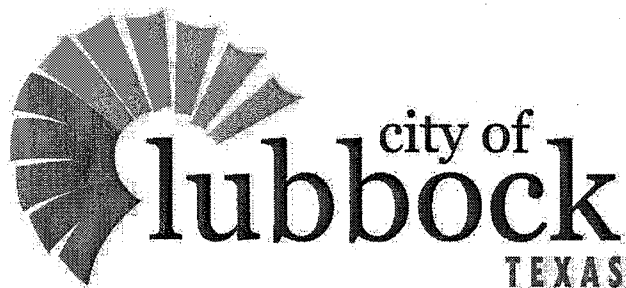


**Application for a WaterSMART Feasibility Study Grant under
the Title XVI Water Reclamation and Reuse Program**

for the

**City of Lubbock Potable Water Reuse Implementation
Feasibility Study**



March 3, 2015

Project Name: City of Lubbock Potable Water Reuse Implementation Strategy Feasibility Study

Applicant: City of Lubbock, Texas

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1 Technical Proposal

1.1 EXECUTIVE SUMMARY

Date: March 3, 2015
Applicant Name: City of Lubbock
Service Area: City of Lubbock and wholesale customers
County: Lubbock
State: Texas

The City of Lubbock (City) provides water and wastewater service to customers within the City. The City also supplies water to seven wholesale customers, including Shallowater, Ransom Canyon and Buffalo Springs. The City completed a Strategic Water Supply Plan in 2013 that identified several water supply strategies to meet the future needs of its service area. A number of potable water reuse options were considered in the 2013 Strategic Water Supply Plan. However, in the plan, it was recognized that this initial high-level assessment of reclaimed water options would need to be refined through the development of a more detailed feasibility study specifically focusing on potable water reuse. The feasibility study proposed in this application describes this follow-on effort.

The potable reuse options to be evaluated in this study will focus on the three main categories of potable reuse identified in the 2013 Strategic Water Supply Plan, i.e.

1. Indirect potable reuse (IPR)- surface water augmentation;
2. Indirect potable reuse (IPR)- groundwater augmentation; and
3. Direct potable reuse (DPR).

Lubbock has been implementing treatment improvements at its existing Southeast Water Reclamation Plant (WRP) in recent years, resulting in improved effluent quality with the intent to ultimately develop a potable reuse project. In addition, the City is constructing a second water reclamation plant, the Northwest WRP, which is using membrane bioreactor technology and will also provide very high quality effluent.

The purpose of this feasibility study is to identify a strategy for augmentation of Lubbock's potable water supply with reclaimed water that is first and foremost protective of public health and the environment, and is also reliable and sustainable, while minimizing the financial impact to the City.

1.2 TECHNICAL STUDY DESCRIPTION

1.2.1 Background

The City of Lubbock is located in Lubbock County, and is centrally positioned in the South Plains Region of Texas. Lubbock is part of the Texas Water Development Board (TWDB) 21-county Llano Estacado Regional Water Planning Area (also known as Region O). The Llano Estacado Region is semi-arid and has limited surface water. Typical surface water in the region is limited to ephemeral stream flows and stormwater collected in playa lakes. In addition, several larger water supply reservoirs have been developed that impound major streams.

Lubbock's current water supply relies on both surface and groundwater and comes from the following sources (Figure 1):

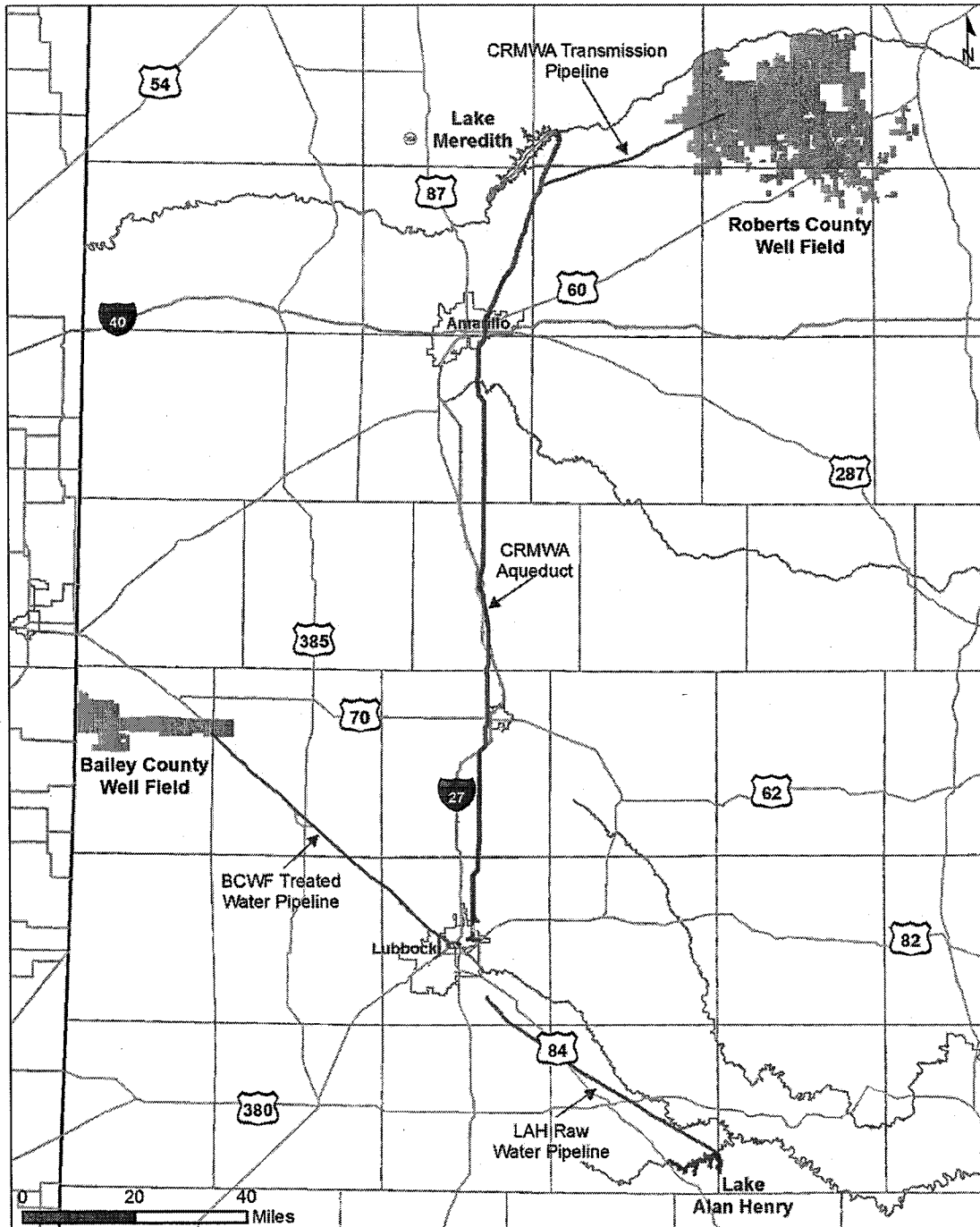
- Canadian River Municipal Water Authority (CRMWA) supplies
 - Lake Meredith (limited use)
 - Roberts County Well Field
- Bailey County Well Field
- Lake Alan Henry

