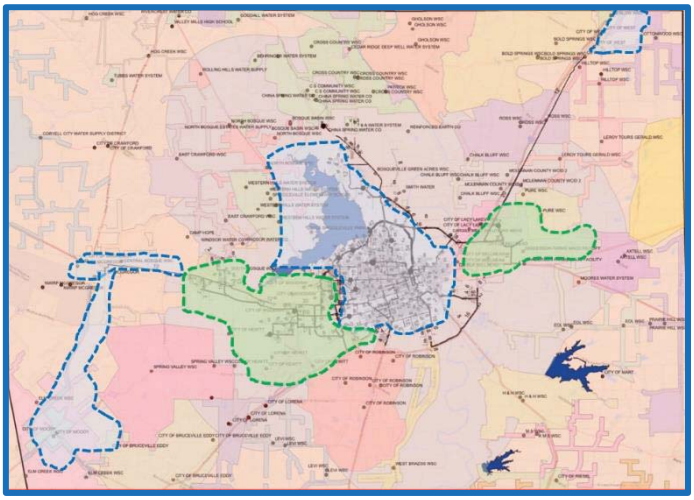
Over time the likelihood of conflicts over water will increase…many or most will focus on water cost and the disparity between the cost of groundwater and the cost of treated surface water. A large part of the surface water expense is the high cost of conveyance, pipes and pumps. Water sales in McLennan County have resolved "water wars" and will provide the means to avoid future conflicts over water. A good example is the Bold Spring Water Supply Corporation, a small, rural public water system in western McLennan County. In 2010, as reported in the Waco Tribune Herald (see Appendix), there were grave concerns for the future of groundwater availability due to declines in the Trinity Aquifer. In 2016, after working with the City of Waco, a water sales contract and a treated surface water connection was secured and the concern, as well as the potential conflict was resolved. The water marketing project will provide more opportunity to resolving water conflicts in McLennan County.

– Increasing resiliency to drought

The water marketing project will support the implementation of the McLennan County conjunctive use plan (McLennan 2017). Conjunctive use will provide substantial redundant supplies to the PGRM users allowing wells that were being drawn down significantly to recover and be more resistant drought. The same resistant can be expected for peripheral, rural groundwater systems where the GAM model shows that with the conjunctive use system meeting groundwater replenishment goal the availability of Trinity Aquifer supplies will increase and thereby provide more resistance to drought.

– Sustaining agricultural communities

Groundwater is the sole water supply source for most of the farming and agricultural communities in rural McLennan County. This map shows the urban areas serviced with surface water in blue shading and the urban areas using groundwater. The public water systems show outside these two areas are the rural, ag-based communities that will benefit from more resilient groundwater supplies. (A larger scale version of this map is in the Appendix).



– Demonstrating a water marketing approach that is innovative and which may be applied by others.

The following are several of the innovation items associated with the McLennan County water marketing strategy:

- *County government as basis for planning and developing water mkt strategy is unique in Texas. The successful collaboration of the McLennan WRGroup since 2014 and the execution of the DCP/conjunctive use project (McLennan 2017) demonstrate that counties can be effective regional water planning units of Texas government.*
- *Many rural areas in Texas are in a similar situation with declining aquifers; the McLennan County marketing approach can be a guide for these areas.*
- *Reuse as an alternative supply source to lower groundwater pumping is also unique and will have application in many other areas in Texas.*

Identifying various types of replacement supplies (e.g., surface water, reuse, Brazos River alluvium) and then developing the water market to use those sources in achieving the groundwater replenishment goal (GRG) is unique to the McLennan County project, but would have applications in other areas in Texas and the western U.S.

– Providing instream flows for species, recreation or water objectives.

Although not a prominent issue or benefit of the McLennan County project, the Brazos River alluvium project will examine the underflow benefits of the alluvium aquifer. Those benefits would be preserved should Brazos River alluvium be identified for use.

3) Explain the extent to which the water market/water marketing strategy activities will be ready to proceed upon completion of the strategy, addressing each of the following:

– Describe your plans and timeline for implementing the strategy upon its completion

Implementation of the strategy will depend on the effectiveness of the outreach effort and the ability to demonstrate the value of preserving the long-term availability of groundwater. Anticipating acceptance of the need and the benefits, the timeline for implementation will be shortened. With acceptance by the PGRM users of incentives to replace groundwater pumping, the major steps and the estimated timeline for implementation would be (recognizing that the efforts can occur concurrently and will be iterative:

1. *Complete water sales contracts with PGRM users: 6-8 months*
2. *Institute the county-wide water augmentation rate: 8-10 months*
3. *Establishing management and record-keeping responsibility: 2-3 months*
4. *Continuing to identify alternative or supplies to gain replenishment: ongoing*

– Are there complex issues, including issues of law or policy, that would need to be resolved before the strategy could be implemented?

The following complex issues are anticipated:

- *Legal issues related to water sales contracts & reuse (complicated but many exist)*
- *Developing incremental charge on use of groundwater (STGCD legal authority)*
- *Policy issues – STGCD authority and adjustments to its Management Plan*

- *Brazos alluvium technical studies underway by Baylor University and Brazos River Authority to estimate reliable and possible use; will need to also address the water rights issues (how much would be Groundwater Under Influence of Surface Water?)*

– Explain whether previous planning, outreach and/or water marketing activities have been completed, including work on any of the three required project components.

McLennan 2017 Report was completed with the support and input of the McLennan WRGroup. This group recommended pursuing implementation of the conjunctive use system. The 2017 project addressed several issues that can and will be part of the Project Components identified in the FOA.

B. Level of Stakeholder Support and Involvement

Identify stakeholders in the planning area who have **committed** to be involved in the planning process

– Describe their commitment, e.g., will they contribute funding or in-kind services or otherwise engage in the planning process?

The commitment of the McLennan County stakeholders serving on the McLennan WRGroup is confirmed by commitments to pay (this was realized on the McLennan 2017 project and anticipated for the water market project), participate in regular meeting, provide in-kind services in legal, engineering and financing areas, and willingness to communicate with respective city councils, boards, and public groups.

– Please explain whether the proposed project is supported by a diverse set of stakeholders. For example, is the project strategy supported by entities representing environmental, agricultural, municipal, tribal or recreation uses?

Every water interest in McLennan County is represented on the McLennan WRGroup. This diverse group includes urban and rural, surface water and groundwater, agricultural and municipal, environmental and economic interests. The general public holds two seats on the Group. The support of the Group is evidenced by the letters of support provided with this application and the fact that the agreed to fund its pro-rata share of the project local cost. A list of the McLennan WRGroup members and their affiliations is provided in the Appendix.

– Describe stakeholders in the planning area who have expressed their support for the planning process, whether they have committed to participate. Support can include letters of support from stakeholders or a description of feedback from interested stakeholders; such letters should identify the stakeholder's specific interest.

Support letters from representative of each type of supporter mentioned above are included in the Appendix. Commitment is strong as evidenced by each Group member's willingness to participate and to pay a pro-rata portion of local project cost.

– Is there is opposition to the proposed strategy? If so, describe the opposition and explain how it will be addressed. Opposition will not necessarily result in fewer points.

No so much opposition as concern with the cost-difference between surface and groundwater use (Note, one objective needs to be reducing the cost of GW replenishment sources—for

example, can reuse supplies be provided at less cost than treated surface water or are Brazos River alluvium supplies available; can other surface water sources (Lake Belton via Bluebonnet WSC or Trandinghouse Lake to be used as possible less cost alternative because of existing conveyance or because source is proximal to gw users, etc.)

- Do any separate planning efforts express support for the recent planning efforts water market/water marketing strategy activities? Or, will the proposed water marketing strategy component complement other ongoing or recent planning efforts within the area? Other relevant planning efforts can include:
  - Water Management Plans, Water Conservation Plans & Drought Contingency Plans
  - State Water Plans, Other planning efforts

The water marketing project will be compliment both regional and local plans. The Brazos G Regional Plan will recognize the McLennan water strategy in its next update after the project is completed; the Brazos River alluvium study will provide pertinent information on a potential Trinity groundwater replacement source; the City of Waco and the PGRM cities water master plans will be used for laying out interconnections and estimating costs. The Texas Water Development Board's (TWDB) update to the Trinity Aquifer GAM will provide critical information on the aquifer and its future condition. The McLennan County Drought Contingency Plan (DCP) and the City of Waco's DCP both involve monitoring the drought condition of Lake Waco for triggering responses; these will be considered in the water marketing strategy.

- Please describe any relevant planning efforts, including who is undertaking these efforts and whether they support or are complemented by the water market/water marketing strategy activities. Explain how the proposed water marketing strategy will avoid duplication or complication of other ongoing planning efforts.

Brazos G Regional Planning is ongoing with major updates every five years. The Brazos River Authority has on-going planning that could identify alternative supply sources, upstream of McLennan County (e.g., gains in Brazos Basin water supply from the System Operations of the Authority's reservoirs, the construction of Allens Creek Reservoir, new reservoir inter-connections like the Lake Belton to Lake Stillhouse Hollow pipeline). The McLennan project will not duplicate any of these ongoing planning efforts.

- Describe what efforts that **you will undertake** to ensure participation by a **diverse** array of stakeholders in developing the water marketing strategy.

The following efforts are anticipated and included in the project tasks cited in the Project Component section:

- *McLennan WRGroup regular updates, meetings, and communication on progress*
- *Workshops (see the above list of anticipated Workshops) and related Tasks in Project Component section above*

C. Ability to Meet Program Requirements

Response on the extent to which McLennan County proposal supports the applicant's ability to proceed with developing the proposed water marketing strategy upon entering into a financial assistance agreement and to complete the proposed strategy within the required time frame.

- Describe how the three required project components (outreach and partnership building, scoping and planning activities, and development of a water marketing strategy) of a water marketing strategy grant will be addressed within the required timeframe.

The project tasks described above were considered and organized to address, with as much detail as possible and as known at this point, the three required project components within the timeframe proposed. The project component section also identifies the critical milestones that will accomplished and the timeframe for each. The tasks in the section are listed sequential, recognizing the needed sequential flow of information and results from one task to the next. As noted, in some cases these tasks are iterative; that is, one task output feeds the next task and that output can require refinement of a preceding task. The detailed task schedule is provided in the Appendix.

- Describe the availability and quality of the existing data and models applicable to the proposed water marketing strategy.

The most critical of these is the McLennan 2017 Report that lays out the infrastructure framework for the conjunctive use system and provides the technical support for quantifying the benefits to groundwater reliability in McLennan County. The McLennan 2017 appendices include available data and information on all public water systems in the county. From this report, the output from the GAM are available. An extensive database of permitted groundwater wells in McLennan County is available from the Southern Trinity GCD. The Texas Water Development Board (TWDB) provides data and information on the Trinity Aquifer, including recent GAM results. Baylor University in cooperation with the Brazos River Authority is currently conducting studies of the Brazos River Alluvium in McLennan County. Infrastructure cost data and indexes are available from the TWDB Brazos G Regional Reports. The City of Waco has a recently completed Water Master Plan with details on the Waco water systems. The Reclamation approved Title XVI Feasibility Study for the Flat Creek Reuse project provides data and information on the primary reuse project to be considered in the marketing strategy.

- Identify staff with appropriate technical expertise and describe their qualifications. Describe any plans to request additional technical assistance from Reclamation, or by contract.

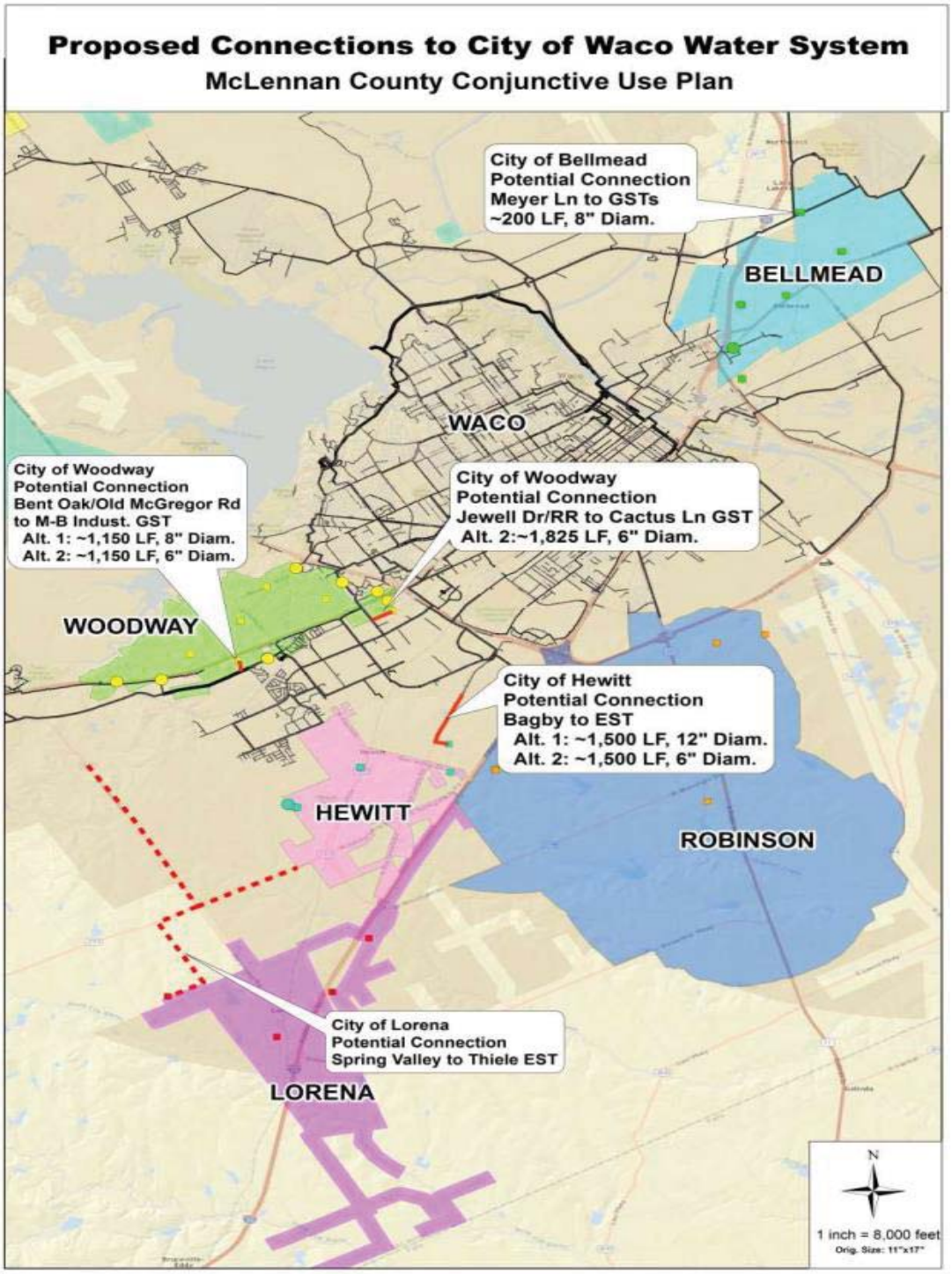
At this point, technical assistance from Reclamation is not envisioned; however, during the project, communications with Austin Area Reclamation staff could identify a need. The key staff directly involved are the following:

***Dustin Chapman**, McLennan County Administrator – Mr. Chapman is a Baylor University Law School graduate and handles the manages affairs in the County Judge's office. His role will be to support the overall management and administration of the grant and interaction with the County Judge's office.*

Three McLennan County Financial Professionals will support the grant and provide input and review:

- ***Frances Bartlett**, County Auditor*
- ***Hailee Gilbreath**, First Assistant County Auditor*
- ***Megan Ramsey**, Assistant County Auditor*

***J. Tom Ray, PE, D-WRE**. Water Resources Manager for Lockwood, Andrews & Newnam, Inc (LAN), located in the LAN Waco office. Mr. Ray has 40 years of water resources, water marketing, groundwater and surface water development experience. Mr. Ray managed the previous McLennan County project that produces the McLennan 2017 Report.*



Preliminary engineering from the McLennan County Conjunctive Use Plan (McLennan 2017)

D. Department of the Interior Priorities

1. Creating a conservation stewardship legacy second only to Teddy Roosevelt

The McLennan Project will promote (and result in) conservation of water resources. It will adopt sound science, engineering, economics and concern for the local environment. No regulation changes are anticipated or use of DOI water resources or lands.

2. Utilizing our natural resources

None of the specific items listed will be applicable to the McLennan County project.

3. Restoring trust with local communities

The proposed project will provide open dialogue between water interests in McLennan County facilitated by the McLennan WRGroup.

4. Striking a regulatory balance

The project will help balance regulatory demands within the county by providing a SW supply to avoid regulatory consequences of over-pumping permitted wells located in areas vulnerable to loss of pressure. The Southern Trinity GCD permits all wells in McLennan County.

5. Modernizing our infrastructure

The proposed project will provide new construction and remove the impediments to this new construction by identifying the value and benefits of groundwater conservation (preserving the Trinity Aquifer) and rate incentives to help reduce the financial burden of implementation.

2. PROJECT BUDGET

Funding Plan and Letters of Commitment

Based on preliminary discussions regarding this grant application, it is anticipated that funding will follow the plan used for the McLennan 2017 project. It was acceptable to the selected public entities providing the local match (all are represented on the McLennan WRGroup) to use the 2014 population as the basis for allocating cost. Smaller municipalities were grouped into a 'county other' category; the allocation for this group was assigned to McLennan County. The anticipated allocation will be pro rata based on the agreed, 2014 population for each public entity. In 2015, the municipal members present agreed to support a funding plan where each city in the county would contribute on a population, pro-rata basis. In-kind contributions will also be included in the funding plan. The in-kind contributions will consist of staff time and resources to support data collection, review and evaluation. If subsequently the McLennan WRGroup decides on a different or modification of the basis of allocation, Reclamation will be notified and provided with the updated allocation and modified Funding Plan. **Table 2** below shows the final allocations amounts used to support the McLennan 2017 study. As of 2018, all allocations had been paid.

The total project cost is summarized in **Table 3** below. It shows the expected funding sources, cash and in-kind amounts, and the percentages of each of the total project funding. If this project application is successful, the funding plan for the non-federal cost-share requirement will discussed at a meeting of the McLennan WRGroup. A schedule to complete the letters of commitment from each entity to provide pro-rata contributions that will total the required $75,000 local match will be presented. The commitments (letters or completed forms) will be submitted within 30 days of award notification. The funds available to support the non-federal match do not require loans or grants from other entities and are available from the cities' budgeted funds. There are no other contingencies associated with this funding commitment.

The non-federal cost will be committed in total as cash funds; however, once the Work Plan is completed, there will likely be non-federal, in-kind contributions that the applicant will identify under specific work tasks.

- Expenses incurred prior to the submittal of this application will not be requested for grant funding.
- Within 30 days of award announcement, the identity and specific amount of funding toward the non-federal cost will be submitted, long with the letters of commitment.
- No other federal partners are involved in the project; no other federal funding is being requested.
- There are no pending funding requests.

The total cash contributions will be at $150,000 and in-kind contributions will be at least at the 2015 amounts, possibly more given the legal requirements for developing a marketing plan. It is expected that the STGCD may had significantly greater in-kind contribution to the project. The funding levels will be updated and provided to Reclamation in the event the proposed project is selected for funding.

Exhibit 1. Anticipated Local Share Allocation *(based on McLennan 2017 project allocations)*

McLennan Co Profile, Texas Association of Counites (US Census based)

Entity	2014 Population	Percent of Total City	Percent of Total County	Local Share Allocation
Bellmead city:	10,184	5.04%	4.21%	$ 3,340.22
Beverly Hills city:	2,041			
Bruceville-Eddy city (pt.):	1,494			
Crawford town:	738			
Gholson city:	1,076			
Golinda city (pt.):	151			
Hallsburg city:	518			
Hewitt city:	14,166	7.01%	5.86%	$ 4,646.26
Lacy-Lakeview city:	6,633	3.28%	2.74%	$ 2,175.54
Leroy city:	341			
Lorena city:	1,733	0.86%	0.72%	$ 568.40
Mart city (pt.):	1,915			
McGregor city (pt.):	5,041	2.50%	2.08%	$ 1,653.38
Moody city:	1,384			
Riesel city:	1,020			
Robinson city:	11,416	5.65%	4.72%	$ 3,744.30
Ross city:	287			
Valley Mills city (pt.):	13			
Waco city:	130,194	64.44%	53.84%	$ 42,701.92
West city:	2,927	1.45%	1.21%	$ 960.02
Woodway city:	8,760	4.34%	3.62%	$ 2,873.16
Total Major Cities	202,032			
McLennan County _ 2014	241,807			
		94.57%		
Cities participating in McL Water Resources Group	191,054			
Cities not participating	10,978			
Total for McL cities	**202,032**	**83.55%**		**$ 62,663.20**
McLennan "County Other (non-city)"	**39,775**	**16.45%**		**$ 12,336.80**

Table 2. Funding Sources

Funding Sources	% of Total Study Cost	Total Cost by Source
Recipient Funding	43.5 %	$ 75,000.00
Reclamation Funding	43.5 %	$ 75,000.00
Other Federal Funding		$ 0.00
Total Cash Contributions	87.0 %	$ 150,000
In-Kind Contributions (McL County/ STGCD / Participants)	13.0 %	$ 7,500
Project Total Funding	100.0%	$ 157,500

Budget Proposal

The contributions and total project cost are shown in **Table 3**. The summary of funding by source is presented in **Table 4**, and the more detailed budget proposal by budget line item, with the total hourly efforts, consultants' anticipated cost, and the indirect cost factored at 28.0% are shown in **Table 5**.

Table 3. Total Project Cost Table

Source	Amount
Costs to be reimbursed with requested Federal funds	$ 75,000.00
Costs to be paid by applicant (responsible for providing)	$ 82,500.00
Value of third-party contributions	$ 0
TOTAL PROJECT COST	$ 157,500.00

Table 4. Summary of Non-Federal and Federal Funding Sources

Funding Sources	Amount
Non-Federal Entities	
1. McLennan County (through agreement with local entities) cash	$ 75,000.00
2. Southern Trinity GCD (in-kind)	$ 4,500.00
3. McLennan County participating entities (in-kind)	$ 3,000.00
Non-Federal Subtotal	
Other Federal Entities	
REQUESTED RECLAMATION FUNDING	$ 75.000.00

Budget Narrative

The funding of the local share of the proposed project will be accomplished through the cash contributions of the participating municipalities and McLennan County, on a pro-rata basis. The local cash contributions will be supplemented with technical, management and administrative 'in-kind' contributions by primarily McLennan County staff and professional staff of the Southern Trinity GCD. For this project budget, the value of the in-kind contributions is somewhat higher than the McLennan-2017 study because of the anticipated involvement of the STGCD in the groundwater modeling tasks. The assigned dollar values of these in-kind services are shown in **Table 5**.

The following is a brief description of the items included in the budget proposal presented in Table 5:

Wages & Salaries: It is anticipated based on the McLennan-2017 Study that the applicant's project manager will be Dustin Chapman, who is the in-house attorney and administrative manager for Judge Felton. The STGCD General Manager will be the primary contributor to the project; it is anticipated that either other STGCD or input from STGCD consultants will be involved in the modeling and modeling evaluation tasks (for this proposed budget, the 'other STGCD staff' amount would be assigned either to actual staff or to STGCD consultant contributions).

The contribution of administrative staff for McLennan County is broken out in Table 5 because these costs can be adequately documented, and an indirect factor applied to them.

Fringe Benefits: The dollar cost of fringe benefits is not broken out in Table 5 but is included in the salary rate. Fringe benefits for McLennan County include health and life insurance, retirement contributions, sick leave, vacation, etc. The STGCD has a similar range of benefits.

Travel: The proposed project is within the McLennan County; therefore, travel is anticipated to be minimal and of a significant amount to break-out in Table 5.

Table 5. Budget Proposal

Budget Item Description	Computation		Quantity Type	Total Cost
	$/Unit	Quantity		
Salaries and Wages				
County Legal	$ 150.00	10	Hours	$ 1,500.00
County Financial	$ 75.00	20	Hours	$ 1,500.00
Southern Trinity GCD Mg	$ 110.00	26	Hours	$ 2,860.00
Other STGCD professional	$ 80.00	20.5	Hours	$1,640.00
Fringe Benefits				
Full-Time Employees	(all categories by full time)			
Travel - NO TRAVEL to be expensed				
Equipment – NO EQUIPMENT to be expensed				
Supplies and Materials – NO SUPPLIES OR MATERIALS to be expensed				
Contractual				
Legal (not in-kind) Services	$ 20,000.00	1	Lump	$ 20,000.00
Hydrogeologic Consultant	$ 20,000.00	1	Lump	$ 20,000.00
Engineering/Technical & Project Control	$ 70,000.00	1	Lump	$ 70,000.00
Economic/Rate Work	$ 40,000.00	1	Lump	$ 40, 000.00
Other				
Other				
TOTAL DIRECT COSTS				
Indirect Costs				
Type of rate	28.00 %			$ 2,100.00
TOTAL ESTIMATED PROJECT COSTS				$ 157,500.00

Equipment: No need for equipment that is not already available (computers, office equipment, etc.) is anticipated; therefore, equipment is not broken out in Table 5.

Materials and Supplies: The cost of printing materials for distribution at regularly scheduled Water Resources Group meetings is expected, but that cost will not be significant to the level of showing in Table 5.

Contractual: The bulk of the proposed project work as presented in the Technical Proposal section will be accomplished by consultants. Three areas of consultant services are expected:

- Prime/Engineering Consultant – Conducts engineering required for layout and costing of surface water convenience systems. Provides engineering recommendations on optimizing groundwater replacement scenarios. As prime, this consultant will manage, monitor and oversee the other professional consultants.
- Groundwater (Hydrogeological) Consultant – Conducts the review and evaluation of groundwater models and evaluates the capability to reliably estimate future Trinity Aquifer conditions based the various scenarios of pumping and conjunctive use of surface water.

- Economic (Water Rate) Consultant – Performs economic and operating cost data collection; evaluates several scenarios for managing cost and producing revenues to support groundwater replacement; and offers an optimal, county-wide 'water rate' to support implementation.

Procurement will be on a cost competitive basis and, for professional consultants (engineering, registered hydrogeologists), on a qualifications basis with cost open to negotiation after selection on qualifications.

Third-Party In-Kind Contributions: Other than the in-kind contribution identified in Table 5, there will no other 'third-party' contributions associated with the project.

Environmental and Regulatory Compliance Costs: For this project, routine utility construction (installation of pipes, pumps and storage) is anticipated. The project manager and the utilities represented on the Water Resources Group conduct this type of construction routinely. There are local permits involved that will be included on a proposed project basis (each conveyance scenario will include permitting and regulatory cost). Construction will be in the urban area in and near the City of Waco; therefore, environmental (habitat disruption, wetlands issues, etc.) impacts are not anticipated. It should be recognized that a successful implementation of this project will avoid future construction for replacement surface water delivery in the rural areas of the county, where habitat issues could be significant.

Indirect Costs: McLennan County has a federally-approved indirect cost rate. The 2015 rate affidavit is provided in the Appendix. If the project is selected for funding an updated affidavit will be provided.

3. ENVIRONMENTAL AND CULTURAL RESOURCES COMPLIANCE

This section addresses the proposed project potential impacts to the project area environment and cultural resources.

– Will the project impact the surrounding environment?

For recommended project, the anticipated construction will be within urbanized areas in and near the City of Waco. The City will have environmental and cultural criteria that the project must address prior to construction. Urban construction will avoid many habitat impacts because construction will be primarily within previously disturbed areas. Importantly, the proposed project would help avoid construction of water lines into the rural areas of the county to provide replacement supplies if the Trinity Aquifer in those areas is unavailable.

– Endangered species or critical habitat?

We are not aware of endangered species or critical habitat that the project could disrupt; however, major utilities projects have recently started that involved a survey of endangered species, wetlands, habitat, etc. We know that projects requiring these surveys were cleared by Federal and State agencies to proceed with construction.

- Wetlands, WOTUS and Jurisdictional Waters?

There are Jurisdictional Waters within McLennan County, including major reservoirs, rivers and stream segments. These waters are identified; therefore, the proposed project would be able either to avoid those waters or to acquire Section 404 or other permits to proceed.

- When was the water delivery system constructed?

The construction of public water systems in McLennan County varies significantly.

- Modifications to irrigation systems?

No such modification will be involved with the proposed project.

- Any buildings, structures or features eligible for National listing?

No such sites will be affected or impacted by the proposed project.

- Any archeological sites in proposed project area?

None are known; if identified these will be avoided.

- Will the proposed project have a adverse affect on low income or minority populations?

No, in fact, the project would have a positive impact for rural areas of the county that can have lower income populations.

- Indian sacred sites impacted?

No.

- Will project contribute to spread of invasive, non-native species?

No.

4. REQUIRED PERMITS OR APPROVALS

The McLennan County Water Strategy will not require permits or authorizations for its development. However, the implementation of the Strategy will require legal reviews and approvals by the local jurisdiction governing councils or boards. In Texas, any significant change in a State approved water system requires the change to be submitted and approved by the Texas Commission on Environmental Quality (TCEQ). TCEQ Regulations govern approval of public water systems in Texas.

Existing Analysis Contributing to the Water Marketing Strategy

If there is planning work relevant to one or more of the three required components, please include a link to any existing plans or work.

The McLennan 2015 Report is the most relevant existing work. The Conjunctive Use section, which is provided in the Appendix. The complete report, which includes the approved McLennan County Drought Contingency Plan and a separate plan for providing surface water to rural system in eastern McLennan County with arsenic over the MCL, is available on the McLennan County website: https://www.co.mclennan.tx.us/DocumentCenter/View/6759/Drought-Contingency-and-Water-Supply-Resiliency-Plan

The Brazos G Regional Plan, a component plan of the Texas State Water Plan, includes the McLennan County area. This planning document includes useful unit costs and cost estimating procedures. To remain consistent with the State Water Plan, the McLennan County project will adopt the unit cost and costing procedures. The Brazos G Regional Plan is available on the Texas Department of Water Resources website:
https://www.twdb.texas.gov/waterplanning/rwp/regions/g/index.asp

The Southern Trinity Groundwater Conservation District, established by the State of Texas to manage groundwater in McLennan County, published its Groundwater Management Plan in 2015. This Plan includes critical information for the McLennan County Water Marketing project, including permitting requirements, "Desired Future Conditions" for the Trinity Aquifer, and other policies and procedures it follows in the management of McLennan County groundwater. The Groundwater Management Plan is available on the STGCD website:
http://southerntrinitygcd.org/wp-content/uploads/2015/03/STGCD_MP_2015_04_23.pdf

5. LETTERS OF SUPPORT

The support letters were received and are included from representative members of McLennan WRGroup. The letters include cities that are in the PGRM area (City of Hewitt), potential surface water sellers and reuse providers (City of Waco), representatives of agricultural and rural communities (Texas Farm Bureau), the support of the Trinity Aquifer managing agency (Southern Trinity Groundwater Conservation District), the Brazos River basin surface water agency (Brazos River Authority) and professionals that assist with question regarding recharge, groundwater/surface water interaction and alluvium aquifer use (Joe Yelderman, Ph.D., Baylor University). The letters identify the area of assistance for the McLennan County project that can be expected from each supporter. The letters are included in the Appendix.

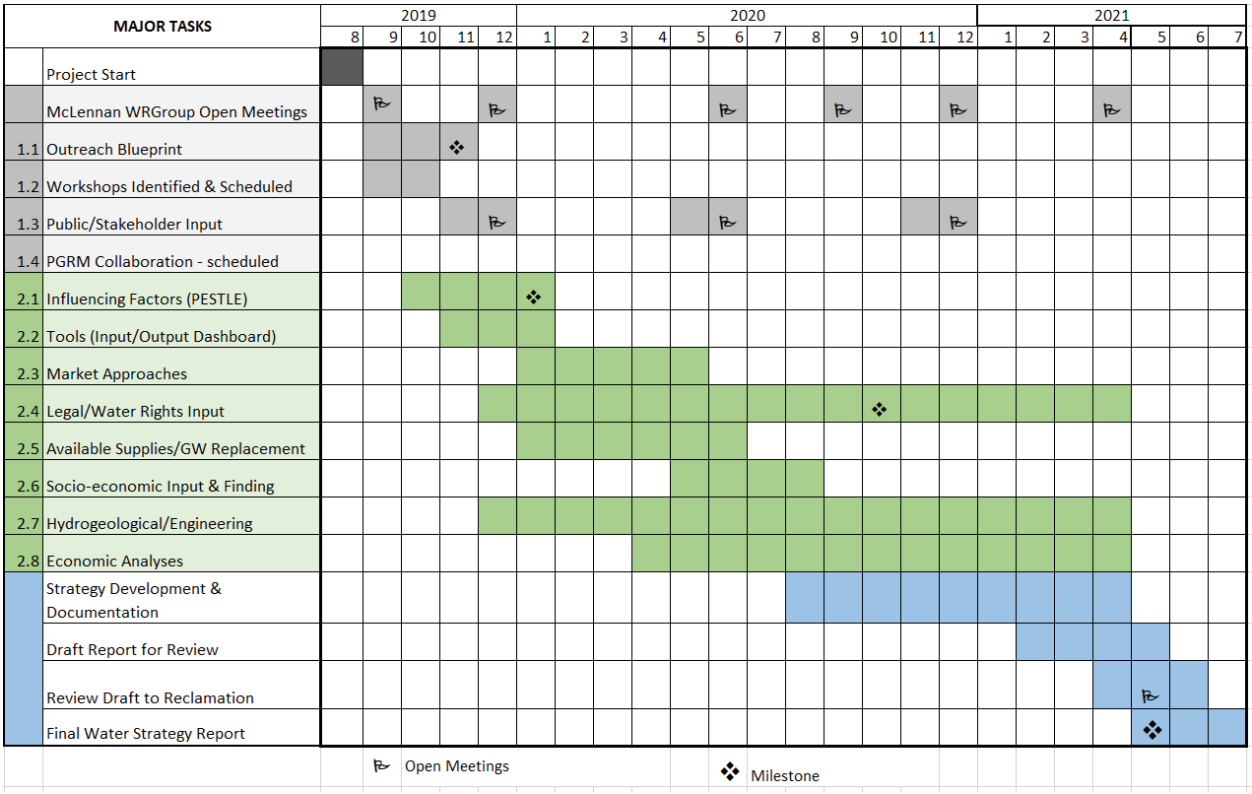
6. OFFICAL RESOLUTION

An official resolution adopted by the McLennan County Commissioners Court on July 23, 2019 is provided below.

Appendices - Table of Contents

Appendix A – Support Letters

Appendix B – Project Schedule with Meetings & Milestones:



Appendix C – Municipal Water Needs

Water User Group	Surplus/(Shortage)[1]		Comment
	2040 (acft/yr)	2070 (acft/yr)	
City of Bellmead	206	45	Projected surplus
City of Beverly Hills	0	0	Demand equals supply
City of Bruceville-Eddy	1,040	929	Projected surplus
Chalk Bluff WSC	466	471	Projected surplus
Coryell City Water Supply District			See Coryell County
City of Crawford	(3)	(7)	Projected shortage – see plan below
Cross Country WSC	109	(138)	Projected shortage – see plan below
Elm Creek WSC			See Bell County
City of Gholson	749	709	Projected surplus
City of Golinda			See Falls County
City of Hallsburg	0	0	Projected surplus
City of Hewitt	(211)	(231)	Projected shortage – see plan below
City of Lacy-Lakeview	261	95	Projected surplus
City of Lorena	95	1	Projected surplus
City of Mart	(182)	(245)	Projected shortage – see plan below
City of McGregor	2,004	1,759	Projected surplus
City of Moody	404	347	Projected surplus
North Bosque WSC	(265)	(628)	Projected shortage – see plan below
City of Riesel	(11)	(19)	Projected shortage – see plan below
City of Robinson	(720)	(1,909)	Projected shortage – see plan below
Tri-County SUD			See Falls County
Valley Mills			See Bosque County
City of Waco	6,144	(2,730)	Projected shortage – see Chapter 5.38
City of West	888	850	Projected surplus
West Brazos WSC			See Falls County
Western Hills WS	306	270	Projected surplus
City of Woodway	(20)	(103)	Projected shortage – see plan below
County-Other	301	340	Projected surplus

https://www.wacotrib.com/news/water-issues-loom-large-for-mclennan-county-area-communities/article_da4b9337-475e-539d-ab90-c4b922c55d8c.html

Water issues loom large for McLennan County area communities

By J.B. Smith Tribune-Herald staff writer Apr 18, 2010

Bold Springs Water Supply Corp. president John Rochelle stands by the company's well near West. Faced with Trinity Aquifer, the rural water supply recently reserved 500,000 gallons a day of surface water from Lake Waco.

McLennan County's new groundwater district is trying to fight the overpumping and decline of the Trinity Aquifer with a conservation strategy that may sound like the status quo. The strategy: Let everybody pump at least as much water as they have in the past, and let water levels continue to fall 10 feet a year.

Under the Southern Trinity Groundwater Conservation District's plan, a county that pumped down the Trinity 700 feet in the last century would pump it down as much as 500 feet in the next 50 years.At that level, experts said, groundwater would still be available, but costly to pump. Water quality also may decline. And smaller rural water suppliers might have to replace their wells.

The projected drawdown poses a risk to nearly half of McLennan County's population — those served by Bellmead, Hewitt, Woodway and other suburban and rural water suppliers heavily dependent on the Trinity.

Former State Sen. Kip Averitt, who pushed for groundwater districts as a solution to projected water shortages, said the drawdown projections are alarming and would amount to "mining" a finite resource.

"I don't know how much pumping the Trinity can stand," said Averitt, who was chairman of the Senate Natural Resources Committee and still speaks publicly on state water issues. "I'm pretty sure 500 feet would be excessive. . . . I don't think anyone will allow it. It would be nothing short of a sin if we allow that aquifer to be depleted. If at some point it's ruined and can't be restored, that means all future generations will lose it." Still, he said he hopes the groundwater district, combined with the rising price of pumping, will pressure local suppliers to shift to surface water sources such as Lake Waco and slow the depletion of the aquifer.

Proponents of the groundwater district say it's the first step in getting McLennan County's thirst for groundwater under control. Until now, suppliers and private well owners have been allowed to pump without limit. That's because Texas' "right of capture" doctrine gives landowners the right to the water under their land. But the state government has encouraged the use of locally controlled groundwater districts to limit individual pumping to conserve regional groundwater supplies. The Legislature in 2007 authorized McLennan County to create what is now called the Southern Trinity Groundwater District to manage a groundwater reserve that the state declared was being overpumped.

Limiting water use

The new district developed a plan that would limit larger users' consumption to reach "desired future conditions" over 50 years — including the 10-foot yearly drawdown and a collective annual pumping cap of 20,600 acre-feet per year. Southern Trinity officials said that was based on the county's estimated peak use in the early 2000s of about 17,600 acre-feet, with an extra margin for growth.

The city of Waco draws about 32,000 acre-feet a year from Lake Waco.

Now the deadline is approaching for groundwater users to apply to the Southern Trinity districts for water permits based on their use during the 2000s. If those permits add up to less than the 20,600-acre-foot goal, the remainder of the water rights will be divided among the applicants. The plan would exclude new users, such as industries that want to use groundwater. A recent example was Sanderson Farms, the chicken-processing plant that is located near Texas State Technical College and uses Trinity wells. Many current water suppliers in the district doubt there will be much surplus water to spare, if any, once the historical use permits are granted.

Hewitt City Manager Adam Miles said the groundwater cap means Hewitt will have to rethink its plans to develop more groundwater.

"If you had asked me even six months ago about our future strategy, I would have said, 'We're going to drill more wells,' " he said.

But with Hewitt expecting to grow from 13,000 people now to 23,000 in the next couple of decades, groundwater isn't the solution, he said. Now, instead of wells, Hewitt officials are discussing meeting

their growing needs with surface water, probably from Lake Waco. Hewitt already buys some treated Waco water in the summer but may need to increase its contract for more supply.

Woodway, Hewitt's neighbor, also buys Waco water for summertime peaks and might consider buying more in the future, Woodway City Engineer Nick Clark said. But he said Woodway is landlocked and expecting only modest future growth.

The city of Lorena is looking to meet its aggressive growth projections with surface water from Waco or from Robinson, which already supplies Lorena some of its water from the Brazos River.

Lorena City Manager Billy Clemons said the town's growth moratorium will continue until the Bull Hide Creek sewer plant is finished in 2011, but after that, he expects a growth explosion.

"We know growth is imminent," he said. "It's going to go gangbusters after (the new sewer plant) starts. In the 10 years after that, we'll double our need for water. We can go about 10 years based on our contract with Robinson, but after that we're going to have an additional source.

Selling to small towns

Waco is a willing seller. The city has spent tens of millions of dollars in the last decade to position itself as a regional water supplier, by raising Lake Waco, constructing new mains and water towers and now building a $50 million water treatment upgrade intended to improve the quantity and quality of Waco water. The city is letting neighboring water suppliers reserve water in Lake Waco for future use, water that Waco would treat and deliver.

The cities of West and Lacy-Lakeview locked in long-term contracts a few years ago, when the price was about half what it is today. The city of LacyLakeview now draws all its water from Waco and West is a regular user.

Another recent customer is **Bold Springs Water Supply Corporation** near West. The company still draws Trinity water but has reserved 500,000 gallons a day from Waco and soon may create a connection to it, president John Rochelle said. Waco Assistant City Manager Wiley Stem said Waco bases the wholesale water rates based on its cost in securing, treating and transmitting the water.

"It's a great deal, especially when you consider the alternative: No water," Waco Assistant City Manager Wiley Stem said.

He hopes to meet in the next month with the groundwater district board to discuss how suppliers could combine surface and groundwater to extend the life of the aquifer.

"Without us talking and planning together, if we went our way and they went theirs, one of us could run out of water," he said.

Preferring groundwater

In a report for the state-appointed Brazos G Regional Water Planning Group last April, the engineering firm HDR found that the majority of groundwater-dependent suppliers in McLennan County were not interested in buying water from Waco and preferred to keep using groundwater as long as possible.

David Dunn of HDR, project engineer for the regional planning group, said that in the long term, suppliers will realize that groundwater won't meet their needs. "I think as people start to recognize

what these future drawdowns are going to mean to their business, they're going to look toward Waco as a supplier," he said. But he said there's a danger in waiting too long to reserve a surface water supply, because Waco is free to sell its water at any time. "For some of these folks who just wanted to go along pumping groundwater, there may not be water there," he said.

Dunn said that as levels continue to drop, groundwater quality may drop, too, with more saline, iron and manganese content, so treatment costs will rise. Dunn said pumping costs will rise, and wells will ultimately have to be deepened or replaced. Smaller wells tend to be too narrow to accommodate the large underground pumps that would be required to bring deep water to the surface, and the cost of replacing them can run to $1 million.

"It's going to take more money to pull water out of the ground," he said. "Even with 400 to 500 feet of drawdown, there's still water left, but it's going to cost more to go get it."

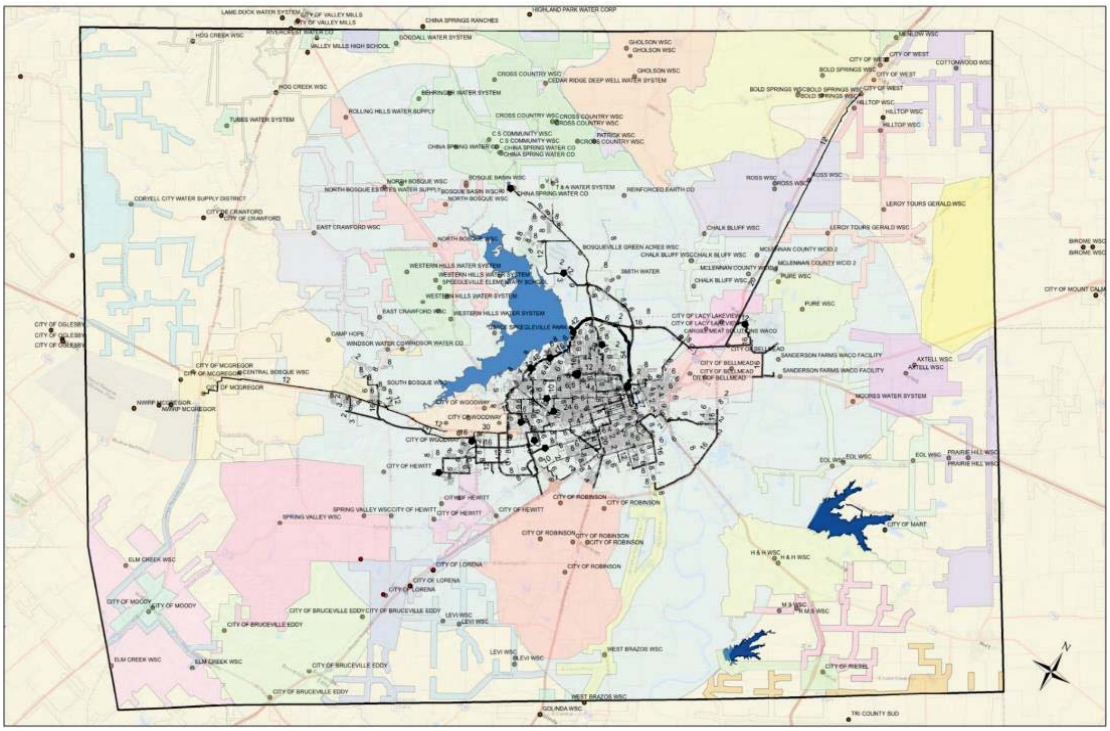
The Waco suburbs already have some of the most advanced drawdowns in the vast Trinity Aquifer and are projected to have the greatest drawdowns during the next 50 years, according to the HDR report. McLennan County's drawdowns would have effects on the surrounding rural communities, such as Clifton.

Appendix E – Anticipated Roles and Responsibilities

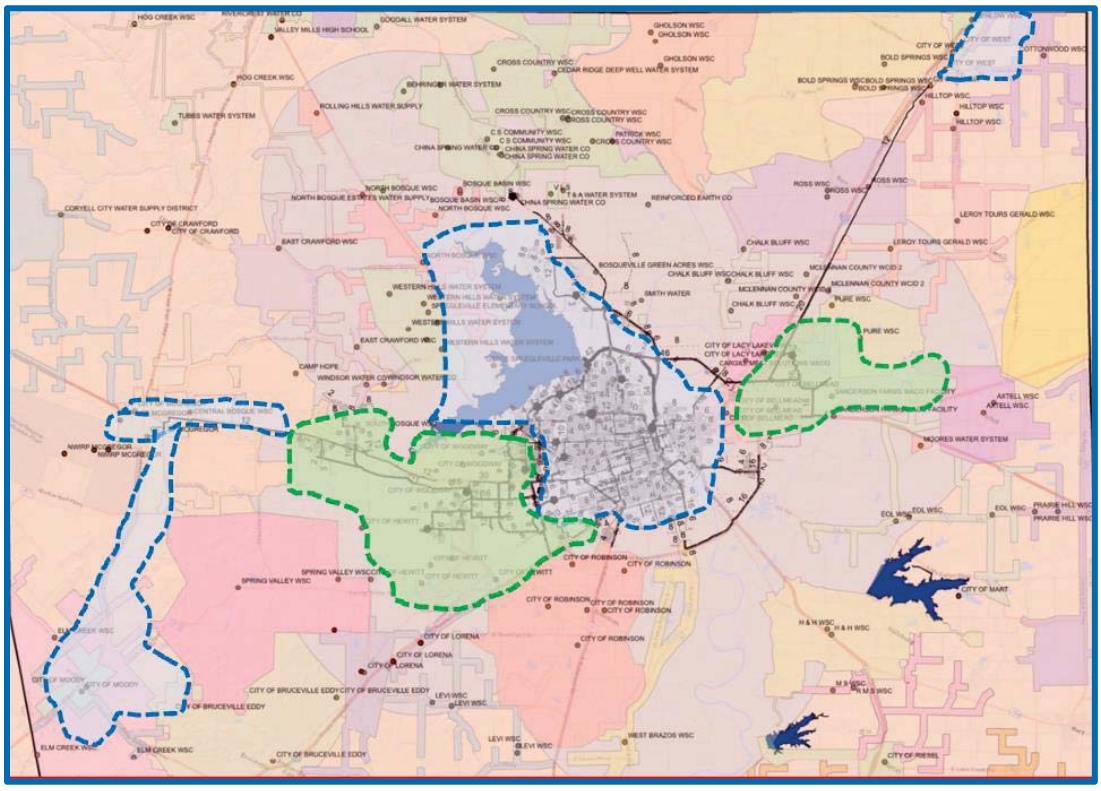
Entity	Task Category	Description
McLennan County (McL)	Management	Oversight, coordination, project budget
McL Water Resources Group (WResGrp)	Management	Advisory group for overall project
Southern Trinity GCD	Technical – GW	Manage groundwater tasks, report to
City of Waco (Waco)	Technical – SW	Major surface water supplier; Lake Waco
Brazos River Authority	Technical – SW	Water rights, water development, Brazos basin
Groundwater Users		
• PGRM Users	GW	Top GW users; targets for replacing GW
• Type 2 Systems	GW/SW	Other potential SW users
• Type 3 Systems	GW	Peripheral, risk of future aquifer drawdown

Appendix F – Maps – McLennan Public Water System and Water Use

PWS in McLennan County (CCNs)



Surface Water/Groundwater Use Access



Appendix G – Workshops and Collaboration

McLennan County Water Marketing Strategy

Workshops & Collaboration

- With PGRM users to present, review, discuss issues, costs, and procedures
- With City of Waco legal on contract provisions for sell of replacement water
- Outreach rural and ag communities facilitated through STGCD and Farm Bureau
- Engineering/Groundwater/Economics analyses information from meetings:
    - With engineering consultants representing the PGRM cities/rural water systems
    - With City of Waco on treated water cost, conveyance and construction funding approaches
    - With groundwater consultants & STGCD on groundwater modeling and further quantifying the benefits of reducing gw pumping
- Workshop of sources of replenishment supply – reuse opportunities for lowering groundwater pumping; use of Brazos alluvium, potential for developing surface water in the rural areas (facilitated by BRA and BU)

Collaboration

Collaboration will be achieved through two critical elements: 1) the continued participation and guidance of the **McLennan County Water Resources Group (McLennan WRGroup)** and 2) the use of Workshops to collect pertinent information related to water sales, to obtain legal, engineering and water cost information and, importantly, to inform and receive feedback from the public, the water users of McLennan County. Establishing a comprehensive water market strategy, collaboratively developed, broadly presented discussed, that achieves the GRG, may be difference in sustaining rural communities and the McLennan County agricultural economy.

SUPPLEMENT Contents

Item	Description	Date
1	Memo announcing the first meeting of the McLennan County Water Resources Group (McL Group)	Oct 2014
2	Presentation at first McL Group meeting	Oct 2014
3	Notes and "Purpose Statement" presented at McL Group meeting	Nov 2014
4	Agenda for McL Group meeting	Jan 2015
5	Agenda, Meeting notes, for McL Group meeting	Mar 2015
6	Agenda, Minutes and Presentation at McL Group meeting	May 2015
7	Agenda and Handout for McL Group meeting	Jul 2015
8	McL Group meeting – Agenda, Handout, Meeting Minutes and Presentation	Sep 2015
9	McL Group meeting – Agenda and Presentation	Nov 2015
10	McL Group sponsored County-wide public meeting – Announcement letter, Reminder Memo, Presentation & Sign-in Sheets	Mar 2016
11	Presentation to Waco City Council	Apr 2016
12	Waco Tribune Herald newspaper article on McL Plan efforts	Apr 2016
13	Meeting with McLennan County area Engineering Consultants to Review Project and Scope	Apr 2016
14	McL Group meeting – Agenda	May 2016
15	McL Group sponsored special meeting with Arsenic-impacted systems & EPA Region VI	Oct 2016
16	McL Group meeting – Agenda,Sign-in Sheet and Presentation	Dec 2016
17	Special meeting with Arsenic-impacted systems to review McL Arsenic Break-out Plan	Jan 2017
18	McL Group meeting – Agenda, Handout, Meeting Minutes and Presentation	Apr 2017

Appendix I – Indirect Cost Rate certification

JBI

MCLENNAN COUNTY, TEXAS

FISCAL YEAR 2015
CONSOLIDATED LOCAL CENTRAL SERVICES
OMB A-87 COST ALLOCATION PLAN
And
INDIRECT COST RATE PROPOSAL
Based on Fiscal Year 2013 Expenditures

CERTIFICATION STATEMENT

This is to certify that I have reviewed the cost plan submitted herewith and to the best of my knowledge and belief:

(1) All costs (for the fiscal year ended September 30, 2013) included in this proposal dated January 21, 2015, to establish cost allocation or billings for the period of October 1, 2014 to September 30, 2015, are allowable in accordance with the requirements of OMB Circular A-87, "Cost Principles for State, Local, and Indian Tribal Governments," and the federal award(s) to which they apply. Unallowable costs have been accounted for in allocating costs as indicated in the cost allocation plan.

(2) All costs included in this proposal are properly allocable to Federal awards on the basis of a beneficial or causal relationship between the expenses incurred and the awards to which they are allocated in accordance with applicable requirements. Further, the same costs that have been treated as indirect costs have not been claimed as direct costs. Similar types of costs have been accounted for consistently.

I declare that the foregoing is true and correct.

McLennan County, Texas

Signature: 

Mr. Stan Chambers
McLennan County Auditor

Date of Execution: 1-27-15

Indirect Cost Rate Calculation

Total Allowable Indirect Costs:	**11,778,202**	**= 27.37% County-wide Indirect Cost Rate***
Total Operating Salaries and Fringe:	**43,034,992**	

**Indirect Cost Rate adjusted by Carry Forward*

Appendix J – Brazos River Alluvium Aquifer Study.
Baylor University; Principal Investor: Joe Yelderman, Ph.D.

The Brazos River Alluvium Aquifer (Alluvium) is an unconfined aquifer that runs from Bosque and Hill Counties in the middle Brazos River Basin through Fort Bend County in the lower Brazos River basin. Previous studies in the northern half of the aquifer (Bosque, McLennan, and Falls Counties) have revealed that there is compartmentalization in some areas of the aquifer, where the aquifer is not influenced by river flows, and in other areas the aquifer is directly recharged by the Brazos River. To date similar studies have not been conducted in the lower half of the Brazos River Alluvium.

Starting in FY 2020, the BRA will participate with local universities, local groundwater conservation districts, and other interested parties in a proposed three year continuation of efforts previously confined primarily to McLennan County. These studies will seek to better understand the interaction between the Brazos River and the Alluvium in Brazos, Grimes and Waller Counties. The team will perform geospatial analysis using Texas Water Development Board's (TWDB) groundwater database and data submitted in Drillers Reports from the area, conduct cross-section monitoring to record changes in bank material and identify possible connectivity between the river and the alluvium. Current and historical water chemistry data of both the Brazos River and Alluvium will be examined for similarities or differences in specific conductance, temperature, cations and anions, and the ratio of hydrogen and oxygen isotopes. Finally, data loggers will be installed to monitor changes in the water table elevation. The goal of the studies is to provide scientific data and improved understanding on if there is interaction between the river and Alluvium, how this any identified interaction impacts water quality and flow in the river, and how the aquifer responds to rainfall events and changing river stages.

