DRAFT FEASIBILITY REPORT
FEASIBILITY ANALYSIS OF WATER SUPPLY FOR SMALL PUBLIC WATER SYSTEMS

WHITEFACE ISD
PWS ID# 0400020

Prepared for:

THE TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Prepared by:

THE UNIVERSITY OF TEXAS BUREAU OF ECONOMIC GEOLOGY

AND

PARSONS

Preparation of this report was financed by the Texas Commission on Environmental Quality through the Drinking Water State Revolving Fund Small Systems Assistance Program

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AUGUST 2010

EXECUTIVE SUMMARY

INTRODUCTION

The University of Texas Bureau of Economic Geology (BEG) and its subcontractor, Parsons Transportation Group Inc. (Parsons), was contracted by the Texas Commission on Environmental Quality (TCEQ) to conduct a project to assist with identifying and analyzing alternatives for use by Public Water Systems (PWS) to meet and maintain Texas drinking water standards.

The overall goal of this project was to promote compliance using sound engineering and financial methods and data for PWSs with recently recorded sample results exceeding maximum contaminant levels (MCL). The primary objectives of this project were to provide feasibility studies for PWSs and the TCEQ Water Supply Division, which evaluates water supply compliance options, and to suggest a list of compliance alternatives that may be further investigated by the subject PWS for future implementation.

This feasibility report provides an evaluation of water supply alternatives for the Whiteface Consolidated Independent School District (ISD) PWS (PWS ID# 0400020, located approximately 36 miles west of Lubbock, Texas. Whiteface ISD is located in the City of Whiteface on State Highway 114 and Farm-to-Market Road 1780 in eastern Cochran County, Texas. Whiteface ISD is a non-community water system that serves approximately 410 students and faculty during the school year from August through May. The water source for the Whiteface ISD PWS comes from one groundwater well completed in the Ogallala aquifer, Well #1 (G0400020A), to a depth of 214 feet. The well is rated at 200 gallons per minute (gpm). The PWS has a second well of unknown capacity, Well #2 (G0400020B), which is used for emergency purposes only.

Whiteface ISD PWS recorded arsenic concentrations of 0.0066 milligrams per liter (mg/L) to 0.0194 mg/L and selenium concentrations of 0.0356 mg/L to 0.0823 mg/L between October 2001 and May 2009, which exceeds the maximum contaminant level (MCL) of 0.010 mg/L and 0.050 mg/L, respectively (USEPA 2010a; TCEQ 2008a). Fluoride and total dissolved solids (TDS) were also detected in concentrations of 2.52 to 3.12 mg/L and 905 mg/L to 1,070 mg/L, respectively, between October 2001 and May 2008, exceeding the secondary MCL of 2 mg/L and 500 mg/L, respectively (USEPA 2010a; TCEQ 2008b). The latest laboratory analysis for arsenic indicates Whiteface ISD is now in compliance; however, the contaminant has fluctuated above and below the regulatory limits, and arsenic compliance may still be an issue. Therefore, this report is written to address an arsenic violation should future analysis cause the ISD to be non-compliant.

Basic system information for the Whiteface ISD PWS is shown in Table ES.1.

Table ES.1 Whiteface ISD PWS
Basic System Information

Population served	410
Connections	1
Average daily flow rate	0.0011 million gallons per day (mgd)
Peak demand flow rate	3.05 gallons per minute
Water system peak capacity	0.011 mgd
Typical arsenic range	0.0066 to 0.0194 mg/L
Typical selenium range	35.6 to 82.3 mg/L

STUDY METHODS

The methods used for this project were based on a pilot project performed in 2004 and 2005 by TCEQ, BEG, and Parsons. Methods for identifying and analyzing compliance options were developed in the pilot project (a decision tree approach).

The process for developing the feasibility study used the following general steps:

1. Gather data from the TCEQ and Texas Water Development Board databases, from TCEQ files, and from information maintained by the PWS;
2. Conduct financial, managerial, and technical (FMT) evaluations of the PWS;
3. Perform a geologic and hydrogeologic assessment of the study area;
4. Develop treatment and non-treatment compliance alternatives which, in general, consist of the following possible options:
   a. Connecting to neighboring PWSs via new pipeline or by pumping water from a newly installed well or an available surface water supply within the jurisdiction of the neighboring PWS;
   b. Installing new wells within the vicinity of the PWS into other aquifers with confirmed water quality standards meeting the MCLs;
   c. Installing a new intake system within the vicinity of the PWS to obtain water from a surface water supply with confirmed water quality standards meeting the MCLs;
   d. Treating the existing non-compliant water supply by various methods depending on the type of contaminant; and
   e. Delivering potable water by way of a bottled water program or a treated water dispenser as an interim measure only.

5. Assess each of the potential alternatives with respect to economic and non-economic criteria;
6. Prepare a feasibility report and present the results to the PWS.

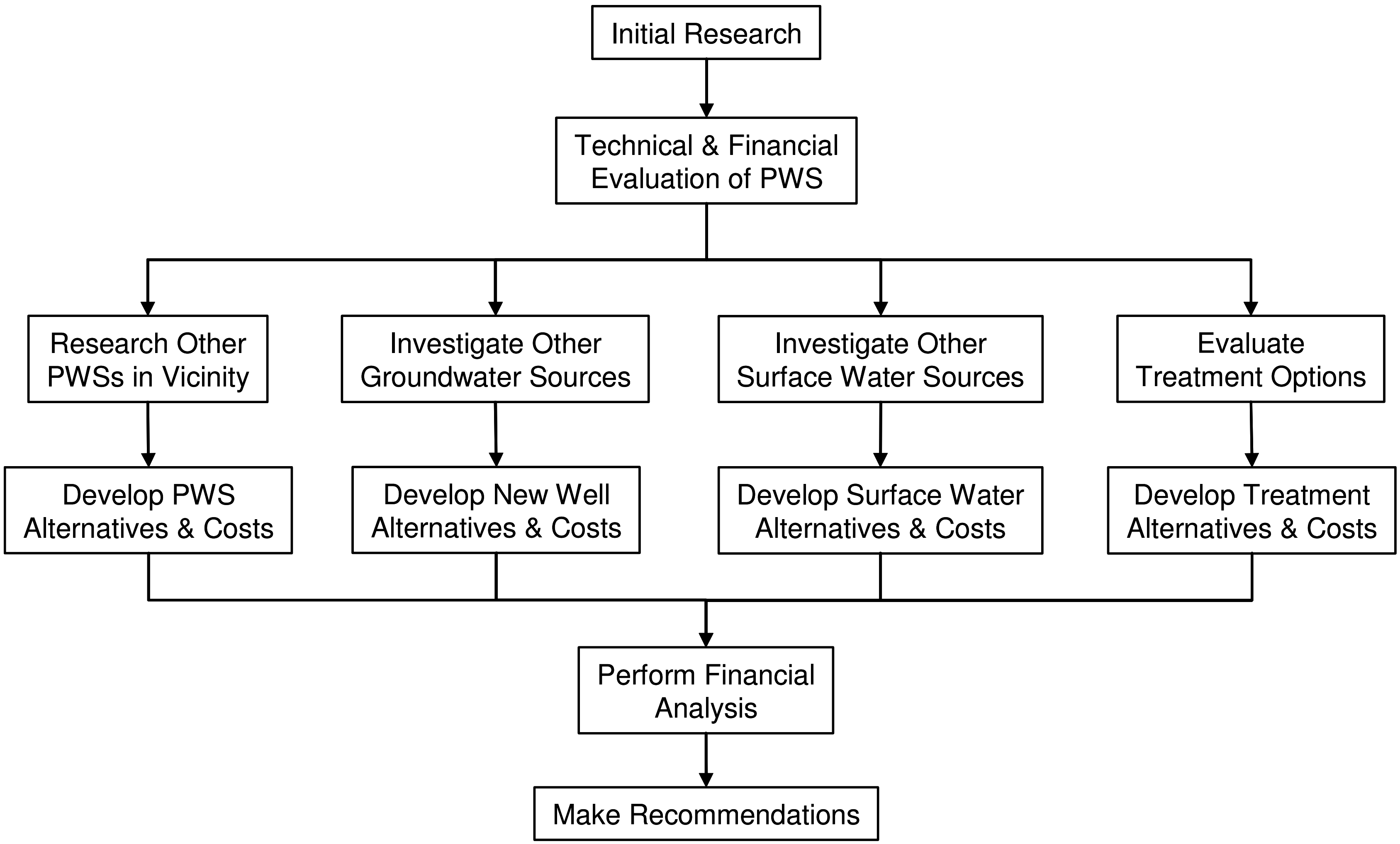
This basic approach is summarized in Figure ES-1.

HYDROGEOLOGICAL ANALYSIS

The Whiteface ISD PWS obtains groundwater from the Ogallala North Texas Aquifer. Arsenic, selenium, fluoride, and TDS are commonly found in area wells at concentrations greater than the MCL. Arsenic concentrations can vary significantly over relatively short distances; as a result, there could be good quality groundwater nearby. Additionally, systems with more than one well should characterize the water quality of each well. If one of the wells is found to produce compliant water, as much production as possible should be shifted to that well as a method of achieving compliance. It may also be possible to do down-hole testing on non-compliant wells to determine the source of the contaminants. If the contaminants derive primarily from a single part of the formation, that part could be excluded by modifying the existing well, or avoided altogether by completing a new well.

Regional analyses show that concentrations of arsenic and fluoride tend to decrease with well depth. Therefore, deepening or casing off shallow portions of existing Whiteface ISD PWS wells might help to improve water quality, provided the aquifer is thick enough.

Figure ES.1 Summary of Project Methods



COMPLIANCE ALTERNATIVES

Overall, the system has a good level of FMT capacity. The system has many positive aspects, including dedicated staff and longevity, an interconnection with the Whiteface community water system for emergency water supply, and recent compliance with the arsenic standard; however, the system had some areas that needed improvement to be able to address future compliance issues, including district school funding limitations.

There are several PWSs within 35 miles of Whiteface ISD. Many of these nearby systems also have water quality problems, but the Canadian River Municipal Water Authority (CRMWA) provides good quality water in the area. In general, feasibility alternatives were developed based on obtaining water from the nearest PWSs, either by directly purchasing water, or by expanding the existing well field. There is a minimum of surface water available in the area, and obtaining a new surface water source is considered through an alternative where treated surface water is obtained through the City of Levelland. In addition to the City of Levelland, the Lubbock Public Water System is a potential large regional water supplier.

The Whiteface ISD is currently using point-of-use (POU) units in their cafeteria and at all their drinking water fountains; therefore, centralized treatment alternatives, including POU and point-of-entry were not further evaluated as alternatives in this report.

Developing a new well close to Whiteface ISD is likely to be the best solution if compliant groundwater can be found. Having a new well close to Whiteface ISD is likely to be one of the lower cost alternatives since the PWS already possesses the technical and managerial expertise needed to implement this option. The cost of new well alternatives quickly increases with pipeline length, making proximity of the alternate source a key concern. A new compliant well or obtaining water from a neighboring compliant PWS has the advantage of providing compliant water to all taps in the system.

FINANCIAL ANALYSIS

A financial analysis of the various alternatives for the Riviera ISD PWS was performed using estimated system revenues and expenses. Table ES.2 provides a summary of the financial impact of implementing selected compliance alternatives, including the rate increase necessary to meet current operating expenses. The alternatives were selected to highlight results for the best alternatives from each different type or category.

Some of the compliance alternatives offer potential for shared or regional solutions. A group of PWSs could work together to implement alternatives for developing a new groundwater source or expanding an existing source, obtaining compliant water from a large regional provider, or for central treatment. Sharing the cost for implementation of these alternatives could reduce the cost on a per user basis. Additionally, merging PWSs or management of several PWSs by a single entity offers the potential for reduction in administrative costs.

Table ES.2 Selected Financial Analysis Results

Alternative	Funding Option	Annual Water Cost per Student
Current	NA	$12
To meet current expenses	NA	$12
Purchase water from the City of Whiteface	100% Grant	$45
	Loan/Bond	$71

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ACRONYMS AND ABBREVIATIONS

µg/L	Micrograms per liter
°F	Degrees Fahrenheit
AFY	Acre feet per year
ANSI	American National Standards Institute
BAT	Best available technology
BEG	Bureau of Economic Geology
bgs	Below ground surface
CA	Chemical analysis
CD	Community Development
CDBG	Community Development Block Grants
CCN	Certificate of Convenience and Necessity
CFR	Code of Federal Regulations
CR	County Road
CRMWD	Colorado River Municipal Water District
DWSRF	Drinking Water State Revolving Fund
FMT	Financial, managerial, and technical
GAM	Groundwater Availability Model
gpd	gallons per day
gpm	Gallons per minute
gpy	Gallons per year
ISD	Independent School District
MCL	Maximum contaminant level
mgd	Million gallons per day
mg/L	milligram per liter
MHI	Median household income
MOR	Monthly operating report
NMEFC	New Mexico Environmental Financial Center
NPDWR	National Primary Drinking Water Regulations
O&M	Operation and Maintenance
Parsons	Parsons Transportation Group, Inc.
POE	Point-of-entry
POU	Point-of-use
PRV	Pressure-reducing valve
PVC	Polyvinyl chloride
PWS	Public water system
RO	Reverse osmosis
RUS	Rural Utilities Service

SDWA	Safe Drinking Water Act
SRF	State Revolving Fund
SSCT	Small System Compliance Technology
TAC	Texas Administrative Code
TCEQ	Texas Commission on Environmental Quality
TDRA	Texas Department of Rural Affairs
TDS	Total dissolved solids
TSS	Total suspended solids
TWDB	Texas Water Development Board
USEPA	United States Environmental Protection Agency
WAM	Water Availability Model
WRT	Water Treatment Technologies, Inc.

SECTION 1
INTRODUCTION

The University of Texas Bureau of Economic Geology (BEG) and its subcontractor, Parsons Transportation Group Inc. (Parsons), were contracted by the Texas Commission on Environmental Quality (TCEQ) to assist with identifying and analyzing compliance alternatives for use by Public Water Systems (PWS) to meet and maintain Texas drinking water standards.

The overall goal of this project is to promote compliance using sound engineering and financial methods and data for PWSs that have recently had sample results that exceed maximum contaminant levels (MCL). The primary objectives of this project are to provide feasibility studies for PWSs and the TCEQ Water Supply Division that evaluate water supply compliance options, and to suggest a list of compliance alternatives that may be further investigated by the subject PWS with regard to future implementation. The feasibility studies identify a range of potential compliance alternatives, and present basic data that can be used for evaluating feasibility. The compliance alternatives addressed include a description of what would be required for implementation, conceptual cost estimates for implementation, and non-cost factors that could be used to differentiate between alternatives. The cost estimates are intended for comparing compliance alternatives, and to give a preliminary indication of potential impacts on water rates resulting from implementation.

It is anticipated the PWS will review the compliance alternatives in this report to determine if there are promising alternatives, and then select the most attractive alternative(s) for more detailed evaluation and possible subsequent implementation. This report contains a decision tree approach that guided the efforts for this project, and also contains steps to guide a PWS through the subsequent evaluation, selection, and implementation of a compliance alternative.

This feasibility report provides an evaluation of water supply compliance options for the Whiteface Consolidated Independent School District (ISD), PWS ID# 0400020, located in Cochran County, hereinafter referred to in this document as the "Whiteface ISD PWS." Recent sample results from the Whiteface ISD water system exceeded the MCLs for arsenic and selenium (USEPA 2010*a*; TCEQ 2008a). Sample results also exceeded the secondary standards for fluoride and total dissolved solids (TDS) (USEPA 2010a; TCEQ 2008b). The location of the Whiteface ISD PWS is shown on Figure 1.1. Various water supply and planning jurisdictions are shown on Figure 1.2. These water supply and planning jurisdictions are used in the evaluation of alternate water supplies that may be available in the area.

1.1 PUBLIC HEALTH AND COMPLIANCE WITH MCLs

The goal of this project is to promote compliance for PWSs that supply drinking water exceeding regulatory maximum contaminant levels (MCL). This project only addresses those contaminants and does not address any other violations that may exist for a PWS. As mentioned above, the Whiteface ISD water system had recent sample results exceeding the MCL for arsenic and selenium and the secondary MCLs for fluoride and TDS. In general, contaminant(s) in drinking water above the MCL(s) can have both short-term (acute) and long-term or lifetime (chronic) effects. Health concerns related to drinking water above MCLs for these chemicals are briefly described below.

Potential health effects from long-term ingestion of water with levels of arsenic above the MCL (0.010 mg/L) include non-cancerous effects, such as thickening and discoloration of the skin, stomach pain, nausea, vomiting, diarrhea, numbness in hands and feet, partial paralysis, blindness, and cancerous effects, including skin, bladder, lung, kidney, nasal passage, liver and prostate cancer (USEPA 2010b).

Potential short-term health effects from the ingestion of water with levels of selenium above the MCL (0.050 mg/L) include hair and fingernail changes, damage to the peripheral nervous, fatigue and irritability. Long-term exposure of selenium has the potential to cause the following effects from a lifetime exposure at levels above the MCL; hair or fingernail loss; damage to kidney and liver tissue, and the nervous and circulatory systems (USEPA 2010c).

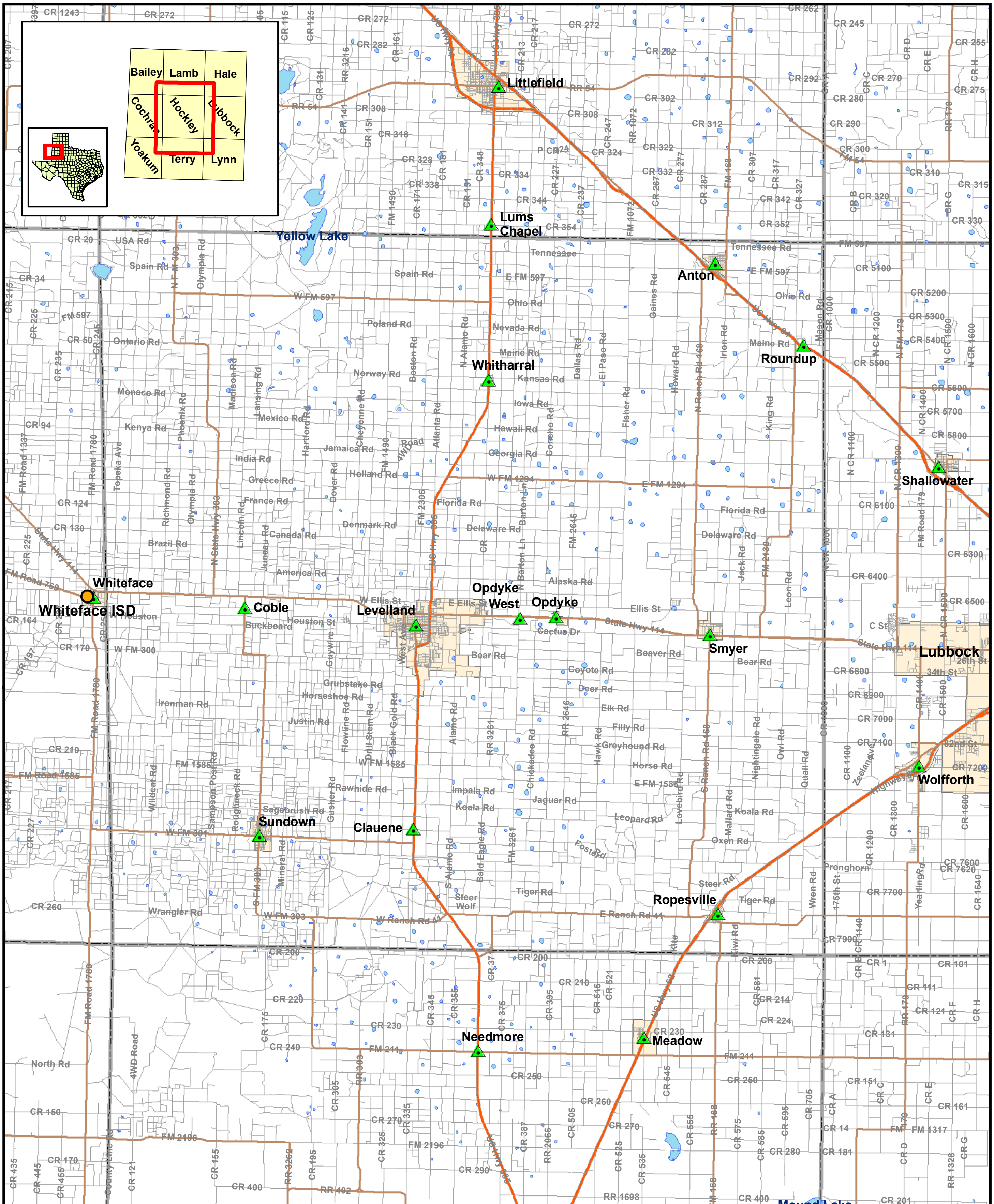
Potential health effects from the ingestion of water with levels of fluoride above the MCL (4 mg/L) over many years include bone disease, including pain and tenderness of the bones. Additionally, the U.S. Environmental Protection Agency (USEPA) has set a secondary fluoride standard of 2 mg/L to protect against dental fluorosis, which in its moderate or severe forms may result in a brown staining and/or pitting of the permanent teeth in children under nine years of age (USEPA 2010c).

1.2 METHOD

The method for this project follows that of a pilot project performed by TCEQ, BEG, and Parsons. The pilot project evaluated water supply alternatives for PWSs that supplied drinking water with contaminant concentrations above U.S. Environmental Protection Agency (USEPA) and Texas drinking water standards. Three PWSs were evaluated in the pilot project to develop the method (*i.e.*, decision tree approach) for analyzing options for provision of compliant drinking water. This project is performed using the decision tree approach that was developed for the pilot project, and which was also used for subsequent projects.

Other tasks of the feasibility study are as follows:

- Identifying available data sources;
- Gathering and compiling data;
- Conducting financial, managerial, and technical (FMT) evaluations of the selected PWSs;
- Performing a geologic and hydrogeologic assessment of the area;
- Developing treatment and non-treatment compliance alternatives;
- Assessing potential alternatives with respect to economic and non-economic criteria;
- Preparing a feasibility report; and
- Suggesting refinements to the approach for future studies.



Legend

- Study System
- Cities
- City Limits
- Counties
- Interstate
- Highway
- Major Road
- Minor Road

N

Miles
0 1.5 3

Figure 1.1

WHITEFACE ISD

Location Map

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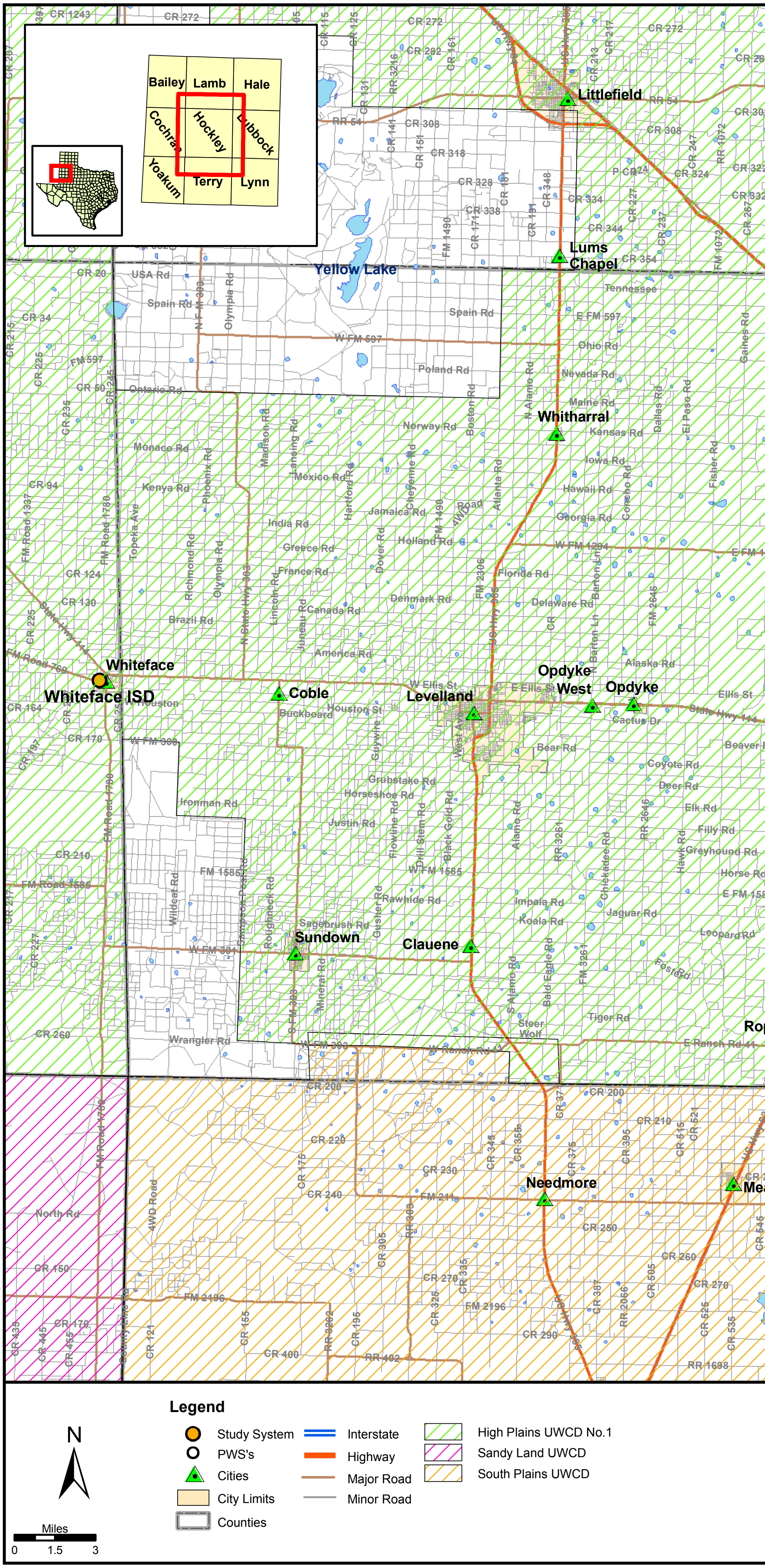

Figure 1.2

WHITEFACE ISD

Groundwater Conservation Districts

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The remainder of Section 1 of this report addresses the regulatory background, and provides a summary of radium abatement options. Section 2 describes the method used to develop and assess compliance alternatives. The groundwater sources of arsenic, selenium, and fluoride are addressed in Section 3. Findings for the Whiteface ISD PWS, along with compliance alternatives development and evaluation, can be found in Section 4. Section 5 references the sources used in this report.

1.3 REGULATORY PERSPECTIVE

The Utilities & Districts and Public Drinking Water Sections of the TCEQ Water Supply Division are responsible for implementing requirements of the Federal Safe Drinking Water Act (SDWA) which include oversight of PWSs and water utilities. These responsibilities include:

- Monitoring public drinking water quality;
- Processing enforcement referrals for MCL violators;
- Tracking and analyzing compliance options for MCL violators;
- Providing FMT assessment and assistance to PWSs;
- Participating in the Drinking Water State Revolving Fund program to assist PWSs in achieving regulatory compliance; and
- Setting rates for privately owned water utilities.

This project was conducted to assist in achieving these responsibilities.

1.4 ABATEMENT OPTIONS

When a PWS exceeds a regulatory MCL, the PWS must take action to correct the violation. Potential MCL exceedances at the Whiteface ISD PWS involve arsenic, selenium, and fluoride. The following subsections explore alternatives considered as potential options for obtaining/providing compliant drinking water.

1.4.1 Existing Public Water Supply Systems

A common approach to achieving compliance is for the PWS to make arrangements with a neighboring PWS for water supply. For this arrangement to work, the PWS from which water is being purchased (supplier PWS) must have water in sufficient quantity and quality, the political will must exist, and it must be economically feasible.

1.4.1.1 Quantity

For purposes of this report, quantity refers to water volume, flow rate, and pressure. Before approaching a PWS as a potential supplier, the non-compliant PWS should determine its water demand on the basis of average day and maximum day. Peak instantaneous demands can be met through proper sizing of storage facilities. Further, the potential for obtaining the appropriate quantity of water to blend to achieve compliance should be considered. The concept of blending involves combining water with low levels of contaminants with non-compliant water in sufficient quantity that the resulting blended water is compliant. The exact blend ratio would depend on the quality of the water a potential supplier PWS can provide, and would likely vary over time. If high quality water is purchased, produced or otherwise obtained, blending can reduce the amount of high quality water required. Implementation of blending will require a control system to ensure the blended water is compliant.

If the supplier PWS does not have sufficient quantity, the non-compliant community could pay for the facilities necessary to increase the quantity to the extent necessary to supply the needs of the non-compliant PWS. Potential improvements might include, but are not limited to:

- Additional wells;
- Developing a new surface water supply,
- Additional or larger-diameter piping;
- Increasing water treatment plant capacity
- Additional storage tank volume;
- Reduction of system losses,
- Higher-pressure pumps; or
- Upsized, or additional, disinfection equipment.

In addition to the necessary improvements, a transmission pipeline would need to be constructed to tie the two PWSs together. The pipeline must tie-in at a point in the supplier PWS where all the upstream pipes and appurtenances are of sufficient capacity to handle the new demand. In the non-compliant PWS, the pipeline must tie in at a point where no downstream bottlenecks are present. If blending is the selected method of operation, the tie-in point must be selected to ensure all the water in the system is blended to achieve regulatory compliance.

1.4.1.2 Quality

If a potential supplier PWS obtains its water from the same aquifer (or same portion of the aquifer) as the non-compliant PWS, the quality of water may not be significantly better. However, water quality can vary significantly due to well location, even within the same aquifer. If localized areas with good water quality cannot be identified, the non-compliant PWS would need to find a potential supplier PWS that obtains its water from a different aquifer or from a surface water source. Additionally, a potential supplier PWS may treat non-compliant raw water to an acceptable level.

Surface water sources may offer a potential higher-quality source. Since there are significant treatment requirements, utilization of surface water for drinking water is typically most feasible for larger local or regional authorities or other entities that may provide water to several PWSs. Where PWSs that obtain surface water are neighbors, the non-compliant PWS may need to deal with those systems as well as with the water authorities that supply the surface water.

1.4.2 Potential for New Groundwater Sources

1.4.2.1 Existing Non-Public Supply Wells

Often there are wells not associated with PWSs located in the vicinity of the non-compliant PWS. The current use of these wells may be for irrigation, industrial purposes, domestic supply, stock watering, and other purposes. The process for investigating existing wells as a viable alternative source is as follows:

- Existing data sources (see below) will be used to identify wells in the areas that have satisfactory quality. For the Whiteface ISD PWS, the following standards could be used in a rough screening to identify compliant groundwater in surrounding systems:
  - Nitrate (measured as nitrogen) concentrations less than 8 milligrams per liter (mg/L) (below the MCL of 10 mg/L);
  - Fluoride concentration less than 2.0 mg/L (below the Secondary MCL of 2 mg/L);
  - Arsenic concentration less than 0.008 mg/L (below the MCL of 0.01 mg/L);
  - Uranium concentration less than 0.024 mg/L (below the MCL of 0.030 mg/L; and
  - Selenium concentration less than 0.04 mg/L (below the MCL of 0.05 mg/L).
- The recorded well information will be reviewed to eliminate those wells that appear to be unsuitable for the application. Often, the "Remarks" column in the Texas Water Development Board (TWDB) hard-copy database provides helpful information. Wells eliminated from consideration generally include domestic and stock wells, dug wells, test holes, observation wells, seeps, and springs, destroyed wells, wells used by other communities, etc.
- Wells of sufficient size are identified. Some may be used for industrial or irrigation purposes. Often the TWDB database will include well yields, which may indicate the likelihood that a particular well is a satisfactory source.
- At this point in the process, the local groundwater control district (if one exists) should be contacted to obtain information about pumping restrictions. Also, preliminary cost estimates should be made to establish the feasibility of pursuing further well development options.
- If particular wells appear to be acceptable, the owner(s) should be contacted to ascertain their willingness to work with the PWS. Once the owner agrees to participate in the program, additional data should be collected to characterize the quality and quantity of the well water. Many owners have more than one well, and

would probably be the best source of information regarding the latest test dates, who tested the water, flow rates, and other well characteristics.