In addition to these conventional sources, the City has been providing reclaimed water from its Southeast Water Reclamation Plant (SEWRP) to the Xcel Energy Jones Power Plant (previously Southwestern Public Service) since 1968. The City also contracted with two private cotton farming operations in 2012 and provides reclaimed water to these farms when water is available.

The City has been proactive in planning for future water supply to meet projected future growth and demands. The most recent Strategic Water Supply Plan was completed in 2013 and identified several potential water supply options that would augment existing supplies through potable water reuse strategies. The evaluation of potable reuse options in the Strategic Water Supply plan was performed at a high level and was intended to serve as a starting point for a more detailed evaluation of each alternative.

Subsequent to the 2013 Strategic Water Supply Plan, the City budgeted funds to perform detailed evaluations of the three identified potable reuse strategies: indirect potable reuse (IPR) through groundwater augmentation; IPR through surface water augmentation; and direct potable reuse (DPR). Some of these funds have already been used to support a follow-on study focusing on ASR and groundwater IPR, which is ongoing. In addition, the City has supported and participated in several other collaborative research projects related to potable reuse. These include:

**Figure 1: Study Area and Existing City of Lubbock Water Supplies
(from 2013 Strategic Water Supply Plan)**



- Texas Water Development Board (TWDB) project to develop a resource document for DPR. This project will be completed in March 2015;
- WaterReuse Research Foundation Project WRRF 12-06; Guidelines for Engineered Storage Systems; and
- WaterReuse Research Foundation Project WRRF 13-02; Model Public Communication Plan for Advancing DPR Acceptance

The City would like to use funding from the Title XVI Feasibility grant program, supported by matching funds, to perform a detailed feasibility study that leverages the initial information developed through the Strategic Water Supply Plan, the ongoing ASR/groundwater IPR study and the TWDB DPR project. The goal of this feasibility study is to prepare a detailed evaluation and comparison of potable water reuse alternatives and identify the best strategy for future development and implementation of water reuse for the City of Lubbock.

Assessment of the feasibility of Potable Water Reuse Implementation for the City of Lubbock will be performed by completing the tasks described below.

1.2.2 Task 1 - Preliminary Project Planning/Background Information

- Gather, review, and summarize previous reports relevant to water reuse and water supply, including but not limited to:
 - City of Lubbock Strategic Water Supply Plan, February 2013
 - Canyon Lakes Water Reuse Project, March 2012
 - Improvements to the SEWRP, Design Memorandum, August 2007
 - City of Lubbock Wastewater Master Plan, 2009
 - Llano Estacado Regional Water Planning Area, Regional Water Plan, 2011
 - Northwest Water Reclamation Plant Feasibility Study, 2012
 - Northwest Water Reclamation Plant Final Design Report, 2014
- Summarize the City's current and projected water and wastewater situation:
 - Water demands through 2060.
 - Water supplies through 2060, potential sources of additional water, and plans for new water facilities.
 - Water quality concerns for the current and projected water supplies
 - Wastewater flows through 2060, disposal options, and plans for new wastewater facilities.
- Describe the need for additional water supply to be provided through a potable reuse project. Provide a general description of the potential project(s), identifying the project sponsor and affected entities.
- Describe the study area. Illustrate the study area on a GIS map.

1.2.3 Task 2 – Water Reclamation and Reuse Opportunities

Identify opportunities for water reclamation and reuse in the study area:

- Using information gathered from Task 1, provide a review of potential uses for reclaimed water in the study area. Since the focus of the evaluation is on potable reuse strategies, a detailed evaluation of additional nonpotable reuse customers will not be performed.
- Using information gathered in Task 1, define the need and market for reclaimed water in the study area.
- Identify potential barriers to implementing a reuse project, such as physical constraints, public acceptance, institutional and regulatory issues, costs, etc. Identify methods to eliminate obstacles which may inhibit the use of reclaimed water, including pricing.

