1.0 INTRODUCTION

1.1 Purpose of the Preliminary Engineering Report

This Preliminary Engineering Report (PER) has been prepared for the City of Natalia for the following purposes:

- To assess the current condition and performance of the existing drinking water production and distribution system;
- To consider improvement alternatives within these systems; and
- To make recommendations for such improvements within these systems.

This PER was prepared in accordance with all applicable requirements of the United States Department of Agriculture Rural Utility Services (USDA-RUS), and the guidelines of RUS Bulletin 1780-2. It is anticipated that this PER will accompany the City's application for funding from the USDA-Rural Development Program.

This report has been prepared in conjunction with a similar report detailing recommended improvements to the City's waste water collection and treatment systems.

2.0 PROJECT PLANNING AREA

2.1 Location

The City of Natalia is located within Medina County, Texas at a distance approximately 30 miles southwest of San Antonio, Texas. A Vicinity Map is provided for review as Exhibit No. 1 within Appendix "A." Natalia is generally bordered between Interstate 35 and State Highway 132 (TX-132). The municipal water system is supplied with drinking water by two primary groundwater wells located at a single site approximately 4.5 miles north of the City. The municipal service area is approximately 1 (one) square mile in size, and is composed mostly of residential customers with few commercial customers. The average base elevation within the service area is 710 feet above Mean Sea Level (MSL).

2.2 Current Service Count

The City of Natalia currently serves a total of 552 meter connections. Of these, 64 connections are classified as commercial, and 488 are residential.

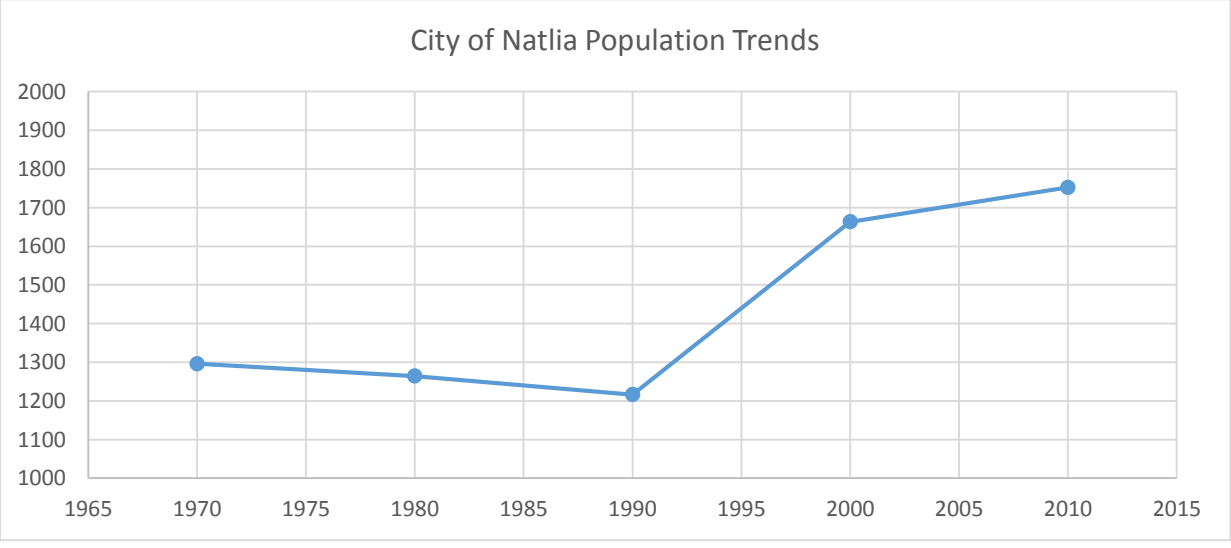
2.3 Environmental Resources Present

An Environmental Report (ER) for the proposed water system improvements project has been prepared by Kelley Environmental Consulting, LLC. A copy of the stand-alone ER document has been submitted under separate cover to accompany this PER document. Based solely upon an onsite survey of the proposed project sites, there have been no identified potential significant impacts on any biological, cultural, historical or natural resources, nor has there been any determination of adverse effects to the human environment which may be a result of the proposed improvements.

2.4 Growth Area and Population Trends

There is not a significant amount of undeveloped land and platted (but unoccupied) lots within the City of Natalia's utility service area. At this time, there are no immediate plans to expand the municipal utility service area. Some localized expansion could occur in the future if development occurs in areas around the Interstate 35 / FM 471 interchange.

Municipal population trends were evaluated using the 2010 United States Census Bureau information for the City of Natalia. Historic decennial census data from 1970 to 2010 was plotted using a Microsoft Excel spreadsheet. Using the most current ten-year growth rate of 5.4% between 2000 and 2010, the population data is projected out to 1,945 at the year 2030 for the purposes of this PER.



2.5 Community Engagement

A comprehensive Master Plan for the City of Natalia was last completed by Community Development Management Co. in 1996. It included an analysis of the current drinking water production, storage, and distribution systems as well as the wastewater collection system and treatment plant. No other studies have been completed on the City's water supply and distribution systems to date.