A better understanding of these interactions will help TCEQ, TWDB, BRA and groundwater conservation districts make more informed decisions regarding groundwater pumping, implementing environmental flow recommendations, water availability, and water quality. Improved understanding on the above items will also contribute to conservation of freshwater mussels through identification of potential reintroduction areas and future hydrological persistence as managers will be able to make knowledgeable decisions on the interface between the river and aquifer and reduce threats to the long-term viability of freshwater mussels.

Appendix K

DROUGHT CONTINGENCY and WATER SUPPLY RESILENCY PLAN for McLENNAN COUNTY, TEXAS

July 31, 2017

DRAFT

McLennan County Water Resources Group

Table of Contents

EXECUTIVE SUMMARY

This Executive Summary provides the key findings, results and recommendations of the McLennan County Drought Contingency and Water Supply Resiliency Plan (referred to throughout this report as "McL Co Plan").

1. Introduction, Organization and Content of the McL Plan

The McL Co Plan is the result of a cooperative effort at every level within McLennan County—local government, public, state and regional agency, federal agencies through the US Bureau of Reclamation—to provide a comprehensive **response** that addresses the current and future water supply needs and constraints on a county-wide basis. The McL Plan sets out a **response** to McLennan County drought conditions; further, water supply resiliency is considered through plans for conjunctive use of surface water and groundwater sources currently available to the county.

The McL Co Plan report is organized in three component plans to best present these water resources "problems" and corresponding "solutions." The solutions are planning level, well-vetted blueprints. The guidelines of the US Bureau of Reclamation (USBOR) drought contingency plan are addressed. The following components are included:

Chapter 1: Background on McLennan County Water Planning

Chapter 2: McL Co Drought Response and Contingency Plan

Chapter 3: Groundwater-Surface Water Conjunctive Use Plan

Chapter 4: Arsenic Mitigation Plan

Chapter 5: Implementation

Public Outreach

This chapter, Chapter 1, discusses the water supply situation in McL Co and introduces the McL Co Water Resources Group and its role and purpose. It provides an overview of drought impacts in the County, and discuss the County-wide efforts through the McLennan County Water Resources Group to undertake efforts to build a plan for a resilient water supply. Chapter 2 is the McL Co Drought Response and Contingency

Plan. It follows the requirements of the US Bureau of Reclamation. Chapter 3 is the McL Co Conjunctive Use Plan. It provides a plan to strategically utilize surface water resources in the county to reduce dependence on and depletion of groundwater resources in the area. Chapter 4, the Arsenic Mitigation Plan, provides a plan to convey surface water from Lake Waco to nine affected systems in McLennan County to dilute arsenic concentrations from the groundwater supply. Chapter 5, Implementation, provides details about executing the plans contained herein. Finally, the Public Outreach Chapter contains items such as sign-in sheets, correspondence, and presentations involved with public interaction on this project.

McLennan County Water Resources

The water supplies available to McLennan County include both groundwater and surface water. The surface water supplies include both Lake Waco and to a lesser amount Lake Belton. Lake Waco is the primary water supply for the City of Waco and several wholesale water customers in McLennan County. The dependable yield of Lake Waco is recognized as 78,790 acre-feet per year (AF-Yr). The City of Waco has additional surface water supply available from the Brazos River. Based on 1914 water right, one of the oldest and highest priority rights in the Brazos River basin, the City of Waco has 5,600 AF-Yr of Brazos River water rights.

The Bluebonnet Water Supply Corporation, through a water supply agreement with the Brazos River Authority for 8,301 AF-Yr, has commitments in McLennan County totaling 7,125 AF-Yr, with the Cities of McGregor and Woodway at 2,139 AF-Yr and 1,362 AF-Yr, respectively, having the largest supply contracts.

The groundwater supply for McLennan County is primarily Trinity Aquifer supplies although the Brazos River alluvium also has significant storage. The Texas Water Development Board (TWDB) established the Trinity Aquifer groundwater availability used as 20,690 AF-Yr and the storage of the Brazos River Alluvium in McLennan County as 15,023 AF-Yr. The Southern Trinity Groundwater Conservation District (STGCD) in the 2010 *Groundwater Management Plan*, estimated McLennan County Trinity Aquifer use for 2008 as 19,830 AF-Yr. Although the Brazos River alluvium has significant storage current use of these supplies is constrained by a number of factors. The TWDB estimated the

alluvium use at only 645 AF-Yr. Baylor University researchers and others are currently studying the Brazos River alluvium that could lead to lessening the constraints on its use.

Drought Impacts

The impacts of drought in Central Texas and McLennan County are significant and well documented. These occurrences, which at times are severe and extended, impose stress on water supply systems—imposing diminishing supply conditions during periods of abnormally high-water demand—restrict both agricultural operations and water recreation, and stress the aquatic habitat and environmental conditions of lakes and streams as flows diminish, water temperatures increase, and water surfaces recede. The **vulnerabilities** caused by drought conditions in McLennan County and the various **responses** and efforts to **mitigate** the impacts are presented in Chapter 2, the *McLennan County Drought Response and Contingency Plan*.

Opportunity for Conjunctive Use

With properly planned interconnection of these two sources of supply, the overall resiliency of McLennan County's supply increases. The interconnected supplies can provide a planned response to both the increased demand from growth in McLennan County and the occurrence of prolonged drought. The City of Waco's 2015 *Water Master Plan* identifies conjunctive use as a viable opportunity for supplementing water supplies. Chapter 3 presents the *McLennan County Conjunctive Use Plan*.

2. Drought Contingency Plan for McLennan County

The Drought Contingency Plan for the McLennan County area involves a twofold process: first, to recognize, identify and address how certain existing risks and potential constraints to water supply can be overcome and, second, to build a drought contingency plan, using the Six Elements, to be compatible with resolving those local constraints.

The six standard drought-contingency planning elements were used to incorporate tasks to address the water risk elements unique to the planning area. The McLennan County Water Resources Group served as the Drought Task Force to oversee and comments on the Drought Contingency portion of the McL Plan.

The six elements addressed in the McL Plan include the following; these are described in detail in Chapter 2:

1) The **Drought Monitoring** element defines a data collection and evaluation plan; existing drought monitoring information at both the State and regional (Brazos River Authority) level will be used. Extensive historical drought data and daily updates are available from State and national agencies. Drought models used by the Brazos River Authority for the Brazos River Basin and by the Texas Commission on Environmental Quality (TCEQ) will be used as appropriate.
2) The **Vulnerability Assessment** identifies risks due to drought; the Drought Task Force, representing public and environmental interests, will provide input and comment.
3) The **Mitigation Actions** will be based on input to local water risk and identified drought vulnerabilities.
4) **Response Actions** include set of suggested actions, both for mitigation projects and for triggered response actions; this will include an initial prioritization. The actions and suggested priorities will be thoroughly reviewed with the Drought Task Force and adopted by the Task Force in the implementation phase (see Chapter 5).
5) **Operational and Administrative Framework** identifies the responsibilities of the key agencies, including the McLennan County cities, water districts and water supply corporations, in implementing and executing an effective drought contingency plan for McLennan County. The implementation of the framework is also discussed in Chapter 5 of this report.
6) **Plan Updates** are scheduled as part of the operational framework for carrying out the McL Plan.

McLennan County Drought Impacts

The impacts of drought in Central Texas and McLennan County are significant and well documented. In McLennan County, surface water supplies, particularly Lake Waco and Lake Belton, have reduced the County's vulnerability to drought impacts. While this is true of the City of Waco water system, the outlying areas of McLennan County that are

dependent on groundwater are more vulnerable due to increased pumping of the aquifer during drought. The increased pumping triggers a risk to the sustainability due to loss of aquifer pressures, both short- and long-term availability of groundwater is jeopardized.

The long-term dependable yield of major surface water reservoirs throughout Texas, including Lake Waco and Lake Belton, were based on the hydrologic conditions of the 1951-1956 drought. The major factor that would impact (shorten) the dependability of the surface water supply of these two Central Texas reservoirs is the occurrence of a more severe drought than the 1951-56 "drought of record." A severe drought approaching the severity of the mid-1950s drought conditions, at least on an annual cycle, occurred in 2011. Both of the 1951-56 and 2011 droughts were record-setting for McLennan County in terms of lack of rainfall and declines in streamflows. The drought of 2011 is of primary concern to water planners and a benchmark in preparing the McL Co Plan.

Vulnerabilities

Whereas severe drought presents the greatest vulnerability to McLennan County water resources, other constraints on its water resources are recognized and addressed in the McL Plan. Acting alone, the relative risk of these situations compared to the potential drought impact on surface water supplies is relatively low. However, adding these impacts during drought conditions increases the susceptibility of water supplies to drought impacts.

Of specific concern in McLennan County are two outside issues: zebra mussel impacts on raw water intake and conveyance; and, arsenic contamination levels in several small groundwater systems in the eastern portion of the County. The response to threat of zebra mussels is being actively addressed by the City of Waco's Water Utilities Department. The response to arsenic contamination is more complex. This threat is handled separately in the McL Plan in Chapter 4, the *Arsenic Break-out Plan*.

Identifying and Monitoring Drought Conditions in McLennan County

The following table shows the various agencies that will provide drought related information used in triggering drought contingency plan responses:

Data Type	Record/Information Needed or Desired	Data Collection Agencies
Drought Impacts	Water Supply Availability (lake elevations), PDSI, temperature, soil moisture, Groundwater conditions/pressures, drought related regulatory actions	US Army Corps of Engineers (Fort Worth District); NOAA, USGS; Texas Water Development Board (TWDB); Texas Commission on Environmental Quality (TCEQ); BRA; Southern Trinity GWCD; City of Waco
Public Water Systems Drought Contingency Triggers or Stages – Drought Response Conditions	Public water system drought contingency response to drought impacts on water system	Various Public Water Systems in McLennan County
Effective Drought Conditions (identifying drought onset and ending conditions)	For McLennan County measures of degradation & improvement in drought-related conditions	US Drought Monitor; NOAA Climate (drought monitor); TWDB (Water Data for Texas); TCEQ; BRA; and several others
Drought Severity Conditions	Correlation of drought conditions, extent and duration, to water systems in McLennan County	US Drought Monitor; TWDB (Water Data for Texas)
"Correlating Tables"	Correlating McLennan County drought response to available surface water for conjunctive use system	McLennan County & Drought Planning Task Force

Drought Response

The response to drought conditions includes specific triggers related to the vulnerability of Lake Waco, the primary surface water supply in McLennan County and the source of surface water for use in the McLennan County Conjunctive Use Plan described in Chapter 3. It is important to recognize that the availability of surface water in operation of the conjunctive use plan is reduced relative to the drought impacts on Lake Waco. As the Lake Waco vulnerabilities increases, the drought becomes more severe, the use of surface water, Lake Waco supplies, is proportionately reduced. **During drought conditions, when the surface water supply for conjunctive use is reduced, the reduction**

is surface water supply is compensated by increased groundwater pumping. Therefore, during drought conditions, groundwater use is allowed to increase, recognizing that after drought conditions end and surface water becomes available without vulnerability to Lake Waco, the aquifer conditions will recover.

The following table shows the reduction in available surface water, Lake Waco supplies, as drought conditions increase and the additional restrictions are triggered under the McLennan County Drought Contingency Plan.

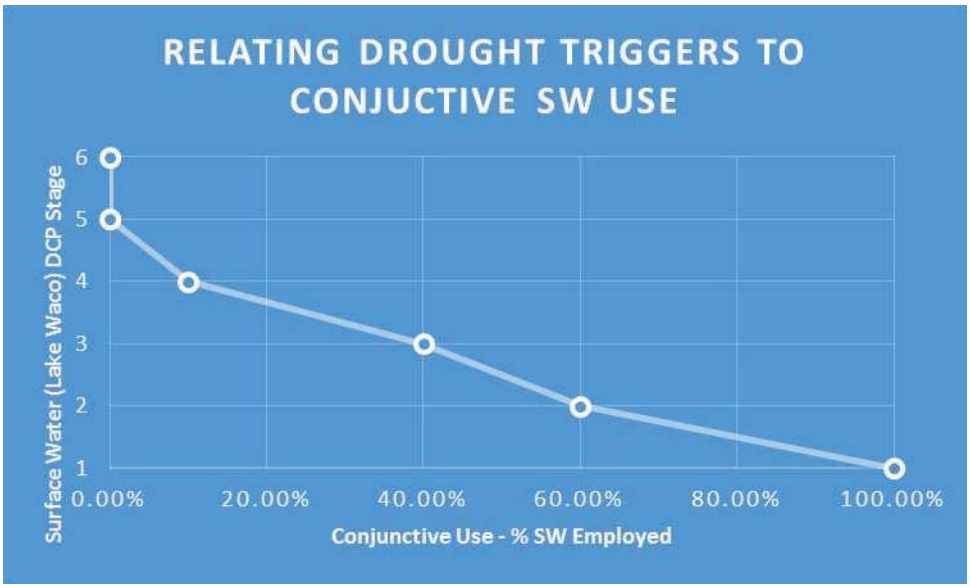


Figure ES-1 Lake Waco Drought Stage & Available SW for Conjunctive Use

The responses triggered by each identified drought vulnerability stage are shown in the following table:

Drought Stage	Trigger	Response Actions
1 – Water Watch	Yearly for the period May 1 – September 30	Wise water use is encouraged during this stage. Systems should practice good water management techniques; homeowners to use both inside and outside water smartly and without waste. Consider landscape plants and features that will require less water. Groundwater systems in McLennan County should follow the recommendations of the Southern Trinity Groundwater Conservation District in the wise use of groundwater.
2 – MILD Water Shortage	A decrease in the Lake Waco reservoir level to 452 msl (at which the reservoir is at about 60% of its capacity).	Available Waco water for the McLennan County Conjunctive Use system is restricted to 60% of total committed amounts; Irrigation of outdoor lawns and landscape restricted to every third day as a limit; The County shall limit use of water for purposes to those activities necessary to maintain the public health, safety and welfare and any computer-controlled irrigation systems that incorporate evapotranspiration data in setting irrigation run times. The Public Water Systems shall note any incidents observed of "excessive watering" and notify to customers. "Excessive watering" occurs where run-off extends for a distance greater than ten (10) feet from the customer's property or where there is washing or hosing down of buildings, sidewalks, driveways, patios, porches, parking surfaces or other paved surfaces. The Southern Trinity Groundwater Conservation District's advisories for wise operation of groundwater systems and conservation of groundwater should be followed by McLennan County groundwater-based systems.

3 – MODERATE Water Shortage	A decrease in the Lake Waco reservoir level to 450 msl (at which the reservoir is at about 55% of its capacity)	Available Waco water for the McLennan County Conjunctive Use system is restricted to 40% of total committed amounts. Non-essential water use shall be restricted. Public Water Systems should impose a mandatory limit on irrigation to a two (2) days per week at designated, low-evaporation times. Hand-watering with hose or five (5) gallon bucket allowed. The Southern Trinity Groundwater Conservation District's advisories for wise operation of groundwater systems and conservation of groundwater should be followed by McLennan County groundwater-based systems. As deemed necessary, the STGCD will issue special advisories in response to drought conditions or other factors impacting groundwater systems.
4 – SEVERE Water Shortage	A decrease in the Lake Waco reservoir level to 446 msl (at which the reservoir is at about 45% of its capacity)	Available Waco water for the McLennan County Conjunctive Use system is restricted to 10% of total committed amounts. Public Water Systems should impose a mandatory limit on irrigation to a two (2) days per week but restricted to designated, low-evaporation times. Newly constructed swimming pools, Jacuzzis, spas, ornamental ponds, and fountains may be filled once. Watering of newly installed landscaping is exempt from Stage 4 restrictions for no more than one (1) month from the date of planting. After the first month, the landscape water day's schedule and hourly restrictions must be followed. Excessive water run-off from any landscaped area onto streets, alleys, or parking lots is prohibited. Run-off is excessive when it extends for a distance greater than ten (10)

		feet from the customer's property. Public Water Systems should consider and impose as appropriate and necessary: • Washing or hosing down of buildings, sidewalks, driveways, patios, porches, parking areas, or other paved surfaces is prohibited. • Refilling after draining private swimming pools, Jacuzzis, spas, ornamental ponds, and fountains is prohibited. Refilling shall mean to replace more than twenty-five (25) percent of the facility's water capacity. • Washing or rinsing vehicles on owner's premises must follow the landscape water days schedule as set out above. A hand-held hose equipped with a positive shut-off nozzle and/or hand-held bucket must be used. The Southern Trinity Groundwater Conservation District's advisories for wise operation of groundwater systems and conservation of groundwater should be followed by McLennan County groundwater-based systems. As deemed necessary, the STGCD will issue special advisories in response to drought conditions or other factors impacting groundwater systems.
5 – CRITICAL Water Shortage	A decrease in the Lake Waco reservoir level to 445 msl (at which the reservoir is at about 40% of its capacity)	Waco water for the McLennan County Conjunctive Use system is NOT AVAILABLE. Public Water Systems should impose all Stage 4 restrictions. The Southern Trinity Groundwater Conservation District's advisories for wise operation of groundwater systems and conservation of groundwater shall be followed by McLennan County groundwater-based systems. As deemed necessary, the STGCD will issue special advisories in response to drought conditions or other factors impacting groundwater systems.

6 – EMERGENCY Water Shortage	A decrease in the Lake Waco reservoir level to 440 msl (at which the reservoir is at about 30% of its capacity)	Waco water for the McLennan County Conjunctive Use system is NOT AVAILABLE. Public Water Systems should continue the Stage 5 restrictions and consider further actions as deemed necessary. The Southern Trinity Groundwater Conservation District's advisories for wise operation of groundwater systems and conservation of groundwater should be followed by McLennan County groundwater-based systems. As deemed necessary, the STGCD will issue special advisories in response to drought conditions or other factors impacting groundwater systems. The STGCD will collaborate with the City of Waco and other surface water systems on further restrictions, as necessary.

Drought Mitigation Actions

The mitigation actions identified for McLennan County are intended to build long-term water supply resiliency, including mitigating impacts on the future loss of groundwater pressures particularly in the Hosston Aquifer, and to mitigate risks associated with Central Texas drought conditions.

For McLennan County, a number of mitigation actions were identified and evaluated. These were discussed with the McLennan County Water Resources Group (the Drought Planning Task Force) and presented in public meetings. The mitigation actions require cooperation between McLennan County water systems. Both surface water-based systems and groundwater systems considered actions that were based on conjunctive use of the two supply sources.

The primary mitigation action in response is the conjunctive use of surface water and groundwater. The conjunctive use plan by reducing dependency on groundwater during normal, non-drought conditions, was shown to decrease the vulnerability of surface water during drought conditions and increase the of McLennan County resiliency of groundwater to recover after drought conditions. The *McLennan County Conjunctive Use Plan* was prepared and presented to the McLennan County Water Resources Group.

3. Conjunctive Use Plan

The Conjunctive Use Plan provides a method to strategically utilize available water resources to ensure water supply resiliency for all of McLennan County. The Conjunctive Use Plan will address three of the issues identified affecting water supply resiliency:

1.) Declining aquifer pressures;

2.) Future Growth/Development and increasing water demands; and

3.) Drought demands.

Components of the Conjunction Use Plan

1) ***Groundwater Modeling***

Groundwater modeling was a critical component of developing the conjunctive use plan. Groundwater modeling was used to assess the response of the Trinity aquifer to

continual pumping at present-day rates and to assess the aquifer's response to different scenarios of decreased pumping. A simplified analytical model was developed to guide the more accurate numerical modeling approach using the TWDB Groundwater Availability Model (GAM).

2) *Analytical Model*

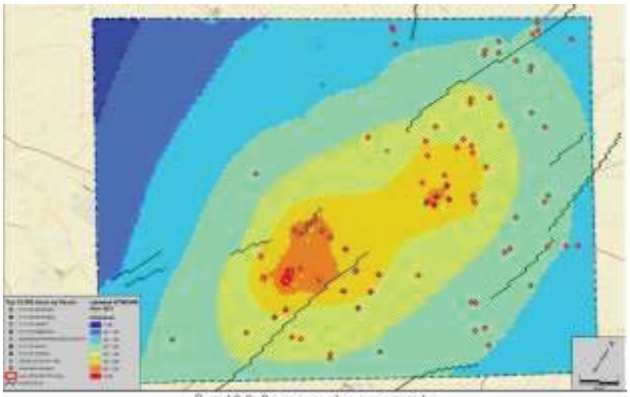
Initially, a preliminary "analytical" model was created to model the effects of different pumping scenarios. The analytical model was used to determine response patterns from pumping variations (uniform pumping reduction vs targeted pumping reductions) to narrow down the best approach for reducing drawdown in the county. The results from the analytical model determined that a targeted approach, focusing on the major groundwater producers, had the greatest regional benefit to the aquifer levels. Therefore the targeted approach was used to guide numerical modeling.

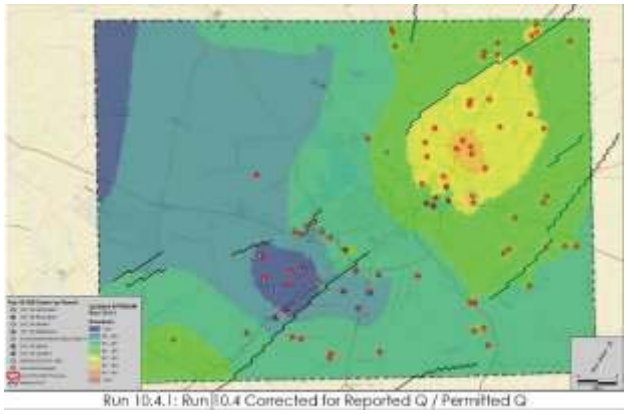
3) Numerical Modeling: GAM

The TWDB Northern Trinity GAM was the numerical model used to obtain more accurate results. Several run scenarios were created using the GAM. The GAM is the best tool for verifying the long-term benefits to the aquifer of conjunctive use of surface water to reduce groundwater pumping. The latest GAM model run (Run #10), approved by the TWDB, was adjusted to reduce the groundwater pumping by for several scenarios: using surface water from Lake Waco delivered from the Waco Mount Carmel Water Treatment Plant to reduce the current groundwater pumping by 30%, 50% and 75%.

In the GAM10 run, the current groundwater pumping rates for several large groundwater users in McLennan County were high to much higher than the actual rates reported by these users. The GAM10 run for the Cities of Hewitt, Woodway, Robinson, and Bellmead, all among the largest McLennan County groundwater users, had groundwater pumping rates that were 151%, 80%, 58% and 29%, respectively, greater than the actual, current production. It was therefore important the GAM inputs for these users be adjusted to align with actual groundwater production.

Using the adjusted model inputs, the long-term benefits to the Trinity Aquifer were examined using the 50% reduction in production. The following exhibits show the potential long-term benefits to the Trinity Aquifer based on the 50% reduction in groundwater pumping by the five users, the Cities of Hewitt, Woodway, Bellmead, Robinson and Lorena (Run 10.4.1). The pumping rates for both scenarios are





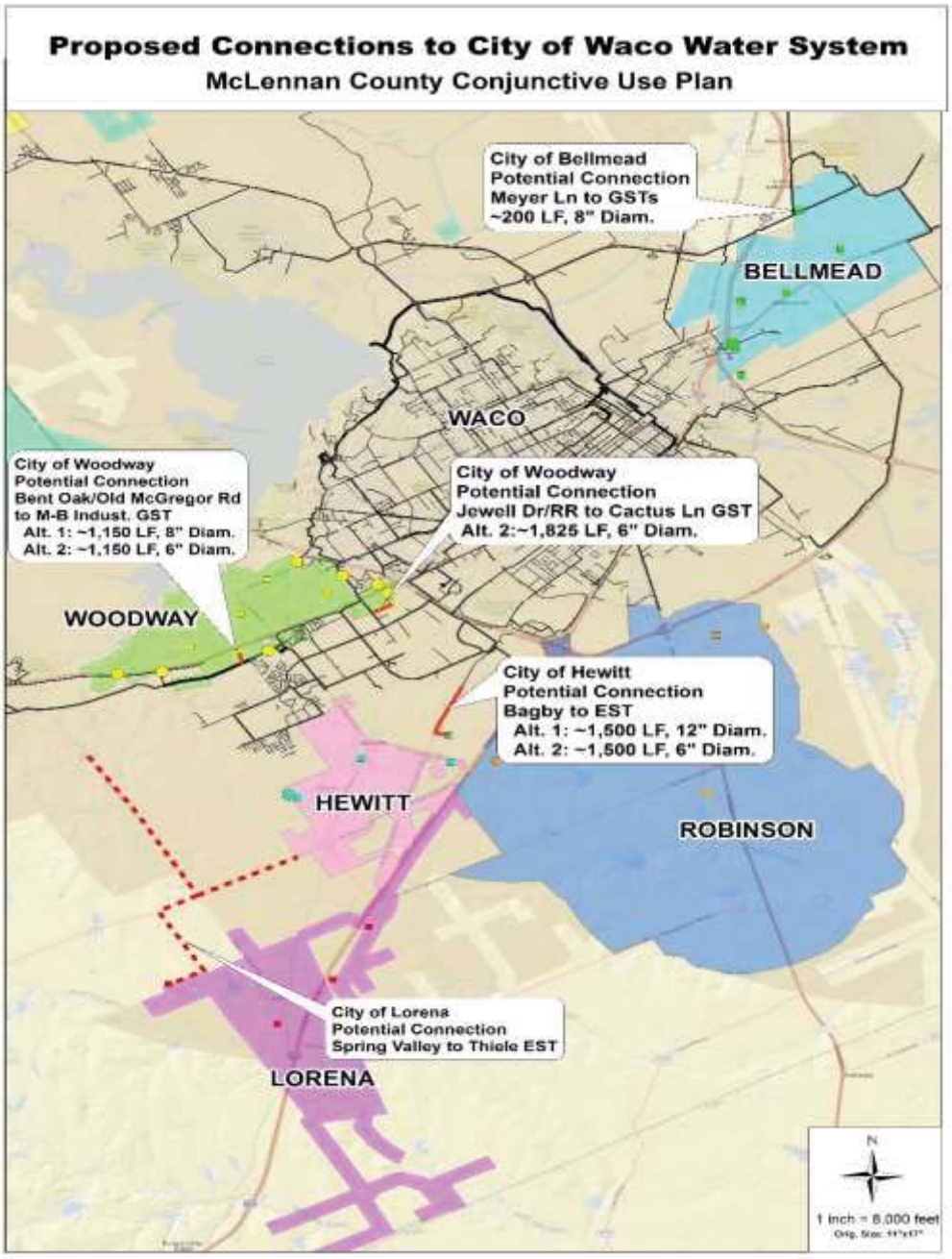
maintained through 2070. The Run 10.0 graphic is the drawdown in 2070 if no reductions in groundwater pumping occurred; the second graphic, Run 10.4.1, shows the levels of drawdown resulting with a 50% replacement of groundwater (reduction in pumping) with surface.

Comparing the outcome of these two scenarios shows that a 50% reduction in groundwater pumping by five major users (Cities Hewitt, Woodway, Lorena, Robinson and Bellmead) results in a significant improvement in the aquifer levels or pressures in the long-term future.

Surface Water Conveyance Plan

To reduce groundwater pumping by 50% on an average day basis, additional connections to the City of Waco water system are necessary for Woodway, Hewitt, and Bellmead. The City of Robinson is projected to have adequate supply, at 50% reduction of groundwater, for 2070, assuming that their current contracts continue and water rights are utilized.

The proposed connections to the City of Waco water system are shown below:



Individual summary sheets are included in Chapter 3 for each of the five major groundwater users requiring reduced groundwater pumping under the Conjunctive Use Plan.

4. Arsenic System Break-out Plan

Nine systems in McLennan County are currently under Administrative Order (AO) for arsenic levels exceeding the drinking water MCL. The McLennan County arsenic-impacted systems are listed below:

1. Axtell Water Supply Company (WSC)
2. Birome WSC
3. City of Riesel
4. Elk Oak Lake (EOL) WSC
5. Leroy-Tours-Gerald (LTG) WSC
6. Meier Settlement (MS) WSC
7. Moore Water System
8. Riesel-Meier Settlement (RMS) WSC
9. Prairie Hill WSC

The arsenic concentrations of the systems vary. Even within a particular well, the arsenic concentration can vary from day to day. The following table summarizes the maximum arsenic levels available from TCEQ testing records or from data provided by the systems for each of the systems under AO. The table also shows each system's pumping permit amount as provided by the Southern Trinity Groundwater Conservation District (STGCD), and their projected 2070 Peak Day Demand.

Water System	Max Tested Arsenic Concentration (mg/L)	STGCD Permit Amount (Gal/Yr)	2070 Peak Demand (Gal/Day)*
Axtell WSC	0.018	68,407,000	575,901
Birome WSC- *Plant 5 Only*	0.014	N/A (wells outside McL Co)	71,428
City of Riesel	0.017	42,780,978	357,411
Elk Oak Lake (EOL) WSC	0.022	69,989,000	664,248
Leroy-Tours-Gerald (LTG) WSC	0.022	54,419,000	318,207
Meier Settlement (MS) WSC	0.0125	7,593,990	75,085
Moore Water System	0.03*	6,397,000	97,065
Riesel-Meier Settlement (RMS) WSC**	0.018	51,957,203	549,485
Prairie Hill WSC	0.031	68,454,000	558,866

**** See Appendix A of Chapter 4 for additional information on 2070 Peak Demands.***
*****Arsenic concentration data was unavailable for Moore Water System. A concentration of 0.03 was assumed.***
****** RMS is a WSC that is shared between MS and City of Riesel. The total STGCD permitted amount for RMS is split between MS and City of Riesel, with MS and City of Riesel having rights to 48.62 acre-ft/yr and 110.83 ac-ft/yr, respectively.***

To mitigate the arsenic-contaminated groundwater issues within McLennan County, the recommended approach is to blend the arsenic-contaminated groundwater with another "clean" water source (having a much lower arsenic concentration) such that the resulting solution will have a diluted arsenic concentration below the MCL. The target "blended" solution arsenic concentration chosen for this plan is 0.0085 mg/l, which provides a 15% buffer below the MCL. For this approach, it was assumed that water blending will occur at well sites. Therefore, the assumed delivery point(s) for the blending water source is to the individual well sites.

Proposed infrastructure needed to deliver treated Lake Waco surface water to the arsenic-impacted wells is shown in Exhibits 1 through 3. Each conveyance plan is discussed in detail in Chapter 4, which includes cost estimates for each.

5. Implementation

The scope of the McL Plan will require continued efforts and support of the wide range of entities that participated in its development. As discussed in Chapter 5, there are a number of task that will be required for implementation the concepts and recommendations of the McL Plan. These include the following:

1) Discussions and on-going coordination with all McLennan County groundwater users on the benefits of reduced groundwater pumping;
2) Coordination on the Operating Framework for the McLennan County Drought Contingency Plan;
3) Adoption by McLennan County of the Drought Contingency Plan;
4) Instituting a framework of five-year updates to the McLennan County Drought Contingency Plan;
5) Development of water rate structure(s) to support the reduced groundwater pumping by the major groundwater users; and,
6) Ongoing public involvement, outreach and participation and costs and benefits are considered during the implementation phase.

CHAPTER 1- BACKGROUND

1.0- Introduction

The McLennan County Drought Contingency and Water Supply Resistivity Plan (McL Co Plan) is a cooperative effort at every level within McLennan County—local government, public, state and regional agency, federal agencies through the US Bureau of Reclamation—to provide a comprehensive **response** that addresses the current and future water supply needs and constraints on a county-wide basis. The McL Plan sets out a **response** to McLennan County drought conditions; further, water supply resiliency is considered through plans for conjunctive use of surface water and groundwater sources currently available to the county.

1.1- Content and Layout of the McL Co Plan

Although one county in scope, the McL Plan deals with two primary water resources issues: 1.) drought conditions and the means to respond and mitigate the impacts; and 2.) declining groundwater pressures and means to avoid potential losses in future groundwater availability. The McL Co Plan also addresses two issues that are either aggravated by these conditions, or exacerbate them. First, preliminary, planning level plans to handle arsenic contamination in several small groundwater-based systems in eastern McL Co are included and second, the potential for zebra mussels, an aquatic invasive species, in Lake Waco interfering with surface water availability is addressed.

1.2- Organization of this Report: Individual Component Plans

The McL Co Plan report is organized in three component plans to best present these water resources "problems" and corresponding "solutions." The solutions are planning level, well-vetted blueprints. The guidelines of the US Bureau of Reclamation (USBOR) drought contingency plan are addressed. The following components are included:

- Chapter 1: Background on McLennan County Water Planning
- Chapter 2: McL Co Drought Response and Contingency Plan
- Chapter 3: Groundwater-Surface Water Conjunctive Use Plan
- Chapter 4: Arsenic Mitigation Plan

- Chapter 5: Implementation
- Public Outreach

This chapter, Chapter 1, discusses the water supply situation in McL Co and introduces the McL Co Water Resources Group and its role and purpose. It provides an overview of drought impacts in the County, and discuss the County-wide efforts through the McLennan County Water Resources Group to undertake efforts to build a plan for a resilient water supply. Chapter 2 is the McL Co Drought Response and Contingency Plan. It follows the requirements of the US Bureau of Reclamation. Chapter 3 is the McL Co Conjunctive Use Plan. It provides a plan to strategically utilize surface water resources in the county to reduce dependence on and depletion of groundwater resources in the area. Chapter 4, the Arsenic Mitigation Plan, provides a plan to convey surface water from Lake Waco to nine affected systems in McLennan County to dilute arsenic concentrations from the groundwater supply. Chapter 5, Implementation, provides details about executing the plans contained herein. Finally, the Public Outreach Chapter contains items such as sign-in sheets, correspondence, and presentations involved with public interaction on this project.

1.3- Background Information

As background to the chapters, the following two items are discussed in some detail:

- Water resources and the related water supply situation for McLennan County; and the
- McLennan County Water Resources Group (McL Group) and the overall public involvement efforts.

Since the background information provides the framework for the developing the component plans, this information is provided initially.

1.4- Purpose

Establishing a surface water/groundwater conjunction use arrangement between cities, groundwater systems, large and rural water utilities throughout McLennan County for the purposes of:

1. Providing **response** action triggered by McLennan County drought conditions in order to mitigate drought vulnerability for water systems throughout McLennan County; and
2. Building county-wide water supply resiliency to drought, to declining conditions in aquifer pressures, to arsenic conditions in the eastern area of the county, and to risks compounding drought impacts in McLennan County.

The objective of these efforts was to provide long-term benefits to McLennan County that build water supply resiliency to future droughts and conditions particular to McLennan County water suppliers that constrain or may constrain the water supply availability. The goal was to increase reliability of water supplies and propose a means to improve overall water supply management.

1.5- McLennan County Water Resources

The water supply planning for McLennan County addressed the need to preserve groundwater supplies for the future while increasing the resiliency of surface water supplies during drought conditions. The water supplies available to McLennan County include both groundwater and surface water. The surface water supplies include both Lake Waco and to a lesser amount Lake Belton. As described below surface water, on a volume basis, is the primary resource in McLennan County, with the City of Waco providing Lake Waco supplies, a dependable supply of 78,790 acre-feet per year, and the Bluebonnet Water Supply Corporation (WSC) providing Lake Belton to areas in western McLennan County. Groundwater supplies in McLennan County are also critical to both urban areas as well as the rural areas of the County. Using these sources individually, without well-planned inter-connection of the two sources, is not the best path forward for McLennan County to preserve and resilient supplies.

Lake Waco is the primary water supply for the City of Waco and several wholesale water customers in McLennan County. The dependable yield of Lake Waco is recognized as 78,790 acre-feet per year (AF-Yr). The City of Waco has additional surface water supply available from the Brazos River. Based on 1914 water right, one of

the oldest and highest priority rights in the Brazos River basin, the City of Waco has 5,600 AF-Yr of Brazos River water rights.

The City of Waco is a major Wholesale Water Provider (WWP) identified in the Brazos G Regional Plan. The current plan shows the following summary of the wholesale water contracts held by the City of Waco:

Wholesale Water Supplier	Year					
	2020	2030	2040	2050	2060	2070
WACO						
City of Waco	30,114	29,344	28,224	27,059	26,921	28,333
City of Bellmead	0	0	0	0	0	0
City of Hewitt	383	558	877	1,198	1,519	1,833
City of Lacy-Lakeview	1,120	1,120	1,120	1,120	1,120	1,120
City of Woodway	431	657	859	1,083	1,316	1,548
City of Beverly Hills	252	261	268	281	297	312
City of West	1,120	1,120	1,120	1,120	1,120	1,120
City of Robinson	560	560	560	560	560	560
Bold Springs Water Supply (McLennan C-O)	560	560	560	560	560	560
Hilltop Water Supply (McLennan C-O)	97	97	97	97	97	97
Central Bosque WSC (McLennan C-O)	70	70	70	70	70	70
McLennan County Manufacturing	2,503	2,888	3,249	3,618	3,948	4,403
McLennan County Steam Electric (SCEA)	15,000	15,000	15,000	15,000	15,000	15,000
Total Contracts	**52,211**	**52,236**	**52,005**	**51,766**	**52,528**	**54,956**

The Bluebonnet Water Supply Corporation, through a water supply agreement with the Brazos River Authority for 8,301 AF-Yr, has commitments in McLennan County totaling 7,125 AF-Yr, with the Cities of McGregor and Woodway at 2,139 AF-Yr and 1,362 AF-Yr, respectively, having the largest supply contracts.

The current Brazos G Regional Plan shows the following commitments for Bluebonnet Water Supply Corporation in McLennan County:

Wholesale Water Supplier	Year					
	2020	2030	2040	2050	2060	2070
BLUEBONNET WSC						
City of Bruceville-Eddy	938	938	938	938	938	938
Elm Creek WSC	654	654	654	654	654	654
City of McGregor	2,139	2,139	2,139	2,139	2,139	2,139
Moffat WSC	869	869	869	869	869	869
City of Moody	401	401	401	401	401	401
Pendleton WSC	461	461	461	461	461	461
Spring Valley WSC (McLennan C-O)	301	301	301	301	301	301
City of Woodway	1,362	1,362	1,362	1,362	1,362	1,362
Total Contracts	**7,125**	**7,125**	**7,125**	**7,125**	**7,125**	**7,125**

The groundwater supply for McLennan County is primarily Trinity Aquifer supplies although the Brazos River alluvium also has significant storage. The Texas Water Development Board (TWDB) established the Trinity Aquifer groundwater availability used as 20,690 AF-Yr and the storage of the Brazos River Alluvium in McLennan County as 15,023 AF-Yr. The Southern Trinity Groundwater Conservation District (STGCD) in the 2010 *Groundwater Management Plan*, estimated McLennan County Trinity Aquifer use for 2008 as 19,830 AF-Yr. Although the Brazos River alluvium has significant storage current use of these supplies is constrained by a number of factors. The TWDB estimated the alluvium use at only 645 AF-Yr. Baylor University researchers and others are currently studying the Brazos River alluvium that could lead to lessening the constraints on its use.

1.5.1- Current Water Supply Available in McLennan County

The City of Waco has a number of wholesale water contracts. Within the McLennan County, even though Lake Waco, the surface water source, is substantially greater in volume than the current groundwater production, consideration of the distribution in use and sustainability of the two sources was critical. Lake Waco is the supply for the primary source for the City of Waco; groundwater provides supply for both urban areas (see Table 1.5.1-1) in the central area of the County and rural areas in the peripheral, outlying areas.

Table 1.5.1-1: Mixed Supply (GW & SW) Systems		
System	Surface Water Connection	Type of Connection
City of Waco	City of Waco	Base Supply
City of Bruceville Eddy	Bluebonnet WSC	Supplemental Supply
City of Crawford	City of Crawford	Supplemental Supply
City of Lorena	City of Robinson	Base Supply
City of McGregor	Bluebonnet WSC	Supplemental Supply
City of Moody	Bluebonnet WSC	Supplemental Supply
City of Robinson	City of Waco/City of Robinson	Supplemental Supply
City of West	City of Waco	Base Supply
Elm Creek WSC	Bluebonnet WSC	Supplemental Supply
Spring Valley WSC	Bluebonnet WSC	Supplemental Supply
City of Woodway	Bluebonnet WSC, City of Waco	Supplemental Supply
Bold Springs WSC	City of Waco*	Supplemental Supply
Cargill Meat Solutions	City of Waco	Emergency Supply
City of Bellmead	City of Waco	Emergency Supply
City of Hewitt	City of Waco	Supplemental Supply
City of Mart	City of Mart	Supplemental Supply
Hilltop WSC	City of Waco*	Supplemental Supply
Sanderson Farms Inc.	City of Waco	Emergency Supply
South Bosque WSC	City of Waco	Emergency Supply
West Brazos WSC	City of Waco	Emergency Supply
City of Robinson	City of Waco	Supplemental Supply
City of Lorena	City of Robinson	Base Supply
** Connection has been approved, but is not constructed/operable yet.*		

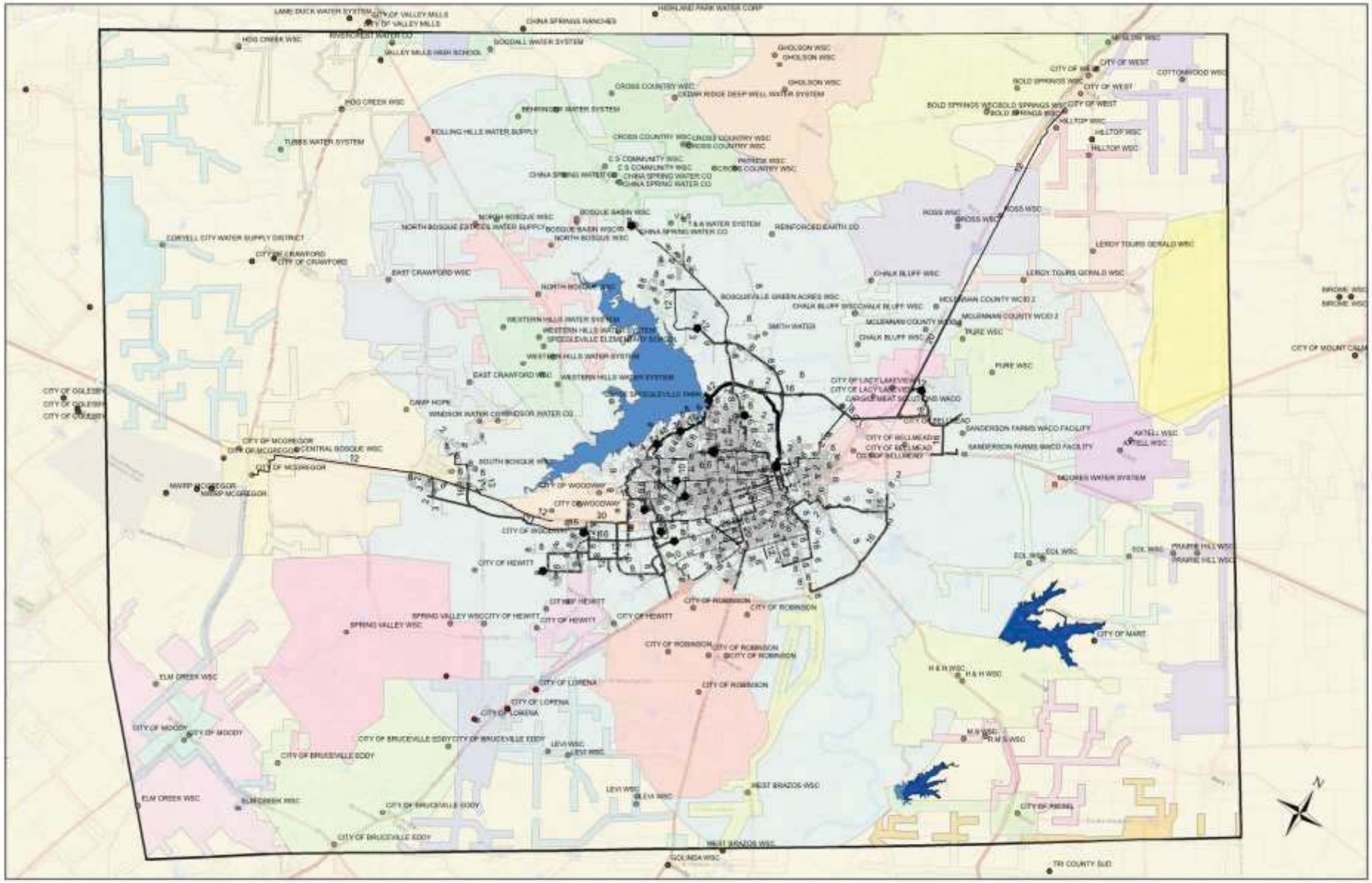
Both the Brazos G Regional Plan, published in December 2015, and the City of Waco's Water Master Plan, dated October 2015, stated that McLennan County groundwater supplies, primarily from the Trinity Aquifer sands, were not sustainable. Referring to the Trinity Aquifer, the Brazos G Regional Plan stated, "Trinity Aquifer is most extensive and has about 79 percent of the supplies.... Although the Trinity Aquifer as a whole can provide 148,441 acft/yr, local areas have experienced very substantial drawdowns and probably will require many wells to be replaced with larger and deeper ones." This statement certainly applies to McLennan County groundwater supplies.

1.5.2- Water Users in McLennan County

The Certificates of Convenience and Necessity (CCN) held by water systems currently operating in McLennan County are shown on Exhibit 1.5.2-1. There are a total of 56

water CCNs. Of these, 33 systems use only groundwater, 3 systems use only surface water, and 20 systems use both groundwater and surface water. The following systems have access to both surface water and groundwater sources. The majority rely on groundwater for their primary supply and use surface water to supplement supply or for emergency situations.

Exhibit 1.5.2-1: McLennan County CCNs



1.5.3- Opportunity for Conjunctive Use

With properly planned interconnection of these two sources of supply, the overall resiliency of McLennan County's supply increases. The interconnected supplies can provide a planned **response** to both the increased demand from growth in McLennan County and the occurrence of prolonged drought. The City of Waco's 2015 Water Master Plan identifies conjunctive use as a viable opportunity for supplementing water supplies.

In addition, conjunctive use of water supply sources provides increased capacity to address other types of constraints on the County's water supply. Specifically, the occurrence of arsenic in several groundwater supplies located in the eastern area of the County and the sporadic occurrence of zebra mussels in Lakes Waco and Belton that could interfere, at least for short-periods, with the production of surface water supplies can be mitigated through the flexibility provided by conjunctive use of the County's two supply sources.

1.6- McLennan County Drought Impacts

The impacts of drought in Central Texas and McLennan County are significant and well documented. These occurrences, which at times are severe and extended, impose stress on water supply systems—imposing diminishing supply conditions during periods of abnormally high water demand—restrict both agricultural operations and water recreation, and stress the aquatic habitat and environmental conditions of lakes and streams as flows diminish, water temperatures increase, and water surfaces recede.

In McLennan County, surface water supplies, particularly Lake Waco and Lake Belton, have reduced the County's vulnerability to drought impacts. While this is true of the City of Waco water system, the outlying areas of McLennan County that are dependent on groundwater are more vulnerable due to increased pumping of the aquifer during drought. The increased pumping triggers a risk to the sustainability, on the short- and long-term, of the Trinity Aquifer.

The **vulnerabilities** caused by drought conditions in McLennan County and the various **responses** and efforts to **mitigate** the impacts are presented in Chapter 2, the *McLennan County Drought Response and Contingency Plan*.

1.6.1- Occurrence, Duration and Severity

For Texas water supply-planners, hydrologists and others managing surface water supplies, the 1951-56 drought conditions have traditionally been markers for "worst-case" condition. Texas experienced its last extreme drought in 2011. Both of the 1951-56 and 2011 droughts were record-setting for McLennan County in terms of lack of rainfall and declines in streamflows.

The long-term dependable yield[1] of major surface water reservoirs throughout Texas, including Lake Waco and Lake Belton, were based on the hydrologic conditions of the 1951-1956 drought. The major factor that would impact (shorten) the dependability of the surface water supply of these two Central Texas reservoirs is the occurrence of a more severe drought than the 1951-56 "drought of record." Therefore, the recent, severe drought conditions of 2011 are of primary concern to water planners, including those that prepared the McLennan County Drought Contingency and Water Supply Resiliency Plan.

From 1908 to 2011, the occurrence of long-term (>12 months), severe droughts in the McLennan County area can be measured as the number of droughts exceeded a -4 on the Palmer Drought Severity Index (PDSI).[2]

1.7- McLennan County Water Resources Group (McL Group)

Since the supplies are in place and water systems dependent on those systems are in operation and have been for many years, there is an opportunity to develop and implement a viable conjunctive use arrangement that would provide these multiple benefits. However, without cooperation of the entities operating those systems, it could not be successful. Under the leadership of McLennan County Judge Scott Felton water

[1] The long-term dependable yield or firm yield of a reservoir is typically defined as the maximum yield that could have been delivered without failure during the historical drought of record.
[2] The Palmer Drought Severity Index (PDSI) uses readily available temperature and precipitation data to estimate relative dryness. It is a standardized index that spans -10 (dry) to +10 (wet).

interests throughout the county voluntarily joined together to discuss and work on successful water need solutions. This group, known as the McLennan County Water Resources Group, began meeting informally in October 2014. Current members of the Group are shown in the box below.

McLennan County Water Resources Group – Membership

Honorable Scott M. Felton, McLennan County Judge	Mayor Kyle Deaver, City of Waco
City of Bellmead	City of Hewitt
City of Lacy Lakeview	City of Lorena
City of McGregor	City of Robinson
City of West	Bluebonnet Water Supply Corporation
Brazos River Authority	Southern Trinity Groundwater Conservation District
Texas Farm Bureau	Baylor University
Community Members:	
Peter Kultgen	All meetings open to the public
Lyndon Olsen, Jr.	

Since its formation, the McL Group has meet regularly, typically every two to three months, to discuss water supplies and needs. The following shows the current members represented on the McL Group. Although not directly under the Texas Open Meeting rules, the meetings of the McL Group are open to the public. It is an open forum, conducted with an agenda but with an opportunity for those attending to ask questions and enter into the discussions.

1.7.1- Purpose of McL Group Defined

One of the first tasks accomplished by the Group was the definition of its purpose. In November 2014, the Group agreed to the statement of purpose shown in the text box at right.

An immediate concern was the lack of representation on regional and State committees, Boards, and advisory bodies that directly or indirectly dealt with McLennan County's water resources. It was important to the Group that McLennan County water plans be initiated and prepared by McLennan County interests. The McLennan County generated plans could then be submitted for consideration by State and regional planning groups. Members have made progress toward this objective with Judge Felton and the City of Waco being represented on the Brazos G Regional Water Planning Group. The preparation of this McLennan County plan fulfills the need to prepare a locally-based plan.

Purpose of the McL Group

Develop water management principals, strategies, and projects to provide a sustainable water supply for McLennan County.

- Ensure local representation at the State and Federal level, including:
  - Region G Regional Water Plan – Advisory Group
  - Brazos River Authority – Board of Directors
    - Brazos River Water Master Stakeholders Committee
  - Groundwater Planning
- Establish an intergovernmental partnership
- Inventory and protect supplies for the County
- Develop, fund, and implement infrastructure projects to meet county wide demand
- Encourage equitable water rates
- Provide for public education and outreach

1.7.2- Function of McL Group- Designation as "Drought Task Force"

Comprised of water managers from throughout McLennan County, the McL Group discusses water challenges for McLennan County and works to carry out the purpose adopted by the group. One important function of the McL Group is its role as the "Drought Task Force" in developing and carrying-out the McLennan County Drought Contingency Plan described in Chapter 2. This designation satisfies very well the Bureau of Reclamation's requirement of a group comprised of "interested stakeholders in the area." Not only are the members of the McL Group interested stakeholders, this group had been meeting regularly, on a voluntary basis, for over a year to discuss the McLennan County water situation.

1.8- Inventory of McLennan County Water Supplies

An important starting point for the McL Group discussion was an overview of the water supply resources available to McLennan County and the demands on those supplies. The McL Group wanted to understand the extent of water supply currently available and, importantly, how reliable and sustainable those supplies would be over time and as the county experiences impacts from drought and other conditions.

The water supply resources for the county as presented to the Group are shown in Figure 1.8-1.

The water resources of McLennan County consist of significant quantities of surface water both within the County, Lake Waco, and imported into the County, from nearby Lake Belton. Lake Waco, which is the primary water supply for the City of Waco, is a reservoir owned and operated by the US Army Corps of Engineers. The City of Waco holds the water rights for the reservoir's water supply (water conservation pool yield), and the Brazos River Authority serves as the non-federal sponsor for the project. The water

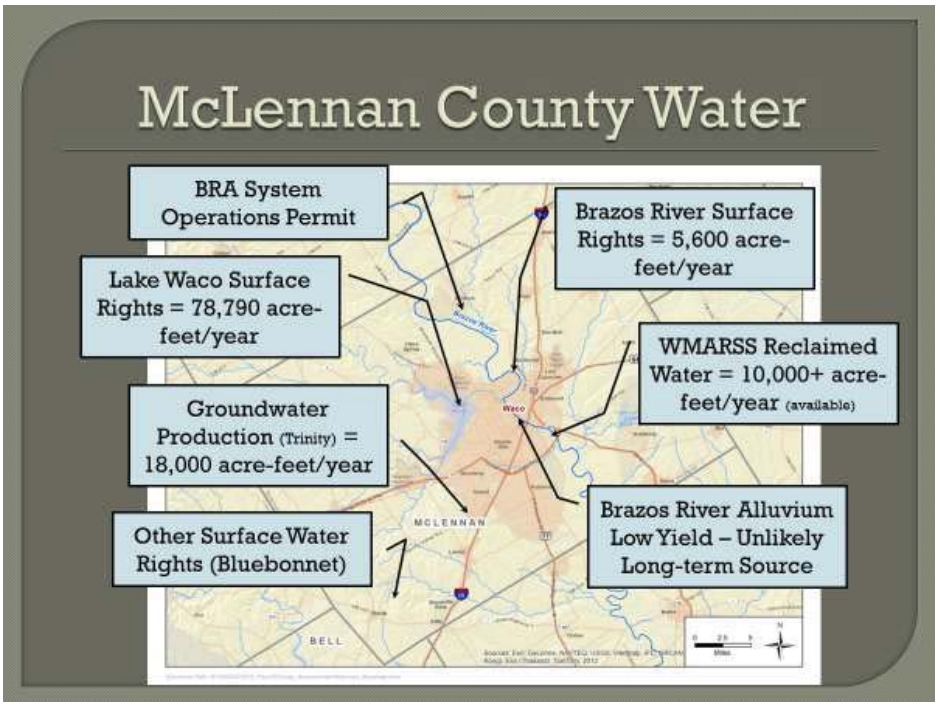


Figure 1.8-1: McLennan County Water Resources

conservation pool was enlarged in 2003 when its elevation was increased seven feet. The current yield of the enlarged Lake Waco is 78,790 acre-feet per year.

The Brazos River and its major tributary, the Bosque River, also provide surface water resources although the water supply use of the river resources is limited. Both the City of Waco and the City of Robinson have rights to use the Brazos River as a water supply source. Waco's water right permit is one of the most senior water rights in the Brazos River Basin, dating to 1914. Currently, Waco does not use the Brazos River for water supply, but it is a vital component for Waco long-range water planning. In the past, the Brazos River flows were diverted for use at Waco's Riverside Water Treatment Plant. The future use of Brazos River supplies are currently being considered by the City and are included in the City's recently completed Water Master Plan.