1.2.4 Task 3 – Reclaimed Water Sources and Reuse Technology

Identify the sources of reclaimed water and current and future reuse technologies:

- Potential sources of reclaimed water include the Southeast Water Reclamation Plant (SEWRP) and the future Northwest Water Reclamation Plant (NWWRP), scheduled to be operational in 2018. Both plants are/will be owned and operated by the City of Lubbock. Describe these facilities, including the following information:
 - Treatment capacities, existing and projected flows, and quantities of available reclaimed water.
 - Treatment processes, design criteria, and plans for future facilities.
 - Reclaimed water quality:
 - Document the quality of the effluent from the SEWRP. Identify additional data necessary to evaluate reclaimed water quality requirements, if any, and request that the City perform laboratory analyses. Identify any parameters that limit the use of SEWRP effluent for eventual potable reuse and additional treatment processes necessary to remove the limitation.
 - Document the effluent discharge permit limits and projected quality of the effluent from the NWWRP.
 - Review current and pending effluent discharge permit limits for the existing SEWRP and identify potential regulatory changes that could impact effluent quality.
- Describe current use of reclaimed water from the SEWRP. Define type of use and amount of water reused. Prepare a map showing existing reclaimed water pipelines and use sites.
- Summarize water reclamation and reuse technology currently in use and opportunities for development of improved technologies to augment the potable water supply.

1.2.5 Task 4 – Water Supply Alternatives

Evaluation of water supply alternatives will consider potable water reuse options as well as non-reuse water supply options to meet future water demands. The potable reuse options to be considered include:

1. **Indirect potable reuse (IPR)- surface water augmentation.** Several potential surface water IPR strategies were considered as part of the 2013 Strategic Water Supply Plan. These strategies will be used as a starting point to further develop potential surface water IPR options to be evaluated in the feasibility study.
2. **Indirect potable reuse (IPR)- groundwater augmentation.** The City is currently performing a study to evaluate the feasibility of ASR and groundwater IPR. Results from this study will be used as a starting point to further develop a groundwater IPR option.
3. **Direct potable reuse (DPR)-** several potential DPR scenarios were considered in the 2013 Strategic Water Supply Plan. In addition, the City was sponsor and participated in the Texas Water Development Board project to develop a resource document for DPR. Information from these studies will be used as a starting point to develop potential DPR options to be considered.

Non-reuse alternatives to be evaluated will include the following strategies considered in the 2013 Strategic Water Supply Plan:

1. Development of Phase 2 of surface water supply from Lake Alan Henry
2. Development of an additional transmission line from the Roberts County Well Field to the CRMWA aqueduct

The evaluation of water supply alternatives will include the following sub-tasks:

- Define the water supply objectives that all alternatives are to meet.
- Define water quality performance targets for each potable reuse alternative, including pathogen removal goals, chemical targets and aesthetic goals.
- An initial screening evaluation of potable reuse alternatives will be performed using available information developed from existing studies. A decision matrix summarizing cost and non-cost factors will be used as a tool to identify no more than three recommended potable reuse alternatives for subsequent detailed evaluation. A workshop with City staff will be held to review the decision matrix and discuss criteria, weighting factors and rankings.
- Describe water supply alternatives (other than the proposed reuse alternatives) to meet the objectives, including benefits of each alternative, total project cost, life cycle cost, and corresponding cost of the project water produced expressed in dollars per million gallons and/or dollars per acre-foot.
- Define up to three treatment process schemes for each potable reuse alternative. Document how each scheme will meet established water quality performance targets.

- Develop conceptual treatment and conveyance designs for each of the potable reuse alternatives. Illustrate system infrastructure for each alternative on a GIS map.
 - Identify the general infrastructure, including but not limited to, wastewater treatment upgrades, advanced water treatment, pipelines, pump stations, etc., that is needed to treat and convey reclaimed water while meeting Federal and State legal and permitting requirements.
- Describe waste-stream discharge treatment and disposal water quality requirements for each of the alternatives.
 - Evaluate alternatives for disposal of concentrate for treatment schemes that generate concentrate streams (such as reverse osmosis)
 - Determine expected concentrate water quality based on available data.
 - Evaluate the feasibility of a surface discharge of concentrate
 - Define receiving water quality requirements
 - Define any additional treatment needed to meet receiving water quality goals
 - Evaluate other strategies for disposal, as needed, which may include:
 - Deep well injection
 - Evaporation ponds/mechanical evaporators
 - Additional advanced treatment to reduce volume of concentrate stream or achieve zero liquid discharge
 - Define strategies for discharge treatment or disposal of other waste-stream residuals generated by each potable reuse treatment scheme.

1.2.6 Task 5 – Costs and Benefits

Develop cost and benefit information for each of the potable reuse project alternatives:

- Develop life-cycle cost estimates. The level of detail will be as required for feasibility studies in RM D&S, Cost Estimating (FAC 09-01). Estimates will include:
 - Capital costs, including expenditures for major structures and facilities and other types of construction and non-construction expenses.
 - Annual operation, maintenance, and replacement costs.
 - Unit costs in terms of dollars per million gallons and/or dollars per acre-foot of capacity.
- Prepare a tabular comparison of life-cycle costs for the potable reuse alternatives with life-cycle costs developed for non-reuse alternatives (developed in Task 4).
- Identify and analyze potential benefits, including but not limited to, the following:

- Reduction, postponement, or elimination of development of new or expanded water supplies;
 - Reduction or elimination of the use of existing diversions from natural watercourses, or withdrawals from aquifers;
 - Reduction of demand on existing Federal or other water supply facilities; and
 - Reduction, postponement, or elimination of new or expanded wastewater facilities.
- Where sufficient information is available, develop quantitative benefit estimates for the potable reuse alternatives.
 - For benefits that are difficult to quantify (e.g., a drought tolerant water supply, reduced water importation, and other social or environmental benefits), provide qualitative descriptions of the benefits.

1.2.7 Task 6 – Energy Evaluation

Efficient use of energy will be a significant consideration in the development of and evaluation of each of the potable reuse alternatives.

- Evaluate the energy requirements of each of the potable reuse alternatives and prepare a tabular comparison of projected energy usage.
- Evaluate potential energy saving measures that could be integrated into the design of new treatment facilities, such as energy recovery systems and/or variable frequency drives.
- Evaluate the feasibility of including renewable energy elements as part of the project by
 - Purchasing energy from a local utility that provides renewable energy
 - Integrating renewable energy components into the treatment and conveyance systems, such as wind turbines, solar panels or micro-turbines.