- After collecting as much information as possible from cooperative owners, the non-compliant PWS would then narrow the selection of wells and sample and analyze them for quality. Wells with good quality water would then be potential candidates for test pumping. In some cases, a particular well may need to be refurbished before test pumping. Information obtained from test pumping would then be used in combination with information about the general characteristics of the aquifer to determine whether a well at that location would be suitable as a supply source.
- Where financial resources allow, it is recommended that new wells be installed instead of using existing wells to ensure the well characteristics are known and the well meets current construction standards.
- Permit(s) would then be obtained from the groundwater control district or other regulatory authority, and an agreement with the owner (purchase or lease, access easements, etc.) would then be negotiated.

1.4.2.2 Develop New Wells

If no existing wells are available for development, the PWS or group of PWSs has an option of developing new wells. Records of existing wells, along with other hydrogeologic information and modern geophysical techniques, should be used to identify potential locations for new wells. In some areas, the TWDB's Groundwater Availability Model (GAM) may be applied to indicate potential sources. Once a general area is identified, landowners and regulatory agencies should be contacted to determine an exact location for a new well or well field. Pump tests and water quality tests would be required to determine if a new well will produce an adequate quantity of good quality water. Permits from the local groundwater control district or other regulatory authority could also be required for a new well.

1.4.3 Potential for Surface Water Sources

Water rights law dominates the acquisition of water from surface water sources. For a PWS, 100 percent availability of water is required, except where a back-up source is available. For PWSs with an existing water source, although it may be non-compliant because of elevated concentrations of one or more parameters, water rights may not need to be 100 percent available.

1.4.3.1 Existing Surface Water Sources

"Existing surface water sources" of water refers to municipal water authorities and cities that obtain water from surface water sources. The process of obtaining water from such a source is generally less time consuming and less costly than the process of developing a new source; therefore, it should be a primary course of investigation. An existing source would be limited by its water rights, the safe yield of a reservoir or river, or by its water treatment or water conveyance capability. The source must be able to meet the current demand and honor contracts with communities it currently supplies. In many cases, the contract amounts reflect projected future water demand based on population or industrial growth.

A non-compliant PWS would look for a source with sufficient spare capacity. Where no such capacity exists, the non-compliant PWS could offer to fund the improvements necessary to obtain the capacity. This approach would work only where the safe yield could be increased (perhaps by enlarging a reservoir) or where treatment capacity could be increased. In some instances water rights, where they are available, could possibly be purchased.

In addition to securing the water supply from an existing source, the non-compliant PWS would need to arrange for transmission of the water to the PWS. In some cases, that could require negotiations with, contracts with, and payments to an intermediate PWS (an intermediate PWS is one where the infrastructure is used to transmit water from a "supplier" PWS to a "supplied" PWS, but does not provide any additional treatment to the supplied water). The non-compliant PWS could be faced with having to fund improvements to the intermediate PWS in addition to constructing its own necessary transmission facilities.

1.4.3.2 New Surface Water Sources

Communication with the TCEQ and relevant planning groups from the beginning is essential in the process of obtaining a new surface water source. Preliminary assessment of the potential for acquiring new rights may be based on surface water availability maps located on the TWDB website. Where water rights appear to be available, the following activities need to occur:

- Discussions with TCEQ to indicate the likelihood of obtaining those rights. The TCEQ may use the Water Availability Model (WAM) to assist in the determination.
- Discussions with landowners to indicate potential treatment plant locations.
- Coordination with U.S. Army Corps of Engineers and local river authorities.
- Preliminary engineering design to determine the feasibility, costs, and environmental issues of a new treatment plant.

Should these discussions indicate that the best option is a new surface water source, the community would proceed with more intensive planning (initially obtaining funding), permitting, land acquisition, and detailed designs.

1.4.6 Point-of-Entry and Point-of-Use Treatment Systems

Point-of-entry (POE) and Point-of-use (POU) treatment devices or systems rely on many of the same treatment technologies used in central treatment plants. However, while central treatment plants treat all water distributed to consumers to the same level, POU and POE treatment devices are designed to treat only a portion of the total flow. POU devices treat only the water intended for direct consumption, typically at a single tap or limited number of taps, while POE treatment devices are typically installed to treat all water entering a single home, business, school, or facility. POU and POE treatment systems may be an option for PWSs where central treatment is not affordable. Updated USEPA guidance on use of POU and POE treatment devices is provided in "*Point-of-Use or Point-of-Entry Treatment Options for Small Drinking Water Systems,"* EPA 815-R-06-010, April 2006 (USEPA 2006).

Point-of-entry treatment systems can be used to provide compliant drinking water. These systems typically use small adsorption or reverse osmosis treatment units installed "under the sink" in the case of POU, and where water enters a house or building in the case of POE. It should be noted that POU treatment units would need to be more complex than units typically found in commercial retail outlets to meet regulatory requirements, making purchase and installation more expensive. Point-of-entry and POU treatment units would be purchased and owned by the PWS. These solutions are decentralized in nature, and require utility personnel entry into houses or at least onto private property for installation, maintenance, and testing. Due to the large number of treatment units that would be employed and would be largely out of the control of the PWS, it is very difficult to ensure 100 percent compliance. Prior to selection of a POE or POU program for implementation, consultation with TCEQ would be required to address measurement and determination of level of compliance.

The National Primary Drinking Water Regulations (NPDWR), 40 CFR Section 141.100, covers criteria and procedures for PWSs using POE devices and sets limits on the use of these devices. According to the regulations (July 2005 Edition), the PWS must develop and obtain TCEQ approval for a monitoring plan before POE devices are installed for compliance with an MCL. Under the plan, POE devices must provide health protection equivalent to central water treatment meaning the water must meet all NPDWR and would be of acceptable quality similar to water distributed by a well-operated central treatment plant. In addition, monitoring must include physical measurements and observations such as total flow treated and mechanical condition of the treatment equipment. The system would have to track the POE flow for a given time period, such as monthly, and maintain records of device inspection. The monitoring plan should include frequency of monitoring for the contaminant of concern and number of units to be monitored. For instance, the system may propose to monitor every POE device during the first year for the contaminant of concern and then monitor one-third of the units annually, each on a rotating schedule, so each unit would be monitored every three years. To satisfy the requirement that POE devices must provide health protection, the water system may be required to conduct a pilot study to verify the POE device can provide treatment equivalent to central treatment. Every building connected to the system must have a POE device installed, maintained, and properly monitored. Additionally, TCEQ must be assured that every building is subject to treatment and monitoring, and that the rights and responsibilities of the PWS customer convey with title upon sale of property.

Effective technology for POE devices must be properly applied under the monitoring plan approved by TCEQ and the microbiological safety of the water must be maintained. TCEQ requires adequate certification of performance, field-testing, and, if not included in the certification process, a rigorous engineering design review of the POE devices. The design and application of the POE devices must consider the tendency for increase in heterotrophic bacteria concentrations in water treated with activated carbon. It may be necessary to use frequent backwashing, post-contactor disinfection, and Heterotrophic Plate Count monitoring to ensure that the microbiological safety of the water is not compromised.

The SDWA [§1412(b)(4)(E)(ii)] regulates the design, management and operation of POU and POE treatment units used to achieve compliance with an MCL. The requirements associated with these regulations, relevant to MCL compliance are:

- POU and POE treatment units must be owned, controlled, and maintained by the water system, although the utility may hire a contractor to ensure proper operation and maintenance (O&M) and MCL compliance. The water system must retain unit ownership and oversight of unit installation, maintenance, and sampling; the utility ultimately is the responsible party for regulatory compliance. The water system staff need not perform all installation, maintenance, or management functions, as these tasks may be contracted to a third party-but the final responsibility for the quality and quantity of the water supplied to the community resides with the water system, and the utility must monitor all contractors closely. Responsibility for O&M of POU or POE devices installed for SDWA compliance may not be delegated to homeowners.
- POU and POE units must have mechanical warning systems to automatically notify customers of operational problems. Each POU or POE treatment device must be equipped with a warning device (e.g., alarm, light) that would alert users when their unit is no longer adequately treating their water. As an alternative, units may be equipped with an automatic shut-off mechanism to meet this requirement.
- If the American National Standards Institute issued product standards for a specific type of POU or POE treatment unit, only those units that have been independently certified according to those standards may be used as part of a compliance strategy.

The following observations with regard to using POE and POU devices for SDWA compliance were made by Raucher, *et al.* (2004):

- If POU devices are used as an SDWA compliance strategy, certain consumer behavioral changes will be necessary (e.g., encouraging people to drink water only from certain treated taps) to ensure comprehensive consumer health protection.
- Although not explicitly prohibited in the SDWA, USEPA indicates that POU treatment devices should not be used to treat for radon or for most volatile organic contaminants to achieve compliance, because POU devices do not provide 100 percent protection against inhalation or contact exposure to those contaminants at untreated taps (e.g., showerheads).
- Liability – PWSs considering unconventional treatment options (POU, POE, or bottled water) must address liability issues. These could be meeting drinking water standards, property entry and ensuing liabilities, and damage arising from improper installation or improper function of the POU and POE devices.

1.4.7 Water Delivery or Central Drinking Water Dispensers

Water delivery and central drinking water dispensers were not considered viable alternatives for a school application.

SECTION 2
EVALUATION METHOD

2.1 DECISION TREE

The decision tree is a flow chart for conducting feasibility studies for a non-compliant PWS. The decision tree is shown in Figures 2.1 through 2.4. The tree guides the user through a series of phases in the design process. Figure 2.1 shows Tree 1, which outlines the process for defining the existing system parameters, followed by optimizing the existing treatment system operation. If optimizing the existing system does not correct the deficiency, the tree leads to six alternative preliminary branches for investigation. The groundwater branch leads through investigating existing wells to developing a new well field. The treatment alternatives address centralized and on-site treatment. The objective of this phase is to develop conceptual designs and cost estimates for the six types of alternatives. The work done for this report follows through Tree 1 and Tree 2, as well as a preliminary pass through Tree 4.

Tree 3, which begins at the conclusion of the work for this report, starts with a comparison of the conceptual designs, selecting the two or three alternatives that appear to be most promising, and eliminating those alternatives that are obviously infeasible. It is envisaged that a process similar to this would be used by the study PWS to refine the list of viable alternatives. The selected alternatives are then subjected to intensive investigation, and highlighted by an investigation into the socio-political aspects of implementation. Designs are further refined and compared, resulting in the selection of a preferred alternative. The steps for assessing the financial and economic aspects of the alternatives (one of the steps in Tree 3) are given in Tree 4 in Figure 2.4.

2.2 DATA SOURCES AND DATA COLLECTION

2.2.1 Data Search

2.2.1.1 Water Supply Systems

The TCEQ maintains a set of files on public water systems, utilities, and districts at its headquarters in Austin, Texas. The files are organized under two identifiers: a PWS identification number and a CCN number. The PWS identification number is used to retrieve four types of files:

- CO – Correspondence,
- CA – Chemical analysis,
- MOR – Monthly operating reports (quality/quantity), and
- FMT – Financial, managerial and technical issues.

Figure 2.1
TREE 1 – EXISTING FACILITY ANALYSIS

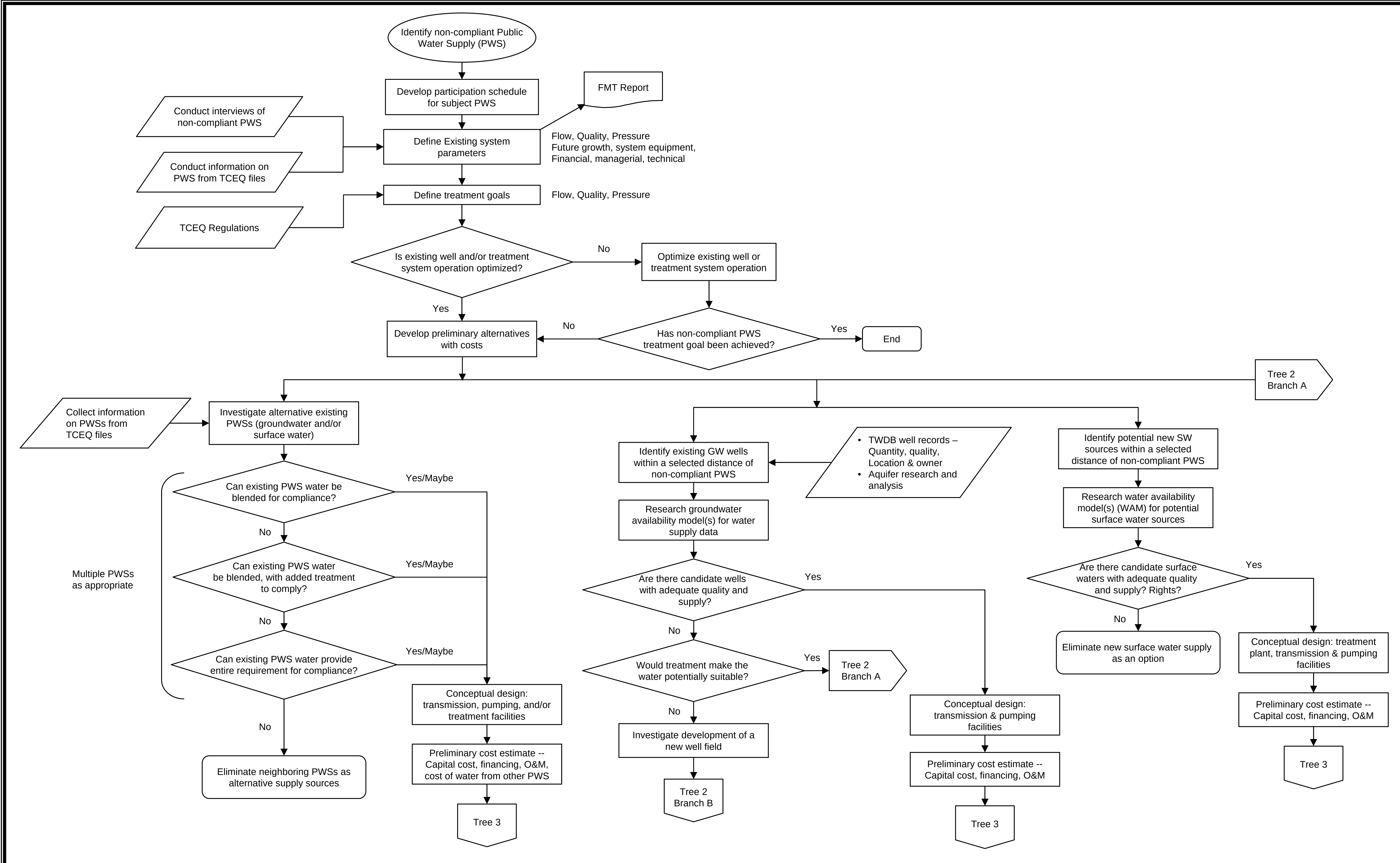
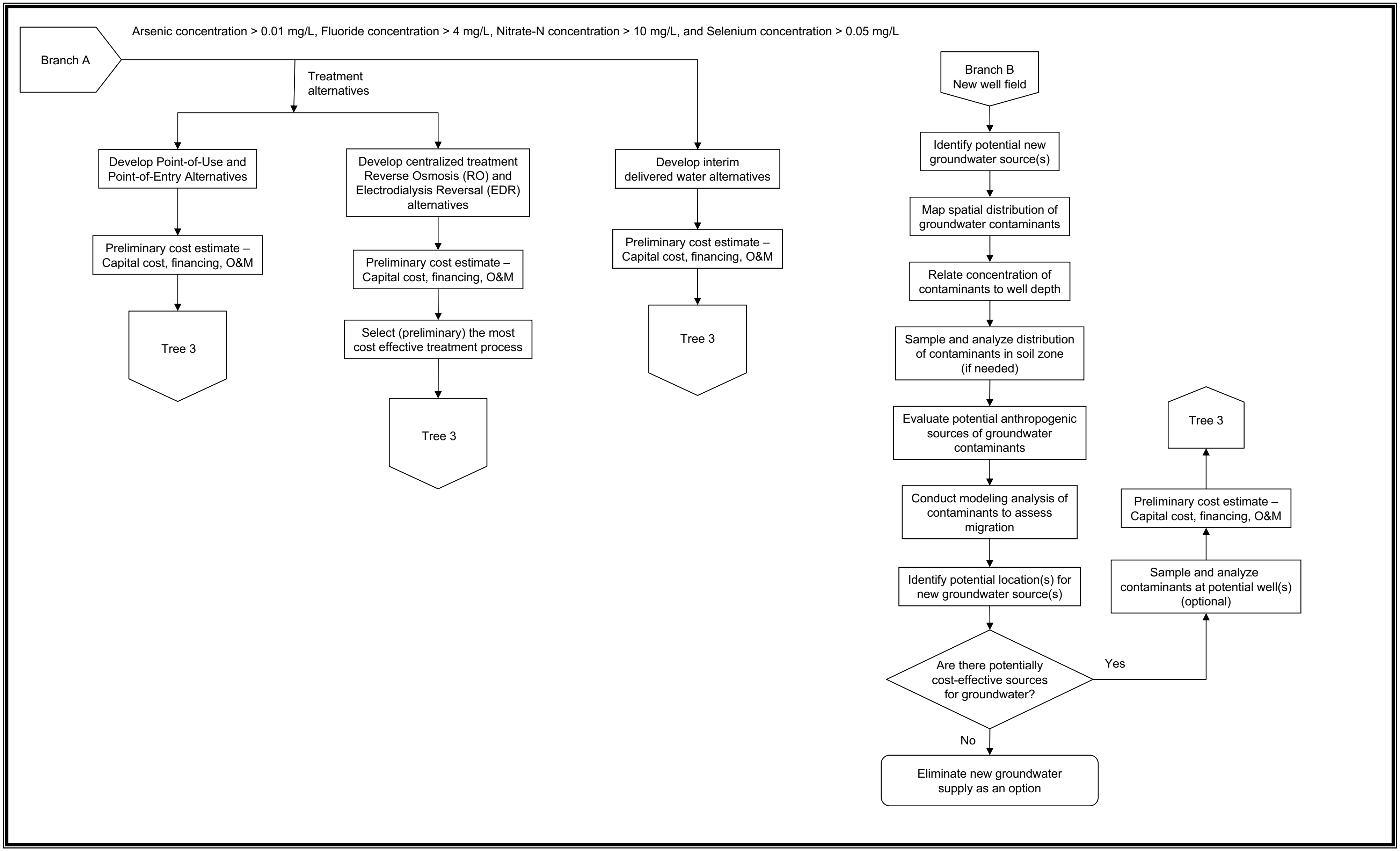


Figure 2.2
TREE 2 – DEVELOP TREATMENT ALTERNATIVES



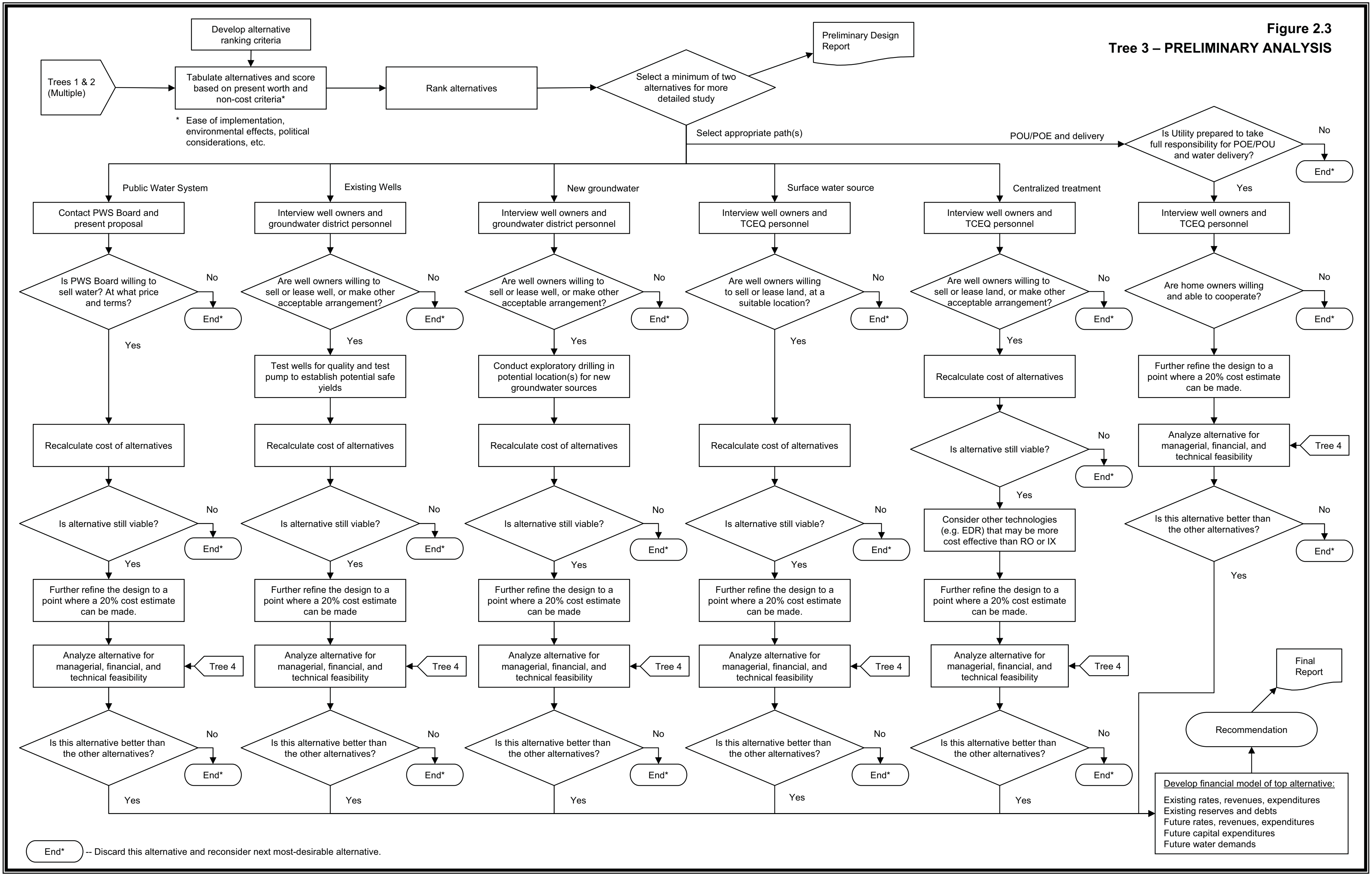
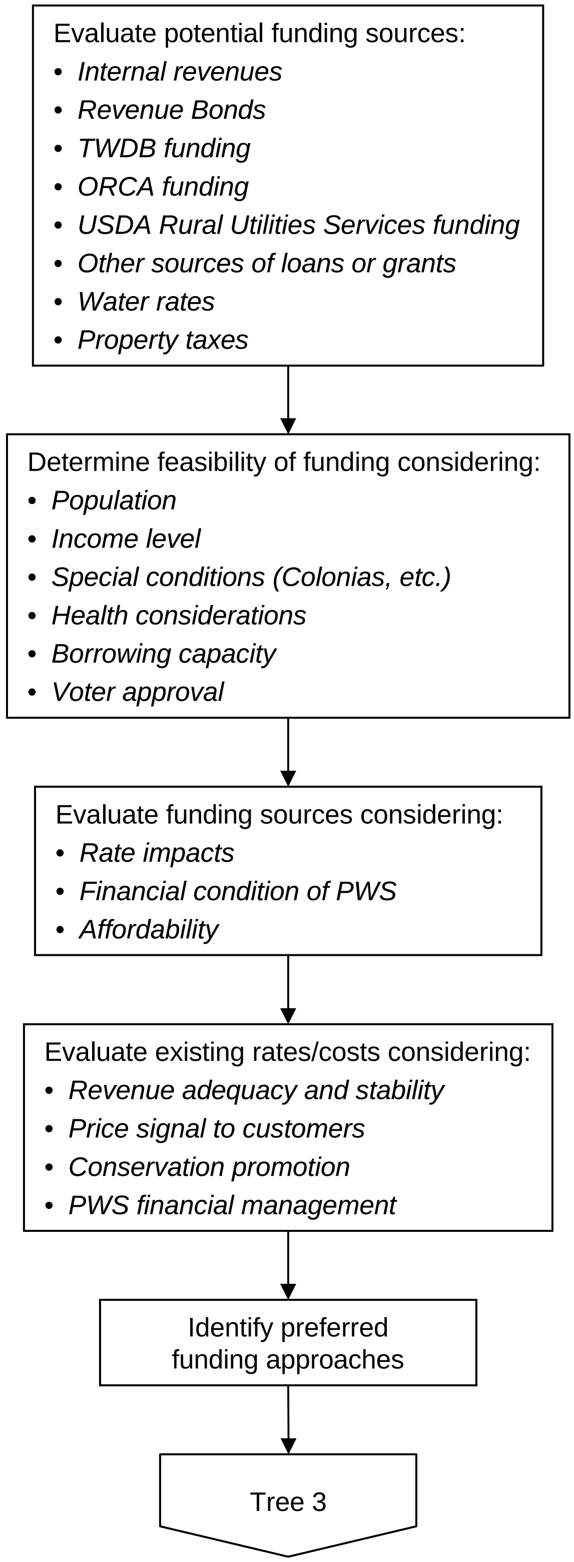


Figure 2.3
Tree 3 – PRELIMINARY ANALYSIS
Develop alternative ranking criteria
Trees 1 & 2 (Multiple)
Tabulate alternatives and score based on present worth and non-cost criteria*
* Ease of implementation, environmental effects, political considerations, etc.
Rank alternatives
Select a minimum of two alternatives for more detailed study
Preliminary Design Report
Select appropriate path(s)
POU/POE and delivery
Is Utility prepared to take full responsibility for POE/POU and water delivery?
No
End*
Yes
Public Water System
Existing Wells
New groundwater
Surface water source
Centralized treatment
Contact PWS Board and present proposal
Interview well owners and groundwater district personnel
Interview well owners and TCEQ personnel
Is PWS Board willing to sell water? At what price and terms?
Are well owners willing to sell or lease well, or make other acceptable arrangement?
Are well owners willing to sell or lease land, at a suitable location?
Are well owners willing to sell or lease land, or make other acceptable arrangement?
Are home owners willing and able to cooperate?
Test wells for quality and test pump to establish potential safe yields
Conduct exploratory drilling in potential location(s) for new groundwater sources
Recalculate cost of alternatives
Further refine the design to a point where a 20% cost estimate can be made.
Is alternative still viable?
Analyze alternative for managerial, financial, and technical feasibility
Tree 4
Consider other technologies (e.g. EDR) that may be more cost effective than RO or IX
Further refine the design to a point where a 20% cost estimate can be made
Is this alternative better than the other alternatives?
Final Report
Recommendation
Develop financial model of top alternative:
Existing rates, revenues, expenditures
Existing reserves and debts
Future rates, revenues, expenditures
Future capital expenditures
Future water demands
End* -- Discard this alternative and reconsider next most-desirable alternative.

Figure 2.4
TREE 4 – FINANCIAL



The CCN files generally contain a copy of the system's Certificate of Convenience and Necessity, along with maps and other technical data.

These files were reviewed for the PWS and surrounding systems.

The following websites were consulted to identify the water supply systems in the area:

- Texas Commission on Environmental Quality
  www3.tceq.state.tx.us/iwud/.
- USEPA Safe Drinking Water Information System
  www.epa.gov/safewater/data/getdata.html

Groundwater Control Districts were identified on the TWDB web site, which has a series of maps covering various groundwater and surface water subjects. One of those maps shows groundwater control districts in the State of Texas.

2.2.1.2 Existing Wells

The TWDB maintains a groundwater database available at www.twdb.state.tx.us that has two tables with helpful information. The "Well Data Table" provides a physical description of the well, owner, location in terms of latitude and longitude, current use, and for some wells, items such as flow rate, and nature of the surrounding formation. The "Water Quality Table" provides information on the aquifer and the various chemical concentrations in the water.

2.2.1.3 Surface Water Sources

Regional planning documents were consulted for lists of surface water sources.

2.2.1.4 Groundwater Availability Model

GAMs are numerical computer models of the major and minor Texas aquifers developed by the TWDB to assess groundwater availability over a 50-year planning period, and the possible effects of various proposed water management strategies on the aquifer systems. The GAM for the Ogallala aquifer was investigated as a potential tool for identifying available and suitable groundwater resources for the PWS.

2.2.1.5 Water Availability Model

The WAM is a computer-based simulation predicting the amount of water that would be in a river or stream under a specified set of conditions. WAMs are used to determine whether water would be available for a newly requested water right or amendment. If water is available, these models estimate how often the applicant could count on water under various conditions (*e.g.*, whether water would be available only one month out of the year, half the year, or all year, and whether that water would be available in a repeat of the drought of record).

WAMs provide information that assist TCEQ staff in determining whether to recommend the granting or denial of an application.

2.2.1.6 Financial Data

An evaluation of existing data will yield an up-to-date assessment of the financial condition of the water system. As part of a site visit, financial data were collected in various forms such as electronic files, hard copy documents, and focused interviews. Data sought included:

- Annual Budget
- Audited Financial Statements
  - Balance Sheet
  - Income & Expense Statement
  - Cash Flow Statement
  - Debt Schedule
- Water Rate Structure
- Water Use Data
  - Production
  - Billing
  - Customer Counts

2.2.1.7 Demographic Data

Basic demographic data were collected from the 2000 Census to establish incomes and eligibility for potential low cost funding for capital improvements. Median household income (MHI) and number of families below poverty level were the primary data points of significance. If available, MHI for the customers of the PWS should be used. In addition, unemployment data were collected from current U.S. Bureau of Labor Statistics. These data were collected for the following levels: national, state, and county.

2.2.2 PWS Interviews

2.2.2.1 PWS Capacity Assessment Process

Capacity assessment is the industry standard term for evaluation of a water system's FMT capacity to effectively deliver safe drinking water to its customers now and in the future at a reasonable cost, and to achieve, maintain and plan for compliance with applicable regulations. The assessment process involves interviews with staff and management who have a responsibility in the operations and management of the system.

Financial, managerial, and technical capacity are individual yet highly interrelated components of a system's capacity. A system cannot sustain capacity without maintaining adequate capability in all three components.

Financial capacity is a water system's ability to acquire and manage sufficient financial resources to allow the system to achieve and maintain compliance with SDWA regulations. Financial capacity refers to the financial resources of the water system, including but not limited to, revenue sufficiency, credit worthiness, and fiscal controls.

Managerial capacity is the ability of a water system to conduct its affairs so the system is able to achieve and maintain compliance with SDWA requirements. Managerial capacity refers to the management structure of the water system, including but not limited to, ownership accountability, staffing and organization, and effective relationships with customers and regulatory agencies.

Technical capacity is the physical and operational ability of a water system to achieve and maintain compliance with SDWA regulations. It refers to the physical infrastructure of the water system, including the adequacy of the source water, treatment, storage and distribution infrastructure. It also refers to the ability of system personnel to effectively operate and maintain the system and to otherwise implement essential technical knowledge.

Many aspects of water system operations involve more than one component of capacity. Infrastructure replacement or improvement, for example, requires financial resources, management planning and oversight, and technical knowledge. A deficiency in any one area could disrupt the entire operation. A system that is able to meet both its immediate and long-term challenges demonstrates that it has sufficient FMT capacity.

Assessment of FMT capacity of the PWS was based on an approach developed by the New Mexico Environmental Finance Center (NMEFC), which is consistent with the TCEQ FMT assessment process. This method was developed from work the NMEFC did while assisting USEPA Region 6 in developing and piloting groundwater comprehensive performance evaluations. The NMEFC developed a standard list of questions that could be asked of water system personnel. The list was then tailored slightly to have two sets of questions – one for managerial and financial personnel, and one for operations personnel (the questions are included in Appendix A). Each person with a role in the FMT capacity of the system was asked the applicable standard set of questions individually. The interviewees were not given the questions in advance and were not told the answers others provided. Also, most of the questions are open-ended type questions so they were not asked in a fashion to indicate what would be the "right" or "wrong" answer. The interviews lasted between 45 minutes to 75 minutes depending on the individual's role in the system and the length of the individual's answers.

In addition to the interview process, visual observations of the physical components of the system were made. A technical information form was created to capture this information. This form is also contained in Appendix A. This information was considered supplemental to the interviews because it served as a check on information provided in the interviews. For example, if an interviewee stated he or she had an excellent preventative maintenance schedule and the visit to the facility indicated a significant amount of deterioration (more than would be expected for the age of the facility) then the preventative maintenance program could be further investigated or the assessor could decide that the preventative maintenance program was inadequate.

