Technical Memo for El Creston Mutual Domestic Water Consumers Association Water System Improvement Project San Miguel County, NM August 2015

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1.0 Introduction

El Creston Mutual Domestic Water Consumers Association (MDWCA), located in San Miguel County, is currently comprised of homeowners who live in areas north of I-25 (Upper El Creston) and south of I-25 (Lower El Creston) and include the communities of Ojitos Frios Ranches, Pine Ridge, Blue Ridge, La Manga, Romeroville, Ojita, Sheridan, and La Manga. The March 2011 Preliminary Engineering Report (PER) was prepared to obtain funding for a community water system in which four possible alternatives were evaluated to provide a reliable water supply system for the association members as listed below.

1. Construction of a centralized water system for the entire service area (well, tank and distribution lines)
2. Connection to the City of Las Vegas water system
3. Procurement of water from the Milliken Ranch
4. Construction of a decentralized water system that divides the service area into two sections – Upper and Lower El Creston which will be built in sub-phases as funding becomes available.

The recommended alternative identified in the PER is to build a decentralized water system comprised of two separate service areas, Upper and Lower El Creston. Each service area would consist of a well, water storage tank and distribution lines. Due to anticipated limitations in funding, the two systems would be built independently of each other in sub-phases. Both systems will be constructed in a manner so that they can be connected in the future.

In March of 2014 a Supplement to the PER was prepared on behalf of El Creston MDWCA in order to add clarify to the water system improvements identified for the Upper El Creston service area. Supplement No. 1 defined the distinct projects for Upper El Creston by funding source through sub-phases.

In September 2014 a Supplement No. 2 to the PER was prepared in order to combine Sub-Phase 2 and Sub-Phase 3 for the Upper El Creston Service area as defined during the meeting with staff from the United State Department of Agriculture – Rural Development (USDA-RD) on September 3, 2014. Supplement No. 2 to the PER was specifically prepared to coincide with a funding application to USDA-RD for a specific amount of funding to combine Sub-Phase 2 and Sub-Phase 3. At the time of this Technical Memo, El Creston is currently developing the application to USDA-RD for that particular phase of the project while simultaneously working on an application under the

New Mexico Finance Authority under the Drinking Water State Revolving Loan Fund (DWSRLF) for the same project.

2.0 Need for Project

El Creston was incorporated in 2004; by 2009, about 60 of the existing private wells in the area went dry, forcing families to haul water to their homes or use rain catchment systems. At the same time, some homeowners noticed a significant decline in the water levels in their wells.

The MDWCA was formed to unite water users in the area so that they can work towards the common goal of providing a safe and reliable source of potable water to members. The water association members would like to develop, construct and operate a water supply system. Construction of the proposed system will provide drinking water and fire protection to members and help to maintain current land values in the area.

In 2010, the MDWCA obtained a loan from the New Mexico Board of Finance and with that money purchased a used truck which was converted to purchase and haul potable water from the City of Las Vegas. The Association charges a rate of $110 to haul 1,500 gallons ($0.073 per gallon) to its members, and is operating on a positive balance to accommodate loan repayment as well as vehicle repairs and maintenance.

In 2012, El Creston MDWCA secured funding from the Water Trust Board (WTB) to design a water supply well, a 40,000 gallon water storage tank, a pump house, approximately 3,700 linear feet of 8-inch waterline and a water fill station. In 2013, 2014 and 2015, El Creston MDWCA secured funding from the WTB and Capital Outlay Appropriations to construct the project designed from 2012 WTB funding. To date, only the exploratory water supply well has been drilled.

Construction was placed on hold in late December 2014 due to exceedance of U.S. Environmental Protection Agency (USEPA) Secondary Drinking Water Standards for sulfate [250 milligrams per liter (mg/L)] and total dissolved solids (500 mg/L) that were discovered during the first phase of the exploratory well. Sulfate concentrations were found to range from 960 to 990 mg/L and total dissolved solids (TDS) ranges from 1,540 mg/L to 1,680 mg/L. Exceedance of Secondary Standards for TDS and sulfate does not constitute a violation of the Safe Drinking Water Act (SDWA) regulations thus, the Association could supply water to its members. However, at these concentrations, the taste of the water can be disagreeable to consumers.

SMA was tasked with preparing this Technical Memorandum to evaluate short and long-term alternatives for a safe drinking water source.

3.0 Evaluation of Alternatives

The following four alternatives are evaluated in this Technical Memo:

1. Proceed with Current Project and Install a Water Treatment System

2. Proceed with Current Project – No Treatment
3. Construct a Replacement Well into a Different Formation
4. Connect to the City of Las Vegas Utilities Water System

Each of the alternatives were evaluated considering the design criteria reported in the PER as summarized below.

Project Phase	Year Ending	Max Connections	Service Population	Yearly Demand (ac-ft/yr)	Average Daily Demand (gpd)	Average Flow Rate (gpm)
I	2015	80	208	15.0	13,390	9.3
II	2018	105	273	19.6	17,500	12.2
III	2024	185	481	34.5	30,800	21.4
IV*	2035	300	780	56.0	50,000	34.7

* - Full Buildout

Capital and annual costs were developed for each alternative considered in this report. The level of accuracy for costs including construction and associated engineering services are conceptual and for purposes of comparing the most cost-effective alternatives and are not intended to serve as the basis of quotes or bids for the work. Probable construction costs were developed based on unit price data from published estimating guides and SMA's catalog of recent bid prices. Actual costs may vary based on a number of factors including competitive bidding and market factors.