1.2.8 Task 7 – Environmental Considerations and Potential Effects

For the potable reuse alternatives, identify environmental considerations and potential impacts:

- Describe potentially significant impacts on endangered or threatened species, public health or safety, natural resources, regulated waters of the United States, or cultural resources.
- Describe potentially significant environmental effects or unique or undefined environmental risks.
- Describe the status of required Federal, state, tribal, and/or local environmental compliance measures, including copies of any documents that have been prepared, or results of any relevant studies.
- Describe other available information that would assist with assessing the measures that may be necessary to comply with the National Environmental Policy Act (NEPA) and

other applicable Federal, state, or local environmental laws such as the Endangered Species Act or the Clean Water Act.

- Describe how the proposed potable reuse alternatives will affect water supply and water quality from the perspective of a regional, watershed, aquifer, or river basin condition.
- Describe the extent of public involvement in the feasibility study and summarize comments received, if any.
- Describe the potential effects the project may have on historic properties. Include potential mitigation measures, the potential for adaptive reuse of facilities, an analysis of historic preservation costs, and the potential for heritage education, if necessary.

1.2.9 Task 8 – Legal and Institutional Requirements

Identify legal and institutional requirements or barriers to implementation of the proposed potable reuse alternatives:

- For direct potable reuse, use information developed in the Texas Water Development Board Direct Potable Reuse Resource Document to inform identification of legal issues.
- Identify permits required for implementation. These may include, but not be limited to State Chapter 210 authorizations, Federal 404 permits, State permits under Chapter 290, or State TPDES discharge permits.
- Identify water rights issues, including rights to wastewater discharges, potentially resulting from implementation of the proposed potable reuse alternatives.
- Identify the need for multi-jurisdictional or interagency agreements, any coordination undertaken, and any planned coordination activities.
- Describe permitting procedures required for the implementation of water reclamation projects in the study area and any measures that the City can implement that could speed the permitting process.
- Describe any unresolved issues associated with implementing the proposed water reclamation and reuse project, how and when such issues will be resolved, and how the project would be affected if such issues are not resolved.
- Identify current and projected wastewater discharge requirements resulting from the proposed potable reuse alternatives. Depending on the outcome of the concentrate disposal evaluation, this discussion may include requirements for disposal of concentrate through a surface discharge.

1.2.10 Task 9 – Economic Analysis and Selection of Water Supply Alternative

Taking into account information developed in the previous tasks, perform an economic analysis of the proposed potable reuse alternatives relative to other water supply alternatives and select the City's preferred water supply alternative:

- Describe current study area conditions and provide projections of the future with and without the project. Describe how the project can alleviate economic problems and meet future water demands.
- Compare the costs of the potable reuse alternatives and the other water supply alternatives. Cost comparisons will be based on meeting the same water demands and will use the same interest rates and analysis periods.
- Select a preferred alternative. Justify the selection in terms of meeting objectives, demands, needs, cost effectiveness, and other criteria important to the decision.

1.2.11 Task 10 -- Public Outreach Plan

- Document available resources and tools developed by the WaterReuse Research Foundation and other utilities related to public outreach.
- Provide recommendations for public outreach and education strategies that may be used to communicate with the public regarding implementation of the recommended Title XVI project.

1.2.12 Task 11 – Implementation and Funding Plan

Develop an implementation and funding plan, including the following information:

- A plan for implementing the preferred alternative:
 - Describe the treatment and infrastructure requirements.
 - Describe the extent to which the proposed alternative will use proven technologies and conventional system components.
 - Identify basic research needs, if any.
 - Describe research needs associated with the proposed potable reuse project, including the objectives to be accomplished through research. Depending on treatment schemes identified, pilot- and/or bench-scale testing of treatment processes will likely be necessary to obtain TCEQ approval. Research related to concentrate disposal strategies may also be identified.
 - Describe the basis for Reclamation participation in the identified research.
 - Identify the parties who will administer and conduct necessary research.
 - Develop a schedule for implementation of the preferred alternative, including basic research, including pilot-testing, design and construction, customer contracts, permitting, and other necessary elements.
- A plan for funding the proposed project construction, operation, maintenance, and replacement costs:

- Describe the willingness of the City to pay for its share of capital costs and the full operation, maintenance, and replacement costs.
- Describe how the City will pay construction, annual operation and maintenance, and replacement costs. Identify the potential sources of revenue, including grants and/or loans that may be available to fund design and construction of the preferred alternative.
- Describe all Federal and non-Federal sources of funding and any restrictions on such sources, for example, minimum or maximum cost-share limitations.
- Describe the reasonably foreseeable future actions that the City would take if Federal funding were not provided for the proposed water reclamation and reuse project, including estimated costs.

1.2.13 Task 12 – Final Report

Prepare a Title XVI feasibility report that organizes and describes work performed in the previous tasks and meets applicable requirements of RM Directives & Standards WTR 11-01.

1.2.14 Task 13 -- Project Administration

Monitor the project staffing, budget and schedule during the project. Provide semi-annual financial and program performance reports to the Bureau of Reclamation.

