TABLE OF CONTENTS – CHAPTER FIVE

LIST OF FIGURES

LIST OF TABLES

APPENDICES

This page intentionally left blank

Table 5.1: Strategies by Water User Group

WUG	Strategy Name	Section
Aqua WSC	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
	New LCRA Contract with Infrastructure	*5.2.3.1.7*
	Expanded Local Use of Groundwater – Carrizo-Wilcox Aquifer	*5.2.4.1.1*
	Expanded Local Use of Groundwater – Carrizo-Wilcox Aquifer (Alternative)	*5.3.2.1*
Austin	Austin Return Flows	*5.2.1.1*
	Conservation	*5.2.3.2.1*
	Blackwater and Greywater Reuse	*5.2.3.2.2*
	Aquifer Storage and Recovery	*5.2.3.2.3*
	Off-Channel Reservoir and Evaporation Suppression	*5.2.3.2.4*
	Onsite Rainwater and Stormwater Harvesting	*5.2.3.2.5*
	Community-Scale Stormwater Harvesting	*5.2.3.2.5*
	Brackish Groundwater Desalination	*5.2.3.2.6*
	Centralized Direct Non-Potable Reuse	*5.2.3.2.7*
	Decentralized Direct Non-Potable Reuse	*5.2.3.2.8*
	Capture Local Inflows to Lady Bird Lake	*5.2.3.2.9*
	Indirect Potable Reuse through Lady Bird Lake	*5.2.3.2.10*
	Longhorn Dam Operation Improvements	*5.2.3.2.11*
	Lake Austin Operations	*5.2.3.2.12*
	Drought Management	*5.2.4.9.1*
Barton Creek West WSC	Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
Barton Creek WSC	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
	Water Purchase Amendment	*5.2.4.7*

Bastrop	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
	New LCRA Contract with Infrastructure	*5.2.3.1.7*
Bastrop County WCID 2	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
	New LCRA Contracts with Infrastructure	*5.2.3.1.7*
Bay City	Drought Management	*5.2.4.9.1*
	Expanded Local Use of Groundwater – Gulf Coast Aquifer	*5.2.4.1.4*
Bertram	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
	Expanded Local Use of Groundwater – Ellenburger-San Saba Aquifer	*5.2.4.1.3*
Blanco	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
	Direct Reuse (Non-Potable)	*5.2.5.5.1*
Boling MWD	Drought Management	*5.2.4.9.1*
Briarcliff	Drought Management	*5.2.4.9.1*
Buda	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
	Direct Potable Reuse	*5.2.4.9.1*
	Direct Reuse (Non-Potable)	*5.2.5.5.6*
	BS/EACD – Edwards/Middle Trinity ASR	*5.2.4.4.1*
	BS/EACD – Saline Edwards ASR	*5.2.4.4.2*
	Groundwater Importation – Alliance Regional Water Authority Pipeline	*5.2.4.3.2*
Burnet	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
	LCRA Contract Amendments Requiring Infrastructure	*5.2.3.1.5*
	Burnet County Regional Projects - Buena Vista	*5.2.4.5.1*
Caney Creek MUD of Matagorda County	Drought Management	*5.2.4.9.1*
Cimarron Park Water	Drought Management	*5.2.4.9.1*
Columbus	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*

Corix Utilities Texas Inc	Drought Management	*5.2.4.9.1*
	Expanded Local Use of Groundwater – Gulf Coast Aquifer	*5.2.4.1.4*
Cottonwood Creek MUD 1	Drought Management	*5.2.4.9.1*
Cottonwood Shores	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
Creedmoor-Maha WSC	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
	BS/EACD – Edwards/Middle Trinity ASR	*5.2.4.4.1*
	Water Purchase	*5.2.4.7*
Cypress Ranch WCID 1	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
Deer Creek Ranch Water	Drought Management	*5.2.4.9.1*
Dripping Springs WSC	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
	LCRA Contract Amendment	*5.2.3.1.4*
	Expanded Local Use of Groundwater - Trinity Aquifer	*5.2.4.1.6*
	Rainwater Harvesting	*5.2.4.6*
	Direct Potable Reuse	*5.2.5.4.2*
	Direct Reuse (Non-Potable)	*5.2.5.5.7*
Eagle Lake	Drought Management	*5.2.4.9.1*
Elgin	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
	Expanded Local Use of Groundwater – Carrizo-Wilcox Aquifer	*5.2.4.1.1*
	Development of New Groundwater Supplies – Trinity Aquifer	*5.2.4.2.6*
Fayette County WCID Monument Hill	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
Fayette WSC	Drought Management	*5.2.4.9.1*
Flatonia	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
Fredericksburg	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
	Direct Reuse (Non-Potable)	*5.2.5.5.5*

Garfield WSC	Drought Management	*5.2.4.9.1*
	Expanded Local Use of Groundwater – Trinity Aquifer	*5.2.4.1.6*
Goldthwaite	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
	Goldthwaite Water Supply (Considered only)	*5.4*
Granite Shoals	Drought Management	*5.2.4.9.1*
	LCRA Contract Amendment	*5.2.3.1.4*
Hays	Drought Management	*5.2.4.9.1*
	Development of New Groundwater Supplies – Trinity Aquifer	*5.2.4.2.6*
	BS/EACD – Edwards/Middle Trinity ASR	*5.2.4.4.1*
	Rainwater Harvesting	*5.2.4.6*
	Water Purchase	*5.2.4.7*
Hays County WCID 1	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
Hays County WCID 2	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
Hornsby Bend Utility	Drought Management	*5.2.4.9.1*
Horseshoe Bay	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
	LCRA Contract Amendment	*5.2.3.1.4*
	Direct Reuse (Non-Potable)	*5.2.5.5.2*
Hurst Creek MUD	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
Johnson City	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
	Expanded Local Use of Groundwater – Ellenburger-San Saba Aquifer	*5.2.4.1.3*
Jonestown WSC	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
Kelly Lane WCID 1	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
Kingsland WSC	Drought Management	*5.2.4.9.1*
La Grange	Municipal Conservation	*5.2.2.3*

	Drought Management	*5.2.4.9.1*
Lago Vista	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
	Direct Reuse (Non-Potable)	*5.2.5.5.9*
Lakeway MUD	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
	Direct Reuse (Non-Potable)	*5.2.5.5.10*
LCRA	Conservation	*5.2.2.1* *5.2.3.1.8*
	General LCRA Strategy - LCRA System Operation Approach	*5.2.3.1.1*
	Amendments to Water Management Plan	*5.2.3.1.2*
	Amendments to Water Rights and Acquisition of New Water Rights	*5.2.3.1.3*
	LCRA Contract Amendments	*5.2.3.1.4*
	LCRA Contract Amendments with Infrastructure	*5.2.3.1.5*
	New LCRA Contracts	*5.2.3.1.6*
	New LCRA Contract Amendments with Infrastructure	*5.2.3.1.7*
	Expand use of Groundwater in Bastrop County (Carrizo-Wilcox Aquifer)	*5.2.3.1.9*
	Import Return Flows from Williamson County	*5.2.3.1.10*
	Baylor Creek Reservoir	*5.2.3.1.11*
	Off-Channel Reservoirs	*5.2.3.1.14*
	Downstream Return Flows	*5.2.1.2* *5.2.3.1.15*
	Aquifer Storage and Recovery (ASR) Carrizo-Wilcox	*5.2.3.1*
	LCRA Expand Use of Groundwater in Bastrop County (Carrizo-Wilcox Aquifer) – Alternative Strategy	*5.3.1.1*

LCRA	LCRA Brackish Groundwater Desalination from the Gulf Coast Aquifer (Alternative Strategy)	*5.3.1.2*
	LCRA Supplement Bay and Estuary Inflows with Brackish Groundwater (Alternative Strategy)	*5.3.1.3*
Llano	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
	Water Purchase	*5.2.4.7*
	Direct Potable Reuse	*5.2.5.4.3*
	Reservoir Capacity Expansion (Considered only)	*5.4*
Loop 360 WSC	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
Manor	Drought Management	*5.2.4.9.1*
Manville WSC	Drought Management	*5.2.4.9.1*
	Expanded Local Use of Groundwater – Trinity Aquifer	*5.2.4.1.6*
Marble Falls	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
	LCRA Contract Amendments with Infrastructure	*5.2.3.1.5*
	Burnet County Regional Projects – Marble Falls	*5.2.4.5.3*
	Direct Reuse (Non-Potable)	*5.2.5.5*
Markham MUD	Drought Management	*5.2.4.9.1*
Matagorda County WCID 6	Drought Management	*5.2.4.9.1*
Matagorda Waste Disposal & WSC	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
Meadowlakes	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
	Direct Reuse (Non-Potable)	*5.2.5.5.4*
North Austin MUD 1	Drought Management	*5.2.4.9.1*
	New LCRA Contracts	*5.2.3.1.6*
North San Saba WSC	Drought Management	*5.2.4.9.1*
	New LCRA Contracts	*5.2.3.1.6*

Northtown MUD	Drought Management	*5.2.4.9.1*
	New LCRA Contracts	*5.2.3.1.6*
Oak Shores Water System	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
Palacios	Drought Management	*5.2.4.9.1*
Pflugerville	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
	LCRA Contract Amendment	*5.2.3.1.4*
	Expanded Local Use of Groundwater – Edwards-BFZ Aquifer	*5.2.4.1.2*
Richland SUD	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
Rollingwood	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
	New LCRA Contracts	*5.2.3.1.6*
Rough Hollow in Travis County	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
San Saba	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
Schulenburg	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
Senna Hills MUD	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
Shady Hollow MUD	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
Smithville	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
	New LCRA Contracts with Infrastructure	*5.2.3.1.7*
	Develop New Groundwater Supplies – Yegua-Jackson Aquifer	*5.2.4.2.7*
Sunrise Beach Village	Drought Management	*5.2.4.9.1*

Sunset Valley	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
	New LCRA Contracts	*5.2.3.1.6*
	Expanded Local Use of Groundwater – Edwards-BFZ Aquifer	*5.2.4.1.2*
	Development of New Groundwater Supplies – Trinity Aquifer	*5.2.4.2.6*
	Rainwater Harvesting	*5.2.4.6*
Sweetwater Community	Drought Management	*5.2.4.9.1*
Travis County MUD 2	Drought Management	*5.2.4.9.1*
Travis County MUD 4	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
	Water Purchase	*5.2.4.7*
Travis County MUD 10	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
	Development of New Groundwater Supplies – Trinity Aquifer	*5.2.4.2.6*
Travis County MUD 14	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
	Water Purchase	*5.2.4.7*
Travis County WCID 10	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
Travis County WCID 17	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
	Direct Reuse (Non-Potable)	*5.2.5.5.11*
Travis County WCID 18	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
Travis County WCID 19	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
Travis County WCID 20	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
Travis County WCID Point Venture	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
	LCRA Contract Amendments	*5.2.3.1.4*
Weimar	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
Wells Branch MUD	Drought Management	*5.2.4.9.1*
	New LCRA Contracts	*5.2.3.1.6*

West Travis County Public Utility Agency	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
	LCRA Contract Amendments Requiring Infrastructure	*5.2.3.1.5*
	Hays County Pipeline	*5.2.4.3.1*
	Direct Potable Reuse	*5.2.5.4.4*
	Direct Reuse (Non-Potable)	*5.2.5.5.8*
Wharton	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
	Expanded Local Use of Groundwater – Gulf Coast Aquifer	*5.2.4.1*
	Wharton Water Supply	*5.2.5.2*
Wharton County WCID 2	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
Windermere Utility	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
	Water Purchase	*5.2.4.7*
	New LCRA Contracts	*5.2.3.1.6*
County-Other, Bastrop	Municipal Conservation	*5.2.2.3*
County-Other, Blanco	Drought Management	*5.2.4.9.1*
	Brush Management	*5.2.4.8*
County-Other, Burnet	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
	New LCRA Contract with Infrastructure	*5.2.3.1.7*
	Burnet County Regional Projects – Buena Vista	*5.2.4.5.1*
	Burnet County Regional Projects – East Lake Buchanan	*5.2.4.5.2*
	Burnet County Regional Projects – Marble Falls	*5.2.4.5.3*
County-Other, Colorado	Drought Management	*5.2.4.9.1*
	Expanded Local Use of Groundwater – Gulf Coast Aquifer	*5.2.4.1.4*

County-Other, Fayette	Drought Management	*5.2.4.9.1*
	Expanded Local Use of Groundwater – Gulf Coast Aquifer	*5.2.4.1.4*
	Expanded Local Use of Groundwater – Sparta Aquifer	*5.2.4.1.5*
	Development of New Groundwater Supplies – Sparta Aquifer	*5.2.4.2.5*
County-Other, Gillespie	Drought Management	*5.2.4.9.1*
	Brush Management	*5.2.4.8*
County-Other, Hays	Drought Management	*5.2.4.9.1*
	Expanded Local Use of Groundwater - Trinity Aquifer	*5.2.4.1.6*
	Hays County Pipeline	*5.2.4.3.1*
	BS/EACD – Edwards/Middle Trinity ASR	*5.2.4.4.1*
	BS/EACD – Saline Edwards ASR	*5.2.4.4.2*
	Rainwater Harvesting	*5.2.4.6*
	Brush Management	*5.2.4.8*
County-Other, Llano	Drought Management	*5.2.4.9.1*
	Direct Potable Reuse	*5.2.5.4.3*
County-Other, Matagorda	Drought Management	*5.2.4.9.1*
County-Other, Mills	Drought Management	*5.2.4.9.1*
County-Other, San Saba	Drought Management	*5.2.4.9.1*
County-Other, Travis	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
	Brush Management	*5.2.4.8*
County-Other, Wharton	Drought Management	*5.2.4.9.1*
County-Other, Williamson	Drought Management	*5.2.4.9.1*
County-Other, Aqua Texas - Rivercrest	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
Irrigation, Colorado	Drought Management	*5.2.4.9.2*
	On-Farm Conservation	*5.2.2.5.1*
	Irrigation Operations Conveyance Improvements	*5.2.2.5.2*
	Sprinkler Irrigation	*5.2.2.5.3*
	Real-Time Use Metering and Monitoring	*5.2.2.5.4*
	Expanded Local Use of Groundwater - Gulf Coast Aquifer	*5.2.4.1.4*

Irrigation, Matagorda	Drought Management	*5.2.4.9.2*
	On-Farm Conservation	*5.2.2.5.1*
	Irrigation Operations Conveyance Improvements	*5.2.2.5.2*
	Sprinkler Irrigation	*5.2.2.5.3*
	Real-Time Use Metering and Monitoring	*5.2.2.5.4*
	Expanded Local Use of Groundwater - Gulf Coast Aquifer	*5.2.4.1.4*
	Development of New Groundwater Supplies - Gulf Coast Aquifer	*5.2.4.2.2*
Irrigation, Mills	Drought Management	*5.2.4.9.2*
	Drip Irrigation	*5.2.2.5.5*
	Expanded Local Use of Groundwater - Trinity Aquifer	*5.2.4.1.6*
Irrigation, Wharton	Drought Management	*5.2.4.9.2*
	On-Farm Conservation	*5.2.2.5.1*
	Irrigation Operations Conveyance Improvements	*5.2.2.5.2*
	Sprinkler Irrigation	*5.2.2.5.3*
	Real-Time Use Metering and Monitoring	*5.2.2.5.4*
	Expanded Local Use of Groundwater - Gulf Coast Aquifer	*5.2.4.1.4*
Irrigation, Gillespie	Drip Irrigation	*5.2.2.5.5*
Irrigation, San Saba	Drip Irrigation	*5.2.2.5.5*
Manufacturing, Fayette	Develop New Groundwater Supplies – Yegua-Jackson Aquifer	*5.2.4.2.7* *5.2.7*
Mining, Bastrop	Mining Conservation	*5.2.2.4*
Mining, Burnet	Mining Conservation	*5.2.2.4*
	Expanded Local Use of Groundwater – Ellenburger-San Saba Aquifer	*5.2.4.1.3*
	Development of New Groundwater Supplies – Ellenburger-San Saba Aquifer	*5.2.4.2.1*
	Development of New Groundwater Supplies – Hickory Aquifer	*5.2.4.2.3*
	Development of New Groundwater Supplies – Marble Falls Aquifer	*5.2.4.2.4*

Mining, Fayette	Expanded Local Use of Groundwater – Yegua-Jackson Aquifer	*5.2.4.1.7*
Mining, Hays	Expanded Local Use of Groundwater - Trinity Aquifer	*5.2.4.1.6*
	Water Purchase Amendment	*5.2.4.7* *5.2.5.5.6*
Steam-Electric, Colorado	-	-
Steam-Electric, Fayette	LCRA Contract Amendments	*5.2.3.1.4*
	Austin Steam-Electric Water Management Strategies	*5.2.9.1*
Steam-Electric, Matagorda	LCRA Contract Amendments	*5.2.3.1.4*
	STP Nuclear Operating Company Water Management Strategies	*5.2.9.2*
Steam-Electric, Travis	Austin Return Flows	*5.2.1.1*
	Centralized Direct Reuse	*5.2.3.2.7*
Brookesmith SUD*	Drought Management	*5.2.4.9.2*
Canyon Lake Water Service*	Drought Management	*5.2.4.9.2*
Cedar Park*	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
El Campo*	Drought Management	*5.2.4.9.1*
Georgetown*	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
Goforth SUD*	Drought Management	*5.2.4.9.2*
Kempner WSC*	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
Leander*	Drought Management	*5.2.4.9.1*
	LCRA Contract Amendments	*5.2.3.1.4*
Lee County WSC*	Drought Management	*5.2.4.9.1*
Polonia WSC*	Drought Management	*5.2.4.9.1*
Round Rock*	Municipal Conservation	*5.2.2.3*
	Drought Management	*5.2.4.9.1*
West End WSC*	Drought Management	*5.2.4.9.1*
Williamson County WSID 3*	Drought Management	*5.2.4.9.1*
Williamson Travis Counties MUD 1*	Drought Management	*5.2.4.9.1*
Zephyr WSC*	Drought Management	*5.2.4.9.1*

* Region K is not the primary region for this WUG.

CHAPTER 5.0: IDENTIFICATION, EVALUATION, AND SELECTION OF WATER MANAGEMENT STRATEGIES BASED ON NEED

Chapter 4 identified the WUGs in the region with water needs. *Appendix 4A* lists all WUGs within Region K with shortages. This chapter (*Chapter 5*) describes the analysis regarding the identification, evaluation, and selection of appropriate water management strategies for the Region K. Water management strategies have been defined for each of the identified future water shortages within Region K as required by the regional water planning process. Included within this chapter are:

- Description of the potentially feasible water management strategies
- Definition of the recommended and alternative water management strategies
- Allocation of selected strategies to specific WUGs

In addition to the above, this chapter has a sub-section specifically to address water conservation, including any recommended water conservation management strategies.

5.1 POTENTIAL WATER MANAGEMENT STRATEGIES

Region K presented their process for identifying potential water management strategies for public comment at the April 11, 2018 Region K meeting.

TWDB regional water planning guidelines provide a list of potentially feasible water management strategies that should include, but is not limited to:

- Expanded use of existing supplies.
- New supply development.
- Conservation and drought management measures.
- Reuse of wastewater.
- Interbasin transfers.
- Emergency transfers.

The Region K process that was used to identify potentially feasible water management strategies for the region includes the following:

1. Define groupings or common areas with supply deficiencies.
2. Develop a comprehensive list of potentially feasible strategies for each area.
    - Recommended and alternative strategies from 2016 Region K Water Plan
    - Strategies documented in local plans
    - Suggestions from the public
3. Meet with potential suppliers/WUGs for each area to determine current strategies under consideration.
4. Prepare qualitative rating based on cost, reliability, environmental impact, and political acceptability for the various strategies.
5. Select one or more additional strategies for each area, if appropriate.
6. Present proposed shortlist at Public Meeting during Region K Planning Group meeting for modification and/or approval.

The complete list of potentially feasible water management strategies considered in the 2021 RWP are included in *Appendix 5A*. *Appendix 5A* also includes a table that identifies whether each category of water management strategy required for consideration by TWDB is potentially feasible or is not potentially feasible for each Water User Group (WUG) with water needs. All potentially feasible water management strategies were evaluated under drought of record conditions.

5.2 RECOMMENDED WATER MANAGEMENT STRATEGIES

The primary emphasis of the regional water planning effort is the development of regional water management strategies sufficient to meet the projected needs of WUGs throughout the state. Water needs are determined by comparing user group water demands to the water supplies available to that user group. The following sections present information concerning the identification, evaluation, and selection of specific water management strategies to meet specific projected water supply shortages for the LCRWPA (Region K). If a project sponsor wishes to be considered for certain types of State funding, the project that the funding is requested for must be included in the Regional and State Water Plan. It should be noted that local plans that are not inconsistent with the regional water supply plan are also eligible to apply for certain types of TWDB financial assistance to implement those local plans even though they have not been specifically recommended in this plan.

The identified water needs presented in *Chapter 4* are based on Modeled Available Groundwater (MAG) volumes and conservative surface water availability estimates, which assume only water available during a repeat of the worst Drought of Record (DOR), that all water rights are being fully and simultaneously utilized, and exclude water available from LCRA on an interruptible basis and water available as a result of municipal return flows to the Colorado River. The water management strategies are intended to alleviate these projected water supply shortages (water needs). A table of the recommended water management strategies by WUG is contained in *Appendix 5B*. *Appendix 5D* contains the TWDB Costing Tool Cost Summary for each applicable strategy. In accordance with 31 TAC §357.34(e)(3)(A), regional and state water plans are not to include the cost of distribution of water within a water user group service area.

Regional water planning groups are required to take into account and report water loss estimates in the evaluation of water management strategies. A summary of municipal water loss for Region K is provided at the end of *Chapter 1*. It shows an average real loss of 14.1% for the region. Reported real losses for individual municipal WUG from the 2015 audit submitted to TWDB range from 0% to 61%. These real losses are embedded in the water use survey data that the TWDB uses to project municipal water demands and determine water needs in the regional water planning process. Certain conservation strategies recommended in the 2021 Region K Water Plan are intended to decrease the water loss for existing infrastructure, both for municipal and for irrigation water users. Drought management strategies recommended in this plan have no associated water losses. Strategies involving new or amended contracts or the purchase of water from a supplier are assumed to have no additional water losses with the use of existing infrastructure.

Recommended and alternative surface water strategies such as new reservoirs have water losses associated with evaporation that are included in the modeling analyses. Surface water strategies containing new infrastructure such as pump stations and transmission pipelines are assumed to have negligible water losses. Reuse projects are assumed to have negligible water losses as well.

Recommended and alternative groundwater strategies include aquifer storage and recovery (ASR), expanded local use of groundwater, and development of new groundwater supplies, including importation from outside of the region. ASR reduces the water losses associated with evaporation from a reservoir, but there can be water losses due to recovery efficiency from the aquifer. Migration rates vary depending on the aquifer used for storage, and impacts will depend on how long the stored water remains in the aquifer. Recovery efficiency will have some impacts on water volume but should have negligible impacts on the firm yield volumes. Groundwater expansion strategies that assume additional yield from existing infrastructure have no additional water losses associated with them. Groundwater expansion, development, and importation strategies that require new infrastructure are assumed to have negligible water losses. Desalination strategies in this plan have yields that are assumed to account for approximately 10 percent water loss, due to concentrate disposal.

Per House Bill 807 (HB 807), if a Regional Water Planning Area (RWPA) has significant identified water needs, the Regional Water Planning Group (RWPG) shall provide a specific assessment of the potential for ASR projects to meet those needs. At the October 9, 2019 meeting, the LCRWPG determined the threshold of significant water needs by evaluating existing needs in the LCRWPA. The LCRWPG did not believe ASR would be feasible cost-wise for the Irrigation WUGs in Colorado, Matagorda, and Wharton Counties, and therefore they removed Irrigation needs from consideration for this determination. Thus, significant identified water need was defined as a municipal WUG with a need of 10,000 ac-ft/yr or greater; this includes Austin, West Travis County PUA, and Aqua WSC.

- The needs in West Travis County PUA are met through conservation, drought management, and strategies requiring infrastructure. One such strategy, the Hays County Pipeline (*Section 5.2.4.3.1*), obtains its water from the Guadalupe-Blanco River Authority (GBRA) Mid-Basin (Phase 2) Project, which develops water from the Guadalupe River and an Aquifer Storage and Recovery (ASR) in the Carrizo-Wilcox in Gonzales County in Region L.
- The ASR evaluation for Austin may be found in *Section 5.2.3.2.3*.
- A full strategy evaluation of ASR was not conducted for Aqua WSC. In Aqua WSC, the current groundwater supply is limited, and utilization of surface water is required to meet needs in later decades. As such, the implementation of ASR is cost-prohibitive compared to the cost of surface water infrastructure.
- ASR was also evaluated and recommended for LCRA (*Section 5.2.3.1.12*) in the Carrizo-Wilcox Aquifer and smaller entities in Hays and Travis counties (*Section 5.2.4.4*).

5.2.1 Utilization of Return Flows

Approximately 60 percent of all municipal diversions by Austin and others are currently returned to the Colorado River as effluent discharges. Unless otherwise authorized by permit, once discharged to the river, this water is subject to diversion under existing water rights' permits. State law currently allows a water right holder to consumptively use all the water authorized by permit, unless discharge is required by permit. Direct reuse is one possible manner in which a water right holder may increase consumptive use of the water authorized for diversion and use under the water right. The Region K Cutoff WAM for the Colorado River that was used for determining water supply in this round of planning excludes all sources of return flows from the model. The inclusion of return flows in the model is proposed as a water management strategy for the benefit of water rights and environmental flows and indirect reuse by Austin in future regional water plans, consistent with a settlement agreement between Austin and the Lower Colorado River Authority.

The exclusion of all return flows in the determination of water supply leads to conservatively low estimates of available surface water supply for planning purposes. Water shortages for entities that currently use and rely upon the return flows may not be realistic as long as upstream return flow discharges continue into the future. For purposes of this plan, the water management strategies include use of projected state surface water that result from discharge of return flows by Austin and Pflugerville. Strategies related to Austin's reuse of treated effluent are described in *Section 5.2.3.2*. This plan assumed projected levels of effluent to be discharged by Pflugerville of 60 percent of the total projected demand after water savings for drought management, conservation, and reuse have been accounted for in each planning decade. Effluent not being directly reused by Austin as a strategy and these other projected levels of effluent were made available to help meet environmental flow needs of the river and Matagorda Bay and water rights, according to the prior appropriation doctrine. Therefore, return flow assumptions for purposes of developing LCRA's water management strategies incorporate and reflect Austin's proposed strategies of reuse of effluent to meet portions of municipal and manufacturing demand and Austin's steam-electric demand in Travis County, including use of reclaimed water at the Sand Hill Energy Center, and the return flow sharing strategy described in *Section 5.2.1.1*.

5.2.1.1 Austin Return Flows

In 2007, Austin and LCRA signed a settlement agreement that resolved several permitting disputes and outlined a proposed arrangement for shared rights to the beneficial use of return flows discharged by Austin. According to the settlement agreement, the two parties will seek regulatory approval to effectuate the strategy of joint return flow benefit. The settlement contemplates that the return flows will be managed between the two parties to first help satisfy environmental flow needs before Austin conducts indirect reuse. If Austin has an indirect reuse project in operation that is consistent with the terms and conditions of the Settlement Agreement, LCRA will not call on return flow passage for diversion under LCRA's water rights unless, first, environmental needs and, second, Austin's indirect reuse needs are met.

At this time, Austin has not developed plans for implementing an indirect reuse project under the Austin-LCRA Joint Application for Reuse pending at TCEQ, as outlined by Austin and LCRA 2007 Settlement Agreement. Future Region K plans are expected to include assumptions related to indirect reuse under this pending joint Austin-LCRA permit.

In this plan, after meeting the environmental flow requirements, as needed, in the Region K Cutoff model, the projected remaining return flows were made available to meet all downstream demands, including municipal, irrigation, and industrial (including steam-electric) water needs, in accordance with the prior appropriation doctrine. The partitioning of Austin's municipal return flows between environmental flow requirements and water rights will be modeled by Austin and LCRA as part of the TCEQ permit review process. Environmental flow requirements will likely change in the future based on the latest scientific studies and actual water right utilization levels throughout the basin. The settlement agreement contemplates a framework for joint management between the two parties so that environmental flow requirements, as based on the best available science at the time, will be satisfied with Austin's return flows prior to beneficial use by either party's water rights.

Until Austin and LCRA have been granted regulatory approval for the strategy of joint return flow benefit and until Austin implements an indirect reuse project consistent with the terms and conditions of the Settlement Agreement, the beneficial use of these return flows as a water management strategy as indicated in *Table 5.2* helps meet the projected needs identified in *Chapter 4* which were the result of the conservative modeling assumptions used in *Chapter 3*.

The quantity of return flows is projected to remain somewhat consistent over the 50-year planning period. Even though water demands in in the Austin area are projected to increase the quantity of water reused during this period is projected to increase as well. However, beyond 2070 in the long-term, Austin projects that it will significantly increase its reuse of treated effluent to nearly 100 percent through direct and indirect reuse. As return flows discharged by Austin may diminish in the future due to enhanced reclamation of water, other sources may need to be dedicated or developed to meet needs that may currently be met by return flows discharged by Austin.

Table 5.2: Estimated Continued Benefits of Projected Austin Return Flows Strategy in the 2021 Region K Plan

Austin Return Flows	2020	2030	2040	2050	2060	2070
Projected Austin Effluent minus reuse	108,978	114,129	102,440	102,121	99,557	100,935
Estimated Benefits to Major Water Rights						
Highland Lakes	7,910	8,016	7,629	7,095	6,644	6,183
Austin [1]	23,589	23,466	23,342	23,219	23,095	22,972
STP	2,396	2,349	2,303	2,257	2,210	2,164
Garwood [2]	2,000	2,000	2,000	2,000	2,000	2,000
Gulf Coast [2]	1,364	1,323	1,282	1,240	1,199	1,199
Lakeside [2]	6,876	6,701	6,525	6,349	6,174	6,174
Pierce Ranch [2]	1,594	1,509	1,424	1,339	1,254	1,254
Irrigation [3]	17,006	16,765	16,526	16,287	16,047	15,809
Estimated Benefit to Matagorda Bay	46,243	52,000	41,408	42,336	40,933	43,181

Note: Estimates derived using a version of the Region K Cutoff Model (Supply Version) with return flows included. The benefits for Garwood, Gulf Coast, Lakeside, Pierce Ranch, and Irrigation were post-processed based on percentages of each Water Right allocated for Irrigation and other uses.

[1] The benefit shown here is derived by calculating the increase in water availability to Austin's upstream run-of-river water rights when the downstream return flow strategy is added to the Region K Strategy Model. Therefore, the benefit shown does not reflect indirect reuse in the form of return flows diversion downstream of a discharge location.

[2] These values represent the gains due to return flows in the portions of the water rights used for non-irrigation purposes.

[3] This value represents the gains due to return flows in the portion of the Irrigation ROR water rights that are used for irrigation purposes.

Cost Implications of Proposed Strategy

There are no capital costs associated with the diversion of this water because the diversions are done under existing water rights permits with existing infrastructure. Energy costs have been calculated for diverting the return flows from the Colorado River using the TWDB Costing Tool. The annual energy costs are $1,217,000, with a unit cost of $11/ac-ft.

Environmental Considerations

Return flows provide a positive impact to the instream flows as they travel downstream to either reach the bay as freshwater inflows or be diverted by downstream water users. There are zero anticipated impacts to cultural resources.

Agricultural & Natural Resources Considerations

Return flows, when available for diversion by the downstream irrigators, provide a positive impact to agriculture. Benefits to irrigation are shown in *Table 5.2.*

Issues and Considerations

Issues related to ownership of treated wastewater effluent are discussed in *Chapter 8 (Section 8.1.8)*.

5.2.1.2 Downstream Return Flows

In addition to Austin's return flows, return flows from Pflugerville are considered in the plan as a water management strategy. This strategy assumed a projected level of effluent to be discharged by Pflugerville of 60 percent of the total projected demand after water savings for drought management and conservation have been accounted for in each planning decade. Pflugerville currently has no plans for reuse, so it is assumed that all the effluent would be released for downstream use. It is also assumed that diversions available from the return flows will be reduced by 10 percent due to channel losses and evaporation, which have been incorporated into the yields. *Table 5.3* shows the estimated benefits of these return flows by planning decade. These downstream return flows are assigned as a benefit to LCRA.

Table 5.3: Downstream Return Flows Yield

Water Management Strategies (ac-ft/yr)					
2020	**2030**	**2040**	**2050**	**2060**	**2070**
3,985	4,969	6,072	7,164	8,267	8,267

Cost Implications of Proposed Strategy

There are no capital costs associated with the diversion of this water because the diversions are done with existing infrastructure or proposed infrastructure with costs identified in other strategies. Energy costs have been calculated for diverting the return flows from the Colorado River using the TWDB Costing Tool. The annual energy costs are $89,000, with a unit cost of $11/ac-ft.

Environmental Considerations

Return flows provide a positive impact to the instream flows as they travel downstream to a diversion point. A potential diversion point for LCRA for these downstream return flows is the proposed Mid-Basin Reservoir project diversion point. Environmental impacts beyond the diversion point would be up to 8,267 ac-ft/yr of diverted flow. There are zero anticipated impacts to cultural resources.

Agricultural & Natural Resources Considerations

If the return flows are diverted for storage in the proposed Mid-Basin Reservoir by LCRA, negligible impacts to agricultural users are expected (zero acres impacted). There is a potential agricultural benefit from flows that are not stored and travel further downstream to be available for run-of-river irrigation diversions. This benefit could reach up to 8,267 ac-ft/yr.

Issues and Considerations

Issues related to ownership of treated wastewater effluent are discussed in *Chapter 8* of the 2021 Region K Plan.

5.2.2 Conservation

The LCRWPG supports conservation as an important component of water planning. It is more effective and less costly to use less water than to develop new sources. Conservation can be implemented at the municipal, industrial, and agricultural levels.

All entities applying for a new water right or an amendment to an existing water right are required to prepare and implement a water conservation plan. Entities with 3,300 or more connections, as well as those having a financial obligation greater than $500,000 with TWDB, are also required to submit water conservation plans. The plan is to be submitted to TCEQ along with the application.

Additional entities that are required to prepare and submit conservation plans include municipal, industrial, and other non-agricultural water right holders of 1,000 ac-ft/yr or greater; and agricultural water right holders of 10,000 ac-ft/yr or greater.

Online model water conservation plans are available at the following link:

https://www.tceq.texas.gov/permitting/water_rights/wr_technical-resources/conserve.html

5.2.2.1 LCRA Conservation

5.2.2.1.1. Enhanced Municipal and Industrial Conservation

LCRA recently completed its 2019 Water Conservation Plan that addresses water conservation practices for its firm water customers (municipal, industrial, power generation, and recreational). These efforts include five-year and 10-year water conservation goals for municipal (including firm irrigation/recreation customers), industrial, and agricultural use that will promote effective water conservation throughout communities in LCRA's rapidly growing service area. More details on the 2019 Water Conservation Plan can be found online at:

https://www.lcra.org/water/watersmart/Documents/LCRA-WCP-May2019.pdf.

Conservation measures include regulations, financial incentives, and education for water efficiency. All customers with new or renewing contracts must develop and implement water conservation plans. Along with the basic requirements, LCRA actively encourages customers to adopt additional measures such as a permanent watering schedule limiting use to twice per week and irrigation standards for new development. Financial incentives include providing cost-share grants to firm water customers and offering financial incentives for landscape irrigation technologies. Education efforts include providing irrigation evaluation training and assistance for wholesale customers' staff, community outreach presentations and participating in the coordination of the Central Texas Water Efficiency Network annual water conservation symposium.

Table 5.4 below shows the expected water savings from the enhanced municipal and industrial conservation strategy. It should be noted that the municipal water savings are from LCRA customers, most of which are also Water User Groups in the Region K planning process and are likely already included in the Municipal Conservation strategy in *Section 5.2.2.3*. The savings for the municipal strategies will be achieved through LCRA customer WUGs and are not above and beyond the conservation strategy savings associated with those individual WUGs. We want to acknowledge the impact that LCRA has by providing education and funding to its customers for implementation of conservation measures, but these savings are not counted in addition to the savings documented in *Table 5.8* in the Municipal Conservation section. The municipal water savings portion in *Table 5.4* below is approximately 4,500 ac-ft/yr in 2020 and 9,000 ac-ft/yr in 2030 and increases proportionally in later decades, leaving 600 ac-ft/yr of water savings for industrial purposes in 2020, 700 ac-ft/yr in 2030, and increasing proportionally in later decades.

Table 5.4: Water Savings from LCRA Enhanced Municipal and Industrial Conservation (ac-ft/yr)

Decade	Water Savings (ac-ft/yr)
2020	5,100
2030	9,700
2040	15,000
2050	20,000
2060	20,000
2070	20,000

Cost Implications of Proposed Strategy

The cost for this strategy was developed as part of the 2010 *Water Supply Resource Plan: Water Supply Option Analysis (Strategy II)* for LCRA. For the 2021 Region K Plan, capital costs were updated to $53,647,000 (September 2018 dollars). The TWDB Cost Estimating Tool was used to calculate total project costs at $74,415,000. The total annual cost is $5,236,000, generating a unit cost of $262/ac-ft of water saved. The cost per volume of water is expected to vary over implementation, and LCRA anticipates a range between $300 and $400/ac-ft, allowing that some of the costs associated with the conservation measures would not be capital. The most cost-effective conservation measures would be expected to be implemented first, and thus the cost per volume saved would expect to increase over time. For municipal WUGs discussed in Section 5.2.2.3, this cost is already incorporated into the WUG cost. LCRA would be off-setting a portion of their costs.

Environmental Impact

Conservation programs do not require additional infrastructure, meaning no environmental mitigation is necessary.

Zero environmental impacts (all environmental factors) are anticipated, as the impacts are already accounted for in the individual conservation strategies identified in *Sections 5.2.2.3*.

Agricultural & Natural Resources Considerations

Zero impacts to agriculture are anticipated (zero acres impacted), as enhanced municipal and industrial conservation will reduce a small portion of the expected increases to firm demands over time.

5.2.2.1.2. Agricultural Conservation

Irrigators in Colorado, Wharton, and Matagorda Counties have the largest irrigation needs in Region K. LCRA's strategies to be implemented as part of its sale of water to Williamson County under HB 1437 and those under its Agricultural Water Supply Resource Plan (WSRP) are designed to extend the availability of interruptible water supply to meet irrigation demands beyond that which would be expected without those improvements. LCRA actively pursues state and federal grants to supplement HB 1437 and other funds to implement irrigation operation conveyance improvements. Many strategies, which are outlined in detail under Irrigation Conservation in *Section 5.2.2.5* rely are based on the various strategies outlined in the Agricultural WSRP. Costs and savings for some of these strategies, such as automating the operation of major check structures and creating a centralized SCADA control system, have been updated based on projects that are already underway.

5.2.2.2 Austin Conservation

Austin began an aggressive water conservation program in the mid-1980s in response to rapid growth and a series of particularly dry years. Austin has achieved significant reductions in both per capita consumption and peak day to average day demand ratio. For the per capita use calculations, Austin used a modified GPCD from year 2011 approved by the LCRWPG and TWDB as their base year since Austin had mandatory water conservation measures in place from September through December that year.

In 1990, Austin's conservation program evolved from primarily reacting to high summertime demands to a comprehensive program with the goals of reducing both per capita consumption and peak day demand. To achieve these broader goals, Austin has implemented and anticipates continuing water conservation efforts and programs in a number of areas including:

- Leak reduction, leak response, and water loss reduction
- Water main replacement program
- Drought tolerant WaterWise landscaping
- Irrigation system audits and efficiency programs
- Water use efficiency programs including irrigation system and vehicle wash facility assessments
- Public education and outreach including school programs
- Rebate and incentive programs
- Local ordinances that increase water efficiency by customers (e.g., water use benchmarking, landscape transformation)
- Support of legislation that increases water efficiency in plumbing products and appliances at both the State and Federal level
- Increased water efficiency in utility operations
- Conservation-oriented tiered rate structures
- A/C Condensate recovery and cooling tower rebates
- Meter and water use efficiency programs

Through its various water conservation programs, Austin has made significant advances in reducing per capita water use in its service area. Austin is committed to continuing to seek ways to reduce its per capita demands as a best management practice for its utility. In 2009, the Austin City Council charged the Citizens Water Conservation Implementation Task Force (CWCITF) with producing a list of possible conservation measures to reduce water use in Austin beyond the savings that were expected from recommendations from a previous City Council created water conservation task force, the 2007 Water Conservation Task Force. As directed by Council resolution in May 2010, Austin Water evaluated the savings potential of the CWCITF strategies along with the savings expected from ongoing and planned efforts and developed an action plan to reduce water use in Austin to 140 gallons per capita, per day or lower by 2020. In harmony with this goal, efforts are made to increase Austin's customers' understanding of their water use and to educate them on ways to use water more efficiently. The following strategies were identified by Austin Water 140 GPCD Conservation Plan (140 Plan) to meet the following program goals:

- Reach 140 GPCD by 2020
- Reduce peak demand
- Pursue cost effective strategies
- Ensure conservation reaches all customer sectors
- Ensure consumer awareness of conservation
- Promote innovation in water conservation

Over the past ten years, Austin Water's conservation measures and programs have achieved or exceeded the following goals:

- Reducing peak daily demand by one percent per year over a ten-year period or by 25 million gallons per day (MGD) by 2017; and
- Reducing average per capita water use on a rolling 5-year basis to no more than 140 gallons per capita per day (GPCD) by 2020.

The utility achieved its ten-year peak day reduction goal within three years, or in 2010, and achieved its ten-year goal of a rolling 5-year total average per capita water use of 140 GPCD within five years, or in 2015. The utility further decreased its total average per capita consumption to 120 GPCD in 2019.

In the 2019 update to its Water Conservation Plan, Austin set new five and ten-year total average per capita consumption goals of 119 GPCD by 2024 and 106 GPCD by 2029, to be achieved primarily through the implementation of new demand management strategies identified in the November 2018 *Water Forward Plan*. Implementation and additional savings from many of these new programs are expected to begin over the next five years.

A system water loss reduction goal under the *Water Forward Plan* includes maintaining an Infrastructure Leak Index (ILI) at or below 2.7 by 2020 and further reducing and maintaining ILI to 2.0 or below by 2040. Austin Water reported a preliminary ILI of 3.84 in 2018. ILI is an indication of the level of leakage in a water system, with lower ILIs representing lower-water-loss-systems.

Projected savings from municipal and manufacturing conservation are shown in the following table. Note that these projected savings from conservation represent estimated savings from implementing Austin's Water Forward Plan strategies. These strategies include implementation of water loss reduction efforts, water main and service line replacements, advanced metering infrastructure, landscape transformation, and AC condensate reuse. These savings do not include additional potential savings from water conservation and demand reduction measures such as graywater use, rainwater harvesting, stormwater harvesting, and water reuse. Additional conservation savings from these other demand reduction strategies are discussed in upcoming sections.

Table 5.5: Austin Conservation Strategy Yield (ac-ft/yr)

Water Management Strategies (ac-ft/yr)					
2020	**2030**	**2040**	**2050**	**2060**	**2070**
4,910	14,890	24,870	30,120	35,370	40,620

Costs Implications of Proposed Strategy

Capital and O&M costs were provided by the Austin Water Forward Plan, dated 2018. In order to provide a comparable cost consistent with other strategies in this report, annual costs were developed using the Texas Water Development Board (TWDB) Cost Estimating Tool in September 2018 dollars. Costs were calculated to include a variety of conservation measures. The unit cost is presented as an average, with some conservation measures being more expensive and some being less. Capital costing efforts focused on advanced metering infrastructure (smart meters), water main and service line replacements, and leak detection and repair, but were meant to encompass other types of capital-cost associated conservation measures as well, including continued implementation of the conservation strategies included in the bulleted list above. The unit cost for this strategy has increased significantly since the last planning cycle; this is largely due to an increased scope of utility-side water loss control efforts.

Many of the non-capital cost measures are mentioned above, but it is not an exclusive list, and Region K encourages the TWDB to provide funding for all types of conservation measures for WUGs and wholesale water providers within Region K and around the state.

Table 5.6: Austin Conservation Strategy Cost

Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
$514,560,000	$719,616,000	$54,569,000	$1,343

Environmental Considerations

Water conservation is a beneficial strategy. For example, water conservation strategies generally do not require the movement of water between locations. In addition, water conservation generally does not result in adverse impacts to environmental flows or other environmental considerations. The conservation strategies by Austin are estimated to reduce demand by an additional 40,620 ac-ft/yr by 2070. Note that water conservation can cause changes to wastewater concentrations over time, in which case treatment processes may need to be adjusted to maintain permitted discharge parameters. There are zero anticipated impacts to cultural resources.

Agricultural & Natural Resources Considerations

Zero impacts to agriculture are anticipated (zero acres impacted). Negligible direct impacts to other water resources are expected as a result of implementing this strategy.

5.2.2.3 Municipal Conservation

Reduction of municipal water demand through conservation has been a primary focal point for Regional Water Planning in Texas since the 2011 planning cycle. The water demands approved by TWDB and the individual Regional Water Planning Groups (RWPGs) have already been adjusted to incorporate the effects of the 1991 State Water Saving Performance Standards for Plumbing Fixtures Act. In addition, RWPGs are required to consider further water conservation measures in their plan or explain reasons for not recommending conservation for Water User Groups (WUGs) with water needs.

The Lower Colorado Regional Planning Area (LCRWPA) currently anticipates 58 municipal WUGs with shortages in the year 2070. Thirty-eight (38) of these WUGs have per capita water demands in excess of the 140 gallons per capita per day (GPCD) goal proposed by the Water Conservation Implementation Task Force (WCITF) and may be able to reduce their shortages through conservation practices.

A methodology was developed to determine the anticipated municipal water conservation savings for the WUGs within the LCRWPA. First, WUGs were required to meet the following criteria to be chosen for conservation measures:

- Be a municipal WUG. Conservation was considered, regardless of whether a municipality had a water need.
- Have a year 2020 per capita water usage of greater than 140 GPCD, indicating a potential for savings through conservation.

Per capita water demands were determined from the measured or projected population and water demands for each WUG during each decade. The following methodology was used in calculating water demand reductions:

- If the 2020 GPCD is greater than 140, 10% GPCD reduction per decade until 140 GPCD is reached.
- If the 2020 GPCD is less than 140, no conservation is considered.
- Defer to Water Conservation goals, if applicable.

This method is slightly more conservative than the WCITF recommendation of a 1 percent per year reduction in per capita water demand in order to reach the target demand of 140 GPCD; if a WUG has a high GPCD in 2020 and doesn't reach 140 by 2070, the overall reduction is about 45%. Conservation was applied immediately in 2020 regardless of the beginning year of a WUG shortage so that conservation could be implemented early enough to have significant effects on demand by the time the shortage was realized.

A lower limit of 140 GPCD was set unless a WUG specified in their Water Conservation Plan their intent to reduce further. This was done so that conservation was only recommended to reach reasonable levels. For WUGs that were anticipated to reach a per capita usage below 140 GPCD without conservation in later decades, the lower demands approved by the Regional Planning Group and TWDB were carried forward.

The new per capita usage for each decade was then used along with the projected WUG population to determine the new projected water demands for each decade. These values were subtracted from the original water demands to determine the amount of water conserved in each decade. Per House Bill (HB) 807 of the 86th Texas Legislature, the new per capita daily usage is included in *Appendix 5C.*

Burnet County-Other did not fall under the above criteria but is recommended to receive water from the Buena Vista Regional Project *(Section 5.2.4.5.1*) through an interbasin transfer, requiring that the highest practicable level of achievable water conservation be considered. Therefore, municipal conservation is recommended for Burnet County-Other, Brazos Basin, based on the achievement of 130 GPCD by 2020 and 125 GPCD by 2030.

Bastrop County WCID 2 also did not fall under the above criteria but is recommended to receive water from the Bastrop County Regional Project (*Section 5.2.3.1.7*) through an interbasin transfer, requiring that the highest practicable level of achievable water conservation be considered. Therefore, municipal conservation is recommended for Bastrop County WCID 2, Colorado Basin, based on the achievement of 77 GPCD by 2060, a 5% reduction. Due to the small reduction, there are no capital costs associated with this strategy. Conservation measures were assumed to be non-capital approaches, which could include both labor and materials associated with implementing standards, incentives, and education and outreach.

The Austin WUG is not included in this strategy because Austin Water Conservation is a separate strategy and is discussed in *Section 5.2.3.2.1*.

Examples of measures that can be implemented to meet municipal conservation include, but are not limited to, the following:

<u>Utility water loss audits and repair</u>. System water audits are required every five years for all retail utilities and every year for utilities over 3,300 connections. To maximize the benefits of this measure, a utility would use the information from the water audit to revise meter testing and repair practices, reduce unauthorized water use, improve accounting for unbilled water, and implement effective water loss management strategies. Water loss strategies for new development, to minimize the need for line flushing, can include the addition of extra meters along various line routes to collect more accurate data on water flowing through those routes, creating loops in the water distribution lines, and placing chlorine injection stations strategically throughout the development to avoid the need for excessive flushing to keep chlorine residuals in compliance.

<u>“Smart” meters and automatic meter infrastructure (AMI).</u> A "smart" water meter is a measuring device that has the ability to store and transmit consumption data frequently. Sometimes "smart" meters are referred to as "time-of-use" meters because in addition to measuring the volume consumed, they also record the date and time the consumption occurs. "Smart" meters can be read remotely and more frequently, providing instant access to water consumption information for both customers and water utilities. "Smart" water meters are one component of an automated meter infrastructure (AMI) system that water utilities may choose to deploy. AMI systems using "smart" water meters are capable of measuring, collecting, and analyzing water use information and then communicating this information back to the customer via the internet either on request or on a fixed schedule. AMI systems can include hardware, software, communications, consumer water use portals and controllers, and other related systems. AMI differs from automatic meter reading (AMR) in that it enables two-way communications with the meter and the water utility. AMI extends current advanced meter reading (AMR) technology by providing two-way meter

communications for purposes such as real-time usage and pricing information, leak and abnormal usage detection, and targeted water efficiency messaging.

Customer behavioral engagement software. Software programs are now available that utilize customer water use data to develop individual water use reports for customers. This software works best when a utility has AMI but can also be used without AMI. The objectives of this measure are to assist customers with their personal water management, identify potential water savings, achieve water and cost savings, and increase customer participation in the utility's incentive programs. These software programs can provide information in a variety of ways and have the ability to run on multiple platforms, including computers, tablets and mobile phone devices. One utility utilizing this type of program identified a 3-5% savings in total water use of customers utilizing this information compared to a control group.

A permanent landscape watering schedule limiting spray irrigation of ornamental landscape to no more than twice per week. Several communities in Region K have already adopted a permanent watering schedule for the hot periods of the year, typical from May 1 to September 30 each year. Austin has adopted a year-round outdoor watering schedule. This measure, which typically includes enforcement provisions, saves a substantial amount of water and also lowers peak use during the summer, reducing pressure on water treatment plants and extending the period of time before a new plant is needed.

In the March 2018 report *Water Conservation by the Yard: A Statewide Analysis of Outdoor Water Savings Potential,* the Sierra Club, National Wildlife Federation, and Texas Living Waters Project provided a regional and statewide perspective of outdoor water use and the potential savings from year-round no more than twice per week watering restrictions. WUGs with conservation as a recommended strategy can reference *Table 5.7* for informational purposes showing the impact of the potential water savings. Should a WUG make low efforts of implementation, an estimated 3.5% of the GPCD can be reduced. High efforts of implementation, including education and enforcement, can result in a reduction of 8.5%.

Table 5.7: Reference Information on Potential Savings from Outdoor Watering Restriction to No More than Twice Per Week

WUG	Municipal Demand (ac-ft/yr)		Low Effort Water Savings (3.5%) (ac-ft/yr)		High Effort Water Savings (8.5%) (ac-ft/yr)	
	2020	2070	2020	2070	2020	2070
Aqua WSC (p)	10,318	37,239	361	1,303	877	3,165
Barton Creek West WSC	436	427	15	15	37	36
Barton Creek WSC	524	893	18	31	45	76
Bastrop	2,046	8,660	72	303	174	736
Bastrop County WCID 2	479	2,580	17	90	41	219
Bertram	430	764	15	27	37	65
Blanco	316	425	11	15	27	36
Buda (p)	1,768	7,338	62	257	150	624
Burnet	1,661	2,949	58	103	141	251
Cedar Park (p)	2,251	2,546	79	89	191	216
Columbus	1,134	1,313	40	46	96	112

WUG	Municipal Demand (ac-ft/yr)		Low Effort Water Savings (3.5%) (ac-ft/yr)		High Effort Water Savings (8.5%) (ac-ft/yr)	
	2020	2070	2020	2070	2020	2070
Cottonwood Shores	245	433	9	15	21	37
County-Other, Bastrop	1,418	3,437	50	120	121	292
County-Other, Burnet	3,414	4,838	119	169	290	411
County-Other, Travis (Aqua Texas - Rivercrest)	317	312	11	11	27	27
Creedmoor-Maha WSC	643	1,008	23	35	55	86
Cypress Ranch WCID 1	121	163	4	6	10	14
Dripping Springs WSC	1,930	7,476	68	262	164	635
Elgin	1,572	5,704	55	200	134	485
Fayette County WCID Monument Hill	184	235	6	8	16	20
Flatonia	346	470	12	16	29	40
Fredericksburg	3,351	4,322	117	151	285	367
Georgetown (p)	84	150	3	5	7	13
Goldthwaite	400	451	14	16	34	38
Hays County WCID 1	821	797	29	28	70	68
Hays County WCID 2	285	844	10	30	24	72
Horseshoe Bay	2,816	3,624	99	127	239	308
Hurst Creek MUD	1,718	1,699	60	59	146	144
Johnson City	353	480	12	17	30	41
Jonestown WSC	675	866	24	30	57	74
Kelly Lane WCID 1	322	311	11	11	27	26
Kempner WSC (p)	132	196	5	7	11	17
La Grange	957	1,292	33	45	81	110
Lago Vista	1,868	3,428	65	120	159	291
Llano	862	913	30	32	73	78
Loop 360 WSC	1,225	1,486	43	52	104	126
Marble Falls	2,354	6,446	82	226	200	548
Matagorda Waste Disposal & WSC	127	137	4	5	11	12
Meadowlakes	852	835	30	29	72	71
North San Saba WSC	185	195	6	7	16	17
Oak Shores Water System	150	169	5	6	13	14

WUG	Municipal Demand (ac-ft/yr)		Low Effort Water Savings (3.5%) (ac-ft/yr)		High Effort Water Savings (8.5%) (ac-ft/yr)	
	2020	2070	2020	2070	2020	2070
Pflugerville (p)	10,403	21,156	364	740	884	1,798
Richland SUD (p)	224	235	8	8	19	20
Rollingwood	383	377	13	13	33	32
Rough Hollow in Travis County	589	1,213	21	42	50	103
Round Rock (p)	278	470	10	16	24	40
San Saba	1,175	1,241	41	43	100	105
Schulenburg	701	958	25	34	60	81
Senna Hills MUD	420	708	15	25	36	60
Shady Hollow MUD	793	749	28	26	67	64
Smithville	821	3,125	29	109	70	266
Sunset Valley	368	753	13	26	31	64
Travis County MUD 10	74	124	3	4	6	11
Travis County MUD 4	1,500	2,603	53	91	128	221
Travis County WCID 10	3,499	5,026	122	176	297	427
Travis County WCID 17	9,370	11,841	328	414	796	1,006
Travis County WCID 18	1,070	1,779	37	62	91	151
Travis County WCID 19	449	444	16	16	38	38
Travis County WCID 20	584	577	20	20	50	49
Travis County WCID Point Venture	255	624	9	22	22	53
Weimar	496	569	17	20	42	48
West Travis County Public Utility Agency	11,197	20,507	392	718	952	1,743
Wharton	1,680	1,955	59	68	143	166
Wharton County WCID 2	456	535	16	19	39	45
Windermere Utility	2,920	2,809	102	98	248	239
Total Potential Savings from Outdoor Watering Restrictions			**3,395**	**6,535**	**8,246**	**15,872**

(p) - demands and potential savings shown are only for the portion of the WUG that lies within the Region K boundaries
Note: Lakeway MUD requested not to be included in this table as they have already implemented year-round twice per week watering restrictions.

<u>TCEQ 344 landscape irrigation standards for all new development.</u> House Bill 1656, passed in 2007, requires all municipalities with a population of more than 20,000 to adopt these standards. Municipal utility districts and water control improvement districts were also allowed to adopt the standards. Some of the requirements include requiring licensed irrigators to properly design and install the irrigation including

proper pressure and zoning for plan requirements, installing a rain sensor, no spray on narrow strips of landscape and other design standards. The licensed irrigator is also required to leave a water schedule and design plan with the customer.

Landscape standards for new development. Several Region K WUGs have adopted a variety of landscape standards, including requiring the use of native and adapted plants and drought tolerant turf, limits on irrigated landscape or turf area and a minimum of six inches of adequate soil. The Capital Area Homebuilder's Association adopted recommended standards for new development that have many of these same requirements.

Landscape irrigation evaluations. WUGs can provide or hire a contractor to provide this service if a majority of customers in the utility service area utilize automatic in-ground irrigation systems. These evaluations can identify irrigation system issues such as leaks, as well as provide the customer with an efficient, appropriate watering schedule. This service also provides a positive customer service image for the utility and can affect positive behavior change through face to face site visits with individual customers.

Public outreach and education programs. To be effective, water conservation education and outreach should be planned and implemented in a consistent and continual manner. Traditional methods such as print and electronic media activities and staffing of community events can be combined effectively with social media applications to relay messaging quickly and frequently to a wide audience with little cost. For smaller utilities, there are many low-cost or free resources available that can be utilized to implement effective public outreach and education programs.

Region K encourages the TWDB to provide funding for all types of conservation measures for WUGs and wholesale water providers within Region K and around the state. The Texas Water Conservation Advisory Council provides ongoing development and updates of many conservation measures – or best management practices (BMPs) – that can meet a WUG's water conservation strategy. More information can be found at the Council's website www.savetexaswater.org.

Table 5.8 shows conservation water savings based on the methodology above. Target GPCD goals, as required for inclusion in the plan by HB807 and based on the methodology above, are included in *Appendix 5C*.

Table 5.8: Municipal Conservation Yield

WUG	County	Basin	Water Management Strategies (ac-ft/yr)					
			2020	2030	2040	2050	2060	2070
Aqua WSC	Bastrop	Brazos	4	2	1	0	0	0
Aqua WSC	Bastrop	Colorado	408	244	116	33	0	0
Aqua WSC	Bastrop	Guadalupe	3	2	1	0	0	0
Bastrop	Bastrop	Colorado	184	355	433	558	744	992
Bastrop County WCID 2	Bastrop	Colorado	0	0	0	0	93	125
County-Other, Bastrop	Bastrop	Brazos	1	1	1	2	2	2
County-Other, Bastrop	Bastrop	Colorado	124	198	219	255	307	381

WUG	County	Basin	Water Management Strategies (ac-ft/yr)					
			2020	2030	2040	2050	2060	2070
County-Other, Bastrop	Bastrop	Guadalupe	3	5	5	6	8	9
Elgin	Bastrop	Colorado	66	119	224	405	531	700
Smithville	Bastrop	Colorado	69	59	54	59	75	97
Blanco	Blanco	Guadalupe	0	27	23	21	21	21
Johnson City	Blanco	Colorado	31	28	25	23	23	23
Bertram	Burnet	Brazos	39	85	142	205	238	257
Burnet	Burnet	Brazos	1	1	2	3	3	3
Burnet	Burnet	Colorado	149	329	543	691	754	810
Cottonwood Shores	Burnet	Colorado	22	26	27	28	29	32
County-Other, Burnet	Burnet	Brazos	63	91	71	68	70	74
County-Other, Burnet	Burnet	Colorado	112	162	127	122	125	131
Georgetown	Burnet	Brazos	8	17	28	35	39	41
Horseshoe Bay	Burnet	Colorado	49	134	241	368	505	645
Kempner WSC	Burnet	Brazos	12	12	11	11	12	12
Marble Falls	Burnet	Colorado	212	567	1,193	1,801	2,387	2,566
Meadowlakes	Burnet	Colorado	77	145	210	271	326	377
Columbus	Colorado	Colorado	102	195	286	384	484	581
Weimar	Colorado	Colorado	15	27	40	50	51	53
Weimar	Colorado	Lavaca	30	56	82	102	105	108
Fayette County WCID Monument Hill	Fayette	Colorado	17	33	50	68	75	78
Flatonia	Fayette	Guadalupe	6	12	17	17	18	19
Flatonia	Fayette	Lavaca	25	51	73	75	78	80
La Grange	Fayette	Colorado	86	82	69	63	64	66
Schulenburg	Fayette	Lavaca	63	128	199	235	246	254
Fredericksburg	Gillespie	Colorado	302	598	903	1,234	1,578	1,802
Buda	Hays	Colorado	159	292	382	499	636	793
Dripping Springs WSC	Hays	Colorado	174	289	339	417	522	576
Hays County WCID 1	Hays	Colorado	74	136	196	226	225	225

WUG	County	Basin	Water Management Strategies (ac-ft/yr)					
			2020	2030	2040	2050	2060	2070
Hays County WCID 2	Hays	Colorado	26	62	114	169	211	259
West Travis County Public Utility Agency	Hays	Colorado	405	984	1,610	2,546	3,631	4,840
Horseshoe Bay	Llano	Colorado	204	406	574	746	887	1,000
Llano	Llano	Colorado	78	147	208	263	285	295
Matagorda Waste Disposal & WSC	Matagorda	Brazos-Colorado	5	6	5	5	5	5
Matagorda Waste Disposal & WSC	Matagorda	Colorado	7	10	8	7	8	8
Goldthwaite	Mills	Brazos	1	2	2	2	2	2
Goldthwaite	Mills	Colorado	35	63	59	57	59	61
North San Saba WSC	San Saba	Colorado	17	32	46	60	74	85
Richland SUD	San Saba	Colorado	20	39	55	69	70	72
San Saba	San Saba	Colorado	106	208	300	378	469	556
Aqua WSC	Travis	Colorado	49	26	10	3	0	0
Barton Creek West WSC	Travis	Colorado	39	76	109	139	167	193
Barton Creek WSC	Travis	Colorado	47	110	183	258	330	409
Cedar Park	Travis	Colorado	203	420	590	586	583	582
County-Other, Travis (Aqua Texas - Rivercrest)	Travis	Colorado	29	55	79	102	123	142
Creedmoor-Maha WSC	Travis	Colorado	30	37	55	86	93	100
Creedmoor-Maha WSC	Travis	Guadalupe	2	2	4	6	6	6
Cypress Ranch WCID 1	Travis	Colorado	6	9	14	20	21	20
Elgin	Travis	Colorado	13	25	47	81	94	107
Hurst Creek MUD	Travis	Colorado	155	302	437	560	673	776
Jonestown WSC	Travis	Colorado	56	47	41	39	40	41
Kelly Lane WCID 1	Travis	Colorado	29	52	48	47	46	46
Lago Vista	Travis	Colorado	168	375	622	914	1,098	1,198

WUG	County	Basin	Water Management Strategies (ac-ft/yr)					
			2020	2030	2040	2050	2060	2070
Lakeway MUD	Travis	Colorado	248	492	748	1,015	1,169	1,168
Loop 360 WSC	Travis	Colorado	110	225	339	450	559	679
Oak Shores Water System	Travis	Colorado	14	29	42	54	65	70
Pflugerville	Travis	Colorado	563	549	606	674	754	743
Rollingwood	Travis	Colorado	34	64	90	116	142	148
Rough Hollow in Travis County	Travis	Colorado	53	220	319	319	319	319
Round Rock	Travis	Colorado	6	1	0	0	0	0
Senna Hills MUD	Travis	Colorado	38	85	142	200	258	321
Shady Hollow MUD	Travis	Colorado	71	90	74	65	64	64
Sunset Valley	Travis	Colorado	33	73	123	183	256	343
Travis County MUD 10	Travis	Colorado	7	15	25	27	28	30
Travis County MUD 4	Travis	Colorado	135	309	507	731	962	1,198
Travis County WCID 10	Travis	Colorado	315	660	1,031	1,440	1,858	2,275
Travis County WCID 17	Travis	Colorado	843	1,748	2,794	3,658	4,317	4,451
Travis County WCID 18	Travis	Colorado	75	58	47	43	43	46
Travis County WCID 19	Travis	Colorado	40	79	114	146	176	203
Travis County WCID 20	Travis	Colorado	53	103	149	190	228	263
Travis County WCID Point Venture	Travis	Colorado	23	55	94	146	189	216
West Travis County Public Utility Agency	Travis	Colorado	603	1,295	2,034	2,914	3,729	4,530
Windermere Utility	Travis	Colorado	118	62	29	13	8	7
Wharton	Wharton	Brazos-Colorado	83	91	73	67	68	69
Wharton	Wharton	Colorado	68	74	60	55	55	57
Wharton County WCID 2	Wharton	Brazos-Colorado	41	76	97	96	99	101
Total			**7,994**	**14,456**	**21,090**	**28,080**	**34,602**	**39,912**

Cost Implications of Proposed Strategy

Facility costing efforts focused on smart meters and leak detection and repair but were meant to encompass other types of capital-cost associated conservation measures as well. Costs for leak detection and repair were estimated assuming 10% of the WUG's pipeline is replaced in a 50-year timespan. Implementing this conservation strategy would reduce approximately 3% of the demand. Smart meters were assumed a cost of $270 per home, with the assumption that 100 percent of homes would implement this strategy over the planning horizon. Implementing this conservation strategy would reduce approximately 5% of the demand. If overall calculated water savings were less than facility implementation, assumptions were modified to more accurately reflect calculated savings. *Table 5.9* and *Table 5.10* show a breakdown of costs associated with leak detection and repair and advanced metering infrastructure, respectively.

Table 5.9: Municipal Conservation – Leak Detection and Repair Costs

WUG	Pipe Length* (Miles)	Maximum Water Reduction (ac-ft)	Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
Aqua WSC (p)	28.9	174	$8,766,000	$11,710,000	$824,000	$4,733
Barton Creek West WSC	0.7	13	$212,000	$284,000	$20,000	$1,561
Barton Creek WSC	2	27	$606,000	$810,000	$57,000	$2,128
Bastrop	6	260	$1,818,000	$2,428,000	$171,000	$658
Bertram	2	23	$359,000	$480,000	$34,000	$1,483
Blanco	3.5	10	$1,055,000	$1,409,000	$99,000	$9,814
Buda (p)	4.6	220	$1,388,000	$1,854,000	$130,000	$591
Burnet	6.1	88	$1,848,000	$2,469,000	$174,000	$1,967
Cedar Park (p)	6	76	$1,817,000	$2,427,000	$171,000	$2,239
Columbus	4	39	$1,203,000	$1,607,000	$113,000	$2,869
Cottonwood Shores	2.3	12	$411,000	$549,000	$38,000	$3,197
County-Other, Bastrop	4.5	103	$1,360,000	$1,817,000	$128,000	$1,241
County-Other, Burnet	5.3	95	$1,607,000	$2,146,000	$151,000	$1,591
County-Other, Travis (Aqua Texas - Rivercrest)	2.5	9	$754,000	$1,007,000	$71,000	$7,585
Creedmoor-Maha WSC	3.1	30	$933,000	$1,246,000	$88,000	$2,910
Cypress Ranch WCID 1	0.7	5	$209,000	$279,000	$20,000	$4,090
Dripping Springs WSC	6.3	216	$1,897,000	$2,533,000	$178,000	$824
Elgin	4.9	171	$1,485,000	$1,983,000	$140,000	$818
Fayette County WCID Monument Hill	0.7	7	$126,000	$168,000	$12,000	$1,702

WUG	Pipe Length* (Miles)	Maximum Water Reduction (ac-ft)	Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
Flatonia	3.4	14	$615,000	$821,000	$58,000	$4,113
Fredericksburg	13.7	130	$4,151,000	$5,544,000	$390,000	$3,008
Georgetown (p)	2.1	5	$371,000	$495,000	$35,000	$7,778
Goldthwaite	2.3	14	$697,000	$931,000	$66,000	$4,878
Hays County WCID 1	3.4	24	$1,031,000	$1,377,000	$97,000	$4,057
Hays County WCID 2	2.4	25	$436,000	$583,000	$41,000	$1,619
Horseshoe Bay	14.5	109	$4,394,000	$5,869,000	$413,000	$3,799
Hurst Creek MUD	1.7	51	$500,000	$668,000	$47,000	$922
Johnson City	2.1	12	$636,000	$849,000	$60,000	$5,161
Jonestown WSC	4.9	21	$1,491,000	$1,992,000	$140,000	$6,679
Kelly Lane WCID 1	1.2	9	$358,000	$478,000	$34,000	$3,644
Kempner WSC (p)	1.7	5	$305,000	$408,000	$28,000	$6,022
La Grange	4.6	32	$1,389,000	$1,855,000	$131,000	$4,057
Lago Vista	12.5	103	$3,788,000	$5,059,000	$356,000	$3,462
Lakeway MUD	6.8	96	$2,061,000	$2,753,000	$194,000	$2,014
Llano	5.3	27	$1,606,000	$2,145,000	$151,000	$5,513
Loop 360 WSC	1.2	45	$370,000	$494,000	$35,000	$785
Marble Falls	9.4	193	$2,848,000	$3,805,000	$268,000	$1,386
Matagorda Waste Disposal & WSC	3.9	4	$700,000	$935,000	$66,000	$16,058
Meadowlakes	3.5	25	$1,048,000	$1,400,000	$98,000	$3,912
North San Saba WSC	8.5	6	$1,525,000	$2,038,000	$143,000	$24,444
Oak Shores Water System	0.4	5	$121,000	$161,000	$11,000	$2,170
Pflugerville (p)	7	283	$2,120,000	$2,831,000	$199,000	$704
Richland SUD (p)	2.3	7	$416,000	$556,000	$39,000	$5,532
Rollingwood	1.6	11	$485,000	$647,000	$46,000	$4,067
Rough Hollow in Travis County	3	36	$904,000	$1,207,000	$85,000	$2,336
Round Rock (p)	0	2	$6,000	$8,000	$1,000	$417
San Saba	5.9	37	$1,788,000	$2,388,000	$168,000	$4,512
Schulenburg	3.1	29	$939,000	$1,255,000	$88,000	$3,062
Senna Hills MUD	0.5	21	$152,000	$202,000	$14,000	$659

WUG	Pipe Length* (Miles)	Maximum Water Reduction (ac-ft)	Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
Shady Hollow MUD	1.5	22	$455,000	$607,000	$43,000	$1,914
Smithville	1.3	37	$402,000	$536,000	$38,000	$1,040
Sunset Valley	0.8	23	$242,000	$324,000	$23,000	$1,018
Travis County MUD 10	0.5	4	$142,000	$189,000	$13,000	$3,495
Travis County MUD 4	5.5	78	$1,667,000	$2,227,000	$157,000	$2,011
Travis County WCID 10	7.8	151	$2,364,000	$3,157,000	$222,000	$1,472
Travis County WCID 17	26.2	355	$7,939,000	$10,605,000	$746,000	$2,100
Travis County WCID 18	2	28	$616,000	$823,000	$58,000	$2,059
Travis County WCID 19	0.3	13	$79,000	$106,000	$7,000	$526
Travis County WCID 20	1.1	17	$333,000	$445,000	$31,000	$1,791
Travis County WCID Point Venture	1.1	19	$333,000	$445,000	$31,000	$1,656
Weimar	2.2	17	$667,000	$891,000	$63,000	$3,691
West Travis County Public Utility Agency	28	615	$8,485,000	$11,333,000	$797,000	$1,295
Wharton	8.1	59	$2,454,000	$3,278,000	$231,000	$3,939
Wharton County WCID 2	2.5	16	$758,000	$1,012,000	$71,000	$4,424
Windermere Utility	2.8	44	$845,000	$1,129,000	$79,000	$1,781

(p) - demands and potential savings shown are only for the portion of the WUG that lies within the Region K boundaries
* 10% of total pipeline length for utility assumed for replacement.

Table 5.10: Municipal Conservation – Advanced Metering Infrastructure Costs

WUG	Smart Meters Installed by 2070	Maximum Water Reduction (ac-ft)	Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
Aqua WSC (p)	12,347	290	$3,334,000	$4,453,000	$647,000	$2,230
Barton Creek West WSC	446	21	$120,000	$160,000	$23,000	$1,077
Barton Creek WSC	402	45	$109,000	$146,000	$21,000	$470
Bastrop	16,299	433	$4,401,000	$5,878,000	$854,000	$1,972
Bertram	1,078	38	$291,000	$388,000	$56,000	$1,466
Blanco	807	17	$218,000	$291,000	$43,000	$2,558
Buda (p)	13,912	367	$3,756,000	$5,017,000	$729,000	$1,987
Burnet	4,540	147	$1,226,000	$1,638,000	$238,000	$1,614

WUG	Smart Meters Installed by 2070	Maximum Water Reduction (ac-ft)	Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
Cedar Park (p)	4,174	127	$1,127,000	$1,505,000	$219,000	$1,720
Columbus	1,535	66	$414,000	$553,000	$80,000	$1,219
Cottonwood Shores	781	20	$210,000	$281,000	$41,000	$2,069
County-Other, Bastrop	6,471	172	$1,747,000	$2,333,000	$339,000	$1,973
County-Other, Burnet	7,212	158	$1,947,000	$2,601,000	$378,000	$2,390
County-Other, Travis (Aqua Texas - Rivercrest)	258	16	$70,000	$93,000	$14,000	$897
Creedmoor-Maha WSC	3,325	50	$898,000	$1,199,000	$174,000	$3,452
Cypress Ranch WCID 1	595	8	$161,000	$215,000	$31,000	$3,804
Dripping Springs WSC	14,123	360	$3,813,000	$5,094,000	$740,000	$2,056
Elgin	14,272	285	$3,853,000	$5,147,000	$747,000	$2,619
Fayette County WCID Monument Hill	334	12	$90,000	$120,000	$17,000	$1,447
Flatonia	788	24	$213,000	$285,000	$41,000	$1,745
Fredericksburg	5,356	216	$1,446,000	$1,932,000	$281,000	$1,300
Georgetown (p)	232	8	$63,000	$84,000	$12,000	$1,600
Goldthwaite	825	23	$223,000	$298,000	$43,000	$1,907
Hays County WCID 1	1,216	40	$328,000	$438,000	$64,000	$1,606
Hays County WCID 2	1,244	42	$336,000	$449,000	$66,000	$1,564
Horseshoe Bay	2,671	181	$721,000	$963,000	$140,000	$773
Hurst Creek MUD	1,032	85	$279,000	$373,000	$54,000	$636
Johnson City	784	19	$212,000	$283,000	$41,000	$2,116
Jonestown WSC	1,414	35	$382,000	$510,000	$73,000	$2,089
Kelly Lane WCID 1	564	16	$152,000	$203,000	$29,000	$1,865
Kempner WSC (p)	309	8	$83,000	$112,000	$17,000	$2,194
La Grange	2,170	54	$586,000	$782,000	$113,000	$2,100
Lago Vista	4,740	171	$1,280,000	$1,710,000	$248,000	$1,447
Lakeway MUD	5,088	161	$1,374,000	$1,835,000	$266,000	$1,657
Llano	1,314	46	$355,000	$474,000	$68,000	$1,490
Loop 360 WSC	852	74	$230,000	$307,000	$45,000	$606
Marble Falls	8,247	322	$2,227,000	$2,975,000	$432,000	$1,340

WUG	Smart Meters Installed by 2070	Maximum Water Reduction (ac-ft)	Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
Matagorda Waste Disposal & WSC	264	7	$71,000	$95,000	$14,000	$2,044
Meadowlakes	847	42	$229,000	$306,000	$44,000	$1,054
North San Saba WSC	234	10	$63,000	$84,000	$12,000	$1,231
Oak Shores Water System	211	8	$57,000	$76,000	$11,000	$1,302
Pflugerville (p)	19,335	471	$5,220,000	$6,973,000	$1,013,000	$2,149
Richland SUD (p)	346	12	$93,000	$124,000	$18,000	$1,532
Rollingwood	486	19	$131,000	$175,000	$25,000	$1,326
Rough Hollow in Travis County	1,899	61	$513,000	$685,000	$99,000	$1,632
Round Rock (p)	172	4	$46,000	$62,000	$9,000	$2,250
San Saba	1,224	62	$331,000	$442,000	$64,000	$1,031
Schulenburg	1,497	48	$404,000	$539,000	$78,000	$1,628
Senna Hills MUD	698	35	$188,000	$252,000	$37,000	$1,045
Shady Hollow MUD	1,455	37	$393,000	$525,000	$76,000	$2,029
Smithville	2,507	61	$677,000	$904,000	$131,000	$2,152
Sunset Valley	643	38	$174,000	$232,000	$33,000	$876
Travis County MUD 10	199	6	$54,000	$72,000	$10,000	$1,613
Travis County MUD 4	1,421	130	$384,000	$513,000	$74,000	$569
Travis County WCID 10	3,720	251	$1,004,000	$1,341,000	$194,000	$772
Travis County WCID 17	15,708	592	$4,241,000	$5,665,000	$823,000	$1,390
Travis County WCID 18	1,944	47	$525,000	$701,000	$102,000	$2,173
Travis County WCID 19	227	22	$61,000	$81,000	$12,000	$541
Travis County WCID 20	377	29	$102,000	$137,000	$20,000	$693
Travis County WCID Point Venture	867	31	$234,000	$312,000	$45,000	$1,442
Weimar	867	28	$234,000	$312,000	$45,000	$1,582
West Travis County Public Utility Agency	19,637	1025	$5,302,000	$7,083,000	$1,028,000	$1,003
Wharton	3,887	98	$1,050,000	$1,403,000	$204,000	$2,087
Wharton County WCID 2	922	27	$249,000	$333,000	$48,000	$1,794
Windermere Utility	3,135	74	$847,000	$1,130,000	$164,000	$2,218

(p) - demands and potential savings shown are only for the portion of the WUG that lies within the Region K boundaries
Note: Lakeway MUD requested 5,088 connections.

The Texas Water Development Board (TWDB) Cost Estimating Tool methodology was used to determine facility costs, project costs, annual costs, and unit costs. A 10% operations and maintenance (O&M) cost was included in annual costs for smart meters, but no O&M was included for leak detection and repair because there should be no additional O&M costs for replacing an existing pipe. The unit cost is presented as an average, with some conservation measures being more expensive and some being less.

Remaining conservation measures were assumed to be non-capital approaches, which could include both labor and materials associated with implementing standards, incentives, and education and outreach. Conservation measures for non-capital approaches were included in the annual costs at an average of $250/ac-ft of water savings. The following table provides the total cost information for WUGs with a recommended conservation strategy, including both capital and non-capital costs.

Table 5.11: Municipal Conservation Total Cost

WUG	County	Basin	Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
Aqua WSC	Bastrop	Brazos	$106,145	$141,784	$12,899	$3,167
Aqua WSC	Bastrop	Colorado	$10,642,081	$14,215,166	$1,293,285	$3,167
Aqua WSC	Bastrop	Guadalupe	$75,130	$100,355	$9,130	$3,167
Bastrop	Bastrop	Colorado	$6,219,000	$8,306,000	$1,099,750	$1,109
Bastrop County WCID 2	Bastrop	Colorado	$0	$0	$31,250	$250
County-Other	Bastrop	Brazos	$18,726	$25,012	$2,992	$1,264
County-Other	Bastrop	Colorado	$3,013,372	$4,024,942	$481,475	$1,264
County-Other	Bastrop	Guadalupe	$74,902	$100,046	$11,968	$1,264
Elgin	Bastrop	Colorado	$4,632,600	$6,187,793	$845,784	$1,208
Smithville	Bastrop	Colorado	$1,078,802	$1,440,741	$169,086	$1,736
Blanco	Blanco	Guadalupe	$1,272,212	$1,700,238	$141,621	$5,265
Johnson City	Blanco	Colorado	$847,656	$1,131,823	$100,911	$3,255
Bertram	Burnet	Brazos	$650,000	$868,000	$138,895	$541
Burnet	Burnet	Brazos	$12,414	$16,586	$2,247	$684
Burnet	Burnet	Colorado	$3,061,586	$4,090,414	$554,098	$684
Cottonwood Shores	Burnet	Colorado	$621,371	$830,020	$79,616	$2,512
County-Other	Burnet	Brazos	$1,278,074	$1,706,998	$190,241	$2,090
County-Other	Burnet	Colorado	$2,276,077	$3,039,935	$338,794	$2,090
Georgetown	Burnet	Brazos	$434,000	$579,000	$54,225	$1,326
Horseshoe Bay	Burnet	Colorado	$2,005,407	$2,678,580	$349,543	$542
Kempner WSC	Burnet	Brazos	$388,291	$519,566	$45,077	$3,635

WUG	County	Basin	Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
Marble Falls	Burnet	Colorado	$5,075,000	$6,780,000	$1,212,605	$473
Meadowlakes	Burnet	Colorado	$1,277,000	$1,706,000	$219,600	$582
Columbus	Colorado	Colorado	$1,617,000	$2,160,000	$311,915	$537
Weimar	Colorado	Colorado	$295,597	$394,677	$44,928	$849
Weimar	Colorado	Lavaca	$605,403	$808,323	$92,017	$849
Fayette County WCID Monument Hill	Fayette	Colorado	$216,000	$288,000	$43,725	$563
Flatonia	Fayette	Guadalupe	$156,147	$208,573	$21,569	$1,154
Flatonia	Fayette	Lavaca	$671,853	$897,427	$92,806	$1,154
La Grange	Fayette	Colorado	$1,974,236	$2,637,312	$244,072	$2,835
Schulenburg	Fayette	Lavaca	$1,343,000	$1,794,000	$210,315	$828
Fredericksburg	Gillespie	Colorado	$5,597,000	$7,476,000	$1,035,160	$574
Buda	Hays	Colorado	$5,144,000	$6,871,000	$910,515	$1,148
Dripping Springs WSC	Hays	Colorado	$5,710,084	$7,627,247	$917,658	$1,593
Hays County WCID 1	Hays	Colorado	$1,359,000	$1,815,000	$201,585	$892
Hays County WCID 2	Hays	Colorado	$772,000	$1,032,000	$154,795	$598
West Travis County Public Utility Agency	Hays	Colorado	$7,121,797	$9,512,948	$1,940,936	$401
Horseshoe Bay	Llano	Colorado	$3,109,593	$4,153,420	$542,002	$542
Llano	Llano	Colorado	$1,961,000	$2,619,000	$274,415	$931
Matagorda Waste Disposal & WSC	Matagorda	Brazos-Colorado	$308,595	$412,260	$32,505	$5,140
Matagorda Waste Disposal & WSC	Matagorda	Colorado	$462,405	$617,740	$48,705	$5,140
Goldthwaite	Mills	Brazos	$23,790	$31,780	$3,002	$1,800
Goldthwaite	Mills	Colorado	$896,210	$1,197,220	$113,103	$1,800
North San Saba WSC	San Saba	Colorado	$1,588,000	$2,122,000	$172,325	$2,030
Richland SUD	San Saba	Colorado	$509,000	$680,000	$70,350	$974
San Saba	San Saba	Colorado	$2,119,000	$2,830,000	$346,105	$623
Aqua WSC	Travis	Colorado	$1,276,634	$1,705,264	$155,144	$3,167
Barton Creek West WSC	Travis	Colorado	$332,000	$444,000	$82,635	$429

WUG	County	Basin	Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
Barton Creek WSC	Travis	Colorado	$715,000	$956,000	$162,465	$397
Cedar Park	Travis	Colorado	$2,944,000	$3,932,000	$486,705	$824
County-Other, Travis (Aqua Texas - Rivercrest)	Travis	Colorado	$824,000	$1,100,000	$114,185	$806
Creedmoor-Maha WSC	Travis	Colorado	$1,720,779	$2,297,818	$252,469	$2,506
Creedmoor-Maha WSC	Travis	Guadalupe	$110,221	$147,182	$16,171	$2,506
Cypress Ranch WCID 1	Travis	Colorado	$370,000	$494,000	$53,040	$2,502
Elgin	Travis	Colorado	$705,400	$942,207	$128,786	$1,208
Hurst Creek MUD	Travis	Colorado	$779,000	$1,041,000	$260,970	$336
Jonestown WSC	Travis	Colorado	$1,872,747	$2,502,106	$213,821	$3,825
Kelly Lane WCID 1	Travis	Colorado	$510,000	$681,000	$69,655	$1,353
Lago Vista	Travis	Colorado	$5,068,000	$6,769,000	$834,940	$697
Lakeway MUD	Travis	Colorado	$3,435,000	$4,588,000	$688,130	$588
Loop 360 WSC	Travis	Colorado	$600,000	$801,000	$220,130	$324
Oak Shores Water System	Travis	Colorado	$178,000	$237,000	$36,095	$516
Pflugerville	Travis	Colorado	$7,340,224	$9,804,939	$1,212,082	$1,607
Rollingwood	Travis	Colorado	$616,000	$822,000	$100,560	$678
Rough Hollow in Travis County	Travis	Colorado	$1,417,000	$1,892,000	$239,590	$750
Round Rock	Travis	Colorado	$52,255	$69,787	$9,532	$1,489
Senna Hills MUD	Travis	Colorado	$340,000	$454,000	$116,965	$365
Shady Hollow MUD	Travis	Colorado	$848,000	$1,132,000	$126,595	$1,402
Sunset Valley	Travis	Colorado	$416,000	$556,000	$126,640	$369
Travis County MUD 10	Travis	Colorado	$196,000	$261,000	$28,120	$925
Travis County MUD 4	Travis	Colorado	$2,051,000	$2,740,000	$478,490	$399
Travis County WCID 10	Travis	Colorado	$3,368,000	$4,498,000	$884,280	$389
Travis County WCID 17	Travis	Colorado	$12,180,000	$16,270,000	$2,444,905	$549
Travis County WCID 18	Travis	Colorado	$1,141,381	$1,524,479	$159,888	$2,129

WUG	County	Basin	Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
Travis County WCID 19	Travis	Colorado	$140,000	$187,000	$60,795	$300
Travis County WCID 20	Travis	Colorado	$435,000	$582,000	$105,260	$400
Travis County WCID Point Venture	Travis	Colorado	$567,000	$757,000	$117,545	$544
West Travis County Public Utility Agency	Travis	Colorado	$6,665,203	$8,903,052	$1,816,499	$401
Windermere Utility	Travis	Colorado	$1,691,955	$2,259,450	$243,738	$2,060
Wharton	Wharton	Brazos-Colorado	$1,927,148	$2,574,480	$240,371	$2,655
Wharton	Wharton	Colorado	$1,576,852	$2,106,520	$196,679	$2,655
Wharton County WCID 2	Wharton	Brazos-Colorado	$1,007,000	$1,345,000	$133,650	$1,318

Environmental Considerations

Conservation has potential impacts for WUGs that are served by groundwater. Communities that are served by surface water will divert less water from streams, meaning more water will remain in channels for downstream uses. However, groundwater communities contribute to streamflow by discharging treated groundwater into streams (typically 60 percent of water supplied is discharged following treatment). Conservation measures implemented by these WUGs may lead to an overall decrease in streamflow which is derived from groundwater sources. However, streamflow would not be expected to be decreased if the conservation is in the outdoor irrigation usage sector. Individual WUG implementation has negligible impacts to the region, but full regional implementation could leave up to approximately 40,000 ac-ft/yr in the lakes and aquifers. This additional water would increase storage levels, delay drought triggers, and increase springflows. There are zero anticipated impacts to cultural resources.