The information presented in the Master Plan indicated, at that time, that the total number of water meter connections served by the system (512) versus the available production capacity was within the limits of regulatory requirements of the Texas Commission on Environmental Quality (TCEQ). The total number of water meter connections served by the overall water production and distribution system represented only 27% of the City's total available water system service pumping capacity at that time. The total number of water meter connections, however, were in excess of the TCEQ allowable number of connections with respect to available storage. At the time of the Master Plan, the City fell just shy of this requirement, an issue that has since been corrected with the construction of a 100,000 gallon elevated storage tank.

The overall goal of this system improvements project is to improve the reliability and performance of the water distribution system through system modifications, rehabilitation, and enhancements and the replacement of failing system components. The details of various system improvements were presented to City staff during a meeting on August 12, 2015. From this meeting, the projects were prioritized and presented at a special meeting of the City Council held on September 2, 2015. This meeting was open to the public.

3.0 EXISTING FACILITIES

3.1 Location Maps

Location maps showing the location of the City's water infrastructure have been included as Exhibit No. 2 as part of Appendix "A". Photographs of major system elements are also included as Exhibit No. 1 as part of Appendix "B".

3.2 History

Limited historical records are available for the systems. Available records reference initial construction of water mains around 1970. Most of the mains were constructed with iron/steel, and have shown evidence of corrosion over time. Work has continued since to replace sections of aging metal pipe with PVC.

The City's water supply was originally fed by a well located adjacent to the City's school property. This well draws water from the Carizzo aquifer, and is now used only for irrigation water for the schools. The two raw water wells (located on a common site off of FM 446) that are currently used as the City's primary source were originally drilled in 1982 and 1993, respectively. An additional well was drilled in 1996 (also located off of FM 446 approximately 1.7 miles further south) that is currently used as a back-up for the two primary wells further to the north.

Projects were chosen based on known ongoing system maintenance issues and deficiencies. Additional system wide audits to determine water loss, energy use, and system efficiencies were not conducted as part of the development of this preliminary engineering report.

3.3 Existing Infrastructure

The existing drinking water distribution system serves 552 water meter connections that are located within a single pressure plane, all served by the City's 100,000 gallon elevated storage tank. Additional storage is available as an 80-ft high, 365,000 gallon stand pipe located at the elevated storage site.

The City's regular water supply comes from two (2) wells at a shared site located off of Highway 463. State well number 6849302 was drilled in 1992 and production capacity was reported at 1641 gpm at that time. State well number 6849301 was drilled in 1982 and was tested at 542 gpm. Both wells pull water from the Edward's Aquifer. A backup well is also located about 1.7 miles south of the primary wells, which also draws from the Edward's Aquifer. This wellsite is not as well maintained, and the equipment is also showing its age. All three wells are drilled to a depth of approximately 2,500 feet. Water from the Edward's Aquifer source is generally of high quality, requiring little in the way of treatment. Once pumped, water requires only chlorine disinfection by the City before being sent to the City's standpipe and elevated storage tank (both at the same site). The City has an allotted volume of Edward's water that can be used annually. This volume is carefully monitored and excessive usage results in additional fees.

Specific deficiencies within the water system include the following:

- <u>Deteriorating Water Main Distribution Piping</u> – The City's drinking water distribution system contains approximately 11 miles of buried water main piping, ranging in size from 2 to 8 inches in diameter. According to system operations personnel, the City is repairing water main leaks on an, "as needed," basis, but there is no current plan to systematically replace the aging water mains located within the City. Maintenance staff has indicated that the oldest water mains in the system are old galvanized steel and tend to break/leak the most often. From past maintenance efforts, City staff knows the general areas where

these mains are found, but the exact limits are unknown. Staff also reports that water mains constructed with asbestos cement-lined pipes (AC pipes) exist within the system. AC pipes are susceptible to breakage and fracture in shifting soils, and they present potential health hazards to leak repair crews who handle those types of material. It is now common practice to replace AC pipe when possible in water distribution systems.

- Missing and Faulty Water Main Isolation Valves – Utility maintenance staff reports having difficulty isolating areas within the distribution system's pressure plane where emergency water main repairs occasionally are required. Many of the valves' locations are unknown, the lids having been covered up during roadwork. Other valves do not operate properly due to their age and the lack of a formal plan for exercising valves on a regular basis. This situation can prevent repair crews from shutting off water flow in affected problem areas, thus extending the amount of time a leak can occur, and possibly requiring a "wet," repair. In addition to making water main repairs difficult and unsafe, "wet" repairs potentially can contaminate the drinking water within the piping system, which poses health risks to drinking water customers.

- Manual Read Water Meters – Known, problematic water meters located throughout the municipal drinking water distribution system are generally replaced on an "as-needed" basis. Currently, consumption values on each of the 500 +/- water meters must be read and recorded manually, thus requiring significant labor and resources to be expended on a monthly basis to complete that task. It is believed that these aging valves (along with pipe leaks and breaks discussed above) contribute to the City's current average water loss of 15%. This water loss number results in the unrecoverable expense of pumping water at the City's well site without recovering fees through billed metering.