1.9- Inventory of Water Supply/Water Resources Challenges

Based on information from the City of Waco, Brazos River Authority, recent water master planning studies, and input from City Managers throughout the County, the "water supply challenges" were identified. These challenges were presented to the McL Group as shown in Figure 1.9-1. These challenges were not quantified in detail but were presented as a starting point, a means to orient the Group on water needs and help establish the objectives of a McLennan County water plan.

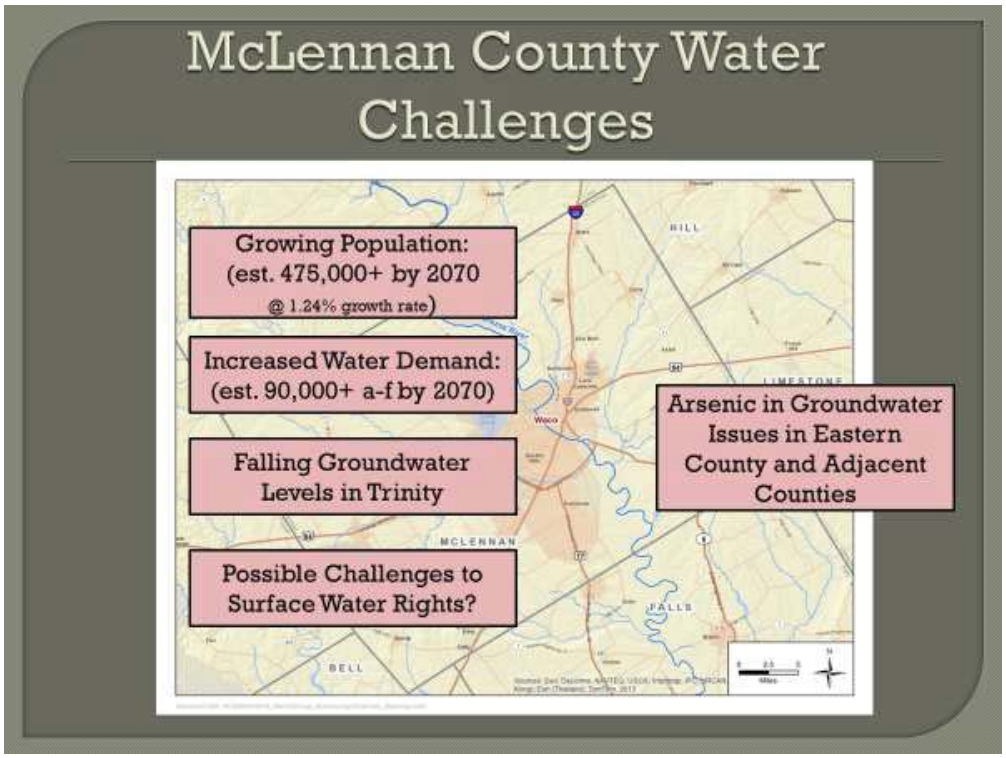


Figure 1.9-1: Water Challenges Presented to the McLennan County Water Resources Group

The challenges range from increased water demand from population growth, declining pressures in the Trinity Aquifer, the primary source of groundwater in the County to arsenic contamination in the groundwater used for water supply in the north and eastern areas of the county. The population of McLennan County, particularly its urban centers, continues to increase and is expected to reach 475,000 people by the year 2070. This will represent an increase in water demands throughout the County of around 90,000 acre-feet per year. Recent groundwater modeling (the Groundwater Availability Model Run 10 [GAM10]) shows significant declines in the Trinity Aquifer hydrostatic pressures particularly in the urban areas that use groundwater predominantly for municipal/industrial uses. These declines in aquifer pressures will continue to drawdown the aquifer levels making the groundwater more difficult and costly to produce. As a result of these declines, the Southern Trinity Groundwater Conservation District or the Texas Water Development Board, following State law, could impose restrictions on additional groundwater permitting and/or production.

1.10- Public Outreach and Involvement

The public outreach for the McL Plan is led by the McLennan County Water Resources Group, the McL Group, but each component of the plan has targeted public involvement appropriate to those component efforts. Public outreach is stated and adopted by the McL Group in its Purpose statement. All meetings of the McL Group have been open to public. Further, the leadership of the McL Group has reached out to specific groups (e.g., the groundwater systems with arsenic contamination problems) to attend specific McL Group meetings where issues of importance to those groups would be presented and discussed.

McLennan County Water Resources Group Meetings

Date	Description
10/8/14	WRG Meeting
11/20/14	WRG Meeting
3/19/15	WRG Meeting
5/21/15	WRG Meeting
7/16/15	WRG Meeting
9/24/15	WRG Meeting
11/19/15	WRG Meeting
3/31/16	County Meeting
4/5/16	Waco City Council Meeting
4/12/16	McL Co Consultant Meeting
10/14/16	Arsenic Systems Meeting with EPA
12/1/16	WRG Meeting
4/27/16	WRG Meeting

For the efforts under the drought contingency planning, Chapter 2, the McL Group designated the group, as a whole, to be the Drought Task Force. Several specific meetings were held with the arsenic contaminated groundwater system representatives to review in detail the "Arsenic Break-out Plan." This included a McL Group meeting with the arsenic group representatives and the head of compliance at EPA Region VI. The outreach efforts were important in compiling the data and information needed to develop the Conjunctive Use Plan, Chapter 3. Separate meetings between the consulting team and individual cities and water systems were conducted to collect current information.

The outreach to the public helped guide the overall approach to the McL Co. Plan as well as the specific activities needed to build each component of the Plan.

CHAPTER 2: DROUGHT RESPONSE AND CONTINGENCY PLAN

2.0- Introduction

The Drought Contingency Plan for the McLennan County area involves a twofold process: first, to recognize, identify and address how certain existing risks and potential constraints to water supply can be overcome and, second, to build a drought contingency plan, using the Six Elements, to be compatible with resolving those local constraints.

The six standard planning elements[3] will incorporate tasks to address the water risk elements unique to the planning area. The Drought Task Force[4] will oversee the effort. A consultant with expertise in drought contingency and water supply planning will conduct the planning. The consultant will work with the Task Force in preparing the Work Plan that will identify how each of the six elements will be addressed and accomplished. Public input on the Work Plan will be included. The **Drought Monitoring** element defines a data collection and evaluation plan; existing drought monitoring information at both the State and regional (Brazos River Authority) level will be used. Extensive historical drought data and daily updates are available from State and national agencies. Drought models used by the Brazos River Authority for the Brazos River Basin and by the Texas Commission on Water Quality for the State will be used as appropriate. The consultant will identify risks in the first step of the **Vulnerability Assessment**; however, the Drought Task Force represents public and environmental interests will provide input and comment. The **Mitigation Actions** and **Response Actions** will be based on input to local water risk and identified drought vulnerabilities. The consultant will build a suggested set of actions, both for mitigation projects and for triggered response actions; this will include an initial prioritization. The actions and suggested priorities will be thoroughly reviewed with the Drought Task Force and adopted by the Task Force.

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[3] USBR

[4] The McL Co Drought Task Force is comprised of members of the McL Co Water Resources Group. The purpose of the Drought Task Force is to ensure a resilient water supply is available during times of drought.

The Plan will address the risks triggered or further aggravated by drought occurrence. These include concerns include:

1) Public health concerns with limited groundwater supplies in rural areas that are contaminated with arsenic levels exceeding the current EPA criteria;
2) Uncertainty of the future impacts of the recent occurrence of zebra mussels in Lake Waco; and,
3) Decline in the Trinity Aquifer due to over-reliance and aggravated by climate changes.

The Response and Mitigation Actions will be thoroughly evaluated, but water reuse has already been identified as a key component to drought response because of its potential to free surface water supplies to the groundwater systems with arsenic problems. The diversity of water interests in McLennan County have been working together to address long-term water resources concerns; the McLennan County Water Resources Group, formed on a voluntary basis in 2014 and consisting of the cities, water supply corporations, Brazos River Authority, groundwater conservation district, local citizen and business interests has been informed of the WaterSMART grant opportunity, supports this application, and will assist with successful development and implementation of the Plan. Pertinent aspects of the McLennan County Plan will be submitted for incorporation in the regional water plan, the Brazos G Water Plan, and the state water plan.

2.1- Organization of the Drought Response and Contingency Plan

2.1.1- Six Required Elements

The components of the McLennan County Drought Contingency Plan include the six elements recognized by the US Bureau of Reclamation as necessary elements of a sound plan. The following key elements are highlighted throughout the County's Drought Contingency Plan:

- **Drought Monitoring**
- **Vulnerability Assessment**

- **Mitigation Actions**
- **Response Actions**
- **Operational and Administrative Framework**
- **Plan Update Process**

2.1.2- McLennan County Distinctive Elements

These elements are considered in conjunction with several unique McLennan County specific elements. These specific elements include the condition of the Trinity Aquifer as monitored by the Southern Trinity Groundwater Conservation District, the occurrence of arsenic contamination above the EPA limit (current MCL) in nine groundwater systems, and the incidental occurrence of zebra mussels in both Lake Belton and Lake Waco.

Distinctive to McLennan County and related to establishing and implementing a drought contingency plan include the opportunity for conjunctive use of surface water supplies to supplement and relieve stress on groundwater systems thereby increasing future availability in terms of sustainability and in response to increased demands during drought conditions. As described in other sections, the County has the surface water supplies available that can be wisely managed in conjunction with groundwater supplies.

2.1.3- Collaboration Elements

McLennan County water managers also bring cooperation and a willingness to develop a workable drought contingency plan. This element of cooperation is critical in the development, implementation and updates to the plan. **Collaboration** is a hallmark of the McLennan County Plan. As described previously, the McLennan County Water Resources Group, consisting of water managers, public and other stakeholders throughout the county, has directed the process. Shortly after the WaterSMART funding was received, the McLennan County Water Resources Group voted to be designated as "Drought Planning Task Force" to fulfill the requirements for stakeholders who want to actively participate in the drought planning effort.

Through regularly scheduled meetings of the Drought Planning Task Force, water interests and other stakeholders are given an opportunity to learn about the McLennan County plan and to participate, ask questions and generally provide input.

2.1.4- Contents and Organization

In order to address all elements properly and to provide the background and perspective on McLennan County drought conditions and impacts, this report is organized and contains the following:

Section 1) McLennan County Drought Impacts to provide background and answer the question, "How will drought affect us?"

- Overview of Drought Severity and Occurrence
- **Vulnerability** Assessment to relate the Drought Risks

Section 2) McLennan County Drought Monitoring to address the question, "How to recognize the next drought in early stages?"

- **Monitoring** to Identify McLennan County Drought Conditions
- Discussion of Existing Drought Contingency Plans
- Use of "triggers" to Identify Appropriate **Response** actions, including the operation of the McLennan County Conjunctive Use Plan

Section 3) McLennan County Drought Mitigation Efforts to answer the question, "How can the county guard and wisely use its water resources during the next drought?"

- Discussion of the Conjunctive Use Plan to **Mitigate** Future Drought Impacts
- Identification of **Emergency Actions** for Unanticipated Situations

Section 4) **Operational Framework** to Identify Responsibilities in Implementation

- Conducting Monitoring to Identify Triggers and Response Actions
- Discussion and Schedule for **Updating the Plan**

2.2- McLennan County Drought Impacts

The impacts of drought in Central Texas and McLennan County are significant and well documented. These occurrences, which at times are severe and extended, impose stress on water supply systems—imposing diminishing supply conditions during periods of

abnormally high water demands—restrict both agricultural operations and water recreation, and stress the aquatic habitat and environmental conditions of lakes and streams as flows diminish, water temperatures increase, and water surfaces recede.

In McLennan County, surface water supplies, particularly Lake Waco and Lake Belton, have reduced the County's vulnerability to drought impacts. While this is true of the City of Waco water system, the outlying areas of McLennan County that are dependent on groundwater are more vulnerable due to increased pumping of the aquifer during drought. The increased pumping triggers a risk to the sustainability, on the short- and long-term, of the Trinity Aquifer.

The long-term dependable yield[5] of major surface water reservoirs throughout Texas, including Lake Waco and Lake Belton, were based on the hydrologic conditions of the 1951-1956 drought. The major factor that would impact (shorten) the dependability of the surface water supply of these two Central Texas reservoirs is the occurrence of a more severe drought than the 1951-56 "drought of record." Therefore, the recent, severe drought conditions of 2011 are of primary concern to water planners, including those that prepared the McLennan County Drought Contingency and Water Supply Resiliency Plan.

The **vulnerabilities** caused by drought conditions in McLennan County and the various **responses** and efforts to **mitigate** the impacts are presented below.

2.2.1- Occurrence, Duration and Severity

For Texas water supply-planners, hydrologists, and others managing surface water supplies, the 1951-56 drought conditions have traditionally been markers for the "worst-case" condition. Texas experienced its last extreme drought in 2011. Both of the 1951-56 and 2011 droughts were record-setting for McLennan County in terms of lack of rainfall and declines in streamflows.

2.2.1.1- Precipitation Records

In terms of precipitation, the 2011 drought resulted in a lower annual rainfall statewide than any of the annual amounts for the 1951-56 drought. "A record low statewide

[5] The long-term dependable yield or firm yield of a reservoir is typically defined as the maximum yield that could have been delivered without failure during the historical drought of record.

average annual precipitation of 11.27 inches for the period 1895-2011 was recorded during the 2011 water year; the prior record low statewide average annual precipitation was 13.91 inches during the 1956 water year."[6] Correspondingly, for the year 1956 Texas received about 50 percent of its normal annual precipitation; in 2011 this dropped to about 40 percent of normal.[7]

2.2.1.2- Temperature Records

In terms of temperature extremes, Texas and McLennan County experienced, as shown in *Figure 2.2.1.2-1* taken from a recent National Oceanic and Atmospheric Administration (NOAA) report[8], shows the number of days the temperature exceeded 100° F. The summer of 2011, according to the NOAA constituted a "heat wave" of significant historic proportion.

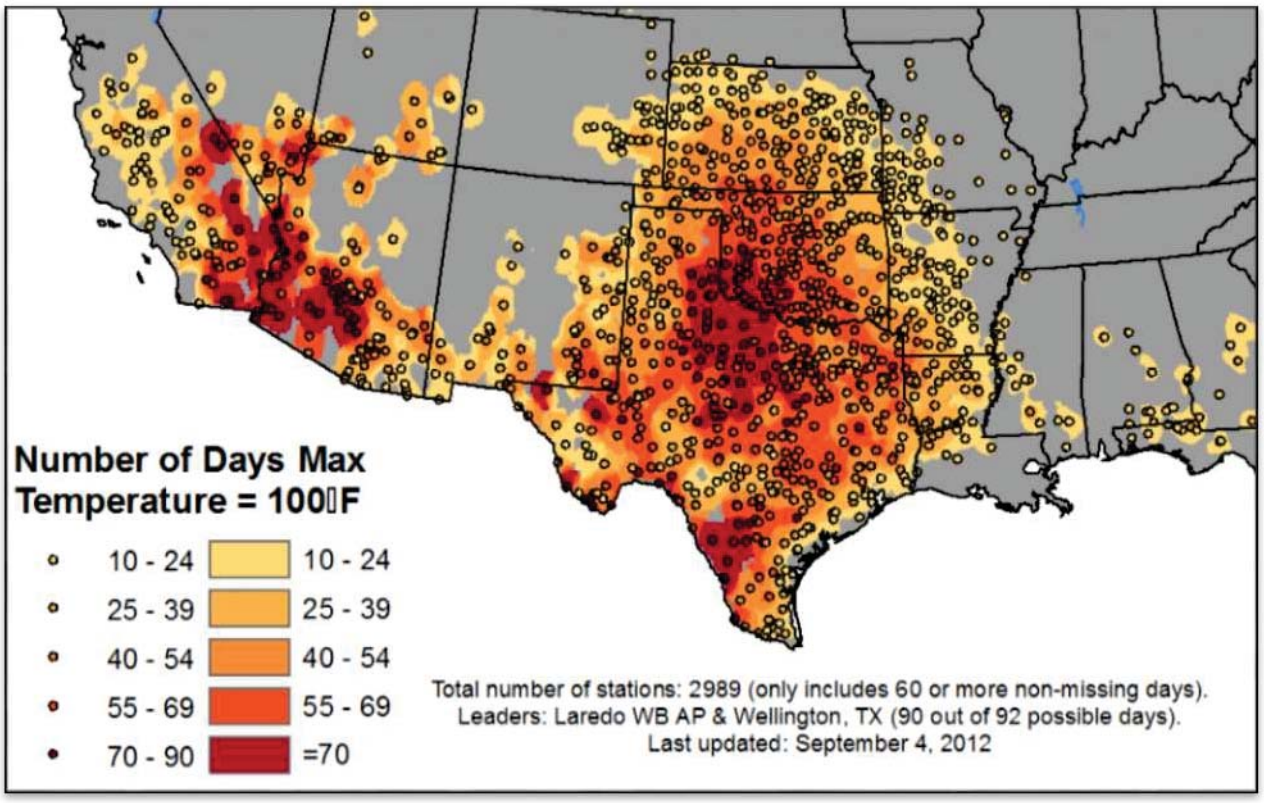


Figure 2.2-1 *Persistent Heat - Number of Days in Summer 2011*

[6] USGS Scientific Investigations Report 2013-5113, *A Historical Perspective on Precipitation, Drought Severity, and Streamflow in Texas during 1951-1956 and 2011*. Reston, VA. 2013.
[7] *Ibid.*
[8] NOAA Technical Report NASDIS 142-4, *Regional Climate Trends and Scenarios for the U.S. National Climate Assessment; Part 4. Climate of the U.S. Great Plains*, 2013.

The McLennan County area of Central Texas had 90 days of excessive high (> 100° F) in calendar year 2011. This 'heat wave' included 44 consecutive days of 100° F, occurring in the period from June 30 to Aug 12. This is the longest streak of 100° F days for the climatologic record of McLennan County (1898 to present). The entire month of July 2011 had high temperatures equal or exceeding 100° F. Figure 2.2-2 presents the temperature records for Waco, Texas prepared by the National Weather Service of the NOAA (Dallas/Fort Worth Forecasting Center).

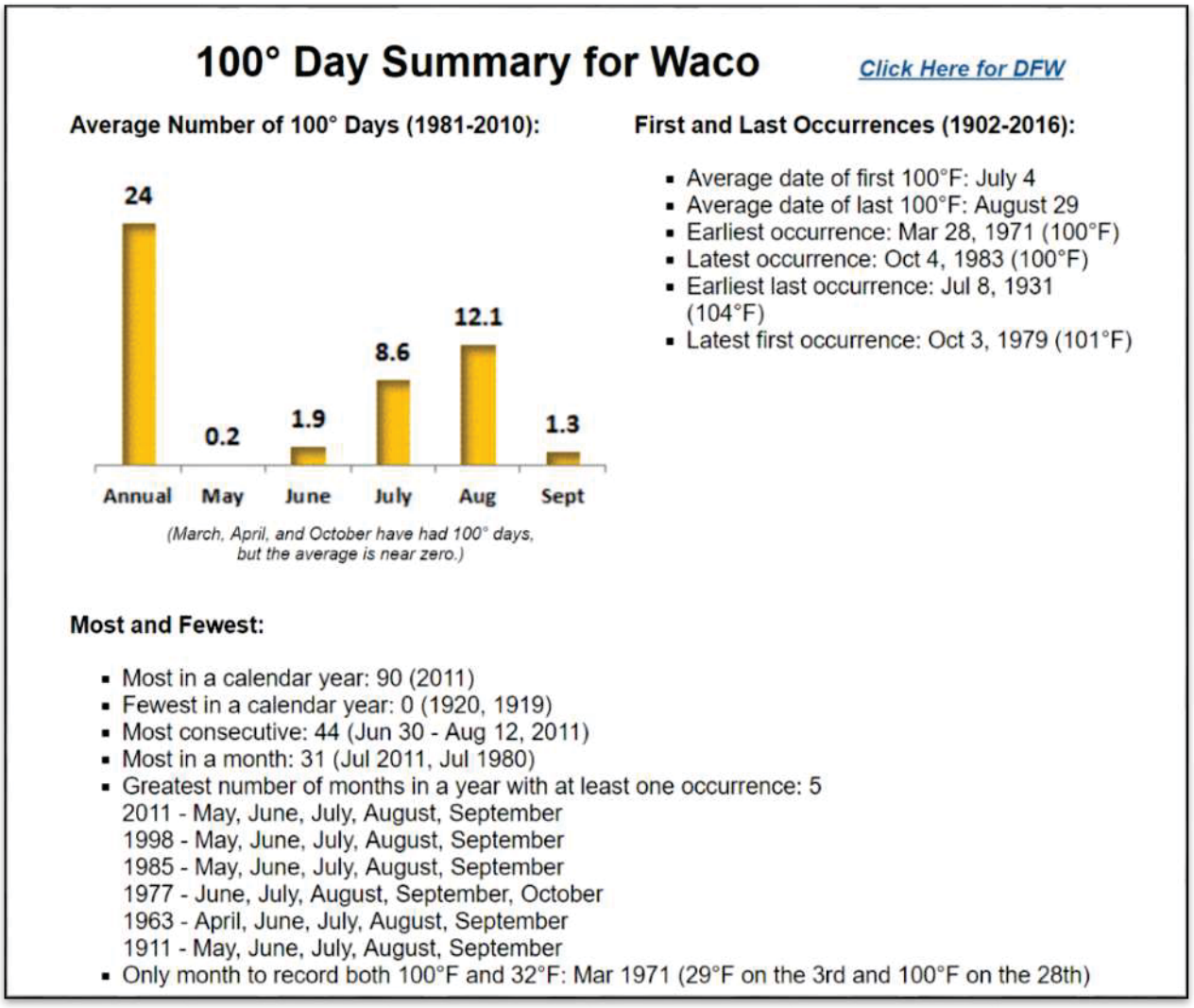


Figure 2.2-2 *Temperature Records for Waco, Texas (NOAA)*

2.2.1.3- Drought Onset and Decline

It is also pertinent to this plan to recognize that the onset of drought, even severe drought, can occur in a relatively short period of time. Again, referring to the USGS report cited above, the onset of the 2011 drought occurred between October 2010, when none of the state was classified as being in a drought, and April 2011, when "...nearly all of Texas was in a severe to extreme drought, by July 2011, more than 75 percent (of Texas) was in an exceptional drought."[9] The USGS presented the variation of drought magnitude over time graphically (see Figure 2.2-3; USGS Report Figure 3). The rapid onset and decline in "exceptional drought" conditions should be noted. **This rapid onset of drought in Texas, including McLennan County, is a key consideration in developing an effective drought contingency and response plan.**

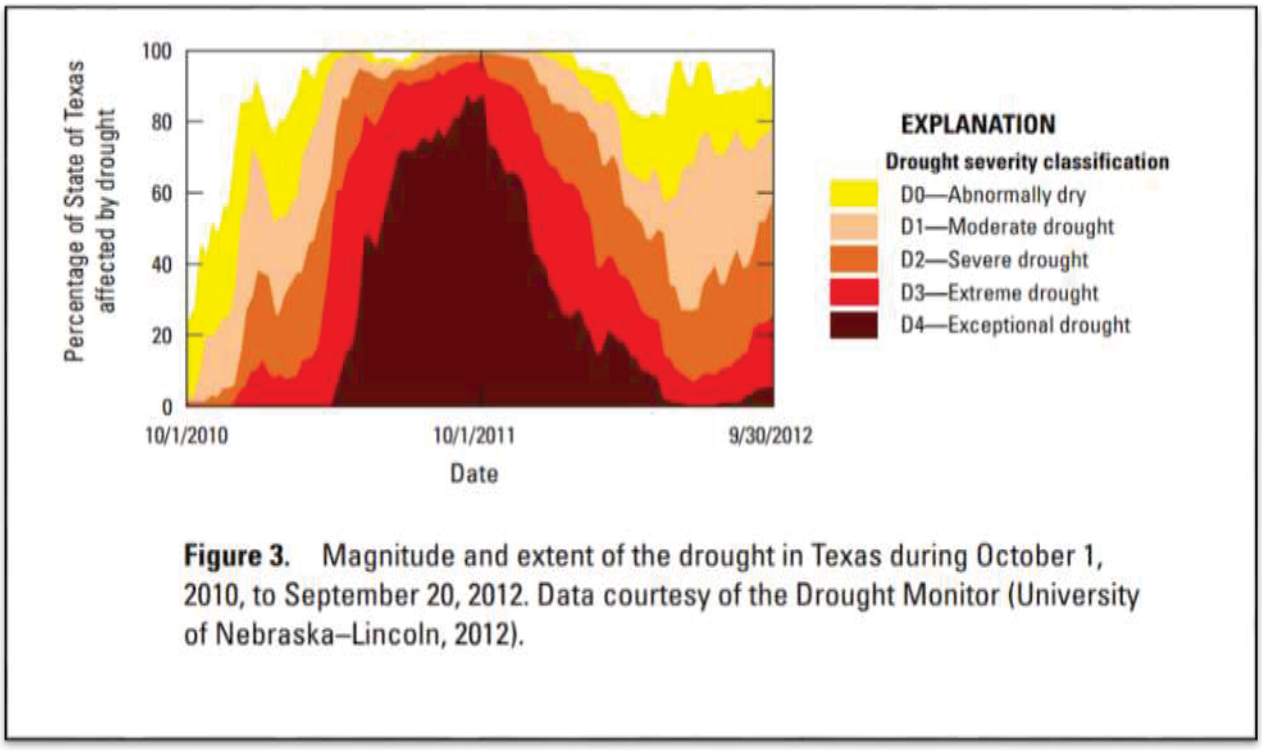


Figure 3. Magnitude and extent of the drought in Texas during October 1, 2010, to September 20, 2012. Data courtesy of the Drought Monitor (University of Nebraska–Lincoln, 2012).

Figure 2.2-3

For purposes of the McLennan County Plan, these two record-setting drought events are the markers that are used to define "worst case" condition in identifying **vulnerabilities** and prescribing **mitigation** or **response** actions needed.

[9] *Ibid.*

From 1908 to 2011, the occurrence of long-term (>12 months), severe droughts in the McLennan County area can be measured as the number of droughts that exceeded a -4 on the Palmer Drought Severity Index (PDSI)[10]

For McLennan County, the PDSI data for the occurrence of severe droughts between 1900 and 2011 is shown in Figure 2.2-4.

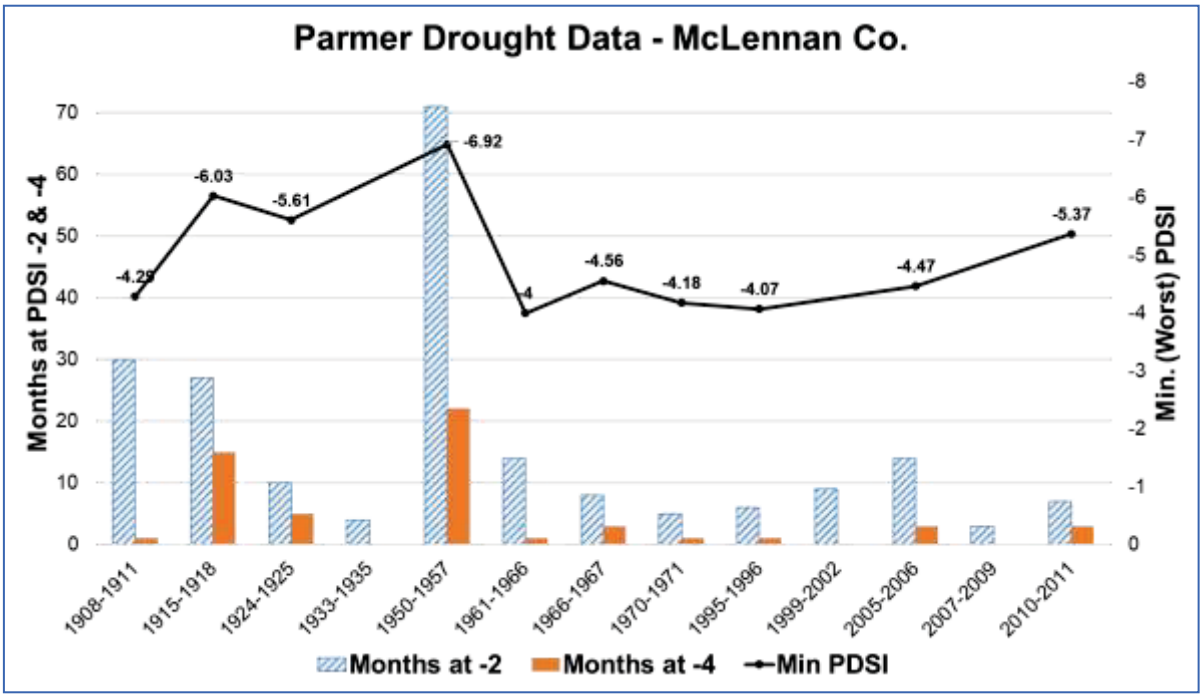


Figure 2.2-4

2.2.2- Drought Vulnerabilities – Central Texas and McLennan County

The NOAA classifies several types of drought—all occur in Texas and McLennan County, and each has associated **vulnerabilities** based on the type of impacts. NOAA distinguishes[11] a *meteorological drought* based on the measured severity and duration of a dry period.

[10] The Palmer Drought Severity Index (PDSI) uses readily available temperature and precipitation data to estimate relative dryness. It is a standardized index that spans -10 (dry) to +10 (wet).
[11] NOAA Technical Report NASDIS 142-4, *Regional Climate Trends and Scenarios for the U.S. National Climate Assessment; Part 4. Climate of the U.S. Great Plains*, 2013.

- *Meteorological droughts* occur frequently, nearly every year, but are of short duration. The **vulnerabilities** to meteorological drought is the least severe because of the temporary and transitory nature of their occurrence.

- *Agricultural drought* is measured by the dryness relative to the needs for water for watering crops. Vulnerability to this type of drought in McLennan County relates to loss of pasture and high-quality grazing area for cattle. Non-irrigated crops will be stressed under these conditions, often to the degree of loss of crop yield. Local surface water "tanks" used for cattle and irrigation are vulnerable to agricultural drought.

  Loss of yield and requirements for purchasing feed or importing hay for cattle is costly to Central Texas and McLennan County agriculture. Agricultural losses in Texas due to the 2011 drought are estimated at over $5.2 billion.

- *Hydrological* drought occurs when water supply is reduced due to periods of precipitation shortages. The hydrologic storage systems are negatively impacted, with less water available for irrigation, navigation, hydropower and recreation.

The 2011 drought in the southern Great Plains was the most intense event in that area in the observational record extending back to 1895, based on the Palmer Drought Severity Index in Texas, the summer of 2011 was both the warmest on record and the driest on record.

2.2.3- McLennan County – Circumstances and Local Conditions Potentially Increasing Water Supply Vulnerability

Several risks associated with circumstances external to drought conditions exist in McLennan County. Acting alone, the relative risk of these situations compared to the potential drought impact on surface water supplies is relatively low. However, adding these impacts during drought conditions increases the susceptibility of water supplies to drought impacts.

Of specific concern in McLennan County are two outside issues: zebra mussel impacts on raw water intake and conveyance; and, arsenic contamination levels in several small groundwater systems in the eastern portion of the County.

The following subsections discuss the potential increased vulnerability due to these outside factors.

2.2.3.1- Surface Water Augmented Vulnerabilities – Zebra Mussels

As shown in Figure 1.3.1-1, since the late 1980's, zebra mussels have spread rapidly throughout the northeast United States and Mississippi Valley and into Texas. Zebra mussels invaded Texas in 2009 and have continued to spread throughout the State.

Water Supply Vulnerability. From a water supply perspective, zebra mussels, due to very rapid and prolific population growth, have constricted the capacity of conveyance pipelines, interfered with values and control mechanisms, resulted in operation impediments and accumulations of foul-smelling mussel shells. During drought conditions that occur contemporaneous with the presence of an established zebra mussel population, water supply can be further threatened due to constrictions in the raw water intake and/or need to employ chemical or other controls to reduce the zebra mussel accumulation.

Local Water Supply Occurrence. Zebra mussels were found in both Lake Belton and Lake Waco. Adult zebra mussels were reported at Lake Belton in September 2013 and have continued to be found. At Lake Waco, there was an isolated incident resulting in the detection of zebra mussels in October 2014; unlike Lake Belton, subsequent monitoring did not detect the presence of adult or juvenile zebra mussels. Both reservoirs are susceptible to continued or future proliferation. Monitoring is on-going each spawning season by the Texas Parks and Wildlife Department.

At Lake Belton where the zebra mussel population continues to be well-established, water purveyors are considering control methods that will ensure the capacity of the intake structures and pumps are not limited. At Lake Waco control methods were employed in the lake at the site of the potential infestation and continued monitoring has not detected the presence of zebra mussels.

Drought Response – Mitigation Actions. The methods of control of zebra mussels in reducing or eliminating the water supply vulnerabilities are well documented and, particularly in the Great Lakes and Mississippi Valley, control measures have been in operation for many years. Zebra mussels, particularly at the veliger (larval) stage, are highly susceptible to chlorine and other oxidants as well as a wide array of other treatment methods. Based on this experience, the means to control zebra mussels at both Lakes Belton and Waco are available.

The City of Waco currently monitors Lake Waco for zebra mussels and can initiate chlorination at the raw water intake to eliminate accumulations (colonization) in the raw water conveyance facilities. In 2014 when zebra mussels were accidentally introduced into Lake Waco, the City employed measures immediately to isolate the area where the zebra mussels were introduced (see Figure 1.3.1-2). Oxidants are available that can safely be added at the raw water intake that will expiate zebra mussels without causing harm to Lake Waco and its environment.

At Lake Belton, the Bell County Water Control and Improvement District No. 1 has operated its raw water intake since 2013 without interference from zebra mussel colonization. In order to be prepared for future problems, the District is considering means to add zebra mussel controls at its intake structure.

2.2.3.2- Groundwater Augmented Vulnerabilities – Arsenic Contamination

In 2001, when EPA lowered the Maximum Contaminant Level (MCL) for arsenic from 50 parts per billion (ppb) to 10 ppb several small groundwater systems in McLennan County exceeded the MCL. The arsenic occurrence in McLennan County is described in more detail in the "Arsenic Break-out Plan," Component Three of the *McLennan County Drought Contingency and Water Supply Resiliency Plan*.

Vulnerability during Drought Conditions – The McLennan County Plan lays out how treated surface water will be provided to the nine groundwater systems currently exceeding the arsenic MCL. Through water supply agreements with the City of Waco, treated Lake Waco water will be provided for blending in quantities sufficient to reduce the arsenic levels to concentrations safely below the MCL.

Unlike the conjunctive use system described in Chapter 3 of the McLennan Plan, where surface water use could be restricted under specific drought stages (see Chapter 3, Section 3.3.1 and other), the surface water provided for reducing arsenic concentrations cannot be interrupted. The MCL for arsenic should not be exceeded under any circumstances. However, the quantity of surface water required for mitigating the arsenic impacts is minor relative to total capacity of the City of Waco's water supply. A special provision is included in this McLennan County DCP to note that surface water to the arsenic-impacted systems cannot be reduced during drought conditions.

2.2.3.3- Augmented Vulnerability – Future Drought Conditions/Climate Variation

A third external risk that adds to McLennan County's drought vulnerabilities is the potential for future drought conditions to increase in severity due to changing climate conditions in Central Texas.

The NOAA report cited above includes a discussion of climate variation scenarios that could occur in the future based on high and low emission conditions[12]. The future scenarios are based on the 2013 National Climate Assessment report modeling. For the Great Plains area the report shows a range of potential changes in the future (2041-2070), with the more drastic increases or changes associated with the high emission condition. The following exhibits are taken from the modeling results as presented in the NOAA 2013 report. A star (★) has been added to each set of maps to show the general location of McLennan County.

Depending on the emissions generated in the future, the NOAA has identified the following trends that will need to be considered in future updates to the McLennan County DCP:

[12] The "high" and "low" emission conditions as described in the NOAA report (NOAA 2013). The high scenario "describes a very heterogeneous world. The underlying theme is self-reliance and preservation of local identities, which results in continuously increasing global population. Economic development is primarily regionally oriented and per capita economic growth and technological change are more fragmented and slower than in the other storylines" (IPCC 2000). The low emissions scenario describes "a convergent world with…global population that peaks in mid-century and declines thereafter…but with rapid changes in economic structures toward a service and information economy…the introduction of clean and resource-efficient technologies. The emphasis is on global solutions to economic, social, and environmental sustainability…."

- The projected number of "hot" days will increase in the future (2041-2070) by a moderate number of 13 or less for the McLennan County/Central Texas area under the "low" emissions scenario and more concerning increase of 16 or more days under the "high" emissions scenario.
- Important to drought conditions, the projected number of consecutive dry days will increase modestly by 1-2 days under the "low" emissions scenario as compared to 2-4 days under the "high" emissions scenario.
- Heavy precipitation days will decrease but not significantly: under both scenarios the change will be less than 0.4 days.

If these scenarios are sound indicators of future climate variation, it would be anticipated that the drought conditions would become more severe and prolonged with the increased number of hot days. The PDSI will reflect these conditions when present. Updates to the McLennan County DCP and other DCPs will be required.

Current drought monitoring as discussed below will be important in identifying future climate trends and variations. Changes to drought triggers or other DCP responses can be developed to reflect the water supply risk associated with identified changes in climate.

2.3- McLennan County Drought Monitoring

2.3.1- Data Collection & Drought Monitoring

A number of sources provide readily accessible data and information on drought conditions in Central Texas and McLennan County. Working through the McLennan County Drought Planning Task Force, the partners that routinely provide, assemble and evaluate drought-related data and information were identified. The types of pertinent information/data collected are used to identify drought response and trigger actions to implement drought conservation and other measures.

2.3.2- Pertinent Drought Information Collected and Monitored

The following are pertinent drought information/data used to monitor drought and to identify triggers or stages for response actions (in local and regional drought contingency plans):

- Lake elevations – as a measure of surface water supply impact (primarily Lake Waco; secondarily Lake Belton);
- Palmer Drought Severity Index (PDSI) – as an index of daily air temperatures combined algorithmically with area precipitation data and available water in soil layer;
- Temperature (consecutive days of 100 degree or "heat wave" indicators); and,
- Local conditions (effective storage, etc.) of the local water supply and distribution system.

These data and information are not only specific to McLennan County but also applied to McLennan County to identify drought stages or triggers. The application is unique to McLennan County because of the surface water/groundwater conjunctive use system described in a separate Component of this Plan.

2.3.3- Drought Data Collection Agencies

Considering these "special conditions" for McLennan County, the following table shows the agencies providing data or information, type of data, and the records or information typically collected. Drought-related data for McLennan County is readily available from both federal and Texas agencies identified in the table.

With respect to water system-specific impacts, the individual water systems in McLennan County would provide data or information on those impacts. These impacts could include all supply-restricting conditions within the Public Water System for supply, treatment and delivery, including conditions that would exacerbate drought impacts such as water quality conditions (e.g., arsenic contamination in groundwater systems that exceeds the EPA Maximum Contamination Level) and conditions affecting access

to water supply (e.g., potential accumulation of zebra mussels that would restrict raw water conveyance from Lake Waco or Lake Belton).

Data and Drought Monitoring Agency Partners

Data Type	Record/Information Needed or Desired	Data Collection Agencies
Drought Impacts	Water Supply Availability (lake elevations), PDSI, temperature, soil moisture, Groundwater conditions/pressures, drought related regulatory actions	US Army Corps of Engineers (Fort Worth District); NOAA, USGS; Texas Water Development Board (TWDB); Texas Commission on Environmental Quality (TCEQ); BRA; Southern Trinity GWCD; City of Waco
Public Water Systems Drought Contingency Triggers or Stages – Drought Response Conditions	Public water system drought contingency response to drought impacts on water system	Various Public Water Systems in McLennan County
Effective Drought Conditions (identifying drought onset and ending conditions)	For McLennan County measures of degradation & improvement in drought-related conditions	US Drought Monitor; NOAA Climate (drought monitor); TWDB (Water Data for Texas); TCEQ; BRA; and several others
Drought Severity Conditions	Correlation of drought conditions, extent and duration, to water systems in McLennan County	US Drought Monitor; TWDB (Water Data for Texas)
"Correlating Tables"	Correlating McLennan County drought response to available surface water for conjunctive use system	McLennan County & Drought Planning Task Force

2.3.4- Drought Monitoring Partners

For purposes of the McLennan County Drought Contingency Plan (McLennan DCP), the local water systems with TWDB/TCEQ-approved drought contingency plans and the Southern Trinity GWCD are important monitoring partners. These agencies are responsible for monitoring drought conditions and assessing the impacts and response under their drought contingency plan and/or ordinances.

As mentioned above, several retail and wholesale water purveyors operating within McLennan County have State of Texas approved Drought Contingency Plans (DCP):

- Brazos River Authority
- City of Robinson
- City of Waco
- City of Woodway
- City of Hewitt

These agencies and cities have developed DCPs specifically for the conditions of the individual water system. The TCEQ requires all wholesale and retail public water systems serving 3,300 connections or more to submit and have approved a DCP. For approval, the DCP must conform to the requirements of the Texas Administrative Code §288(b). DCPs must be updated every five years.

The approach adopted in these individual DCPs differs; however, the DCPs have a number of items in common:

- Drought stages or triggers with responses specified;
- Specific targets for water use reductions (public water systems);
- Assigned responsibility or authority for implementing the DCP;
- Descriptions and/or measures for assigning stages or triggers;
- Notification procedures;
- Enforcement procedures;
- Description of exceptions and procedures for granting exceptions;
- Public input to the plan;
- Means for updating the DCP;
- Means of coordination with Brazos G Regional Planning; and
- Official adoption of the DCP by the City Council or governing Board.

The McLennan County Drought Contingency Plan (McLennan DCP) incorporates the approved DCPs in McLennan County and relies on those agencies implementing DCPs

in McLennan County to provide monitoring and drought trigger information. The McLennan County Drought Planning Task Force oversees the coordination efforts.

The McLennan DCP provides recommended drought response actions, at stages corresponding to the Waco DCP, for water systems that are not required to have an approved DCP.

2.3.5- Correlation between Drought Stages/Triggers and Conjunctive Use

The relationship between drought responses and the availability of surface water must be recognized in both the drought contingency and conjunctive use implementation plans. Briefly stated: as drought conditions become more severe and the drought responses more restrictive on water use, the restrictions on the availability of surface water supply for conjunctive use in McLennan County will be needed.

There is a correlation between surface water availability, particularly from Lake Waco, and increased drought severity; restrictions on surface water availability will limit availability for conjunctive use with groundwater. As surface water becomes more limited in drought, groundwater systems participating in the McLennan County Conjunctive Use System will need to compensate for these surface water restrictions either by increasing groundwater pumping, where possible, or implementing drought response measures to reduce water demand.

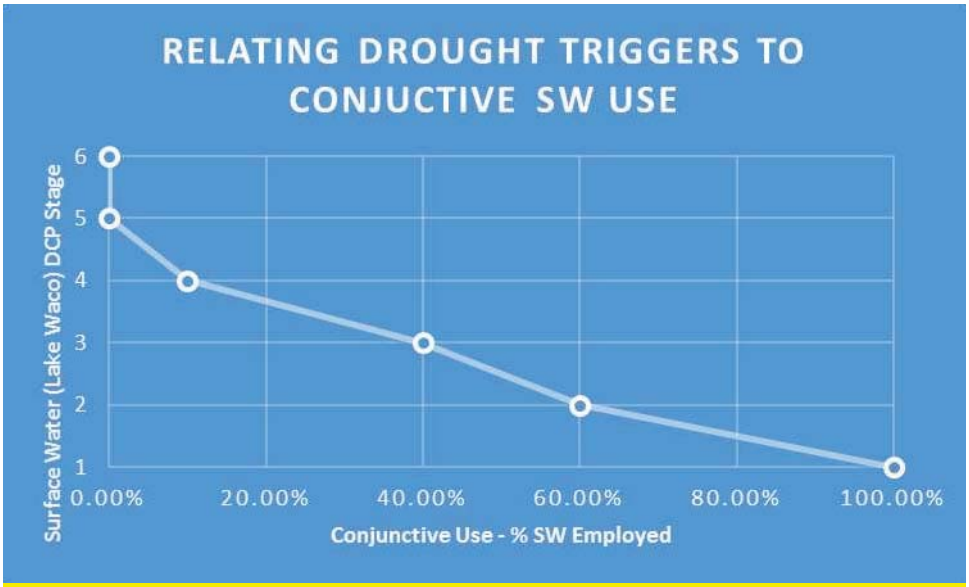


Figure 2.3-1 Lake Waco Drought Stage & Available SW for Conjunctive Use

Figure 2.3.5-1 shows the relationship between drought stage encountered at Lake Waco, as monitored by the City of Waco, and the percent of Lake Waco surface water available to be employed or used in the McLennan County Conjunctive Use System.

Exhibit 2.3.5-1shows the relationship between the McLennan County drought triggers (response actions) and the City of Waco's Drought Contingency Plan drought stage triggers. As the drought stage increases in severity the corresponding availability of Lake Waco water for conjunctive use in McLennan County is reduced. The exception to this reduction in Lake Waco water use is the supply dedicated to the McLennan County water systems with arsenic concentrations that must be reduced by dilution to comply with the MCL. These systems must continue to receive Lake Waco treated water for dilution even during severe drought conditions.

Exhibit 2.3.5-2 provides a description of the McLennan County response action corresponding to each drought stage the Waco Drought Contingency Plan. The availability of Waco water for conjunctive use is reduced and finally eliminated as the drought stages progress in severity.

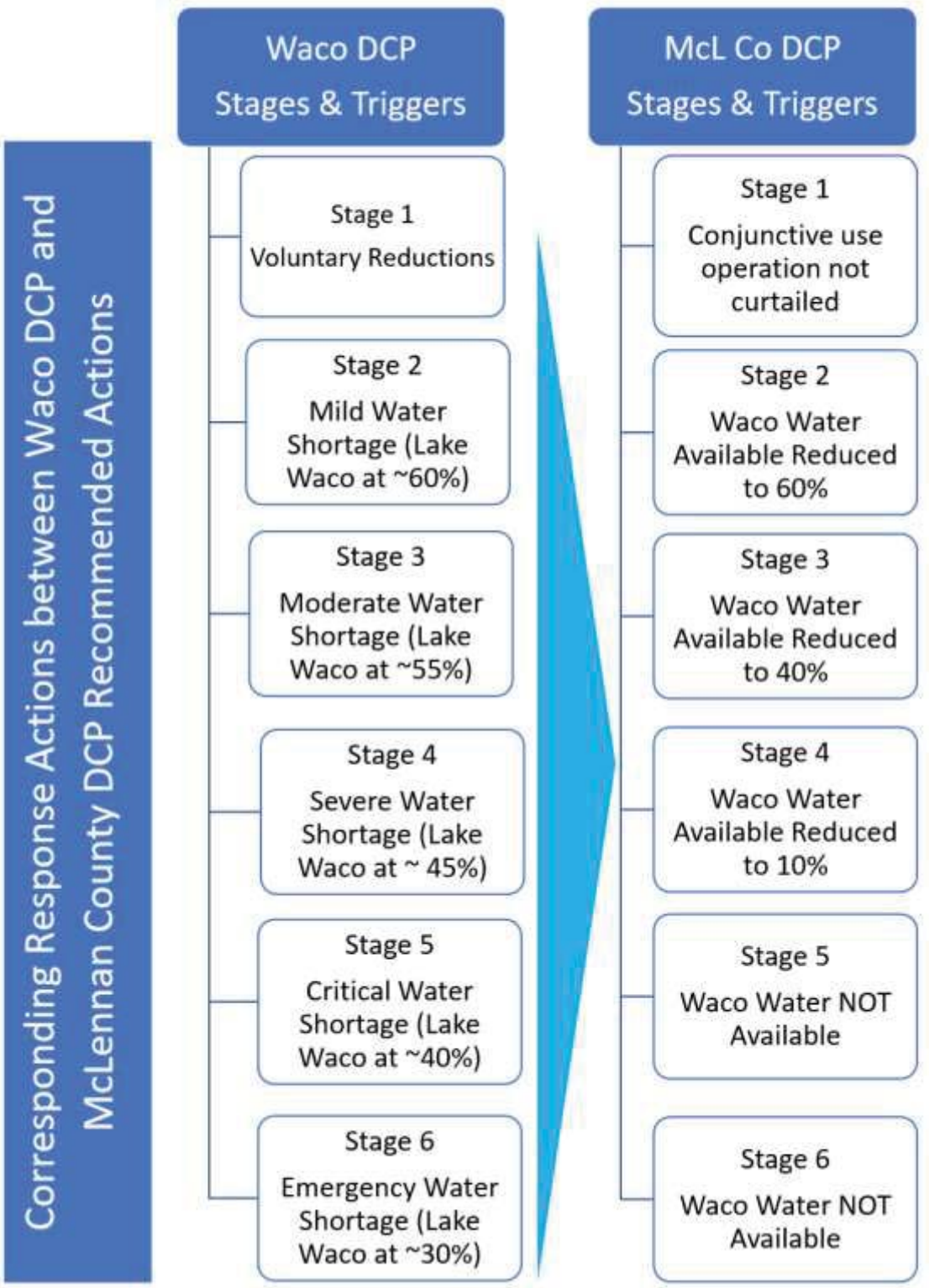

Corresponding Response Actions between Waco DCP and McLennan County DCP Recommended Actions
Waco DCP Stages & Triggers
Stage 1 Voluntary Reductions
Stage 2 Mild Water Shortage (Lake Waco at ~60%)
Stage 3 Moderate Water Shortage (Lake Waco at ~55%)
Stage 4 Severe Water Shortage (Lake Waco at ~ 45%)
Stage 5 Critical Water Shortage (Lake Waco at ~40%)
Stage 6 Emergency Water Shortage (Lake Waco at ~30%)
McL Co DCP Stages & Triggers
Stage 1 Conjunctive use operation not curtailed
Stage 2 Waco Water Available Reduced to 60%
Stage 3 Waco Water Available Reduced to 40%
Stage 4 Waco Water Available Reduced to 10%
Stage 5 Waco Water NOT Available
Stage 6 Waco Water NOT Available

Exhibit 2.3-1

Exhibit 2.3-2. McLennan County Drought Contingency Response Actions Triggered by Drought Stage and Corresponding to Lake Waco Drought Stage Conditions

Drought Stage	Trigger	Response Actions
1 – Water Watch	Yearly for the period May 1 – September 30	Wise water use is encouraged during this stage. Systems should practice good water management techniques; homeowners to use both inside and outside water smartly and without waste. Consider landscape plants and features that will require less water. Groundwater systems in McLennan County should follow the recommendations of the Southern Trinity Groundwater Conservation District in the wise use of groundwater.
2 – MILD Water Shortage	A decrease in the Lake Waco reservoir level to 452 msl (at which the reservoir is at about 60% of its capacity).	Available Waco water for the McLennan County Conjunctive Use system is restricted to 60% of total committed amounts; Irrigation of outdoor lawns and landscape restricted to every third day as a limit; The County shall limit use of water for purposes to those activities necessary to maintain the public health, safety and welfare and any computer-controlled irrigation systems that incorporate evapotranspiration data in setting irrigation run times. The Public Water Systems shall note any incidents observed of "excessive watering" and notify to customers. "Excessive watering" occurs where run-off extends for a distance greater than ten (10) feet from the customer's property or where there is washing or hosing down of buildings, sidewalks, driveways, patios, porches, parking surfaces or other paved surfaces. The Southern Trinity Groundwater Conservation District's advisories for wise operation of groundwater systems and conservation of groundwater should be followed by McLennan County groundwater-based systems.
3 – MODERATE	A decrease in the Lake Waco reservoir	Available Waco water for the McLennan County Conjunctive Use system is restricted to

Water Shortage	level to 450 msl (at which the reservoir is at about 55% of its capacity)	40% of total committed amounts. Non-essential water use shall be restricted. Public Water Systems should impose a mandatory limit on irrigation to a two (2) days per week at designated, low-evaporation times. Hand-watering with hose or five (5) gallon bucket allowed. The Southern Trinity Groundwater Conservation District's advisories for wise operation of groundwater systems and conservation of groundwater should be followed by McLennan County groundwater-based systems. As deemed necessary, the STGCD will issue special advisories in response to drought conditions or other factors impacting groundwater systems.
4 – SEVERE Water Shortage	A decrease in the Lake Waco reservoir level to 446 msl (at which the reservoir is at about 45% of its capacity)	Available Waco water for the McLennan County Conjunctive Use system is restricted to 10% of total committed amounts. Public Water Systems should impose a mandatory limit on irrigation to a two (2) days per week but restricted to designated, low-evaporation times. Newly constructed swimming pools, Jacuzzis, spas, ornamental ponds, and fountains may be filled once. Watering of newly installed landscaping is exempt from Stage 4 restrictions for no more than one (1) month from the date of planting. After the first month, the landscape water day's schedule and hourly restrictions must be followed. Excessive water run-off from any landscaped area onto streets, alleys, or parking lots is prohibited. Run-off is excessive when it extends for a distance greater than ten (10) feet from the customer's property.

		Public Water Systems should consider and impose as appropriate and necessary: • Washing or hosing down of buildings, sidewalks, driveways, patios, porches, parking areas, or other paved surfaces is prohibited. • Refilling after draining private swimming pools, Jacuzzis, spas, ornamental ponds, and fountains is prohibited. Refilling shall mean to replace more than twenty-five (25) percent of the facility's water capacity. • Washing or rinsing vehicles on owner's premises must follow the landscape water days schedule as set out above. A hand-held hose equipped with a positive shut-off nozzle and/or hand-held bucket must be used. The Southern Trinity Groundwater Conservation District's advisories for wise operation of groundwater systems and conservation of groundwater should be followed by McLennan County groundwater-based systems. As deemed necessary, the STGCD will issue special advisories in response to drought conditions or other factors impacting groundwater systems.
5 – CRITICAL Water Shortage	A decrease in the Lake Waco reservoir level to 445 msl (at which the reservoir is at about 40% of its capacity)	Waco water for the McLennan County Conjunctive Use system is NOT AVAILABLE. Public Water Systems should impose all Stage 4 restrictions. The Southern Trinity Groundwater Conservation District's advisories for wise operation of groundwater systems and conservation of groundwater shall be followed by McLennan County groundwater-based systems. As deemed necessary, the STGCD will issue special advisories in response to drought conditions or other factors impacting groundwater systems.
6 –	A decrease in the	Waco water for the McLennan County

EMERGENCY Water Shortage	Lake Waco reservoir level to 440 msl (at which the reservoir is at about 30% of its capacity)	Conjunctive Use system is NOT AVAILABLE. Public Water Systems should continue the Stage 5 restrictions and consider further actions as deemed necessary. The Southern Trinity Groundwater Conservation District's advisories for wise operation of groundwater systems and conservation of groundwater should be followed by McLennan County groundwater-based systems. As deemed necessary, the STGCD will issue special advisories in response to drought conditions or other factors impacting groundwater systems. The STGCD will collaborate with the City of Waco and other surface water systems on further restrictions, as necessary.

