

DRAFT

**Attachment 1**

**Changes to Appendix C – Water Management Strategy Evaluation  
Technical Memorandums**

**APPENDIX C**  
WATER MANAGEMENT STRATEGY EVALUATION  
TECHNICAL MEMORANDUMS

**APPENDIX C**

**C.2 REUSE**

DRAFT

<b>WUG:</b> Mitchell County, Steam Electric Power	<b>Capital Cost:</b> \$8,642,000
<b>WMS Name:</b> Reuse Sales from Colorado City	<b>Annual Cost</b> \$1,428 per acre-foot (During Amortization): \$4.38 per 1,000 gal
<b>WMS Type:</b> Direct Non-Potable Reuse (Type II)	<b>Annual Cost</b> \$212 per acre-foot (After Amortization): \$0.65 per 1,000 gal
<b>WMS Yield:</b> 500 acre-feet per year	<b>Implementation:</b> 2020
<b>WMS Status:</b> Recommended	

### Strategy Description

Colorado City plans to sell most, if not all, of their wastewater effluent to FGE Power for use as cooling water at a new power plant being built in Mitchell County. This water management strategy is a generalized direct non-potable reuse strategy developed for the Region F Plan that assumes all of Colorado City's wastewater is sold to the steam electric power industry in Mitchell County. This strategy assumes that the current WWTP will need no improvements in order to bring a portion of the plant's effluent to Type II standards. If the plant's effluent does not already meet Type II standards, then the cost will be greater than shown in this plan. The strategy assumes ten miles of 10-inch transmission pipeline will need to be constructed in order to convey the reuse water from the plant to the FGE power plant. If this strategy is pursued, additional site-specific studies will be required to determine actual quantities of water available, costs and potential impacts.

### Quantity, Reliability and Cost

This strategy is based on an additional reuse supply of 500 acre-feet per year of Type II non-potable reuse supply for sales to the steam electric power industry in Mitchell County. This supply is considered to be very reliable. The cost of this strategy is estimated at \$8,462,000 but may be different depending on site-specific situations.

### Environmental Factors

This strategy assumes that 500 acre-feet of reuse supply will be used for the steam electric power industry. This may reduce the demand on other water sources and decrease the environmental impacts of those uses.

Since Colorado City does not currently discharge their wastewater into a water body, streamflows will not be impacted.

### Agricultural and Rural Impacts

None identified.

### Impacts to Natural Resources and Key Parameters of Water Quality

Reuse would result in a reduction in the quantity of water discharged by the City. It is not expected to adversely impact natural resources or key parameters of water quality.

### Impacts on Other Water Resources and Management Strategies

To the extent that this supply reduces the demand on other water resources that the FGE power plant in Mitchell County utilizes, this strategy may reduce competition for water from those sources.

### Other Issues Affecting Feasibility

None identified.

**APPENDIX C**  
**C.4 GROUNDWATER DEVELOPMENT**

DRAFT

<b>WUG:</b>	<b>Balmorhea</b>	<b>Capital Cost:</b>	\$1,948,000
<b>WMS Name:</b>	<b>Develop Edwards-Trinity Plateau Aquifer Supplies</b>	<b>Annual Cost</b> (During Amortization):	\$1,053 per acre-foot \$3.23 per 1,000 gal
<b>WMS Type:</b>	Groundwater Development	<b>Annual Cost</b> (After Amortization):	\$140 per acre-foot \$0.43 per 1,000 gal
<b>WMS Yield:</b>	150 acre-feet per year	<b>Implementation:</b>	2030
<b>WMS Status:</b>	Recommended		

### Strategy Description

The City of Balmorhea is evaluating a groundwater source in the Edwards-Trinity Plateau aquifer. This source has been identified as currently supplying water for municipal, industrial and agricultural uses. However, the long-term water availability and quality of the proposed well field should be assessed further. This strategy assumes that two new wells would be drilled to provide approximately 150 acre-feet per year. This well would produce water from approximately 600 feet below the surface.

This strategy also includes 5 miles of 6-inch diameter pipeline that will connect the well to the current infrastructure.