- Lack of Back-up Power at Well Site – Power to the well site is fed overhead to a common panel shared between the two wells. The well site, however, lacks back-up power in the form of a stand-by generator. Per staff, elevated storage volume generally will sustain pressure to the entire system for 3-4 hours in the event of a power outage. After that, pressures drop and the level of service cannot be maintained.

- Lack of Back-up Power for SCADA – The City maintains SCADA communications between City hall and the well and elevated storage tank sites. These communications, like the wells above, do not currently have provisions for back-up power. A power outage at City Hall results in no communications, and disabled remote operations, of the two sites. This can result in lack of system pressures do to a drained tank. In an extreme event (i.e. inoperable control valve at the tank site), this could also result in a tank overflow.

- No Adjacent System Interconnect for Emergency Supply of Drinking Water – Service areas for the East Medina Special Utility District (EMSUD) are located to the north and west of the City of Natalia, while service areas for the Benton City Water Supply Corporation are located south and east of the City. The City has no interconnect with either of these providers leaving them without a reliable emergency source of water in the event of interruption in supply resulting from a major line break or a weather related event affecting the well site. The backup well is not utilized enough to ensure reliability. The City is also without options if their allowable volume taken from the Edwards Aquifer is exhausted, resulting in costly fees/fines. A new water supply could also help facilitate future growth.

- Water Wells in need of Periodic Rehabilitation – The City of Natalia operates three groundwater wells, two primary and one back-up well located north of the City. Each of the wells pump groundwater from the Edward's aquifer sand formations at a depth of approximately 2,500 vertical feet below grade. Records indicating periodic rehabilitation of the wells are not available, and City staff was not aware of when previous rehabilitation efforts had taken place.

- Minor Corrosion of the Stand Pipe – Recent inspection reports discussed minor corrosion on the interior and exterior of the City's 365,000 gallon standpipe. Records are not available to as when the stand pipe was last coated. Protective interior and exterior coatings are typically redone every 15-20 years. City staff did say that the standpipe has not been repainted within this time frame. Failure to address existing corrosion and repaint the standpipe will eventually lead to more corrosion and more costly repairs.

3.4 Financial Status of Existing Facilities

The following items have been provided by the City of Natalia and included in Appendix "C", as a synopsis of the City's financial status:

- The City of Natalia's current utility billing rate structure
- Detailed water usage by customer
- Utility fixed asset list
- 2014/2015 budget vs. actual
- 2015/2016 budget
- Current financial audit (completed for the 2013/2014 fiscal year)

The audit covering the 2014/2015 fiscal year will be available in February, 2016. The City does not have an asset management plan.

Based upon customer usage data provided for the month of August 2015, there were 552 water meter connections within the entire drinking water distribution system, consuming a monthly average of 5,116,277 gallons of water during that time period. Residential service (including multi-family housing) accounts for approximately 88% of the active service meter connections, and 76% of the volume of water used. Based upon this data, it is estimated that a residential service connection consumes an average of 8,025 gallons of water each month, while non-residential service connections average approximately 18,925 gallons per month of water consumption

4.0 NEED FOR PROJECTS

The City of Natalia is committed to providing high-quality, safe, and reliable drinking water at all times to all of its customers, and the general public at large.

4.1 Health, Sanitation, Security, and Regulatory Compliance

Safe and reliable drinking water utility services are essential to providing proper health, sanitation, and fire flow protection to customers within a municipal service area. The disruption of such a critical service due to inadequate or inoperable water system facilities would create a significant risk to the health and life-safety of residents and visitors within the City of Natalia.

Drinking water production, storage, and distribution systems must be planned, designed, constructed, operated, and maintained in accordance with all applicable standards and practices, as well as be in compliance with all local, state, and federal regulations and codes. Specifically, the City of Natalia's drinking water utility system is required to meet or exceed all applicable TCEQ regulations for public drinking water system operations.

The written findings from TCEQ from their most recent compliance inspection of Natalia's water supply and distribution infrastructure has been included as Appendix "D".

4.2 System Operation and Maintenance

The well pumps supply water to the utility system on an, "as needed," basis. Activation and deactivation of the well pump is controlled by SCADA based on the level in the City's elevated storage tank, which is located at a separate site from the well. Water stored within the elevated tank is then transferred to the standpipe via gravity, as controlled by automatic control valving.

Operational manpower at the well site and tank site is provided by municipal employees who are responsible for conducting limited maintenance and monitoring of the utility system. The

operators respond to customer inquiries, perform minor maintenance activities, collect system operational data when required, and collect water samples for routine chemical and disinfection analysis as required by state and federal regulatory agencies.

Basic operation and maintenance of the drinking water distribution system is conducted by utility operations personnel when possible, and involves the exercising of isolation valves and the flushing of water main piping by opening fire hydrants on a periodic basis, or when required to mitigate the taste and odor effects of, "stagnant," or stale water within the pipeline.