4.0 Alternatives

4.1 Alternative 1 – Install a Water Treatment System

SMA's engineers consulted with AdEdge and FilterTech Systems, who are experienced manufacturers of many types of pre-engineered domestic water treatment systems. These firms recommend a reverse osmosis (RO) system which is the best available technology to remove high dissolved solids and sulfate from water. RO will also remove the radio-chemicals present in the well water.

The Association would agree to proceed with the current project under contract including construction of the new 40,000 gallon water storage tank, completing the water supply well, construction of a pump house, installation of a water fill station, installation of 4,000 linear feet of 2-, 4-, 6 and 8-inch waterlines, service connections, gate valves, fire hydrants and water meters. The project identified below will be an addition to the project currently under contract.

1. Design Criteria

The following design criteria were used as the basis of the Water Treatment System alternative:

- Well Pump Capacity 25 gpm
- Average Water Consumption 64 gpd/capita
- Average annual water demand:

- Phase I 13,390 gpd (15.0 ac-ft/yr)
- Phase II 17,500 gpd (19.6 ac-ft/yr)
- Phase III 30,800 gpd (34.5 ac-ft/yr)
- Phase IV 50,000 gpd (56.0 ac-ft/yr)

- Treated water flow stream (Phase I & II) 20 gpm
- Treated water flow stream (Phase III & IV) 40 gpm

Treated Water TDS Concentration 500 mg/L
Treated Water Sulfates Concentration 250 mg/l

The conceptual treatment process for a single unit RO system is illustrated on Figure 1. The RO system is a 25 gallon per minute (gpm) skid mounted system. This system would fill the new storage tank with treated water at a rate of 20 gpm including bypass flow for blending. Condensate (reject water) consumes about 3.5 gpm (25 percent of flow). Since the treatment system would operate based on demand, the operating time of the unit will increase over the design life as average daily demand increases

The treatment system used as the basis of preliminary design will exceed its capacity near the beginning of Phase III. A second unit would be added as part of the Phase III improvements assuming predicted growth rate of the Association's service area and treatment will continue until full build-out (Phase IV) is complete.

2. Map

A conceptual site layout plan is shown on Figure 2.

3. Environmental Impacts

No additional impacts beyond the construction of above ground facilities including the storage tank, and booster pump house are expected. All facilities including the new treatment system and disposal pond would be built within the 10,000 square foot fenced area.

Operations would result in high TDS reject water that will be discharged to a lined evaporation pond. Note that gross alpha particle concentration were found to be 12.4 pCi/L (plus or minus 3.94 pCi/L). Adjusting this value for uranium concentration, the gross alpha particle concentration is 7.5 Ci/L which is less than the 15 pCi/L SDWA maximum contaminant level (MCL). Thus, it is expected that these chemicals will concentrate further in the treatment waste stream and may pose waste disposal issues.

The pond will be designed to meet the requirements of a New Mexico Groundwater Quality discharge permit. With the presence of the radio-chemicals, it is assumed that a double liner system will be required to prevent potential impacts to ground water quality.