Agricultural & Natural Resources Considerations

Zero impacts to agriculture are anticipated (zero acres impacted). Negligible direct impacts to other water resources are expected as a result of implementing this strategy.

5.2.2.4 Mining Conservation

Mining conservation is being considered as a strategy to meet certain mining needs in Bastrop and Burnet Counties. Conservation for mining involves taking the existing pumped groundwater, once used, letting it settle, and then recycling it for additional use rather than pumping additional groundwater from the aquifer.

This strategy assumes that the existing supply can be recycled up to five times, as needed, in order to meet the mining demands. Mining in Burnet County has additional groundwater strategies providing supply, but there is no additional groundwater available under the MAG to meet the mining water needs in Bastrop County, Guadalupe Basin.

Table 5.12 provides the conservation savings yield from recycling the existing water supply.

Table 5.12: Mining Conservation Yield

WUG	County	Basin	Water Management Strategies (ac-ft/yr)					
			2020	2030	2040	2050	2060	2070
Mining	Bastrop	Guadalupe	2	243	308	233	0	0
Mining	Burnet	Colorado	1,300	1,300	1,300	1,300	1,300	1,800

Cost Implications of Proposed Strategy

It is assumed that there are no facilities' costs for this strategy. Energy costs for recycling the water were calculated using the TWDB Costing Tool.

Table 5.13: Mining Conservation Cost

WUG	County	Basin	Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
Mining	Bastrop	Guadalupe	$0	$0	$5,000	$16
Mining	Burnet	Colorado	$0	$0	$60,000	$33

Agricultural & Natural Resources Considerations

Zero environmental impacts (all environmental factors) are anticipated from this strategy. Zero impacts to agriculture are also anticipated.

5.2.2.5 Irrigation Conservation

Several types of conservation measures are recommended to meet Irrigation needs, specifically in Colorado, Matagorda, and Wharton counties. The following sections describe the recommended measures in more detail.

5.2.2.5.1. On-Farm Conservation

The water needed for irrigation in Colorado, Wharton, and Matagorda counties is the largest deficit identified within the LCRWPA. On-farm water conservation for irrigation is one of the water management strategies developed to address the issue.

Analysis

It is anticipated that significant water savings can be achieved using precision land leveling (including levees), multiple field inlets, and irrigation pipeline. The estimated amount of water savings from on-farm water conservation accomplished from 2011 to 2018 is substantial with more than 48,000 acres of land leveled and over 200,000 feet of irrigation pipeline installed during that timeframe. The majority of these improvements were made in Colorado County, likely due to the fact that since from 2012-2015, the only irrigation division receiving water from the Colorado River was Garwood, which is 80 percent in Colorado County. However, for many years there has been low participation in Matagorda County, so for maximum water savings to be realized, participation in NRCS's Environmental Quality Incentives Program (EQIP) in Matagorda County must increase substantially.

The conservation estimate was based on updated estimates of total rice acreage available for improvement in each county from the USDA/NASS 2017 Census of Agriculture and the NRCS EQIP Conservation Applied Practices by County 2018. The estimate assumes that the average annual improvement of land leveling will continue in Matagorda (~440 ac/yr) and Wharton Counties (~790 ac/yr) and 50 percent of unimproved acreage will be improved in Colorado County through 2070. It also assumes 50 percent adoption of multiple inlets and 25 percent adoption of irrigation pipeline, based on current unimproved acreage for each county. *Table 5.14* shows unimproved acreage in Colorado, Matagorda, and Wharton counties.

Table 5.14: Unimproved Acreage

County	Cropland[1]	Est. Acres in Use Per Year[2]	Conservation Applied[3] (acres)	Unimproved Land	Unimproved Land Available to Save Water
Colorado	135,012	31%	30,098	104,914	33,026
Matagorda	176,443	67%	7,122	169,321	54,183
Wharton (K)	217,873	71%	15,836	202,037	142,803

[1] USDA/NASS 2017 Census of Agriculture (Land in farms – Cropland)
[2] 2017 NASS Planted Acres (Total planted acres/Cropland)
[3] NRCS EQIP Conservation Applied Practices by County 2018

Rice utilizes significantly more water than many other Texas crops because of the growing environment adopted for rice production. Rice is grown in standing water primarily due to the plant's requirement for saturated soil moisture conditions during most of its vegetative and reproductive stages, and secondarily to minimize competition from undesirable plants. The flood culture is not required to grow rice but is currently the only practical method for maintaining the required saturated soil conditions.

There are many potential on-farm irrigation improvements, but in general, water savings can best be achieved by minimizing flooding depth and improving management of the flushing and flooding operations. The techniques that have the most significant impact in accomplishing these goals include precision or laser land leveling, use of permanent levees with permanent water control structures, use of a field lateral with multiple field inlets, and improved management of water control activities. Individual water conservation measures are discussed in the following sections.

Table 5.15: On-Farm Conservation Estimate of Water Savings

WUG	County	Basin	On-Farm Conservation Estimate of Water Savings (ac-ft/yr)					
			2020	2030	2040	2050	2060	2070
Irrigation	Colorado	Brazos-Colorado	2,206	2,647	3,088	3,529	3,971	4,412
Irrigation	Colorado	Colorado	685	823	960	1,097	1,234	1,371
Irrigation	Colorado	Lavaca	2,769	3,322	3,876	4,430	4,984	5,537
Irrigation	Matagorda	Brazos-Colorado	2,536	3,043	3,550	4,058	4,565	5,072
Irrigation	Matagorda	Colorado	21	25	29	33	38	42
Irrigation	Matagorda	Colorado-Lavaca	2,489	2,987	3,484	3,982	4,480	4,978
Irrigation	Wharton	Brazos-Colorado	7,795	9,354	10,913	12,472	14,031	15,590
Irrigation	Wharton	Colorado	3,553	4,263	4,974	5,685	6,395	7,106
Total			**22,054**	**26,464**	**30,874**	**35,286**	**39,698**	**44,108**

Note: Demand reductions through advanced conservation were distributed to county-basin irrigation WUGs based on the location of shortages.

Laser Land Leveling

In the production of rice, there are many benefits to having fields that are almost level but still have some slope for drainage, typically 0.15 foot or less in elevation change for 100 feet of distance. An almost level field will allow a more uniform shallow water depth across the field, reducing the total amount of water applied to the field. Land grading can give a field this desired condition by using a laser-guided grader equipped with GPS.

Precision land leveling or can reduce the amount of water used by 25 to 30 percent and increase production by 10 to 15 percent. A 2012 savings verification study prepared for LCRA by the University of Texas LBJ School of Public Affairs[1] found that precision leveling, in and of itself, accounts for a 0.30 ac-ft/ac reduction in on-farm water use for the first crop at a 95 percent confidence interval when compared to water use in unleveled fields. Fields where permanent levees were utilized as part of the precision leveling process saved more water than fields that were just land leveled. Fields that were precision leveled and had some levees removed showed an average savings of 0.70 ac-ft/ac, though this higher estimate is not statistically significant. From 2009 to 2012, this study developed, tested and validated qualitative and statistical methods for evaluating how on-farm water usage varies in LCRA's Lakeside Irrigation Division between fields and between farmers by analyzing water use data from 2006-2011. This study estimates the water savings from precision land leveling, compared to other factors that influence water use. Another savings verification study prepared for LCRA by the University of Wisconsin using 2012-2016 data in the Garwood Irrigation Division found that decreasing the density of levees results in a statistically significant reduction in water use.

Interest in large investments in long-term land improvements such as precision land leveling in the rice industry is greater among those rice growers who own their own land. In that case, improvements benefit the landowner and make sense economically, particularly when there is matching grant money available from the Natural Resources Conservation Service. However, in many cases, land is leased on an annual

[1] Ramirez, A.K. and Eaton, D. J. "Statistical Testing for Precision Graded Verification," a report from the University of Texas at Austin to the Lower Colorado River Authority, Austin, TX, September 2012

basis for rice production. There is usually no long-term agreement between the landowner and farmer, although share-renting arrangements are common. A rental-for-cash arrangement makes it difficult for the farmer to justify a significant capital expenditure and can limit the amount of land where precision leveling is being implemented. The topography and soil type also may limit the amount of land where this practice could be implemented.

Levees are used to separate the individual cuts in a rice field. Maintenance of a uniform shallow water depth allows the levees to maintain greater freeboard or levee height above the water surface. If there is insufficient freeboard, rainfall can cause the levees to overtop and fail with the worst-case result being loss of water from the entire field. Minimizing the flooding depth allows the producer to capture rainwater, replacing an equal amount of water that would normally have been diverted from the river or pumped from wells. The amount of water saved can vary with rainfall during the growing season but can replace a significant quantity of the water normally diverted from the river and minimize the amount of tail water or rice field runoff water.

NRCS guidelines require a maximum slope for precision land leveled fields that can vary based on crop and field characteristics. Fields that are improved to a higher standard generally have a smaller average elevation change and between adjacent levees, a smaller overall field slope, and also have levees that are straighter and farther apart from each other, resulting in lower levee density. LCRA savings verification studies conducted in both Lakeside and Garwood irrigation divisions have found that fields with lower levee density use less water. Fewer levees also reduce labor costs required to manage water within a field and can increase production yield.

Permanent Perimeter Levees

Permanent, taller levees can be installed around the perimeter and in the interior of the rice field. Permanent levees can allow a farmer the ability to hold deeper water for the purpose of safely utilizing rainfall without the fear of breaching the smaller, more traditional levees. The permanent levees are much less likely to be damaged or breached by heavy rain events. LCRA savings verification studies have found that the presence of permanent perimeter levees reduces water use.

Use of Multiple Field Inlets

Another method used by rice producers to conserve water is the utilization of multiple field inlets for applying water to the individual cuts or land sections between levees. The use of multiple inlets allows for many benefits that result in water savings. The water savings is further enhanced when multiple inlets are applied in combination with land leveling. Most of the acreage that has been land leveled through EQIP since 2011 had multiple inlets installed as well. Limited funding and increased competitiveness of the EQIP program led many producers to include both practices in their EQIP applications as a means of increasing their chances of having their applications funded. The most significant benefit of multiple inlets is the ability to apply water where and when it is needed and at a shallower depth. Because of the shallow water, rice production is increased while the total water applied is minimized. A side lateral with multiple inlets is often paired with a similar drain, as opposed to draining all water from a field through the lowest cut. This can allow the field to drain more quickly, shortening the time to harvest, preventing runoff of nutrients, and reducing irrigation labor, and increasing the potential for higher production yield of a ratoon crop. A model called Rice Water Conservation Analyzer developed for LCRA in 2008 estimated that multiple inlets save 0.4 ac-ft/ac. This estimate was also published in the 2011 LCRA agricultural water supply resource plan.

Irrigation Pipelines

The practice of replacing on-farm canal ditches with pipeline reduces losses and increases efficiency of water delivery. The decision to line a canal or replace the canal using a pipeline is often made based on how much water is conveyed in the canal and the quality of water in the canal; the smaller the capacity of the canal, the more likely it is a candidate for replacement using a pipeline. PVC Plastic Irrigation Pipe is commonly used in this application and is available in diameters from 6 to 27 inches with pressure ratings from 80 psi to 200 psi. The strategy assumes savings of 0.18 ac-ft/ac, per a series of interviews with L.G. Raun, Jr. and Ronald Gertson.

Cost Implications of Proposed Strategy

The total cost for the on-farm strategies, developed through the Texas Water Development Board (TWDB) Cost Estimating Tool, is $64,153,000. Many of these on-farm conservation strategies are eligible for funding of up to 70 percent through the EQIP program. Funding for this program in the affected Region K counties may be expanded due to a recent federal grant. Individual producers and landowners bear the costs associated with these on-farm strategies except for that portion that may be eligible for reimbursement through EQIP or HB1437 grants. *Table 5.16* shows the cost of the various conservation strategies based on September 2018 costs. *Table 5.17* shows the facilities, project, annual, and unit cost by WUG.

Table 5.16: Estimated Unit Cost of Agricultural Conservation Improvements

Improvement	Improvement Cost per Acre
Precision Land Leveling[1]	$440
Multiple Inlets[1]	$160
Irrigation Pipeline[2]	$241

[1] Texas State Soil & Water Conservation Board, 2019
[2] Interviews with L.G. Raun, Jr. and Ronald Gertson, 2006

Table 5.17: Cost Estimate for On-Farm Conservation

WUG	County	Basin	Total Facilities Cost	Total Project Costs	Largest Annual Cost	Unit Cost ($/ac-ft)
Irrigation	Colorado	Brazos-Colorado	$4,625,988	$6,416,809	$497,717	$113
Irrigation	Colorado	Colorado	$1,437,467	$1,993,943	$154,659	$113
Irrigation	Colorado	Lavaca	$5,806,468	$8,054,279	$624,727	$113
Irrigation	Matagorda	Brazos-Colorado	$5,318,274	$7,377,094	$572,201	$113
Irrigation	Matagorda	Colorado	$43,795	$60,749	$4,712	$113
Irrigation	Matagorda	Colorado-Lavaca	$5,219,349	$7,239,873	$561,558	$113
Irrigation	Wharton	Brazos-Colorado	$16,346,846	$22,675,068	$1,758,782	$113
Irrigation	Wharton	Colorado	$7,450,812	$10,335,185	$801,644	$113

Environmental Considerations

On-farm conservation for rice production could influence the instream water balance during dry, summer months in two ways: (1) by reducing the amount of return flows introduced to streams, and (2) by reducing the amount of water diverted from streams. The balance of these two impacts could potentially result in a net gain or loss in dry weather instream flows, depending on the farming practices used. First, the reduced return flows from irrigated fields would negatively impact flows downstream of the fields. These return flows would typically occur during the summer months when this discharge can provide habitat for species and other ecological benefits. However, conservation could have a positive impact on instream flows by reducing the amount of water diverted for irrigation thereby increasing the amount of store water potentially available to meet environmental flow needs over the long term. Overall, it is likely that there would be zero impacts to streamflow and the bay. There are zero anticipated impacts to cultural resources.

Agricultural & Natural Resources Considerations

On-farm conservation methods have the potential benefit to agriculture in that by reducing the demand for water overall, they increase the likelihood that demands for water could be met on a more consistent basis. In some cases, grant funding and low-interest loan funding availability is critical to local implementation. Impacts to agriculture are mainly cost-related, as shown in *Table 5.17.*

5.2.2.5.2. Irrigation Operations Conveyance Improvements

The water needed for irrigation in Colorado, Wharton, and Matagorda Counties is the largest deficit identified within the LCRWPA. Irrigation operation conveyance improvement is one of the water management strategies identified in LCRA's Agricultural WSRP to address the issue.

Analysis

In addition to the water conservation measures implemented on-farm, substantial water can be saved by improving the efficiency of the canal systems that deliver water to the individual irrigator. These improvements would include: 1) improving the efficiency of water delivery in canal systems by automating the operation of major checks structures within the irrigation division; 2) creating a centralized control system for each irrigation division, allowing each canal system to be monitored and operated remotely; 3) adding flow regulating reservoirs to balance flows; 4) targeted lining of high-loss canal segments; and 5) regular maintenance of canal banks, including vegetation control and repairing sections damaged by cattle and other animals. Since the 2016 Region K plan, all of the main Gulf Coast Irrigation Division gates were automated by LCRA, improving the efficiency of water delivery in canal systems. LCRA plans to automate the main canal structures in all LCRA-controlled canal systems by or before 2030.

Centralized SCADA control is an essential back bone to upgrading the efficiency of water delivery in the canal systems. LCRA is pursuing the development of software to allow downstream control of these gates, which could increase savings substantially by relaying downstream water demand information real-time to upstream gates, rather than simply maintaining a constant upstream level at each site. The combination of centralized control and automation of all major check structures required to operate the system remotely are expected to eliminate 50 to 70 percent of estimated overflows lost from the end of the system, for a savings of 3.5 percent of average historical water use. This savings estimate was developed for upstream control gates. This savings estimate has been corroborated with reduction in overflows from the ends of the canal lines in Gulf Coast, as well as a regression savings analysis comparing predicted water use to actual water diverted, taking into account normal variations due to climate and acreage variability.

The 2008 LSWP PVA estimated 65,000 ac-ft/yr of water savings from improved efficiency of rice irrigation delivery system by the LCRA irrigation divisions in an average scenario. Details of this conservation estimate can be found in a report titled Conservation Strategies in the LCRA Irrigation Divisions – 2007 dated May 23, 2008. Changes to the conservation estimates shown in the table below reflect project implementation.

Table 5.18: Irrigation Operations Conveyance Improvements Estimate of Water Savings

WUG	County	Basin	Irrigation Operations Conveyance Improvements Estimate of Water Savings (ac-ft/yr)					
			2020	2030	2040	2050	2060	2070
Irrigation	Colorado	Brazos-Colorado	503	1,145	1,788	2,431	3,074	3,716
Irrigation	Colorado	Colorado	156	356	556	755	955	1,155
Irrigation	Colorado	Lavaca	631	1,438	2,245	3,051	3,858	4,665
Irrigation	Matagorda	Brazos-Colorado	1,471	3,351	5,232	7,112	8,992	10,872
Irrigation	Matagorda	Colorado	12	28	43	59	74	90
Irrigation	Matagorda	Colorado-Lavaca	1,444	3,289	5,134	6,980	8,825	10,670
Irrigation	Wharton	Brazos-Colorado	1,225	2,791	4,357	5,923	7,489	9,055
Irrigation	Wharton	Colorado	558	1,272	1,986	2,700	3,413	4,127
Total			**6,000**	**13,670**	**21,341**	**29,011**	**36,680**	**44,350**

Note: Demand reductions through advanced conservation were distributed to county-basin irrigation WUGs based on the location of shortages.

Cost Implications of Proposed Strategy

The total estimated cost for the irrigation district conveyance improvement strategies recommended in the LCRA's Agricultural Water Supply Resource Plan is $100,980,000. There is currently no mechanism in place to pay for the irrigation conveyance improvements recommended in this plan. *Table 5.19* shows the facilities, project, annual, and unit cost by WUG. The unit cost shown in the table represents an average of more expensive strategies, such as balancing reservoirs, and less expensive options, such as automated canal gates.

Table 5.19: Cost Estimate for Irrigation Operations Conveyance Improvements

WUG	County	Basin	Total Facilities Cost	Total Project Costs	Largest Annual Cost	Unit Cost ($/ac-ft)
Irrigation	Colorado	Brazos-Colorado	$6,100,143	$8,461,667	$717,373	$193
Irrigation	Colorado	Colorado	$1,895,543	$2,629,356	$222,915	$193
Irrigation	Colorado	Lavaca	$7,656,805	$10,620,953	$900,436	$193
Irrigation	Matagorda	Brazos-Colorado	$17,846,571	$24,755,443	$2,098,746	$193
Irrigation	Matagorda	Colorado	$146,964	$203,857	$17,283	$193
Irrigation	Matagorda	Colorado-Lavaca	$17,514,606	$24,294,966	$2,059,707	$193
Irrigation	Wharton	Brazos-Colorado	$14,862,921	$20,616,745	$1,747,870	$193
Irrigation	Wharton	Colorado	$6,774,447	$9,397,011	$796,671	$193

Environmental Impact

The improvement of existing irrigation conveyances that provide water to farms will allow for customers to be served with fewer losses in transmission. This will result in a reduced overall demand for water and will reduce the volume of diversions that will have to be dedicated to maintaining flow in canals. If fully implemented, impacts to streamflows and the bay are approximately 50% of the conservation savings, or up to 22,175 ac-ft/yr by 2070. There are zero anticipated impacts to cultural resources.

Agricultural & Natural Resources Considerations

Irrigation conveyance improvement conservation methods have the potential benefit to agriculture in that by reducing the demand for water overall, they increase the likelihood that demands for water could be met on a more consistent basis. Impacts to agriculture are mainly cost-related, as shown in *Table 5.19.*

5.2.2.5.3. Sprinkler Irrigation

An additional form of conservation that farmers could undertake to reduce water demands when growing rice involves converting the method used from field flooding to sprinkler irrigation. The following is an excerpt from the Texas Rice Producers Legislative Group's supporting documentation for submittal of an ETF grant application, provided by Ronald Gertson. The excerpt has been slightly modified from its original form.

Analysis

In South America and the US Midwest, rice growers have had moderate success in growing rice under sprinkler irrigation. New technologies need to be demonstrated and adopted for rice farmers to decrease annual water use while maintaining profitable production. Pivot/linear-move sprinkler shows great promise as being an economic alternative to flood irrigation with much lower water use. The development of these alternative systems while maintaining a saturated soil environment to allow maximum yields and restrict weed growth is key for rice growing. Water use efficiency in rice is focused on having an effective water delivery system and optimizing grower water management decision-making.

The primary concept being deployed in this investigation is the use of sprinkler-delivered irrigation water as a means of both eliminating the standard two-to-four flushing periods at the beginning of the growing season and as a means of shortening the duration of the traditional flood irrigation period. Flushing is the standard method for maintaining soil moisture during the early growing season when rice plants are not sufficiently mature to thrive in a flood culture. A flush is essentially a temporary flood in which water is moved through the field by gravity. Each flush results in the loss of considerable tailwater as water is removed from the field. One flush uses 5-to-7 inches of water, while a sprinkler could efficiently accomplish the needed field wetting with the application of only 1-to-2 inches, yielding a water use reduction of 4-to-5 inches per flush. A number of commonly used weed herbicides in rice require water applications for maximum effectiveness. Timely sprinkler applications for the activation of these herbicides offers some hope for reducing weed pressures early thereby potentially enabling the delay of the permanent flood and therefore reducing the period that flood waters are lost to direct evaporation.

Weed control has been the major limiting factor in the use of sprinkler technology in rice production. LEPA (low elevation precision application) is one of the most efficient irrigation technologies. LEPA discharges water from very low hanging and closely spaced nozzles, which may enhance weed control in comparison to other sprinkler irrigation. LEPA also makes possible the elimination of water application to the panicles of mature rice plants (as occurs with traditional impact sprinkler nozzles). This should greatly reduce the fissuring of rice grains which often occurs with the use of sprinkler irrigation in rice.

Table 5.20 provides the potential water savings for each WUG by implementing sprinkler irrigation as a strategy. An assumed water savings of eight (8) inches per acre, or 0.67 ac-ft/ac, was used for the calculation. The number of acres was determined by looking at the total number of acres planted for first crop rice in 2011 in the LCRA Irrigation Districts. This total acreage was used because it was part of the methodology used to calculate the Irrigation Demand Projections for Colorado, Matagorda, and Wharton counties, as documented in the agriculture projection memo included in Appendix 2C of the 2021 Region K Water Plan. Only acres using surface water were assumed, as surface water is more likely to be restricted during drought years, and surface water users may be more likely to convert to sprinkler irrigation. The percent of acres this strategy is assumed to be applied to ranges from 2% in 2020 up to 25% in 2050 and beyond. For Colorado County, this assumes 6,749 acres are converted by 2050; for Matagorda County, this assumes 4,213 acres are converted by 2050; and for Wharton County, this assumes 6,129 acres are converted by 2050.

Table 5.20: Sprinkler Irrigation Estimate of Water Savings

WUG	County	Basin	Sprinkler Irrigation Estimate of Water Savings (ac-ft/yr)					
			2020	2030	2040	2050	2060	2070
Irrigation	Colorado	Brazos-Colorado	140	701	1,403	1,753	1,753	1,753
Irrigation	Colorado	Colorado	44	218	436	545	545	545
Irrigation	Colorado	Lavaca	176	880	1,761	2,201	2,201	2,201
Irrigation	Matagorda	Brazos-Colorado	113	565	1,129	1,412	1,412	1,412
Irrigation	Matagorda	Colorado	1	5	9	12	12	12
Irrigation	Matagorda	Colorado-Lavaca	111	554	1,108	1,385	1,385	1,385
Irrigation	Wharton	Brazos-Colorado	225	1,123	2,245	2,807	2,807	2,807
Irrigation	Wharton	Colorado	102	512	1,023	1,279	1,279	1,279
Total			**912**	**4,558**	**9,114**	**11,394**	**11,394**	**11,394**

Note: Demand reductions through advanced conservation were distributed to county-basin irrigation WUGs based on the location of shortages.

Cost Implications of Proposed Strategy

Costs for the strategy were assumed using a study performed for Region A on water management strategies for reducing irrigation demands. The cost for converting to sprinkler irrigation, updated to September 2018 dollars, was $499/acre modified. Project costs, annual costs, and unit costs were determined using the TWDB Cost Estimating Tool methodology. It was assumed that operations and maintenance would be greater due to an increased production cost, as irrigators using sprinkler irrigation must control for grass and weeds. *Table 5.21* shows the breakdown of cost by WUG.

Table 5.21: Cost Estimate for Sprinkler Irrigation

WUG	County	Basin	Total Facilities Cost	Total Project Costs	Largest Annual Cost	Unit Cost ($/ac-ft)
Irrigation	Colorado	Brazos-Colorado	$1,312,346	$1,820,452	$324,877	$185
Irrigation	Colorado	Colorado	$407,795	$565,682	$100,952	$185
Irrigation	Colorado	Lavaca	$1,647,236	$2,285,003	$407,781	$185
Irrigation	Matagorda	Brazos-Colorado	$1,056,492	$1,465,538	$261,540	$185
Irrigation	Matagorda	Colorado	$8,700	$12,068	$2,154	$185
Irrigation	Matagorda	Colorado-Lavaca	$1,036,840	$1,438,278	$256,675	$185
Irrigation	Wharton	Brazos-Colorado	$2,100,571	$2,913,857	$520,006	$185
Irrigation	Wharton	Colorado	$957,430	$1,328,122	$237,016	$185

Environmental Considerations

This type of irrigation will reduce the flooding in the fields that is released as return flows. If fully implemented, during non-drought years, impacts of reduction to streamflows and the bay are approximately 100% of the conservation savings, or up to 11,393 ac-ft/yr by 2070. During drought years, water for irrigation may not be available without implementation of this strategy, which would allow this strategy to provide a positive return flow to the streams and bay. There are zero anticipated impacts to cultural resources.

Agricultural & Natural Resources Considerations

The proposed strategy replaces the method of water supply to rice fields. No impact is expected as a result of this strategy. One of the important considerations is whether irrigators have the ability to pay for the improvements. Grant funding and low-interest loan funding availability is a critical factor in local implementation. Impacts to agriculture are mainly cost-related, as shown above in *Table 5.21.*

5.2.2.5.4. Real-Time Use Metering and Monitoring

The water needed for irrigation in Colorado, Wharton, and Matagorda counties is the largest deficit identified within the LCRWPA. Real-time use metering and monitoring for irrigation is one of the water management strategies developed to address the issue.

Analysis

Real-time monitoring involves the installation of meters that assess water use by automatically recording and transferring flow data at 15-minute intervals. These meters are equipped with sensors that use continuous wave Doppler ultrasound to measure the speed of dirt, bubbles and other particles in the stream flow. Water providers and users are able to accurately quantify the usage, generating awareness of consumption and cost, thereby improving irrigation efficiency and providing a water savings.

In 2015, the Gulf Coast Water Authority (GCWA) received a $200,000 grant from the TWDB's Agricultural Water Conservation Grants Program for the installation of real-time water use monitoring equipment and implementation of conservation pricing. From 2016 to 2018, this project estimated an annual 34 percent water savings rate. According to the GCWA, these savings may be attributed to: 1) generally wetter conditions during the irrigation season, 2) effective measures by irrigators in lowering irrigation water usage, 3) incentivizing water conservation through direct invoicing based on irrigation meter data, and 4) incentivizing water conservation through a tiered pricing structure based on the metered usage per certified acre. Prior to this project, water use was estimated and billed based on the irrigated acres for first and second crop and water attributed to field flushing.

Currently, within LCRA irrigation divisions, surface water use is measured once daily using a velocity probe, and total use is calculated for each field. LCRA staff controls adjustments to the water flow into each field turnout. These surface water users already implement volumetric billing, as well as a tiered pricing structure, accounting for 0.3 ac-ft/ac water saved. The difference in first crop water demand between GCWA and the LCRA's Gulf Coast Irrigation Division in 2017 and 2018 was 0.54 ac-ft/ac. Access to real-time water consumption data would lead to additional savings from increased precision of water deliveries, decreased leakage rates at turnouts, and more precise management of water use by farmers for irrigation scheduling.

This strategy assumes meters with real-time monitoring capabilities will be installed throughout rice farms in the irrigation divisions in the lower part of the Lower Colorado Regional Water Planning Area (LCRWPA). The estimated savings, shown in *Table 5.22*, assumes these meters save 0.3 ac-ft/ac.

Table 5.22: Real-Time Use Metering and Monitoring Estimate of Water Savings

WUG	County	Basin	Real-Time Use Metering and Monitoring Estimate of Water Savings (ac-ft/yr)					
			2020	2030	2040	2050	2060	2070
Irrigation	Colorado	Brazos-Colorado	3,156	3,071	2,989	2,908	2,830	2,754
Irrigation	Colorado	Colorado	981	954	929	904	879	856
Irrigation	Colorado	Lavaca	3,961	3,855	3,751	3,650	3,552	3,457
Irrigation	Matagorda	Brazos-Colorado	2,541	2,472	2,406	2,341	2,278	2,217
Irrigation	Matagorda	Colorado	21	20	20	19	19	18
Irrigation	Matagorda	Colorado-Lavaca	2,494	2,426	2,361	2,298	2,236	2,176
Irrigation	Wharton	Brazos-Colorado	5,052	4,916	4,784	4,655	4,530	4,408
Irrigation	Wharton	Colorado	2,303	2,241	2,180	2,122	2,065	2,009
Total			**20,509**	**19,955**	**19,420**	**18,897**	**18,389**	**17,895**

Note: Demand reductions through advanced conservation were distributed to county-basin irrigation WUGs based on the location of shortages.

Cost Implications of Proposed Strategy

The cost of the meter and installation used by the GCWA grant averages $6,000 each. It is estimated that about 3,000 meters would be required to serve the rice farming areas in Colorado, Matagorda, and Wharton Counties, as this strategy has not been implemented on a large scale. Both Lower Neches Valley Authority and GCWA purchased additional sensors ($1,600-$1,800 each) that remain buried at certain turnout structures to allow the data logger portion of the meter to be moved and connected to the sensors each season as field are rotated. On average, 1,200 turnouts are in service yearly in LCRA's irrigation divisions. Project costs, annual costs, and unit costs were determined using the TWDB Cost Estimating Tool and proportionally split. Project and annual cost assumptions included administrative and design costs, interest, and debt service. *Table 5.23* shows the breakdown of cost by WUG. Facilities costs shown are associated with the maximum demand reduction volume listed.

Table 5.23: Cost Estimate for Real-Time Use Metering and Monitoring

WUG	County	Basin	Total Facilities Cost	Total Project Costs	Largest Annual Cost	Unit Cost ($/ac-ft)
Irrigation	Colorado	Brazos-Colorado	$2,770,152	$3,842,663	$325,801	$103
Irrigation	Colorado	Colorado	$860,790	$1,194,059	$101,238	$103
Irrigation	Colorado	Lavaca	$3,477,052	$4,823,251	$408,940	$103
Irrigation	Matagorda	Brazos-Colorado	$2,230,086	$3,093,501	$262,283	$103
Irrigation	Matagorda	Colorado	$18,364	$25,474	$2,160	$103
Irrigation	Matagorda	Colorado-Lavaca	$2,188,604	$3,035,959	$257,404	$103
Irrigation	Wharton	Brazos-Colorado	$4,433,970	$6,150,655	$521,484	$103
Irrigation	Wharton	Colorado	$2,020,982	$2,803,438	$237,690	$103

Environmental Considerations

Due to more efficient practices, the reduction of tailwater would allow for less water to be recovered. Impacts to return flows would be zero as this strategy's savings are based on demand reduction. There are zero anticipated impacts to cultural resources.

Agricultural & Natural Resources Considerations

With an increased awareness of consumption and cost that the meters provide, the strategy could be expanded and integrated with canal systems, providing further savings. As the limiting factor in agriculture in the LCRWPA is water availability, generating a more accurate estimate of water use would reduce the water per acre required. During times of non-drought, this would allow farmers to increase production acres by up to 6,547 acres in 2020.

5.2.2.5.5. Drip Irrigation

Per the Natural Resources Conservation Service (NRCS), drip irrigation is a micro irrigation method to apply water to the root zone of crops through low pressure, low volume devices. Water is supplied through small diameter pipelines with emitters located close to ground-level. As the emitters have very small discharge openings that are easily clogged, all systems require clean water. A drip irrigation system using groundwater may require a fine mesh screen filter and a centrifugal sand separator, while a system using surface water may require a sand filter to remove sediment, algae, and other impurities.

These systems are ideal for many vegetable and flower crops as well as orchards and vineyards. Drip irrigation systems are efficient, easy to install, and not affected by wind. The conservation features of drip irrigation come from the precise application of water and minimal runoff, less evaporation from an essentially closed system, and less water lost to weeds and undesirable plants. Kansas State University research shows possible irrigation water savings of as much as 25 percent.[2] In the year 2000, micro irrigation amounted to approximately 1.2 percent of the acres irrigated in the state of Texas.

This strategy is applied to Irrigation in Mills, Gillespie, and San Saba Counties. Irrigation in Mills County demonstrates a need, and representatives from Gillespie and San Saba Counties requested consideration of this strategy. Water savings is shown in *Table 5.24*. Applied water savings of drip irrigation application is assumed to be 25 percent.

The *2017 Census of Agriculture* by the National Agricultural Statistics Service (NASS) determined the total cropland in Mills County. As crop rotation is practiced in the Lower Colorado Regional Water Planning Area (LCRWPA), the NASS Planted Acres 2017 provided a percentage of cropland in use per year. Total estimated savings assumes 5 percent of non-rice cropland in use (515 acres) will be improved with drip irrigation systems in Mills County. These crops include wheat/oats and pecans, which require 2.13 ac-ft/ac and 5.00 ac-ft/ac of water, respectively.

Hill Country Underground Water Conservation District provided the planted acreage of vineyards in Gillespie County (750 acres). Total estimated savings assumes 5 percent of land (38 acres) will be improved with drip irrigation systems. According to Texas A&M AgriLife, grapes require 2.00 ac-ft/ac of water.

The *2017 Census of Agriculture* by the NASS determined the total acreage of planted pecans in San Saba County (10,017 acres). Total estimated savings assumes 5 percent of land in use (501 acres) will be improved with drip irrigation systems. Pecan growth typically requires 5.00 ac-ft/ac of water.

Table 5.24: Drip Irrigation Estimate of Water Savings

WUG	County	Basin	Drip Irrigation Estimate of Water Savings (ac-ft/yr)					
			2020	2030	2040	2050	2060	2070
Irrigation	Mills	Brazos	459	459	459	459	459	459
Irrigation	Gillespie	Colorado	28	28	28	28	28	28
Irrigation	San Saba	Colorado	626	626	626	626	626	626
Total			**1,113**	**1,113**	**1,113**	**1,113**	**1,113**	**1,113**

The strategy of drip irrigation was considered in the lower basin of the LCRWPA, including Colorado, Wharton, and Matagorda counties, but it was not found to be feasible. These counties are large producers of rice, and as rice is often grown in standing water due to the plant's requirement for saturated soil moisture conditions during most of its vegetative and reproductive stages, drip irrigation is not recommended for rice farming.

Cost Implications of Proposed Strategy

Drip irrigation requires a high level of management and maintenance. Filters need to be cleaned and lines should be flushed on a regular basis. Algae and bacteria growth in the lines can be controlled by periodic

[2] Lamm, F. R., H. L. Manges, L. R. Stone, A. H. Khan, and D. H. Rogers. "Water requirement of subsurface drip-irrigated corn in northwest Kansas." *Transactions of the ASAE*. 38 (2): 441-448. 1995.

injections of chlorine into the system, while build-up of mineral deposits such as iron, calcium, or magnesium can be controlled by periodic injections of a mild acid solution.

Micro-irrigation can be the most efficient form of irrigation and typically requires the most capital expense per acre of irrigated land. Per the 2004 Texas Water Development Board (TWDB) Report 362, installation costs range from $800 to $1,200/ac. Project costs, annual costs, and unit costs were determined using the TWDB Cost Estimating Tool in September 2018 dollars. For planning purposes, the LCRWPG assumed a facilities cost of $1,200/ac and an operations and maintenance cost of 30%.

Table 5.25 shows the breakdown of cost. Facilities costs shown are associated with the full demand reduction volume listed.

Table 5.25: Cost Estimate for Drip Irrigation

WUG	County	Basin	Total Facilities Cost	Total Project Costs	Largest Annual Cost	Unit Cost ($/ac-ft)
Irrigation	Mills	Brazos	$618,000	$857,000	$245,000	$534
Irrigation	Gillespie	Colorado	$46,000	$64,000	$18,000	$643
Irrigation	San Saba	Colorado	$601,000	$834,000	$239,000	$382

5.2.3 Major Water Provider Management Strategies

There are three Major Water Providers, as defined by the State planning process in Region K: LCRA, Austin, and West Travis County Public Utility Agency (WTCPUA). Austin and WTCPUA are also water customers of LCRA, and together they supply a large portion of Region K's water needs for multiple beneficial purposes.

5.2.3.1 LCRA Water Management Strategies

LCRA holds surface water rights to over 2.1 million ac-ft of water in the Colorado River Basin, and holds groundwater permits for industrial use, as well as rights to develop groundwater in Bastrop County. Combined, LCRA's surface water rights authorize every legal purpose of use and help meet certain environmental flow needs. The LCRA is directed by the Texas Legislature to be the steward of its water rights in serving as the regional water supplier. The LCRA supplies water for municipal, agricultural, manufacturing, steam electric, mining, and other water uses. The LCRA currently has contracts to supply water to entities in Bastrop, Burnet, Colorado, Fayette, Gillespie, Hays, Lampasas (Region G), Llano, Mason, Matagorda, San Saba, Travis, Wharton, and Williamson (including the portion of Williamson in Region G) counties.

LCRA has no existing firm municipal and industrial water needs, as identified in *Table 4.15* of *Chapter 4*. With additional new contracts and contract amendments that are recommended in this plan, the firm water needs for LCRA begin in the 2020 decade, without accounting for new strategies including return flows. In addition, the new critical drought period and reduced water availability required LCRA to look at a variety of water supply options. LCRA's strategy for meeting the region's changing and future water needs will be predicated on LCRA's ability to continue to use all its water rights as a system. This includes not only the amendment of its water rights to meet changing and future water needs, but also an aggressive water conservation efforts program and the development of new water supplies. *Table 5.26* below provides a summary of all the recommended strategies related to the LCRA as a wholesale water provider. The sections following the table discuss the strategies in more detail.

Table 5.26: Summary of LCRA Water Management Strategies (ac-ft/yr)

Recommended Strategy	2020	2030	2040	2050	2060	2070
Downstream Return Flows	3,985	4,969	6,072	7,164	8,267	8,267
Enhanced Municipal and Industrial Conservation	5,100	9,700	15,000	20,000	20,000	20,000
Amendment of ROR Water Rights, including Garwood	N/A	N/A	N/A	N/A	N/A	N/A
Acquire New Water Rights	0	250	250	250	250	250
LCRA Contract Amendments	(12,600)	(5,700)	(6,100)	(9,800)	(13,150)	(13,320)
LCRA Contract Amendments with Infrastructure	0	(7,400)	(8,400)	(10,600)	(10,600)	(11,500)
New LCRA Contracts	0	0	(6,320)	(6,520)	(6,720)	(6,720)
New LCRA Contracts with Infrastructure	0	(3,200)	(7,900)	(12,400)	(20,400)	(31,600)
Expand Use of Groundwater - Carrizo-Wilcox Aquifer	0	30	30	30	30	30
Import Return Flows from Williamson County	0	5,460	10,920	16,380	21,840	25,000
Baylor Creek Reservoir	0	0	18,000	18,000	18,000	18,000
Aquifer Storage and Recovery	0	0	12,973	12,973	12,973	12,973
Enhanced Recharge	0	0	14,486	14,486	14,486	14,486
Mid-Basin Off-Channel Reservoir	0	20,000	20,000	20,000	20,000	20,000
Prairie Site Off-Channel Reservoir	0	19,500	9,500	0	0	0
Excess Flows Permit (5731) Off-Channel Reservoir	39,247	39,247	39,247	39,247	39,247	39,247
Total	**35,732**	**82,856**	**117,758**	**109,210**	**104,223**	**95,113**

5.2.3.1.1. General LCRA Strategy - LCRA System Operation Approach

To meet existing water needs in the basin, LCRA has traditionally used its larger water rights together as a system, including its water rights for lakes Buchanan and Travis as well as its downstream run-of-river (ROR) rights. To date, LCRA has largely done this through its Water Management Plan (discussed below) and thus, its efforts have been focused on the management of lakes Buchanan and Travis to meet projected firm municipal and industrial customer demands while continuing to provide interruptible supplies to downstream agricultural operations and provide both firm and interruptible supplies to help meet certain environmental flow needs.[3] More recently, LCRA has increased use of its ROR rights and groundwater rights to meet downstream needs that would otherwise have been met from stored water released from lakes

[3] For a general description of the LCRA Water Management Plan (WMP), see *Section 3.2.1.1.2.1.*

Buchanan and Travis. Indeed, most of LCRA's firm contracts provide operational flexibility to LCRA by recognizing that LCRA can meet its commitments from any source available to LCRA. As water needs increase and change over time, LCRA will continue to employ a system approach that considers *all* its water supplies and the most efficient way to meet water needs within LCRA's service area. LCRA may pursue amendments to its existing water rights, acquire or develop new water supplies, and implement aggressive water conservation measures and water use efficiencies, all to provide LCRA with the flexibility it needs to help meet future water demands within its service area.

Issues and Considerations

The use of a system approach allows LCRA greater flexibility to help meet water needs throughout its service area from a variety of water supply sources. The system approach may involve a number of specific strategies, including amendments to its existing water rights, acquisition or development of new water supplies, and implementation of aggressive water conservation measures and water use efficiencies, which are examined in greater detail in succeeding sections, with an analysis of the environmental consequences of each.

5.2.3.1.2. Amendments to Water Management Plan

LCRA's current Water Management Plan was approved in November 2015 (2015 WMP). LCRA has pending an application to amend the 2015 WMP to adjust the conditions under which it will provide water from lakes Buchanan and Travis for interruptible agricultural purposes and environmental flows to ensure that it can satisfy the demands of its firm customers, considering a year 2025 level of demand and 2020 demands for downstream agricultural operations. To ensure that LCRA can meet projected firm customer demands over the fifty-year planning horizon covered by this plan, and as LCRA implements other water supply strategies that affect how it operates its system of water supplies, LCRA will likely seek further amendments to its Water Management Plan to adjust the conditions under which it will provide water from lakes Buchanan and Travis to help meet demands for firm, interruptible agricultural, and environmental flows purposes.

Environmental Flow Assumptions for WMP Revisions

For the simulation of 2020 and 2070 conditions, the modeling incorporates all the key environmental flow elements of the 2015 WMP, including three levels of instream flow criteria with the subsistence criteria engaged at all times, and five levels of bay inflow criteria, with the threshold criteria engaged at all time. The modeling also includes the maximum environmental flow caps implemented as stipulated in the 2015 WMP. Environmental flow criteria are determined on two dates during the year based on several conditions in the basin. The RWPG used the 2015 WMP because this is the WMP in effect. LCRA filed a proposed new WMP in early 2019 that is still under review by TCEQ.

Issues and Considerations

The 2015 WMP commits 33,440 ac-ft of firm water for instream and bay and estuary inflows. In addition, interruptible water is also supplied to help meet environmental flow needs under the 2015 WMP. Firm and interruptible water provided by LCRA will provide some additional benefit to instream flows and bay and estuary inflows. However, the main issue of growth in municipal, manufacturing and steam-electric demand has a potential to reduce the amount of interruptible supply LCRA can make available for environmental flow needs in the future. To the extent that LCRA is able to provide interruptible water to the lower counties for agricultural use could also benefit environmental flows. Interruptible water traveling downstream to the point of diversion also helps meet instream flow needs. In addition, some agricultural return flows make their way to the Colorado River and Matagorda Bay system.

Available Interruptible Water Supply for Agriculture

The LCRA supplies interruptible water to four major agricultural operations within the three lower counties. Three operations are owned and operated by LCRA—the Garwood, Gulf Coast and Lakeside agricultural divisions. The forth operation is Pierce Ranch which is privately owned and operated. Historically, LCRA has supplied water to these four agricultural operations using its four ROR water rights to the extent that flows in the river are available. However, often in the height of the irrigation season, ROR flows available in the Colorado River are insufficient to meet the needs of the four operations. LCRA may make stored water from lakes Buchanan and Travis available on an interruptible basis at any time that the actual demand for stored water under firm commitments is less than the combined firm yield of lakes Buchanan and Travis. The conditions under which LCRA can provide interruptible stored water are set forth in detail in the LCRA's Water Management Plan, as amended from time to time. Consistent with these conditions, LCRA has provided interruptible stored water from lakes Buchanan and Travis to meet the demands of these four operations. In 2012-2015, TCEQ issued emergency orders amending the prior version of the WMP that resulted in the suspension of releases of interruptible stored water for downstream agricultural use in Gulf Coast, Lakeside and Pierce Ranch. The 2015 WMP includes a three-tier regime for interruptible agricultural customers that considers lake storage and inflow conditions. The structure includes three curtailment conditions: extraordinary drought, less severe drought and normal conditions, for decisions on whether and how much stored water from the Highland lakes would be available for interruptible agricultural customers. It allocates water to the Gulf Coast, Lakeside and Pierce Ranch operations separately for first season (March 1 conditions) and second season (July 1 conditions), and it includes a look-ahead test that prevents release of interruptible stored water if the LCRA Board of Directors determines that lake storage will drop below set levels in the upcoming crop season or the next 12 months.

LCRA's firm customers' demands are well below their full contract commitments and LCRA does not expect firm customers' demands to increase to their full commitments for some time. Therefore, LCRA expects that, absent extraordinary drought conditions such as those that were experienced between 2011 and 2015, it will be able to supply interruptible water to the agricultural operations in many years without frequent or significant curtailment. However, over time, as the LCRA's current firm customers draw fully on their commitments and as LCRA contracts to provide more firm water, there will be less interruptible water available for agricultural purposes in the lower basin and the conditions of curtailment and allocation of available interruptible supply among the agricultural operations will be modified.[4]

As discussed above, *Table 5.27* presents an analysis of the amount of interruptible water expected to be available during each decade of the planning period using a modified version of the Region K Cutoff Model (Strategy) based on incorporating regional water planning demand projections for LCRA's existing firm customers, updated estimates for future agricultural water needs in LCRA's lower basin agricultural operations, and assumed levels of passive water conservation discussed elsewhere in this plan. The amount of interruptible water available for agricultural use is estimated to decrease from approximately 63,495 ac-ft/yr in 2020 to 0 ac-ft/yr in 2050 due to increased firm demands in the basin. Interruptible water availability

[4] When LCRA purchased both the Garwood Irrigation Company and Pierce Ranch water rights, it made certain commitments to provide interruptible stored water based upon specific requirements in the purchase agreements. This affects the manner in which LCRA allocates available interruptible water supply among the four irrigation operations.

reported in this table is for the Gulf Coast, Lakeside and Pierce Ranch water rights. Irrigation water available to the Garwood water right is reported in *Chapter 3* of the 2021 Region K Water Plan.

Table 5.27: Available Interruptible LCRA Water Supply for Agricultural Use

Decade	Available [1] Interruptible Water Supply (ac-ft/yr)
2020	63,495
2030 [2]	25,797
2040	13,105
2050 [2]	0
2060 [2]	0
2070	0

[1] Annual supply of interruptible stored water available averaged over the drought of record.
[2] Simulations were conducted for only 2020, 2040, and 2070. Information for other decades was interpolated from the results from those decades.

As the table indicates, the availability of interruptible water supply is expected to decrease significantly in the future as the demands for firm water increase. It should be noted that these values differ from the results of analysis completed by LCRA in support of its Water Management Plan because the Region K Cutoff Model includes different assumptions per the planning guidelines.

Cost Implications of Proposed Strategy

Capital expenditures for water supply purposes would not be required to implement this alternative since diversions would be made under existing water rights. Where allowed, the cost of raw water is included in the overall cost of service to deliver the water within each agricultural operation under this alternative. Rates between LCRA’s agricultural divisions vary based on several factors, including canal operation costs and contractual restrictions. The 2019 cost rate for the Gulf Coast and Lakeside divisions is $60/ac-ft of water delivered from the canal system. The 2019 Garwood cost rates range from $37 to $44/ac-ft, depending on the customer’s location in the canal system.

Issues and Considerations

The 2015 WMP includes a three-tier regime for interruptible agricultural customers that considers lake storage and inflow conditions. Additional details are provided on the previous page of this document. How this may be handled in future amendments to the WMP during the planning period cannot be known at this time; however, it is clear that actual availability of this supply from year to year, or by season, can vary greatly, largely as a function of drought conditions, lake levels, inflows into the lakes, and demands for firm water.

Environmental Considerations

As noted above, the increasing municipal, manufacturing and steam-electric demands will reduce the amount of interruptible water that is available over time for the downstream agricultural operations. This could indirectly reduce the water available in the lower basin to help meet instream and bay and estuary inflows needs. In the earlier planning decades, this strategy can provide additional streamflow of up to approximately 63,495 ac-ft/yr, as shown in *Table 5.27*. There are zero anticipated impacts to cultural resources.

Agricultural & Natural Resources Considerations

Interruptible water, when it's available, has a positive impact on agriculture. The impact decreases over time as the availability decreases over time. In the earlier planning decades, this strategy can provide additional water for agriculture of up to approximately 63,495 ac-ft/yr, as shown in *Table 5.27*.

5.2.3.1.3. Amendments to Water Rights and Acquisition of New Water Rights

LCRA owns three downstream run-of-river (ROR) water rights which authorize a total diversion of up to 503,750 ac-ft/yr on the lower Colorado River (14-5475, 14-5476, 14-5477).

Today, LCRA uses these water rights primarily as part of its interruptible water supply provided for irrigated agriculture within Colorado, Wharton, and Matagorda Counties. However, these water rights are already authorized for multiple beneficial purposes and, in some cases, authorized for use in other locations. By further amending these water rights to add additional diversion points and authorization to store the water in existing or new reservoirs, LCRA could use these water rights to meet firm demands in conjunction with its other water supplies. LCRA already received an amendment to add new diversions points to another of its ROR rights, Certificate of Adjudication No. 14-5434, and can use that right today to meet upstream firm demands. Further, LCRA uses ROR water under Certificate of Adjudication No. 14-5476 to supply industrial demands along its canal system and is authorized to store water available under this right in its new Arbuckle reservoir. Similar amendments could be pursued for the other ROR rights. This water management strategy recognizes that LCRA intends to amend any and all its ROR water rights to meet future and changing water needs.

In addition to amending existing water rights, from time to time, LCRA may purchase water rights that have the potential to enhance LCRA's overall water supply portfolio. Acquisition of water rights by LCRA could occur in any of LCRA's water service area counties, and these counties include all the counties in the Region K regional planning area. For purposes of describing a water management strategy, the acquisition could be for a water right authorizing run-of-river diversions up to 500 ac-ft/yr. However, the quantity could also vary considerably from the amount assumed, dependent on the actual amount and location of water rights available for purchase, which cannot be predicted with any certainty at this time. Further, for planning purposes, the water right is assumed to have a reliable supply of about one-half of its diversion right, or about 250 ac-ft/year of reliable water acquired for each water right. Amendments similar to those discussed above for LCRA's existing ROR rights may be needed. This strategy is expected to come online by 2030.

Cost Implications of Proposed Strategy

Capital expenditures for water supply purposes would not be required to implement the amendment portion of this strategy to the extent that the diversions of these rights for other purposes will be done at locations already authorized for diversion under other water rights held by LCRA using existing infrastructure, stored in existing reservoirs, or diverted by customers with existing infrastructure. The annual cost of providing raw water under this alternative is the September 2018 LCRA system rate for water diverted, which is $145/ac-ft.

The acquisition cost used for the analysis is $500/ac-ft of reliable water, though cost could vary greatly depending on the specific characteristics of any water right acquired (one-time cost, which can be considered a capital investment). This will be a capital cost of $125,000.

Issues and Considerations

Conversion of agricultural rights to serve municipal, manufacturing, and steam-electric needs may not have a significant impact on downstream instream and bay and estuary freshwater inflows. TCEQ may include special conditions to limit diversions based on environmental flow needs, and some of the water supplied from these rights may be to downstream customers. Further, water from other sources may be provided to meet the downstream agricultural needs or to help meet environmental flow needs. In addition, use of ROR water for municipal needs upstream could result in a greater volume of return flows, which if returned to the river in Austin and surrounding area locations, would help off-set any reduction in downstream ROR flows and help provide for instream flow needs. In addition, municipal return flows are more constant than the flows required for agricultural use. Municipal return flows are expected to be discharged year-round whereas downstream agricultural demands are significantly reduced during the winter months.

Issues and considerations for the amendment of a surface water right is site-specific and depends on several factors, including impacts to existing water rights and environmental flows compared to full use of the water right as authorized for use at its existing location. The terms and conditions of any potential water right acquisition will be very case-specific and will be affected by a number of factors, such as the timing of the need for the water, priority date, etc.

Environmental Considerations

Impacts related to the amendment of the Gulf Coast and Lakeside water rights can be considered negligible because they are already quantified and accounted for under the off-channel reservoir strategies, as discussed in *Section 5.2.3.1.10*. It is anticipated that amendments to the Pierce Ranch water right would have negligible impacts during times of drought, due to the limited available water. The water right has an authorized diversion of 55,000 ac-ft/yr with a priority date of 9/01/1907. Depending on the location of the new diversion, the diversion amount, and special conditions contained in the amendment, instream flows could be reduced. Impacts will be evaluated during the TCEQ permitting process and the amended water right will be subject to instream flow requirements.

For acquisition of water rights, there is a potential positive benefit of up to 250 ac-ft/yr to environmental flows during drought conditions for the situation where upstream water rights are acquired and the diversion point is moved downstream, thereby leaving water in a portion of the river that otherwise would have been diverted upstream. For the situation where a water right is moved upstream, the TCEQ typically will impose permit conditions to protect intervening water right holders and address instream environmental impacts.

There are zero anticipated impacts to cultural resources.

Agricultural & Natural Resources Considerations

Amendments to LCRA's ROR rights could reduce availability of that water for agricultural purposes. Impacts related to the amendment of the Gulf Coast and Lakeside water rights can be considered negligible because they are already quantified and accounted for under the off-channel reservoir strategies, as discussed in later sections. It is anticipated that amendments to the Pierce Ranch water right would have negligible impacts during times of drought, due to the limited available water even as currently authorized. The water right has an authorized diversion of 55,000 ac-ft/yr. However, LCRA has a contractual obligation to deliver up to 30,000 ac-ft/yr to Pierce Ranch. Run-of-river water deliveries to irrigation above 30,000 ac-ft/yr are not from this water right and no impact would occur to agriculture by the transfer of a portion of this water right.

5.2.3.1.4. LCRA Contract Amendments

LCRA has contracts or Board reservations for raw water supply with numerous water user groups (WUGs). LCRA has indicated that it expects to continue providing water to these entities throughout the 50-year planning period and expects to meet these customers' projected increased demands for water through amendments to existing contracts to increase contract quantities. For the purposes of this plan, water supplied to these customers largely comes from lakes Buchanan and Travis. However, as discussed in more detail elsewhere in this chapter, LCRA operates its water rights as a system. To the extent that these customers have obtained contracts or amendments to contracts since 1999, their current LCRA contract provides that water may be supplied under the contract from any source available to LCRA at the time the customer uses water. Water sources include supply from lakes Buchanan and Travis, LCRA's ROR rights, groundwater, or other sources that might come under LCRA's control. To the extent that existing customers' contracts do not contain this language, and such customers need to renew their contracts or increase the contract quantity, the new contracts will include similar language regarding source of supply.

Capital expenditures for water supply purposes were not assumed to be required to implement this alternative. The average cost of providing raw water under this alternative is $145/ac-ft in September 2018 dollars. *Table 5.28* contains a summary of the WUGs for which this strategy is applied, and the amount of water planned for in the contract amendment (where increased amounts of water are needed).

Table 5.28: LCRA Contract Amendments Yield

WUG	County	Basin	Water Management Strategies (ac-ft/yr)					
			2020	2030	2040	2050	2060	2070
Granite Shoals	Burnet	Colorado	0	0	0	0	50	170
Horseshoe Bay	Burnet	Colorado	0	0	400	600	800	800
Steam-Electric (COA)	Fayette	Colorado	4,300	4,300	4,300	4,300	4,300	4,300
Dripping Springs WSC*	Hays	Colorado	0	0	0	1,000	2,000	2,000
Steam-Electric (STPNOC)	Matagorda	Colorado	8,300	0	0	0	0	0
Leander	Travis	Colorado	0	1,400	1,400	2,600	2,600	2,600
Pflugerville	Travis	Colorado	0	0	0	1,300	3,400	3,400
Travis County WCID Point Venture	Travis	Colorado	0	0	0	0	0	50
Total			**12,600**	**5,700**	**6,100**	**9,800**	**13,150**	**13,320**

* The West Travis County PUA Contract Amendment with Infrastructure Strategy in Section 5.2.3.1.5 includes infrastructure sized to accommodate this contract amendment amount, as Dripping Springs WSC is a treat-and-transport customer of West Tavis County PUA.

Cost Implications of Proposed Strategy

Capital expenditures for water supply purposes were not assumed to be required to implement this alternative. The average cost of providing raw water under this strategy is currently (September 2018) $145/ac-ft.

Issues and Considerations

Amendment of existing contracts to meet increasing municipal, manufacturing, and steam-electric demands will provide for the needs of a growing population but could reduce the amount of interruptible water available for agricultural use and environmental flows depending on what other strategies are implemented by LCRA to further enhance and optimize operation of its system of water supplies. Similarly, as firm water customers use more of their contracted water, the available interruptible supply could be reduced.

Environmental Considerations

Depending on the location of the contracted water, some environmental impacts to instream flows and freshwater inflows to Matagorda Bay can be expected from increased use of water under LCRA contracts, including amendments to existing contracts and new water sale contracts. Increased firm demands for municipal and industrial uses will reduce the amount of interruptible water available for release. Interruptible water provides a benefit to instream flows as it travels downstream to the diversion points. Increased contract volumes for users at the downstream end of the basin would also increase instream flows. Individual WUG implementation of this strategy has negligible impacts to streamflows and the bay, but full regional implementation could remove up to 13,320 ac-ft/yr from the Highland Lakes or other LCRA sources by 2070.

There are zero anticipated impacts to cultural resources.

Agricultural & Natural Resources Considerations

The increasing municipal and industrial needs for water will have a significant impact on agriculture as the available supply of interruptible water gradually diminishes over time. The extent of these impacts to interruptible water availability cannot reasonably be quantified as part of this regional planning process because it will be affected by the rate at which firm demands actually materialize and could also be affected by the timing and implementation of other strategies by LCRA to further enhance and optimize operation of its system of water supplies.

5.2.3.1.5. LCRA Contract Amendments with Infrastructure

LCRA has contracts or Board reservations for raw water supply with numerous water user groups (WUGs). LCRA has indicated that it expects to continue providing water to these entities throughout the 50-year planning period and expects to meet these customers' projected increased demands for water through amendments to existing contracts to increase contract quantities. For the purposes of this plan, water supplied to these customers may come from the Highland Lakes or the Colorado River. However, as discussed in more detail elsewhere in *Chapter 5* of the 2021 Plan, LCRA operates its water rights as a system. To the extent that these customers have obtained contracts or amendments to contracts since 1999, their current LCRA contract provides that water may be supplied under the contract from any source available to LCRA at the time the customer uses water. Water sources include supply from lakes Buchanan and Travis, LCRA's ROR rights, groundwater, or other sources that might come under LCRA's control. To the extent that existing customers' contracts do not contain this language, and such customers need to renew their contracts or increase the contract quantity, the new contracts will include similar language regarding source of supply.

For this strategy, capital expenditures for infrastructure are required to provide the contract amendment amount. Some amendments are associated with regional projects, and the costs associated with these projects are included in separate sections.

Table 5.29 contains a summary of the WUGs for which this strategy is applied, and the amount of water planned for in the contract amendment (where increased amounts of water are needed).

Table 5.29: LCRA Contract Amendments with Infrastructure Yield

WUG	County	Basin	Water Management Strategies (ac-ft/yr)					
			2020	2030	2040	2050	2060	2070
Burnet	Burnet	Colorado	0	1,000	2,000	2,000	2,000	2,000
Marble Falls	Burnet	Colorado	0	4,000	4,000	4,000	4,000	4,000
West Travis County PUA	Hays, Travis	Colorado	0	2,400	2,400	4,600	4,600	5,500
Total			**0**	**7,400**	**8,400**	**10,600**	**10,600**	**11,500**

Cost Implications of Proposed Strategy

The infrastructure required for each WUG is detailed below.

- Burnet and Marble Falls
  - The infrastructure associated with the contract amendments for these WUGs are described and costed in the various Burnet County Regional Projects strategies. For Burnet, costs are included in the Buena Vista Regional Project Strategy (*Section 5.2.4.5.1*); for Marble Falls, costs are included in the Marble Falls Regional Water System Strategy (*Section 5.2.4.5.3*)
- West Travis County PUA (WTCPUA)
  - Two (2) 844 HP intake pump stations, for a total of 6.7 MGD transmitted flow, located adjacent to current pump station on the Colorado River at Bohls Hollow
  - 2-mile, 30-inch raw water transmission main to existing WTCPUA-owned water treatment plant

Costing assumptions for the West Travis County PUA (WTCPUA) strategy are detailed as follows. The infrastructure for West Travis County PUA in this strategy was sized to provide treatment for both the WTCPUA contract amendment amount (5,500 ac-ft/yr) and the amendment amount for WTCPUA's treat and transport customers listed in the LCRA Contract Amendments Strategy (2,000 ac-ft/yr). The Texas Water Development Board Cost Estimating Tool was used to size and cost infrastructure, with a peaking factor of 2 assumed. Consistent with the tool, all costs are given in September 2018 dollars. Land acquisition costs (for the raw water pump station and transmission main) and an annual $145/ac-ft water purchase cost is also assumed.

Costs for this strategy are detailed in the table below. The largest portion of the costs is the intake pump stations. Costs associated with the Burnet and Marble Falls amendments are included in *Sections 5.2.4.5.1* and *5.2.4.5.3*, respectively.

Table 5.30: LCRA Contract Amendments with Infrastructure Cost

WUG	County	Basin	Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
West Travis County PUA	Hays, Travis	Colorado	$25,499,000	$35,402,000	$4,300,000	$782

Issues and Considerations

Amendment of existing contracts to meet increasing municipal, manufacturing, and steam-electric demands will provide for the needs of a growing population but could reduce the amount of interruptible water available for agricultural use and environmental flows as demands actually materialize and depending on what other strategies are implemented by LCRA to further enhance and optimize operation of its system of water supplies. Similarly, as firm water customers use more and more of their contracted water, the available interruptible supply could be reduced.

Environmental Considerations

Depending on the location of the contracted water, some environmental impacts to instream flows and freshwater inflows to Matagorda Bay can be expected from increased use of water under LCRA contracts, including amendments to existing contracts and new water sale contracts. Increased firm demands for municipal and industrial uses will reduce the amount of interruptible water available for release. Interruptible water provides a benefit to instream flows as it travels downstream to the diversion points. Individual WUG implementation of this strategy has negligible impacts to streamflows and the bay, but full regional implementation could remove up to 11,500 ac-ft/yr from the Highland Lakes or other proposed LCRA sources by 2070.

There are zero anticipated impacts to cultural resources.

Agricultural & Natural Resources Considerations

In general, the increasing municipal and manufacturing needs for water will have a significant impact on agriculture as the available supply of interruptible water gradually diminishes over time. The extent of these impacts to interruptible water availability cannot reasonably be quantified as part of this regional planning process because it will be affected by the rate at which firm demands materialize and could also be affected by the timing and implementation of other strategies by LCRA to further enhance and optimize operation of its system of water supplies.

5.2.3.1.6. New LCRA Contracts

Region K has identified shortages within LCRA's service area that are not currently covered by a water sale contract from LCRA but for which LCRA may be willing and able to provide raw water. In particular, many of these include rural communities in the upper portion of the LCRWPA and certain current wholesale customers of Austin whose contract is expected to expire during the planning period. Certain wholesale customers currently receiving water from Austin may need to obtain raw water contracts directly from LCRA in the future. Austin plans to continue to treat and transport this water. This raw water contracting approach generally does not apply to Austin wholesale customers that are Municipal Utility Districts (MUDs), since Austin generally plans to annex these areas in the future, consistent with the MUD's creation agreements with Austin.

As new customers, contracts for water supplied to these customers will come from any source available to LCRA at the time the customer uses water. *Table 5.31* summarizes recommended new LCRA contracts over the planning horizon.

Table 5.31: New LCRA Contracts Yield

WUG	County	Basin	Water Management Strategies (ac-ft/yr)					
			2020	2030	2040	2050	2060	2070
North Austin MUD 1*	Travis, Williamson	Colorado, Brazos	0	0	770	770	770	770
Northtown MUD*	Travis	Colorado	0	0	900	1,100	1,300	1,300
Rollingwood*	Travis	Colorado	0	0	250	250	250	250
Sunset Valley	Travis	Colorado	0	0	300	300	300	300
Travis County WCID 10*	Travis	Colorado	0	0	2,300	2,300	2,300	2,300
Wells Branch MUD*	Travis, Williamson	Colorado, Brazos	0	0	1,400	1,400	1,400	1,400
Windermere Utility*	Travis	Colorado	0	0	400	400	400	400
Total			**0**	**0**	**6,320**	**6,520**	**6,720**	**6,720**

*Current wholesale customers of Austin

Cost Implications of Proposed Strategy

Capital expenditures for water supply purposes were not assumed to be required to implement this strategy. The average cost of providing raw water under this strategy is $145/ac-ft in September 2018 dollars.

Issues and Considerations

Much of the water that would be dedicated to new LCRA contracts in Travis County is already being supplied through Austin Water. Based on Austin's raw water contracting plans in this manner, the only change will be that LCRA will contract directly with those certain wholesale customers for raw water instead of Austin Water and Austin Water will continue to treat and transport the water to these entities.

Environmental Considerations

Individual WUG implementation of this strategy has negligible impacts to streamflows and the bay, but full regional implementation could remove up to 6,320 ac-ft/yr from the Highland Lakes or other LCRA sources by 2070. There are zero anticipated impacts to cultural resources.

Agricultural & Natural Resources Considerations

Any large new contracts that would need to use supplies from lakes Buchanan and Travis or other LCRA firm water supplies may decrease over time the amount of interruptible water available for agriculture. The extent of these impacts to interruptible water availability cannot reasonably be quantified as part of this regional planning process because it will be affected by the rate at which firm demands actually materialize and could also be affected by the timing and implementation of other strategies by LCRA to further enhance and optimize operation of its system of water supplies.

5.2.3.1.7. New LCRA Contracts with Infrastructure

Region K has identified shortages within LCRA's service area that are not currently covered by a water sale contract from LCRA but for which LCRA may be willing and able to provide raw water. To supply this water, new infrastructure will be needed in order to obtain and treat the water. As new customers, contracts for water supplied to these customers may come from any source available to LCRA at the time the customer uses water. However, for the purposes of costing, all identified WUGs are assumed to receive water from surface water intakes along the Colorado River.

Due to a lack of groundwater availability for regional planning purposes under the MAG for the Carrizo-Wilcox Aquifer in Bastrop County, the LCRWPG looked at surface water as a source to meet water needs in future decades. Aqua WSC, Bastrop, and Bastrop County WCID 2 are assumed to receive water from the Bastrop Regional Project, which will deliver water from a single intake and water treatment plant to transmission mains to each WUG's distribution system. For Burnet County-Other, the infrastructure needed is associated with a regional project and the costs associated are included in a separate section.

Table 5.32 summarizes recommended new LCRA contract yields over the planning horizon.

Table 5.32: New LCRA Contracts with Infrastructure Yield

WUG	County	Basin	Water Management Strategies (ac-ft/yr)					
			2020	2030	2040	2050	2060	2070
Aqua WSC	Bastrop	Colorado	0	0	2,500	6,000	12,000	20,000
Bastrop	Bastrop	Colorado	0	0	0	1,000	2,500	4,000
Bastrop County WCID 2	Bastrop	Colorado	0	0	0	0	500	1,500
Bastrop Regional Project Total			**0**	**0**	**2,500**	**7,000**	**15,000**	**25,500**
Smithville	Bastrop	Colorado	0	0	0	0	0	700
County-Other	Burnet	Brazos, Colorado	0	3,200	5,400	5,400	5,400	5,400
Total			**0**	**3,200**	**7,900**	**12,400**	**20,400**	**31,600**

Cost Implications of Proposed Strategy

Costs were developed using the Texas Water Development Board Cost Estimating Tool and reported in September 2018 dollars. In addition to the infrastructure listed below, an additional $145/ac-ft of water purchase from LCRA was assumed. The Bastrop Regional Project costs have been split proportionally among Aqua WSC, Bastrop, and Bastrop County WCID 2 based on yield.

The infrastructure required for each WUG is detailed below.

- Bastrop County Regional Project
    - WUGs serviced: Aqua WSC, Bastrop, and Bastrop County WCID 2
    - 805 HP raw water intake pump station on the Colorado River near Bastrop
    - 0.5-mi, 42-in raw water transmission main to water treatment plant
    - 24 MGD surface water treatment plant
    - 5-mi, 36-in treated water transmission main to Aqua WSC
    - 3-mi, 18-in treated water transmission main to Bastrop
    - 2-mi, 10-in treated water transmission main to Bastrop County WCID 2

- Smithville
    - 23 HP raw water intake pump station on Colorado River
    - 0.5-mi, 8-in raw water transmission main
    - 0.6 MGD surface water treatment plant

- Burnet County-Other
    - The infrastructures associated with this new water sale contract are described and costed in various Burnet County Regional Projects strategies, including the Buena Vista Regional Project Strategy (*Section 5.2.4.5.1*), the East Lake Buchanan Strategy (*Section 5.2.4.5.2*), and the Marble Falls Regional Water System Strategy (*Section 5.2.4.5.3*).

Table 5.33: New LCRA Contracts with Infrastructure Cost

WUG	County	Basin	Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
Aqua WSC	Bastrop	Colorado	$95,048,000	$132,037,000	$18,286,000	$914
Bastrop	Bastrop	Colorado	$19,010,000	$26,407,000	$3,657,000	$914
Bastrop County WCID 2	Bastrop	Colorado	$7,129,000	$9,903,000	$1,372,000	$914
Smithville	Bastrop	Colorado	$7,573,000	$10,589,000	$1,373,000	$1,961

Environmental Considerations

Individual WUG implementation of this strategy has negligible impacts to instream flows and flows to the bay, but full regional implementation could remove up to 31,600 ac-ft/yr from the Highland Lakes or other LCRA sources by 2070.

Agricultural & Natural Resources Considerations

Any large new contracts that would require releases from lakes Buchanan and Travis or other LCRA firm water supplies may decrease over time the amount of interruptible water available for agriculture. The extent of these impacts to interruptible water availability cannot reasonably be quantified as part of this regional planning process because it will be affected by the rate at which firm demands materialize and could also be affected by the timing and implementation of other strategies by LCRA to further enhance and optimize operation of its system of water supplies.

5.2.3.1.8. Conservation

TWDB requires that all conservation strategies be located within a single Conservation section in the 2021 Region K Water Plan. LCRA conservation strategies are covered in *Section 5.2.2.1*, LCRA Conservation.

5.2.3.1.9. Expand Use of Groundwater in Bastrop County (Carrizo-Wilcox Aquifer)

LCRA plans to continue expanding its use of groundwater sources to meet future demands. LCRA currently holds groundwater permits from the Lost Pines Groundwater Conservation District for production wells in the Carrizo-Wilcox Aquifer in Bastrop County and has filed applications for permits to develop up to 25,000 ac-ft/yr of additional groundwater in Bastrop County for municipal, industrial, and other beneficial uses.

A preliminary analysis from LCRA indicated that a well field would be located on the Griffith League Ranch in central Bastrop County and used LCRA customer demands. The groundwater is anticipated for use in Bastrop County, but could also potentially be used in Travis and Lee Counties within the LCRA service area.

The yield for this strategy was determined by subtracting the water that is currently allocated from the available water under the Modeled Available Groundwater (MAG). However, because the TWDB rules require the planning group to treat the MAG as a cap in the planning process, there is only a small quantity of groundwater available; therefore, the delivery of water under this strategy is limited to the local area around the well field. The Carrizo-Wilcox Aquifer in Bastrop County had little remaining water under the MAG for strategies after regional water planning supplies were allocated, so strategy volumes are limited. *Table 5.34* shows the implementation decade and the amount of water to be pumped for all planning decades.

Table 5.34: LCRA Expand Use of Groundwater (Carrizo-Wilcox) Yield

Water Management Strategies (ac-ft/yr)					
2020	**2030**	**2040**	**2050**	**2060**	**2070**
0	30	30	30	30	30

Since the MAG is not a cap on groundwater permitting, there is additional demand that could be served if the Lost Pines Groundwater Conservation District issues a permit to LCRA for a larger yield. However, because a larger amount would exceed the MAG cap that is imposed by the TWDB planning rules, such a strategy is included as an alternative strategy.

The following infrastructure would be required for this strategy:

- One (1) 18 gpm Water Supply Well
- Approximately 1000 feet of raw water transmission piping and appurtenances

A peaking factor of one (1) was assumed. The number of new wells was determined in the Cost Estimating Tool, based on the largest quantity of water supplied over the planning period. The well was assumed to have an efficiency of 80%.

Cost Implications of Proposed Strategy

In order to provide a comparable cost consistent with other strategies in this report, costs were developed using the Texas Water Development Board (TWDB) Cost Estimating Tool in September 2018 dollars. The Cost Estimating Tool was also used to determine operating costs.

The capital cost for this strategy is primarily driven by the cost of the well field and transmission pipeline. Additional capital costs including engineering, legal services, contingencies, environmental and archeology studies and mitigation, land acquisition and surveying, and interest during construction were estimated using the Cost Estimating Tool. Annual costs including debt service, operation and maintenance, and pumping energy costs were also estimated using the tool. The following table shows the estimated costs associated with this strategy.

Table 5.35: LCRA Expand Use of Groundwater (Carrizo-Wilcox) Cost

Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
$174,000	$331,000	$25,000	$833

Environmental Considerations

This strategy's yield is so small it will have negligible impacts. No unreasonable impacts to surface water resources are anticipated. The water supply is within the Modeled Available Groundwater (MAG), so this strategy could contribute to the overall drawdown in the aquifer of up to 240 feet, relative to January 2000 conditions.

While it is assumed that this strategy would have negligible impacts to cultural resources, coordination with the Texas Historical Commission will need to occur and proper environmental field studies will need to be performed before any construction begins. The project is subject to requirements of the LCRA's Incidental Take Permit and Habitat Conservation Plan and associated requirements of the U.S. Fish and Wildlife Service. In addition, there are several endangered or threatened species that may need to be taken into consideration during design. *Appendix 1A* in *Chapter 1* provides a list of rare, threatened, and endangered species by county. These species may need to be considered during construction of infrastructure.

Agricultural & Natural Resources Considerations

No impacts to agriculture (zero impacted acres) are expected as a result of implementing this strategy.

5.2.3.1.10. Import Return Flows from Williamson County

LCRA has been evaluating water management strategies to develop water supplies by importing return flows (i.e. treated wastewater effluent) from entities in Williamson County that have contracts with LCRA for firm water from the Colorado River and for which exempt interbasin transfer permits have been issued allowing the water to be used in the Brazos River basin within Williamson County.

A recent engineering study evaluated various options for returning water back to the Colorado River basin. The most likely source of return flows is the Brushy Creek Regional Wastewater Treatment Plant (BCRWWTP) which currently discharges into Brushy Creek which is in the Brazos River Basin. Return flows could also be secured from the Leander wastewater treatment plant, which also discharges further upstream into Brushy Creek, in the Brazos River basin.

Two options have been considered: 1) return flows could be pumped directly from the BCRWWTP through a 16-mile transmission pipeline to the mid-basin reservoir proposed as an LCRA strategy in this regional plan or to other terminal storage, or 2) return flows could be discharged to Brushy Creek from the BCRWWTP and/or the Leander WWTP and a bed-and-banks permit would be used to transport the water downstream for diversion at a pump station that would pump the water through an 11-mile transmission pipeline to Wilbarger Creek which feeds into the Colorado River. The return flows can be transported by the bed-and-banks of Wilbarger Creek and the Colorado River to diversions points of LCRA's firm customers, or to one of the off-channel reservoirs. Alignments and cost estimates were prepared for LCRA by the engineering consultant. LCRA may need to obtain an interbasin transfer permit to import return flows from the Brazos River basin to the Colorado River basin. LCRA will likely also secure a bed and banks permit to retain ownership and control of the imported return flows once discharged into the Colorado River basin.

Consistent with the 2016 Regional Water Plan, Option 1 has been evaluated since it has more infrastructure requirements and a longer pipeline route. Based on these criteria, the water management strategy will consist of obtaining necessary water rights permits, construction of tertiary treatment upgrades at BCRWWTP, a pump station and a storage tank at BCRWWTP, and a water transmission pipeline. There are two Brushy Creek WWTP locations. Based on available flow data from each location, East and West, the source for this strategy is assumed to be the BCRWWTP East.

Table 5.36: LCRA Import Return Flows from Williamson County Yield

Water Management Strategies (ac-ft/yr)					
2020	**2030**	**2040**	**2050**	**2060**	**2070**
0	5,460	10,920	16,380	21,840	25,000

Cost Implications of Proposed Strategy

The TWDB Cost Estimating Tool and information from LCRA's consultant was used to determine project costs. The facilities cost for this strategy is primarily driven by the cost of the transmission pipeline. The following table shows the estimated costs associated with this strategy. Costs are given in September 2018 dollars.

The following infrastructure was proposed:

- Pump Station and Storage Tank at BCRWWTP
- Tertiary Treatment upgrade at BCRWWTP
- Approximately sixteen (16) miles of 42-inch transmission piping and appurtenances

Table 5.37: LCRA Import Return Flows from Williamson County Cost

Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
$54,241,000	$75,734,000	$6,080,000	$243

Environmental Considerations

Either option will need to ensure that water quality is not degraded as a result of discharge to a mid-basin reservoir or Wilbarger Creek. Infrastructure improvements identified at the WWTP include tertiary treatment for phosphorus removal before effluent can be discharged into a reservoir.

The discharge point shall be at a point in the reservoir or creek where it has sufficient capacity to handle the additional flow without detrimental effects to a reservoir or stream banks. The environmental impact should be low.

Depending on where the imported return flows are used, water available to help meet instream flows in the Colorado River could increase up to 25,000 ac-ft/yr as a result of the imported return flows. Return flows that are not stored and/or used to meet local or downstream demands could help meet freshwater inflow needs of Matagorda Bay.

While it is assumed that this strategy would have negligible impacts to cultural resources, coordination with the Texas Historical Commission will need to occur and proper environmental field studies will need to be performed before any construction begins. Refer to *Chapter 1, Appendix 1A*, for the complete list by county of threatened and endangered species in the Lower Colorado Regional Water Planning Area. These species may need to be considered during construction of infrastructure.

Agricultural & Natural Resources Considerations

Depending on firm demands, imported return flows could be used by LCRA to meet firm demands that would otherwise be met from stored water releases from the Highland Lakes, potentially increasing availability of interruptible water supply up to 25,000 ac-ft/yr. Imported return flows may also be used to directly increase the amount of interruptible water supply available for agricultural water users.

Interbasin Transfer Considerations

In order to bring return flows from the Brazos River Basin to the Colorado River Basin, an interbasin transfer permit (IBT) will be required, under Texas Water Code §11.085. In order to implement this strategy, LCRA would need to comply with all the provisions stated in the Code. One of the provisions requires a comparison of the water needs in the basin of origin to the water needs in the proposed receiving basin. The projected water needs (2020-2070) for the Brazos River Basin and the Colorado River Basin, as determined using data from DB22 provided by TWDB, are shown in the table below.

Table 5.38: Total Water Needs Comparison between Brazos and Colorado River Basins (ac-ft/yr)

Total Water Needs	2020	2030	2040	2050	2060	2070
Brazos River Basin	681,578	1,172,362	1,217,527	1,279,251	1,345,452	1,425,354
Colorado River Basin	238,514	402,780	441,353	469,808	513,426	571,151

Texas Water Code §11.085 also requires regional water plans to mention proposed methods and efforts by the receiving basin to avoid waste and implement water conservation. LCRA's 2019 Water Conservation Plan addresses water conservation practices for its firm water customers (municipal, industrial, power generation, and recreational). These efforts include five-year and 10-year implementation plans that will guide effective water conservation throughout communities in LCRA's rapidly growing service area and may achieve highest practicable levels of water conservation.