2.3.6- McLennan County Response Actions – Triggering Stages

The following are recommended response actions by McLennan County water systems that do not have an approved DCP. As discussed above, the stages correspond to those adopted in the Waco DCP. The monitoring of drought stages will involve coordination between members of the McLennan County Water Resources Group (Drought Task Force). In areas of McLennan County with approved DCP, the stages and triggers associated with those approved DCPs will apply; the McLennan County DCP applies only to those areas without an approved DCP.

2.4- Drought Mitigation Efforts

2.4.1-McLennan County Drought Mitigation Actions

The mitigation actions identified for McLennan County are intended to build long-term water supply resiliency, including mitigating impacts on the future loss of groundwater pressures particularly in the Hosston Aquifer, and to mitigate risks associated with Central Texas drought conditions.

For McLennan County, a number of mitigation actions were identified and evaluated. These were discussed with the McLennan County Water Resources Group (the Drought Planning Task Force) and presented in public meetings. The mitigation actions require cooperation between McLennan County water systems. Both surface water-based systems and groundwater systems considered actions that were based on conjunctive use of the two supply sources. In considering the long-term viability of the Trinity Aquifer, the McLennan County Water Resources Group recognized the need to wisely use surface water to the extent practicable to replace continued heavy pumping of groundwater. The studies and evaluations completed as part of this Plan documented the long-term benefits to groundwater resiliency in McLennan County based on pursuing smart, conjunctive use of the County's surface water and groundwater.

2.4.1.1- Primary Mitigation Action – Conjunctive Water Use

Achieving a resilient, long-term water supply for McLennan County during both drought and normal water demand conditions requires cooperation of McLennan County water purveyors and the conjunctive use of supplies available to them. As part of this

Plan, the opportunity for and benefits of conjunctively using surface water and groundwater were evaluated. A *McLennan County Conjunctive Use Plan* was prepared and presented to the McLennan County Water Resources Group. An entire component of the McLennan County Plan is dedicated to the conjunctive use plan.

The conjunctive use details and recommendations are provided in Chapter Three of this McLennan County Plan.

2.4.1.2- Primary Mitigation Action – Arsenic Mitigation

A critical component of the McLennan County Plan provides for the mitigation of arsenic contamination levels in several, small groundwater systems in McLennan County. These systems faced costly alternatives and the potential of EPA enforcement. In a cooperative effort, the City of Waco, working with the County Judge and the McLennan County Water Resources Group, agreed to make treated surface water available to these systems in quantities sufficient to mitigate the arsenic concentrations to levels below the EPA's Maximum Contaminant Level. The *Arsenic Break-out Plan* was prepared as a separate effort to provide the arsenic-impaired systems with a readily available alternative that could be presented to EPA. On October 14, 2016, at a public meeting of the McLennan Water Resources Group, the plan and a proposed schedule for its implementation were presented to EPA Region VI officials, the McLennan County Judge, and representatives of the affected groundwater systems.

The Arsenic Break-out Plan details and recommendations are provided in Chapter Four of this McLennan County Plan.

2.4.1.3- McLennan County Drought Response Actions

This section identifies the specific response actions recommended for implementation during drought conditions. The McLennan County Drought Contingency Plan (DCP) is not a stand-alone plan but incorporates the existing, approved DCPs of water providers in McLennan County. As mentioned above, the McLennan County DCP drought triggers and response actions correlate to the stages, triggers and response actions involving the primary surface water supply in McLennan County, the City of Waco's DCP.

2.5- Operational Framework

This section discusses the procedures and responsibilities for implementing the McLennan DCP.

2.5.1- Responsibility for Identifying Drought Stages and Triggers

Since the criteria for the McLennan County DCP drought stages are directly related to the Lake Waco surface water elevation and its water supply, the Drought Task Force will coordinate with the City of Waco on the monitoring of Lake Waco water supply. The City of Waco staff monitor water supply and demand conditions on a daily basis. In accordance with the Waco DCP, the City determines when conditions warrant initiation or termination of each stage of the Plan, that is, when the specified triggers are reached.

2.5.2- Framework and Responsibility for Notifying McLennan County Water Systems

The Drought Response Task Force will be responsible for notifying McLennan County public water systems without DCPs of drought conditions, stages and triggers. The Task Force or its designated agent will identify contacts at the public water systems to notify of drought stages and recommended response actions.

2.5.3- Schedule for Updating the McLennan County DCP

The Drought Response Task Force will ensure that the McLennan County DCP is reviewed and updated as needed every five (5) years.

CHAPTER 3- CONJUNCTIVE USE PLAN

3.0- Introduction

Meeting the challenge of maintaining a long-term resilient water supply for McL Co requires two steps: 1.) Re-examining the County's water supply needs, considering the impacts of drought, arsenic contamination, and zebra mussel complications and 2.) Applying methods to conserve and protect available supplies. One significant opportunity for McL Co to help achieve resilient water supply is the conjunctive[13] use of surface water and ground water.

The Conjunctive Use Plan provides a method to strategically utilize available water resources to ensure water supply resiliency for all of McLennan County. The Conjunctive Use Plan will address three of the issues identified affecting water supply resiliency:

1.) Declining pressures in the Trinity Aquifer;

2.) Future population growth and development resulting in increasing water demands; and,

3.) Drought impacts.

The general approach of the Conjunctive Use Plan is to more fully utilize renewable[14] sources of surface water throughout the county in order to relieve dependence on the Trinity Aquifer. In turn, this will reduce the depletion rate of pressures within the aquifer. The benefits of this approach are two-fold: the viability of a reliable source of groundwater may be extended for future generations, and groundwater may be more readily available during future droughts when surface water supplies are limited.

Developing the Conjunctive Use Plan involved an analysis of existing and future water supply and water demands for the county, groundwater modeling using the TWDB Groundwater Availability Model (GAM), and a feasibility analysis for supplying water from alternate sources to reduce groundwater pumping.

[13] Conjunctive use for the purpose of the McL Co Plan is the joint utilization of both surface water and groundwater sources for water supply.
[14] Compared to the groundwater resources in McLennan County which essentially do not recharge, surface water supplies may be considered renewable as they recharge with precipitation.

Solutions presented include a preliminary layout of infrastructure needed to distribute supplementary surface water in the county, and planning level cost estimates for infrastructure improvements and water rates.

3.1- Problem

Several problems threaten the resiliency of water supply in McLennan County. Declining aquifer pressure levels pose a threat for several reasons: uncertainty about the quality of groundwater from deeper levels of the aquifer, and increasing expenses to extract the groundwater from deeper and deeper elevations. Future growth in the region threatens water resiliency due to increased demands. Drought also poses a serious threat to water supply resiliency. During a drought, the demand for water increases while the available supply of surface water decreases. The complications of these problems are discussed in greater detail below.

3.1.1- Declining Aquifer Levels

The Trinity Aquifer provides primary source of groundwater in McLennan County for cities and rural communities in McLennan County. Declining aquifer levels over recent decades due to large volume pumping have raised concerns about the availability of groundwater supply for the future. Additionally, declining aquifer levels may lead to water quality issues requiring additional treatment to bring to water to acceptable standards for potable use.

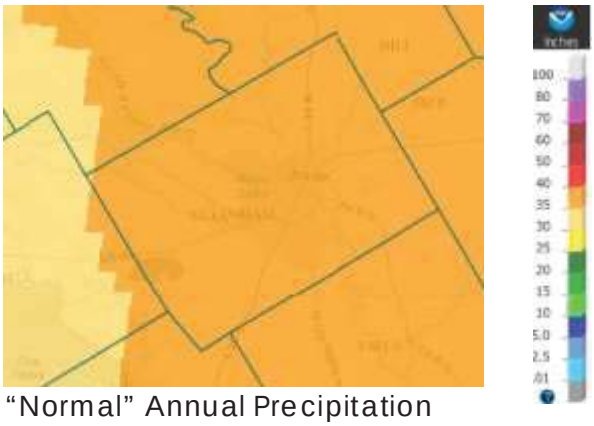
3.1.2- Growth

Future growth and development in McLennan County will increase demand for water supply, water distribution infrastructure, and water treatment infrastructure. A reliable, resilient water supply is critical for continued development in the county.

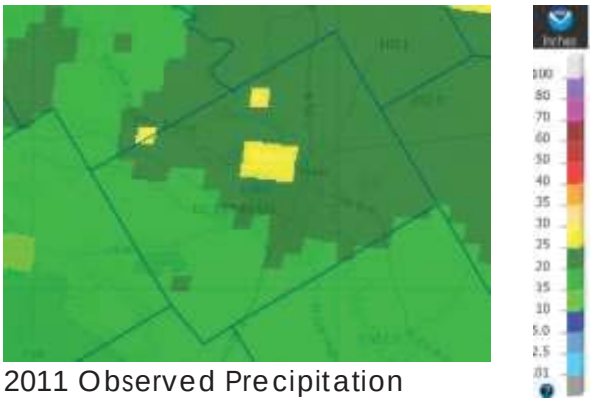
3.1.3- Drought

Drought impacts both surface water and groundwater. Both sources are impacted by increased demand during drought conditions. Additionally, surface water sources are impacted by reduced available supply due to evaporation and lack of precipitation. Through review of annual precipitation records from NOAA (see Figure 3.1-1), it was determined that 2013 represented the closest rainfall to a “normal year,” and 2011

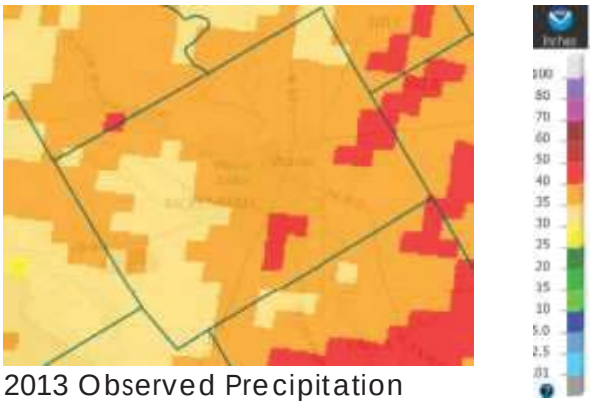
represented a severe drought. To gauge impacts of drought on water demand, 2013 (normal rainfall year) production was compared to 2011 (drought condition) production for several McLennan County systems. On average, 2011 (drought) production was 20% higher than 2013 (normal rainfall) production.



"Normal" Annual Precipitation



2011 Observed Precipitation



2013 Observed Precipitation

Figure 3.1-1: NOAA Precipitation Records

A resilient water supply is critical to ensure sufficient supply during a drought, when demands are increased and supply is reduced. The conjunctive use of water supplies will provide an opportunity to improve the drought resiliency of the water resources in McL Co.

3.2- Approach

To address the problems identified in the previous section (declining aquifer levels, future growth, and drought), the approach of the conjunctive use plan is to strategically reduce pumping of the aquifer. Strategic reduction of pumping means that pumping is reduced in systems such that the greatest benefit to the aquifer may be realized. The main premise is to reduce groundwater pumping in order to slow the decline of aquifer levels, and instead to utilize surface water for supply where feasible. Reducing the decline of the aquifer will help to preserve groundwater for use during times when surface water supplies become limited, such as during a severe drought.

The overall approach consisted of the following steps, which are discussed in greater detail in the sections which follow.

1. Review Existing and Future Supply and Demand
2. Identify Surface Water Availability by System
3. Identify Existing Connections Between Systems
4. Modeling Recommendations- Determine Surface Water Needed by Systems to Achieve Benefit to Aquifer
5. Recommendations for Surface Water Conveyance

3.2.1- Evaluation of existing and future supply and demand

To understand the water needs of the county, a review of existing and future water supply and demand was conducted. Data was collected for nearly 60 water supply systems identified as having service area within McLennan County. Data was compiled from multiple sources including the water systems themselves, the Southern Trinity Groundwater Conservation District, Texas Water Development Board Regional Plan,

TCEQ, Waco Water Master Plan, and FHLM Report. A table of compiled data is provided in the Appendix.

3.2.1.1- Surface Water Supplies

Based on review of the water rights data available from the TCEQ's online resources, the following table, Table 3.2-1 summarizes the surface water rights of public water supply users in McLennan County.

Table 3.2-1
Surface Water Rights in McLennan County- Public Water Supply Systems

Water Right Number(s)	Reservoir Name	Water Right Holder	Volume (acre-ft/yr) 2020	Volume (acre-ft/yr) 2070
2315, 2317, 5094, 5840	Lake Waco	City of Waco	96,919	96,919
4340	Lake Brazos	City of Waco	5,600	5,600
4135	Tonk Creek; Rock Quarry Lake	City of Crawford	55	55
5000	New Lake Mart	City of Mart	500	500
5085	Brazos River	City of Robinson	13,100	13,100
2154	Brazos River	City of Lorena	1,000	*Expires Sept. 2047
TOTAL			117,174	116,174 (assuming Lorena WR is not renewed)

As seen in the table, five different entities currently hold surface water rights in McLennan County: City of Waco, City of Crawford, City of Mart, City of Robinson, and City of Lorena, for a combined total of 117,174 acre-ft/yr. The City of Waco is the most significant surface water rights holder in McLennan County, accounting for nearly 90% of the total surface water rights in the county.

Several water suppliers in McLennan County have access to surface water sources through their water rights or through wholesale contracts with other systems. The following table summarizes those systems with access to surface water.

Table 3.2-2 Summary of Surface Water Uers in McLennan County			
System	**Surface Water Source**	**Amount (Acre-ft/Yr)**	**Comments**
Bold Springs	Lake Waco	560	Through wholesale contract with City of Waco (0.5 MGD). *Note- this agreement/connection is still pending at the time of the report.*
Cargill Meat	Lake Waco	Unknown	Through City of Waco
Central Bosque WSC	Lake Waco	70	Through wholesale contract with City of Waco
	Lake Belton	Unknown	Through wholesale contract with City of McGregor, through Bluebonnet WSC
City of Bellmead	Lake Waco	EMERGENCY	Through wholesale contract with City of Waco
City of Bruceville Eddy	Lake Belton	938	Through wholesale contract with Bluebonnet WSC
City of Crawford	Tonk Creek; Quarry Lake	55	WR# 4135
City of Hewitt	Lake Waco	2,240	Through wholesale contract with City of Waco (not to exceed 2 MGD)
	Brazos River	280	Through wholesale contract with City of Lorena (not to exceed 0.25 MGD). Note- The water received from City of Lorena may be SW + GW, as City of Lorena uses GW and also uses a wholesale SW contract with City of Robinson
City of Lacy-Lakeview	Lake Waco	1,120	Through wholesale contract with City of Waco
City of Lorena	Brazos River	1,000	WR# 2154; Treated and transmitted to Lorena system through contract with City of Robinson. (Current contract: not to exceed 0.5 MGD or surcharge fee)
City of Mart	New Lake Mart	500	WR# 5000
City of McGregor	Lake Belton	2,139	Wholesale contract with Bluebonnet WSC
City of Moody	Lake Belton	401	Wholesale contract with Bluebonnet WSC
City of Robinson	Brazos River	13,100	WR# 5085
	Lake Waco	560	Through wholesale contract with City of Waco
City of Waco	Lake Waco	96,919	WR#'s 2315; 2317; 5094; 5840. Note that the firm yield for Lake Waco is 81,070 acre-ft/yr (Source: City of Waco Water Master Plan, 2015)
	Lake Brazos	5,600	WR# 4340
City of West	Lake Waco	1,120	Through wholesale contract with City of Waco
City of Woodway	Lake Waco	431	Through wholesale contract with City of Waco. Increases each decade to 1548 acre-ft/yr in 2070.
	Lake Belton	1,362	Through wholesale contract with Bluebonnet WSC
Elm Creek WSC	Lake Belton	654	Through wholesale contract with Bluebonnet WSC
Hilltop WSC	Lake Waco	97	Through wholesale contract with City of Waco
South Bosque WSC	Lake Waco	EMERGENCY ONLY	Through wholesale contract with City of Waco
Spring Valley WSC	Lake Belton	301	Through wholesale contract with Bluebonnet WSC
West Brazos WSC	Lake Waco	EMERGENCY ONLY	Through wholesale contract with City of Waco

3.2.1.2- Groundwater Supplies

The Southern Trinity Groundwater Conservation District (STGCD) regulates the withdrawal and use of groundwater in McLennan County. Permits are required to drill or operate a well within McLennan County. Certain wells may qualify for exemptions if the following criteria are met: "A well may be considered exempt if it is equipped to produce no more than 25,000 gallons of groundwater per day, is intended solely for domestic or livestock use, and the well is located on a tract of land that is 10 acres or more in size." To date, the district has issued permits to approximately 60 users in the area for 17,748 acre-ft/yr (5,782,947 thousand gallons), and there are 52 exempt permits encompassing 137 wells in the county. The allotted maximum annual withdrawal, including exempt uses, is 20,194 ac-ft/yr (6,580,215 thousand gallons). Based upon this information, nearly 90% of the allotted maximum withdrawal is already permitted.

Approximately 60% of the total permitted groundwater in McLennan County is held by the top 10 by volume permit-holders. The table below summarizes the permitted use and the historical production of the top ten users (by HUPP).

Water Supplier	Aquifer Formation	Permit (1000 Gallons)	2013 Production (1000 Gallons)	2014 Production (1000 Gallons)	2015 Production (1000 Gallons)
City of Woodway	Hosston	664,212	414,419	386,387	404,459
City of Bellmead	Hosston	481,279	400,025	337,616	422,622
City of Hewitt	Hosston	469,655	438,421	323,966	372,441
City of Robinson	Hosston	462,035	433,652	350,827	351,675
Sanderson Farms	Hosston	391,987	365,167	385,065	369,342
City of Waco	Hosston	289,169	167,962	112,262	194,710
Aqua Texas Inc.	Hensell	250,733	100,038	79,029	82,854
City of Lorena	Hosston	189,962	46,687	55,257	62,963
Cargill Meat Solutions	Hensell	181,821	137,100	152,308	131,231
Cross Country WSC	Hensell	170,562	131,778	118,583	115,885
Total (Top 10)		3,551,415	2,785,942	2,444,534	2,668,067

The following table summarizes the current overall water supply resources available in McLennan County. As a whole, McLennan County currently has 134,922 acre-ft/yr of water supply available.

Existing McLennan County Water Resources Summary	
	Acre-Ft/Yr
Total Surface Water (SW) Rights	117,174
Total Groundwater (GW) Permits	17,748
Total SW + GW Available	134,922

3.2.1.3- Water Demands

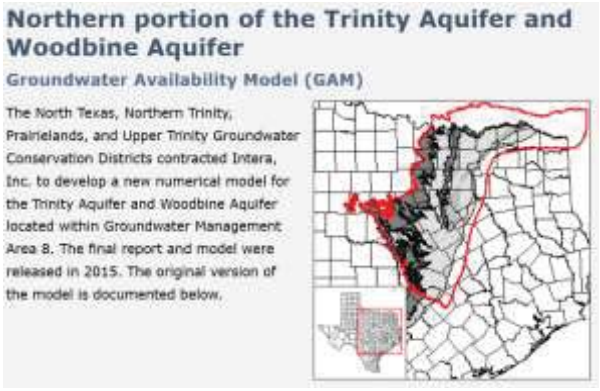
Water demands in McLennan County come from a diverse spectrum of needs: residential, municipal, industrial, and agricultural. The TWDB 2016 Region G Water Plan projects the total water demand for McLennan County to increase from 72,092 acre-ft/yr in 2020 to 98,392 acre-ft/yr in 2070, a 35% increase.

Water demands from various sources such as TWDB, TCEQ, FHLM, and input from local water suppliers were analyzed. Every water supplier identified in McLennan County was sent a summary sheet for their system. The summary sheet included water supply and demand data which was collected from various sources, and also requested local input about the supply and demand for each system. For the purposes of the McL Co Plan, preference was given to locally provided data, where available.

A summary of the demand data for the various entities is included in the appendix.

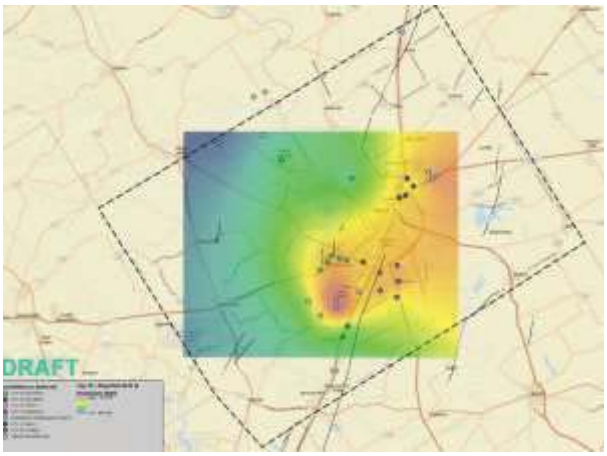
3.2.2- Groundwater Modeling

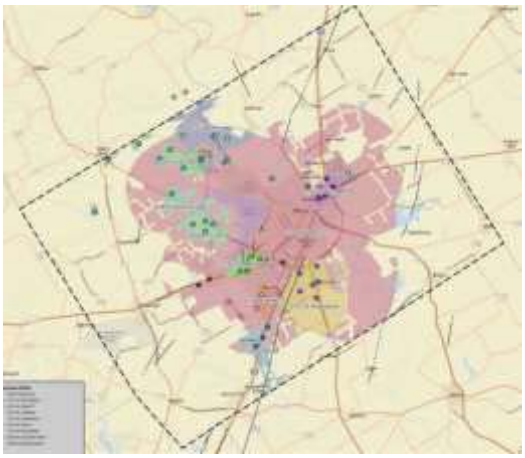
Groundwater modeling was a critical component of developing the conjunctive use plan. Groundwater modeling was used to assess the response of the Trinity aquifer to continual pumping at present-day rates and to assess the aquifer's response to different scenarios of decreased pumping. A simplified analytical model was developed to guide the more accurate numerical modeling approach using the TWDB Groundwater Availability Model (GAM).



3.2.2.1- Analytical Model

Initially, a preliminary "analytical" model was created to model the effects of different pumping scenarios. The analytical model was used to determine response patterns from pumping variations (uniform pumping reduction vs targeted pumping reductions) to narrow down the best approach for reducing drawdown in the county. The results from the analytical model determined that a targeted approach, focusing on the major groundwater producers, had the greatest regional benefit to the aquifer levels. Therefore the targeted approach was used to guide numerical modeling.





3.2.2.2- Numerical Modeling: GAM

The TWDB Northern Trinity GAM was the numerical model used to obtain more accurate results. Several run scenarios were created using the GAM.

3.2.2.2.1- Modeling Methodology/Assumptions

3.2.2.2.2- Modeling Results

The following table summarizes the scenarios and the results. Run 10.0 represented the baseline condition in the GAM, meaning that no changes were made to the current well pumping rates. The baseline scenario was setup to simulate pumping continuing at the 2010 GAM well pumping rates (2010 is the "current" year in the GAM model) through 2070. The baseline scenario results predict an average county drawdown from current levels of 543 ft by 2070. Runs 10.1-10.7 show varying degrees of improvement from different reductions in pumping. The "Reduced by %" column shows the percentage reduction in average drawdown compared to the No-Change/Baseline condition, Run 10.0.

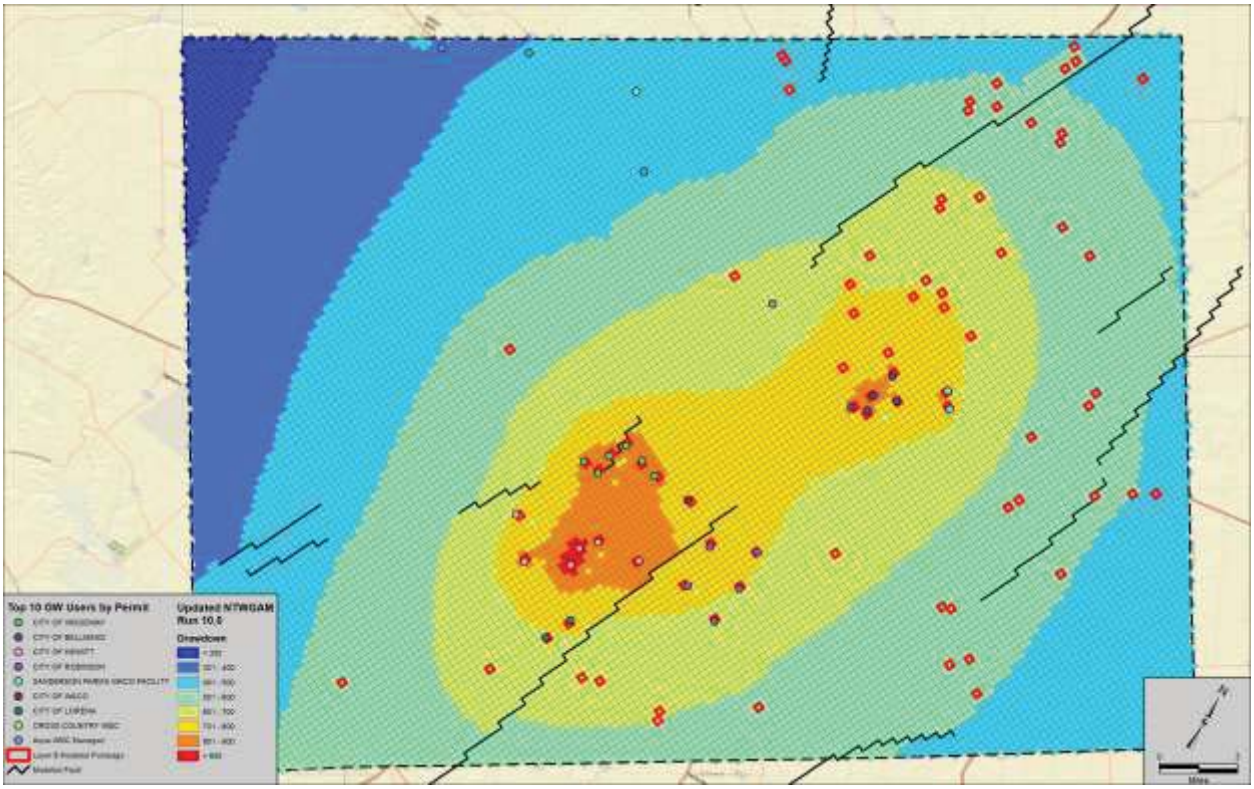
Trinity Aquifer Hosston Formation GAM Results (Original GAM Pumping Rates)					
	Description	**Average Drawdown Δ (feet)**	**Reduced by (%)**	**Max DD (ft)**	**Min DD (ft)**
Run 10.0	No Change/Baseline: Existing Pumping Rates (as in GAM) continue through 2070	543	–	1,064	256
Run 10.1	Reduce All McLennan County Wells by 30%	320	48	592	191
Run 10.2	Reduce Robinson, Lorena, Hewitt, and Woodway by 50%	353	47	695	196
Run 10.3	Reduce Robinson, Lorena, Hewitt, Woodway, Bellmead, Waco, and Sanderson by 30%	393	37	661	212
Run 10.4	Reduce Robinson, Lorena, Hewitt, Woodway, and Bellmead by 50%	320	48	611	179
Run 10.5	Reduce Robinson, Lorena, Hewitt, Woodway, Bellmead, Waco, and Sanderson by 25%	414	33	725	218
Run 10.6	Reduce Robinson, Lorena, Hewitt, Woodway, Bellmead, Waco, and Sanderson by 50%	285	54	420	181
Run 10.7	Reduce Robinson, Lorena, Hewitt, Woodway, Bellmead, Waco, and Sanderson by 75%	158	75	297	-103

The following table summarizes the pumping rates for the various Hosston Aquifer wells for the different model scenarios:

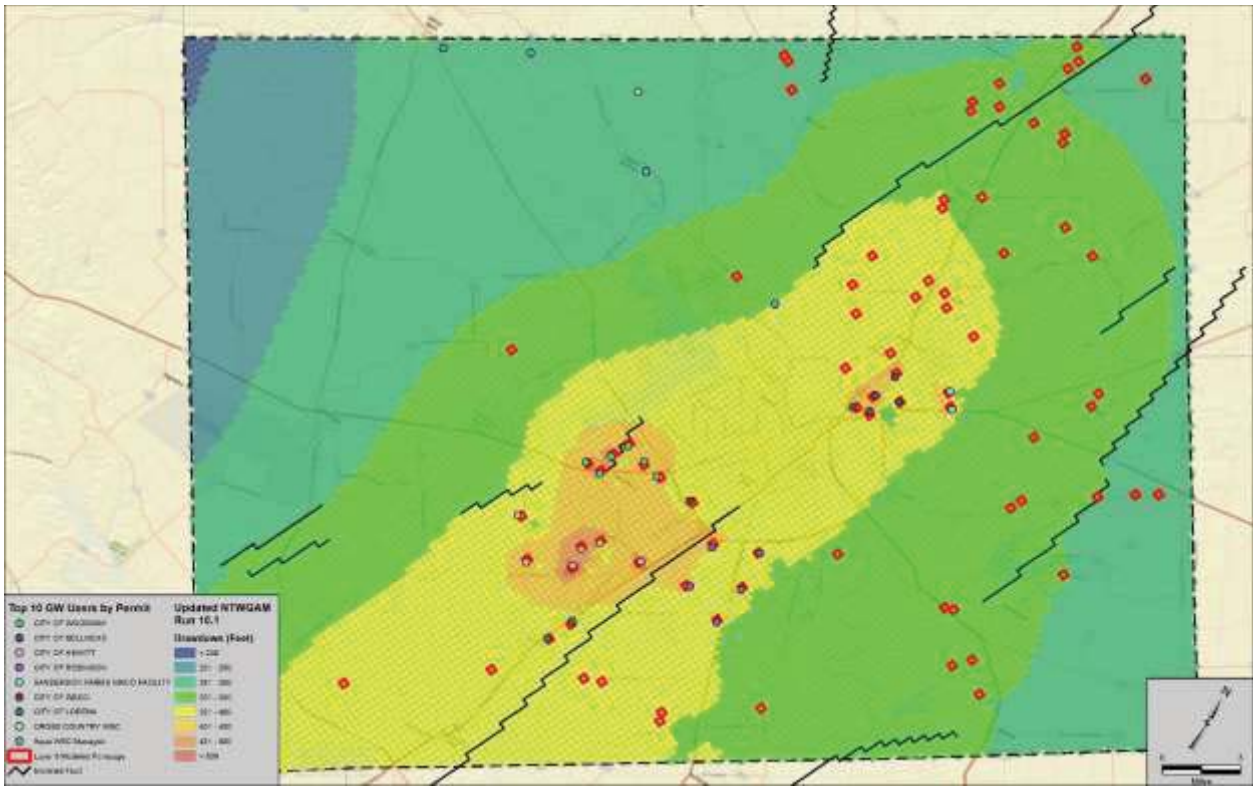
Run	Description	GW Pumped by User (cf/day)								Total GW Used (cf/day)	Total Drawdown	Drawdown Reduced %
		Hewitt	Woodway	Robinson	Lorena	Bellmead	Sanderson	Waco	Other			
10	Base, no change	372,056	269,969	226,879	8,649	194,909	179,464	4,633	645,357	**1,901,915**	543	N/A
10.1	Reduce all by 30%	260,439	188,978	158,815	6,054	136,436	125,625	3,243	451,750	**1,331,340**	320	48
10.2	Reduce 4 South users by 50%	186,028	134,984	113,439	4,324	194,909	179,464	4,633	645,357	**1,463,139**	353	43
10.3	Reduce Top 10 by 30%	260,439	188,978	158,815	6,054	136,436	125,625	3,243	645,357	**1,524,947**	393	37
10.4	Reduce 4 South users + Bellmead by 50%	186,028	134,984	113,439	4,324	97,454	179,464	4,633	645,357	**1,365,684**	320	48
10.5	Reduce Top 10 by 25%	279,042	202,477	170,159	6,487	146,182	134,598	3,475	645,357	**1,587,775**	414	33
10.6	Reduce Top 10 by 50%	186,028	134,984	113,439	4,324	97,454	89,732	2,317	645,357	**1,273,636**	285	54
10.7	Reduce Top 10 by 75%	93,014	67,492	56,720	2,162	48,727	44,866	1,158	645,357	**959,496**	158	75

Notes:
"4 South Users" = Robinson, Hewitt, Lorena, and Woodway
"Top 10"= Members of the Top 10 (by HUPP) with Hosston wells: Robinson, Hewitt, Lorena, Woodway, Bellmead, Sanderson, Waco
"Other"= Remainder of wells in the county

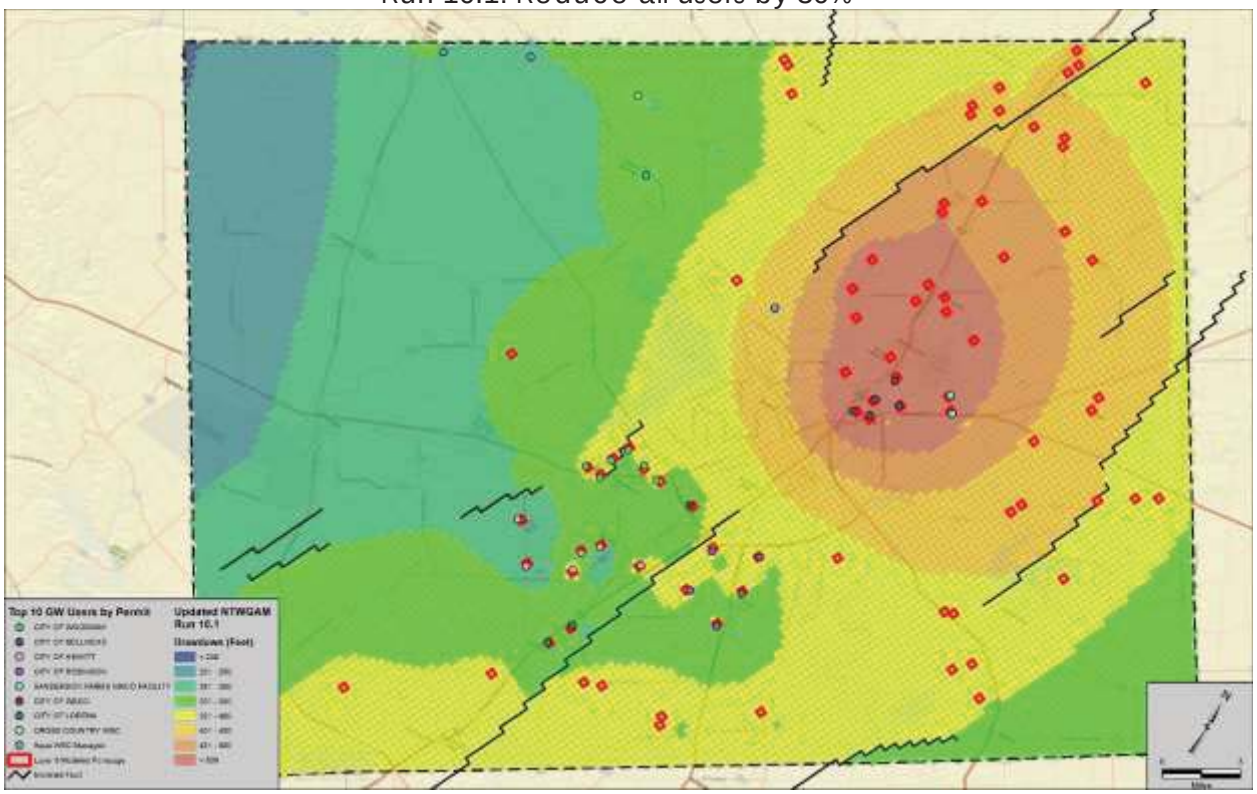
Aerial views of the county showing projected drawdown contours for the various model scenarios listed in the table above are included below.



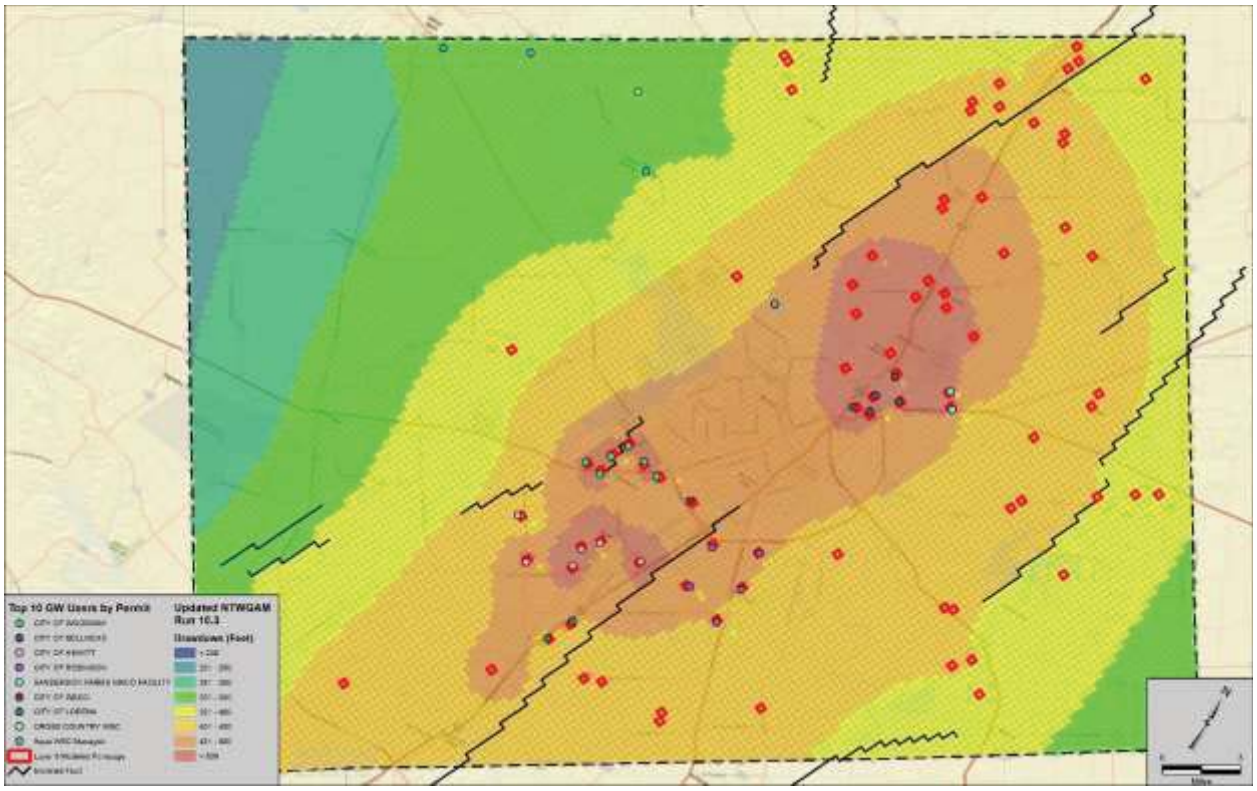
Run 10.0: Base, no changes made



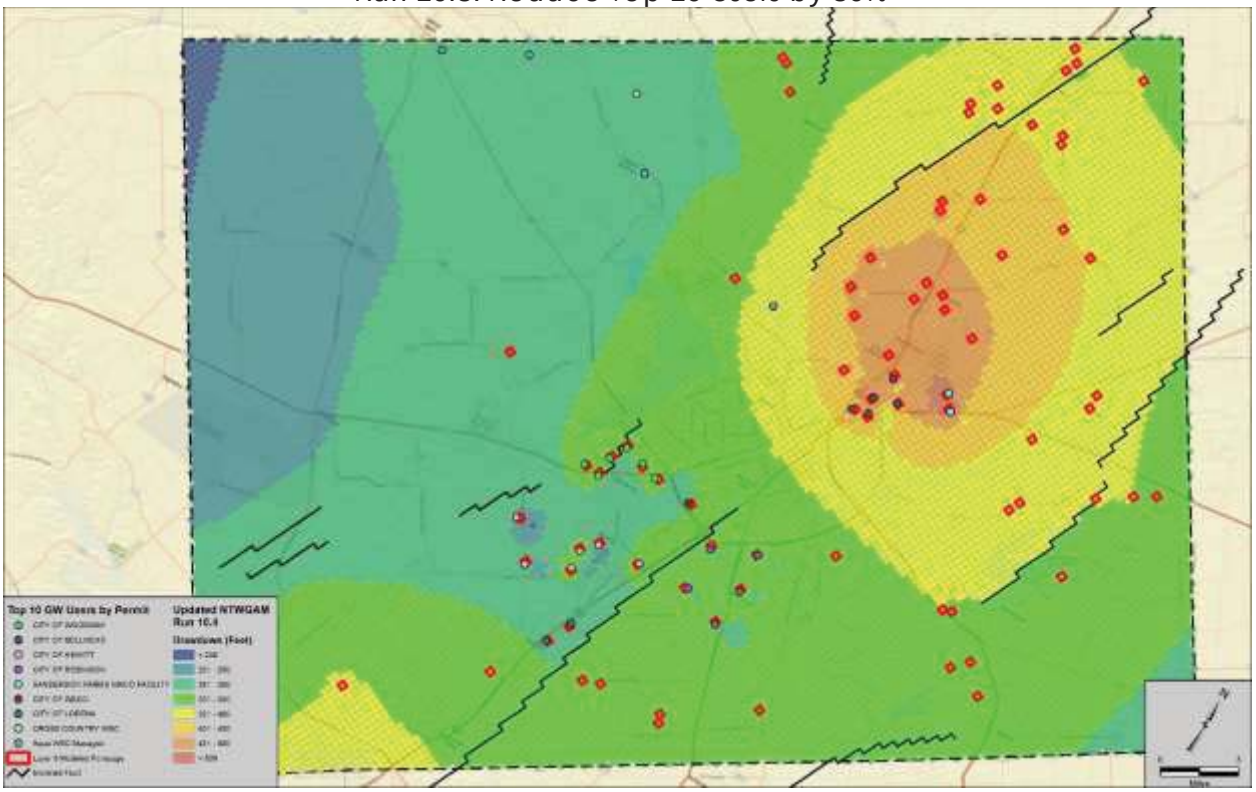
Run 10.1: Reduce all users by 30%



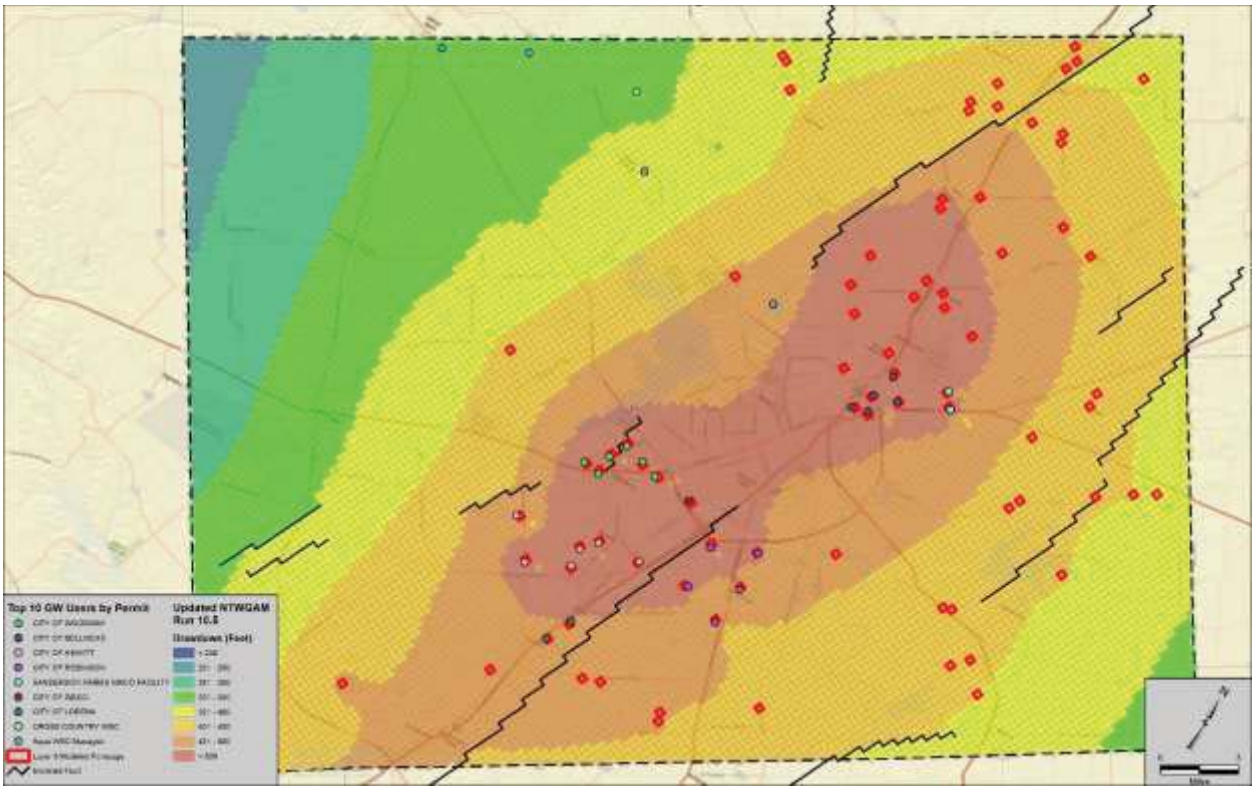
Run 10.2: Reduce Hewitt, Woodway, Robinson, and Lorena by 50%



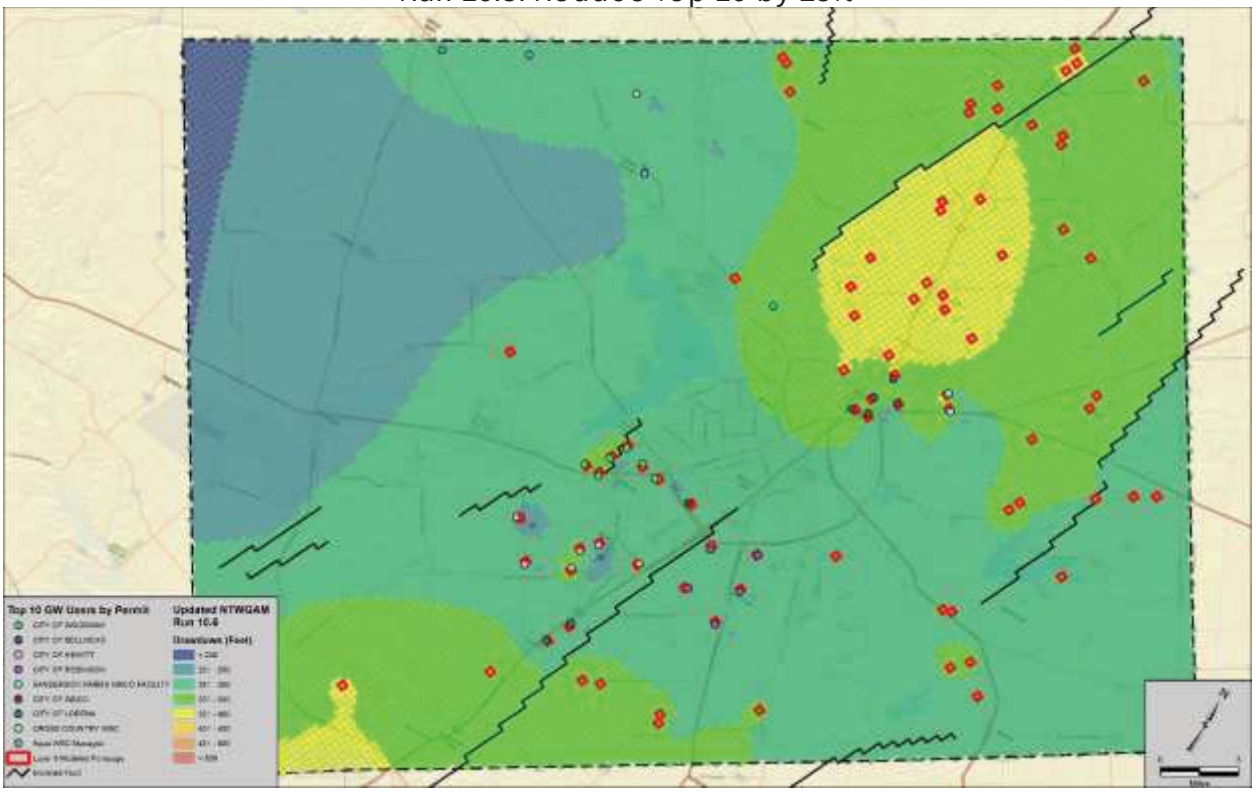
Run 10.3: Reduce Top 10 Users by 30%



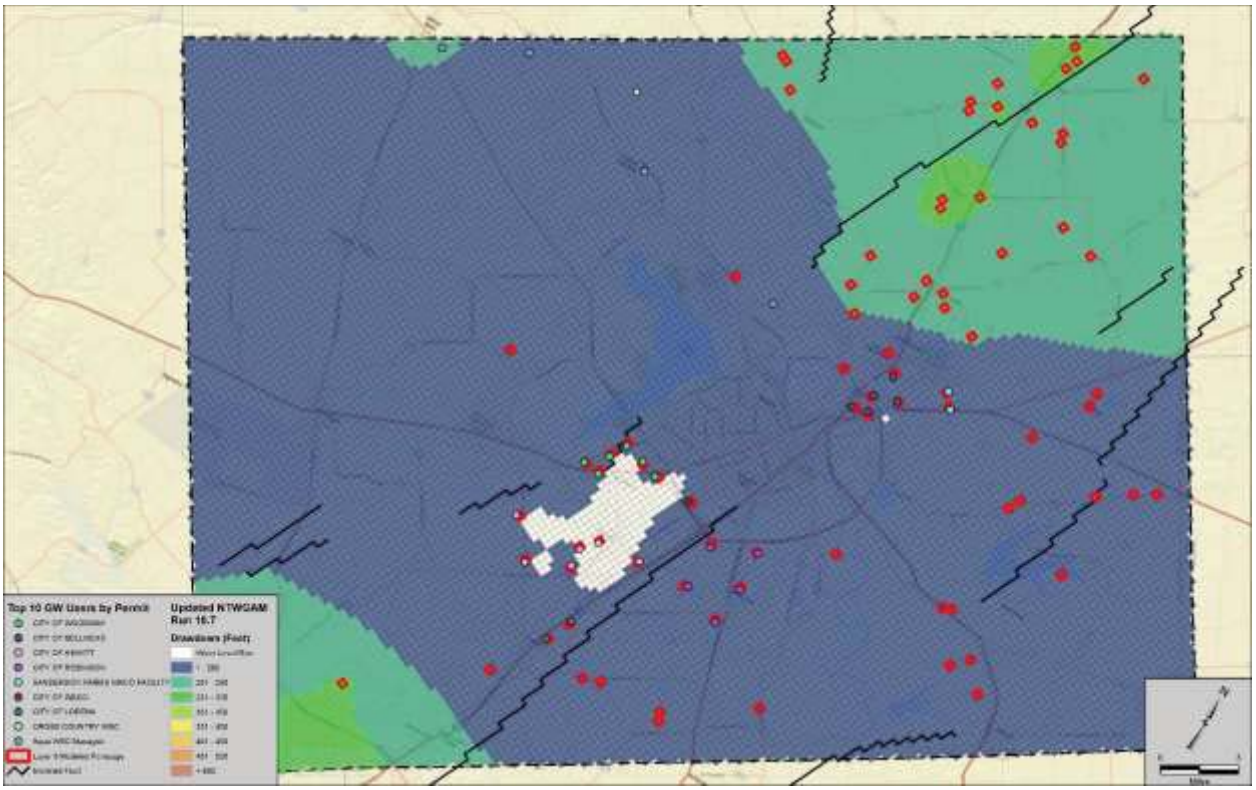
Run 10.4: Reduce Hewitt, Woodway, Robinson, Lorena, and Bellmead by 50%



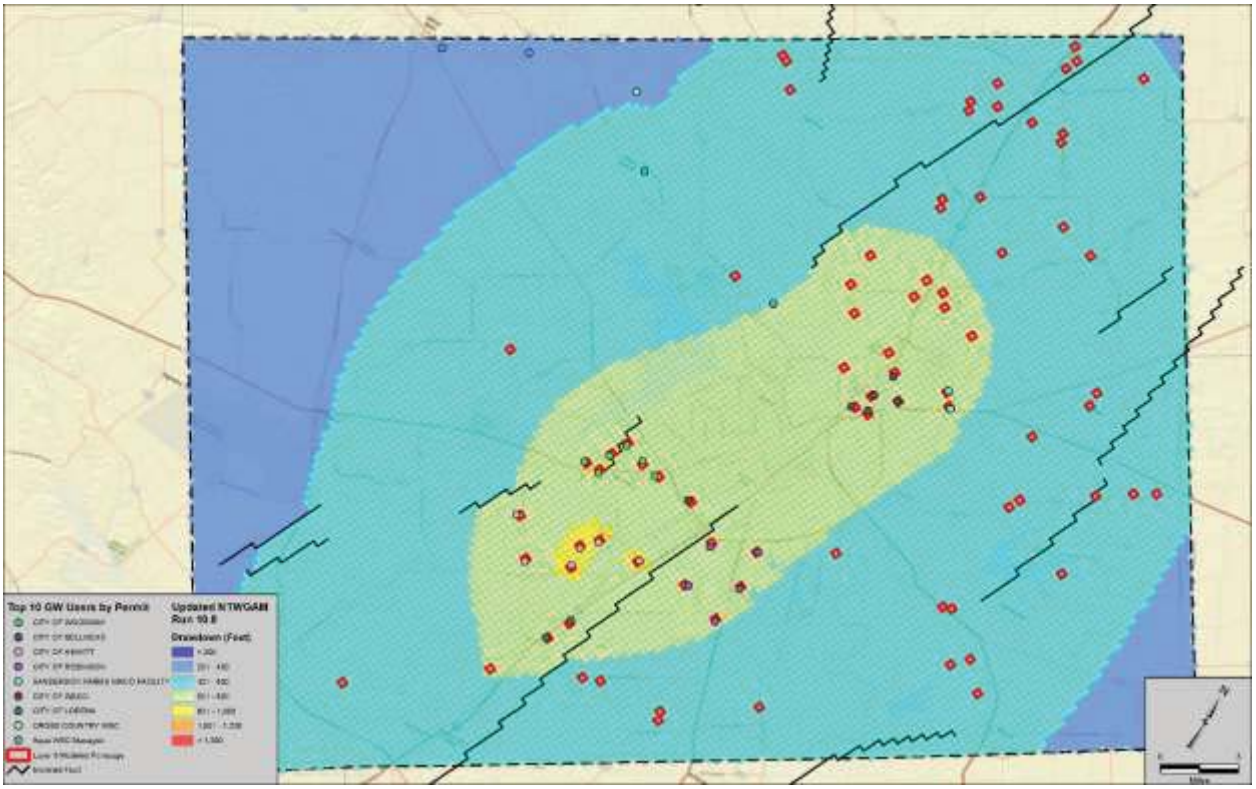
Run 10.5: Reduce Top 10 by 25%



Run 10.6: Reduce Top 10 by 50%



Run 10.7: Reduce Top 10 by 75%



Run 10.8: No Flow for Top 10 until 2050 (40 Years)

Run 10.0 represents the "base-line" condition, meaning the GAM was run with no changes to pumping rates from 2010 through 2070. This run simulates the drawdown response of the Hosston aquifer if the current pumping rates (as in the GAM 10) continue through 2070. As seen from the Run 10.0 baseline image, there are two "hot spots" of drawdown in the county: one centered over the Hewitt area and the other centered over the Bellmead area.