Figure 1. Conceptual RO Treatment System Flow Diagram

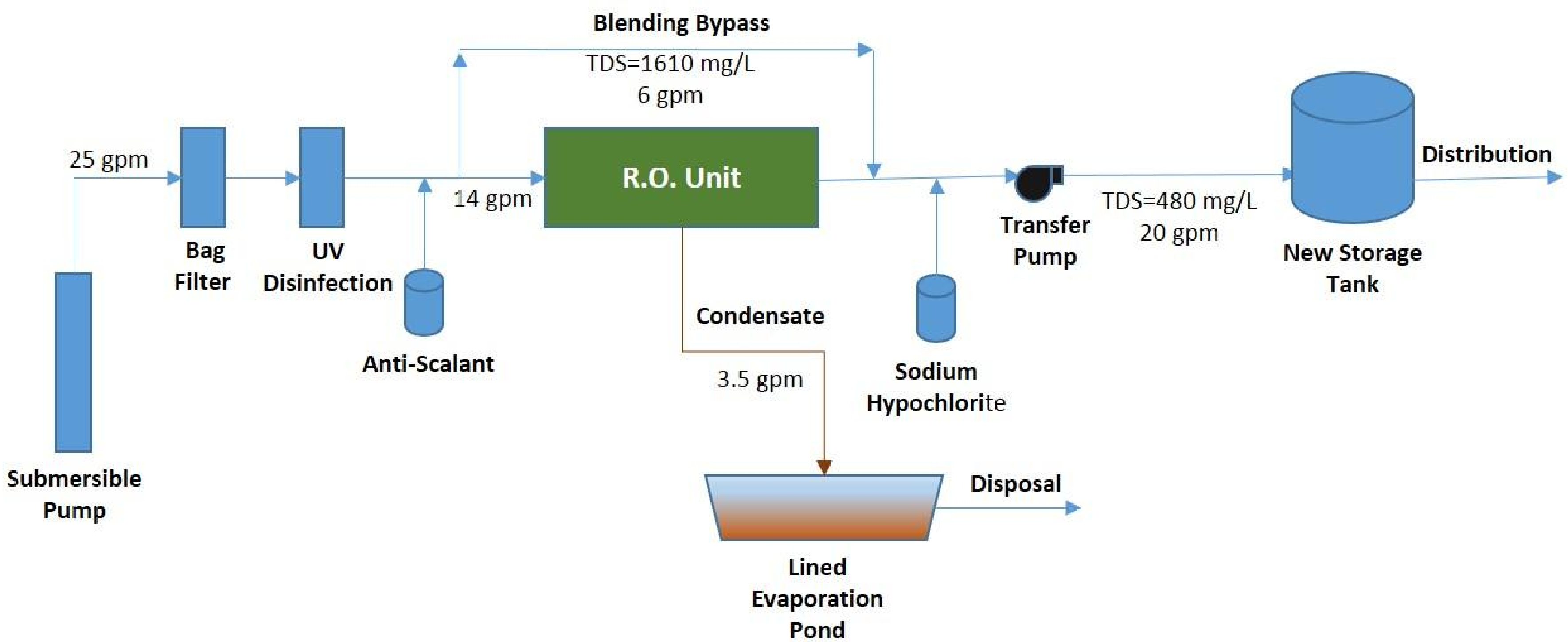
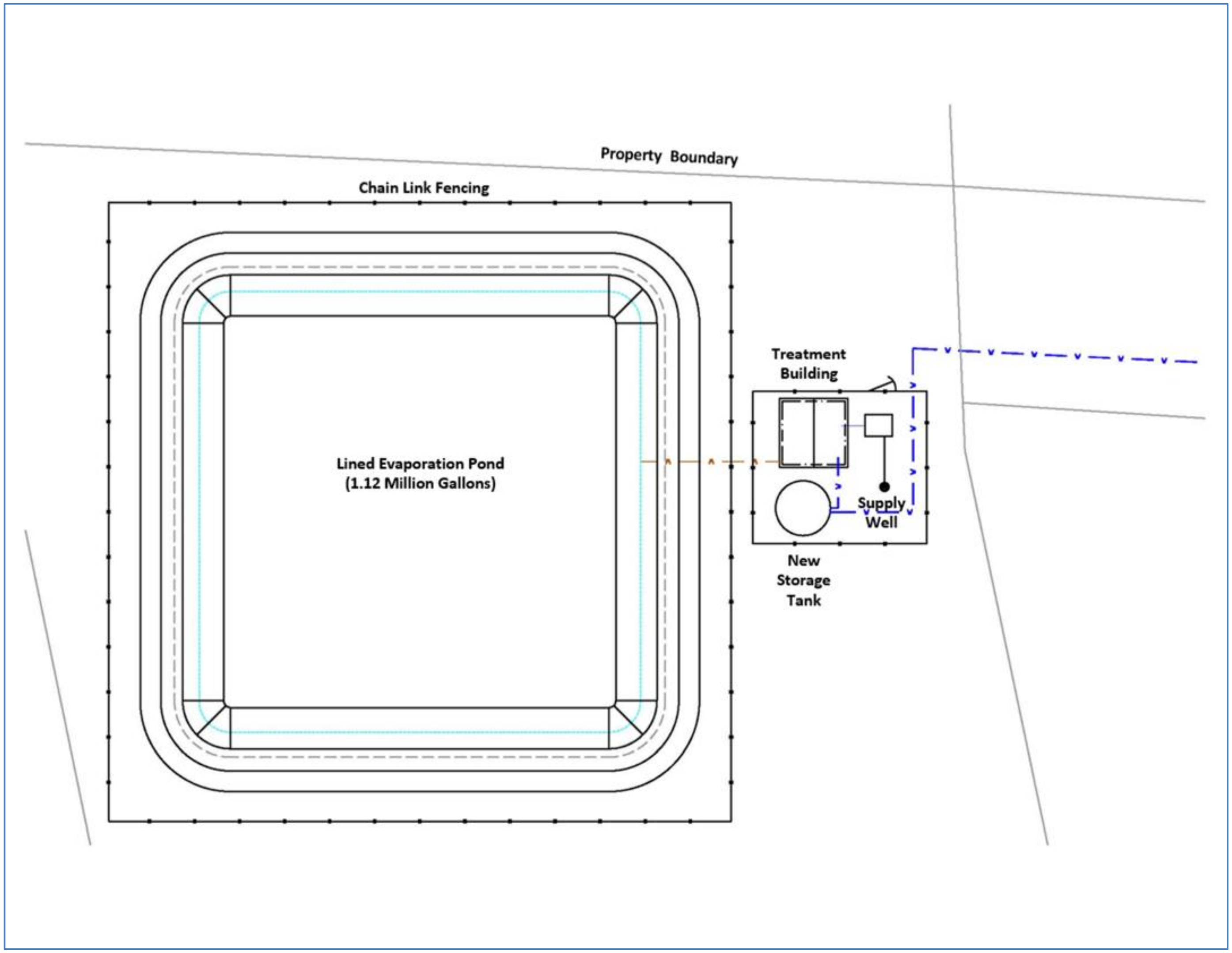


Figure 2. Conceptual Treatment System Site Layout



No adverse environmental impacts are foreseen with this alternative if properly design, permitted and maintained.