Details related to the conservation efforts recommended for LCRA as a major water provider are discussed in *Section 5.2.2.1*.

5.2.3.1.11. Baylor Creek Reservoir

This strategy consists of a new, 48,390 ac-ft earthen dam reservoir, located in Fayette County, adjacent to the Cedar Creek Reservoir (Lake Fayette) and the Fayette Power Project. LCRA has authorization to store water in the reservoir through their water right. On June 19, 2015, TCEQ granted LCRA a permit amendment extending the start of construction to September 18, 2035.

The purpose of this reservoir is to capture available river water not needed downstream and store the captured water for later use. The demand served by this strategy would be industrial use, in the form of cooling water requirements for the adjacent power plant. With water right amendments, the project could also provide water to downstream industrial demands and environmental uses.

The infrastructure required to implement this strategy includes:

- New 48,390 ac-ft earthen dam reservoir constructed along Baylor Creek
- A new river intake, pump station, and two 108-inch diameter, 20,600-foot long pipelines, to pump from the Colorado river to the reservoir. These pipes would also allow for return flow to the Colorado River
- Two 108-inch diameter, 100-foot long pipelines, for outlet of return flows to the Colorado River
- Two stilling basins, one in the new reservoir and one in the existing river

The maximum authorized impoundment amount for this reservoir is 48,390 ac-ft. Currently, the Baylor Creek permit only authorizes diversion and storage of water appropriated under the Highland Lakes water rights and use of that water for industrial purposes (steam-electric cooling). In order to develop a firm yield from the project, multiple permit amendments would be needed to the existing Baylor Creek permit, and perhaps to other LCRA ROR permits, in order to authorize diversion and storage of ROR flows.

An amendment to Certificate of Adjudication 14-5474A, granted April 29, 2011, states that the Owner is authorized to divert up to 73,579 ac-ft/yr of water for industrial purposes under Certificates of Adjudication 14-5478 and 14-5482, and to transport the water via pipeline to the proposed Baylor Creek Reservoir and existing Cedar Creek Reservoir. Based on information provided by LCRA, the project yield from this strategy that is available through the drought of record would be 18,000 ac-ft/yr, starting in the year 2040.

Cost Implications of Proposed Strategy

Capital costs for this strategy were developed based on information provided by LCRA and input into the Texas Water Development Board (TWDB) Cost Estimating Tool. Additionally, LCRA-provided cost estimates for environmental and archeological studies, permitting, and mitigation were input into the costing tool. Consistent with the tool, all costs are given in September 2018 dollars.

The following table shows the estimated costs associated with this strategy.

Table 5.39: LCRA Baylor Creek Reservoir Cost

Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
$152,060,000	$219,883,000	$16,333,000	$907

Environmental Considerations

The Baylor Creek Reservoir would rely on capturing available river flows for its yield, thus environmental impacts as compared to a reservoir on the Colorado River should be negligible. The LCRA off-channel reservoir strategies (Prairie, Mid-Basin, and Excess Flows OCRs) allow for releases of water for improved water quantity and quality for environmental uses.

While diversions would be made under amended existing rights, this strategy would contribute to the removal of up to 73,579 ac-ft/yr from the Colorado River for storage in the proposed Baylor Creek Reservoir and existing Cedar Creek Reservoir that otherwise might not have been captured.

While it is assumed that this strategy would have negligible impacts to cultural resources, coordination with the Texas Historical Commission will need to occur and proper environmental field studies will need to be performed before any construction begins. Refer to *Chapter 1, Appendix 1A*, for the complete list by County of threatened and endangered species in the Lower Colorado Regional Water Planning Area. These species may need to be considered during construction of infrastructure.

Agricultural & Natural Resources Considerations

The construction of the Baylor Creek Reservoir will lessen the need to send Highland Lakes' water to industrial customers near the coast and could improve agricultural water reliability and efficiency. The new reservoir will increase LCRA's operational flexibility, which, in turn, has the potential to enhance the availability of freshwater to the region, including farmlands, managed waterfowl habitat, and coastal wetlands. This project could potentially provide up to 18,000 ac-ft/yr of water for agriculture purposes during a drought year, depending on firm customer needs.

5.2.3.1.12. Aquifer Storage and Recovery (ASR) Carrizo-Wilcox

This strategy utilizes surface water that is diverted from the Colorado River and treated at a surface water treatment facility. The treated water would either be delivered to meet existing demands or diverted to aquifer storage for later recovery and use. The annual availability was determined by obtaining the storage size of the ASR from LCRA (based on their modeling), dividing it by the number of months in the Drought of Record (111), and multiplying by 12. An annual availability during the Drought of Record was calculated to be 12,973 ac-ft/yr for this strategy, and it is assumed to come online beginning in 2040. It is assumed that the diversion point would be located in Bastrop County with the ASR wells located in an adjacent aquifer, but implementation of this strategy could occur at a more downstream diversion point as well.

The source of the water for the project is assumed to be the Colorado River through a raw water intake in Bastrop County. Water would be diverted under LCRA's existing water rights at up to 18,000 ac-ft/yr, but based on the nature of the strategy, would focus on capturing high-level flows. Raw water would be conveyed to a new water treatment plant (WTP). Components of the WTP include an inline rapid mix, backwash supply pump station, recarbonation basin, gravity thickener, clarifier, oxidant/disinfection contactor, backwash waste equalization basing, centrifuges, all chemical storage and feed systems, media filters, treated water storage, high service pump station, and operations and maintenance buildings.

To satisfy the water demand, a high service pump station would feed treated water through a 5 mile, 36-inch diameter pipeline along the SH-71 right-of-way, to a currently undetermined delivery point. The pipeline diameter was calculated to maintain flow velocities under 5 feet per second.

Treated water in excess of the demand would be sent to the ASR wellfield. A medium service pump station and ground storage tank are required at both the water treatment plant and the ASR wellfield. The dual locations are required to meet the peak day demands at all times. The ASR wellfield would include eleven (11) 12-inch diameter wells that are spaced at 0.5-mile intervals.

Cost Implications of Proposed Strategy

Costs for this strategy were developed using the Texas Water Development Board (TWDB) Cost Estimating Tool, based on the infrastructure identified above. Consistent with the tool, all costs are given in September 2018 dollars. The following table shows the estimated costs associated with this strategy.

Table 5.40: LCRA Aquifer Storage and Recovery Cost

Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
$105,198,000	$146,592,000	$16,863,000	$1,300

Environmental Considerations

While this strategy will be diverting up to 18,000 ac-ft/yr of water from the Colorado River under existing water right(s), it is anticipated that the amended water right(s) allowing for diversion in this location would require TCEQ's SB3 environmental flow standards be met, which are considered adequate to support a sound ecological environment, to the maximum extent reasonable, considering other public interests and other relevant factors. Therefore, since diversions will be subject to the standards, this strategy is not expected to significantly adversely impact environmental flows because diversions are not likely to be possible at times that could impair water quality or other environmental flow considerations.

While it is assumed that this strategy would have negligible impacts to cultural resources, coordination with the Texas Historical Commission will need to occur and proper environmental field studies will need to be performed before any construction begins. Refer to *Chapter 1, Appendix 1A*, for the complete list by county of threatened and endangered species in the Lower Colorado Regional Water Planning Area. These species may need to be considered during construction of infrastructure.

Agricultural & Natural Resources Considerations

The implementation of this strategy would lessen the need to send Highland Lakes' water to potential customers in the Bastrop County area and could improve agricultural water reliability and efficiency. This strategy could increase LCRA's operational flexibility, which, in turn, has the potential to enhance the availability of freshwater to the region, including farmlands, managed waterfowl habitat and coastal wetlands, of up to 18,000 ac-ft/yr.

<u>5.2.3.1.13.</u> <u>Enhanced Recharge</u>

Enhanced recharge, also known as Managed Aquifer Recharge (MAR), is considered as a potential water management strategy for the LCRA for agricultural shortages in the lower Colorado River Basin. Enhanced recharge can be accomplished in a variety of ways: spreading basins, vadose zone injection wells, direct injection wells, and aquifer storage and recovery (ASR) wells. Only spreading basins are considered in this strategy.

This strategy consists of diverting water from the Colorado River, when available, and pumping to one or more recharge basins located in the recharge zone of the Gulf Coast Aquifer. The recharge basins would be designed and maintained to promote rapid entry of the water in the basins into the aquifer. The source of recharge water could be a low reliability junior water right, or it could be from one of LCRA's senior ROR water rights, particularly in the winter months when water is not otherwise being diverted. Section 11.023 of the Texas Water Code describes purposes for which water may be appropriated, and states that state water may be appropriated, stored, or diverted for recharge into an aquifer underlying this state other than an aquifer described under Subsection (c) through surface infiltration or an aquifer recharge project as defined by Section 27.201. During drought conditions, when backup surface water supplies are intermittent, the water stored underground by this project would be available to groundwater users in the area and also to wells that could augment canal flows. There may be issues with water ownership that would need to be addressed prior to implementation.

This project provides a place to store water diverted during high flows, prevents evaporative losses of the stored water, and provides a distribution system of the water through the groundwater aquifer.

The strategy would consist of:

- Providing engineered rapid infiltration basins and providing recovery wells utilizing existing diversions and canal systems.

An authorized diversion of 18,000 ac-ft/yr was used. Storage capability of 134,000 ac-ft/yr was determined by LCRA's modeling efforts. The annual availability was determined by taking the total storage, dividing it by the number of months in the Drought of Record (111), and multiplying by 12. An annual availability during the Drought of Record was calculated to be 14,486 ac-ft/yr for this strategy, and it is assumed to come online beginning in 2040.

The following infrastructure was proposed:

- Four (4) recharge basins 600' wide x 1,500' long x 4' high
- Simple Intake Structure with pipe extending to existing canal
- Two (2) Pump Stations
- Approximately 0.5 miles of transmission piping and appurtenances
- Combination of 28 new and 27 leased wells

Cost Implications of Proposed Strategy

A capital cost estimate was provided by LCRA from a preliminary feasibility analysis. The capital cost estimate was in August 2011 dollars. In order to provide a comparable cost consistent with other strategies in this report, costs were adjusted to September 2018 dollars using the ENR Construction Cost Index. In order to keep the costing similar to other projects, the intake and pump station costs were calculated using the TWDB Costing Tool instead of the costs provided, as the costs provided were far smaller than what the TWDB Costing Tool calculates. The capital cost for this strategy is primarily driven by the cost of the recharge basins and well fields.

In addition, engineering, legal, environmental, and land acquisition costs were also taken from the analysis and updated to September 2018, as they were higher than what the TWDB Costing Tool generated. Remaining costs for this strategy were developed using the Texas Water Development Board (TWDB) Cost Estimating Tool. Consistent with the tool, all costs are given in September 2018 dollars. The following table shows the estimated costs associated with this strategy.

Table 5.41: LCRA Enhanced Recharge Cost

Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
$47,285,000	$71,125,000	$5,428,000	$375

Environmental Considerations

If a new junior water right is used, instream flow and freshwater inflow requirements would be met before water can be diverted, thereby limiting impacts to the environment. Pulse flows in the river could potentially be reduced by up to 18,000 ac-ft/yr. There are zero anticipated impacts to cultural resources.

Agricultural & Natural Resources Considerations

Positive impacts of up to 18,000 ac-ft/yr to agriculture are expected as a result of implementing this strategy, due to the ability to provide water supply for agricultural purposes that can be accessed during drought periods.

5.2.3.1.14. Off-Channel Reservoirs

Mid-Basin Reservoir

The purpose of an off-channel reservoir (OCR) is to capture available flows from the Colorado River that are not needed to meet senior water rights or environmental flow obligations. The source of the water would be diversions under existing water rights, although a water right permit amendment would be required to authorize diversion and storage of available flows at a mid-basin location. For planning purposes, this reservoir is assumed to be located in Bastrop County The demands served by this strategy would be municipal, industrial, agricultural, environmental flows, and other beneficial uses near the site and downstream. The firm yield for this strategy is projected to be about 20,000 ac-ft/yr and is not projected to come online until 2030.

Table 5.42: LCRA Mid-Basin Reservoir Yield

Water Management Strategies (ac-ft/yr)					
2020	**2030**	**2040**	**2050**	**2060**	**2070**
0	20,000	20,000	20,000	20,000	20,000

Cost Implications of Proposed Strategy

For planning purposes, costs for this strategy were estimated based on the information provided by LCRA for the LCRA Lower Basin Off-Channel Reservoir capital costs during the 2016 planning cycle. The Mid-Basin OCR is assumed to have the same capacity and design as the Lower Basin OCR. To calculate the cost of the reservoir alone, the estimate for the Lower Basin Reservoir was converted from 2013 to 2018 dollars. Costs for this strategy were developed using the Texas Water Development Board (TWDB) Cost Estimating Tool. Consistent with the tool, all costs are given in September 2018 dollars.

Infrastructure used to estimate costs for this strategy include:

- 40,000 ac-ft capacity off channel reservoir
- 9,000-ft pipe, intake, and pump station pumping water from river to reservoir
- 9,000-ft pipe, intake, and pump station to return flows
- 33-mile transmission pipe, intake, pump station and booster station to deliver water to point of use

The following table shows the estimated costs associated with this strategy.

Table 5.43: LCRA Mid-Basin Reservoir Cost

Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
$234,428,000	$344,259,000	$26,265,000	$1,313

Environmental Considerations

The Mid-Basin Off-Channel Reservoir is off-channel and would rely on capturing available river flows under existing amended water rights for its yield. Thus, environmental impacts compared to an on-channel reservoir are minimal. In addition, the reservoir will enhance LCRA's ability to manage flows in the river, including releases to Matagorda Bay, managed waterfowl habitat, and coastal wetlands.

The environmental impacts to instream flows and bay and estuary inflows were analyzed for this project as part of the 2016 Region K Plan. Because the reservoir uses existing water rights, the instream flows showed some variation, both increases and decreases, as compared to a model without the reservoir. Certain assumptions were included in this analysis. Future changes to how LCRA might manage its system could change the variations. This strategy could potentially remove up to 20,000 ac-ft/yr from the Colorado River under existing water rights but will create additional waterfowl habitat.

While it is assumed that this strategy would have negligible impacts to cultural resources, coordination with the Texas Historical Commission will need to occur and proper environmental field studies will need to be performed before any construction begins. Refer to *Chapter 1, Appendix 1A*, for the complete list by county of threatened and endangered species in the Lower Colorado Regional Water Planning Area. These species may need to be considered during construction of infrastructure.

Agricultural & Natural Resources Considerations

Agricultural users in the lower Colorado River Basin predominantly rely on interruptible water supply provided from ROR rights and stored water released from the Highland Lakes. Due to current historic drought in the Basin, characterized by low inflows and reservoir storage condition, interruptible water releases from the Highland Lakes for agricultural use were largely stopped after 2011, with the exception of the Garwood operations. The construction of the Mid-Basin Off-Channel will lessen the need to release Highland Lakes' water to meet firm water demands near the coast and could improve interruptible agricultural water reliability and efficiency. The new reservoir will increase LCRA's operational flexibility, which, in turn, has the potential to enhance the water availability in the lower basin for a variety of purposes, including agriculture. This strategy could potentially make available up to 20,000 ac-ft/yr of water for agricultural purposes, depending on firm customer needs.

Prairie Site Regulating Reservoir

This strategy consists of a new earthen ring dike off-channel reservoir with 2,000 ac-ft of storage located near Eagle Lake in Colorado County, approximately three miles from the Colorado River.

The proposed off-channel regulating reservoir would provide operational flexibility for LCRA in providing water to the Lakeside Irrigation Division customers. The Prairie Site Reservoir would release flows to the Lakeside agricultural division canals. Water would be stored when demand for irrigation is reduced (e.g., due to rain events or other weather events) and then used later when demand for irrigation water increased. The source of the water is diversions from the Colorado River under LCRA's existing water rights.

This strategy would provide other benefits. Currently, when water is released from the Highland Lakes to downstream water users, it takes several days to reach those users, because the lakes are far from the point of use. If it rains in the time it takes for the stored water to get from the release point to the point of use, the released stored water may no longer be needed at that time but could be captured and stored in the off-channel reservoir to be beneficially used at a later time in lieu of additional releases of stored water.

Additionally, since this off-channel reservoir would be located a shorter distance to the users than the existing release points, released water from this reservoir would reach the users sooner.

The infrastructure required to implement this strategy includes:

- New 2,000 ac-ft storage capacity earthen ring dike reservoir
- Connecting canal from the Prairie Canal to the reservoir
- Canal improvements (i.e., shaping, grading, and raising of a portion of the canal banks)
- Check structure and low-head pumps to convey and lift flow from the Prairie Canal to the reservoir
- 36-inch-diameter culvert addition at the canal crossing the railroad and FM 102
- 60-inch-diameter culvert replacement at the transfer point from the Prairie system to the Main system at FM 1093
- Spillway for conveyance of flood flows from rainfall events
- Energy dissipation structures for discharge into the reservoir and return flow into Prairie Canal

The conserved water from this strategy is projected to be an estimated of up to 19,000 ac-ft/yr for interruptible agricultural supply. The conserved water volume decreases over time due to the decrease in interruptible supplies. This strategy could be online by the year 2030.

Table 5.44: LCRA Prairie Site Regulating Reservoir Yield

Water Management Strategies (ac-ft/yr)					
2020	**2030**	**2040**	**2050**	**2060**	**2070**
0	19,000	9,500	0	0	0

Cost Implications of Proposed Strategy

Costs for this strategy were developed based on information provided by LCRA. Consistent with the Texas Water Development Board (TWDB) Cost Estimating Tool, all costs are given in September 2018 dollars. The following table shows the estimated costs associated with this strategy.

Table 5.45: LCRA Prairie Site Regulating Reservoir Cost

Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
$10,235,000	$16,690,000	$944,000	$50

Environmental Considerations

The Prairie Reservoir is a relatively small, off-channel reservoir that would rely on utilizing existing water rights and capturing available river flows for its conservation benefit. Thus, environmental impacts, as compared to an on-channel reservoir, are minimal. In addition, the reservoir will enable LCRA to enhance its ability to manage flows in the lower portion of the Colorado River, and to manage waterfowl habitat and coastal wetlands.

While it is assumed that this strategy would have negligible impacts to cultural resources, coordination with the Texas Historical Commission will need to occur and proper environmental field studies will need to be performed before any construction begins. Refer to *Chapter 1, Appendix 1A*, for the complete list by county of threatened and endangered species in the Lower Colorado Regional Water Planning Area. These species may need to be considered during construction of infrastructure.

Agricultural & Natural Resources Considerations

Agricultural users in the lower Colorado River Basin predominantly rely on interruptible water supply provided from ROR rights and stored water released from the Highland Lakes. Due to recent historic drought in the basin, characterized by low inflows and reservoir storage condition, interruptible water releases from the Highland Lakes for agricultural use were largely stopped between 2012 and 2015, with the exception of the Garwood operations. The construction of the Prairie Reservoir will help improve interruptible agricultural water reliability and efficiency. The new reservoir will increase LCRA's operational flexibility, which, in turn, has the potential to enhance the water availability in the lower basin for a variety of purposes, including agriculture. This strategy could potentially make available up to 19,000 ac-ft/yr of interruptible water for agricultural purposes within the Lakeside operations.

Impacts on Other Water Resources in the State

Because of the small size of the regulating reservoir, minimal impacts to downstream flows are expected as a result of implementing this strategy.

Excess Flows Reservoir

LCRA holds TCEQ Water Use Permit No. 5731, which authorizes LCRA to divert, store, and use for various beneficial purposes up to 853,514 ac-ft/yr from the Colorado River, subject to significant environmental flow requirements, into one or more off-channel reservoirs (up to 500,000 ac-ft of off-channel storage) located within Colorado, Wharton, and Matagorda counties. By April 2021, LCRA must apply for an amendment to the permit to either authorize specific off-channel reservoir(s) or extend the time for filing an amendment to authorize the specific reservoir(s). No location and size are yet determined, but for cost estimating purposes and assignment with the TWDB database, Colorado County is used as the location, and the size is expected to be comparable to the Arbuckle off-channel reservoir at 40,000 ac-ft, although it could be smaller or larger. This facility is one of a potential series of reservoirs that are authorized under this permit. This proposed strategy differs from two of the other potential off-channel reservoirs LCRA is considering (Prairie and Mid-Basin OCR) in that the TCEQ Permit No. 5731 already authorizes the storage facility, subject to a permit amendment specifying its location, and various other requirements, including but not limited to dam safety review. It is also possible that, in lieu of a separate additional off-channel reservoir, the Excess Flows Permit could be used in conjunction with other water rights as a source of supply for the Prairie Site or Arbuckle reservoirs.

The purpose of an off-channel reservoir is to capture available river flows not needed downstream and store the captured water for later use. The reservoir could supply water directly to end users, or release water back to the river for use downstream. The demands served by this strategy could range from municipal and industrial uses to agricultural users near the coast, and environmental flow needs.

This strategy would provide other benefits. Currently, when water is released from the Highland Lakes to downstream water users, it takes several days to reach those users, because the lakes are far from the point of use. If it rains in the time it takes for the water to get from the release point to the point of use, the

Highland Lakes water may no longer be needed at that time but could be captured and stored in the off-channel reservoir to be beneficially used at a later time in lieu of additional releases of Highland Lakes water. Additionally, since this off-channel reservoir would be located a shorter distance to the users than the existing release points, released water from this reservoir would reach the users sooner.

The projected yield from this strategy was determined using the Region K Cutoff Model and is shown by decade in *Table 5.46.*

Table 5.46: LCRA Excess Flows Reservoir Yield

Water Management Strategies (ac-ft/yr)					
2020	2030	2040	2050	2060	2070
0	39,247	39,247	39,247	39,247	39,247

Cost Implications of Proposed Strategy

For planning purposes, costs for this strategy were based on a storage capacity of 40,000 ac-ft, although this may not be the final storage capacity, as discussed. The cost for the off-channel reservoir was estimated by taking the 2014 cost from the preliminary engineering estimate for the LCRA Lower Basin Off-Channel Reservoir (which also has a capacity of 40,000 ac-ft) and converting from 2014 to 2018 dollars using the construction cost index, on the assumption that the Excess Flows OCR will have a similar design. Costs for this strategy were developed using the Texas Water Development Board (TWDB) Cost Estimating Tool. Consistent with the tool, all costs are given in September 2018 dollars. The following table shows the estimated costs associated with this strategy.

Infrastructure used to estimate costs for this strategy includes:

- 40,000 ac-ft capacity off channel reservoir
- 9,000-ft pipe, intake, and pump station pumping water from river to reservoir
- 9,000-ft pipe, intake, and pump station to return flows
- 56-mile transmission pipe, intake, and pump station to deliver water to point of use

Table 5.47: LCRA Excess Flows Reservoir Cost

Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
$377,094,000	$540,110,000	$48,713,000	$1,241

Environmental Considerations

The Excess Flows Off-Channel Reservoir is off-channel and would rely for its yield on capturing river flows available only after meeting significant instream flow and freshwater inflow requirements. Due to the environmental restrictions in the permit, diversions are not expected to have any significant environmental impacts. In addition, the reservoir will enhance LCRA's ability to manage flows in the lower basin, including potential use of the water for managed waterfowl habitat and, with further amendments, water stored in the reservoir might be released to help meet inflow needs of Matagorda Bay. This strategy could potentially remove up to 39,247 ac-ft/yr from the Colorado River.

While it is assumed that this strategy would have negligible impacts to cultural resources, coordination with the Texas Historical Commission will need to occur and proper environmental field studies will need to be performed before any construction begins. Refer to *Chapter 1, Appendix 1A*, for the complete list by county of threatened and endangered species in the Lower Colorado Regional Water Planning Area. These species may need to be considered during construction of infrastructure.

Agricultural & Natural Resources Considerations

Agricultural users in the lower Colorado River Basin predominantly rely on interruptible water supply provided from ROR rights and stored water released from the Highland Lakes. Due to the recent historic drought in the basin, characterized by low inflows and reservoir storage condition, interruptible water releases from the Highland Lakes for agricultural use were largely stopped from 2012 to 2015, with the exception of the Garwood operations. The construction of the Excess Flows Off-Channel Reservoir will lessen the need to release Highland Lakes' water to meet firm water demands near the coast and improve interruptible agricultural water reliability and efficiency. The new reservoir will increase LCRA's operational flexibility, which, in turn, has the potential to enhance the water availability in the lower basin for a variety of purposes, including agriculture. This strategy could potentially make available up to 39,247 ac-ft/yr of water for agricultural purposes, depending on firm customer needs.

5.2.3.1.15. Downstream Return Flows

Downstream return flows from Pflugerville are discussed in *Section 5.2.1.2*. This benefit is assigned to LCRA, and through a bed and banks permit, the return flows could be transported to a diversion location for an LCRA customer or to be stored in an off-channel reservoir.

5.2.3.2 Austin Water Management Strategies

Austin provides water for municipal, manufacturing, and steam-electric water uses. Austin's existing service area covers portions of Travis, Williamson, and Hays Counties. Austin water management strategies and total water amounts for each strategy are summarized in the following table.

Table 5.48: Summary of Austin Water Management Strategies (ac-ft/yr)

Recommended Strategy	2020	2030	2040	2050	2060	2070
Municipal and Manufacturing						
Conservation	4,910	14,890	24,870	30,120	35,370	40,620
Blackwater and Greywater Reuse	0	1,450	3,450	5,400	7,340	9,290
Aquifer Storage and Recovery	0	0	7,900	10,500	13,200	15,800
Off-Channel Reservoir and Evaporation Suppression	0	0	0	0	0	25,827
Onsite Rainwater and Stormwater Harvesting	0	690	1,640	2,520	3,390	4,270
Community-Scale Stormwater Harvesting	0	55	132	154	175	197
Brackish Groundwater Desalination	0	0	0	0	0	5,000
Centralized Reclaimed Water Capacity (Direct Reuse)	500	2,990	10,250	14,583	18,917	23,250
Decentralized Direct Non-Potable Reuse	0	1,400	4,160	8,330	12,510	16,680
Capture Local Inflows to Lady Bird Lake	0	0	3,000	3,000	3,000	3,000
Longhorn Dam Operation Improvements	0	3,000	3,000	3,000	3,000	3,000
Total	**5,410**	**24,475**	**58,402**	**77,607**	**96,902**	**146,934**
Strategies to be Implemented under Drought Conditions only						
Drought Management	8,266	9,708	11,281	12,423	13,389	14,666
Indirect Potable Reuse through Lady Bird Lake	0	0	11,000	14,000	17,000	20,000
Lake Austin Operations	1,250	1,250	1,250	1,250	1,250	1,250
Total	**9,516**	**10,958**	**23,531**	**27,673**	**31,639**	**35,916**
Steam-Electric						
LCRA Contract Amendment	4,300	4,300	4,300	4,300	4,300	4,300
Centralized Reclaimed Water Capacity (Direct Reuse)	0	1,750	1,750	1,750	1,750	1,750
Total	**4,300**	**6,050**	**6,050**	**6,050**	**6,050**	**6,050**
Total of All Categories	**19,226**	**41,483**	**87,983**	**111,330**	**134,591**	**188,900**

5.2.3.2.1. Water Conservation

The Austin Conservation strategy is discussed in detail in the Conservation Section, specifically *Section 5.2.2.2*, as required by the TWDB.

5.2.3.2.2. Blackwater and Greywater Reuse

For the purpose of this evaluation, Austin Water defines Greywater Reuse as the reuse of water from the laundry, shower, bathroom lavatory, and bath at the lot/unit scale to meet non-potable demands. There are two main types of reuse: greywater diversion and greywater treatment systems. Greywater diversion systems typically include a surge-tank, filter, and a pump (if needed). Greywater treatment systems include treatment, storage and a pump. Depending on the level of treatment, greywater can be used for a variety of applications, including irrigation, toilet flushing, and clothes washing. In establishing typical yields and costs for this strategy as part of the Austin Water Forward Plan, Austin Water assumed a proportion of newly constructed buildings would be equipped in the following manner:

- Single-family residences with greywater diversion for outdoor end use
- Single-family and multi-family residences with greywater treatment for outdoor, toilet flushing, and clothes washing end uses
- Commercial buildings with greywater treatment for outdoor irrigation, toilet flushing, and cooling water

For the purpose of this evaluation, Austin Water defines Lot-Scale Wastewater Reuse (or 'Blackwater Reuse") as the onsite capture and treatment of the wastewater stream generated from a building for onsite reuse via a dual plumbing system to supply outdoor demands (ex: irrigation/landscaping) and non-potable indoor demands (ex: toilets, clothes washing, cooling towers). Blackwater treatment plants are most commonly installed in commercial buildings and high density, multi-story multi-family residential buildings. Treatment may be one or a combination of membrane bioreactor, moving bed biofilm reactor, passive (e.g. engineered wetlands) or other systems, with microfiltration or ultrafiltration, and ultraviolet disinfection and/or chlorination. Wastes (sludge) from the treatment process are typically discharged back to the wastewater network. For both Blackwater and Greywater Reuse, the Water Forward Plan assumes back-up supply from the potable water distribution system or centralized reclaimed water system.

In establishing typical yields and costs for this strategy, the following is assumed:

- A proportion of newly constructed multi-family residences and commercial buildings will be equipped with a blackwater treatment system supplying outdoor and non-potable indoor end uses.

Combined as a single strategy, Blackwater and Greywater Reuse are expected to provide approximately 9,290 ac-ft/yr of new water supply by 2070 during Drought of Record conditions. Yield estimates were determined using blackwater/greywater supply source generation estimates and census-tract-level demand estimates. While water availability through this strategy is consistent throughout the year, it is limited to the storage capacity of each system; thus, a water balance calculation coupled the blackwater supply and demand estimates with storage sized at three times the average daily blackwater generation volume. Model parcel-level estimates were then multiplied by expected growth projections throughout the city to estimate city-wide yield. Consideration is given to the minimum dry weather flows that must be retained in the centralized wastewater system to maintain the necessary scouring velocities. Back-up supply from the central water system is required to provide adequate supply to meet full annual water demands at each building/facility in any given year. This strategy is intended to provide supplemental supply that reduces water demands on the overall system. The yields for blackwater and greywater supplies are consistent throughout drought and average conditions because the supplies are generated by indoor uses of water. The strategy is expected to be online by 2030. The Drought of Record yields projected for the blackwater and greywater strategies are shown below.

Table 5.49: Austin Blackwater and Greywater Reuse Yield

Water Management Strategies (ac-ft/yr)					
2020	**2030**	**2040**	**2050**	**2060**	**2070**
0	1,450	3,450	5,400	7,340	9,290

Note that *Table 5.2* considers all reuse strategies, including onsite blackwater and greywater reuse, in developing the Austin return flows projections.

Cost Implications of Proposed Strategy

Estimates for capital and O&M costs were provided by Austin, from data in their Austin Water Forward Plan that included 2018 costs. In order to provide a comparable cost consistent with other strategies in this report, annual costs and unit costs were developed using the Texas Water Development Board (TWDB) Cost Estimating Tool in September 2018 dollars. Capital costs include storage, treatment and pumping for each separate system, but do not include on-site collection or distribution. The following table shows the estimated costs associated with this strategy.

Table 5.50: Austin Blackwater and Greywater Reuse Cost

Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
$33,905,000	$47,031,000	$21,871,000	$2,534

Environmental Considerations

The proposed building- and lot-scale treatment technologies are assumed to incur small footprints, this strategy provides environmental benefit by reducing the energy spent transmitting wastewater from far reaches of the collection system to existing centralized wastewater treatment plants.

No outdoor end uses for this strategy are proposed for sensitive recharge areas, including the Edwards Aquifer Recharge Zone.

Consistent with city or other codes, applicable studies will be performed before construction of new buildings and sites to determine if there are any impacts to cultural resources, wildlife habitat, or other environmental aspects.

Agricultural & Natural Resources Considerations

No impacts to agriculture are expected as a result of implementing this strategy.

5.2.3.2.3. Aquifer Storage and Recovery

Aquifer Storage and Recovery (ASR) is a strategy in which water is stored in an aquifer during wetter periods and recovered for use during drier periods. ASR offers an opportunity to improve water supply during drought and to reduce evaporative losses through the concept of "water-banking." By storing water underground, losses to evaporation incurred by above-ground storage reservoirs (lakes) are avoided. This type of strategy is currently being used by cities in the U.S. and Texas including San Antonio, Kerrville, and El Paso.

Per the Austin Water Forward Plan, treated Colorado River water under Austin's existing water rights and contract agreements is the proposed source of water for this strategy, particularly during non-drought years. A number of potential storage aquifers will be considered for the strategy. Since the last regional water planning cycle, Austin has performed feasibility analyses to better understand the hydrogeology of the Northern Edwards and Trinity Aquifers in order to evaluate potential for recharge and extraction. The analyses found that current regulatory restrictions would prevent injection into or transection of the Edwards Aquifer. The Carrizo-Wilcox Aquifer has been identified as a candidate for storage, given its favorable hydrogeological properties and the San Antonio Water System's experience with an ASR facility in this aquifer.

As part of this strategy, Austin will construct and implement a pilot facility in order to assess the storage capacity, recovery capacity, migration losses, and other characteristics of the aquifer. Analysis of treatment requirements to provide acceptable water quality for aquifer injection and for distribution will be conducted. Results from this pilot project will inform decisions about the full-scale ASR facility.

The initial phase of the full-scale ASR strategy is planned to be online by 2040 with a storage volume of 60,000 ac-ft and the capacity to withdraw about 7,900 ac-ft/yr on average over the critical period of the Drought of Record and up to 60,000 ac-ft in a maximum withdrawal year. By 2070, this strategy is expected to have a storage volume of 120,000 ac-ft and provide an average of 15,800 ac-ft/yr over the critical period of the Drought of Record and up to approximately 60,000 ac-ft in a maximum withdrawal year. Expanded supplies are planned to be available by 2115. Piping from the water source to the wells and from the wells to the distribution system will be required. Significant land acquisition by Austin may be required for the aquifer storage and recovery wells and other facilities. Control of injected water may present challenges, and additional protections may be necessary to ensure that stored water is protected.

Conceptually, the purpose of ASR is to provide additional water supplies in times of drought or other unforeseen events. Water availability from the ASR is dependent on several factors. Because the aquifer is acting as a "water-bank," its capacity to provide water in times of drought is dependent on the degree that surface water was successfully stored in the aquifer, generally in wetter years. The estimated average over the critical period of the Drought of Record yields are shown in the following table.

Table 5.51: Austin Aquifer Storage and Recovery Yield

Water Management Strategies (ac-ft/yr)					
2020	**2030**	**2040**	**2050**	**2060**	**2070**
0	0	7,900	10,500	13,200	15,800

Cost Implications of Proposed Strategy

Capital costs were provided by Austin in 2018 dollars. In order to provide a comparable cost consistent with other strategies in this report, annual costs were developed using the Texas Water Development Board (TWDB) Cost Estimating Tool in September 2018 dollars. The Cost Estimating Tool was also used to determine operating costs.

Capital costs associated with this strategy include:

- Reversible pipeline (38-mile estimate)
- Wells (1800 gpm @1600 ft each)
- Pump Station (Into Aquifer 850 HP, Out of Aquifer 1650 HP)
- Land acquisition
- Treatment to drinking water quality prior to storage in aquifer
- Pilot testing

The following table shows the estimated costs associated with this strategy.

Table 5.52: Austin Aquifer Storage and Recovery Cost

Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
$248,350,000	$370,527,000	$35,300,000	$2,234

Environmental Considerations

The ASR strategy will require permitting to ensure it complies with all environmental considerations. Project planning will include identification of permit requirements, including environmental permitting, to implement the strategy.

Water to be stored in the ASR facility is planned to come from Austin's existing distribution infrastructure and was therefore modeled as being diverted from the river at any of Austin's existing water treatment plants. In general, if there is vacant storage capacity in any month in the ASR and if there are unused portions of Austin's available water, then water could be diverted for injection into the ASR. In preliminary conceptual planning for this strategy, instream flow conditions were checked for the water rights with new diversion points before the ASR was modeled as diverting water. This strategy helps satisfy a component of City of Austin demands already anticipated to be met through Colorado River diversions, particularly during drought and low reservoir storage volume conditions in lakes Travis and Buchanan. Although to store water in the aquifer more water may be diverted in a particular year than otherwise would have been diverted, this would be done in a wetter year when water is typically available to the environment. In certain drought years demand for river diversions may be able to be reduced while water is being drawn out of ASR to meet demands. As a result, impacts to environmental flows should be minimal.

It is assumed that there would be no impacts to cultural resources, but if applicable, coordination with the Texas Historical Commission prior to construction will be performed. Refer to *Chapter 1, Appendix 1A*, for the complete list by county of threatened and endangered species in the Lower Colorado Regional Water Planning Area. These species may need to be considered during construction of infrastructure.

Agricultural & Natural Resources Considerations

Impacts to agriculture should be considered negligible. Water storage in the ASR is driven by the availability of excess surface water flows in years of non-drought. The pumping of water into the ASR is anticipated to be conducted in wetter periods when water is typically available to other users in the basin. Therefore, this strategy is anticipated to have negligible effects on other users.

5.2.3.2.4. Off-Channel Reservoir and Evaporation Suppression

This strategy involves the construction of a new off-channel reservoir (OCR) in the Austin region that Austin Water would own and operate. The purpose of the off-channel reservoir is to capture river flows when available under Austin's water rights and store the captured water for later municipal use. This strategy helps satisfy a component of Austin demands already anticipated to be met through Colorado River diversions, particularly during drought and low reservoir storage volume conditions in lakes Travis and Buchanan.

Per the 1999 contract with the Lower Colorado River Authority (LCRA), Austin is to utilize water under its own Colorado River water rights before drawing on stored water from LCRA. This contract is a combination of Austin's run-of-river rights with backup and additional water from LCRA for a firm water total of up to 325,000 ac-ft/yr. Unutilized portions of Austin's water rights are made available to the OCR strategy. According to the Austin Water Forward Plan, in order to fully utilize Austin's existing water rights as part of this OCR project, it is likely that water right amendments will be required for this strategy.

Potential implementation issues for the OCR include significant land area requirements and that the yield of the reservoir is dependent on the reliability of flow in the Colorado River. The cost for land, included in *Appendix 5D*, is assumed to be a percentage of facility costs.

Additionally, the OCR project includes an evaporation suppression strategy to reduce natural evaporation from the open-air off-channel reservoir. Per the TWDB's Water Data for Texas tool, open reservoirs in the Austin area can lose up to 8 inches of water to evaporation in the summer months. There are different ways to suppress evaporation, and various options will be explored. Evaporation suppression options including solar panels, plastic balls, monomolecular layer powders, among others, would be planned to be considered. While Austin's Water Forward Plan (2018) was used to develop the strategy, the Water Forward models were not used to develop the firm yield for the 2021 Region K Plan. The OCR was added into the approved Region K Cutoff Model and the firm yield was calculated in accordance with the approved hydrologic variance, including the Region K Drought of Record period, October 2007 through December 2016. Modeling results indicate that the firm yield of municipal supply from the OCR is projected to be 25,000 ac-ft/yr.

This strategy is expected to provide approximately 25,827 ac-ft/yr by 2070. This is based on 25,000 ac-ft/yr for the reservoir, and 827 ac-ft/yr for the evaporation suppressant. Assuming the suppressant is effective, this strategy would act as a "water bank," accumulating water in wetter years and providing supplemental supply in times of drought.

The estimated yield for these strategies is shown in *Table 5.53*.

Table 5.53: Austin Off-Channel Reservoir and Evaporation Suppression Yield

Water Management Strategies (ac-ft/yr)					
2020	**2030**	**2040**	**2050**	**2060**	**2070**
0	0	0	0	0	25,827

Cost Implications of Proposed Strategy

Capital and O&M costs in 2018 dollars were provided by the Austin Water Forward Plan. In order to provide a comparable cost consistent with other strategies in this report, annual and unit costs were developed using the Texas Water Development Board (TWDB) Cost Estimating Tool in September 2018 dollars.

Capital costs associated with this strategy include:

- 25,000 ac-ft off channel reservoir
- River intake
- Pump station and pipeline (river to reservoir)
- Pump station and pipeline (reservoir to point of use)
- Appurtenances of evaporation suppressant application

Table 5.54 shows the estimated costs associated with this strategy.

Table 5.54: Austin Off-Channel Reservoir and Evaporation Suppression Cost

Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
$226,171,000	$334,642,000	$25,444,000	$1,018

Environmental Considerations

According to the Austin Water Forward Plan, in order to fully utilize Austin's water rights as part of this OCR project, it is likely that water right amendments will be required for this strategy. In preliminary conceptual planning for this strategy, instream flow conditions were checked before the OCR was modeled as diverting water. A conservative estimate of water availability was used to avoid impacts to existing streamflow requirements. This strategy helps satisfy a component of Austin demands already anticipated to be met through Colorado River diversions, particularly during drought and low reservoir storage volume conditions in lakes Travis and Buchanan. Although to store water in the OCR more water may be diverted from the river in particular conditions than otherwise would have been diverted, however, this would be done in wetter conditions when water is typically available to the environment. In certain drought periods demand for river diversions may be able to be reduced while water is being drawn out of OCR to meet demands.

Environmental studies and permits may be needed to address potential impacts of evaporation suppression options including assessment of impact on oxygen transfer between water and air, lake temperature, source water quality, waterfowl, and aquatic life.

It is assumed that there would be no impacts to cultural resources, but if applicable, coordination with the Texas Historical Commission prior to construction will be performed. Refer to *Chapter 1, Appendix 1A*, for the complete list by county of threatened and endangered species in the Lower Colorado Regional Water Planning Area. These species may need to be considered during construction of infrastructure.

Agricultural & Natural Resources Considerations

Negligible impacts to agriculture are expected as a result of implementing this strategy. The pumping of water into this reservoir is anticipated to be conducted during high flow events when water is typically available to other users in the basin. In addition, most of the pumping would occur in high flow events during drought periods when interruptible customers would be expected to be cut off, per LCRA's Water Management Plan. Therefore, this strategy is anticipated to have negligible effects on other users.

Additional study is needed to evaluate various evaporation suppression options to ensure the effectiveness and safety of the chosen technology. Monitoring would be necessary to ensure public safety and efficacy of the evaporation suppression technology.

5.2.3.2.5. Onsite Rainwater and Stormwater Harvesting and Community-Scale Stormwater Harvesting

Lot-Scale Rainwater Harvesting involves the capture and storage of roof water to supply a range of onsite demands at the lot/building scale. Lot-Scale Stormwater Harvesting involves the capture and storage of stormwater runoff generated from impervious surfaces (including water from paved surfaces and roof water) within the lot boundary of developments to supply a range of onsite demands at the lot/building scale. Community Scale Stormwater Harvesting involves the collection of stormwater runoff from urban areas (e.g. impervious surfaces including roads, pavements and roofs), for treatment and reuse for irrigation/landscaping or reuse for dual pipe systems at the community scale. The implementation of either as a water management strategy is dependent upon the catchment area, storage capacity, rainfall frequency and water demand of the end user. On average, the Austin area generally receives about 32 inches of rainfall per year. This rainfall is not distributed uniformly during the year and, as a result, implementation of rainwater and stormwater harvesting as a water management strategy should consider water demands and supplies over a multi-month period. The Austin Water Forward Plan's Onsite Rainwater and Stormwater and Community-Scale Stormwater Harvesting strategy accounts for this variation by analyzing historical rainfall data from 1938-2016.

For existing buildings, retrofitting structures with internal connections to a dual supply source can be cost prohibitive and/or practically difficult. The Austin Water Forward Plan has assumed that stormwater harvesting at the community scale and lot scale for existing development would generally be used for irrigation/landscaping.

Onsite Rainwater and Stormwater Harvesting

For Lot-Scale Stormwater and Rainwater Harvesting, it is assumed existing buildings will only apply harvested stormwater to irrigation. For the future, however, Austin's Water Forward Plan strategies include phased use of dual plumbing and internal connections for non-potable end uses including toilet flushing, and cooling towers for new development, initially focusing on large-scale commercial development. Water availability beyond the expected yields for this strategy is dependent on rainfall, storage sizing, and end use demands. In establishing typical yields for this strategy, Austin used the following methodology:

- Onsite Rainwater Harvesting: The Water Forward Plan strategy is for a proportion of newly constructed single family residential, multi-family residential, and commercial buildings to have a rainwater tank supplying outdoor end uses and indoor (non-potable) end uses via dual plumbing. The Region K strategy assumes back-up supply from the potable water or centralized reclaimed water system.

  City-wide yield estimates used daily rainfall for the historical period and census-tract-level demand estimates. These were coupled with daily water balance calculations, typical roof areas, a roof runoff coefficient, and tank volumes optimized from yield/storage curves in order to maximize yield and minimize cost & tank footprint/space (2,000 gallons per house for single family residential, 5,000 gallons per building for multi-family residential, and 10,000 gallons per building for commercial). Model parcel-level estimates were then multiplied by expected growth projections throughout the city to estimate city-wide yield. The final yield is a summation of the total of all facility locations. Modeling has shown that supplies from this strategy are available during the Drought of Record.

- Onsite Stormwater Harvesting: The Water Forward Plan includes onsite stormwater harvesting for a proportion of newly constructed multi-family residential and commercial buildings via an underground stormwater harvesting tank at each building supplying outdoor end uses. The Region K strategy assumes that there will be filtration via an onsite system and back-up supply from the potable water distribution system or centralized reclaimed water system.

  City-wide yield estimates used daily rainfall for the historical period and census-tract-level demand estimates. These were coupled with model parcel-level estimates based on daily water balance calculations, nominal building roof areas, ratio of roof area to other impervious area, connected catchment area for other impervious surfaces, a roof runoff coefficient, and tank volumes optimized from yield/storage curve in order to maximize yield and minimize cost and tank footprint/space (10,000 gallons per nominal building/lot for multi-family residential and 30,000 gallons per nominal building/lot for commercial). Model parcel-level estimates were then multiplied by expected growth projections throughout the city to estimate city-wide yield. The final yield is a summation of the total of all facility locations. Modeling has shown that supplies from this strategy are available during the Drought of Record.

In establishing typical yields for this strategy, Austin assumed the installation of rainwater and stormwater harvesting systems in a portion of new and existing buildings equipped in the following manner:

- Rainwater Harvesting
  - Single-family residences with outdoor end use
  - Multi-family residences with outdoor end use and indoor (non-potable) toilet flushing end use
  - Commercial buildings with outdoor end use and indoor (non-potable) toilet flushing and cooling water end uses
- Stormwater Harvesting
  - Multi-family residences and commercial buildings with outdoor end use

This strategy provides water supply throughout the Drought of Record. When onsite rainwater and stormwater harvesting is not available, Austin Water, as a major water provider, will continue to provide firm water supply to its customers via the potable water system and reclaimed water through the reclaimed water system, in addition to other water management strategies. Austin Water has an overall plan to use firm and other water supplies as a system[5] to provide water through a Drought of Record.

This strategy is expected to provide 4,270 ac-ft/yr in Drought of Record conditions by 2070. The estimated average yield over the Drought of Record for these strategies is shown in *Table 5.55*.

Table 5.55: Austin Onsite Rainwater and Stormwater Harvesting Yield

Water Management Strategies (ac-ft/yr)					
2020	**2030**	**2040**	**2050**	**2060**	**2070**
0	690	1,640	2,520	3,390	4,270

Cost Implications of Proposed Strategy

Estimates for capital and O&M costs in 2018 dollars were provided by Austin, from data in their Austin Water Forward Plan. In order to provide a comparable cost consistent with other strategies in this report, annual and unit costs were developed using the Texas Water Development Board (TWDB) Cost Estimating Tool in September 2018 dollars. Capital costs include storage, treatment, and pumping for each building, but do not include on-site distribution. The following table shows the estimated costs associated with this strategy.

Table 5.56: Austin Onsite Rainwater and Stormwater Harvesting Cost

Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
$8,480,000	$11,768,000	$4,976,000	$1,165

Environmental Considerations

No environmental impacts are expected as a result of implementing this strategy, including impacts to cultural resources or wildlife habitat. Rainwater and stormwater harvesting can provide environmental benefit due to the relatively short distance between the rainwater storage and the end use on the property, reduced energy requirements due to gravity fed collection systems, and the small footprints of storage tanks. Additionally, rainwater and stormwater harvesting can provide environmental benefit by reducing runoff during large storm events.

In some states, water right authorizations or permits are required for rainwater harvesting projects. Texas, however, does not require authorization for rainwater harvesting projects.

Agricultural & Natural Resources Considerations

No impacts to agriculture are expected as a result of implementing this strategy.

[5] TWDB General Guidelines for Fifth Cycle of Regional Water Plan Development Section 3.3 - System Availability and Related WMSs (TWDB Guidelines, April 2018)

Impacts on Other Water Resources of the State

The Austin Water Forward Plan assumes relatively small-scale implementation of this strategy. There are no impacts are expected on other Water Resources of the State at the proposed scale of implementation.

Community-Scale Stormwater Harvesting

Austin Water has assumed that stormwater harvesting at the community level for existing developments would be used solely for irrigation/landscaping, however other configurations could be considered in the future.

Water availability beyond expected yields is dependent on rainfall, storage sizing, and end use demands. Catchment areas for existing developments are calculated from Travis County Contours 2012 (dataset obtained from the Austin Open Data Portal). For new development areas, the development itself is taken as the stormwater catchment. The Runoff Coefficient is assumed to be 0.9. Tank volumes are optimized from yield/storage curves in order to maximize yield and minimize cost and tank footprint. In establishing typical yields for this strategy, Austin used the following methodology:

- Community-Scale Stormwater Harvesting: In Water Forward, the community-scale stormwater harvesting strategy is used to meet needs for irrigation/landscaping of open space. It is assumed that the stormwater will undergo filtration prior to use. Storage is assumed to be an underground tank/cistern or more typically open storage such as a wet-pond. The Region K strategy assumes back-up supply from the potable water distribution system or centralized reclaimed water system.

  City-wide yield estimates used daily rainfall analyzed for the historical period and census-tract-level demand estimates. These were coupled with community/neighborhood-level estimates based on connected catchment area, runoff coefficient, perviousness per land use type, and catchment areas of proposed storages calculated from Travis County topography or the development itself is taken as the stormwater catchment. Stormwater may be harvested from storm drains or flood detention structures. Community/neighborhood-level estimates were then multiplied by expected growth projections throughout the city to estimate city-wide yield. The final yield is a summation of the total of all facility locations. Modeling has shown that supplies from this strategy are available during the Drought of Record.

In establishing typical yields and costs for this strategy, Austin assumed the installation of stormwater harvesting systems in a proportion of new and existing buildings equipped in the following manner:

- Existing single-family residences, multi-family residences, and commercial buildings with outdoor end use
- Newly constructed single-family residences, multi-family residences, and commercial buildings with outdoor end use and indoor (non-potable) toilet flushing, clothes washing, and cooling water

This strategy provides water supply throughout the Drought of Record. When onsite rainwater and stormwater harvesting is not available, Austin Water, as a major water provider, will continue to provide firm water supply to its customers via the potable water system and reclaimed water through the reclaimed water system, in addition to other water management strategies. Austin Water has an overall plan to use firm and other water supplies as a system to provide water through a Drought of Record.

This strategy is expected to provide approximately 197 ac-ft/yr by 2070. This strategy is expected to begin providing supply in 2030.

The estimated combined drought yield for these strategies is shown in *Table 5.57*.

Table 5.57: Austin Community-Scale Stormwater Harvesting Yield

Water Management Strategies (ac-ft/yr)					
2020	**2030**	**2040**	**2050**	**2060**	**2070**
0	55	132	154	175	197

Cost Implications of Proposed Strategy

Estimates for capital and O&M costs in 2018 dollars were provided by Austin, from data in their Austin Water Forward Plan. In order to provide a comparable cost consistent with other strategies in this report, annual costs were developed using the Texas Water Development Board (TWDB) Cost Estimating Tool in September 2018 dollars. Capital costs include storage, treatment, pumping, and the community-scale collection system. The following table shows the estimated costs associated with this strategy.

Table 5.58: Austin Community-Scale Stormwater Harvesting Cost

Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
$204,000	$288,000	$127,000	$645

Environmental Considerations

Environmental impacts as a result of implementing this strategy are expected to be negligible, including impacts to cultural resources or wildlife habitat. Additionally, rainwater and stormwater harvesting can provide environmental benefit by reducing runoff during large storm events.

Quality Considerations

No impacts to water quality are expected as a result of implementing this strategy.

Agricultural & Natural Resources Considerations

No impacts to agriculture are expected, as a result of implementing this strategy.

Impacts on Other Water Resources of the State

Austin has assumed relatively small-scale implementation of this strategy, however, if large-scale adoption were to occur, localized capture of stormwater could reduce flows to downstream surface water bodies. This reduction can be seen as a benefit, as it reduces the negative impacts of peak storm flows (reduced water quality, flooding, etc.).

5.2.3.2.6. Brackish Groundwater Desalination

Austin Water's Water Forward Plan includes brackish groundwater desalination as a strategy for the 2070 planning horizon. Brackish groundwater is defined as groundwater containing between 1,000 and 9,999 milligrams per liter (mg/L) of total dissolved solids. To be utilized for potable use, brackish groundwater may be desalinated or blended with another source water with low total dissolved solids. Texas has already begun implementing brackish groundwater desalination projects, including the commissioning of a 27.5 MGD project by the City of El Paso in 2007 and a 12 MGD project by the San Antonio Water System in 2016.

The specific process used to desalinate water varies depending upon the total dissolved solids, the temperature, and other physical characteristics of the source water, but always requires disposal of concentrate, called brine, that has a higher total dissolved solids content than the source water. Austin Water has identified the following aquifers as potential sources for brackish groundwater: the Edwards, Trinity, Gulf Coast, and Carrizo-Wilcox Aquifers. While Austin Water has not yet selected the aquifer source for this strategy, costs and yields were estimated based on extraction from the Trinity Aquifer and the saline portion of the Edwards Aquifer.

This strategy is expected to provide approximately 5,000 ac-ft/yr by 2070 total, as shown in the table below. Supplies would come from two sources: 2,300 ac-ft/yr from the Trinity Aquifer and 2,700 ac-ft/yr from the Saline Edwards Aquifer. If the volumes are split between the Saline Edwards and the Trinity Aquifers, the full 5,000 ac-ft/yr can be supplied without exceeding each aquifer's MAG. Per the Austin Water Forward Plan, the strategy is expected to be online by 2070, with plans for expanded capacity to 16,000 ac-ft/yr by 2115.

Table 5.59: Austin Brackish Groundwater Desalination Yield

Water Management Strategies (ac-ft/yr)					
2020	**2030**	**2040**	**2050**	**2060**	**2070**
0	0	0	0	0	5,000

Water availability and quality for this strategy is dependent on the selection of source aquifer and utilization rates. Per the TWDB Report 276 (see p. 97, Fig. 12, and Fig. 24), favorable areas for extraction from the Trinity Aquifer within Travis County are located west of Central Austin, and include the upper, middle, and lower Trinity Aquifers. Yields from the lower Trinity Aquifer are "small to moderate and the water is fresh to moderately saline in quality" (500-6,000 mg/L TDS). The middle and upper Trinity Aquifers generally have "lower yields and permeabilities than the lower Trinity, but provide better quality," and are consistently fresh in large pockets. To achieve a yield of 2,300 ac-ft/yr, Austin will likely pursue extraction from the lower Trinity, given its higher yields. Additional information on groundwater availability and quality of the Trinity Aquifer in Travis County may be found in TWDB Report 276.

According to the Barton Springs/Edwards Aquifer Conservation District (BS/EACD), *BS/EACD Report of Investigations 2017-1015*, water sampled from the saline part of Edwards Aquifer in Southeast Travis County ranged from 8,877 mg/L to 18,622 mg/L. Per the same report, "estimates indicate relatively high-yielding wells are possible in the Saline Edwards, with yields greater than 1,000 gpm," indicating that Edwards Aquifer Saline Zone is favorable for extraction. Due to the higher total dissolved solids content of yields from Edwards Aquifer, treatment facilities must be suitable for nearly saline water.

Cost Implications of Proposed Strategy

Facilities and O&M costs were provided by the Austin Water Forward Plan, dated 2018. Costs were updated based on the inclusion of two wellfields in different aquifers, versus one in the Austin Water Forward Plan. In order to provide a comparable cost consistent with other strategies in this report, annual costs were developed using the Texas Water Development Board (TWDB) Cost Estimating Tool in September 2018 dollars.

Infrastructure costs associated with this strategy include:

- Two (2) wellfields, one for the Trinity Aquifer and one for the Saline Edwards Aquifer
- Pump station
- Storage tank
- Reverse osmosis treatment facilities
- Evaporation ponds for disposal
- Land acquisition

The following table shows the estimated costs associated with this strategy.

Table 5.60: Austin Brackish Groundwater Desalination Cost

Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
$86,547,000	$167,689,000	$14,976,000	$2,995

Environmental Considerations

Environmental permits will need to be obtained for the disposal of concentrate brine.

It is assumed that there would be no impacts to cultural resources, but applicable coordination with the Texas Historical Commission prior to construction will be performed. Refer to *Chapter 1, Appendix 1A*, for the complete list by county of threatened and endangered species in the Lower Colorado Regional Water Planning Area. These species may need to be considered during construction of infrastructure.

Additionally, desalination facilities generally require greater energy demands in comparison to surface or low total dissolved solids (TDS) groundwater facilities. Austin would plan to pursue green energy sources for operation of a brackish desalination facility.

Agricultural & Natural Resources Considerations

There are negligible impacts to agriculture or natural resources with respect to acres of land anticipated from this strategy; however, the additional drawdown of the aquifer has the potential to impact agriculture by creating the need to lower pumps, redrill wells, and pay for additional electricity for pumping. As these impacts are indefinite, it is difficult to determine quantified costs associated with these potential impacts. However, the groundwater permitting process is a public process and local groundwater users that may be affected have the ability to provide input regarding concerns on potential drawdown. Given the low permeability of the Trinity Aquifer within Travis County, additional studies will be needed to determine the impacts of the proposed extraction location on the surrounding groundwater table.

5.2.3.2.7. Centralized Direct Non-Potable Reuse

The Austin reclaimed water program is also referred to as Austin's Water Reclamation Initiative. This direct reuse program includes continued development of water distribution systems to provide reclaimed water to meet non-potable water demands within the Austin water service area. Austin has established its Central Reclaimed Water System from the Walnut Creek Wastewater Treatment Plant (WWTP) and its South system from the South Austin Regional WWTP. Through Water Forward, Austin's integrated water resource plan, Austin is also implementing decentralized reuse strategies, which are included in the Region K plan as a separate water management strategy. Austin projects that it will need to develop the use of reclaimed water to the maximum extent possible, up to and if necessary, 100 percent reuse of its effluent to meet future needs. As the level of authorized reclaimed water use in the Austin water service area increases, the amount of flow it returns to the Colorado River may decrease accordingly.

Austin is currently using reclaimed water from its existing reclaimed system to irrigate several golf courses, provide water for cooling towers, and meet other non-potable needs. Austin estimates this use to be approximately 4,600 ac-ft/yr. In order to expand the availability and use of reclaimed water, Austin has completed a series of planning activities, including the 2018 Water Forward Plan. In addition, Austin completed the publication of the 1998 Water Reclamation Initiative (WRI) Planning Document, completion of the north and south system master plans, and a Title XVI federal cost-share program feasibility study in conjunction with the Federal Bureau of Reclamation (FBR).

In addition to the water conservation measures Austin has implemented to reduce water demands, Austin is pursuing the development of reclaimed water as an additional supply of water to meet non-potable demands in the area. To meet the total projected water demands, the Water Reclamation Initiative would need to supply up to an additional 23,250 ac-ft/yr for direct municipal and manufacturing, and 1,750 ac-ft/yr for steam-electric non-potable purposes by the year 2070. The approximate total amount of this direct reuse supply in Travis County would be approximately 30,000 ac-ft/yr, which includes approximately 4,600 ac-ft/yr of existing direct reuse supply.

Austin anticipates that the use of reclaimed water will increase steadily from the current level of 4,600 ac-ft/yr with construction of additional major infrastructure components of the reclaimed system, including pump stations, storage, reclaimed water mains, and wastewater treatment plant filter and process improvements at multiple facilities. Austin will continue to pursue implementation of its WRI and anticipates that additional capacity will be available in the future as the needs increase over the planning horizon. *Table 5.61* shows the projected capacity increases for the three main categories of reuse for each decade of the planning period.

Table 5.61: Anticipated Centralized Reclaimed Water Capacity (Direct Reuse)

Year	2020	2030	2040	2050	2060	2070
Existing Direct Reuse Yield (ac-ft/yr)	4,600	4,600	4,600	4,600	4,600	4,600
Additional Municipal and Manufacturing Direct Reuse Yield (ac-ft/yr)	500	2,990	10,250	14,583	18,917	23,250
Additional Steam- Electric Direct Reuse Yield (ac-ft/yr)	0	1,750	1,750	1,750	1,750	1,750
Total Projected Direct Reuse Yield (ac-ft/yr)	5,100	9,340	16,600	20,930	25,270	29,600

Through its ongoing water resources planning efforts such as Water Forward, Austin Water evaluates its water reuse program and options for expansion. Future Region K plan updates will reflect changes as additional Austin water reclamation program information becomes available.

Projected Reduction of Return Flows

Austin recognizes that the water demand projections contained in the Lower Colorado Regional Water Plan are only projections. Actual water demands may increase faster or slower than projected. Austin will monitor the growth of its water demands and adjust its reclaimed water program, as well as its other water conservation programs, accordingly. As a result, Austin has indicated that it may increase the use of reclaimed water at a faster rate than projected in this plan. Austin believes that the increased use of reclaimed water will provide, in addition to the benefit of conserving sources of raw water, a monetary benefit to Austin through decreased raw water costs. As return flows discharged by Austin may diminish in the future due to increasing reclamation of water, other sources may need to be dedicated or developed to meet needs that may currently be met by return flows discharged by Austin.

Any decrease in municipal return flows will likely be gradual. However, Austin projects that it will increase its use of reclaimed water to the maximum extent feasible to meet demands above 325,000 ac-ft/yr, whether those demands occur before or after 2070.

Cost Implications of Proposed Strategy

In addition to water conservation, the use of reclaimed water has been identified as a significant source of water to meet Austin's projected demand deficits in 2070. Austin has completed planning studies, including the Water Forward Plan, for a centralized direct non-potable reuse to serve potential customers in Austin's service area. Centralized reuse will provide a portion of the water supply required to meet Austin's identified needs.

Costs for this strategy were developed based on background information provided by Austin Water in 2018 dollars. In order to provide a comparable cost consistent with other strategies in this report, annual costs were developed using the Texas Water Development Board (TWDB) Cost Estimating Tool in September 2018 dollars.

The following table shows the estimated costs associated with this strategy for the planning, design, and construction of the additional major infrastructure components of the reclaimed system, including pump stations, storage, reclaimed water mains, and wastewater treatment plant filter and process improvements at multiple facilities.

Table 5.62: Austin Centralized Direct Non-Potable Reuse Cost

Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
$210,931,000	$286,031,000	$24,865,000	$995

Environmental Considerations

The water quality impacts from direct reuse of reclaimed water are regulated by the TCEQ through 30 TAC Chapter 210. Reclaimed water projects authorized under these regulations are presumed to be protective of human health and the environment. The potential impacts generated through the construction of the proposed pipelines and pump stations will need to be addressed in the preliminary engineering studies to be conducted for these projects.

The use of reclaimed water presents an alternative for providing water for non-potable uses without the development of new water supplies for Austin for the planning period. The costs and environmental impacts of expanding Austin's current reuse system will have to be determined as more specific information, such as the locations of customers to be served, is identified. The extent of pipeline and other transmission facilities will have to be determined before specific environmental impacts can be estimated. However, the majority of the facilities needed will most likely be placed in existing easements and, therefore, minimize the impact upon natural resources.

Table 5.63 shows the expected return flows from Austin after accounting for reuse and other demand reduction measures. Over the planning period, return flow amounts are projected to continue to be in the range of approximately 100,000 to 115,000 ac-ft/yr. The environmental impact analysis for this strategy compared the impact of return flows less the amount of reuse to the impact of no return flows for 2020 and 2070 scenarios. As would be expected, the impacts to instream flows and freshwater inflows to Matagorda Bay showed mainly flow increases.

Negligible impacts are anticipated to wildlife habitat and cultural resources.

Agricultural & Natural Resources Considerations

Impact to agriculture is negligible based on the projected return flow amounts over the planning period, as shown in *Table 5.63.*

Table 5.63: Projected Austin Return Flows by Decade*

2020	2030	2040	2050	2060	2070
108,978	114,129	102,440	102,121	99,557	100,935

*Based on data provided by Austin. These are projected return flow amounts after accounting for Austin's projected conservation, direct reuse, and other projects utilizing Austin's treated effluent. These projections are subject to change and are updated each planning cycle.

As allowed by state law and as contemplated by Austin and LCRA 2007 Settlement Agreement, Austin intends to use reclaimed water to the maximum extent feasible to meet demands above 325,000 ac-ft/yr, whether those demands occur before or after 2070. As a result, although current projections do not indicate that Austin will need to reuse all its effluent during this planning cycle, this strategy could result in Austin potentially reusing all its effluent to meet growing demands and, ultimately, Austin could have zero return flow to the Colorado River from its wastewater treatment plants (WWTP).

5.2.3.2.8. Decentralized Direct Non-Potable Reuse

The Decentralized Direct Non-Potable Reuse strategy proposes to treat and reuse wastewater in close proximity to the source of wastewater production. Smaller wastewater treatment plants are used to treat the wastewater to non-potable quality. End-uses of reused water include toilet flushing; cooling water; and irrigation not in the Critical Water Quality Zone, floodplain, or the Edwards Aquifer Recharge Zone. Austin has developed the methods listed below for decentralized direct non-potable reuse.

Distributed Wastewater Reuse

Distributed Wastewater Reuse is defined by the COA as the collection of wastewater from the sewage system of new developments, treatment to non-potable quality, and reuse at the local/community scale. Capital required for this method includes a small-scale treatment plant, balancing storage, transfer pump and piping, and distribution piping.

Sewer Mining (Wastewater Scalping)

Sewer mining is defined by the COA as the extraction of wastewater from the existing centralized wastewater collection system, treatment to non-potable quality, and reuse at the local/community scale for new or existing developments. Capital required for this method includes extraction (riser and pump from sewer main), small-scale treatment plant, balancing storage, transfer pump and piping, and distribution piping.

This strategy is expected to provide approximately 16,680 ac-ft/yr by 2070, as shown in the table below. Water availability is dependent on wastewater flows from the system area, storage capacities of the proposed system, and proposed end uses for non-potable water. While conservation efforts may decrease wastewater flows over time, wastewater flows are a relatively consistent and predictable source water, in comparison to rain or surface water. Per the Austin Water Forward Plan, the strategy is expected to be online by 2030.

Table 5.64: Austin Decentralized Direct Non-Potable Reuse Yield

Water Management Strategies (ac-ft/yr)					
2020	**2030**	**2040**	**2050**	**2060**	**2070**
0	1,400	4,160	8,330	12,510	16,680

Cost Implications of Proposed Strategy

Estimates for capital and O&M costs were provided by Austin Water in 2018 dollars, not including engineering, legal, or contingency costs. Facilities' costs include collection, treatment, storage, and pumping. No costs related to distribution of the treated reclaimed water were included. In order to provide a comparable cost consistent with other strategies in this report, engineering, legal, and contingency costs were developed using the Texas Water Development Board (TWDB) Cost Estimating Tool in September 2018 dollars.

The following table shows the estimated costs associated with this strategy that are allowed under regional water planning guidelines.

Table 5.65: Austin Decentralized Direct Non-Potable Reuse Operations Cost

Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
$5,549,000	$7,703,000	$6,105,000	$366

Environmental Considerations

Assuming the proposed local wastewater plants incur a small footprint, this strategy provides environmental benefit by reducing the energy spent transmitting wastewater from far reaches of the collection system to existing centralized wastewater treatment plants.

It is assumed that there would be no impacts to cultural resources, but applicable coordination with the Texas Historical Commission prior to construction will be performed. Refer to *Chapter 1, Appendix 1A*, for the complete list by county of threatened and endangered species in the Lower Colorado Regional Water Planning Area. These species may need to be considered during construction of infrastructure.

No outdoor end uses for this strategy are proposed for sensitive recharge areas, including the Edwards Aquifer Recharge Zone.

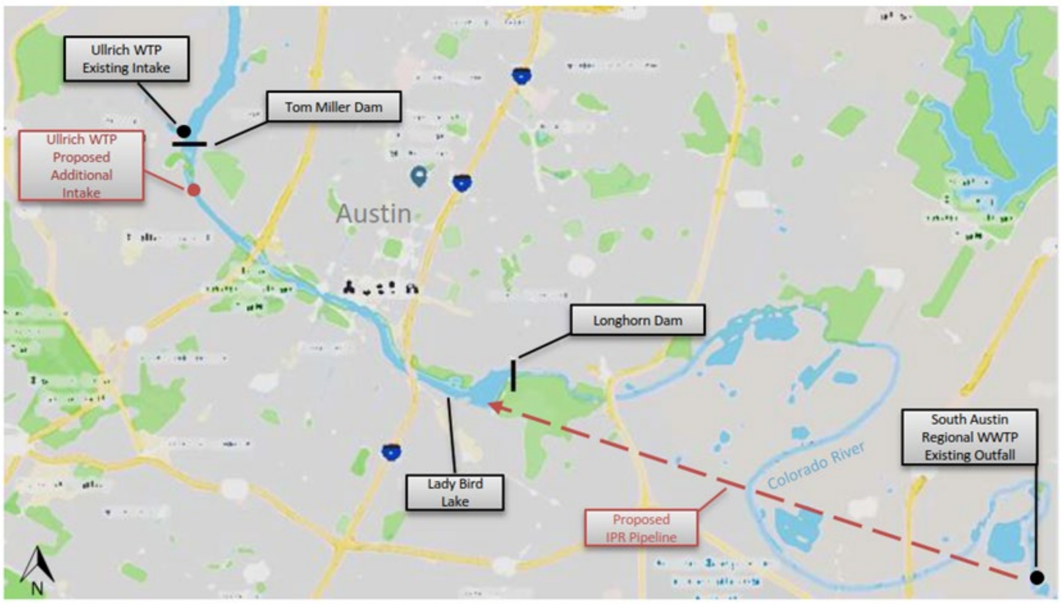
Agricultural & Natural Resources Considerations

Impact to agriculture is negligible based on the projected return flow amounts over the planning period.

5.2.3.2.9. Capture Local Inflows to Lady Bird Lake

This strategy for Austin involves capturing spring flows, including Barton Springs, and stormwater flows in Lady Bird Lake when they are not needed for downstream senior water rights including downstream instream flows or LCRA's Water Management Plan. This strategy facilitates the diversion of the city's run-of-river water during wetter periods and would plan to use the infrastructure installed as part of the Austin Indirect Potable Reuse through Lady Bird Lake strategy to convey water from Lady Bird Lake (LBL) to the intake at Ullrich Water Treatment Plant, as shown in *Figure 5.1*.

Figure 5.1: Capture Local Inflows to Lady Bird Lake and Indirect Potable Reuse through Lady Bird Lake Project



Note: figure is schematic and conceptual. Precise location of proposed infrastructure will vary.

This strategy is expected to provide an annual yield of 3,000 ac-ft/yr over the Drought of Record conditions, once implemented, as shown in the following table. Water availability for the Capture Local Inflows to Lady Bird Lake option would generally be intermittent and seasonal, with availability more likely in the months of November through February when downstream agricultural irrigation operations are offline. While the strategy may not intend to produce a yield year-round, the annual yield is modeled for Drought of Record conditions and that yield would be available on average in every year of the drought. Per the Austin Water Forward Plan, the strategy is expected to be online by 2040.

Table 5.66: Austin Capture Local Inflows to Lady Bird Lake Yield

Water Management Strategies (ac-ft/yr)					
2020	2030	2040	2050	2060	2070
0	0	3,000	3,000	3,000	3,000

In cases when local inflows to Lady Bird Lake are not available as a supplemental water supply, Austin Water, as a major water provider, will continue to use water from its Colorado River rights and LCRA back-up contract, in addition to other water management strategies. Austin Water has an overall plan to use firm and other water supplies as a system to provide water through a Drought of Record. The Capture Local Inflows to Lady Bird Lake water management strategy was added into the approved Region K Cutoff Model. The Region K Cutoff Model is described in *Appendix 3B* of the 2021 Region K Water Plan. The models used for Austin's Water Forward Plan were not used to develop the firm yield for the 2021 Region K Plan. The firm yield for this strategy was calculated for the Region K Drought of Record period, October 2007 through December 2016, in accordance with the Region K's approved hydrologic variance. Modeling results indicate that the drought of record average yield from this strategy is projected to be 3,000 ac-ft/yr or more.

Cost Implications of Proposed Strategy

The capital costs for the infrastructure required to convey the water captured in Lady Bird Lake to the Ullrich Water Treatment Plant are included in the Austin Indirect Potable Reuse through Lady Bird Lake strategy and are not included as part of this strategy. The annual and unit costs for operation and maintenance for this strategy are based on scaled O&M costs for 3,000 ac-ft from the Indirect Potable Reuse through Lady Bird Lake strategy, which was based on the Austin Water Forward plan, dated 2018. In order to provide a comparable cost consistent with other strategies in this report, annual costs were developed using the Texas Water Development Board (TWDB) Cost Estimating Tool in September 2018 dollars.

The following table shows the estimated annual and unit costs.

Table 5.67: Austin Capture Local Inflows to Lady Bird Lake Cost

Total Facilities Cost[1]	Total Project Cost[1]	Largest Annual Cost	Unit Cost ($/ac-ft)
$0	$0	$994,000	$331

[1] Infrastructure and costs are included in Indirect Potable Reuse through Lady Bird Lake.

Environmental Considerations

This strategy involves capturing spring flows, including Barton Springs, and stormwater flows in Lady Bird Lake when they are not needed for downstream senior water rights including LCRA's Water Management Plan. Diversions are anticipated to generally be conducted during wetter periods when water is typically available to other users in the basin. Therefore, this strategy is anticipated to have negligible effects on downstream flows in the Colorado River and estuary flows to Matagorda Bay. There is not an additional water right permit anticipated to be required for this strategy.

Agricultural & Natural Resources Considerations

Impacts to agriculture, cultural resources, or natural resources including wildlife habitat are not expected.

5.2.3.2.10. Indirect Potable Reuse through Lady Bird Lake

Austin is proposing Indirect Potable Reuse through Lady Bird Lake as a strategy. The strategy would consist of conveying a highly treated portion of the South Austin Regional Wastewater Treatment Plant discharge to Lady Bird Lake via a reclaimed water transmission main. Water would be withdrawn from Lady Bird Lake with an intake pump station and pumped into the Ullrich Water Treatment Plant intake line. The infrastructure associated with pulling the water from Lady Bird Lake for treatment at Ullrich Water Treatment Plant could also be used with the Capture Local Inflows to Lady Bird Lake strategy for Austin to provide a smaller amount of water more regularly under wetter conditions outside a drought, as shown in *Figure 5.1* in *Section 5.2.3.2.9*.

The Austin Water Forward Plan recommends that this strategy be utilized only when Highland Lakes storage volumes are well below emergency levels. Therefore, this option is only being considered at this time as a source of supply under certain extreme drought conditions.

The Austin Water Forward Plan estimates that this strategy will be online by 2040, with yields up to 20,000 ac-ft/yr by 2070, as shown in the table below.

Table 5.68: Austin Indirect Potable Reuse through Lady Bird Lake Yield

Water Management Strategies (ac-ft/yr)					
2020	**2030**	**2040**	**2050**	**2060**	**2070**
0	0	11,000	14,000	17,000	20,000

The major infrastructure required for this strategy includes:

- Acceleration of construction of reclaimed water lines identified in Austin's Reclaimed Master Plan
- Water Intake and Pump Station
- Transmission piping and appurtenances
- Improvements at South Austin Regional Wastewater Treatment Plant for a portion of the effluent to have additional treatment before discharge into Lady Bird Lake

As part of developing the indirect potable reuse strategy, a number of permitting and engineering analyses will need to be conducted. Project components to be addressed include water quality modeling, TCEQ permitting, and public education.

Cost Implications of Proposed Strategy

Capital and O&M cost estimates were provided by Austin Water. In order to provide a comparable cost consistent with other strategies in this report, annual costs were developed using the Texas Water Development Board (TWDB) Cost Estimating Tool in September 2018 dollars.

Note that the costs associated with the reclaimed water main that will transfer water from South Austin Regional Wastewater Treatment Plant to Lady Bird Lake are not included in the total capital costs for this strategy but are instead included in the costs associated with the Austin Centralized Direct Non-Potable Reuse strategy.

The following table shows the estimated costs associated with this strategy.

Table 5.69: Austin Indirect Potable Reuse through Lady Bird Lake Cost

Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
$23,409,000	$35,839,000	$9,147,000	$457

Environmental Considerations

As stated previously, increased level of treatment of wastewater may be required to ensure sufficient water quality in Lady Bird Lake. Additional investigation will be required to evaluate environmental and water quality considerations and permitting in Lady Bird Lake.

This strategy helps satisfy a component of Austin demands already anticipated to be met through Colorado River diversions, particularly during drought and low reservoir storage volume conditions in lakes Travis and Buchanan.

There are no expected impacts to cultural resources. Refer to *Chapter 1, Appendix 1A*, for the complete list by county of threatened and endangered species in the Lower Colorado Regional Water Planning Area. These species may need to be considered during construction of infrastructure.

Agricultural & Natural Resources Considerations

Impact to agriculture is negligible based on the projected return flow amounts over the planning period.

5.2.3.2.11. Longhorn Dam Operations Improvements

This storage efficiency strategy consists of making improvements to Longhorn Dam. As part of this strategy, new bascule gate controls and operations will be installed to increase the efficiency of gate operations and reduce water loss downstream. Without this strategy in place, water lost out of Lady Bird Lake due to inefficiencies may need to be made up out of the Highland Lakes and would be unavailable to other users in the basin. Austin currently has projects in its CIP for improvements to Longhorn Dam that would help increase the dam's storage efficiency by installing new bascule gate controls. Cumulatively, these projects are expected to deliver approximately 3,000 ac-ft/yr of water savings, as shown in the following table.

Table 5.70: Austin Longhorn Dam Operations Improvement Yield

Water Management Strategies (ac-ft/yr)					
2020	**2030**	**2040**	**2050**	**2060**	**2070**
0	3,000	3,000	3,000	3,000	3,000

Cost Implications of Proposed Strategy

Costs for this strategy were developed based on information provided by Austin Water about the cost for bascule gate improvements, in 2018 dollars. In order to provide a comparable cost consistent with other strategies in this report, annual and unit costs were developed using the Texas Water Development Board (TWDB) Cost Estimating Tool in September 2018 dollars.

The capital cost for this strategy is primarily driven by the improvements to the gates. The following table shows the estimated costs associated with this strategy.

Table 5.71: Austin Longhorn Dam Operations Improvement Cost

Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
$1,000,000	$1,388,000	$108,000	$36

Environmental Considerations

This strategy provides efficiencies that reduce unintended releases of water downstream in excess of environmental flow (instream flows) requirements, saving an estimated amount of up to 3,000 ac-ft/yr. LCRA manages the river system to meet downstream environmental flow needs and is ultimately responsible for ensuring instream flows requirements are being met. These requirements can be found in the LCRA Water Management Plan.

There are no expected impacts to cultural resources or wildlife habitat from this strategy.

Agricultural & Natural Resources Considerations

Negligible impacts to agriculture or natural resources are expected as a result of implementing this strategy.

5.2.3.2.12. Lake Austin Operations

Lake Austin is normally operated as a pass-through lake with relatively stable lake levels. This strategy would allow Lake Austin to operate with a varying level in the event that combined storage in lakes Travis and Buchanan drops below 600,000 ac-ft, as included in the Austin Water Forward Plan. This would allow local flows to be captured during storm events and stored for use, as opposed to excess runoff spilling through the Tom Miller Dam to flow downstream. The level could vary by approximately 3 feet during months outside of the peak recreational period for Lake Austin. The period for operating with a variable level would potentially be in the months of October through May.

This strategy provides water supplies during the Drought of Record. The Lake Austin Operations water management strategy was added into the approved Region K Cutoff Model. The Region K Cutoff Model is described in *Appendix 3B* of the 2021 Region K Water Plan. The firm yield for this strategy was calculated for the Region K Drought of Record period, October 2007 through December 2016, in accordance with Region K's approved hydrologic variance. Modeling results indicate that the drought of record average yield from this strategy is projected to be about 1,250 ac-ft/yr.

There are no capital costs and no new permits associated with this strategy, and it could be implemented fairly quickly if needed under a Drought of Record condition. Austin plans to conduct a robust public outreach and education process in advance of possible implementation of this strategy.

The projected annual yields for the Drought of Record from this strategy are shown in the following table.

Table 5.72: Austin Lake Austin Operations Yield

Water Management Strategies (ac-ft/yr)					
2020	**2030**	**2040**	**2050**	**2060**	**2070**
1,250	1,250	1,250	1,250	1,250	1,250

Cost Implications of Proposed Strategy

Annual and unit costs in 2018 dollars were taken from the Austin Water Forward effort, dated 2018, and are shown in the following table. In order to provide a comparable cost consistent with other strategies in this report, annual costs were developed using the Texas Water Development Board (TWDB) Cost Estimating Tool in September 2018 dollars. No construction or capital costs were assumed. The costs listed include potential costs for professional public outreach resources and water treatment O&M costs to implement this strategy.

Table 5.73: Austin Lake Austin Operations Cost

Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
$0	$0	$545,000	$436

Environmental Considerations

Environmental impacts are expected to be negligible.

Agricultural & Natural Resources Considerations

No impacts to agriculture, cultural resources, or wildlife habitat are expected as a result of implementing this strategy.

Impacts on Other Water Resources in the State

Minimal impacts to downstream flows are expected as a result of implementing this strategy.

5.2.3.3 West Travis County Public Utility Agency

West Travis County Public Utility Agency (WTCPUA) provides water to both retail customers and wholesale customers in Hays and Travis counties. Water management strategies have been developed to meet their future needs and their customers' potential future needs. WTCPUA currently has a contract for water with LCRA, and the majority of their wholesale customers also have contracts for water from LCRA. WTCPUA provides the treatment and transport for the contracted water, thus infrastructure has been sized to handle future wholesale customer needs, but the water supply contracts themselves will be with LCRA. See *Section 5.2.3.1.4* for additional information on the LCRA contract amendments for wholesale customers of WTCPUA. Recommended strategies for WTCPUA are listed below, although the details for each strategy are provided in other sections of the chapter. The respective sections are provided.

- Municipal Conservation – See *Section 5.2.2.3* for additional details

- Municipal Drought Management - See *Section 5.2.4.9.1* for additional details
- Hays County Pipeline - See *Section 5.2.4.3.1* for additional details
- Direct Potable Reuse - See *Section 5.2.5.4.4* for additional details
- Direct Reuse (Non-Potable) - See *Section 5.2.5.5.8* for additional details

5.2.4 Regional Water Management Strategies

There are several water management strategies that apply to multiple WUG categories, applied throughout the region. These strategies are discussed in this regional water management section of the report. For strategies specific to a category of water use, (Municipal, Irrigation, Manufacturing, Mining, and Steam-Electric Power) refer to later sections of the report.

For municipal WUGs with shortages, water conservation was considered before these regional strategies, please refer to *Section 5.2.2.3*.

5.2.4.1 Expanded Local Use of Groundwater

This group of strategies includes WUGs with existing groundwater sources that may be seeking to expand the amount of groundwater they produce from that source or sources to meet their increasing needs. The general strategy is divided into sections by aquifer.

5.2.4.1.1. Carrizo-Wilcox Aquifer

This strategy would involve pumping additional groundwater from the Carrizo-Wilcox Aquifer, either using the WUG's existing wells or drilling additional wells. This additional water, referred to as remaining supply, was determined by subtracting the water that is currently allocated from the available water under the Modeled Available Groundwater (MAG). The Carrizo-Wilcox Aquifer in Bastrop County had little remaining water for strategies after supplies were allocated, so strategy volumes are limited.

Table 5.74 presents the WUGs that would utilize this strategy along with the implementation decade and the amount of water to be pumped.