1.3 EVALUATION CRITERIA

Evaluation Criterion 1: Statement of Problems and Needs – 10 Points

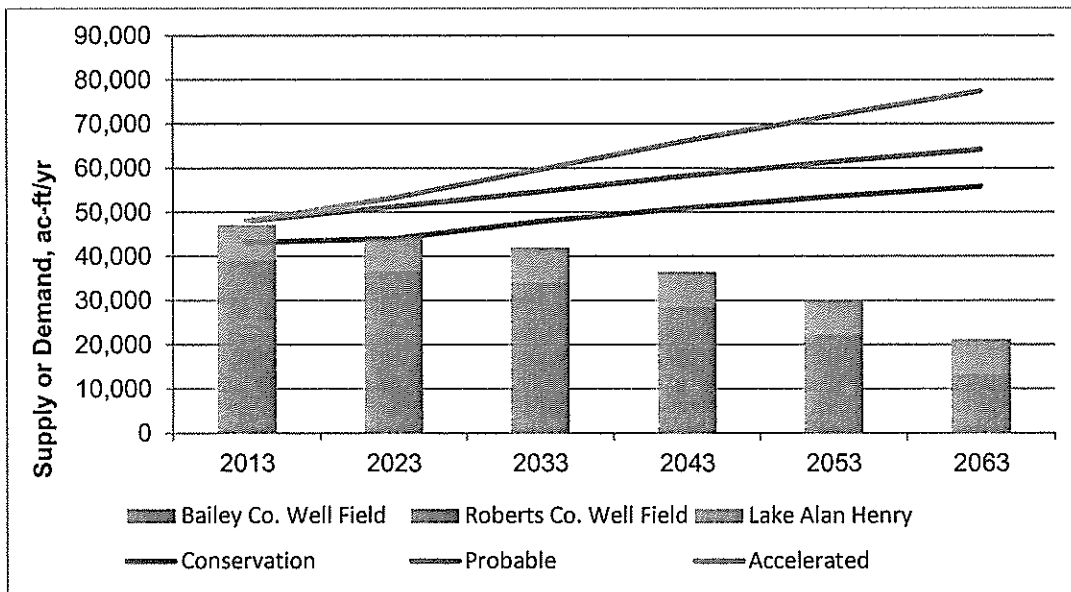
Points will be awarded based on the presence of watershed-based water resource management problems and needs for which water reclamation and reuse may provide a solution. Describe in detail the water resource management problems and needs in the area and explain how water reclamation and reuse may address those problems and needs. Additional consideration will be given to proposals that explain how the problems and needs in the area may be impacted by climate change, and/or if the feasibility study will include climate change information in the supply and demand projections used.

The City of Lubbock is located in West Texas in a semi-arid region with an average annual rainfall of about 19 inches per year. Lubbock currently relies on water supply from both surface water and groundwater sources. The City purchases water from the Canadian River Municipal Water Authority (CRMWA), who provides surface water from Lake Meredith (depending on availability) and groundwater from the Roberts County Well Field (Ogallala Aquifer). Lubbock also has its own supply of groundwater from the Bailey County Well Field, also in the Ogallala Aquifer. In addition, in 2012, the City completed construction of a project to pump water from Lake Alan Henry to a new water treatment plant located on the south side of the City. Lubbock also provides treated water to seven wholesale customers, including the City of Shallowater, Town of Ransom Canyon and Buffalo Springs.

Water management challenges in this area are significant. Water levels in the Ogallala, which also is the primary water supply for the surrounding agricultural community, have been declining for many years due to overpumping. During the most recent drought, water levels in Lake Meredith had fallen too low for CRMWA's member cities to continue using water from the reservoir. In addition, surface water rights within the Brazos River basin have been very contentious between users in the upper and lower portions of the basin. Maintaining or expanding existing critical habitat ranges for threatened and endangered species has also been a focus in this area. A portion of the North Fork downstream of Lubbock has been designated as critical habitat for the sharpnose shiner and smalleye shiner, which have recently been listed as protected species under the Endangered Species Act.

The rapid depletion of the Lake Meredith supply in 2010-2011 called attention to the impact that changing climate conditions may have on surface water supplies. While climate change has not explicitly been accounted for in the 2013 Strategic Water Supply Plan or the Regional Water Supply planning process overseen by the TWDB, both plans do account for the inherent uncertainty in the predictability of both supply and demand by identifying alternative water supply strategies that could be pursued if the recommended strategies are not sufficient to meet the changing needs. In addition, the regional water planning groups are required to identify new droughts of record, if such have occurred. This feasibility study will address climate change using a similar approach.

A projection of water supply demands and availability of existing supplies is shown in the figure below, using data from the 2013 Strategic Water Supply Plan. It is clear that there is need for additional supplies to meet future demands.



Development of a potable reuse project would clearly help to address these problems by maximizing the efficiency of the existing water supplies and deferring the need to develop additional groundwater and surface water resources.

Evaluation Criterion 2: Water Reclamation and Reuse Opportunities – 15 points

Points will be awarded based on the extent to which the proposal demonstrates that the Title XVI feasibility study will explore opportunities for water reclamation and reuse in the study area.

Through previous water supply planning activities, the City of Lubbock has identified three potential options for using highly treated wastewater effluent to augment potable water supplies in the future. These options include indirect potable reuse via discharge to surface water; indirect potable reuse via aquifer storage and recovery (ASR) and direct potable reuse. High-level (appraisal-level) evaluations of each option were performed in the 2013 Strategic Water Supply Plan. However, this plan did not perform detailed feasibility evaluations of the options and potential alternatives that might combine elements of each option into a strategy for reclaiming wastewater that provides the greatest overall benefit to the City. Because of the preliminary information that has been developed for each of these options, it is envisioned that the outcome of this feasibility study will be a very detailed conceptual plan and design for a recommended water reuse strategy that the City could begin implementing immediately.

(1) Describe how the feasibility study will investigate potential uses for reclaimed water (e.g., environmental restoration, fish and wildlife, groundwater recharge, municipal, domestic, industrial, agricultural, power generation, and recreation).

The use of reclaimed water for this study is augmentation of potable water supplies through surface water augmentation, groundwater recharge or direct potable reuse. All options will serve municipal, domestic and industrial users through augmentation of the potable water system. In addition, the surface water augmentation option may serve to enhance recreational and environmental uses of the surface water body.

(2) Describe the potential water market available to use any recycled water that might be produced upon completion of a Title XVI project, as well as methods to stimulate recycled water demand and methods to eliminate obstacles to the use of reclaimed water.