4. Land Requirements

The treatment system would fit inside the existing 10,000 foot compound and be housed in its own 25-foot by 25-foot control building. The five-foot deep lined evaporation pond would encompass approximately 184 by 184 feet (0.78 acres) and require additional space to build. The land requirement for this alternative is approximately 1 acre.

5. Construction Problems

No construction problems are anticipated.

6. Cost Estimates

The treatment system manufacturer's estimate the purchase cost of a 25 gpm packaged RO system is between $74,000 and $82,000. Operation and maintenance costs of the system including electrical power (based on $0.10 kilowatt-hour), anti-scale chemical, and RO membrane and pre-filter replacement are estimated to be in the $0.25 per 1000 gallons treated or $163 per year.

Based on the current daily water demand of 13,900 gallons (Phase I) and the treatment system producing 20 gpm, the system will operate approximately 11 to 12 hours to refill the tank during low demand period. AdEdge estimated a concentrate (reject) flow of 25 percent of the influent flow rate or 3.5 gpm. The reject water would then accumulate at the rate of 2,343 gallons per day or 114,345 cubic feet of water per year. Assuming an annual evaporation rate of 55 inches per year, the initial yearly volume of water discharged would evaporate leaving the inorganic solids to be disposed. In subsequent years, the pond may need to be pumped and condensate disposed at an accepting facility such as a wastewater treatment plant. Over time, the pond capacity will diminish and a second pond will be required (Phase III) as water demand increases over time.

For this alternative, the pond would be a total of five feet deep with an operating water level of three feet allowing for two feet of freeboard. The freeboard will allow for precipitation accumulation and growth over time. The liner system will consist of two layers of 60-mil thick HDPE separated with drainage net and laid on top of geotextile fabric cushion. The ponds includes an electronic leak detection system and vadose zone monitoring wells.

Construction: The construction cost for this alternative is estimated at $240,000 (See Table 1).

Table 1: Alternative 2 Capital Cost: Treatment System

Item	Cost
Pre-Engineered Treatment System	$82,000.00
Treatment Building (25-ft x 25-ft)	$10,000.00
Evaporation Pond (excavation, fill, lining and wells)	$104,000.00
Yard Piping and Valves	$5,000.00
Subtotal - Total Construction	***$201,000.00***
Engineering on new work (15%)	$30,150.00
Construction Management on New Work (6%)	$12,060.00
Total Capital Cost	**$240,000.00**

Non-Construction: The non-construction cost is estimated at $42,210.00 for engineering services including planning, design, surveying, environmental permitting and geotechnical studies.

Annual O&M: The annual O&M cost is estimated at $38,000.00 (See Table 2).
Table 3

Table 2: Alternative 1 Annual Costs: Water Treatment

Item	Cost	
Basic Operating Budget	$	27,500.00
Basic material, electrical and chemicals (1,790 gpd)	$	163.34
Operator labor (1 hr/day)	$	5,292.50
Well Pump Electricity (25 HP)	$	2,062.25
Solids removal and disposal (50 cyds "dry sludge")/year)	$	1,750.00
Sampling and Analytical	$	1,200.00
Total Annual Cost	**$**	**38,000.00**
Net Present Value (NPV) (20 years at 1.2%)	**$**	**1,000,000.00**

8. Advantages / Disadvantages

Advantages:

- The RO system is reliable and simple to operate.
- The treatment system will improve the taste of the water encouraging new member to join the Association.
- Reduced pipe and equipment scale formation potential.
- Can provide water to the entire El Creston service area
- The ability to continue with the first phases of El Creston's project in a short time frame.

Disadvantages:

- Cost of operations, maintenance and monitoring of the water treatment system borne by the Association.

- Increased level of operator training and attention and an operator special classification of “Small Water Advanced”.
- Brine waste disposal pond permitting, management and waste disposal. It assumed that the waste will be non-hazardous and can be disposed at a permitted solid waste landfill. However, concentration of radio-chemicals may create hazardous waste.
- Will require replacement overtime and an additional pond will be required by Phase III.

4.2 Proceed with Current Project

For this alternative, the Association would agree to proceed with the current project under contract including construction of the new 40,000 gallon water storage tank, completing the water supply well, construction of a pump house, installation of a water fill station, installation of 4,000 linear feet of 2-, 4-, 6 and 8-inch waterlines, service connections, gate valves, fire hydrants and water meters.

Since, TDS and sulfate are considered National Secondary Drinking Water Standards, they are not regulated constituents. National Secondary Drinking Water Standards generally describe constituents that may cause aesthetic effects such as taste, odor, or color. Therefore, the water customers would be responsible for installing home devices that improve the water if desired. Home devices would include small RO systems, ion exchange systems, under sink filtration or similar technologies. Many residents have installed rain catchment systems to replace dry wells (60 water supply wells which have gone dry between 2006) and have already installed home devices that improve their water quality.