4.3 Existing Facilities Conditions

Most of the City's buried water distribution infrastructure is generally undersized, aged, and in need of repair. Some sections of the system have been upgraded since the system was initially installed, but record drawings, maps, or documents (produced typically during upgrades of the water main piping and distribution system network) do not exist for use by utility operations and maintenance personnel outside of basic design plans from the original installation.

The City's regular water supply comes from two (2) wells at a shared site located off of Highway 463. At the time of report development, the well condition appeared to be acceptable for continued use. Furthermore, there are no reports from the City of diminishing well capacities that would result in the infrastructure not being fit as a continued primary water source. This site is generally well maintained, but the existing equipment (pumps, flow meters, panels, etc.) is showing some signs of aging.

The tank site, which includes both the elevated storage tank and the City's stand pipe is in good condition and appears suitable for continued use.

4.4 Growth

There is not a significant amount of undeveloped land and platted (but unoccupied) lots within the City of Natalia's utility service area. At this time, there are no immediate plans to expand the municipal utility service area. Some localized expansion could occur in the future if development occurs in areas around the I-35 / FM 471 interchange.

Municipal population trends were evaluated using the 2010 United States Census Bureau information for the City of Natalia. Historic decennial census data from 1970 to 2010 was plotted using a Microsoft Excel spreadsheet. Using the most current ten-year growth rate of 5.4% between 2000 and 2010, the population data is projected out to 1,945 at the year 2030 for the purposes of this PER.

5.0 PROJECTS CONSIDERED

There have been very few CIP projects completed over recent years focused on upgrading or maintaining existing water infrastructure. As a result, the list of feasible projects that would help meet the City's water infrastructure needs is long. Using a USDA search grant, the City hired M&S Engineering to develop a prioritized list of suggested water improvement projects. In selecting and prioritizing the project list, sustainability, system reliability, infrastructure criticality (impact to public should a failure occur), and long term maintenance, were all considered. Specific sustainability-related benefits considered include the use of PVC pipe for pipeline connections and replacements. PVC, when installed correctly, has a very long life expectancy and has a relatively minimal environmental load in terms of CO2 emission, when compared to metal products for the same application. Included below (section 5.2) are the projects that were considered to improve the existing water production, storage, and distribution system within the City of Natalia.

5.1 No Improvements within the Water Production, Storage, and Distribution System

The City of Natalia could certainly continue to operate and maintain the existing drinking water production, storage, and distribution system in its current form and condition. This option would require the City to achieve a higher level of preparedness to respond to any potential emergency situations, such as breaks in a water main, tank leakage, well failure, etc. Additionally, an increase in the number and frequency of water main leaks in the future should be anticipated by the City if this option is chosen, as the older galvanized steel water mains age in place, and are attacked continuously by corrosive soil conditions below grade. Selection of the, "Do Nothing," option means that the City would continue to deal with temporary drops in pressure during power outages and maintenance staff would continue to repair leaks/breaks as they occur. The well sites would remain in service as-is, and maintenance would be conducted on an as-needed basis. The City of Natalia would delay the replacement of mains at this time along with other improvements in supply/system redundancy.

5.2 Project Analysis

5.2.1 Prioritized Project List

1. Well Site Upgrades: This project would improve the performance and reliability of the City's (2) existing raw water wells and the back-up well. Work would include the addition of standby power at the primary well site in the form of a diesel generator and associated automatic transfer switch. New flow meters would also replace old, existing meters at both sites with newer technology. The project would include servicing of the existing well pumps, new control valves, and a video inspection of the condition of each well to ensure the wells will continue to provide a reliable water source into the future. Having a well

site located more than four miles north of the City limits also poses problems with additional time needed for maintenance staff responding to any issues at the well site. For this reason, back-up power will also be added to existing SCADA infrastructure at the well site and at the elevated tank site by the addition of battery back-up, and at City hall with a permanent standby generator, to ensure that operations can be reliably monitored and controlled remotely during periods of power outage at these locations. This project was given the highest priority because of the criticality of having back-up power at the City's only primary water source and the fact that the project benefits are realized by the entire City.

2. Upgrades to the Oldest Portion of the Water Distribution System: Areas of the City (approximately 10,000 feet of main, or 25% of the distribution system) have been identified as having old, galvanized water mains. These areas have also been identified as suffering breaks/leaks the most often. Replacement of these mains with new PVC mains would reduce breaks and leaks, and ultimately decrease the amount of water that is pumped and lost in the system. At the same time, system valving will be analyzed to determine proper protocol for isolating the school property and Love's Travel Center such that these two sites may be served directly by the elevated tank and remain with water in the event of a break elsewhere in the system. New hydrants will be spaced such that residents have improved fire flow within a reasonable distance from any structure. This project was given high priority due to the City's high water loss rates during recent years. From discussions with City staff, the City will consider replacing water mains in additional areas in the future as funding allows.