The results images of the remaining scenarios show drawdown conditions for the different scenarios of pumping reduction. As can be seen from the images, reducing the pumping rates of the largest volume users benefits the aquifer by lessening the projected drawdown, as compared to the baseline condition.

The following table summarizes the amount of "replacement" surface water that would be needed to supplement the pumping reductions for each model scenario, so that there is no overall change to each system's water supply. The far-right column, "SW Reqd/Total Drawdown," shows a normalized value of the volume of water required (cubic ft) to reduce the average drawdown of the aquifer by one foot. This number shows the benefit of strategic pumping reductions compared to uniform pumping reduction, and provides a means to compare scenarios to see the which scenario provides the most best improvement to the aquifer with the least amount of replacement water needed. For example, Run 10.1 and Run 10.4 both produce an average drawdown of 320 ft (see Table above.) as compared to 543 ft. However, Run 10.1 would require greater pumping reduction than Run 10.4. It's important to note that the "SW Reqd/Total Drawdown" does not take into account expense related to transmitting the replacement water. It only accounts for volume of water needed compared to the resulting benefit to the aquifer.

Run	Description	SW Required to Replace GW by User (cf/day)								Total SW Required	SW Reqd/Total Drawdown (cf/day/ft-saved)
		Hewitt	Woodway	Robinson	Lorena	Bellmead	Sanderson	Waco	Other		
10	Base, no change	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
10.1	Reduce all by 30%	111,616	80,990	68,063	2,594	58,472	53,839	1,390	193,606	570,574	2,559
10.2	Reduce 5 South users by 50%	186,028	134,984	113,439	4,324	0.00	0	0	0	438,776	2,309
10.3	Reduce Top 10 by 30%	111,616	80,990	68,063	2,594	58,472	53,839	1,390	0	376,967	2,513
10.4	Reduce 5 South users + Bellmead by 50%	186,028	134,984	113,439	4,324	97,454	0	0	0	536,230	2,405
10.5	Reduce Top 10 by 25%	93,014	67,492	56,719	2,162	48,727	44,866	1,158	0	314,139	2,435
10.6	Reduce Top 10 by 50%	186,028	134,984	113,439	4,324	97,454	89,732	2,316	0	628,279	2,435
10.7	Reduce Top 10 by 75%	279,042	202,476	170,159	6,486	146,181	134,598	3,475	0	942,419	2,448

Notes:
"5 South Users" = Robinson, Hewitt, Lorena, Bellmead and Woodway
"Top 10"= Members of the Top 10 (by HUPP) with Hosston wells: Robinson, Hewitt, Lorena, Woodway, Bellmead, Sanderson, Waco
"Other"= Remainder of wells in the county

3.2.2.2.3- GAM Findings/Adjustments

The GAM model breaks McLennan County into 0.25 square mile grids. Pumpage is attributed to grid cells representing wells within the county. The majority of the large volume groundwater users ("Top 10" discussed above) in the county have wells located in the Hosston formation of the Trinity aquifer. A comparison between the 2010 pumping rates used in the GAM model with the 2013 and 2015 production values and the STGCD permitted production is shown in the table below.

From the comparison table, it can be seen that there are significant differences between the GAM and the actual or permitted production for some systems. For example, the permitted amount for Hewitt is approximately 469,655 thousand gallons per year. The pumping rate for Hewitt in the GAM is set at approximately 1,015,788 thousand gallons per year (115% higher). The differences are not all consistently higher, however. The GAM pumping rate for Lorena is 88% lower than the permitted amount.

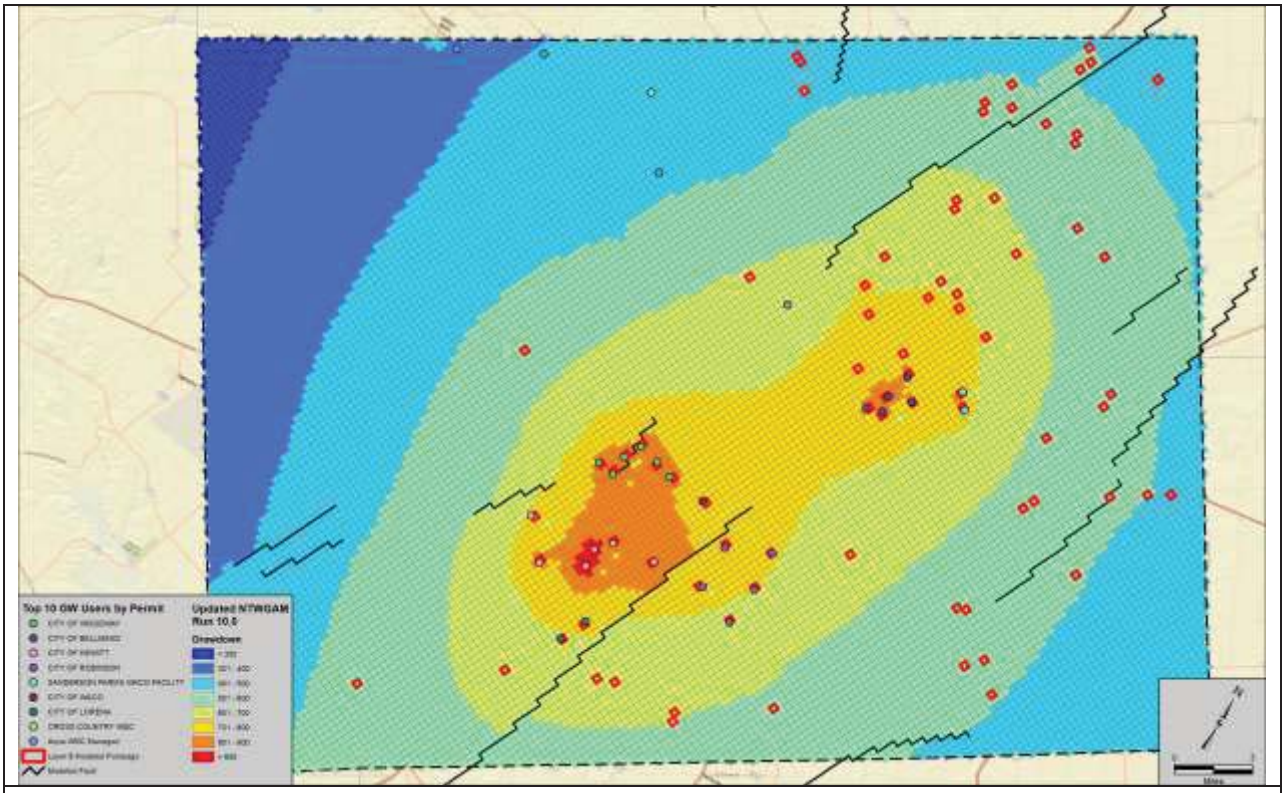
Comparison of Pumping Rates: GAM vs Actual Production and STGCD Permit- Hosston Formation								
Description	**Hewitt**	**Woodway**	**Robinson**	**Lorena**	**Bellmead**	**Sanderson**	**Waco**	**Other in McL Co.**
GAM (1000gal/yr)	1,015,788	737,068	619,424	23,613	532,139	489,973	12,649	1,761,952
STGCD Permit (1000gal/yr)- Hosston	469,655	664,212	462,035	189,962	481,279	391,987	289,169	1,423,035
STGCD 2015 (1000gal/yr)	372,440	404,459	351,675	62,962	422,622	369,342	194,709	987,457
STGCD 2013 (1000gal/yr)	438,420	414,419	433,651	46,687	400,025	365,167	167,961	997,132
Avg (2013 and 2015, 1000gal/yr)	405,430	409,439	392,663	54,824	411,323	367,254	181,335	992,295
% diff between model and avg production	151%	80%	58%	-57%	29%	33%	-93%	78%
% diff between model and permit	116%	11%	34%	-88%	11%	25%	-96%	24%

Although it is possible that some of the variability in pumping values may be attributed to exempt[15] wells in the county, in order to assess the response of the aquifer locally to changes in pumping, revisions were made to the GAM to use production values more closely representing actual conditions.

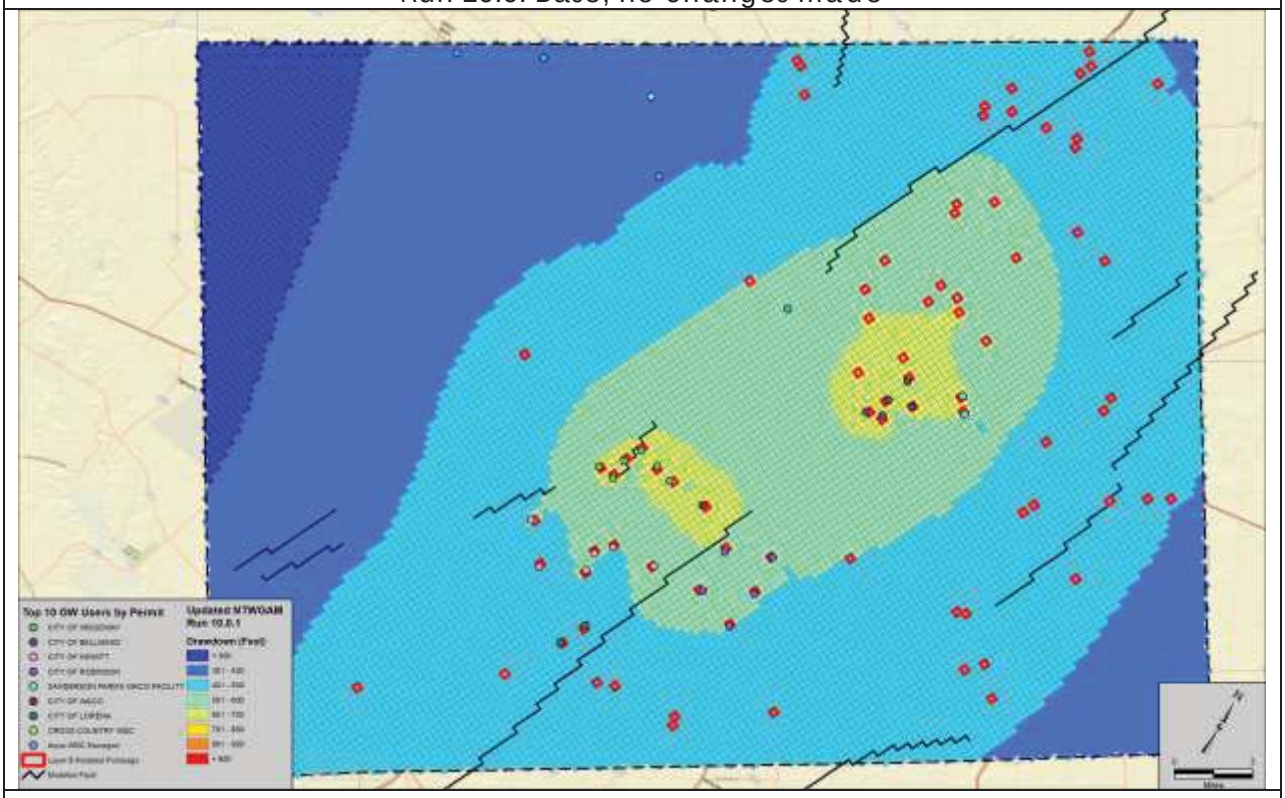
3.2.2.2.4- Adjusted GAM Results

The GAM model was re-run for the "10.0.1-revised baseline" (i.e. maintain revised 2010 pumping rates through 2070) and 10.4.1 (i.e. 50% pumpage reduction of Bellmead, Hewitt, Woodway, Robinson, and Lorena). The drawdown results for the revised scenarios are presented below.

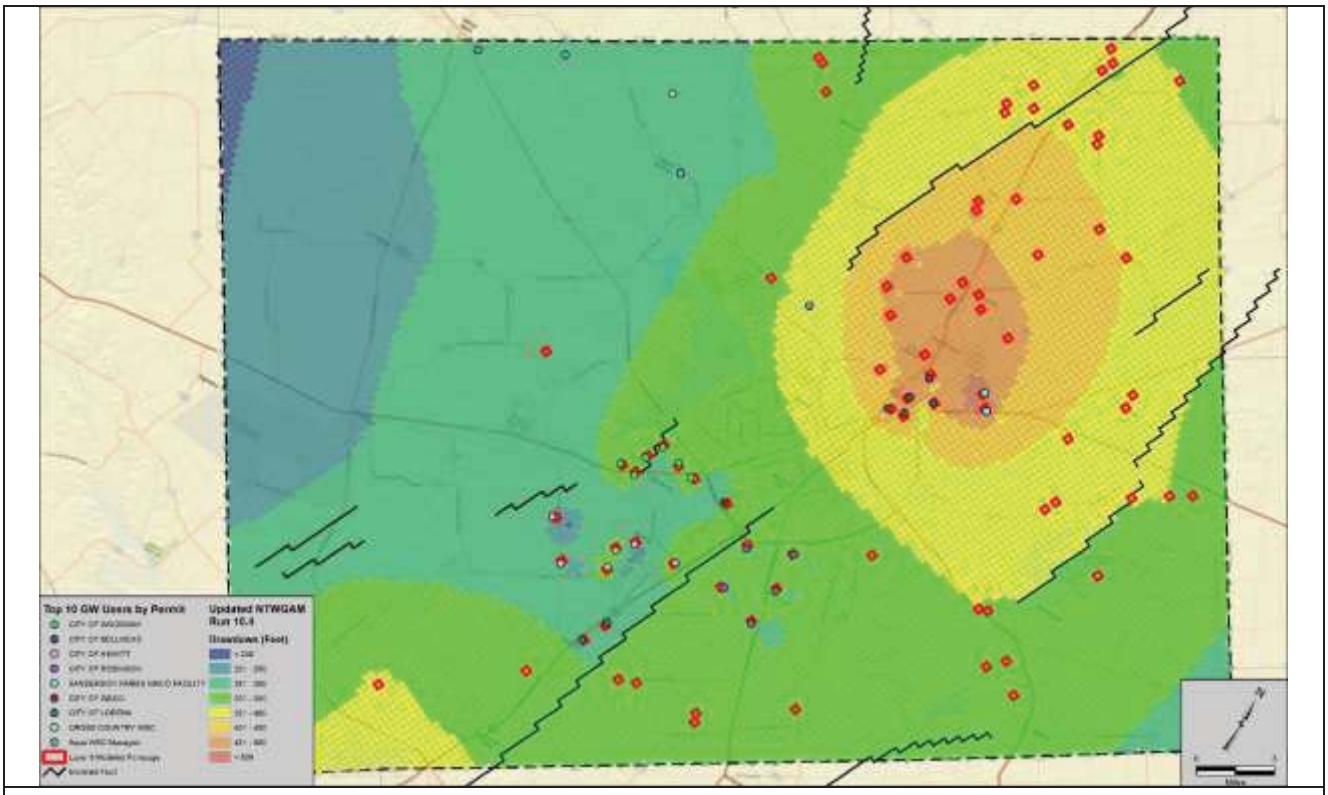
[15] In McLennan County, exemptions may be granted for wells that produce less than 25,000 gallons per day, are located on over ten acres, and are used solely for domestic or livestock use. There are 52 exempt permits which encompass 137 exempt wells in the county. Source: STGCD



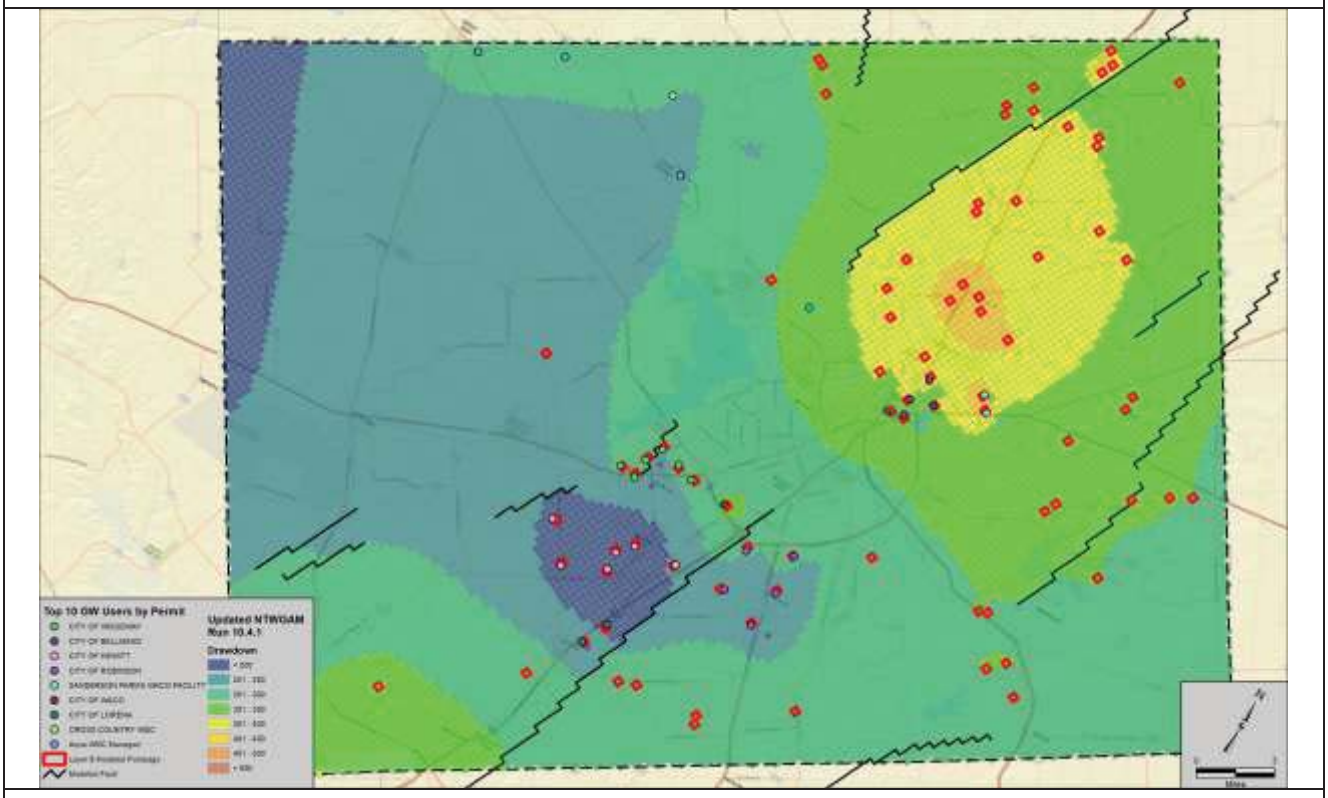
Run 10.0: Base, no changes made



Run 10.0.1: Run 10.0 Corrected for Reported Q / Permitted Q



Run 10.4: Reduce Hewitt, Woodway, Robinson, Lorena, and Bellmead by 50%



Run 10.4.1: Run 10.4 Corrected for Reported Q / Permitted Q

Based upon the results of the revised GAM runs, it is clear that the pumping rates have significant impact on the drawdown of the aquifer. Therefore it is recommended that additional review to the GAM model be made, in order to ensure that pumping rates in McLennan County accurately reflect pumping conditions.

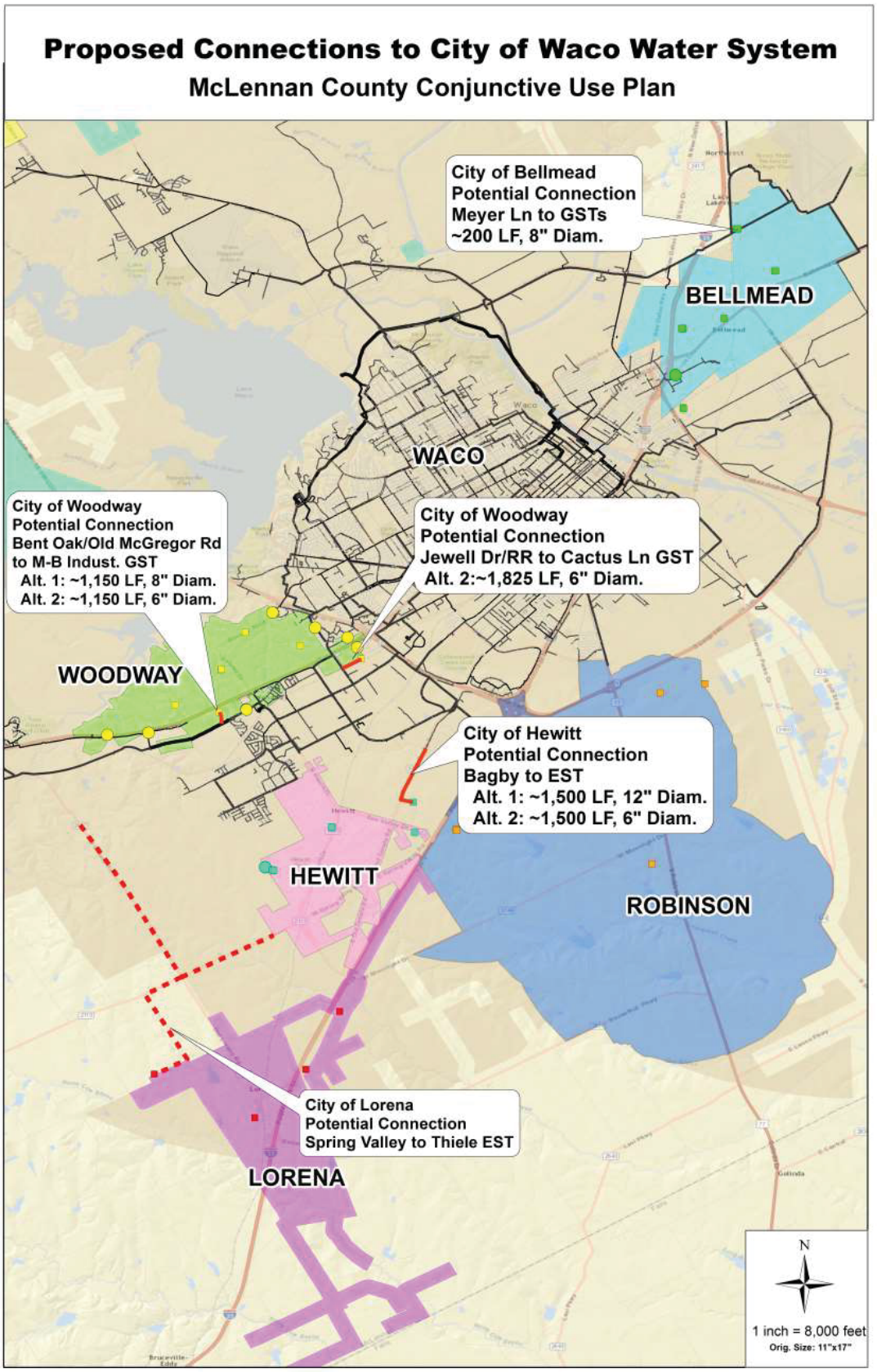
3.3- Solution

In order to slow the declining aquifer levels, prepare for future growth, and provide a drought resilient water supply, conjunctive use of water sources in McLennan County is needed. In order to achieve conjunctive use, it is recommended that the major groundwater users reduce groundwater pumping by 50% on average (as discussed earlier in the modeling section) and supplement water supply with surface water from the City of Waco.

3.3.1- Recommendation

To reduce groundwater pumping by 50% on an average day basis, additional connections to the City of Waco water system are necessary for Woodway, Hewitt, and Bellmead. The City of Robinson and City of Lorena are projected to have adequate supply, at 50% reduction of groundwater, for 2070, assuming that their current contracts continue and water rights are utilized.

For the McLennan County Conjunctive Use Plan, it is assumed that groundwater pumping will be reduced by 50% of current pumping rates, on average. Therefore, supplemental surface water from the City of Waco would also be supplied to meet any predicted shortfalls on an *average demand basis*. Any peak demands, such as during a time of drought, would be met by increased groundwater pumping. However, over the long term, groundwater pumping would be reduced by 50% such that the benefit to the aquifer might be realized, as demonstrated by the modeling effort.



Proposed Connections to Waco System

3.3.2- Cost Estimates

The following tables present planning level cost estimates for each of the major entities recommended to construct a supply connection to the City of Waco system.

City of Hewitt: Alternative 1

City of Hewitt 50% Reduction of Current Groundwater Pumpage					
To Meet Existing (2020) Demands:					
No system improvement needed. Utilize existing wholesale contracts with City of Waco and City of Lorena to replace groundwater.					
To Meet Future (2070) Demands:					
Prop. Connection Location	**Exist. COW WL Size (in)**	**Prop. User WL Size (in)**	**Prop. Length (ft)**	**Delivery Location**	
Bagby Ave (~650 LF N. of Alliance Rd Intersection).	12	12	1,500	Hewitt EST (Alliance Pkwy)	
Alternative 1					
Description	**Cost**	**Cost Units**	**Quantity**	**Quantity Units**	**Estimated Cost**
12" PVC WL	$ 65.00	$/LF	1,500	LF	$ 97,500
12" Water Tie-In	$ 3,000.00	Ea.	2	Ea.	$ 6,000
12" Gate Valve	$ 2,500.00	Ea.	1	Ea.	$ 2,500
Meter	$ 16,550.00	Ea.	1	Ea.	$ 16,550
Subtotal					$ 122,600
Contingency (20%)	20%				$ 24,500
Total					**$ 147,100**

City of Hewitt: Alternative 2

City of Hewitt 50% Reduction of Current Groundwater Pumpage					
To Meet Existing (2020) Demands:					
No system improvement needed. Utilize existing wholesale contracts with City of Waco and City of Lorena to replace groundwater.					
To Meet Future (2070) Demands:					
Prop. Connection Location	**Exist. COW WL Size (in)**	**Prop. User WL Size (in)**	**Prop. Length (ft)**	**Delivery Location**	
Bagby Ave (~650 LF N. of Alliance Rd Intersection).	12	12	1,500	Hewitt EST (Alliance Pkwy)	
Alternative 1					
Description	**Cost**	**Cost Units**	**Quantity**	**Quantity Units**	**Estimated Cost**
6" PVC WL	$ 35.00	$/LF	1,500	LF	$ 52,500
6" Water Tie-In	$ 2,000.00	Ea.	2	Ea.	$ 4,000
6" Gate Valve	$ 1,250.00	Ea.	1	Ea.	$ 1,250
Meter	$ 7,316.00	Ea.	1	Ea.	$ 7,316
Subtotal					$ 65,100
Contingency (20%)	20%				$ 13,000
Total					**$ 78,100**

City of Lorena 50% Reduction of Current Groundwater Pumpage					
To Meet Existing (2020) Demands:					
No system improvement needed. Utilize existing wholesale contract with City of Robinson. Recommend connection to COW system for redundancy.					
To Meet Future (2070) Demands:					
Prop. Connection Location	**Exist. COW WL Size (in)**	**Prop. User WL Size (in)**	**Prop. Length (ft)**	**Delivery Location**	
Intersection of Old Lorena Rd. and Spring Valley Rd.	12	6	14,000	145 Mattson Ln. EST	
Description	**Cost**	**Cost Units**	**Quantity**	**Quantity Units**	**Estimated Cost**
6" PVC WL	$ 35.00	$/LF	14,000	LF	$ 490,000
6" Water Tie-In	$ 2,000.00	Ea.	2	Ea.	$ 4,000
6" Gate Valve	$ 1,250.00	Ea.	1	Ea.	$ 1,250
Meter	$ 7,316.00	Ea.	1	Ea.	$ 7,316
Subtotal					$ 502,600
Contingency (20%)	20%				$ 100,500
Total					**$ 603,100**

City of Bellmead 50% Reduction of Current Groundwater Pumpage					
To Meet Existing (2020) Demands:					
Shortfall of ~0.45 MGD (average). Supplement with City of Waco surface water.					
To Meet Future (2070) Demands:					
Shortfall of ~ 0.64 MGD (average). Supplement with City of Waco surface water. Recommended connection size: 8".					
Prop. Connection Location	**Exist. COW WL Size (in)**	**Prop. User WL Size (in)**	**Prop. Length (ft)**	**Delivery Location**	
Meyers Ln (~500 LF East of Intersection of Bellmead Dr. and Meyers Ln.)	16"	8"	200	Meyers Lane Tank(s)	
Description	**Cost**	**Cost Units**	**Quantity**	**Quantity Units**	**Estimated Cost**
8" PVC WL	$ 45.00	$/LF	200	LF	$ 9,000
8" Water Tie-In	$ 2,000.00	Ea.	2	Ea.	$ 4,000
8" Gate Valve	$ 1,500.00	Ea.	1	Ea.	$ 1,500
Meter	$ 11,930.00	Ea.	1	Ea.	$ 11,930
Subtotal					$ 26,400
Contingency (20%)	20%				$ 5,300
Total					**$ 31,700**

City of Woodway 50% Reduction of Current Groundwater Pumpage					
To Meet Existing (2020) Demands:					
Shortfall of ~0.59 MGD (average). Supplement with City of Waco surface water.					
To Meet Future (2070) Demands:					
Shortfall of ~ 0.59 MGD (average). Supplement with City of Waco surface water.					
Alternate 1: New connection to supply 2070 shortfall.					
Prop. Connection Location	**Exist. COW WL Size (in)**	**Prop. User WL Size (in)**	**Prop. Length (ft)**	**Delivery Location**	
Bent Oak/Old McGregor Rd	16	8	1,150	M-B Industrial GST	
Alternate 2: Deliver to 2 locations					
Bent Oak/Old McGregor Rd	16	6	1,150	M-B Industrial GST	
Jewell Dr/Railroad	16	6	1,825	Cactus Ln GST	
Cost Estimates					
Alternate Option 1					
Description	**Cost**	**Cost Units**	**Quantity**	**Quantity Units**	**Estimated Cost**
8" PVC WL	$ 45.00	$/LF	1,150	LF	$ 51,750
8" Water Tie-In	$ 2,000.00	Ea.	2	Ea.	$ 4,000
8" Gate Valve	$ 1,500.00	Ea.	1	Ea.	$ 1,500
Meter	$ 11,930.00	Ea.	1	Ea.	$ 11,930
Subtotal					$ 69,200
Contingency (20%)	20%				$ 13,800
Total					**$ 83,000**
Alternate Option 2					
Description	**Cost**	**Cost Units**	**Quantity**	**Quantity Units**	**Estimated Cost**
6" PVC WL	$ 35.00	$/LF	2,975	LF	$ 104,125
6" Water Tie-In	$ 2,000.00	Ea.	4	Ea.	$ 8,000
6" Gate Valve	$ 1,250.00	Ea.	2	Ea.	$ 2,500
Meter	$ 7,316.00	Ea.	2	Ea.	$ 14,632
Subtotal					$ 129,257
Contingency (20%)	20%				$ 25,851
Total					**$ 155,108**

3.4- Conclusion

The following "cut sheets" summarize the conjunctive use plan for the five major entities requiring reduced groundwater pumping under the Conjunctive Use Plan. Each "cut sheet" contains a summary table of existing connections to the City of Waco system, a summary of supply and demand for 2020 and 2070 conditions, recommendation exhibit and summary, cost estimates, and a graph showing the projected relationship between supply and demand from 2020-2070.

City of Hewitt
Conjunctive Use Plan- Summary

Existing Connection to COW System

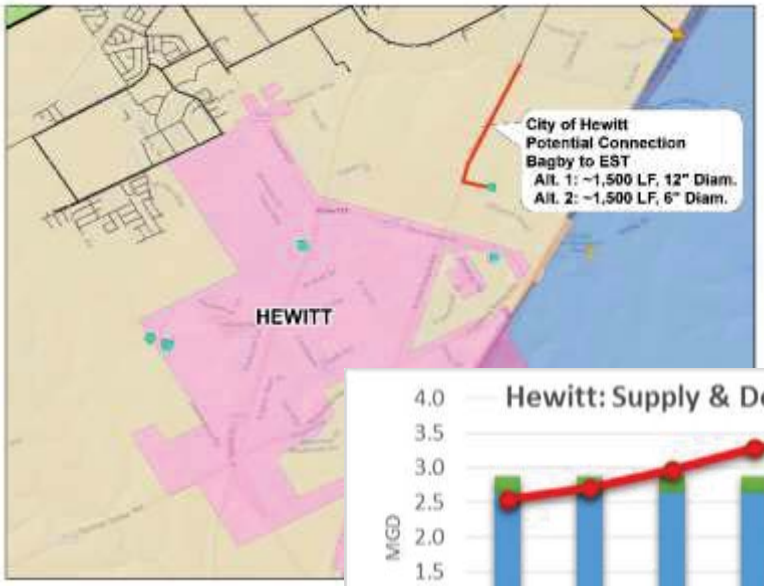
Location	COW Diameter	User Diameter
Warren Rd/Ritchie Rd	16"	16"

Supply and Demand Analysis

Year	Service Area Avg. Demand (MGD)	Wholesale Contract Demands (MGD)	Total Avg. Demand (MGD)	GW Supply (assumed at 50% of permit) (MGD)	SW Supply (Existing Contract w/ COW not to exceed 2 MGD)	Supply from Lorena (Existing Contract is for 0.25 MGD)	Total Supply *	Avg. Shortfall Supply-Avg. Demand (MGD)
2020	2.56	0	2.56	0.64	2	0.25	2.89	0.33
2070	3.75	0	3.75	0.64	2	0.25	2.89	-0.86

Recommendations

Alternative	Avg. SW Needed from COW (MGD)	Assumed Velocity (ft/s)	Required Diameter	Selected Diameter	Description
Alt. 1	0.86	3	9"	12"	New connection to COW system, with capacity to supply Avg 2070 shortfall
Alt. 2	0.00041	3	3.8"	6"	Utilize existing 16" connection to COW at 3 fps for the existing COW contract + add'l SW, and then construct an additionl connection to supply remaining 2070 Avg shortfall.



Cost Estimate					
Alternative 1					
Description	**Cost**	**Cost Units**	**Qty**	**Qty Units**	**Estimated Cost**
12" PVC WL	$ 65	$/LF	1,500	LF	$ 97,500
12" Water Tie-In	$ 3,000	Ea.	2	Ea.	$ 6,000
12" Gate Valve	$ 2,500	Ea.	1	Ea.	$ 2,500
8" Meter	$ 16,550	Ea.	1	Ea.	$ 16,550
Subtotal					$ 122,600
Contingency (20%)	20%				$ 24,500
Alt. 1 Total					**$ 147,100**
Alternative 2					
6" PVC WL	$ 35	$/LF	1,500	LF	$ 52,500
6" Water Tie-In	$ 2,000	Ea.	2	Ea.	$ 4,000
6" Gate Valve	$ 1,250	Ea.	1	Ea.	$ 1,250
4" Meter	$ 7,316	Ea.	1	Ea.	$ 7,316
Subtotal					$ 65,100
Contingency (20%)					$ 13,000
Alt. 2 Total					**$ 78,100**

City of Robinson
Conjunctive Use Plan- Summary

Existing Connection to COW System

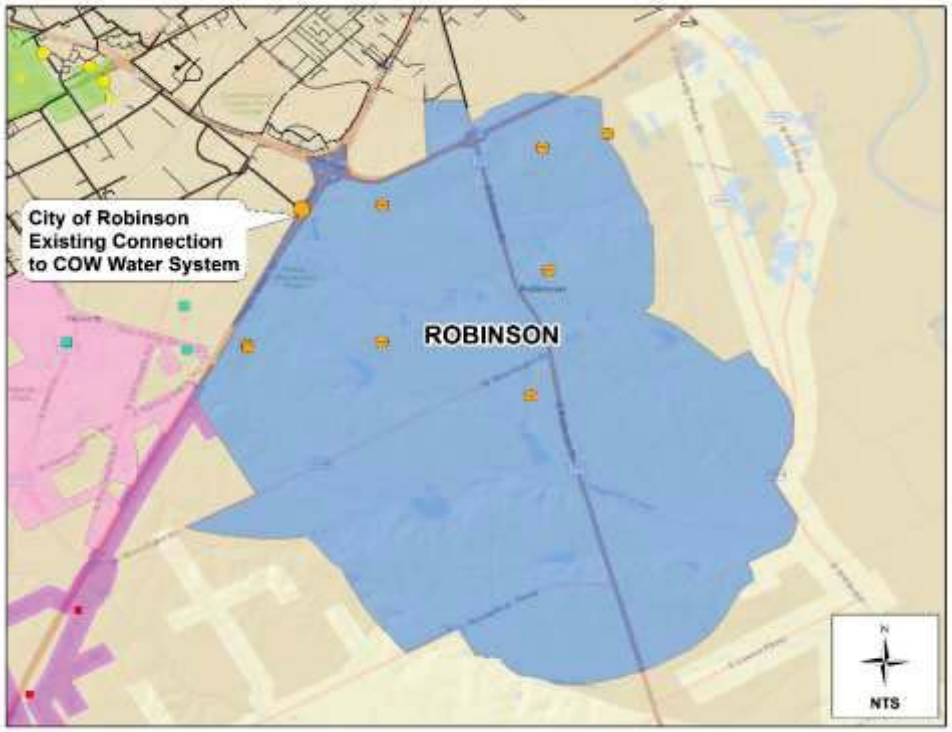
Location	COW Diameter	User Diameter
N. Side of Corp. Pkwy at IH35	16"	18"

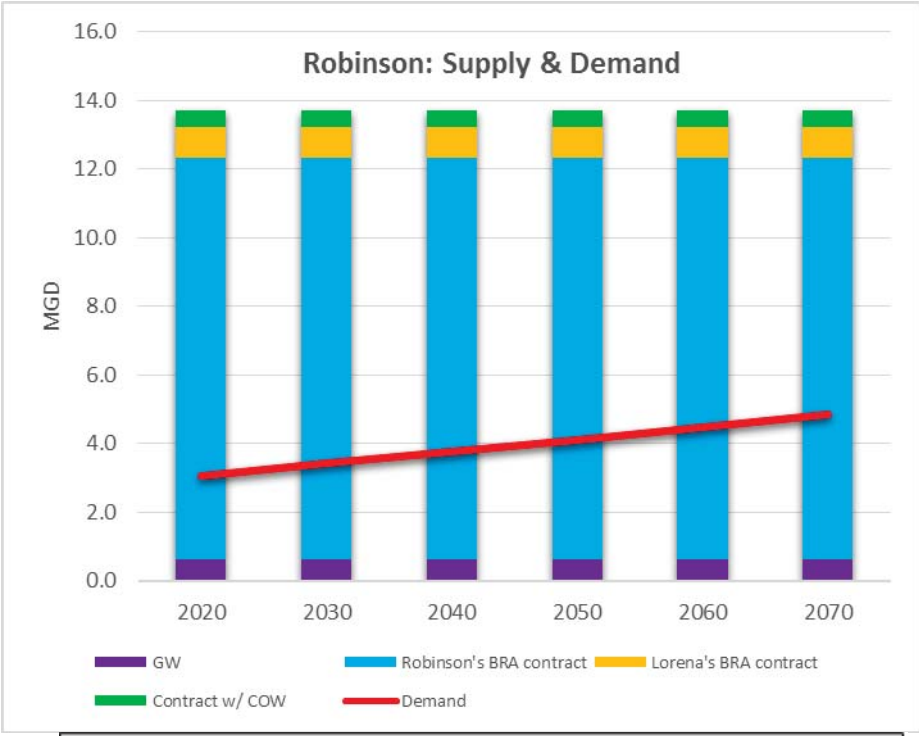
Supply and Demand Analysis

Year	Service Area Avg. Demand (MGD)	Wholesale Contract Demands (MGD)	Total Avg. Demand (MGD)	GW Supply (assumed at 50% of permit) (MGD)	SW Supply (Robinson's BRA contract, 13,100 ac-ft/yr) (MGD)	SW Supply (Lorena's BRA contract, 1000 ac-ft/yr) (MGD)	SW Supply (Contract w/ COW for 560 ac-ft/yr)	Total Supply	Avg. Shortfall Supply-Avg. Demand (MGD)
2020	2.18	0.89	3.07	0.63	11.7	0.89	0.5	13.72	10.65
2070	3.94	0.89	4.84	0.63	11.7	0.89	0.5	13.72	8.89

Recommendations

N/A: Robinson is projected to have surplus water supply, considering their existing water rights and contracts.





Cost Estimate: N/A. No improvements are recommended for the City of Robinson to acquire access to adequate water supply for future 2070 average demands.

City of Lorena
Conjunctive Use Plan- Summary

Existing Connection to COW System

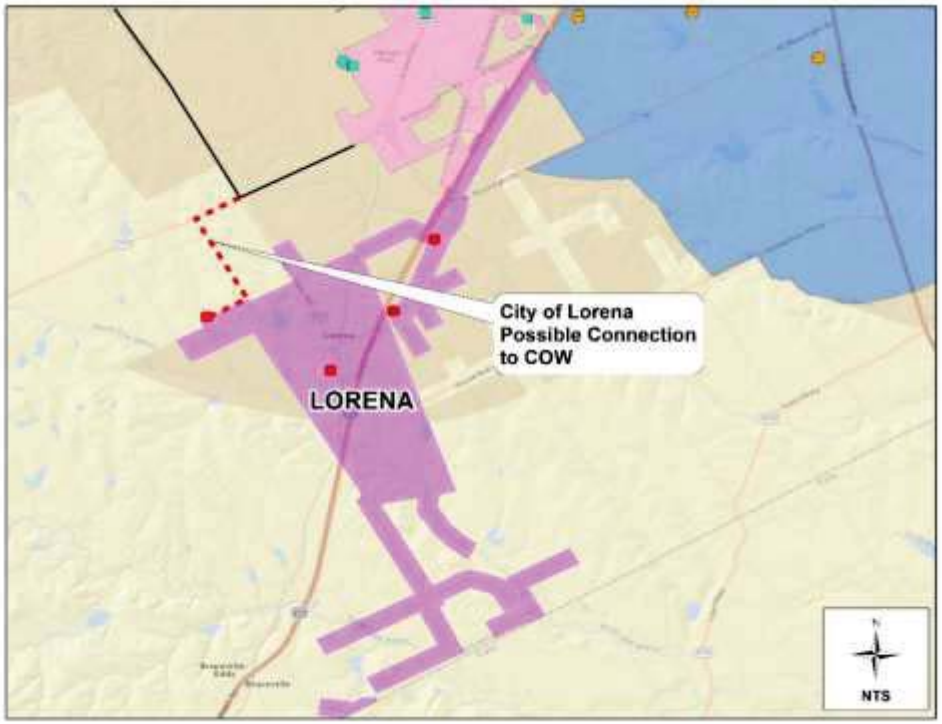
Location	COW Diameter	User Diameter
N/A		

Supply and Demand Analysis

Year	Service Area Avg. Demand (MGD)	Wholesale Contract Demands (MGD)	Total Avg. Demand (MGD)	GW Supply (assumed at 50% of permit) (MGD)	SW Supply (Contract w/ Robinson) (MGD)	Total Supply	Avg. Shortfall Supply-Avg. Demand (MGD)
2020	0.28	0.25	0.53	0.09	0.89	0.98	0.45
2070	0.41	0.25	0.66	0.09	0.89	0.98	0.32

Recommendations

Lorena is not projected to experience a shortfall under average demand conditions.
A potential connection to COW system at Spring Valley/Old Lorena is suggested to provide a redundant source of supply.



Cost Estimate

Alternative 1

Description	Cost	Cost Units	Qty	Qty Units	Estimated Cost
6" PVC WL	$ 35	$/LF	14,000	LF	$ 490,000
6" Water Tie-In	$ 2,000	Ea.	2	Ea.	$ 4,000
6" Gate Valve	$ 1,250	Ea.	1	Ea.	$ 1,250
4" Meter	$ 7,316	Ea.	1	Ea.	$ 7,316
Subtotal					$ 502,600
Contingency (20%)	20%				$ 100,500
Alt. 1 Total					**$ 603,100**

City of Bellmead
Conjunctive Use Plan- Summary

Existing Connection to COW System

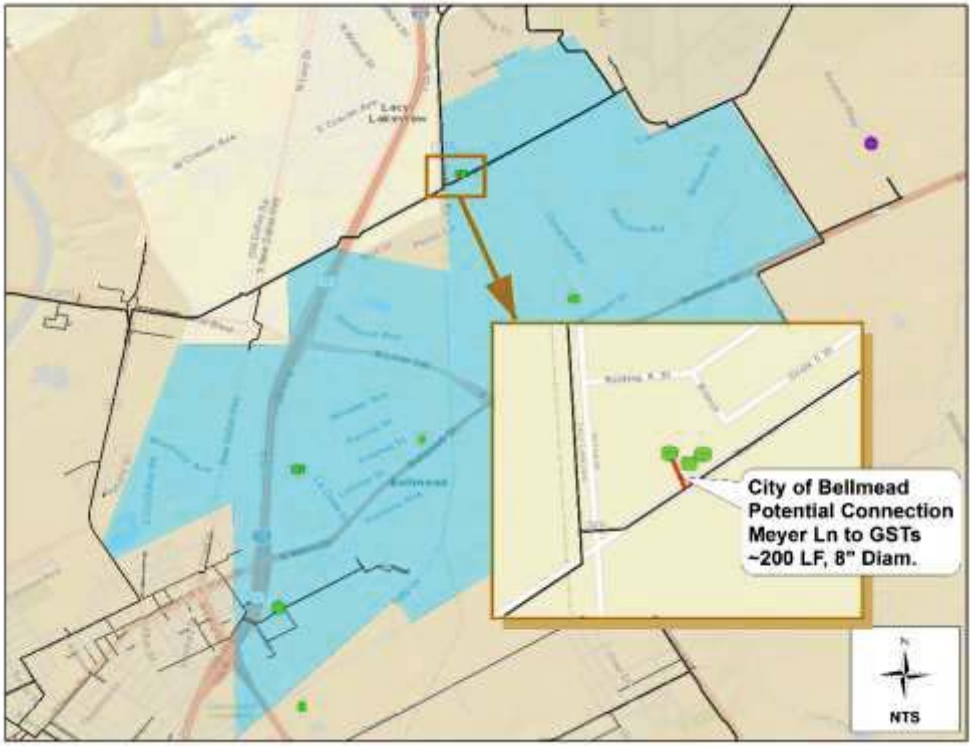
Location	COW Diameter	User Diameter
Corsicana St. & Bethard	8"	6"

Supply and Demand Analysis

Year	Service Area Avg. Demand (MGD)	Wholesale Contract Demands (MGD)	Total Avg. Demand (MGD)	GW Supply (assumed at 50% of permit) (MGD)	SW Supply (MGD)	Total Supply (MGD)	Avg. Shortfall Supply-Avg. Demand (MGD)
2020	1.11	0	1.11	0.66	0	0.66	-0.45
2070	1.3	0	1.3	0.66	0	0.66	-0.64

Recommendations

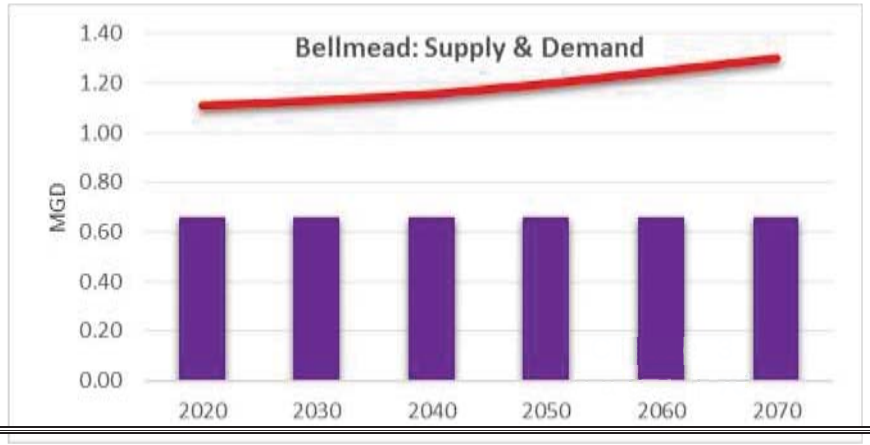
Alternative	Avg. SW Needed from COW (MGD)	Assumed Velocity (ft/s)	Required Diameter	Selected Diameter	Description
Alt. 1	0.64	3	7.79"	8"	Construct new 8" line connecting to COW's 16" waterline along Meyer Ln to deliver water to the 3 GSTs.