1. Design Criteria

The design for this project was approved by NMED-DWB and CPB in June and August 2013.

2. Map

A site plan of the approved design is shown on Figure 4.

3. Environmental Impacts

The construction of above ground facilities such as the storage tank and booster pump house will impact less than 0.25 acres which is considered minimal disturbance. No adverse environmental impacts were found for this alternative.

4. Land Requirements

All easements and/or right-of-way permits have been secured for the project.

5. Construction Problems

Rock excavation is anticipated for a percentage of the waterline installation. Rock encountered during waterline installation has been included in the cost estimate.

7. Cost Estimates

Construction: The construction cost for this project are currently at $706,165.05. No additional costs are assumed.

Non-Construction: The non-construction cost are currently $265.893.00 for basic engineering services including planning, design, bid administration and construction administration.

Annual O&M: The annual O&M cost is estimated at $27,500.00, shown in Table 3.
Table 3

Table 3 - Alternative 3 Annual Costs: Existing Project

Item	Cost
Basic Operating Budget	$ 27,500.00
Total Annual Cost	**$ 27,500.00**
Net Present Value (NPV) (20 years at 1.2%)	**$ 490,000.00**

8. Advantages / Disadvantages

Advantages:

- An abundant water source that allows the Association to control their water delivery system.
- The ability to provide water to the entire El Creston service area.
- Completes the remainder of the El Creston's project within the available funding limits.
- Leaves the selection of treatment up to the individual needs of the members if they choose.

Disadvantages:

- Additional maintenance and shorter life of equipment the scale-forming and corrosive nature of the water.
- Reduction in number of new members due to complaints about water quality.

4.3 Construct a Replacement Well

The purpose of constructing a new well would be to locate a formation with better water quality than the current well. SMA has investigated the hydrogeology and geochemistry in the region to locate a potential well site with lower TDS and sulfate (See Appendix B). The hydrogeologic study indicates that the most viable source of better quality water will be a well drilled in the Glorieta or Santa Rosa Sandstones in the northern portion of the Association's service area where the aquifers are intersected shallowly and nearer to the northern most recharge areas. The hydraulically productive zones would be encountered at 650 feet or less.

1. Design Criteria

Construction of a new well will be based on the following criteria (also see Appendix B):

- New Well Capacity — 175 gpm
- Average Water Consumption — 64 gpd/capita
- Average annual water demand:
  - Phase I — 13,390 gpd (15.0 ac-ft)
  - Phase II — 17,500 gpd (19.6 ac-ft)
  - Phase III — 30,800 gpd (34.5 ac-ft)

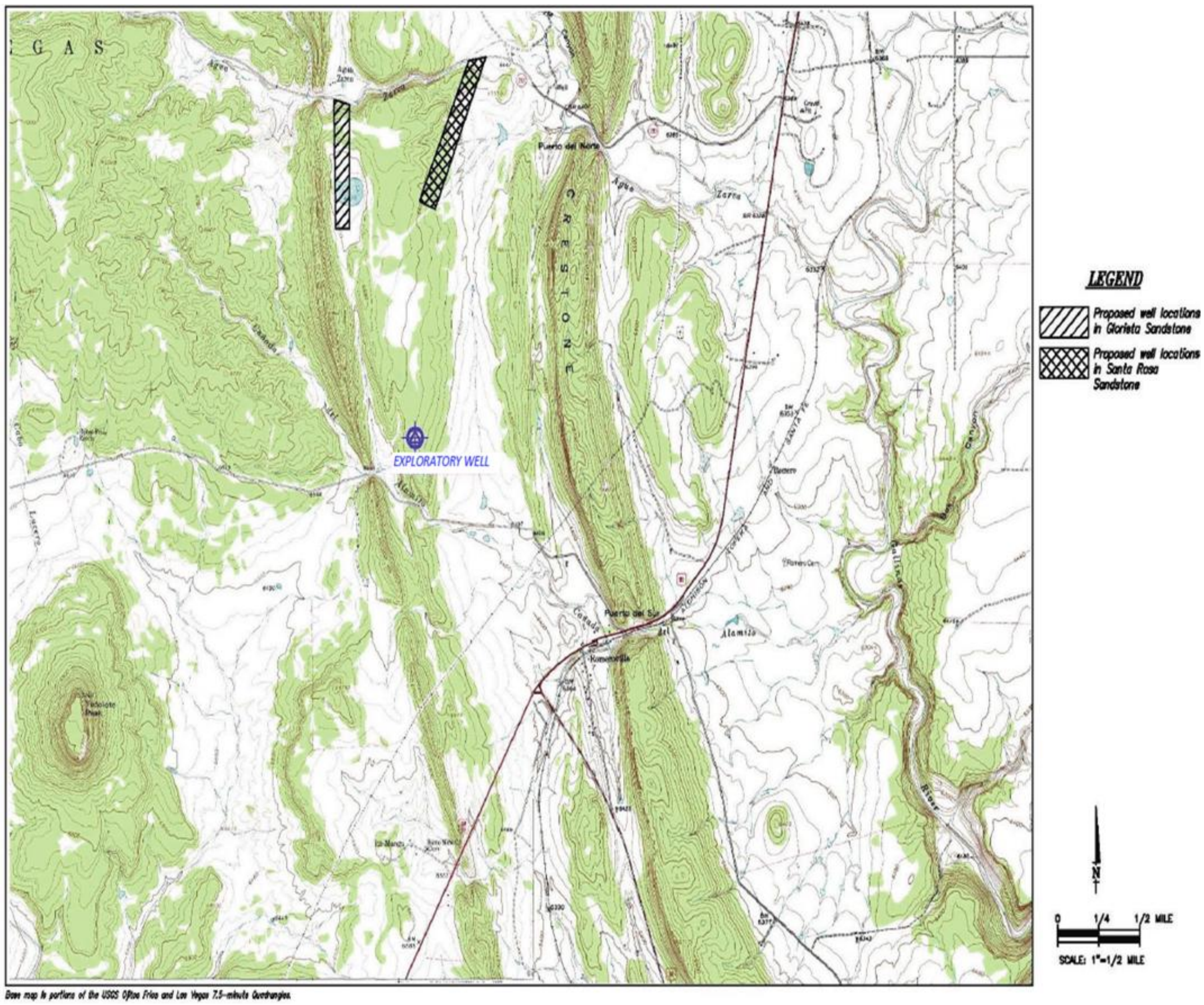
- Phase IV 50,000 gpd (56.0 ac-ft)