3. Emergency Interconnect with East Medina Special Utility District: A new interconnect with East Medina Special Utility District would allow for a temporary water source should there be a break in the City's pipe from the wells along Highway 463, a major failure (lightning strike) at the well site, or if repairs are being completed requiring shutdown of the well site. A suitable location for this interconnect is at the intersection of CR 675 and FM 463. His project was given high priority due to the relative ease to construct due to the City's water main being in close proximity the East Medina's main coupled with the benefit of having a reliable water source should the City's well be down for any extended period of time.

4. Miscellaneous Water Tank Rehabilitation: It was noted during a recent inspection of the City's tanks (by others) that corrosion is evident on the interior and exterior of the existing stand pipe. Also, minor surface cracking was evident in concrete pier caps on the elevated tank. This project would include sandblasting visible rust and repainting the stand pipe, along with repairs to the surface cracking at the pier caps of the elevated tank. This project was given moderate priority. The deficiencies noted above are not considered an

immediate threat to the stability and reliable operation of the tank structures. Other items in this list will also provide a more immediate impact on the overall system and do more to increase the reliability of supply to the citizens of Natalia.

5. System-wide Meter Replacement: This would involve replacing approximately 552 existing water meters with automatic read meters. Utility staff feels that replacing all meters in the system would reduce the City's annual water loss percentage and increase billings through improved accuracy. Automatic read meters would also greatly cut the time to read meters and would free up staff time for other needs. This project has been assigned a lower priority status as it is somewhat unknown what impact new meters will actually have in reducing the City's water loss. While new meters typically will benefit a utility by improving accuracy of readings, it would require testing of a representative number of existing meters to better predict the benefit.

6. Upgrades to the Remainder of the Water Distribution System: Areas of the City not replaced under item #2 above (approximately 30,000 feet of main, or 75% of the distribution system) have been identified as including old, galvanized mains, AC (Asbestos Cement) mains, and older cast/ductile iron mains. Breaks/leaks are not uncommon in these areas of the system, however not as common as the portion of the system identified in item #2. Replacement of these mains with new PVC mains would reduce breaks and leaks, and ultimately decrease the amount of water that is pumped and lost in the system. New hydrants will be spaced such that residents have improved fire flow within a reasonable distance from any structure. This project has been assigned a lower priority due the high cost of replacing mains and the City's resultant desire to improve only a small section of the City at this time, and complete additional areas (both water and sewer) as future funding will allow.

5.2.2 Design Criteria

Summarized below is a listing of the relevant hydraulic design criteria that the drinking water distribution system should satisfy, when feasible, to optimize system performance and meet or exceed all applicable regulatory guidelines and requirements.

- Average Daily Water Demand per Meter Connection: 340 Gallons per Day (gpd)
- Maximum Daily Water Demand per Meter Connection 550 gpd
- Minimum Distribution System Pressure: 40 Pounds per Sq. Inch (psi)
- Maximum Distribution System Pressure: 80 psi
- Minimum Peak Hour System Pressure: 35 psi
- Minimum System Pressure with Fire Flow Demand: 20 psi
- Maximum System Flow Velocity: 7 Feet per Second (fps)

- Maximum System Flow Velocity with Fire Flow Demand: 15 fps

In instances where only isolated portions of the system can be upgraded, some of the criteria above may not be met through the upgrade. In these instances, design will allow for the criteria above to be met once additional projects (upgrades to the remainder of the system) can be completed.

Water meters, meter boxes / vaults, and any other exposed water system appurtenances should be suitable for use in hot, dusty environments where UV exposure from sunlight is constant during several months of the year.

5.2.3 Environmental Impacts

As will be discussed in greater detail in sections 6.0 and 7.0, projects # 1-3 have been selected to move forward for the funding application to USDA based on priority, criticality to the system, and the desired loan limitations of the City of Natalia. All of the drinking water utility system improvements described above will be located either directly upon / under property currently owned by the City of Natalia, or they will be located upon / under private property within public rights-of-way corridors that are currently possessed by the City. Thus, no apparent environmental impacts resulting from implementation of the system improvements listed and described above are anticipated to occur within the project location boundaries. Additional information can be found in the associated Environmental Report (submitted under separate cover) for the proposed projects.

5.2.4 Land Requirements

Generally, all projects will be installed and/or constructed on land owned currently by the City of Natalia, or within public right-of-way easements located upon private property. However, some new utility easement agreements for corridors located outside of established public rights-of-way possibly may be required for execution prior to the installation of new valves, pipelines, fire hydrants, etc. within the project areas. This will be better known when project surveys occur.

5.2.5 Potential Construction Problems

Progressive utility work along some moderate slopes may be required during trench excavation for water main pipeline installation. During trench excavation, some hardened rocks and limestone formations may be encountered by workers and equipment, and seasonal groundwater just below grade may be present.

Pipeline utility work along existing narrow streets and roadways may be difficult, and will probably require the use of temporary traffic barricades, warning signs with lights, and flagmen during the time construction work is underway. Driveway access for private property owners and businesses must be maintained at all times during construction. Access to rear lots, alleyways, and other easement corridors may be constrained by existing above-grade structures, fences, etc.