Table 5.74: Carrizo-Wilcox Aquifer Expansion Yield

WUG	County	Basin	Water Management Strategies (ac-ft/yr)					
			2020	2030	2040	2050	2060	2070
Aqua WSC	Bastrop	Brazos (to Colorado)	0	100	250	500	800	800
Bastrop County Total for Brazos River Basin			**0**	**100**	**250**	**500**	**800**	**800**
Aqua WSC	Bastrop	Colorado	0	200	100	50	0	0
Elgin	Bastrop	Colorado	0	0	0	0	50	50
Bastrop County Total for Colorado River Basin			**0**	**200**	**100**	**50**	**50**	**50**

This strategy was applied to the following WUGs in Bastrop County: Aqua WSC and Elgin. Elgin is located in both Bastrop and Travis Counties in Region K, and a portion of the strategy supplies for Elgin were allocated to the Travis County portion. While the need for Aqua WSC is located in the Colorado basin, this strategy supplies Aqua WSC with groundwater from the Brazos and Colorado basins. The needs for Aqua WSC are close to 20,000 ac-ft/yr by 2070 after conservation and drought management are implemented, and this strategy does not have the available groundwater volume to meet that need. An alternative version of this strategy was developed that does meet the full need of Aqua WSC through groundwater. It is included in *Section 5.3.2*.

Cost Implications of Proposed Strategy

Table 5.75 presents a summary of the probable costs for each WUG utilizing this strategy. The four cost components analyzed during cost estimation of this strategy were: Total Facilities Cost, Total Project Cost, Annual Cost, and Unit Cost.

The costs of the groundwater supply strategies were estimated using the Texas Water Development Board (TWDB) Cost Estimating Tool. For WUGs with a strategy yield of greater than 100 ac-ft/yr, yield is assumed to be acquired through the construction of new wells. The number of new wells was determined in the Cost Estimating Tool, based on the largest quantity of water supplied over the planning period. Wells were all assumed to be the same type, size, at the same elevation, and to have an efficiency of 80%. The well field layout was determined by two wells per "node," a 0.5-mile transmission line between each well and its node, and an additional 0.5 mile "trunk" line connecting to the next node. One mile of transmission piping to connect the wellfield to the distribution system was assumed. A peaking factor of two (2) was assumed (twice the largest quantity of water supplied). Assumptions of well capacity and depth were made by reviewing historical well data for wells located in proximity to each WUG. Historical data was obtained using the Texas Water Development Board Groundwater Database's well search and water level search functions.

Aqua WSC is supplied by two river basins through this strategy, thus two separate well fields are assumed, one for each basin. The costs for each basin have been combined for this analysis.

Additional capital costs including engineering, legal services, contingencies, environmental and archeology studies and mitigation, land acquisition and surveying, and interest during construction were estimated using the Cost Estimating Tool. Annual costs including debt service, operation and maintenance, and pumping energy costs were also estimated using the tool.

For WUGs with a strategy yield of less than or equal to 100 ac-ft/yr (Elgin), yield is assumed to be acquired through additional pumping from existing wells. For this WUG, only the increased annual energy cost was included in the unit cost for the strategy, with no capital expenditures. Assumptions for well capacity, depth, efficiency, elevation, and layout follow the methodology for new well construction listed above.

Table 5.75: Carrizo-Wilcox Aquifer Expansion Cost

WUG	County	Basin	Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
Aqua WSC	Bastrop	Brazos, Colorado	$6,460,000	$9,163,000	$801,000	$1,001
Elgin	Bastrop	Colorado	$0	$0	$4,000	$80

Environmental Considerations

The environmental impacts of expanded groundwater use will vary depending upon site characteristics. Some impacts may occur from the expansion of existing groundwater infrastructure, but well sites are generally small in areal extent, and the disturbance from pipeline construction is temporary. Availability numbers were developed by the Lost Pines Groundwater Conservation District for this aquifer in Bastrop County, and they attempt to limit the groundwater use to the amount that can be replenished on an annual basis. If this is the case, then the impact on the environment should be low. The water supply is within the Modeled Available Groundwater (MAG), so this strategy could contribute to drawdown in the aquifer of up to 240 feet by 2070, relative to January 2000 conditions. The Groundwater Conservation Districts will monitor the aquifer levels for any needed changes to the identified available volume.

While it is assumed that this strategy would have negligible impacts to cultural resources and wildlife habitat, coordination with the Texas Historical Commission will need to occur and proper environmental field studies will need to be performed before any construction begins. Refer to *Chapter 1, Appendix 1A,* for the complete list by county of threatened and endangered species in the Lower Colorado Regional Water Planning Area. These species may need to be considered during construction of infrastructure.

Agricultural & Natural Resources Considerations

There are negligible impacts to agriculture or natural resources with respect to acres of land anticipated from this strategy; however, the additional drawdown of the aquifer has the potential to impact agriculture by creating the need to lower pumps, redrill wells, and pay for additional electricity for pumping. As these impacts are indefinite, it is difficult to determine quantified costs associated with these potential impacts. However, the groundwater permitting process is a public process and local groundwater users that may be affected have the ability to provide input regarding concerns on potential drawdown.

5.2.4.1.2. Edwards-BFZ Aquifer

This strategy would involve pumping additional groundwater from the Edwards-BFZ Aquifer using the WUGs' existing wells. This additional water, referred to as remaining supply, was determined by subtracting the water that is currently allocated from the available water.

Table 5.76 presents the WUGs that would utilize this strategy along with the implementation decade and the amount of water to be pumped. Each of the two WUGs requested that this strategy be included, but the amount of remaining available groundwater was small, so the strategy volumes are small.

Table 5.76: Edwards-BFZ Aquifer Expansion Yield

WUG	County	Basin	Water Management Strategies (ac-ft/yr)					
			2020	2030	2040	2050	2060	2070
Pflugerville	Travis	Colorado	0	0	20	20	20	20
Sunset Valley	Travis	Colorado	0	0	50	50	50	50
Travis County Total for Colorado River Basin			**0**	**0**	**70**	**70**	**70**	**70**

This strategy was applied to the Pflugerville and Sunset Valley WUGs in Travis County in the Colorado Basin.

Cost Implications of Proposed Strategy

Table 5.77 presents a summary of the probable costs for each WUG utilizing this strategy. The cost components analyzed during cost estimation of this strategy include Annual Cost and Unit Cost.

Per Barton Springs/Edwards Aquifer GCD requirements, a $0.17 per 1,000 gallons (approximately $55.39/ac-ft) production fee was assumed.

The costs of the groundwater supply strategies were estimated using the Texas Water Development Board (TWDB) Cost Estimating Tool. No new wells or distribution piping was assumed for this strategy; instead, yield is assumed to be acquired through additional pumping from existing wells. As such, only the increased annual energy cost was included in the unit cost for the strategy, with no capital costs assumed.

Table 5.77: Edwards-BFZ Aquifer Expansion Cost

WUG	County	Basin	Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
Pflugerville	Travis	Colorado	$0	$0	$1,000	$50
Sunset Valley	Travis	Colorado	$0	$0	$6,000	$120

Environmental Considerations

The environmental impacts of expanded groundwater use will vary depending upon site characteristics. Some impacts may occur from the expansion of existing groundwater infrastructure, but well sites are generally small in areal extent, and the disturbance from pipeline construction is temporary. Water supply is within the MAG, so spring/streamflow should be maintained at 42 ac-ft/month and 49.7 ac-ft/month or higher, as dictated by the DFC for the Edwards-BFZ Aquifer for Travis County for GMA-8 and GMA-10, respectively, as described in *Chapter 3* of the 2021 Plan. There are zero anticipated impacts to cultural resources.

Agricultural & Natural Resources Considerations

There are negligible impacts to agriculture or natural resources with respect to acres of land anticipated from this strategy; however, the additional drawdown of the aquifer has the potential to impact agriculture by creating the need to lower pumps, redrill wells, and pay for additional electricity for pumping. As these impacts are indefinite, it is difficult to determine quantified costs associated with these potential impacts. However, the groundwater permitting process is a public process and local groundwater users that may be affected have the ability to provide input regarding concerns on potential drawdown.

5.2.4.1.3. Ellenburger-San Saba Aquifer

This strategy would involve pumping additional groundwater from the Ellenburger-San Saba Aquifer, either using the WUG’s existing wells, drilling additional wells or in the case of Bertram, using a raw water intake. This additional water, referred to as remaining supply, was determined by subtracting the water that is currently allocated from the available water.

Table 5.78 presents the WUGs that would utilize this strategy along with the implementation decade and the amount of water to be pumped.

Table 5.78: Ellenburger-San Saba Aquifer Expansion Yield

WUG	County	Basin	Water Management Strategies (ac-ft/yr)					
			2020	2030	2040	2050	2060	2070
Johnson City	Blanco	Colorado	0	100	100	100	100	100
Blanco County Total for Colorado River Basin			**0**	**100**	**100**	**100**	**100**	**100**
Bertram	Burnet	Colorado (to Brazos)	0	750	2,000	2,000	2,000	2,000
Mining	Burnet	Colorado	0	1,000	1,000	1,000	1,000	1,000
Burnet County Total for Colorado River Basin			**0**	**1,750**	**3,000**	**3,000**	**3,000**	**3,000**

This strategy was applied to the following WUGs: Johnson City in Blanco County, Mining in Burnet County, and Bertram in Burnet County.

Cost Implications of Proposed Strategy

Table 5.79 presents a summary of the probable costs for each WUG utilizing this strategy. The four cost components analyzed during cost estimation of this strategy were: Total Facilities Cost, Total Project Cost, Annual Cost, and Unit Cost.

The costs of the groundwater supply strategies were estimated using the Texas Water Development Board (TWDB) Cost Estimating Tool.

For new wells, a peaking factor of two (2) was assumed (twice the largest quantity of water supplied). The number of new wells was determined in the Cost Estimating Tool, based on the largest quantity of water supplied over the planning period. Wells were all assumed to be the same type, size, at the same elevation, and to have an efficiency of 80 percent. The well field layout was determined by two wells per "node," a 0.5-mile transmission line between each well and its node, and an additional 0.5 mile "trunk" line connecting to the next node.

Bertram provided details specific to their project that have been included in this analysis. The identified water source for the Bertram groundwater expansion project is the accumulated water that collects in an old quarry pit located approximately three miles south of the city of Burnet in the Colorado Basin. TCEQ has made the determination that the quarry is an off-channel reservoir and does not require any water right permits. Raw water (considered to be groundwater for regional water planning purposes) will be pumped from the existing pit/reservoir to an existing nearby ground storage tank. In addition, one or more groundwater wells would be drilled in the area to increase access. Infrastructure required for this project includes:

- ~1.8 MGD raw water intake from quarry pit/reservoir, assumed to be located 50 feet deep

- ~1.8 MGD rated capacity water treatment plant
- 7,470 linear feet of 16-inch transmission pipe
- One (1) contingency well

Additional capital costs including engineering, legal services, contingencies, environmental and archeology studies and mitigation, land acquisition and surveying, and interest during construction were estimated using the Cost Estimating Tool. No land acquisition costs were assumed for Bertram as they own or lease the property the wells would be drilled on. Annual costs including debt service, operation and maintenance, and pumping energy costs were also estimated using the tool.

Johnson City has additional unused wells that can come online so costs were only included for additional energy requirements for this WUG.

Table 5.79: Ellenburger-San Saba Aquifer Expansion Cost

WUG	County	Basin	Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
Johnson City	Blanco	Colorado	$0	$0	$7,000	$70
Bertram	Burnet	Colorado (to Brazos)	$14,926,000	$20,829,000	$2,470,000	$1,235
Mining	Burnet	Colorado	$4,782,000	$7,097,000	$581,000	$581

Environmental Considerations

The environmental impacts of expanded groundwater use from the Ellenburger-San Saba Aquifer will vary depending upon site characteristics but are not expected to be significant. Some impacts may occur from the expansion of existing groundwater infrastructure, but well sites are generally small in areal extent and the disturbance from pipeline construction is temporary. The water supply is within the Modeled Available Groundwater (MAG), so this strategy could contribute to maintaining at least a 90% saturated thickness of the aquifer from 2010 to 2070, as described in *Chapter 3*. The Groundwater Conservation Districts will monitor the aquifer levels for any needed changes to the identified available volume.

While it is assumed that this strategy would have negligible impacts to cultural resources and wildlife habitat, coordination with the Texas Historical Commission will need to occur and proper environmental field studies will need to be performed before any construction begins. Refer to *Chapter 1, Appendix 1A*, for the complete list by County of threatened and endangered species in the Lower Colorado Regional Water Planning Area. These species may need to be considered during construction of infrastructure.

Agricultural & Natural Resources Considerations

The Ellenburger-San Saba is a source of water supply for agricultural interests in Burnet, Blanco, Gillespie, and Llano Counties. There are negligible impacts to agriculture or natural resources with respect to acres of land anticipated from this strategy; however, the additional drawdown of the aquifer has the potential to impact agriculture by creating the need to lower pumps, redrill wells, and pay for additional electricity for pumping. As these impacts are indefinite, it is difficult to determine quantified costs associated with these potential impacts. However, the groundwater permitting process is a public process and local groundwater users that may be affected have the ability to provide input regarding concerns on potential drawdown.

5.2.4.1.4. Gulf Coast Aquifer

This strategy would involve pumping additional groundwater from the Gulf Coast Aquifer, either using the WUG's existing wells or drilling additional wells. This additional water, referred to as remaining supply, was determined by subtracting the water that is currently allocated from the available water. This strategy includes expanding groundwater for the Wharton Water User Group (WUG) in response to the Wharton Water Supply strategy, detailed in *Section 5.2.5.2.*

Table 5.80 presents the WUGs that would utilize this strategy along with the implementation decade and the amount of water to be pumped. Additional groundwater was only allocated to meet each WUG's individual shortage.

Table 5.80: Gulf Coast Aquifer Expansion Yield

WUG	County	Basin	Water Management Strategies (ac-ft/yr)					
			2020	2030	2040	2050	2060	2070
Irrigation	Colorado	Brazos-Colorado	2,500	2,500	2,500	2,500	2,500	2,500
Colorado County Total for Brazos-Colorado River Basin			**2,500**	**2,500**	**2,500**	**2,500**	**2,500**	**2,500**
Corix Utilities Texas Inc.	Colorado	Colorado	0	0	0	1	2	4
County-Other	Colorado	Colorado	0	133	133	133	133	133
Irrigation	Colorado	Colorado	550	550	550	550	550	550
Colorado County Total for Colorado River Basin			**550**	**683**	**683**	**683**	**683**	**683**
Irrigation	Colorado	Lavaca	5,000	5,000	5,000	5,000	5,000	5,000
Colorado County Total for Lavaca River Basin			**5,000**	**5,000**	**5,000**	**5,000**	**5,000**	**5,000**
County-Other	Fayette	Lavaca	1	1	20	41	41	41
Fayette County Total for Lavaca River Basin			**1**	**1**	**20**	**41**	**41**	**41**
Bay City	Matagorda	Brazos-Colorado	0	75	75	75	75	75
Matagorda County Total for Brazos-Colorado River Basin			**0**	**75**	**75**	**75**	**75**	**75**
Irrigation	Matagorda	Colorado-Lavaca	300	300	300	300	300	300
Matagorda County Total for Colorado-Lavaca River Basin			**300**	**300**	**300**	**300**	**300**	**300**
Irrigation	Wharton	Brazos-Colorado	5,000	5,000	5,000	5,000	5,000	5,000
Wharton	Wharton	Brazos-Colorado	0	3,000	3,000	3,000	3,000	3,000
Wharton County Total for Brazos-Colorado River Basin			**5,000**	**8,000**	**8,000**	**8,000**	**8,000**	**8,000**
Irrigation	Wharton	Colorado	600	600	600	600	600	600
Wharton County Total for Colorado River Basin			**600**	**600**	**600**	**600**	**600**	**600**

Cost Implications of Proposed Strategy

Table 5.81 presents a summary of the probable costs for each WUG utilizing this strategy. The four cost components analyzed during cost estimation of this strategy were: Total Facilities Cost, Total Project Cost, Annual Cost, and Unit Cost.

The costs of the groundwater supply strategies were estimated using the Texas Water Development Board (TWDB) Cost Estimating Tool. For WUGs with a strategy yield of greater than 100 ac-ft/yr, yield is assumed to be acquired through the construction of new wells. The number of new wells was determined in the Cost Estimating Tool, based on the largest quantity of water supplied over the planning period. Wells were all assumed to be the same type, size, at the same elevation, and to have an efficiency of 80%. The well field layout was determined by two wells per "node," a 0.5-mile transmission line between each well and its node, and an additional 0.5 mile "trunk" line connecting to the next node. One mile of transmission piping to connect to the distribution system was assumed for municipal WUGs other than County-Other. A peaking factor of two (2) was assumed (twice the largest quantity of water supplied). Assumptions of well capacity and depth were made by reviewing historical well data for wells located in proximity to each WUG. Historical data was obtained using the Texas Water Development Board Groundwater Database's well search and water level search functions.

Additional project costs including engineering, legal services, contingencies, environmental and archeology studies and mitigation, land acquisition and surveying, and interest during construction were estimated using the Cost Estimating Tool. Annual costs including debt service, operation and maintenance, and pumping energy costs were also estimated using the tool.

For WUGs with a strategy yield of less than or equal to 100 ac-ft/yr, yield is assumed to be acquired through additional pumping from existing wells. For these WUGs, only the increased annual energy cost was included in the unit cost for the strategy, with no capital expenditures. Assumptions for well capacity, depth, efficiency, elevation, and layout follow the methodology for new well construction listed above.

An annual production fee of $1/ac-ft was assumed for WUGs within the Fayette County GCD.

Table 5.81: Gulf Coast Aquifer Expansion Cost

WUG	County	Basin	Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
Irrigation	Colorado	Brazos-Colorado	$3,069,000	$4,482,000	$442,000	$177
Corix Utilities Texas Inc.	Colorado	Colorado	$0	$0	$198	$50
County-Other	Colorado	Colorado	$1,406,000	$2,003,000	$162,000	$1,218
Irrigation	Colorado	Colorado	$972,000	$1,424,000	$137,000	$249
Irrigation	Colorado	Lavaca	$6,019,000	$8,774,000	$853,000	$171
County-Other	Fayette	Lavaca	$0	$0	$2,000	$49
Bay City	Matagorda	Brazos-Colorado	$0	$0	$4,000	$53
Irrigation	Matagorda	Colorado-Lavaca	$985,000	$1,431,000	$129,000	$430

Irrigation	Wharton	Brazos-Colorado	$5,676,000	$8,325,000	$851,000	$170
Wharton	Wharton	Brazos-Colorado	$6,354,000	$9,100,000	$817,000	$272
Irrigation	Wharton	Colorado	$878,000	$1,293,000	$125,000	$208

Environmental Considerations

The environmental impacts of expanded groundwater use will vary depending upon site characteristics but are not expected to be significant. Some impacts may occur from the expansion of existing groundwater infrastructure, but well sites are generally small in areal extent and the disturbance from pipeline construction is temporary. No Gulf Coast Aquifer use is expected to surpass the current, available yield of the aquifers as determined in *Chapter 3* of the 2021 Region K Water Plan. The water supply is within the Modeled Available Groundwater (MAG), so this strategy could contribute to drawdown in the aquifer of up to 13 feet by 2070, relative to January 2000 conditions.

While it is assumed that this strategy would have negligible impacts to cultural resources and wildlife habitat, coordination with the Texas Historical Commission will need to occur and proper environmental field studies will need to be performed before any construction begins. Refer to *Chapter 1, Appendix 1A*, for the complete list by county of threatened and endangered species in the Lower Colorado Regional Water Planning Area. These species may need to be considered during construction of infrastructure.

Agricultural & Natural Resources Considerations

This strategy will help meet the needs of agricultural users in the region by providing additional groundwater supply to the irrigation WUGs listed in *Table 5.80*; however, the additional drawdown of the aquifer has the potential to impact agriculture by creating the need to lower pumps, redrill wells, and pay for additional electricity for pumping. As these impacts are indefinite, it is difficult to determine quantified costs associated with these potential impacts. However, the groundwater permitting process is a public process and local groundwater users that may be affected have the ability to provide input regarding concerns on potential drawdown.

5.2.4.1.5. Sparta Aquifer

This strategy would involve pumping additional groundwater, either via existing wells or by drilling additional wells. *Table 5.82* presents the WUG that would utilize this strategy along with the implementation decade and the amount of water to be pumped. Additional groundwater was only allocated to meet the WUG's shortage.

Table 5.82: Sparta Aquifer Expansion Yield

WUG	County	Basin	Water Management Strategies (ac-ft/yr)					
			2020	2030	2040	2050	2060	2070
County-Other	Fayette	Colorado	0	40	98	145	180	204
Fayette County Total for Colorado River Basin			**0**	**40**	**98**	**145**	**180**	**204**

This strategy was applied to the Fayette County-Other WUG, beginning in 2030.

Cost Implications of Proposed Strategy

Table 5.83 presents a summary of the probable costs for the WUG utilizing this strategy. The four cost components analyzed during cost estimation of this strategy were: Total Construction Cost, Total Capital Cost, Annual Cost, and Unit Cost.

The costs of the groundwater supply strategy were estimated using the Texas Water Development Board (TWDB) Cost Estimating Tool. For this strategy, it was assumed that a new well field and transmission piping (interconnecting well piping) was provided.

A peaking factor of two (2) was assumed (twice the largest quantity of water supplied). The number of new wells was determined in the Cost Estimating Tool, based on the largest quantity of water supplied over the planning period. Wells were all assumed to be the same type, size, at the same elevation, and to have an efficiency of 80%. The well field layout was determined by two wells per "node," a 0.5-mile transmission line between each well and its node, and an additional 0.5 mile "trunk" line connecting to the next node. One mile of transmission piping to connect the wellfield to the distribution system was assumed.

Additional capital costs including engineering, legal services, contingencies, environmental and archeology studies and mitigation, land acquisition and surveying, and interest during construction were estimated using the Cost Estimating Tool. Annual costs including debt service, operation and maintenance, and pumping energy costs were also estimated using the tool.

Per Fayette County GCD requirements, 20 acres of land acquisition and an annual production fee of $1/ac-ft was assumed.

Table 5.83: Sparta Aquifer Expansion Cost

WUG	County	Basin	Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
County-Other	Fayette	Colorado	$1,674,000	$2,638,000	$230,000	$1,127

Environmental Impact

Water from this strategy is within the identified available groundwater from the aquifer. The impact on the environment from construction of wells and pipelines is expected to be low, with most of the impact occurring during the construction process itself.

The water supply is within the Modeled Available Groundwater (MAG), so this strategy could contribute to drawdown in the aquifer of up to 47 feet by 2070, relative to January 2000 conditions.

While it is assumed that this strategy would have negligible impacts to cultural resources and wildlife habitat, coordination with the Texas Historical Commission will need to occur and proper environmental field studies will need to be performed before any construction begins. Refer to *Chapter 1, Appendix 1A*, for the complete list by county of threatened and endangered species in the Lower Colorado Regional Water Planning Area. These species may need to be considered during construction of infrastructure.

Agricultural & Natural Resources Considerations

The Sparta Aquifer water is used for limited agricultural purposes in Fayette County and increased use of this source for municipal purposes is expected to have a negligible impact to agriculture or natural resources with respect to acres of land anticipated from this strategy; however, the additional drawdown of the aquifer has the potential to impact agriculture by creating the need to lower pumps, redrill wells, and pay for additional electricity for pumping. As these impacts are indefinite, it is difficult to determine quantified costs associated with these potential impacts. However, the groundwater permitting process is a public process and local groundwater users that may be affected have the ability to provide input regarding concerns on potential drawdown.

5.2.4.1.6. Trinity Aquifer

This strategy would involve pumping additional groundwater from a currently used source, either using their existing wells or drilling additional wells. *Table 5.84* presents the WUGs that would utilize this strategy along with the implementation decade and the amount of water to be pumped.

Table 5.84: Trinity Aquifer Expansion Yield

WUG	County	Basin	Water Management Strategies (ac-ft/yr)					
			2020	2030	2040	2050	2060	2070
County-Other	Hays	Colorado	0	0	0	0	0	200
Dripping Springs WSC	Hays	Colorado	0	0	300	300	300	300
Mining	Hays	Colorado	600	600	600	600	600	600
Colorado County Total for Colorado River Basin			**600**	**600**	**900**	**900**	**900**	**1,100**
Irrigation	Mills	Brazos	300	300	300	300	300	300
Mills County Total for Brazos River Basin			**300**	**300**	**300**	**300**	**300**	**300**
Garfield WSC	Travis	Colorado	0	0	0	7	26	47
Manville WSC	Travis	Colorado	0	0	0	0	0	703
Travis County Total for Colorado River Basin			0	**0**	**0**	**7**	**26**	**750**

This strategy was applied to County-Other, Dripping Springs WCS, and Mining in Hays County; Irrigation in Mills County; and Garfield WSC and Manville WSC in Travis County.

Cost Implications of Proposed Strategy

Table 5.85 presents a summary of the probable costs for each WUG utilizing this strategy. The four cost components analyzed during cost estimation of this strategy were: Total Facilities Cost, Total Project Cost, Annual Cost, and Unit Cost.

The costs of the groundwater supply strategies were estimated using the Texas Water Development Board (TWDB) Cost Estimating Tool. For WUGs with a strategy yield of greater than 100 ac-ft/yr, the yield is assumed to be acquired through the construction of new wells.

The number of new wells was determined in the Cost Estimating Tool, based on the largest quantity of water supplied over the planning period. Wells were all assumed to be the same type, size, at the same elevation, and to have an efficiency of 80%. The well field layout was determined by two wells per "node," a 0.5-mile transmission line between each well and its node, and an additional 0.5 mile "trunk" line connecting to the next node. One mile of transmission piping to connect the wellfield to the distribution system was assumed for municipal WUGs. Mining and Irrigation uses are assumed to be onsite, and therefore a one-mile transmission line with pump station is not needed. A peaking factor of two (2) was assumed (twice the largest quantity of water supplied). Assumptions of well capacity and depth were made by reviewing historical well data for wells located in proximity to each WUG. Historical data was obtained using the Texas Water Development Board Groundwater Database's well search and water level search functions.

Additional capital costs including engineering, legal services, contingencies, environmental and archeology studies and mitigation, land acquisition and surveying, and interest during construction were estimated using the TWDB Cost Estimating Tool. Annual costs including debt service, operation and maintenance, and pumping energy costs were also estimated using the tool.

For WUGs with a strategy yield of less than or equal to 100 ac-ft/yr (Garfield WSC), the yield is assumed to be acquired through additional pumping from existing wells. For this WUG, only the increased annual energy cost was included in the unit cost for the strategy, with no capital expenditures. Assumptions for well capacity, depth, efficiency, elevation, and layout follow the methodology for new well construction listed above.

Table 5.85: Trinity Aquifer Expansion Cost

WUG	County	Basin	Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
County-Other	Hays	Colorado	$1,803,000	$2,674,000	$236,000	$1,180
Dripping Springs WSC	Hays	Colorado	$2,371,000	$3,507,000	$307,000	$1,023
Mining	Hays	Colorado	$1,625,000	$2,409,000	$224,000	$373
Irrigation	Mills	Brazos	$883,000	$1,323,000	$121,000	$403
Garfield WSC	Travis	Colorado	$0	$0	$4,000	$85
Manville WSC	Travis	Colorado	$3,420,000	$5,035,000	$452,000	$643

Environmental Considerations

The impacts of construction of wells and pipelines, if properly managed, are expected to produce negligible impacts to the environment, and primarily during the construction period itself. The water supply is within the Modeled Available Groundwater (MAG), so this strategy could contribute to the following maximum drawdowns by 2070, relative to January 2000 conditions: in Hays County (GMA 9), up to 30 feet; in Mills County, up to 13 feet, depending on the formation; in Travis County, up to 146 feet, depending on the formation.

While it is assumed that this strategy would have negligible impacts to cultural resources and wildlife habitat, coordination with the Texas Historical Commission will need to occur and proper environmental field studies will need to be performed before any construction begins. Refer to *Chapter 1, Appendix 1A*, for the complete list by county of threatened and endangered species in the Lower Colorado Regional Water Planning Area. These species may need to be considered during construction of infrastructure.

Agricultural & Natural Resources Considerations

This strategy provides supply for irrigation in Mills County, which will have a positive impact on agriculture. There are negligible impacts to agriculture or natural resources with respect to acres of land anticipated from this strategy; however, the additional drawdown of the aquifer has the potential to impact agriculture by creating the need to lower pumps, redrill wells, and pay for additional electricity for pumping. As these impacts are indefinite, it is difficult to determine quantified costs associated with these potential impacts. However, the groundwater permitting process is a public process and local groundwater users that may be affected have the ability to provide input regarding concerns on potential drawdown.

5.2.4.1.7. Yegua-Jackson Aquifer

This strategy would involve pumping additional groundwater, either using their existing wells or by drilling additional wells. *Table 5.86* presents the WUG that would utilize this strategy along with the implementation decade and the amount of water to be pumped.

This strategy was applied to the Fayette Mining, Colorado Basin WUG. The water demand for this WUG decreases over time, so the water need no longer exists after the 2030 decade.

Table 5.86: Yegua-Jackson Aquifer Expansion Yield

WUG	County	Basin	Water Management Strategies (ac-ft/yr)					
			2020	2030	2040	2050	2060	2070
Mining	Fayette	Colorado	760	760	0	0	0	0
Fayette County Total for Colorado River Basin			**760**	**760**	**0**	**0**	**0**	**0**

Cost Implications of Proposed Strategy

Table 5.87 presents a summary of the probable costs for each WUG utilizing this strategy. The four cost components analyzed during cost estimation of this strategy were: Total Facilities Cost, Total Project Cost, Annual Cost, and Unit Cost.

The costs of the groundwater supply strategies were estimated using the Texas Water Development Board (TWDB) Cost Estimating Tool. For all these strategies, it was assumed that a new well field and transmission piping (interconnecting well piping) was provided.

A peaking factor of two (2) was assumed (twice the largest quantity of water supplied). The number of new wells was determined in the Cost Estimating Tool, based on the largest quantity of water supplied over the planning period. Wells were all assumed to be the same type, size, at the same elevation, and to have an efficiency of 80%. The well field layout was determined by two wells per "node," a 0.5-mile transmission line between each well and its node, and an additional 0.5 mile "trunk" line connecting to the next node.

The wellfield was assumed to be onsite and that no additional transmission piping was needed to reach the supply location.

Per Fayette County GCD requirements, 380 acres of land acquisition and a $1/ac-ft production fee was assumed.

Additional capital costs including engineering, legal services, contingencies, environmental and archeology studies and mitigation, land acquisition and surveying, and interest during construction were estimated using the Cost Estimating Tool. Annual costs including debt service, operation and maintenance, and pumping energy costs were also estimated using the tool.

Table 5.87: Yegua-Jackson Aquifer Expansion Cost

WUG	County	Basin	Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
Mining	Fayette	Colorado	$2,127,000	$5,463,000	$431,000	$567

Environmental Considerations

Water from this strategy is within the identified available groundwater from the aquifer. The impact on the environment from construction of wells and pipelines is expected to be low, with most of the impact occurring during the construction process itself.

The water supply is within the Modeled Available Groundwater (MAG), so this strategy could contribute to drawdown in the aquifer of up to 77 feet by 2070, relative to January 2010 conditions.

While it is assumed that this strategy would have negligible impacts to cultural resources and wildlife habitat, coordination with the Texas Historical Commission will need to occur and proper environmental field studies will need to be performed before any construction begins. Refer to *Chapter 1, Appendix 1A,* for the complete list by county of threatened and endangered species in the Lower Colorado Regional Water Planning Area. These species may need to be considered during construction of infrastructure.

Agricultural & Natural Resources Considerations

The Yegua-Jackson Aquifer is a source of water supply for agricultural interests in Fayette County. There are negligible impacts to agriculture or natural resources with respect to acres of land anticipated from this strategy; however, the additional drawdown of the aquifer has the potential to impact agriculture by creating the need to lower pumps, redrill wells, and pay for additional electricity for pumping. As these impacts are indefinite, it is difficult to determine quantified costs associated with these potential impacts. However, the groundwater permitting process is a public process and local groundwater users that may be affected have the ability to provide input regarding concerns on potential drawdown.

5.2.4.2 Development of New Groundwater Supplies

This group of strategies includes those WUGs that are obtaining groundwater from new groundwater sources which they have not tapped previously.

5.2.4.2.1. Ellenburger-San Saba Aquifer

This strategy would involve developing a new well field to pump water from the Ellenburger-San Saba Aquifer for WUGs that do not currently use the Ellenburger-San Saba Aquifer as a source of water. For Mining WUGs, it is assumed that the new wellfield will be constructed within the mining property and transmission from the wellfield to the site is not required. A new well field will consist of new wells and one-half mile segments of line between wells and nodes. *Table 5.88* presents the WUG that would utilize this strategy along with the implementation decade and the amount of water needed.

Table 5.88: Ellenburger-San Saba Aquifer Development Yield

WUG	County	Basin	Water Management Strategies (ac-ft/yr)					
			2020	2030	2040	2050	2060	2070
Mining	Burnet	Brazos	0	0	0	300	400	700
Burnet County Total for Brazos River Basin			**0**	**0**	**0**	**300**	**400**	**700**

This strategy was applied to the Mining WUG in Burnet County in the Brazos Basin.

Cost Implications of Proposed Strategy

Table 5.89 presents a summary of the probable costs for the WUG utilizing this strategy. The four cost components analyzed during cost estimation of this strategy were: Total Facilities Cost, Total Project Cost, Annual Cost, and Unit Cost.

The costs of the groundwater supply strategies were estimated using the Texas Water Development Board (TWDB) Cost Estimating Tool. For all these strategies, it was assumed that a new well field and transmission piping (interconnecting well piping) was provided.

A peaking factor of two (2) was assumed (twice the largest quantity of water supplied). The number of new wells was determined in the Cost Estimating Tool, based on the largest quantity of water supplied over the planning period. Wells were all assumed to be the same type, size, at the same elevation, and to have an efficiency of 80%. The well field layout was determined by two wells per "node," a 0.5-mile transmission line between each well and its node, and an additional 0.5 mile "trunk" line connecting to the next node.

Additional capital costs including engineering, legal services, contingencies, environmental and archeology studies and mitigation, land acquisition and surveying, and interest during construction were estimated using the Cost Estimating Tool. Annual costs including debt service, operation and maintenance, and pumping energy costs were also estimated using the tool.

Table 5.89: Ellenburger-San Saba Aquifer Development Cost

WUG	County	Basin	Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
Mining	Burnet	Brazos	$3,119,000	$4,495,000	$374,000	$534

Environmental Considerations

The additional pumping from the Ellenburger-San Saba Aquifer is within the available yield of the aquifer for all decades. The construction of well sites and pipelines is anticipated to have a low environmental impact primarily during the construction period, if proper precautions are taken to avoid environmentally sensitive areas. The water supply is within the Modeled Available Groundwater (MAG), which allows for a potential reduction of the saturated thickness of the aquifer by 10% from 2010 to 2070, as described in *Chapter 3*.

While it is assumed that this strategy would have negligible impacts to cultural resources and wildlife habitat, coordination with the Texas Historical Commission will need to occur and proper environmental field studies will need to be performed before any construction begins. Refer to *Chapter 1, Appendix 1A*, for the complete list by county of threatened and endangered species in the Lower Colorado Regional Water Planning Area. These species may need to be considered during construction of infrastructure.

Agricultural & Natural Resources Considerations

The Ellenburger-San Saba is a source of water supply for agricultural interests in Burnet, Blanco, Gillespie, and Llano Counties. There are negligible impacts to agriculture or natural resources with respect to acres of land anticipated from this strategy; however, the additional drawdown of the aquifer has the potential to impact agriculture by creating the need to lower pumps, redrill wells, and pay for additional electricity for pumping. As these impacts are indefinite, it is difficult to determine quantified costs associated with these potential impacts. However, the groundwater permitting process is a public process and local groundwater users that may be affected have the ability to provide input regarding concerns on potential drawdown.

5.2.4.2.2. Gulf Coast Aquifer

This strategy would involve developing a new well field to pump water from the Gulf Coast Aquifer for WUGs that do not currently use the Gulf Coast Aquifer as a source of water. For Irrigation WUGs, it is assumed that the new wellfield will be constructed near the irrigated acreage, and transmission from the wellfield to the field is not required. A new well field will consist of new wells, and one-half mile segments of line between wells and nodes. *Table 5.90* presents the WUG that would utilize this strategy along with the implementation decade and the amount of water needed.

Table 5.90: Gulf Coast Aquifer Development Yield

WUG	County	Basin	Water Management Strategies (ac-ft/yr)					
			2020	2030	2040	2050	2060	2070
Irrigation	Matagorda	Colorado	510	510	510	510	510	510
Matagorda County Total for Colorado River Basin			**510**	**510**	**510**	**510**	**510**	**510**

This strategy was applied to the Irrigation WUG in Matagorda County in the Colorado Basin.

Cost Implications of Proposed Strategy

Table 5.91 presents a summary of the probable costs for the WUG utilizing this strategy. The four cost components analyzed during cost estimation of this strategy were: Total Facilities Cost, Total Project Cost, Annual Cost, and Unit Cost.

The costs of the groundwater supply strategies were estimated using the Texas Water Development Board (TWDB) Cost Estimating Tool. For all these strategies, it was assumed that a new well field and transmission piping (interconnecting well piping) was provided.

A peaking factor of two (2) was assumed (twice the largest quantity of water supplied). The number of new wells was determined in the Cost Estimating Tool, based on the largest quantity of water supplied over the planning period. Wells were all assumed to be the same type, size, at the same elevation, and to have an efficiency of 80%. The well field layout was determined by two wells per “node,” a 0.5-mile transmission line between each well and its node, and an additional 0.5 mile “trunk” line connecting to the next node.

Additional capital costs including engineering, legal services, contingencies, environmental and archeology studies and mitigation, land acquisition and surveying, and interest during construction were estimated using the Cost Estimating Tool. Annual costs including debt service, operation and maintenance, and pumping energy costs were also estimated using the tool.

Table 5.91: Gulf Coast Aquifer Development Cost

WUG	County	Basin	Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
Irrigation	Matagorda	Colorado	$843,000	$1,195,000	$92,000	$180

Environmental Considerations

The impacts to the environment from the additional yield being sought from the Gulf Coast Aquifer are expected to be negligible. Impacts from construction of wells and pipelines should be limited primarily to the construction period. The water supply is within the Modeled Available Groundwater (MAG), so this strategy could contribute to drawdown in the aquifer of up to 13 feet by 2070, relative to January 2000 conditions. This use of groundwater will provide additional return flows to the Colorado River and Matagorda Bay from agriculture.

While it is assumed that this strategy would have negligible impacts to cultural resources and wildlife habitat, coordination with the Texas Historical Commission will need to occur and proper environmental field studies will need to be performed before any construction begins. Refer to *Chapter 1, Appendix 1A,* for the complete list by county of threatened and endangered species in the Lower Colorado Regional Water Planning Area. These species may need to be considered during construction of infrastructure.

Agricultural & Natural Resources Considerations

This strategy provides additional water supply for irrigation in Matagorda County, which benefits agriculture. There are negligible impacts to agriculture or natural resources with respect to acres of land anticipated from this strategy; however, the additional drawdown of the aquifer has the potential to impact agriculture by creating the need to lower pumps, redrill wells, and pay for additional electricity for pumping. As these impacts are indefinite, it is difficult to determine quantified costs associated with these potential impacts. However, the groundwater permitting process is a public process and local groundwater users that may be affected have the ability to provide input regarding concerns on potential drawdown.

5.2.4.2.3. Hickory Aquifer

This strategy would involve developing a new well field to pump water from the Hickory Aquifer for WUGs that do not currently use the Hickory Aquifer as a source of water. For Mining WUGs, it is assumed that the new wellfield will be constructed within the mining property and transmission from the wellfield to the site is not required. A new well field will consist of new wells and one-half mile segments of line between wells and nodes. *Table 5.92* presents the WUG that would utilize this strategy along with the implementation decade and the amount of water needed.

Table 5.92: Hickory Aquifer Development Yield

WUG	County	Basin	Water Management Strategies (ac-ft/yr)					
			2020	2030	2040	2050	2060	2070
Mining	Burnet	Colorado	0	1,000	1,000	1,000	1,000	1,000
Burnet County Total for Colorado River Basin			**0**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**

This strategy was applied to the Mining WUG in Burnet County in the Colorado Basin.

Cost Implications of Proposed Strategy

Table 5.93 presents a summary of the probable costs for each WUG utilizing this strategy. The four cost components analyzed during cost estimation of this strategy were: Total Facilities Cost, Total Project Cost, Annual Cost, and Unit Cost.

The costs of the groundwater supply strategies were estimated using the Texas Water Development Board (TWDB) Cost Estimating Tool. For all these strategies, it was assumed that a new well field and transmission piping (interconnecting well piping) was provided.

A peaking factor of two (2) was assumed (twice the largest quantity of water supplied). The number of new wells was determined in the Cost Estimating Tool, based on the largest quantity of water supplied over the planning period. Wells were all assumed to be the same type, size, at the same elevation, and to have an efficiency of 80%. The well field layout was determined by two wells per "node," a 0.5-mile transmission line between each well and its node, and an additional 0.5 mile "trunk" line connecting to the next node.

Additional capital costs including engineering, legal services, contingencies, environmental and archeology studies and mitigation, land acquisition and surveying, and interest during construction were estimated using the Cost Estimating Tool. Annual costs including debt service, operation and maintenance, and pumping energy costs were also estimated using the tool.

Table 5.93: Hickory Aquifer Development Cost

WUG	County	Basin	Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)

Mining	Burnet	Colorado	$3,431,000	$4,863,000	$432,000	$432

Environmental Considerations

The additional pumping from the Hickory Aquifer is within the available yield of the aquifer for all decades. The construction of well sites and pipelines is anticipated to have a low environmental impact primarily during the construction period, if proper precautions are taken to avoid environmentally sensitive areas. The water supply is within the Modeled Available Groundwater (MAG), which allows for a potential reduction of the saturated thickness of the aquifer by 10% from 2010 to 2070.

While it is assumed that this strategy would have negligible impacts to cultural resources and wildlife habitat, coordination with the Texas Historical Commission will need to occur and proper environmental field studies will need to be performed before any construction begins. Refer to *Chapter 1, Appendix 1A*, for the complete list by county of threatened and endangered species in the Lower Colorado Regional Water Planning Area. These species may need to be considered during construction of infrastructure.

Agricultural & Natural Resources Considerations

The location of this proposed strategy currently has no irrigation wells, so no impact to agriculture is expected. Should construction begin, there are negligible impacts to agriculture or natural resources with respect to acres of land anticipated from this strategy; however, the additional drawdown of the aquifer has the potential to impact agriculture by creating the need to lower pumps, redrill wells, and pay for additional electricity for pumping. As these impacts are indefinite, it is difficult to determine quantified costs associated with these potential impacts. However, the groundwater permitting process is a public process and local groundwater users that may be affected have the ability to provide input regarding concerns on potential drawdown.

5.2.4.2.4. Marble Falls Aquifer

This strategy would involve developing a new well field to pump water from the Marble Falls Aquifer. For Mining WUGs, it is assumed that the new wellfield will be constructed within the mining property and transmission from the wellfield to the site is not required. A new well field will consist of new wells and one-half mile segments of line between wells and nodes. *Table 5.94* presents the WUG that would utilize this strategy along with the implementation decade and the amount of water needed.

Table 5.94: Marble Falls Aquifer Development Yield

WUG	County	Basin	Water Management Strategies (ac-ft/yr)					
			2020	2030	2040	2050	2060	2070
Mining	Burnet	Colorado	0	0	1,000	1,000	1,000	1,000
Burnet County Total for Colorado River Basin			**0**	**0**	**1,000**	**1,000**	**1,000**	**1,000**

This strategy was applied to the Mining WUG in Burnet County in the Colorado Basin.

Cost Implications of Proposed Strategy

Table 5.95 presents a summary of the probable costs for each WUG utilizing this strategy. The four cost components analyzed during cost estimation of this strategy were: Total Facilities Cost, Total Project Cost, Annual Cost, and Unit Cost.

The costs of the groundwater supply strategies were estimated using the Texas Water Development Board (TWDB) Cost Estimating Tool. For all these strategies, it was assumed that a new well field and transmission piping (interconnecting well piping) was provided.

A peaking factor of two (2) was assumed (twice the largest quantity of water supplied). The number of new wells was determined in the Cost Estimating Tool, based on the largest quantity of water supplied over the planning period. Wells were all assumed to be the same type, size, at the same elevation, and to have an efficiency of 80%. The well field layout was determined by two wells per “node,” a 0.5-mile transmission line between each well and its node, and an additional 0.5 mile “trunk” line connecting to the next node.

Additional capital costs including engineering, legal services, contingencies, environmental and archeology studies and mitigation, land acquisition and surveying, and interest during construction were estimated using the Cost Estimating Tool. Annual costs including debt service, operation and maintenance, and pumping energy costs were also estimated using the tool.

Table 5.95: Marble Falls Aquifer Development Cost

WUG	County	Basin	Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
Mining	Burnet	Colorado	$2,346,000	3,345,000	$307,000	$307

Environmental Considerations

The environmental impacts of expanded groundwater use will vary depending upon site characteristics. The construction of well sites and pipelines is anticipated to have a low environmental impact primarily during the construction period, if proper precautions are taken to avoid environmentally sensitive areas. The water supply is within the Modeled Available Groundwater (MAG), which allows for a potential reduction of the saturated thickness of the aquifer by 10% from 2010 to 2070, as described in *Chapter 3*.

While it is assumed that this strategy would have negligible impacts to cultural resources and wildlife habitat, coordination with the Texas Historical Commission will need to occur and proper environmental field studies will need to be performed before any construction begins. Refer to *Chapter 1, Appendix 1A*, for the complete list by county of threatened and endangered species in the Lower Colorado Regional Water Planning Area. These species may need to be considered during construction of infrastructure.

Agricultural & Natural Resources Considerations

There are negligible impacts to agriculture or natural resources with respect to acres of land anticipated from this strategy; however, the additional drawdown of the aquifer has the potential to impact agriculture by creating the need to lower pumps, redrill wells, and pay for additional electricity for pumping. As these impacts are indefinite, it is difficult to determine quantified costs associated with these potential impacts. However, the groundwater permitting process is a public process and local groundwater users that may be affected have the ability to provide input regarding concerns on potential drawdown.

5.2.4.2.5. Sparta Aquifer

This strategy would involve developing a new well field to pump water from the Sparta Aquifer. A new well field will consist of new wells and one-half mile segments of line between wells and nodes. *Table 5.96* presents the WUG that would utilize this strategy along with the implementation decade and the amount of water needed.

Table 5.96: Sparta Aquifer Development Yield

WUG	County	Basin	Water Management Strategies (ac-ft/yr)					
			2020	2030	2040	2050	2060	2070
County-Other	Fayette	Colorado (to Lavaca)	400	400	400	400	400	400
Fayette County Total for Colorado River Basin			**400**	**400**	**400**	**400**	**400**	**400**

Cost Implications of Proposed Strategy

Table 5.97 presents a summary of the probable costs for each WUG utilizing this strategy. The four cost components analyzed during cost estimation of this strategy were: Total Facilities Cost, Total Project Cost, Annual Cost, and Unit Cost.

The costs of the groundwater supply strategies were estimated using the Texas Water Development Board (TWDB) Cost Estimating Tool. For all these strategies, it was assumed that a new well field and transmission piping (interconnecting well piping) was provided.

A peaking factor of two (2) was assumed (twice the largest quantity of water supplied). The number of new wells was determined in the Cost Estimating Tool, based on the largest quantity of water supplied over the planning period. Wells were all assumed to be the same type, size, at the same elevation, and to have an efficiency of 80%. The well field layout was determined by two wells per "node," a 0.5-mile transmission line between each well and its node, and an additional 0.5 mile "trunk" line connecting to the next node.

A 5-mile transmission pipeline was assumed. The transmission line was assumed to be one pipe, five miles long, with a diameter based on a velocity of 5 ft/s at peak flow.

Per Fayette County GCD requirements, 200 acres of land acquisition and a $1/ac-ft production fee was assumed. Additionally, treatment costs for the removal of iron and manganese are assumed for manufacturing and municipal WUGs developing new sources of groundwater.

Additional capital costs including engineering, legal services, contingencies, environmental and archeology studies and mitigation, land acquisition and surveying, and interest during construction were estimated using the Cost Estimating Tool. Annual costs including debt service, operation and maintenance, and pumping energy costs were also estimated using the tool.

Table 5.97: Sparta Aquifer Development Cost

WUG	County	Basin	Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
County-Other	Fayette	Colorado (to Lavaca)	$3,266,000	$6,056,000	$677,000	$1,693

Environmental Considerations

The environmental impacts of expanded groundwater use will vary depending upon site characteristics. The construction of well sites and pipelines is anticipated to have a low environmental impact primarily during the construction period, if proper precautions are taken to avoid environmentally sensitive areas. The water supply is within the Modeled Available Groundwater (MAG), so this strategy could contribute to drawdown in the aquifer of up to 47 feet by 2070, relative to January 2000 conditions.

While it is assumed that this strategy would have negligible impacts to cultural resources and wildlife habitat, coordination with the Texas Historical Commission will need to occur and proper environmental field studies will need to be performed before any construction begins. Refer to *Chapter 1, Appendix 1A,* for the complete list by county of threatened and endangered species in the Lower Colorado Regional Water Planning Area. These species may need to be considered during construction of infrastructure.

Agricultural & Natural Resources Considerations

The Sparta Aquifer water is used for limited agricultural purposes in Fayette County and increased use of this source for municipal purposes is expected to have a negligible impact on agriculture or natural resources with respect to acres of land anticipated from this strategy; however, the additional drawdown of the aquifer has the potential to impact agriculture by creating the need to lower pumps, redrill wells, and pay for additional electricity for pumping. As these impacts are indefinite, it is difficult to determine quantified costs associated with these potential impacts. However, the groundwater permitting process is a public process and local groundwater users that may be affected have the ability to provide input regarding concerns on potential drawdown.

5.2.4.2.6. Trinity Aquifer

This strategy would involve developing a new well field to pump water from the Trinity Aquifer for WUGs that do not use the Trinity Aquifer as an existing source. A new well field will consist of acquisition of a site, new wells, 5 miles of transmission line, and one-half mile segments of line between wells and nodes. A new storage tank is also assumed for those WUGs with new supplies greater than 100 ac-ft/yr. *Table 5.98* presents the WUGs that would utilize this strategy along with the implementation decade and the amount of water needed.

Table 5.98: Trinity Aquifer Development Yield

WUG	County	Basin	Water Management Strategies (ac-ft/yr)					
			2020	2030	2040	2050	2060	2070
Hays	Hays	Colorado	0	100	100	100	100	100
Hays County Total for Colorado River Basin			**0**	**100**	**100**	**100**	**100**	**100**

Elgin	Travis (to Bastrop)	Colorado	0	0	0	0	1,000	1,825
Sunset Valley	Travis	Colorado	0	0	300	300	300	300
Travis County MUD 10	Travis	Colorado	0	100	100	100	100	100
Travis County Total for Colorado River Basin			**0**	**100**	**400**	**400**	**1,400**	**2,225**

The portion of the Trinity Aquifer in Hays County that Hays would use is located within GMA 10. The portion of the Trinity Aquifer in Travis County that Elgin would use is located within GMA 8. The portion of the Trinity Aquifer in Travis County that Sunset Valley would use is located within GMA 10. The portion of the Trinity Aquifer in Travis County that Travis County MUD 10 would use is located within GMA 9.

Cost Implications of Proposed Strategy

Table 5.99 presents a summary of the probable costs for the WUG utilizing this strategy. The four cost components analyzed during cost estimation of this strategy were: Total Facilities Cost, Total Project Cost, Annual Cost, and Unit Cost.

The costs of the groundwater supply strategies were estimated using the Texas Water Development Board (TWDB) Cost Estimating Tool. For all these strategies, it was assumed that a new well field and transmission piping (interconnecting well piping) were provided.

A peaking factor of two (2) was assumed (twice the largest quantity of water supplied). The number of new wells was determined in the Cost Estimating Tool, based on the largest quantity of water supplied over the planning period. Wells were all assumed to be the same type, size, at the same elevation, and to have an efficiency of 80%. The well field layout was determined by two wells per "node," a 0.5-mile transmission line between each well and its node, and an additional 0.5 mile "trunk" line connecting to the next node.

A 5-mile transmission pipeline was assumed with a pump station. The transmission line was assumed to be one pipe, five miles long, with a diameter based on a velocity of 5 ft/s at peak flow. Additionally, a new ground storage tank is assumed for all municipal WUGs with a strategy supply greater than 100 ac-ft/yr.

For WUGs in the Barton Springs/Edwards Aquifer GCD, a $0.17/1,000 gallons (approximately $55.39/ac-ft) production fee was assumed. Additionally, treatment costs for the removal of iron and manganese are assumed for manufacturing and municipal WUGs developing new sources of groundwater.

Additional capital costs including engineering, legal services, contingencies, environmental and archeology studies and mitigation, land acquisition and surveying, and interest during construction were estimated using the Cost Estimating Tool. Annual costs including debt service, operation and maintenance, and pumping energy costs were also estimated using the tool.

Table 5.99: Trinity Aquifer Development Cost

WUG	County	Basin	Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
Hays	Hays	Colorado	$2,492,000	$3,719,000	$383,000	$3,830

Elgin	Travis (to Bastrop)	Colorado	$10,225,000	$14,774,000	$1,740,000	$953
Sunset Valley	Travis	Colorado	$3,664,000	$5,401,000	$619,000	$2,063
Travis County MUD 10	Travis	Colorado	$2,492,000	$3,719,000	$383,000	$3,830

Environmental Considerations

The impacts of construction of wells and pipelines, if properly managed, are expected to produce negligible impacts to the environment, and primarily during the construction period itself.

The water supply is within the Modeled Available Groundwater (MAG), so this strategy could contribute to the following maximum drawdowns by 2070, relative to January 2000 conditions: in GMA 8 in Travis County, up to 146 feet, depending on the formation; in GMA 9 in Hays and Travis counties, up to 30 feet; in GMA 10 in Hays and Travis counties, up to 25 feet.

While it is assumed that this strategy would have negligible impacts to cultural resources and wildlife habitat, coordination with the Texas Historical Commission will need to occur and proper environmental field studies will need to be performed before any construction begins. Refer to *Chapter 1, Appendix 1A*, for the complete list by county of threatened and endangered species in the Lower Colorado Regional Water Planning Area. These species may need to be considered during construction of infrastructure.

Agricultural & Natural Resources Considerations

There are negligible impacts to agriculture or natural resources with respect to acres of land anticipated from this strategy; however, the additional drawdown of the aquifer has the potential to impact agriculture by creating the need to lower pumps, redrill wells, and pay for additional electricity for pumping. As these impacts are indefinite, it is difficult to determine quantified costs associated with these potential impacts. However, the groundwater permitting process is a public process and local groundwater users that may be affected have the ability to provide input regarding concerns on potential drawdown.

5.2.4.2.7. Yegua-Jackson Aquifer

This strategy would involve developing a new well field to pump water from the Yegua-Jackson Aquifer. A new well field will consist of acquisition of a site, new wells, 5 miles of transmission line, one-half mile segments of line between wells and nodes, and will assume that the WUG has the available storage capacity to store this additional water.

Groundwater supplied to Smithville is assumed to be imported from Fayette County.

Table 5.100 presents the WUGs that would utilize this strategy along with the implementation decade and the amount of water needed.

Table 5.100: Yegua-Jackson Aquifer Development Yield

WUG	County	Basin	Water Management Strategies (ac-ft/yr)					
			2020	2030	2040	2050	2060	2070
Manufacturing	Fayette	Lavaca	0	100	100	100	100	100
Fayette County Total for Lavaca River Basin			**0**	**100**	**100**	**100**	**100**	**100**
Smithville	Fayette (to Bastrop)	Colorado	0	700	700	700	700	700
Fayette County Total for Colorado River Basin			**0**	**700**	**700**	**700**	**700**	**700**

This strategy was applied to the Manufacturing WUG in Fayette County in the Lavaca Basin and to Smithville in Bastrop County in the Colorado Basin.

Cost Implications of Proposed Strategy

Table 5.101 presents a summary of the probable costs for each WUG utilizing this strategy. The four cost components analyzed during cost estimation of this strategy were: Total Facilities Cost, Total Project Cost, Annual Cost, and Unit Cost.

The costs of the groundwater supply strategies were estimated using the Texas Water Development Board (TWDB) Cost Estimating Tool. For all these strategies, it was assumed that a new well field and transmission piping (interconnecting well piping) was provided.

A peaking factor of one (1) was assumed. The number of new wells was determined in the Cost Estimating Tool, based on the largest quantity of water supplied over the planning period. Wells were all assumed to be the same type, size, at the same elevation, and to have an efficiency of 80%. The well field layout was determined by two wells per “node,” a 0.5-mile transmission line between each well and its node, and an additional 0.5 mile “trunk” line connecting to the next node.

A 5-mile transmission pipeline was assumed. The transmission line was assumed to be one pipe, five miles long, with a diameter based on a velocity of 5 ft/s at peak flow.

The following assumptions were made per Fayette County GCD requirements: one half acre of wellfield land acquisition per acre-foot of water supplied, a $1/ac-ft production fee, and a $0.025/1,000-gal ($8.15/ac-ft) export fee (where applicable). Additionally, treatment costs for the removal of iron and manganese are assumed for manufacturing and municipal WUGs developing new sources of groundwater.

Additional capital costs including engineering, legal services, contingencies, environmental and archeology studies and mitigation, land acquisition and surveying, and interest during construction were estimated using the Cost Estimating Tool. Annual costs including debt service, operation and maintenance, and pumping energy costs were also estimated using the tool.

Table 5.101: Yegua-Jackson Aquifer Development Cost

WUG	County	Basin	Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
Manufacturing	Fayette	Lavaca	$2,178,000	$3,425,000	$358,000	$3,960
Smithville	Fayette (to Bastrop)	Colorado	$6,056,000	$13,421,000	$1,321,000	$1,887

Environmental Considerations

Water from this strategy is within the identified available groundwater from the aquifer. The impact on the environment from construction of wells and pipelines is expected to be low, with most of the impact occurring during the construction process itself.

The water supply is within the Modeled Available Groundwater (MAG), so this strategy could contribute to an overall drawdown in the aquifer of up to 77 feet by 2070, relative to January 2010 conditions. It is assumed that using water within the stated available yield should result in negligible impacts to springflows, but aquifer levels and springflows should be monitored.

While it is assumed that this strategy would have negligible impacts to cultural resources and wildlife habitat, coordination with the Texas Historical Commission will need to occur and proper environmental field studies will need to be performed before any construction begins. Refer to *Chapter 1, Appendix 1A*, for the complete list by county of threatened and endangered species in the Lower Colorado Regional Water Planning Area. These species may need to be considered during construction of infrastructure.

Agricultural & Natural Resources Considerations

The Yegua-Jackson Aquifer is a source of water supply for agricultural interests in Fayette County. There are negligible impacts to agriculture or natural resources with respect to acres of land anticipated from this strategy; however, the additional drawdown of the aquifer has the potential to impact agriculture by creating the need to lower pumps, redrill wells, and pay for additional electricity for pumping. As these impacts are indefinite, it is difficult to determine quantified costs associated with these potential impacts. However, the groundwater permitting process is a public process and local groundwater users that may be affected have the ability to provide input regarding concerns on potential drawdown.

5.2.4.3 Water Importation

The strategies discussed in this section bring water into Region K from outside of the region. These strategies have been requested for inclusion in both the Region K Plan and the South Central Texas (Region L) Plan. Coordination with Region L has occurred on the strategies in this section.

5.2.4.3.1. Hays County Pipeline

This strategy encompasses two regions, Region K and Region L. It involves bringing water from a delivery point near the Kyle area to Western Hays County. It is not itself a source of supply, but rather provides the infrastructure required to import potential water supplies from multiple areas around Central Texas. The supply will come from the Guadalupe-Blanco River Authority (GBRA) Mid-Basin (Phase 2) Project that develops water from the Guadalupe River and an Aquifer Storage and Recovery (ASR) in the Carrizo-Wilcox in Gonzales County in Region L and sends it through a transmission line to the Kyle area.

The Region L portion of this strategy includes a pipeline capable of conveying up to 15,000 ac-ft/yr from multiple potential sources to Wimberley. The Region K portion of this strategy would upsize this pipeline to allow conveyance of an additional 4,000 ac-ft/yr, or 19,000 ac-ft/yr total. It would also add an additional pipeline capable of conveying the 4,000 ac-ft/yr from a point to be determined between Kyle and Wimberley towards West Travis County PUA. For this strategy, the 4,000 ac-ft/yr of water is from the GBRA Mid-Basin (Phase 2) Project in Gonzales County.

The table below shows the projected use for only the Region K water user groups.

Table 5.102: Hays County Pipeline Yield for Region K

WUG	County	Basin	Importing From			Water Management Strategies (ac-ft/yr)					
			Region	County	Aquifer	2020	2030	2040	2050	2060	2070
County-Other	Hays	Colorado	L	Gonzales	GBRA Mid-Basin (Phase 2)	0	1,000	1,000	1,000	1,000	1,000
West Travis County PUA	Hays	Colorado	L	Gonzales	GBRA Mid-Basin (Phase 2)	0	3,000	3,000	3,000	3,000	3,000

Cost Implications of Proposed Strategy

The table below shows the estimated costs for this strategy. Only the additional costs required for the Region K portion of the strategy are shown. The Region L costs are shown in the separate 2021 South Central Texas Regional Water Plan. Costs from the 2016 Region K Water Plan were used, and five additional miles of piping length was added to extend past the 2016 Region K Water Plan destination of Dripping Springs. The infrastructure that the costs are based on include approximately 19 miles of 18” pipeline and the costs needed to upsize the Region L pipeline to carry the additional 4,000 ac-ft/yr until the Region K pipeline splits off. The updated 2016 Region K Water Plan costs were then converted to September 2018 costs, consistent with TWDB planning requirements. The total costs have been split proportionally between project participants. Costs also include annual raw water purchase from GBRA at $1,492/ac-ft, which is the unit cost of water from the GBRA Mid-Basin (Phase 2) Project.

Table 5.103: Hays County Pipeline Cost for Region K

WUG	County	Basin	Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
County-Other	Hays	Colorado	$5,512,500	$7,485,500	$2,118,500	$2,119
West Travis County PUA	Hays	Colorado	$16,537,500	$22,456,500	$6,335,500	$2,119

Environmental Considerations

The environmental impacts of the construction should be able to be minimized as long as care is taken to avoid environmentally sensitive areas and provide proper restoration to the surface when complete.

It is assumed the pipeline construction would have negligible impacts on cultural resources and wildlife habitat, but coordination with the Texas Historical Commission will need to occur and proper environmental field studies will need to be performed before construction begins. Refer to *Chapter 1, Appendix 1A*, for the complete list by county of threatened and endangered species in the Lower Colorado Regional Water Planning Area. These species may need to be considered during construction of infrastructure.

Refer to the 2021 South Central Texas Regional Water Plan, Region L, for any impacts associated with the Region L portion of the strategy.

Agricultural & Natural Resources Considerations

No impacts (zero acres impacted) to agriculture and natural resources are anticipated Refer to the 2021 South Central Texas Regional Water Plan for any impacts associated with the Region L portion of the strategy.

Other Impacts

In general, importing water from rural areas may affect rural users, as described in *Chapter 8* of the 2021 Plan.

5.2.4.3.2. Alliance Regional Water Authority Pipeline

This strategy involves the withdrawal and transport of groundwater from the Carrizo-Wilcox Aquifer in Gonzales County to the I-35 Corridor area near San Marcos, Kyle and Buda. This is primarily a Region L strategy, but a large portion of Buda is within Region K. The infrastructure required to implement this strategy includes:

- New well fields in Caldwell and Gonzales Counties.
- New treatment facilities near the new well fields.
- New pump stations and pipelines to convey the water to a delivery point near the Hays-Caldwell county line, approximately 5 miles northeast of San Marcos.

The following table lists the projected water use of this strategy.

Table 5.104: ARWA Pipeline Yield for Region K

WUG	County	Basin	Importing From			Water Management Strategies (ac-ft/yr)					
			Region	County	Aquifer	2020	2030	2040	2050	2060*	2070*
Buda	Hays	Colorado	L	Caldwell	Carrizo-Wilcox	762	762	1,829	1,829	2,007	2,007

*In 2060 and 2070, a small portion of the volume (21 AF) has been identified for the Region L portion of Buda.

Detailed information on this strategy, including Region L water user groups and yields, is included in the 2021 South Central Texas Regional Water Plan under the ARWA/GBRA Project.

Cost Implications of Proposed Strategy

The following table below describes the estimated costs for this strategy. The costs identified are Buda's portion of the overall ARWA project cost. Buda's portion of the ARWA costs is 5.08%.

Table 5.105: ARWA Pipeline Cost for Region K

WUG	County	Basin	Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
Buda	Hays	Colorado	$15,403,000	$21,965,000	$2,337,000	$1,106

More detailed cost information for this strategy is included in the 2021 South Central Texas Regional Water Plan under the ARWA/GBRA Project.

Environmental Considerations

There are several rare species that are in the vicinity of the project. Of these, the only one that is protected by USFWS or TPWD is the Cagle's map turtle.

It is assumed the pipeline construction would have negligible impacts on cultural resources, but coordination with the Texas Historical Commission will need to occur and proper environmental field studies will need to be performed before construction begins. Refer to *Chapter 1, Appendix 1A*, for the complete list by county of threatened and endangered species in the Lower Colorado Regional Water Planning Area. These species may need to be considered during construction of infrastructure.

More detailed environmental considerations for this strategy are included in the 2021 South Central Texas Regional Water Plan under the ARWA/GBRA Project.

Agricultural & Natural Resources Considerations

There are negligible impacts to agriculture or natural resources with respect to acres of land anticipated from this strategy; however, the additional drawdown of the aquifer has the potential to impact agriculture by creating the need to lower pumps, redrill wells, and pay for additional electricity for pumping. As these impacts are indefinite, it is difficult to determine quantified costs associated with these potential impacts. However, the groundwater permitting process is a public process and local groundwater users that may be affected have the ability to provide input regarding concerns on potential drawdown.

Other Impacts

In general, importing water from rural areas may affect rural users, as described in *Chapter 8* of the 2021 Plan.

5.2.4.4 Aquifer Storage and Recovery

5.2.4.4.1. BS/EACD –Edwards/Middle Trinity ASR

The basic definition of aquifer storage and recovery (ASR) is the storage of water in a suitable aquifer during times of excess water supply, and the recovery of the water from the same aquifer during times of greater water demand. Water is injected and removed from the aquifer through wells. ASR has the benefit of underground storage, so there is no evaporation, and dedicated storage tanks or reservoirs do not have to be built. There are also fewer environmental issues compared to surface storage because it does not change the surface of the land. This type of strategy is currently being used by cities in Texas including San Antonio, Kerrville, and El Paso.

For Hays, Hays County-Other, and Creedmoor-Maha WSC, the proposed source of water for this strategy is groundwater from the Edwards (Balcones Fault Zone, or BFZ) Aquifer in Hays County, although other sources could be used as well. For Buda, water sources include the Edwards-BFZ Aquifer as well as an existing GBRA surface water contract sourcing from Canyon Lake. Water would only be drawn from the Edwards-BFZ Aquifer for storage in the ASR during non-drought years, in months of low demand by water users who are permitted to withdraw from the Edwards-BFZ Aquifer.

The proposed storage aquifer for this strategy is the Middle Trinity Aquifer. This aquifer overlaps with the Edwards-BFZ Aquifer but is located at a greater depth; water will be pumped from the Edwards-BFZ Aquifer at a higher elevation to the Middle Trinity Aquifer at a lower elevation. The Middle Trinity Aquifer was selected as a storage aquifer because of its favorable hydrogeologic conditions which allow for water injection and a low rate of stored water migration. Additionally, the Middle Trinity Aquifer is located close to the source water and close to the distribution system, which is ideal for ASR.

At this time, the following WUGs have made progress towards or have been suggested as possible utilities for implementing this strategy: Buda, Creedmoor-Maha WSC, Hays, and Hays County-Other. Each WUG would implement their own ASR system with associated infrastructure.

At this time, one WUG has indicated interest and/or progress toward implementing this strategy. As of June 2019, Buda has completed a feasibility study for this strategy and allocated funds for a pilot test to begin in the fall of 2019, with facilities expected to be online in 2020. Strategy yield is expected to be 150 ac-ft/yr by 2020, with a full capacity of 600 ac-ft/yr reached by 2030.

The following infrastructure is required to implement the strategy for Buda:

- Existing wells should have capacity to extract the needed Edwards-BFZ Aquifer water, so no new extraction wells are assumed in the costing.
- New treatment facilities to treat the water to standards suitable for injection into the Middle Trinity Aquifer. A minimal level of treatment is assumed, with some mineral removal, as the extracted groundwater should be relatively clean.
- Four (4) new injection-extraction wells, each used to both inject and extract water to/from the Middle Trinity Aquifer. Since the Middle Trinity Aquifer overlaps with the Edwards aquifer, it is assumed that the wells extracting from Edwards and the wells injecting into Middle Trinity can be located in close proximity. Thus, no intermediate pump stations or pipelines are assumed.

- New transmission pump stations and pipelines to convey the water to the points of use. It is assumed that 1 mile of pipeline is sufficient to convey the water into the existing distribution system, for the various water users. Costs would be higher or lower, depending on actual distance.

For the remaining WUGs, the BS/EACD has available 2 cubic feet per second (1,448 ac-ft/yr) of freshwater from the Edwards-BFZ Aquifer for storage in ASR in a given year. Assuming 50% of years are non-drought years, total available withdrawal yield for these WUGs would be 724 ac-ft/yr. This strategy is expected to be online by 2030 and to provide the following yields to each WUG: 289 ac-ft/yr to Creedmoor-Maha WSC, 146 ac-ft/yr to Hays, and 289 ac-ft/yr to Hays County-Other. If other sources of water are identified for these WUGs, additional yield could be obtained from this strategy. Infrastructure required for each WUG's ASR project will include:

- Two (2) new extraction wells from the Edwards aquifer. The number of new wells was determined in the Cost Estimating Tool, based on the largest quantity of water supplied over the planning period. Wells were all assumed to be the same type, size, at the same elevation, and to have an efficiency of 80% and a peaking factor of 2. The well field layout was determined by two wells per "node," a 0.5-mile transmission line between each well and its node, and an additional 0.5 mile "trunk" line connecting to the next node.
- New treatment facilities to treat the water to standards suitable for injection into the Middle Trinity Aquifer. A minimal level of treatment is assumed, with some mineral removal, as the extracted groundwater should be relatively clean.
- Two (2) new injection-extraction wells, each used to both inject and extract water to/from the Middle Trinity Aquifer. Since the Middle Trinity Aquifer overlaps with the Edwards aquifer, it is assumed that the wells extracting from Edwards and the wells injecting into Middle Trinity can be located in close proximity. Thus, no intermediate pump stations or pipelines are assumed.
- New transmission pump stations and pipelines to convey the water to the points of use. It is assumed that 1 mile of pipeline is sufficient to convey the water to the existing distribution system, for the various water users. Costs would be higher or lower, depending on actual distance.

Table 5.106 summarizes the yields by decade for this strategy.

Table 5.106: BS/EACD – Edwards/Middle Trinity ASR Yield

WUG	County	Basin	Water Management Strategies (ac-ft/yr)					
			2020	2030	2040	2050	2060	2070
Buda	Hays	Colorado	150	600	600	600	600	600
Hays	Hays	Colorado	0	146	146	146	146	146
Hays County-Other	Hays	Colorado	0	289	289	289	289	289
Creedmoor-Maha WSC	Travis	Colorado	0	289	289	289	289	289

Cost Implications of Proposed Strategy

Costs for this strategy were developed based on background information provided by BS/EACD and Buda and were computed using the Texas Water Development Board (TWDB) Cost Estimating Tool. Consistent with the tool, all costs are given in September 2018 dollars.

If other sources of water other than the Edwards-BFZ Aquifer are identified for Hays, Hays County-Other, and Creedmoor-Maha WSC, strategy yields could be increased and unit costs reduced.

The table below shows the estimated costs for this strategy.

Table 5.107: BS/EACD – Edwards/Middle Trinity ASR Cost

WUG	County	Basin	Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
Buda	Hays	Colorado	$5,235,000	$7,349,000	$839,000	$1,398
Hays	Hays	Colorado	$4,026,000	$5,673,000	$561,000	$3,842
Hays County-Other	Hays	Colorado	$4,235,000	$5,975,000	$633,000	$2,190
Creedmoor-Maha WSC	Travis	Colorado	$4,235,000	$5,975,000	$633,000	$2,190

Environmental Considerations

BS/EACD and TCEQ permits will be required to ensure the facility complies with all environmental considerations. This includes an aquifer study to determine the impact of the strategy on the proposed storage aquifer.

During average rainfall, the strategy may decrease springflow by removing up to an additional 1,324 ac-ft/yr for storage, within permitted amounts. Negligible impacts are expected during drought periods.

While it is assumed that this strategy would have negligible impacts to cultural resources and wildlife habitat, coordination with the Texas Historical Commission will need to occur and proper environmental field studies will need to be performed before any construction begins. Refer to *Chapter 1, Appendix 1A*, for the complete list by county of threatened and endangered species in the Lower Colorado Regional Water Planning Area. These species may need to be considered during construction of infrastructure.

Agricultural & Natural Resources Considerations

Negligible impacts to natural resources are expected as a result of implementing this strategy. If water is used for irrigation purposes, it would provide up to an additional 1,324 ac-ft/yr of water supply for agriculture. If it is used for municipal or manufacturing purposes, it would have no impact on agriculture, including zero agricultural acres impacted..

5.2.4.4.2. BS/EACD – Saline Edwards Desalination and ASR

The basic definition of aquifer storage and recovery (ASR) is the storage of water in a suitable aquifer during times of excess water supply, and the recovery of the water from the same aquifer during times of greater water demand. Water is injected and removed from the aquifer through wells. ASR has the benefit of underground storage, so there is no evaporation, and dedicated storage tanks or reservoirs do not have to be built. There are also fewer environmental issues compared to surface storage because it does not change the surface of the land. This type of strategy is currently being used by cities in Texas including San Antonio, Kerrville, and El Paso.

The water source for this strategy is brackish groundwater (8,000 mg/L TDS) from the saline Edwards-BFZ Aquifer. Water extracted from the saline Edwards-BFZ Aquifer will be desalinated prior to use or storage. The storage aquifer for this strategy is the saline portion of the Edwards-BFZ Aquifer. This portion of the aquifer is more suited for storage than the freshwater portion, as it has lower transmission rates and much higher residence times.

The ASR system will be operated as follows: in winter months, when consumer demands are low, a portion of the treated water will be pumped back into the aquifer for storage. In summer months, when consumer demands are high, the stored ASR water will be retrieved and distributed. This system allows for a reduced sizing of the treatment plant, as peak demands are mitigated through ASR.

The potential users identified to date for this water include Buda and rural users in Hays County.

While the 2018 Desalination/ASR feasibility report prepared for Barton Springs / Edwards Aquifer Conservation District sizes the project at 2.5 MGD (2,800 ac-ft/yr), for regional water planning purposes, the full amount of water is not available within the Modeled Available Groundwater (MAG) due to other projects in the 2021 Region K Plan. As a result, for regional water planning purposes, the sizing for this strategy has been limited to 1,300 ac-ft/yr. The infrastructure required to implement this strategy includes:

- Thee (3) extraction wells from the saline Edwards Aquifer. The extraction location is assumed to be the Texas Disposal Systems site in Creedmoor, TX. A peaking factor of one (1) was assumed for wells, given that ASR wells will supply water in order to mitigate peak demands. The number of new wells was determined in the Cost Estimating Tool, based on the largest quantity of water supplied over the planning period. Wells were all assumed to be the same type, size, at the same elevation, and to have an efficiency of 80%. The well field layout was determined by two wells per "node," a 0.5-mile transmission line between each well and its node, and an additional 0.5-mile "trunk" line connecting to the next node.
- Two (2) ASR injection-extraction wells to store/retrieve treated water in/from the saline Edwards aquifer. It is assumed that the ASR wells will be located 1 mile from the extraction wellfield, to prevent migration of stored ASR water. Therefore, 1 mile of transmission main and an associated pump station is assumed. Given the relatively short storage time (less than one year), minimal treatment via chlorine disinfection is assumed of ASR water upon extraction.
- ~1.2 MGD (1,300 ac-ft/yr) desalination treatment facility to treat water extracted from the saline Edwards-BFZ Aquifer. Source water is assumed to be brackish groundwater with a TDS of 8,000 mg/L. A reduced peaking factor was assumed because ASR wells will supply water in order to mitigate peak demands.
- Two (2) concentrate injection wells into the saline zone of the Edwards Aquifer. Concentrate injection is assumed to occur at a greater depth than the water extracted for treatment.
- New transmission pump stations and pipelines to convey the water to the points of use. It is assumed that 3 miles of pipeline is sufficient to convey the water to the existing distribution system, for the various water users.

Other requirements for this strategy include an aquifer study for the identified aquifer to determine feasibility and implementation requirements. The land required for the aquifer storage and recovery wells would also have to be purchased.

The yield from this strategy is projected to be 1,300 ac-ft/yr, including 800 ac-ft/yr for Buda and 500 ac-ft/yr for Hays County-Other. The water use for each is projected to start in the 2040 planning decade. The table below shows the projected yields by decade for this strategy.

Table 5.108: BS/EACD – Saline Edwards Desalination and ASR Yield

WUG	County	Basin	Water Management Strategies (ac-ft/yr)					
			2020	2030	2040	2050	2060	2070
Buda	Hays	Colorado	0	0	800	800	800	800
County-Other	Hays	Colorado	0	0	500	500	500	500

Cost Implications of Proposed Strategy

Costs for this strategy were developed using the Texas Water Development Board (TWDB) Cost Estimating Tool based on background information provided by BS/EACD. Consistent with the tool, all costs are given in September 2018 dollars.

Per Barton Springs/Edwards Aquifer GCD requirements, a $0.08 per 1,000 gallons (approximately $26.07/ac-ft) fee was assumed for production from the Saline Edwards Management Zone.

There is the potential for reduced annual and unit costs for this strategy due to beneficial use of methane produced by an existing landfill located on-site. The energy produced from this methane could be used to power the desalination plant, pump station, and/or wells associated with this strategy. For the purposes of the 2021 Regional Water Plan, the costs for this strategy do not assume any reduction in power costs from this potential future power source, but future planning cycles could include this cost reduction.

The table below shows the estimated costs for this strategy.

Table 5.109: BS/EACD – Saline Edwards Desalination and ASR Cost

WUG	County	Basin	Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
Buda	Hays	Colorado	$7,302,000	$10,332,000	$1,572,000	$1,951
County-Other	Hays	Colorado	$4,475,000	$6,332,000	$964,000	$1,951

Environmental Considerations

While environmental considerations for underground storage are less than that for surface storage, extensive permitting will still be required to ensure the facility complies with all environmental considerations. This includes an aquifer study to determine the impact of the strategy on the proposed storage aquifer. It also includes consideration of environmental impacts of disposal of the brine generated by the desalination treatment process.

The water supply for this strategy is within the Modeled Available Groundwater (MAG), so this strategy could contribute to drawdown in the aquifer of up to 75 feet by 2070, relative to January 2000 conditions.

While it is assumed that this strategy would have negligible impacts to cultural resources and wildlife habitat, coordination with the Texas Historical Commission will need to occur and proper environmental field studies will need to be performed before any construction begins. Refer to *Chapter 1, Appendix 1A*, for the complete list by county of threatened and endangered species in the Lower Colorado Regional Water Planning Area. These species may need to be considered during construction of infrastructure.

Additionally, desalination facilities require greater energy demands, and thus produce more greenhouse gas emissions, in comparison to surface or groundwater facilities. While many studies demonstrate this water-energy relationship, the following list of energy requirements by water source type draw from the findings of the *EPRI Journal*, ("Water & Sustainability Volume 4," R. Goldstein et al, 2002) and the *International Journal of Environmental Science and Development* ("Energy Efficient Reverse Osmosis Desalination," R. Dashtpour et al, 2012):

- Fresh surface water: 1,406 kWh, or 994 kg CO2eq, per MG water treated
- Fresh groundwater: 1,834 kWh, or 1290 kg CO2eq, per MG water treated
- Desalination by reverse osmosis: 11,355 kWh, or 8030 kg CO2eq, per MG water treated

Thus, even the most energy-efficient desalination processes produce approximately six to eight times as many greenhouse gas emissions, as compared to fresh and groundwater sources. There is the potential for reduced annual and unit costs for this strategy due to beneficial use of methane produced by an existing landfill located on-site. The energy produced from this methane could be used to power the desalination plant, pump station, and/or wells associated with this strategy.

Agricultural & Natural Resources Considerations

Negligible impacts to natural resources are expected as a result of implementing this strategy. If water is used for irrigation purposes, it would provide up to an additional 1,300 ac-ft/yr of water supply for agriculture. If it is used for municipal or manufacturing purposes, it would have no impact on agriculture, including zero agricultural acres impacted.

5.2.4.5 Burnet County Regional Projects

5.2.4.5.1. Buena Vista[6]

The Buena Vista Regional Project would serve Burnet and the Cassie and Buena Vista subdivisions (County-Other) in Burnet County, along with potential other small communities falling under County-Other. The following table shows the yields for this strategy.

[6] *Source: Roth, S. (2011). North Option 3: Burnet, Bertram, Buena Vista, and Cassie. In Burnet-Llano County Regional Facility Study (pp. 72-74).*

Table 5.110: Buena Vista Regional Project Yield

WUG	County	Basin	Water Management Strategies (ac-ft/yr)					
			2020	2030	2040	2050	2060	2070
Burnet	Burnet	Colorado	0	1,000	2,000	2,000	2,000	2,000
County-Other	Burnet	Brazos	0	500	1,000	1,000	1,000	1,000
County-Other	Burnet	Colorado	0	565	1,884	1,884	1,884	1,884

A portion of County-Other is located in the Brazos River basin, and because the water supplied by the Buena Vista Regional Project is coming from Lake Buchanan in the Colorado River basin, the project will require an interbasin transfer permit (IBT) under Texas Water Code 11.085. However, many provisions of 11.085, including 11.085(k), which requires an analysis of the water needs in the basin of origin and the receiving basin, will not apply to an IBT permit for this project. TWC 11.085(v)(4) stipulates that projects transferring water from one river basin to another, but within a single county, must obtain authorization for the interbasin transfer, but that only TWC 11.085(a) applies. Because County-Other is in Burnet County, which is also the location of the water supply, the exemption provided by TWC 11.085(v)(4) applies.

For the proposed Buena Vista Regional Project, Burnet's existing raw water intake (RWI), water treatment plant (WTP), and 18-inch transmission main would remain in place and serve as the core of the regional water system. The RWI, WTP and associated high service pump station (HSPS) firm capacities would all be expanded to 5,130 ac-ft/yr (4.58 MGD) to meet the added demand of the other entities. Over time, the RWI, WTP, and HSPS will each be expanded incrementally, reaching an ultimate firm capacity of 9,766 ac-ft/yr (8.72 MGD) in the year 2040. This includes a peaking factor of two on the yields shown in the table above.

New transmission mains (8-inch for Buena Vista; 6-inch extension for Cassie) will be extended west and northwest from the WTP to serve the Buena Vista and Cassie Subdivision areas. Additionally, an 18-inch raw water pipeline will be installed alongside the existing 16-inch raw water line that runs from the RWI to the WTP. The flow within the existing 18-inch potable water transmission line would also need to be increased, requiring the construction of a 200,000-gallon ground storage tank and booster pump about 3.1 miles east of the existing WTP.

When the water demand exceeds the capacity provided by the 18-inch line, booster pump, and storage tank, a new 12-inch transmission main would be constructed along the route of the existing 18-inch transmission main from the WTP to the City of Burnet to supplement its capacity. The new transmission main would be tied into the intermediate storage tank and booster pump station.

Cost Implications of Proposed Strategy

Costs for this strategy were pulled from the *Burnet-Llano County Regional Facility Study* and updated using the Texas Water Development Board (TWDB) Cost Estimating Tool. Consistent with the tool, all costs are given in September 2018 dollars.

The table below shows the estimated costs for this strategy.