Following interviews and observations of the facility, answers that all personnel provided were compared and contrasted to provide a clearer picture of the true operations at the water system. The intent was to go beyond simply asking the question, "Do you have a budget?" to actually finding out if the budget was developed and being used appropriately. For example, if a water system manager was asked the question, "Do you have a budget?" he or she may say, "yes" and the capacity assessor would be left with the impression that the system is doing well in this area. However, if several different people are asked about the budget in more detail, the assessor may find that although a budget is present, operations personnel do not have input into the budget, the budget is not used by the financial personnel, the budget is not updated regularly, or the budget is not used in setting or evaluating rates. With this approach, the inadequacy of the budget would be discovered and the capacity deficiency in this area would be noted.

Following the comparison of answers, the next step was to determine which items noted as a potential deficiency truly had a negative effect on the system's operations. If a system had what appeared to be a deficiency, but this deficiency was not creating a problem in terms of the operations or management of the system, it was not considered critical and may not have needed to be addressed as a high priority. As an example, the assessment may have revealed an insufficient number of staff members to operate the facility. However, it may also have been revealed that the system was able to work around that problem by receiving assistance from a neighboring system, so no severe problems resulted from the number of staff members. Although staffing may not be ideal, the system does not need to focus on this particular issue. The system needs to focus on items that are truly affecting operations. As an example of this type of deficiency, a system may lack a reserve account which can then lead the system to delay much-needed maintenance or repair on its storage tank. In this case, the system needs to address the reserve account issue so that proper maintenance can be completed.

The intent was to develop a list of capacity deficiencies with the greatest impact on the system's overall capacity. Those were the most critical items to address through follow-up technical assistance or by the system itself.

2.2.2.2 Interview Process

PWS personnel were interviewed by the project team, and each was interviewed separately. Interview forms were completed during each interview.

2.3 ALTERNATIVE DEVELOPMENT AND ANALYSIS

The initial objective for developing alternatives to address compliance issues is to identify a comprehensive range of possible options that can be evaluated to determine the most promising for implementation. Once the possible alternatives are identified, they must be defined in sufficient detail so a conceptual cost estimate (capital and O&M costs) can be developed. These conceptual cost estimates are used to compare the affordability of compliance alternatives, and to give a preliminary indication of rate impacts. Consequently, these costs are pre-planning level and should not be viewed as final estimated costs for alternative implementation. The basis for the unit costs used for the compliance alternative cost estimates is summarized in Appendix B. Other non-economic factors for the alternatives, such as reliability and ease of implementation, are also addressed.

2.3.1 Existing PWS

The neighboring PWSs were identified, and the extents of their systems were investigated. PWSs farther than 35 miles from the non-compliant PWSs were not considered because the length of the pipeline required would make the alternative cost prohibitive. The quality of water provided was also investigated. For neighboring PWSs with compliant water, options for water purchase and/or expansion of existing well fields were considered. The neighboring PWSs with non-compliant water were considered as possible partners in sharing the cost for obtaining compliant water either through treatment or developing an alternate source.

The neighboring PWSs were investigated to get an idea of the water sources in use and the quantity of water that might be available for sale. They were contacted to identify key locations in their systems where a connection might be made to obtain water, and to explore on a preliminary basis their willingness to partner or sell water. Then, the major system components that would be required to provide compliant water were identified. The major system components included treatment units, wells, storage tanks, pump stations, and pipelines.

Once the major components were identified, a preliminary design was developed to identify sizing requirements and routings. A capital cost estimate was then developed based on the preliminary design of the required system components. An annual O&M cost was also estimated to reflect the change in O&M expenditures that would be needed if the alternative was implemented.

Non-economic factors were also identified. Ease of implementation was considered, as well as the reliability for providing adequate quantities of compliant water. Additional factors were whether implementation of an alternative would require significant increase in the management or technical capability of the PWS, and whether the alternative had the potential for regionalization.

2.3.2 New Groundwater Source

It was not possible in the scope of this project to determine conclusively whether new wells could be installed to provide compliant drinking water. To evaluate potential new groundwater source alternatives, three test cases were developed based on distance from the PWS intake point. The test cases were based on distances of 10 miles, 5 miles, and 1 mile. It was assumed a pipeline would be required for all three test cases, and a storage tank and pump station would be required for the 10-mile and 5-mile alternatives. It was also assumed that new wells would be installed, and that their depths would be similar to the depths of the existing wells, or other existing drinking water wells in the area.

A preliminary design was developed to identify sizing requirements for the required system components. A capital cost estimate was then developed based on the preliminary design of the required system components. An annual O&M cost was also estimated to reflect the change (*i.e.*, from current expenditures) in O&M expenditures that would be needed if the alternative was implemented.

Non-economic factors were also identified. Ease of implementation was considered, as well as the reliability for providing adequate quantities of compliant water. Additional factors were whether implementation of an alternative would require significant increase in the management or technical capability of the PWS, and whether the alternative had the potential for regionalization.

2.3.3 New Surface Water Source

New surface water sources were considered. Availability of adequate quality water from rivers and major reservoirs in the surrounding area were investigated. TCEQ WAMs were inspected, and the WAM was run, where appropriate.

2.3.4 Treatment

The only common treatment technologies considered potentially applicable for removal of arsenic and selenium are RO and EDR. These two processes can remove fluoride and TDS as well as arsenic and selenium and other dissolved constituents. RO treatment is considered for central treatment alternatives, as well as POU and POE alternatives. EDR is considered for central treatment only.

Both RO and EDR treatments produce a liquid waste: a reject stream from RO process and a concentrate stream from EDR process. As a result, volume of raw water (well water) is greater than the volume of potable water produced. The EDR can operate at a slightly greater recovery rate (conversion rate of raw water to potable water) than RO, especially if recovery is limited by silica or low solubility salts. Partial RO treatment and blending treated and untreated water might be feasible while meeting all MCLs. However for a relatively small 50-gpm system, the complexities of a blending system may offset its benefits. The EDR operation can be tailored to provide a desired constituent effluent concentration by controlling the electrical energy applied. The treatment units were sized based on flow rates, and capital and annual O&M cost estimates were made based on the size of the treatment equipment required and the average water consumption rate, respectively. Neighboring non-compliant PWSs were identified to look for opportunities where the costs and benefits of central treatment could be shared between systems.

Non-economical factors were also identified. Ease of implementation was considered, as well as the reliability for providing adequate quantities of compliant water. Additional factors were whether implementation of an alternative would require significant increase in the management or technical capability of the PWS, and whether the alternative had the potential for regionalization.

2.4 COST OF SERVICE AND FUNDING ANALYSIS

The primary purpose of the cost of service and funding analysis is to determine the financial impact of implementing compliance alternatives, primarily by examining the required rate increases, and also the fraction of household income that water bills represent. The current financial situation of the non-compliant PWS is also reviewed to determine what rate increases are necessary to achieve or maintain long-term financial viability.

2.4.1 Financial Feasibility

A key financial metric is the comparison of average annual household water bill for a PWS customer to the MHI for the area. MHI data from the 2000 Census are used, at the most detailed level available for the community. Typically, county level data are used for small rural water utilities due to small population sizes. Annual water bills are determined for existing, base conditions, including consideration of additional rate increases needed under current conditions. Annual water bills are also calculated after adding incremental capital and operating costs for each of the alternatives to determine feasibility under several potential funding sources. It has been suggested by agencies such as USEPA that federal and state programs consider several criteria to determine "disadvantaged communities" with one based on the typical residential water bill as a percentage of MHI.

Additionally, the use of standard ratios provides insight into the financial condition of any business. Three ratios are particularly significant for water utilities:

- Current Ratio = current assets (liquid assets that could be readily converted to cash) divided by current liabilities (accounts payable, accrued expenses, and other short-term financial obligations) provides insight into the ability to meet short-term payments. For a healthy utility, the value should be greater than 1.0.
- Debt to Net Worth Ratio = total debt (total amount of long-term debt) divided by net worth (total assets minus total liabilities) shows to what degree assets of the company have been funded through borrowing. A lower ratio indicates a healthier condition.

- Operating Ratio = total operating revenues divided by total operating expenses show the degree to which revenues cover ongoing expenses. The value is greater than 1.0 if the utility is covering its expenses.

2.4.2 Median Household Income

The 2000 U.S. census is used as the basis for MHI. In addition to consideration of affordability, the annual MHI may also be an important factor for sources of funds for capital programs needed to resolve water quality issues. Many grant and loan programs are available to lower income rural areas, based on comparisons of local income to statewide incomes. In the 2000 Census, MHI for the State of Texas was $39,927, compared to the U.S. level of $41,994. The census broke down MHIs geographically by block group and ZIP code. The MHIs can vary significantly for the same location, depending on the geographic subdivision chosen. The MHI for each PWS was estimated by selecting the most appropriate value based on block group or ZIP code based on results of the site interview and a comparison with the surrounding area.

2.4.3 Annual Average Water Bill

The annual average household water bill was calculated for existing conditions and for future conditions incorporating the alternative solutions. Average residential consumption is estimated and applied to the existing rate structure to estimate the annual water bill. The estimates are generated from a long-term financial planning model that details annual revenue, expenditure, and cash reserve requirements over a 30-year period.

2.4.4 Financial Plan Development

The financial planning model uses available data to establish base conditions under which the system operates. The model includes, as available:

- Accounts and consumption data
- Water tariff structure
- Beginning available cash balance
- Sources of receipts:
  - Customer billings
  - Membership fees
  - Capital Funding receipts from:
    - Grants
    - Proceeds from borrowing
- Operating expenditures:
  - Water purchases

- Utilities
- Administrative costs
- Salaries

- Capital expenditures
- Debt service:
  - Existing principal and interest payments
  - Future principal and interest necessary to fund viable operations
- Net cash flow
- Restricted or desired cash balances:
  - Working capital reserve (based on 1-4 months of operating expenses)
  - Replacement reserves to provide funding for planned and unplanned repairs and replacements

From the model, changes in water rates are determined for existing conditions and for implementing the compliance alternatives.

2.4.5 Financial Plan Results

Results from the financial planning model are summarized in two areas: percentage of household income and total water rate increase necessary to implement the alternatives and maintain financial viability.

2.4.5.1 Funding Options

Results are summarized in a table that shows the following according to alternative and funding source:

- Percentage of the median annual household income the average annual residential water bill represents.
- The first year in which a water rate increase would be required
- The total increase in water rates required, compared to current rates

Water rates resulting from the incremental capital costs of the alternative solutions are examined under a number of funding options. The first alternative examined is always funding from existing reserves plus future rate increases. Several funding options were analyzed to frame a range of possible outcomes.

- Grant funds for 100 percent of required capital. In this case, the PWS is only responsible for the associated O&M costs.

- Grant funds for 75 percent of required capital, with the balance treated as if revenue bond funded.
- Grant funds for 50 percent of required capital, with the balance treated as if revenue bond funded.
- State revolving fund loan at the most favorable available rates and terms applicable to the communities.
- If local MHI > 75 percent of state MHI, standard terms, currently at 3.8 percent interest for non-rated entities. Additionally:
  - If local MHI = 70-75 percent of state MHI, 1 percent interest rate on loan.
  - If local MHI = 60-70 percent of state MHI, 0 percent interest rate on loan.
  - If local MHI = 50-60 percent of state MHI, 0 percent interest and 15 percent forgiveness of principal.
  - If local MHI less than 50 percent of state MHI, 0 percent interest and 35 percent forgiveness of principal.
- Terms of revenue bonds assumed to be 25-year term at 6.0 percent interest rate.

2.4.5.2 General Assumptions Embodied in Financial Plan Results

The basis used to project future financial performance for the financial plan model includes:

- No account growth (either positive or negative).
- No change in estimate of uncollectible revenues over time.
- Average consumption per account unchanged over time.
- No change in unaccounted for water as percentage of total (more efficient water use would lower total water requirements and costs).
- No inflation included in the analyses (although the model has provisions to add escalation of O&M costs, doing so would mix water rate impacts from inflation with the impacts from the alternatives being examined).
- Minimum working capital fund established for each district, based on specified months of O&M expenditures.
- O&M for alternatives begins 1 year after capital implementation.
- Balance of capital expenditures not funded from primary grant program is funded through debt (bond equivalent).
- Cash balance drives rate increases, unless provision chosen to override where current net cash flow is positive.

2.4.5.3 Interpretation of Financial Plan Results

Results from the financial plan model are presented in a Table 4.4 which shows the percentage of MHI represented by the annual water bill that results from any rate increases necessary to maintain financial viability over time. In some cases, this may require rate increases even without implementing a compliance alternative (the no action alternative). The table shows any increases such as these separately. The results table shows the total increase in rates necessary, including both the no-action alternative increase and any increase required for the alternative. For example, if the no action alternative requires a 10 percent increase in rates and the results table shows a rate increase of 25 percent, then the impact from the alternative is an increase in water rates of 15 percent. Likewise, the percentage of household income in the table reflects the total impact from all rate increases.

2.4.5.4 Potential Funding Sources

A number of potential funding sources exist for rural utilities, which typically provide service to less than 50,000 people. Both state and federal agencies offer grant and loan programs to assist rural communities in meeting their infrastructure needs. Most are available to "political subdivisions" such as counties, municipalities, school districts, special districts, or authorities of the state with some programs providing access to private individuals. Grant funds are made more available with demonstration of economic stress, typically indicated with MHI below 80 percent that of the state. The funds may be used for planning, design, and construction of water supply construction projects including, but not limited to, line extensions, elevated storage, purchase of well fields, and purchase or lease of rights to produce groundwater. Interim financing of water projects and water quality enhancement projects such as wastewater collection and treatment projects are also eligible. Some funds are used to enable a rural water utility to obtain water or wastewater service supplied by a larger utility or to finance the consolidation or regionalization of neighboring utilities. Three Texas agencies that offer financial assistance for water infrastructure are:

- Texas Water Development Board has several programs that offer loans at interest rates lower than the market offers to finance projects for public drinking water systems that facilitate compliance with primary drinking water regulations. Additional subsidies may be available for disadvantaged communities. Low interest rate loans with short and long-term finance options at tax exempt rates for water or water-related projects give an added benefit by making construction purchases qualify for a sales tax exemption. Generally, the program targets customers with eligible water supply projects for all political subdivisions of the state (at tax exempt rates) and Water Supply Corporations (at taxable rates) with projects.
- Texas Department of Rural Affairs (TDRA) is a Texas state agency with a focus on rural Texas by making state and federal resources accessible to rural communities. Funds from the U.S. Department of Housing and Urban Development Community Development Block Grants (CDBG) are administered by TDRA for small, rural communities with populations less than 50,000 that cannot directly receive federal grants. These communities are known as non-entitlement areas. One of the program

objectives is to meet a need having a particular urgency, which represents an immediate threat to the health and safety of residents, principally for low- and moderate-income persons.

- U.S. Department of Agriculture Rural Development Texas (Texas Rural Development) coordinates federal assistance to rural Texas to help rural Americans improve their quality of life. The Rural Utilities Service (RUS) programs provide funding for water and wastewater disposal systems.

The application process, eligibility requirements, and funding structure vary for each of these programs. There are many conditions that must be considered by each agency to determine eligibility and ranking of projects. The principal factors that affect this choice are population, percent of the population under the state MHI, health concerns, compliance with standards, Colonia status, and compatibility with regional and state plans. Technical assistance is available to assist local entities with the preparation of funding request applications from each agency.

SECTION 3
UNDERSTANDING SOURCES OF CONTAMINANTS

3.1 OVERVIEW OF THE STUDY AREA

The regional study area is defined by six Texas counties including Bailey, Lamb, Cochran, Hockley, Yoakum, and Terry (Figure 3.1) and is located in the Texas High Plains. Portions of Lamb and Bailey Counties that lie north of a regional 500 mg/L groundwater total dissolved solids (TDS) contour are excluded from the study area. The contour separates regionally lower TDS water to the north (median 390 mg/L) from regionally higher TDS water to the south (median 890 mg/L).

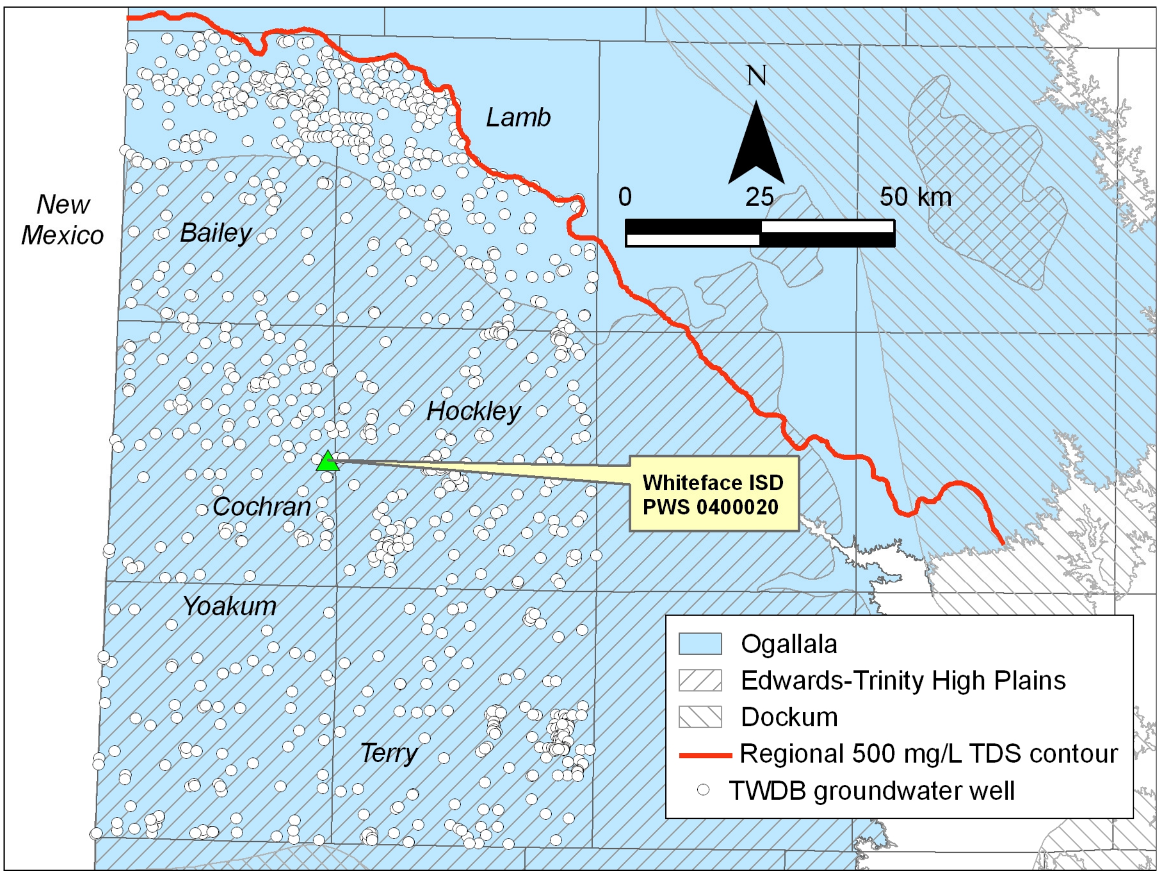


Figure 3.1 Regional Study Area, Major and Minor Aquifers, Groundwater Well Locations, and Location of the Whiteface ISD PWS

Most wells are completed in the Tertiary sediments of the Ogallala aquifer. Other aquifers in the region are underlying older aquifers, including the Cretaceous-age Edwards-Trinity (High Plains) aquifer, and the Dockum aquifer of Triassic age.

Aquifers in the study area and in the Texas High Plains in general include the Ogallala (Tertiary age), the Edwards-Trinity High Plains (Cretaceous age) and Dockum (Triassic age) aquifers. The Whiteface ISD PWS operates two wells, both completed in the Ogallala aquifer.

The Ogallala is classified as a major aquifer by the State of Texas and is by far the most heavily exploited in the study area, primarily for irrigation purposes to support the large agricultural economy. There are 1132 wells in the study area completed in the Ogallala aquifer that have water quality analyses in the Texas Water Development Board (TWDB) database. The Edwards-Trinity High Plains and the Dockum aquifers are classified as minor aquifers by the State of Texas. There are only 34 wells in the study area completed in the Edwards-Trinity, and seven wells completed in the Dockum that have water quality analyses in the TWDB database, representing only ~3% of the study area wells. Data for the Edwards-Trinity and Dockum wells are not considered further in this analysis.

Data used for this study include information come from two sources:

- TWDB groundwater database available at www.twdb.state.tx.us. The database includes information on the location and construction of wells throughout the state as well as historical measurements of water chemistry and levels in the wells.

- Texas Commission on Environmental Quality (TCEQ) Public Water Supply database (not publicly available). The database includes information on the location, type, and construction of water sources used by PWS in Texas, along with historical measurements of water levels and chemistry.

3.2 CONTAMINANTS OF CONCERN IN THE STUDY AREA

The primary contaminants of concern in the region include arsenic, fluoride, nitrate-N, and selenium. The maximum contaminant level (MCL) concentrations allowed in public water supply system drinking water by the U.S. Environmental Protection Agency are summarized in Table 3.1. Additionally, the USEPA has established secondary MCL values for TDS and fluoride.

Table 3.1 Maximum Contaminant Level Values for Contaminants of Concern in the Study Area.

Contaminant	MCL	Units	MCL Type
Arsenic	10	µg/L (ppb)	Primary
Fluoride	4	mg/L (ppm)	Primary
Nitrate-N	10	mg/L (ppm)	Primary
Selenium	50	µg/L (ppb)	Primary
Total dissolved solids	500	mg/L (ppm)	Secondary
Fluoride	2	mg/L (ppm)	Secondary

3.2.1 Arsenic

Arsenic concentrations exceed the MCL (10 µg/L) throughout the study area, with the generally higher concentrations located in the southern two counties (Figure 3.2). Approximately 29 percent of Ogallala aquifer wells in the study area have arsenic concentrations above the MCL (Table 3.2). Approximately 7.6 percent of wells have arsenic concentrations >20 µg/L (twice the MCL).

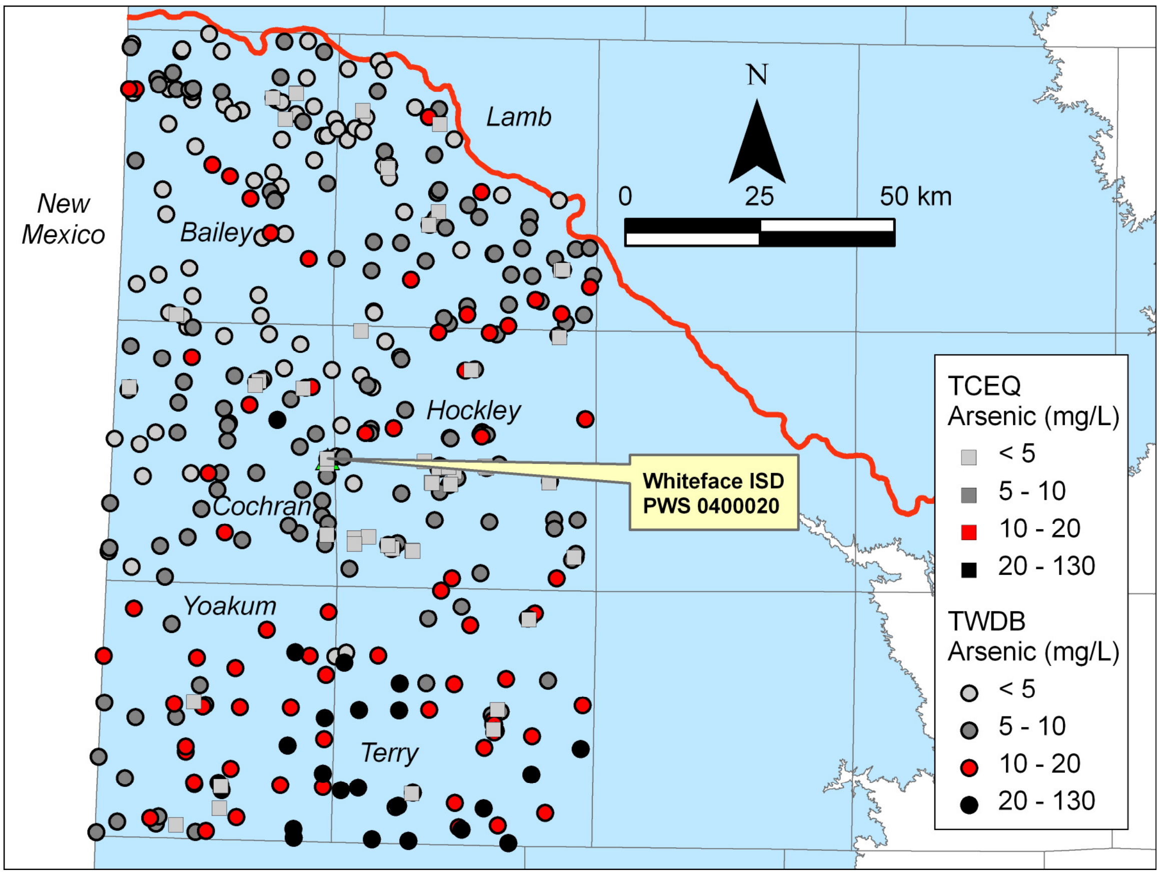


Figure 3.2 Spatial Distribution of Arsenic Concentrations in the Study Area.

Data represent the latest sample for wells in the TWDB and TCEQ databases. Data for TWDB wells represent values for single wells. For TCE wells, locations shown represent the spatial average for all wells associated with a PWS system entry point and concentrations may represent blended water from multiple wells and/or treated water.

Table 3.2 Summary of Arsenic Concentrations in Groundwater Well Samples Based on the Most Recent Sample Data from the TWDB Database.

Aquifer	Wells with Measurements	Median (µg/L)	Range (µg/L)	Wells that Exceed MCL	% of Wells that Exceed MCL
Ogallala	329	7.4	0.74 – 130	97	29

3.2.2 Fluoride

Fluoride concentrations exceed the MCL (4 mg/L) throughout the study area, with generally higher concentrations located in the southern and eastern areas (Figure 3.3). Approximately 26 percent of Ogallala aquifer wells in the study area have fluoride concentrations above the MCL (Table 3.3). Only six wells (0.6%) have fluoride concentrations >8 mg/L (twice the MCL).

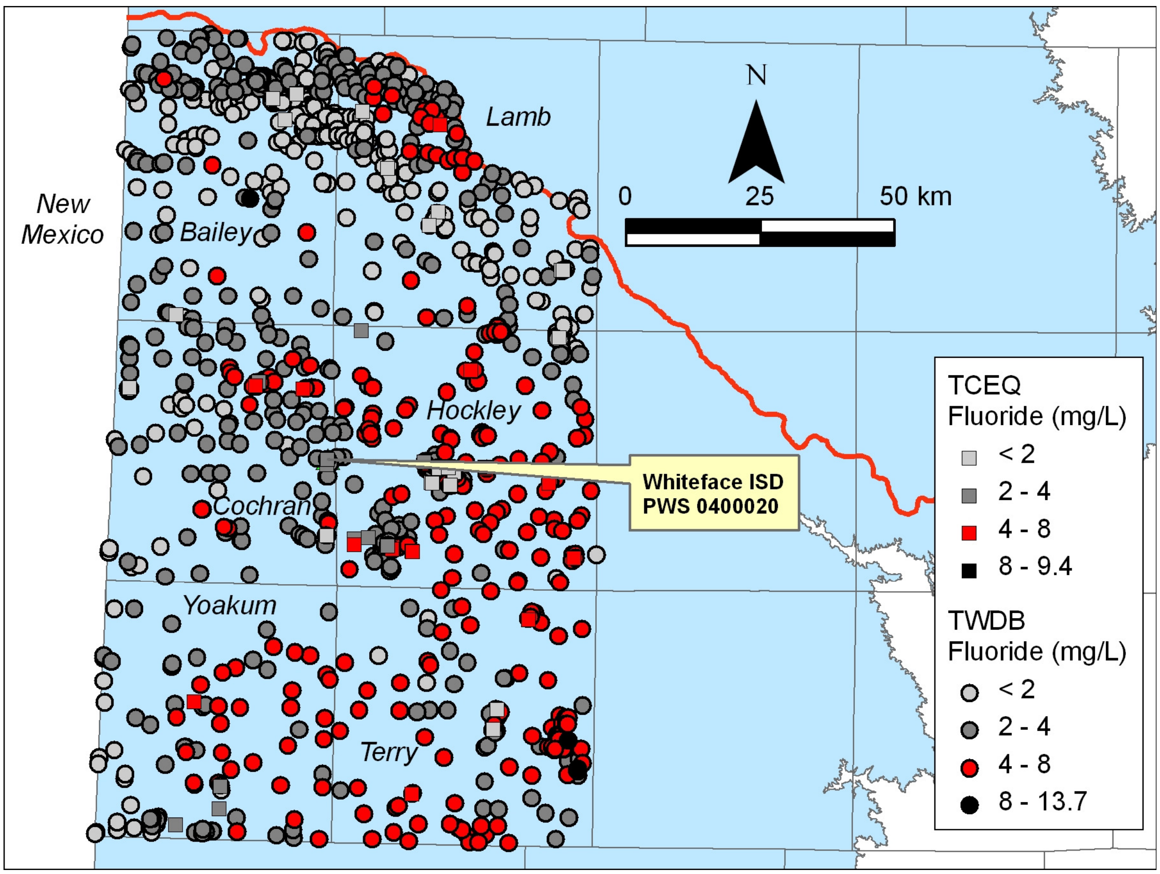


Figure 3.3 Spatial Distribution of Fluoride Concentrations in the Study Area.

Data represent the latest sample for wells in the TWDB and TCEQ databases. Data for TWDB wells represent values for single wells. For TCE wells, locations shown represent the spatial average for all wells associated with a PWS system entry point and concentrations may represent blended water from multiple wells and/or treated water.

Table 3.3 Summary of Fluoride Concentrations in Groundwater Well Samples Based on the Most Recent Sample Data from the TWDB Database.

Aquifer	Wells with Measurements	Median (mg/L)	Range (mg/L)	Wells that Exceed MCL	% of Wells that Exceed MCL
Ogallala	956	2.9	<0.05 – 13.7	252	26

3.2.3 Nitrate-N

Nitrate-N concentrations exceed the MCL (10 mg/L) throughout the study area, with generally higher concentrations located in the far southern and far northern areas (Figure 3.4). Approximately 8 percent of Ogallala aquifer wells in the study area have nitrate-N concentrations above the MCL (Table 3.4). Only 10 wells (1%) have nitrate-N concentrations >20 mg/L (twice the MCL).

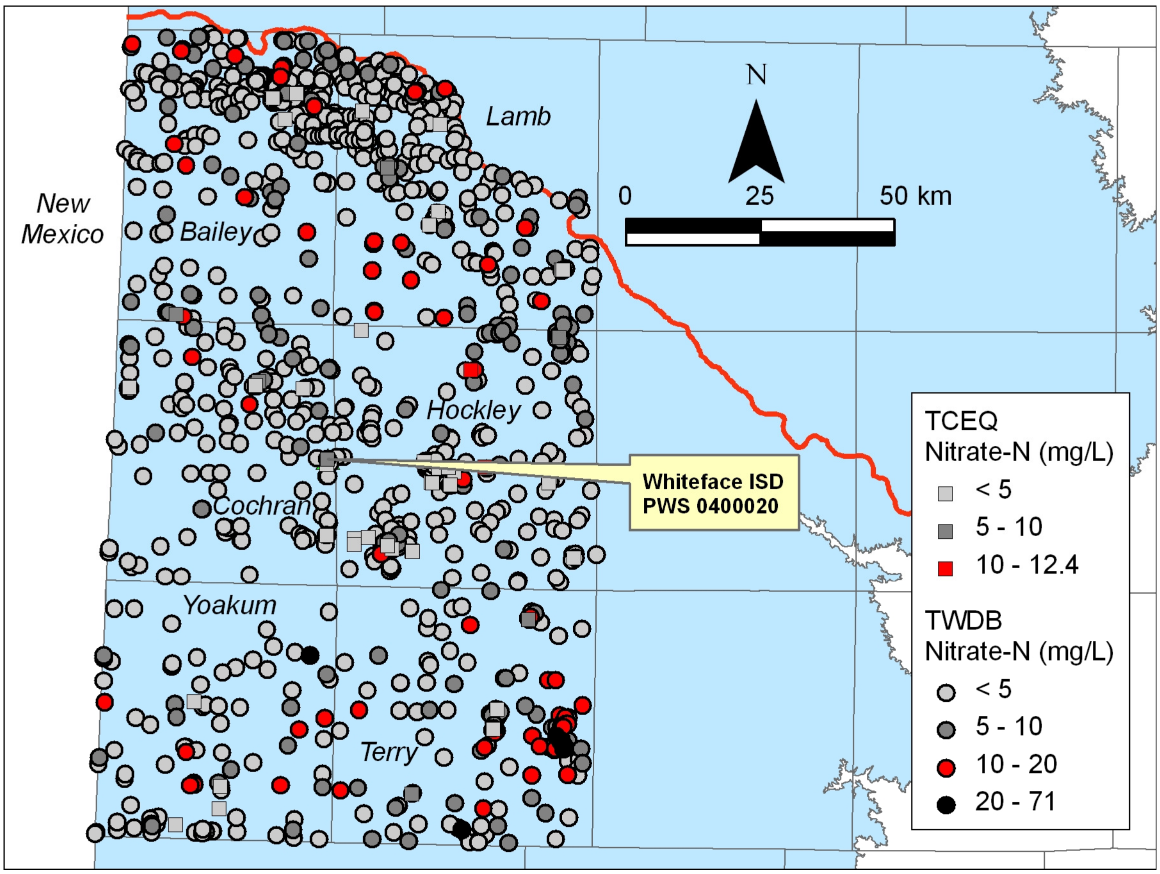


Figure 3.4 Spatial Distribution of Nitrate-N Concentrations in the Study Area.