Existing property improvements, including landscaping and mature trees, may be impacted at many public and private properties during construction. Trenchless pipeline construction, including horizontal directional drill and jack&bore installations, could be required in some specific locations to avoid above grade or buried conflicts. Installation of some temporary water distribution mains may be required to keep customer service lines active while existing distribution mains are being replaced or upsized.

Many residences have landscape and flatwork improvements in place that will be impacted during meter box installation. This could require meter box placement at a location offset from the existing meter and service lateral location.

Property owners adjacent to each of the project areas may have to contend with elevated levels of dust and noise during storage of construction materials at each of the project sites. It is anticipated that most residents will be understanding and cooperative. Both City staff and other City representatives will be prepared to educate residents and business owners of the pending improvements to the drinking water utility system and how these improvements are of benefit to their communities.

Construction activities pertaining to existing water distribution infrastructure invariably require some degree of interruption in service. During design development, service interruptions will be limited by providing guidelines for the Contractor's construction sequencing. Service interruptions resulting from work at the well site can be mitigated by filling the City's elevated storage and stand pipe tankage. Interruptions resulting from connections to existing distribution infrastructure downstream of the tanks can be mitigated by making these connections during low demand periods (overnight) with prior notice given to affected customers.

5.2.6 Cost Estimates

A summary of estimated costs for all projects listed in section 5.2.1 has been included below.

City of Natalia - Preliminary Project Cost Estimates	
Project Description	Estimated Initial Capital Cost
Well Site Upgrades	$349,000
Upgrades to the Oldest Portion of the Water Distribution System	$484,000
Emergency Interconnect with East Medina SUD	$45,000
Miscellaneous Water Tank Rehabilitation	$129,000
System-wide Meter Replacement	$75,000
Upgrades to the Remainder of the Water Distribution System	$1,590,000

5.2.7 Project Advantages and Disadvantages

Well Site Upgrades: Adding standby power in the form of an onsite diesel generator at the primary well site will allow reliable operation of well pumps in the event of a power outage. City staff reports an estimated 3-4 hours of service volume available during a power interruption at the wells. In past events, this time has been insufficient and the lack of water has required shutdowns to the City's schools. Replacement of meters and valving at the well sites will result in improved reliability of these functions. Accurate meters assure that the water pumped from the Edwards Aquifer is correctly monitored, possibly helping to avoid any fees or fines the City may incur if pumped water were to be overestimated. New control valves will also help limit future maintenance at the site.

One disadvantage of the proposed well site upgrades is that it will require the operation and long-term maintenance of the diesel generator. Generators require periodic runs and monitoring of fuel levels/age to ensure proper performance when they are needed. Installation of control valves and flow meters will also require that the wells are offline temporarily. This will require planning and coordination between City staff and the Contractor to ensure there is no interruption in service.

Upgrades to the Oldest Portion of the Water Distribution System: Advantages gained by installing new water main pipelines to replace existing, older water mains include fewer service interruptions, reduced maintenance efforts, and reduced water loss from a reduction in leaks and breaks. Reductions in water loss result in less lost revenue for the City and the potential for a reduction of costly fees and penalties for overdraws from the Edwards Aquifer.

A disadvantage to this type of utility work within congested, urban environments is that there will be significant impacts to both residential and business customers as far as access to their properties through construction zones is concerned. Sidewalks, driveways, landscaping, flatwork, and other improvements that have been made over the years across and adjacent to

right-of-way corridors may be need to be taken out of service temporarily while construction work takes place beneath, beside or over them.

Emergency Interconnect with East Medina Special Utility District: Establishing an emergency interconnect with East Medina will afford the City an alternate water source in the instance that there is an interruption in water supply from the City's well site. Repairs or maintenance needed at the well site or along the pipe route between the well site and the interconnect can be completed without the extreme expediency that would otherwise be required due to interruption of the City's sole water source.

Disadvantages to an emergency interconnect are few. The interconnect will simply be a piped connection between two water mains, which are already relatively close in proximity. The interconnect will, however, introduce new valving which must be exercised and a flow meter which must be calibrated at regular intervals.

Miscellaneous Water Tank Rehabilitation: This project would include rectifying existing corrosion and recoating of the interior and exterior of the standpipe. These items would be advantageous by prolonging the useful lives of the structures through preventing the severity of existing corrosion and the reducing the likelihood of new corrosion moving forward.

Some of the disadvantages associated with performing minor rehab are the relative cost and impact to the system that would be required, even to make these minor improvements. Any work completed on the interior of the standpipe would require complete draining of the structure, completion of work, and disinfection before the structure could be placed back into reliable service. It is estimated that the time out of service could approach one month, depending on the severity of repairs required.

System-wide Meter Replacement: Some of the advantages related to replacement of existing water meters throughout the City with ones that have AMR capability include a reduction in operating costs (fewer vehicles and personnel required to read meters manually), increased revenue recovery resulting from enhanced meter accuracy, improved accuracy of field operations personnel (fewer re-reads of meters required), and improved worker safety (less contact with hostile animals, irate customers, etc. during meter reads).