Cost Estimate

Alternative 1

Description	Cost	Cost Units	Qty	Qty Units	Estimated Cost
8" PVC WL	$ 45	$/LF	200	LF	$ 9,000
8" Water Tie-In	$ 2,000	Ea.	2	Ea.	$ 4,000
8" Gate Valve	$ 1,500	Ea.	1	Ea.	$ 1,500
6" Meter	$ 11,930	Ea.	1	Ea.	$ 11,930
Subtotal					$ 26,400
Contingency (20%)	20%				$ 5,300
Alt. 1 Total					**$ 31,700**



City of Woodway
Conjunctive Use Plan- Summary

Existing Connection to COW System

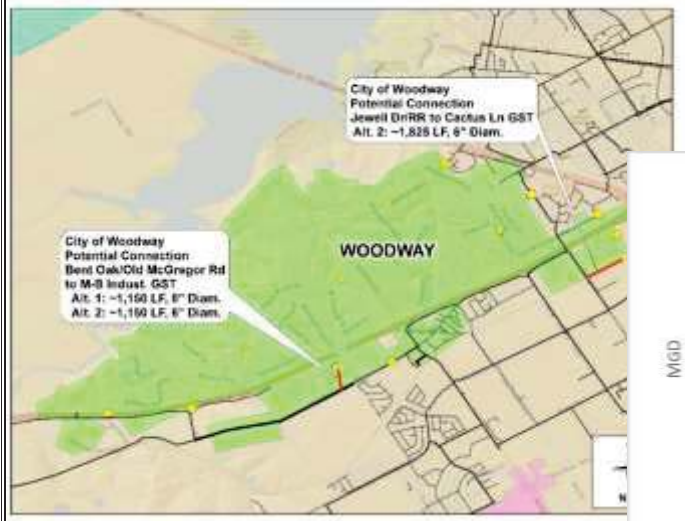
Location	COW Diameter	User Diameter
Otis Dr/Old McGregor Rd	8"	6"
Broad St. at City Limits	6"	6"
Delhi Rd at City Limits	16"	6"
Bosque Ln at City Limits	8"	6"
Sunn Dr/Old McGregor Rd	16"	3"
Sunn Dr/Old McGregor Rd	16"	4"
Wickson Rd/Hwy 84	12"	6"
Bush Dr/Hwy 84	12"	6"

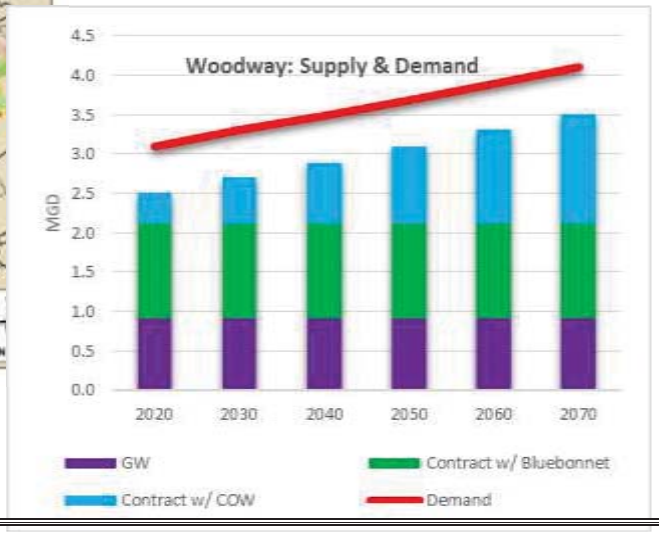
Supply and Demand Analysis

Year	Service Area Avg. Demand (MGD)	Wholesale Contract Demands (MGD)	Total Avg. Demand (MGD)	GW Supply (assumed at 50% of permit) (MGD)	SW Supply (Bluebonnet Contract: 1,362 acre-ft/yr) (MGD)	SW Supply (COW Contract) (MGD)	Total Supply (MGD)	Avg. Shortfall Supply-Avg. Demand (MGD)
2020	3.1	0	3.1	0.91	1.22	0.38	2.51	-0.59
2070	4.1	0	4.1	0.91	1.22	1.38	3.51	-0.59

Recommendations

Alternative	Avg. SW Needed from COW (MGD)	Assumed Velocity (ft/s)	Required Diameter	Selected Diameter	Description
Alt. 1	0.59	3	7.5"	8"	New connection to supply Avg. 2070 shortfall.
Alt. 2	0.297	3	5.3"	6"	2 new connections to supply Avg. 2070 shortfall, each assumed to supply 50% of shortfall.
	0.297	3	5.3"	6"	





Cost Estimate					
Alternative 1					
Description	**Cost**	**Cost Units**	**Qty**	**Qty Units**	**Estimated Cost**
8" PVC WL	$ 45	$/LF	1,150	LF	$ 51,750
8" Water Tie-In	$ 2,000	Ea.	2	Ea.	$ 4,000
8" Gate Valve	$ 1,500	Ea.	1	Ea.	$ 1,500
6" Meter	$ 11,930	Ea.	1	Ea.	$ 11,930
Subtotal					$ 69,200
Contingency (20%)	20%				$ 13,800
Alt. 1 Total					**$ 83,000**
Alternative 2					
6" PVC WL	$ 35	$/LF	2,975	LF	$ 104,125
6" Water Tie-In	$ 2,000	Ea.	4	Ea.	$ 8,000
6" Gate Valve	$ 1,250	Ea.	2	Ea.	$ 2,500
4" Meter	$ 7,316	Ea.	2	Ea.	$ 14,632
Subtotal					$ 129,257
Contingency (20%)					$ 25,851
Alt. 2 Total					**$ 155,108**

3.5- Appendices

Utility	CCN #	PWS #	EngrRep	TWDB_Recognized	Is Industry?	AR_Prob?	As Max Concentration on TCEQ web	As Max provided by WSC	As Design Concentration (mg/L)	Waco Surface Water As Concentration (mg/L)	As MCL (EPA)	α	ServiceArea (acre)	% of County Other	GW	SW	Comments
CITY OF ROBINSON	0		WP	1		0							#N/A		1	1	
CITY OF LORENA	10030		KPA	1		0							6,226		1		Purchased SW from C O Robinson; 2 active wells, 1 inactive well, 1 inactive connection with Levi WSC
BLUEBONNET WSC	11594		?	0		0							2,897	2.4%	0		
CITY OF BRUCEVILLE EDDY	11285		Tabor	1		0							15,904		1	1	TCEQ shows SW from Bluebonnet + 2 active wells; 4 inactive wells
CITY OF MCGREGOR	10033		WP	1		0							4,838		1	1	TCEQ shows 1 SW connection with Bluebonnet WSC; 3 wells- 2 active 1 inactive. Inactive one is US-84. Sells water to Central Bosque.
CITY OF MOODY	10021		?	1		0							1,911		1	1	
ELM CREEK WSC	10031		Tabor	1		0							17,784		1	1	
SPRING VALLEY WSC	11287		Tabor	0		0							21,666	17.8%	1	1	
CITY OF WOODWAY	10022		TWG	1		0							3,544		1	1	
CENTRAL BOSQUE WSC	10032		?	0		0							13,275	10.9%	0	1	TCEQ info shows that they receive SW from City of McGregor and SW from City of Waco and that they have 1 well is is "I' for inactive;
CITY OF LACY LAKEVIEW	10028		WP	1		0							2,948		0	1	
SOUTH BOSQUE WSC	11627		?	0		0							14	0.0%	1		
CARGILL MEAT SOLUTIONS	#N/A				1									0.0%	1		
CITY OF BELLMEAD	10024		BSP	1		0							4,720		1		
CITY OF HEWITT	10038		Cayote	1		0							2,844		1	1	
CITY OF WACO	10039		Multiple- TWG, LAN, WP	1		0							220,715		1	1	
CITY OF WEST	10026		WP	1		0							1,026		1	1	
WEST BRAZOS WSC	11283		Tabor	1		0							5,174		1		has 3 active wells, 1 inactive; has active emergency CC with COW
BOLD SPRINGS WSC	10006		Tabor	0		0							20,370	16.7%	1	1	
HILLTOP WSC	10017		Duff	0		0							1,664	1.4%	1	1	
CITY OF MART	0		Gil Gregory	1		0							#N/A		1		
CITY OF CRAWFORD	0		Snyder	1		0							#N/A		1		TCEQ shows 2 intakes- rock quarry lake and tonk creek; also 2 wells that are active
AXTELL WSC	11178		Tabor	0		1	0.018		0.018	0.0022	0.01	0.506329	6,226	5.1%	1		
BIROME WSC	10013		Duff	0		1	0.014		0.014	0.0022	0.01	0.338983	11,450	9.4%	0		Well locations outside MCL Co, but have some service area inside
CITY OF RIESEL	10029		TWG	1		1	0.017	0.0142	0.017	0.0022	0.01	0.472973	2,254		1		
E O L WSC	10014		Duff	0		1	0.022		0.022	0.0022	0.01	0.606061	4,925	4.0%	1		
LEROY TOURS GERALD WSC	10025		Duff	0		1	0.022	0.0154	0.022	0.0022	0.01	0.606061	4,429	3.6%	1		
M S WSC	11284		Duff	0		1	0.012	0.0125	0.0125	0.0022	0.01	0.242718	3,566	2.9%	1		
MOORE WATER SYSTEM	11878		Duff	0		1	Unknown	Unknown	0.03	0.0022	0.01	0.719424	219	0.2%	1		2 Active wells; 1 inactive plugged well
PRAIRIE HILL WSC	10020		?	0		1	0.027	0.031	0.031	0.0022	0.01	0.729167	6,117	5.0%	1		
R M S WSC	0		?	0		1	0.018	0.0128	0.018	0.0022	0.01	0.506329	#N/A	#N/A	1		
TRI COUNTY SUD	10054		?	1		1	0.034		0.034	0.0022	0.01	0.754717	3,150		0		Well locations outside MCL Co., but have some service area inside

SUPPLY

Utility	GW_Source	STGCD GWSupply_PERMIT	STGCD GWSupply_Exist (Gal 2015)	STGCD GWSupply_Exist (Gal 2013)	TWDB GWSupply_Exist (Gal 2013)	Add'l GW Supply Source (through contract)	Add'l GW Supply Amount	Available GW_SUPPLY EXIST	SW_Source	SW Supply_Exist (Gal)	GWSupply_Future (2070)	SWSupply_Future (2070)	TOTAL FUTURE SUPPLY 2070
CITY OF ROBINSON	OTHER AQUIFER	462,035,000	351,675,000	433,651,500	433,651,600			462,035,000	Brazos River Lake Waco (thru City of Waco)	182,476,560	462,035,000	182,476,560	644,511,560
CITY OF LORENA	TRINITY AQUIFER	189,962,000	62,962,600	46,687,030	46,753,900			189,962,000	Brazos River (thru City of Robinson)	325,851,000	189,962,000	325,851,000	515,813,000
BLUEBONNET WSC	#N/A	#N/A	#N/A	#N/A	#N/A			#N/A	Lake Belton (thru Bluebonnet)		0	0	-
CITY OF BRUCEVILLE EDDY	OTHER AQUIFER	113,229,000	85,749,000	123,256,000	123,556,000			113,229,000	Lake Belton (thru Bluebonnet)	305,648,238	113,229,000	305,648,238	418,877,238
CITY OF MCGREGOR	TRINITY AQUIFER	140,097,715	90,635,000	101,187,200	43,991,000			140,097,715	Lake Belton (thru Bluebonnet)	696,995,289	140,097,715	696,995,289	837,093,004
CITY OF MOODY	TRINITY AQUIFER	20,040,000	3,180,000	2,012,800	630,900			20,040,000	Lake Belton (thru Bluebonnet)	130,666,251	20,040,000	130,666,251	150,706,251
ELM CREEK WSC	TRINITY AQUIFER	73,420,000	54,020,000	53,224,000	53,969,700			73,420,000	Lake Belton (thru Bluebonnet)	213,106,554	73,420,000	213,106,554	286,526,554
SPRING VALLEY WSC	OTHER AQUIFER	40,403,243	5,884,000	12,954,000	12,325,000			40,403,243	Lake Belton (thru Bluebonnet)	98,081,151	40,403,243	98,081,151	138,484,394
CITY OF WOODWAY	TRINITY AQUIFER	664,212,000	404,459,000	414,419,000	409,957,302			664,212,000	Lake Belton (thru Bluebonnet) Lake Waco (thru City of Waco)	584,250,843	664,212,000	584,250,843	1,248,462,843
CENTRAL BOSQUE WSC	#N/A	#N/A	#N/A	#N/A	#N/A			#N/A	Lake Belton (thru City of McGregor, thru Bluebonnet) Lake Waco (thru City of Waco)	22,809,570	0	22,809,570	22,809,570
CITY OF LACY LAKEVIEW	#N/A	#N/A	#N/A	#N/A	#N/A			#N/A	Lake Waco (thru City of Waco)	364,953,120	0	364,953,120	364,953,120
SOUTH BOSQUE WSC	#N/A	5,935,000	3,071,000	3,923,000	#N/A			5,935,000	Lake Waco (thru City of Waco)	EMERGENCY ONLY	5,935,000	EMERGENCY ONLY	5,935,000
CARGILL MEAT SOLUTIONS	TRINITY AQUIFER	181,821,000	131,231,000	137,100,000	140,795,000			181,821,000	Lake Waco (thru City of Waco)	Unknown	181,821,000	Unknown	181,821,000
CITY OF BELLMEAD	TRINITY AQUIFER	481,279,000	422,622,000	400,025,000	399,983,000			481,279,000	Lake Waco (thru City of Waco)	EMERGENCY ONLY	481,279,000	EMERGENCY ONLY	481,279,000
CITY OF HEWITT	TRINITY AQUIFER	469,655,000	372,440,800	438,420,600	438,420,700			469,655,000	Lake Waco (thru City of Waco)	124,800,933	469,655,000	124,800,933	594,455,933
CITY OF WACO	TRINITY AQUIFER OTHER AQUIFER	289,169,000	194,709,930	167,961,508	168,232,918			289,169,000	Lake Waco (thru City of Waco)	17,012,680,710	289,169,000	17,012,680,710	17,301,849,710
CITY OF WEST	TRINITY AQUIFER	158,816,000	56,623,000	30,922,000	31,733,000			158,816,000	Lake Waco (thru City of Waco)	364,953,120	158,816,000	364,953,120	523,769,120
WEST BRAZOS WSC	#N/A	36,431,000	31,396,000	50,739,000	#N/A			36,431,000	Lake Waco (thru City of Waco)	EMERGENCY ONLY	36,431,000	EMERGENCY ONLY	36,431,000
BOLD SPRINGS WSC	OTHER AQUIFER	77,545,000	64,939,000	65,690,000	65,690,000			77,545,000	Lake Waco? (City of Waco)	182,476,560	77,545,000	182,476,560	260,021,560
HILLTOP WSC	TRINITY AQUIFER	34,223,000	17,451,000	31,130,000	26,411,500			34,223,000	Lake Waco? (City of Waco)	31,607,547	34,223,000	31,607,547	65,830,547
CITY OF MART	TRINITY AQUIFER	59,764,000	41,892,000	25,630,000	25,862,000			59,764,000	New Lake Mart	Unknown	59,764,000	Unknown	59,764,000
CITY OF CRAWFORD	OTHER AQUIFER	57,829,494	42,635,600	47,203,000	47,378,400			57,829,494	Rock Quarry Lake & Tonk Creek	78,840,000	57,829,494	78,840,000	136,669,494
AXTELL WSC	TRINITY AQUIFER	68,407,000	52,677,000	59,695,000	58,885,500			68,407,000			68,407,000	0	68,407,000
BIROME WSC	#N/A	#N/A	#N/A	#N/A	#N/A			#N/A			0	0	-
CITY OF RIESEL	OTHER AQUIFER	42,780,978	62,217,400	34,065,600	3,285,760	*FROM RMS*	**36,114,588**	78,895,565			78,895,565	0	78,895,565
E O L WSC	TRINITY AQUIFER	69,989,000	49,712,000	38,804,000	59,538,500			69,989,000			69,989,000	0	69,989,000
LEROY TOURS GERALD WSC	OTHER AQUIFER	54,419,000	47,511,000	51,891,000	52,141,000			54,419,000			54,419,000	0	54,419,000
M S WSC	OTHER AQUIFER	7,593,990	24,869,000	20,547,000	4,773,400	*FROM RMS*	**15,842,615**	23,436,605			23,436,605	0	23,436,605
MOORE WATER SYSTEM	#N/A	6,397,000	3,002,000	1,653,000	#N/A			6,397,000			6,397,000	0	6,397,000
PRAIRIE HILL WSC	OTHER AQUIFER	68,454,000	62,444,000	67,650,000	67,750,000			68,454,000			68,454,000	0	68,454,000
R M S WSC	TRINITY AQUIFER	51,957,203	#VALUE!	#VALUE!	46,988,300			51,957,203			51,957,203	0	51,957,203
TRI COUNTY SUD	#N/A	#N/A	#N/A	#N/A	#N/A			#N/A			0	0	-

LOCAL INPUT- SUPPLY

Utility	*Local Comments on Supply*	*STGWCD PERMITTED AMT (GAL/YR)*	*STGCD 2015 (GAL/YR)*	*STGCD 2013 (GAL/YR)*	*SW Source*	*SW Supply (GAL/YR)*	Demand_2020_Gal
CITY OF ROBINSON					Brazos River (1,000 ac-ft/yr BRA contract to treat for LORENA) + Brazos River (13,100 ac-ft/yr BRA contract, Robinson) + Contract with COW for 560 ac-ft/yr	4,776,975,660	794,098,887
CITY OF LORENA	Kevin Neal provided feeback.	189,962,000	58,032,400	46,753,900	Brazos River (1,000 ac-ft/yr BRA contract, treated by City of Robinson)	325,851,000	100,687,959
BLUEBONNET WSC							#N/A
CITY OF BRUCEVILLE EDDY							95,148,492
CITY OF MCGREGOR							259,377,396
CITY OF MOODY							61,585,839
ELM CREEK WSC							65,170,200
SPRING VALLEY WSC							40,403,243
CITY OF WOODWAY							1,132,983,927
CENTRAL BOSQUE WSC	Response Received.				Lake Belton (thru Bluebonnet)- 22,809,570 gal/yr Lake Waco (thru COW)- 6,774,800 gal/yr	29,584,370	#N/A
CITY OF LACY LAKEVIEW							251,556,972
SOUTH BOSQUE WSC							5,935,000
CARGILL MEAT SOLUTIONS							181,821,000
CITY OF BELLMEAD							404,381,091
CITY OF HEWITT	The STGCD amount includes the "Lorena Well" which will be turned back over to the City of Hewitt The Water from City of Lorena is from both GW and SW	678,835,697	372,440,800	438,420,600	Lake Waco (thru City of Waco) and Brazos River (thru City of Lorena, thru City of Robinson)	821,250,000	883,382,061
CITY OF WACO							10,371,185,628
CITY OF WEST							159,666,990
WEST BRAZOS WSC							60,608,286
BOLD SPRINGS WSC		77,545,000	64,939,000	67,055,900	Lake Waco	182,500,000	77,545,000
HILLTOP WSC		34,223,000	23,676,000	26,411,500			34,223,000
CITY OF MART							114,699,552
CITY OF CRAWFORD		57,829,494	42,635,600	47,203,000	Rock Quarry Lake/Tonk Creek	17,921,805	48,551,799
AXTELL WSC							68,407,000
BIROME WSC							#N/A
CITY OF RIESEL							44,315,736
E O L WSC							69,989,000
LEROY TOURS GERALD WSC							54,419,000
M S WSC							23,436,605
MOORE WATER SYSTEM							6,397,000
PRAIRIE HILL WSC							68,454,000
R M S WSC							0
TRI COUNTY SUD							6,842,871

Utility	CCN #	PWS #	EngrRep	TWDB_Recognized	Is Industry?	AR_Prob?	As Max Concentration on TCEQ web	As Max provided by WSC	As Design Concentration (mg/L)	Waco Surface Water As Concentration (mg/L)	As MCL (EPA)	α	ServiceArea (acre)	% of County Other	GW	SW	Comments
AQUA TEXAS INC	13201		#N/A	0		0							14,087		1		Tied to Aqua?
BOSQUE BASIN WSC	12341		?	0		0							186	0.2%	1		
C S COMMUNITY WSC	11945		Duff	0		0							5	0.0%	1		
CEDAR RIDGE DEEP WELL WATER SYSTEM	12091		?	0		0							102	0.1%	1		
CHALK BLUFF WSC	10019		Duff	1		0							1,249		1		
CHILDRESS CREEK WSC	11000		Cayote	0		0							879	0.7%	0		
CITY OF HALLSBURG	0		#N/A	1		0							#N/A		0		
CITY OF VALLEY MILLS	0		#N/A	1		0							#N/A		0		2 active wells; primarily serves Bosque County-located near McL border
CORYELL CITY WSD	10453		?	1		0							11,151		0		
COTTONWOOD WSC	10015		Tabor	0		0							4,944	4.1%	1		
CROSS COUNTRY WSC	11286		Duff	1		0							12,271		1		
EAST CRAWFORD WSC	11396		Multiple-Tabor, Duff	0		0							7,559	6.2%	1		
GHOLSON WSC	11194		Duff	1		0							14,496		1		
GOLINDA WSC	10009		?	1		0							331		0		Well locations outside MCL, but have some service area inside; TCEQ shows 2 active wells + inactive CC with Levi WSC
H & H WSC	10016		Duff	0		0							10,561	8.7%	1		
HIGHLAND PARK WSC	0		Duff	0		0							425	0.3%	0		
HOG CREEK WSC	10035		?	0		0							1,693	1.4%	1		
LASS WATER COMPANY	12258		?	0		0							797	0.7%	1		
LEVI WSC	10018		Tabor	0		0							4,616	3.8%	1		
MCLENNAN COUNTY WCID NO 2	0		Tabor	0		0							#N/A	#N/A	1		3 active wells
MENLOW WSC	11266		?	0		0							440	0.4%	1		
NORTH BOSQUE WSC	10023		?	1		0							5,105		1		
PATRICK WSC	12352		Duff	0		0							568	0.5%	1		
PURE WSC	10036		Duff	0		0							5,161	4.2%	1		
ROSS WSC	11268		Tabor	0		0							11,655	9.6%	1		
WINDSOR WATER COMPANY	11281		?	0		0							372	0.3%	1		
SANDERSON FARMS INC	#N/A				1									0.0%	1		
SUM													121,705				
TWDB's Non-Municipal Categories																	
County- Other																	

SUPPLY

Utility	GW_Source	STGCD GWSupply_PERMIT	STGCD GWSupply_Exist (Gal 2015)	STGCD GWSupply_Exist (Gal 2013)	TWDB GWSupply_Exist (Gal 2013)	Add'l GW Supply Source (through contract)	Add'l GW Supply Amount	Available GW_SUPPLY EXIST	SW_Source	SW Supply_Exist (Gal)	GWSupply_Future (2070)	SWSupply_Future (2070)	TOTAL FUTURE SUPPLY 2070
AQUA TEXAS INC	#N/A	250,733,000	242,740,900	250,733,000	305,076,100			250,733,000			250,733,000	0	250,733,000
BOSQUE BASIN WSC	TRINITY AQUIFER	13,924,000	8,204,000	8,744,900	6,046,800			13,924,000			13,924,000	0	13,924,000
C S COMMUNITY WSC	OTHER AQUIFER	17,961,000	8,690,700	7,253,000	7,094,000			17,961,000			17,961,000	0	17,961,000
CEDAR RIDGE DEEP WELL WATER SYSTEM	OTHER AQUIFER	5,192,000	5,225,000	5,129,000	5,130,000			5,192,000			5,192,000	0	5,192,000
CHALK BLUFF WSC	TRINITY AQUIFER	130,557,000	113,255,000	131,721,000	#N/A			130,557,000			130,557,000	0	130,557,000
CHILDRESS CREEK WSC	#N/A	#N/A	#N/A	#N/A	#N/A			#N/A			0	0	-
CITY OF HALLSBURG	#N/A	#N/A	#N/A	#N/A	#N/A			#N/A			0	0	-
CITY OF VALLEY MILLS	#N/A	#N/A	#N/A	#N/A	#N/A			#N/A			0	0	-
CORYELL CITY WSD	#N/A	#N/A	#N/A	#N/A	#N/A			#N/A			0	0	-
COTTONWOOD WSC	OTHER AQUIFER	21,570,000	12,823,000	15,228,300	15,446,600			21,570,000			21,570,000	0	21,570,000
CROSS COUNTRY WSC	TRINITY AQUIFER	170,562,405	115,884,700	131,777,520	132,682,700			170,562,405			170,562,405	0	170,562,405
EAST CRAWFORD WSC	OTHER AQUIFER	74,910,000	76,397,000	82,095,000	82,872,300			74,910,000			74,910,000	0	74,910,000
GHOLSON WSC	OTHER AQUIFER	87,991,000	69,959,000	65,750,000	70,752,000			87,991,000			87,991,000	0	87,991,000
GOLINDA WSC	#N/A	#N/A	#N/A	#N/A	#N/A			#N/A			0	0	-
H & H WSC	OTHER AQUIFER	69,334,000	47,686,000	51,438,000	51,438,200			69,334,000			69,334,000	0	69,334,000
HIGHLAND PARK WSC	#N/A	#N/A	#N/A	#N/A	#N/A			#N/A			0	0	-
HOG CREEK WSC	OTHER AQUIFER	26,558,000	345,000	2,449,000	15,375,398			26,558,000			26,558,000	0	26,558,000
LASS WATER COMPANY	OTHER AQUIFER	#N/A	#N/A	#N/A	6,455,000			#N/A			0	0	-
LEVI WSC	TRINITY AQUIFER	107,717,543	80,749,800	67,308,200	67,309,000			107,717,543			107,717,543	0	107,717,543
MCLENNAN COUNTY WCID NO 2	TRINITY AQUIFER	84,315,000	71,571,000	70,913,000	70,863,000			84,315,000			84,315,000	0	84,315,000
MENLOW WSC	#N/A	18,726,038	8,311,500	9,491,600	#N/A			18,726,038			18,726,038	0	18,726,038
NORTH BOSQUE WSC	OTHER AQUIFER	187,675,415	121,934,200	105,923,700	121,908,300			187,675,415			187,675,415	0	187,675,415
PATRICK WSC	TRINITY AQUIFER	17,126,000	12,115,000	12,198,000	12,207,300			17,126,000			17,126,000	0	17,126,000
PURE WSC	OTHER AQUIFER	27,510,000	18,803,800	12,112,400	12,085,500			27,510,000			27,510,000	0	27,510,000
ROSS WSC	OTHER AQUIFER	109,993,514	83,946,000	100,778,000	102,405,000			109,993,514			109,993,514	0	109,993,514
WINDSOR WATER COMPANY	TRINITY AQUIFER	42,740,000	26,274,000	29,753,000	21,710,000			42,740,000			42,740,000	0	42,740,000
SANDERSON FARMS INC	#N/A	391,987,000	369,342,000	365,167,000	#N/A			391,987,000			391,987,000	0	391,987,000
TWDB's Non-Municipal Categories													
County- Other													

LOCAL INPUT- SUPPLY

Utility	Local Comments on Supply	STGWCD PERMITTED AMT (GAL/YR)	STGCD 2015 (GAL/YR)	STGCD 2013 (GAL/YR)	SW Source	SW Supply (GAL/YR)	Demand_2020_Gal
AQUA TEXAS INC	Response Received, but no input included on supply						69,080,412
BOSQUE BASIN WSC							13,924,000
C S COMMUNITY WSC							17,961,000
CEDAR RIDGE DEEP WELL WATER SYSTEM							5,192,000
CHALK BLUFF WSC							87,653,919
CHILDRESS CREEK WSC							#N/A
CITY OF HALLSBURG							26,393,931
CITY OF VALLEY MILLS							1,629,255
CORYELL CITY WSD					Purchased from Gatesville	55,000,000	40,731,375
COTTONWOOD WSC							21,570,000
CROSS COUNTRY WSC							133,273,059
EAST CRAWFORD WSC							74,910,000
GHOLSON WSC							50,506,905
GOLINDA WSC							6,191,169
H & H WSC							69,334,000
HIGHLAND PARK WSC							#N/A
HOG CREEK WSC							26,558,000
LASS WATER COMPANY							#N/A
LEVI WSC							107,717,543
MCLENNAN COUNTY WCID NO 2							84,315,000
MENLOW WSC		18,726,044	8,695,100	9,491,300	-	-	18,726,038
NORTH BOSQUE WSC							201,701,769
PATRICK WSC							17,126,000
PURE WSC							27,510,000
ROSS WSC							109,993,514
WINDSOR WATER COMPANY							42,740,000
SANDERSON FARMS INC							391,987,000
TWDB's Non-Municipal Categories							
County- Other							1,151,231,583

325851

	SERVICE AREA DEMAND (TWDB or set to Permitted Pumping)					SERVICE AREA DEMAND- from FHLM Study (S. Roth)						SERVICE AREA DEMAND- from Waco Water MP (B. Wallace)			DEMAND - LOCAL INPUT										OTHER CONTRACTS DEMAND-TWDB				
Utility	Demand_2010_Gal	Demand_2040_Gal	Demand_2050_Gal	Demand_2060_Gal	Demand_2070_Gal	Avg Day Demand 2020 - Gal/yr	Avg Day Demand 2030 - Gal/yr	Avg Day Demand 2040 - Gal/yr				2020 Demand Gal/Yr	2030 Demand Gal/Yr	2040 Demand Gal/Yr	Source of local input	Local Comments	HISTORICAL DEMAND 2011 (Drought Year)	Demand 2020_Gal	Demand 2030_Gal	Demand 2040_Gal	Demand 2050_Gal	Demand 2060_Gal	Demand 2070_Gal	Interconnects (BF= buys from, ST= sells to)	TWDB Other Contracts Demand - 2020	TWDB Other Contracts Demand - 2030	TWDB Other Contracts Demand - 2040	TWDB Other Contracts Demand - 2050	TWDB Other Contracts Demand - 2060
CITY OF ROBINSON	910,304,605	1,052,172,879	1,178,928,918	1,309,921,020	1,439,609,718	#N/A	#N/A	#N/A								2011 Demand is SW + GW	750,067,700							ST: City of Lorena	325,851,000	325,851,000	325,851,000	325,851,000	325,851,000
CITY OF LORENA	110,463,489	119,587,317	129,016,996	139,790,079	150,217,311	#N/A	#N/A	#N/A																BF: City of Robinson (P); Levi WSC (Open) ST: City of Hewitt	85,880,000	85,880,000	85,880,000	85,880,000	85,880,000
BELL-BENNETT WSC	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																ST: Moffat WSC (P); City of Bruceville-Eddy (P); Elm Creek WSC (P); City of Meridy (P); City of McGregor (P); Spring Valley WSC (P); Pendleton WSC (P)	2,321,688,375	2,321,688,375	2,321,688,375	2,321,688,375	2,321,688,375
CITY OF BRUCEVILLE EDDY	103,036,257	104,924,032	110,137,638	116,328,807	122,519,976	#N/A	#N/A	#N/A																BF: Bluebonnet WSC					
CITY OF MCGREGOR	263,287,608	267,197,820	273,714,840	283,164,519	292,940,049	#N/A	#N/A	#N/A																BF: Bluebonnet WSC, ST: Central Bosque WSC	Unknown	Unknown	Unknown	Unknown	Unknown
CITY OF MOODY	63,866,796	65,821,902	68,754,561	72,664,773	76,574,985	#N/A	#N/A	#N/A																BF: Bluebonnet WSC					
ELM CREEK WSC	72,013,071	78,530,091	85,372,962	92,867,535	100,362,108	#N/A	#N/A	#N/A								"We have received your spreadsheet and have found the information to be accurate and quite thorough. We have no additional information to add."								BF: Bluebonnet WSC					
SPRING VALLEY WSC	40,403,243	40,403,243	40,403,243	40,403,243	40,403,243	#N/A	#N/A	#N/A																BF: Bluebonnet WSC					
CITY OF WOODWAY	1,206,626,253	1,272,648,155	1,345,418,779	1,421,362,062	1,496,959,494	#N/A	#N/A	#N/A								Phone call w/ Mitch: GW supply permitted is slightly lower than what is on their HUPP permit (possibly rounding error?). Tom should have SW supply #'s from Waco & Bluebonnet; Demand projections from TWDB go to 2070, but Woodway expects to be fully built out before then & has no room to expand.								BF: City of Waco (P), Bluebonnet WSC (O), Bluebonnet Contract thru McGregor (O)					
CENTRAL BOSQUE WSC	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A							David Posten			31,063,589	32,542,887	34,022,026	35,501,244	36,980,463	38,459,681	BF: City of Waco, Bluebonnet WSC					
CITY OF LACY LAKE VIEW	266,220,267	279,906,009	295,872,708	314,772,066	333,997,275	#N/A	#N/A	#N/A																BF: City of Waco					
SOUTH BOSQUE WSC	5,935,000	5,935,000	5,935,000	5,935,000	5,935,000	#N/A	#N/A	#N/A							David Posten	"The numbers you have should be fine" -David Posten								BF: City of Waco (I)					
CARGILL MEAT SOLUTIONS	181,821,000	181,821,000	181,821,000	181,821,000	181,821,000	#N/A	#N/A	#N/A																BF: City of Waco (I)					
CITY OF BELLMEAD	413,504,919	422,202,896	436,314,489	455,213,847	474,764,907	#N/A	#N/A	#N/A								Here is the figure we have for production in 2011. 431,085,000 gals produced in 2011.	431,085,000							BF: City of Waco (I)					
CITY OF HEWITT	989,283,636	1,084,757,979	1,187,075,193	1,295,257,725	1,402,788,555	#N/A	#N/A	#N/A							Karen Sexton City of Hewitt Utilities Dept.			934,089,750	990,975,000	1,018,400,000	1,200,667,500	1,259,250,000	1,369,750,000	BF: City of Waco BF: City of Lorena ST: City of Waco (EMERGENCY ONLY) ST: City of Waco (EMERGENCY ONLY)					
CITY OF WACO	10,960,975,938	11,493,742,323	12,095,914,971	12,759,673,458	13,424,735,349	#N/A	#N/A	#N/A				11,585,100,000	13,048,750,000	14,413,850,000										ST: TSTC (P), City of West (P), Smith Water (O), China Spring Water Co (O), City of Hewitt (P), West Brazos WSC (O), City of Woodway (P), City of Lacy Lakeview (P), Cargill Meat Solutions Waco (O), South Bosque WSC (O), City of Bellmead (P) BF: Bluebonnet WSC (O)	1,414,319,191	1,545,185,442	1,764,953,813	1,892,542,608	2,073,064,062
CITY OF WEST	161,296,245	162,925,500	165,858,159	170,430,073	175,307,838	#N/A	#N/A	#N/A																ST: Bold Springs (O), Cottonwood WSC (O)					
WEST BRAZOS WSC	62,889,243	65,496,051	69,080,412	72,990,624	76,900,836	#N/A	#N/A	#N/A							Mark Kocian	Estimated growth from total amount of production @ 5%		94,977,000	99,738,920	104,704,866	109,940,109	115,473	121,208,970	BF: City of Waco (I)					
BOLD SPRINGS WSC	77,545,000	77,545,000	77,545,000	77,545,000	77,545,000	#N/A	#N/A	#N/A							John Rochelle jrochelle42@gmail.com	When in drought years, we use much more water as livestock needs water. In 2011, we used more than 80,000,000 gallons. We have averaged over the last 6 years using 66,247,500 gallons/yr.	80,000,000	67,330,900	69,000,000	71,000,000	72,000,000	73,000,000	76,500,000	BF: Hilltop (O), City of West (O) ST: Hilltop WSC (O)					
HILLTOP WSC	34,223,000	34,223,000	34,223,000	34,223,000	34,223,000	#N/A	#N/A	#N/A								There was significant rainfall during the 2013 and 2015 base years. There can be significant increases in water usage during drought years for livestock, sprinklers, etc. For example, in 2011 water production was 36,300,000. Historically, area has had approximate 4% average population growth every decade.	36,300,000	27,500,000	28,600,000	29,800,000	31,000,000	32,200,000	33,500,000	BF: Bold Springs (O) ST: Bold Springs (O)					
CITY OF MART	119,913,168	124,800,933	130,666,251	137,834,973	145,003,695	141,620,000	151,840,000	162,790,000																None					
CITY OF CRAWFORD	47,900,097	47,900,097	47,900,097	48,551,799	49,203,501	#N/A	#N/A	#N/A							Marilyn Judy judyfamily@aol.com	Crawford notes - Surface Water - Permit allows us to divert 85 Acre Feet and use 55 acre feet of water - permit #4135		48,800,000	50,700,000	52,100,000	53,600,000	55,000,000	56,400,000	None					
AXTELL WSC	68,407,000	68,407,000	68,407,000	68,407,000	68,407,000	62,780,000	67,525,000	72,635,000																BF: EOL WSC (E)					
BIROME WSC	#N/A	#N/A	#N/A	#N/A	#N/A	33,215,000	35,405,000	37,595,000																					
CITY OF RESEL	44,315,736	44,315,736	44,641,587	45,619,140	46,922,544	#N/A	#N/A	#N/A																BF: RMS, Tri County SUD (E)					
E.O.L WSC	69,989,000	69,989,000	69,989,000	69,989,000	69,989,000	68,985,000	75,190,000	82,490,000																ST: Axtell WSC (E), Prairie Hill WSC (E)					
LEROY TOLIVER GERALD WSC	54,419,000	54,419,000	54,419,000	54,419,000	54,419,000	39,785,000	43,415,000	47,085,000																ST: Pure WSC (E)					
MCS WSC	23,436,605	23,436,605	23,436,605	23,436,605	23,436,605	11,680,000	12,045,000	12,045,000																BF: H&H WSC (E), RMS (P), City of Resel (E)					
MOORE WATER SYSTEM	6,397,000	6,397,000	6,397,000	6,397,000	6,397,000	15,330,000	15,330,000	15,695,000																None					
PRAIRIE HILL WSC	68,454,000	68,454,000	68,454,000	68,454,000	68,454,000	54,385,000	57,305,000	60,225,000																BF: EOL WSC (E)					
R.H.S. WSC	0	0	0	0	0	45,625,000	53,290,000	62,415,000																ST: MS WSC (P), City of Resel (P)	51,957,203	51,957,203	51,957,203	51,957,203	51,957,203
TRI COUNTY SUD	7,494,573	8,146,275	9,123,828	10,101,381	10,753,083	#N/A	#N/A	#N/A																					

	SERVICE AREA DEMAND (TWDB or set to Permitted Pumping)					SERVICE AREA DEMAND- from FHLM Study (S. Roth)						SERVICE AREA DEMAND - from Waco Water MP (B. Wallace)			DEMAND - LOCAL INPUT										OTHER CONTRACTS DEMAND-TWDB				
Utility	Demand_2030_Gal	Demand_2040_Gal	Demand_2050_Gal	Demand_2060_Gal	Demand_2070_Gal	Avg Day Demand 2030- Gal/Yr	Avg Day Demand 2030- Gal/yr	Avg Day Demand 2040- Gal/Yr				2020 Demand Gal/Yr	2030 Demand Gal/Yr	2040 Demand Gal/Yr	Source of local input	Local Comments	HISTORICAL DEMAND 2011 (Drought Year)	Demand 2020_Gal	Demand 2030_Gal	Demand 2040_Gal	Demand 2050_Gal	Demand 2060_Gal	Demand 2070_Gal	Interconnects (BF= buys From, ST= sells to)	TWDB Other Contracts Demand- 2020	TWDB Other Contracts Demand- 2030	TWDB Other Contracts Demand- 2040	TWDB Other Contracts Demand- 2050	TWDB Other Contracts Demand- 2060
AQUA TEXAS INC	73,642,326	77,552,538	81,462,750	85,372,962	89,283,174	#N/A	#N/A	#N/A							Mark Kocian MAKocian@aquaamerica.com	These projections are based on 10% growth per every 10 years. From 2006 to 2015, Aqua Texas has grown approximately 10%.	298,778,000	328,655,800	361,521,380	3,917,673,518	437,440,869	481,184,956	529,103,352	Smith Water BF: City of Waco (E)					
BOSQUE BASIN WSC	13,924,000	13,924,000	13,924,000	13,924,000	13,924,000	#N/A	#N/A	#N/A																None					
C S COMMUNITY WSC	17,961,000	17,961,000	17,961,000	17,961,000	17,961,000	#N/A	#N/A	#N/A																BF: Chriss Springs Water (E)					
CEDAR RIDGE DEEP WELL WATER SYSTEM	5,192,000	5,192,000	5,192,000	5,192,000	5,192,000	#N/A	#N/A	#N/A																ST: Cross Country WSC (E)					
CHALK BLUFF WSC	84,089,558	81,136,889	79,813,495	79,507,644	79,507,644	113,150,000	131,765,000	154,030,000																None					
CHILDRESS CREEK WSC	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																					
CITY OF MALONE	27,371,484	28,249,037	29,978,292	31,607,547	33,236,802	#N/A	#N/A	#N/A																					
CITY OF VALLEY MILLS	2,280,957	2,606,808	3,259,510	3,584,361	4,236,063	#N/A	#N/A	#N/A																					
CORYELL CITY WSD	47,900,097	54,091,366	60,608,286	67,451,157	73,968,177	#N/A	#N/A	#N/A							Jason Krabloch (GM) Jason@coryellcitywater.com	"For our overall system, I have seen a growth of about 30-40 meters in the past 3 years that I've been employed (we are currently at 1805 connections.) This includes all parts of our system through which is Coryell, McLennan, Bosque (small amount), and Hamilton (small amount). I'm only seeing growth rather than decline. I can get more specific number of taps we've gained if that helps but again it is for our entire system. Sorry for the late response, but with just giving some estimates, we use roughly 505 million gallons per year for our 240 meter connections for the McLennan County customers we have. I hope this is adequate information. Coryell City Water Supply has been only a purchased water system from the city of Gatesville for quite some time now. We have a well in Mclennan that we are currently trying to get going again through ST GCD but is not yet active. As for the spreadsheet you sent, I do not have any additional information to add regarding groundwater for Mclennan county. If an amount of water sold to customers of Mclennan county by means of surface water is what you were looking for, I can provide some rough numbers. Let me know if there is anything else I can help with.		55,000,000	55,552,482	56,110,513	56,674,150	57,243,448	57,818,466							
COTTONWOOD WSC	21,570,000	21,570,000	21,570,000	21,570,000	21,570,000	#N/A	#N/A	#N/A																BF: City of West (E)					
CROSS COUNTRY WSC	132,295,506	131,317,993	130,969,655	133,273,059	134,576,463	#N/A	#N/A	#N/A																BF: Cedar Ridge Deep Well (E) , Highland Park WSC (E) ST: Travis County MUD 2 (P)					
EAST CRAWFORD WSC	74,910,000	74,910,000	74,910,000	74,910,000	74,910,000	#N/A	#N/A	#N/A																None					
GHOLSON WSC	54,417,117	58,001,478	61,911,690	66,479,604	71,035,518	104,025,000	108,040,000	112,055,000																ST Latham Springs Baptist Encampment					
GOUNDA WSC	7,820,424	9,123,828	10,427,232	11,730,636	13,034,040	#N/A	#N/A	#N/A																					
H & H WSC	69,334,000	69,334,000	69,334,000	69,334,000	69,334,000	59,860,000	66,097,000	73,000,000								Largest Usage was in 2011 (62,192,400 gal); no other comments w/ input so will assume that they approve of the other demand/supply #s	62,192,400							ST: MS WSC (E)					
HIGHLAND PARK WSC	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																ST: Cross Country WSC (E)					
HOG CREEK WSC	26,558,000	26,558,000	26,558,000	26,558,000	26,558,000	#N/A	#N/A	#N/A																None					
LASS WATER COMPANY	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																					
LEVI WSC	107,717,543	107,717,543	107,717,543	107,717,543	107,717,543	#N/A	#N/A	#N/A																					
MCLENNAN COUNTY WCID NO 2	84,315,000	84,315,000	84,315,000	84,315,000	84,315,000	72,635,000	73,365,000	74,095,000																None					
MENLOW WSC	18,726,038	18,726,038	18,726,038	18,726,038	18,726,038	#N/A	#N/A	#N/A								"The Menlow WSC service area covers both Hill and McLennan counties. Water from it's No. 2 well in McLennan County is comingled with water from it's No. 1 well in Hill County to serve members in both counties." No other demand input provided. All demand local input was marked Not Available.								NONE					
NORTH BOSQUE WSC	244,714,101	283,490,370	322,592,490	362,346,312	401,774,283	#N/A	#N/A	#N/A							David Posten	"This looks OK." -David Posten								None					
PATRICK WSC	17,126,000	17,126,000	17,126,000	17,126,000	17,126,000	#N/A	#N/A	#N/A																None					
PURE WSC	27,510,000	27,510,000	27,510,000	27,510,000	27,510,000	15,330,000	15,330,000	15,695,000																BF: Leroy Touns Gerald (E)					
ROSS WSC	109,993,514	109,993,514	109,993,514	109,993,514	109,993,514	81,760,000	90,155,000	99,280,000																BF: EOL WSC (E)					
WINDSOR WATER COMPANY	42,740,000	42,740,000	42,740,000	42,740,000	42,740,000	#N/A	#N/A	#N/A							Roger Wilson windsorwater@hot.rr.com	Provided handwritten, mailed response.		14,520,000	19,520,000	24,520,000	29,520,000	34,520,000	39,520,000	None					
SANDERSON FARMS INC	39,187,000					#N/A	#N/A	#N/A																None					

SUM

TWDB's Non-Municipal Categories					
County-Other	1,110,826,059	1,077,263,405	1,058,689,899	1,054,453,836	1,053,476,283

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							0.2													
		OTHER CONTRACTS DEMAND- Waco Water MP (TWG)					Additional DEMAND- Drought		SUMMARY OF DATA											
Utility	TWDB Other Contracts Demand- 2070	Waco WMP Other Contracts (Wholesale) 2016 (Gal/Yr)	Waco WMP Other Contracts (Wholesale) 2020 (Gal/Yr)	Waco WMP Other Contracts (Wholesale) 2030 (Gal/Yr)	Waco WMP Other Contracts 2040 (Gal/Yr)		Drought A- 2020	Drought A- 2070	GW SUPPLY- Existing (Gal/Yr)	SW SUPPLY- Existing (Gal/Yr)	TOT SUPPLY- Existing	Service Area Demand- 2020	Wholesale Contracts Demands- 2020	Drought A (+20%) Demands 2020	Drought A Demands- 2070	TOT DEMAND- (No Drought) 2020	TOT DEMAND- (Drought A) 2020	Surplus/Shortfall (No Drought) 2020 (negatives represent shortfall)	Surplus/Shortfall (Drought A) (2020) (negatives represent shortfall)
CITY OF ROBINSON	325,851,000								462,035,000	4,776,975,640	**5,239,010,660**	794,098,887	325,851,000	223,089,977	0	1,119,949,887	1,343,939,864	4,119,060,773	3,895,070,796	
CITY OF LORENA	85,880,000								189,962,000	325,851,000	**515,813,000**	100,687,959	85,880,000	37,213,592		186,567,959	223,881,551	329,245,041	291,931,449	
BELLBONNET WSC	2,321,688,375								0	0	**0**	0	2,321,688,375	464,337,675		2,321,688,375	2,786,026,050	(2,321,688,375)	(2,786,026,050)	
CITY OF BELVEDERE EDDY									113,229,000	305,648,238	**418,877,238**	95,148,492	0	19,029,698		95,148,492	114,178,190	323,728,746	304,699,048	
CITY OF MCGREGOR	Unknown								140,097,715	696,995,289	**837,093,004**	259,377,396	Unknown	51,875,479		259,377,396	311,252,875	577,715,608	525,840,129	
CITY OF MOODY									20,040,000	130,666,251	**150,706,251**	61,585,839	0	12,317,168		61,585,839	73,903,007	89,120,412	76,803,244	
ELM CREEK WSC									73,420,000	213,106,554	**286,526,554**	65,170,200	0	13,034,040		65,170,200	78,204,240	221,356,354	208,322,314	
SPRING VALLEY WSC									40,403,243	98,081,151	**138,484,394**	40,403,243	0	8,080,649		40,403,243	48,483,892	98,081,151	90,000,502	
CITY OF WOODWAY									644,212,000	584,250,843	**1,248,462,843**	1,132,983,927	0	226,596,785		1,132,983,927	1,359,580,712	115,478,916	(111,117,869)	
CENTRAL BOSQUE WSC									0	29,584,370	**29,584,370**	31,063,589	0	6,212,718		31,063,589	37,276,307	(1,479,218)	(7,691,937)	
CITY OF LACY LAKE VIEW									0	164,953,120	**164,953,120**	251,556,972	0	50,311,394		251,556,972	301,868,366	113,396,148	63,084,754	
SOUTH BOSQUE WSC									5,935,000	EMERGENCY ONLY	**5,935,000**	5,935,000	0	1,187,000		5,935,000	7,122,000	0	(1,187,000)	
CARGILL MEAT SOLUTIONS									181,821,000	Unknown	**181,821,000**	181,821,000	0	0		181,821,000	181,821,000	0	0	
CITY OF BELLMEAD									481,279,000	EMERGENCY ONLY	**481,279,000**	404,381,091	0	80,876,218		404,381,091	485,257,309	76,897,909	(3,978,309)	
CITY OF HEWITT									678,835,697	821,250,000	**1,500,085,697**	934,089,750	0	186,817,950		934,089,750	1,120,907,700	565,995,947	379,177,997	
CITY OF WACO	2,250,978,708	2,887,150,000	4,062,490,000	4,453,000,000	4,810,700,000				289,169,000	17,012,680,710	**17,301,849,710**	11,585,103,000	4,062,490,000	3,129,510,000		15,647,550,000	18,777,060,000	1,654,299,710	(1,475,210,290)	
CITY OF WEST									158,816,000	364,953,120	**523,769,120**	159,666,990	0	31,933,398		159,666,990	191,600,388	364,102,130	332,168,732	
WEST BRAZOS WSC									36,431,000	EMERGENCY ONLY	**36,431,000**	94,970,000	0	18,994,000		94,970,000	113,964,000	(58,539,000)	(77,533,000)	
BOLD SPRINGS WSC									77,545,000	182,500,000	**260,045,000**	67,310,900	0	13,466,180		67,310,900	80,797,080	192,734,100	179,247,920	
HILLTOP WSC									34,223,000	31,607,547	**65,830,547**	27,500,000	0	5,500,000		27,500,000	33,000,000	38,330,547	32,830,547	
CITY OF MART									59,764,000	Unknown	**59,764,000**	141,620,000	0	28,324,000		141,620,000	169,944,000	(81,856,000)	(110,180,000)	
CITY OF CRAWFORD									57,829,494	17,921,805	**75,751,299**	48,800,000	0	9,760,000		48,800,000	58,560,000	26,951,299	17,191,299	
AXTELL WSC									68,407,000	0	**68,407,000**	62,780,000	0	12,556,000		62,780,000	75,336,000	(31,787,342)	(38,144,810)	
BIROME WSC									0	0	**0**	33,215,000	0	6,643,000		33,215,000	39,858,000	(11,259,122)	(13,511,186)	
CITY OF BRYAN									78,895,565	0	**78,895,565**	44,315,736	0	8,863,147		44,315,736	53,178,883	(20,960,145)	(25,152,174)	
E.O.L WSC									69,989,000	0	**69,989,000**	68,985,000	0	13,797,000		68,985,000	82,782,000	(41,809,091)	(50,170,909)	
LEROY TOURS GERALD WSC									54,419,000	0	**54,419,000**	39,785,000	0	7,957,000		39,785,000	47,742,000	(24,112,121)	(28,934,545)	
MCLENNAN WSC									23,436,605	0	**23,436,605**	11,680,000	0	2,336,000		11,680,000	14,016,000	(2,834,955)	(3,401,946)	
MOORE WATER SYSTEM									6,397,000	0	**6,397,000**	15,330,000	0	3,066,000		15,330,000	18,396,000	(13,028,777)	(13,234,532)	
PEARL HILL WSC									68,454,000	0	**68,454,000**	54,385,000	0	10,877,000		54,385,000	65,262,000	(19,655,726)	(47,586,875)	
RIVES WSC	51,957,203								51,957,203	0	**51,957,203**	45,625,000	51,957,203	19,516,441		97,582,203	117,098,643	(49,408,710)	(59,290,452)	
TRI COUNTY SUD									0	0	**0**	6,842,871	0	1,368,574		6,842,871	8,211,445	(5,164,431)	(6,197,317)	

		OTHER CONTRACTS DEMAND - Waco Water MP (TWG)				Additional DEMAND- Drought		SUMMARY OF DATA										
Utility	TWDB Other Contracts Demand-2070	Waco WMP Other Contracts (Wholesale) 2014 (Gal/Yr)	Waco WMP Other Contracts (Wholesale) 2020 (Gal/Yr)	Waco WMP Other Contracts (Wholesale) 2030 (Gal/Yr)	Waco WMP Other Contracts 2040 (Gal/Yr)	Drought A-2020	Drought A-2070	GW SUPPLY-Existing (Gal/Yr)	SW SUPPLY-Existing (Gal/Yr)	TOT SUPPLY-Existing	Service Area Demand-2020	Wholesale Contracts Demands-2020	Drought A (+20%) Demands 2020	Drought A Demands-2070	TOT DEMAND-(No Drought) 2020	TOT DEMAND-(Drought A) 2020	Surplus/Shortfall (No Drought) 2020 [negatives represent shortfall]	Surplus/Shortfall (Drought A) (2020) [negatives represent shortfall]
AQUA TEXAS INC								250,733,000	0	**250,733,000**	328,655,800	0	65,731,160		328,655,800	394,386,960	(77,922,800)	(143,653,960)
BOSQUE BASIN WSC								13,924,000	0	**13,924,000**	13,924,000	0	2,784,800		13,924,000	16,708,800	0	(2,784,800)
C S COMMUNITY WSC								17,961,000	0	**17,961,000**	17,961,000	0	3,592,200		17,961,000	21,553,200	0	(3,592,200)
CEDAR RIDGE DEEP WELL WATER SYSTEM								5,192,000	0	**5,192,000**	5,192,000	0	1,038,400		5,192,000	6,230,400	0	(1,038,400)
CHALK BLUFF WSC								130,557,000	0	**130,557,000**	113,150,000	0	22,630,000		113,150,000	135,780,000	17,407,000	(5,223,000)
CHILDRESS CREEK WSC								0	0	**0**	0	0	0		0	0	0	0
CITY OF HALLSBURG								0	0	**0**	26,393,931	0	5,278,786		26,393,931	31,672,717	(26,393,931)	(31,672,717)
CITY OF VALLEY MILLS								0	0	**0**	1,629,255	0	325,851		1,629,255	1,955,106	(1,629,255)	(1,955,106)
COPPELL CITY WSD								0	55,000,000	**55,000,000**	55,000,000	0	11,000,000		55,000,000	66,000,000	0	(11,000,000)
COTTONWOOD WSC								21,570,000	0	**21,570,000**	21,570,000	0	4,314,000		21,570,000	25,884,000	0	(4,314,000)
CROSS COUNTRY WSC								170,562,405	0	**170,562,405**	133,273,059	0	26,654,612		133,273,059	159,927,671	37,289,346	10,634,734
EAST CRAWFORD WSC								74,910,000	0	**74,910,000**	74,910,000	0	14,982,000		74,910,000	89,892,000	0	(14,982,000)
GHOLSON WSC								87,991,000	0	**87,991,000**	104,025,000	0	20,805,000		104,025,000	124,830,000	(16,034,000)	(36,839,000)
GOLINDA WSC								0	0	**0**	6,191,169	0	1,238,234		6,191,169	7,429,403	(6,191,169)	(7,429,403)
H & H WSC								69,334,000	0	**69,334,000**	59,860,000	0	11,972,000		59,860,000	71,832,000	9,474,000	(2,498,000)
HIGHLAND PARK WS C								0	0	**0**	0	0	0		0	0	0	0
HOG CREEK WSC								26,558,000	0	**26,558,000**	26,558,000	0	5,311,600		26,558,000	31,869,600	0	(5,311,600)
LASS WATER COMPANY								0	0	**0**	0	0	0		0	0	0	0
LEVI WSC								107,717,543	0	**107,717,543**	107,717,543	0	21,543,509		107,717,543	129,261,051	0	(21,543,509)
MCLENNAN COUNTY WCID NO 2								84,315,000	0	**84,315,000**	72,635,000	0	14,527,000		72,635,000	87,162,000	11,680,000	(2,847,000)
MENLOW WS C								18,726,044	0	**18,726,044**	18,724,038	0	3,745,208		18,726,038	22,471,246	6	(3,745,202)
NORTH BOSQUE WSC								187,675,415	0	**187,675,415**	201,701,769	0	40,340,354		201,701,769	242,042,123	(14,026,354)	(54,366,708)
PATRICK WSC								17,126,000	0	**17,126,000**	17,126,000	0	3,425,200		17,126,000	20,551,200	0	(3,425,200)
PURE WSC								27,510,000	0	**27,510,000**	15,330,000	0	3,066,000		15,330,000	18,396,000	12,180,000	9,114,000
ROSS WS C								109,993,514	0	**109,993,514**	81,760,000	0	16,352,000		81,760,000	98,112,000	28,233,514	11,881,514
WINDSOR WATER COMPANY								42,740,000	0	**42,740,000**	14,520,000	0	2,904,000		14,520,000	17,424,000	28,220,000	25,316,000
SANDERSON FARMS INC								391,987,000	0	**391,987,000**	391,987,000	0	0		391,987,000	391,987,000	0	0