Table 5.111: Buena Vista Regional Project Cost

WUG	County	Basin	Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
Burnet	Burnet	Colorado	$8,402,539	$11,828,829	$2,271,089	$1,136
County-Other	Burnet	Brazos	$4,201,269	$5,914,414	$1,135,545	$1,136
County-Other	Burnet	Colorado	$7,915,192	$11,142,757	$2,139,366	$1,136

Note that the annual costs include $145/ac-ft required for water purchase. The contracting portion of the strategy is included under the New LCRA Contracts with Infrastructure and LCRA Contract Amendments with Infrastructure strategy.

Environmental Considerations

This project covers several miles. This project could remove up to 5,000 ac-ft/yr of water from the Highland Lakes, with no return flows. Impacts from construction of intakes, treatment plants, and pipelines should be limited primarily to the construction period as long as care is taken to avoid environmentally sensitive areas and provide proper restoration to the surface when complete.

While it is assumed that this strategy would have negligible impacts to cultural resources and wildlife habitat, coordination with the Texas Historical Commission will need to occur and proper environmental field studies will need to be performed before any construction begins. Refer to *Chapter 1, Appendix 1A*, for the complete list by county of threatened and endangered species in the Lower Colorado Regional Water Planning Area. These species may need to be considered during construction of infrastructure.

Agricultural & Natural Resources Considerations

Impacts to agriculture should be relatively limited. Up to 5,000 ac-ft/yr would be removed from the Highland Lakes. As firm municipal and industrial demands increase in the future, less interruptible water will be available to meet downstream agriculture demands.

5.2.4.5.2. East Lake Buchanan[7]

A portion of the water user group (WUG) defined as County-Other in Burnet County currently receives their water from multiple groundwater sources. This water supply is unreliable and contaminated with radionuclides. To help alleviate concerns of water reliability and quality, Burnet County has proposed the East Lake Buchanan Project, a water supply system for the surrounding region. The project consists of replacing the existing groundwater sources with a new surface water supply. A new raw water intake would pump to a regional water treatment plant located near Bonanza Beach, along the northeast side of Lake Buchanan, as shown below in *Figure 5.2.* This location was chosen because it is a relatively undeveloped part of the lake's eastern shore that offers access to an even deeper part of the lake. A proposed high service pump station and transmission mains would deliver water south to Council Creek Village and north to the other participants in this area.

[7] *Source: Roth, S. (2011). North Option 2A: NE Buchanan Regional Alternative (Intake near Bonanza Beach). In Burnet-Llano County Regional Facility Study (pp. 71-72).*

Figure 5.2: East Lake Buchanan Regional Project Location

The following table shows the yield for this strategy.

Table 5.112: East Lake Buchanan Regional Project Yield

WUG	County	Basin	Water Management Strategies (ac-ft/yr)					
			2020	2030	2040	2050	2060	2070
County-Other	Burnet	Colorado	0	498	935	935	935	935

Based on the LCRA Lake Buchanan bathometry map, the lowest contour near the proposed intake structure location is 950 ft-MSL, which is 33.7 feet below the historical low water surface elevation for the lake. The raw water intake and pump station are planned to have a firm capacity of 997 ac-ft/yr (0.89 MGD) by the year 2030. Both will subsequently be expanded to reach a capacity of 1,871 ac-ft/yr (1.67 MGD) by the year 2040 to meet increased demand in the area. This includes a peaking factor of two on the yield shown in the table above.

A 10-inch raw water pipeline will be used to transport pumped raw water from the intake to the water treatment plant. This 10-inch line will be sized to meet the demands of 1,871 ac-ft/yr expected for the year 2040. This includes a peaking factor of two on the yield shown in the table above.

A high service pump station will be constructed, initially with a capacity of 997 ac-ft/yr, at the water treatment plant to pump finished water from the water treatment plant to the regional transmission main and then to the participating distribution systems. This high service pump station will later be expanded to reach a capacity of 1,871 ac-ft/yr. This includes a peaking factor of two on the yield shown in the table above.

A 12-inch regional transmission main will be constructed east along an easement to FM 2341 at the southern edge of Council Creek Village. The 12-inch main will extend to the delivery point to Council Creek Village, where it would be reduced to a 10-inch transmission main extending northwest along FM 2341 to Bonanza Beach, South Silver Creek (I, II and III), and Burnet County MUD 2 with a branch to other northeast Lake Buchanan developments. An extension would provide treated water to Paradise Point via a 4-inch underwater crossing of Lake Buchanan. The regional transmission mains would deliver water to each participant's existing distribution system or into their existing water storage tanks. A 50,000-gallon regional storage tank is also recommended to maintain system pressure and improve pump operating conditions at the high service pump station.

Cost Implications of Proposed Strategy

Costs for this strategy were pulled from the Burnet-Llano County Regional Facility Study and updated using the Texas Water Development Board (TWDB) Cost Estimating Tool. Consistent with the tool, all costs are given in September 2018 dollars. The table below shows the estimated costs for this strategy.

Table 5.113: East Lake Buchanan Regional Project Cost

WUG	County	Basin	Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
County-Other	Burnet	Colorado	$8,306,000	$11,925,000	$1,830,000	$1,957

Note: The annual costs include $145/ac-ft required for water purchase. The contracting portion of the strategy is included under the New LCRA Contracts with Infrastructure strategy.

Environmental Considerations

This project covers several miles. This project could remove up to 935 ac-ft/yr of water from the Highland Lakes, with no return flows. Impacts from construction of intakes, treatment plants, and pipelines should be limited primarily to the construction period as long as care is taken to avoid environmentally sensitive areas and provide proper restoration to the surface when complete.

While it is assumed that this strategy would have negligible impacts to cultural resources and wildlife habitat, coordination with the Texas Historical Commission will need to occur and proper environmental field studies will need to be performed before any construction begins. Refer to *Chapter 1, Appendix 1A*, for the complete list by county of threatened and endangered species in the Lower Colorado Regional Water Planning Area. These species may need to be considered during construction of infrastructure.

Agricultural & Natural Resources Considerations

Impacts to agriculture should be minimal. Up to 935 ac-ft/yr would be removed from the Highland Lakes. As firm municipal and industrial demands increase in the future, less interruptible water will be available to meet downstream agriculture demands.

5.2.4.5.3. Marble Falls[8]

The Marble Falls Regional Water System would serve Marble Falls and County-Other entities, including Blanco San Miguel, Capstone Water System, and Windermere Oaks WSC, and potential others. This regional system has been proposed to address water reliability issues in several of these communities and to serve future development needs along Highway 281 and Highway 71. The system would also provide interconnects for either permanent or emergency water needs throughout the service area.

[8] *Source: Roth, S. (2011). South Option 2: Southeast Burnet County Regional System. In Burnet-Llano County Regional Facility Study (pp. 76-78).*

The following table shows the yields for this strategy.

Table 5.114: Marble Falls Regional Project Yield

WUG	County	Basin	Water Management Strategies (ac-ft/yr)					
			2020	2030	2040	2050	2060	2070
County-Other	Burnet	Colorado	0	1,578	1,578	1,578	1,578	1,578
Marble Falls	Burnet	Colorado	0	4,000	4,000	4,000	4,000	4,000

A new raw water intake (RWI) and pump station and WTP would be constructed upstream of Max Starcke Dam. A high service pump station (HSPS) would also be constructed at the WTP to pump finished potable water out into the transmission system. The regional plan also includes the incorporation of existing and addition of new transmission lines to serve the future County-Other Burnet community developments along Highways 71 and 281. Two new storage tanks (one ground, one elevated) and a booster pump station out in the transmission system are also planned.

An 18" main would need to be constructed that runs from the proposed WTP located at Max Starcke Dam to a new elevated storage tank (EST) and booster pump station located at Highway 71. At Highway 71, the main transitions into a 16" line that runs to a proposed ground storage tank (GST) at the Blanco/Burnet county line for water to serve Blanco San Miguel. Blanco San Miguel would be responsible for building their own pump station at the GST.

Additionally, a new 10" line would be built starting at the EST and booster pump station at Highway 71 and heading 2.6 miles southeast to Quail Creek and another 2.7 miles to the Spicewood Turnoff. At this point one 6-inch water transmission main would extend to Windermere Oaks WSC.

Cost Implications of Proposed Strategy

Costs for this strategy were pulled from the *Burnet-Llano County Regional Facility Study* and updated using the Texas Water Development Board (TWDB) Cost Estimating Tool. Consistent with the tool, all costs are given in September 2018 dollars.

The table below shows the estimated costs for this strategy.

Table 5.115: Marble Falls Regional Project Cost

WUG	County	Basin	Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
County-Other	Burnet	Colorado	$11,426,800	$16,014,200	$2,266,000	$1,436
Marble Falls	Burnet	Colorado	$28,965,200	$40,593,800	$5,744,000	$1,436

Environmental Considerations

This project covers several miles. This project could remove up to 5,600 ac-ft/yr of water from the Highland Lakes, with no return flows. Impacts from construction of intakes, treatment plants, and pipelines should be limited primarily to the construction period as long as care is taken to avoid environmentally sensitive areas and provide proper restoration to the surface when complete.

While it is assumed that this strategy would have negligible impacts to cultural resources and wildlife habitat, coordination with the Texas Historical Commission will need to occur and proper environmental field studies will need to be performed before any construction begins. Refer to *Chapter 1, Appendix 1A*, for the complete list by County of threatened and endangered species in the Lower Colorado Regional Water Planning Area. These species may need to be considered during construction of infrastructure.

Agricultural & Natural Resources Considerations

Impacts to agriculture should be minimal. Up to 5,600 ac-ft/yr would be removed from the Highland Lakes. As firm municipal and industrial demands increase in the future, less interruptible water will be available to meet downstream agriculture demands.

5.2.4.6 Rainwater Harvesting

Rainwater harvesting is collecting the run-off from a structure or other impervious surface in order to store for later use. As stated on the TWDB website under Rainwater FAQ, "rainwater harvesting is valued as a water conservation tool to reduce demand on more traditional water supply sources." This strategy is not intended to meet all water needs of a particular household but is intended to provide a supplemental supply that reduces demands on the WUG.

The implementation of rainwater harvesting as a water management strategy is dependent upon the catchment area, storage capacity, rainfall frequency, and water demand of the end user. During 2011, at the peak of the drought of record, Travis County received approximately 19 inches of rain and Hays County received approximately 18 inches of rain. This rainfall is not distributed uniformly during the year and, as a result, implementation of rainwater harvesting as a water management strategy should consider water demands and supplies over a multi-month period.

Typically, rooftops serve as the catchment area for rainwater harvesting systems, either from a single residence or a group of buildings. A catchment area of 2,000 square feet yields about 1,000 gallons for 1 inch of rainfall. The required storage capacity is a function of the rainfall frequency and water demand. As stated above, the variability of rainfall results in a need to consider sizing facilities to provide storage over a multi-month period in order to balance rainfall with water demand. This strategy assumes each household has a 15,000-gallon storage capacity.

If rainwater harvesting is considered for non-potable, secondary uses, as opposed to being a primary water supply, the significance of storage is lessened, and the only remaining concern is the distribution system to deliver the water. This distribution system typically consists of a pump and pressure tank. However, some rainwater catchment systems are gravity driven, where pressurized systems may not be required. If rainwater harvesting is considered as the primary potable water supply, additional considerations concerning filtration and disinfection must be considered. The filtration is readily available with cloth and carbon filtration units. The disinfection is readily available with either chemical or ultraviolet systems. Like the non-potable use, a distribution system is required and includes a pump and pressure tank.

For the purposes of planning, it was assumed that 10% of households (one catchment area per household) will implement large-scale rainwater harvesting starting in 2030. By 2070, that is about 893 households in

Hays County-Other, 1,467 households in Dripping Springs WSC, 124 households in Hays, and 64 households in Sunset Valley. By this estimation, one household implementing rainwater harvesting will yield approximately 0.055 ac-ft, or 17,920 gallons, in a drought year. Based on an assumed 15,000-gallon storage capacity, the limiting factor to yield is the drought-conditions rainfall; thus, this full yield will be available at each location throughout the full period of drought of record conditions. Assuming a catchment area of a house is about 2,000 square feet and the conditions stated above, the yield is estimated for drought of record rainfall conditions, shown in the following table.

Table 5.116: Rainwater Harvesting Yield

WUG	County	Basin	Water Management Strategies (ac-ft/yr)					
			2020	2030	2040	2050	2060	2070
County-Other	Hays	Colorado	0	16	24	31	36	50
Dripping Springs WSC	Hays	Colorado	0	34	44	57	73	81
Hays	Hays	Colorado	0	3	4	4	6	7
Sunset Valley	Travis	Colorado	0	2	2	3	3	4

Cost Implications of Proposed Strategy

The project costs – that is, full system costs and operations and maintenance costs – of rainwater harvesting systems are borne by individual system owners, although some water user groups provide incentives to these individuals such as rebates and tax credits. The actual cost of a rainwater harvesting system is proportional to the water demand to be served by the system. It is assumed that a single-family household system consists of 15,000 gallons of storage, a pump and pressure tank, cloth filtration, carbon filtration, an ultraviolet disinfection system and miscellaneous piping. All equipment is assumed to be located on the footprint of the homeowner's property. The capital cost for this system is about $11,500 for a system with a 30-year life.

The Texas Water Development Board (TWDB) Cost Estimating Tool methodology was used to determine facility costs, project costs, annual costs, and unit costs for 893 households in Hays County-Other, 1,467 households in Dripping Springs WSC, 124 households in Hays, and 64 households in Sunset Valley. A 5% operations and maintenance (O&M) cost was applied to annual costs. The following table identifies the facilities, project, annual, and unit costs associated with the rainwater harvesting strategy.

Table 5.117: Rainwater Harvesting Cost

WUG	County	Basin	Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
County-Other	Hays	Colorado	$10,275,000	$10,275,000	$1,236,800	$24,962
Dripping Springs WSC	Hays	Colorado	$16,867,000	$16,867,000	$2,030,200	$24,961
Hays	Hays	Colorado	$1,429,000	$1,429,000	$172,000	$24,966
Sunset Valley	Travis	Colorado	$739,000	$739,000	$89,000	$22,918

Environmental and Agricultural Considerations

The benefit of rainfall harvesting is a decreased use of surface water or groundwater. Because of the close distance between the rainwater storage and the end use on the property, the gravity fed collection system, and the small footprints of storage tanks, there are no significant environmental or energy consumption impacts. Rainwater harvesting can additionally be beneficial from a stormwater management standpoint by reducing runoff during large storm events. Overall, zero environmental impacts (all environmental factors) are anticipated from this strategy. Zero impacts to agriculture are also anticipated.

In some states, water right permits or authorizations are required for rainwater harvesting projects. Texas, however, does not require authorization for rainwater harvesting projects.

5.2.4.7 Water Purchase

This strategy acknowledges that certain WUGs in the region currently or may in the future purchase water from water providers other than LCRA. For those that currently purchase water from a provider, it is likely that these WUGs will purchase additional water as population and demands increase over time.

It should be noted that while several WUGs receive treat and transport services from West Travis County PUA, their contract for water is with LCRA, so strategies are included under LCRA contracts and contract amendments.

Table 5.118 lists the WUG that will implement this strategy as a new purchase, along with the volume of water needed and the entity supplying the water. *Table 5.119* lists the WUGs that will increase their existing contract, along with the volume of water needed and the entity supplying the water.

Table 5.118: New Water Purchase Suppliers and Yield

WUG	County	Basin	Supplier	Water Management Strategies (ac-ft/yr)					
				2020	2030	2040	2050	2060	2070
Hays	Hays	Colorado	Buda	0	0	0	0	70	140
Mining	Hays	Colorado	Buda (Reuse)	0	200	600	600	800	1,000
Windermere Utility	Travis	Colorado	Blue Water	0	500	500	500	500	500
Llano	Llano	Colorado	Burnet	177	0	0	0	0	0

Table 5.119: Water Purchase Amendment Suppliers and Yield

WUG	County	Basin	Supplier	Water Management Strategies (ac-ft/yr)					
				2020	2030	2040	2050	2060	2070
Barton Creek WSC	Travis	Colorado	Travis County MUD 4	90	90	90	90	90	90
Creedmoor-Maha WSC	Travis	Colorado	Aqua WSC	0	0	335	335	335	335
Travis County MUD 14	Travis	Colorado	Aqua WSC	0	0	0	35	35	35

Cost Implications of Proposed Strategy

The assumption used for this strategy is that the water is sold at retail cost, so there is no additional cost to the WUG, apart from Hays. Costs are based on the $/1,000-gallon cost currently charged by the water seller. For Hays to be able to purchase water from Buda, it is assumed that a one-mile pipeline would need to be built to connect the two systems.

Llano's water need is largely based on regional water planning WAM modeling assumptions regarding senior water right holders in the basin simultaneously diverting and totally consuming the water up to their full authorizations. Historically, Llano has had limited experience with running low on water, even for just a temporary basis. The Llano strategy for emergency water shortage conditions would be implemented by purchasing raw water from Burnet to be delivered by truck to the water treatment plant. As such, cost would depend on rates for hauling raw water and volumes to be transported. Llano provided a cost estimate consisting of an approximate 250,000 gallons per day, or 48 truckloads, supplied at $35,000/day. This strategy would not be feasible for Llano to implement long-term.

Table 5.120 identifies the facilities, project, annual, and unit costs associated with the water purchase strategies.

Table 5.120: New Water Purchase & Water Purchase Amendment Cost

WUG	County	Basin	Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
Hays	Hays	Colorado	$134,000	$213,000	$215,000	$1,536
Mining	Hays	Colorado	$0	$0	$1,596,670	$1,597
Llano	Llano	Colorado	$0	$0	$8,074,588	$45,619
Barton Creek WSC	Travis	Colorado	$0	$0	$146,633	$1,629
Creedmoor-Maha WSC	Travis	Colorado	$0	$0	$409,350	$1,222
Travis County MUD 14	Travis	Colorado	$0	$0	$42,768	$1,222
Windermere	Travis	Colorado	$0	$0	$583,273	$1,167

Environmental Considerations

It is assumed the pipeline construction would have negligible impacts on cultural resources and wildlife habitat, but coordination with the Texas Historical Commission will need to occur and proper environmental field studies will need to be performed before construction begins. The impact of constructing the pipeline along an existing road should be low, with most of the impact occurring during the construction process itself.

Refer to *Chapter 1, Appendix 1A*, for the complete list by county of threatened and endangered species in the Lower Colorado Regional Water Planning Area. These species may need to be considered during construction of infrastructure.

Agricultural & Natural Resources Considerations

No impacts (zero acres impacted) to agriculture are expected as a result of implementing this strategy.

5.2.4.8 Brush Management

The following is a condensed version of the draft *Brush Control as a Water Management Strategy* prepared by HDR for Region G Planning Group and proposed for inclusion in Region K. Water supply yields and costs have been developed separately by Region K using a 2000 study of the Pedernales River/Lake Travis watershed.

Brush management is a potential water management strategy that could possibly create additional water supply in Texas. The Texas Brush Control Program, created in 1985 and operated by the Texas State Soil and Water Conservation Board (TSSWCB), served to study and implement brush control programs until September 2011. HB1808 established a new program in 2012, the Water Supply Enhancement Program (WSEP), with the purpose and intent of increasing available surface and ground water supplies through the selective control of brush species detrimental to water conservation. The program did not receive appropriations for the biennium beginning September 1, 2019, so any use of the program would require action by the legislature.

When the program has appropriations, the TSSWCB collaborates with soil water conservation districts and other local, regional, state, and federal agencies to identify watersheds across the state where it is feasible to implement brush control in order to enhance water supplies. The TSSWCB uses a competitive grant process to rank feasible projects and allocate WSEP grant funds, giving priority to projects that balance the most critical water conservation need of municipal water user groups with the highest projected water yield from brush management.

Brush management for water supply enhancement is addressed differently by the 16 Regional Water Planning Groups (RWPG). It typically is described as, alternatively, brush control, brush management, land stewardship, or range management. Brush management is a possible recommended or alternative Water Management Strategy which may have a quantified yield or a zero yield.

In prioritizing projects for funding, brush management for water supply enhancement must be viewed favorably by the RWPG where the proposed project is located. “Viewed favorably” is distinguished as a recommended or alternative Water Management Strategy or as a Policy Recommendation. Otherwise, the application is considered not to qualify for funding (State Water Supply Enhancement Plan, TSSWCB, July 2014).

Implementation

Brush Management is a land management practice that converts land that is covered with brush (such as juniper, mesquite, and saltcedar) to grasslands. The impact of these practices can increase water availability through reduced extraction of soil water for transpiration and increased recharge to shallow groundwater and emergent springs. To a lesser extent, there is the potential for increased runoff during rainfall events (Brush Control and Range Management: 2011 Brazos G Regional Water Plan).

Grazing management is very important following any type of upland brush control to allow the desirable forages to exert competition with the brush plants and to maintain good herbaceous groundcover, which hinders establishment of woody plant seedlings. Continued maintenance of brush is necessary to ensure the benefits of this potential strategy.

Target species are those noxious brush species that consume water to a degree that is detrimental to water conservation (i.e., phreatophytes).

Eligible Species:

- mesquite (Prosopis spp.)
- juniper (Juniperus spp.)
- saltcedar (Tamarix spp.)

Other species of interest conditionally eligible:

- huisache (Acacia smallii)
- Carrizo cane (Arundo donax)

The following methods of brush control are commonly practiced in Texas and have shown to have effective results.

Mechanical Brush Control

A wide variety of mechanical brush control methods are available. The simplest is selective brush control with a hand axe and chain saw. Grubbing and piling is frequently done with a bulldozer. This may be either clear-cut or selective.

Moderate to heavy mesquite or cedar can be grubbed (bulldozer with a 3-foot-wide grubbing attachment) or root plowed for $210 to $535/acre. Two-way chaining can be effective on moderate to heavy cedar, but it often just breaks off mesquite and they re- sprout profusely from the bud zones below ground. Using hydraulic shears mounted on Bobcat loaders can be effective on blueberry juniper (a non-sprouting species) for a cost of $85 to $175/acre. If the shears are used on mesquite or redberry juniper one must spray the stump immediately with an herbicide, which will cost in the range of $175/acre.

Chemical Brush Control

Several herbicides are approved for brush control and may be applied by aircraft, from booms on tractor-pulled spray rigs, or from hand tanks. Some herbicides are also available in pellet form.

Chemical treatments with Triclopyr (Remedy®) and Clopyralid methyl were shown to achieve about 70 percent root kill in studies around the state and in adjacent states. Generally, commercial aerial applications are not as effective, which is most likely due to fewer controls. Other herbicide treatments are available, but many will achieve little root kill. Aerial spraying of brush such as mesquite costs about $28 per acre and does not vary with plant density or canopy cover.

Brush Control by Prescribed Burning

Prescribed burning is defined as the application of fire to a predetermined area. The burn is conducted under prescribed conditions to achieve the desired effects. Prescribed burning allows for the control or suppression of undesirable vegetation to facilitate distribution of grazing and browsing animals, to improve forage production and/or quality, and to improve wildlife habitat.

Prescribed burning is estimated at $52/ac by EQIP payments. Actual costs will depend on how rocky the soils are and the amount of large brush to remove from the fire guards (i.e., a once-over pass with a maintainer versus clearing heavy brush with a bulldozer, then smoothing up the fire guard). Prescribed burning will only be effective under the right environmental conditions, and with an adequate amount of fine fuel (dead or dormant grasses). For successful burns, a pasture deferment is essential for part or all the growing season prior to burning and burned pastures must be rested after the burn. On average, a 12-month deferment is necessary, which may increase costs if a rancher cannot utilize the land for livestock grazing.

Burning rarely affects moderate to heavy stands of mature mesquite. Burning only topkills the smooth-bark of mesquite plants and they re-sprout profusely. For mesquite, fire only gives short-term suppression, and stimulates the development of heavier canopy cover than was present pre-burn. Burning is not usually an applicable tool in moderate to heavy cedar (juniper) because these stands suppress production of an adequate amount of grass for fine fuel. Burning can be excellent for controlling junipers over 4 feet tall, if done correctly. Prescribed burning is often not recommended for initial clearing of heavy brush due to the concern that the fire could become too hot and sterilize the soil. Burning is often used for maintenance of brush removal.

Bio-Control of Brush

Bio-control of salt cedar is a relatively new technique to be used in Texas. This control method has been studied for nearly 20 years and there have been pilot studies in the Lake Meredith watershed and most recently in the Colorado River Basin. Research has shown that the Asian leaf beetle can consume substantial quantities of salt cedar in a relatively short time period, and generally does not consume other plants. Different subspecies of the Asian beetle appear to be sensitive to varying climatic conditions, and there is on-going research on appropriate subspecies for Texas. It is recommended that this control method be integrated with chemical and mechanical removal to best control re-growth. The cost per acre is unknown.

Supply Attained by Brush Control

Although the actual supply benefit resulting from a brush management project is site specific, a 2000 study of the Pedernales River/Lake Travis watershed projected an average annual water yield increasing flows to Lake Travis by 57,050 ac-ft/yr. While average inflows into lakes Travis and Buchanan from 1942-2013 were 1,230,301 ac-ft (per USGS), the inflows during 2011 – the drought of record – were 127,802 ac-ft. Adjusted for drought of record conditions, brush management can increase drought-condition inflows to Lake Travis by 5,926 ac-ft/yr. This would be considered a benefit to LCRA and its customers.

While the above analysis focuses on increased runoff, there is also a local benefit to groundwater based on increased deep drainage. A study[9] documenting a water balance assessment on rangeland at the Texas Agriculture Experiment Station in Sonora, TX shows that removing juniper does not necessarily increase runoff because the soil under the cut brush maintains high infiltration rates after removal. The research indicated an increase in the deep drainage infiltration from 0 inches at 36% juniper to 0.3 inches at 18%

[9] Thurow, T. and Hester, J. “How an increase or reduction in juniper cover alters rangeland hydrology.” Texas A&M University: Texas Natural Resources Server. 1997.

juniper, and up to 3.7 inches for complete juniper removal with 100% grass. 3.7 inches of deep drainage/yr is equal to 100,500 gallons/ac/yr.

From the Pedernales River/Lake Travis study, it is assumed that 203,752 acres of brush are managed; this assumes 72,000 acres in Blanco County, 114,000 acres in Gillespie County, 8,500 acres in Hays County, and 8,500 acres in Travis County. If 40 percent of the brush removal acres contain juniper in quantities that can increase deep drainage by 0.3 inches per year, the additional benefit to local groundwater could be up to 2,000 ac-ft of water. Based on this projection, this yield has been allocated proportionally by geographic area to four counties in the Region K area.

This allocation is listed under County-Other, as shown in *Table 5.121*, and is assumed to be in effect by 2030. This quantified supply estimate will be available in a sustained manner throughout drought of record conditions as the increased permeability in the soil allows for additional deep drainage; these estimates assume the minimum rainfall and do not account for any surface water inflows. The 2017 State Water Supply Enhancement Plan mentions proposed feasibility for other areas in Region K, including the Barton Springs segment of the Edwards Aquifer (Barton and Onion Creeks), Lake Buchanan (including San Saba River, Brady Creek, and lower Pecan Bayou), and Lake LBJ, primarily Llano River below confluences of South and North Llano Rivers. Region K supports the funding of these feasibility studies but is not showing yields and costs for brush management strategies in those areas at this time. Region K acknowledges that brush management could be applied to other counties as well including, but not limited to, San Saba, Llano, Burnet, and Mills counties.

Table 5.121: Brush Management Yield

WUG	County	Basin	Water Management Strategies (ac-ft/yr)					
			2020	2030	2040	2050	2060	2070
County-Other	Blanco	Colorado	0	708	708	708	708	708
County-Other	Gillespie	Colorado	0	1,125	1,125	1,125	1,125	1,125
County-Other	Hays	Colorado	0	83	83	83	83	83
County-Other	Travis	Colorado	0	83	83	83	83	83

Cost Implications of Proposed Strategy

Brush management projects are site specific and costs can vary widely. For this strategy, costs were taken from the Pedernales/Lake Travis Watershed study and applied proportionally to the geographic area of the four counties. The average state cost share adjusted to September 2018 dollars was reported as $150.95/acre improved. Assuming the full 203,752 acres are improved, the facilities cost of the state's share totals $28,911,000. The state cost share is estimated as the difference between the present value of the total cost per acre of the control program and the present value of the benefits to the rancher. The costs to the state include only the cost for the state's cost share for brush control. Costs that are not accounted for, but which must be incurred, include costs for administering the program. Under current law, this task will be the responsibility of the Texas State Soil and Water Conservation Board. *Table 5.122* identifies the facilities, project, annual, and unit costs for the state associated with brush management in the region.

Table 5.122: Brush Management Cost

WUG	County	Basin	Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
County-Other	Blanco	Colorado	$10,240,000	$10,522,274	$842,646	$1,190
County-Other	Gillespie	Colorado	$16,261,000	$16,708,308	$1,338,037	$1,190
County-Other	Hays	Colorado	$1,205,000	$1,238,209	$99,158	$1,190
County-Other	Travis	Colorado	$1,205,000	$1,238,209	$99,158	$1,190

Environmental Considerations

On specific tracts where brush control would incorporate state or federal funding, regulatory compliance with the Texas Antiquities Code and National Historic Preservation Act may be required that may involve cultural resource surveys and incorporation of preservation measures. The Texas Commission on Environmental Quality has established regulations governing prescribed burning. There may also be local and county regulations associated with burning practices.

This strategy will have no impact on agriculture, including zero agricultural acres impacted.

Implementation Issues

The extent of brush management that may be desired by landowners will depend on how they plan to manage their land for wildlife and how the brush control will affect the value of the land for wildlife recreation purposes. In recent years, the value of ranch lands which have sufficient brush cover to support wildlife populations, particularly white-tailed deer, wild turkey, bobwhite, and scaled quail, has increased at a faster rate than the value of those lands which are void of brush or woody vegetation. Consequently, many landowners can be expected to support brush control to the extent that it does not exclude wildlife populations.

Other implementation issues for landowner participation include the perceived economic benefit of brush management. If the land is currently not actively managed for ranching or wildlife recreation the owner may choose not to participate. Decreased profitability of sheep, goat, and cattle grazing systems will influence the economics of brush control by ranchers, and consequently their willingness to participate. Also, the size of the land tracts can affect the total amount of brush removed and the effectiveness of a program. Watersheds that contain many small tracts are less likely to have the contiguous land owner participation that is needed to realize the water supply benefits associated with brush control.

5.2.4.9 Drought Management

Drought management is different from conservation in that conservation tends to look at the long-term and takes more permanent steps to reduce a community’s GPCD slowly over time. Actions such as replacing old water fixtures with new low-flow fixtures, providing public education to the community about native vegetation that requires less water, and performing audits on waterlines to check for leaks are examples of conservation measures that, over time, can reduce the amount of water that a community needs. Drought management, on the other hand, attempts to reduce a community’s GPCD by a larger amount over a shorter period of time. Both drought management and conservation can be important and effective in their own ways.

The GPCD numbers used in this plan are an annual average. The actual amount of water used is generally higher in the summer and lower in the winter, mainly due to outdoor watering in the warmer months. By restricting outdoor watering to once per week during the warmer months as a way of managing drought, the annual average GPCD for a community can be significantly lowered, depending on the level of restriction and the effort to provide the appropriate information to the public. Tiered water rates, which charge higher $/1,000-gallon rates once a customer uses more than a specified amount, have also been found to be effective in reducing water use.

5.2.4.9.1. Municipal Utilities

Some municipal WUGs implemented mandatory water use restrictions during the summer of 2011. The Edwards-BFZ Aquifer in Hays County and Travis County – permitted by the BS/EACD – reached Critical Drought Stage, which required users to reduce water use by 30 percent. Austin restricted outdoor watering to one day per week. Both types of restrictions were effective in reducing water use. Austin showed that municipal WUGs that currently have their demands met (no shortage/need) can still be proactive by implementing drought management during times of reduced rainfall. Many other WUGs did not implement mandatory water restrictions until late in 2011 or early 2012. Thus, the water demand projections in the Region K Water Plan generally do not reflect implemented drought management water restrictions inherently. Based upon the restrictions implemented in recent years, it can be anticipated that in the future, during times of reduced rainfall comparable to 2011, water use restrictions would be implemented in a large portion of the region. Triggers associated with these recommended strategies include those referenced in the LCRA Water Management Plan and the individual municipal drought contingency plans (DCPs). The Palmer Drought Severity Index is another resource that could be used for determining triggers for these strategies.

The methodology applied for the drought management strategy for municipal WUGs is as follows:

- GPCD greater than 100 – 20% water demand reduction each decade.
- GPCD less than or equal to 100 – 5% water demand reduction each decade.
- Defer to a WUG's DCP "Severe" trigger response goal when possible.
- Consider whether mandatory water use restrictions were in place in 2011.
- Consider levels of conservation that have been implemented since 2011.

For this planning cycle, drought management is recommended for most municipal WUGs regardless of need. The LCRWPG encourages municipal WUGs to follow their DCPs, as appropriate. For some WUGs that have drought management recommended as a strategy, the percent of water use reduction is as high as 30 percent per the "Severe" trigger goal as indicated in the WUG's respective DCP. Drought management is applied after conservation; this total demand reduction, which can reach up to 59 percent for a WUG with a high GPCD, is feasible during Drought of Record conditions as water conservation follows the WCITF recommendations and drought management follows the WUGs' trigger response goals. *Table 5.123* below shows the municipal WUGs that would utilize this strategy along with the implementation decade and the amount of water saved.

Table 5.123: Municipal Drought Management Water Savings

WUG	County	Basin	Water Management Strategies (ac-ft/yr)					
			2020	2030	2040	2050	2060	2070
Aqua WSC	Bastrop	Brazos	17	23	30	39	52	69
Aqua WSC	Bastrop	Colorado	1,733	2,278	3,058	3,949	5,246	6,966
Aqua WSC	Bastrop	Guadalupe	12	16	21	28	37	49
Bastrop	Bastrop	Colorado	372	471	631	849	1,143	1,534
Bastrop County WCID 2	Bastrop	Colorado	24	35	49	68	94	129
County-Other	Bastrop	Brazos	2	2	2	2	3	4
County-Other	Bastrop	Colorado	250	274	322	386	474	591
County-Other	Bastrop	Guadalupe	6	7	8	10	12	15
Creedmoor-Maha WSC	Bastrop	Colorado	0	0	0	0	0	0
Elgin	Bastrop	Colorado	213	213	197	158	210	279
Lee County WSC	Bastrop	Brazos	7	8	9	11	15	19
Lee County WSC	Bastrop	Colorado	10	11	13	15	20	26
Polonia WSC	Bastrop	Colorado	3	4	4	5	6	8
Smithville	Bastrop	Colorado	150	198	259	343	456	606
Blanco	Blanco	Guadalupe	63	55	60	63	65	66
Canyon Lake Water Service	Blanco	Guadalupe	11	14	16	20	23	27
County-Other	Blanco	Colorado	70	65	59	56	54	54
County-Other	Blanco	Guadalupe	53	49	44	42	41	40
Johnson City	Blanco	Colorado	64	77	84	87	90	91
Bertram	Burnet	Brazos	78	85	88	89	94	101
Burnet	Burnet	Brazos	1	1	1	1	2	2
Burnet	Burnet	Colorado	301	328	338	361	395	425
Corix Utilities Texas Inc	Burnet	Colorado	25	30	34	37	41	44
Cottonwood Shores	Burnet	Colorado	45	53	61	68	75	80
County-Other	Burnet	Brazos	246	273	273	300	325	348
County-Other	Burnet	Colorado	437	486	486	534	579	620
Georgetown	Burnet	Brazos	15	17	17	19	20	22

WUG	County	Basin	Water Management Strategies (ac-ft/yr)					
			2020	2030	2040	2050	2060	2070
Granite Shoals	Burnet	Colorado	29	32	35	38	44	53
Horseshoe Bay	Burnet	Colorado	125	158	178	190	195	194
Kempner WSC	Burnet	Brazos	32	35	39	42	45	49
Kingsland WSC	Burnet	Colorado	2	3	3	3	4	4
Marble Falls	Burnet	Colorado	428	567	738	772	759	776
Meadowlakes	Burnet	Colorado	155	140	126	113	102	92
Columbus	Colorado	Colorado	206	194	180	169	157	146
Corix Utilities Texas Inc	Colorado	Colorado	9	9	9	9	9	10
County-Other	Colorado	Brazos-Colorado	18	14	11	10	10	10
County-Other	Colorado	Colorado	113	90	71	61	61	62
County-Other	Colorado	Lavaca	39	31	24	21	21	21
Eagle Lake	Colorado	Brazos-Colorado	30	26	24	22	23	23
Eagle Lake	Colorado	Colorado	68	60	54	51	52	54
Weimar	Colorado	Colorado	30	28	26	25	26	27
Weimar	Colorado	Lavaca	61	57	53	51	53	55
Aqua WSC	Fayette	Colorado	1	1	1	1	1	1
County-Other	Fayette	Colorado	124	116	106	102	104	107
County-Other	Fayette	Guadalupe	7	7	6	6	6	6
County-Other	Fayette	Lavaca	58	54	49	48	49	50
Fayette County WCID Monument Hill	Fayette	Colorado	33	32	31	30	30	31
Fayette WSC	Fayette	Colorado	122	126	128	131	136	141
Fayette WSC	Fayette	Guadalupe	8	8	8	9	9	9
Fayette WSC	Fayette	Lavaca	14	15	15	15	16	16
Flatonia	Fayette	Guadalupe	12	12	12	13	14	14
Flatonia	Fayette	Lavaca	51	53	52	56	58	60
La Grange	Fayette	Colorado	174	196	213	226	237	245
Lee County WSC	Fayette	Colorado	25	24	23	22	23	23

WUG	County	Basin	Water Management Strategies (ac-ft/yr)					
			2020	2030	2040	2050	2060	2070
Schulenburg	Fayette	Lavaca	128	131	128	130	136	141
West End WSC	Fayette	Colorado	7	7	8	8	9	10
County-Other	Gillespie	Colorado	144	105	90	95	100	105
County-Other	Gillespie	Guadalupe	6	4	4	4	4	4
Fredericksburg	Gillespie	Colorado	610	589	560	535	508	504
Austin	Hays	Colorado	9	38	59	94	137	198
Buda	Hays	Colorado	322	443	607	813	1,045	1,309
Cimarron Park Water	Hays	Colorado	18	12	12	11	11	11
County-Other	Hays	Colorado	158	103	132	155	176	243
Deer Creek Ranch Water	Hays	Colorado	1	1	2	2	2	2
Dripping Springs WSC	Hays	Colorado	351	580	753	972	1,239	1,380
Goforth SUD	Hays	Colorado	8	10	12	16	20	24
Hays	Hays	Colorado	37	47	59	70	87	107
Hays County WCID 1	Hays	Colorado	149	134	121	114	114	114
Hays County WCID 2	Hays	Colorado	52	61	70	76	95	117
West Travis County Public Utility Agency	Hays	Colorado	819	921	933	1,033	1,104	1,151
Corix Utilities Texas Inc	Llano	Colorado	37	37	37	37	37	37
County-Other	Llano	Colorado	13	10	11	11	10	9
Horseshoe Bay	Llano	Colorado	516	482	423	386	342	301
Kingsland WSC	Llano	Colorado	46	52	51	48	52	57
Llano	Llano	Colorado	337	296	221	144	150	171
Sunrise Beach Village	Llano	Colorado	0	0	0	0	0	0
Bay City	Matagorda	Brazos-Colorado	582	593	596	605	614	621
Bay City	Matagorda	Colorado	1	1	1	1	1	1
Caney Creek MUD of Matagorda County	Matagorda	Brazos-Colorado	26	19	13	13	13	13

WUG	County	Basin	Water Management Strategies (ac-ft/yr)					
			2020	2030	2040	2050	2060	2070
Corix Utilities Texas Inc	Matagorda	Brazos-Colorado	1	1	1	1	1	1
Corix Utilities Texas Inc	Matagorda	Colorado	0	0	0	0	0	0
County-Other	Matagorda	Brazos-Colorado	22	23	22	23	23	23
County-Other	Matagorda	Colorado	5	5	5	5	5	5
County-Other	Matagorda	Colorado-Lavaca	25	25	25	25	25	25
Markham MUD	Matagorda	Colorado-Lavaca	5	5	5	5	5	5
Matagorda County WCID 6	Matagorda	Brazos-Colorado	6	6	6	6	6	6
Matagorda Waste Disposal & WSC	Matagorda	Brazos-Colorado	9	9	9	10	10	10
Matagorda Waste Disposal & WSC	Matagorda	Colorado	14	14	14	14	15	15
Palacios	Matagorda	Colorado-Lavaca	70	55	41	34	33	34
Brookesmith SUD	Mills	Colorado	1	1	1	1	2	2
Corix Utilities Texas Inc	Mills	Colorado	2	2	2	2	2	3
County-Other	Mills	Brazos	21	17	13	13	13	13
County-Other	Mills	Colorado	29	24	19	18	18	19
Goldthwaite	Mills	Brazos	2	2	2	2	2	2
Goldthwaite	Mills	Colorado	71	66	67	70	73	76
Zephyr WSC	Mills	Colorado	0	0	0	0	0	0
Corix Utilities Texas Inc	San Saba	Colorado	3	3	3	3	3	3
County-Other	San Saba	Colorado	44	44	43	43	43	44
North San Saba WSC	San Saba	Colorado	34	32	29	25	23	22
Richland SUD	San Saba	Colorado	41	38	35	31	32	33
San Saba	San Saba	Colorado	214	202	182	162	149	137
Aqua WSC	Travis	Colorado	208	240	270	304	334	362
Austin	Travis	Colorado	7,766	9,045	10,489	11,480	12,271	13,342

WUG	County	Basin	Water Management Strategies (ac-ft/yr)					
			2020	2030	2040	2050	2060	2070
Barton Creek West WSC	Travis	Colorado	79	71	64	58	52	47
Barton Creek WSC	Travis	Colorado	119	127	131	130	125	121
Briarcliff	Travis	Colorado	60	68	76	85	93	106
Cedar Park	Travis	Colorado	410	393	393	393	393	393
Cottonwood Creek MUD 1	Travis	Colorado	5	5	6	6	7	7
County-Other	Travis	Colorado	172	167	165	162	157	156
County-Other	Travis	Guadalupe	2	2	2	2	2	2
County-Other (Aqua Texas - Rivercrest)	Travis	Colorado	58	52	47	42	38	34
Creedmoor-Maha WSC	Travis	Colorado	29	31	33	36	39	42
Creedmoor-Maha WSC	Travis	Guadalupe	2	2	2	2	2	3
Cypress Ranch WCID 1	Travis	Colorado	6	6	7	7	7	7
Deer Creek Ranch Water	Travis	Colorado	2	2	3	3	3	3
Elgin	Travis	Colorado	41	45	42	32	37	42
Garfield WSC	Travis	Colorado	10	12	13	14	15	16
Goforth SUD	Travis	Guadalupe	0	1	1	1	1	2
Hornsby Bend Utility	Travis	Colorado	30	34	38	41	44	47
Hurst Creek MUD	Travis	Colorado	313	281	253	228	205	185
Jonestown WSC	Travis	Colorado	124	132	141	150	158	165
Kelly Lane WCID 1	Travis	Colorado	73	66	66	66	66	66
Lago Vista	Travis	Colorado	340	362	373	384	408	446
Lakeway MUD	Travis	Colorado	502	478	454	430	409	409
Leander	Travis	Colorado	320	594	616	645	659	686
Loop 360 WSC	Travis	Colorado	223	209	196	183	170	161
Manor	Travis	Colorado	161	204	249	302	350	395
Manville WSC	Travis	Colorado	488	589	687	799	899	993
North Austin MUD 1	Travis	Colorado	4	4	4	4	4	4

WUG	County	Basin	Water Management Strategies (ac-ft/yr)					
			2020	2030	2040	2050	2060	2070
Northtown MUD	Travis	Colorado	36	42	47	53	59	63
Oak Shores Water System	Travis	Colorado	27	28	26	23	21	20
Pflugerville	Travis	Colorado	2,460	3,068	3,748	4,423	5,103	5,103
Rollingwood	Travis	Colorado	70	63	57	52	47	46
Rough Hollow in Travis County	Travis	Colorado	107	199	179	179	179	179
Round Rock	Travis	Colorado	68	79	88	99	109	118
Senna Hills MUD	Travis	Colorado	76	82	84	83	80	77
Shady Hollow MUD	Travis	Colorado	144	137	137	137	137	137
Sunset Valley	Travis	Colorado	67	69	72	75	79	82
Sweetwater Community	Travis	Colorado	82	172	172	172	172	172
Travis County MUD 10	Travis	Colorado	17	18	19	20	22	23
Travis County MUD 14	Travis	Colorado	9	10	11	12	13	14
Travis County MUD 2	Travis	Colorado	45	46	48	49	52	56
Travis County MUD 4	Travis	Colorado	341	355	360	364	360	351
Travis County WCID 10	Travis	Colorado	796	786	766	748	720	688
Travis County WCID 17	Travis	Colorado	2,132	2,076	2,056	1,882	1,791	1,848
Travis County WCID 18	Travis	Colorado	263	304	342	385	423	458
Travis County WCID 19	Travis	Colorado	82	74	66	60	54	48
Travis County WCID 20	Travis	Colorado	106	96	86	77	70	63
Travis County WCID Point Venture	Travis	Colorado	46	53	57	62	71	82
Wells Branch MUD	Travis	Colorado	70	68	66	65	65	65
West Travis County Public Utility Agency	Travis	Colorado	1,219	1,212	1,178	1,182	1,134	1,077
Williamson County WSID 3	Travis	Colorado	20	22	20	19	19	19

WUG	County	Basin	Water Management Strategies (ac-ft/yr)					
			2020	2030	2040	2050	2060	2070
Williamson Travis Counties MUD 1	Travis	Colorado	22	19	18	18	17	17
Windermere Utility	Travis	Colorado	560	560	560	560	560	560
Boling MWD	Wharton	Brazos-Colorado	12	9	7	6	6	6
County-Other	Wharton	Brazos-Colorado	185	158	138	141	143	147
County-Other	Wharton	Colorado	96	82	71	73	74	76
County-Other	Wharton	Colorado-Lavaca	31	26	23	23	24	24
County-Other	Wharton	Lavaca	3	3	2	2	2	2
El Campo	Wharton	Colorado	1	1	1	1	1	1
Wharton	Wharton	Brazos-Colorado	168	173	181	189	195	201
Wharton	Wharton	Colorado	138	142	148	154	160	165
Wharton County WCID 2	Wharton	Brazos-Colorado	83	80	78	81	84	87
Austin	Williamson	Brazos	491	625	733	849	981	1,126
County-Other	Williamson	Brazos	13	19	18	17	16	15
North Austin MUD 1	Williamson	Brazos	39	37	36	36	36	36
Wells Branch MUD	Williamson	Brazos	4	4	4	4	4	4
Total			**32,804**	**36,630**	**40,330**	**44,006**	**48,336**	**53,100**

Cost Implications of Proposed Strategy

There are two types of costs associated with drought management. One cost associated with this strategy is related mainly to public outreach and enforcement. The annual costs can vary depending on the number of customers who need to be informed of the water use restrictions, the methods chosen to reach the customers, and the level of enforcement. In some cases, increased water rates and fines can recover the expenses of public outreach. The East Bay Municipal Utility District (EBMUD) in California provided an example for costs by hiring a public outreach consultant with the goal of saving a certain amount of water. The contract was for $1.75 million with a goal of saving 36,000 ac-ft of water in June 2008. After updating to September 2018 dollars, this works out to a unit cost of $66/ac-ft.

The second type of cost is that to the water supplier (utility) in reduced water sold, as well as economic impacts to the local area by not having that water. That cost was determined using the TWDB *Socioeconomic Impacts of Projected Water Shortages.*, prepared for the 2021 planning cycle and included in *Chapter 4* of this plan. The results of that report show that utility revenue losses are $16 million in 2020, based on municipal projected shortages of 4,726 ac-ft/yr, and increase to $419 million by 2070, based on municipal projected shortages of 107,425 ac-ft/yr. This equates to a unit cost ranging from $3,385 to $3,900 per ac-ft.

Environmental Considerations

In many cases, reducing groundwater use during a drought allows for more springflow to provide water downstream. Reducing surface water use allows more water to remain in the streams, rivers, and lakes. If all WUGs implemented their Drought Contingency Plans (DCPs), combined springflows and surface water flows could increase up to 53,100 ac-ft/yr if the water were available during a drought period. As this supply may not be available during a drought period and as different WUGs have different DCP triggers, no environmental impacts (all environmental factors) are anticipated from individual WUGs implementing their DCP.

Agricultural & Natural Resources Considerations

No impacts to agriculture (zero impacted acres) are expected.

5.2.4.9.2. Irrigation

Drought management is recommended for several of the Irrigation WUGs. Irrigation has severe shortages throughout the planning period, and drought management may be a necessary strategy to implement.

Surface water irrigators in Colorado, Matagorda, and Wharton counties receive water under the authorities of the Garwood, Lakeside, Pierce Ranch, and Gulf Coast Irrigation Divisions. The LCRA Water Management Plan (WMP) determines water availability for these users based on hydrologic conditions and surface water availability. During times of drought, the WMP implements water restrictions by curtailment of water. Because of this, irrigation surface water users were not assumed to implement drought management.

This drought management strategy would assume that during severe drought conditions, farmers that use groundwater would restrict their usage by 25 percent. In addition, drought management is recommended for Irrigation in Mills County (Brazos Basin). There are limited supplies of water in that area of the county, and it is assumed that the growth of agriculture would be reduced based on water available. The Palmer Drought Severity Index is a resource that could be used for determining triggers for these strategies. The volumes of water saved (ac-ft/yr) are also shown below in *Table 5.124*.

Table 5.124: Irrigation Drought Management Water Savings

WUG	County	Basin	Water Management Strategies (ac-ft/yr)					
			2020	2030	2040	2050	2060	2070
Irrigation	Colorado	Brazos-Colorado	3,268	3,180	3,094	3,011	2,930	2,851
Irrigation	Colorado	Colorado	1,015	988	962	936	911	886
Irrigation	Colorado	Lavaca	4,102	3,991	3,884	3,780	3,678	3,579
Irrigation	Matagorda	Brazos-Colorado	4,262	4,147	4,036	3,927	3,822	3,719

Irrigation	Matagorda	Colorado	35	34	33	32	31	31
Irrigation	Matagorda	Colorado-Lavaca	4,183	4,070	3,961	3,854	3,750	3,650
Irrigation	Mills	Brazos	149	145	141	137	134	130
Irrigation	Wharton	Brazos-Colorado	11,773	11,456	11,148	10,848	10,557	10,273
Irrigation	Wharton	Colorado	5,366	5,222	5,081	4,945	4,812	4,682
Total			**34,153**	**33,234**	**32,340**	**31,470**	**30,624**	**29,800**

Cost Implications of Proposed Strategy

Costs for drought management for irrigation were determined using the TWDB Socioeconomic Impact Analysis of Unmet Needs from the 2021 Region K Water Plan, which shows an impact cost to the local economy based on the missed opportunity to grow agriculture. This cost, which is an opportunity cost rather than an implementation cost, was used due to the fact that farming is an important part of the local economy, and the high cost of agriculture necessitates the farmers maximize their yield to generate a profit. Unit costs range from county to county. The unit cost for Irrigation WUGs in Colorado County is $192/ac-ft; the unit cost for Irrigation WUGs in Matagorda County is $168/ac-ft; the unit cost for Irrigation WUGs in Mills County is $777/ac-ft; and the unit cost for Irrigation WUGs in Wharton County is $233/ac-ft. No capital costs are associated with this strategy.

Environmental Considerations

In the case of irrigation in the lower portion of the basin, return flows can be valuable sources of streamflow during later summer months. This strategy would reduce irrigation return flows by up to 6,800 ac-ft/yr. It would also reduce the acreage of potential feedstock for migratory birds by approximately 22,000. There are zero anticipated impacts to cultural resources.

Agricultural & Natural Resources Considerations

Farming is an important part of the economy in the lower three counties in the region. Not supplying water to meet irrigation needs has negative economic impacts to the entire agriculture economy and rural local economies. Cost impacts are described above.

5.2.5 Municipal Water Management Strategies

The municipal WUGs include water utilities and County-Other (rural/unincorporated areas of municipal water use aggregated on a county basis).

Several strategies were identified to meet the municipal shortages including conservation; conservation was the first strategy considered for municipal WUGs with needs. For several municipal WUGs with shortages, the following regional management strategies were selected:

- Expansion of Current Groundwater Supplies
- Development of New Groundwater Supplies
- Water Importation

- Aquifer Storage and Recovery
- Water Purchase
- Drought Management

These regional strategies are explained in detail in *Section 5.2.4* of this report.

In addition to these strategies, several municipal WUGs with shortages purchase water from LCRA. Amendments to these LCRA contracts or new LCRA contracts are also identified as a strategy to meet shortages. These strategies are explained in *Sections 5.2.3.1.3*, *0*, *06*, and *07*.

In addition to the strategies identified above, additional municipal strategies have been identified to meet specific WUG needs. The following sections provide a description, analysis, and cost breakdown for these municipal strategies.

5.2.5.1 Municipal Conservation

Municipal conservation is covered in the required consolidated Conservation section of *Chapter 5.* More specifically, it is discussed in *Section 5.2.2.3*, Municipal Conservation.

5.2.5.2 Wharton Water Supply

Diminishing reliability of groundwater supplies have caused the Wharton Water User Group (WUG) to proactively develop water supply strategies that could enable it to meet the water demands for area growth not otherwise planned for in regional water planning. It believes that its proximity to the Houston urban area and the new I-69 corridor will increase its water demands during the next fifty years beyond those otherwise anticipated in regional water planning. A regional water supply study for the City of Wharton and East Bernard, published April 2017, detailed three alternative supply sources to provide additional water: surface water, additional groundwater, and aquifer storage and recovery. Of the alternatives, the study recommended the use of additional groundwater from the Gulf Coast Aquifer.

This strategy is described in detail in the Expanded Local Use of Groundwater section of this report as a recommended strategy. See *Section 5.2.4.1.4* for additional information.

5.2.5.3 Bastrop Regional Project

Combined with an increasing demand and limited groundwater, the following entities within Bastrop County are likely to require a new contract with LCRA for surface water supply from the Highland Lakes; Aqua Water Supply Corporation (WSC), Bastrop, and Bastrop County WCID 2. All would require new infrastructure to treat surface water as they currently have groundwater treatment and distribution infrastructure. See *Section 5.2.3.1.7*, New LCRA Contracts with Infrastructure, for strategy details.

5.2.5.4 Direct Potable Reuse

Direct Potable Reuse (DPR) is a water supply strategy that reclaims wastewater effluent to potable water quality and distributes treated potable water to users via a centralized distribution system. DPR is proposed as a strategy for three municipal WUGs within Region K.

Table 5.125 and *Table 5.126* list the project yields and associated costs, respectively, for each of the WUGs. Following the tables, each WUG has an individual section where details are discussed further.

Table 5.125: Direct Potable Reuse Yield

WUG	County	Basin	Water Management Strategies (ac-ft/yr)					
			2020	2030	2040	2050	2060	2070
Buda	Hays	Colorado	0	2,240	2,240	2,240	2,240	2,240
Dripping Springs WSC	Hays	Colorado	0	560	560	560	560	560
Llano	Llano	Colorado	0	280	280	280	280	280
West Travis County PUA	Hays, Travis	Colorado	0	336	336	336	336	336

Table 5.126: Direct Potable Reuse Cost

WUG	County	Basin	Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
Buda	Hays	Colorado	$24,148,000	$33,503,000	$4,399,000	$1,964
Dripping Springs WSC	Hays	Colorado	$8,736,000	$12,119,000	$1,446,000	$2,582
Llano	Llano	Colorado	$7,432,000	$10,415,000	$1,054,000	$3,764
West Travis County PUA	Hays, Travis	Colorado	$5,606,000	$7,788,000	$972,000	$2,893

5.2.5.4.1. Buda

Buda has contracted with the consulting engineer responsible for design of the Buda WWTP Phase III Expansion project to perform a Feasibility Study for evaluation of direct potable water reuse (DPR) alternatives. A draft Feasibility Study Report was submitted in May 2015 that defined feasibility, anticipated treatment process, proposed improvements, regulatory requirements, and planning-level cost estimates for a potential 1.5 MGD to 2 MGD Direct Potable Reuse project. This reuse project would be in addition to the non-potable direct reuse project recommended for Buda, as discussed in *Section 5.2.5.5*.

As part of the feasibility study phase, Buda met with TCEQ staff involved in approval of DPR projects. This meeting confirmed the regulatory feasibility of the proposed DPR project and provided definition of the procedures required by TCEQ for implementation. A 12-month detailed effluent characterization study followed and was completed in 2018. Pilot testing design has begun and is anticipated to be completed by 2021. After the completion of pilot testing, and approved permits from TCEQ are obtained, full-scale design and construction are anticipated to be completed before 2030.

This strategy is expected to provide 2,240 ac-ft/yr of potable water supply, beginning in the 2030 decade and extending through the planning period to 2070.

Cost Implications of Proposed Strategy

Based on the Feasibility Study Report assumptions and preliminary findings, the cost estimate includes a DPR WTP with 2.0 MGD capacity; modifications at the Buda WWTP site including effluent transfer pumping facilities and biological denitrification process; facilities for treatment and disposal of wastes from the DPR WTP treatment process under a TPDES permit; and offsite finished water pipeline, storage, and blending facilities. The costs from the Feasibility Study Report were reported in May 2015 dollars.

The cost of water purchase of the treated water has not been valued in this cost estimate, as no water purchase cost has been identified at this time. This assumption may be reevaluated in future regional water planning cycles.

Costs from the Feasibility Study Report were converted from May 2015 dollars to September 2018 dollars and input into the Texas Water Development Board's Cost Estimating Tool. The total facilities cost for this strategy is $24,148,000; the total project cost is $33,503,000; the total annual cost is $4,399,000; and the unit cost is $1,964/ac-ft/yr.

Environmental Considerations

If Buda decides to proceed with implementation of Direct Potable Reuse, it is anticipated that residuals from the DPR WTP treatment process would be further treated, then co-disposed under a TPDES permit with any remaining Buda WWTP effluent, accounting for diversions for direct non-potable and potable reuse. As a result, the Total Dissolved Solids (TDS) concentration of the WWTP effluent return flow to the Plum Creek watershed would be increased but remain within water-quality based limits authorized by TCEQ through the TPDES permitting process. Regulated constituents (chloride, sulfate) concentrations in the return flow to Plum Creek would also be increased, subject to TPDES permit limits.

For discharge to Andrews Branch, TCEQ's water quality modeling method is based on existing ambient segment concentrations of 867.8 mg/L TDS, 117.5 mg/L chloride, and 88 mg/L sulfate, and segment criteria of 1,120 mg/L TDS, 350 mg/L chloride, and 150 mg/L sulfate. Preliminary evaluations done for the DPR Feasibility Study indicated that TPDES limits of 1,314 to 1,324 mg/L TDS and 178 mg/L sulfate may be needed for disposal of residuals from a proposed 2 MGD DPR WTP treatment process through co-discharge with 1.5 MGD of WWTP effluent. TPDES limits did not appear to be required for chloride. Having completed its 12-month effluent characterization study in 2018, Buda is in the process of defining anticipated DPR WTP residuals and resulting blended discharge water quality parameters.

Buda discharges treated effluent to tributaries of Plum Creek, and by increasing the effluent reuse, this strategy will reduce the effluent discharge to natural waterways by up to 2,240 ac-ft/yr.

It is assumed that the project will have negligible impacts on cultural resources, but coordination with the Texas Historical Commission will need to occur before construction begins. Refer to *Chapter 1, Appendix 1A*, for the complete list by county of threatened and endangered species in the Lower Colorado Regional Water Planning Area. These species may need to be considered during construction of infrastructure.

Agricultural & Natural Resources Considerations

No impacts to agriculture (zero impacted acres) are expected as a result of implementing this strategy.

5.2.5.4.2. Dripping Springs WSC

In addition to reuse water allocated for non-potable direct reuse (see *Section 5.2.5.5*), Dripping Springs is looking at the option of allocating a portion of produced wastewater effluent for potable reuse. In preparation for a DPR project, Dripping Springs completed a feasibility study in April 2015 which examined treatment methods, regulatory requirements, and planning-level capital costs.

The results of this study indicated that DPR is a feasible option for Dripping Springs. The most cost-effective treatment option, ozone-biofiltration, was recommended for further consideration. Pilot testing, determination of residual disposal method, and permitting through TCEQ will need to be completed prior to project implementation.

This strategy would supply 560 ac-ft/yr (0.5 MGD), beginning in the 2030 decade and extending through the planning period to 2070.

Cost Implications of Proposed Strategy

Infrastructure required to implement this strategy includes:

- Retrofitting of the existing wastewater treatment plant, including biological nutrient removal
- 0.5 MGD DPR water treatment plant (includes advanced oxidation via ozone, biofiltration, ultrafiltration, UV disinfection, chlorine disinfection, and pH stabilization)
- Engineered storage buffer
- 0.5 MGD high service pump station and 8-inch PVC water line to convey DPR finished water to existing treated storage tank, allowing for tie-in into existing water system
- Outfall structure for backup WWTP effluent discharge to Walnut Springs Creek (required for permitting)

The cost of water purchase of the treated water has not been valued in this cost estimate, as no water purchase cost has been identified at this time. This assumption may be reevaluated in future regional water planning cycles.

Costs from the *City of Dripping Springs Direct Potable Reuse Feasibility Study* (April 2015) were converted from April 2015 dollars to September 2018 dollars and input into the Texas Water Development Board's Cost Estimating Tool. For this strategy, the total facilities cost is $8,736,000; the total project cost is $12,119,000; the total annual cost is $1,446,000/yr; and the annual unit cost is $2,582/ac-ft.

Environmental Considerations

Due to the increased wastewater effluent production as its population increases, Dripping Springs anticipates the need to discharge treated effluent into Walnut Springs Creek. Substantial implementation of direct potable reuse of effluent can mitigate or eliminate the need to discharge into Walnut Springs Creek.

As a part of the permitting process through TCEQ, a disposal method for the DPR WTP treatment residuals will need to be identified. Because the concentrations of regulated constituents (Total Dissolve Solids, chloride, sulfate, etc.) will be higher through DPR than conventional wastewater treatment, alternatives to land application or direct discharge may need to be pursued, including but not limited to: deep well injection, evaporation ponds, mechanical evaporation, or brine crystallization.

It is assumed that the project will have negligible impacts on cultural resources, but coordination with the Texas Historical Commission will need to occur before construction begins. Refer to *Chapter 1, Appendix 1A*, for the complete list by county of threatened and endangered species in the Lower Colorado Regional Water Planning Area. These species may need to be considered during construction of infrastructure.

Agricultural & Natural Resources Considerations

No impacts to agriculture (zero impacted acres) are expected as a result of implementing this strategy.

5.2.5.4.3. Llano

Llano requested a direct potable reuse strategy to be included for use in emergency drought conditions. In preparation for a DPR project, Llano will need to complete a feasibility analysis, pilot testing, and obtain relevant permits from the TCEQ.

This strategy is expected to provide 280 ac-ft/yr of potable water supply. This strategy will be included as a supply beginning in the 2030 decade and extending through the planning period to 2070.

Cost Implications of Proposed Strategy

Infrastructure required to implement this strategy includes:

- 0.25 MGD DPR treatment plant (includes reverse osmosis, microfiltration or ultrafiltration, ultraviolet disinfection, advanced oxidation processes, and pH stabilization)
- 6-in, 2-mile, above-ground transmission main and associated pumps to deliver treated water from the DPR plant to existing conventional water treatment plant for blending
- High service pump station expansion at existing wastewater treatment facility, to transmit water from advanced wastewater treatment to water treatment plant

The cost of water purchase of the treated water has not been valued in this cost estimate, as no water purchase cost has been identified at this time. This assumption may be reevaluated in future regional water planning cycles.

Costs were developed using the Texas Water Development Board Cost Estimating Tool and reported in September 2018 dollars. A 0.25 MGD advanced treatment plant was included in the costing to cover necessary additional treatment of the wastewater effluent before transmission to the water treatment plant. It is assumed additional treatment infrastructure would be added as an expansion to the existing wastewater treatment facilities. The cost of a 0.25 MGD DPR treatment plant was entered as an external cost based on estimated costs of advanced treatment facilities for the Buda and Dripping Springs direct potable reuse strategies. It was assumed that the cost of installing an above-ground pipeline per linear foot would be approximately half of the cost of a buried pipe installation. For this strategy, the total facilities cost is $7,432,000; the total project cost is $10,415,000; the total annual cost is $1,054,000/yr; and the annual unit cost is $3,764/ac-ft. Costs do not include concentrate disposal or upgrades to the existing water treatment plant that may be required by TCEQ.

Environmental Considerations

As a part of the permitting process through TCEQ, a disposal method for the DPR WTP treatment residuals will need to be identified. Because the concentrations of regulated constituents (Total Dissolve Solids, chloride, sulfate, etc.) will be higher through DPR than conventional wastewater treatment, alternatives to land application may need to be pursued, including but not limited to: deep well injection, evaporation ponds, mechanical evaporation, or brine crystallization.

It is assumed that the project will have negligible impacts on cultural resources, but coordination with the Texas Historical Commission will need to occur before construction begins. Refer to *Chapter 1, Appendix 1A*, for the complete list by county of threatened and endangered species in the Lower Colorado Regional Water Planning Area. These species may need to be considered during construction of infrastructure.

Agricultural & Natural Resources Considerations

No impacts to agriculture (zero impacted acres) are expected as a result of implementing this strategy.

5.2.5.4.4. West Travis County PUA

In addition to their allocation for non-potable direct reuse (see *Section 5.2.5.5*), West Travis County PUA requested that Region K include a strategy in the 2021 Plan for them to allocate a portion of produced wastewater effluent for potable reuse. In preparation for a DPR project, West Travis County PUA will need to complete a feasibility analysis, pilot testing, and obtain relevant permits from the TCEQ.

This strategy is expected to provide 336 ac-ft/yr of potable water supply, beginning in the 2030 decade and extending through the planning period to 2070.

Cost Implications of Proposed Strategy

Infrastructure required to implement this strategy includes:

- 0.3 MGD DPR treatment plant (includes reverse osmosis, microfiltration or ultrafiltration, ultraviolet disinfection, advanced oxidation processes, and pH stabilization)
- 6-in, 0.5-mile transmission main and associated pumps to deliver treated water from the DPR plant to existing conventional water treatment plant for blending
- High service pump station expansion at existing water treatment facility, to transmit water produced via DPR to distribution system

The cost of water purchase of the treated water has not been valued in this cost estimate, as no water purchase cost has been identified at this time. This assumption may be reevaluated in future regional water planning cycles.

Costs were developed using the Texas Water Development Board Cost Estimating Tool and reported in September 2018 dollars. For this strategy, the total facilities cost is $5,606,000; the total project cost is $7,788,000; the total annual cost is $972,000/yr; and the annual unit cost is $2,893/ac-ft. Costs do not include concentrate disposal or upgrades to the existing wastewater treatment plant to meet influent criteria for the DPR plant.

Environmental Considerations

West Travis County PUA cannot discharge wastewater into the Highland Lakes, so direct potable reuse presents an alternative to disposal via land application.

As a part of the permitting process through TCEQ, a disposal method for the DPR WTP treatment residuals will need to be identified. Because the concentrations of regulated constituents (Total Dissolve Solids, chloride, sulfate, etc.) will be higher through DPR than conventional wastewater treatment, alternatives to land application may need to be pursued, including but not limited to: deep well injection, evaporation ponds, mechanical evaporation, or brine crystallization.

It is assumed that the project will have negligible impacts on cultural resources, but coordination with the Texas Historical Commission will need to occur before construction begins. Refer to *Chapter 1, Appendix 1A*, for the complete list by county of threatened and endangered species in the Lower Colorado Regional Water Planning Area. These species may need to be considered during construction of infrastructure.

Agricultural & Natural Resources Considerations

No impacts to agriculture (zero impacted acres) are expected as a result of implementing this strategy.

5.2.5.5 Direct Reuse (Non-Potable)

Direct Reuse is recommended as a strategy for several municipal WUGs within Region K. Yield information was obtained directly from these WUGs. *Table 5.127* and *Table 5.128* summarize the project yields and associated costs, respectively, for each of the WUGs, with the exception of Austin, which is discussed in *Sections 5.2.3.2.7 and 5.2.3.2.8*. Following the tables, each WUG then has an individual section where details are discussed further. There are many other municipal WUGs that have active reuse programs, but do not have a recommended reuse strategy.

Table 5.127: Direct Reuse Yield

WUG	County	Basin	Water Management Strategies (ac-ft/yr)					
			2020	2030	2040	2050	2060	2070
Blanco	Blanco	Guadalupe	0	146	146	146	146	146
Horseshoe Bay	Burnet, Llano	Colorado	0	154	154	154	154	154
Marble Falls	Burnet	Colorado	0	100	200	300	400	500
Meadowlakes	Burnet	Colorado	75	75	75	75	75	75
Fredericksburg	Gillespie	Colorado	0	132	132	132	132	132
Buda	Hays	Colorado	100	1,120	1,120	1,120	1,680	1,680
Dripping Springs WSC	Hays	Colorado	0	390	460	531	601	672
West Travis County PUA	Hays, Travis	Colorado	0	224	224	224	224	224
Lago Vista	Travis	Colorado	0	224	336	448	560	673
Lakeway MUD	Travis	Colorado	0	450	450	900	900	900
Travis County WCID 17	Travis	Colorado	0	510	510	510	510	510

Table 5.128: Direct Reuse Cost

WUG	County	Basin	Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
Blanco	Blanco	Guadalupe	$770,000	$1,110,000	$103,000	$705
Horseshoe Bay	Burnet, Llano	Colorado	$781,000	$1,084,000	$103,000	$669
Marble Falls	Burnet	Colorado	$980,000	$1,388,000	$148,000	$296
Meadowlakes	Burnet	Colorado	$0	$0	$0	$0
Fredericksburg*	Gillespie	Colorado	$7,335,000	$10,175,000	$789,000	$5,977
Buda	Hays	Colorado	$0	$0	$0	$0
Dripping Springs WSC	Hays	Colorado	$1,045,000	$1,450,000	$169,000	$251
West Travis County PUA	Hays, Travis	Colorado	$31,000	$207,000	$27,000	$121
Lago Vista	Travis	Colorado	$153,000	$212,000	$94,000	$140
Lakeway MUD	Travis	Colorado	$1,952,000	$2,736,000	$275,000	$306
Travis County WCID 17*	Travis	Colorado	$6,510,000	$9,030,000	$719,000	$1,410

* Costs for WUGs marked with an asterisk were calculated by inputting external capital costs provided by the WUG, adjusted to September 2018 dollars, into the TWDB's Unified Costing Model (UCM).

The cost of water purchase of the treated water has not been valued in this cost estimate, as no water purchase cost has been identified at this time. This assumption may be reevaluated in future regional water planning cycles.

5.2.5.5.1. Blanco

Blanco's wastewater treatment plant produces approximately 146 ac-ft/yr of effluent. Currently, Blanco uses approximately 30% of produced wastewater effluent for applications on the site of the wastewater treatment plant. Blanco is in the process of obtaining a permit from TCEQ to allow distribution of reclaimed water and plans to distribute the entirety of effluent produced. This strategy would supply 146 ac-ft/yr of reclaimed water for irrigation and construction uses, to be online by 2030.

Cost Implications of Proposed Strategy

Anticipated infrastructure needs for the proposed 146 ac-ft/yr include:

- Transmission piping to deliver water to irrigation customers
- High service pump station
- Storage tank on WWTP site

Regional planning guidelines do not allow distribution-level costs to be included in the regional water plans. As such, transmission piping to deliver water to customers will be required to implement this strategy but will not be included in the cost estimate for regional planning purposes. It will be assumed a pump station will be added on site of WWTP for the newly constructed reclaimed water system.

Costs were developed using the Texas Water Development Board Cost Estimating Tool and reported in September 2018 dollars. For this strategy, the total project cost is $1,110,000; the total annual cost is $103,000/yr; and the annual unit cost is $705/ac-ft.

Environmental Considerations

Increased use of reclaimed water for applications that do not require potable water will mitigate pressure on drinking water supplies and potentially delay need for expansion of water supplies.

It is assumed that the project will have negligible impacts on cultural resources, but coordination with the Texas Historical Commission will need to occur before construction begins. Refer to *Chapter 1, Appendix 1A*, for the complete list by county of threatened and endangered species in the Lower Colorado Regional Water Planning Area. These species may need to be considered during construction of infrastructure.

Agricultural & Natural Resources Considerations

No impacts to agriculture (zero impacted acres) are expected as a result of implementing this strategy.

5.2.5.5.2. Horseshoe Bay

Horseshoe Bay has a reclaimed water system of Type I Designation through a TCEQ reuse permit. Horseshoe Bay currently supplies approximately 516 ac-ft/yr of reuse water for irrigation of various golf courses. This strategy would utilize an additional 154 ac-ft/yr of reuse water by transmitting reclaimed water to the Summit Rock Golf Course (located in Llano County) via a 12-inch transmission line. This strategy is anticipated to be online by 2030.

Because centralized sewer systems in the Highland Lakes area cannot return effluent to the lakes, there is much potential to use effluent in place of raw lake water supply. Horseshoe Bay is considering additional use of reclaimed water and may identify additional reclaimed infrastructure needs in the future.

Cost Implications of Proposed Strategy

Infrastructure required to implement this strategy includes:

- 5,500 ft of 12-inch transmission line
- Two road crossings via directional drilling
- High service pump station to be installed at the existing effluent pond

The 5,500-ft, 12-inch transmission line is anticipated to deliver reclaimed water to the Summit Rock Golf Course for irrigation use. As regional planning guidelines do not allow distribution-level costs to be included in the regional water plans, the transmission line will not be included in the cost estimate for regional planning purposes.

Costs were developed using the Texas Water Development Board Cost Estimating Tool and reported in September 2018 dollars. Planned infrastructure reported by Horseshoe Bay was input into the costing tool to determine total and annual costs. For this strategy, the total project cost is $1,084,000; the total annual cost is $103,000/yr; and the annual unit cost is $669/ac-ft.

Environmental Considerations

Horseshoe Bay cannot discharge water into the Highland Lakes, and therefore has no discharge point currently. Use of reclaimed water offers an alternative to disposal. Increased use of reclaimed water for applications that do not require potable water will mitigate pressure on drinking water supplies and potentially delay need for expansion of water supplies.

It is assumed that the project will have negligible impacts on cultural resources, but coordination with the Texas Historical Commission will need to occur before construction begins. Refer to *Chapter 1, Appendix 1A*, for the complete list by county of threatened and endangered species in the Lower Colorado Regional Water Planning Area. These species may need to be considered during construction of infrastructure.

Agricultural & Natural Resources Considerations

Golf courses in the area draw some water from Lake LBJ for irrigation. In addition to replacing use of potable water for irrigation, wastewater effluent can be used in place of raw lake water for irrigation in Horseshoe Bay, requiring less water to be drawn from the Highland Lakes surface water.

No impacts to agriculture (zero acres impacted) are expected as a result of implementing this strategy.

5.2.5.5.3. Marble Falls

Marble Falls currently supplies approximately 1.5 MGD (approximately 1,680 ac-ft/yr) of reuse water for the irrigation of city parks, golf courses, and other users in Burnet County. Marble Falls is currently completing a study assessing a potential expansion of their wastewater treatment plant which would include upgrades and an additional capacity resulting in increased effluent. This study is in its early stages and additional reclaimed water supplies related to expansion will be distributed.

There is a need for expanded transmission infrastructure to provide direct reuse to future customers. This strategy would provide 100 ac-ft/yr of direct reuse by 2030, with an ultimate supply of 500 ac-ft by 2070.

Cost Implications of Proposed Strategy

Marble Falls currently has infrastructure in place for distributing reclaimed water; as such, it will be assumed that most costs associated with this strategy will be related to expanding distribution (i.e. adding transmission piping). In addition, there may be need for additional storage and pumping capacity due to increased WWTP capacity and reclaimed water supply when the WWTP is expanded.

Infrastructure required to implement this strategy may include:

- Transmission piping
- Storage tank
- High service pump station

Regional planning guidelines do not allow distribution-level costs to be included in the regional water plans. As such, transmission piping to deliver water to customers will be required to implement this strategy but will not be included in the cost estimate for regional planning purposes. Cost of a new pump station will be included in the estimate under the assumption additional on-site pumping will be required for increased effluent due to plant expansion.

Costs were developed using the Texas Water Development Board Cost Estimating Tool and reported in September 2018 dollars. For this strategy, the total project cost is $1,388,000; the total annual cost is $148,000/yr; and the annual unit cost is $296/ac-ft.

Environmental Considerations

Increased use of reclaimed water for applications that do not require potable water will mitigate pressure on drinking water supplies and potentially delay need for expansion of water supplies.

It is assumed that the project will have negligible impacts on cultural resources, but coordination with the Texas Historical Commission will need to occur before construction begins. Refer to *Chapter 1, Appendix 1A*, for the complete list by county of threatened and endangered species in the Lower Colorado Regional Water Planning Area. These species may need to be considered during construction of infrastructure.

Agricultural & Natural Resources Considerations

No impacts to agriculture (zero acres impacted) are expected as a result of implementing this strategy.

5.2.5.5.4. Meadowlakes

Meadowlakes utilizes the entirety of the 140,000 gallons per day (gpd) of wastewater effluent it produces for irrigation. Meadowlakes has recently begun a project to reuse Marble Falls effluent for a yield of 75 ac-ft/yr of reclaimed water for irrigation use. The project has already been constructed and will thus be considered online by 2020.

Cost Implications of Proposed Strategy

There are no cost implications associated with this strategy, as it has already been constructed.

Environmental Considerations

Increased use of reclaimed water for applications that do not require potable water will mitigate pressure on drinking water supplies and potentially delay need for wastewater treatment plant expansion.

Agricultural & Natural Resources Considerations

No impacts to agriculture (zero acres impacted) are expected as a result of implementing this strategy.

5.2.5.5.5. Fredericksburg

Fredericksburg produces approximately 1,568 ac-ft of wastewater effluent per year. In the summer months, most of the produced effluent is applied to golf courses for irrigation; in winter months, when irrigation demands are low, a portion of the effluent is discharged into a receiving stream. Adding reclaimed water storage would allow for winter effluent to be captured for use in the summer to supply existing and future customers with reclaimed water. This strategy will provide a method of capturing 132 ac-ft/yr (43 million gallons per year) of otherwise discharged winter effluent. The strategy is assumed to be online by 2030.

Cost Implications of Proposed Strategy

Infrastructure required for this strategy includes:

- 43-million-gallon reclaimed water reuse pond that would be built on-site at the WWTP
- Above-ground storage tank could be considered as an alternative method for effluent storage, however costs for this option would be significantly higher
- Pump Station
- Existing transmission mains would be used

Additional reclaimed water infrastructure may be identified in the future as effluent generation and non-potable use demands increase.

External capital costs were provided from the Water, Wastewater, and Reuse System Plan (Freese and Nichols, February 2017) and input into the Texas Water Development Board Cost Estimating Tool, converted to September 2018 dollars. For this strategy, the total project cost is $10,175,000; the total annual cost is $789,000/yr; and the annual unit cost is $5,977/ac-ft.

Distribution-level infrastructure and associated costs are not included in regional water planning but will be required to implement this strategy.

Environmental Considerations

Increased use of reclaimed water for applications that do not require potable water will mitigate pressure on drinking water supplies and potentially delay need for expansion of water supplies.

It is assumed that the project will have negligible impacts on cultural resources, but coordination with the Texas Historical Commission will need to occur before construction begins. Refer to *Chapter 1, Appendix 1A*, for the complete list by county of threatened and endangered species in the Lower Colorado Regional Water Planning Area. These species may need to be considered during construction of infrastructure.

Agricultural & Natural Resources Considerations

No impacts to agriculture (zero impacted acres) are expected as a result of implementing this strategy.

5.2.5.5.6. Buda

Buda currently owns one wastewater treatment plant, which is operated and maintained by the Guadalupe-Blanco River Authority (GBRA). Reclaimed water implementation for Buda consists of multiple related projects funded through Buda's "Purple Pipe Fund." This funding is provided for irrigation of some parks & road medians with Type I reclaimed water, along with the bulk sale of Type I reclaimed water for non-potable uses, improving the condition of grass/landscaping while reducing demand on Buda's drinking water supply. Buda intends to expand reclaimed water implementation through its Capital Projects program and anticipates that the implementation of this strategy will continue to reduce the potable water supply demand by Buda.

This strategy would provide an expansion of reclaimed water service primarily for the Sunfield subdivision, located east of Buda. This strategy is expected to be partially online by 2030, to supply 1,120 ac-ft/yr, with a full capacity of 1,680 ac-ft/yr (1.5 million gallons per day) by 2070. Another potential reclaimed water user identified through the planning process is the Mining WUG in Hays County. Mining has water needs in Hays County and does not require potable water to meet a large portion of those needs. Mining in Hays County is identified in *Section 5.2.4.7* as a potential water purchaser of reuse water from Buda.

Buda's direct reuse system may require additional infrastructure beyond this scope in the future, depending on future demands of the contributing areas of Buda. Additionally, a portion of generated wastewater effluent will be treated and utilized for Buda's Direct Potable Reuse strategy (*Section 5.2.5.4.1*), thus proposed yields for direct reuse may shift in favor of allocation for potable supply in later decades.

Cost Implications of Proposed Strategy

The capital cost for this strategy is primarily driven by the length of the proposed new pipeline and new effluent pump station additions. It is assumed that the plant already has conventional treatment processes for BOD removal and disinfection in place to meet TCEQ reclaimed water Type I requirements. The pipeline proposed for this strategy is 24-inch in diameter, spanning approximately 3.75 miles from Buda's wastewater treatment plant to the proposed Sunfield subdivision east of Buda, but may service other irrigation sites of interest, such as Stagecoach Park, City Park or various roadway medians.

Infrastructure needed for the proposed 1,680 ac-ft/yr includes:

- Approximately 4 miles of transmission line

Costs were developed using the Texas Water Development Board Cost Estimating Tool and reported in September 2018 dollars. Planned infrastructure reported by Buda was input into the costing tool to determine total and annual costs. The planned 4-mile transmission line for this project was not included as distribution level costs are not included per regional planning guidelines. Because only distribution level costs are required for this strategy, associated costs are $0 for regional planning purposes.

Environmental Considerations

The main advantage the reuse water strategy has over other strategies is that it may be implemented at a low cost, while reducing the need for expanded water supplies. Buda discharges treated effluent to tributaries of Plum Creek, and by increasing the effluent reuse, will reduce the effluent discharge to natural waterways by up to 1,680 ac-ft/yr.

It is assumed that the project will have negligible impacts on cultural resources, but coordination with the Texas Historical Commission will need to occur before construction begins. Refer to *Chapter 1, Appendix 1A*, for the complete list by county of threatened and endangered species in the Lower Colorado Regional Water Planning Area. These species may need to be considered during construction of infrastructure.

Agricultural & Natural Resources Considerations

No impacts to agriculture (zero impacted acres) are expected, as a result of implementing this strategy.

5.2.5.5.7. Dripping Springs WSC

Dripping Springs is in Hays County, an area which has experienced large amounts of population growth in the past 10 years and is provided water by Dripping Springs WSC. There is a need for Dripping Springs to increase wastewater treatment capacity for future growth. In response Dripping Springs has filed to increase its TLAP-permitted capacity and obtained a TPDES discharge permit, including the approval of a reclaimed water system. A wastewater treatment plant expansion is anticipated to be constructed from 2019-2022 and will include biological nutrient removal.

Currently, the South Regional Wastewater Collection, Treatment and Disposal Facility permitted capacity is 348,500 GPD (390 ac-ft/yr). Dripping Springs plans to use up to 100% of the effluent generated for direct reuse by 2030. Pending TCEQ approval of the plant's expanded capacity to 995,000 GPD, approximately 600,000 GPD (672 ac-ft/yr) of the effluent would be diverted to direct reuse. With the planned wastewater expansion pending, additional reclaimed water will be available to service existing and new end-users, including: Sports Park, Charro Park, the Caliterra development, hay fields near the wastewater treatment plant, Howard Ranch subdivision, construction processes, irrigation of certain food crops, and other developments planned nearby. To serve these customers, additional infrastructure is needed.