### Quantity, Reliability and Cost

The quantity and reliability of water from this source is expected to be approximately 125 gpm. Historical municipal and agricultural use indicates that the Edwards-Trinity Plateau may be a viable source for municipal use but may require some treatment or blending based on local groundwater conditions. For this plan, the new well is assumed to supply an additional 150 acre-feet per year. The reliability of the supply is considered to be high, based on the aquifer characteristics observed to contain large pools of mostly potable water. The total capital cost is estimated at \$1.9 million. This strategy assumes that adequate water quality for municipal use can be reached through blending with Balmorhea's other groundwater sources. If the quality of water requires advanced treatment, costs would be higher than estimated here.

### Environmental Factors

The aquifer is a proven groundwater source for municipal, industrial and agricultural purposes. However, the long-term water quality is unknown. Groundwater development from this source should be evaluated for potential impacts on springflows and base flows of area rivers. It is unlikely that this strategy would cause subsidence.

### Agricultural and Rural Impacts

Springflows from the Edwards-Trinity Plateau supply much of the base flow of flowing streams in the area. Many of these streams are used for irrigation. Wells provide water for ranching, domestic and municipal supplies throughout the area. It is assumed that the proposed level of additional groundwater development will not impact agricultural or rural users.

### Impacts to Natural Resources and Key Parameters of Water Quality

The water quality in the Edwards-Trinity Plateau aquifer ranges from generally fresh to slightly saline in the outcrop areas, and brackishwater in subsurface portions. Water levels have remained relatively stable because recharge has generally kept pace with the relatively low amounts of pumping over the extent of the aquifer. This strategy is not expected to impact key parameters of water quality.

No impacts to natural resources have been identified.

**Impacts on Other Water Resources and Management Strategies**

No other water management strategies will be impacted.

**Other Issues Affecting Feasibility**

The economic viability of the project will depend upon the ability to locate groundwater of sufficient quality to blend with existing sources without advanced treatment.

DRAFT

<b>WUG:</b>	<b>Bronte</b>	<b>Capital Cost:</b>	\$23,694,000
<b>WMS Name:</b>	<b>Develop Other Aquifer Supplies in Southwest Coke County</b>	<b>Annual Cost</b> (During Amortization):	\$2,424 per acre-foot \$7.44 per 1,000 gal
<b>WMS Type:</b>	Groundwater Development	<b>Annual Cost</b> (After Amortization):	\$340 per acre-foot \$1.04 per 1,000 gal
<b>WMS Yield:</b>	800 acre-feet per year	<b>Implementation:</b>	2030
<b>WMS Status:</b>	Alternative		

### Strategy Description

The Coke County Underground Water District has done some groundwater exploration in southwest Coke County. Bronte is considering developing 5 new wells in this area. It is estimated that the wells would produce around 100 gpm from a 300 ft depth and be of adequate quality for municipal use without advanced treatment. A 31-mile, 10-inch transmission pipeline would be needed to deliver these supplies to the City.

### Quantity, Reliability and Cost

This strategy is estimated to supply 800 acre-feet per year. The reliability is considered medium based on the work done by the Coke County Underground Water District but the strategy is still dependent on locating wells with adequate production and water quality. The costs are estimated at \$23.7 million.

### Environmental Factors

Some testing and exploration has been done in this area but the long term water quality is unknown. Other environmental factors were not identified.

### Agricultural and Rural Impacts

No agricultural and rural impacts are anticipated.

### Impacts to Natural Resources and Key Parameters of Water Quality

None identified.

### Impacts on Other Water Resources and Management Strategies

Other strategies for the City of Bronte may be impacted. The need for this strategy may be reduced if Robert Lee were to develop independent supplies from one of their Alternative Water Management Strategies.

### Other Issues Affecting Feasibility

Because the long-term reliability and quality of this supply is unknown, the City may need to develop other alternatives to meet long-term needs. Funding construction of this infrastructure will be a significant strain on the financial resources of the City.