Data represent the latest sample for wells in the TWDB and TCEQ databases. Data for TWDB wells represent values for single wells. For TCE wells, locations shown represent the spatial average for all wells associated with a PWS system entry point and concentrations may represent blended water from multiple wells and/or treated water.

Table 3.4 Summary of nitrate-N Concentrations in Groundwater Well Samples Based on the Most Recent Sample Data from the TWDB Database.

Aquifer	Wells with Measurements	Median (mg/L)	Range (mg/L)	Wells that Exceed MCL	% of Wells that Exceed MCL
Ogallala	977	2.5	<0.01 – 71	81	8

3.2.4 Selenium

Selenium concentrations exceed the MCL (50 mg/L) throughout the study area, with generally higher concentrations located in the far southern and far northern areas (Figure 3.5). Approximately 8 percent of Ogallala aquifer wells in the study area have selenium concentrations above the MCL (Table 3.5). Only two wells (0.6%) have selenium concentrations >100 µg/L (twice the MCL).

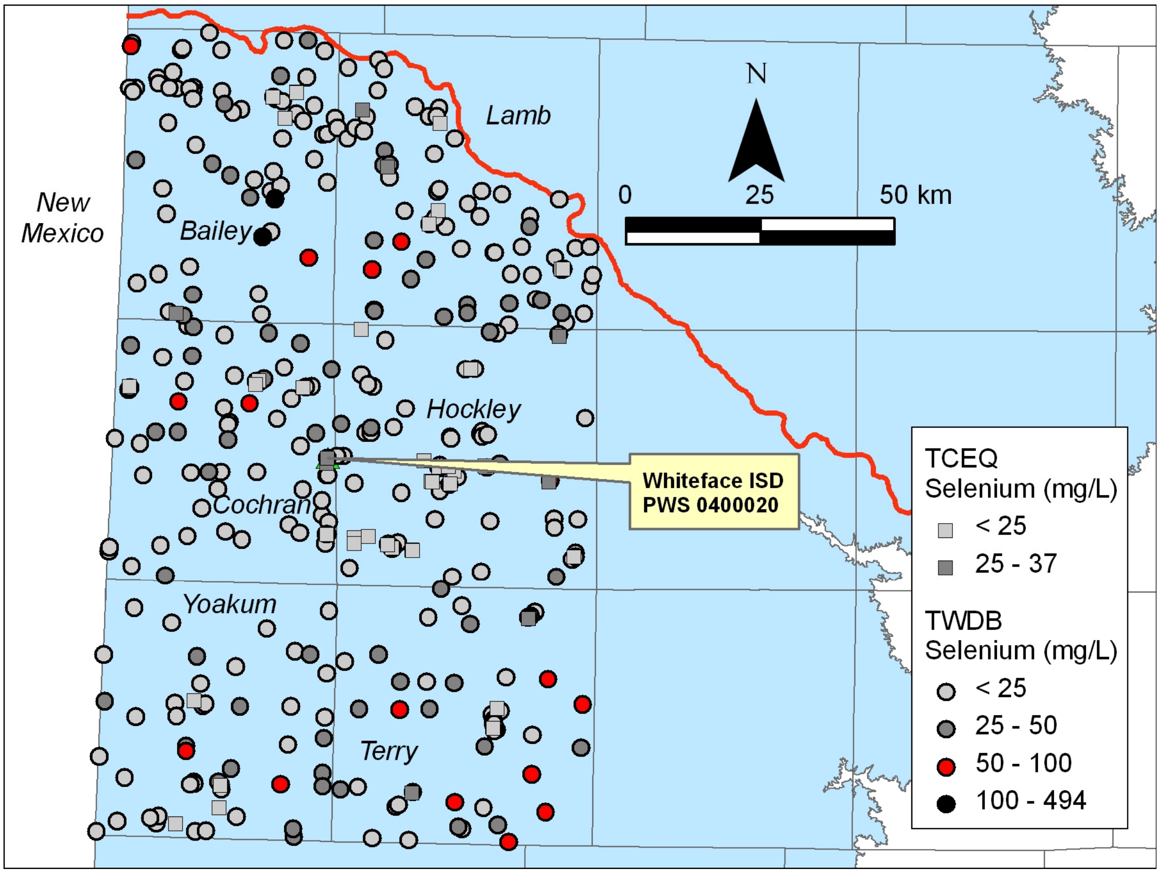


Figure 3.5 Spatial Distribution of Selenium Concentrations in the Study Area.

Data represent the latest sample for wells in the TWDB and TCEQ databases. Data for TWDB wells represent values for single wells. For TCE wells, locations shown represent the spatial average for all wells associated with a PWS system entry point and concentrations may represent blended water from multiple wells and/or treated water.

Table 3.5 Summary of Selenium Concentrations in Groundwater Well Samples Based on the Most Recent Sample Data from the TWDB Database.

Aquifer	Wells with Measurements	Median (mg/L)	Range (mg/L)	Wells that Exceed MCL	% of wells that exceed MCL
Ogallala	330	16.8	<1.0 – 494	20	6

3.2.5 Total Dissolved Solids

TDS concentrations exceed the secondary MCL (500 mg/L) throughout the study area (Figure 3.6). Approximately 81 percent of Ogallala aquifer wells in the study area have TDS concentrations above the secondary MCL (Table 3.6). Approximately 28 percent of wells have TDS concentrations above 1,000 mg/L (twice the secondary MCL).

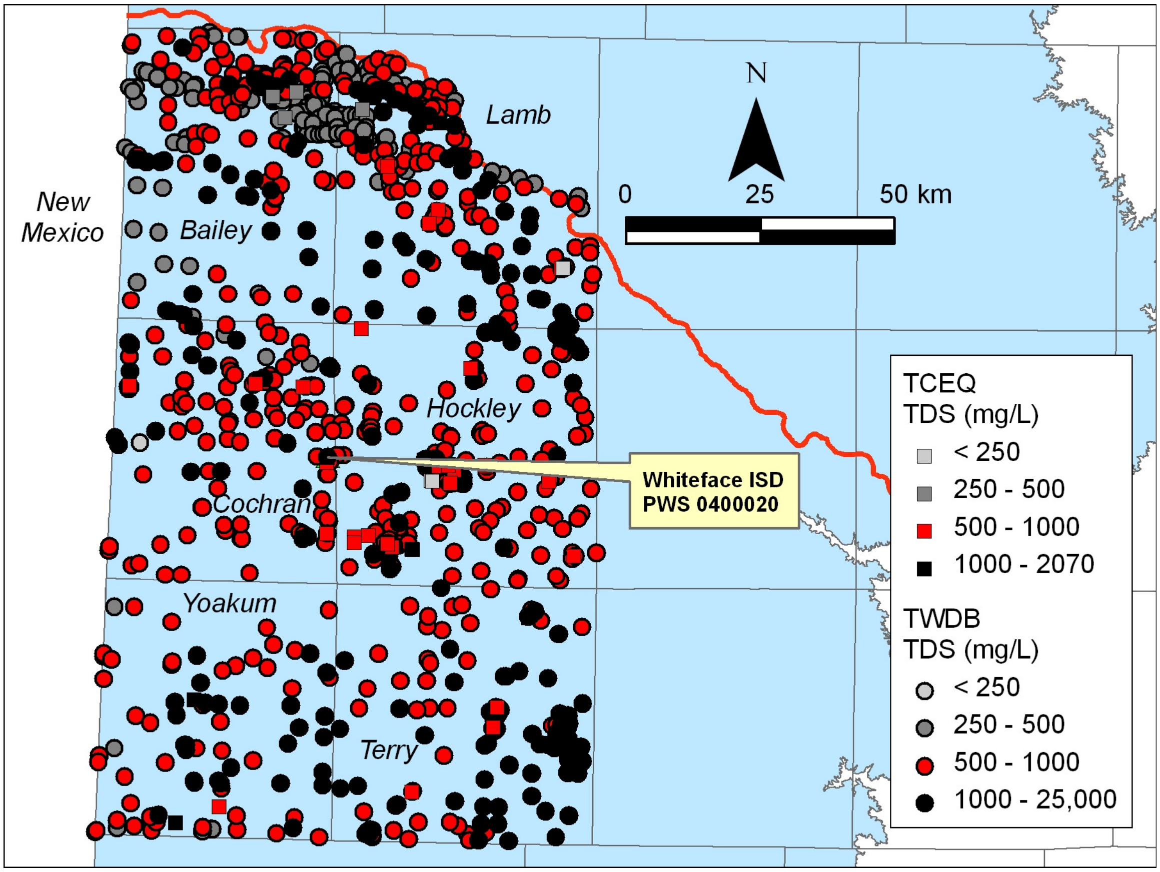


Figure 3.6 Spatial distribution of Fluoride Concentrations in the Study Area.

Data represent the latest sample for wells in the TWDB and TCEQ databases. Data for TWDB wells represent values for single wells. For TCE wells, locations shown represent the spatial average for all wells associated with a PWS system entry point and concentrations may represent blended water from multiple wells and/or treated water.

Table 3.6 Summary of Fluoride Concentrations in Groundwater Well Samples Based on the Most Recent Sample Data from the TWDB Database.

Aquifer	Wells with measurements	Median (mg/L)	Range (mg/L)	Wells that Exceed Secondary MCL	% of Wells that Exceed the Secondary MCL
Ogallala	925	723	249 – 113,000	752	81

3.2.6 Regional Relationship between Fluoride and Arsenic

Arsenic concentrations are moderately correlated with fluoride concentrations regionally (Figure 3.7a). The probability of arsenic concentrations >MCL increases regularly with increasing fluoride concentration, particularly for fluoride concentrations > ~3 mg/L (Figure 3.7b).

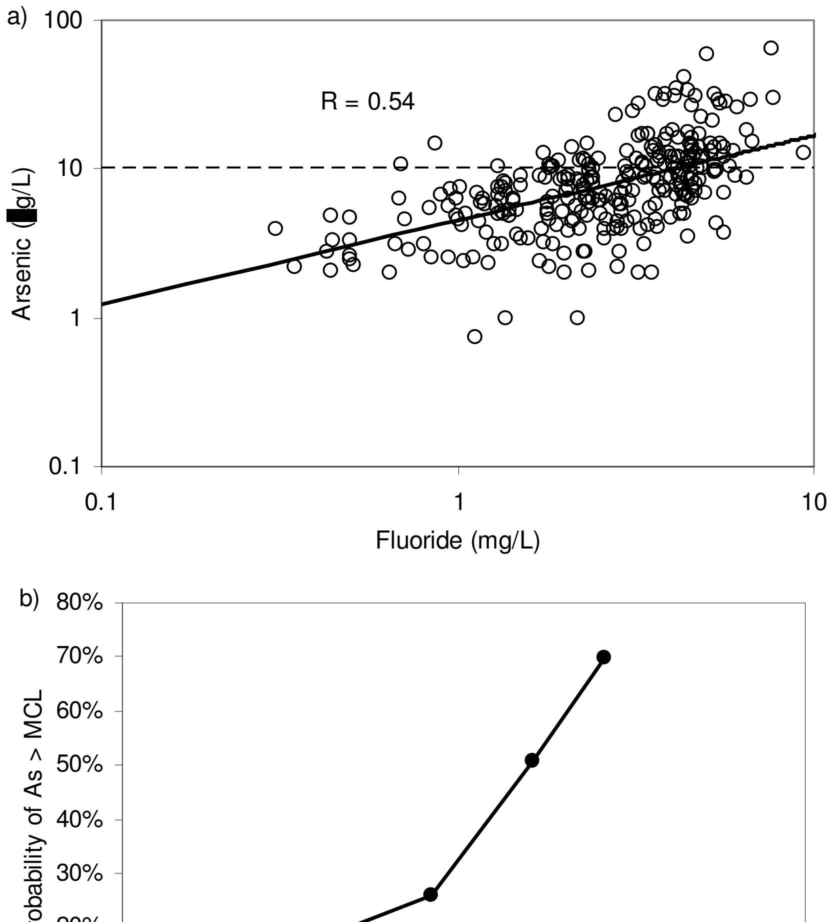


Figure 3.7 Relationship Between Fluoride and Arsenic Concentrations in the Study Area

Relationship between a) fluoride and arsenic concentrations in study area groundwater samples and b) the probability of arsenic concentrations exceeding the arsenic MCL (10 □g /L) for 20th percentile groups of fluoride concentration. Points shown in b) represent median values of fluoride within each group.

3.3 REGIONAL GEOLOGY

The major aquifer in the study area is the southern part of the Ogallala aquifer, which is equivalent to the Ogallala Formation, the predominant geologic unit that makes up the High Plains aquifer. The Ogallala Formation is late Tertiary (Miocene–Pliocene, or about 2–12 million years ago) in age (Nativ 1988). It consists of coarse fluvial sandstone and conglomerates deposited in the paleovalleys of a mid-Tertiary erosional surface, and eolian sand that was deposited in intervening upland areas (Gustavson and Holliday 1985). In the Ogallala-South area, the Ogallala formation is composed of deposition on top of a paleoupland. The formation is thin, resulting in a small saturated thickness and shallow water table. The top of the Ogallala Formation is marked in many places by a resistant calcite layer known as the "caprock caliche."

Within much of the study area, the Ogallala Formation is overlain by Quarternary-age (Pleistocene–Holocene) eolian, fluvial, and lacustrine sediments collectively called the Blackwater Draw Formation (Holliday 1989). The texture of the formation ranges from sand and gravel along riverbeds to clay-rich sediments in playa floors.

In much of the southern High Plains, the Ogallala Formation lies on top of Lower Cretaceous (Comanchean) strata. The top of the Cretaceous sediment is marked by an uneven erosional surface that represents the end of the Laramide orogeny. Cretaceous strata are absent beneath the thick Ogallala paleovalley fill deposits because they were removed by prior erosion. The Cretaceous sediments were deposited in a subsiding shelf environment and consist of the Trinity Group (including the basal sandy, permeable Antlers Formation); the Fredericksburg Group (limey to shaley formations including the Walnut, Comanche Peak, and Edwards Formations, as well as the Kiamichi Formation); and the Washita Group (low-permeability, shaley sediments of Duck Creek Formation) (Nativ 1988). The sequence results in two main aquifer units: the Antlers Sandstone (also termed the Trinity or Paluxy sandstone, about 15 m thick) and the Edwards Limestone (about 30 m thick). These aquifer units constitute the Edwards-Trinity (High Plains) aquifer (Ashworth and Flores 1991). The limestone decreases in thickness to the northwest and transitions into the Kiamichi and Duck Creek formations.

The Ogallala Formation also overlies the Triassic Dockum Group in much of the southern High Plains. The Dockum Group is generally about 150 m thick and is exposed along the margins of the High Plains. The uppermost sediments consist of red mudstone that generally forms an aquitard. Underlying units (Trujillo Sandstone [Upper Dockum] and Santa Rosa Sandstone [lower Dockum]) form the Dockum aquifer. Water quality in the Dockum is generally poor (Dutton and Simpkins 1986). The sediments of the Dockum were deposited in a continental fluvio-lacustrine environment that included streams, deltas, lakes, and mud flats (McGowen, et al. 1977) and included alternating arid and humid climatic conditions. The Triassic rocks reach up to 600 m thick in the Midland Basin.

3.4 DETAILED ASSESSMENT

Whiteface ISD (PWS 0400020)

The Whiteface ISD PWS has two wells: G0400020A (Well A, 200 ft deep) and G0400020B (Well B, 208 ft deep), both completed in the Ogallala aquifer. Well A is classified as operational while Well B is for emergency use. The system has one metered connection.

Table 3.7 Arsenic, fluoride, nitrate-N, selenium, and TDS concentrations in Whiteface ISD PWS entry point samples (data from the TCEQ PWS database).

Sample Date	Sample Location	Arsenic µg/L	Fluoride mg/L	Nitrate-N mg/L	Selenium µg/L	TDS mg/L
10/11/01	EP 1	8.1	2.80	6.10	38.1	908
02/27/03	EP 1	7.5	2.90	7.73	37.4	905
10/26/04	EP 1	–	2.89	6.48	–	–
02/24/05	EP 1	–	–	5.60	–	–
06/15/05	EP 1	–	–	6.30	–	–
08/29/05	EP 1	–	–	5.90	–	–
12/06/05	EP 1	–	2.92	4.56	–	–
02/15/06	EP 1	–	2.81	4.42	–	952
05/23/06	EP 1	6.6	–	3.80	35.6	–
08/31/06	EP 1	–	–	4.66	–	–
11/16/06	EP 1	–	–	3.92	–	–
06/12/07	EP 1	–	3.12	3.35	–	–
05/01/08	EP 1	–	2.52	5.64	–	1070
02/18/09	EP 1	–	–	6.70	–	–
05/26/09	EP 1	19.4	–	–	82.3	–
08/19/09	EP 1	–	–	5.94	42.9	–
09/10/09	EP 1	7.1	–	–	–	–
11/03/09	EP 1	15.9	–	–	72.3	–

<u>Sample Location</u>: EP; entry point and number.

There were 18 samples between 2001 and 2009 for the Whiteface ISD PWS that were analyzed for different constituents at different times (Table 3.7). Arsenic concentrations exceeded the MCL (10 µg/L) for two samples analyzed in 2009 and ranged from 6.6 to 19.4 µg/L (median 7.8 µg/L). Fluoride concentrations did not exceed the primary MCL (4 mg/L) in any of the seven samples analyzed and ranged from 2.52 and 3.12 mg/L (median 2.9 mg/L). All fluoride analyses exceeded the secondary MCL (2 mg/L). Nitrate-N concentrations did not exceed the MCL in any of the 15 samples analyzed and ranged from 3.35 to 7.73 mg/L (median 5.6 mg/L). Selenium concentrations exceeded the MCL (50 µg/L) in the same two samples for which arsenic exceeded and ranged from 35.6 to 82.3 µg/L (median 40.5 µg/L). TDS concentrations exceeded the secondary MCL (500 mg/L) in all four samples analyzed and ranged from 905 to 1070 mg/L median (930 mg/L).

There is one PWS system located within 10 km of Whiteface ISD PWS (Table 3.6, Figures 3.8 through 3.12). The City of Whiteface PWS operates three wells also completed in the Ogallala aquifer, all of which are compliant with all contaminants of concern.

Excluding public water supply wells, there are 25 groundwater wells listed in the TWDB data base that are within 10 km of Whiteface ISD PWS that have been analyzed for one or more of the contaminants of concern (Table 3.6, Figures 3.8 through 3.12). All wells are completed in the Ogallala aquifer. Many samples are dated, ranging from 1961 to 2008 (median 1989). However, 12 samples since 1990 have been analyzed for all for the contaminants of concern and 10 of those are compliant with all of the primary MCL values.

Arsenic concentrations for TWDB wells located within 10 km of Whiteface ISD PWS range from 4.06 to 10.1 μg/L (median 6.36 μg/L). Twelve wells out of 13 (92%) were compliant with the arsenic MCL (10 μg/L) (Figure 3.8). Arsenic concentrations greater than the MCL are generally located to the northeast of Whiteface ISD PWS.

Fluoride concentrations range from 1.8 to 5.4 mg/L (median 3.02 mg/L) and 20 wells out of 25 (80%) were compliant with the primary fluoride MCL (4 mg/L). However, only one well out of 25 (4%) was compliant with the secondary fluoride MCL (2 mg/L) (Figure 3.9). As with arsenic, fluoride concentrations greater than the MCL are generally located to the northeast of Whiteface ISD PWS.

Nitrate-N concentrations range from <0.02 to 5.16 mg/L and all nearby wells were compliant with the nitrate-N MCL (10 mg/L) (Figure 3.10).

Selenium concentrations range from <4.1 to 33 μg/L (median 14.4 μg/L) and all nearby wells were compliant with the selenium MCL (50 μg/L) (Figure 3.11).

TDS concentrations range from 602 to 1584 mg/L (median 821 mg/L) and none of the 25 wells were compliant with the secondary TDS MCL (500 mg/L) (Figure 3.12). There does not appear to be a local spatial trend regarding TDS concentrations.

Summary of Alternative Groundwater Sources for Whiteface ISD PWS.

There are several alternative groundwater sources within 10 km of Whiteface ISD PWS that were compliant with all primary MCL concentrations of concern. The closest location is the City of Whiteface PWS, located approximately 1 km south. Of the 10 TWDB wells compliant with all primary MCL concentrations, four wells are located within 5 km of Whiteface IDS PWS. Wells that are non-compliant with both arsenic and fluoride MCL concentrations are located to the northeast of Whiteface ISD PWS.

Table 3.8 Arsenic, fluoride, nitrate-N, selenium, and TDS concentrations in potential alternative groundwater sources within 10 km of Whiteface ISD PWS.

Samples that are compliant with all primary MCL concentrations are highlighted.

PWD ID / Well ID	System / Owner	Sample date	As mg/L	F mg/L	NO_3-N mg/L	Se mg/L	TDS mg/L
TCEQ Database							
0400002	City of Whiteface	02/15/06	–	–	–	–	872
		02/21/08	–	–	3.29	–	–
		11/20/08	–	2.64	–	–	–
		02/18/09	7.6	–	–	36.6	–
TWDB Database							
2419503	Owens Brothers Feed	07/27/81	–	2.50	1.56	–	778
2419601	A. J. & Louise Luper	07/10/80	–	2.50	3.68	–	844
2419602	Curtis Griffith	08/16/88	–	3.40	5.16	–	852
2419801	Harp,Wright, & Rushing	08/22/80	–	2.20	1.20	–	848
2419902	E.J. & David Smiley	07/11/03	8.73	2.40	2.38	25.6	754
2420401	Whiteface Farms, Inc.	07/28/69	–	5.40	3.39	–	751
2420701	Carmen C. Rejino, Jr.	08/14/75	–	3.30	3.61	–	713
2420702	Ricky & Cindy Davidson	08/07/87	–	3.00	0.56	–	852
2420703	Joe Roberts	01/23/85	–	3.30	<0.02	–	734
2420704	Mr. Hershell Hill	04/21/04	4.06	3.65	1.13	25.8	843
2420802	Whiteface Farms	05/10/00	10.1	4.10	1.35	7.7	972
2420901	Johnny Crouch	08/11/87	–	4.10	1.93	–	1045
2420902	Whiteface Farms	08/23/88	–	4.50	3.35	–	627
2420903	Whiteface Farms	08/22/90	<10.0	3.80	2.18	33.0	772
2420904	Hershell Hill	05/23/96	9.9	4.27	3.12	23.6	778
2427202	Water Flood	05/24/61	–	1.80	0.23	–	1584
2427301	Johnny Fietz	07/10/80	–	2.60	0.97	–	822
2427501	Wright & Wright	06/18/08	6.93	2.90	0.89	8.0	1081
2427902	John Henry Dean Trust	08/08/03	5.07	2.91	1.45	21.5	602
2428103	Carl McWherter	07/01/05	4.42	2.82	2.41	14.1	856
2428105	F. Payne	07/27/81	–	2.90	2.28	–	821
2428106	Sally McAteer	04/29/04	5.38	3.47	1.76	7.4	803
2428401	E.C. White, Jr.	07/22/03	6.43	2.62	2.57	14.6	745
2428402	Elbert White	06/18/08	6.29	2.05	4.81	8.8	837
2428501	Daniel & Helen Graf	07/14/05	4.12	3.45	0.16	<4.1	753
Median		1989	6.36	3.00	1.93	14.35	821

As: arsenic, *F*: fluoride, *NO_3-N*: nitrate-N, *Se*: selenium, *TDS*: total dissolved solids.

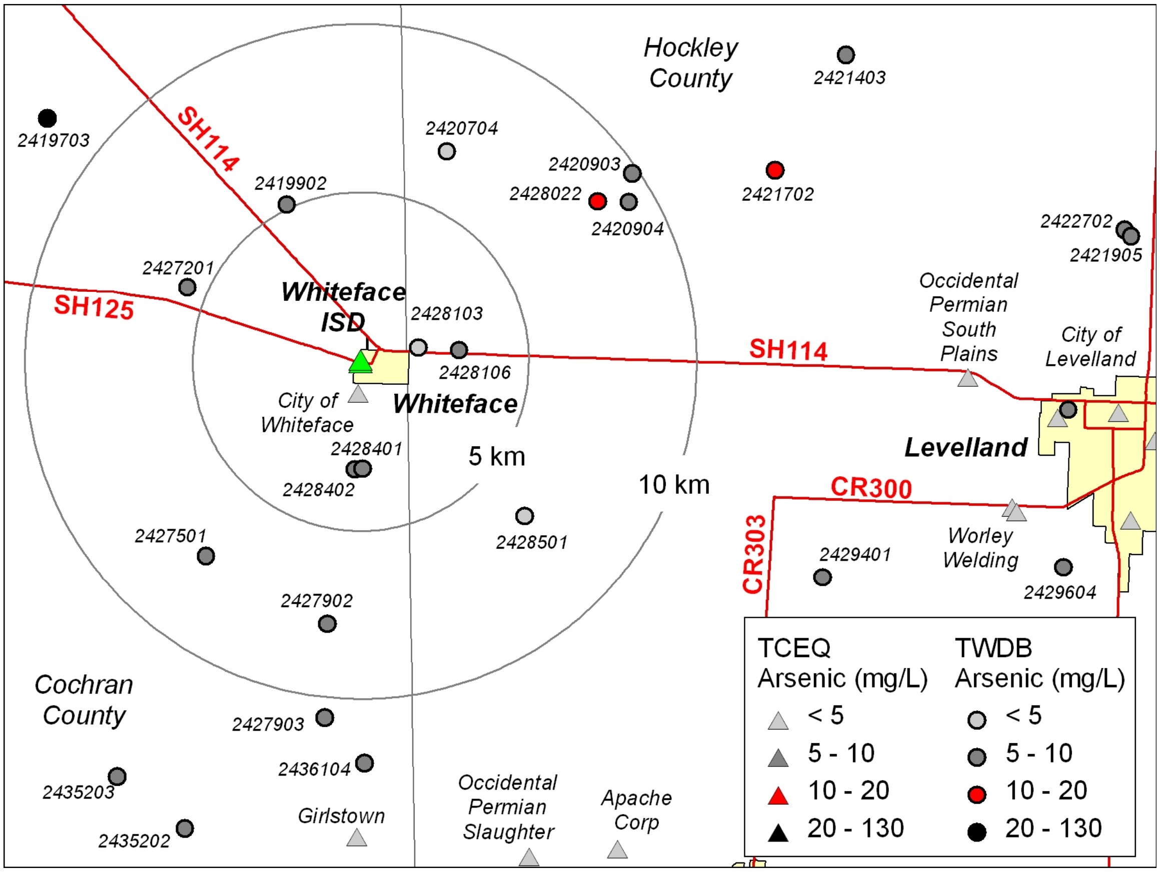


Figure 3.8 Arsenic concentrations in groundwater near Whiteface ISD PWS.

Sample data shown represent the most recent sample. Data in the TCEQ PWS database may represent entry point samples that combine water from multiple wells and may also reflect post-treatment concentrations. Samples from the TWDB database represent samples from single wells and represent raw water concentrations.

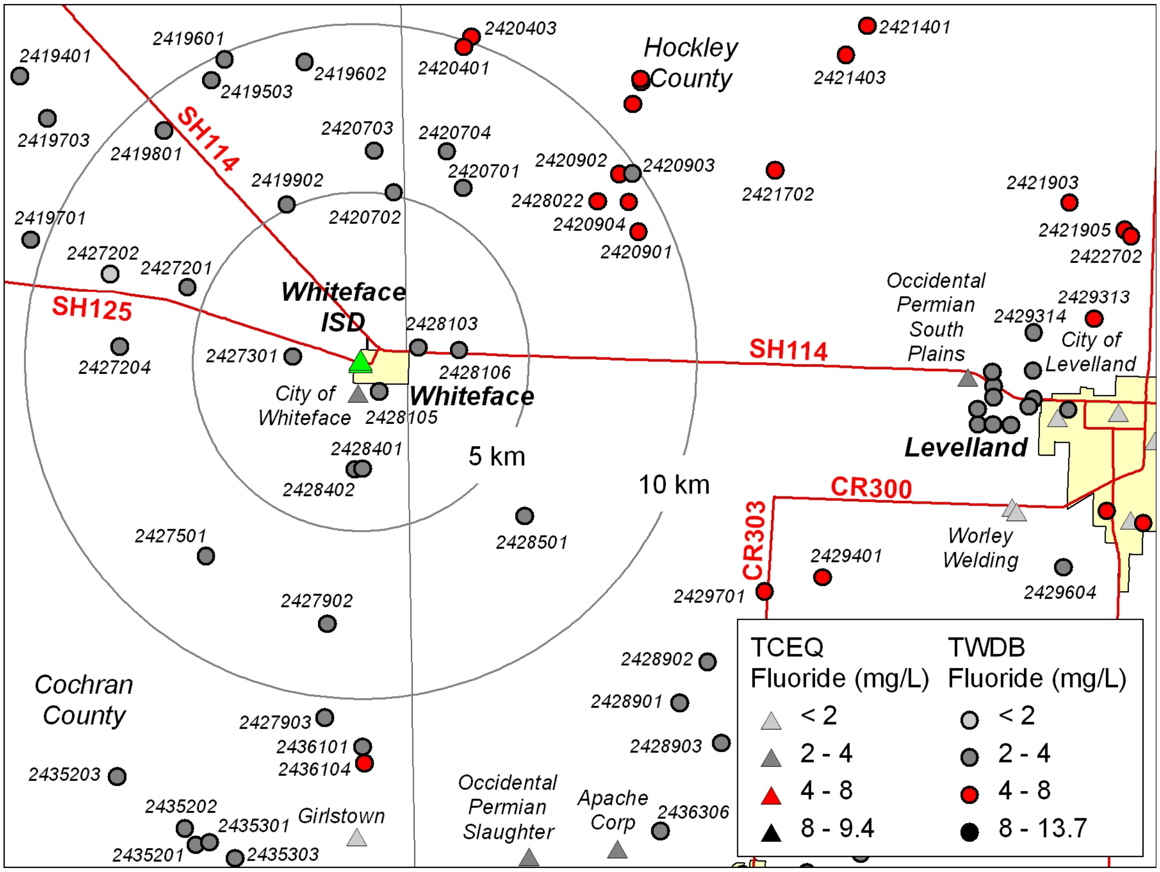


Figure 3.9 Fluoride Concentrations in Groundwater Near Whiteface ISD PWS.

Sample data shown represent the most recent sample. Data in the TCEQ PWS database may represent entry point samples that combine water from multiple wells and may also reflect post-treatment concentrations. Samples from the TWDB database represent samples from single wells and represent raw water concentrations.