Because the focus of the study is on augmentation of potable water supplies, the market for reclaimed water will be determined by the demand for these potable supplies within Lubbock's service area. The projected demands are illustrated in the figure included in the discussion of Criterion 1. However, as mentioned earlier, the biggest challenge in marketing potable reuse is the public perception that the water may not be safe. This issue will be addressed through development of a public outreach plan, as described in Task 10 of the Technical Study Description.

(3) Describe the sources of water that will be investigated for potential reclamation, including impaired surface and ground waters.

The sources of water to be evaluated include treated effluent from the City's Southeast Water Reclamation Plant (SEWRP) and a new Northwest Water Reclamation Plant (NWWRP), scheduled to be in operation by 2018.

The SEWRP currently consists of two operating treatment facilities, Plants 3 and 4. Recent Plant 4 modifications completed in 2012 include a conversion of the conventional activated sludge process with aeration basins to biological nutrient removal (BNR) utilizing an Integrated Fixed-film Activated Sludge (IFAS) process. Effluent from the two plants is filtered through cloth media units and disinfected with an ultraviolet (UV) disinfection system prior to discharge or land application disposal. Currently only the Plant 4 effluent is of high enough quality to discharge to the North Fork Double Mountain Fork of the Brazos River (North Fork). In order for all of the City's effluent to meet stream discharge requirements, Plant 3 will need to be upgraded in a similar manner as Plant 4. The design of Plant 3 improvements is scheduled to begin in 2017. Improvements are estimated to be completed by 2021.

The new NWWRP will be a membrane bioreactor facility using closed loop biological reactors (CLBR) with vertical shaft aerators and membrane filters. Phosphorus removal will be performed through chemical addition and ultraviolet disinfection will be used. The NWWRP will produce high quality water that meets all receiving stream discharge requirements. The initial phase will have an annual average flow of 3 mgd; a second phase will expand to 6 mgd. This plant is scheduled to be operational in 2018.

Evaluation Criterion 3: Description of Potential Alternatives – 15 points

Points will be awarded based on the extent to which the proposal demonstrates that the Title XVI feasibility study will develop descriptions of water supply alternatives, including a proposed Title XVI project and other water supply alternatives.

Three strategies for potable water supply augmentation will be evaluated in this project. These include indirect potable reuse via surface water augmentation, indirect potable reuse via groundwater augmentation and direct potable reuse (DPR). The City has developed preliminary concepts for each strategy in its 2013 Strategic Water Supply Plan. These concepts will be used as a starting point for development of options to be evaluated in this feasibility study. In addition, the City is currently completing a more focused evaluation of aquifer storage and recovery and groundwater IPR that will be complete in spring 2015 and will provide a strong basis for development of the groundwater IPR option(s). Furthermore, the City's participation in the Texas Water Development Board DPR Resource Document project, scheduled to be finalized in March 2015, will directly inform the DPR option(s). Through this effort, the City collected 6 months of water quality data from its SEWRP, including data for all primary and secondary drinking water MCLs and a wide range of trace organic constituents. This data set will be extremely valuable in evaluating potential treatment strategies and defining follow-on piloting and testing needs.

(1) Describe the objectives all alternatives will be designed to meet. What other water supply alternatives will be investigated as part of the Title XVI feasibility study?

The primary objective of this study is to identify a strategy for augmentation of Lubbock's potable water supply with reclaimed water that is first and foremost protective of public health and the environment, and is reliable and sustainable, while minimizing the financial impact to the City. Evaluation of this objective will be determined through the following factors:

- Unit cost of water produced (in \$/acre-foot)
- Compliance with regulatory requirements and other guidelines related to protection of public health and the environment
- Ability of the alternative to defer the need to develop additional water supplies
- Reliability of the supply (e.g. drought-resistance)
- Project risk (e.g. permitting, junior water rights, public acceptance, etc.)
- Environmental impacts, including energy efficiency

A potable reuse option is assumed to be implemented in every water supply strategy alternative included in the 2013 Strategic Water Supply Plan. However, other water supply sources will also be needed to meet the projected growth in demands. The non-reuse strategies that will be evaluated for this study represent two non-reuse strategies identified in the Water Supply Plan that could either be deferred or eliminated if a potable reuse strategy is implemented.

1. Development of Phase 2 of surface water supply from Lake Alan Henry
2. Development of an additional transmission line from the Roberts County Well Field to the CRMWA aqueduct.

(2) Provide a general description of the proposed project that will be the subject of a Title XVI feasibility study.

The reuse options developed in the 2013 Strategic Water Supply Plan will be used as a starting point for development of a recommended potable reuse project. Six specific options were identified and include:

- 1) Surface Water IPR Options:
 - a) Discharge of reclaimed water from the SEWRP to the North Fork; diversion of this flow 2.7 miles downstream at County Road 7300 and pumping the water to the South WTP for treatment.
 - b) Discharge of reclaimed water from the SEWRP to the North Fork; diversion of this flow 67 miles downstream where it will be pumped directly to the Lake Alan Henry Pump Station and treated at the South WTP.
 - c) Extend existing effluent pipeline currently serving the Hancock Land Application Site to a tributary on the South Fork. Reclaimed water will flow into Lake Alan Henry and be diverted at the Lake Alan Henry Pump Station.
- 2) Groundwater IPR Option:
 - a) Reclaimed water will be treated and injected into the Ogallala Aquifer, recovered down gradient and transported to the North WTP for treatment.
- 3) Direct Potable Reuse (DPR) Options
 - a) Reclaimed water from the SEWRP will be treated and blended with other raw water supplies and pumped to the South WTP for further treatment.
 - b) Reclaimed water from the SEWRP will be treated and blended with other raw water supplies and pumped to the North WTP for further treatment.

The 2013 Strategic Water Supply Plan did not evaluate specific options for reusing effluent from the NWWRP. Options for reusing this future source will be considered in this feasibility study.