Some of the disadvantages associated with implementing an AMR system within the City's water utility service area include the considerable upfront capital expenditure on new meters, transponders, mobile computers, software, training, etc., the addition of annual service and maintenance fees to the City's operations and maintenance budget, and the addition of some complexities associated with the introduction of new technologies into the system.

Upgrades to the Remainder of the Water Distribution System: The advantages and disadvantages for these improvements are identical to those listed above under the project titled Upgrades to the Oldest Portion of the Water Distribution System. The variance here lies with the prioritization of water mains in the system that are believed to be in the worst condition. The cost per linear foot of pipe to complete the project would be similar between projects. However, this project would have a lower cost/benefit realized due to the assumed better condition of the existing infrastructure.

6.0 SELECTION OF PROJECTS

The project list discussed herein is focused primarily on maintenance related repairs and upgrades in the reliability of the system, as opposed to system expansions, and wide scale replacements/upsizings. Projects listed were prioritized based on current condition of the infrastructure, criticality to the overall water distribution system, impacts to public health and safety resulting from failure, as well as cost. This list was prioritized at the same time a similar list was being prioritized for wastewater system improvement projects. The City also set a limit for the amount of funding (combined for water and wastewater improvement projects) they wished to apply for.

Provided below in a tabular format is a cost and recommendation summary for the proposed project alternatives. Recommended projects are cost-effective and feasible drinking water system improvements that benefit a large group of customers through a significant reduction in the possibility of diminished water pressure or complete loss of service.

City of Natalia Project Summary			
Project Number	Project Description	Estimated Total Capital Cost (not including Future O&M Costs)	Recommended? Y or N
1	Well Site Upgrades	$349,000	Yes
2	Upgrades to Oldest Portion of the Water Distribution System	$484,000	Yes
3	Emergency Interconnect with East Medina SUD	$45,000	Yes
4	Miscellaneous Water Tank Rehabilitation	$129,000	No
5	System-wide Meter Replacement	$75,000	No
6	Upgrades to the Remainder of the Water Distribution System	$1,590,000	No

7.0 PROPOSED PROJECTS AND POSSIBLE ALTERNATIVES

7.1 Recommended Water System Improvement Projects

Construction of the water system improvement projects summarized below is recommended for expansion and enhancement of the safety and reliability of the City's potable water production, storage and distribution system. A system map depicting each of the proposed projects has been included as Appendix "F".

City of Natalia Recommended Water System Improvement Projects
1. Upgrades at the City's well site, including the addition of back-up power, new flow meters and valving, video inspection of the wells, and servicing of well pumps.
2. Replacement of approximately 10,000 feet of oldest water main within the City's distribution system with new PVC water mains and associated valving/hydrants.

3. Creating an emergency interconnect with the East Medina Special Utility District to establish an alternate water supply during service interruption from the well site.

7.2 Alternatives to the Recommended Projects

In addition to prioritizing each of the possible projects and developing the list above, a possible alternative to each of the four (4) selected projects was developed and is discussed below.

Miscellaneous Wellsite Upgrades: One alternative to making wellsite upgrades is for the City to establish interconnect(s) with one or more neighboring utility districts, and forego pumping and supplying water from the existing wells. This alternative would likely result in high costs from purchasing water, and would require the City to verify that the other utility districts had the excess capacity and infrastructure required to provide reliable supply and pressure. Purchasing all water from another source also means the City can recover little income from its water supply to the residents. This alternative would also be more attractive if the existing wells (the City's supply that has proven to be reliable over many years) did not already exist. With the existing wells, the option of simply rehabbing the site and adding back-up emergency power allows the City to control their own supply for years to come with a limited additional capital investment.

Replacement of Aging Water Mains: There is no cost-effective capital project approach to resolving the condition of the water mains other than replacement. However, one alternative to replacement at this time is to continue to repair leaks as they occur, possibly replacing small sections of mains as work is required. This option would result in a system not constructed as reliably and efficiently as it would with a single replacement effort; that is the system would include more repair sleeves, connections, and other points with mechanical joints than what would otherwise be required. Replacing/repairing small sections of main also is difficult for the City to track with respect to the overall goal of replacing all aging mains in the system. Replacing mains in a large area at a single time can be accomplished more cost effectively than making multiple, smaller replacements because the Contractor only has to mobilize manpower and equipment once and material can be purchased in larger (bulk) quantities. The impacts to surrounding residents also can be limited to a single project.

Emergency Interconnect with East Medina SUD: One other option considered aside from establishing an emergency interconnect with East Medina SUD was an emergency interconnect with another neighboring utility to the east, Benton City Water Supply Corporation. Through discussions with staff from Benton City, there was less perceived interest in establishing an interconnect with the City. Also, a significantly greater length of pipeline would be required to establish a connection, possibly including a bore under I-35. The interconnect with East Medina can be established with very little cost. Also, the interconnect location would be along the

primary feed from the City's existing wells, meaning the City could likely operate their system in the same manor as if water was being supplied from the wells.