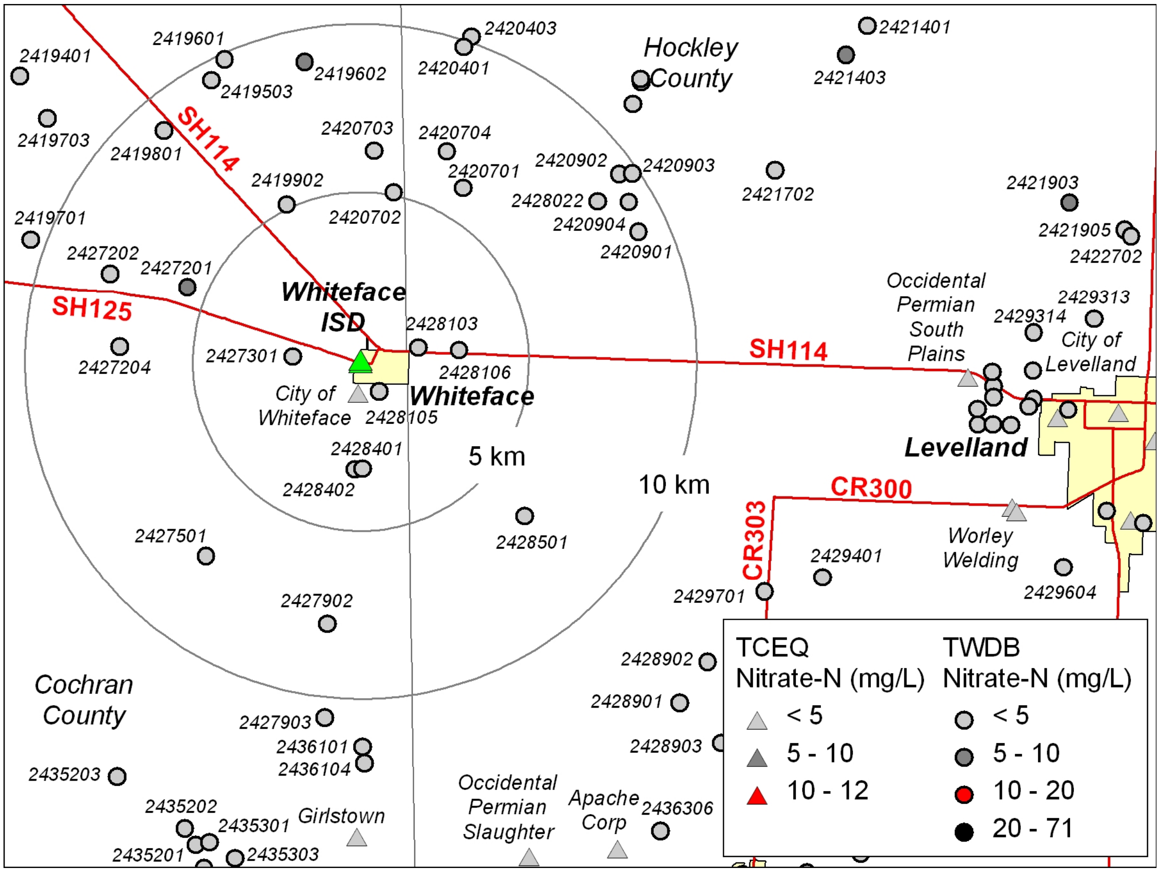


Figure 3.10 Nitrate-N Concentrations in Groundwater Near Whiteface ISD PWS.

Sample data shown represent the most recent sample. Data in the TCEQ PWS database may represent entry point samples that combine water from multiple wells and may also reflect post-treatment concentrations. Samples from the TWDB database represent samples from single wells and represent raw water concentrations.

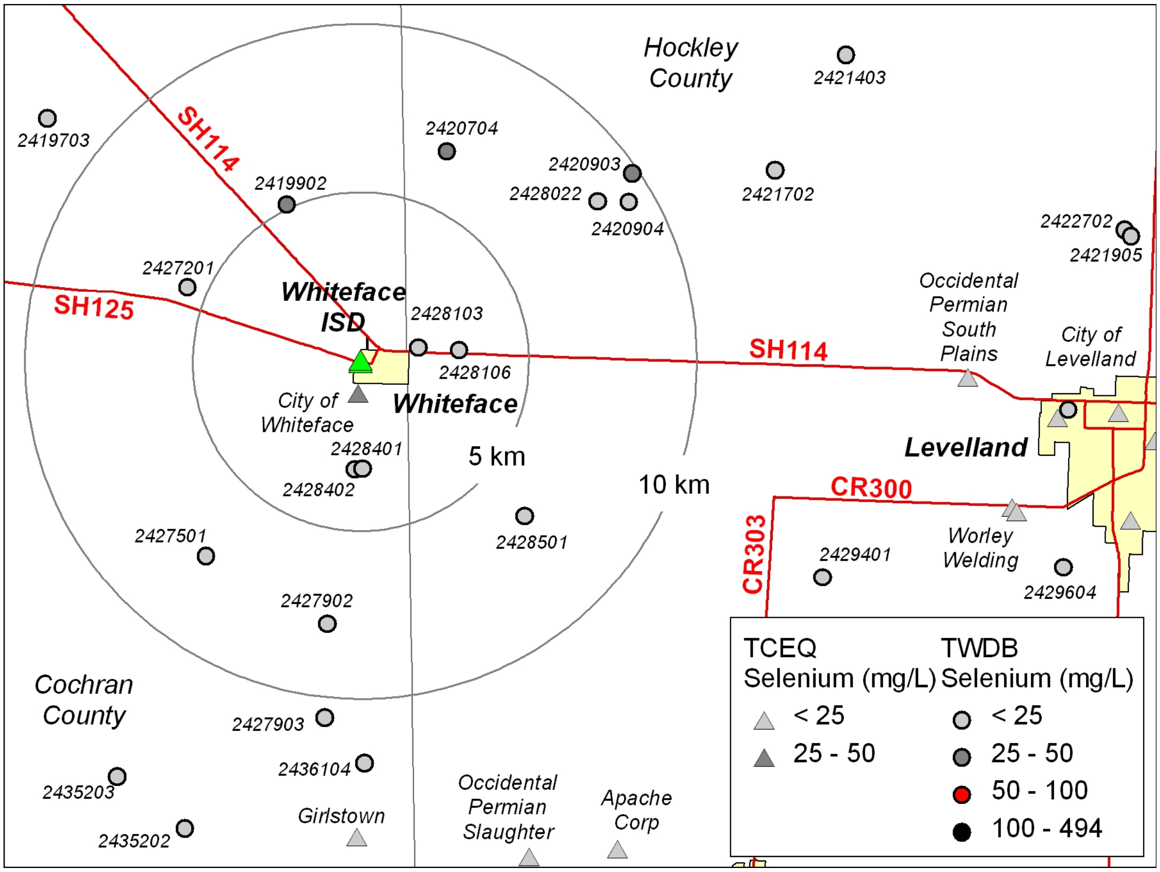


Figure 3.11 Selenium Concentrations in Groundwater Near Whiteface ISD PWS.

Sample data shown represent the most recent sample. Data in the TCEQ PWS database may represent entry point samples that combine water from multiple wells and may also reflect post-treatment concentrations. Samples from the TWDB database represent samples from single wells and represent raw water concentrations.

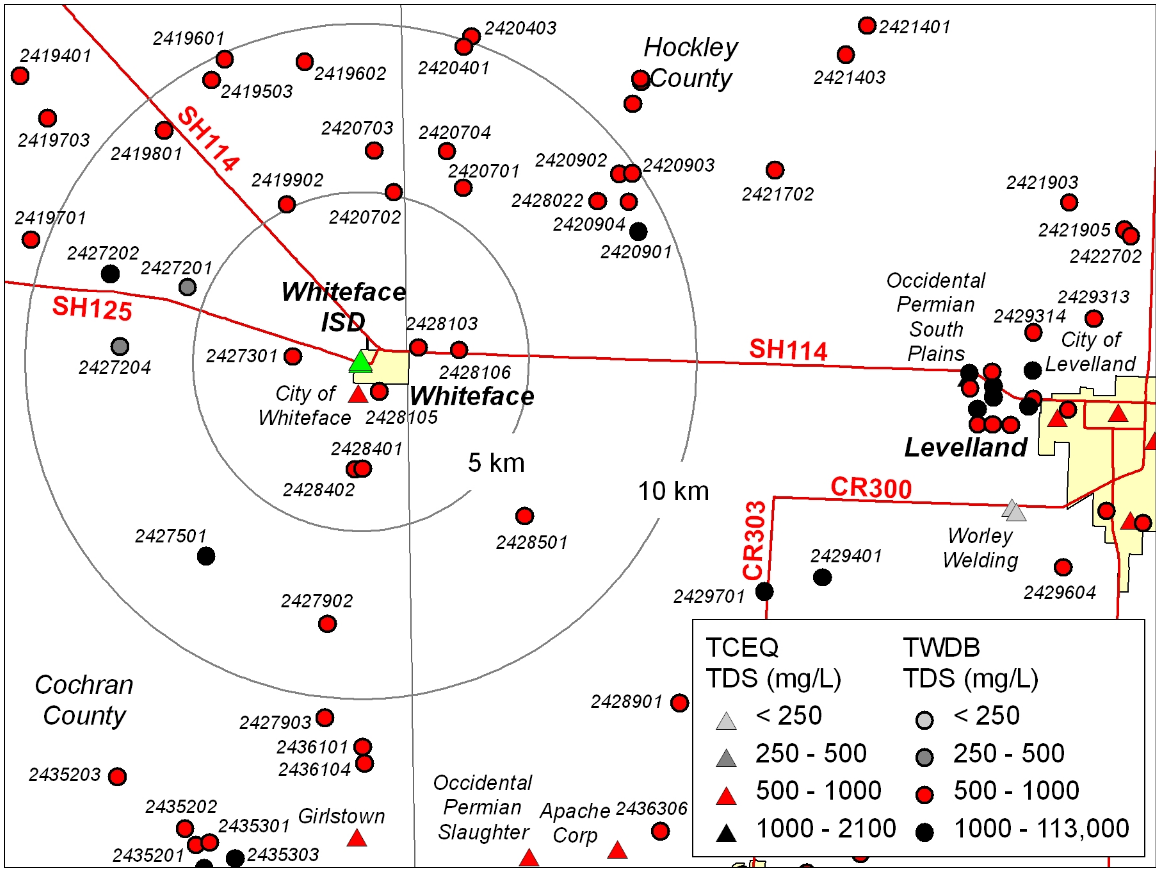


Figure 3.12 Total Dissolved Solids Concentrations in Groundwater Near Whiteface ISD PWS.

Sample data shown represent the most recent sample. Data in the TCEQ PWS database may represent entry point samples that combine water from multiple wells and may also reflect post-treatment concentrations. Samples from the TWDB database represent samples from single wells and represent raw water concentrations.

SECTION 4
ANALYSIS OF THE WHITEFACE ISD PWS

4.1 DESCRIPTION OF EXISTING SYSTEM

4.1.1 Existing System

The Whiteface ISD PWS is shown in Figure 4.1. The Whiteface ISD PWS has one water supply connection and serves a population of 410 students and faculty. The school is located at 2nd and Arthur Streets in Whiteface, Texas and has six buildings, including one cafeteria, two gymnasiums, and approximately 10 showering facilities. The water source for the Whiteface ISD PWS comes from one groundwater well completed in the Ogallala aquifer, Well #1 (G0400020A), to a depth of 214 feet. The well is rated at 200 gallons per minute (gpm) and the total production capacity of the wells is 0.288 million gallons per day (mgd). During March 2008 to March 2009, Whiteface PWS used a total of 212,258 gallons, or approximately 1,100 gallons per day. The PWS has a second well with a capacity of 150 gpm, Well #2 G0400020B, that is used for emergency purposes only. Approximately, 90 percent of the water is used for irrigation. The groundwater has high total dissolved solids content. The TDS concentration is typically 1,000 mg/L, which negatively affects taste. The school district currently uses reverse osmosis units to treat all the water used in the cafeteria and drinking fountains.

The school district was out of compliance for arsenic until the results of their April water analysis were received. The average of the last four water analyses indicates the non-treated potable water has an arsenic concentration below the MCL of 0.010 mg/L. The results are as follows:

Date	Concentration (mg/L)
September 2009	0.0071
November 2009	0.0159
February 2010	0.0067
April 2010	0.0066
Average	0.0091

The two wells pump water through a 0.01 million gallon steel pressure tank to the distribution system. Disinfection with hypochlorite is performed at the Well #1 before water is pumped into the distribution system. Well #1 is located west of the high school and Well #2 is located south of the school maintenance shop. The water system does not contain any elevated or ground storage tanks.

The Whiteface ISD PWS recorded arsenic concentrations of 0.0066 mg/L to 0.0194 mg/L and selenium concentrations of 0.0356 mg/L to 0.0823 mg/L between October 2001 and May 2009, which exceeds the MCL of 0.010 mg/L and 0.050 mg/L, respectively (USEPA 2010a; TCEQ 2008a). Fluoride and TDS have also been detected in concentrations of 2.52 to 3.12 mg/L and 905 mg/L to 1070 mg/L, respectively, between October 2001 and May 2008, exceeding the secondary MCL of 2 mg/L and 500 mg/L, respectively (USEPA 2010a; TCEQ 2008b). Therefore, it is likely the Whiteface ISD PWS would face compliance issues under the water quality standards for these contaminants. The treatment employed for disinfection is not appropriate or effective for removal of arsenic, selenium, and fluoride so optimization is not expected to be effective for increasing removal of these contaminants. However, there is a potential opportunity for system optimization to reduce arsenic, selenium, and fluoride concentrations. The system has more than one well, and since contaminant concentrations can vary significantly between wells, arsenic, selenium, and fluoride concentrations should be determined for each well. If one or more wells happens to produce water with acceptable concentrations, as much production as possible should be shifted to that well. It may also be possible to identify contaminant-producing strata through comparison of well logs or through sampling of water produced by various strata intercepted by the well screen.

Basic system information is as follows:

- Population served: 410
- Connections: 1
- Average daily flow: 0.0011 mgd
- Total production capacity: 0.288 mgd
- Typical arsenic range: 0.00664 to 0.0194 mg/L
- Typical selenium range: 0.0356 to 0.0823 mg/L
- Typical fluoride range: 2.52 to 3.12 mg/L
- Typical nitrate range: 3.35 to 7.73 mg/L
- Typical total dissolved solids range: 905 to 1070 mg/L
- Typical calcium range: 104 mg/L
- Typical sulfate range: 259 to 290 mg/L
- Typical bicarbonate ($CaCO_3$) range: 222 to 713 mg/L
- Typical sodium range: 75.2 mg/L
- Typical iron range: 0.038 to 0.059 mg/L
- Typical magnesium range: 110 mg/L
- Typical manganese range: 0.0024 to 0.008 mg/L

The typical ranges for water quality data listed above are based on a TCEQ database that contains data updated through the beginning of 2010.

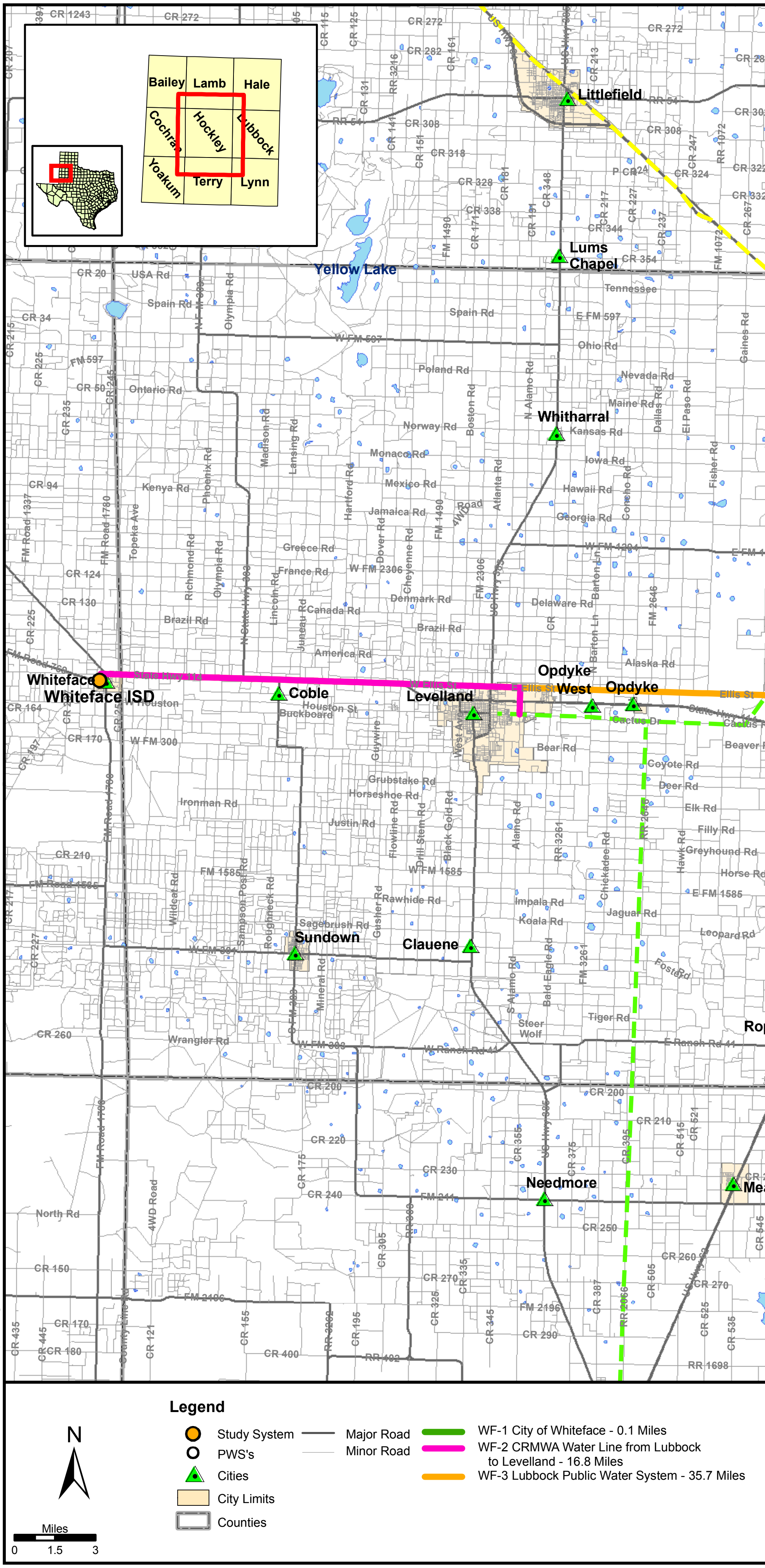


Figure 4.1

WHITEFACE ISD

Pipeline Alternative

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4.1.2 Capacity Assessment for the Whiteface ISD Water System

The project team conducted a capacity assessment of the Whiteface ISD Water system on August 5, 2010. The results of this evaluation are separated into four categories: general assessment of capacity, positive aspects of capacity, capacity deficiencies, and capacity concerns. The general assessment of capacity describes the overall impression of the technical, managerial, and financial capability of the water system. The positive aspects of capacity describe the strengths of the system. These factors can provide the building blocks for the system to improve capacity deficiencies. The capacity deficiencies noted are those aspects that are creating a particular problem for the system related to long-term sustainability. Primarily, these problems are related to the system's ability to meet current or future compliance, ensure proper revenue to pay the expenses of running the system, and to ensure the proper operation of the system. The last category, capacity concerns, includes items that are not causing significant problems for the system at this time. However, the system may want to address them before they become problematic.

- The project team interviewed the following individuals.
- Jimmy Erickson, Business Manager
- Tom Rohmfeld, Facilities Manager and Water Operator

4.1.2.1 General Structure of the Water System

The Whiteface ISD water system, classified as a non-community, non-transient water system, provides water to school buildings serving approximately 410 students from pre-kindergarten through high school and school staff. The water system serving the school buildings has two wells, both located on school property. One of the wells is less than 500 feet from the City of Whiteface community well. The system has a 10,000 gallon pressure tank which is 40 years old and needs to be replaced. TCEQ has approved installing a smaller 6,000 gallon pressure tank, which the school estimates will cost $60,000. There are reverse osmosis systems installed in the cafeteria kitchen, on the ice maker, and on all water fountains. The ISD's water system also provides water for approximately 10 acres of playing fields.

The Facilities Manager has been with the school for 22 years and is a level D licensed water operator. There are two additional facilities/maintenance staff. The school is served by the Whiteface community sewer system. The Whiteface ISD is designated a Chapter 41 school by the Texas Education Agency and receives 75% of their annual funding from the local taxes and 25% from the state. The district's budget is capped at $5,000,000 annually.

The district water system exceeds the standards for arsenic and provides the Public Notification required. The business manager and facilities manager were enthusiastic about receiving help and would be willing to accepting additional assistance. They are eager to receive the report and sharing it with the board.

4.1.2.2 General Assessment of Capacity

Based on the team's assessment, this system has a good level of capacity. There are several positive managerial, financial and technical aspects of the water system, but there are also some areas that need improvement. The deficiencies noted could prevent the water system from being able to meet compliance now or in the future and may also impact the water system's long-term sustainability.

4.1.2.3 Positive Aspects of Capacity

In assessing a system's overall capacity, it is important to look at all aspects – positive and negative. It is important for systems to understand those characteristics that are working well, so those activities can be continued or strengthened. In addition, these positive aspects can assist the system in addressing the capacity deficiencies or concerns. The factors that are particularly important for the Whiteface ISD water system are listed below.

- **Dedicated Staff –** The school superintendent, business manager, and water operator are aware of the non-compliance issue and will take whatever measures are necessary to come into compliance. The board members have also been made aware of the issue. The facilities manager/water operator is on call 24 hours a day and has good knowledge of the water system and current regulations.
- **Emergency Interconnection** – Whiteface ISD water system has an interconnection with the Whiteface community water system for emergency water supply.

4.1.2.4 Capacity Deficiencies

The following capacity deficiencies were noted in conducting the assessment. These deficiencies seriously impact the ability of the water system to meet compliance with current and future regulations and to ensure long-term sustainability.

- **Compliance with Arsenic Standard** – Whiteface ISD water system is now in compliance with the arsenic standard, since their April 2010 laboratory analysis resulted in the rolling 12 month average arsenic concentration to fall below the 0.01 mg/L MCL.

4.1.2.5 Potential Capacity Concerns

The following items were concerns regarding capacity but no specific operational, managerial, or financial problems can be attributed to these items at this time. The system should address the items listed below to further improve technical, managerial, and financial capabilities and to improve the system's long-term sustainability.

- **Funding Limitations –** The districts school's funding amount is set by the Comptroller's Office, which is based on formulas and the number of students attending the school. Expenses for the water and wastewater system are included in the "facilities and maintenance" budget. Emergency expenses for the water system are paid for out of the fund balance and must be repaid. Because the district's funding is capped annually, there is potentially a lack of available funds to ensure the ability of the district to comply with current and future drinking water regulations.

4.2 ALTERNATIVE WATER SOURCE DEVELOPMENT

4.2.1 Identification of Alternative Existing Public Water Supply Sources

Using data drawn from the TCEQ drinking water and TWDB groundwater well databases, the PWSs surrounding the Whiteface ISD PWS were reviewed with regard to their reported drinking water quality and production capacity. PWSs that appeared to have water supplies with water quality issues were ruled out from evaluation as alternative sources, while those without identified water quality issues were investigated further. Small systems were only considered if they were established residential or non residential systems within 5 miles of the Whiteface ISD PWS. Large systems or systems capable of producing greater than four times the daily volume produced by the study system were considered if they were within 35 miles of the study system. A distance of 35 miles was considered to be the upper limit of economic feasibility for constructing a new water line. Table 4.1 is a list of the selected PWSs based on these criteria for large and small PWSs within 35 miles of the Whiteface ISD. If it was determined these PWSs had excess supply capacity and might be willing to sell the excess, or might be a suitable location for a new groundwater well, the system was taken forward for further consideration and identified with "EVALUATE FURTHER" in the comments column of Table 4.1.

Table 4.1 Selected Public Water Systems within 35 Miles of the Whiteface ISD

PWS ID	PWS Name	Distance from Whiteface ISD (miles)	Comments/Other Issues
0400002	CITY OF WHITEFACE	0.59	Small GW system. WQ issues: None. **Evaluate Further**
0400013	MORTON COUNTRY OF MORTON	8.6	Small GW system. WQ issues: Arsenic, Fluoride, Iron, Manganese
0400003	GIRLSTOWN USA	8.78	Small GW system. WQ issues: Sulfate, TDS
1100022	OCCIDENTAL PERMIAN SLAUGHTER GASOLINE PLANT	9.68	Small GW system. WQ issues: Fluoride
1100039	OCCIDENTAL PERMIAN MALLET PLANT	10.32	Small GW system. WQ issues: Fluoride
1100019	OCCIDENTAL PERMIAN LTD SOUTH PLAINS RMT	11.26	Small GW system. WQ issues: Fluoride, Manganese, Sulfate, Total Hardness as CaCO3, TDS
0400001	CITY OF MORTON	11.84	Large GW system. WQ issues: Arsenic, Fluoride, Iron, Sulfate, TDS
1100040	WORLEY WELDING WORKS	12.42	Small GW system. WQ issues: None. Other well options located closer.
1100003	CITY OF SUNDOWN	12.61	Large GW system. WQ issues: TDS
1100002	CITY OF LEVELLAND	13.91	Large GW and purchased water system. WQ issues: Fluoride, Iron, Manganese, TDS, Gross Alpha Particle Activity
1100017	OCCIDENTAL PERMIAN E SLAUGHTER	14.48	Small GW system. WQ issues: Arsenic, Fluoride, Manganese, Sulfate, TDS

PWS ID	PWS Name	Distance from Whiteface ISD (miles)	Comments/Other Issues
1100005	PEP ALTER COOP HWY 303	15.35	Small GW system. WQ issues: None. Other well options located closer.
1970003	CRMWA Pipeline from Lubbock to Levelland	16.8	Large SW/GW system. WQ issues: None. **Evaluate Further**
1100034	WAYNEBOS STORE	18.31	Small GW system. WQ issues: Arsenic, Fluoride, Nitrate (as N)
1100030	CITY OF OPDYKE WEST	18.46	Small GW system. WQ issues: Arsenic, Fluoride, Gross Alpha
1100011	WHITHARRAL WSC	19.97	Small GW system. WQ issues: Fluoride, Nitrate, Nitrate (as N), Sulfate, TDS, Gross Alpha, Gross Alpha Particle Activity
0090011	MAPLE WSC	24.2	Small GW system. WQ issues: Nitrate (as N), Sulfate, TDS
0400012	BLEDSOE WSC	24.4	Small GW system. WQ issues: TDS
1100010	CITY OF SMYER	26.4	Small GW and purchased water system. WQ issues: Fluoride, Sulfate, TDS, Gross Alpha, Gross Alpha Particle Activity
1520002	LUBBOCK PUBLIC WATER SYSTEM	28.69	Large GW, surface water and purchased water system. WQ issues: None. **Evaluate Further**
1400026	ALLSUPS 256	29.53	Small GW system. WQ issues: Nitrate (as N)
1100004	CITY OF ROPESVILLE	29.79	Small GW system. WQ issues: Arsenic, Fluoride
2230002	CITY OF MEADOW	29.86	Small GW system. WQ issues: Arsenic, Fluoride, Nitrate (as N), Sulfate, TDS, Gross Alpha, Gross Alpha Particle Activity
1100001	CITY OF ANTON	30.25	Large GW system. WQ issues: Arsenic, Nitrate (as N), Sulfate, Total Hardness as CaCO3, TDS, Gross Alpha, Gross Alpha Particle Activity
1400006	CITY OF AMHERST	31.23	Small GW system. WQ issues: None. Other well options located closer.
2510002	CITY OF PLAINS	31.82	Large GW system. WQ issues: Arsenic, Fluoride, Sulfate, TDS
1520250	SCOTT MANUFACTURING	34.01	Small GW system. WQ issues: Arsenic, Fluoride, Iron, Manganese, TDS
1520039	PECAN GROVE MOBILE HOME PARK	34.13	Small GW system. WQ issues: Arsenic, Fluoride, Gross Alpha, Combined Uranium, Gross Alpha Particle Activity
1400005	CITY OF SUDAN	34.41	Small GW system. WQ issues: Nitrate (as N)
1520156	ELM GROVE MOBILE HOME PARK	34.5	Small GW system. WQ issues: Arsenic, Manganese, Selenium, Combined Uranium
1400010	SPADE WSC	34.89	Small GW system. WQ issues: Iron

GW – Groundwater
SW – Surface water
WQ – Water quality

After the PWSs in Table 4.1 with water quality problems were eliminated from further consideration, the remaining PWSs were screened by proximity to Whiteface ISD PWS and sufficient total production capacity for selling or sharing water. Based on the initial screening summarized in Table 4.1, three alternatives were selected for further evaluation. These alternatives are summarized in Table 4.2. These alternatives are direct connections to the City of Whiteface, the CRMWA pipeline, and the Lubbock Public Water System. Descriptions of the City of Whiteface, the CRMWA, and Lubbock Public Water System follow Table 4.2.

Table 4.2 Public Water Systems within the Vicinity of the Whiteface ISD PWS Selected for Further Evaluation

PWS ID	PWS Name	Population	Connections	Total Production (mgd)	Avg Daily Usage (mgd)	Approx. Dist. from Whiteface ISD	Comments/Other Issues
0400002	City of Whiteface	544	191	0.662	0.083	0.10	Smaller GW system that does have excess capacity.
1970003	CRMWA Pipeline from Lubbock to Levelland	500,415	186,961	162.53	60.43	16.8	Large SW/GW system that has limited capacity. Option involves connecting to pipeline located between Lubbock and Levelland. Would require CRMWA approval before considering.
1520002	Lubbock Public Water System	218,327	78,719	106.00	31.87	35.7	Large SW/GW system that does have excess capacity. The primary source of water for the City of Lubbock in the northwestern portion of their distribution system is the Bailey County Wellfield.

4.2.1.1 City of Whiteface (0400002)

The City of Whiteface operates three wells with two of the wells located approximately 0.1 miles from Whiteface ISD. The two nearby wells (214 feet and 220 feet) operate full time whereas the third well (260 feet) located near the city limits operates on an as-needed basis. Total production capacity is 0.662 MGD for a population of 544 (191 connections). The average daily consumption is 0.083 mgd. According to available information on this PWS, there are no reported exceedances for constituents of concern above the associated MCLs. The system currently has excess water capacity.

4.2.1.2 Canadian River Municipal Water Authority (1670001)

The Canadian River Municipal Water Authority (CRMWA) was formed over 50 years ago by a group of Panhandle communities to provide drinking water from Lake Meredith. The CRMWA currently has contracts to provide water to 11 member cities in west Texas, including Amarillo, Borger, Brownfield, Lamesa, Levelland, Lubbock, O'Donnell, Pampa, Plainview, Slaton, and Tahoka. A pipeline ranging in size from 8 feet to 1.5 feet is used to convey raw water approximately 160 miles from Lake Meredith and a well field in Roberts County (40 miles northeast of Lake Meredith) to the Lubbock water treatment plant. Along the pipeline route, four cities (Amarillo, Borger, Pampa, and Plainview) receive their allocated water supply and each of these four cities treats their own water. The rest of the untreated water for the other seven member cities goes to the City of Lubbock water treatment plant. The treated water is pumped into the City of Lubbock distribution system and to the other six member cities. The raw water line flows by gravity from Amarillo to the Lubbock treatment plant. The treated water leaving the City of Lubbock water treatment plant flows by gravity in the east leg pipeline to Lamesa; however, the water in the west leg to Levelland and Brownfield is pumped.

The current volume of water delivered annually by the CRMWA to the member cities is 85,000 acre-feet (35,000 acre-feet from Lake Meredith and 50,000 acre-feet from the well field in Roberts County). The available water volume is set by the CRMWA and may fluctuate during the year, but the volume is based on water levels in the well field and in the lake. The provision for each member city is based on a contracted percentage of the available acre-feet. The City of Lubbock is under contract to receive 41.6 mgd from the CRMWA, and the City of Lubbock water treatment plant treats an additional 5.4 mgd for the other six member cities receiving treated water from the City of Lubbock water treatment plant. When the CRMWA program was established in the 1960s, the system was designed to accommodate the 11 member cities at the time and there were no plans to add additional member cities.