The detailed elements of the proposed project will be determined during the course of the feasibility study. However, the goal of the study is to define a potable reuse project that will use available reclaimed water from the City's SEWRP and/or NWWRP to augment the City's drinking water supply. As mentioned above, the evaluation will consider the relative benefits and challenges of implementing indirect potable reuse (surface water or groundwater augmentation) and direct potable reuse. The recommended project will be selected based on cost and non-cost factors and may include a combination of indirect and direct potable reuse strategies.

(3) Describe alternative measures or technologies for water reclamation, distribution, and reuse that will be investigated as part of the Title XVI feasibility study.

This evaluation will consider multiple treatment technologies that could be used to meet the water quality performance goals and other project priorities for each alternative.

Both water reclamation plants provide (or will provide) high quality filtered, secondary effluent with nutrient removal as feed water for any subsequent advanced treatment processes. For the DPR and groundwater IPR alternatives, one treatment option will include low pressure membranes followed by RO and ultraviolet radiation/advanced oxidation. This process has been approved by the TCEQ elsewhere in the state for DPR and in other states for groundwater IPR. Alternative advanced treatment processes to be considered include ozonation combined with biological activated contactors, granular activated carbon and nanofiltration. Selection of recommended processes will be evaluated based on ability to achieve water quality goals, unit cost of water produced, impact on the formation of disinfection byproducts, operational and energy requirements and resulting generation of treatment residuals.

With respect to disposal of concentrate from reverse osmosis treatment, previous studies and ongoing research by the Bureau of Reclamation, in addition to studies by the Texas Water Development Board, WaterReuse Research Foundation and others will be used to identify the most feasible strategies for further concentration and/or disposal of the concentrate.

Evaluation Criterion 4: Stretching Water Supplies – 15 points

Points will be awarded based on the extent to which the proposal demonstrates that the Title XVI feasibility study will address activities that will help to secure and stretch water supplies.

(1) Describe the potential for the project to reduce, postpone, or eliminate the development of new or expanded water supplies. Include description of any specific issues that will be investigated or information that will be developed as part of the Title XVI feasibility study.

Based on information from the 2013 Strategic Water Supply Plan, a potable reuse project would provide up to approximately 10,000 acre-feet per year of additional water supply for Lubbock. Implementation of a potable reuse project would allow the City to defer for 20 to 30 years projects that would divert additional water from Lake Alan Henry, develop other surface water supplies or expand the use of groundwater supplies. Deferral of additional surface water and groundwater withdrawals in this region is extremely critical to the sustainability of regional water supplies, as well as the economy. All of Lubbock's groundwater supplies are drawn from the Ogallala Aquifer, which in most areas has experienced significant declines in water levels over the last several decades due to over-pumping and slow recharge rates.

(2) Describe the potential for the project to reduce or eliminate the use of existing diversions from natural watercourses or withdrawals from aquifers. Include description of any specific issues that will be investigated or information that will be developed as part of the Title XVI feasibility study.

If the Title XVI project were implemented, it could result in the immediate reduction of diversions from Lake Alan Henry and/or existing groundwater supplies, particularly during non-drought conditions. As discussed above, the project would ultimately result in deferring the need to develop additional surface water and groundwater supplies. The feasibility study will evaluate the relative cost and non-cost benefits associated with strategies for meeting peak demands and annual water supply requirements that provide the greatest benefit to the City and the region with respect to conserving existing surface water and groundwater supplies.

(3) Describe the potential for the project to reduce the demand on existing Federal water supply facilities. Include description of any specific issues that will be investigated and information that will be developed as part of the Title XVI feasibility study.

Lake Meredith, created through the Canadian River Project, is a Bureau of Reclamation project. As discussed above, due to municipal and industrial demands on the lake and extended drought, the lake became unusable as a water supply in 2011. The proposed project would clearly help to reduce the demand on this supply. In addition, there is a US Army Corps of Engineers reservoir (Lake Whitney) located downstream of Lake Alan Henry in the Brazos River Basin. The proposed project could help to reduce the diversions from Lake Alan Henry and could allow more water to flow downstream to this federal project.

Evaluation Criterion 5: Environment and Water Quality – 15 points

Points will be awarded based on the extent to which the proposal demonstrates that the feasibility study will address the potential for a water reclamation and reuse project to improve surface, groundwater, or effluent discharge quality; restore or enhance habitat for non-listed species; or provide water or critical habitat for federally-listed threatened or endangered species.

(1) Describe the potential for the project to improve the quality of surface or groundwater, including description of any specific issues that will be investigated or information that will be developed as part of the Title XVI feasibility study.

For the potable reuse options that involve discharge to surface water or groundwater injection, the goal would be to treat the water to a level that would, at a minimum, not degrade the existing water quality and would meet all regulatory requirements for discharge or injection. Depending on the particular option, it is likely that the reclaimed water could significantly improve the quality of the receiving surface or groundwater. For example, if full reverse osmosis treatment is used for the groundwater IPR option, the low dissolved solids content of the water injected could serve to reduce the levels in the aquifer over time.

(2) Describe the potential for the project to improve flow conditions in a natural stream channel, including description of any specific issues that will be investigated or information that will be developed as part of the Title XVI feasibility study.

All of the surface water IPR options identified in the 2013 Strategic Water Supply Plan would result in increased flows in segments of the receiving streams and would provide recreational and aquatic life benefits.

(3) Describe the potential for the project to provide water or habitat for federally listed threatened or endangered species, including description of any specific issues that will be investigated or information that will be developed as part of the Title XVI feasibility study.

Three federally listed endangered species have the potential to occur within or migrate across the study area: the whooping crane, the sharpnose shiner, and the smalleye shiner. The proposed project should not impact the whooping crane which is a migrant through the area. In August 2014, the United States Fish and Wildlife Service designated several lengths of the Brazos River in the study area as critical habitat for the endangered shiner species.