- TDS and Sulfate Concentration – less than 500 and 250 mg/L, respectively

2. Map

The following map illustrates the proposed location of the new supply well and interconnections with the new tank and well site.

Figure 3. Map of Connection to New Water Supply Well



3. Environmental Impacts

Environmental impacts include access road and well site disturbance from heavy duty vehicles and potential drilling fluid release.

4. Construction Problems

Similar wells have been drilled near the proposed location with no known construction problems.

5. Cost Estimates

The new well would be drilled in the Glorieta Sandstone formation as recommended in the Hydrogeological Report (Appendix B). A 18,500 linear foot water transmission pipeline four inches in diameter would be constructed in the State Highway 283 right-of-way then routed southward in the shoulder of Mirasol Road to the new tank site. The cost are summarized below (Table 4)

Table 4 - Alternative __ Capital Cost: New Well Construction

Item	Cost
New Well	$238,000.00
Transmission line to tank (18,500 linear feet)	$647,500.00
Subtotal - Total Construction	$885,500.00
Engineering on New Work (5%)	$44,275.00
Construction Management on New Work (6%)	$ 53,130.00
Total Capital Cost	**$982,900.00**

Non-Construction: The non-construction cost is estimated at nearly $97,405.00 for engineering services including planning, design, easement negotiation, exploratory and production well permits, surveying (easements and topography), bidding, and construction administration.

Annual O&M: The annual O&M cost is estimated at $34,315.00 and summarized below (Table 5).

Table 5: Alternative __ Annual Cost: New Well Construction

Item	Cost
Basic O&M per PER	$27,500.00
Pipeline maintenance and repair (1% of Construction)	$4,625.00
Well Pump Electricity (25 HP)	$2,190.00
Total Annual Cost	**$34,315.00**
Net Present Value (NPV) (20 years at 1.2%)	**$ 1,430,000.00**

8. Advantages / Disadvantages

Advantages:

- An abundant water source that allows the Association to control their water delivery system.
- Potential to blend low TDS and sulfate water with current well to enhance the available supply.
- The ability to provide water to the entire El Creston service area’

- The ability to complete the remainder of the El Creston's project in a short time frame

Disadvantages:

- Since most of the regional groundwater is characterized by high TDS (Brinkman), there is a risk of drilling the well in another high TDS and sulfate water bearing strata.
  Transmission line would need to include right-of-way permitting and environmental clearance.
- High cost.

4.4 Connect to the City of Las Vegas Water System

For this alternative, the Association would connect to the City of Las Vegas water system at the Taylor Well 4 which is close to the MDWCA service area. Taylor Well 4 has a high production rate (approximately 250 gpm) and water quality that meets USEPA primary standards. Taylor Well 4 has a treatment system to remove the high TDS and sulfate. Sulfate was last reported (2004) to be 51 mg/L.

This alternative could compliment the previous three alternatives as a potential long-term strategy. For the sake of this report, it will be evaluated as a stand-alone alternative. Several meetings between the City of Las Vegas and El Creston MDWCA regarding this alternative have occurred over the past two years, however no conclusive decisions have been made pending a 72-hour pump test on El Creston's exploratory well. Should the findings of this report recommend this alternative as the alternative of choice, the following items would still need to be negotiated.

- Ownership of El Creston's exploratory/production well
- Sharing waterline and booster system construction costs
- Operation and maintenance costs for waterline and booster system identified under this alternative
- Water rights allocation for El Creston's full build-out
- Water rates for El Creston's customers

The El Creston water storage and distribution system would be the same as currently designed and expand through Phase IV as planned in the PER.