If a member city has excess water, that particular city can decide through its city council how much water it would like to allocate to a non-member PWS. If the non-member city is to receive water directly from a member city's distribution system, then the CRMWA would not be involved. However, if a non-member is requesting to receive the water (essentially a portion of a member city's allocation) via a direct line from the CRMWA line, then the non-member city must get approval from the CRMWA and the 11 member cities for distribution of water to the non-member PWS. The non-member PWS would be responsible for financing the installation of the pipeline to the CRMWA treated water line from Lubbock. The CRMWA would be involved throughout the process of a non-member PWS applying for, securing access to, and eventually receiving water through the CRMWA system.

4.2.1.3 City of Lubbock Water System (1520002)

The City of Lubbock PWS produces an average of 38 to 40 mgd for the City of Lubbock and five surrounding small municipalities with a total production capacity of 156 mgd. The service pump capacity can meet a peak demand of over 291 mgd. In addition to treating water for the City of Lubbock distribution system, the Lubbock water treatment plant treats about 6 mgd on average for the six CRMWA member cities receiving treated water from the City of Lubbock.

The City of Lubbock receives water from two sources, the CRMWA and the Bailey County well field. Additional details on the CRMWA are provided in a separate description. As a member of the 11-City agreement with the CRMWA, the City of Lubbock is responsible for receiving raw water from the Lake Meredith/Roberts County well field located 160 miles north of Lubbock and treating the water.

A CRMWA aqueduct distributes the treated water to six other PWSs: Levelland, Brownfield, Slaton, Tahoka, O'Donnell, and Lamesa. The majority of City of Lubbock water supply comes from the CRMWA with the secondary supply being the Bailey County well field located 60 miles northwest of Lubbock. The city has water rights to 82,000 surface acres at the Bailey County well field. The water received from Bailey County is treated at the central station in Bailey County before it enters the pipeline leading to Lubbock. As the water reaches Lubbock, it enters directly into the distribution system predominantly in the northwest section of Lubbock. It should be noted that the City of Lubbock normally utilizes its total annual water allocation from CRMWA. If Lubbock needs additional water, its supply is supplemented with water from the Bailey County well field. The well field consists of 150 wells capable of producing 50 mgd total (pipeline is limited to 40 mgd). In 2006, the City of Lubbock pumped an average of 9.3 mgd from the Bailey County well field. However, most of this water was pumped during the summer months. At peak flows, the pipeline is at near capacity.

In addition to the population of Lubbock, five cities are connected to the City of Lubbock distribution system. Shallowater and Reese Redevelopment Authority, located northwest and west of Lubbock, have had contracts with the city for more than 30 years to receive water predominantly originating in Bailey County. The contract allows up to the equivalent of 5 percent of what the city consumes each year. After determining that city wastewater disposal practices had contaminated Buffalo Springs and Ransom Canyon groundwater supplies, the City of Lubbock dedicated another half billion gallons of water per year to each of those communities. Buffalo Springs and Ransom Canyon are located east of Lubbock and receive water mostly originating from Lake Meredith and the Roberts County well field. A fifth city, Littlefield, located northwest of the city has a water line connected to the Bailey County pipeline for an emergency supply of water over a 72-hour period. Additionally, Lubbock-Cooper Independent School District can buy up to 18.3 million gallons a year. The decision to add these five cities to the City of Lubbock water supply was a decision made by the Lubbock City Council.

The City of Lubbock is constructing a new reservoir that will be part of the new water supply system water supply system from Lake Alan Henry located 65 miles southeast of Lubbock. The amount of water available from this system will be staged into the existing Lubbock system over several years to match Lubbock's needs. The system is estimated to be operating in 2012.

4.2.2 Potential for New Groundwater Sources

4.2.2.1 Installing New Compliant Wells

Developing new wells or well fields is recommended, provided good quality groundwater available in sufficient quantity can be identified. Since a number of water systems in the area have water quality problems, it should be possible to share in the cost and effort of identifying compliant groundwater and constructing well fields.

Installation of a new well in the vicinity of the system intake point is likely to be an attractive option provided compliant groundwater can be found, since the PWS is already familiar with operation of a water well. As a result, existing nearby wells with good water quality should be investigated. Re-sampling and test pumping would be required to verify and determine the quality and quantity of water at those wells.

The use of existing wells should probably be limited to use as indicators of groundwater quality and availability. If a new groundwater source is to be developed, it is recommended that a new well or wells be installed instead of using existing wells. This would ensure well characteristics are known and meet standards for drinking water wells.

Some of the alternatives suggest new wells be drilled in areas where existing wells have acceptable water quality. In developing the cost estimates, Parsons assumed the aquifer in these areas would produce the required amount of water with only one well. Site investigations and geological research, which are beyond the scope of this study, could indicate whether the aquifer at a particular site and depth would provide the amount of water needed or if more than one well would need to be drilled in separate areas.

4.2.2.2 Results of Groundwater Availability Modeling

Regional groundwater withdrawal in the Texas High Plains region is extensive and likely to remain near current levels over the next decades. In Cochran County, where the PWS is located, groundwater is available mostly from the relatively shallow Ogallala aquifer and, to a lesser extent, the underlying Edwards-Trinity (High Plains) aquifer. The Ogallala provides drinking water to most of the communities in the Texas panhandle, as well as irrigation water. The Edwards-Trinity (High Plains) is a lower yield aquifer used almost exclusively as an irrigation and industrial water source.

Two supply wells for the Whiteface ISD PWS withdraw water are completed in the southern Ogallala aquifer. A search of registered wells was conducted using TCEQ's Public Water Supply database to assess groundwater sources utilized within a 10-mile radius of the PWS. The search indicated that nearly all registered wells in operation within the search area are utilized for public supply and domestic use, having the Ogallala aquifer as groundwater source. Within a 10-mile radius of the system, only a few active irrigation and industrial supply wells are completed in the Edwards-Trinity (High Plains) aquifer.

Groundwater Supply

The Ogallala is the largest aquifer in the United States. The aquifer outcrop underlies eastern New Mexico and much of the Texas High Plains region, extending eastward over most of Andrews County. The Ogallala provides significantly more water for users than any other aquifer in the state. The aquifer saturated thickness ranges up to an approximate depth of 600 feet. Supply wells have an average yield of approximately 500 gal/min, but higher yields, up to 2,000 gal/min, are found in previously eroded drainage channels filled with coarse-grained sediments (TWDB 2007).

Water level declines in excess of 300 feet have occurred in several aquifer areas over the last decades. The 2007 Texas Water Plan anticipated that, over a 50-year planning period, the water supply would have more than a 40 percent depletion, from 5,968,260 AFY projected for 2010, to 3,534,124 AFY by the year 2060. Nearly 95 percent of the groundwater pumped from the Ogallala Aquifer is used for irrigated agriculture.

Groundwater Availability

Regional groundwater withdrawal in the Texas High Plains region is extensive and likely to remain near current levels for several decades. Regional data reported in the 2007 State Water Plan indicated that in Cochran County, water needs over a 50-year planning period would nearly double, from 39,909 AFY in 2010 to 73,140 AFY by the year 2060. The increase water demand would be associated almost entirely with irrigation water use, with a projected increase of domestic and municipal use of only 496 AFY over the same planning period.

A groundwater availability model (GAM) for the Ogallala aquifer was developed by the TWDB (Blandford, et al. 2003). Modeling was performed to develop long-term groundwater projections based on historical water use and aquifer conditions. Predictive simulations using the GAM model indicated that, if estimated future withdrawals are realized, aquifer water levels could decline to a point at which significant regions currently practicing irrigated agriculture could be essentially dewatered by 2050 (Blandford et al., 2003). The 2007 State Water Plan, however, indicates that the rate of decline has slowed relative to previous decades, and water levels have risen in a few areas.

The GAM model predicted that the most critical depletions in the southern Ogallala Aquifer would be take place in Cochran County, as well as Hockley, Lubbock, Yoakum, Terry, and Gaines Counties, where the simulated drawdown in the year 2050 would exceed 100 feet (Blandford et al., 2003). The Ogallala Aquifer GAM was not run for the PWS system as water use by the system would represent only a minor addition to regional withdrawal conditions, making potential changes in aquifer levels beyond the spatial resolution of the regional GAM model

4.2.3 Potential for New Surface Water Sources

The Whiteface ISD PWS is located in the northwest margin of the Brazos River Basin, in close proximity to the Colorado River Basin. There is a low potential for development of new surface water sources for PWS system as indicated by limited water availability within the upper reach of the Brazos River Basin. The 2007 Texas State Water Plan estimated that the average yield over the entire basin is 3.2 inches per year, with water rights assigned primarily to municipal and industrial uses (49 and 31 percent, respectively). In the upper basin, a significant increase demand for surface water use is anticipated due to the decline in groundwater supply from the Ogallala Aquifer. Despite the increasing demand, the 2007 State Water Plan anticipates a steadily increase of basin water supply (1,595,000 AFY in the year 2010) over the next 50 years, as several proposed long-term management strategies are implemented along the Brazos River Basin.

The TWDB developed a surface water availability model for the Brazos River Basin as a tool to determine, at a regional level, the maximum amount of water available during the drought of record over the simulation period. For the Whiteface ISD PWS vicinity, simulation data indicate that there is a low availability of surface water for new uses. Surface water availability maps were developed by TCEQ for the Brazos River Basin, illustrating percent of months of flow per year. Availability maps indicate that in the site vicinity, and over all of Cochran County, unappropriated flows for new applications are typically available between 25 and 50 percent of the time. This availability is inadequate for development of new municipal water supplies as a 100 percent year-round availability is required by TCEQ for new surface water source permit applications. Very limited water availability has also been projected by the TCEQ for the nearby Colorado River Basin that extends over most of west and central Cochran County.

4.2.4 Options for Detailed Consideration

The initial review of alternative sources of water results in the following options for more-detailed consideration:

1. City of Whiteface. Compliant groundwater would be purchased from the City of Whiteface to be used by the Whiteface ISD. A pipeline would be constructed to convey water from the City of Whiteface to the Whiteface ISD (Alternative WF-1).

2. CRMWA Water Line from Lubbock to Levelland. A pipeline would be constructed from the CRMWA main pipeline that conveys treated water from the Lubbock treatment plant to the City of Levelland to Whiteface ISD (Alternative WF -2).

3. Lubbock Public Water System. Treated water would be purchased from the City of Lubbock to be used by the Whiteface ISD. A pipeline would be constructed to convey water from the City of Lubbock's Bailey County well field pipeline to the Whiteface ISD (Alternative WF-3).

4. New Wells at 10, 5, and 1 mile. Installing a new well within 10, 5, or 1 mile of the Whiteface ISD PWS may produce compliant water in place of the water produced by the existing active well. A pipeline and pump station would be constructed to transfer the water to the Whiteface ISD PWS (Alternatives WF-4, WF-5, and WF-6).

4.3 ALTERNATIVE DEVELOPMENT AND ANALYSIS

A number of potential alternatives for compliance with the MCL for arsenic and selenium have been identified. Each of the potential alternatives is described in the following subsections. It should be noted that the cost information given is the capital cost and change in O&M costs associated with implementing the particular alternative. Appendix C contains cost estimates for the compliance alternatives. These compliance alternatives represent a range of possibilities, and a number of them are likely not feasible. However, all have been presented to provide a complete picture of the range of alternatives considered. It is anticipated that a PWS will be able to use the information contained herein to select the most attractive alternative(s) for more detailed evaluation and possible subsequent implementation.

4.3.1 Alternative WF-1: Purchase Compliant Groundwater from City of Whiteface

This alternative involves purchasing potable water from the City of Whiteface, which will be used to supply the Whiteface ISD PWS. The City of Whiteface currently has sufficient excess capacity for this alternative to be feasible, although any agreement to supply water would have to be negotiated and approved by the City Council. For purposes of this report, in order to allow direct and straightforward comparison with other alternatives, this alternative assumes that water would be purchased from the City. Also, it is assumed that Whiteface ISD would obtain all its water from the City of Whiteface.

This alternative would require construction of a 5,000 gallon feed tank at a point adjacent to a City of Whiteface water main and a new pipeline from the feed tank to a new 5,000-gallon storage tank for Whiteface ISD PWS. The required pipeline would be 4-inches in diameter, approximately 0.1 miles long, and follow W. 2nd Street eastward to the corner of N. Tyler Street and tap into the existing City of Whiteface distribution system. A pump station would also be required to pump water into the Whiteface ISD distribution system.

The pump station would include two pumps, including one standby, and would be housed in a building. It is assumed the pumps and piping would be installed with capacity to meet all water demand for the Whiteface ISD PWS, since the incremental cost would be relatively small, and it would provide operational flexibility.

By definition this alternative involves regionalization, since Whiteface ISD would be obtaining drinking water from an existing larger supplier.

The estimated O&M cost for this alternative includes the purchase price for the treated water minus the cost related to current operation of the Whiteface ISD PWS's wells. Additionally, the maintenance costs for the pipeline, pump station, electric power, and O&M are included in the cost estimate. The estimated capital cost for this alternative is $237,400 million, with an estimated annual O&M cost of $37,300. If the purchased water was used for blending rather than for the full water supply, the annual O&M cost for this alternative could be reduced because of reduced pumping costs and reduced water purchase costs. However, additional costs would be incurred for equipment to ensure proper blending, and additional monitoring to ensure the finished water is compliant.

The reliability of adequate amounts of compliant water under this alternative should be good. From the perspective of the Whiteface ISD PWS, this alternative would be characterized as easy to operate and repair, since O&M and repair of pipelines and pumps are well understood. If the decision were made to perform blending then the operational complexity would increase.

The feasibility of this alternative is dependent on an agreement being reached with the City of Whiteface to purchase treated drinking water.

4.3.2 Alternative WF-2: Purchase Treated Water from the CRMWA via the Water Line from Lubbock to Levelland

This alternative involves purchasing potable water from the CRMWA, which would be used to supply the Whiteface ISD PWS. As previously stated, Whiteface ISD must get approval from the CRMWA and 11 member cities to construct a direct water line from the CRMWA main distribution line to the city's water supply. For purposes of this report, in order to allow direct and straightforward comparison with other alternatives, this alternative assumes that water would be purchased from the CRMWA. Also, it is assumed that Whiteface ISD would obtain all its water from the CRMWA.

This alternative would require construction of a 5,000-gallon feed tank at a point adjacent to CRMWA's main distribution line, and a pipeline from the feed tank to a new 5,000-gallon storage tank for Whiteface ISD PWS. A pump station would also be required to overcome pipe friction and the elevation differences between the feed tank and Whiteface ISD. The required pipeline would be 4 inches in diameter and would follow north from the intersection of Alamo Road and Cactus Drive, then turn left on Ellis Street (Ellis eventually becomes Texas 114) continuing to Pierce Street, then turn left on Pierce Street and right on W. 4th Street to Arthur Street, then turn right on Arthur St. continuing on to W. 2nd Street to the Whiteface ISD. Using this route, the length of pipe required would be approximately 16.8 miles.

The pump station would include two pumps, including one standby, and would be housed in a building. It is assumed the pumps and piping would be installed with capacity to meet all water demand for the Whiteface ISD PWS, since the incremental cost would be relatively small, and it would provide operational flexibility.

By definition this alternative involves regionalization, since Whiteface ISD would be obtaining drinking water from an existing larger supplier.

The estimated O&M cost for this alternative includes the purchase price for the treated water minus the cost related to current operation of the Whiteface ISD PWS's wells. Additionally, the maintenance costs for the pipeline, pump station, electric power, and O&M are included in the cost estimate. The estimated capital cost for this alternative is $2.93 million, with an estimated annual O&M cost of $42,100. If the purchased water was used for blending rather than for the full water supply, the annual O&M cost for this alternative could be reduced because of reduced pumping costs and reduced water purchase costs. However, additional costs would be incurred for equipment to ensure proper blending, and additional monitoring to ensure the finished water is compliant.

The reliability of adequate amounts of compliant water under this alternative should be good. The CRMWA has adequate O&M resources. From the perspective of the Whiteface ISD PWS, this alternative would be characterized as easy to operate and repair, since O&M and repair of pipelines and pump stations is well understood, and Whiteface ISD personnel currently operate pipelines and pump stations. If the decision were made to perform blending then the operational complexity would increase.

The feasibility of this alternative is dependent on an agreement being reached between Whiteface ISD, the CRMWA, and 11 member cities to purchase compliant drinking water

4.3.3 Alternative WF-3: Purchase Treated Water from the City of Lubbock

This alternative involves purchasing potable water from the City of Lubbock, which will be used to supply the Whiteface ISD PWS. The City of Lubbock currently has sufficient excess capacity for this alternative to be feasible, although current City policy only allows drinking water to be provided to areas annexed by the City. For purposes of this report, in order to allow direct and straightforward comparison with other alternatives, this alternative assumes that water would be purchased from the City. Also, it is assumed that Whiteface ISD would obtain all its water from the City of Lubbock.

This alternative would require construction of a pump station and a 5,000-gallon feed tank at a point adjacent to the City of Lubbock's water main, and a pipeline from the feed tank to a new 5,000-gallon storage tank for Whiteface ISD PWS. Due to water pressure limits on the pipe, an additional pump station and 5,000-gallon feed tank would be required along the pipeline. The required pipeline would be 4-inches in diameter, approximately 35.7 miles long. The pipeline would follow north on Arthur St, then east on W. 4th St., then north on Pierce St. and east on Texas 114, then continue east on W. Ellis and E. Ellis Streets, crossing FM 2130, then south on Leon to Texas 114 (also known as Levelland Hwy and Texas 114), turn east and cross CR 1000 and CR 1300 and tap into the existing City of Lubbock distribution system.

Each pump station would include two pumps, including one standby, and would be housed in a building. It is assumed the pumps and piping would be installed with capacity to meet all water demand for the Whiteface ISD PWS, since the incremental cost would be relatively small, and it would provide operational flexibility.

By definition this alternative involves regionalization, since Whiteface ISD would be obtaining drinking water from an existing larger supplier.

The estimated O&M cost for this alternative includes the purchase price for the treated water minus the cost related to current operation of the Whiteface ISD's wells. Additionally, the maintenance cost for the pipeline, two pump stations, electric power, and O&M are included in the cost estimate. The estimated capital cost for this alternative is $5.57 million, with an estimated annual O&M cost of $73,100. If the purchased water was used for blending rather than for the full water supply, the annual O&M cost for this alternative could be reduced because of reduced pumping costs and reduced water purchase costs. However, additional costs would be incurred for equipment to ensure proper blending, and additional monitoring to ensure the finished water is compliant.

The reliability of adequate amounts of compliant water under this alternative should be good. The City of Lubbock provides treated surface water on a large scale, facilitating adequate O&M resources. From the perspective of the Whiteface ISD PWS, this alternative would be characterized as easy to operate and repair, since O&M and repair of pipelines and pumps are well understood. If the decision were made to perform blending then the operational complexity would increase.

The feasibility of this alternative is dependent on an agreement being reached with the City of Lubbock to purchase treated drinking water.

4.3.4 Alternative WF-4: New Well at 10 Miles

This alternative consists of installing one new well within 10 miles of the Whiteface ISD that would produce compliant water in place of the water produced by the existing well. At this level of study, it is not possible to positively identify an existing well or the location where a new well could be installed.

This alternative would require constructing one new 220-foot well, a new pump station with a 5,000-gallon feed tank at the new well, and a pipeline from the new well/feed tank to a new 5,000-gallon storage tank with two service pumps installed within a pump house near the existing intake point for the Whiteface ISD system. The pump station and feed tank would be necessary to overcome pipe friction and changes in land elevation. For this alternative, the pipeline is assumed to be approximately 10 miles long, and would be a 4-inches in diameter and discharge to the new 5,000-gallon storage tank at the Whiteface ISD. The pump station would include a feed tank, two transfer pumps, including one standby, and would be housed in a building. The new storage tank would include two service pumps, including one standby, and would be housed in a building.

Depending on well location and capacity, this alternative could present some options for a more regional solution. It may be possible to share water and costs with another nearby system.

The estimated capital cost for this alternative includes installing the well, constructing the pipeline, the pump station, the storage and feed tank, and pump house. The estimated O&M cost for this alternative includes O&M for the pipeline and pump station. The estimated capital cost for this alternative is $1.79 million, and the estimated annual O&M cost for this alternative is $52,000.

The reliability of adequate amounts of compliant water under this alternative should be good, since water wells, pump stations and pipelines are commonly employed. From the perspective of the Whiteface ISD PWS, this alternative would be similar to operate as the existing system. Whiteface ISD personnel have experience with O&M of wells, pipelines, and pump stations.

The feasibility of this alternative is dependent on the ability to find an adequate existing well or success in installing a well that produces an adequate supply of compliant water. It is likely that an alternate groundwater source would not be found on land owned by Whiteface ISD, so landowner cooperation would likely be required.

4.3.5 Alternative WF-5: New Well at 5 miles

This alternative consists of installing one new well within 5 miles of the Whiteface ISD that would produce compliant water in place of the water produced by the existing wells. At this level of study, it is not possible to positively identify an existing well or the location where new a well could be installed.

This alternative would require constructing one new 220-foot well, a new pump station with a 5,000-gallon feed tank at the new well, and a pipeline from the new well/feed tank to a new 5,000-gallon storage tank with two service pumps installed within a pump house near the existing intake point for the Whiteface ISD system. The pump station and feed tank would be necessary to overcome pipe friction and changes in land elevation. For this alternative, the pipeline is assumed to be 4-inches in diameter, approximately 5 miles long, and would discharge to a new 5,000-gallon storage tank at the Whiteface ISD PWS. The pump station would include two transfer pumps, including one standby, and would be housed in a building. The new storage tank would include two service pumps, including one standby, and would be housed in a building.

Depending on well location and capacity, this alternative could present some options for a more regional solution. It may be possible to share water and costs with another nearby system.

The estimated capital cost for this alternative includes installing the well, constructing the pipeline, the pump station, the storage and feed tank, and pump house. The estimated O&M cost for this alternative includes O&M for the pipeline and pump station. The estimated capital cost for this alternative is $1.03 million, and the estimated annual O&M cost for this alternative is $50,600.

The reliability of adequate amounts of compliant water under this alternative should be good, since water wells, pump stations and pipelines are commonly employed. From the perspective of the Whiteface ISD PWS, this alternative would be similar to operate as the existing system. Whiteface ISD personnel have experience with O&M of wells, pipelines and pump stations.

The feasibility of this alternative is dependent on the ability to find an adequate existing well or success in installing a well that produces an adequate supply of compliant water. It is likely an alternate groundwater source would not be found on land owned by Whiteface ISD, so landowner cooperation would likely be required.

4.3.6 Alternative WF-6: New Well at 1 mile

This alternative consists of installing one new well within 1 mile of the Whiteface ISD PWS that would produce compliant water in place of the water produced by the existing well. At this level of study, it is not possible to positively identify an existing well or the location where a new well could be installed.

This alternative would require constructing one new 220-foot well and a pipeline from the new well to a new 5,000-gallon storage tank with two service pumps installed within a pump house at the existing intake point for the Whiteface ISD system. Since the new well is relatively close, a pump station would not be necessary. For this alternative, the pipeline is assumed to be 4 inches in diameter, approximately 1 mile long, and would discharge to a new 5,000-gallon storage tank at the Whiteface ISD PWS. The new storage tank would include two service pumps, including one standby, and would be housed in a building.

Depending on well location and capacity, this alternative could present some options for a more regional solution. It may be possible to share water and costs with another nearby system.

The estimated capital cost for this alternative includes installing the well, storage tank, and constructing the pipeline. The estimated O&M cost for this alternative includes O&M for the pipeline. The estimated capital cost for this alternative is $319,300, and the estimated annual O&M cost for this alternative is $24,300.

The reliability of adequate amounts of compliant water under this alternative should be good, since water wells and pipelines are commonly employed. From the perspective of the Whiteface ISD PWS, this alternative would be similar to operate as the existing system. Whiteface ISD personnel have experience with O&M of wells, pipelines and pump stations.

The feasibility of this alternative is dependent on the ability to find an adequate existing well or success in installing a well that produces an adequate supply of compliant water. It is possible an alternate groundwater source would not be found on land owned by Whiteface ISD, so landowner cooperation may be required.

4.4 Summary of Alternatives

Table 4.3 provides a summary of the key features of each alternative for Whiteface ISD PWS.

Table 4.3 Summary of Compliance Alternatives for Whiteface ISD PWS

Alt No.	Alternative Description	Major Components	Capital Cost[1]	Annual O&M Cost	Total Annualized Cost	Reliability	System Impact	Remarks
WF-1	Purchase Water from City of Whiteface	- Storage tank - Pump station/feed tank - 0.1-mile pipeline	$237,400	$37,300	$58,000	Good	N	Agreement must be successfully negotiated with City of Whiteface. Blending may be possible. Costs could possibly be shared with small systems along pipeline route.
WF-2	Purchase Water from CRMWA	- Storage tank - Pump station/feed tank - 16.8-mile pipeline	$2,930,000	$42,100	$297,600	Good	N	Agreement must be successfully negotiated with the CRMWA. Blending may be possible. Costs could possibly be shared with small systems along pipeline route.
WF-3	Purchase Water from City of Lubbock	- Storage tank - 2 Pump stations/feed tank - 35.7-mile pipeline	$5,568,300	$73,100	$558,600	Good	N	Agreement must be successfully negotiated with City of Lubbock. Blending may be possible. Costs could possibly be shared with small systems along pipeline route.
WF-4	Install new compliant well within 10 miles	- New well - Storage tank - Pump station/feed tank - 10-mile pipeline	$1,787,800	$52,000	$207,900	Good	N	May be difficult to find well with good water quality. Costs could possibly be shared with small systems along pipeline route.
WF-5	Install new compliant well within 5 miles	- New well - Storage tank - Pump station/feed tank - 5-mile pipeline	$1,030,500	$50,600	$140,400	Good	N	May be difficult to find well with good water quality. Costs could possibly be shared with small systems along pipeline route.
WF-6	Install new compliant well within 1 mile	- New well - Storage tank - 1-mile pipeline	$319,300	$24,300	$52,200	Good	N	May be difficult to find well with good water quality.

Notes: *N – No significant increase required in technical or management capability*
T – Implementation of alternative will require increase in technical capability
M – Implementation of alternative will require increase in management capability
1 – See cost breakdown in Appendix C
2 – 20-year return period and 6 percent interest

4.5 COST OF SERVICE AND FUNDING ANALYSIS

Since the Whiteface ISD is a public school there are no revenues from the sale of water. Information available to complete the financial analysis included estimated expenses for the PWS from Whiteface ISD personnel, water production capacity data for the Whiteface ISD PWS from the TCEQ website.

This analysis will need to be performed in a more detailed fashion and applied to alternatives deemed attractive and worthy of more detailed evaluation. A more detailed analysis should include additional factors such as:

- Cost escalation,
- Price elasticity effects where increased rates may result in lower water consumption,
- Costs for other system upgrades and rehabilitation needed to maintain compliant operation.

4.5.1 Financial Plan Development

Since financial records for the Whiteface ISD PWS were not available and no revenues are generated from the sale of water, the following assumptions were made to derive estimates for input into the financial planning model. These assumptions were:

1) Water system expenses are $5,000
2) 2009 revenues equal 2009 expenses for operation of the water system.
3) The existing potable water system is paid for and has been fully depreciated
4) A nominal fee per student/teacher for water use was assigned in order to simulate a revenue stream.
5) An average consumption of 0.0011 mgd is held constant across the year to account for irrigation, housekeeping, school events, and other water needs throughout the year.

The Whiteface ISD has a population of 410. While students/teachers do not pay for the water they consume, an annual base rate was established which accounts for $5,000 of the water system revenues. This arbitrary value results in theoretical revenue equal to the $5,000 in operating expenses. These values were used in the financial planning model.

While these assumptions are arbitrary, they help to frame costs of the water system operation and allow impacts of the incremental costs of the various alternatives to be evaluated.

4.5.2 Current Financial Condition

4.5.2.1 Cash Flow Needs

Cash flow needs could not be evaluated for the Whiteface ISD PWS because the system provides water to the school campus without cost. The school budget covers the operation of the water system. However, since it was assumed that theoretical water revenues are equal to the operating expenses, any capital improvements to the water system would require additional funding.

4.5.2.2 Ratio Analysis

Current Ratio

The Current Ratio for the Whiteface ISD PWS could not be determined due to lack of necessary financial data to determine this ratio.

Debt to Net Worth Ratio

A Debt-to-Net-Worth Ratio also could not be determined owing to lack of the necessary financial data to determine this ratio.

Operating Ratio

Because of the lack of complete separate financial data specifically related to the Whiteface ISD PWS, the Operating Ratio could not be accurately determined.

4.5.3 Financial Plan Results

Each of the compliance alternatives for the Whiteface ISD PWS was evaluated using the financial model to determine the overall increase in water rates that would be necessary to pay for the improvements. Each alternative was examined under the various funding options described in Section 2.4.

Results of the financial impact analysis are provided in Table 4.4 and Figure 4.2. Table 4.4 and Figure 4.2 present rate impacts assuming that revenues match expenses, without funding reserve accounts, and that operations and implementation of compliance alternatives are funded with revenue and are not paid for from reserve accounts. Figure 4.2 provides a bar chart that, in terms of the yearly billing to an average customer, shows the following:

- Current annual average bill,
- Projected annual average bill including rate increase, if needed, to match existing expenditures, and
- Projected annual bill including rate increases needed to fund implementation of a compliance alternative (this does not include funding for reserve accounts).

The two bars shown for each compliance alternative represent the rate changes necessary for revenues to match total expenditures assuming 100 percent grant funding and 100 percent loan/bond funding. Most funding options will fall between 100 percent grant and 100 percent loan/bond funding, with the exception of 100 percent revenue financing. Establishing or increasing reserve accounts would require an increase in rates. If existing reserves are insufficient to fund a compliance alternative, rates would need to be raised before implementing the compliance alternative. This would allow for accumulation of sufficient reserves to avoid larger but temporary rate increases during the years the compliance alternative was being implemented.

4.5.4 Evaluation of Potential Funding Options

There are a variety of funding programs available to entities as described in Section 2.4. Whiteface ISD PWS is most likely to obtain funding from programs administered by the TWDB, TDRA, and Rural Development. This report contains information that would be used for an application for funding. Information such as financial analyses, water supply assessment, and records demonstrating health concerns, failing infrastructure, and financial need, may be required by these agencies. This section describes the candidate funding agencies and their appropriate programs as well as information and steps needed to begin the application process.

This report should serve to document the existing water quality issues, infrastructure need and costs, and water system information needed to begin the application process. Although this report is at the conceptual level, it demonstrates that significant funding will be needed to meet Safe Drinking Water Standards. The information provided in this report may serve as the needed documentation to justify a project that may only be possible with significant financial assistance.

4.5.4.1 TWDB Funding Options

TWDB programs include the Drinking Water State Revolving Fund (DWSRF), Rural Water Assistance Fund (RWAF), State Loan Program (Development Fund II), and Economically Distressed Areas Program (EDAP). Additional information on these programs can be found online at the TWDB website under the Assistance tab, Financial Assistance section, under the Public Works Infrastructure Construction subsection.

Drinking Water State Revolving Fund

The DWSRF offers net long-term interest lending rates below the rate the borrower would receive on the open market for a period no longer than 20 years. A cost-recovery loan origination charge is imposed to cover the administrative costs of operating the DWSRF, but an additional interest rate subsidy is offered to offset the charge. The terms of the loan typically require a revenue or tax pledge. The DWSRF program can provide funds from State sources or Federal capitalization grants. State loans provide a net long-term interest rate of 0.7 percentage points below the rate the borrower would receive on the open market at the time of loan closing and Federal Capitalization Grants provide a lower net long-term interest rate of 1.2 percentage points. "Disadvantaged communities" may obtain loans at even greater subsidies and up to a 30-year loan term.

The loan application process has several steps: pre-application, application and commitment, loan closing, funding and construction monitoring, and any other special requirements. In the pre-application phase, prospective loan applicants are asked to submit a brief DWSRF Information Form to the TWDB that describes the applicant's existing water facilities, additional facility needs and the nature of projects being considered for meeting those needs, project cost estimates, and "disadvantaged community" status. The TCEQ assigns a priority rating that includes an applicant's readiness to proceed. TWDB staff notifies prospective applicants of their priority rating and encourage them to schedule a pre-planning conference for guidance in preparing the engineering, planning, environmental, financial, and water conservation portions of the DWSRF application.