If any of the potable reuse options were employed, this could eliminate the need to develop new surface water sources. One such source that has been discussed is construction of the Post Reservoir, which would impound a segment of the North Fork that is designated as critical habitat for the endangered shiner species. Construction of the Post Reservoir could impede migration and base flow conditions in that segment of the Brazos River, thereby potentially adversely impacting the critical habitat of the endangered shiner species. Implementing any of the potable reuse options would be beneficial to the endangered shiner species if the alternative to those options is the construction of the Post Reservoir.

Of the three surface water augmentation options, none should adversely impact threatened and endangered species. The only option that would take place in designated critical habitat for the endangered shiner species is the option where the reclaimed water would be diverted from the North Fork 67 miles downstream from the discharge site, to be pumped into Lake Alan Henry. While occurring in designated critical habitat, this option should not adversely impact shiner species. Conversely, since flows in the river segment would be augmented by the reclaimed water up to the diversion point, there is a potential beneficial impact to the shiner species if this option were employed. The diversion system for this option would be designed to not impact shiner species, or impede their movement in the river.

Evaluation Criterion 6: Legal and Institutional Requirements – 10 Points

Points will be awarded based on the extent to which the proposal demonstrates that the feasibility study will address legal or institutional requirements or barriers to implementing a project, including water rights issues and any unresolved issues associated with implementation of a water reclamation and reuse project.

Several legal and institutional issues will need to be addressed as part of this study.

Surface Water Rights: For the surface water IPR options, the City must have a water right permit to divert the reclaimed water downstream. The City currently has a water right (Water Use Permit 3985) that allows them to divert up to 10,089 ac-ft/yr at the County Road 7300 location. The City is currently pursuing amendment to this and other water rights to secure unfettered rights to all effluent generated by the City. Amended or new water rights permits would be needed to implement other surface water IPR options.

Groundwater Rights: For the groundwater IPR option, the City will need to acquire permits from the High Plains Underground Water Conservation District No. 1. In addition, this district will need to promulgate rules regarding ASR and groundwater injection. There may also be permitting obligations pursuant to Texas Water Code Section 11.154 depending upon regulatory characterization of the associated return flows.

Discharge Permits: Compliance with TPDES discharge permitting requirements must be maintained. If changes to quantity or location of the discharge or treatment processes is included as part of the recommended project, amended permits will be required.

Water Quality Requirements: Texas does not have any specific regulations that address potable reuse. Currently, potable reuse projects are addressed on a case-by-case basis at the TCEQ. The City would need to meet with the TCEQ to discuss the water quality goals and proposed treatment to ensure that the project could be supported and permitted by the TCEQ.

Concentrate Disposal: For options that require disposal of concentrate, disposal of these residuals will likely require some form of permitting, depending on the disposal option selected. Surface discharge, injection wells and evaporation ponds will all require permits from the TCEQ.

Other Regulatory Issues: Project alternatives will also consider permitting issues related to construction, such as Section 404 permitting, as well as property and easement acquisition requirements

Evaluation Criterion 7: Renewable Energy and Energy Efficiency – 10 points

Points will be awarded based on the extent to which the proposal demonstrates that the Title XVI feasibility study will address methods to incorporate the use of renewable energy or will otherwise address energy efficiency aspects of the water reclamation and reuse project being investigated.

As discussed in Task 6 of the Technical Study Description, a detailed evaluation of energy efficiency (e.g. comparison of advanced treatment processes such as reverse osmosis to less energy-intensive treatment processes) and the incorporation of renewable energy elements will be carried out as part of the project. Renewable elements that will be considered include the use of solar panels to power instrumentation, incorporation of wind energy or use of micro hydroelectric energy generation. In addition to the evaluation described in Task 6, if the project were implemented, there could be energy savings that result from deferring the need to deliver water from supplies further away from the City, such as Lake Alan Henry, the CRMWA supplies or the Bailey County Well Field. The study will also address these potential energy benefits.

Evaluation Criterion 8: Watershed Perspective – 10 points

Points will be awarded based on the extent to which the proposal demonstrates that the Title XVI feasibility study will address alternatives that promote and apply a regional or watershed perspective to water resource management.

Lubbock is located in the Llano Estacado Regional Water Planning Area, which includes 21 counties and is located in the upstream portion of four major river basins (Canadian, Red, Brazos and Colorado). The Ogallala Formation is the principal aquifer in the region and serves as all or part of the water source for the majority of water users. Lubbock is the largest City in the region and is one of four wholesale water providers. Because implementation of a potable reuse project would defer the need to use other surface water and groundwater resources, it would benefit not only the City itself, but wholesale customers of the City and other water users in the region that share these supplies. As the largest City in the region, Lubbock is leading by example to use its existing resources as efficiently as possible and seeks to influence others in the region to do the same.

2 Required Permits and Approvals

No permits or approvals are required to perform the feasibility study.

3 Funding Plan

Non-federal funds will be provided by the City of Lubbock. The cash portion of the contribution will be supplied from Capital Improvement Program funds.

Table 1: Summary of Non-Federal and Federal Funding Sources

Funding Sources	Funding Amount
Non-Federal Entities	
1.City of Lubbock	\$ 229,342
2.	
3.	
Non-Federal Subtotal:	\$ 229,342
Other Federal Entities	
1.	
2.	
3.	
Other Federal Subtotal:	
Requested Reclamation Funding	\$ 150,000
Total Project Funding	\$ 379,342

4 Letters of Commitment

Not Applicable.

5 Official Resolution

Will be forwarded within 30 days of application submittal.

Table 3: Funding Sources Summary

Funding Sources	Total Cost by Source	% of Total Study Cost
Recipient Funding	\$229,342	60%
Reclamation Funding	\$150,000	40%
Other Federal Funding	\$0	0%
Totals	\$379,342	100%