2. Design Criteria

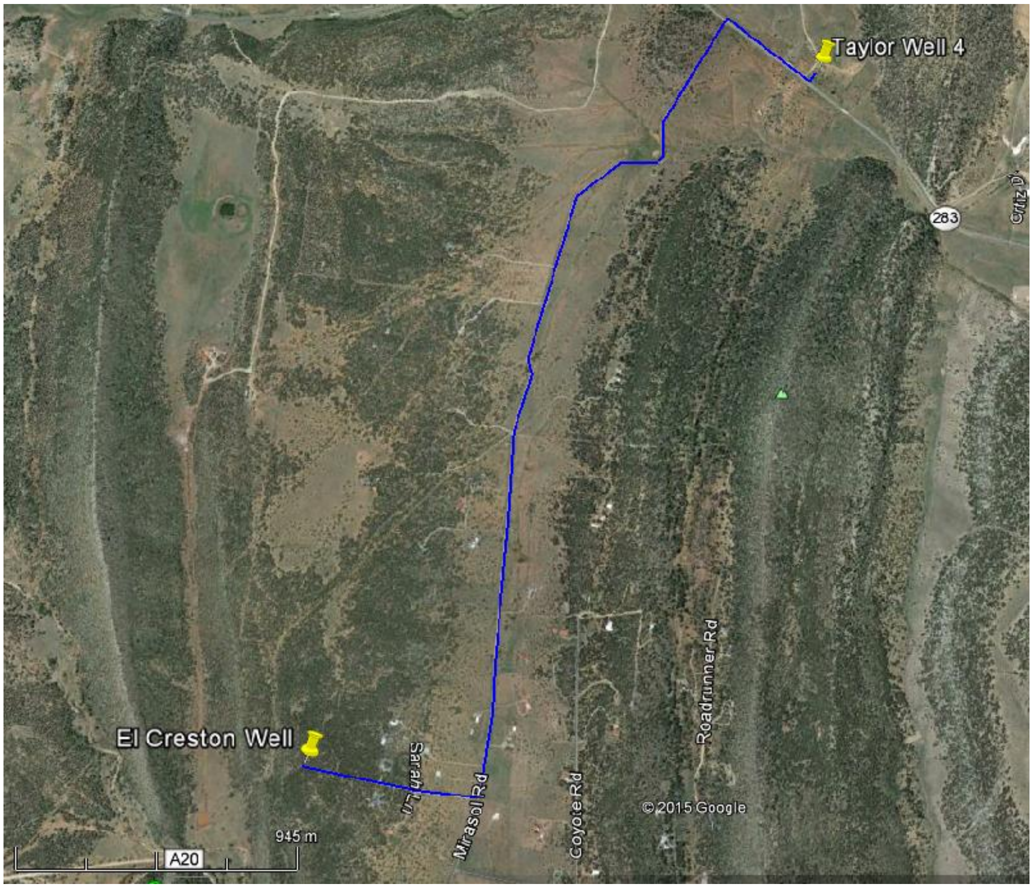
The scope of work includes the design and construction of an 8-inch water transmission line connection to the City of Las Vegas existing 25,000 gallon water storage tank, a cased road crossing, booster station (approximately 7.5 horsepower), approximately 13,600 linear feet of four-inch waterline to El Creston's 40,000 gallon water storage tank, 13,600 linear feet of 6-inch waterline (gravity) to the Taylor Well site, twelve four-inch and 6-inch gate valves, and a four-inch water meter in meter enclosure including topographical survey, material testing allowance and traffic control.

- Average Water Consumption — 64 gpd/capita
- Service Population for Phase 1 Improvements — 208 persons

2. Map

The route of the proposed transmission line from the Taylor Well 4 to the future El Creston 40,000 gallon tank is shown below.

Figure 4. Map of Connection to City of Las Vegas Water Utility



4. Environmental Impacts

The construction of above ground facilities such as the storage tank and booster pump house will have impact less than 0.25 acres which is considered minimal disturbance. The pipeline would be constructed in existing road and highway right of ways.

No adverse environmental impacts are foreseen with this alternative.

5. Land Requirements

An easement currently exists for El Creston's 40,000 gallon water storage tank. Land would be required for the booster pump house site. A half-acre was estimated for the site in the construction costs. Easements and right-of-ways may be required for work within county and/or state roads, federal land, and private property for waterline installation. The La Manga booster pump station will be located in the county right-of-way.

6. Construction Problems

Differing site conditions including rock may be present in the project area.

7. Cost Estimates

Construction: All construction costs to transmit water to and from the City's Taylor Well would be paid for by City water utility. Excluding treatment costs, the probable cost of construction and engineering is approximately $1.1 million dollars which includes the design and construction of approximately 27,000 linear feet of 6 and 8-inch pipeline and a booster station.

Non-Construction: Non-construction costs would be paid for by the City as part of the connection.

Annual O&M: The annual O&M cost is estimated at $62,000 shown in Table 6.

The cost to consumers will depend on the negotiated rate that is paid to the City. For the purpose of this report, the water purchase cost in Table 6 is the City of Las Vegas' bulk water rate.