SUM

TWDB's Non-Municipal Categories

County-Other

32 5851

							SUPPLY													
Utility	CCN #	EngrRep	TWDB_ Recognized	AR_Prob?	ServiceArea (acre)	% of County Other	GW	SW	GW_Source	STGCD GWSupply_PERMIT	STGCD GWSupply_Exist (Gal 2015)	STGCD GWSupply_Exist (Gal 2013)	TWDB GWSupply_Exist (Gal 2013)	GW_SUPPLY EXIST (Assumed as permit)	SW_Source	SW Supply_Exist (Gal)	GWSupply_Future (2070)	SWSupply_Future (2070)	TOTAL Supply_ Future (2070)
TRI COUNTY SUD	10054	?	1	1	3,150		0		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A			#N/A	0	0
BIROME WSC	10013	Duff	0	1	11,450	7.0%	0		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A			#N/A	0	0
MCLENNAN COUNTY WCID NO 2	0	Tabor	0	1	#N/A	#N/A	1		TRINITY AQUIFER	84,315,000	71,571,000	70,913,000	70,863,000	84,315,000			84,315,000	0	84,315,000
ROSS WSC	11268	Tabor	0	1	11,655	7.1%	1		OTHER AQUIFER	83,567,000	83,946,000	100,778,000	102,405,000	83,567,000			83,567,000	0	83,567,000
E O L WSC	10014	Duff	0	1	4,925	3.0%	1		TRINITY AQUIFER	69,989,000	49,712,000	38,804,000	59,538,500	69,989,000			69,989,000	0	69,989,000
PRAIRIE HILL WSC	10020	?	0	1	6,117	3.7%	1		OTHER AQUIFER	68,454,000	62,444,000	67,650,000	67,750,000	68,454,000			68,454,000	0	68,454,000
AXTELL WSC	11178	Tabor	0	1	6,226	3.8%	1		TRINITY AQUIFER	68,407,000	52,677,000	59,695,000	58,885,500	68,407,000			68,407,000	0	68,407,000
LEROY TOURS GERALD WSC	10025	Duff	0	1	4,429	2.7%	1		OTHER AQUIFER	54,419,000	47,511,000	51,891,000	52,141,000	54,419,000			54,419,000	0	54,419,000
CITY OF RIESEL	10029	TWG	1	1	2,254		1		OTHER AQUIFER	36,115,000	62,217,400	34,065,600	3,285,760	36,115,000			36,115,000	0	36,115,000
MOORE WATER SYSTEM	11878	Duff	0	1	219	0.1%	1		#N/A	6,397,000	3,002,000	1,653,000	#N/A	6,397,000			6,397,000	0	6,397,000
CORYELL CITY WSD	10453	?	1	0	11,151		0		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A			#N/A	0	0
GOLINDA WSC	10009	?	1	0	331		0		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A			#N/A	0	0
WESTERN HILLS WATER SYSTEM	0	?	1	0	#N/A		0		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A			#N/A	0	0
CITY OF LACY LAKEVIEW	10028	WP	1	0	2,948		0	1	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	Lake Waco (City of Waco)	364,953,120	#N/A	364,953,120	364,953,120
CITY OF HALLSBURG	0	#N/A	1	0	#N/A		0		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A			#N/A	0	0
CITY OF VALLEY MILLS	0	#N/A	1	0	#N/A		0		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A			#N/A	0	0
BLUEBONNET WSC	11594	?	0	0	2,897	1.8%	0		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	Lake Belton (Bluebonnet)		#N/A	0	0
CENTRAL BOSQUE WSC	10032	?	0	0	13,275	8.1%	0	1	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	Lake Waco (City of Waco)	22,809,570	#N/A	22,809,570	22,809,570
CHILDRESS CREEK WSC	11000	Cayote	0	0	879	0.5%	0		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A			#N/A	0	0
HIGHLAND PARK WSC	0	Duff	0	0	425	0.3%	0		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A			#N/A	0	0
CITY OF WOODWAY	10022	TWG	1	0	3,544		1	1	TRINITY AQUIFER	664,212,000	404,459,000	414,419,000	409,957,302	664,212,000	Lake Belton (Bluebonnet) Lake Waco (City of Waco)	584,250,843	664,212,000	584,250,843	1,248,462,843
CITY OF BELLMEAD	10024	BSP	1	0	4,720		1		TRINITY AQUIFER	481,279,000	422,622,000	400,025,000	399,983,000	481,279,000	Lake Waco (City of Waco)	0	481,279,000	0	481,279,000
CITY OF HEWITT	10038	Cayote	1	0	2,844		1	1	TRINITY AQUIFER	469,655,000	372,440,800	438,420,600	438,420,700	469,655,000	Lake Waco (City of Waco)	124,800,933	469,655,000	124,800,933	594,455,933
CITY OF ROBINSON	0	WP	1	0	#N/A		1	1	OTHER AQUIFER	462,035,000	351,675,000	433,651,500	433,651,600	462,035,000	Lake Waco (City of Waco)	182,476,560	462,035,000	182,476,560	644,511,560
CITY OF WACO	10039	Multiple-TWG, LAN, WP	1	0	220,715		1	1	TRINITY AQUIFER OTHER AQUIFER	289,169,000	194,709,930	167,961,508	168,232,918	289,169,000	Lake Waco (City of Waco)	9,894,791,466	289,169,000	9,894,791,466	10,183,960,466
AQUA TEXAS INC	13201	#N/A	0	0	14,087		1		#N/A	250,733,000	242,740,900	250,733,000	#N/A	250,733,000			250,733,000	0	250,733,000
CITY OF LORENA	10030	KPA	1	0	6,226		1		TRINITY AQUIFER	189,962,000	62,962,600	46,687,030	46,753,900	189,962,000			189,962,000	0	189,962,000
CROSS COUNTRY WSC	11286	Duff	1	0	12,271		1		TRINITY AQUIFER	162,315,000	115,884,700	131,777,520	132,682,700	162,315,000			162,315,000	0	162,315,000
CITY OF WEST	10026	WP	1	0	1,026		1	1	TRINITY AQUIFER	158,816,000	56,623,000	30,922,000	31,733,000	158,816,000	Lake Waco (City of Waco)	364,953,120	158,816,000	364,953,120	523,769,120
NORTH BOSQUE WSC	10023	?	1	0	5,105		1		OTHER AQUIFER	134,011,000	121,934,200	105,923,700	121,908,300	134,011,000			134,011,000	0	134,011,000
CHALK BLUFF WSC	10019	Duff	1	0	1,249		1		TRINITY AQUIFER	130,557,000	113,255,000	131,721,000	#N/A	130,557,000			130,557,000	0	130,557,000
CITY OF BRUCEVILLE EDDY	11285	Tabor	1	0	15,904		1	1	OTHER AQUIFER	113,229,000	85,749,000	123,256,000	123,556,000	113,229,000	Lake Belton (Bluebonnet)	305,648,238	113,229,000	305,648,238	418,877,238
GHOLSON WSC	11194	Duff	1	0	14,496		1		OTHER AQUIFER	87,991,000	69,959,000	65,750,000	70,752,000	87,991,000			87,991,000	0	87,991,000
LEVI WSC	10018	Tabor	0	0	4,616	2.8%	1		TRINITY AQUIFER	87,114,000	80,749,800	67,308,200	67,309,000	87,114,000			87,114,000	0	87,114,000
BOLD SPRINGS WSC	10006	Tabor	0	0	20,370	12.4%	1	1	OTHER AQUIFER	77,545,000	64,939,000	65,690,000	65,690,000	77,545,000	Lake Waco? (City of Waco)	182,476,560	77,545,000	182,476,560	260,021,560
EAST CRAWFORD WSC	11396	Multiple-Tabor, Duff	0	0	7,559	4.6%	1		OTHER AQUIFER	74,910,000	76,397,000	82,095,000	82,872,300	74,910,000			74,910,000	0	74,910,000
ELM CREEK WSC	10031	Tabor	1	0	17,784		1	1	TRINITY AQUIFER	73,420,000	54,020,000	53,224,000	53,969,700	73,420,000	Lake Belton (Bluebonnet)	213,106,554	73,420,000	213,106,554	286,526,554
CITY OF MCGREGOR	10033	WP	1	0	4,838		1	1	TRINITY AQUIFER	73,350,000	90,635,000	101,187,200	43,991,000	73,350,000	Lake Belton (Bluebonnet)	696,995,289	73,350,000	696,995,289	770,345,289
H & H WSC	10016	Duff	0	0	10,561	6.4%	1		OTHER AQUIFER	69,334,000	47,686,000	51,438,000	51,438,200	69,334,000				0	0
CITY OF MART	0	Gil Gregory	1	0	#N/A		1		TRINITY AQUIFER	59,764,000	41,892,000	25,630,000	25,862,000	59,764,000				0	0
R M S WSC	0	?	0	0	#N/A	#N/A	1		TRINITY AQUIFER	0	0	0	46,988,300	46,988,300				0	0
CITY OF CRAWFORD	0	Snyder	1	0	#N/A		1		OTHER AQUIFER	45,679,000	42,635,600	47,203,000	47,378,400	45,679,000				0	0
WINDSOR WATER COMPANY	11281	?	0	0	372	0.2%	1		TRINITY AQUIFER	42,740,000	26,274,000	29,753,000	21,710,000	42,740,000				0	0
WEST BRAZOS WSC	11283	Tabor	1	0	5,174		1		#N/A	36,431,000	31,396,000	50,739,000	#N/A	36,431,000				0	0
HILLTOP WSC	10017	Duff	0	0	1,664	1.0%	1	1	TRINITY AQUIFER	34,223,000	17,451,000	31,130,000	26,411,500	34,223,000	Lake Waco? (City of Waco)	31,607,547		31,607,547	31,607,547
PURE WSC	10036	Duff	0	0	5,161	3.1%	1		OTHER AQUIFER	27,510,000	18,803,800	12,112,400	12,085,500	27,510,000				0	0
HOG CREEK WSC	10035	?	0	0	1,693	1.0%	1		OTHER AQUIFER	26,558,000	345,000	2,449,000	15,375,398	26,558,000				0	0
M S WSC	11284	Duff	0	0	3,566	2.2%	1		OTHER AQUIFER	23,437,000	24,869,000	20,547,000	4,773,400	23,437,000				0	0
COTTONWOOD WSC	10015	Tabor	0	0	4,944	3.0%	1		OTHER AQUIFER	21,570,000	12,823,000	15,228,300	15,446,600	21,570,000				0	0
SPRING VALLEY WSC	11287	Tabor	0	0	21,666	13.2%	1	1	OTHER AQUIFER	20,396,000	5,884,000	12,954,000	12,325,000	20,396,000	Lake Belton (Bluebonnet)	98,081,151		98,081,151	98,081,151
CITY OF MOODY	10021	?	1	0	1,911		1	1	TRINITY AQUIFER	20,040,000	3,180,000	2,012,800	630,900	20,040,000	Lake Belton (Bluebonnet)	130,666,251		130,666,251	130,666,251
C S COMMUNITY WSC	11945	Duff	0	0	5	0.0%	1		OTHER AQUIFER	17,961,000	8,690,700	7,253,000	7,094,000	17,961,000				0	0
PATRICK WSC	12352	Duff	0	0	568	0.3%	1		TRINITY AQUIFER	17,126,000	12,115,000	12,198,000	12,207,300	17,126,000				0	0
BOSQUE BASIN WSC	12341	?	0	0	186	0.1%	1		TRINITY AQUIFER	13,924,000	8,204,000	8,744,900	6,046,800	13,924,000				0	0
MENLOW WSC	11266	?	0	0	440	0.3%	1		#N/A	7,725,000	8,311,500	9,491,600	#N/A	7,725,000				0	0
LASS WATER COMPANY	12258	?	0	0	797	0.5%	1		OTHER AQUIFER	#N/A	#N/A	#N/A	6,455,000	6,455,000				0	0
SOUTH BOSQUE WSC	11627	?	0	0	14	0.0%	1		#N/A	5,935,000	3,071,000	3,923,000	#N/A	5,935,000				0	0
CEDAR RIDGE DEEP WELL WATER SYSTEM	12091	?	0	0	102	0.1%	1		OTHER AQUIFER	5,192,000	5,225,000	5,129,000	5,130,000	5,192,000				0	0
SANDERSON FARMS INC	#N/A					0.0%	1		#N/A	391,987,000	369,342,000	365,167,000	#N/A	391,987,000				0	0
CARGILL MEAT SOLUTIONS	#N/A					0.0%	1		TRINITY AQUIFER	181,821,000	131,231,000	137,100,000	140,795,000	181,821,000				0	0

SUM 164,042

TWDB's Non-Municipal Categories																			
County- Other																			

325851

		DEMAND								
Utility		Demand_2020_Gal	Demand_2030_Gal	Demand_2040_Gal	Demand_2050_Gal	Demand_2060_Gal	Demand_2070_Gal	Interconnects (BF= buys from, ST= sells to)	2070 Shortfall	
TRI COUNTY SUD		6,842,871	7,494,573	8,146,275	9,123,828	10,101,381	10,753,083			10,753,083
BIROME WSC		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		#N/A	
MCLENNAN COUNTY WCID NO 2		84,315,000	84,315,000	84,315,000	84,315,000	84,315,000	84,315,000	None		0
ROSS WSC		83,567,000	83,567,000	83,567,000	83,567,000	83,567,000	83,567,000	None		0
E O L WSC		69,989,000	69,989,000	69,989,000	69,989,000	69,989,000	69,989,000	ST: Axtell WSC (E) , Prairier Hill WSC (E)		0
PRAIRIE HILL WSC		68,454,000	68,454,000	68,454,000	68,454,000	68,454,000	68,454,000	BF: EOL WSC (E)		0
AXTELL WSC		68,407,000	68,407,000	68,407,000	68,407,000	68,407,000	68,407,000	BF: EOL WSC (E)		0
LEROY TOURS GERALD WSC		54,419,000	54,419,000	54,419,000	54,419,000	54,419,000	54,419,000	ST: Pure WSC (E)		0
CITY OF RIESEL		44,315,736	44,315,736	44,315,736	44,641,587	45,619,140	46,922,544	BF: RMS, Tri County SUD (E)		10,807,544
MOORE WATER SYSTEM		6,397,000	6,397,000	6,397,000	6,397,000	6,397,000	6,397,000	None		0
CORYELL CITY WSD		40,731,375	47,900,097	54,091,266	60,608,286	67,451,157	73,968,177			73,968,177
GOLINDA WSC		6,191,169	7,820,424	9,123,828	10,427,232	11,730,636	13,034,040			13,034,040
WESTERN HILLS WATER SYSTEM		69,080,412	73,642,326	77,552,538	81,462,750	85,372,962	89,283,174	None		89,283,174
CITY OF LACY LAKEVIEW		251,556,972	266,220,267	279,906,009	295,872,708	314,772,066	333,997,275	BF: City of Waco		(30,955,845)
CITY OF HALLSBURG		26,393,931	27,371,484	28,349,037	29,978,292	31,607,547	33,236,802			33,236,802
CITY OF VALLEY MILLS		1,629,255	2,280,957	2,606,808	3,258,510	3,584,361	4,236,063			4,236,063
BLUEBONNET WSC		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		#N/A	
CENTRAL BOSQUE WSC		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		#N/A	
CHILDRESS CREEK WSC		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		#N/A	
HIGHLAND PARK WSC		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	ST: Cross Country WSC (E)	#N/A	
CITY OF WOODWAY		1,132,983,927	1,206,626,253	1,272,448,155	1,345,438,779	1,421,362,062	1,496,959,494	BF: City of Waco (P), Bluebonnet WSC (O), Bluebonnet Contract thru McGregor (O)		248,496,651
CITY OF BELLMEAD		404,381,091	413,504,919	422,302,896	436,314,489	455,213,847	474,764,907	BF: City of Waco (E)		(6,514,093)
CITY OF HEWITT		883,382,061	989,283,636	1,084,757,979	1,187,075,193	1,295,257,725	1,402,788,555	BF: City of Waco		808,332,622
CITY OF ROBINSON		794,098,887	930,304,605	1,052,172,879	1,178,928,918	1,309,921,020	1,439,609,718	ST: City of Lorena		795,098,158
CITY OF WACO		10,371,185,628	10,960,975,938	11,493,742,323	12,095,914,971	12,759,673,458	13,424,735,349	ST: TSTC (P), City of West (P), Smith Water (E), China Spring Water Co (E), City of Hewitt (P), West Brazos WSC (E), City of Woodway (P), City of Lacy Lakeview (P), Cargill Meat Solutions Waco (E), South Bosque WSC (E), City of Bellmead (P) BF: Bluebonnet WSC (E)		3,240,774,883
AQUA TEXAS INC		250,733,000	0	0	0	0	0			(250,733,000)
CITY OF LORENA		100,687,959	110,463,489	119,587,317	129,036,996	139,790,079	150,217,311	BF: City of Robinson (P); Levi WSC (Open)		(39,744,689)
CROSS COUNTRY WSC		133,273,059	132,295,506	131,317,953	131,969,655	133,273,059	134,576,463	BF: Cedar Ridge Deep Well (E) , Highland Park WSC (E) ST: Travis County MUD 2 (P)		(27,738,537)
CITY OF WEST		159,666,990	161,296,245	162,925,500	165,858,159	170,420,073	175,307,838	ST Bold Springs (E) , Cottonwood WSC (E)		(348,461,282)
NORTH BOSQUE WSC		201,701,769	244,714,101	283,490,370	322,592,490	362,346,312	401,774,283	None		267,763,283
CHALK BLUFF WSC		87,653,919	84,069,558	81,136,899	79,833,495	79,507,644	79,507,644	None		(51,049,356)
CITY OF BRUCEVILLE EDDY		95,148,492	100,036,257	104,924,022	110,137,638	116,328,807	122,519,976	BF: Bluebonnet WSC		(296,357,262)
GHOLSON WSC		50,506,905	54,417,117	58,001,478	61,911,690	66,473,604	71,035,518	ST Latham Springs Baptist Encampment		(16,955,482)
LEVI WSC		87,114,000	87,114,000	87,114,000	87,114,000	87,114,000	87,114,000			0
BOLD SPRINGS WSC		77,545,000	77,545,000	77,545,000	77,545,000	77,545,000	77,545,000	BF: Hilltop (E), City of West (E) ST: Hilltop WSC (E)		(182,476,560)
EAST CRAWFORD WSC		74,910,000	74,910,000	74,910,000	74,910,000	74,910,000	74,910,000	None		0
ELM CREEK WSC		65,170,200	72,013,071	78,530,091	85,372,962	92,867,535	100,362,108	BF Bluebonnet WSC		(186,164,446)
CITY OF MCGREGOR		259,377,396	263,287,608	267,197,820	273,714,840	283,164,519	292,940,049	BF: Bluebonnet WSC, ST Central Bosque WSC		(477,405,240)
H & H WSC		69,334,000	69,334,000	69,334,000	69,334,000	69,334,000	69,334,000	ST: MS WSC (E)		69,334,000
CITY OF MART		114,699,552	119,913,168	124,800,933	130,666,251	137,834,973	145,003,695	None		145,003,695
R M S WSC		46,988,300	46,988,300	46,988,300	46,988,300	46,988,300	46,988,300	ST: MS WSC (P), City of Riesel (P)		46,988,300
CITY OF CRAWFORD		48,551,799	47,900,097	47,900,097	47,900,097	48,551,799	49,203,501	None		49,203,501
WINDSOR WATER COMPANY		42,740,000	42,740,000	42,740,000	42,740,000	42,740,000	42,740,000	None		42,740,000
WEST BRAZOS WSC		60,608,286	62,889,243	65,496,051	69,080,412	72,990,624	76,900,836			76,900,836
HILLTOP WSC		34,223,000	34,223,000	34,223,000	34,223,000	34,223,000	34,223,000	BF: Bold Springs (E) ST: Bold Springs (E)		2,615,453
PURE WSC		27,510,000	27,510,000	27,510,000	27,510,000	27,510,000	27,510,000	BF: Leroy Tours Gerald (E)		27,510,000
HOG CREEK WSC		26,558,000	26,558,000	26,558,000	26,558,000	26,558,000	26,558,000	None		26,558,000
M S WSC		23,437,000	23,437,000	23,437,000	23,437,000	23,437,000	23,437,000	BF: H&H WSC (E), RMS (P), City of Riesel (E)		23,437,000
COTTONWOOD WSC		21,570,000	21,570,000	21,570,000	21,570,000	21,570,000	21,570,000	BF: City of West (E)		21,570,000
SPRING VALLEY WSC		20,396,000	20,396,000	20,396,000	20,396,000	20,396,000	20,396,000	BF: Bluebonnet WSC		(77,685,151)
CITY OF MOODY		61,585,839	63,866,796	65,821,902	68,754,561	72,664,773	76,574,985	BF: Bluebonnet WSC		(54,091,266)
C S COMMUNITY WSC		17,961,000	17,961,000	17,961,000	17,961,000	17,961,000	17,961,000	BF: China Springs Water (E)		17,961,000
PATRICK WSC		17,126,000	17,126,000	17,126,000	17,126,000	17,126,000	17,126,000	None		17,126,000
BOSQUE BASIN WSC		13,924,000	13,924,000	13,924,000	13,924,000	13,924,000	13,924,000	None		13,924,000
MENLOW WSC		7,725,000	7,725,000	7,725,000	7,725,000	7,725,000	7,725,000			7,725,000
LASS WATER COMPANY		6,455,000	6,455,000	6,455,000	6,455,000	6,455,000	6,455,000			6,455,000
SOUTH BOSQUE WSC		5,935,000	5,935,000	5,935,000	5,935,000	5,935,000	5,935,000	BF: City of Waco (E)		5,935,000
CEDAR RIDGE DEEP WELL WATER SYSTEM		5,192,000	5,192,000	5,192,000	5,192,000	5,192,000	5,192,000	ST: Cross Country WSC (E)		5,192,000
SANDERSON FARMS INC		391,987,000	391,987,000					None		0
CARGILL MEAT SOLUTIONS		181,821,000	181,821,000					BF: City of Waco (E)		0

SUM

TWDB's Non-Municipal Categories							
County- Other		1,151,231,583	1,110,826,059	1,077,263,406	1,058,689,899	1,054,453,836	1,053,476,283

Water System Name:

Consulting Engr & Contact Info:

Interconnections:

1. _____
    a. Emergency Use Only? or “Take or Pay Contract?”

    b. Location of interconnection?

    c. Pipe size at interconnection… both sides?

    d. Storage tank at connection?
        i. Size?

Any other interconnections?

2. _____

3. _____

System:

1. Any electronic (GIS files, CAD files, pdfs) or record drawings (paper plans) of transmission mains?

2. Can staff describe major transmission main locations?

3. Location of storage tanks (ground and elevated)

4. Well Locations? WTP locations?

Water System Name:

Consulting Engr & Contact Info:

Interconnections:

1. _____
    a. Emergency Use Only? or “Take or Pay Contract?”

    b. Location of interconnection?

    c. Pipe size at interconnection… both sides?

    d. Storage tank at connection?
        i. Size?

Any other interconnections?

2. _____

3. _____

System:

1. Any electronic (GIS files, CAD files, pdfs) or record drawings (paper plans) of transmission mains?

2. Can staff describe major transmission main locations?

3. Location of storage tanks (ground and elevated)

4. Well Locations? WTP locations?

Water System Name:

Consulting Engr & Contact Info:

Interconnections:

1. _____
    a. Emergency Use Only? or “Take or Pay Contract?”

    b. Location of interconnection?

    c. Pipe size at interconnection… both sides?

    d. Storage tank at connection?
        i. Size?

Any other interconnections?

2. _____

3. _____

System:

1. Any electronic (GIS files, CAD files, pdfs) or record drawings (paper plans) of transmission mains?

2. Can staff describe major transmission main locations?

3. Location of storage tanks (ground and elevated)

4. Well Locations? WTP locations?

CHAPTER 4: ARSENIC MITIGATION PLAN

4.0- Introduction

The McLennan Country Water Supply Plan is cooperative effort between public water suppliers in McLennan County to manage and strategically use water resources in the county. The three main goals of the plan are:

1. Preserve Groundwater Availability
2. Provide Drought Resiliency
3. Mitigate Arsenic-Impacted Water Systems

In 2001, "EPA adopted a new standard for arsenic in drinking water of 0.01 mg/l or 10 parts per billion (ppb), replacing the old standard of 50 ppb."[16] When the new Maximum Contaminant Level (MCL) for arsenic became effective, several groundwater systems in McLennan County became non-compliant. The "Arsenic Mitigation Breakout Plan" addresses the third overall plan goal listed above.

4.1- Affected Systems

Nine systems in McLennan County are currently under Administrative Order (AO) for arsenic levels exceeding the drinking water MCL. The McLennan County arsenic-impacted systems are listed below:

10. Axtell Water Supply Company (WSC)
11. Birome WSC
12. City of Riesel
13. Elk Oak Lake (EOL) WSC
14. Leroy-Tours-Gerald (LTG) WSC
15. Meier Settlement (MS) WSC
16. Moore Water System
17. Riesel-Meier Settlement (RMS) WSC
18. Prairie Hill WSC

[16] Source: https://www.epa.gov/dwreginfo/drinking-water-arsenic-rule-history

The nine arsenic-impacted systems are groundwater systems located along the northeast edge of McLennan County as shown in **Figure 2**.

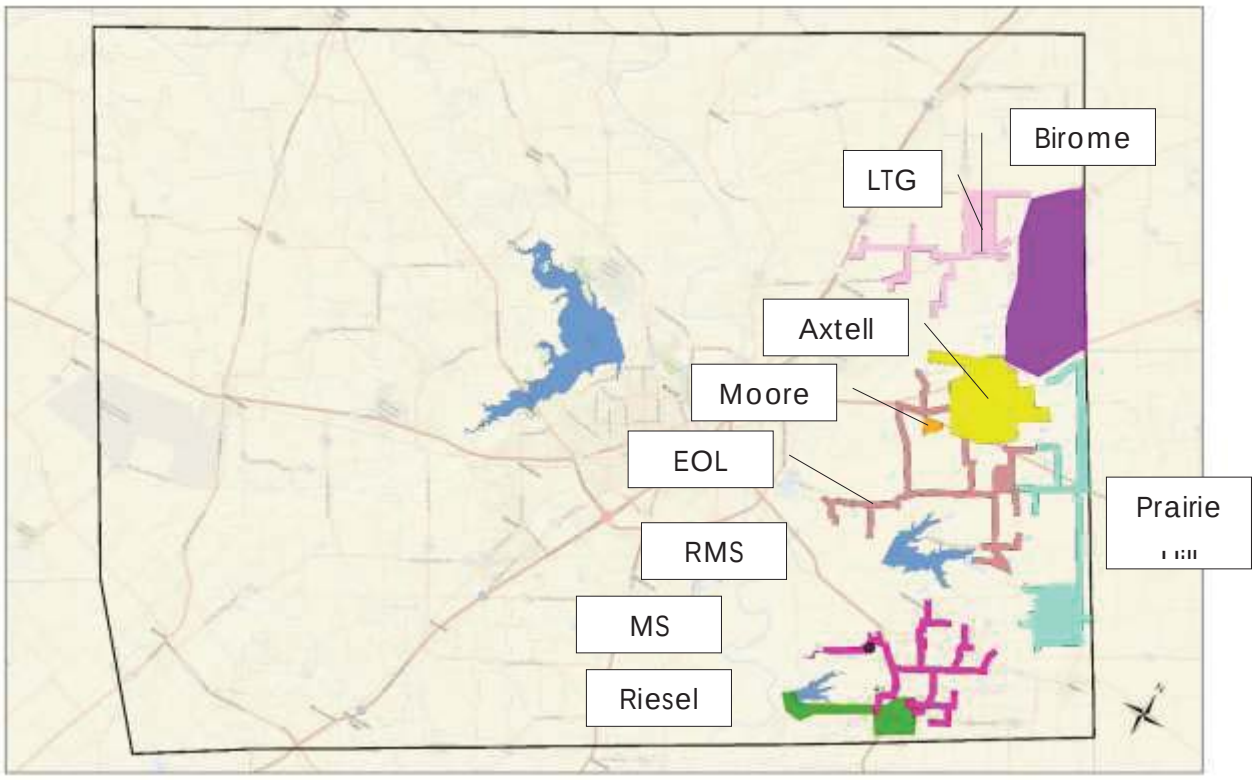


Figure 2: Nine Arsenic Systems in McLennan County

The arsenic concentrations of the systems vary. Even within a particular well, the arsenic concentration can vary from day to day. The following table summarizes the maximum arsenic levels available from TCEQ testing records or from data provided by the systems for each of the systems under AO. The table also shows each system's pumping permit amount as provided by the Southern Trinity Groundwater Conservation District (STGCD), and their projected 2070 Peak Day Demand.

Water System	Max Tested Arsenic Concentration (mg/L)	STGCD Permit Amount (Gal/Yr)	2070 Peak Demand (Gal/Day)*
Axtell WSC	0.018	68,407,000	575,901
Birome WSC- *Plant 5 Only*	0.014	N/A (wells outside McL Co)	71,428
City of Riesel	0.017	42,780,978	357,411
Elk Oak Lake (EOL) WSC	0.022	69,989,000	664,248
Leroy-Tours-Gerald (LTG) WSC	0.022	54,419,000	318,207
Meier Settlement (MS) WSC	0.0125	7,593,990	75,085
Moore Water System	0.03*	6,397,000	97,065
Riesel-Meier Settlement (RMS) WSC**	0.018	51,957,203	549,485
Prairie Hill WSC	0.031	68,454,000	558,866

** See Appendix A for additional information on 2070 Peak Demands.*
***Arsenic concentration data was unavailable for Moore Water System. A concentration of 0.03 was assumed.*
**** RMS is a WSC that is shared between MS and City of Riesel. The total STGCD permitted amount for RMS is split between MS and City of Riesel, with MS and City of Riesel having rights to 48.62 acre-ft/yr and 110.83 ac-ft/yr, respectively.*

4.2- Solution

The solution and schedule described in the following sections were presented to members of the EPA Region VI Enforcement Group and engineers/representatives of the arsenic-impacted systems at a McLennan County Water Resources Group meeting on October 14, 2016. At the meeting Region VI members expressed their approval of the plan to address the arsenic issues in McLennan County.

4.2.1- Approach

Public involvement and local input were critical components to development of the Arsenic Mitigation Plan. Information about each water system's individual needs and unique situation were needed to develop a feasible plan. Requests for system-specific information were sent out to the various entities. Several public meetings were

organized to discuss project progress and receive feedback from stakeholders. Additionally, meetings were held with the affected systems' consultant engineering representatives to discuss specific technical aspects of each system's needs.

To mitigate the arsenic-contaminated groundwater issues within McLennan County, the recommended approach is to blend the arsenic-contaminated groundwater with another "clean" water source (having a much lower arsenic concentration) such that the resulting solution will have a diluted arsenic concentration below the MCL. The target "blended" solution arsenic concentration chosen for this plan is 0.0085 mg/l, which provides a 15% buffer below the MCL. For this approach, it was assumed that water blending will occur at well sites. Therefore, the assumed delivery point(s) for the blending water source is to the individual well sites.

The recommended water source for blending is treated surface water from Lake Waco. Treated Lake Waco surface water has a low arsenic concentration, and the existing City of Waco distribution system has large diameter transmission mains located a reasonable distance from the target delivery points. Treated Lake Waco surface water may be obtained through a wholesale contract(s) with the City of Waco.

The nine arsenic-impacted systems in McLennan County are all located along the northeastern county boundary. The close proximity of the systems to one another allows the opportunity to share the infrastructure needed to transmit water from the Waco system to the delivery points (well sites). Logical grouping of the systems to maximize infrastructure sharing opportunity and minimize infrastructure capital costs resulted in three groups:

1. MS WSC, RMS WSC, City of Riesel (and H&H[17])
2. Axtell WSC, Moore WSC, EOL WSC, Prairie Hill WSC (and Birome[18])
3. LTG WSC

[17] H&H WSC is not under AO by the EPA for arsenic MCL violation. However, it may be advantageous for H&H to participate in a shared water transmission main supplying City of Waco surface water to provide a redundant source of supply for their system for future needs or emergencies.

[18] Birome WSC's wells are located outside McLennan County. Birome has a treatment plant site (Plant 5) in close proximity to the Axtell system. Infrastructure sizing has been calculated including only the projected needs for Birome's Plant 5 location.

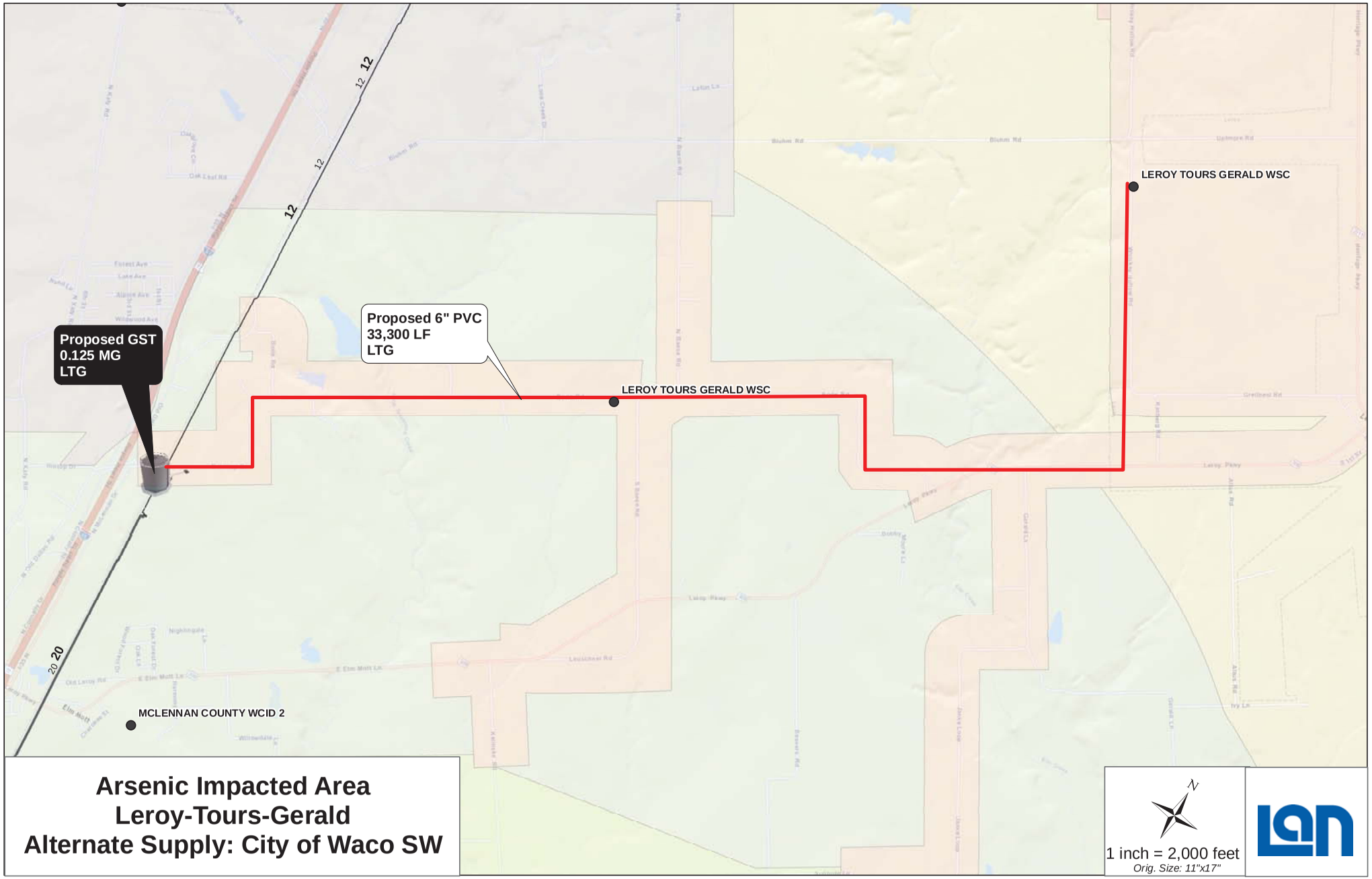
4.2.2- Proposed Infrastructure

rf Assumptions used in developing the "planning level" infrastructure design are summarized below:

- Pipe sizing was based on an assumed transmission velocity not exceeding 3 ft/s and delivering sufficient dilution water to meet projected 2070 Peak Day demands for each system concurrently.
- For systems with multiple delivery sites, the projected total blending water demand for the system was assumed to be equally distributed between delivery sites. (i.e. for a system with 2 well sites, 50% of their total blending water needed was assumed delivered to each well site)
- No pipes smaller than 6 inches were recommended, although in some cases capacity requirements may allow for a smaller diameter pipe.
- Elevations along proposed route layouts based on TNRIS contour data.
- Tank sizing was based on 200 gal/connection[19].
- Pump sizes were based on assumed efficiency of 70% and providing sufficient head to deliver water to a height of 30ft[20] above ground surface at the delivery points, while maintaining a minimum of 35 psi[21] in the transmission line.

Planning level design calculations for each proposed connection are included in the Appendix.

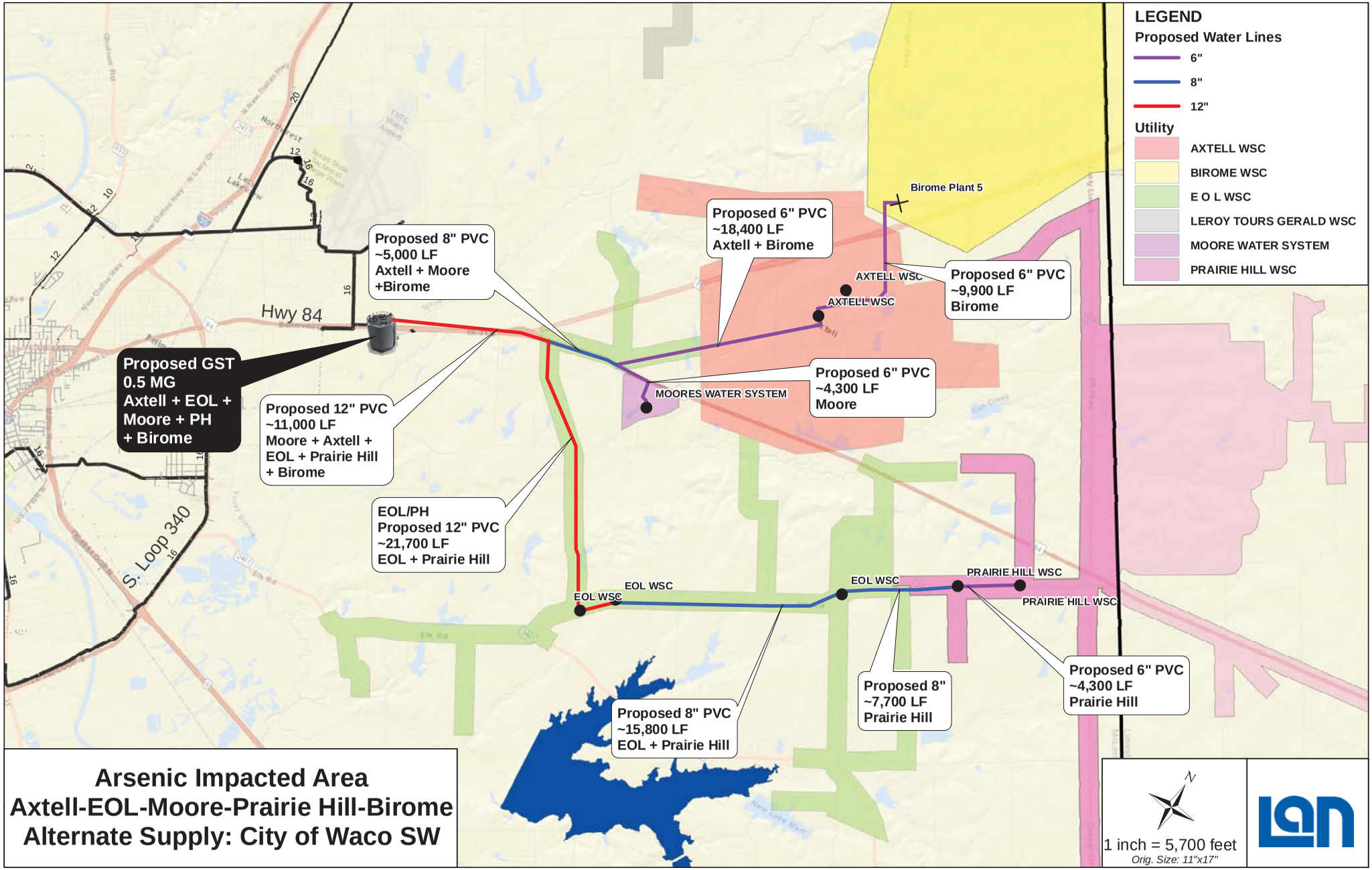
[19] The number of connections used for tank sizing was adjusted by the percentage of Waco blending water needed to meet the target arsenic concentration.
[20] Height of 30ft above grade was chosen to represent delivering blending water to the top of a 30ft tall tank. A 30ft tall tank may represent a potential blending tank, depending on individual system design.
[21] It may be possible to receive an exception to the 35 psi requirement, reducing to 5 psi, provided that certain criteria are met. For planning purposes, the 35 psi requirement was assumed.



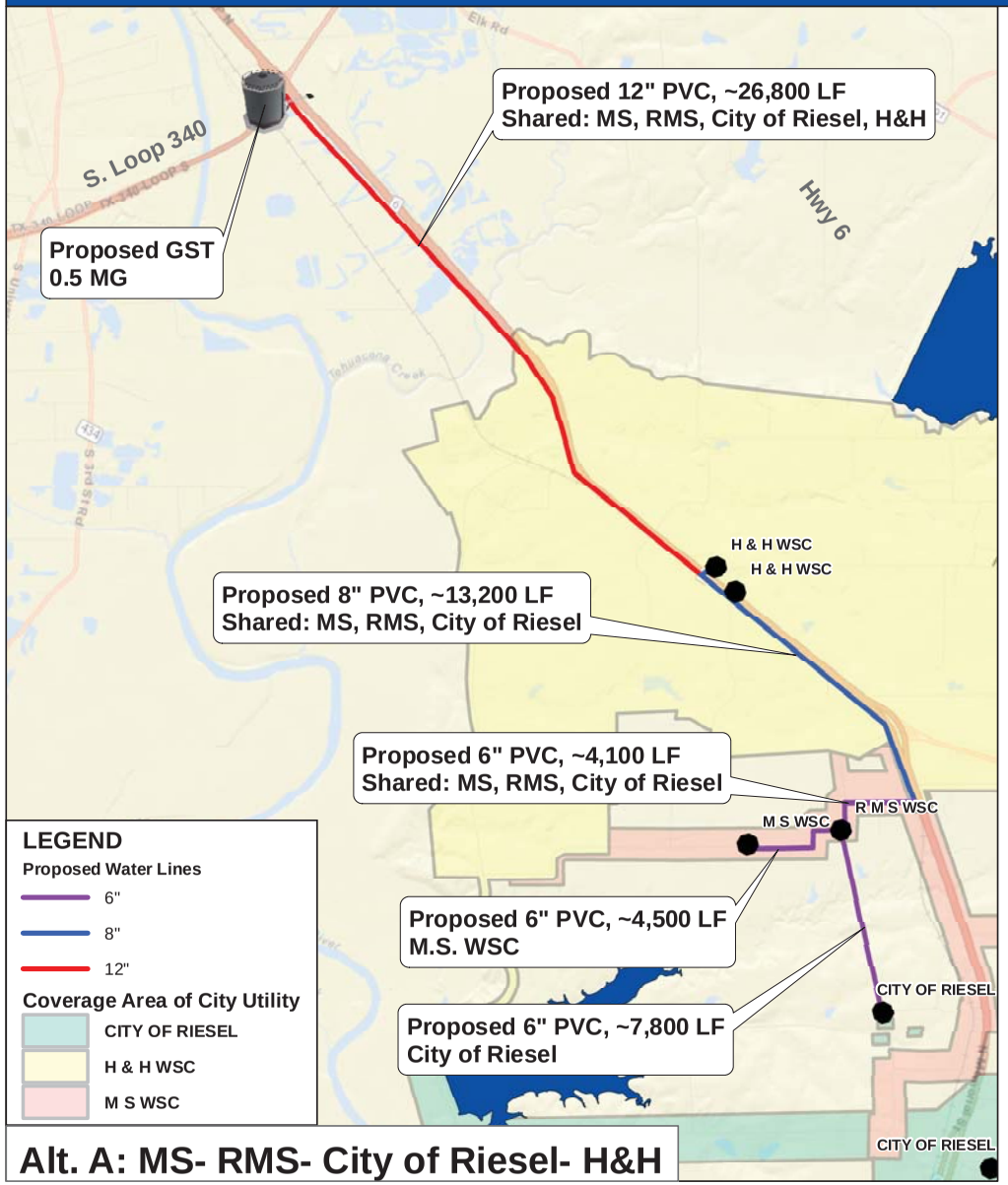
Arsenic Impacted Area
Leroy-Tours-Gerald
Alternate Supply: City of Waco SW

1 inch = 2,000 feet

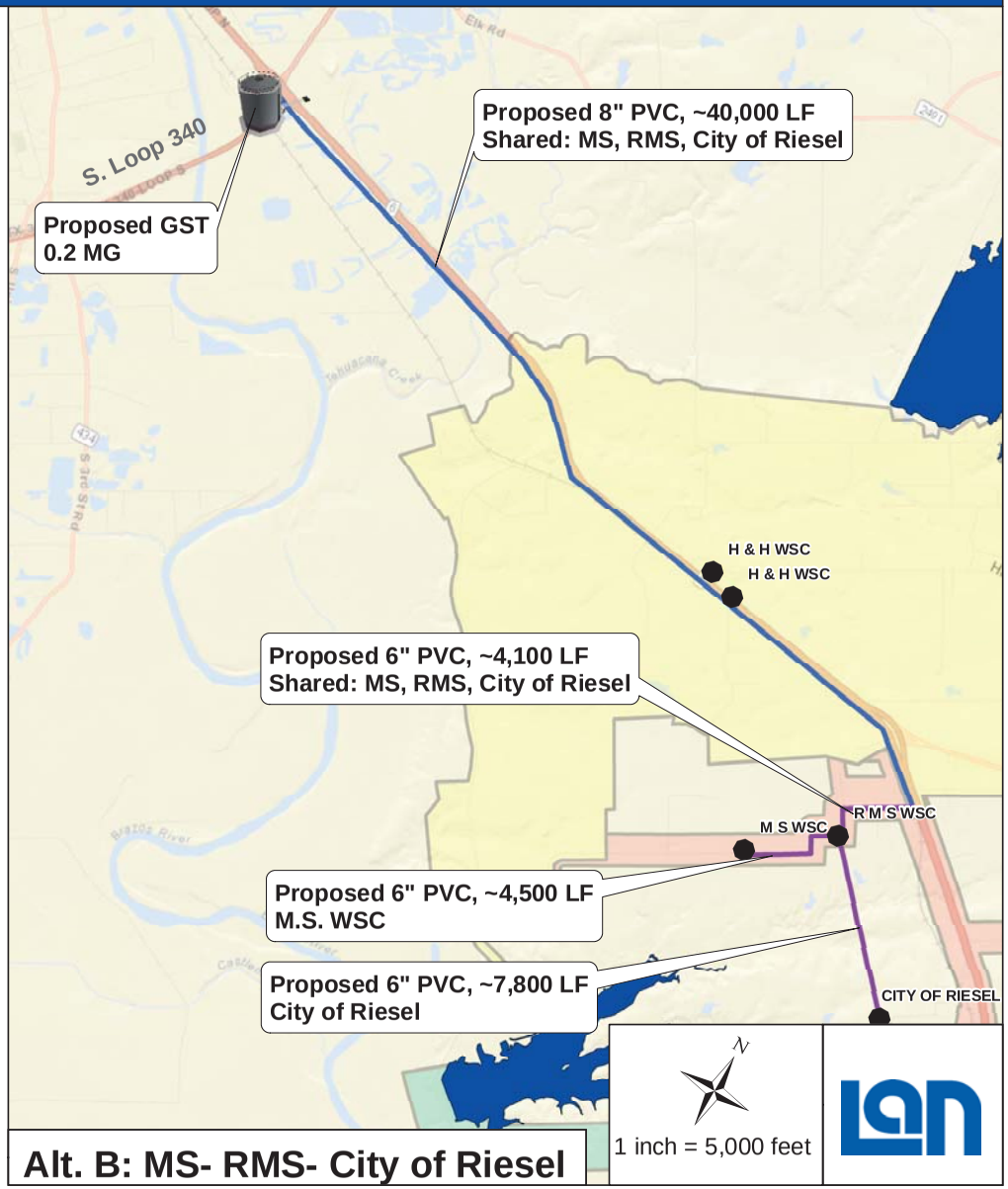
Orig. Size: 11"x17"


LEGEND
Proposed Water Lines
6"
8"
12"
Utility
AXTELL WSC
BIROME WSC
E O L WSC
LEROY TOURS GERALD WSC
MOORE WATER SYSTEM
PRAIRIE HILL WSC
Birome Plant 5
Proposed 6" PVC
~18,400 LF
Axtell + Birome
Proposed 8" PVC
~5,000 LF
Axtell + Moore
+Birome
Proposed 6" PVC
~9,900 LF
Birome
AXTELL WSC
AXTELL WSC
Hwy 84
Proposed GST
0.5 MG
Axtell + EOL +
Moore + PH
+ Birome
Proposed 6" PVC
~4,300 LF
Moore
MOORES WATER SYSTEM
Proposed 12" PVC
~11,000 LF
Moore + Axtell +
EOL + Prairie Hill
+ Birome
EOL/PH
Proposed 12" PVC
~21,700 LF
EOL + Prairie Hill
S. Loop 340
EOL WSC
EOL WSC
EOL WSC
PRAIRIE HILL WSC
PRAIRIE HILL WSC
Proposed 8" PVC
~15,800 LF
EOL + Prairie Hill
Proposed 8"
~7,700 LF
Prairie Hill
Proposed 6" PVC
~4,300 LF
Prairie Hill
Arsenic Impacted Area
Axtell-EOL-Moore-Prairie Hill-Birome
Alternate Supply: City of Waco SW
N
1 inch = 5,700 feet
Orig. Size: 11"x17"

Proposed Layout Arsenic Mitigation
Alternate Supply: City of Waco SW



Alt. A: MS- RMS- City of Riesel- H&H



Alt. B: MS- RMS- City of Riesel

4.2.3- Cost Estimates/Funding

Planning level cost estimates are summarized in the tables below for each of the three proposed connections to the City of Waco system. Detailed cost estimate breakdowns are included in the appendix for each proposed connection.

Proposed Connection	Participants	Estimated Cost
1	Leroy Tours Gerald (LTG)	$ 3,091,400
2	EOL-Axtell-Prairie Hill-Moore-Birome Plant 5	$ 10,613,200
3A*	City of Riesel+ RMS+ MS+ H&H	$ 7,673,400
3B*	City of Riesel+ RMS+ MS	$ 5,939,000
*Note- For Connection 3, Alternative A includes H&H. Alternative B does not include H&H.		

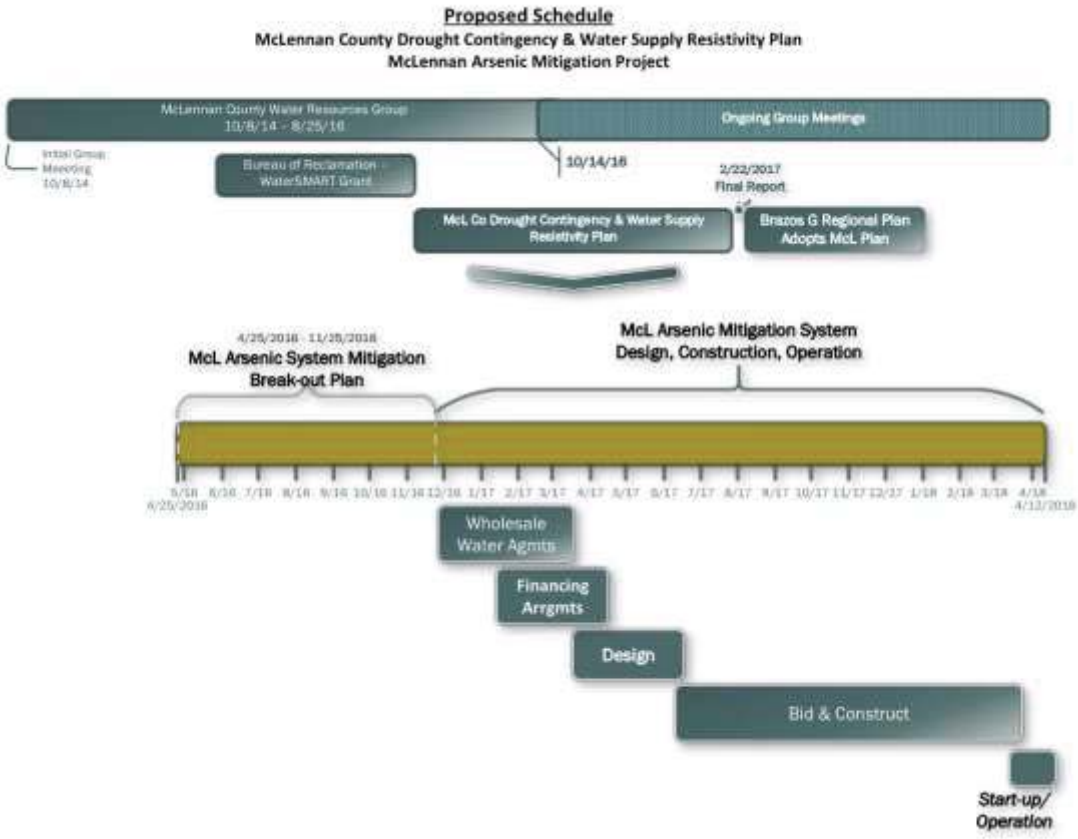
A brief description of potential sources of funding for these systems is listed below.

1. TWDB's SWIFT funding provided the plan is approved in the Brazos G Regional Plan
2. TWDB low-interest loans
3. USDA grants and/or low-interest loans

   The United States Department of Agriculture offers grants and low-interest loans to help small, rural communities finance necessary water projects. An application is required. Selection priority is based on a number of factors including project necessity, number of affected residents, average household income of affected residents, and length of time the improvement has been needed.

4.3- Schedule

The schedule below was presented during one of the Water Resources Group Meetings which included representatives from the EPA.