This strategy would provide approximately 390 ac-ft/yr of direct reuse by 2030, with a full capacity of approximately 672 ac-ft/yr supplied by 2070. Dripping Springs also plans to use wastewater effluent for Direct Potable Reuse, as discussed in *Section 5.2.5.4.2.* Thus, proposed yields for direct reuse may shift in favor of allocation for potable supply in later decades.

Cost Implications of Proposed Strategy

Infrastructure needed for the proposed 672 ac-ft/yr includes:

- High service pump station
- Ground storage tank
- Transmission main to irrigation customers

Regional planning guidelines do not allow distribution-level costs to be included in the regional water plans. As such, transmission piping to deliver water to customers will be required to implement this strategy but will not be included in the cost estimate for regional planning purposes. Cost of a new pump station will be included in the estimate under the assumption additional pumping on-site of WWTP will be required for increased reclaimed water flow due to plant expansion.

Costs were developed using the Texas Water Development Board Cost Estimating Tool and reported in September 2018 dollars. For this strategy, the total project cost is $1,450,000; the total annual cost is $169,000/yr; and the annual unit cost is $251/ac-ft.

Environmental Considerations

Due to the increased wastewater effluent production as its population increases, Dripping Springs anticipates the need to discharge treated effluent into Walnut Springs Creek. Substantial implementation of direct reuse of effluent can mitigate or eliminate the need to discharge into Walnut Springs Creek.

It is assumed that the project will have negligible impacts on cultural resources, but coordination with the Texas Historical Commission will need to occur before construction begins. Refer to *Chapter 1, Appendix 1A*, for the complete list by county of threatened and endangered species in the Lower Colorado Regional Water Planning Area. These species may need to be considered during construction of infrastructure.

Agricultural & Natural Resources Considerations

In the preliminary engineering report for the South Regional Wastewater System Expansion Study, a proposed potential use of reclaimed wastewater effluent was irrigation of hay fields as well as some food crops of varieties that would come into minimal contact with the treated effluent and fit requirements set in the Texas Administrative Code (30 TAC, Chapter 210.24(s)). Disposal of effluent through distribution as reclaimed water would be beneficial because Dripping Springs faces limited land available for drip irrigation disposal near the WWTP. Available land will continue to be restricted as development continues in the vicinity.

5.2.5.5.8. West Travis County PUA

West Travis County PUA has several projects planned to expand direct reuse supply by 2030. Supply will be expanded to Bee Cave City Park, Falconhead, and Ladina Subdivision for residential and irrigation uses. A total of approximately 224 ac-ft/yr will be distributed, including effluent going to drip irrigation fields. This strategy is anticipated to be online by 2030.

Cost Implications of Proposed Strategy

Infrastructure to increase beneficial use supply will include:

- Extension of existing reclaimed transmission line
- Reclaimed water storage tank
- High service pump station
- Drip irrigation system, assumed to be $1,200/ac, per the 2004 Texas Water Development Board (TWDB) Report 362

West Travis County PUA is also interested in installing a reverse osmosis filtration and membrane system, which is considered in the cost for the Direct Potable Reuse Strategy for West Travis County PUA (see *Section 5.2.5.4.4*). Per regional planning guidelines, distribution-level infrastructure and associated costs are not to be included in the regional water plans. As such, the cost of reclaimed water drip irrigation and the extension to the existing reclaimed transmission piping are not included. As this strategy is an expansion of an existing reclaimed water system, it is assumed any additional pump stations will be associated with distribution-level costs as well and are not included.

Costs were developed using the Texas Water Development Board Cost Estimating Tool and reported in September 2018 dollars. For this strategy, the total project cost is $207,000; the total annual cost is $27,000/yr; and the annual unit cost is $121/ac-ft.

Environmental Considerations

West Travis County PUA cannot discharge into the Highland Lakes, so direct reuse presents a good disposal alternative. Additionally, increasing use of reclaimed water for applications that do not require potable water will mitigate pressure on drinking water supplies and potentially delay need for expansion of water supplies.

It is assumed that the project will have negligible impacts on cultural resources, but coordination with the Texas Historical Commission will need to occur before construction begins. Refer to *Chapter 1, Appendix 1A*, for the complete list by county of threatened and endangered species in the Lower Colorado Regional Water Planning Area. These species may need to be considered during construction of infrastructure.

Agricultural & Natural Resources Considerations

No impacts to agriculture (zero impacted acres) are expected, as a result of implementing this strategy.

5.2.5.5.9. Lago Vista

Lago Vista currently produces approximately 504 ac-ft/yr of reclaimed water for golf course irrigation and plans to expand their reclaimed water system to deliver non-potable water to a centralized distribution system for residential use. Beyond the existing reclaimed water produced for golf course irrigation, this strategy would provide 224 ac-ft/yr of additional reclaimed water by 2030, with full expansion to 673 ac-ft/yr by 2070.

Cost Implications of Proposed Strategy

Lago Vista has an existing reclaimed water system. This strategy is comprised of expanding that existing system to residential use. Infrastructure required for this strategy includes:

- Reclaimed water storage tanks
- Re-chlorination system
- Expansion of reclaimed water transmission piping to residential customers

Costs were developed using the Texas Water Development Board Cost Estimating Tool and reported in September 2018 dollars. For this strategy, the total project cost is $212,000; the total annual cost is $94,000/yr; and the annual unit cost is $140/ac-ft. Per regional planning guidelines, distribution-level infrastructure and associated costs will not be included in the regional water plans, therefore the cost of extending existing water transmission and any additional pumping that may be required for the new portion of the line were not considered in this cost estimate.

Environmental Considerations

Increased use of reclaimed water for applications that do not require potable water will mitigate pressure on drinking water supplies and potentially delay need for wastewater treatment plant expansion.

It is assumed that the project will have negligible impacts on cultural resources, but coordination with the Texas Historical Commission will need to occur before construction begins. Refer to *Chapter 1, Appendix 1A*, for the complete list by county of threatened and endangered species in the Lower Colorado Regional Water Planning Area. These species may need to be considered during construction of infrastructure.

Agricultural & Natural Resources Considerations

No impacts to agriculture (zero impacted acres) are expected as a result of implementing this strategy.

5.2.5.5.10. Lakeway MUD

Lakeway Municipal Utility District (LMUD) is seeking to expand its existing direct reuse system. Approximately 324 residences are currently served by the reuse system, which provides approximately 97 ac-ft/yr of reclaimed water.

LMUD currently produces 673 ac-ft/yr of reclaimed water for golf courses, city medians and parks used by the City of Lakeway and other commercial entities throughout the Lakeway community. LMUD has immediate plans to expand the reclaimed water system to service an additional 324 residences (approximately 97 ac-ft/yr demand) by 2021.

LMUD plans to continue further expansion of the reclaimed water system to beneficially reuse all reclaimed water produced from an approximate 900 ac-ft/yr expansion of their 5-5 Water Recycling Plant. The expansion is needed to service nearby MUDs and extend centralized wastewater service to out-of-district Lakeway areas currently using septic systems. These expansions are anticipated to occur in two phases: the first to provide 450 ac-ft/yr by 2025, and the second to provide an additional 450 ac-ft/yr likely occurring roughly 10 years later. Infrastructure associated with expansion of the reclaimed water system will include reclaimed water storage ponds, storage tanks, force mains and pump stations.

This strategy would be online by 2030, providing 450 ac-ft/yr, with an ultimate capacity of 900 ac-ft/yr from 2050 onward.

Cost Implications of Proposed Strategy

Infrastructure required to implement this strategy includes:

- Reclaimed water storage tanks
- Reclaimed water storage ponds
- Force mains and pump stations

Force mains and pump stations were not included in estimate, as regional planning guidelines do not allow distribution-level costs to be included in the regional water plans. Because this strategy is comprised of expanding an existing reclaimed water distribution system, it is assumed no new pump stations will be built on the WWTP, and any new pump stations constructed will be considered distribution-related costs.

Costs were developed using the Texas Water Development Board Cost Estimating Tool and reported in September 2018 dollars. For this strategy, the total project cost is $2,736,000; the total annual cost is $275,000/yr; and the annual unit cost is $306/ac-ft.

Environmental Considerations

Increased use of reclaimed water for applications that do not require potable water will mitigate pressure on drinking water supplies and potentially delay need for expansion of water supplies.

It is assumed that the project will have negligible impacts on cultural resources, but coordination with the Texas Historical Commission will need to occur before construction begins. Refer to *Chapter 1, Appendix 1A*, for the complete list by county of threatened and endangered species in the Lower Colorado Regional Water Planning Area. These species may need to be considered during construction of infrastructure.

Agricultural & Natural Resources Considerations

No impacts to agriculture (zero impacted acres) are expected as a result of implementing this strategy.

5.2.5.5.11. Travis County WCID 17

Travis County WCID 17 has seventeen planned improvement projects for the Flintrock Effluent Disposal and Reclaimed Irrigation System. This system will provide Type I effluent to a series of existing and proposed effluent disposal fields and reclaimed water irrigation systems and will include improvements to storage, pumping, and transmission. Eight of the planned improvement projects will increase direct reuse supplies for irrigation, distributing a proposed total of 510 ac-ft/yr of reclaimed water to irrigation fields.

Reclaimed water projects among the planned improvements include:

- Flintrock Effluent Storage Basin, Reclaimed Water Irrigation Pump Station, Effluent Transfer Pumps Station & Effluent Main
- Lakeway Regional Effluent Control Valve Assembly
- Serene Hills Storage Tank #1

- Flintrock Golf Course Rough Irrigation
- Serene Hills Storage Tank #2
- Serene Hills R.O.W. Irrigation Conversion
- Serene Hills Effluent Pump Station and Effluent Main
- Reuse Irrigation Pump Expansion

Construction is anticipated to begin from fiscal year 2021 to 2022, with planned completion dates from 2021-2026. The yield for this strategy is 510 ac-ft/yr and is anticipated to be online in 2030. Infrastructure associated with these projects include reclaimed water storage basins, storage tanks, force mains, and pump stations.

Cost Implications of Proposed Strategy

Capital costs for this strategy were provided by a consultant for Travis County WCID 17. Because regional planning guidelines do not allow the inclusion of distribution-level costs in the regional water plans, some of the projects listed above were not considered for this estimate, including: Lakeway Regional Effluent Control Valve Assembly, Flintrock Golf Course Rough Irrigation, Serene Hills R.O.W. Irrigation Conversion, Serene Hills Effluent Pump Station and Effluent Main, and Reuse Irrigation Pump Expansion. As these projects are related to adding pipe lines, valves, and pump stations to distribute reclaimed water, they are assumed to be entirely distribution-level costs.

Capital costs were input into the Texas Water Development Board Cost Estimating Tool in September 2018 dollars. Annual costs were generated by the costing tool. For this strategy, the total project cost is $9,030,000; the total annual cost is $719,000/yr; and the annual unit cost is $1,410/ac-ft.

Environmental Considerations

Increased use of reclaimed water for applications that do not require potable water will mitigate pressure on drinking water supplies and potentially delay need for expansion of water supplies.

It is assumed that the project will have negligible impacts on cultural resources, but coordination with the Texas Historical Commission will need to occur before construction begins. Refer to *Chapter 1, Appendix 1A*, for the complete list by county of threatened and endangered species in the Lower Colorado Regional Water Planning Area. These species may need to be considered during construction of infrastructure.

Agricultural & Natural Resources Considerations

No impacts to agriculture (zero impacted acres) are expected, as a result of implementing this strategy.

5.2.6 Irrigation Water Management Strategies

The existing water supplies available to the irrigators in Region K are not enough to meet the projected needs. A shortage would occur in all decades of the planning period should the critical drought be repeated. Using the Region K Cutoff Model with no return flows and assuming full use of the ROR irrigation rights to meet irrigation demands in those operations, the maximum annual shortage is projected to decrease from 254,000 ac-ft/yr in 2020 to approximately 186,000 ac-ft/yr in 2070. The calculated shortages are expected to decrease due to projected decreases in water demand. *Table 5.129* shows the water needs for all of the Irrigation WUGs in Region K and the number of WUGs with water deficits for each decade.

Table 5.129: Total Irrigation Water Needs

Category Name	Water Needs (ac-ft/yr)					
	2020	2030	2040	2050	2060	2070
Irrigation	(254,364)	(239,922)	(225,869)	(212,193)	(198,886)	(185,938)
No. of WUGs with Need	9	9	9	9	9	9

Irrigation in Mills County has water needs of 1,737 ac-ft/yr starting in 2020. The strategies identified to meet those needs are as follows:

- Drought Management (Discussed in *Section 5.2.4.9.2*)
- Irrigation Conservation – Drip Irrigation (Discussed in *Section 5.2.4.1.6*)
- Expand Use of the Trinity Aquifer (Discussed in *Section 5.2.4.1.6*)

The water needs for Irrigation in Mills County are not fully met through these three strategies, leaving unmet needs for Irrigation in Mills County ranging from 829 ac-ft/yr in 2020 to 848 ac-ft/yr in 2070. Irrigation needs separate from Mills County are identified in *Table 5.130* and correspond to Colorado, Matagorda, and Wharton Counties. The strategies recommended by the LCRWPG for Irrigation in these counties are summarized in *Table 5.131*.

Table 5.130: Irrigation Water Needs in Rice-Growing Counties

County	Water Needs (ac-ft/yr)					
	2020	2030	2040	2050	2060	2070
Colorado	(54,318)	(49,661)	(45,130)	(40,720)	(36,429)	(32,254)
Matagorda	(123,222)	(118,068)	(113,053)	(108,173)	(103,424)	(98,803)
Wharton	(75,087)	(70,456)	(65,949)	(61,563)	(57,296)	(53,144)
Total	**(252,627)**	**(238,185)**	**(224,132)**	**(210,456)**	**(197,149)**	**(184,201)**

All the recommended strategies are discussed in other sections of *Chapter 5*. The identified sections are as follows:

- Drought Management (Discussed in *Section 5.2.4.9.2*)
- On-Farm Conservation (Discussed in *Section 5.2.2.5.1*)
- Irrigation Operations Conveyance Improvements (Discussed in *Section 5.2.2.5.2*)
- Sprinkler Irrigation (Discussed in *Section 5.2.2.5.3*)
- Real-Time Use Metering and Monitoring (Discussed in *Section 5.2.2.5.34*)
- Return Flows (Discussed in *Section 5.2.1.1*)
- LCRA WMP Interruptible Water (Discussed in *Section 5.2.3.1.2*)

In addition, while not a yield-producing strategy, HB 1437 is a funding mechanism for implementing strategies including those for irrigation. HB 1437 requires water being transported out of the Colorado River Basin to the Brazos River Basin to be replaced to the extent that there is no net loss of surface water in the

Colorado River Basin. One of the methods for replacing that water is through on-farm conservation in the lower three counties. Historically, farmers received about 80 percent of the total costs from a combination of funding through NRCS' EQIP funds and HB 1437 funds, with farmers bearing 20 percent of the cost of implementing conservation.

Table 5.131: Summary of Recommended Water Management Strategies to Meet Irrigation Needs in Colorado, Matagorda, and Wharton Counties

Water Management Strategies	2020 Needs	2030 Needs	2040 Needs	2050 Needs	2060 Needs	2070 Needs
	(252,627)	(238,185)	(224,132)	(210,456)	(197,149)	(184,201)
	Water Management Strategy Yield (ac-ft/yr)					
Drought Management	34,004	33,088	32,199	31,333	30,491	29,671
On-Farm Conservation	22,054	26,464	30,874	35,286	39,698	44,108
Irrigation Operations Conveyance Improvements	6,000	13,670	21,341	29,011	36,680	44,350
Sprinkler Irrigation	912	4,558	9,114	11,394	11,394	11,394
Real-Time Use Metering and Monitoring	20,509	19,955	19,420	18,897	18,389	17,895
Return Flows	17,006	16,765	16,526	16,287	16,047	15,809
Development and Expansion of Groundwater Supplies	14,460	14,460	14,460	14,460	14,460	14,460
LCRA WMP Interruptible Water (2010 WMP)	63,495	25,797	13,105	0	0	0
(Future LCRA WMP, including OCR supplies)	*	*	*	*	*	*
Remaining Shortage/Surplus	**(74,187)**	**(83,428)**	**(67,093)**	**(53,788)**	**(29,990)**	**(6,514)**

* Availability of interruptible water will be increased using recommended OCRs; the estimated quantity is subject to WMP amendments through TCEQ and the hydrologic outcome of the current drought.

After the recommended strategies, there are remaining unmet needs for Irrigation in Colorado, Matagorda, and Wharton counties for the 2021 Region K Plan. The remaining needs shown in Table 5.127 incorporate surpluses that occur in some counties/basins.

5.2.7 Manufacturing Water Management Strategies

Development of new groundwater supplies was identified to meet manufacturing WUG needs in Fayette County. The following regional water management strategy was selected to meet Manufacturing needs:

- Development of New Groundwater Supplies (Discussed in *Section 5.2.4.2.7*)

5.2.8 Mining Water Management Strategies

The following regional water management strategies were selected to meet Mining needs:

- Mining Conservation (Discussed in *Section 5.2.2.4*)

- Expanded Local Use of Groundwater (Discussed in *Section 5.2.4.1.3, Section 5.2.4.1.6, Section 5.2.4.1.7*)
- Development of New Groundwater Supplies (Discussed in *Section 5.2.4.2.1, Section 5.2.4.2.3, Section 5.2.4.2.4*)
- Water Purchase (Discussed in *Section 5.2.4.6*)

There is also identified unmet Mining needs in the 2021 Region K Plan. These needs were identified in Bastrop County in coordination with Region G. The mining industry in that area pumps groundwater to lower the water table in order to allow access to mining activities. It was determined that the Mining demands were not true demands, and therefore did not need to have recommended water management strategies. The unmet Mining WUG needs are as follows:

Table 5.132: Unmet Mining Needs in Region K

WUG	County	Basin	Unmet Needs (ac-ft/yr)					
			2020	2030	2040	2050	2060	2070
Mining	Bastrop	Colorado	(449)	(3,947)	(4,557)	(3,220)	0	0

5.2.9 Steam-Electric Power Water Management Strategies

Steam-electric needs in the region include those for Austin in Fayette County and STPNOC in Matagorda County. While the 2021 Region K Water Plan does show Steam-electric water needs in Colorado County of 4,743 ac-ft/yr for every decade, these are based on demand projections included in *Chapter 2* that have been determined not to exist. One of the steam-electric facilities that the demands are based on currently does not exist and has no plans for construction. The other facility does exist but has no consumptive demands. Therefore, the water needs identified for this planning cycle for the Steam-electric WUG in Colorado County are not real and the LCRWPG has not developed strategies to meet them. The following sections discuss the recommended strategies for meeting the Steam-Electric water needs.

5.2.9.1 Austin Steam-Electric Water Management Strategies

Austin has steam-electric power demands in Fayette, Matagorda, and Travis Counties. Austin's portion of the South Texas Project (STP) demand is included in the STP total steam-electric demand in Matagorda County, and is therefore not addressed here. The table below shows the steam-electric water demands in Fayette and Travis Counties.

Table 5.133: Austin Steam-Electric Power Water Demands

Category Name	Water Demands (ac-ft/yr)					
	2020	2030	2040	2050	2060	2070
Fayette (Austin's portion)	10,300	10,300	10,300	10,300	10,300	10,300
Travis	10,253	10,253	10,253	10,253	10,253	10,253

To meet Austin's steam electric power needs, Austin has identified two main water management strategies in addition to current supplies. These are use of water released from the LCRA Contract Amendment

(*Section 5.2.3.1.3*) and Centralized Direct Non-Potable Reuse (*Section 5.2.3.2.7)*. These are summarized in the following table showing the steam- electric supplies and water management strategies in Fayette and Travis counties.

Table 5.134: Austin Steam-Electric Supplies and Water Management Strategies (ac-ft/yr)

Austin Supplies & Strategies	2020	2030	2040	2050	2060	2070
Fayette County Supplies						
LCRA Purchase – Highland Lakes/Reservoir System	7,016	7,016	7,016	7,016	7,016	7,016
Fayette County Strategies						
LCRA Contract Amendment – Steam-Electric (COA)	4,300	4,300	4,300	4,300	4,300	4,300
Fayette Total	**11,316**	**11,316**	**11,316**	**11,316**	**11,316**	**11,316**
Travis County Supplies						
LCRA Purchase – Highland Lakes/Reservoir System	5,153	5,153	5,153	5,153	5,153	5,153
Run-of-River Right 5471	9,240	9,240	9,240	9,240	9,240	9,240
Travis County Strategies						
Direct Reuse – Steam-Electric	0	1,750	1,750	1,750	1,750	1,750
Travis Total	**14,393**	**16,143**	**16,143**	**16,143**	**16,143**	**16,143**

It is anticipated that there will be additional infrastructure needed. The probable costs associated with Austin's direct reuse water management strategy for supplying steam electric needs in Travis County are estimated to be approximately $995/ac-ft (as shown in the Austin Centralized Direct Non-Potable Reuse section of this chapter). Costs to amend Austin Energy's contract with LCRA are shown at $145/ac-ft and are included in the LCRA Contract Amendment section of this chapter.

5.2.9.2 STP Nuclear Operating Company Water Management Strategies

The South Texas Project Electric Generating Station (STP) is a nuclear power facility located southwest of Bay City, in Matagorda County. The facility's demand is based on higher availability of generation capacity, added generating capacity, and blowdown of the reservoir to maintain water quality. This demand during the 50-year planning horizon will be satisfied significantly through (1) the management strategies of continued run-of-the-river diversions of up to 102,000 ac-ft/yr, under Certificate of Adjudication No. 14-5437[10], (2) continued use of STPNOC's existing off-channel reservoirs authorized under Certificate of Adjudication No. 14-5437; and (3) continued pumpage of groundwater for the purposes of incorporation in STPNOC's processes. Supplementing its run-of-the-river diversions, STPNOC also has a contract with LCRA for firm backup water of 20,000 acre-feet for 2-unit operation and 40,000 acre-feet for additional generating units, for so long as electric generation facilities are operated at the site.

[10] STPNOC's interest in the water rights evidenced in the certificate are as agent for the STPNOC owners, the City of San Antonio acting through the City Public Service Board, COA, and NRG South Texas, LP.

Based on current projections completed for the 2021 Region K Plan, shortages of approximately 11,300 ac-ft/yr have been identified commencing as early as 2020 for Steam-Electric supplies in Matagorda County during a repeat of the DOR. It is of additional note that STPNOC's diversions to their reservoir can be affected by water quality at the STPNOC diversion point. In order to support a long-term reliable electric supply for Texas, alternative strategies have been identified for offsetting these shortages and to manage potential water quality effects at the current permitted diversion point near the plant as upstream demands increase over time, although the recent amendment to the water right to allow diversion upstream of the LCRA Bay City dam may provide some ability to mitigate any water quality impacts.

STPNOC and LCRA negotiated an extension and amendment to the water supply contract in 2006, which helps ensure a long-term, cost effective water supply for the STP plant. Additional and alternative strategies include but are not limited to the following:

- Blend brackish surface water in STPNOC reservoir
- Alternate canal delivery
- LCRA contract amendment
- Water right permit amendment
- Dedication of return flows from other users

Conservation also is an integral part of STPNOC's operational philosophy as documented in the Water Conservation Plan filed with the TCEQ.

5.2.9.2.1. Blend Brackish Surface Water in STPNOC Reservoir

During an emergency situation, when the STPNOC reservoir reaches 30 feet mean sea level (MSL), STPNOC and LCRA will pursue relief from the TCEQ to be allowed to pump brackish surface water to blend in with the existing fresh water in the STPNOC reservoir. A firm yield of 3,000 ac-ft was determined for each decade in the planning period. This strategy has no cost associated with it, no environmental impacts, and no impacts to agriculture.

5.2.9.2.2. Alternate Canal Delivery

The STP facility currently has run-of-river rights and withdraws cooling water directly from the Lower Colorado River. However, the existing diversion point is very close to Matagorda Bay, which results in water at the diversion point being mixed with high salinity water from the bay during lower flow periods on the Colorado River.

For this strategy, water would be withdrawn from the Lower Colorado River, upstream of the Bay City Dam, and transported to the cooling water reservoir adjacent to the STP. The water pulled upstream of the dam would be better quality (less saline) than the water withdrawn from the existing diversion point. STP's current contract allows diversion from this point, but currently there are no physical means in place to facilitate this. The source of the water is the same as the current source: flows from the Colorado River.

The infrastructure required to implement this strategy includes:

- Existing LCRA pump station and irrigation canals, to transport the water through the canals as close as possible to the existing cooling water reservoir
- New pipeline to transport the water from the irrigation canals to the cooling water reservoir

STP would have to pay LCRA for the use of their pump station and irrigation canal. The estimated cost is approximately $120-150/ac-ft. In addition, there may be an existing regulatory issue with using the existing pump station for this strategy. Any regulatory issues would need to be resolved prior to implementing this strategy.

Since the existing irrigation canals are fairly close to the existing reservoir, the pipeline length to convey water from the canals to the reservoir is expected to be relatively short. For the purposes of this report, the length is assumed to be 1,000 feet.

The yield from this strategy is projected to be 12,727 ac-ft/yr. This is based on continuous pumping of 32,000 gallons per minute over only the winter months out of the year. This duration is assumed at 90 days. This will only make up a small percentage of the currently permitted 102,000 ac-ft/yr, so the majority of the volume is still expected to come from the existing diversion point. There are no plans to increase the permitted amount at the time of this report. The project yield from this strategy is shown in the following table.

Table 5.135: STP Alternate Canal Delivery Yield

WUG	County	Basin	Water Management Strategies (ac-ft/yr)					
			2020	2030	2040	2050	2060	2070
Steam-Electric	Matagorda	Colorado	0	12,727	12,727	12,727	12,727	12,727

Cost Implications of Proposed Strategy

Costs for this strategy were developed based on background information provided by STP, and the Texas Water Development Board (TWDB) Cost Estimating Tool. Consistent with the tool, all costs are given in September 2018 dollars. Costs shown assume a cost of $135/ac-ft for use of the LCRA pump station and irrigation canal.

The following table shows the estimated costs associated with this strategy.

Table 5.136: STP Alternate Canal Delivery Cost

WUG	County	Basin	Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
Steam-Electric	Matagorda	Colorado	$4,436,000	$6,158,000	$2,326,000	$183

Environmental Considerations

Minimal environmental impacts are expected as a result of implementing this strategy, since the same amount of water is being withdrawn, only at a different point. The only potential impact would be to environmental uses between the new withdrawal point (Bay City Dam) and the existing withdrawal point. However, withdrawal could be managed to meet any environmental flows first, before withdrawing from the new withdrawal point. If additional flow is still required, it could be taken from the existing withdrawal point. Thus, environmental impacts should be negligible.

While it is assumed that this strategy would have negligible impacts to cultural resources and wildlife habitat, coordination with the Texas Historical Commission will need to occur and proper environmental field studies will need to be performed before construction begins. Refer to *Chapter 1, Appendix 1A*, for the complete list by County of threatened and endangered species in the Lower Colorado Regional Water Planning Area. These species may need to be considered during construction of infrastructure.

Agricultural & Natural Resources Considerations

Negligible impacts to agriculture (zero impacted acres) or natural resources are expected as a result of implementing this strategy since the diversion is planned for the winter months (non-irrigation season).

5.2.9.2.3. LCRA Contract Amendment

An additional contract amendment for 8,300 ac-ft/yr with LCRA for the 2020 planning decade is another way to meet STP needs. LCRA projects such as the off-channel reservoirs are ways to increase LCRA's supply to meet these increased demands for new firm contracts and contract amendments. This strategy is described in *Section 5.2.3.1.4*, LCRA Contract Amendments.

5.2.9.2.4. Water Right Permit Amendment

A joint application (14-5437C) between STP and LCRA was filed in 2010 with TCEQ. The application is to amend the water right to allow an average diversion of 102,000 ac-ft over any five consecutive years with a single year cap not to exceed 245,000 ac-ft. There is no impact to existing water rights. There is no additional yield, no costs, and no impacts associated with this permit amendment. The joint application was filed with TCEQ in 2010 and is under "technical review."

5.2.9.2.5. Return Flows from Other Users

STP benefits from return flows sent downstream from upper basin users such as Austin. See *Section 5.2.1.1* for more information regarding Austin return flows and the benefits associated with the return flows.

5.3 ALTERNATIVE WATER MANAGEMENT STRATEGIES

LCRA is looking at several options to help meet future needs in the decades to come and would like to include some of the potential strategies as alternative strategies while the evaluation process continues. In addition, an expanded local use of groundwater strategy provides water exceeding the MAG.

5.3.1 Alternative Strategies for LCRA Major Water Supply

This section contains alternative new water supply options for LCRA. This water would provide additional firm yield to LCRA as a major water provider and could be used to meet various needs throughout Region K.

Table 5.137: LCRA Major Water Supply Alternative Water Management Strategy Yield

LCRA Alternative Strategy	Water Management Strategies (ac-ft/yr)					
	2020	2030	2040	2050	2060	2070
Expand Use of Groundwater in Bastrop County (Carrizo-Wilcox Aquifer)	0	25,000	25,000	25,000	25,000	25,000
Brackish Groundwater Desalination	0	0	22,400	22,400	22,400	22,400
Supplement Bay and Estuary Inflows with Brackish Groundwater	0	12,000	12,000	12,000	12,000	12,000

5.3.1.1 Expand Use of Groundwater in Bastrop County (Carrizo-Wilcox Aquifer)

LCRA plans to continue expanding its use of groundwater sources to meet future demands. LCRA currently holds groundwater permits from the Lost Pines Groundwater Conservation District for production wells in the Carrizo-Wilcox Aquifer in Bastrop County and has filed applications for permits to develop up to 25,000 ac-ft/yr of additional groundwater in Bastrop County for municipal, industrial, and other beneficial uses. The alternative strategy was assumed to be implemented in 2030.

A preliminary analysis from LCRA indicated that a well field would be located on the Griffith League Ranch in central Bastrop County. The groundwater is anticipated for use in Bastrop County, but could also potentially be used in Travis County.

Whereas the recommended strategy for expanded use of the Carrizo-Wilcox Aquifer for LCRA allocates water available under the Modeled Available Groundwater (MAG), this alternative version exceeds the amount available under the MAG when considering other permitted pumping. The groundwater source for this strategy will be the Carrizo-Wilcox Aquifer in Bastrop County.

The following infrastructure would be required for this strategy:

- Eight (8) 2,600 gpm Water Supply Wells and well transmission piping
- Approximately 4.5 miles of raw water transmission piping and appurtenances
- Primary Pump Station

A peaking factor of one (1) was assumed. A peak flow per well of 2,600 gpm was determined in the costing tool based on a total of eight wells. Wells were all assumed to be the same type, size, at the same elevation, and to have an efficiency of 80%. The well field layout was determined by two wells per “node,” a 0.5-mile transmission line between each well and its node, and an additional 0.5 mile “trunk” line connecting to the next node.

Cost Implications of Proposed Strategy

Costs were developed using the Texas Water Development Board (TWDB) Cost Estimating Tool in September 2018 dollars. The Cost Estimating Tool was also used to determine operating costs.

Per the Lost Pines Groundwater Conservation District, a $11.40/ac-ft production fee was assumed.

The capital cost for this strategy is primarily driven by the cost of the well field and transmission pipeline. Additional capital costs including engineering, legal services, contingencies, environmental and archeology studies and mitigation, land acquisition and surveying, and interest during construction were estimated using the Cost Estimating Tool. Annual costs including debt service, operation and maintenance, and pumping energy costs were also estimated using the tool. The following table shows the estimated costs associated with this strategy.

Table 5.138: Alternative LCRA Expand Use of Groundwater in Bastrop County (Carrizo-Wilcox Aquifer) Cost

Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
$27,239,000	$38,139,000	$4,740,000	$190

Environmental Considerations

The water supply for this strategy exceeds the Modeled Available Groundwater (MAG), so drawdown in the aquifer could contribute to a drawdown of more than 240 feet in the aquifer by 2070, relative to January 2000 conditions.

The project is subject to requirements of the LCRA's Incidental Take Permit and Habitat Conservation Plan and associated requirements of the U.S. Fish and Wildlife Service. In addition, there are several endangered or threatened species that may need to be taken into consideration during design. *Appendix 1A* in *Chapter 1* provides a list of rare, threatened, and endangered species by county. These species may need to be considered during construction of infrastructure.

There are zero anticipated impacts to cultural resources.

Agricultural & Natural Resources Considerations

There are negligible impacts to agriculture or natural resources with respect to acres of land anticipated from this strategy; however, the additional drawdown of the aquifer has the potential to impact agriculture by creating the need to lower pumps, redrill wells, and pay for additional electricity for pumping. As these impacts are indefinite, it is difficult to determine quantified costs associated with these potential impacts. However, the groundwater permitting process is a public process and local groundwater users that may be affected have the ability to provide input regarding concerns on potential drawdown.

5.3.1.2 Brackish Groundwater Desalination from the Gulf Coast Aquifer

This strategy includes the extraction of brackish groundwater from the Gulf Coast Aquifer in Matagorda County, its treatment using reverse osmosis (RO), and the delivery of approximately 22,400 ac-ft/yr (20 mgd) of potable water to Bay City area for municipal and industrial use, beginning in the 2040 decade. The RO permeate (waste generated in the RO process) would be disposed of directly into the ground via a deep injection wellfield. Brackish Groundwater Desalination is suggested as an alternative strategy rather than a recommended strategy because it exceeds available resources, as identified in the regional water planning process.

Cost Implications of Proposed Strategy

Costs for this strategy were developed using the Texas Water Development Board (TWDB) Cost Estimating Tool, based on infrastructure described in the LCRA 2009 Water Supply Resource Plan. Consistent with the tool, all costs are given in September 2018 dollars. The following table shows the estimated costs associated with this strategy.

Infrastructure associated with this strategy include:

- 25 MGD reverse osmosis treatment plant
- Fifteen (15) miles of 36-inch transmission pipe to supply treated water to Bay City area
- 2.86 miles of 12-inch RO permeate line
- Extraction wellfield with 14 wells
- Deep injection wellfield for disposal of RO permeate with 6 wells
- 2 MG ground storage tank
- High service pump station

Table 5.139: Alternative LCRA Brackish Groundwater Desalination Cost

Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
$165,047,000	$229,006,000	$31,199,000	$1,393

Environmental Considerations

The Matagorda Bay region includes a significant amount of acreage designated as wetlands, which serve as the habitat for numerous terrestrial and marine species, some of which are threatened and/or endangered. Refer to *Chapter 1, Appendix 1A*, for the complete list by county of threatened and endangered species in the Lower Colorado Regional Water Planning Area. These species may need to be considered during construction of infrastructure.

Some additional potential environmental impacts would be related to the potential degradation of the quality of the groundwater in the vicinity of the proposed wells, and the management of the RO waste and byproducts such as concentrated salt solution. The current groundwater availability models do not include quality information or capability to model changes in water quality. For that reason, it is not possible to determine whether the flows being pumped will impact the overall quality of the aquifer in this area. Management of the concentrated salt solution by deep well injection should adequately confine the materials within deep aquifers with similar salt concentrations to minimize any negative impacts.

Currently, the Modeled Available Groundwater (MAG) does not distinguish between fresh water and brackish water in the Gulf Coast Aquifer. As such, exceeding the MAG long-term would likely contribute to exceedance of the Desired Future Conditions, which is no more than 13 feet of average drawdown by 2069, relative to January 2000 conditions.

There are zero anticipated impacts to cultural resources.

Agricultural & Natural Resources Considerations

This strategy does not put increased demand on water supplies already being used by agriculture and does not move supply from agricultural uses to other usage. To the extent that the supplies would be used to offset a demand that may otherwise need to be met with Colorado River water, and depending on when those demands materialize, it is possible that incorporation of these supplies into LCRA's system will allow additional interruptible water of somewhere between 0 ac-ft/yr and 22,400 ac-ft/yr to be made available for agricultural purposes (variables do not allow for a 1:1 ratio).

5.3.1.3 Supplement Bay & Estuary Inflows with Brackish Groundwater

Brackish groundwater delivery to the Matagorda Bay Estuary System is considered as a potential water management strategy for the LCRA (major water provider) to offset required releases from the Highland Lakes. By developing a new source to meet environmental needs, the firm supply that would otherwise be released from the Highland Lakes to meet bay and estuary inflow requirements can remain in the Highland Lakes and become a firm supply for LCRA's existing and future customers. Equivalence of brackish groundwater to achieve the same effect as a volume of water released from the Highland Lakes would be a function of the brackish groundwater total dissolved solids (TDS) values, the effectiveness of delivery directly to the lower marsh versus through the channel, and the amount of released water that reaches the Bay.

As part of its plan for growth, LCRA is considering brackish groundwater delivery for Bay & Estuary needs as a potential water source strategy in the 2021 Regional Water Plan. The strategy would consist of:

- Obtaining a permit from Coastal Plains GCD
- Developing a well field in the Matagorda Bay Delta (Gulf Coast Aquifer, Matagorda Bay, Colorado Basin) with associated piping for discharge into the lower marsh

A preliminary project concept sizes the well field supply with a capacity of 12,000 ac-ft/yr. A peak pumping capacity of 3,150 ac ft per month could be potentially feasible, depending on results of future studies. The infrastructure required for this strategy consists of:

- Twelve (12) brackish stainless-steel groundwater wells, depths up to 1,200 ft
- Simple Outfall Structure

The project yield is estimated to be 12,000 ac-ft/yr for decades 2030-2070. Because this volume of groundwater exceeds the Modeled Available Groundwater (MAG), which does not distinguish between fresh water and brackish water, this strategy can only be included in the 2021 Region K Plan as an alternative strategy, rather than a recommended strategy.

Cost Implications of Proposed Strategy

A project cost estimate was provided by LCRA in May 2014 dollars. Costs from the provided estimate were adjusted to September 2018 dollars via ENR CCI indices and input into the Texas Water Development Board (TWDB) Cost Estimating Tool.

Note that the cost of engineering, legal costs, contingency, mobilization, annual well pump replacement, and annual lease fee were not calculated via the TWDB costing tool, but provided from the referenced May 2014 LCRA costs, adjusted to September 2018 dollars.

The capital cost for this strategy is primarily driven by the cost of the well fields. The following table shows the estimated costs associated with this strategy.

Table 5.140: Alternative LCRA Supplement Bay & Estuary Inflows with Brackish Groundwater Cost

Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
$26,073,000	$47,269,000	$6,381,000	$532

Environmental Considerations

Timing and location of delivery of brackish groundwater could have equal or possibly more effective impacts to the bay than releases from Highland Lakes' storage. Modeling and potential pilot testing would be necessary to determine effects of incoming salinity and delivery location. Instream flows would possibly be reduced by up to 12,000 ac-ft/yr as a result of not releasing stored water.

This strategy could be used by LCRA to help meet environmental needs that would otherwise be met from stored water releases from the Highland Lakes, potentially increasing availability of interruptible water supply by up to 12,000 ac-ft/yr.

While it is assumed that this strategy would have negligible impacts to cultural resources and wildlife habitat, coordination with the Texas Historical Commission will need to occur and proper environmental field studies will need to be performed before any construction begins. Refer to *Chapter 1, Appendix 1A*, for the complete list by county of threatened and endangered species in the Lower Colorado Regional Water Planning Area. These species may need to be considered during construction of infrastructure.

Agricultural & Natural Resources Considerations

No impacts (zero acres impacted) to agriculture are anticipated.

5.3.2 Other Alternative Water Management Strategies

The following strategy is included in the 2021 Region K Water Plan as an alternative strategy for Aqua WSC.

5.3.2.1 Expanded Local Use of Groundwater – Carrizo-Wilcox Aquifer

This alternative strategy would involve pumping additional groundwater from the Carrizo-Wilcox Aquifer through the drilling of additional wells in order to supply the Aqua WSC WUG. Whereas the recommended strategy for expanded use of the Carrizo-Wilcox Aquifer allocates water available under the Modeled Available Groundwater (MAG), this alternative version exceeds the MAG in order to meet the total need for Aqua WSC after implementation of drought management and conservation, which totals 19,121 ac-ft/yr by 2070.

Table 5.141 presents the WUGs that would utilize this strategy along with the implementation decade and the amount of water to be pumped.

Table 5.141: Alternative Carrizo-Wilcox Aquifer Expansion Yield

WUG	County	Basin	Water Management Strategies (ac-ft/yr)					
			2020	2030	2040	2050	2060	2070
Aqua WSC	Bastrop	Brazos (to Colorado)	0	0	0	0	0	5,736
Aqua WSC	Bastrop	Colorado	0	5,500	5,500	5,500	13,385	13,385

This strategy was applied to Aqua WSC in Bastrop County in the Colorado River Basin. While the need for Aqua WSC is located in the Colorado basin, this strategy supplies the Aqua WSC system with groundwater from both the Brazos and Colorado basins.

Cost Implications of Proposed Strategy

Table 5.142 presents a summary of the probable costs for each WUG utilizing this strategy. The four cost components analyzed during cost estimation of this strategy were: Total Facilities Cost, Total Project Cost, Annual Cost, and Unit Cost.

The costs of the groundwater supply strategy were estimated using the Texas Water Development Board (TWDB) Cost Estimating Tool. The number of new wells was determined in the Cost Estimating Tool, based on the largest quantity of water supplied over the planning period. Wells were all assumed to be the same type, size, at the same elevation, and to have an efficiency of 80%. The well field layout was determined by two wells per "node," a 0.5-mile transmission line between each well and its node, and an additional 0.5 mile "trunk" line connecting to the next node. One mile of transmission piping to connect each wellfield to the distribution system was assumed. A peaking factor of two (2) was assumed (twice the largest quantity of water supplied). Assumptions of well capacity and depth were made by reviewing historical well data for wells located in proximity to each WUG. Historical data was obtained using the Texas Water Development Board Groundwater Database's well search and water level search functions.

Because water is supplied to Aqua WSC by two river basins through this strategy, two separate well fields are assumed, one for each basin. The costs for each basin have been combined for this analysis. A greater portion of wells are assumed to draw from the Colorado Basin allocation, as it covers the majority of Bastrop County.

Additional capital costs including engineering, legal services, contingencies, environmental and archeology studies and mitigation, land acquisition and surveying, and interest during construction were estimated using the Cost Estimating Tool. Annual costs including debt service, operation and maintenance, and pumping energy costs were also estimated using the tool.

Table 5.142: Alternative Carrizo-Wilcox Aquifer Expansion Cost

WUG	County	Basin	Total Facilities Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
Aqua WSC	Bastrop	Brazos, Colorado	$26,836,000	$37,682,000	$4,220,000	$221

Environmental Considerations

The environmental impacts of expanded groundwater use will vary depending upon site characteristics. Some impacts may occur from the expansion of existing groundwater infrastructure, but well sites are generally small in areal extent, and the disturbance from pipeline construction is temporary. The water supply is beyond the Modeled Available Groundwater (MAG), so this strategy could contribute to drawdown in the aquifer in excess of 240 feet by 2070, relative to January 2000 conditions.

While it is assumed that this strategy would have negligible impacts to cultural resources and wildlife habitat, coordination with the Texas Historical Commission will need to occur and proper environmental field studies will need to be performed before any construction begins. Refer to *Chapter 1, Appendix 1A,* for the complete list by county of threatened and endangered species in the Lower Colorado Regional Water Planning Area. These species may need to be considered during construction of infrastructure.

There are negligible impacts to agriculture or natural resources with respect to acres of land anticipated from this strategy; however, the additional drawdown of the aquifer has the potential to impact agriculture by creating the need to lower pumps, redrill wells, and pay for additional electricity for pumping. As these impacts are indefinite, it is difficult to determine quantified costs associated with these potential impacts. However, the groundwater permitting process is a public process and local groundwater users that may be affected have the ability to provide input regarding concerns on potential drawdown.

5.4 CONSIDERED, BUT NOT RECOMMENDED OR ALTERNATIVE STRATEGIES

The TWDB rules require the RWPG to evaluate all potentially feasible water management strategies to meet the Region's identified demand deficits. Feasibility is based on evaluation criteria established by the TWDB and the RWPG including project cost, unit cost, yield, reliability, environmental impact, local preference, and institutional constraints. Several water management strategies were identified and evaluated, but after initial evaluation, were determined by the RWPG or in some cases the potential project sponsor to not be suitable for consideration at this time or the project sponsor decided to no longer include them. These strategies are discussed in the following sections.

5.4.1 Tail Water Recovery

Tail water recovery is defined by the Natural Resources Conservation Service (NRCS) as a planned irrigation system in which facilities utilized for the collection, storage, and transportation of irrigation tail water and/or rainfall runoff for reuse have been installed. The system allows for the capture of a portion of the irrigation field return flows, stores them until needed, and then conveys the water from the storage facility to a point of entry back into the irrigation system.

This strategy was evaluated under the Irrigation Conservation strategy, but the LCRWPG determined the strategy to not be feasible, since other strategies reduce the amount of tail water to be recovered.

5.4.2 Reservoir Capacity Expansion

Reservoir capacity expansion involves increasing storage capacity so that water may be more readily available for use. During times of drought, the Llano Water User Group (WUG) installs a flashboard system downstream along the Llano River Lake, an on-channel reservoir. Llano is also considering the installation of additional flashboards upstream along the dam of Llano Park Lake. Flashboards, which consist of individual wooden boards or structural panels anchored to the crest of a dam, can be used as means of raising the reservoir storage level above a fixed spillway crest level. In addition to increased storage capacity, the additional water depth provided by flashboards reduces the sedimentation rate, allowing for a higher quality of water to be pumped at the reservoir's water supply intake. Flashboards are a temporary measure, as they can only be used during low inflow periods; they must either be removed before floods occur or designed to safely fail automatically.

This strategy was modeled using the strategy version of the Region K Cutoff Model and was shown not to increase yields in drought-of-record conditions under regional water planning guidelines. As such, this particular strategy cannot be recommended in the 2021 Region K Water Plan but can be included as a considered strategy. The strategy was requested for inclusion in the 2021 RWP to accurately reflect Llano's water situation.

Reservoir capacity expansion is also a component of the Goldthwaite Water Supply strategy, referenced below.

5.4.3 Goldthwaite Water Supply

Goldthwaite Water User Group (WUG) is developing a multi-step water supply strategy involving water permit acquisition and amendments, reservoir development, and reuse. Though this strategy does not provide water under drought-of-record conditions, it was requested for inclusion in the 2021 RWP to accurately reflect the WUG's water situation. Due to limited information available, this strategy can be classified as considered, but not as recommended or alternative.

Goldthwaite obtained diversion rights to 1,000 ac-ft/yr of irrigation water under certificate of adjudication (COA) 14-2546, for which they are requesting an amendment to allow municipal and industrial usage. This amendment would also: 1) sever this diversion amount from 14-2546 and add it to current COA 14-2553A; 2) move the diversion point downstream to the same location at 14-2553A; and 3) revise the number of authorized off-channel reservoirs as well as the capacity of those reservoirs.

Under current COA 14-2553A, Goldthwaite has 1,500 ac-ft/yr water rights on the Colorado River with three (3) reservoirs permitted with a storage capacity of 315 ac-ft. The permit amendment would allow for the addition of a fourth off-channel reservoir and increasing the total permitted storage capacity to 650 ac-ft capacity.

Goldthwaite currently has the ability to reuse 250 ac-ft/yr wastewater for irrigation purposes. With the amendment, language changes will permit Goldthwaite to reuse all diverted water, though there are no specific plans in development regarding expansion of reuse.

5.4.4 Groundwater Importation – Carrizo-Wilcox to LCRA System

As part of their Water Supply Resource Plan, the LCRA developed several alternative water supply options to meet future demands. These new water supply options would provide additional firm yield to LCRA as a regional water provider and could be used to meet various needs throughout Region K. This water supply strategy involved developing approximately 35,000 ac-ft of untreated groundwater from outside the Planning Area and Colorado River Basin and transporting the water to eastern Travis County, beginning in 2040. This water supply option would utilize groundwater produced from the Simsboro Formation of the Carrizo-Wilcox Aquifer in northern Burleson County. A pipeline with two booster pump stations would be required to convey the water to the conceptual delivery point in Travis County.

The well field was assumed to be located in Burleson County, with a delivery point in eastern Travis County at approximately State Highway 130 (SH130) and the Colorado River, but exact location of the well field and delivery point could depart from this assumption. The pipeline alignment conceptually followed SH21, FM 696, and US Highway 290 to its delivery point in the vicinity of SH130.

5.4.5 Groundwater Supply for FPP

LCRA and Austin jointly own the Fayette Power Project (FPP) in Fayette County. LCRA previously evaluated evaluating possible water supplies to augment LCRA's share of the surface water supply provided to the FPP cooling water reservoir (Cedar Creek Reservoir) used for process and cooling water. Currently, water at FPP is diverted from Cedar Creek Reservoir, and LCRA's share of water in Cedar Creek Reservoir comes from local inflows from Cedar Creek, and stored water released from the Highland Lakes.

Groundwater was considered another source of water to address surface water filtering concerns (algae) and help alleviate potential drought contingency plan cutbacks from the Colorado River. Water supply sources identified include groundwater both on- and off- the FPP property. Groundwater supplied on-property would come from the Oakville Sandstone and the Catahoula Tuff, which are part of the Gulf Coast Aquifer System. The preliminary analysis indicates that a groundwater well field could not be located near the FPP due to high levels of total dissolved solids (TDS). Groundwater off-property could be provided from the Carrizo-Wilcox Aquifer, from the Yegua-Jackson Aquifer, or from both in Fayette and/or Bastrop Counties.

5.4.6 Oceanwater Desalination

LCRA requested that this strategy be evaluated as part of the regional water planning process, but a project sponsor was not identified for the 2021 Region K Plan.

This strategy proposes to intake seawater directly from the Gulf of Mexico (the "Gulf") to deliver approximately 22,400 ac-ft/yr (20 MGD) to users in the Bay City area of Matagorda County. The proposed desalination process would divert 55 MGD directly from the Gulf near the Matagorda Bay, treat the water using reverse osmosis (RO) filtration, and deliver 20 MGD of treated water serve industrial users in and around Bay City. Approximately 25 MGD of RO permeate (reject water with high concentrations of dissolved solids) would then be delivered back to the Gulf through a direct diffuser pipe perpendicular to the coastline. Unit processes reduce the amount of water that can be delivered (e.g., some is removed with sludge, etc.), thus the sum of RO permeate and treated water (45 MGD) is less than the total intake water (55 MGD).

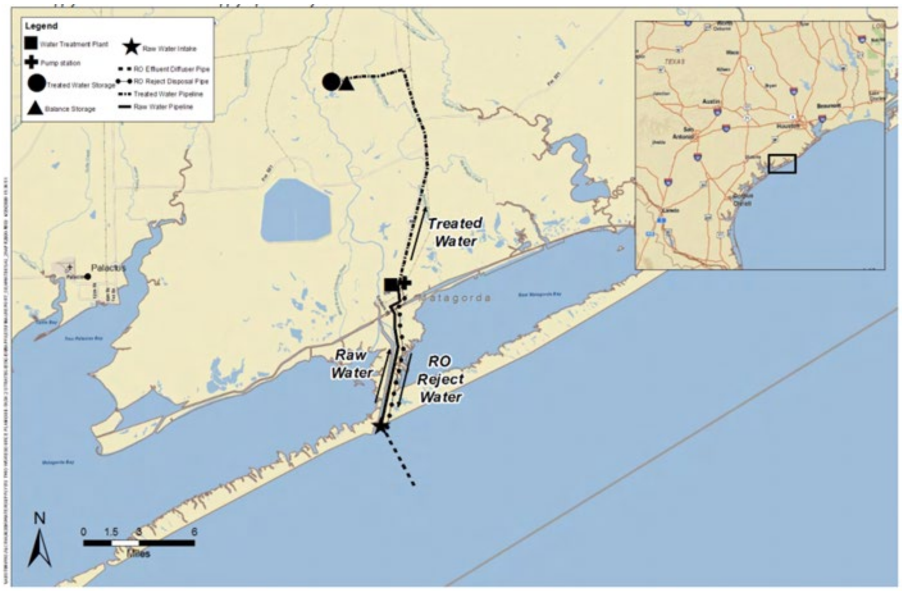
Infrastructure to be constructed as a part of this strategy includes:

- 55 MGD Intake pump station
- 8.15 miles of 48-inch raw water pipeline
- 2 MG raw water flow equalization basin
- 20 MGD reverse osmosis treatment plant
  (including raw water screening and intake pumps, flocculation, sedimentation, gravity thickening, first and second pass RO, ultrafiltration membranes, centrifuges, all chemical storage and feed systems, internal pumping facilities and storage, water storage, and an O&M building)
- 60 MG treated water storage facility (50' TDH)
- 15.7 miles of 36-inch treated water pipeline
- 25 MGD 8.15 miles of 36-inch RO permeate (reject water and desalination byproduct) return pipeline
- 0.5-mile sealed discharge pipeline extending from coastline into open waters, to avoid discharge near the coastline
- 3.8 miles of progressively smaller RO permeate discharge diffuser pipeline

The source water is characterized by a total dissolved solids (TDS) concentration of 35,000 mg/L or more, and desalination treatment processes for this strategy were sized based on this assumption. Extensive environmental studies and permitting are assumed to be required for the seawater intake and brine disposal structures.

The firm yield for this strategy is approximately 22,400 ac-ft/yr, with an assumed online decade of 2060. The yield by decade is reported in the table below. A schematic showing the strategy infrastructure is included below as an example of a potential generic project, taken from the *Water Supply Resource Plan: Water Supply Option Analysis (July 2009, CH2M Hill)*.

Figure 5.3: Oceanwater Desalination



Note this figure is schematic and was developed for the purpose of creating order of magnitude cost estimates.

The Matagorda Bay region includes a significant amount of acreage designated as wetlands, which serve as the habitat for numerous terrestrial and marine species, some of which are threatened and/or endangered. These species may need to be considered during construction of infrastructure. Additionally, the Big Boggy National Wildlife Refuge is nearby the proposed project area and must be avoided by the pipeline.

Environmental study and permitting will be needed to inform design and operation of the plant intake. Oceanwater desalination intake stations, especially surface-level intakes, are prone to entrainment of aquatic organisms and their propagules (eggs, larvae, and spores), which leads to organism mortality. While not currently proposed, indirect intakes located below the sea or beach floor, composed of wells or buried pipes, could greatly reduce the environmental impact of the intake.

Brine disposal also presents environmental impacts. The selected discharge method (ocean disposal) elevates salinity and reduces dissolved oxygen concentrations at the discharge location, which can lead to organism mortality. The proposed discharge pipeline is a 3.8-mile diffuser pipe, which may help disperse and mitigate the effects of elevated salinity levels.

5.5 DOCUMENTATION OF THE IDENTIFICATION AND EVALUATION PROCESS

The process that the Water Management Strategies Committee went through to identify and evaluate the potentially feasible water management strategies for this planning cycle is documented in the Water Management Strategies Committee meeting minutes included in *Appendix 5F*.

APPENDIX 5A

POTENTIALLY FEASIBLE WATER MANAGEMENT STRATEGIES

Table 5A-1: Region K Water Management Strategies Considered and Evaluated

Table 5A-2: Region K Potentially Feasible WMS Screening

Table 5A-1: Region K Water Management Strategies Considered and Evaluated

Every WUG Entity with an Identified Need		WMSs NAMED TO BE CONSIDERED BY STATUTE											ADDITIONAL WMSs NAMED TO BE CONSIDERED BY RULE									
Water User Group Name	Maximum Need 2020-2070 (af/yr)	Conservation	Drought Management	Reuse	Management of Existing Supplies	Development of large-scale marine seawater or brackish groundwater	Conjunctive Use	Acquisition of available existing supplies	Development of new supplies	Development of regional water supply or regional management of water supply facilities	Voluntary transfer of water (incl. regional water banks, sales, leases, options, subordination agreements, and financing agreements)	Emergency transfer of water under Section 11.139	System optimization, reallocation of reservoir storage to new uses, contracts, water marketing, enhancement of yield, improvement of water quality	New SW supply	New GW supply	Brush control; precipitation enhancement	Interbasin transfers of surface water	Aquifer storage and recovery	Cancellation of water rights	Rainwater harvesting	other
Aqua WSC	26,087	PF	PF	nPF	nPF	nPF	nPF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	
Austin	8,770	PF	PF	PF	PF	PF	nPF	nPF	PF	nPF	PF	nPF	PF	PF	nPF	nPF	nPF	PF	nPF	PF	
Barton Creek WSC	586	nPF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	
Bastrop	5,902	PF	PF	PF	nPF	nPF	nPF	nPF	PF	nPF	PF	nPF	nPF	PF	PF	nPF	nPF	nPF	nPF	nPF	
Bastrop County WCID 2	1,178	nPF	PF	nPF	nPF	nPF	nPF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	
Bay City	198	nPF	nPF	nPF	nPF	nPF	nPF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	
Bertram	394	PF	PF	nPF	nPF	nPF	nPF	PF	PF	nPF	PF	nPF	nPF	PF	nPF	nPF	nPF	nPF	nPF	nPF	
Briarcliff	104	PF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	
Buda	4,839	PF	PF	PF	PF	PF	nPF	nPF	nPF	PF	nPF	nPF	PF	nPF	nPF	nPF	nPF	PF	nPF	nPF	
Corix Utilities Texas Inc	13	PF	PF	nPF	nPF	nPF	nPF	PF	nPF	nPF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	
Creedmoor-Maha WSC	757	PF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	
Dripping Springs WSC	4,819	PF	PF	PF	nPF	nPF	nPF	nPF	nPF	nPF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	
Elgin	2,853	PF	PF	nPF	nPF	nPF	nPF	PF	nPF	nPF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	
Garfield WSC	63	PF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	
Goldthwaite	18	PF	PF	nPF	nPF	nPF	nPF	PF	PF	nPF	PF	nPF	nPF	PF	nPF	nPF	nPF	nPF	nPF	nPF	
Granite Shoals	222	nPF	PF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	
Hays	353	PF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	
Hays County WCID 1	80	PF	PF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	
Hays County WCID 2	160	PF	PF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	
Horseshoe Bay	940	PF	PF	PF	nPF	nPF	nPF	nPF	nPF	nPF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	
Hurst Creek MUD	12	PF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	
Johnson City	80	PF	PF	nPF	nPF	nPF	nPF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	
Jonestown WSC	116	PF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	
Lakeway MUD	143	PF	PF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	
Leander	3,281	PF	PF	PF	nPF	nPF	nPF	nPF	nPF	PF	PF	nPF	nPF	nPF	nPF	nPF	PF	nPF	nPF	nPF	
Llano	642	PF	PF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	PF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	
Loop 360 WSC	236	PF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	
Manville WSC	1,696	nPF	PF	nPF	nPF	nPF	nPF	PF	nPF	nPF	PF	nPF	nPF	nPF	nPF	nPF	nPF	PF	nPF	nPF	
Marble Falls	1,766	PF	PF	PF	nPF	nPF	nPF	nPF	nPF	PF	nPF	nPF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	
Meadowlakes	285	PF	PF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	
North Austin MUD 1	802	PF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	
Northtown MUD	1,268	nPF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	
Pflugerville	9,220	PF	PF	PF	nPF	nPF	nPF	PF	nPF	nPF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	
Rollingwood	377	nPF	PF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	
Schulenburg	118	PF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	
Senna Hills MUD	304	PF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	
Smithville	1,348	PF	PF	nPF	nPF	nPF	nPF	nPF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	
Sunset Valley	713	PF	PF	nPF	nPF	nPF	nPF	nPF	PF	nPF	PF	nPF	nPF	nPF	PF	nPF	nPF	PF	nPF	nPF	
Travis County MUD 10	28	nPF	PF	nPF	nPF	nPF	nPF	nPF	PF	nPF	nPF	nPF	nPF	nPF	PF	nPF	nPF	nPF	nPF	nPF	
Travis County MUD 14	49	nPF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	
Travis County WCID 10	5,026	PF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	

Table 5A-1: Region K Water Management Strategies Considered and Evaluated

Every WUG Entity with an Identified Need		WMSs NAMED TO BE CONSIDERED BY STATUTE											ADDITIONAL WMSs NAMED TO BE CONSIDERED BY RULE								
Water User Group Name	Maximum Need 2020-2070 (af/yr)	Conservation	Drought Management	Reuse	Management of Existing Supplies	Development of large-scale marine seawater or brackish groundwater	Conjunctive Use	Acquisition of available existing supplies	Development of new supplies	Development of regional water supply or regional management of water supply facilities	Voluntary transfer of water (incl. regional water banks, sales, leases, options, subordination agreements, and financing agreements)	Emergency transfer of water under Section 11.139	System optimization, reallocation of reservoir storage to new uses, contracts, water marketing, enhancement of yield, improvement of water quality	New SW supply	New GW supply	Brush control; precipitation enhancement	Interbasin transfers of surface water	Aquifer storage and recovery	Cancellation of water rights	Rainwater harvesting	other
Travis County WCID 17	*1,836*	PF	PF	nPF	nPF	nPF	nPF	nPF	nPF	PF	nPF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	
Travis County WCID 18	*379*	PF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	
Travis County WCID Point Venture	*339*	PF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	
Wells Branch MUD	*1,397*	PF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	
West Travis County Public Utility Agency	*10,966*	PF	PF	PF	nPF	nPF	nPF	nPF	nPF	PF	PF	PF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	
Wharton	*87*	PF	nPF	nPF	nPF	nPF	nPF	PF	nPF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	
Windermere Utility	*1,462*	PF	PF	nPF	nPF	nPF	nPF	nPF	nPF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	
County-Other, Burnet	*162*	PF	PF	nPF	nPF	nPF	nPF	nPF	PF	PF	PF	nPF	nPF	PF	nPF	PF	nPF	nPF	nPF	nPF	
County-Other, Colorado	*195*	nPF	PF	nPF	nPF	nPF	nPF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	
County-Other, Fayette	*789*	nPF	PF	nPF	nPF	nPF	nPF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	
County-Other, Hays	*801*	nPF	PF	nPF	nPF	PF	nPF	PF	PF	PF	nPF	nPF	nPF	nPF	PF	PF	nPF	PF	nPF	nPF	
County-Other, Wharton	*155*	PF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	
Irrigation, Colorado	*54,318*	PF	PF	nPF	nPF	nPF	nPF	PF	PF	PF	nPF	nPF	PF	PF	nPF	nPF	nPF	PF	nPF	nPF	
Irrigation, Matagorda	*123,222*	PF	PF	nPF	nPF	nPF	nPF	PF	PF	PF	nPF	nPF	PF	PF	nPF	nPF	nPF	PF	nPF	nPF	
Irrigation, Mills	*1,737*	nPF	nPF	nPF	nPF	nPF	nPF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	
Irrigation, Wharton	*75,087*	PF	PF	nPF	nPF	nPF	nPF	PF	PF	PF	nPF	nPF	PF	PF	nPF	nPF	nPF	PF	nPF	nPF	
Manufacturing, Fayette	*40*	nPF	nPF	nPF	nPF	nPF	nPF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	
Mining, Bastrop	*4,865*	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	
Mining, Burnet	*5,281*	PF	nPF	nPF	nPF	nPF	nPF	PF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	
Mining, Fayette	*760*	nPF	nPF	nPF	nPF	nPF	nPF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	
Mining, Hays	*1,579*	nPF	nPF	nPF	nPF	nPF	nPF	PF	PF	nPF	nPF	nPF	nPF	nPF	PF	nPF	nPF	nPF	nPF	nPF	
Steam-Electric, Colorado	*4,971*	PF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	
Steam-Electric, Fayette	*4,299*	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	
Steam-Electric, Matagorda	*11,276*	nPF	nPF	nPF	PF	nPF	nPF	nPF	nPF	nPF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	

nPF = considered but determined 'not potentially feasible' (may include WMSs that were initially identified as potentially feasible)

PF = considered 'potentially feasible' and therefore evaluated

(all WMS evaluations shall be presented in the regional water plan including for WMSs considered potentially feasible but not recommended)

WUGs WITH NEED (REGION K NOT PRIMARY)																					
Brookesmith SUD	*1*	PF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	
Canyon Lake Water Service	*2*	PF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	
Cedar Park	*666*	PF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	
Goforth SUD	*419*	PF	PF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	nPF	

Table 5A-2: Region K Potentially Feasible Water Management Strategy Screening (for 2021 Region K Plan)

	Water Management Strategy	Water User Group or Wholesale Provider	Strategy Description	Addressing a Need?	Cost of Water ($/ac-ft)	Max Yield (ac-ft/yr)	Starting Decade	Basin	Interbasin Transfer (Yes/No)	Screening Matrix Factors (Positive (1), Neutral (0), Negative (-1)) Cost	Yield	Location	Water Quality	Environmental and Natural Resources	Local Preference	Institutional Constraints	Socioeconomic Impacts	Impacts on Water Resources	Impacts on Agricultural Resources	Impacts to Recreation	Impacts on Other Management Strategies	Total of Screening Factors
1	**Oceanwater Desalination**	0_N/A	Desalination of seawater from the Gulf of Mexico via reverse osmosis	No	$3,530	22,400	2060	N/A	N/A	-1	0	0	-1	-1	0	-1	0	0	0	0	0	-4
2	**Drought Management**	AQUA WSC	Mandatory water use reduction by 20%	Yes	$66	7,448	2020	All	No	1	0	1	0	0	0	1	0	1	0	0	0	4
3	**Conservation**	AQUA WSC	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	Yes	$2,230	464	2020	All	No	-1	0	1	0	0	0	0	0	1	0	0	0	1
4	**Expand Local Use of Groundwater**	AQUA WSC	Expand use of Carrizo-Wilcox aquifer by developing wellfield in Brazos Basin of Bastrop County	Yes	$1,001	800	2030	Colorado	Yes	0	-1	-1	0	0	1	1	0	0	0	0	0	0
5	**Expand Local Use of Groundwater**	AQUA WSC	Expand use of Carrizo-Wilcox aquifer by developing wellfield in Colorado Basin of Bastrop County	Yes	$1,001	200	2030	Colorado	No	0	-1	1	0	0	1	1	0	0	0	0	0	2
6	**Alternative - Expand Local Use of Groundwater**	AQUA WSC	Expand use of Carrizo-Wilcox aquifer by developing wellfield in Brazos Basin of Bastrop County	Yes	$221	5,736	2070	Colorado	Yes	1	1	-1	0	0	1	-1	0	-1	0	0	-1	-1
7	**Alternative - Expand Local Use of Groundwater**	AQUA WSC	Expand use of Carrizo-Wilcox aquifer by developing wellfield in Colorado Basin of Bastrop County	Yes	$221	13,385	2030	Colorado	No	1	1	1	0	0	1	-1	0	-1	0	0	-4	-2
8	**New LCRA Contract (with infrastructure)**	AQUA WSC	Purchase SW through contract and construct new SWTP and transmission line from Colorado River	Yes	$914	20,000	2040	Colorado	No	0	1	1	0	0	0	-1	0	0	0	-1	0	0
9	**Drought Management**	AUSTIN	Mandatory water use reduction by 5%	Yes	$66	14,666	2020	All	No	1	0	1	0	0	0	1	0	1	0	0	0	4
10	**Austin Conservation**	AUSTIN	Reduction in both per capita consumption and peak day to average day demand ratio	Yes	$1,343	40,620	2020	Colorado	No	-1	0	1	0	0	0	0	0	1	0	0	0	1
11	**Austin Blackwater and Greywater Reuse**	AUSTIN	Decentralized small-scale reuse.	Yes	$2,354	9,290	2030	Colorado	No	-1	1	1	1	1	0	0	0	1	-1	0	0	3
12	**Aquifer Storage and Recovery**	AUSTIN	Using treated effluent or surface water from the Colorado River is diverted to aquifer storage for later recovery	Yes	$2,234	15,800	2040	Colorado	No	-1	1	0	0	0	0	-1	0	0	0	0	0	-1
13	**Austin Off-Channel Reservoir and Evaporation Suppression**	AUSTIN	Construction of a new off-channel reservoir	Yes	$985	25,287	2070	Colorado	No	0	0	0	0	1	0	0	0	1	0	0	0	2
14	**Austin Onsite Rainwater and Stormwater Harvesting**	AUSTIN	Development of catchment areas to capture rainwater for potable or non-potable use.	Yes	$1,165	4,270	2030	Colorado	No	-1	0	1	0	0	0	0	0	0	0	0	0	0
15	**Austin Community Scale Stormwater Harvesting**	AUSTIN	Development of catchment areas to capture rainwater for potable or non-potable use.	Yes	$645	197	2030	Colorado	No	1	0	1	0	0	0	0	0	0	0	0	0	2
16	**Austin Brackish Groundwater Desalination**	AUSTIN	Desalination of groundwater extracted from both the Trinity and the Saline Edwards aquifers.	Yes	$2,995	5,000	2070	Colorado	No	-1	1	0	0	-1	1	-1	0	1	0	0	0	0
17	**Austin Centralized Direct Non-Potable Reuse**	AUSTIN	Direct reuse of wastewater effluent for municipal and manufacturing purposes	Yes	$995	23,250	2020	Colorado	No	0	1	1	1	1	0	0	0	1	-1	0	0	4
18	**Austin Decentralized Direct Non-Potable Reuse**	AUSTIN	Direct reuse of community-scale wastewater effluent for municipal and manufacturing purposes	Yes	$366	16,680	2030	Colorado	No	1	1	1	1	1	0	0	0	1	0	0	0	6
19	**Capture Local Inflows to Lady Bird Lake**	AUSTIN	Install intake below Tom Miller Dam and pumping excess flows to the water treatment plant	Yes	$213	3,000	2040	Colorado	No	1	1	0	0	0	0	-1	0	0	0	0	0	1
20	**Longhorn Dam Operation Improvements**	AUSTIN	Increase Longhorn Dam's storage efficiency with projects including security upgrades, electrical updates, gate improvements, and data acquisition and monitoring improvements.	Yes	$36	3,000	2030	Colorado	No	1	1	0	0	0	0	0	0	0	0	0	0	2
21	**Indirect Potable Reuse through Lady Bird Lake**	AUSTIN	Conveying WWTP discharge to Lady Bird Lake and withdrawing water to be treated at the WTP	Yes	$457	20,000	2020	Colorado	No	1	1	0	-1	-1	0	-1	0	0	0	0	0	-1
22	**Lake Austin Operations**	AUSTIN	Would allow the lake to operate at a varying level instead of constant in order to capture local flows	Yes	$218	1,250	2020	Colorado	No	1	-1	0	0	0	0	0	0	0	0	-1	0	-1
23	**Drought Management**	BARTON CREEK WEST WSC	Mandatory water use reduction by 20%	No	$66	47	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
24	**Conservation**	BARTON CREEK WEST WSC	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	No	$1,077	193	2020	Colorado	No	-1	0	1	0	0	0	0	0	1	0	0	0	1
25	**Drought Management**	BARTON CREEK WSC	Mandatory water use reduction by 25%	Yes	$66	121	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
26	**Conservation**	BARTON CREEK WSC	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	Yes	$470	409	2020	Colorado	No	1	0	1	0	0	0	0	0	1	0	0	0	3
27	**Water Purchase Amendment**	BARTON CREEK WSC	Water purchase amendment with Travis County MUD 4	Yes	$1,629	90	2020	Colorado	No	-1	0	1	0	0	0	0	0	1	0	0	0	1
28	**Drought Management**	BASTROP	Mandatory water use reduction by 20%	Yes	$66	1,534	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
29	**Conservation**	BASTROP	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	Yes	$1,972	992	2020	Colorado	No	-1	0	1	0	0	0	0	0	1	0	0	0	1

Table 5A-2: Region K Potentially Feasible Water Management Strategy Screening (for 2021 Region K Plan)

	Water Management Strategy	Water User Group or Wholesale Provider	Strategy Description	Addressing a Need?	Cost of Water ($/ac-ft)	Max Yield (ac-ft/yr)	Starting Decade	Basin	Interbasin Transfer (Yes/No)	Screening Matrix Factors (Positive (1), Neutral (0), Negative (-1)) Cost	Yield	Location	Water Quality	Environmental and Natural Resources	Local Preference	Institutional Constraints	Socioeconomic Impacts	Impacts on Water Resources	Impacts on Agricultural Resources	Impacts to Recreation	Impacts on Other Management Strategies	Total of Screening Factors
30	**New LCRA Contract (with infrastructure)**	BASTROP	Purchase SW through contract and construct new SWTP and transmission line from Colorado River	Yes	$914	4,000	2050	Colorado	No	0	1	1	0	0	0	-1	0	0	0	-1	0	0
31	**Drought Management**	BASTROP COUNTY WCID 2	Mandatory water use reduction by 5%	Yes	$66	129	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
32	**Conservation**	BASTROP COUNTY WCID 2	Conservation efforts to lower GPCD	Yes	$250	125	2030	Colorado	No	1	0	1	0	0	0	0	0	1	0	0	0	3
33	**New LCRA Contract (with infrastructure)**	BASTROP COUNTY WCID 2	Purchase SW through contract and construct new SWTP and transmission line from Colorado River	Yes	$914	1,500	2060	Colorado	No	0	1	1	0	0	0	-1	0	0	0	-1	0	0
34	**Drought Management**	BAY CITY	Mandatory water use reduction by 20%	Yes	$66	622	2020	All	No	1	0	1	0	0	0	1	0	1	0	0	0	4
35	**Expand Local Use of Groundwater**	BAY CITY	Expand use of Gulf Coast aquifer in Brazos-Colorado Basin of Matagorda County	Yes	$53	75	2030	Brazos-Colorado	No	1	-1	1	0	0	1	0	0	0	0	0	0	2
36	**Drought Management**	BERTRAM	Mandatory water use reduction by 20%	Yes	$66	101	2020	Brazos	No	1	0	1	0	0	0	1	0	1	0	0	0	4
37	**Conservation**	BERTRAM	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	Yes	$1,466	257	2020	Brazos	No	-1	0	1	0	0	0	0	0	1	0	0	0	1
38	**Expand Local Use of Groundwater**	BERTRAM	Expand use of Ellenburger-San Saba aquifer in Colorado Basin of Burnet County. Pumping water from inactive quarry in Colorado Basin for storage and use in Bertram in the Brazos Basin.	Yes	$1,235	2,000	2030	Brazos	Yes	-1	1	1	0	0	1	0	0	0	0	0	0	2
39	**Drought Management**	BLANCO	Mandatory water use reduction by 20%	No	$66	66	2020	Guadalupe	No	1	0	1	0	0	0	1	0	1	0	0	0	4
40	**Conservation**	BLANCO	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	No	$2,558	27	2020	Guadalupe	No	-1	0	1	0	0	0	0	0	1	0	0	0	1
41	**Direct Reuse**	BLANCO	Direct reuse of wastewater effluent.	No	$705	146	2030	Guadalupe	No	0	-1	1	0	1	1	0	0	1	0	0	0	3
42	**Drought Management**	BOLING MWD	Mandatory water use reduction by 20%	No	$66	6	2020	Brazos-Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
43	**Drought Management**	BRIARCLIFF	Mandatory water use reduction by 20%	Yes	$66	106	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
44	**Drought Management**	BROOKESMITH SUD	Mandatory water use reduction by 20%	Yes	$66	2	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
45	**Drought Management**	BUDA	Mandatory water use reduction by 20%	Yes	$66	1,309	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
46	**Conservation**	BUDA	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	Yes	$1,987.00	793	2020	Colorado	No	-1	0	1	0	0	0	0	0	1	0	0	0	1
47	**Direct Reuse**	BUDA	Direct reuse of wastewater effluent.	Yes	$0	1,680	2020	Colorado	No	1	-1	1	0	1	1	0	0	1	0	0	0	4
48	**Groundwater Importation (ARWA Pipeline)**	BUDA	Importation of groundwater from the Carrizo-Wilcox aquifer in Gonzales County (Region L) through a pipeline. Buda portion.	Yes	$1,106	2,113	2030	Colorado	No	-1	1	-1	0	0	1	0	0	0	0	0	0	1
49	**Saline Edwards ASR Project**	BUDA	Non-drought year available freshwater Edwards BFZ aquifer volume will be stored in the Edwards BFZ (Saline Zone). In times of drought, water will be pumped, treated, and piped to users within the BSEACD district.	Yes	$1,951	800	2040	Colorado	No	-1	0	0	1	0	0	0	0	1	0	0	0	0
50	**Edwards / Middle Trinity ASR Project**	BUDA	Non-drought year available freshwater Edwards BFZ aquifer volume will be stored in the Trinity aquifer. In times of drought, water will be pumped, treated, and piped to users within the BSEACD district.	Yes	$1,740	600	2020	Colorado	No	-1	0	1	0	0	1	0	0	1	0	0	0	2
51	**Direct Potable Reuse**	BUDA	Directly treat reclaimed water for potable use within the municipality.	Yes	$1,964	2,240	2030	Colorado	No	-1	0	1	1	0	1	-1	0	1	0	0	0	2
52	**Drought Management**	BURNET	Mandatory water use reduction by 20%	No	$66	427	2020	All	No	1	0	1	0	0	0	1	0	1	0	0	0	4
53	**Conservation**	BURNET	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	No	$1,614	813	2020	All	No	-1	0	1	0	0	0	0	0	1	0	0	0	1
54	**LCRA Contract Amendment with Infrastructure**	BURNET	See Buena Vista Regional Project.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	N/A	N/A	N/A	N/A	N/A
55	**Buena Vista Regional Project**	BURNET	Contract with LCRA. Expansion of Buchanan WTP and transmission of treated surface water to Buena Vista residents and others	No	$1,136	2,000	2030	Colorado	No	-1	1	1	1	0	0	-1	0	0	0	-1	0	0
56	**Drought Management**	CANEY CREEK MUD OF MATAGORDA COUNTY	Mandatory water use reduction by 20%	No	$66	26	2020	Brazos-Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
57	**Drought Management**	CANYON LAKE WATER SERVICE	Mandatory water use reduction by 20%	Yes	$66	27	2020	Guadalupe	No	1	0	1	0	0	0	1	0	1	0	0	0	4
58	**Drought Management**	CEDAR PARK	Mandatory water use reduction by 20%	Yes	$66	393	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
59	**Conservation**	CEDAR PARK	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	Yes	$1,720	582	2020	Colorado	No	-1	0	1	0	0	0	0	0	1	0	0	0	1

Table 5A-2: Region K Potentially Feasible Water Management Strategy Screening (for 2021 Region K Plan)

	Water Management Strategy	Water User Group or Wholesale Provider	Strategy Description	Addressing a Need?	Cost of Water ($/ac-ft)	Max Yield (ac-ft/yr)	Starting Decade	Basin	Interbasin Transfer (Yes/No)	Screening Matrix Factors (Positive (1), Neutral (0), Negative (-1)) Cost	Yield	Location	Water Quality	Environmental and Natural Resources	Local Preference	Institutional Constraints	Socioeconomic Impacts	Impacts on Water Resources	Impacts on Agricultural Resources	Impacts to Recreation	Impacts on Other Management Strategies	Total of Screening Factors
60	**Drought Management**	CIMARRON PARK WATER	Mandatory water use reduction by 20%	No	$66	11	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
61	**Drought Management**	COLUMBUS	Mandatory water use reduction by 20%	No	$66	206	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
62	**Conservation**	COLUMBUS	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	No	$1,219	581	2020	Colorado	No	-1	0	1	0	0	0	0	0	1	0	0	0	1
63	**Drought Management**	CORIX UTILITIES TEXAS INC.	Mandatory water use reduction by 20%	Yes	$66	98	2020	All	No	1	0	1	0	0	0	1	0	1	0	0	0	4
64	**Expand Local Use of Groundwater**	CORIX UTILITIES TEXAS INC.	Expand use of Gulf Coast aquifer in Colorado Basin of Colorado County	Yes	$50	4	2050	Colorado	No	1	1	1	0	0	0	0	0	0	0	0	0	3
65	**Drought Management**	COTTONWOOD CREEK MUD 1	Mandatory water use reduction by 5%	No	$66	7	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
66	**Drought Management**	COTTONWOOD SHORES	Mandatory water use reduction by 20%	No	$66	80	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
67	**Conservation**	COTTONWOOD SHORES	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	No	$2,069	32	2020	Colorado	No	-1	0	1	0	0	0	0	0	1	0	0	0	1
68	**Drought Management**	COUNTY-OTHER, BASTROP	Mandatory water use reduction by 20%	No	$66	609	2020	All	No	1	0	1	0	0	0	1	0	1	0	0	0	4
69	**Conservation**	COUNTY-OTHER, BASTROP	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	No	$1,973	393	2020	All	No	-1	0	1	0	0	0	1	0	1	0	0	0	2
70	**Drought Management**	COUNTY-OTHER, BLANCO	Mandatory water use reduction by 20%	No	$66	122	2020	All	No	1	0	1	0	0	0	1	0	1	0	0	0	4
71	**Brush Management**	COUNTY-OTHER, BLANCO	Removal of brush to increase recharge and runoff. Firm yield determined from Pedernales River Watershed Feasibility Study.	No	$1,190	708	2030	Colorado	No	1	-1	1	0	1	1	-1	0	0	0	0	0	2
72	**Drought Management**	COUNTY-OTHER, BURNET	Mandatory water use reduction by 20%	Yes	$66	927	2020	All	No	1	0	1	0	0	0	1	0	1	0	0	0	4
73	**Conservation**	COUNTY-OTHER, BURNET	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	Yes	$2,390	205	2020	All	No	-1	0	1	0	1	0	1	0	0	0	0	0	2
74	**Marble Falls Regional Project**	COUNTY-OTHER, BURNET	Contract with LCRA. Construction of new raw water intake and regional WTP at Max Starcke Dam, and construction of transmission lines to support future development.	No	$1,436	1,578	2030	Colorado	No	-1	1	1	0	0	0	-1	0	0	0	-1	0	-1
75	**Buena Vista Regional Project**	COUNTY-OTHER, BURNET	Contract with LCRA. Expansion of Buchanan WTP and transmission of treated surface water to Buena Vista residents and others	Yes	$1,136	1,000	2030	Brazos	No	-1	1	1	1	0	0	-1	0	0	0	-1	0	0
76	**Buena Vista Regional Project**	COUNTY-OTHER, BURNET	Contract with LCRA. Expansion of Buchanan WTP and transmission of treated surface water to Buena Vista residents and others	No	$1,136	1,884	2030	Colorado	No	-1	1	1	1	0	0	-1	0	0	0	-1	0	0
77	**New LCRA Contract (with infrastructure)**	COUNTY-OTHER, BURNET	See Buena Vista Regional Project, East Lake Buchanan Regional Project, and Marble Falls Regional Project.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	N/A	N/A	N/A	N/A	N/A
78	**East Lake Buchanan Regional Project**	COUNTY-OTHER, BURNET	Contract with LCRA. Regional SWTP and deep water intake at Council Creek Village to provide treated water to communities along East Lake Buchanan	No	$1,957	935	2030	Colorado	No	-1	0	1	1	0	0	-1	0	0	0	-1	0	-1
79	**Drought Management**	COUNTY-OTHER, COLORADO	Mandatory water use reduction by 20%	Yes	$66	170	2020	All	No	1	0	1	0	0	0	1	0	1	0	0	0	4
80	**Expand Local Use of Groundwater**	COUNTY-OTHER, COLORADO	Expand use of Gulf Coast aquifer in Colorado Basin of Colorado County	Yes	$1,218	133	2020	Colorado	No	-1	0	1	0	0	0	1	0	0	0	0	0	1
81	**Drought Management**	COUNTY-OTHER, FAYETTE	Mandatory water use reduction by 20%	Yes	$66	190	2020	All	No	1	0	1	0	0	0	1	0	1	0	0	0	4
82	**Expand Local Use of Groundwater**	COUNTY-OTHER, FAYETTE	Expand use of Gulf Coast aquifer in Lavaca Basin of Fayette County	Yes	$49	41	2020	Lavaca	No	1	1	1	0	0	0	1	0	0	0	0	0	4
83	**Expand Local Use of Groundwater**	COUNTY-OTHER, FAYETTE	Expand use of Sparta aquifer in Colorado Basin of Fayette County	Yes	$1,127	204	2030	Colorado	No	-1	1	1	0	0	0	0	0	0	0	0	0	1
84	**Development of New Groundwater Supply**	COUNTY-OTHER, FAYETTE	Develop a new supply of groundwater in the Sparta aquifer in the Colorado Basin of Fayette County	Yes	$1,498	400	2020	Lavaca	Yes	-1	0	0	0	0	0	0	0	0	0	0	0	-1
85	**Drought Management**	COUNTY-OTHER, GILLESPIE	Mandatory water use reduction by 20%	No	$66	150	2020	All	No	1	0	1	0	0	0	1	0	1	0	0	0	4
86	**Brush Management**	COUNTY-OTHER, GILLESPIE	Removal of brush to increase recharge and runoff. Firm yield determined from Pedernales River Watershed Feasibility Study.	No	$1,190	1,125	2030	Colorado	No	1	-1	1	0	1	1	-1	0	0	0	0	0	2
87	**Drought Management**	COUNTY-OTHER, HAYS	Mandatory water use reduction by 20%	Yes	$66	243	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
88	**Groundwater Importation (Hays County Pipeline)**	COUNTY-OTHER, HAYS	Importation of groundwater from the Carrizo-Wilcox aquifer in Gonzales County (Region L) through a pipeline. Region L pipeline runs from delivery point near Kyle to the Wimberley area in Hays County. Region K pipeline will run from a to-be-determined connection point along the pipeline to the Dripping Springs area. Alternative version would use Forestar water (Region G Lee County Carrizo-Wilcox) as the source.	Yes	$774	1,000	2030	Colorado	No	0	1	-1	0	0	-1	0	0	0	0	0	0	-1
89	**Rainwater Harvesting**	COUNTY-OTHER, HAYS	Development of catchment areas to capture rainwater for potable or non-potable use.	Yes	$24,962	50	2030	Colorado	No	-1	-1	1	0	0		0	0	0	0	0	0	-1