7.3 Recommended Projects Cost Estimate

Where applicable, a life cycle cost analysis was completed for each project and an associated project alternative (or option). Where projects focus primarily on maintenance of the system and/or replacement of aging infrastructure, parts of the 20-year cost analysis may not be applicable. Operation and maintenance costs as well as salvage value items are only presented for items that are considered additions to the existing system (i.e. not items/projects that simply replace or are repairs to existing infrastructure). These analysis have been provided as part of Appendix E.

The opinions of probable costs for water system improvements are preliminary and were developed from industry unit costs that reflect typical bid pricing for similar construction projects in areas surrounding and similar to the City of Natalia. Costs for engineering and contingency are generally estimated as percentages of the overall construction estimate.

Note: Costs can vary somewhat depending upon a number of variables. Some of the main factors affecting costs are described as follows:

- Quality—Prices for materials and workmanship should represent sound construction work.
- Overtime—Labor costs should be adjusted accordingly if the schedule is accelerated to require effort beyond normal working hours.
- Size of Project—Economies of scale can reduce costs for large projects and, conversely, unit costs can often run higher for small projects.
- Location—Within dense neighborhoods, traffic (especially school-related traffic) and site storage limitations may increase costs.
- Season of the year / weather conditions
- Contractor management
- Building code requirements
- Availability of skilled labor and building materials
- Owner's special requirements and/or restrictions
- Safety requirements
- Environmental considerations
- Traffic control

7.4 Project Schedule

A proposed Project Schedule for funding and administration of the recommended water distribution system improvements is provided for review within Appendix "G".

Due to the standalone nature of each project, it is anticipated that, "construction packages," consisting of construction plans, specifications, and contract documents will be developed for each of the three projects.

7.5 Annual Operating Budget

For information related to annual operating budgets prepared by the City of Natalia, the following documents are provided for review within Appendix "C":

- Utility fixed asset list
- 2014/2015 budget vs. actual
- 2015/2016 budget
- Current financial audit (completed for the 2013/2014 fiscal year)

The audit covering the 2014/2015 fiscal year will be available in February, 2016. The City does not have an asset management plan.

8.0 CONCLUSIONS AND RECOMMENDATIONS

To determine projects for recommendation, staff at M&S Engineering worked with City staff to determine the deficiencies and needs present in the water distribution system. Deficiencies included issues relating to the level of service the City is currently able to provide its customers, system redundancy and reliability, as well as issues facing the maintenance staff day-to-day. These system deficiencies were then used to develop a suggested list of capital improvements that would be of benefit to the City of Natalia and its water customers. This list was prioritized based on the criticality of the need being served, how many of the City's customers are potentially impacted, and the benefit to the City's staff in terms of improving their abilities to provide daily service. Costs estimates were then performed for the prioritized projects and projects selected based on the City's desire to pursue approximately $1,500,000 in USDA funding.

Through the efforts described above, it has been concluded that the most critical need for the City at this time is improvement in system reliability. The absence of a standby power source at the well site results in interruptions to the City's sole water source in the event of a power outage. In addition, a break in the 8-inch water main feeding the City's distribution system from the north

also can isolate customers from its sole supply for extended periods of time. For these reasons, two of the three recommended system improvements to be completed using USDA funding focus on improving the system reliability by providing back-up power at the well site and establishing an emergency water source through an interconnect with a neighboring water utility.

The following project alternatives have been selected:

City of Natalia **Recommended Water System Improvement Projects**
1. Upgrades at the City's well site, including the addition of back-up power, new flow meters and valving, video inspection of the wells, and servicing of well pumps.
2. Replacement of approximately 10,000 feet of oldest water main within the City's distribution system with new PVC water mains and associated valving/hydrants.
3. Creating an emergency interconnect with the East Medina Special Utility District to establish an alternate water supply during service interruption from the well site.

In all cases, there is not a more economical option for improvement that would provide the City the same benefits long term. PVC was selected as the material to be used for new water lines due to numerous factors:

- PVC is non-corrosive and resistant to chemical attack, meaning it should outlast metal (ductile iron) used in the same application without application of costly linings/coatings for protection. These properties mean that the PVC pipe also does not adversely alter water quality.
- PVC is more flexible (less rigid) than ductile iron pipe, allowing some flexibility in installation.
- PVC pipes have smoother wall surfaces than most other types of water main piping, meaning there is less friction loss, and therefore higher delivery pressures, in a PVC distribution system.
- PVC material cost is competitive to other pipe materials, especially when life cycle cost is considered.
- PVC is commonly used for water distribution systems, meaning contractors are familiar with its use.

Replacement of **all** lines in the system is something that the City has considered, but it is not justifiable at this time due to the high cost and their desire to limit the amount of funding requested. Instead, the portion of the system determined to be the oldest (and with the most frequent leaks/breaks) has been prioritized for replacement with new PVC mains. The recommendation to replace the oldest section ensures that the greatest benefit will be realized by the City in correlation with the USDA funding dollars spent. PVC mains have a long, established

useful life. Placement of mains will favor locations where the mains will be unlikely to suffer damage from miscellaneous excavation.

All selected improvements will meet TCEQ's criteria for water supply and water distributions systems.