<b>WUG:</b>	<b>Junction</b>	<b>Capital Cost:</b>	\$7,457,000
<b>WMS Name:</b>	<b>Develop Edwards-Trinity-Plateau Aquifer Supplies</b>	<b>Annual Cost</b> (During Amortization):	\$1,573 per acre-foot \$4.83 per 1,000 gal
<b>WMS Type:</b>	Groundwater Development	<b>Annual Cost</b> (After Amortization):	\$154 per acre-foot \$0.47 per 1,000 gal
<b>WMS Yield:</b>	370 acre-feet per year	<b>Implementation:</b>	2030
<b>WMS Status:</b>	Recommended		

### Strategy Description

The City of Junction is evaluating a groundwater source in the Edwards-Trinity Plateau aquifer to back up its current supplies. Water from this source is not widely used because of low well yields and poor water quality. This source is currently used for manufacturing. This strategy assumes that seven new wells would be drilled to provide approximately 370 acre-feet per year. These wells are assumed to produce water from approximately 190 feet below the surface with elevated TDS levels. It is assumed that this water is blended with surface water. However, if it is determined that the water qualities of the two sources are incompatible, the groundwater may require advanced treatment. Costs for advanced treatment are not included. This strategy assumes that the new wells will be drilled within three miles of the City's existing infrastructure. This project includes 1,800 feet of 6-inch diameter well field collection piping and three miles of 8-inch transmission piping to connect to existing infrastructure.

### Quantity, Reliability and Cost

The quantity and reliability of water from this source is expected to be approximately 40 gpm. Historical use indicates that the Edwards-Trinity Plateau may be a viable source but may contain high TDS. For this plan, the seven new wells are assumed to supply an additional 370 acre-feet per year. The reliability of the supply is considered to be medium because of water quantity and quality issues.

### Environmental Factors

The blending of slightly brackish water with Junction's existing supplies may increase the TDS levels of treated wastewater from the City. It is expected the increase will not exceed current discharge limits. No other environmental impacts are identified.

### Agricultural and Rural Impacts

Wells provide water for ranching, domestic and municipal supplies throughout the area. This strategy assumes sufficient groundwater rights would be obtained on a willing buyer-willing seller basis, which should mitigate potential impacts to agricultural and rural water users.

### Impacts to Natural Resources and Key Parameters of Water Quality

Water quality in the Edwards-Trinity Plateau aquifer ranges from fresh to slightly saline in the outcrop areas, and brine water in subsurface portions. Water levels have remained relatively stable because recharge has generally kept pace with the relatively low amounts of pumping. No impacts to natural resources have been identified.

### Impacts on Other Water Resources and Management Strategies

None identified.

### Other Issues Affecting Feasibility

A significant challenge for this strategy is locating areas with sufficient well production where the water quality is good.

<b>WUG:</b>	<b>Robert Lee, Bronte, Robert Lee</b>	<b>Capital Cost:</b>	<b>\$4,232,000</b>
<b>WMS Name:</b>	<b>Develop Edwards-Trinity-Plateau Supplies in Nolan County</b>	<b>Annual Cost</b> (During Amortization):	<b>\$1,871</b> per acre-foot <b>\$5.74</b> per 1,000 gal
<b>WMS Type:</b>	Groundwater Development	<b>Annual Cost</b> (After Amortization):	<b>\$197</b> per acre-foot <b>\$0.60</b> per 1,000 gal
<b>WMS Yield:</b>	<b>178</b> acre-feet per year	<b>Implementation:</b>	<b>2030</b>
<b>WMS Status:</b>	<b>Recommended</b>		

### Strategy Description

Robert Lee and Bronte and Robert Lee are considering developing new groundwater wells in south central Nolan County, which is in Region G. These wells produce water from the Edwards Trinity aquifer. For the purposes of this strategy, it is assumed that five new wells and approximately 15 miles of 6-inch transmission pipeline would be needed.

### Quantity, Reliability and Cost

This strategy will provide **178** acre-feet per year. The reliability of this strategy is considered to be low to medium since it is dependent on finding adequate water quality and quantity. Capital costs are estimated at **\$4.2 million**.

### Environmental Factors

There are no significant environmental issues associated with this strategy.

### Agricultural and Rural Impacts

Robert Lee and Bronte and Robert Lee are rural communities. Increased water security provided by this strategy will have a positive impact on the vitality of this rural community.

### Impacts to Natural Resources and Key Parameters of Water Quality

None identified.

### Impacts on Other Water Resources and Management Strategies

If Robert Lee is able to implement one of the alternative groundwater strategies in this plan, their need to purchase from Bronte may be reduced and Bronte may be able to develop smaller quantities of future water supply. Or if Bronte were to implement this strategy, it may reduce Robert Lee's need to find additional sources of water.

### Other Issues Affecting Feasibility

Since the reliability of this supply is unknown, the City should consider other alternatives to meet long-term needs as well. Funding construction of these new wells will be a significant strain on the financial resources of the City.