Table 5A-2: Region K Potentially Feasible Water Management Strategy Screening (for 2021 Region K Plan)

	Water Management Strategy	Water User Group or Wholesale Provider	Strategy Description	Addressing a Need?	Cost of Water ($/ac-ft)	Max Yield (ac-ft/yr)	Starting Decade	Basin	Interbasin Transfer (Yes/No)	Screening Matrix Factors (Positive (1), Neutral (0), Negative (-1))												Total of Screening Factors
										Cost	Yield	Location	Water Quality	Environmental and Natural Resources	Local Preference	Institutional Constraints	Socioeconomic Impacts	Impacts on Water Resources	Impacts on Agricultural Resources	Impacts to Recreation	Impacts on Other Management Strategies	
90	**Saline Edwards ASR Project**	COUNTY-OTHER, HAYS	Non-drought year available freshwater Edwards BFZ aquifer volume will be stored in the Edwards BFZ (Saline Zone). In times of drought, water will be pumped, treated, and piped to users within the BSEACD district.	Yes	$1,950	500	2040	Colorado	No	-1	0	0	1	0	0	0	0	1	0	0	0	0
91	**Edwards / Middle Trinity ASR Project**	COUNTY-OTHER, HAYS	Non-drought year available freshwater Edwards BFZ aquifer volume will be stored in the Trinity aquifer. In times of drought, water will be pumped, treated, and piped to users within the BSEACD district.	Yes	$2,156	289	2030	Colorado	No	-1	0	1	0	0	0	0	0	1	0	0	0	1
92	**Brush Management**	COUNTY-OTHER, HAYS	Removal of brush to increase recharge and runoff. Firm yield determined from Pedernales River Watershed Feasibility Study.	Yes	$1,190	83	2030	Colorado	No	1	0	1	0	1	1	-1	0	0	0	0	0	3
93	**Expand Local Use of Groundwater**	COUNTY-OTHER, HAYS	Expand use of Trinity aquifer in Colorado Basin of Hays County	Yes	$1,180	200	2070	Colorado	No	-1	1	1	0	0	0	0	0	0	0	0	0	1
94	**Drought Management**	COUNTY-OTHER, LLANO	Mandatory water use reduction by 5%	No	$66	13	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
95	**Drought Management**	COUNTY-OTHER, MATAGORDA	Mandatory water use reduction by 5%	No	$66	53	2020	All	No	1	0	1	0	0	0	1	0	1	0	0	0	4
96	**Drought Management**	COUNTY-OTHER, MILLS	Mandatory water use reduction by 20%	No	$66	50	2020	All	No	1	0	1	0	0	0	1	0	1	0	0	0	4
97	**Drought Management**	COUNTY-OTHER, SAN SABA	Mandatory water use reduction by 20%	No	$66	44	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
98	**Drought Management**	COUNTY-OTHER, TRAVIS	Mandatory water use reduction by 20%	No	$66	174	2020	All	No	1	0	1	0	0	0	1	0	1	0	0	0	4
99	**Brush Management**	COUNTY-OTHER, TRAVIS	Removal of brush to increase recharge and runoff. Firm yield determined from Pedernales River Watershed Feasibility Study.	No	$1,190	83	2030	Colorado	No	1	-1	1	0	1	1	-1	0	0	0	0	0	2
100	**Drought Management**	COUNTY-OTHER, TRAVIS (AQUA TEXAS - RIVERCREST)	Mandatory water use reduction by 20%	No	$66	58	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
101	**Conservation**	COUNTY-OTHER, TRAVIS (AQUA TEXAS - RIVERCREST)	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	No	$897	142	2020	Colorado	No	0	0	1	0	1	0	1	0	0	0	0	0	3
102	**Drought Management**	COUNTY-OTHER, WHARTON	Mandatory water use reduction by 20%	Yes	$66	314	2020	All	No	1	0	1	0	0	0	1	0	1	0	0	0	4
103	**Drought Management**	COUNTY-OTHER, WILLIAMSON	Mandatory water use reduction by 20%	No	$66	18	2020	Brazos	No	1	0	1	0	0	0	1	0	1	0	0	0	4
104	**Drought Management**	CREEDMOOR-MAHA WSC	Mandatory water use reduction by 5%	Yes	$66	45	2020	All	No	1	0	1	0	0	0	1	0	1	0	0	0	4
105	**Conservation**	CREEDMOOR-MAHA WSC	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	Yes	$3,452	106	2020	All	No	-1	0	1	0	0	0	0	0	1	0	0	0	1
106	**Water Purchase Amendment**	CREEDMOOR-MAHA WSC	Water purchase amendment with Aqua WSC	Yes	$1,222	335	2040	Colorado	No	-1	1	1	0	0	0	0	0	1	0	0	0	2
107	**Edwards / Middle Trinity ASR Project**	CREEDMOOR-MAHA WSC	Non-drought year available freshwater Edwards BFZ aquifer volume will be stored in the Trinity aquifer. In times of drought, water will be pumped, treated, and piped to users within the BSEACD district.	Yes	$2,156	289	2030	Colorado	No	-1	0	1	0	0	0	0	0	1	0	0	0	1
108	**Drought Management**	CYPRESS RANCH WCID 1	Mandatory water use reduction by 5%	No	$66	7	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
109	**Conservation**	CYPRESS RANCH WCID 1	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	No	$3,804	21	2020	Colorado	No	-1	0	1	0	0	0	0	0	1	0	0	0	1
110	**Drought Management**	DEER CREEK RANCH WATER	Mandatory water use reduction by 5%	No	$66	5	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
111	**Drought Management**	DRIPPING SPRINGS WSC	Mandatory water use reduction by 20%	Yes	$66	1,380	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
112	**Conservation**	DRIPPING SPRINGS WSC	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	Yes	$2,056	576	2020	Colorado	No	-1	0	1	0	0	0	0	0	1	0	0	0	1
113	**Rainwater Harvesting**	DRIPPING SPRINGS WSC	Development of catchment areas to capture rainwater for potable or non-potable use.	Yes	$24,961	81	2030	Colorado	No	-1	-1	1	0	0		0	0	0	0	0	0	-1
114	**LCRA Contract Amendment**	DRIPPING SPRINGS WSC	Amend existing contract with LCRA for additional supply	Yes	$145	2,000	2050	Colorado	No	1	1	1	0	0	0	0	0	0	0	-1	0	2
115	**Direct Reuse**	DRIPPING SPRINGS WSC	Direct reuse of wastewater effluent.	Yes	$251	390	2030	Colorado	No	1	0	1	0	1	1	0	0	1	0	0	0	5
116	**Direct Potable Reuse**	DRIPPING SPRINGS WSC	Directly treat reclaimed water for potable use within the municipality.	Yes	$2,582	560	2030	Colorado	No	-1	0	1	1	0	1	-1	0	1	0	0	0	2
117	**Expand Local Use of Groundwater**	DRIPPING SPRINGS WSC	Expand use of Trinity aquifer in Colorado Basin of Hays County	Yes	$1,023	300	2040	Colorado	No	-1	1	1	0	0	0	0	0	0	0	0	0	1
118	**Drought Management**	EAGLE LAKE	Mandatory water use reduction by 20%	No	$66	97	2020	All	No	1	0	1	0	0	0	1	0	1	0	0	0	4
119	**Drought Management**	EL CAMPO	Mandatory water use reduction by 15%	No	$66	1	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
120	**Drought Management**	ELGIN	Mandatory water use reduction by 20%	Yes	$66	321	2020	All	No	1	0	1	0	0	0	1	0	1	0	0	0	4

Table 5A-2: Region K Potentially Feasible Water Management Strategy Screening (for 2021 Region K Plan)

	Water Management Strategy	Water User Group or Wholesale Provider	Strategy Description	Addressing a Need?	Cost of Water ($/ac-ft)	Max Yield (ac-ft/yr)	Starting Decade	Basin	Interbasin Transfer (Yes/No)	Screening Matrix Factors (Positive (1), Neutral (0), Negative (-1)) Cost	Yield	Location	Water Quality	Environmental and Natural Resources	Local Preference	Institutional Constraints	Socioeconomic Impacts	Impacts on Water Resources	Impacts on Agricultural Resources	Impacts to Recreation	Impacts on Other Management Strategies	Total of Screening Factors
121	**Conservation**	ELGIN	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	Yes	$2,619	807	2020	All	No	-1	0	1	0	0	0	0	0	1	0	0	0	1
122	**Expand Local Use of Groundwater**	ELGIN	Expand use of Carrizo-Wilcox aquifer in Colorado Basin of Bastrop County	Yes	$80	50	2060	Colorado	No	1	-1	1	0	0	1	0	0	0	0	0	0	2
123	**Development of New Groundwater Supply**	ELGIN	Develop a new supply of groundwater in the Trinity aquifer in the Colorado Basin of Travis County	Yes	$953	1,825	2060	Bastrop	Yes	0	0	0	0	0	0	0	0	0	0	0	0	0
124	**Drought Management**	FAYETTE COUNTY WCID MONUMENT HILL	Mandatory water use reduction by 20%	No	$66	33	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
125	**Conservation**	FAYETTE COUNTY WCID MONUMENT HILL	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	No	$1,447	78	2020	Colorado	No	-1	0	1	0	0	0	0	0	1	0	0	0	1
126	**Drought Management**	FAYETTE WSC	Mandatory water use reduction by 20%	No	$66	166	2020	All	No	1	0	1	0	0	0	1	0	1	0	0	0	4
127	**Drought Management**	FLATONIA	Mandatory water use reduction by 20%	No	$66	74	2020	All	No	1	0	1	0	0	0	1	0	1	0	0	0	4
128	**Conservation**	FLATONIA	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	No	$1,745	99	2020	All	No	-1	0	1	0	0	0	0	0	1	0	0	0	1
129	**Drought Management**	FREDERICKSBURG	Mandatory water use reduction by 20%	No	$66	610	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
130	**Conservation**	FREDERICKSBURG	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	No	$1,300	1,802	2020	Colorado	No	-1	0	1	0	0	0	0	0	1	0	0	0	1
131	**Direct Reuse**	FREDERICKSBURG	Direct reuse of wastewater effluent.	No	$5,977	132	2030	Colorado	No	-1	-1	1	0	1	1	0	0	1	0	0	0	2
132	**Drought Management**	GARFIELD WSC	Mandatory water use reduction by 5%	Yes	$66	16	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
133	**Expand Local Use of Groundwater**	GARFIELD WSC	Expand use of Trinity aquifer in Colorado Basin of Travis County	Yes	$85	47	2050	Colorado	No	1	1	1	0	0	0	0	0	0	0	0	0	3
134	**Drought Management**	GEORGETOWN	Mandatory water use reduction by 20%	No	$66	22	2020	Brazos	No	1	0	1	0	0	0	1	0	1	0	0	0	4
135	**Conservation**	GEORGETOWN	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	No	$1,600	41	2020	Brazos	No	-1	0	1	0	0	0	0	0	1	0	0	0	1
136	**Drought Management**	GOFORTH SUD	Mandatory water use reduction by 5%	Yes	$66	26	2020	All	No	1	0	1	0	0	0	1	0	1	0	0	0	4
137	**Drought Management**	GOLDTHWAITE	Mandatory water use reduction by 20%	Yes	$66	78	2020	All	No	1	0	1	0	0	0	1	0	1	0	0	0	4
138	**Conservation**	GOLDTHWAITE	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	Yes	$1,907	65	2020	All	No	-1	0	1	0	0	0	0	0	1	0	0	0	1
139	**Goldthwaite Water Supply**	GOLDTHWAITE	Multi-step water supply strategy involving water permit acquisition and amendments, reservoir development, and reuse. Limited information available.	No	N/A	0	2020	Colorado	No	-1	-1	1	0	0	1	0	0	0	0	0	0	0
140	**Drought Management**	GRANITE SHOALS	Mandatory water use reduction by 5%	Yes	$66	53	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
141	**LCRA Contract Amendment**	GRANITE SHOALS	Amend existing contract with LCRA for additional supply	Yes	$145	170	2060	Colorado	No	1	1	1	0	0	0	0	0	0	0	-1	0	2
142	**Rainwater Harvesting**	HAYS	Development of catchment areas to capture rainwater for potable or non-potable use.	Yes	$24,966	7	2030	Colorado	No	-1	-1	1	0	0	0	0	0	0	0	0	0	-1
143	**Development of New Groundwater Supply**	HAYS	Develop a new supply of groundwater in the Trinity aquifer in the Colorado Basin of Hays County	Yes	$3,830	100	2030	Colorado	No	-1	0	1	0	0	0	0	0	0	0	0	0	0
144	**Edwards / Middle Trinity ASR Project**	HAYS	Non-drought year available freshwater Edwards BFZ aquifer volume will be stored in the Trinity aquifer. In times of drought, water will be pumped, treated, and piped to users within the BSEACD district.	Yes	$3,747	146	2030	Colorado	No	-1	0	1	0	0	0	0	0	1	0	0	0	1
145	**New Water Purchase**	HAYS	Water purchase from Buda	Yes	$1,536	140	2060	Colorado	No	-1	0	1	0	0	0	0	0	1	0	0	0	1
146	**Drought Management**	HAYS	Mandatory water use reduction by 20%	Yes	$66	107	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
147	**Drought Management**	HAYS COUNTY WCID 1	Mandatory water use reduction by 20%	Yes	$66	149	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
148	**Conservation**	HAYS COUNTY WCID 1	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	Yes	$1,606	226	2020	Colorado	No	-1	0	1	0	0	0	0	0	1	0	0	0	1
149	**Drought Management**	HAYS COUNTY WCID 2	Mandatory water use reduction by 20%	Yes	$66	117	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
150	**Conservation**	HAYS COUNTY WCID 2	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	Yes	$1,564	259	2020	Colorado	No	-1	0	1	0	0	0	0	0	1	0	0	0	1
151	**Drought Management**	HORNSBY BEND UTILITY	Mandatory water use reduction by 5%	No	$66	47	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4

Table 5A-2: Region K Potentially Feasible Water Management Strategy Screening (for 2021 Region K Plan)

	Water Management Strategy	Water User Group or Wholesale Provider	Strategy Description	Addressing a Need?	Cost of Water ($/ac-ft)	Max Yield (ac-ft/yr)	Starting Decade	Basin	Interbasin Transfer (Yes/No)	Screening Matrix Factors (Positive (1), Neutral (0), Negative (-1)) Cost	Yield	Location	Water Quality	Environmental and Natural Resources	Local Preference	Institutional Constraints	Socioeconomic Impacts	Impacts on Water Resources	Impacts on Agricultural Resources	Impacts to Recreation	Impacts on Other Management Strategies	Total of Screening Factors
152	**Drought Management**	HORSESHOE BAY	Mandatory water use reduction by 25%	Yes	$66	641	2020	All	No	1	0	1	0	0	0	1	0	1	0	0	0	4
153	**Conservation**	HORSESHOE BAY	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	Yes	$733	1,645	2020	Colorado	No	0	0	1	0	0	0	0	0	1	0	0	0	2
154	**Direct Reuse**	HORSESHOE BAY	Direct reuse of wastewater effluent.	No	$669	154	2030	Colorado	No	0	-1	1	0	1	1	1	0	1	0	0	0	4
155	**LCRA Contract Amendment**	HORSESHOE BAY	Amend existing contract with LCRA for additional supply	Yes	$145	800	2040	Colorado	No	1	1	1	0	0	0	0	0	0	0	-1	0	2
156	**Drought Management**	HURST CREEK MUD	Mandatory water use reduction by 20%	Yes	$66	313	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
157	**Conservation**	HURST CREEK MUD	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	Yes	$636.00	776	2020	Colorado	No	0	0	1	0	0	0	0	0	1	0	0	0	2
158	**Drought Management**	IRRIGATION, COLORADO	Reduce water demands based on lack of available water.	Yes	$132	8,385	2020	All	No	1	0	1	0	-1	-1	0	-1	-1	-1	0	0	-3
159	**Expand Local Use of Groundwater**	IRRIGATION, COLORADO	Expand use of Gulf Coast aquifer in Brazos-Colorado Basin of Colorado County	Yes	$177	2,500	2020	Brazos-Colorado	No	1	0	1	0	0	0	0	0	0	0	0	0	2
160	**Expand Local Use of Groundwater**	IRRIGATION, COLORADO	Expand use of Gulf Coast aquifer in Colorado Basin of Colorado County	Yes	$249	550	2020	Colorado	No	1	0	1	0	0	0	0	0	0	0	0	0	2
161	**Expand Local Use of Groundwater**	IRRIGATION, COLORADO	Expand use of Gulf Coast aquifer in Lavaca Basin of Colorado County	Yes	$171	5,000	2020	Lavaca	No	1	0	1	0	0	0	0	0	0	0	0	0	2
162	**LCRA WMP - Interruptible Water**	IRRIGATION, COLORADO - MATAGORDA - WHARTON	Interruptible water available using projected municipal and industrial demands versus fully authorized demands	Yes	$60	63,405	2020	All	No	1	1	1	0	1	1	0	0	0	1	-1	0	5
163	**Austin Return Flows**	IRRIGATION, COLORADO - MATAGORDA - WHARTON	Return flows from City of Austin and others	Yes	$11	25,746	2020	All	No	1	0	1	0	1	1	0	0	1	1	0	0	6
164	**Conservation - On farm Conservation**	IRRIGATION, COLORADO	On-Farm conservation measures to reduce the amount of water required for rice growing	Yes	$113	4,412	2020	Brazos-Colorado	No	1	-1	1	0	-1	0	0	0	-1	1	0	0	0
165	**Conservation - On farm Conservation**	IRRIGATION, COLORADO	On-Farm conservation measures to reduce the amount of water required for rice growing	Yes	$113	1,371	2020	Colorado	No	1	-1	1	0	-1	0	0	0	-1	1	0	0	0
166	**Conservation - On farm Conservation**	IRRIGATION, COLORADO	On-Farm conservation measures to reduce the amount of water required for rice growing	Yes	$113	5,537	2020	Lavaca	No	1	-1	1	0	-1	0	0	0	-1	1	0	0	0
167	**Conservation - Irrigation Conveyance Improvements**	IRRIGATION, COLORADO	Improvements to the methods of water delivery to the fields in order to reduce the amount of water needed/lost	Yes	$193	3,716	2020	Brazos-Colorado	No	1	-1	1	0	1	0	0	0	1	1	0	0	4
168	**Conservation - Irrigation Conveyance Improvements**	IRRIGATION, COLORADO	Improvements to the methods of water delivery to the fields in order to reduce the amount of water needed/lost	Yes	$193	1,155	2020	Colorado	No	1	-1	1	0	1	0	0	0	1	1	0	0	4
169	**Conservation - Irrigation Conveyance Improvements**	IRRIGATION, COLORADO	Improvements to the methods of water delivery to the fields in order to reduce the amount of water needed/lost	Yes	$193	4,665	2020	Lavaca	No	1	-1	1	0	1	0	0	0	1	1	0	0	4
170	**Conservation - Real-Time Use Metering and Monitoring**	IRRIGATION, COLORADO	Installation of meters that assess water use by automatically recording and transferring flow data at 15-minute intervals	Yes	$120	3,156	2020	Brazos-Colorado	No	1	-1	1	0	1	0	0	0	1	1	0	0	3
171	**Conservation - Real-Time Use Metering and Monitoring**	IRRIGATION, COLORADO	Installation of meters that assess water use by automatically recording and transferring flow data at 15-minute intervals	Yes	$120	981	2020	Colorado	No	1	-1	1	0	1	0	0	0	1	1	0	0	3
172	**Conservation - Real-Time Use Metering and Monitoring**	IRRIGATION, COLORADO	Installation of meters that assess water use by automatically recording and transferring flow data at 15-minute intervals	Yes	$120	3,961	2020	Lavaca	No	1	-1	1	0	1	0	0	0	1	1	0	0	3
173	**Conservation - Sprinkler Irrigation**	IRRIGATION, COLORADO	Rice farming conversion to sprinkler irrigation (LEPA) versus field flooding	Yes	$185	1,753	2020	Brazos-Colorado	No	1	-1	1	0	-1	-1	0	0	1	0	0	0	0
174	**Conservation - Sprinkler Irrigation**	IRRIGATION, COLORADO	Rice farming conversion to sprinkler irrigation (LEPA) versus field flooding	Yes	$185	545	2020	Colorado	No	1	-1	1	0	-1	-1	0	0	1	0	0	0	0
175	**Conservation - Sprinkler Irrigation**	IRRIGATION, COLORADO	Rice farming conversion to sprinkler irrigation (LEPA) versus field flooding	Yes	$185	2,201	2020	Lavaca	No	1	-1	1	0	-1	-1	0	0	1	0	0	0	0
176	**Conservation - Drip Irrigation**	IRRIGATION, GILLESPIE	Micro irrigation method to apply water to the root zone of crops through low pressure, low volume devices	No	$643	28	2020	Colorado	No	0	-1	1	0	1	0	0	0	1	1	0	0	3
177	**Drought Management**	IRRIGATION, MATAGORDA	Reduce water demands based on lack of available water.	Yes	$193	17,139	2020	All	No	1	0	1	0	-1	-1	0	-1	-1	-1	0	0	-3
178	**Expand Local Use of Groundwater**	IRRIGATION, MATAGORDA	Expanded use of Gulf Coast aquifer in Colorado-Lavaca Basin of Matagorda County	Yes	$430	300	2020	Lavaca	No	1	0	1	0	0	0	0	0	0	0	0	0	2
179	**Development of New Groundwater Supply**	IRRIGATION, MATAGORDA	Develop a new supply of groundwater in the Gulf Coast aquifer in the Colorado Basin of Matagorda County	Yes	$180	510	2020	Colorado	No	1	1	1	0	0	0	0	0	0	0	0	0	3
180	**Conservation - On farm Conservation**	IRRIGATION, MATAGORDA	On-Farm conservation measures to reduce the amount of water required for rice growing	Yes	$113	5,072	2020	Brazos-Colorado	No	1	-1	1	0	-1	0	0	0	-1	1	0	0	0
181	**Conservation - On farm Conservation**	IRRIGATION, MATAGORDA	On-Farm conservation measures to reduce the amount of water required for rice growing	Yes	$113	42	2020	Colorado	No	1	-1	1	0	-1	0	0	0	-1	1	0	0	0
182	**Conservation - On farm Conservation**	IRRIGATION, MATAGORDA	On-Farm conservation measures to reduce the amount of water required for rice growing	Yes	$113	4,978	2020	Colorado-Lavaca	No	1	-1	1	0	-1	0	0	0	-1	1	0	0	0
183	**Conservation - Irrigation Conveyance Improvements**	IRRIGATION, MATAGORDA	Improvements to the methods of water delivery to the fields in order to reduce the amount of water needed/lost	Yes	$193	10,872	2020	Brazos-Colorado	No	1	-1	1	0	1	0	0	0	1	1	0	0	4

Table 5A-2: Region K Potentially Feasible Water Management Strategy Screening (for 2021 Region K Plan)

	Water Management Strategy	Water User Group or Wholesale Provider	Strategy Description	Addressing a Need?	Cost of Water ($/ac-ft)	Max Yield (ac-ft/yr)	Starting Decade	Basin	Interbasin Transfer (Yes/No)	Screening Matrix Factors (Positive (1), Neutral (0), Negative (-1)) Cost	Yield	Location	Water Quality	Environmental and Natural Resources	Local Preference	Institutional Constraints	Socioeconomic Impacts	Impacts on Water Resources	Impacts on Agricultural Resources	Impacts to Recreation	Impacts on Other Management Strategies	Total of Screening Factors
184	**Conservation - Irrigation Conveyance Improvements**	IRRIGATION, MATAGORDA	Improvements to the methods of water delivery to the fields in order to reduce the amount of water needed/lost	Yes	$193	90	2020	Colorado	No	1	-1	1	0	1	0	0	0	1	1	0	0	4
185	**Conservation - Irrigation Conveyance Improvements**	IRRIGATION, MATAGORDA	Improvements to the methods of water delivery to the fields in order to reduce the amount of water needed/lost	Yes	$193	10,670	2020	Colorado-Lavaca	No	1	-1	1	0	1	0	0	0	1	1	0	0	4
186	**Conservation - Real-Time Use Metering and Monitoring**	IRRIGATION, MATAGORDA	Installation of meters that assess water use by automatically recording and transferring flow data at 15-minute intervals	Yes	$120	2,541	2020	Brazos-Colorado	No	1	-1	1	0	1	0	0	0	1	1	0	0	3
187	**Conservation - Real-Time Use Metering and Monitoring**	IRRIGATION, MATAGORDA	Installation of meters that assess water use by automatically recording and transferring flow data at 15-minute intervals	Yes	$120	21	2020	Colorado	No	1	-1	1	0	1	0	0	0	1	1	0	0	3
188	**Conservation - Real-Time Use Metering and Monitoring**	IRRIGATION, MATAGORDA	Installation of meters that assess water use by automatically recording and transferring flow data at 15-minute intervals	Yes	$120	2,494	2020	Colorado-Lavaca	No	1	-1	1	0	1	0	0	0	1	1	0	0	3
189	**Conservation - Sprinkler Irrigation**	IRRIGATION, MATAGORDA	Rice farming conversion to sprinkler irrigation (LEPA) versus field flooding	Yes	$185	1,412	2020	Brazos-Colorado	No	1	-1	1	0	-1	-1	0	0	1	0	0	0	0
190	**Conservation - Sprinkler Irrigation**	IRRIGATION, MATAGORDA	Rice farming conversion to sprinkler irrigation (LEPA) versus field flooding	Yes	$185	12	2020	Colorado	No	1	-1	1	0	-1	-1	0	0	1	0	0	0	0
191	**Conservation - Sprinkler Irrigation**	IRRIGATION, MATAGORDA	Rice farming conversion to sprinkler irrigation (LEPA) versus field flooding	Yes	$185	1,385	2020	Colorado-Lavaca	No	1	-1	1	0	-1	-1	0	0	1	0	0	0	0
192	**Drought Management**	IRRIGATION, MILLS	Reduce water demands based on lack of available water.	Yes	$183	149	2020	Brazos	No	1	0	1	0	0	-1	0	-1	0	-1	0	0	-1
193	**Expansion of Groundwater Supply**	IRRIGATION, MILLS	Expand use of Trinity aquifer in Brazos Basin of Mills County	Yes	$403	300	2020	Brazos	No	1	1	1	0	0	0	1	0	0	0	0	0	4
194	**Conservation - Drip Irrigation**	IRRIGATION, MILLS	Micro irrigation method to apply water to the root zone of crops through low pressure, low volume devices	Yes	$534	459	2020	Brazos	No	0	-1	1	0	1	0	0	0	1	1	0	0	3
195	**Conservation - Drip Irrigation**	IRRIGATION, SAN SABA	Micro irrigation method to apply water to the root zone of crops through low pressure, low volume devices	No	$382	626	2020	Colorado	No	1	-1	1	0	1	0	0	0	1	1	0	0	3
196	**Drought Management**	IRRIGATION, WHARTON	Reduce water demands based on lack of available water.	Yes	$203	8,480	2020	All	No	1	0	1	0	-1	-1	0	-1	-1	-1	0	0	-3
197	**Expand Local Use of Groundwater**	IRRIGATION, WHARTON	Expand use of Gulf Coast aquifer in Brazos-Colorado Basin of Wharton County	Yes	$170	5,000	2020	Brazos-Colorado	No	1	0	1	0	0	0	0	0	0	0	0	0	2
198	**Expand Local Use of Groundwater**	IRRIGATION, WHARTON	Expand use of Gulf Coast aquifer in Colorado Basin of Wharton County	Yes	$208	600	2020	Colorado	No	1	0	1	0	0	0	0	0	0	0	0	0	2
199	**Conservation - On farm Conservation**	IRRIGATION, WHARTON	On-Farm conservation measures to reduce the amount of water required for rice growing	Yes	$113	15,590	2020	Brazos-Colorado	No	1	-1	1	0	-1	0	0	0	-1	1	0	0	0
200	**Conservation - On farm Conservation**	IRRIGATION, WHARTON	On-Farm conservation measures to reduce the amount of water required for rice growing	Yes	$113	7,106	2020	Colorado	No	1	-1	1	0	-1	0	0	0	-1	1	0	0	0
201	**Conservation - Irrigation Conveyance Improvements**	IRRIGATION, WHARTON	Improvements to the methods of water delivery to the fields in order to reduce the amount of water needed/lost	Yes	$193	9,055	2020	Brazos-Colorado	No	1	-1	1	0	1	0	0	0	1	1	0	0	4
202	**Conservation - Irrigation Conveyance Improvements**	IRRIGATION, WHARTON	Improvements to the methods of water delivery to the fields in order to reduce the amount of water needed/lost	Yes	$193	4,127	2020	Colorado	No	1	-1	1	0	1	0	0	0	1	1	0	0	4
203	**Conservation - Real-Time Use Metering and Monitoring**	IRRIGATION, WHARTON	Installation of meters that assess water use by automatically recording and transferring flow data at 15-minute intervals	Yes	$120	5,052	2020	Brazos-Colorado	No	1	-1	1	0	1	0	0	0	1	1	0	0	3
204	**Conservation - Real-Time Use Metering and Monitoring**	IRRIGATION, WHARTON	Installation of meters that assess water use by automatically recording and transferring flow data at 15-minute intervals	Yes	$120	2,303	2020	Colorado	No	1	-1	1	0	1	0	0	0	1	1	0	0	3
205	**Conservation - Sprinkler Irrigation**	IRRIGATION, WHARTON	Rice farming conversion to sprinkler irrigation (LEPA) versus field flooding	Yes	$185	2,807	2020	Brazos-Colorado	No	1	-1	1	0	-1	-1	0	0	1	0	0	0	0
206	**Conservation - Sprinkler Irrigation**	IRRIGATION, WHARTON	Rice farming conversion to sprinkler irrigation (LEPA) versus field flooding	Yes	$185	1,279	2020	Colorado	No	1	-1	1	0	-1	-1	0	0	1	0	0	0	0
207	**Drought Management**	JOHNSON CITY	Mandatory water use reduction by 20%	Yes	$66	91	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
208	**Conservation**	JOHNSON CITY	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	Yes	$2,116	31	2020	Colorado	No	-1	0	1	0	0	0	0	0	1	0	0	0	1
209	**Expand Local Use of Groundwater**	JOHNSON CITY	Expand use of Ellenburger-San Saba aquifer in Colorado Basin of Blanco County	Yes	$2,030	100	2030	Colorado	No	-1	1	1	0	0	0	0	0	0	0	0	0	1
210	**Drought Management**	JONESTOWN WSC	Mandatory water use reduction by 20%	Yes	$66	165	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
211	**Conservation**	JONESTOWN WSC	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	Yes	$2,089.00	56	2020	Colorado	No	-1	0	1	0	0	0	0	0	1	0	0	0	1
212	**Drought Management**	KELLY LANE WCID 1	Mandatory water use reduction by 25%	No	$66	73	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
213	**Conservation**	KELLY LANE WCID 1	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	No	$1,865	52	2020	Colorado	No	-1	0	1	0	0	0	0	0	1	0	0	0	1
214	**Drought Management**	KEMPNER WSC	Mandatory water use reduction by 30%	No	$66	49	2020	Brazos	No	1	0	1	0	0	0	1	0	1	0	0	0	4
215	**Conservation**	KEMPNER WSC	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	No	$2,194	12	2020	Brazos	No	-1	0	1	0	0	0	0	0	1	0	0	0	1

Table 5A-2: Region K Potentially Feasible Water Management Strategy Screening (for 2021 Region K Plan)

	Water Management Strategy	Water User Group or Wholesale Provider	Strategy Description	Addressing a Need?	Cost of Water ($/ac-ft)	Max Yield (ac-ft/yr)	Starting Decade	Basin	Interbasin Transfer (Yes/No)	Screening Matrix Factors (Positive (1), Neutral (0), Negative (-1)) Cost	Yield	Location	Water Quality	Environmental and Natural Resources	Local Preference	Institutional Constraints	Socioeconomic Impacts	Impacts on Water Resources	Impacts on Agricultural Resources	Impacts to Recreation	Impacts on Other Management Strategies	Total of Screening Factors
216	**Drought Management**	KINGSLAND WSC	Mandatory water use reduction by 5%	No	$66	61	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
217	**Drought Management**	LA GRANGE	Mandatory water use reduction by 20%	No	$66	245	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
218	**Conservation**	LA GRANGE	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	No	$2,100	86	2020	Colorado	No	-1	0	1	0	0	0	0	0	1	0	0	0	1
219	**Drought Management**	LAGO VISTA	Mandatory water use reduction by 20%	No	$66	446	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
220	**Conservation**	LAGO VISTA	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	No	$1,447	1,198	2020	Colorado	No	-1	0	1	0	0	0	0	0	1	0	0	0	1
221	**Direct Reuse**	LAGO VISTA	Direct reuse of wastewater effluent.	No	$140	673	2030	Colorado	No	1	0	1	0	1	1	0	0	1	0	0	0	5
222	**Drought Management**	LAKEWAY MUD	Mandatory water use reduction by 20%	Yes	$66	502	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
223	**Conservation**	LAKEWAY MUD	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	Yes	$1,414	1,168	2020	Colorado	No	-1	0	1	0	0	0	0	0	1	0	0	0	1
224	**Direct Reuse**	LAKEWAY MUD	Direct reuse of wastewater effluent.	Yes	$306	900	2030	Colorado	No	1	0	1	0	1	1	0	0	1	0	0	0	5
225	**Austin Return Flows/Indirect Reuse**	LCRA/Austin	Return flows from City of Austin to Colorado River	Yes	$11	71,628	2020	Colorado	No	1	0	1	0	1	0	0	0	1	0	0	0	4
226	**Downstream Return Flows**	LCRA	Return flows from Pflugerville to Colorado River	Yes	$11	8,267	2020	Colorado	No	1	0	1	0	1	0	0	0	1	0	0	0	4
227	**Enhanced Municipal and Industrial Conservation**	LCRA	Condensate Capture strategy by Reducing GPCD and Industrial water use through development of LCRA customer savings by incorporating	Yes	$262	20,000	2020	Colorado	No	1	0	1	0	0	1	0	0	1	0	0	0	4
228	**LCRA Water Management Plan Amendments**	LCRA	See LCRA WMP - Interruptible Water	Yes	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	N/A	N/A	N/A	N/A	N/A
229	**Amendments to Water Rights**	LCRA	Amend run-of-river water rights for additional diversion locations and storage rights	Yes	$0	N/A	2020	Colorado	No	1	0	1	0	0	0	0	0	1	0	0	0	3
230	**Acquire Additional Water Rights**	LCRA	Purchase of water rights owned by others in the basin.	Yes	$500	250	2020	Colorado	No	1	0	1	0	0	0	0	0	0	0	0	0	2
231	**Alternative - Supplement Bay and Estuary Inflows with Brackish Groundwater**	LCRA	Brackish groundwater delivery to the Bay to achieve the same effect as volume of released stored water from Highland Lakes	Yes	$532	12,000	2030	Matagorda	No	0	0	0	-1	-1	0	-1	0	0	0	1	0	-2
232	**Groundwater Importation**	LCRA	Import groundwater from outside of region (assume Carrizo-Wilcox aquifer water from Burleson County).	Yes	$829	35,000	2040	N/A	No	0	0	-1	0	0	0	0	0	0	0	0	0	-1
233	**Development of New Groundwater Supply - FPP Onsite**	LCRA	Develop a new supply of groundwater in the Gulf Coast aquifer in the Colorado Basin of Fayette County	Yes	$675	40	2030	Colorado	No	0	0	1	0	0	0	0	0	1	0	0	0	2
234	**Alternative - Development of New Groundwater Supply - FPP Onsite**	LCRA	Develop a new supply of groundwater in the Gulf Coast aquifer in the Colorado Basin of Fayette County	Yes	$117	700	2040	Colorado	No	1	1	1	0	0	0	0	0	1	0	0	0	4
235	**Development of New Groundwater Supply - FPP Offsite**	LCRA	Develop a new supply of groundwater in the Carrizo-Wilcox aquifer in the Colorado Basin of Fayette County	Yes	$1,257	2,500	2030	Colorado	No	-1	1	0	0	0	0	0	0	1	0	0	0	1
236	**Alternative - Brackish Groundwater Desalination**	LCRA	Extracting and treating brackish groundwater from the Gulf Coast aquifer in Matagorda County for use in the Bay City area	Yes	$1,393	22,400	2040	Colorado	No	-1	1	0	0	0	0	-1	0	0	0	0	0	-1
237	**Expand Local Use of Groundwater**	LCRA	Expand use of Carrizo-Wilcox aquifer in Colorado Basin of Bastrop County	Yes	$833	30	2030	Colorado	No	0	0	1	0	0	0	0	0	0	0	0	0	1
238	**Import Return Flows from Williamson County**	LCRA	Return flows from Brazos River basin to Colorado basin through transmission of WWTP effluent	Yes	$243	25,000	2030	Colorado	Yes	1	0	1	0	0	0	-1	0	1	1	1	-1	3
239	**Baylor Creek Reservoir**	LCRA	Reservoir (Baylor Creek) using diversions from existing LCRA water rights	Yes	$907	18,000	2040	Colorado	No	0	0	1	0	-1	0	0	0	1	1	1	0	3
240	**Aquifer Storage and Recovery**	LCRA	Surface water from the Colorado River is diverted to aquifer storage for later recovery	Yes	$1,300	12,973	2040	Colorado	No	-1	1	1	0	0	0	0	0	0	0	0	0	1
241	**Enhanced Recharge and Conjunctive Use**	LCRA	Surface water from the Colorado River is diverted to recharge basins	Yes	$375	14,486	2030	Colorado	No	0	1	1	0	0	0	0	0	0	1	0	0	3
242	**LCRA - Off-Channel Reservoir(s)**	LCRA	Off-Channel reservoir (Mid Basin Site) using diversions from existing LCRA water rights	Yes	$1,313	20,000	2030	Colorado	No	-1	0	1	0	-1	0	0	0	1	1	1	0	2
243	**LCRA - Off-Channel Reservoir(s)**	LCRA	Off-Channel reservoir (Prairie Site) using diversions from existing LCRA water rights	Yes	$45	19,500	2030	Colorado	No	-1	0	1	0	-1	0	0	0	1	1	1	0	2
244	**LCRA - Off-Channel Reservoir(s)**	LCRA	Off-Channel reservoir receiving diversions from LCRA's Excess Flows permit	Yes	$1,241	39,247	2030	Colorado	No	-1	0	1	0	-1	0	0	0	1	1	1	0	2
245	**Drought Management**	LEANDER	Mandatory water use reduction by 20%	Yes	$66	686	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
246	**LCRA Contract Amendment**	LEANDER	Amend existing contract with LCRA for additional supply	Yes	$145	2,600	2020	Colorado	No	1	1	1	0	0	0	0	0	0	0	-1	0	2

Table 5A-2: Region K Potentially Feasible Water Management Strategy Screening (for 2021 Region K Plan)

	Water Management Strategy	Water User Group or Wholesale Provider	Strategy Description	Addressing a Need?	Cost of Water ($/ac-ft)	Max Yield (ac-ft/yr)	Starting Decade	Basin	Interbasin Transfer (Yes/No)	Screening Matrix Factors (Positive (1), Neutral (0), Negative (-1)): Cost	Yield	Location	Water Quality	Environmental and Natural Resources	Local Preference	Institutional Constraints	Socioeconomic Impacts	Impacts on Water Resources	Impacts on Agricultural Resources	Impacts to Recreation	Impacts on Other Management Strategies	Total of Screening Factors
247	**Drought Management**	LEE COUNTY WSC	Mandatory water use reduction by 20%	No	$66	69	2020	All	No	1	0	1	0	0	0	1	0	1	0	0	0	4
248	**Drought Management**	LLANO	Mandatory water use reduction by 20%	Yes	$66	157	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
249	**Conservation**	LLANO	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	Yes	$1,490	295	2020	Colorado	No	-1	0	1	0	0	0	0	0	1	0	0	0	1
250	**New Water Purchase**	LLANO	Water purchase from Burnet	Yes	$45,619	177	2020	Colorado	No	-1	1	1	0	0	0	0	0	1	0	0	0	2
251	**Direct Potable Reuse**	LLANO	Directly treat reclaimed water for potable use within the municipality.	Yes	$3,764	280	2030	Colorado	No	-1	0	1	1	0	0	-1	0	1	0	0	0	1
252	**Reservoir Capacity Expansion**	LLANO	Installation of flashboard system during drought conditions along the downstream of the Llano River Lake.	Yes	N/A	0	N/A	Colorado	No	-1	-1	1	0	0	0	0	0	0	0	-1	0	-2
253	**Drought Management**	LOOP 360 WSC	Mandatory water use reduction by 20%	Yes	$66	223	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
254	**Conservation**	LOOP 360 WSC	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	Yes	$606.00	679	2020	Colorado	No	0	0	1	0	0	0	0	0	1	0	0	0	2
255	**Drought Management**	MANOR	Mandatory water use reduction by 20%	No	$66	395	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
256	**Development of New Groundwater Supply**	MANUFACTURING, FAYETTE	Develop a new supply of groundwater in the Yegua-Jackson aquifer in the Lavaca Basin of Fayette County	Yes	$3,960	100	2030	Lavaca	No	-1	1	1	0	0	0	0	0	0	0	0	0	1
257	**Drought Management**	MANVILLE WSC	Mandatory water use reduction by 20%	Yes	$66	993	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
258	**Expand Local Use of Groundwater**	MANVILLE WSC	Expand use of Trinity aquifer in Colorado Basin of Travis County	Yes	$643	703	2070	Colorado	No	0	1	1	0	0	0	1	0	0	0	0	0	3
259	**Drought Management**	MARBLE FALLS	Mandatory water use reduction by 20%	Yes	$66	776	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
260	**Conservation**	MARBLE FALLS	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	Yes	$1,340.00	2,566	2020	Colorado	No	-1	0	1	0	0	0	0	0	1	0	0	0	1
261	**Marble Falls Regional Project**	MARBLE FALLS	Contract with LCRA. Construction of new raw water intake and regional WTP at Max Starcke Dam, and construction of transmission lines to support future development.	Yes	$1,436	4,000	2030	Colorado	No	-1	1	1	0	0	0	-1	0	0	0	-1	0	-1
262	**LCRA Contract Amendment with Infrastructure**	MARBLE FALLS	See Marble Falls Regional Project	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	N/A	N/A	N/A	N/A	N/A
263	**Direct Reuse**	MARBLE FALLS	Direct reuse of wastewater effluent.	Yes	$296	500	2030	Colorado	No	1	0	1	0	1	1	0	0	1	0	0	0	5
264	**Drought Management**	MARKHAM MUD	Mandatory water use reduction by 5%	No	$66	5	2020	Colorado-Lavaca	No	1	0	1	0	0	0	1	0	1	0	0	0	4
265	**Drought Management**	MATAGORDA COUNTY WASTE DISPOSAL & WSC	Mandatory water use reduction by 20%	No	$66	6	2020	All	No	1	0	1	0	0	0	1	0	1	0	0	0	4
266	**Conservation**	MATAGORDA COUNTY WASTE DISPOSAL & WSC	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	No	$2,044.00	16	2020	All	No	-1	0	1	0	0	0	0	0	1	0	0	0	1
267	**Drought Management**	MATAGORDA COUNTY WCID 6	Mandatory water use reduction by 5%	No	$66	25	2020	Brazos-Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
268	**Drought Management**	MEADOWLAKES	Mandatory water use reduction by 20%	Yes	$66	155	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
269	**Conservation**	MEADOWLAKES	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	Yes	$1,054.00	377	2020	Colorado	No	-1	0	1	0	0	0	0	0	1	0	0	0	1
270	**Direct Reuse**	MEADOWLAKES	Direct reuse of wastewater effluent.	Yes	$0	75	2020	Colorado	No	1	0	1	0	1	1	0	0	1	0	0	0	5
271	**Mining Conservation**	MINING, BASTROP	Recycling existing pumped groundwater for use in mining operations up to five times.	Yes	$16	308	2020	Guadalupe	No	1	1	1	-1	0	1	0	0	0	0	0	0	3
272	**Development of New Groundwater Supply**	MINING, BURNET	Develop a new supply of groundwater in the Ellenburger-San Saba aquifer in the Brazos Basin of Burnet County	Yes	$534	700	2050	Brazos	No	0	1	1	0	0	0	0	0	0	0	0	0	2
273	**Development of New Groundwater Supply**	MINING, BURNET	Develop a new supply of groundwater in the Hickory aquifer in the Colorado Basin of Burnet County	Yes	$432	1,000	2030	Colorado	No	1	0	1	0	0	0	0	0	0	0	0	0	2
274	**Development of New Groundwater Supply**	MINING, BURNET	Develop a new supply of groundwater in the Marble Falls aquifer in the Colorado Basin of Burnet County	Yes	$307	1,000	2040	Colorado	No	1	0	1	0	0	0	0	0	0	0	0	0	2
275	**Expand Local Use of Groundwater**	MINING, BURNET	Expand use of Ellenburger-San Saba aquifer in Colorado Basin of Burnet County	Yes	$581	1,000	2030	Colorado	No	0	1	1	0	0	0	0	0	0	0	0	0	2
276	**Mining Conservation**	MINING, BURNET	Recycling existing pumped groundwater for use in mining operations up to five times.	Yes	$33	1,800	2020	Colorado	No	1	1	1	-1	0	1	0	0	0	0	0	0	3
277	**Expand Local Use of Groundwater**	MINING, FAYETTE	Expand use of Yegua-Jackson aquifer in Colorado Basin of Fayette County	Yes	$355	760	2020	Colorado	No	1	1	1	0	0	0	0	0	0	0	0	0	3

Table 5A-2: Region K Potentially Feasible Water Management Strategy Screening (for 2021 Region K Plan)

	Water Management Strategy	Water User Group or Wholesale Provider	Strategy Description	Addressing a Need?	Cost of Water ($/ac-ft)	Max Yield (ac-ft/yr)	Starting Decade	Basin	Interbasin Transfer (Yes/No)	Screening Matrix Factors (Positive (1), Neutral (0), Negative (-1)) Cost	Yield	Location	Water Quality	Environmental and Natural Resources	Local Preference	Institutional Constraints	Socioeconomic Impacts	Impacts on Water Resources	Impacts on Agricultural Resources	Impacts to Recreation	Impacts on Other Management Strategies	Total of Screening Factors
278	**Expand Local Use of Groundwater**	MINING, HAYS	Expand use of Trinity aquifer in Colorado Basin of Hays County	Yes	$373	600	2020	Colorado	No	1	-1	1	0	0	0	0	0	0	0	0	0	1
279	**New Water Purchase**	MINING, HAYS	Water purchase (reuse water) from Buda	Yes	$1,597	500	2040	Colorado	No	-1	1	1	0	0	0	0	0	1	0	0	0	2
280	**Drought Management**	NORTH AUSTIN MUD 1	Mandatory water use reduction by 5%	Yes	$66	43	2020	All	No	1	0	1	0	0	0	1	0	1	0	0	0	4
281	**New LCRA Contract**	NORTH AUSTIN MUD 1	Contract with LCRA for water	Yes	$145	80	2040	Colorado	No	1	1	1	0	0	0	0	0	0	0	-1	0	2
282	**New LCRA Contract**	NORTH AUSTIN MUD 1	Once contract with City of Austin ends, contract with LCRA for water.	Yes	$145	690	2040	Brazos	No	1	1	1	0	0	0	0	0	0	0	-1	0	2
283	**Drought Management**	NORTH SAN SABA WSC	Mandatory water use reduction by 20%	No	$66	34	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
284	**Conservation**	NORTH SAN SABA WSC	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	No	$1,231.00	85	2020	Colorado	No	-1	0	1	0	0	0	0	0	1	0	0	0	1
285	**Drought Management**	NORTHTOWN MUD	Mandatory water use reduction by 5%	Yes	$66	63	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
286	**New LCRA Contract**	NORTHTOWN MUD	Once contract with City of Austin ends, contract with LCRA for water.	Yes	$145	1,300	2040	Colorado	No	1	1	1	0	0	0	0	0	0	0	-1	0	2
287	**Drought Management**	OAK SHORES WATER SYSTEM	Mandatory water use reduction by 20%	No	$66	27	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
288	**Conservation**	OAK SHORES WATER SYSTEM	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	No	$1,302.00	70	2020	Colorado	No	-1	0	1	0	0	0	0	0	1	0	0	0	1
289	**Drought Management**	PALACIOS	Mandatory water use reduction by 20%	No	$66	70	2020	Colorado-Lavaca	No	1	0	1	0	0	0	1	0	1	0	0	0	4
290	**Drought Management**	PFLUGERVILLE	Mandatory water use reduction by 25%	Yes	$66	5,103	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
291	**Conservation**	PFLUGERVILLE	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	Yes	$2,149	754	2020	Colorado	No	-1	0	1	0	0	0	0	0	1	0	0	0	1
292	**LCRA Contract Amendment**	PFLUGERVILLE	Amend existing contract with LCRA for additional supply	Yes	$145	3,400	2050	Colorado	No	1	1	1	0	0	0	0	0	0	0	-1	0	2
293	**Expand Local Use of Groundwater**	PFLUGERVILLE	Expand use of Edwards BFZ aquifer in Colorado Basin of Travis County	Yes	$50	20	2040	Colorado	No	1	-1	1	0	0	0	1	0	0	0	0	0	2
294	**Drought Management**	POLONIA WSC	Mandatory water use reduction by 20%	No	$66	8	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
295	**Drought Management**	RICHLAND SUD	Mandatory water use reduction by 20%	No	$66	41	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
296	**Conservation**	RICHLAND SUD	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	No	$1,532	72	2020	Colorado	No	-1	0	1	0	0	0	0	0	1	0	0	0	1
297	**Drought Management**	ROLLINGWOOD	Mandatory water use reduction by 20%	Yes	$66	70	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
298	**Conservation**	ROLLINGWOOD	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	Yes	$1,326	148	2020	Colorado	No	-1	0	1	0	0	0	0	0	1	0	0	0	1
299	**New LCRA Contract**	ROLLINGWOOD	Once contract with City of Austin ends, contract with LCRA for water.	Yes	$145	250	2040	Colorado	No	1	1	1	0	0	0	0	0	0	0	-1	0	2
300	**Drought Management**	ROUGH HOLLOW IN TRAVIS COUNTY	Mandatory water use reduction by 20%	No	$66	179	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
301	**Conservation**	ROUGH HOLLOW IN TRAVIS COUNTY	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	No	$1,632.00	319	2020	Colorado	No	-1	0	1	0	0	0	0	0	1	0	0	0	1
302	**Drought Management**	ROUND ROCK	Mandatory water use reduction by 25%	No	$66	118	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
303	**Conservation**	ROUND ROCK	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	No	$2,250.00	6	2020	Colorado	No	-1	0	1	0	0	0	0	0	1	0	0	0	1
304	**Drought Management**	SAN SABA	Mandatory water use reduction by 20%	No	$66	214	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
305	**Conservation**	SAN SABA	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	No	$1,031.00	556	2020	Colorado	No	-1	0	1	0	0	0	0	0	1	0	0	0	1
306	**Drought Management**	SCHULENBERG	Mandatory water use reduction by 20%	Yes	$66	141	2020	Lavaca	No	1	0	1	0	0	0	1	0	1	0	0	0	4
307	**Conservation**	SCHULENBERG	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	Yes	$1,628.00	254	2020	Lavaca	No	-1	0	1	0	0	0	0	0	1	0	0	0	1
308	**Drought Management**	SENNA HILLS MUD	Mandatory water use reduction by 20%	Yes	$66	84	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4

Table 5A-2: Region K Potentially Feasible Water Management Strategy Screening (for 2021 Region K Plan)

	Water Management Strategy	Water User Group or Wholesale Provider	Strategy Description	Addressing a Need?	Cost of Water ($/ac-ft)	Max Yield (ac-ft/yr)	Starting Decade	Basin	Interbasin Transfer (Yes/No)	Screening Matrix Factors (Positive (1), Neutral (0), Negative (-1)) Cost	Yield	Location	Water Quality	Environmental and Natural Resources	Local Preference	Institutional Constraints	Socioeconomic Impacts	Impacts on Water Resources	Impacts on Agricultural Resources	Impacts to Recreation	Impacts on Other Management Strategies	Total of Screening Factors
309	**Conservation**	SENNA HILLS MUD	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	Yes	$1,045.00	321	2020	Colorado	No	-1	0	1	0	0	0	0	0	1	0	0	0	1
310	**Drought Management**	SHADY HOLLOW MUD	Mandatory water use reduction by 20%	No	$66	144	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
311	**Conservation**	SHADY HOLLOW MUD	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	No	$2,029.00	90	2020	Colorado	No	-1	0	1	0	0	0	0	0	1	0	0	0	1
312	**Drought Management**	SMITHVILLE	Mandatory water use reduction by 20%	Yes	$66	606	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
313	**Conservation**	SMITHVILLE	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	Yes	$2,152.00	97	2020	Colorado	No	-1	0	1	0	0	0	0	0	1	0	0	0	1
314	**Development of New Groundwater Supply**	SMITHVILLE	Develop a new supply of groundwater in the Yegua-Jackson aquifer in the Colorado Basin of Fayette County. To be transferred to Bastrop County.	Yes	$1,887	700	2030	Colorado	Yes	-1	1	-1	0	0	0	0	0	0	0	0	0	-1
315	**New LCRA Contract (with infrastructure)**	SMITHVILLE	Purchase SW through contract and construct new SWTP and transmission line from Colorado River	Yes	$1,961	700	2070	Colorado	No	-1	0	1	0	0	0	-1	0	0	0	-1	0	-2
316	**LCRA Contract Amendment**	STEAM-ELECTRIC, FAYETTE	Amend existing contract with LCRA for additional supply	Yes	$145	4,300	2020	Colorado	No	1	1	1	0	0	0	0	0	0	0	-1	0	2
317	**STPNOC Alternate Canal Delivery**	STEAM-ELECTRIC, MATAGORDA	Divert available Garwood water during winter months through irrigation canal system upstream of Bay City Dam. Pipeline from canal to reservoir.	Yes	$266	12,727	2020	Colorado	No	1	1	1	0	0	0	0	0	0	0	-1	0	2
318	**LCRA Contract Amendment**	STEAM-ELECTRIC, MATAGORDA	Amend existing contract with LCRA for additional supply	Yes	$145	8,300	2020	Colorado	No	1	1	1	0	0	0	0	0	0	0	-1	0	2
319	**STPNOC Brackish Surface Water Blending**	STEAM-ELECTRIC, MATAGORDA	Under emergency conditions, the TCEQ can approve STPNOC to pump brackish surface water to blend with the freshwater in their reservoir	Yes	$0	3,000	2020	Colorado	No	1	1	1	0	0	1	0	0	0	0	0	0	4
320	**Drought Management**	SUNSET VALLEY	Mandatory water use reduction by 20%	Yes	$66	82	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
321	**Conservation**	SUNSET VALLEY	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	Yes	$876.00	343	2020	Colorado	No	0	0	1	0	0	0	0	0	1	0	0	0	2
322	**Rainwater Harvesting**	SUNSET VALLEY	Development of catchment areas to capture rainwater for potable or non-potable use.	Yes	$22,918	4	2030	Colorado	No	-1	-1	1	0	0	1	0	0	0	0	0	0	0
323	**Expand Local Use of Groundwater**	SUNSET VALLEY	Expand use of Edwards BFZ aquifer in Colorado Basin of Travis County	Yes	$120	50	2040	Colorado	No	1	-1	1	0	0	1	0	0	0	0	0	0	2
324	**New LCRA Contract**	SUNSET VALLEY	Contract with LCRA for water.	Yes	$145	300	2040	Colorado	No	1	1	1	0	0	0	0	0	0	0	-1	0	2
325	**Development of New Groundwater Supply**	SUNSET VALLEY	Develop a new supply of groundwater in the Trinity aquifer in the Colorado Basin of Travis County	Yes	$2,063	300	2040	Colorado	No	-1	1	1	0	0	0	1	0	0	0	0	0	2
326	**Drought Management**	SWEETWATER COMMUNITY	Mandatory water use reduction by 20%	No	$66	172	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
327	**Drought Management**	TRAVIS COUNTY MUD 10	Mandatory water use reduction by 25%	Yes	$66	23	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
328	**Conservation**	TRAVIS COUNTY MUD 10	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	Yes	$1,613	30	2020	Colorado	No	-1	0	1	0	0	0	0	0	1	0	0	0	1
329	**Development of New Groundwater Supply**	TRAVIS COUNTY MUD 10	Develop a new supply of groundwater in the Trinity aquifer in the Colorado Basin of Travis County	Yes	$3,830	100	2030	Colorado	No	-1	1	1	0	0	0	1	0	0	0	0	0	2
330	**Drought Management**	TRAVIS COUNTY MUD 14	Mandatory water use reduction by 5%	Yes	$66	14	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
331	**Water Purchase Amendment**	TRAVIS COUNTY MUD 14	Water purchase amendment with Aqua WSC	Yes	$1,222	35	2050	Colorado	No	-1	1	1	0	0	0	0	0	1	0	0	0	2
332	**Drought Management**	TRAVIS COUNTY MUD 2	Mandatory water use reduction by 20%	No	$66	56	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
333	**Drought Management**	TRAVIS COUNTY MUD 4	Mandatory water use reduction by 25%	No	$66	360	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
334	**Conservation**	TRAVIS COUNTY MUD 4	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	No	$569	1,198	2020	Colorado	No	0	0	1	0	0	0	0	0	1	0	0	0	2
335	**Drought Management**	TRAVIS COUNTY WCID 10	Mandatory water use reduction by 25%	Yes	$66	796	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
336	**Conservation**	TRAVIS COUNTY WCID 10	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	Yes	$772.00	2,275	2020	Colorado	No	0	0	1	0	0	0	0	0	1	0	0	0	2
337	**New LCRA Contract**	TRAVIS COUNTY WCID 10	Once contract with City of Austin ends, contract with LCRA for water.	Yes	$145	2,300	2040	Colorado	No	1	1	1	0	0	0	0	0	0	0	-1	0	2
338	**Drought Management**	TRAVIS COUNTY WCID 17	Mandatory water use reduction by 25%	Yes	$66	2,132	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
339	**Conservation**	TRAVIS COUNTY WCID 17	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	Yes	$1,390.00	4,451	2020	Colorado	No	-1	0	1	0	0	0	0	0	1	0	0	0	1
340	**Direct Reuse**	TRAVIS COUNTY WCID 17	Direct reuse of wastewater effluent.	Yes	$1,410	510	2030	Colorado	No	-1	0	1	0	1	0	0	0	1	0	0	0	2

Table 5A-2: Region K Potentially Feasible Water Management Strategy Screening (for 2021 Region K Plan)

Screening Matrix Factors (Positive (1), Neutral (0), Negative (-1))

	Water Management Strategy	Water User Group or Wholesale Provider	Strategy Description	Addressing a Need?	Cost of Water ($/ac-ft)	Max Yield (ac-ft/yr)	Starting Decade	Basin	Interbasin Transfer (Yes/No)	Cost	Yield	Location	Water Quality	Environmental and Natural Resources	Local Preference	Institutional Constraints	Socioeconomic Impacts	Impacts on Water Resources	Impacts on Agricultural Resources	Impacts to Recreation	Impacts on Other Management Strategies	Total of Screening Factors
341	**Drought Management**	TRAVIS COUNTY WCID 18	Mandatory water use reduction by 30%	Yes	$66	458	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
342	**Conservation**	TRAVIS COUNTY WCID 18	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	Yes	$2,173.00	75	2020	Colorado	No	-1	0	1	0	0	0	0	0	1	0	0	0	1
343	**Drought Management**	TRAVIS COUNTY WCID 19	Mandatory water use reduction by 20%	No	$66	82	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
344	**Conservation**	TRAVIS COUNTY WCID 19	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	No	$541.00	203	2020	Colorado	No	0	0	1	0	0	0	0	0	1	0	0	0	2
345	**Drought Management**	TRAVIS COUNTY WCID 20	Mandatory water use reduction by 20%	No	$66	106	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
346	**Conservation**	TRAVIS COUNTY WCID 20	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	No	$693.00	263	2020	Colorado	No	0	0	1	0	0	0	0	0	1	0	0	0	2
347	**Drought Management**	TRAVIS COUNTY WCID POINT VENTURE	Mandatory water use reduction by 20%	Yes	$66	82	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
348	**Conservation**	TRAVIS COUNTY WCID POINT VENTURE	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	Yes	$1,442.00	216	2020	Colorado	No	-1	0	1	0	0	0	0	0	1	0	0	0	1
349	**LCRA Contract Amendment**	TRAVIS COUNTY WCID POINT VENTURE	Amend existing contract with LCRA for additional supply	Yes	$145	50	2070	Colorado	No	1	1	1	0	0	0	0	0	0	0	-1	0	2
350	**Drought Management**	WEIMAR	Mandatory water use reduction by 20%	No	$66	90	2020	All	No	1	0	1	0	0	0	1	0	1	0	0	0	4
351	**Conservation**	WEIMAR	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	No	$1,582.00	161	2020	All	No	-1	0	1	0	0	0	0	0	1	0	0	0	1
352	**Drought Management**	WELLS BRANCH MUD	Mandatory water use reduction by 5%	Yes	$66	74	2020	All	No	1	0	1	0	0	0	1	0	1	0	0	0	4
353	**New LCRA Contract**	WELLS BRANCH MUD	Once contract with City of Austin ends, contract with LCRA for water.	Yes	$145	1,300	2040	Colorado	No	1	1	1	0	0	0	0	0	0	0	-1	0	2
354	**New LCRA Contract**	WELLS BRANCH MUD	Once contract with City of Austin ends, contract with LCRA for water.	Yes	$145	100	2040	Brazos	No	1	1	1	0	0	0	0	0	0	0	-1	0	2
355	**Drought Management**	WEST END WSC	Mandatory water use reduction by 5%	No	$66	10	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
356	**Drought Management**	WEST TRAVIS COUNTY PUA	Mandatory water use reduction by 20%	Yes	$66	2,227	2020	All	No	1	0	1	0	0	0	1	0	1	0	0	0	4
357	**Conservation**	WEST TRAVIS COUNTY PUA	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	Yes	$1,003.00	9,370	2020	Colorado	No	-1	0	1	0	0	0	0	0	1	0	0	0	1
358	**Direct Reuse**	WEST TRAVIS COUNTY PUA	Direct reuse of wastewater effluent.	Yes	$121	224	2030	Colorado	No	1	0	1	0	1	1	0	0	1	0	0	0	5
359	**Direct Potable Reuse**	WEST TRAVIS COUNTY PUA	Directly treat reclaimed water for potable use within the municipality.	Yes	$2,893	336	2030	Colorado	No	-1	0	1	1	0	1	-1	0	1	0	0	0	2
360	**Groundwater Importation (Hays County Pipeline)**	WEST TRAVIS COUNTY PUA	Importation of groundwater from the Carrizo-Wilcox aquifer in Gonzales County (Region L) through a pipeline. Region L pipeline runs from delivery point near Kyle to the Wimberley area in Hays County. Region K pipeline will run from a to-be-determined connection point along the pipeline to the Dripping Springs area. Alternative version would use Forestar water (Region G Lee County Carrizo-Wilcox) as the source.	Yes	$774	3,000	2030	Colorado	No	0	0	-1	0	0	-1	0	0	0	0	0	0	-2
361	**LCRA Contract Amendment with Infrastructure**	WEST TRAVIS COUNTY PUA	Amend existing contract with LCRA for additional supply for Hays and Travis counties	Yes	$782	5,500	2030	Colorado	No	1	1	1	0	0	0	0	0	0	0	-1	0	2
362	**Drought Management**	WHARTON	Mandatory water use reduction by 20%	Yes	$66	366	2020	All	No	1	0	1	0	0	0	1	0	1	0	0	0	4
363	**Conservation**	WHARTON	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	Yes	$2,087.00	151	2020	All	No	-1	0	1	0	0	0	0	0	1	0	0	0	1
364	**Wharton Water Supply**	WHARTON	Expand use of Gulf Coast aquifer in Brazos-Colorado Basin of Wharton County	No	$272	3,000	2030	Brazos-Colorado	No	1	-1	1	0	0	1	0	0	0	0	0	0	2
365	**Drought Management**	WHARTON COUNTY WCID 2	Mandatory water use reduction by 20%	No	$66	87	2020	Brazos-Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
366	**Conservation**	WHARTON COUNTY WCID 2	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	No	$1,794.00	101	2020	Brazos-Colorado	No	-1	0	1	0	0	0	0	0	1	0	0	0	1
367	**Drought Management**	WILLIAMSON COUNTY WSID 3	Mandatory water use reduction by 20%	No	$66	20	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
368	**Drought Management**	WILLIAMSON TRAVIS COUNTIES MUD 1	Mandatory water use reduction by 20%	No	$66	22	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4
369	**New Water Purchase**	WINDERMERE	Water purchase from Blue Water	Yes	$1,167	2,016	2030	Colorado	No	-1	1	1	0	0	1	0	0	1	0	0	0	3
370	**Drought Management**	WINDERMERE UTILITY	Mandatory water use reduction by 20%	Yes	$66	560	2020	Colorado	No	1	0	1	0	0	0	1	0	1	0	0	0	4

Table 5A-2: Region K Potentially Feasible Water Management Strategy Screening (for 2021 Region K Plan)

										Screening Matrix Factors (Positive (1), Neutral (0), Negative (-1))												
	Water Management Strategy	Water User Group or Wholesale Provider	Strategy Description	Addressing a Need?	Cost of Water ($/ac-ft)	Max Yield (ac-ft/yr)	Starting Decade	Basin	Interbasin Transfer (Yes/No)	Cost	Yield	Location	Water Quality	Environmental and Natural Resources	Local Preference	Institutional Constraints	Socioeconomic Impacts	Impacts on Water Resources	Impacts on Agricultural Resources	Impacts to Recreation	Impacts on Other Management Strategies	Total of Screening Factors
371	**Conservation**	WINDERMERE UTILITY	Conservation efforts of 10% per decade GPCD reduction for >140 GPCD	Yes	$2,218.00	118	2020	Colorado	No	-1	0	1	0	0	0	0	0	1	0	0	0	1

Examples of Consideration for Each Screening Matrix Factor (not entirely inclusive)
Cost - Comparison of cost per acre-foot (0-500, 500-1,000, 1,000+)
Yield - Is the yield appropriate to the demand (not overkill or otherwise)?
Location - Proximity to demand center (in basin and in region)
Water Quality - Any concerns about the quality of the water provided?
Environmental and Natural Resources Impact - Impact on habitat, land use, in-stream and B&E flow, etc.
Local Preference - Do we have an active sponsor, is there opposition?
Institutional constraints - Are there legal, regulatory, technology limits?
Impacts on water resources - Effect on other water supplies (groundwater or surface water)?
Impacts on agricultural resources - Effect on commercial agricultural activities?
Impacts on recreation - Are recreational activities impacted?
Impacts on mgt strategies - Does this affect another strategy (may be positive)?

APPENDIX 5B

RECOMMENDED AND ALTERNATIVE WATER MANAGEMENT STRATEGY TABLES

Recommended Water Management Strategy Summary Table

Region	ID	Recommended Water Management Strategy	Total Capital Costs ($)	Estimated Annual Average Unit Cost ($/ac-ft/yr)	Water Supply Volume (ac-ft/yr) 2020	2030	2040	2050	2060	2070
K	K1	Austin Return Flows	$0	$11	0	223	345	475	542	600
K	K2	Downstream Return Flows	$0	$11	560	560	560	560	560	560
K	K3	LCRA Enhanced Municipal and Industrial Conservation	$74,415,000	$262	5,100	9,700	15,000	20,000	20,000	20,000
K	K4	Austin Conservation	$719,616,000	$1,343	4,910	14,890	24,870	30,120	35,370	40,620
K	K5	Municipal Conservation	$205,751,210	$324 - $5,140	7,994	14,456	21,090	28,080	34,695	40,037
K	K6	Mining Conservation	$0	$16 - $33	1,302	1,543	1,608	1,533	1,300	1,800
K	K7	Irrigation Conservation	$203,685,998	$103 - $643	50,585	65,760	81,862	95,698	107,271	118,856
K	K8	LCRA Amendments to Water Management Plan - Interruptible Water	$0	$60	63,495	25,797	13,105	0	0	0
K	K9	Amendments to Water Rights and Acquisition of New Water Rights	$125,000	$500	0	250	250	250	250	250
K	K10	LCRA Contract Amendments	$0	$145	12,600	5,700	6,100	9,800	13,150	13,320
K	K11	LCRA Contract Amendments with Infrastructure	$35,402,000	$782	0	7,400	8,400	10,600	10,600	11,500
K	K12	New LCRA Contracts	$0	$145	0	0	6,320	6,520	6,720	6,720
K	K13	New LCRA Contracts with Infrastructure	$178,936,000	$914 - $1,961	0	3,200	7,900	12,400	20,400	31,600
K	K14	LCRA Expand Use of Groundwater in Bastrop County (Carrizo-Wilcox Aquifer)	$331,000	$833	0	30	30	30	30	30
K	K15	LCRA Import Return Flows from Williamson County	$75,734,000	$243	0	5,460	10,920	16,380	21,840	25,000
K	K16	LCRA Baylor Creek Reservoir	$219,883,000	$907	0	0	18,000	18,000	18,000	18,000
K	K17	LCRA Aquifer Storage and Recovery (ASR) Carrizo-Wilcox	$146,592,000	$1,300	0	0	12,973	12,973	12,973	12,973
K	K18	LCRA Enhanced Recharge (MAR)	$71,125,000	$375	0	0	14,486	14,486	14,486	14,486
K	K19	LCRA Mid-Basin Reservoir	$344,259,000	$1,313	0	20,000	20,000	20,000	20,000	20,000
K	K20	LCRA Excess Flows Reservoir	$540,110,000	$1,241	0	39,247	39,247	39,247	39,247	39,247
K	K21	LCRA Prairie Site Conservation Reservoir	$16,690,000	$50	0	19,000	9,500	0	0	0
K	K22	Austin Blackwater and Greywater Reuse	$47,031,000	$2,534	0	1,450	3,450	5,400	7,340	9,290
K	K23	Austin Aquifer Storage and Recovery	$370,527,000	$2,234	0	0	7,900	10,500	13,200	15,800

Recommended Water Management Strategy Summary Table

Region	ID	Recommended Water Management Strategy	Total Capital Costs ($)	Estimated Annual Average Unit Cost ($/ac-ft/yr)	Water Supply Volume (ac-ft/yr)					
					2020	2030	2040	2050	2060	2070
K	K24	Austin Off-Channel Reservoir and Evaporation Suppression	$334,642,000	$1,018	0	0	0	0	0	25,827
K	K25	Austin Onsite Rainwater and Stormwater Harvesting	$11,768,000	$1,165	0	690	1,640	2,520	3,390	4,270
K	K26	Austin Community Scale Stormwater Harvesting	$288,000	$645	0	55	132	154	175	197
K	K27	Austin Brackish Groundwater Desalination	$167,689,000	$2,995	0	0	0	0	0	5,000
K	K28	Austin Centralized Direct Non-Potable Reuse	$286,031,000	$995	500	2,990	10,250	14,583	18,917	23,250
K	K29	Austin Decentralized Direct Non-Potable Reuse	$7,703,000	$366	0	1,400	4,160	8,330	12,510	16,680
K	K30	Austin Capture Local Inflows to Lady Bird Lake	$0	$331	0	0	3,000	3,000	3,000	3,000
K	K31	Austin Indirect Potable Reuse through Lady Bird Lake	$35,839,000	$457	0	0	11,000	14,000	17,000	20,000
K	K32	Austin Longhorn Dam Operations Improvements	$1,388,000	$36	0	3,000	3,000	3,000	3,000	3,000
K	K33	Austin Lake Austin Operations	$0	$436	1,250	1,250	1,250	1,250	1,250	1,250
K	K34	Expansion of Current Groundwater Supplies - Carrizo-Wilcox Aquifer	$9,163,000	$80 - $1,001	0	300	350	550	850	850
K	K35	Expansion of Current Groundwater Supplies - Edwards (BFZ) Aquifer	$0	$50 - $120	0	0	70	70	70	70
K	K36	Expansion of Current Groundwater Supplies - Ellenburger-San Saba Aquifer	$27,926,000	$70 - $1,235	0	1,850	3,100	3,100	3,100	3,100
K	K37	Expansion of Current Groundwater Supplies - Gulf Coast Aquifer	$36,832,000	$49 - $1,218	13,951	17,159	17,178	17,199	17,199	17,199
K	K38	Expansion of Current Groundwater Supplies - Sparta Aquifer	$2,638,000	$1,127	0	40	98	145	180	204

Recommended Water Management Strategy Summary Table

Region	ID	Recommended Water Management Strategy	Total Capital Costs ($)	Estimated Annual Average Unit Cost ($/ac-ft/yr)	Water Supply Volume (ac-ft/yr)					
					2020	2030	2040	2050	2060	2070
K	K39	Expansion of Current Groundwater Supplies - Trinity Aquifer	$14,948,000	$85 - $1,180	900	900	1,200	1,207	1,226	2,150
K	K40	Expansion of Current Groundwater Supplies - Yegua-Jackson Aquifer	$5,463,000	$567	760	760	0	0	0	0
K	K41	Development of New Groundwater Supplies - Ellenburger-San Saba Aquifer	$4,495,000	$534	0	0	0	300	400	700
K	K42	Development of New Groundwater Supplies - Gulf Coast Aquifer	$1,195,000	$180	510	510	510	510	510	510
K	K43	Development of New Groundwater Supplies - Hickory Aquifer	$4,863,000	$432	0	1,000	1,000	1,000	1,000	1,000
K	K44	Development of New Groundwater Supplies - Marble Falls Aquifer	$3,345,000	$307	0	0	1,000	1,000	1,000	1,000
K	K45	Development of New Groundwater Supplies - Sparta Aquifer	$6,056,000	$1,693	400	400	400	400	400	400
K	K46	Development of New Groundwater Supplies - Trinity Aquifer	$27,613,000	$953 - $3,830	0	200	500	500	1,500	2,325
K	K47	Development of New Groundwater Supplies - Yegua-Jackson Aquifer	$16,846,000	$1,887 - $3,960	0	800	800	800	800	800
K	K48	Hays County Pipeline	$29,942,000	$2,119	0	4,000	4,000	4,000	4,000	4,000
K	K49	Alliance Regional Water Authority Pipeline	$21,965,000	$1,106	0	762	1,829	1,829	2,007	2,007
K	K50	BS/EACD Edwards/Middle Trinity ASR	$24,972,000	$1,398 - $3,842	150	1,324	1,324	1,324	1,324	1,324
K	K51	BS/EACD Saline Edwards Desalination and ASR	$16,664,000	$1,951	0	0	1,300	1,300	1,300	1,300
K	K52	Buena Vista Regional Project	$28,886,000	$1,136	0	2,065	4,884	4,884	4,884	4,884
K	K53	East Lake Buchanan Regional Project	$11,925,000	$1,957	0	498	935	935	935	935
K	K54	Marble Falls Regional Project	$56,608,000	$1,436	0	5,578	5,578	5,578	5,578	5,578
K	K55	Rainwater Harvesting	$29,310,000	$22,918 - $24,966	0	55	74	95	118	142
K	K56	Water Purchase	$213,000	$1,167 - $45,619	267	790	1,525	1,560	1,830	2,100
K	K57	Brush Management	$29,707,000	$1,190	0	1,999	1,999	1,999	1,999	1,999

Recommended Water Management Strategy Summary Table

Region	ID	Recommended Water Management Strategy	Total Capital Costs ($)	Estimated Annual Average Unit Cost ($/ac-ft/yr)	Water Supply Volume (ac-ft/yr)					
					2020	2030	2040	2050	2060	2070
K	K58	Drought Management - Municipalities	$0	$66	32,804	36,630	40,260	44,006	48,336	53,100
K	K59	Drought Management - Irrigation	$0	$168 - $777	34,153	33,234	32,340	31,470	30,624	29,800
K	K60	Direct Potable Reuse	$63,825,000	$1,964 - $3,764	0	3,416	3,416	3,416	3,416	3,416
K	K61	Direct Reuse (Non-Potable)	$27,392,000	$0 - $5,977	175	3,525	3,807	4,540	5,382	5,666
K	K62	Blend Brackish Surface Water in STPNOC Reservoir	$0	$0	3,000	3,000	3,000	3,000	3,000	3,000
K	K63	Alternate Canal Delivery	$6,158,000	$183	0	12,727	12,727	12,727	12,727	12,727

Alternative Water Management Strategy Summary Table

October 2020

Region	ID	Alternative Water Management Strategy	Total Project Costs ($)	Estimated Annual Average Unit Cost ($/ac-ft/yr)	Water Supply Volume (ac-ft/yr)					
					2020	2030	2040	2050	2060	2070
K	KA1	LCRA Ezpand Use of Groundwater in Bastrop County (Carrizo-Wilcox Aquifer)	$38,139,000	$190	0	25,000	25,000	25,000	25,000	25,000
K	KA2	LCRA Brackish Groundwater Desalination from the Gulf Coast Aquifer	$229,006,000	$1,393	0	0	22,400	22,400	22,400	22,400
K	KA3	LCRA Supplement Bay and Estuary Inflows with Brackish Groundwater	$47,269,000	$532	0	12,000	12,000	12,000	12,000	12,000
K	KA4	Expanded Local Use of Groundwater - Carrizo-Wilcox Aquifer (Aqua WSC)	$37,682,000	$221	0	5,500	5,500	5,500	13,385	19,121

APPENDIX 5C

MUNICIPAL CONSERVATION TARGET GPCD GOALS

			Region K Gallons per Capita per Day (GPCD) Projections						Conservation Gallons per Capita per Day (GPCD) Projections						Conservation Demand Reduction (AFY)					
WUG Name	County	Basin	2020	2030	2040	2050	2060	2070	2020	2030	2040	2050	2060	2070	2020	2030	2040	2050	2060	2070
AQUA WSC	BASTROP	Brazos	147	143	141	140	140	140	140	140	140	140	140	140	4	2	1	0	-	-
AQUA WSC	BASTROP	Colorado	147	143	141	140	140	140	140	140	140	140	140	140	408	244	116	33	-	-
AQUA WSC	BASTROP	Guadalupe	147	143	141	140	140	140	140	140	140	140	140	140	3	2	1	0	-	-
BASTROP	BASTROP	Colorado	165	161	159	158	158	158	150	140	140	140	140	140	184	355	433	558	744	992
BASTROP COUNTY WCID 2	BASTROP	Colorado	85	83	82	81	81	81	85	83	82	81	77	77	-	-	-	-	93	125
COUNTY-OTHER, BASTROP	BASTROP	Brazos	162	160	159	158	158	158	148	140	140	140	140	140	1	1	1	2	2	2
COUNTY-OTHER, BASTROP	BASTROP	Colorado	162	160	159	158	158	158	148	140	140	140	140	140	124	198	219	255	307	381
COUNTY-OTHER, BASTROP	BASTROP	Guadalupe	162	160	159	158	158	158	148	140	140	140	140	140	3	5	5	6	8	9
ELGIN	BASTROP	Colorado	125	122	120	119	119	119	119	113	107	102	102	102	66	119	224	405	531	700
SMITHVILLE	BASTROP	Colorado	153	148	146	145	145	145	140	140	140	140	140	140	69	59	54	59	75	97
BLANCO	BLANCO	Guadalupe	131	127	125	124	124	124	131	118	118	118	118	118	-	27	23	21	21	21
JOHNSON CITY	BLANCO	Colorado	154	150	148	147	147	147	140	140	140	140	140	140	31	28	25	23	23	23
BERTRAM	BURNET	Brazos	218	214	212	211	211	211	198	178	160	144	140	140	39	85	142	205	238	257
BURNET	BURNET	Brazos	200	196	195	194	193	193	182	164	147	140	140	140	1	1	2	3	3	3
BURNET	BURNET	Colorado	200	196	195	194	193	193	182	164	147	140	140	140	149	329	543	691	754	810
COTTONWOOD SHORES	BURNET	Colorado	157	154	152	151	151	151	143	140	140	140	140	140	22	26	27	28	29	32
COUNTY-OTHER, BURNET	BURNET	Brazos	137	134	132	131	131	131	130	125	125	125	125	125	63	91	71	68	70	74
COUNTY-OTHER, BURNET	BURNET	Colorado	137	134	132	131	131	131	130	125	125	125	125	125	112	162	127	122	125	131
GEORGETOWN	BURNET	Brazos	198	194	193	193	193	192	180	162	146	140	140	140	8	17	28	35	39	41
HORSESHOE BAY	BURNET	Colorado	410	407	405	404	404	404	374	336	303	272	245	221	49	134	241	368	505	645
KEMPNER WSC	BURNET	Brazos	155	153	151	150	150	149	141	140	140	140	140	140	12	12	11	11	12	12
MARBLE FALLS	BURNET	Colorado	239	235	233	233	233	233	218	196	176	159	143	140	212	567	1,193	1,801	2,387	2,566
MEADOWLAKES	BURNET	Colorado	299	296	295	294	293	293	273	245	221	199	179	161	77	145	210	271	326	377
COLUMBUS	COLORADO	Colorado	264	260	257	255	255	255	240	216	195	175	158	142	102	195	286	384	484	581
WEIMAR	COLORADO	Colorado	205	201	197	196	196	195	186	168	151	140	140	140	15	27	40	50	51	53
WEIMAR	COLORADO	Lavaca	205	201	197	196	196	195	186	168	151	140	140	140	30	56	82	102	105	108
FAYETTE COUNTY WCID MONUMENT HILL	FAYETTE	Colorado	216	213	210	209	209	209	197	177	159	143	140	140	17	33	50	68	75	78
FLATONIA	FAYETTE	Guadalupe	186	182	179	178	178	177	170	153	140	140	140	140	6	12	17	17	18	19
FLATONIA	FAYETTE	Lavaca	186	182	179	178	178	177	170	153	140	140	140	140	25	51	73	75	78	80
LA GRANGE	FAYETTE	Colorado	156	152	149	148	148	148	142	140	140	140	140	140	86	82	69	63	64	66
SCHULENBURG	FAYETTE	Lavaca	199	195	192	191	191	190	181	163	147	140	140	140	63	128	199	235	246	254
FREDERICKSBURG	GILLESPIE	Colorado	248	244	242	240	240	240	226	203	183	165	148	140	302	598	903	1,234	1,578	1,802
AUSTIN	HAYS	Colorado	156	154	154	154	154	154	140	126	126	126	126	126	19	150	237	375	550	792
BUDA	HAYS	Colorado	161	158	158	157	157	157	146	140	140	140	140	140	159	292	382	499	636	793
DRIPPING SPRINGS WSC	HAYS	Colorado	157	154	153	152	152	152	143	140	140	140	140	140	174	289	339	417	522	576
HAYS COUNTY WCID 1	HAYS	Colorado	201	198	196	195	195	195	183	165	148	140	140	140	74	136	196	226	225	225
HAYS COUNTY WCID 2	HAYS	Colorado	208	205	203	202	202	202	189	170	153	140	140	140	26	62	114	169	211	259
WEST TRAVIS COUNTY PUBLIC UTILITY AGENCY	HAYS	Colorado	314	312	311	311	311	311	286	257	232	208	188	169	405	984	1,610	2,546	3,631	4,840
HORSESHOE BAY	LLANO	Colorado	410	407	405	404	404	404	374	336	303	272	245	221	204	406	574	746	887	1,000
LLANO	LLANO	Colorado	216	212	209	207	207	207	196	177	159	143	140	140	78	147	208	263	285	295
MATAGORDA WASTE DISPOSAL & WSC	MATAGORDA	Brazos-Colorado	164	159	156	154	154	154	149	140	140	140	140	140	5	6	5	5	5	5
MATAGORDA WASTE DISPOSAL & WSC	MATAGORDA	Colorado	164	159	156	154	154	154	149	140	140	140	140	140	7	10	8	7	8	8
GOLDTHWAITE	MILLS	Brazos	172	168	165	163	163	163	157	141	140	140	140	140	1	2	2	2	2	2
GOLDTHWAITE	MILLS	Colorado	172	168	165	163	163	163	157	141	140	140	140	140	35	63	59	57	59	61
NORTH SAN SABA WSC	SAN SABA	Colorado	255	251	249	249	249	248	232	209	188	169	152	140	17	32	46	60	74	85
RICHLAND SUD	SAN SABA	Colorado	209	206	203	202	201	202	190	171	154	140	140	140	20	39	55	69	70	72
SAN SABA	SAN SABA	Colorado	310	306	304	302	302	302	282	254	228	206	185	167	106	208	300	378	469	556
AQUA WSC	TRAVIS	Colorado	147	143	141	140	140	140	140	140	140	140	140	140	49	26	10	3	-	-
AUSTIN	TRAVIS	Colorado	156	154	154	154	154	154	142	140	140	140	140	140	15,362	18,091	20,977	22,961	24,541	26,684
BARTON CREEK WEST WSC	TRAVIS	Colorado	291	289	287	286	285	285	265	238	215	193	174	156	39	76	109	139	167	193
BARTON CREEK WSC	TRAVIS	Colorado	666	664	662	662	661	661	606	546	491	442	398	358	47	110	183	258	330	409
CEDAR PARK	TRAVIS	Colorado	184	183	182	182	182	182	168	151	140	140	140	140	203	420	590	586	583	582
COUNTY-OTHER, TRAVIS (AQUA TEXAS - RIVERCREST)	TRAVIS	Colorado	366	363	361	360	360	360	333	299	270	243	218	196	29	55	79	102	123	142
CREEDMOOR-MAHA WSC	TRAVIS	Colorado	99	95	92	90	90	90	94	89	85	81	81	81	30	37	55	86	93	100
CREEDMOOR-MAHA WSC	TRAVIS	Guadalupe	99	95	92	90	90	90	94	89	85	81	81	81	2	2	4	6	6	6
CYPRESS RANCH WCID 1	TRAVIS	Colorado	88	84	83	82	82	81	83	79	75	71	71	71	6	9	14	20	21	20
ELGIN	TRAVIS	Colorado	125	122	120	119	119	119	119	113	107	102	102	102	13	25	47	81	94	107
HURST CREEK MUD	TRAVIS	Colorado	496	493	491	490	490	490	451	406	365	329	296	266	155	302	437	560	673	776
JONESTOWN WSC	TRAVIS	Colorado	153	150	148	147	147	147	140	140	140	140	140	140	56	47	41	39	40	41
KELLY LANE WCID 1	TRAVIS	Colorado	170	167	165	165	164	164	155	140	140	140	140	140	29	52	48	47	46	46