State Loan Program (Development Fund II)

The State Loan Program is a diverse lending program directly from state funding sources. As it does not receive federal subsidies, it is more streamlined. The loans can incorporate more than one project under the umbrella of one loan. Political subdivision of the state are eligible for tax exempt rates. Projects can include purchase of water rights, treatment plants, storage and pumping facilities, transmission lines, well development, and acquisitions.

The loan requires that the applicant pledge revenue or taxes. The maximum financing life is 50 years. The average financing period is 20 to 23 years. The interest rate is set in accordance with the TWDB rules in 31 TAC 363.33(a). The TWDB seeks to provide reasonable rates with minimal risk to the state. The TWDB post rates for comparison for applicants and in August 2010, the TWDB showed their rates for a 22-year, taxable loan at 7.07 percent where the market was at 8.47 percent.

The TWDB staff can discuss the terms of the loan and assist applicants during preparation of the application, and a preapplication conference is encouraged. The application materials must include an engineering feasibility report, environmental information, rates and customer base, operating budgets, financial statements, and project information. The board considers applications monthly.

Economically Distressed Areas Program

The EDAP Program was designed to assist areas along the U.S./Mexico border in areas that were economically distressed. In 2008, this program was extended to apply to the entire state so long as requirements are met. This program provides financial assistance through the provision of grants and loans to communities where present facilities are inadequate to meet minimal residential needs. Eligible communities are those that have median household income less than 75 percent of the state household income. Non-profit water supply corporations can apply, but they must be capable of maintaining and operating the completed system, and hold or be in the process of obtaining a Certificate of Convenience and Necessity. The county where the project is located must adopt model rules for the regulation of subdivisions prior to application for financial assistance. If the applicant is a city, the city must also adopt Model

Subdivision Rules of TWDB (31 Texas Administrative Code [TAC] Chapter 364). The program funds planning, design, construction, and acquisition. Up to 75 percent funding is available for facility plans with certain hardship cases 100 percent funding may be available. Projects must complete the planning, acquisition, and design phase before applying for second phase construction funds. The TWDB works with the applicant to find ways to leverage other state and federal financial resources. For grant fund above 50 percent, the Texas Department of State Health Services must determine if there is a health and safety nuisance.

The loan requires that the applicant pledge revenue or taxes, as well as some collateral for Whiteface ISD PWS. The maximum financing life is 50 years. The average financing period is 20 to 23 years. The lending rate scale varies according to several factors but is set by the TWDB in accordance with the TWDB rules in 31 TAC 363.33(a). The TWDB seeks to provide reasonable rates with minimal loss to the state. The TWDB posts rates for comparison for applicants and in August 2010 the TWDB showed its rates for a 22-year, tax exempt loan at 5.05 percent where the market was at 6.05 percent. Most projects have a financial package with the majority of the project financed with grants. Many have received 100 percent grants.

The first step in the application process is to meet with TWDB staff to discuss the terms of the loan and assist applicants during preparation of the application. Major components of the application materials must include an engineering feasibility report, environmental information, rates and customer base, operating budgets, financial statements, community information, project information, and other legal information.

4.5.4.2 TDRA Funding Options

Created in 2001, TDRA seeks to strengthen rural communities and assist them with community and economic development and healthcare by providing a variety of rural programs, services, and activities. Of their many programs and funds, the most appropriate programs related to drinking water are the Community Development (CD) Fund and Texas Small Towns Environment Program (STEP). These programs offer attractive funding packages to help make improvements to potable water systems to mitigate potential health concerns.

Community Development Fund

The CD Fund is a competitive grant program for water system improvements as well as other utility services (wastewater, drainage improvements, and housing activities). Funds are distributed between 24 state planning regions where funds are allocated to address each region's utility priorities. Funds can be used for various types of public works projects, including water system improvements. Cities with a population of less than 50,000 that are not eligible for direct CDBG funding from the U.S. Department of Housing and Urban Development are eligible. Funds are awarded on a competitive basis decided twice a year by regional review committees using a defined scoring system (past performance with CDBG is a factor). Awards are no less than $75,000 and cannot exceed $800,000. More information can be found at the Office of Community Affairs website under Community Development Fund.

Texas Small Towns Environment Program

Under special occasions some communities are invited to participate in grant programs when self-help is a feasible method for completing a water project, the community is committed to self-help, and the community has the capacity to complete the project. The purpose is to significantly reduce the cost of the project by using the communities' own human, material, and financial capital. Communities with a population of less than 50,000 that are not eligible for direct CDBG funding from the U.S. Department of Housing and Urban Development are eligible. Projects typically are repair, rehabilitation, improvements, service connections, and yard services. Reasonable associated administration and engineering cost can be funded. A letter of interest is first submitted, community meetings are held, and after CDBG staff determines eligibility with a written invitation to apply, an application may be submitted. Awards are only given twice per year on a priority basis so long as the project can be fully funded ($350,000 maximum award). Ranking criteria are project impact, local effort, past performance, percent of savings, and benefit to low to medium-income persons.

4.5.4.3 Rural Development

The RUS agency of Rural Development established Water and Waste Disposal Program for public entities administered by the staff of the Water and Environment Program to assist communities with water and wastewater systems. The purpose is to fund technical assistance and projects to help communities bring safe drinking water and sanitary, environmentally sound, waste disposal facilities to rural Americans in greatest need.

The Water and Waste Disposal Program provides loans, grants, and loan guarantees for drinking water, sanitary sewer, solid waste, and storm drainage facilities in rural areas and cities and towns with a population of 10,000 people and rural areas with no population limits. Recipients must be public entities such as municipalities, counties, special purpose districts, Indian tribes, and non-profit corporations. RUS has set aside direct loans and grants for several areas (e.g., empowerment zones). Projects include all forms of infrastructure improvement, acquisition of land and water rights, and design fees. Funds are provided on a first come, first serve basis; however, staff do evaluate need and assign priorities as funds are limited. Grant/loan mixes vary on a case by case basis and some communities may have to wait though several funding cycles until funds become available.

Entities must demonstrate that they cannot obtain reasonable loans at market rates, but have the capacity to repay loans, pledge security, and operate the facilities. Grants can be up to 75 percent of the project costs, and loan guarantees can be up to 90 percent of eligible loss. Loans are not to exceed a 40-year repayment period, require tax or revenue pledges, and are offered at three rates:

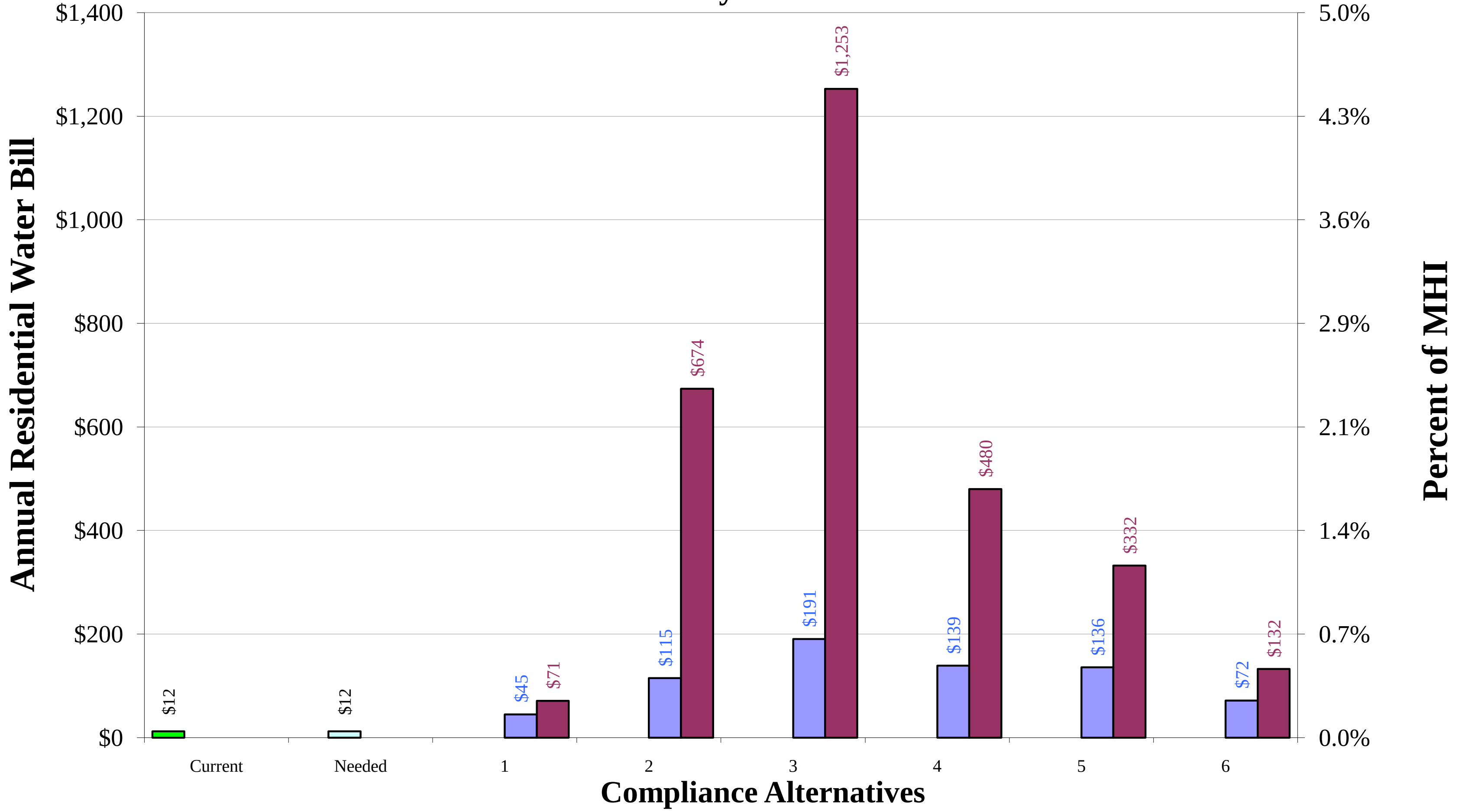
- Poverty Rate - The lowest rate is the poverty interest rate of 4.5 percent. Loans must be used to upgrade or construct new facilities to meet health standards, and the MHI in the service area must be below the poverty line for a family of four or below 80 percent of the statewide MHI for non-metropolitan communities.

- Market Rate – Where the MHI in the service exceeds the state MHI, the rate is based on the average of the "Bond Buyer" 11-Bond Index over a four week period.
- Intermediate Rate – the average of the Poverty Rate and the Market Rate, but not to exceed seven percent.

Whiteface ISD
Table 4.4 Financial Impact on Households

Alternative	Description		All Revenue	100% Grant	75% Grant	50% Grant	SRF	Bond
1	Purchase Water from City of Whiteface	Maximum % of MHI	1.3%	0.2%	0.2%	0.2%	0.2%	0.3%
		Percentage Rate Increase Compared to Current	2787%	269%	324%	378%	409%	487%
		Average Annual Water Bill	$350	$45	$51	$58	$62	$71
2	CRMWA Line from Lubbock to Levelland	Maximum % of MHI	26.0%	0.4%	0.9%	1.4%	1.7%	2.4%
		Percentage Rate Increase Compared to Current	58940%	848%	2000%	3153%	3794%	5458%
		Average Annual Water Bill	$7,158	$115	$255	$394	$472	$674
3	Purchase Lubbock Public Water System	Maximum % of MHI	49.4%	0.7%	1.7%	2.6%	3.2%	4.6%
		Percentage Rate Increase Compared to Current	112013%	1472%	3662%	5853%	7072%	10234%
		Average Annual Water Bill	$13,593	$191	$456	$722	$870	$1,253
4	New Well at 10 Miles	Maximum % of MHI	15.9%	0.5%	0.8%	1.1%	1.3%	1.7%
		Percentage Rate Increase Compared to Current	35964%	1047%	1750%	2454%	2845%	3860%
		Average Annual Water Bill	$4,373	$139	$224	$310	$357	$480
5	New Well at 5 Miles	Maximum % of MHI	9.2%	0.5%	0.7%	0.8%	0.9%	1.2%
		Percentage Rate Increase Compared to Current	20730%	1018%	1424%	1829%	2055%	2640%
		Average Annual Water Bill	$2,526	$136	$185	$234	$261	$332
6	New Well at 1 Mile	Maximum % of MHI	2.9%	0.3%	0.3%	0.4%	0.4%	0.5%
		Percentage Rate Increase Compared to Current	6424%	490%	616%	741%	811%	993%
		Average Annual Water Bill	$791	$72	$87	$102	$110	$132

Figure 4.2
Alternative Cost Summary: Whiteface ISD



Current Average Monthly Bill = $1.01
Median Household Income = $27525
Average Monthly Residential Usage = 80 gallons

SECTION 5
REFERENCES

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APPENDIX A
PWS INTERVIEW FORM

CAPACITY DEVELOPMENT ASSESSMENT FORM

*Prepared By*___________________________________ *Date*___________________________

Section 1. Public Water System Information

1. PWS ID # [ ] 2. Water System Name [ ]

3. County [ ]

4. Owner [ ] Address [ ]

Tele. [ ] E-mail [ ]

Fax [ ] Message [ ]

5. Admin [ ] Address [ ]

Tele. [ ] E-mail [ ]

Fax [ ] Message [ ]

6. Operator [ ] Address [ ]

Tele. [ ] E-mail [ ]

Fax [ ] Message [ ]

7. Population Served [ ] 8. No. of Service Connections [ ]

9. Ownership Type [ ] 10. Metered (Yes or No) [ ]

11. Source Type [ ]

12. Total PWS Annual Water Used [ ]

13. Number of Water Quality Violations (Prior 36 months)

Total Coliform [ ] Chemical/Radiological [ ]

Monitoring (CCR, Public Notification, etc.) [ ] Treatment Technique, D/DBP [ ]

A. Basic Information

1. Name of Water System:

2. Name of Person Interviewed:

3. Position:

4. Number of years at job:

5. Number of years experience with drinking water systems:

6. Percent of time (day or week) on drinking water system activities, with current position (how much time is dedicated exclusively to the water system, not wastewater, solid waste or other activities):

7. Certified Water Operator (Yes or No):

   If Yes,
   7a. Certification Level (water):

   7b. How long have you been certified?

8. Describe your water system related duties on a typical day.

B. Organization and Structure

1. Describe the organizational structure of the Utility. Please provide an organizational chart. (Looking to find out the governance structure (who reports to whom), whether or not there is a utility board, if the water system answers to public works or city council, etc.)

2. If not already covered in Question 1, to whom do you report?

3. Do all of the positions have a written job description?

   3a. If yes, is it available to employees?

   3b. May we see a copy?

C. Personnel

1. What is the current staffing level (include all personnel who spend more than 10% of their time working on the water system)?

2. Are there any vacant positions? How long have the positions been vacant?

3. In your opinion, is the current staffing level adequate? If not adequate, what are the issues or staffing needs (how many and what positions)?

4. What is the rate of employee turnover for management and operators? What are the major issues involved in the turnover (e.g., operator pay, working conditions, hours)?

5. Is the system staffed 24 hours a day? How is this handled (on-site or on-call)? Is there an alarm system to call an operator if an emergency occurs after hours?

D. Communication

1. Does the utility have a mission statement? If yes, what is it?

2. Does the utility have water quality goals? What are they?

3. How are your work priorities set?

4. How are work tasks delegated to staff?

5. Does the utility have regular staff meetings? How often? Who attends?

6. Are there separate management meetings? If so, describe.

7. Do management personnel ever visit the treatment facility? If yes, how often?

8. Is there effective communication between utility management and state regulators (e.g., NMED)?

9. Describe communication between utility and customers.

E. Planning and Funding

1. Describe the rate structure for the utility.

2. Is there a written rate structure, such as a rate ordinance? May we see it?

    2a. What is the average rate for 6,000 gallons of water?

3. How often are the rates reviewed?

4. What process is used to set or revise the rates?

5. In general, how often are the new rates set?

6. Is there an operating budget for the water utility? Is it separate from other activities, such as wastewater, other utilities, or general city funds?

7. Who develops the budget, how is it developed and how often is a new budget created or the old budget updated?

8. How is the budget approved or adopted?

9. In the last 5 years, how many budget shortfalls have there been (i.e., didn't collect enough money to cover expenses)? What caused the shortfall (e.g., unpaid bills, an emergency repair, weather conditions)?

    9a. How are budget shortfalls handled?

10. In the last 5 years how many years have there been budget surpluses (i.e., collected revenues exceeded expenses?

    10a. How are budget surpluses handled (i.e., what is done with the money)?

11. Does the utility have a line-item in the budget for emergencies or some kind of emergency reserve account?

12. How do you plan and pay for short-term system needs?

13. How do you plan and pay for long- term system needs?

14. How are major water system capital improvements funded? Does the utility have a written capital improvements plan?

15. How is the facility planning for future growth (either new hook-ups or expansion into new areas)?

16. Does the utility have and maintain an annual financial report? Is it presented to policy makers?

17. Has an independent financial audit been conducted of the utility finances? If so, how often? When was the last one?

18. Will the system consider any type of regionalization with any other PWS, such as system interconnection, purchasing water, sharing operator, emergency water connection, sharing bookkeeper/billing or other?

F. Policies, Procedures, and Programs

1. Are there written operational procedures? Do the employees use them?

2. Who in the utility department has spending authorization? What is the process for obtaining needed equipment or supplies, including who approves expenditures?

3. Does the utility have a source water protection program? What are the major components of the program?

4. Are managers and operators familiar with current SDWA regulations?

5. How do the managers and operators hear about new or proposed regulations, such as arsenic, DBP, Groundwater Rule? Are there any new regulations that will be of particular concern to the utility?

6. What are the typical customer complaints that the utility receives?

7. Approximately how many complaints are there per month?

8. How are customer complaints handled? Are they recorded?

9. (If not specifically addressed in Question 7) If the complaint is of a water quality nature, how are these types of complaints handled?

10. Does the utility maintain an updated list of critical customers?

11. Is there a cross-connection control plan for the utility? Is it written? Who enforces the plan's requirements?

12. Does the utility have a written water conservation plan?

13. Has there been a water audit of the system? If yes, what were the results?

14. (If not specifically answered in 11 above) What is the estimated percentage for loss to leakage for the system?

15. Are you, or is the utility itself, a member of any trade organizations, such as AWWA or Rural Water Association? Are you an active member (i.e., attend regular meetings or participate in a leadership role)? Do you find this membership helpful? If yes, in what ways does it help you?

G. Operations and Maintenance

1. How is decision-making authority split between operations and management for the following items:

    a. Process Control

    b. Purchases of supplies or small equipment

    c. Compliance sampling/reporting

    d. Staff scheduling

2. Describe your utility's preventative maintenance program.

3. Do the operators have the ability to make changes or modify the preventative maintenance program?

4. How does management prioritize the repair or replacement of utility assets? Do the operators play a role in this prioritization process?

5. Does the utility keep an inventory of spare parts?

6. Where does staff have to go to buy supplies/minor equipment? How often?

    6a. How do you handle supplies that are critical, but not in close proximity (for example if chlorine is not available in the immediate area or if the components for a critical pump are not in the area)

7. Describe the system's disinfection process. Have you had any problems in the last few years with the disinfection system?

    7a. Who has the ability to adjust the disinfection process?

8. How often is the disinfectant residual checked and where is it checked?

    8a. Is there an official policy on checking residuals or is it up to the operators?

9. Does the utility have an O & M manual? Does the staff use it?

10. Are the operators trained on safety issues? How are they trained and how often?

11. Describe how on-going training is handled for operators and other staff. How do you hear about appropriate trainings? Who suggests the trainings – the managers or the operators? How often do operators, managers, or other staff go to training? Who are the typical trainers used and where are the trainings usually held?

12. In your opinion is the level of your on-going training adequate?

13. In your opinion is the level of on-going training for other staff members, particularly the operators, adequate?

14. Does the facility have mapping of the water utility components? Is it used on any routine basis by the operators or management? If so, how is it used? If not, what is the process used for locating utility components?

15. In the last sanitary survey, were any deficiencies noted? If yes, were they corrected?

16. How often are storage tanks inspected? Who does the inspection?

    16a. Have you experienced any problems with the storage tanks?

H. SDWA Compliance

1. Has the system had any violations (monitoring or MCL) in the past 3 years? If so, describe.

2. How were the violations handled?

3. Does the system properly publish public notifications when notified of a violation?

4. Is the system currently in violation of any SDWA or state regulatory requirements, including failure to pay fees, fines, or other administrative type requirements?

5. Does the utility prepare and distribute a Consumer Confidence Report (CCR)? Is it done every year? What type of response does the utility get to the CCR from customers?

I. Emergency Planning

1. Does the system have a written emergency plan to handle emergencies such as water outages, weather issues, loss of power, loss of major equipment, etc?

2. When was the last time the plan was updated?

3. Do all employees know where the plan is? Do they follow it?

4. Describe the last emergency the facility faced and how it was handled.

Attachment A

A. Technical Capacity Assessment Questions

1. Based on available information of water rights on record and water pumped has the system exceeded its water rights in the past year? YES ☐ NO ☐

   In any of the past 5 years? YES ☐ NO ☐ How many times? _____

2. Does the system have the proper level of certified operator? *(Use questions a – c to answer.)*
   YES ☐ NO ☐

   a. What is the Classification Level of the system by NMED? _____

   b. Does the system have one or more certified operator(s)? [20 NMAC 7.4.20]

   YES ☐ NO ☐

   c. If YES, provide the number of operators at each New Mexico Certification Level. [20 NMAC 7.4.12]

   _____NM Small System _____Class 2

   _____NM Small System Advanced _____Class 3

   _____Class 1 _____Class 4

3. Did the system correct any sanitary deficiency noted on the most recent sanitary survey within 6 months of receiving that information? [20 NMAC 7.20.504]

   YES ☐ NO ☐ No Deficiencies ☐

   What was the type of deficiency? *(Check all that are applicable.)*

   Source ☐ Storage ☐

   Treatment ☐ Distribution ☐

   Other _____

   From the system's perspective, were there any other deficiencies that were not noted on the sanitary survey? Please describe.

4. Will the system's current treatment process meet known future regulations?

   Radionuclides YES ☐ NO ☐ Doesn't Apply ☐

   Arsenic YES ☐ NO ☐ Doesn't Apply ☐

   Stage 1 Disinfectants and Disinfection By-Product (DBP)

   YES ☐ NO ☐ Doesn't Apply ☐

   Surface Water Treatment Rule YES ☐ NO ☐ Doesn't Apply ☐

5. Does the system have a current site plan/map? [20 NMAC 7.10.302 A.1.]

   YES ☐ NO ☐

6. Has the system had a water supply outage in the prior 24 months?

YES ☐ NO ☐

What were the causes of the outage(s)? *(Include number of outages for each cause.)*

Drought _____ Limited Supply _____

System Failure _____ Other _____

7. Has the system ever had a water audit or a leak evaluation?

YES ☐ NO ☐ Don't Know ☐

If YES, please complete the following table.

Type of Investigation	Date Done	Water Loss (%)	What approach or technology was used to complete the investigation?	Was any follow-up done? If so, describe

8. Have all drinking water projects received NMED review and approval? [20 NMAC 7.10.201]

YES ☐ NO ☐

If NO, what types of projects have not received NMED review and approval.

Source ☐ Storage ☐

Treatment ☐ Distribution ☐

Other ☐ _____

9. What are the typical customer complaints that the utility receives?

10. Approximately how many complaints are there per month? _____

11. How are customer complaints handled? Are they recorded?

12. What is the age and composition of the distribution system? ***(Collect this information from the Sanitary Survey)***

Pipe Material	Approximate Age	Percentage of the system	Comments
			Sanitary Survey Distribution System Records Attached

13. Are there any dead end lines in the system?

YES ☐ NO ☐

14. Does the system have a flushing program?

YES ☐ NO ☐

If YES, please describe.

15. Are there any pressure problems within the system?

YES ☐ NO ☐

If YES, please describe.

16. Does the system disinfect the finished water?

YES ☐ NO ☐

If yes, which disinfectant product is used? ______

Interviewer Comments on Technical Capacity:

B. Managerial Capacity Assessment Questions

17. Has the system completed a 5-year Infrastructure Capital Improvement Plan (ICIP) plan?

YES ☐ NO ☐

If YES, has the plan been submitted to Local Government Division?

YES ☐ NO ☐

18. Does the system have written operating procedures?

YES ☐ NO ☐

19. Does the system have written job descriptions for all staff?

YES ☐ NO ☐

20. Does the system have:

A preventative maintenance plan?
YES ☐ NO ☐
A source water protection plan?
YES ☐ NO ☐ N/A ☐
An emergency plan?
YES ☐ NO ☐
A cross-connection control program?
YES ☐ NO ☐
An emergency source?
YES ☐ NO ☐
System security measures?
YES ☐ NO ☐

21. Does the system report and maintain records in accordance with the drinking water regulations concerning:

Water quality violations
YES ☐ NO ☐

Public notification
YES ☐ NO ☐

Sampling exemptions
YES ☐ NO ☐

22. Please describe how the above records are maintained:

23. Describe the management structure for the water system, including board and operations staff. Please include examples of duties, if possible.

24. Please describe type and quantity of training or continuing education for staff identified above.

25. Describe last major project undertaken by the water system, including the following: project in detail, positive aspects, negative aspects, the way in which the project was funded, any necessary rate increases, the public response to the project, whether the project is complete or not, and any other pertinent information.

26. Does the system have any debt? YES ☐ NO ☐

If yes, is the system current with all debt payments?
YES ☐ NO ☐

If no, describe the applicable funding agency and the default.

27. Is the system currently contemplating or actively seeking funding for any project?
YES ☐ NO ☐

If yes, from which agency and how much?

Describe the project?

Is the system receiving assistance from any agency or organization in its efforts?

28. Will the system consider any type of regionalization with other PWS? *(Check YES if the system has already regionalized.)*

YES ☐ NO ☐

If YES, what type of regionalization has been implemented/considered/discussed? *(Check all that apply.)*

System interconnection ☐
Sharing operator ☐
Sharing bookkeeper ☐
Purchasing water ☐
Emergency water connection ☐
Other: _____

29. Does the system have any of the following? *(Check all that apply.)*

Water Conservation Policy/Ordinance ☐ Current Drought Plan ☐
Water Use Restrictions ☐ Water Supply Emergency Plan ☐

Interviewer Comments on Managerial Capacity:

C. Financial Capacity Assessment

30. Does the system have a budget?

YES ☐ NO ☐

If YES, what type of budget?

Operating Budget ☐

Capital Budget ☐

31. Have the system revenues covered expenses and debt service for the past 5 years?

YES ☐ NO ☐

If NO, how many years has the system had a shortfall? _____

32. Does the system have a written/adopted rate structure?

YES ☐ NO ☐

33. What was the date of the last rate increase? _____

34. Are rates reviewed annually?

YES ☐ NO ☐

IF YES, what was the date of the last review? _____

35. Did the rate review show that the rates covered the following expenses? *(Check all that apply.)*

Operation & Maintenance ☐

Infrastructure Repair & replacement ☐

Staffing ☐

Emergency/Reserve fund ☐

Debt payment ☐

36. Is the rate collection above 90% of the customers?

YES ☐ NO ☐

37. Is there a cut-off policy for customers who are in arrears with their bill or for illegal connections?

YES ☐ NO ☐

If yes, is this policy implemented?

38. What is the residential water rate for 6,000 gallons of usage in one month. _____

39. In the past 12 months, how many customers have had accounts frozen or dropped for non-payment? _____

[Convert to % of active connections

Less than 1% ☐ 1% - 3% ☐ 4% - 5% ☐ 6% - 10% ☐

11% - 20% ☐ 21% - 50% ☐ Greater than 50% ☐]

40. The following questions refer to the process of obtaining needed equipment and supplies.

a. Can the water system operator buy or obtain supplies or equipment when they are needed?

YES ☐ NO ☐

b. Is the process simple or burdensome to the employees?

c. Can supplies or equipment be obtained quickly during an emergency?

YES ☐ NO ☐

d. Has the water system operator ever experienced a situation in which he/she couldn't purchase the needed supplies?

YES ☐ NO ☐

e. Does the system maintain some type of spare parts inventory?

YES ☐ NO ☐

If yes, please describe.

41. Has the system ever had a financial audit?

YES ☐ NO ☐

If YES, what is the date of the most recent audit? ______

42. Has the system ever had its electricity or phone turned off due to non-payment? Please describe.

Interviewer Comments on Financial Assessment:

43. What do you think the system capabilities are now and what are the issues you feel your system will be facing in the future? In addition, are there any specific needs, such as types of training that you would like to see addressed by NMED or its contractors?

APPENDIX B
COST BASIS

This section presents the basis for unit costs used to develop the conceptual cost estimates for the compliance alternatives. Cost estimates are conceptual in nature (+50%/-30%), and are intended to make comparisons between compliance options and to provide a preliminary indication of possible rate impacts. Consequently, these costs are pre-planning level and should not be viewed as final estimated costs for alternative implementation. Capital cost includes an allowance for engineering and construction management. It is assumed that adequate electrical power is available near the site. The cost estimates specifically do not include costs for the following:

- Obtaining land or easements.
- Surveying.
- Mobilization/demobilization for construction.
- Insurance and bonds

In general, unit costs are based on recent construction bids for similar work in the area; when possible, consultations with vendors or other suppliers; published construction and O&M cost data; and USEPA cost guidance. Unit costs used for the cost estimates are summarized in Table B.1.

Unit costs for pipeline components are based on 2009 RS Means Site Work & Landscape Cost Data. The number of borings and encasements and open cuts and encasements is estimated by counting the road, highway, railroad, stream, and river crossings for a conceptual routing of the pipeline. The number of air release valves is estimated by examining the land surface profile along the conceptual pipeline route. It is assumed that gate valves and flush valves would be installed, on average, every 5,000 feet along the pipeline. Pipeline cost estimates are based on the use of C-900 PVC pipe. Other pipe materials could be considered for more detailed development of attractive alternatives.

Pump station unit costs are based on experience with similar installations. The cost estimate for the pump stations include two pumps, station piping and valves, station electrical and instrumentation, minor site improvement, installation of a concrete pad, fence and building, and tools. The number of pump stations is based on calculations of pressure losses in the proposed pipeline for each alternative. Back-flow prevention is required in cases where pressure losses are negligible, and pump stations are not needed. Construction cost of a storage tank is based on consultations with vendors and 2007 RS Means Site Work & Landscape Cost Data.

Labor costs are estimated based on 2009 RS Means Site Work & Landscape Cost Data specific to the Lubbock County region.

Electrical power cost is estimated to be $0.048 per kWH, as supplied by the City of Whiteface. The annual cost for power to a pump station is calculated based on the pumping head and volume, and includes 11,800 kWH for pump building heating, cooling, and lighting, as recommended in USEPA publication, *Standardized Costs for Water Supply Distribution Systems* (1992).

In addition to the cost of electricity, pump stations have other maintenance costs. These costs cover: materials for minor repairs to keep the pumps operating; purchase of a maintenance vehicle, fuel costs, and vehicle maintenance costs; utilities; office supplies, small tools and equipment; and miscellaneous materials such as safety, clothing, chemicals, and paint. The non-power O&M costs are estimated based on the USEPA publication, *Standardized Costs for Water Supply Distribution Systems* (1992), which provides cost curves for O&M components. Costs from the 1992 report are adjusted to 2010 dollars based on the ENR construction cost index.

Pipeline maintenance costs include routine cleaning and flushing, as well as minor repairs to lines. The unit rate for pipeline maintenance is calculated based on the USEPA technical report, *Innovative and Alternate Technology Assessment Manual MCD 53* (1978). Costs from the 1978 report are adjusted to 2010 dollars based on the ENR construction cost index.

Storage tank maintenance costs include cleaning and renewal of interior lining and exterior coating. Unit costs for storage tank O&M are based on USEPA publication *Standardized Costs for Water Supply Distribution Systems* (1992). Costs from the 1992 report are adjusted to 2010 dollars based on the ENR construction cost index.

The purchase price for point-of-use (POU) water treatment units is based on vendor price lists for treatment units, plus installation. O&M costs for POU treatment units are also based on vendor price lists. It is assumed that a yearly water sample would be analyzed for the contaminant of concern.

The purchase price for point-of-entry (POE) water treatment units is based on vendor price lists for treatment units, plus an allowance for installation, including a concrete pad and shed, piping modifications, and electrical connection. O&M costs for POE treatment units are also based on vendor price lists. It is assumed that a yearly water sample would be analyzed for the contaminant of concern.