4.4- Appendices

Appendix A: Compiled Arsenic Test Data from TCEQ Online Database

Appendix B: Arsenic- Impacted Systems Maximum Day Water Demand Projections

Appendix C: Arsenic-Impacted Systems Blending Water Demand Projections

Appendix D: Arsenic Mitigation System Design Calculations/Cost Estimates

Item D1: Leroy Tours Gerald (LTG) System

Item D2: EOL + Axtell + Prairie Hill + Moore + Birome System

Item D3: City of Riesel + RMS + MS + (H&H) System

Appendix E: Water Resources Group Meeting with EPA Representatives

Item E1: Water Resources Presentation

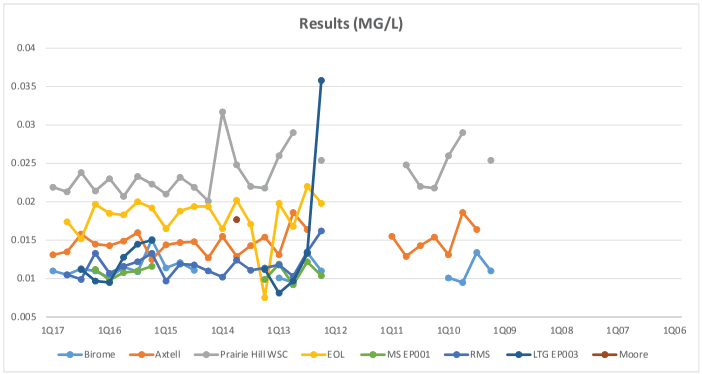
Item E2: Meeting Sign-In Sheet

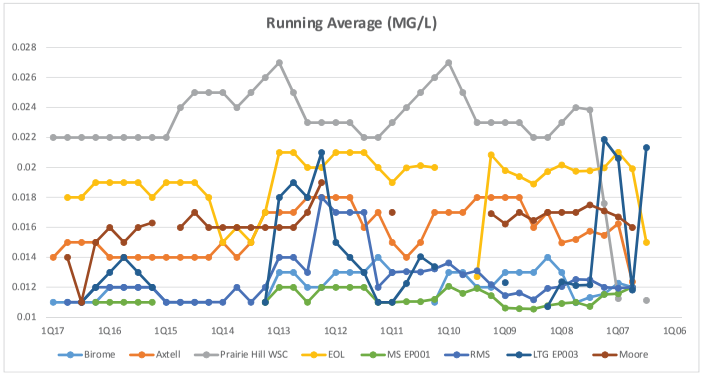
Appendix A

Compiled Arsenic Test Data from TCEQ Online Database

4-4 Appendix A - Compiled Arsenic Test Data from TCEQ Online Database

System	Birome		Axtell		Prairie Hill WSC		EOL				MS				RMS		Riesel				Leroy Tours Gerald LTG				Moore	
PWS ID #	TX1090017		TX1550016		TX1470011		TX1550025				TX1550037				TX1550136		TX1550040				TX1550027				TX1550127	
Location							EP002		EP001		EP001		EP001		EP001		EP001		EP002		EP003		EP001		EP001	
Result/Avg	Result	*Rolling Avg.*	Result	*Rolling Avg.*	Result	*Rolling Avg.*	Result	*Rolling Avg.*	Result	*Rolling Avg.*	Result	*Rolling Avg.*	Result	*Rolling Avg.*	Result	*Rolling Avg.*	Result	*Rolling Avg.*	Result	*Rolling Avg.*	Result	*Rolling Avg.*	Result	*Rolling Avg.*	Result	*Rolling Avg.*
1Q17	*0.011*	*0.011*			0.0219	*0.022*																				
4Q16	0.0105	*0.011*	0.0131	*0.014*	0.0213	*0.022*	0.0174	*0.018*			0.0104	*0.011*			0.0105	*0.011*	0.0108	*0.012*								*0.014*
3Q16	0.0113	*0.011*	0.0135	*0.015*	0.0238	*0.022*	0.0152	*0.018*			0.0104	*0.011*			0.0099	*0.011*	0.0106	*0.012*			0.0112	*0.011*				*0.011*
2Q16	0.011	*0.011*	0.0158	*0.015*	0.0214	*0.022*	0.0197	*0.019*			0.0112	*0.011*	0.0112	*0.011*	0.0133	*0.012*	0.0134	*0.013*			0.0097	*0.012*				*0.015*
1Q16	0.0101	*0.012*	0.0145	*0.015*	0.023	*0.022*	0.0185	*0.019*			0.0107	*0.011*	0.0098	*0.011*	0.0107	*0.012*	0.013	*0.013*			0.0095	*0.013*	*0.0092*	*0.012*		*0.016*
4Q15	0.0115	*0.012*	0.0143	*0.014*	0.0207	*0.022*	0.0183	*0.019*			0.0101	*0.011*	0.0108	*0.011*	0.0116	*0.012*	0.0117	*0.012*			0.0128	*0.014*	*0.0091*	*0.012*		*0.015*
3Q15	0.0109	*0.012*	0.0149	*0.014*	0.0233	*0.022*	0.02	*0.019*			0.0125	*0.012*	0.011	*0.011*	0.0122	*0.012*	0.0127	*0.012*			0.0145	*0.013*	*0.0154*	*0.011*		*0.016*
2Q15	0.0151	*0.012*	0.016	*0.014*	0.0223	*0.022*	0.0192	*0.018*			0.0125	*0.012*	0.0116	*0.011*	0.0133	*0.012*	0.0127	*0.014*			0.015	*0.012*				*0.0163*
1Q15	0.0114	*0.011*	0.0125	*0.014*	0.021	*0.022*	0.0165	*0.019*			0.0103	*0.011*			0.0097	*0.011*	0.0121	*0.013*								
4Q14	0.0121	*0.011*	0.0144	*0.014*	0.0232	*0.024*	0.0188	*0.019*			0.0115	*0.011*			0.0119	*0.011*										*0.016*
3Q14	0.0111	*0.011*	0.0147	*0.014*	0.0219	*0.025*	0.0194	*0.019*			0.0118	*0.011*			0.0118	*0.011*										*0.017*
2Q14		*0.011*	0.0148	*0.014*	0.0201	*0.025*	0.0194	*0.018*			0.011	*0.011*			0.011	*0.011*										*0.016*
1Q14			0.0127	*0.014*	0.0317	*0.025*	0.0165	*0.015*			0.0101	*0.011*			0.0102	*0.011*			*0.0098*	*0.011*						*0.016*
4Q13			0.0155	*0.015*	0.0248	*0.024*	0.0202	*0.016*	0.00922	*0.011*	0.0121	*0.011*			0.0124	*0.012*			*0.0119*	*0.012*					0.0177	*0.016*
3Q13			0.0129	*0.014*	0.022	*0.025*	0.0171	*0.015*			0.0105	*0.012*			0.0111	*0.011*			*0.0105*	*0.012*						*0.016*
2Q13		*0.011*	0.0143	*0.015*	0.0218	*0.026*	0.00753	*0.017*	0.0191	*0.011*			0.0099	*0.011*	0.0114	*0.012*			*0.0125*	*0.013*	0.0112	*0.011*				*0.016*
1Q13	0.0101	*0.013*	0.0154	*0.017*	0.026	*0.027*	0.0198	*0.021*					0.0119	*0.012*	0.0118	*0.014*			*0.014*	*0.015*	0.00812	*0.018*	*0.0062*	*0.014*		*0.016*
4Q12	0.0095	*0.013*	0.0131	*0.017*	0.029	*0.025*	0.0168	*0.021*					0.0092	*0.012*	0.0103	*0.014*			*0.0105*	*0.014*	0.0097	*0.019*	*0.0067*	*0.015*		*0.016*
3Q12	0.0134	*0.012*	0.0186	*0.017*		*0.023*	0.022	*0.02*					0.0122	*0.011*	0.0135	*0.013*			*0.0139*	*0.014*	0.0133	*0.018*	*0.017*	*0.014*		*0.017*
2Q12	0.011	*0.012*	0.0164	*0.018*	0.0254	*0.023*	0.0198	*0.02*	0.0113	*0.012*			0.0104	*0.012*	0.0162	*0.018*			*0.0165*	*0.017*	0.0358	*0.021*	*0.0207*	*0.013*		*0.019*
1Q12		*0.013*		*0.018*		*0.023*		*0.021*		*0.012*				*0.012*		*0.017*				*0.015*		*0.015*				
4Q11		*0.013*		*0.018*		*0.023*		*0.021*		*0.011*				*0.012*		*0.017*				*0.015*		*0.014*				
3Q11		*0.013*		*0.018*		*0.022*		*0.021*		*0.011*				*0.012*		*0.017*				*0.015*		*0.013*				
2Q11		*0.014*		*0.016*		*0.022*		*0.02*		*0.011*				*0.011*		*0.012*				*0.012*		*0.011*				
1Q11		*0.013*		*0.017*		*0.023*		*0.019*						*0.011*		*0.013*				*0.012*		*0.011*				*0.017*
4Q10			0.0155	*0.015*	0.0248	*0.024*		*0.019975*						*0.01105*		*0.01305*				*0.01275*		*0.01226375*				
3Q10			0.0129	*0.014*	0.022	*0.025*		*0.020125*						*0.01105*		*0.013025*				*0.0132*		*0.01405*				
2Q10		*0.011*	0.0143	*0.015*	0.0218	*0.026*		*0.02*		*0.0108*				*0.0112*		*0.013225*				*0.013625*		*0.01338125*				
1Q10	0.0101	*0.013*	0.0154	*0.017*	0.026	*0.027*				*0.01305*				*0.012075*		*0.013625*				*0.013575*				*0.01269*		
4Q09	0.0095	*0.013*	0.0131	*0.017*	0.029	*0.025*				*0.015225*				*0.0116*		*0.01285*								*0.01284875*		
3Q09	0.0134	*0.012*	0.0186	*0.017*		*0.023*		*0.012725*						*0.011925*		*0.0131*								*0.0120775*		
2Q09	0.011	*0.012*	0.0164	*0.018*	0.0254	*0.023*		*0.02085*						*0.01145*		*0.012175*								*0.01176*		*0.016925*
1Q09		*0.013*		*0.018*		*0.023*		*0.0198*						*0.010625*		*0.01145*						*0.01232125*				*0.0162333*
4Q08		*0.013*		*0.018*		*0.023*		*0.0194*						*0.010575*		*0.011625*										*0.017*
3Q08		*0.013*		*0.018*		*0.022*		*0.0189*						*0.01055*		*0.011175*										*0.01646*
2Q08		*0.014*		*0.016*		*0.022*		*0.019725*						*0.010775*		*0.011925*						*0.01071875*				*0.017*
1Q08		*0.013*		*0.017*		*0.023*		*0.020175*						*0.010925*		*0.01205*						*0.012375*				*0.017*
4Q07		*0.010975*		*0.014975*		*0.024*		*0.01975*						*0.011*		*0.012525*						*0.012125*				*0.017*
3Q07		*0.011325*		*0.0152*		*0.02385*		*0.019775*						*0.010725*		*0.0125*						*0.0121625*				*0.0175*
2Q07		*0.01155*		*0.01575*		*0.0176*		*0.019975*						*0.011525*		*0.012*						*0.0218625*				*0.0171*
1Q07		*0.012275*		*0.015475*		*0.01125*		*0.0210125*						*0.011575*		*0.01195*						*0.0206125*				*0.0167*
4Q06		*0.012*		*0.01625*				*0.019925*						*0.012*		*0.012*						*0.011825*				*0.016*
3Q06				*0.012375*		*0.011125*		*0.015*														*0.021325*				
2Q06																										
1Q06																										
MAX	0.0151	*0.014*	0.0186	*0.018*	0.0317	*0.027*	0.022	*0.0210125*	0.0191	*0.015225*	0.0125	*0.012*	*0.0122*	*0.012075*	*0.0162*	*0.018*	0.0134	*0.014*	0.0165	*0.017*	0.0358	*0.0218625*	0.0207	*0.015*	0.0177	*0.019*





Appendix B

Arsenic-Impacted Systems

Maximum Day Water Demand Projections

4.4 Appendix B: Arsenic-impacted Systems Maximum Day Water Demand

Maximum Day Water Demands																		
Entity	Notes (see below)	2010		i_annual (2010 to 2020)	2020		i_annual (2020 to 2030)	2030		i_annual (2030 to 2040)	2040		2050		2060		2070		
		MGD	*Gal/Yr*		*MGD*	*Gal/Yr*		*MGD*	*Gal/Yr*		*MGD*	*Gal/Yr*	*MGD*	*Gal/Yr*	*MGD*	*Gal/Yr*	*MGD*	*Gal/Yr*	*Gal/Day*
Axtell WSC	A	0.372	135,780,000	0.80%	0.403	147,095,000	0.72%	0.433	158,045,000	0.72%	0.465	169,725,000	0.499	182,268,187	0.536	195,738,353	0.576	210,204,005	575,901
Birome WSC	A	0.327	119,355,000	0.65%	0.349	127,385,000	0.61%	0.371	135,415,000	0.58%	0.393	143,445,000	0.416	151,951,173	0.441	160,961,754	0.467	170,506,656	467,142
Birome WSC PLANT 5 ONLY	B	0.050	18,250,000	0.65%	0.053	19,477,829	0.61%	0.057	20,705,657	0.58%	0.0601	21,933,486	0.064	23,234,124	0.067	24,611,889	0.071	26,071,354	71,428
E O L WSC	A	0.39	142,350,000	0.91%	0.427	155,855,000	0.90%	0.467	170,455,000	0.88%	0.51	186,150,000	0.557	203,290,150	0.608	222,008,515	0.664	242,450,412	664,248
H & H WSC	A	0.395	144,175,000	0.99%	0.436	159,140,000	1.01%	0.482	175,930,000	0.99%	0.532	194,180,000	0.587	214,323,154	0.648	236,555,846	0.715	261,094,834	715,328
H&H WSC*	C				0.45	164,250,000	0.00%	0.45	164,250,000	0.00%	0.45	164,250,000	0.450	164,250,000	0.450	164,250,000	0.450	164,250,000	450,000
Leroy Tours Gerald WSC	A	0.191	69,715,000	0.86%	0.208	75,920,000	0.88%	0.227	82,855,000	0.85%	0.247	90,155,000	0.269	98,098,172	0.292	106,741,183	0.318	116,145,692	318,207
Moore Water System	A	0.092	33,580,000	0.11%	0.093	33,945,000	0.00%	0.093	33,945,000	0.11%	0.094	34,310,000	0.095	34,678,925	0.096	35,051,816	0.097	35,428,718	97,065
M S WSC	A	0.07	25,550,000	0.14%	0.071	25,915,000	0.00%	0.071	25,915,000	0.14%	0.072	26,280,000	0.073	26,650,141	0.074	27,025,495	0.075	27,406,136	75,085
Prairie Hill WSC	A	0.412	150,380,000	0.50%	0.433	158,045,000	0.50%	0.455	166,075,000	0.52%	0.479	174,835,000	0.504	184,057,066	0.531	193,765,571	0.559	203,986,172	558,866
R M S WSC	A	0.213	77,745,000	1.61%	0.25	91,250,000	1.57%	0.292	106,580,000	1.59%	0.342	124,830,000	0.401	146,205,000	0.469	171,240,103	0.549	200,562,038	549,485
City of Riesel	D																0.357	130,455,015	357,411

Notes:	
A	System participated in FHLM study. Maximum day water demands from 2010 to 2040 are from the FHLM study. 2050 through 2070 demands are projected assuming the annual growth rate between 2030 and 2040 remains constant.
B	Existing max day demands for Plant 5 (assumed 2010) are as reported by Birome WSC/Duff Engineering. Max day demands for Birome's Plant 5 are projected to 2040 assuming the same annual growth rates as Birome from the FHLM study. Demands for 2050 through 2070 are projected as described in Note A above.
C	H&H is not under AO for arsenic violations. H&H has expressed interest in reserving 0.45 MGD capacity in a potential connection to the City of Waco system. This demand represents the reserve capacity.
D	The City of Riesel did not participate in the FHLM study. The 2070 max day demand is calculated as follows: 2070 Max Day Demand = (2070 Avg. Day Demand) * (Max Daily Demand/Avg Daily Usage)
	Source 2070 Average Day Demand: TWDB
	Source Max Daily Demand (MDD) and Average Daily Usage (ADU): TCEQ Online Database
	MDD= .253 MGD (TCEQ, 2017)
	ADU= 0.91 MGD (TCEQ, 2017)

Appendix C

Arsenic-Impacted Systems

Blending Water Demand Projections

4.4- Appendix C: Blending Water Demand Projections

	GW As Concentration	Waco As Concentration	Final Target As Concentration	$\delta_{arsenic}$	2070 Peak Demand Amount	Amt of Waco Water Needed for Dilution to meet Peak Day 2070	
	(mg/L)	(mg/L)	(mg/L)		Gal/Day	Gal/Day	MG/Day
MS	0.0125	0.0022	0.0085	0.39	75,085	29,159	0.029
RMS	0.0180	0.0022	0.0085	0.60	549,485	330,387	0.330
City of Riesel	0.0170	0.0022	0.0085	0.57	357,411	205,270	0.205
LTG	0.0220	0.0022	0.0085	0.68	318,207	216,960	0.217
Moore WS	0.0300	0.0022	0.0085	0.77	97,065	75,068	0.075
Axtell WSC	0.0180	0.0022	0.0085	0.60	575,901	346,270	0.346
EOL	0.0220	0.0022	0.0085	0.68	664,248	452,896	0.453
Prairie Hill	0.0310	0.0022	0.0085	0.78	558,866	436,614	0.437
Birome- Plant 5 Only	0.0140	0.0022	0.0085	0.47	71,428	33,293	0.033
H&H						450,000	0.450

TOTAL	**3,267,697**	**2,575,917**	**2.58**
	GPD	GPD	MGD

Appendix D

Arsenic Mitigation System Design Calculations/Cost Estimates

Item D1: Leroy Tours Gerald (LTG) System

Item D2: EOL + Axtell + Prairie Hill + Moore + Birome System

Item D3: City of Riesel + RMS + MS + (H&H) System

4.4- Appendix D, Design Calculations/Cost Estimates
Item D1: Leroy Tours Gerald (LTG) System

Blending Water Needs:

Participant System(s)	2070 Blending Water Needed for Peak Day (MGD)
Leroy Tours Gerald (LTG)	0.217
TOTAL	0.22

150.67 gpm

Pipe Sizing:

Participant System(s)	Assumed Velocity, *min* (fps)	Assumed Velocity, *max* (fps)	Qpeak (2070) (cfs)	Min. Diameter Required (in)	Max Diameter Required (in)	Diameter Recommended (in)
Leroy Tours Gerald (LTG)	3.0	5.0	0.3	3.5	4.5	6.0

Pump Sizing:

Alt. 1- Assume constant 24 hr. pump runtime to meet Peak 2070 Demand	**Pipe Diameter (in)**	**L (ft)**	**Hazen Williams' C (assume PVC)**	**Q (cfs)**	**V_actual (ft/s)**	**Friction Head Loss (ft) (Hazen Williams Eq)**
Segment 1	6	12,650	130	0.34	1.710	28.49
Segment 2	6	20,650	130	0.17	0.855	12.90

Pump Elevation (ft) (Ground Level)	543
Max Elevation Along Route (ft) (assume discharge into 30' tall tank)	559
Static Head (ft)	16
Friction Head (ft)	41.39
TCEQ Residual Pressure Req'd (psi)	35.00
Pressure Head (ft)	80.77
Discharge Head to Overcome (ft):	138.16
WHP_out (HP)	**5.26**
Pump Efficiency (n)	0.7
HP into Pump (HP)_ [BHP]	**7.52**
Recommended Pump BHP	10

Tank Sizing:

Existing # Connections (from TCEQ)	537
Dilution Water to Meet 2010 Peak Demand (MGD)	0.130
Gal/Connection	242.50889
Estimated # Connections in 2070	895
$\delta_{arsenic}$	0.68
Adjusted 2070 # Connections	610
Required Tank Volume (MG) *(assume 200 Gal/Adjusted Connection)*	0.122
Recommended Tank Volume (MG)	0.125

Cost Estimate:

Description	**Quantity**	**Quantity Unit**	**Unit Cost**	**Unit Cost Units**	**Cost**	*% of Subtotal*
6 inch PVC Waterline	33,300	LF	$ 35.00	$/LF	$ 1,165,500	*47.13%*
6 inch Water Tie-In	2	Each	$ 2,000.00	$/Each	$ 4,000	*0.16%*
6 inch Gate Valve	3	Each	$ 1,500.00	$/Each	$ 4,500	*0.18%*
4" Water Meter+Strainer	1	Each	$ 7,316.00	$/Each	$ 7,316	*0.30%*
125,000 Gallon Ground Storage Tank	125,000	Gal	$ 2.00	$/Gal	$ 250,000	*10.11%*
10 HP Pump Station	10	HP	$ 72,000.00	$/HP	$ 720,000	*29.11%*
Easements (2.5% of Total LF, 20ft wide)	16,650	Sq-ft	$ 1.50	$/Sq-ft	$ 24,975	*1.01%*
Soft Costs/Engineering (12%)					$ 296,800	*12.00%*
				Subtotal	$ 2,473,100	
				Contingency (25%)	$ 618,300	
				Total	**$ 3,091,400**	

4.4 Appendix D: Design Calculations/Cost Estimates
Item D2 - EOL + Axtell + Prairie Hill + Moore + Birome System

Blending Water Needs:

Participant System(s)	2070 Blending Water Needed for Peak Day (MGD)
EOL WSC	0.45
Axtell WSC	0.35
Prairie Hill WSC	0.44
Birome	0.03
Moore WSC	0.08
Total	**1.34**

Pipe Sizing:

Participant System(s)	Assumed Velocity, *min* (fps)	Assumed Velocity, *max* (fps)	Qpeak (2070) (cfs)	Min. Diameter Required (in)	Max Diameter Required (in)	Diameter Recommended (in)
EOL + Axtell + Prairie Hill + Birome + Moore	3.0	5.0	2.08	8.7	11.3	12
EOL + Prairie Hill	3.0	5.0	1.38	7.1	9.2	12
2/3 EOL + Prairie Hill	3.0	5.0	1.14	6.5	8.4	12
1/3 EOL + Prairie Hill	3.0	5.0	0.91	5.8	7.5	8
Prairie Hill	3.0	5.0	0.68	5.0	6.4	8
1/2 Prairie Hill	3.0	5.0	0.34	3.5	4.5	6
Axtell, Birome, Moore	3.0	5.0	0.70	5.1	6.6	8
Moore	3.0	5.0	0.12	2.1	2.7	6
Axtell + Birome	3.0	5.0	0.59	4.6	6.0	6
1/2 Axtell + Birome	3.0	5.0	0.32	3.4	4.4	6
Birome	3.0	5.0	0.05	1.4	1.8	6

Pump Sizing:

from SS WaterGEMs model

Operating Head (ft)	350
Operating Flow (MGD)	1.35
Assumed Pump Efficiency	0.7
Hydraulic HP	83
Brake HP	118
Recommended HP (for 2070)	125

Tank Sizing:

	EOL	Axtell	Prairie Hill	Birome- Plant 5	Moore	Total
Existing # Connections (from TCEQ)	631	580	685	Unknown	284	2180
Dilution Water to Meet 2010 Peak Demand (MGD)	0.266	0.224	0.322	0.023	0.071	0.906
Gal/Connection	421	386	470	426	251	1953.117
Estimated # Connections in 2070	1075	898	929	78	300	3279.665
$\delta_{arsenic}$	0.68	0.60	0.78	0.47	0.77	
Adjusted 2070 # Connections	733	540	726	36	232	2266.760
Required Tank Volume (MG) *(assume 200 Gal/Adjusted Connection)*	0.1466	0.1080	0.1452	0.0073	0.0463	0.453
Recommended Tank Volume (MG)	0.5					

Cost Estimate:

Description	Quantity	Quantity Unit	Unit Cost	Unit Cost Units	Cost	*% of Subtotal*
12" PVC WL (Prop GST to S League Ranch Rd)	11,000	LF	$ 65	$/LF	$ 712,800	*8.40%*
12" PVC WL (S. League Ranch Rd to Double EE Ranch Rd to FM2491	19,000	LF	$ 65	$/LF	$ 1,235,000	*14.55%*
12" PVC WL (Double EE Ranch Rd/FM 2491 to EOL Well B)	2,600	LF	$ 65	$/LF	$ 169,000	*1.99%*
8" PVC WL (EOL Well B to EOL Well C)	15,400	LF	$ 45	$/LF	$ 693,000	*8.16%*
8" PVC WL (EOL Well C to PHWS Well A)	7,970	LF	$ 45	$/LF	$ 358,650	*4.22%*
6" PVC WL (PHWS Well A to Well B)	4,296	LF	$ 35	$/LF	$ 150,360	*1.77%*
8" PVC WL (Intersection with S. League Ranch Rd to Old Axtell Rd.)	4,952	LF	$ 45	$/LF	$ 222,840	*2.62%*
6" PVC WL (Old Axtell Rd to Moore WS)	4,525	LF	$ 35	$/LF	$ 158,375	*1.87%*
6" PVC (Old Axtell Rd to Birome Plant 5)	27,563	LF	$ 35	$/LF	$ 964,705	*11.36%*
6" PVC (Old Axtell Rd to Axtell Well B)	906	LF	$ 35	$/LF	$ 31,710	*0.37%*
8" Water Meter	2	Ea	$ 16,550	$/Each	$ 33,100	*0.39%*
6" Water Meter	1	Ea	$ 11,930	$/Each	$ 11,930	*0.14%*
4" Water Meter	3	Ea	$ 7,316	$/Each	$ 21,948	*0.26%*
12" Gate Valve	3	Ea	$ 2,500	$/Each	$ 7,500	*0.09%*
8" Gate Valve	4	Ea	$ 1,500	$/Each	$ 6,000	*0.07%*
6" Gate Valve	14	Ea	$ 1,250	$/Each	$ 17,500	*0.21%*
12" Water Tie In	2	Ea	$ 3,000	$/Each	$ 6,000	*0.07%*
8" Water Tie-In	2	Ea	$ 2,000	$/Each	$ 4,000	*0.05%*
6" Water Tie-In	11	Ea	$ 1,600	$/Each	$ 17,600	*0.21%*
GST (0.5 MG)	500,000	Gal	$ 1.50	$/Gal	$ 750,000	*8.83%*
125 HP Pump Station	125	HP	$ 13,420.00	$/HP	$ 1,677,500	*19.76%*
Easements	148,000	Sq-ft	$ 1.50	$/Sq-ft	$ 222,000	*2.61%*
Soft Cost/Engineering (12%)					$ 1,018,900	*12.00%*
				Subtotal	$ 8,490,500	
				Contingency (25%)	$ 2,122,700	
				Total	$ 10,613,200	

4.4- Appendix: Design Calculations/Cost Estimates
Item D3 - City of Riesel + RMS + MS + (H&H System)

Blending Water Needs:

Participant System(s)	2070 Blending Water Needed for Peak Day (MGD)
City of Riesel	0.205
Meier Settlement (MS)	0.029
Riesel-Meier Settlement (RMS)	0.33039
H&H *	0.45
Total	1.015

Note: H&H does not need blending water for arsenic dilution, but has expressed interest to participate for reserve/backup supply

Pipe Sizing: H&H included

Participant System(s)	Assumed Velocity, *min* (fps)	Assumed Velocity, *max* (fps)	Qpeak (2070) (cfs)	Min. Diameter Required (in)	Max Diameter Required (in)	Diameter Recommended (in)
H&H + City of Riesel + MS + RMS	3	5	1.570	7.6	9.8	12
H&H	3	5	0.696	5.1	6.5	8
City of Riesel + MS + RMS	3	5	0.874	5.7	7.3	8
MS	3	5	0.045	1.3	1.7	6
City of Riesel	3	5	0.318	3.4	4.4	6

Pipe Sizing: H&H not included

Participant System(s)	Assumed Velocity, *min* (fps)	Assumed Velocity, *max* (fps)	Qpeak (2070) (cfs)	Min. Diameter Required (in)	Max Diameter Required (in)	Diameter Recommended (in)
City of Riesel + MS + RMS	3	5	0.874	5.7	7.3	8
MS	3	5	0.045	1.3	1.7	6
City of Riesel	3	5	0.318	3.4	4.4	6

Pump Sizing: (Include H&H)

from SS WaterGEMs model

Operating Head (ft)	300
Operating Flow (MGD)	1.014
Assumed Pump Efficiency	0.7
Hydraulic HP	53
Brake HP	76
Recommended HP (for 2070)	75

Pump Sizing: (No H&H)

from SS WaterGEMs model

Operating Head (ft)	350
Operating Flow (MGD)	0.565
Assumed Pump Efficiency	0.7
Hydraulic HP	35
Brake HP	50
Recommended HP (for 2070)	50

Tank Sizing:	City of Riesel	MS	RMS	Sum (COR, MS, RMS)	H&H	Total
Existing # Connections (from TCEQ)	427	248		675	541	
Dilution Water to Meet 2010 Peak Demand (MGD)	0.067	0.027	0.128	0.223	0.45	
Gal/Connection				330	832	
Estimated # Connections in 2070	1084	629		1713	890	
$\delta_{arsenic}$	0.57	0.39	0.60	0.52	NA	
Adjusted 2070 # Connections				893	890	
Required Tank Volume (MG) *(assume 200 Gal/Adjusted Connection)*				0.179	0.178	0.357
Recommended Tank Volume (MG)				0.2		0.5

H&H Annual i

1%

Cost Estimate: Include H&H

Description	Quantity	Quantity Unit	Unit Cost	Unit Cost Units	Cost	% Subtotal
12" WL (GST to H&H Connection)	27,910	LF	$ 65	$/LF	$ 1,814,150	*29.6%*
8" WL (to H&H well)	675	LF	$ 45	$/LF	$ 30,375	*0.5%*
8" WL (from H&H connection to MS)	17,196	LF	$ 45	$/LF	$ 773,820	*12.6%*
6" WL (from MS to Riesel Rattlesnake Well)	7,681	LF	$ 35	$/LF	$ 268,835	*4.4%*
6" WL (from MS to RMS)	4,688	LF	$ 35	$/LF	$ 164,080	*2.7%*
12" Gate Valve	1	Ea	$ 2,500	$/Ea	$ 2,500	*0.0%*
8" Gate Valve	3	Ea	$ 1,500	$/Ea	$ 4,500	*0.1%*
6" Gate Valve	5	Ea	$ 1,250	$/Ea	$ 6,250	*0.1%*
8" Water Meter	1	Ea	$ 16,550	$/Ea	$ 16,550	*0.3%*
6" Water Meter	1	Ea	$ 11,930	$/Ea	$ 11,930	*0.2%*
4" Water Meter	3	Ea	$ 7,316	$/Ea	$ 21,948	*0.4%*
12" Water Tie-In	1	Ea	$ 3,000	$/Ea	$ 3,000	*0.0%*
8" Water Tie In	2	Ea	$ 2,000	$/Ea	$ 4,000	*0.1%*
6" Water Tie-In	6	Ea	$ 1,600	$/Ea	$ 9,600	*0.2%*
GST (0.5 MG)	500,000	Gal	$ 1.50	$/Gal	$ 750,000	*12.2%*
75 HP Pump Station	75	HP	$ 17,200	$/HP	$ 1,290,000	*21.0%*
Easements (20ft wide)	153,620	Sq-ft	$ 1.50	$/sq-ft	$ 230,430	*3.8%*
Soft Cost/Engineering (12%)					$ 736,700	*12.0%*
				Subtotal	$ 6,138,700	
				Contingency (25%)	$ 1,534,700	
				Total	$ 7,673,400	

Cost Estimate: No H&H

Description	Quantity	Quantity Unit	Unit Cost	Unit Cost Units	Cost	% Subtotal
8" WL (GST to MS)	45,106	LF	$ 45	$/LF	$ 2,029,770	*42.7%*
6" WL (from MS to Riesel Rattlesnake Well)	7,681	LF	$ 35	$/LF	$ 268,835	*5.7%*
6" WL (from MS to RMS)	4,688	LF	$ 35	$/LF	$ 164,080	*3.5%*
8" Gate Valve	1	Ea	$ 1,500	$/Ea	$ 1,500	*0.0%*
6" Gate Valve	5	Ea	$ 1,250	$/Ea	$ 6,250	*0.1%*
8" Water Meter	1	Ea	$ 16,550	$/Ea	$ 16,550	*0.3%*
4" Water Meter	3	Ea	$ 7,316	$/Ea	$ 21,948	*0.5%*
8" Water Tie-In	1	Ea	$ 2,000	$/Ea	$ 2,000	*0.0%*
6" Water Tie-In	6	Ea	$ 1,600	$/Ea	$ 9,600	*0.2%*
GST (0.2 MG)	200,000	Gal	$ 2.00	$/Gal	$ 400,000	*8.4%*
50 HP Pump	50	HP	$ 20,600	$HP	$ 1,030,000	*21.7%*
Easements (20 ft wide)	153,620	Sq-ft	$ 1.50	$/sq-ft	$ 230,430	*4.8%*
Soft Costs/Engineering (12%)					$ 570,200	*12.0%*
				Subtotal	$ 4,751,200	
				Contingency (25%)	$ 1,187,800	
				Total	$ 5,939,000	

Appendix E

Water Resources Group Meeting with EPA Representatives

Item E1: Water Resources Presentation

Item E2: Meeting Sign-In Sheet

4.4 Appendix E: McLennan County Water Resources Group Meeting with EPA Representatives from Region VI

Item E1 - Presentation (by LAN)

McLennan Co. Water Plan

Arsenic-Impacted Water Supply Mitigation

October 14, 2016

Agenda

Opening Remarks & Introductions
– Judge Scott Felton
McLennan County

Discussion of Waco Water Supply Availability and Willingness/Ability to Commit to Address the Arsenic Contamination
– Wiley Stem, Deputy City Manager
City of Waco

Addressing the Arsenic Situation through McLennan County Water Project:

Overview of the *McLennan County Drought Contingency and Water Supply Resistivity Plan*

Arsenic Systems Component - Overview of the McLennan Arsenic Mitigation Project

Proposed Layout
Project Schedule
Initial Estimates of Cost
Financing Options

Discussion – EPA Response and Questions

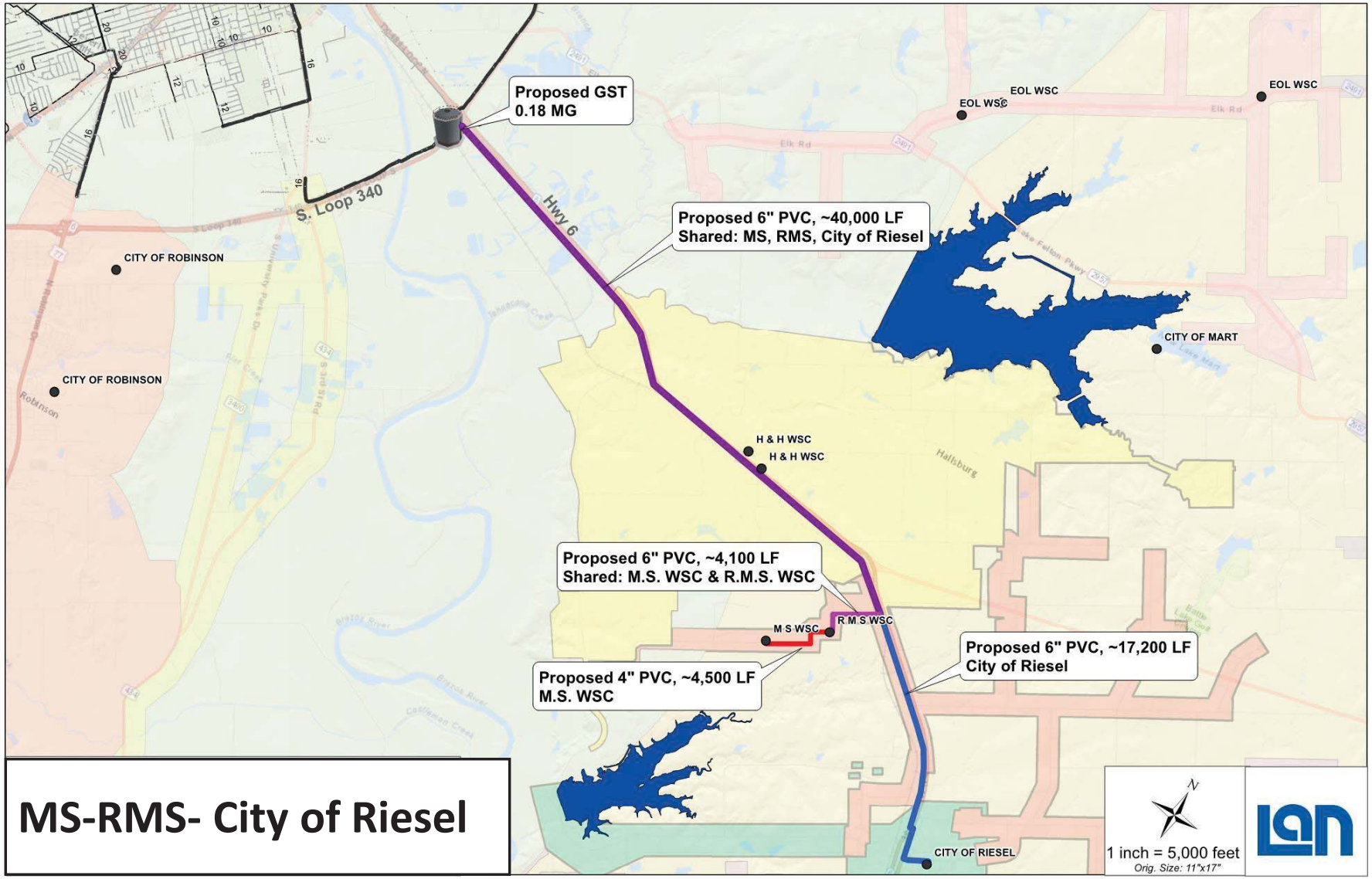
Next Steps

Overview

of the

McLennan County Drought Contingency and Water Supply Resistivity Plan

Addressing the Arsenic Situation



MS-RMS- City of Riesel

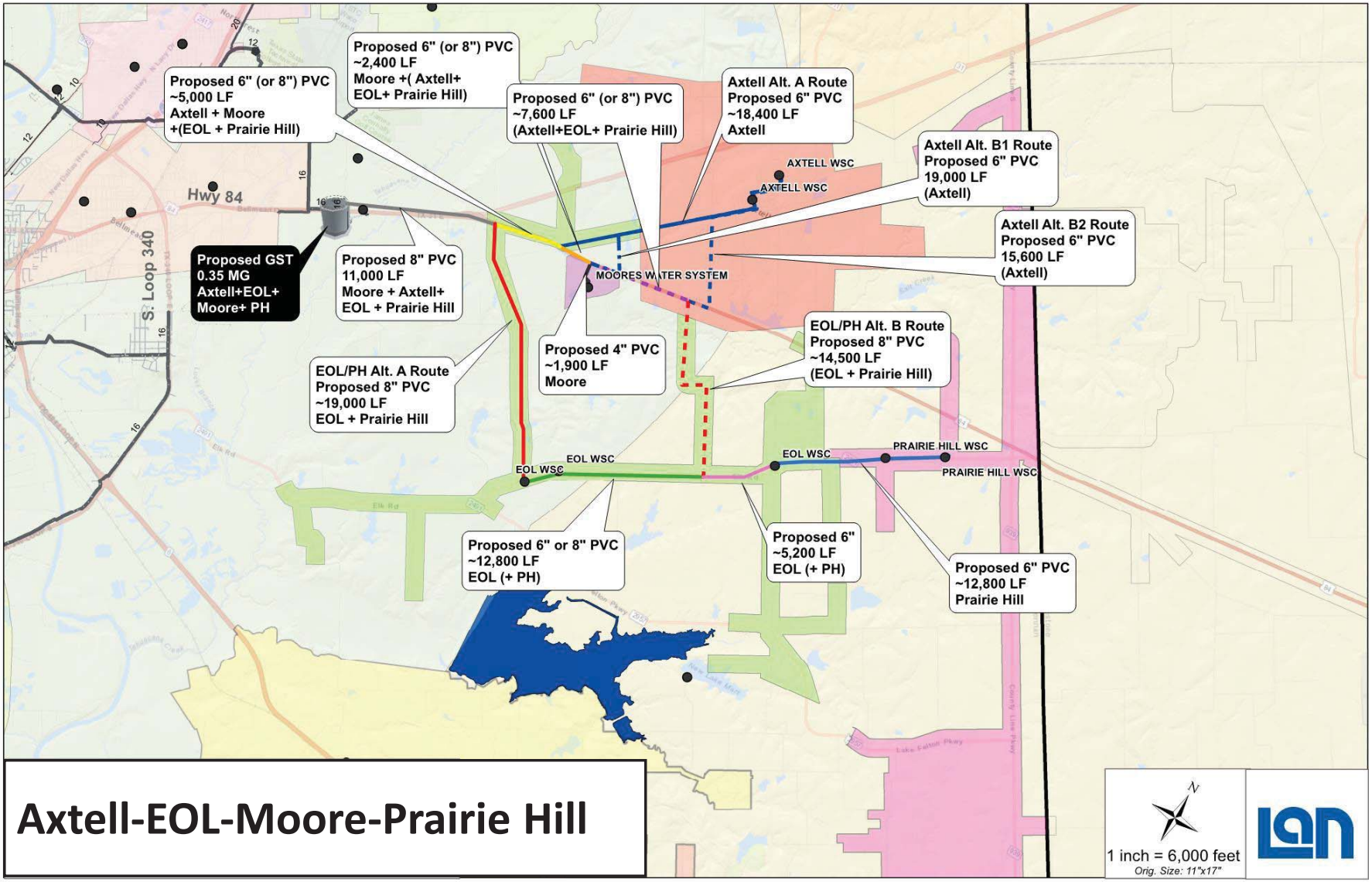
Cost Estimate

MS-RMS-City of Riesel

- Tank: $600,000
- Piping: $2,900,000
- Easements: $400,000
- Engineering/Soft Costs (20%): $780,000
- **TOTAL: $4.7 M***

**Pump Station Costs Not Included*

MS-RMS-City of Riesel:	$4.7 M
TOTAL:	



Axtell-EOL-Moore-Prairie Hill

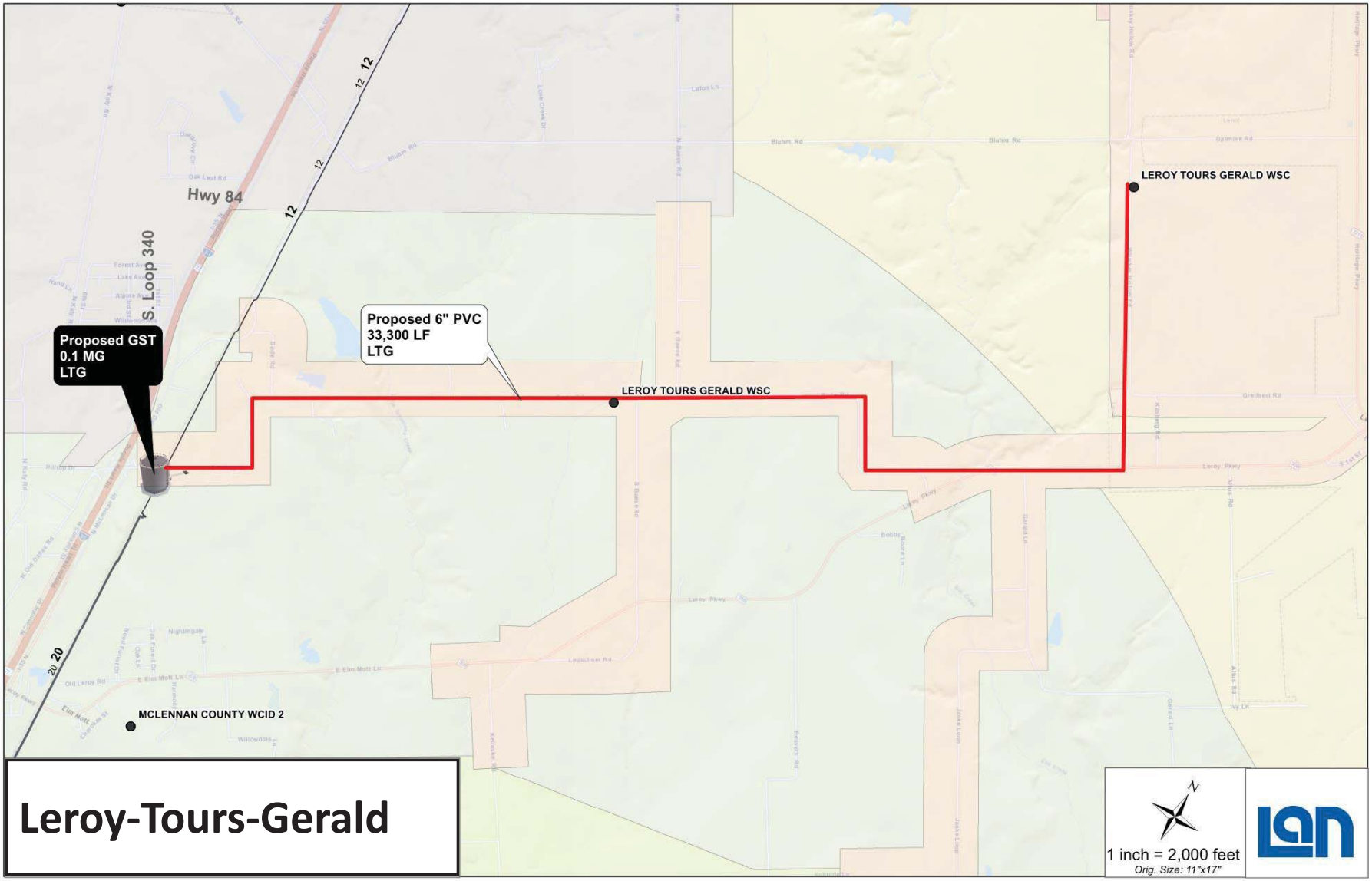
Cost Estimate

Axtell-EOL-Moore-Prairie Hill

- Tank: $1,100,000
- Piping (depends on route): $4,800,000
- Easements: $500,000
- Engineering/Soft Costs (20%): $1,280,000
- **TOTAL: $7.7 M***

**Pump Station Costs Not Included*

MS-RMS-City of Riesel:	$4.7 M
Axtell-EOL-Moore-Prairie Hill:	$7.7 M
TOTAL:	


Hwy 84
S. Loop 340
Proposed GST
0.1 MG
LTG
Proposed 6" PVC
33,300 LF
LTG
LEROY TOURS GERALD WSC
LEROY TOURS GERALD WSC
MCLENNAN COUNTY WCID 2
12
20
Leroy-Tours-Gerald
1 inch = 2,000 feet
Orig. Size: 11"x17"

Cost Estimate

Leroy-Tours-Gerald

- Tank: $315,000
- Piping: $1,500,000
- Easements: $200,000
- Engineering/Soft Costs (20%): $400,000
- **TOTAL: $2.4 M***

**Pump Station Costs Not Included*

MS-RMS-City of Riesel:	$4.7 M
Axtell-EOL-Moore-Prairie Hill:	$7.7 M
Leroy-Tours-Gerald:	$2.4 M
TOTAL:	

Cost Estimate

MS-RMS-City of Riesel
- Tank: $600,000
- Piping: $2,900,000
- Easements: $400,000
- Engineering/Soft Costs (20%): $780,000
- **TOTAL: $4.7 M***

Axtell-EOL-Moore-Prairie Hill
- Tank: $1,100,000
- Piping (depends on route): $4,800,000
- Easements: $500,000
- Engineering/Soft Costs (20%): $1,280,000
- **TOTAL: $7.7 M***

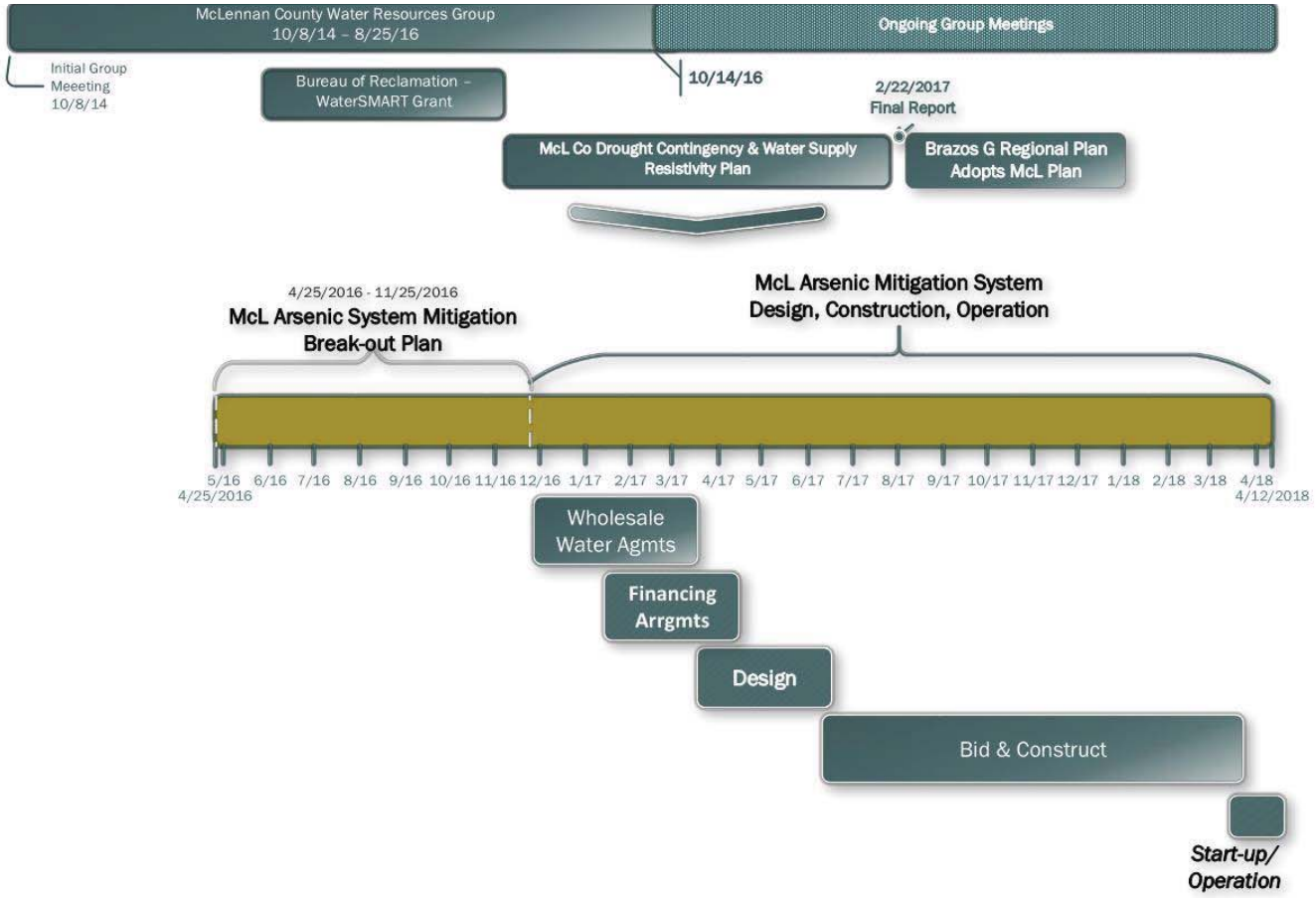
Leroy-Tours-Gerald
- Tank: $315,000
- Piping: $1,500,000
- Easements: $200,000
- Engineering/Soft Costs (20%): $400,000
- **TOTAL: $2.4 M***

**Pump Station Costs Not Included*

MS-RMS-City of Riesel:	$4.7 M
Axtell-EOL-Moore-Prairie Hill:	$7.7 M
Leroy-Tours-Gerald:	$2.4 M
TOTAL:	**$14.8 M**

Proposed Schedule

McLennan County Drought Contingency & Water Supply Resistivity Plan
McLennan Arsenic Mitigation Project



Discussion – EPA Response and Questions

Next Steps

4.4- Appendix E: McL Group Meeting with EPA Region VI
Item E2 - Sign-in Sheet

McLennan County EPA Meeting Sign-In Sheet — **Date: October 14, 2016**

[Please confirm all information below and sign]

NAME	ENTITY / ORGANIZATION	SIGN IF IN ATTENDANCE
Judge Scott M. Felton	McLennan County	Scott M. Felton
Melissa Cordell, Assistant Director of the Enforcement Division - TCEQ		Via phone
Dale Fisseler	Waco, City of	Dale Fisseler
June Ella Martinez, Section Manager of Drinking Water/Special Functions - TCEQ		Via phone
Wiley Stem	Waco, City of	Signature below
Tom Ray	L.A.N. Inc.	Tom Ray
Charles Beseda		Charles Beseda
Caaren Skrobarczyk	Tx. Water Development Brazos G Board	Caaren Skrobarczyk
Bryan Sinclair		Via phone
Dennis Pustejovsky		Signtaure below

McLennan County EPA Meeting Sign-In Sheet **Date: October 14, 2016**

[Please confirm all information below and sign]

NAME	ENTITY / ORGANIZATION	SIGN IF IN ATTENDANCE
Marsha Leroux	L.A.N. Inc.	Marsha Leroux

NAME	ENTITY / ORGANIZATION	SIGN IF IN ATTENDANCE
Mary Dunn	MS Water / RMS	Signature below
Lorean Pulley	MS Water	Signature below
Tricia Freytag - Unsure if attended meeting		
Fred Kubitza	E.O.L. WSC	Signature below
Linda Jordan	Prairie Hill	Signature below
Gerald W. Picha	MS Water - Birome	Signature below
Don Ramsey	LTG	Signature below
Matt Gerath - Unsure if attended meeting	LTG	
Jim Forte - Unsure if attended meeting		
Mark Vickery	Vickery & Sadlier	
John Sadlier John Sadlier	Vickery & Sadlier	John Sadlier

NAME	ENTITY / ORGANIZATION	SIGN IF IN ATTENDANCE
Mehdi Taheri	EPA R6 Enforcmt	Mehdi Taheri
Dorothy Young - Unsure if attended meeting		
Wiley Stem Wiley Stem	Waco, City of	Wiley Stem
Willie Lane Willie Lane	EPA R6	Willie Lane
Mary Dunn Mary Dunn	MS Water/RMS	Mary Dunn
Lorean Pulley Lorean Pulley	MS Water	Lorean Pulley
Gerald Picha Gerald Picha	Birome WSC	Gerald Picha
Rodney Adamek Rodney Adamek	Duff Eng.	Rodney Adamek
Anna Adamek, P.E. Anna Adamek, P.E.	Duff Engineering	Anna Adamek, P.E.
Dennis Pustejovsky Dennis Pustejovsky	Birome WSC	
Linda Jordan Linda Jordan	Prairie Hill WSC	Linda Jordan
FRED KUBITZA Fred Kubitza	E.O.L. WSC.	Fred Kubitza

NAME	ENTITY / ORGANIZATION	SIGN IF IN ATTENDANCE
Don Ramsey Don Ramsey	LTG Water	Don Ramsey
Danny Randolph Danny Randolph	LTG Water	Danny Randolph
Annette Sielaff Annette Sielaff	WS Water	Annette Sielaff
Ronnie Dowdle Ronnie Dowdle	WS Water	Ronnie Dowdle
DAVID WREN David Wren	RMS Water	David Wren

NAME	ENTITY / ORGANIZATION	SIGN IF IN ATTENDANCE
Chuck White Chuck White	Astell Water Supply City of Waco	Chuck White Mayor Kyle Deaver
Kyle Deaver Mayor Kyle Deaver		

CHAPTER 5- IMPLEMENTATION

The scope of the McL Plan will require continued efforts and support of the wide range of entities that participated in its development. There are a number of tasks that will be required for implementation the concepts and recommendations of the McL Plan. These are briefly discussed in the Sections below.

1.0- Continued Discussion and Presentations regarding Groundwater Benefits to McLennan County

Although positive, groundwater modeling to simulate the long-term results of decreased groundwater pumping by the largest groundwater users in McLennan County involves complex methods and the explanation of the approach and results, in terms that groundwater water systems in McLennan County will recognize and appreciate, will require more effort. The continued discussions will involve both the groundwater systems—from the large systems involved directly with the conjunctive use of Lake Waco water to all the other systems that will benefit from improved aquifer conditions—and the Southern Trinity Groundwater Conservation District (STGCD)

It is anticipated that the STGCD will undertake additional groundwater modeling, further improving the GAM runs to reflect actual pumping conditions and will work with individual groundwater systems to identify local well conditions and vulnerabilities.

The McL Group will coordinate with the STGCD in future discussions and presentations.

2.0- Adoption of the McLennan County Drought Contingency Plan

The leadership of the McLennan County Judge, the important implementation step of formally adopting the McLennan County Drought Contingency Plan will be undertaken. The McLennan County Commissioners will be briefed on the plan and its potential benefits for McLennan County and its water users. During the Implementation phase, the Drought Contingency Plan will be presented for consideration and formal adoption.

3.0- Coordination on the Operating Framework

The McLennan County Drought Contingency Plan specifies a number of actions that will be taken. During the Implementation phase, the responsibility for these actions will be formally assigned. This will include not only identifying the agency but also the staff member(s) responsible.

The McL Group will work with the various McLennan County agencies to insure the that the Operational framework laid out in the Plan is properly assigned and executed.

A framework for preparing and approving the required five-year updates to the McLennan County Drought Contingency Plan will be an important part of the assignments formalized during the Implementation phase.

4.0- Development of water rate structure(s) to support the reduced groundwater pumping by the major groundwater users

During the development of the McL Plan presented in this report, several scenarios were presented to the McL Group on developing water rate structures to support or help defer the cost by the large groundwater users of taking Lake Waco water. The deferred cost would relate directly to the economic benefits of future aquifer conditions and availability resulting from the reduced pumping of groundwater by the large groundwater users.

Experienced water rate consultants will evaluate different scenarios and present those first to the McL Group and then to the groundwater users in McLennan County. The following tasks and rate scenarios will be evaluated.

Task 1 – Sample Selection and Information Gathering

At the outset of Task 1, the Project Team will work with Engineer to select up to three (3) sample groundwater users to consider within the financial analysis. This sample will seek to select three representative groups from various geographical, financial, and demographically diverse areas. The final selection will be approved by the Engineer as well as the County's representatives. Once selected, data requests will be provided to the selected groundwater users to gather information needed for the financial analysis.

Such data may include, but not be limited to, financial, operating, ordinances, and utility billing data.

Task 2 – Pricing Scenarios

Based on the information collected in Task 1 and the data provided by the Engineer, the Project Team will consider three different scenarios for pricing surface water to the selected sample groundwater users. These scenarios are outlined in further detail below:

Task 2a – Blended Rate

The Project Team will first consider developing a blended production rate for each selected groundwater user. This rate will include the cost, per 1,000 gallons, of developing groundwater and the cost, per 1,000 gallons, of producing surface water. These costs will then be blended, or weighted, based on the blending or weighting of the total supply to be provided.

Task 2b – Surface Water SWAP

In the second pricing scenario, the Project Team will seek to develop a pricing mechanism whereby groundwater is "swapped" for surface water. Under this pricing scenario, the Project Team will develop a price per 1,000 gallons based on the avoided cost of produced groundwater coupled with the incremental cost associated with producing surface water.

Task 2c – Groundwater Credit

In the third and final scenario, the Project Team will develop the cost of producing surface water, with a per 1,000 gallon credit provided to the groundwater user for unused groundwater supplies. Under this scenario, it is anticipated that the credit will diminish overtime as economically feasible. The level and phasing of the credit will be discussed with the Engineer and with representatives of the County.

Task 3 – Present Value Analysis

Each scenario developed will be analyzed for a 20- to 30-year period, depending on the term of debt needed to support capital costs associated with converting from

groundwater to surface water supplies. The annual rate will be developed on a real dollar as well as a present value basis, and a range of impacts will be developing showing the low, high, and average impact to the groundwater customer of each pricing scenario.

Task 4 – Report Development and Presentation

On completion of the analysis, the Project Team will develop a draft report presenting the analysis conducted including an overview of the methodology utilized under each scenario, as well as the Project Team's overall findings and conclusions.

PUBLIC OUTREACH

Provided as a Supplement

Due the extensive amount of information associated with the public outreach efforts, including pertinent information, agenda, presentations, sign-in sheets, minutes, etc., this section is provided as a separate document.

Please the McL Plan Supplement for this information. Therefore, the Supplement on public outreach is included in the McL Plan by reference.