Table 6 - Alternative 3 Annual Costs: Connect to City Utility

Item	Cost
Phase I Pipeline maintenance and repair (1% of Construction)	$ 838.57
Phase II Pipeline maintenance and repair (1% of Construction)	$ 7,506.25
Phase III Pipeline maintenance and repair (1% of Construction)	$ 3,512.60
Water Purchase (Commercial rate at $0.01018 per gallon)	$ 49,736.27
Total Annual Cost	**$ 62,000**
Net Present Value (NPV) (20 years at 1.2%)	**$ 1,110,000.00**

8. Advantages / Disadvantages

Advantages:

- An established and abundant water source that can provide water to the entire El Creston service area.
- Cost for treatment is divided by more customers.
- Point credit on funding applications for system regionalization.
- Increased membership for the Association and increased revenue with metered connections.

Disadvantages:

- The system would be dependent on an outside water source.
- The City imposes a surcharge for out of City limits customers.
- Implementation could be dependent on the City's drought contingency.
- The Association may be required to purchase surface water rights for the City.

5.0 Conclusions and Recommendations

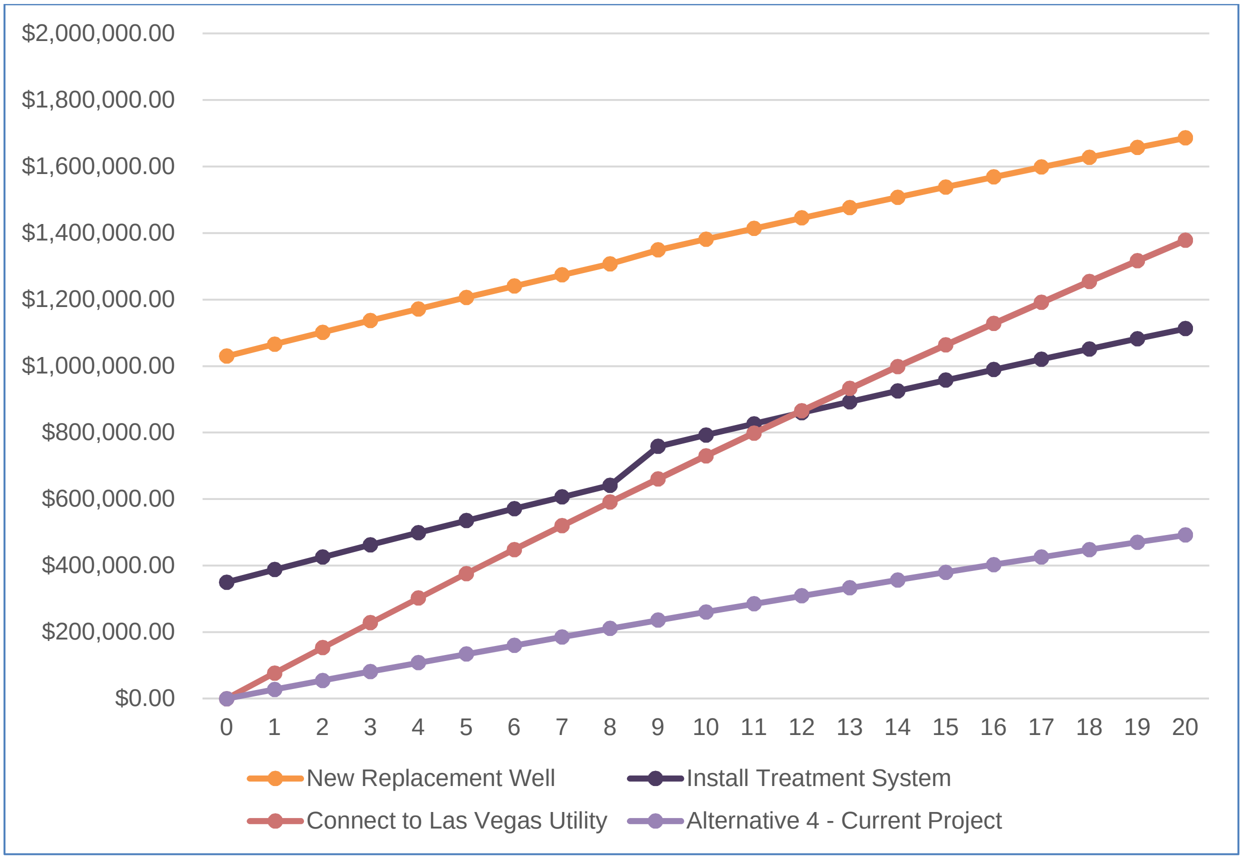
The following graph (Figure 7) compares the net present value (NPV) of each Alternative assuming a 20-year project life and a discount rate of 1.2 percent (per U.S Office of Management and Budget). Since the cost of the current project is under contract, the life-cycle costs remain as reported in the PER.

Given the long-distance to transmit water from the replacement well to the new tank, installation of a new well is considered cost-prohibitive and rejected from further consideration. Although connection to the City's water utility may have the lowest initial cost, it has a high total 20-year projected cost. By year six, the cost to El Creston's customers begins to approach the initial capital cost of the treatment system. Installation of an RO treatment system can be implemented at a lower life-cycle cost than the connection to the City's system.

The treatment system installation alternative has a lower life-cycle cost that allows the Association to maintain long-term control of the water system with improved water quality. The large land area and cost to build and maintain the pond is not desirable,

Overall, implementing the current project it is the preferred alternative.

Figure 5. Alternative Net Present Value Comparison



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APPENDIX A

HYDROGEOLOGICAL REPORT