Central treatment plant costs, for both adsorption and coagulation/filtration, include pricing for buildings, utilities, and site work. Costs are based on pricing given in the various R.S. Means Construction Cost Data References, as well as prices obtained from similar work on other projects. Pricing for treatment equipment was obtained from vendors.

Well installation costs are based on quotations from drillers for installation of similar depth wells in the area. Well installation costs include drilling, a well pump, electrical and instrumentation installation, well finishing, piping, and water quality testing. O&M costs for water wells include power, materials, and labor. It is assumed that new wells located more than

1 mile from the intake point of an existing system would require a storage tank and pump station.

Purchase price for the treatment unit dispenser is based on vendor price lists, plus an allowance for installation at a centralized public location. The O&M costs are also based on vendor price lists. It is assumed that weekly water samples would be analyzed for the contaminant of concern.

Costs for bottled water delivery alternatives are based on consultation with vendors that deliver residential bottled water. The cost estimate includes an initial allowance for set-up of the program, and a yearly allowance for program administration.

The cost estimate for a public dispenser for trucked water includes the purchase price for a water truck and construction of a storage tank. Annual costs include labor for purchasing the water, picking up and delivering the water, truck maintenance, and water sampling and testing. It is assumed the water truck would be required to make one trip each week, and that chlorine residual would be determined for each truck load.

Table B.1
Summary of General Data
Whiteface ISD
0400020
General PWS Information

Service Population	410	**Number of Connections**	1
Total PWS Daily Water Usage	0.0011 (mgd)		

Unit Cost Data

General Items	**Unit**		**Unit Cost**
Treated water purchase cost	*See alternative*		
Water purchase cost (trucked)	$/1,000 gals	$	1.32
Contingency	20%		n/a
Engineering & Constr. Management	25%		n/a
Procurement/admin (POU/POE)	20%		n/a
Pipeline Unit Costs	**Unit**		**Unit Cost**
PVC water line, Class 200, 04"	LF	$	15
Bore and encasement, 10"	LF	$	235
Open cut and encasement, 10"	LF	$	127
Gate valve and box, 04"	EA	$	944
Air valve	EA	$	2,079
Flush valve	EA	$	1,700
Metal detectable tape	LF	$	0.05
Bore and encasement, length	Feet		200
Open cut and encasement, length	Feet		50
Pump Station Unit Costs	**Unit**		**Unit Cost**
Pump	EA	$	8,230
Pump Station Piping, 04"	EA	$	538
Gate valve, 04"	EA	$	944
Check valve, 04"	EA	$	880
Electrical/Instrumentation	EA	$	10,550
Site work	EA	$	6,330
Building pad	EA	$	1,055
Pump Building	EA	$	10,550
Fence	EA	$	6,330
Tools	EA	$	1,055
5,000 gal feed tank	EA	$	12,487
Backflow preventer, 4"	EA	$	2,714
Backflow Testing/Certification	EA	$	110
Well Installation Unit Costs	**Unit**		**Unit Cost**
Well installation	*See alternative*		
Water quality testing	EA	$	1,320
5HP Well Pump	EA	$	4,132
Well electrical/instrumentation	EA	$	5,800
Well cover and base	EA	$	3,165
Piping	EA	$	3,165
5,000 gal ground storage tank	EA	$	12,487
Electrical Power	$/kWH	$	0.048
Building Power	kWH		11,800
Labor	$/hr	$	60
Materials	EA	$	1,585
Transmission main O&M	$/mile	$	285
Tank O&M	EA	$	1,055
POU/POE Unit Costs			
POU treatment unit purchase	EA	$	300
POU treatment unit installation	EA	$	160
POE treatment unit purchase	EA	$	5,275
POE - pad and shed, per unit	EA	$	2,110
POE - piping connection, per unit	EA	$	1,055
POE - electrical hook-up, per unit	EA	$	1,055
POU Treatment O&M, per unit	$/year	$	103
POE Treatment O&M, per unit	$/year	$	1,585
Treatment analysis	$/year	$	210
POU/POE labor support	$/hr	$	42
Dispenser/Bottled Water Unit Costs			
POE-Treatment unit purchase	EA	$	7,385
POE-Treatment unit installation	EA	$	5,275
Treatment unit O&M	EA	$	2,110
Administrative labor	hr	$	46
Bottled water cost (inc. delivery)	gallon	$	1.55
Water use, per capita per day	gpcd		1.0
Bottled water program materials	EA	$	5,275
5,000 gal ground storage tank	EA	$	12,487
Site improvements	EA	$	3,165
Potable water truck	EA	$	115,000.00
Water analysis, per sample	EA	$	210
Potable water truck O&M costs	$/mile	$	2

Central Treatment Unit Costs	**Unit**	**Unit Cost**
General		

APPENDIX C
COMPLIANCE ALTERNATIVE CONCEPTUAL COST ESTIMATES

This appendix presents the conceptual cost estimates developed for the compliance alternatives. The conceptual cost estimates are given in Tables C.1 through C.6. The cost estimates are conceptual in nature (+50%/-30%), and are intended for making comparisons between compliance options and to provide a preliminary indication of possible water rate impacts. Consequently, these costs are pre-planning level and should not be viewed as final estimated costs for alternative implementation.

Table C.1

PWS Name	***Whiteface ISD***
Alternative Name	***Purchase Water from City of Whiteface***
Alternative Number	***WF-1***

Distance from Alternative to PWS (along pipe)		0.1	miles
Total PWS annual water usage		0.402	MG
Treated water purchase cost	$	1.32	per 1,000 gals
Pump Stations needed w/ 1 feed tank each		0	
On site storage tanks / pump sets needed		1	

Capital Costs

Cost Item	Quantity	Unit	Unit Cost	Total Cost
Pipeline Construction				
Number of Crossings, bore	-	n/a	n/a	n/a
Number of Crossings, open cut	2	n/a	n/a	n/a
PVC water line, Class 200, 04"	597	LF	$ 15	$ 8,875
Bore and encasement, 10"	-	LF	$ 235	$ -
Open cut and encasement, 10"	100	LF	$ 127	$ 12,714
Gate valve and box, 04"	0	EA	$ 944	$ 113
Air valve	-	EA	$ 2,079	$ -
Flush valve	0	EA	$ 1,700	$ 203
Metal detectable tape	597	LF	$ 0	$ 30
Subtotal				**$ 21,934**
Pump Station(s) Installation				
Pump	2	EA	$ 8,230	$ 16,460
Pump Station Piping, 04"	1	EA	$ 538	$ 538
Gate valve, 04"	4	EA	$ 944	$ 3,775
Check valve, 04"	2	EA	$ 880	$ 1,760
Electrical/Instrumentation	1	EA	$ 10,550	$ 10,550
Site work	1	EA	$ 6,330	$ 6,330
Building pad	1	EA	$ 1,055	$ 1,055
Pump Building	1	EA	$ 10,550	$ 10,550
Fence	1	EA	$ 6,330	$ 6,330
Tools	1	EA	$ 1,055	$ 1,055
5,000 gal feed tank	-	EA	$ 12,487	$ -
5,000 gal ground storage tank	1	EA	$ 12,487	$ 12,487
Backflow Preventor	1	EA	$ 2,714	$ 2,714
Subtotal				**$ 73,604**
Subtotal of Component Costs				**$ 95,538**
Contingency	20%			$ 19,108
Design & Constr Management	25%			$ 23,885
TOTAL CAPITAL COSTS				**$ 138,531**

Annual Operations and Maintenance Costs

Cost Item	Quantity	Unit	Unit Cost	Total Cost
Pipeline O&M				
Pipeline O&M	0.1	mile	$ 285	$ 32
Subtotal				**$ 32**
Water Purchase Cost				
From PWS	402	1,000 gal	$ 1.32	$ 530
Subtotal				**$ 530**
Pump Station(s) O&M				
Building Power	11,800	kWH	$ 0.048	$ 566
Pump Power	52	kWH	$ 0.048	$ 3
Materials	1	EA	$ 1,585	$ 1,585
Labor	365	Hrs	$ 60.00	$ 21,900
Tank O&M	1	EA	$ 1,055	$ 1,055
Backflow Test/Cert	1	EA	$ 110	$ 110
Subtotal				**$ 25,219**
O&M Credit for Existing Well Closure				
Pump power	635	kWH	$ 0.048	$ (30)
Well O&M matl	1	EA	$ 1,585	$ (1,585)
Well O&M labor	180	Hrs	$ 60.00	$ (10,800)
Subtotal				**$ (12,415)**
TOTAL ANNUAL O&M COSTS				**$ 13,366**

Table C.2

PWS Name ***Whiteface ISD***
Alternative Name ***CRMWA Line from Lubbock to Levelland***
Alternative Number ***WF-2***

Distance from Alternative to PWS (along pipe)	16.8	miles
Total PWS annual water usage	0.402	MG
Treated water purchase cost	$ 1.32	per 1,000 gals
Pump Stations needed w/ 1 feed tank each	1	
On site storage tanks / pump sets needed	1	

Capital Costs

Cost Item	Quantity	Unit	Unit Cost	Total Cost
Pipeline Construction				
Number of Crossings, bore	5	n/a	n/a	n/a
Number of Crossings, open cut	37	n/a	n/a	n/a
PVC water line, Class 200, 04"	88,941	LF	$ 15	$ 1,322,138
Bore and encasement, 10"	1,000	LF	$ 235	$ 234,720
Open cut and encasement, 10"	1,850	LF	$ 127	$ 235,209
Gate valve and box, 04"	18	EA	$ 944	$ 16,788
Air valve	17	EA	$ 2,079	$ 35,343
Flush valve	18	EA	$ 1,700	$ 30,240
Metal detectable tape	88,941	LF	$ 0	$ 4,447
Subtotal				**$ 1,878,885**
Pump Station(s) Installation				
Pump	4	EA	$ 8,230	$ 32,920
Pump Station Piping, 04"	2	EA	$ 538	$ 1,076
Gate valve, 04"	8	EA	$ 944	$ 7,550
Check valve, 04"	4	EA	$ 880	$ 3,521
Electrical/Instrumentation	2	EA	$ 10,550	$ 21,100
Site work	2	EA	$ 6,330	$ 12,660
Building pad	2	EA	$ 1,055	$ 2,110
Pump Building	2	EA	$ 10,550	$ 21,100
Fence	2	EA	$ 6,330	$ 12,660
Tools	2	EA	$ 1,055	$ 2,110
5,000 gal feed tank	1	EA	$ 12,487	$ 12,487
5,000 gal ground storage tank	1	EA	$ 12,487	$ 12,487
Backflow Preventor	-	EA	$ 2,714	$ -
Subtotal				**$ 141,781**
Subtotal of Component Costs				**$ 2,020,666**
Contingency	20%			$ 404,133
Design & Constr Management	25%			$ 505,166
TOTAL CAPITAL COSTS				**$ 2,929,965**

Annual Operations and Maintenance Costs

Cost Item	Quantity	Unit	Unit Cost	Total Cost
Pipeline O&M				
Pipeline O&M	16.8	mile	$ 285	$ 4,801
Subtotal				**$ 4,801**
Water Purchase Cost				
From PWS	402	1,000 gal	$ 1.32	$ 530
Subtotal				**$ 530**
Pump Station(s) O&M				
Building Power	23,600	kWH	$ 0.048	$ 1,133
Pump Power	641	kWH	$ 0.048	$ 31
Materials	2	EA	$ 1,585	$ 3,170
Labor	730	Hrs	$ 60.00	$ 43,800
Tank O&M	1	EA	$ 1,055	$ 1,055
Backflow Test/Cert	0	EA	$ 110	$ -
Subtotal				**$ 49,189**
O&M Credit for Existing Well Closure				
Pump power	635	kWH	$ 0.048	$ (30)
Well O&M matl	1	EA	$ 1,585	$ (1,585)
Well O&M labor	180	Hrs	$ 60	$ (10,800)
Subtotal				**$ (12,415)**
TOTAL ANNUAL O&M COSTS				**$ 42,104**

Table C.3

PWS Name ***Whiteface ISD***
Alternative Name ***Purchase Lubbock Public Water System***
Alternative Number ***WF-3***

Distance from Alternative to PWS (along pipe)		35.7	miles
Total PWS annual water usage		0.402	MG
Treated water purchase cost	$	2.61	per 1,000 gals
Pump Stations needed w/ 1 feed tank each		2	
On site storage tanks / pump sets needed		1	

Capital Costs

Cost Item	Quantity	Unit	Unit Cost	Total Cost
Pipeline Construction				
Number of Crossings, bore	7	n/a	n/a	n/a
Number of Crossings, open cut	49	n/a	n/a	n/a
PVC water line, Class 200, 04"	188,591	LF	$ 15	$ 2,803,456
Bore and encasement, 10"	1,400	LF	$ 235	$ 328,608
Open cut and encasement, 10"	2,450	LF	$ 127	$ 311,493
Gate valve and box, 04"	38	EA	$ 944	$ 35,597
Air valve	36	EA	$ 2,079	$ 74,844
Flush valve	38	EA	$ 1,700	$ 64,121
Metal detectable tape	188,591	LF	$ 0	$ 9,430
Subtotal				**$ 3,627,549**
Pump Station(s) Installation				
Pump	6	EA	$ 8,230	$ 49,380
Pump Station Piping, 04"	3	EA	$ 538	$ 1,614
Gate valve, 04"	12	EA	$ 944	$ 11,325
Check valve, 04"	6	EA	$ 880	$ 5,281
Electrical/Instrumentation	3	EA	$ 10,550	$ 31,650
Site work	3	EA	$ 6,330	$ 18,990
Building pad	3	EA	$ 1,055	$ 3,165
Pump Building	3	EA	$ 10,550	$ 31,650
Fence	3	EA	$ 6,330	$ 18,990
Tools	3	EA	$ 1,055	$ 3,165
5,000 gal feed tank	2	EA	$ 12,487	$ 24,974
5,000 gal ground storage tank	1	EA	$ 12,487	$ 12,487
Backflow Preventor	0	EA	$ 2,714	$ -
Subtotal				**$ 212,671**
Subtotal of Component Costs				**$ 3,840,220**
Contingency	20%			$ 768,044
Design & Constr Management	25%			$ 960,055
TOTAL CAPITAL COSTS				**$ 5,568,319**

Annual Operations and Maintenance Costs

Cost Item	Quantity	Unit	Unit Cost	Total Cost
Pipeline O&M				
Pipeline O&M	35.7	mile	$ 285	$ 10,180
Subtotal				**$ 10,180**
Water Purchase Cost				
From PWS	402	1,000 gal	$ 2.61	$ 1,048
Subtotal				**$ 1,048**
Pump Station(s) O&M				
Building Power	35,400	kWH	$ 0.048	$ 1,699
Pump Power	1,274	kWH	$ 0.048	$ 61
Materials	3	EA	$ 1,585	$ 4,755
Labor	1,095	Hrs	$ 60.00	$ 65,700
Tank O&M	2	EA	$ 1,055	$ 2,110
Backflow Test/Cert	0	EA	$ 110	$ -
Subtotal				**$ 74,325**
O&M Credit for Existing Well Closure				
Pump power	635	kWH	$ 0.048	$ (30)
Well O&M matl	1	EA	$ 1,585	$ (1,585)
Well O&M labor	180	Hrs	$ 60	$ (10,800)
Subtotal				**$ (12,415)**
TOTAL ANNUAL O&M COSTS				**$ 73,137**

Table C.4

PWS Name ***Whiteface ISD***
Alternative Name ***New Well at 10 Miles***
Alternative Number ***WF-4***

Distance from PWS to new well location	10.0	miles
Estimated well depth	220	feet
Number of wells required	1	
Well installation cost (location specific)	$155	per foot
Pump Stations needed w/ 1 feed tank each	1	
On site storage tanks / pump sets needed	1	

Capital Costs

Cost Item	Quantity	Unit	Unit Cost	Total Cost
Pipeline Construction				
Number of Crossings, bore	2	n/a	n/a	n/a
Number of Crossings, open cut	17	n/a	n/a	n/a
PVC water line, Class 200, 04"	52,800	LF	$ 15	$ 784,886
Bore and encasement, 10"	400	LF	$ 235	$ 93,888
Open cut and encasement, 10"	850	LF	$ 127	$ 108,069
Gate valve and box, 04"	11	EA	$ 944	$ 9,966
Air valve	10	EA	$ 2,079	$ 20,790
Flush valve	11	EA	$ 1,700	$ 17,952
Metal detectable tape	52,800	LF	$ 0	$ 2,640
Subtotal				**$ 1,038,191**
Pump Station(s) Installation				
Pump	4	EA	$ 8,230	$ 32,920
Pump Station Piping, 04"	2	EA	$ 538	$ 1,076
Gate valve, 04"	8	EA	$ 944	$ 7,550
Check valve, 04"	4	EA	$ 880	$ 3,521
Electrical/Instrumentation	2	EA	$ 10,550	$ 21,100
Site work	2	EA	$ 6,330	$ 12,660
Building pad	2	EA	$ 1,055	$ 2,110
Pump Building	2	EA	$ 10,550	$ 21,100
Fence	2	EA	$ 6,330	$ 12,660
Tools	2	EA	$ 1,055	$ 2,110
5,000 gal feed tank	1	EA	$ 12,487	$ 12,487
5,000 gal ground storage tank	1	EA	$ 12,487	$ 12,487
Subtotal				**$ 141,781**
Well Installation				
Well installation	220	LF	$ 155	$ 34,100
Water quality testing	2	EA	$ 1,320	$ 2,640
Well pump	1	EA	$ 4,132	$ 4,132
Well electrical/instrumentation	1	EA	$ 5,800	$ 5,800
Well cover and base	1	EA	$ 3,165	$ 3,165
Piping	1	EA	$ 3,165	$ 3,165
Subtotal				**$ 53,002**
Subtotal of Component Costs				**$ 1,232,974**
Contingency	20%			$ 246,595
Design & Constr Management	25%			$ 308,244
TOTAL CAPITAL COSTS				**$ 1,787,813**

Annual Operations and Maintenance Costs

Cost Item	Quantity	Unit	Unit Cost	Total Cost
Pipeline O&M				
Pipeline O&M	10.0	mile	$ 285	$ 2,850
Subtotal				**$ 2,850**
Pump Station(s) O&M				
Building Power	23,600	kWH	$ 0.048	$ 1,133
Pump Power	373	kWH	$ 0.048	$ 18
Materials	2	EA	$ 1,585	$ 3,170
Labor	730	Hrs	$ 60.00	$ 43,800
Tank O&M	1	EA	$ 1,055	$ 1,055
Subtotal				**$ 49,176**
Well O&M				
Pump power	652	kWH	$ 0.048	$ 31
Well O&M matl	1	EA	$ 1,585	$ 1,585
Well O&M labor	180	Hrs	$ 60	$ 10,800
Subtotal				**$ 12,416**
O&M Credit for Existing Well Closure				
Pump power	635	kWH	$ 0.048	$ (30)
Well O&M matl	1	EA	$ 1,585	$ (1,585)
Well O&M labor	180	Hrs	$ 60	$ (10,800)
Subtotal				**$ (12,415)**
TOTAL ANNUAL O&M COSTS				**$ 52,027**

Table C.5

PWS Name ***Whiteface ISD***
Alternative Name ***New Well at 5 Miles***
Alternative Number ***WF-5***

Distance from PWS to new well location	5.0	miles
Estimated well depth	220	feet
Number of wells required	1	
Well installation cost (location specific)	$155	per foot
Pump Stations needed w/ 1 feed tank each	1	
On site storage tanks / pump sets needed	1	

Capital Costs

Cost Item	Quantity	Unit	Unit Cost		Total Cost	
Pipeline Construction						
Number of Crossings, bore	1	n/a	n/a		n/a	
Number of Crossings, open cut	8	n/a	n/a		n/a	
PVC water line, Class 200, 04"	26,400	LF	$	15	$	392,443
Bore and encasement, 10"	200	LF	$	235	$	46,944
Open cut and encasement, 10"	400	LF	$	127	$	50,856
Gate valve and box, 04"	5	EA	$	944	$	4,983
Air valve	5	EA	$	2,079	$	10,395
Flush valve	5	EA	$	1,700	$	8,976
Metal detectable tape	26,400	LF	$	0	$	1,320
Subtotal					**$**	**515,917**
Pump Station(s) Installation						
Pump	4	EA	$	8,230	$	32,920
Pump Station Piping, 04"	2	EA	$	538	$	1,076
Gate valve, 04"	8	EA	$	944	$	7,550
Check valve, 04"	4	EA	$	880	$	3,521
Electrical/Instrumentation	2	EA	$	10,550	$	21,100
Site work	2	EA	$	6,330	$	12,660
Building pad	2	EA	$	1,055	$	2,110
Pump Building	2	EA	$	10,550	$	21,100
Fence	2	EA	$	6,330	$	12,660
Tools	2	EA	$	1,055	$	2,110
5,000 gal feed tank	1	EA	$	12,487	$	12,487
5,000 gal ground storage tank	1	EA	$	12,487	$	12,487
Subtotal					**$**	**141,781**
Well Installation						
Well installation	220	LF	$	155	$	34,100
Water quality testing	2	EA	$	1,320	$	2,640
Well pump	1	EA	$	4,132	$	4,132
Well electrical/instrumentation	1	EA	$	5,800	$	5,800
Well cover and base	1	EA	$	3,165	$	3,165
Piping	1	EA	$	3,165	$	3,165
Subtotal					**$**	**53,002**
Subtotal of Component Costs					**$**	**710,700**
Contingency	20%				$	142,140
Design & Constr Management	25%				$	177,675
TOTAL CAPITAL COSTS					**$**	**1,030,515**

Annual Operations and Maintenance Costs

Cost Item	Quantity	Unit	Unit Cost		Total Cost	
Pipeline O&M						
Pipeline O&M	5.0	mile	$	285	$	1,425
Subtotal					**$**	**1,425**
Pump Station(s) O&M						
Building Power	23,600	kWH	$	0.048	$	1,133
Pump Power	187	kWH	$	0.048	$	9
Materials	2	EA	$	1,585	$	3,170
Labor	730	Hrs	$	60.00	$	43,800
Tank O&M	1	EA	$	1,055	$	1,055
Subtotal					**$**	**49,167**
Well O&M						
Pump power	652	kWH	$	0.048	$	31
Well O&M matl	1	EA	$	1,585	$	1,585
Well O&M labor	180	Hrs	$	60	$	10,800
Subtotal					**$**	**12,416**
O&M Credit for Existing Well Closure						
Pump power	635	kWH	$	0.048	$	(30)
Well O&M matl	1	EA	$	1,585	$	(1,585)
Well O&M labor	180	Hrs	$	60	$	(10,800)
Subtotal					**$**	**(12,415)**
TOTAL ANNUAL O&M COSTS					**$**	**50,593**

Table C.6

PWS Name *Whiteface ISD*
Alternative Name *New Well at 1 Mile*
Alternative Number *WF-6*

Distance from PWS to new well location	1.0	miles
Estimated well depth	220	feet
Number of wells required	1	
Well installation cost (location specific)	$155	per foot
Pump Stations needed w/ 1 feed tank each	0	
On site storage tanks / pump sets needed	1	

Capital Costs

Cost Item	Quantity	Unit	Unit Cost	Total Cost
Pipeline Construction				
Number of Crossings, bore	-	n/a	n/a	n/a
Number of Crossings, open cut	2	n/a	n/a	n/a
PVC water line, Class 200, 04"	5,280	LF	$ 15	$ 78,489
Bore and encasement, 10"	-	LF	$ 235	$ -
Open cut and encasement, 10"	100	LF	$ 127	$ 12,714
Gate valve and box, 04"	1	EA	$ 944	$ 997
Air valve	1	EA	$ 2,079	$ 2,079
Flush valve	1	EA	$ 1,700	$ 1,795
Metal detectable tape	5,280	LF	$ 0	$ 264
Subtotal				**$ 96,337**
Pump Station(s) Installation				
Pump	2	EA	$ 8,230	$ 16,460
Pump Station Piping, 04"	1	EA	$ 538	$ 538
Gate valve, 04"	4	EA	$ 944	$ 3,775
Check valve, 04"	2	EA	$ 880	$ 1,760
Electrical/Instrumentation	1	EA	$ 10,550	$ 10,550
Site work	1	EA	$ 6,330	$ 6,330
Building pad	1	EA	$ 1,055	$ 1,055
Pump Building	1	EA	$ 10,550	$ 10,550
Fence	1	EA	$ 6,330	$ 6,330
Tools	1	EA	$ 1,055	$ 1,055
5,000 gal feed tank	-	EA	$ 12,487	$ -
5,000 gal ground storage tank	1	EA	$ 12,487	$ 12,487
Subtotal				**$ 70,890**
Well Installation				
Well installation	220	LF	$ 155	$ 34,100
Water quality testing	2	EA	$ 1,320	$ 2,640
Well pump	1	EA	$ 4,132	$ 4,132
Well electrical/instrumentation	1	EA	$ 5,800	$ 5,800
Well cover and base	1	EA	$ 3,165	$ 3,165
Piping	1	EA	$ 3,165	$ 3,165
Subtotal				**$ 53,002**
Subtotal of Component Costs				**$ 220,230**
Contingency	20%			$ 44,046
Design & Constr Management	25%			$ 55,057
TOTAL CAPITAL COSTS				**$ 319,333**

Annual Operations and Maintenance Costs

Cost Item	Quantity	Unit	Unit Cost	Total Cost
Pipeline O&M				
Pipeline O&M	1.0	mile	$ 285	$ 285
Subtotal				**$ 285**
Pump Station(s) O&M				
Building Power	11,800	kWH	$ 0.048	$ 566
Pump Power	-	kWH	$ 0.048	$ -
Materials	1	EA	$ 1,585	$ 1,585
Labor	365	Hrs	$ 60.00	$ 21,900
Tank O&M	-	EA	$ 1,055	$ -
Subtotal				**$ 24,051**
Well O&M				
Pump power	652	kWH	$ 0.048	$ 31
Well O&M matl	1	EA	$ 1,585	$ 1,585
Well O&M labor	180	Hrs	$ 60	$ 10,800
Subtotal				**$ 12,416**
O&M Credit for Existing Well Closure				
Pump power	635	kWH	$ 0.048	$ (30)
Well O&M matl	1	EA	$ 1,585	$ (1,585)
Well O&M labor	180	Hrs	$ 60	$ (10,800)
Subtotal				**$ (12,415)**
TOTAL ANNUAL O&M COSTS				**$ 24,337**

APPENDIX D
EXAMPLE FINANCIAL MODEL

Whiteface ISD

Number of Alternatives 6 Selected from Results Sheet

Input Fields are Indicated by:

General Inputs		
Implementation Year	2011	
Months of Working Capital	0	
Depreciation	$ -	
Percent of Depreciation for Replacement Fund	0%	
Allow Negative Cash Balance (yes or no)	No	
Median Household Income	$ 27,525	Whiteface ISD
Median HH Income -- Texas	$ 39,927	
Grant Funded Percentage	0%	Selected from Results
Capital Funded from Revenues	$ -	

	Base Year Growth/Escalation	2009
Accounts & Consumption		
Metered Residential Accounts		
Number of Accounts	0.0%	410
Number of Bills Per Year		12
Annual Billed Consumption		396,000
Consumption per Account Per Pay Period	0.0%	80
Consumption Allowance in Rates		-
Total Allowance		-
Net Consumption Billed		396,000
Percentage Collected		100.0%
Unmetered Residential Accounts		
Number of Accounts	0.0%	0
Number of Bills Per Year		12
Percentage Collected		100.0%
Metered Non-Residential Accounts		
Number of Accounts	0.0%	0
Number of Bills Per Year		12
Non-Residential Consumption		-
Consumption per Account	0.0%	-
Consumption Allowance in Rates		-
Total Allowance		-
Net Consumption Billed		-
Percentage Collected		0.0%
Unmetered Non-Residential Accounts		
Number of Accounts	0.0%	0
Number of Bills Per Year		12
Percentage Collected		100.0%
Water Purchase & Production		
Water Purchased (gallons)	0.0%	-
Average Cost Per Unit Purchased	0.0%	$ -
Bulk Water Purchases	0.0%	$ -
Water Production	0.0%	396,000
Unaccounted for Water		-
Percentage Unaccounted for Water		0.0%

Appendix D
General Inputs

Whiteface ISD		
Number of Alternatives	6	Selected from Results Sheet
Input Fields are Indicated by:		

Residential Rate Structure	Allowance within Tier	
	-	
Estimated Average Water Rate ($/1000gallons)		$ 12.63
Non-Residential Rate Structure		
	-	
Estimated Average Water Rate ($/1000gallons)		$ -
INITIAL YEAR EXPENDITURES	Inflation	Initial Year
Operating Expenditures:		
Salaries & Benefits	0.0%	-
Contract Labor	0.0%	-
Water Purchases	0.0%	-
Chemicals, Treatment	0.0%	-
Utilities	0.0%	-
Repairs, Maintenance, Supplies	0.0%	-
Repairs	0.0%	-
Maintenance	0.0%	-
Supplies	0.0%	-
Administrative Expenses	0.0%	
Accounting and Legal Fees	0.0%	-
Insurance	0.0%	-
Automotive and Travel	0.0%	-
Professional and Directors Fees	0.0%	-
Bad Debts	0.0%	-
Garbage Pick-up	0.0%	-
Miscellaneous	0.0%	-
Other 3	0.0%	5,000
Other 4	0.0%	-
Incremental O&M for Alternative	0.0%	-
Total Operating Expenses		5,000
Non-Operating Income/Expenditures		
Interest Income	0.0%	-
Other Income	0.0%	-
Other Expense	0.0%	-
Transfers In (Out)	0.0%	-
Net Non-Operating		-

Esisting Debt Service		
Bonds Payable, Less Current Maturities		$ -
Bonds Payable, Current		$ -
Interest Expense		$ -

Debt Service for Whiteface ISD
Alternative Number = 6
Funding Source = Loan/Bond

		2009 0	2010 1	2011 2	2012 3	2013 4	2014 5	2015 6	2016 7	2017 8	2018 9	2019 10	2020 11	2021 12	2022 13	2023 14	2024 15	2025 16	2026 17	2027 18	2028 19	2029 20	2030 21	2031 22	2032 23	2033 24	2034 25	2035 26	2036 27	2037 28	2038 29	2039 30
Existing Debt Service	$ -	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Principal Payments		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Interest Payment	0.00%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Debt Service			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
New Balance		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Term	25																															
Revenue Bonds		-	-	319,333	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Forgiveness	0.00%	-	-	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
Balance		-	-	319,333	313,513	307,343	300,804	293,871	286,523	278,734	270,478	261,726	252,449	242,616	232,192	221,144	209,432	197,017	183,858	169,909	155,123	139,450	122,837	105,227	86,560	66,773	45,799	23,566	0	0	0	0
Principal		-	-	5,820	6,170	6,540	6,932	7,348	7,789	8,256	8,752	9,277	9,833	10,423	11,049	11,712	12,414	13,159	13,949	14,786	15,673	16,613	17,610	18,667	19,787	20,974	22,232	23,566	-	-	-	-
Interest	6.00%	-	-	19,160	18,811	18,441	18,048	17,632	17,191	16,724	16,229	15,704	15,147	14,557	13,932	13,269	12,566	11,821	11,031	10,195	9,307	8,367	7,370	6,314	5,194	4,006	2,748	0	0	0	0	0
Total Debt Service		-	-	24,980	24,980	24,980	24,980	24,980	24,980	24,980	24,980	24,980	24,980	24,980	24,980	24,980	24,980	24,980	24,980	24,980	24,980	24,980	24,980	24,980	24,980	24,980	24,980	23,566	0	0	0	0
New Balance		-	-	313,513	307,343	300,804	293,871	286,523	278,734	270,478	261,726	252,449	242,616	232,192	221,144	209,432	197,017	183,858	169,909	155,123	139,450	122,837	105,227	86,560	66,773	45,799	23,566	0	0	0	0	0
Term	20																															
State Revolving Fund		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Forgiveness	0.00%	-	-	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
Balance		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Principal		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Interest	0.00%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Debt Service		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
New Balance		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Term	10																															
Bank/Interfund Loan				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Forgiveness	0.00%	-	-	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
Balance		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Principal		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Interest	8.00%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Debt Service		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
New Balance		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Term	25																															
RUS Loan			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Forgiveness	0.00%		-	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
Balance		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Principal		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Interest	5.00%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Debt Service		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
New Balance		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-