			Region K Gallons per Capita per Day (GPCD) Projections						Conservation Gallons per Capita per Day (GPCD) Projections						Conservation Demand Reduction (AFY)					
WUG Name	**County**	**Basin**	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
LAGO VISTA	TRAVIS	Colorado	220	218	216	216	215	215	200	180	162	146	140	140	168	375	622	914	1,098	1,198
LAKEWAY MUD	TRAVIS	Colorado	226	223	221	220	220	220	205	185	166	150	140	140	248	492	748	1,015	1,169	1,168
LOOP 360 WSC	TRAVIS	Colorado	524	522	520	519	519	519	477	429	386	348	313	282	110	225	339	450	559	679
OAK SHORES WATER SYSTEM	TRAVIS	Colorado	245	242	240	239	239	239	223	201	181	163	146	140	14	29	42	54	65	70
PFLUGERVILLE	TRAVIS	Colorado	148	146	146	145	145	145	140	140	140	140	140	140	563	549	606	674	754	743
ROLLINGWOOD	TRAVIS	Colorado	241	237	233	231	231	231	219	197	177	160	144	140	34	64	90	116	142	148
ROUGH HOLLOW IN TRAVIS COUNTY	TRAVIS	Colorado	190	190	190	190	190	190	173	156	140	140	140	140	53	220	319	319	319	319
ROUND ROCK	TRAVIS	Colorado	143	140	139	139	139	138	140	140	139	139	139	138	6	1	-	-	-	-
SENNA HILLS MUD	TRAVIS	Colorado	308	305	303	302	302	302	280	252	227	204	184	165	38	85	142	200	258	321
SHADY HOLLOW MUD	TRAVIS	Colorado	162	158	155	153	153	153	148	140	140	140	140	140	71	90	74	65	64	64
SUNSET VALLEY	TRAVIS	Colorado	353	350	349	348	349	348	321	289	260	234	211	190	33	73	123	183	256	343
TRAVIS COUNTY MUD 10	TRAVIS	Colorado	190	189	186	186	185	185	173	155	140	140	140	140	7	15	25	27	28	30
TRAVIS COUNTY MUD 4	TRAVIS	Colorado	547	546	546	545	545	545	498	448	404	363	327	294	135	309	507	731	962	1,198
TRAVIS COUNTY WCID 10	TRAVIS	Colorado	410	406	403	402	402	402	373	335	302	272	244	220	315	660	1,031	1,440	1,858	2,275
TRAVIS COUNTY WCID 17	TRAVIS	Colorado	228	226	225	225	224	224	207	187	168	151	140	140	843	1,748	2,794	3,658	4,317	4,451
TRAVIS COUNTY WCID 18	TRAVIS	Colorado	151	147	145	144	144	144	140	140	140	140	140	140	75	58	47	43	43	46
TRAVIS COUNTY WCID 19	TRAVIS	Colorado	588	585	583	581	581	581	535	481	433	390	351	316	40	79	114	146	176	203
TRAVIS COUNTY WCID 20	TRAVIS	Colorado	461	459	457	456	456	456	420	378	340	306	275	248	53	103	149	190	228	263
TRAVIS COUNTY WCID POINT VENTURE	TRAVIS	Colorado	220	217	215	214	214	214	200	180	162	146	140	140	23	55	94	146	189	216
WEST TRAVIS COUNTY PUBLIC UTILITY AGENCY	TRAVIS	Colorado	314	312	311	311	311	311	286	257	232	208	188	169	603	1,295	2,034	2,914	3,729	4,530
WINDERMERE UTILITY	TRAVIS	Colorado	146	143	141	141	140	140	140	140	140	140	140	140	118	62	29	13	8	7
WHARTON	WHARTON	Brazos-Colorado	159	155	151	150	150	150	145	140	140	140	140	140	83	91	73	67	68	69
WHARTON	WHARTON	Colorado	159	155	151	150	150	150	145	140	140	140	140	140	68	74	60	55	55	57
WHARTON COUNTY WCID 2	WHARTON	Brazos-Colorado	182	178	175	173	173	173	166	149	140	140	140	140	41	76	97	96	99	101

APPENDIX 5D

WATER MANAGEMENT STRATEGY COST SUMMARY TABLES

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Mining, Bastrop County, Guadalupe Basin - Mining Conservation

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	*Estimated Costs for Facilities*
ANNUAL COST	
Operation and Maintenance	
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (60724 kW-hr @ 0.08 $/kW-hr)	$5,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$5,000**
Available Project Yield (acft/yr)	308
Annual Cost of Water ($ per acft), based on PF=1	$16
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$16
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$0.05
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$0.05

JB *10/1/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Mining, Burnet County, Colorado Basin - Mining Conservation

Cost based on ENR CCI 11170.28 for September 2018 and
a PPI of 202.4 for September 2018

Item	*Estimated Costs for Facilities*
ANNUAL COST	
Operation and Maintenance	
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (753227 kW-hr @ 0.08 $/kW-hr)	$60,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$60,000**
Available Project Yield (acft/yr)	1,800
Annual Cost of Water ($ per acft), based on PF=1	$33
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$33
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$0.10
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$0.10

JB *10/1/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Multiple - Irrigation Conservation - On-Farm Conservation

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	*Estimated Costs for Facilities*
TOTAL COST OF FACILITIES	**$46,249,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$16,187,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$1,717,000
TOTAL COST OF PROJECT	**$64,153,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$4,514,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$462,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (0 kW-hr @ 0.08 $/kW-hr)	$0
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$4,976,000**
Available Project Yield (acft/yr)	44,106
Annual Cost of Water ($ per acft), based on PF=1	$113
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$10
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$0.35
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$0.03

Alicia Smiley/Jaime Burke *9/27/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Multiple - Irrigation Conservation - Irrigation Operations Conveyance Improvements

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	*Estimated Costs for Facilities*
Integration, Relocations, & Other	$72,798,000
TOTAL COST OF FACILITIES	**$72,798,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$25,479,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$2,703,000
TOTAL COST OF PROJECT	**$100,980,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$7,105,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (2% of Cost of Facilities)	$1,456,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (0 kW-hr @ 0.08 $/kW-hr)	$0
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$8,561,000**
Available Project Yield (acft/yr)	44,350
Annual Cost of Water ($ per acft), based on PF=1	$193
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$33
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$0.59
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$0.10

Note: One or more cost element has been calculated externally

Alicia Smiley/Jaime Burke *10/30/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Multiple - Irrigation Conservation - Sprinkler Irrigation

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	***Estimated Costs for Facilities***
Integration, Relocations, & Other	$8,527,000
TOTAL COST OF FACILITIES	**$8,527,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$2,985,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$317,000
TOTAL COST OF PROJECT	**$11,829,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$832,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (15% of Cost of Facilities)	$1,279,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (0 kW-hr @ 0.08 $/kW-hr)	$0
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$2,111,000**
Available Project Yield (acft/yr)	11,393
Annual Cost of Water ($ per acft), based on PF=1	$185
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$112
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$0.57
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$0.34

Alicia Smiley/Jaime Burke *10/30/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Multiple - Irrigation Conservation - Real-Time Use Metering & Monitoring

Cost based on ENR CCI 11170.28 for September 2018 and
a PPI of 202.4 for September 2018

Item	***Estimated Costs for Facilities***
Integration, Relocations, & Other	$18,000,000
TOTAL COST OF FACILITIES	**$18,000,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$6,300,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$669,000
TOTAL COST OF PROJECT	**$24,969,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$1,757,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (2% of Cost of Facilities)	$360,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (0 kW-hr @ 0.08 $/kW-hr)	$0
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$2,117,000**
Available Project Yield (acft/yr)	20,508
Annual Cost of Water ($ per acft), based on PF=1	$103
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$18
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$0.32
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$0.05

Alicia Smiley/Jaime Burke *10/22/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Irrigation, Mills - Irrigation Conservation - Drip Irrigation

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	Estimated Costs for Facilities
TOTAL COST OF FACILITIES	**$618,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$216,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$23,000
TOTAL COST OF PROJECT	**$857,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$60,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (30% of Cost of Facilities)	$185,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (0 kW-hr @ 0.08 $/kW-hr)	$0
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$245,000**
Available Project Yield (acft/yr)	459
Annual Cost of Water ($ per acft), based on PF=1	$534
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$403
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$1.64
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$1.24

Alicia Smiley/Jaime Burke *9/23/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Irrigation, Gillespie - Irrigation Conservation - Drip Irrigation

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	***Estimated Costs for Facilities***
TOTAL COST OF FACILITIES	**$46,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$16,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$2,000
TOTAL COST OF PROJECT	**$64,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$4,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (30% of Cost of Facilities)	$14,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (0 kW-hr @ 0.08 $/kW-hr)	$0
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$18,000**
Available Project Yield (acft/yr)	28
Annual Cost of Water ($ per acft), based on PF=1	$643
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$500
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$1.97
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$1.53

Alicia Smiley/Jaime Burke *1/21/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Irrigation, San Saba - Irrigation Conservation - Drip Irrigation

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	Estimated Costs for Facilities
TOTAL COST OF FACILITIES	**$601,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$210,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$23,000
TOTAL COST OF PROJECT	**$834,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$59,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (30% of Cost of Facilities)	$180,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (0 kW-hr @ 0.08 $/kW-hr)	$0
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$239,000**
Available Project Yield (acft/yr)	626
Annual Cost of Water ($ per acft), based on PF=1	$382
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$288
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$1.17
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$0.88

Alicia Smiley/Jaime Burke *1/21/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
LCRA - LCRA Enhanced Municipal and Industrial Conservation

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	*Estimated Costs for Facilities*
Integration, Relocations, & Other	$53,647,000
TOTAL COST OF FACILITIES	**$53,647,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$18,776,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$1,992,000
TOTAL COST OF PROJECT	**$74,415,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$5,236,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (0% of Cost of Facilities)	$0
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (0 kW-hr @ 0.08 $/kW-hr)	$0
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$5,236,000**
Available Project Yield (acft/yr)	20,000
Annual Cost of Water ($ per acft), based on PF=1	$262
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$0
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$0.80
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$0.00
Note: One or more cost element has been calculated externally	
KB	*9/24/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
West Travis County PUA - LCRA Contract Amendment with Infrastructure

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	*Estimated Costs for Facilities*
Primary Pump Station (0 MGD)	$16,670,000
Transmission Pipeline (0 in dia., miles)	$2,079,000
Transmission Pump Station(s) & Storage Tank(s)	$6,750,000
TOTAL COST OF FACILITIES	**$25,499,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$8,821,000
Environmental & Archaeology Studies and Mitigation	$82,000
Land Acquisition and Surveying (7 acres)	$52,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$948,000
TOTAL COST OF PROJECT	**$35,402,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$2,491,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$35,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$549,000
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (5340016 kW-hr @ 0.08 $/kW-hr)	$427,000
Purchase of Water (5500 acft/yr @ 145 $/acft)	$798,000
TOTAL ANNUAL COST	**$4,300,000**
Available Project Yield (acft/yr)	5,500
Annual Cost of Water ($ per acft), based on PF=2	$782
Annual Cost of Water After Debt Service ($ per acft), based on PF=2	$329
Annual Cost of Water ($ per 1,000 gallons), based on PF=2	$2.40
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=2	$1.01

Kiera Brown *9/5/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Aqua WSC, Bastrop, Bastrop County WCID #2 - New LCRA Contract w/ Infrastructure

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	***Estimated Costs for Facilities***
Primary Pump Station (18.8 MGD)	$23,150,000
Transmission Pipeline (36 in dia., miles)	$9,407,000
Water Treatment Plant (24 MGD)	$88,630,000
TOTAL COST OF FACILITIES	**$121,187,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$41,945,000
Environmental & Archaeology Studies and Mitigation	$433,000
Land Acquisition and Surveying (40 acres)	$276,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$4,506,000
TOTAL COST OF PROJECT	**$168,347,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$11,845,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$94,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$579,000
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$6,204,000
Advanced Water Treatment Facility	$0
Pumping Energy Costs (11187112 kW-hr @ 0.08 $/kW-hr)	$895,000
Purchase of Water (25500 acft/yr @ 145 $/acft)	$3,698,000
TOTAL ANNUAL COST	**$23,315,000**
Available Project Yield (acft/yr)	25,500
Annual Cost of Water ($ per acft), based on PF=1	$914
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$450
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$2.81
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$1.38

Kiera Brown *10/1/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Smithville - New LCRA Contract with Infrastructure

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	*Estimated Costs for Facilities*
Primary Pump Station (0 MGD)	$3,097,000
Transmission Pipeline (0 in dia., miles)	$105,000
Water Treatment Plant (0.6 MGD)	$4,371,000
TOTAL COST OF FACILITIES	**$7,573,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$2,645,000
Environmental & Archaeology Studies and Mitigation	$46,000
Land Acquisition and Surveying (6 acres)	$41,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$284,000
TOTAL COST OF PROJECT	**$10,589,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$745,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$1,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$77,000
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$437,000
Advanced Water Treatment Facility	$0
Pumping Energy Costs (140990 kW-hr @ 0.08 $/kW-hr)	$11,000
Purchase of Water (700 acft/yr @ 145 $/acft)	$102,000
TOTAL ANNUAL COST	**$1,373,000**
Available Project Yield (acft/yr)	700
Annual Cost of Water ($ per acft), based on PF=1	$1,961
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$897
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$6.02
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$2.75

Kiera Brown *10/1/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
LCRA - Expand Use of Groundwater in Bastrop County (Carrizo-Wilcox Aquifer)

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	***Estimated Costs for Facilities***
Well Fields (Wells, Pumps, and Piping)	$174,000
TOTAL COST OF FACILITIES	**$174,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$61,000
Environmental & Archaeology Studies and Mitigation	$46,000
Land Acquisition and Surveying (6 acres)	$41,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$9,000
TOTAL COST OF PROJECT	**$331,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$23,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$2,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (4426 kW-hr @ 0.08 $/kW-hr)	$0
Purchase of Water (30 acft/yr @ 11.4 $/acft)	$0
TOTAL ANNUAL COST	**$25,000**
Available Project Yield (acft/yr)	30
Annual Cost of Water ($ per acft), based on PF=1	$833
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$67
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$2.56
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$0.20

Kiera Brown *8/20/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
LCRA - Import Return Flows from Williamson County

Cost based on ENR CCI 11170.28 for September 2018 and
a PPI of 202.4 for September 2018

Item	*Estimated Costs for Facilities*
Primary Pump Station (0 MGD)	$8,177,000
Transmission Pipeline (0 in dia., miles)	$34,359,000
Storage Tanks (Other Than at Booster Pump Stations)	$3,054,000
Water Treatment Plant (0 MGD)	$8,651,000
TOTAL COST OF FACILITIES	**$54,241,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$17,266,000
Environmental & Archaeology Studies and Mitigation	$444,000
Land Acquisition and Surveying (26 acres)	$1,756,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$2,027,000
TOTAL COST OF PROJECT	**$75,734,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$5,329,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$374,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$204,000
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (2161821 kW-hr @ 0.08 $/kW-hr)	$173,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$6,080,000**
Available Project Yield (acft/yr)	25,000
Annual Cost of Water ($ per acft), based on PF=1.5	$243
Annual Cost of Water After Debt Service ($ per acft), based on PF=1.5	$30
Annual Cost of Water ($ per 1,000 gallons), based on PF=1.5	$0.75
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1.5	$0.09

Note: One or more cost element has been calculated externally

Erin Hynes *10/18/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
LCRA - Baylor Creek Reservoir

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	***Estimated Costs for Facilities***
Off-Channel Storage/Ring Dike (Conservation Pool 48390 acft, acres)	$49,308,000
Primary Pump Station (0 MGD)	$39,456,000
Transmission Pipeline (0 in dia., miles)	$63,296,000
TOTAL COST OF FACILITIES	**$152,060,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$50,056,000
Environmental & Archaeology Studies and Mitigation	$11,661,000
Land Acquisition and Surveying (33 acres)	$220,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$5,886,000
TOTAL COST OF PROJECT	**$219,883,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$9,816,000
Reservoir Debt Service (3.5 percent, 40 years)	$3,764,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$633,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$986,000
Dam and Reservoir (1.5% of Cost of Facilities)	$740,000
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (4921943 kW-hr @ 0.08 $/kW-hr)	$394,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$16,333,000**
Available Project Yield (acft/yr)	18,000
Annual Cost of Water ($ per acft), based on PF=1	$907
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$153
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$2.78
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$0.47

Note: One or more cost element has been calculated externally

Kiera Brown *8/22/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
LCRA - ASR in Carrizo-Wilcox Aquifer

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	*Estimated Costs for Facilities*
Primary Pump Station (0 MGD)	$17,747,000
Transmission Pipeline (0 in dia., miles)	$6,028,000
Well Fields (Wells, Pumps, and Piping)	$14,845,000
Storage Tanks (Other Than at Booster Pump Stations)	$4,351,000
Water Treatment Plant (16 MGD)	$62,227,000
TOTAL COST OF FACILITIES	**$105,198,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$36,518,000
Environmental & Archaeology Studies and Mitigation	$550,000
Land Acquisition and Surveying (63 acres)	$402,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$3,924,000
TOTAL COST OF PROJECT	**$146,592,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$10,314,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$252,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$444,000
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$4,356,000
Advanced Water Treatment Facility	$0
Pumping Energy Costs (18708533 kW-hr @ 0.08 $/kW-hr)	$1,497,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$16,863,000**
Available Project Yield (acft/yr)	12,973
Annual Cost of Water ($ per acft), based on PF=1	$1,300
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$505
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$3.99
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$1.55

JB *11/26/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
LCRA - LCRA Enhanced Recharge and Conjunctive Use

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	*Estimated Costs for Facilities*
Off-Channel Storage/Ring Dike (Conservation Pool acft, 100 acres)	$12,930,000
Primary Pump Station (0 MGD)	$8,893,000
Transmission Pipeline (0 in dia., miles)	$383,000
Well Fields (Wells, Pumps, and Piping)	$21,812,000
Integration, Relocations, & Other	$3,267,000
TOTAL COST OF FACILITIES	**$47,285,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$19,551,000
Environmental & Archaeology Studies and Mitigation	$1,955,000
Land Acquisition and Surveying (20 acres)	$429,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$1,905,000
TOTAL COST OF PROJECT	**$71,125,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$3,708,000
Reservoir Debt Service (3.5 percent, 40 years)	$863,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$255,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$222,000
Dam and Reservoir (1.5% of Cost of Facilities)	$194,000
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (2323195 kW-hr @ 0.08 $/kW-hr)	$186,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$5,428,000**
Available Project Yield (acft/yr)	14,486
Annual Cost of Water ($ per acft), based on PF=1	$375
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$59
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$1.15
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$0.18

Note: One or more cost element has been calculated externally

JB *11/26/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
LCRA - Mid-Basin Off Channel Reservoir

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	*Estimated Costs for Facilities*
Off-Channel Storage/Ring Dike (Conservation Pool 40000 acft, 2500 acres)	$107,625,000
Intake Pump Stations (35.7 MGD)	$54,360,000
Transmission Pipeline (multiple sizes, lengths)	$53,834,000
Transmission Pump Station(s) & Storage Tank(s)	$18,609,000
TOTAL COST OF FACILITIES	**$234,428,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$79,358,000
Environmental & Archaeology Studies and Mitigation	$10,922,000
Land Acquisition and Surveying (2559 acres)	$10,336,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$9,215,000
TOTAL COST OF PROJECT	**$344,259,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$12,270,000
Reservoir Debt Service (3.5 percent, 40 years)	$7,955,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$572,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$1,740,000
Dam and Reservoir (1.5% of Cost of Facilities)	$1,614,000
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (26430793 kW-hr @ 0.08 $/kW-hr)	$2,114,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$26,265,000**
Available Project Yield (acft/yr)	20,000
Annual Cost of Water ($ per acft), based on PF=2	$1,313
Annual Cost of Water After Debt Service ($ per acft), based on PF=2	$302
Annual Cost of Water ($ per 1,000 gallons), based on PF=2	$4.03
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=2	$0.93
Note: One or more cost element has been calculated externally	
Jaime Burke	*8/28/2020*

Cost Estimate Summary ***Water Supply Project Option*** ***September 2018 Prices*** ***LCRA - LCRA Prairie Site Off-Channel Reservoir***	
Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018	
Item	***Estimated Costs for Facilities***
Off-Channel Storage/Ring Dike (Conservation Pool 2000 acft, 200 acres)	$7,235,000
Integration, Relocations, & Other	$3,000,000
TOTAL COST OF FACILITIES	**$10,235,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$3,582,000
Environmental & Archaeology Studies and Mitigation	$1,208,000
Land Acquisition and Surveying (206 acres)	$1,217,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$448,000
TOTAL COST OF PROJECT	**$16,690,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$293,000
Reservoir Debt Service (3.5 percent, 40 years)	$586,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (0% of Cost of Facilities)	$0
Intakes and Pump Stations (0% of Cost of Facilities)	$0
Dam and Reservoir (0.8% of Cost of Facilities)	$58,000
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (91605 kW-hr @ 0.08 $/kW-hr)	$7,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$944,000**
Available Project Yield (acft/yr)	19,000
Annual Cost of Water ($ per acft), based on PF=2	$50
Annual Cost of Water After Debt Service ($ per acft), based on PF=2	$3
Annual Cost of Water ($ per 1,000 gallons), based on PF=2	$0.15
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=2	$0.01
Note: One or more cost element has been calculated externally	
Kiera Brown	*9/24/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
LCRA - Excess Flows Off Channel Reservoir

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	***Estimated Costs for Facilities***
Off-Channel Storage/Ring Dike (Conservation Pool 40000 acft, 2500 acres)	$107,625,000
Intake Pump Stations (35.7 MGD)	$68,211,000
Transmission Pipeline (36 in dia., miles)	$107,604,000
Transmission Pump Station(s) & Storage Tank(s)	$93,654,000
TOTAL COST OF FACILITIES	**$377,094,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$126,603,000
Environmental & Archaeology Studies and Mitigation	$11,497,000
Land Acquisition and Surveying (2587 acres)	$10,459,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$14,457,000
TOTAL COST OF PROJECT	**$540,110,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$26,050,000
Reservoir Debt Service (3.5 percent, 40 years)	$7,955,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$1,200,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$3,737,000
Dam and Reservoir (1.5% of Cost of Facilities)	$1,614,000
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (101968108 kW-hr @ 0.08 $/kW-hr)	$8,157,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$48,713,000**
Available Project Yield (acft/yr)	39,247
Annual Cost of Water ($ per acft), based on PF=2	$1,241
Annual Cost of Water After Debt Service ($ per acft), based on PF=2	$375
Annual Cost of Water ($ per 1,000 gallons), based on PF=2	$3.81
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=2	$1.15

Note: One or more cost element has been calculated externally

Erin Hynes *11/4/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Austin, LCRA, and others - Austin Return Flows

Cost based on ENR CCI 11170.28 for September 2018 and
a PPI of 202.4 for September 2018

Item	***Estimated Costs for Facilities***
ANNUAL COST	
Operation and Maintenance	
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (15217037 kW-hr @ 0.08 $/kW-hr)	$1,217,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$1,217,000**
Available Project Yield (acft/yr)	114,129
Annual Cost of Water ($ per acft), based on PF=3	$11
Annual Cost of Water After Debt Service ($ per acft), based on PF=3	$11
Annual Cost of Water ($ per 1,000 gallons), based on PF=3	$0.03
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=3	$0.03

JB *11/8/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Austin - Austin Conservation

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	***Estimated Costs for Facilities***
Integration, Relocations, & Other	$514,560,000
TOTAL COST OF FACILITIES	**$514,560,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$180,096,000
Environmental & Archaeology Studies and Mitigation	$5,700,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$19,260,000
TOTAL COST OF PROJECT	**$719,616,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$50,633,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (0.7649% of Cost of Facilities)	$3,936,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (0 kW-hr @ 0.08 $/kW-hr)	$0
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$54,569,000**
Available Project Yield (acft/yr)	40,620
Annual Cost of Water ($ per acft), based on PF=1	$1,343
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$97
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$4.12
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$0.30

Note: One or more cost element has been calculated externally

Kiera Brown *5/2/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Austin - Austin Blackwater & Greywater Reuse

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	***Estimated Costs for Facilities***
Primary Pump Station	$1,807,000
Storage Tanks (Other Than at Booster Pump Stations)	$1,164,000
Advanced Water Treatment Facilities (14.694 MGD Total)	$30,934,000
TOTAL COST OF FACILITIES	**$33,905,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (35% for pipes & 35% for all other facilities)	$11,867,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$1,259,000
TOTAL COST OF PROJECT	**$47,031,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$3,309,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (434.5% of Cost of Facilities)	$5,058,000
Intakes and Pump Stations (434.5% of Cost of Facilities)	$7,850,000
Dam and Reservoir (0% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facilities	$5,654,000
Pumping Energy Costs (0 kW-hr @ 0.09 $/kW-hr)	$0
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$21,871,000**
Available Project Yield (acft/yr)	9,290
Annual Cost of Water ($ per acft), based on PF=1	$2,354
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$1,998
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$7.22
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$6.13

Note: One or more cost element has been calculated externally

EH/AS *8/14/2020*

Cost Estimate Summary Water Supply Project Option September 2018 Prices Austin - Austin Aquifer Storage and Recovery (Pilot and Full Scale)	
Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018	
Item	***Estimated Costs for Facilities***
Primary Pump Station	$28,037,000
Transmission Pipeline	$175,263,000
Well Fields (Wells, Pumps, and Piping)	$40,280,000
Integration, Relocations, & Other	$4,770,000
TOTAL COST OF FACILITIES	**$248,350,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$78,159,000
Environmental & Archaeology Studies and Mitigation	$24,358,000
Land Acquisition and Surveying (8 acres)	$9,743,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$9,917,000
TOTAL COST OF PROJECT	**$370,527,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$26,071,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$2,203,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$701,000
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$4,125,000
Advanced Water Treatment Facility	$0
Pumping Energy Costs (24444420 kW-hr @ 0.09 $/kW-hr)	$2,200,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$35,300,000**
Available Project Yield (acft/yr)	15,800
Annual Cost of Water ($ per acft), based on PF=1	$2,234
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$584
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$6.86
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$1.79
Note: One or more cost element has been calculated externally	
Kiera Brown	*7/3/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Austin - Austin Off-Channel Reservoir with Evaporation Suppression

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	***Estimated Costs for Facilities***
Off-Channel Storage/Ring Dike (Conservation Pool acft, acres)	$213,000,000
Integration, Relocations, & Other	$13,171,000
TOTAL COST OF FACILITIES	**$226,171,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$79,160,000
Environmental & Archaeology Studies and Mitigation	$11,308,000
Land Acquisition and Surveying	$9,046,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$8,957,000
TOTAL COST OF PROJECT	**$334,642,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$2,103,000
Reservoir Debt Service (3.5 percent, 40 years)	$14,271,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$132,000
Intakes and Pump Stations (0% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$3,195,000
Water Treatment Plant	$5,406,000
Advanced Water Treatment Facility	$0
Pumping Energy Costs (3746721 kW-hr @ 0.09 $/kW-hr)	$337,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$25,444,000**
Available Project Yield (acft/yr)	25,000
Annual Cost of Water ($ per acft), based on PF=1	$1,018
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$363
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$3.12
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$1.11

Note: One or more cost element has been calculated externally

Kiera Brown *5/2/2019*

Cost Estimate Summary ***Water Supply Project Option*** ***September 2018 Prices*** ***Austin - Austin Onsite Rainwater and Stormwater Harvesting***	
Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018	
Item	***Estimated Costs for Facilities***
Primary Pump Station	$735,000
Storage Tanks (Other Than at Booster Pump Stations)	$7,306,000
Water Treatment Facilities	$439,000
TOTAL COST OF FACILITIES	**$8,480,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (35% for pipes & 35% for all other facilities)	$2,968,000
Environmental & Archaeology Studies and Mitigation	$5,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$315,000
TOTAL COST OF PROJECT	**$11,768,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$828,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (41.34% of Cost of Facilities)	$3,020,000
Intakes and Pump Stations (30.3% of Cost of Facilities)	$223,000
Dam and Reservoir (0% of Cost of Facilities)	$0
Water Treatment Facilities	$44,000
Advanced Water Treatment Facility	$0
Pumping Energy Costs (9562639 kW-hr @ 0.09 $/kW-hr)	$861,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$4,976,000**
Available Project Yield (acft/yr)	4,270
Annual Cost of Water ($ per acft), based on PF=2	$1,165
Annual Cost of Water After Debt Service ($ per acft), based on PF=2	$971
Annual Cost of Water ($ per 1,000 gallons), based on PF=2	$3.58
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=2	$2.98
Note: One or more cost element has been calculated externally	
EH/AS	*8/14/2020*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Austin - Community-Scale Stormwater Harvesting

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	***Estimated Costs for Facilities***
Primary Pump Station	$25,000
Transmission Pipeline	$99,000
Storage Tanks (Other Than at Booster Pump Stations)	$64,000
Water Treatment Facilities	$16,000
TOTAL COST OF FACILITIES	**$204,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (35% for pipes & 35% for all other facilities)	$71,000
Environmental & Archaeology Studies and Mitigation	$5,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$8,000
TOTAL COST OF PROJECT	**$288,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$20,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (45% of Cost of Facilities)	$73,000
Intakes and Pump Stations (45% of Cost of Facilities)	$11,000
Dam and Reservoir (0% of Cost of Facilities)	$0
Water Treatment Facilities	$2,000
Advanced Water Treatment Facility	$0
Pumping Energy Costs (238566 kW-hr @ 0.09 $/kW-hr)	$21,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$127,000**
Available Project Yield (acft/yr)	197
Annual Cost of Water ($ per acft), based on PF=1	$645
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$543
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$1.98
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$1.67

Note: One or more cost element has been calculated externally

EH/AS *8/14/2020*

Cost Estimate Summary *Water Supply Project Option* *September 2018 Prices* *Austin - Austin Brackish Groundwater Desalination*	
Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018	
Item	***Estimated Costs for Facilities***
Primary Pump Station	$4,152,000
Transmission Pipeline	$41,881,000
Transmission Pump Station(s) & Storage Tank(s)	$5,402,000
Well Fields (Wells, Pumps, and Piping)	$16,129,000
Water Treatment Plant (4.5 MGD)	$18,983,000
TOTAL COST OF FACILITIES	**$86,547,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$68,374,000
Environmental & Archaeology Studies and Mitigation	$4,913,000
Land Acquisition and Surveying (19 acres)	$4,442,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$3,413,000
TOTAL COST OF PROJECT	**$167,689,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$8,972,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$593,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$208,000
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$4,955,000
Advanced Water Treatment Facility	$0
Pumping Energy Costs (3101242 kW-hr @ 0.08 $/kW-hr)	$248,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$14,976,000**
Available Project Yield (acft/yr)	5,000
Annual Cost of Water ($ per acft), based on PF=2	$2,995
Annual Cost of Water After Debt Service ($ per acft), based on PF=2	$1,201
Annual Cost of Water ($ per 1,000 gallons), based on PF=2	$9.19
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=2	$3.68
Note: One or more cost element has been calculated externally	
Erin Hynes	*10/10/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Austin - Austin Centralized Direct Non-Potable Reuse

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	***Estimated Costs for Facilities***
Primary Pump Station	$21,275,000
Transmission Pipeline	$148,561,000
Storage Tanks (Other Than at Booster Pump Stations)	$19,632,000
Water Treatment Plant	$21,463,000
TOTAL COST OF FACILITIES	**$210,931,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$66,398,000
Environmental & Archaeology Studies and Mitigation	$994,000
Land Acquisition and Surveying (7 acres)	$52,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$7,656,000
TOTAL COST OF PROJECT	**$286,031,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$20,125,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$1,682,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$532,000
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$1,614,000
Advanced Water Treatment Facility	$0
Pumping Energy Costs (11399708 kW-hr @ 0.08 $/kW-hr)	$912,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$24,865,000**
Available Project Yield (acft/yr)	25,000
Annual Cost of Water ($ per acft), based on PF=1	$995
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$190
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$3.05
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$0.58

Note: One or more cost element has been calculated externally

JB *11/4/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Austin - Austin Decentralized Non-Potable Reuse

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	*Estimated Costs for Facilities*
Primary Pump Station	$251,000
Transmission Pipeline	$1,109,000
Storage Tanks (Other Than at Booster Pump Stations)	$247,000
Water Treatment Plant (0.5 MGD)	$3,942,000
TOTAL COST OF FACILITIES	**$5,549,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (35% for pipes & 35% for all other facilities)	$1,942,000
Environmental & Archaeology Studies and Mitigation	$5,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$207,000
TOTAL COST OF PROJECT	**$7,703,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$542,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (148.85% of Cost of Facilities)	$2,018,000
Intakes and Pump Stations (148.85% of Cost of Facilities)	$374,000
Dam and Reservoir (0% of Cost of Facilities)	$0
Water Treatment Plant	$394,000
Advanced Water Treatment Facility	$0
Pumping Energy Costs (30857844 kW-hr @ 0.09 $/kW-hr)	$2,777,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$6,105,000**
Available Project Yield (acft/yr)	16,678
Annual Cost of Water ($ per acft), based on PF=2	$366
Annual Cost of Water After Debt Service ($ per acft), based on PF=2	$334
Annual Cost of Water ($ per 1,000 gallons), based on PF=2	$1.12
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=2	$1.02

Note: One or more cost element has been calculated externally

EH/AS *8/14/2020*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Austin - Austin Capture Local Inflows to Lady Bird Lake

Cost based on ENR CCI 11170.28 for September 2018 and
a PPI of 202.4 for September 2018

Item	***Estimated Costs for Facilities***
ANNUAL COST	
Operation and Maintenance	
Intakes and Pump Stations (2.5% of Cost of Facilities)	$103,000
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$879,000
Advanced Water Treatment Facility	$0
Pumping Energy Costs (kW-hr @ 0.08 $/kW-hr)	$12,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$994,000**
Available Project Yield (acft/yr)	3,000
Annual Cost of Water ($ per acft), based on PF=1	$331
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$331
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$1.02
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$1.02

K. Brown *5/13/2020*

Cost Estimate Summary *Water Supply Project Option* *September 2018 Prices* *Austin - Indirect Potable Reuse through Lady Bird Lake*	
Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018	
Item	***Estimated Costs for Facilities***
Intake Pump Stations	$13,909,000
Transmission Pipeline*	$356,000
Advanced Water Treatment Facility	$2,030,000
Integration, Relocations, & Other	$7,114,000
TOTAL COST OF FACILITIES	**$23,409,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (35% for pipes & 35% for all other facilities)	$8,193,000
Environmental & Archaeology Studies and Mitigation	$2,341,000
Land Acquisition and Surveying (16 acres)	$936,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$960,000
TOTAL COST OF PROJECT	**$35,839,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$2,522,000
Operation and Maintenance	
Intakes and Pump Stations (4.932% of Cost of Facilities)	$686,000
Dam and Reservoir (3% of Cost of Facilities)	$0
Water Treatment Plant	$5,858,000
Advanced Water Treatment Facility	$0
Pumping Energy Costs (1012587 kW-hr @ 0.08 $/kW-hr)	$81,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$9,147,000**
Available Project Yield (acft/yr)	20,000
Annual Cost of Water ($ per acft), based on PF=1	$457
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$331
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$1.40
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$1.02
Note: One or more cost element has been calculated externally	
Kiera Brown	*4/29/2019*

* Costs for the majority of pipeline components for this project are included in the Centralized Direct Non-Potable Reuse WMS.

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Austin - Longhorn Dam Operations Improvements

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	Estimated Costs for Facilities
Integration, Relocations, & Other	$1,000,000
TOTAL COST OF FACILITIES	**$1,000,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$350,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$38,000
TOTAL COST OF PROJECT	**$1,388,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$98,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$10,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (0 kW-hr @ 0.08 $/kW-hr)	$0
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$108,000**
Available Project Yield (acft/yr)	3,000
Annual Cost of Water ($ per acft), based on PF=1	$36
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$3
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$0.11
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$0.01

Note: One or more cost element has been calculated externally

JB/AS *8/27/2020*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Aqua WSC - Carrizo-Wilcox Aquifer - Expand Local Use of Groundwater

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	Estimated Costs for Facilities
Primary Pump Station (1.4 MGD)	$1,860,000
Transmission Pipeline (10 in dia., miles)	$419,000
Well Fields (Wells, Pumps, and Piping)	$4,181,000
TOTAL COST OF FACILITIES	**$6,460,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$2,240,000
Environmental & Archaeology Studies and Mitigation	$161,000
Land Acquisition and Surveying (18 acres)	$56,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$246,000
TOTAL COST OF PROJECT	**$9,163,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$645,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$46,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$46,000
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (692497 kW-hr @ 0.08 $/kW-hr)	$55,000
Purchase of Water (800 acft/yr @ 11.4 $/acft)	$9,000
TOTAL ANNUAL COST	**$801,000**
Available Project Yield (acft/yr)	800
Annual Cost of Water ($ per acft), based on PF=2	$1,001
Annual Cost of Water After Debt Service ($ per acft), based on PF=2	$195
Annual Cost of Water ($ per 1,000 gallons), based on PF=2	$3.07
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=2	$0.60

Kiera Brown *8/6/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Elgin - Carrizo-Wilcox Aquifer - Expand Local Use of Groundwater

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	*Estimated Costs for Facilities*
ANNUAL COST	
Operation and Maintenance	
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (38798 kW-hr @ 0.08 $/kW-hr)	$3,000
Purchase of Water (50 acft/yr @ 11.4 $/acft)	$1,000
TOTAL ANNUAL COST	**$4,000**
Available Project Yield (acft/yr)	50
Annual Cost of Water ($ per acft), based on PF=2	$80
Annual Cost of Water After Debt Service ($ per acft), based on PF=2	$80
Annual Cost of Water ($ per 1,000 gallons), based on PF=2	$0.25
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=2	$0.25

Kiera Brown *8/27/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Pflugerville - Edwards BFZ Aquifer - Expand Local Use of Groundwater

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	***Estimated Costs for Facilities***
ANNUAL COST	
Operation and Maintenance	
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (14773 kW-hr @ 0.08 $/kW-hr)	$1,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$1,000**
Available Project Yield (acft/yr)	20
Annual Cost of Water ($ per acft), based on PF=1	$50
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$50
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$0.15
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$0.15

Kiera Brown *8/5/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Sunset Valley - Edwards-BFZ Aquifer - Expand Local Use of Groundwater

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	*Estimated Costs for Facilities*
ANNUAL COST	
Operation and Maintenance	
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (36932 kW-hr @ 0.08 $/kW-hr)	$3,000
Purchase of Water (50 acft/yr @ 55.39 $/acft)	$3,000
TOTAL ANNUAL COST	**$6,000**
Available Project Yield (acft/yr)	50
Annual Cost of Water ($ per acft), based on PF=1	$120
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$120
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$0.37
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$0.37

Kiera Brown *8/28/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Johnson City - Ellenburger-San-Saba Aquifer - Expand Local Use of Groundwater

Cost based on ENR CCI 11170.28 for September 2018 and
a PPI of 202.4 for September 2018

Item	***Estimated Costs for Facilities***
ANNUAL COST	
Operation and Maintenance	
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (85644 kW-hr @ 0.08 $/kW-hr)	$7,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$7,000**
Available Project Yield (acft/yr)	100
Annual Cost of Water ($ per acft), based on PF=2	$70
Annual Cost of Water After Debt Service ($ per acft), based on PF=2	$70
Annual Cost of Water ($ per 1,000 gallons), based on PF=2	$0.21
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=2	$0.21

Kiera Brown, Erin Hynes - 2/4 *2/4/2020*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Bertram - Ellenburger-San Saba Aquifer - Expand Local Use of Groundwater

Cost based on ENR CCI 11170.28 for September 2018 and
a PPI of 202.4 for September 2018

Item	***Estimated Costs for Facilities***
Primary Pump Station (0 MGD)	$4,406,000
Transmission Pipeline (0 in dia., miles)	$724,000
Well Fields (Wells, Pumps, and Piping)	$405,000
Water Treatment Plant (1.8 MGD)	$9,391,000
TOTAL COST OF FACILITIES	**$14,926,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$5,188,000
Environmental & Archaeology Studies and Mitigation	$94,000
Land Acquisition and Surveying (9 acres)	$63,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$558,000
TOTAL COST OF PROJECT	**$20,829,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$1,465,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$11,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$110,000
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$828,000
Advanced Water Treatment Facility	$0
Pumping Energy Costs (703636 kW-hr @ 0.08 $/kW-hr)	$56,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$2,470,000**
Available Project Yield (acft/yr)	2,000
Annual Cost of Water ($ per acft), based on PF=1	$1,235
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$503
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$3.79
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$1.54

Kiera Brown *10/3/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Mining (Burnet County, Colorado Basin) - Ellenburger-San Saba Aquifer - Expand Local Use of GW

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	***Estimated Costs for Facilities***
Well Fields (Wells, Pumps, and Piping)	$4,782,000
TOTAL COST OF FACILITIES	**$4,782,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$1,674,000
Environmental & Archaeology Studies and Mitigation	$326,000
Land Acquisition and Surveying (17 acres)	$125,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$190,000
TOTAL COST OF PROJECT	**$7,097,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$499,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$48,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (426852 kW-hr @ 0.08 $/kW-hr)	$34,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$581,000**
Available Project Yield (acft/yr)	1,000
Annual Cost of Water ($ per acft), based on PF=1	$581
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$82
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$1.78
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$0.25

Kiera Brown *10/3/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Irrigation (Colorado Co., Bra-Col Basin) - Gulf Coast Aquifer - Expand Use of Groundwater

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	*Estimated Costs for Facilities*
Well Fields (Wells, Pumps, and Piping)	$3,069,000
TOTAL COST OF FACILITIES	**$3,069,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$1,074,000
Environmental & Archaeology Studies and Mitigation	$163,000
Land Acquisition and Surveying (8 acres)	$56,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$120,000
TOTAL COST OF PROJECT	**$4,482,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$315,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$31,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (1200910 kW-hr @ 0.08 $/kW-hr)	$96,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$442,000**
Available Project Yield (acft/yr)	2,500
Annual Cost of Water ($ per acft), based on PF=1	$177
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$51
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$0.54
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$0.16

Kiera Brown *8/1/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Corix Utilities Texas Inc. - Gulf Coast Aquifer - Expand Local Use of Groundwater

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	*Estimated Costs for Facilities*
ANNUAL COST	
Operation and Maintenance	
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (2478 kW-hr @ 0.08 $/kW-hr)	$198
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$0**
Available Project Yield (acft/yr)	4
Annual Cost of Water ($ per acft), based on PF=1	$50
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$50
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$0.15
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$0.15

Kiera Brown *7/31/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
County-Other (Colorado Co.) - Gulf Coast Aquifer - Expand Local Use of Groundwater

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	***Estimated Costs for Facilities***
Well Fields (Wells, Pumps, and Piping)	$1,406,000
TOTAL COST OF FACILITIES	**$1,406,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$492,000
Environmental & Archaeology Studies and Mitigation	$44,000
Land Acquisition and Surveying (1 acres)	$7,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$54,000
TOTAL COST OF PROJECT	**$2,003,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$141,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$14,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (82697 kW-hr @ 0.08 $/kW-hr)	$7,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$162,000**
Available Project Yield (acft/yr)	133
Annual Cost of Water ($ per acft), based on PF=1	$1,218
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$158
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$3.74
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$0.48

Kiera Brown *7/29/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Irrigation (Colorado Co., Col Basin) - Gulf Coast Aquifer - Expand Local Use of Groundwater

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	***Estimated Costs for Facilities***
Well Fields (Wells, Pumps, and Piping)	$972,000
TOTAL COST OF FACILITIES	**$972,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$340,000
Environmental & Archaeology Studies and Mitigation	$54,000
Land Acquisition and Surveying (3 acres)	$19,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$39,000
TOTAL COST OF PROJECT	**$1,424,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$100,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$10,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (341978 kW-hr @ 0.08 $/kW-hr)	$27,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$137,000**
Available Project Yield (acft/yr)	550
Annual Cost of Water ($ per acft), based on PF=1	$249
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$67
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$0.76
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$0.21

Kiera Brown *7/31/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Irrigation (Colorado Co., Lav Basin) - Gulf Coast Aquifer - Expand Local Use of Groundwater

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	***Estimated Costs for Facilities***
Well Fields (Wells, Pumps, and Piping)	$6,019,000
TOTAL COST OF FACILITIES	**$6,019,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$2,107,000
Environmental & Archaeology Studies and Mitigation	$308,000
Land Acquisition and Surveying (16 acres)	$105,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$235,000
TOTAL COST OF PROJECT	**$8,774,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$617,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$60,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (2205242 kW-hr @ 0.08 $/kW-hr)	$176,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$853,000**
Available Project Yield (acft/yr)	5,000
Annual Cost of Water ($ per acft), based on PF=1	$171
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$47
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$0.52
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$0.14

Kiera Brown *8/5/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
County-Other (Fayette Co.) - Gulf Coast Aquifer - Expand Local Use of Groundwater

Cost based on ENR CCI 11170.28 for September 2018 and
a PPI of 202.4 for September 2018

Item	***Estimated Costs for Facilities***
ANNUAL COST	
Operation and Maintenance	
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (25493 kW-hr @ 0.08 $/kW-hr)	$2,000
Purchase of Water (41 acft/yr @ 1 $/acft)	$0
TOTAL ANNUAL COST	**$2,000**
Available Project Yield (acft/yr)	41
Annual Cost of Water ($ per acft), based on PF=1	$49
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$49
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$0.15
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$0.15

Kiera Brown *10/7/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Bay City - Gulf Coast Aquifer - Expand Local Use of Groundwater

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	***Estimated Costs for Facilities***
ANNUAL COST	
Operation and Maintenance	
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (47401 kW-hr @ 0.08 $/kW-hr)	$4,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$4,000**
Available Project Yield (acft/yr)	75
Annual Cost of Water ($ per acft), based on PF=1	$53
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$53
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$0.16
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$0.16

Kiera Brown *7/30/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Irrigation (Matagorda Co., Col-Lav Basin) - Gulf Coast Aquifer - Expand Use of Groundwater

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	*Estimated Costs for Facilities*
Well Fields (Wells, Pumps, and Piping)	$985,000
TOTAL COST OF FACILITIES	**$985,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$345,000
Environmental & Archaeology Studies and Mitigation	$49,000
Land Acquisition and Surveying (3 acres)	$13,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$39,000
TOTAL COST OF PROJECT	**$1,431,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$101,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$10,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (225294 kW-hr @ 0.08 $/kW-hr)	$18,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$129,000**
Available Project Yield (acft/yr)	300
Annual Cost of Water ($ per acft), based on PF=1	$430
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$93
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$1.32
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$0.29

Kiera Brown *8/5/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Irrigation (Wharton, Brazos-Colorado) - Expand Local Use of Groundwater - Gulf Coast

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	***Estimated Costs for Facilities***
Well Fields (Wells, Pumps, and Piping)	$5,676,000
TOTAL COST OF FACILITIES	**$5,676,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$1,987,000
Environmental & Archaeology Studies and Mitigation	$327,000
Land Acquisition and Surveying (17 acres)	$112,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$223,000
TOTAL COST OF PROJECT	**$8,325,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$586,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$57,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (2600266 kW-hr @ 0.08 $/kW-hr)	$208,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$851,000**
Available Project Yield (acft/yr)	5,000
Annual Cost of Water ($ per acft), based on PF=1	$170
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$53
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$0.52
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$0.16

Kiera Brown *8/5/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Wharton - Gulf Coast Aquifer - Expand Local Use of Groundwater

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	*Estimated Costs for Facilities*
Primary Pump Station (0 MGD)	$1,191,000
Well Fields (Wells, Pumps, and Piping)	$5,163,000
TOTAL COST OF FACILITIES	**$6,354,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$2,224,000
Environmental & Archaeology Studies and Mitigation	$207,000
Land Acquisition and Surveying (16 acres)	$71,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$244,000
TOTAL COST OF PROJECT	**$9,100,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$640,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$52,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$30,000
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (1181564 kW-hr @ 0.08 $/kW-hr)	$95,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$817,000**
Available Project Yield (acft/yr)	3,000
Annual Cost of Water ($ per acft), based on PF=2	$272
Annual Cost of Water After Debt Service ($ per acft), based on PF=2	$59
Annual Cost of Water ($ per 1,000 gallons), based on PF=2	$0.84
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=2	$0.18

Kiera Brown *7/29/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Irrigation (Wharton Co., Colorado Basin) - Gulf Coast Aquifer - Expand Use of Groundwater

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	***Estimated Costs for Facilities***
Well Fields (Wells, Pumps, and Piping)	$878,000
TOTAL COST OF FACILITIES	**$878,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$307,000
Environmental & Archaeology Studies and Mitigation	$54,000
Land Acquisition and Surveying (3 acres)	$19,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$35,000
TOTAL COST OF PROJECT	**$1,293,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$91,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$9,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (314539 kW-hr @ 0.08 $/kW-hr)	$25,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$125,000**
Available Project Yield (acft/yr)	600
Annual Cost of Water ($ per acft), based on PF=1	$208
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$57
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$0.64
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$0.17

Kiera Brown *7/31/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Fayette County Other (Colorado Basin) - Sparta Aquifer - Expand Local Use of Groundwater

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	Estimated Costs for Facilities
Primary Pump Station (0 MGD)	$858,000
Transmission Pipeline (0 in dia., miles)	$134,000
Well Fields (Wells, Pumps, and Piping)	$682,000
TOTAL COST OF FACILITIES	**$1,674,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$579,000
Environmental & Archaeology Studies and Mitigation	$182,000
Land Acquisition and Surveying (9 acres)	$132,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$71,000
TOTAL COST OF PROJECT	**$2,638,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$186,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$8,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$21,000
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (188610 kW-hr @ 0.08 $/kW-hr)	$15,000
Purchase of Water (204 acft/yr @ 1 $/acft)	$0
TOTAL ANNUAL COST	**$230,000**
Available Project Yield (acft/yr)	204
Annual Cost of Water ($ per acft), based on PF=2	$1,127
Annual Cost of Water After Debt Service ($ per acft), based on PF=2	$216
Annual Cost of Water ($ per 1,000 gallons), based on PF=2	$3.46
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=2	$0.66

Note: One or more cost element has been calculated externally

Kiera Brown *8/5/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Hays County Other (Colorado Basin) - Trinity Aquifer - Expand Local Use of Groundwater

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	*Estimated Costs for Facilities*
Primary Pump Station (0 MGD)	$856,000
Transmission Pipeline (0 in dia., miles)	$134,000
Well Fields (Wells, Pumps, and Piping)	$813,000
TOTAL COST OF FACILITIES	**$1,803,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$624,000
Environmental & Archaeology Studies and Mitigation	$112,000
Land Acquisition and Surveying (9 acres)	$63,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$72,000
TOTAL COST OF PROJECT	**$2,674,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$188,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$9,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$21,000
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (223184 kW-hr @ 0.08 $/kW-hr)	$18,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$236,000**
Available Project Yield (acft/yr)	200
Annual Cost of Water ($ per acft), based on PF=2	$1,180
Annual Cost of Water After Debt Service ($ per acft), based on PF=2	$240
Annual Cost of Water ($ per 1,000 gallons), based on PF=2	$3.62
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=2	$0.74

Kiera Brown *8/6/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Dripping Springs WSC - Trinity Aquifer - Expand Local Use of Groundwater

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	***Estimated Costs for Facilities***
Primary Pump Station (0 MGD)	$871,000
Transmission Pipeline (0 in dia., miles)	$210,000
Well Fields (Wells, Pumps, and Piping)	$1,290,000
TOTAL COST OF FACILITIES	**$2,371,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$819,000
Environmental & Archaeology Studies and Mitigation	$148,000
Land Acquisition and Surveying (11 acres)	$75,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$94,000
TOTAL COST OF PROJECT	**$3,507,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$247,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$15,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$22,000
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (289973 kW-hr @ 0.08 $/kW-hr)	$23,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$307,000**
Available Project Yield (acft/yr)	300
Annual Cost of Water ($ per acft), based on PF=2	$1,023
Annual Cost of Water After Debt Service ($ per acft), based on PF=2	$200
Annual Cost of Water ($ per 1,000 gallons), based on PF=2	$3.14
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=2	$0.61

Kiera Brown *8/6/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Mining (Hays County, Colorado Basin) - Trinity Aquifer - Expand Local Use of Groundwater

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	*Estimated Costs for Facilities*
Well Fields (Wells, Pumps, and Piping)	$1,625,000
TOTAL COST OF FACILITIES	**$1,625,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$569,000
Environmental & Archaeology Studies and Mitigation	$111,000
Land Acquisition and Surveying (6 acres)	$39,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$65,000
TOTAL COST OF PROJECT	**$2,409,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$169,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$16,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (489727 kW-hr @ 0.08 $/kW-hr)	$39,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$224,000**
Available Project Yield (acft/yr)	600
Annual Cost of Water ($ per acft), based on PF=1	$373
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$92
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$1.15
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$0.28

Kiera Brown *8/6/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Irrigation (Mills County, Brazos Basin) - Trinity Aquifer - Expand Local Use of Groundwater

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	*Estimated Costs for Facilities*
Well Fields (Wells, Pumps, and Piping)	$883,000
TOTAL COST OF FACILITIES	**$883,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$309,000
Environmental & Archaeology Studies and Mitigation	$78,000
Land Acquisition and Surveying (5 acres)	$17,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$36,000
TOTAL COST OF PROJECT	**$1,323,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$93,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$9,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (243564 kW-hr @ 0.08 $/kW-hr)	$19,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$121,000**
Available Project Yield (acft/yr)	300
Annual Cost of Water ($ per acft), based on PF=1	$403
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$93
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$1.24
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$0.29

Kiera Brown *8/6/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Garfield WSC - Trinity Aquifer - Expand Local Use of Groundwater

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	*Estimated Costs for Facilities*
ANNUAL COST	
Operation and Maintenance	
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (44865 kW-hr @ 0.08 $/kW-hr)	$4,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$4,000**
Available Project Yield (acft/yr)	47
Annual Cost of Water ($ per acft), based on PF=1	$85
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$85
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$0.26
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$0.26

Kiera Brown *8/6/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Manville WSC - Trinity Aquifer - Expand Local Use of Groundwater

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	***Estimated Costs for Facilities***
Primary Pump Station (0 MGD)	$957,000
Transmission Pipeline (0 in dia., miles)	$285,000
Well Fields (Wells, Pumps, and Piping)	$2,178,000
TOTAL COST OF FACILITIES	**$3,420,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$1,183,000
Environmental & Archaeology Studies and Mitigation	$203,000
Land Acquisition and Surveying (14 acres)	$94,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$135,000
TOTAL COST OF PROJECT	**$5,035,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$354,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$25,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$24,000
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (606720 kW-hr @ 0.08 $/kW-hr)	$49,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$452,000**
Available Project Yield (acft/yr)	703
Annual Cost of Water ($ per acft), based on PF=2	$643
Annual Cost of Water After Debt Service ($ per acft), based on PF=2	$139
Annual Cost of Water ($ per 1,000 gallons), based on PF=2	$1.97
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=2	$0.43

Kiera Brown *8/6/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Mining (Fayette County, Colorado Basin) - Yegua-Jackson Aquifer - Expand Local Groundwater

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	***Estimated Costs for Facilities***
Well Fields (Wells, Pumps, and Piping)	$2,127,000
TOTAL COST OF FACILITIES	**$2,127,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$745,000
Environmental & Archaeology Studies and Mitigation	$163,000
Land Acquisition and Surveying (380 acres)	$2,281,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$147,000
TOTAL COST OF PROJECT	**$5,463,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$384,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$21,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (315077 kW-hr @ 0.08 $/kW-hr)	$25,000
Purchase of Water (760 acft/yr @ 1 $/acft)	$1,000
TOTAL ANNUAL COST	**$431,000**
Available Project Yield (acft/yr)	760
Annual Cost of Water ($ per acft), based on PF=1	$567
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$62
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$1.74
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$0.19

Note: One or more cost element has been calculated externally

Kiera Brown *8/7/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Mining (Burnet County, Brazos Basin) - Ellenburger-San Saba Aquifer - Develop New GW

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	***Estimated Costs for Facilities***
Well Fields (Wells, Pumps, and Piping)	$3,119,000
TOTAL COST OF FACILITIES	**$3,119,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$1,092,000
Environmental & Archaeology Studies and Mitigation	$163,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$121,000
TOTAL COST OF PROJECT	**$4,495,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$316,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$31,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (339481 kW-hr @ 0.08 $/kW-hr)	$27,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$374,000**
Available Project Yield (acft/yr)	700
Annual Cost of Water ($ per acft), based on PF=1	$534
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$83
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$1.64
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$0.25

Kiera Brown *8/7/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Irrigation (Matagorda County, Col Basin) - Gulf Coast Aquifer - Development of New GW

Cost based on ENR CCI 11170.28 for September 2018 and
a PPI of 202.4 for September 2018

Item	***Estimated Costs for Facilities***
Well Fields (Wells, Pumps, and Piping)	$843,000
TOTAL COST OF FACILITIES	**$843,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$295,000
Environmental & Archaeology Studies and Mitigation	$25,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$32,000
TOTAL COST OF PROJECT	**$1,195,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$84,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$8,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (0 kW-hr @ 0.08 $/kW-hr)	$0
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$92,000**
Available Project Yield (acft/yr)	510
Annual Cost of Water ($ per acft), based on PF=1	$180
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$16
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$0.55
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$0.05

Kiera Brown *8/7/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Mining (Burnet County, Colorado Basin) - Hickory Aquifer - Development of New Groundwater

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	*Estimated Costs for Facilities*
Well Fields (Wells, Pumps, and Piping)	$3,431,000
TOTAL COST OF FACILITIES	**$3,431,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$1,201,000
Environmental & Archaeology Studies and Mitigation	$100,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$131,000
TOTAL COST OF PROJECT	**$4,863,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$342,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$34,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (699141 kW-hr @ 0.08 $/kW-hr)	$56,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$432,000**
Available Project Yield (acft/yr)	1,000
Annual Cost of Water ($ per acft), based on PF=1	$432
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$90
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$1.33
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$0.28

Kiera Brown *8/7/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Mining (Burnet County, Colorado Basin) - Marble Falls Aquifer - Development of New GW

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	Estimated Costs for Facilities
Well Fields (Wells, Pumps, and Piping)	$2,346,000
TOTAL COST OF FACILITIES	**$2,346,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$821,000
Environmental & Archaeology Studies and Mitigation	$88,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$90,000
TOTAL COST OF PROJECT	**$3,345,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$235,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$23,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (609846 kW-hr @ 0.08 $/kW-hr)	$49,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$307,000**
Available Project Yield (acft/yr)	1,000
Annual Cost of Water ($ per acft), based on PF=1	$307
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$72
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$0.94
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$0.22

Kiera Brown *8/7/2019*

Cost Estimate Summary ***Water Supply Project Option*** ***September 2018 Prices*** ***Fayette County-Other (Lavaca from Colorado Basin) - Sparta - Development of New GW***	
Cost based on ENR CCI 11170.28 for September 2018 and ***a PPI of 202.4 for September 2018***	
Item	***Estimated Costs for Facilities***
Primary Pump Station (0 MGD)	$933,000
Transmission Pipeline (0 in dia., miles)	$671,000
Well Fields (Wells, Pumps, and Piping)	$1,094,000
Water Treatment Plant (0.4 MGD)	$537,000
TOTAL COST OF FACILITIES	**$3,266,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$1,110,000
Environmental & Archaeology Studies and Mitigation	$307,000
Land Acquisition and Surveying (18 acres)	$1,210,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$163,000
TOTAL COST OF PROJECT	**$6,056,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$426,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$18,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$23,000
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$177,000
Advanced Water Treatment Facility	$0
Pumping Energy Costs (407348 kW-hr @ 0.08 $/kW-hr)	$33,000
Purchase of Water (400 acft/yr @ 1 $/acft)	$0
TOTAL ANNUAL COST	**$677,000**
Available Project Yield (acft/yr)	400
Annual Cost of Water ($ per acft), based on PF=1	$1,693
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$628
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$5.19
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$1.93
Note: One or more cost element has been calculated externally	
Kiera Brown	*10/7/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Hays - Trinity Aquifer - Development of New Groundwater Supplies

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	Estimated Costs for Facilities
Primary Pump Station (0 MGD)	$818,000
Transmission Pipeline (0 in dia., miles)	$671,000
Well Fields (Wells, Pumps, and Piping)	$745,000
Water Treatment Plant (0.1 MGD)	$258,000
TOTAL COST OF FACILITIES	**$2,492,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$839,000
Environmental & Archaeology Studies and Mitigation	$196,000
Land Acquisition and Surveying (13 acres)	$92,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$100,000
TOTAL COST OF PROJECT	**$3,719,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$262,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$14,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$20,000
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$85,000
Advanced Water Treatment Facility	$0
Pumping Energy Costs (21055 kW-hr @ 0.08 $/kW-hr)	$2,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$383,000**
Available Project Yield (acft/yr)	100
Annual Cost of Water ($ per acft), based on PF=2	$3,830
Annual Cost of Water After Debt Service ($ per acft), based on PF=2	$1,210
Annual Cost of Water ($ per 1,000 gallons), based on PF=2	$11.75
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=2	$3.71

Kiera Brown *8/7/2019*

Cost Estimate Summary *Water Supply Project Option* *September 2018 Prices* *Elgin - Trinity Aquifer - Development of New Groundwater*	
Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018	
Item	***Estimated Costs for Facilities***
Primary Pump Station (0 MGD)	$1,594,000
Transmission Pipeline (0 in dia., miles)	$2,180,000
Well Fields (Wells, Pumps, and Piping)	$4,955,000
Storage Tanks (Other Than at Booster Pump Stations)	$82,000
Water Treatment Plant (1.6 MGD)	$1,414,000
TOTAL COST OF FACILITIES	**$10,225,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$3,470,000
Environmental & Archaeology Studies and Mitigation	$482,000
Land Acquisition and Surveying (30 acres)	$201,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$396,000
TOTAL COST OF PROJECT	**$14,774,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$1,039,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$72,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$40,000
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$467,000
Advanced Water Treatment Facility	$0
Pumping Energy Costs (1519662 kW-hr @ 0.08 $/kW-hr)	$122,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$1,740,000**
Available Project Yield (acft/yr)	1,825
Annual Cost of Water ($ per acft), based on PF=2	$953
Annual Cost of Water After Debt Service ($ per acft), based on PF=2	$384
Annual Cost of Water ($ per 1,000 gallons), based on PF=2	$2.93
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=2	$1.18
Note: One or more cost element has been calculated externally	
Kiera Brown	*8/15/2019*

Cost Estimate Summary ***Water Supply Project Option*** ***September 2018 Prices*** ***Sunset Valley - Trinity Aquifer - Development of New Groundwater***	
Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018	
Item	***Estimated Costs for Facilities***
Primary Pump Station (0 MGD)	$930,000
Transmission Pipeline (0 in dia., miles)	$1,048,000
Well Fields (Wells, Pumps, and Piping)	$1,185,000
Storage Tanks (Other Than at Booster Pump Stations)	$50,000
Water Treatment Plant (0.3 MGD)	$451,000
TOTAL COST OF FACILITIES	**$3,664,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$1,230,000
Environmental & Archaeology Studies and Mitigation	$244,000
Land Acquisition and Surveying (17 acres)	$118,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$145,000
TOTAL COST OF PROJECT	**$5,401,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$380,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$23,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$23,000
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$149,000
Advanced Water Treatment Facility	$0
Pumping Energy Costs (333459 kW-hr @ 0.08 $/kW-hr)	$27,000
Purchase of Water (300 acft/yr @ 55.39 $/acft)	$17,000
TOTAL ANNUAL COST	**$619,000**
Available Project Yield (acft/yr)	300
Annual Cost of Water ($ per acft), based on PF=2	$2,063
Annual Cost of Water After Debt Service ($ per acft), based on PF=2	$797
Annual Cost of Water ($ per 1,000 gallons), based on PF=2	$6.33
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=2	$2.44
Note: One or more cost element has been calculated externally	
Kiera Brown	*7/24/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Travis County MUD 10 - Trinity Aquifer - Development of New Groundwater Supplies

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	Estimated Costs for Facilities
Primary Pump Station (0 MGD)	$818,000
Transmission Pipeline (0 in dia., miles)	$671,000
Well Fields (Wells, Pumps, and Piping)	$745,000
Water Treatment Plant (0.1 MGD)	$258,000
TOTAL COST OF FACILITIES	**$2,492,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$839,000
Environmental & Archaeology Studies and Mitigation	$196,000
Land Acquisition and Surveying (13 acres)	$92,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$100,000
TOTAL COST OF PROJECT	**$3,719,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$262,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$14,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$20,000
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$85,000
Advanced Water Treatment Facility	$0
Pumping Energy Costs (21055 kW-hr @ 0.08 $/kW-hr)	$2,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$383,000**
Available Project Yield (acft/yr)	100
Annual Cost of Water ($ per acft), based on PF=2	$3,830
Annual Cost of Water After Debt Service ($ per acft), based on PF=2	$1,210
Annual Cost of Water ($ per 1,000 gallons), based on PF=2	$11.75
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=2	$3.71

Kiera Brown *9/30/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Manufacturing (Fayette County, Lavaca Basin) - Yegua-Jackson Aquifer - Develop New GW

Cost based on ENR CCI 11170.28 for September 2018 and
a PPI of 202.4 for September 2018

Item	***Estimated Costs for Facilities***
Primary Pump Station (0 MGD)	$444,000
Transmission Pipeline (0 in dia., miles)	$671,000
Well Fields (Wells, Pumps, and Piping)	$803,000
TOTAL COST OF FACILITIES	**$2,178,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$728,000
Environmental & Archaeology Studies and Mitigation	$514,000
Land Acquisition and Surveying (70 acres)	$436,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$107,000
TOTAL COST OF PROJECT	**$3,963,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$279,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$15,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$11,000
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$86,000
Advanced Water Treatment Facility	$0
Pumping Energy Costs (68735 kW-hr @ 0.08 $/kW-hr)	$5,000
Purchase of Water (100 acft/yr @ 1 $/acft)	$0
TOTAL ANNUAL COST	**$396,000**
Available Project Yield (acft/yr)	100
Annual Cost of Water ($ per acft), based on PF=1	$3,960
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$1,170
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$12.15
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$3.59

Note: One or more cost element has been calculated externally

Kiera Brown *10/30/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Smithville - Yegua-Jackson Aquifer - Develop New GW

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	***Estimated Costs for Facilities***
Primary Pump Station (0 MGD)	$961,000
Transmission Pipeline (0 in dia., miles)	$1,048,000
Transmission Pump Station(s) & Storage Tank(s)	$0
Well Fields (Wells, Pumps, and Piping)	$3,251,000
Water Treatment Plant (0.6 MGD)	$796,000
TOTAL COST OF FACILITIES	**$6,056,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$2,067,000
Environmental & Archaeology Studies and Mitigation	$2,498,000
Land Acquisition and Surveying (387 acres)	$2,440,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$360,000
TOTAL COST OF PROJECT	**$13,421,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$944,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$43,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$24,000
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$263,000
Advanced Water Treatment Facility	$0
Pumping Energy Costs (511065 kW-hr @ 0.08 $/kW-hr)	$41,000
Purchase of Water (700 acft/yr @ 9.15 $/acft)	$6,000
TOTAL ANNUAL COST	**$1,321,000**
Available Project Yield (acft/yr)	700
Annual Cost of Water ($ per acft), based on PF=1	$1,887
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$539
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$5.79
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$1.65

Note: One or more cost element has been calculated externally

Kiera Brown *10/30/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
WTCPUA, County-Other (Hays) - Groundwater Importation - Hays Co.. Pipeline

Cost based on ENR CCI 11170.28 for September 2018 and
a PPI of 202.4 for September 2018

Item	***Estimated Costs for Facilities***
Transmission Pipeline (0 in dia., miles)	$22,050,000
TOTAL COST OF FACILITIES	**$22,050,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$6,615,000
Environmental & Archaeology Studies and Mitigation	$475,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$802,000
TOTAL COST OF PROJECT	**$29,942,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$2,107,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$220,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (2241062 kW-hr @ 0.08 $/kW-hr)	$179,000
Purchase of Water (4000 acft/yr @ 1492 $/acft)	$5,968,000
TOTAL ANNUAL COST	**$8,474,000**
Available Project Yield (acft/yr)	4,000
Annual Cost of Water ($ per acft), based on PF=1.3	$2,119
Annual Cost of Water After Debt Service ($ per acft), based on PF=1.3	$1,592
Annual Cost of Water ($ per 1,000 gallons), based on PF=1.3	$6.50
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1.3	$4.88

Note: One or more cost element has been calculated externally

JB *1/28/2020*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Buda - BS/EACD Edwards/Middle Trinity ASR

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	Estimated Costs for Facilities
Primary Pump Station (0 MGD)	$958,000
Transmission Pipeline (0 in dia., miles)	$404,000
Well Fields (Wells, Pumps, and Piping)	$3,169,000
Water Treatment Plant (0.5 MGD)	$704,000
TOTAL COST OF FACILITIES	**$5,235,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$1,812,000
Environmental & Archaeology Studies and Mitigation	$88,000
Land Acquisition and Surveying (9 acres)	$17,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$197,000
TOTAL COST OF PROJECT	**$7,349,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$517,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$36,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$24,000
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$232,000
Advanced Water Treatment Facility	$0
Pumping Energy Costs (374537 kW-hr @ 0.08 $/kW-hr)	$30,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$839,000**
Available Project Yield (acft/yr)	600
Annual Cost of Water ($ per acft), based on PF=2	$1,398
Annual Cost of Water After Debt Service ($ per acft), based on PF=2	$537
Annual Cost of Water ($ per 1,000 gallons), based on PF=2	$4.29
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=2	$1.65

Kiera Brown *11/8/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Hays - BS/EACD Edwards/Middle Trinity ASR

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	***Estimated Costs for Facilities***
Primary Pump Station (0 MGD)	$845,000
Transmission Pipeline (0 in dia., miles)	$186,000
Well Fields (Wells, Pumps, and Piping)	$2,677,000
Water Treatment Plant (0.1 MGD)	$318,000
TOTAL COST OF FACILITIES	**$4,026,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$1,400,000
Environmental & Archaeology Studies and Mitigation	$76,000
Land Acquisition and Surveying (9 acres)	$19,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$152,000
TOTAL COST OF PROJECT	**$5,673,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$399,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$29,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$21,000
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$105,000
Advanced Water Treatment Facility	$0
Pumping Energy Costs (89819 kW-hr @ 0.08 $/kW-hr)	$7,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$561,000**
Available Project Yield (acft/yr)	146
Annual Cost of Water ($ per acft), based on PF=2	$3,842
Annual Cost of Water After Debt Service ($ per acft), based on PF=2	$1,110
Annual Cost of Water ($ per 1,000 gallons), based on PF=2	$11.79
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=2	$3.40

Kiera Brown *10/28/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Hays County-Other - BS/EACD Edwards/Middle Trinity ASR

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	***Estimated Costs for Facilities***
Primary Pump Station (0 MGD)	$931,000
Transmission Pipeline (0 in dia., miles)	$186,000
Well Fields (Wells, Pumps, and Piping)	$2,677,000
Water Treatment Plant (0.3 MGD)	$441,000
TOTAL COST OF FACILITIES	**$4,235,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$1,473,000
Environmental & Archaeology Studies and Mitigation	$77,000
Land Acquisition and Surveying (9 acres)	$20,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$160,000
TOTAL COST OF PROJECT	**$5,965,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$420,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$29,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$23,000
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$146,000
Advanced Water Treatment Facility	$0
Pumping Energy Costs (183547 kW-hr @ 0.08 $/kW-hr)	$15,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$633,000**
Available Project Yield (acft/yr)	289
Annual Cost of Water ($ per acft), based on PF=2	$2,190
Annual Cost of Water After Debt Service ($ per acft), based on PF=2	$737
Annual Cost of Water ($ per 1,000 gallons), based on PF=2	$6.72
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=2	$2.26

Kiera Brown	*10/28/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Creedmoor-Maha WSC - BS/EACD Edwards/Middle Trinity ASR

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	***Estimated Costs for Facilities***
Primary Pump Station (0 MGD)	$931,000
Transmission Pipeline (0 in dia., miles)	$186,000
Well Fields (Wells, Pumps, and Piping)	$2,677,000
Water Treatment Plant (0.3 MGD)	$441,000
TOTAL COST OF FACILITIES	**$4,235,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$1,473,000
Environmental & Archaeology Studies and Mitigation	$82,000
Land Acquisition and Surveying (9 acres)	$25,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$160,000
TOTAL COST OF PROJECT	**$5,975,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$420,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$29,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$23,000
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$146,000
Advanced Water Treatment Facility	$0
Pumping Energy Costs (183547 kW-hr @ 0.08 $/kW-hr)	$15,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$633,000**
Available Project Yield (acft/yr)	289
Annual Cost of Water ($ per acft), based on PF=2	$2,190
Annual Cost of Water After Debt Service ($ per acft), based on PF=2	$737
Annual Cost of Water ($ per 1,000 gallons), based on PF=2	$6.72
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=2	$2.26

Kiera Brown *10/28/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Buda and Hays County-Other - BSEACD Desalination and ASR - Saline Edwards

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	***Estimated Costs for Facilities***
Primary Pump Station (2.3 MGD)	$1,960,000
Transmission Pipeline (12 in dia., miles)	$1,340,000
Well Fields (Wells, Pumps, and Piping)	$3,410,000
Two Water Treatment Plants (0.9 MGD and 0.3 MGD)	$5,067,000
TOTAL COST OF FACILITIES	**$11,777,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$4,055,000
Environmental & Archaeology Studies and Mitigation	$261,000
Land Acquisition and Surveying (18 acres)	$125,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$446,000
TOTAL COST OF PROJECT	**$16,664,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$1,172,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$47,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$49,000
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$1,128,000
Advanced Water Treatment Facility	$0
Pumping Energy Costs (1318756 kW-hr @ 0.08 $/kW-hr)	$106,000
Purchase of Water (1300 acft/yr @ 26.07 $/acft)	$34,000
TOTAL ANNUAL COST	**$2,536,000**
Available Project Yield (acft/yr)	1,300
Annual Cost of Water ($ per acft), based on PF=2	$1,951
Annual Cost of Water After Debt Service ($ per acft), based on PF=2	$1,049
Annual Cost of Water ($ per 1,000 gallons), based on PF=2	$5.99
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=2	$3.22

KB *10/30/2019*

Cost Estimate Summary *Water Supply Project Option* *September 2018 Prices* *Vista Regional Project*	
Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018	
Item	***Estimated Costs for Facilities***
Primary Pump Station (0 MGD)	$1,146,000
Transmission Pipeline (0 in dia., miles)	$291,000
Water Treatment Plant (8.7 MGD)	$19,082,000
TOTAL COST OF FACILITIES	**$20,519,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$7,167,000
Environmental & Archaeology Studies and Mitigation	$359,000
Land Acquisition and Surveying (9 acres)	$67,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$774,000
TOTAL COST OF PROJECT	**$28,886,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$2,032,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$3,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$29,000
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$2,631,000
Advanced Water Treatment Facility	$0
Pumping Energy Costs (1786188 kW-hr @ 0.08 $/kW-hr)	$143,000
Purchase of Water (4884 acft/yr @ 145 $/acft)	$708,000
TOTAL ANNUAL COST	**$5,546,000**
Available Project Yield (acft/yr)	4,884
Annual Cost of Water ($ per acft), based on PF=2	$1,136
Annual Cost of Water After Debt Service ($ per acft), based on PF=2	$719
Annual Cost of Water ($ per 1,000 gallons), based on PF=2	$3.48
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=2	$2.21
Note: One or more cost element has been calculated externally	
Jaime Burke	*4/16/2019*

Cost Estimate Summary ***Water Supply Project Option*** ***September 2018 Prices*** ***Burnet County-Other - East Lake Buchanan Project***	
Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018	
Item	***Estimated Costs for Facilities***
Intake Pump Stations (1.7 MGD)	$390,000
Transmission Pipeline (10 in dia., miles)	$627,000
Water Treatment Plant (1.7 MGD)	$7,289,000
TOTAL COST OF FACILITIES	**$8,306,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$2,876,000
Environmental & Archaeology Studies and Mitigation	$361,000
Land Acquisition and Surveying (11 acres)	$62,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$320,000
TOTAL COST OF PROJECT	**$11,925,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$839,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$6,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$10,000
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$806,000
Advanced Water Treatment Facility	$0
Pumping Energy Costs (407953 kW-hr @ 0.08 $/kW-hr)	$33,000
Purchase of Water (935 acft/yr @ 145 $/acft)	$136,000
TOTAL ANNUAL COST	**$1,830,000**
Available Project Yield (acft/yr)	935
Annual Cost of Water ($ per acft), based on PF=2	$1,957
Annual Cost of Water After Debt Service ($ per acft), based on PF=2	$1,060
Annual Cost of Water ($ per 1,000 gallons), based on PF=2	$6.01
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=2	$3.25
Note: One or more cost element has been calculated externally	
Erin Hynes	*4/16/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
County Other - Burnet - Colorado, Marble Falls - Burnet - Colorado - Marble Falls RWS

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	***Estimated Costs for Facilities***
Intake Pump Stations (6.5 MGD)	$2,329,000
Transmission Pipeline (18 in dia., miles)	$2,131,000
Water Treatment Plant (10 MGD)	$35,932,000
TOTAL COST OF FACILITIES	**$40,392,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$14,030,000
Environmental & Archaeology Studies and Mitigation	$570,000
Land Acquisition and Surveying (15 acres)	$100,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$1,516,000
TOTAL COST OF PROJECT	**$56,608,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$3,983,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$21,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$58,000
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$2,970,000
Advanced Water Treatment Facility	$0
Pumping Energy Costs (2110663 kW-hr @ 0.08 $/kW-hr)	$169,000
Purchase of Water (5578 acft/yr @ 145 $/acft)	$809,000
TOTAL ANNUAL COST	**$8,010,000**
Available Project Yield (acft/yr)	5,578
Annual Cost of Water ($ per acft), based on PF=2	$1,436
Annual Cost of Water After Debt Service ($ per acft), based on PF=2	$722
Annual Cost of Water ($ per 1,000 gallons), based on PF=2	$4.41
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=2	$2.22

Note: One or more cost element has been calculated externally

Erin Hynes *4/17/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Hays - Water Purchase needing Infrastructure

Cost based on ENR CCI 11170.28 for September 2018 and
a PPI of 202.4 for September 2018

Item	***Estimated Costs for Facilities***
Transmission Pipeline (0 in dia., miles)	$134,000
TOTAL COST OF FACILITIES	**$134,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$40,000
Environmental & Archaeology Studies and Mitigation	$25,000
Land Acquisition and Surveying (6 acres)	$8,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$6,000
TOTAL COST OF PROJECT	**$213,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$15,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$1,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (18577 kW-hr @ 0.08 $/kW-hr)	$1,000
Purchase of Water (140 acft/yr @ 1411 $/acft)	$198,000
TOTAL ANNUAL COST	**$215,000**
Available Project Yield (acft/yr)	140
Annual Cost of Water ($ per acft), based on PF=2	$1,536
Annual Cost of Water After Debt Service ($ per acft), based on PF=2	$1,429
Annual Cost of Water ($ per 1,000 gallons), based on PF=2	$4.71
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=2	$4.38

JB *10/10/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Brush Management

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	Estimated Costs for Facilities
Integration, Relocations, & Other	$28,911,000
TOTAL COST OF FACILITIES	**$28,911,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 0% for all other facilities)	$0
Interest During Construction (3% for 1 years with a 0.5% ROI)	$796,000
TOTAL COST OF PROJECT	**$29,707,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$2,090,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$289,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (0 kW-hr @ 0.08 $/kW-hr)	$0
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$2,379,000**
Available Project Yield (acft/yr)	2,000
Annual Cost of Water ($ per acft), based on PF=1	$1,190
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$145
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$3.65
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$0.44

Note: One or more cost element has been calculated externally

JB/AS *10/2/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Buda - Direct Potable Reuse

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	***Estimated Costs for Facilities***
Advanced Water Treamtent Facility (2 MGD)	$24,148,000
TOTAL COST OF FACILITIES	**$24,148,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$8,452,000
Land Acquisition and Surveying (1 acres)	$6,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$897,000
TOTAL COST OF PROJECT	**$33,503,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$2,357,000
Operation and Maintenance	
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$2,042,000
Pumping Energy Costs (0 kW-hr @ 0.08 $/kW-hr)	$0
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$4,399,000**
Available Project Yield (acft/yr)	2,240
Annual Cost of Water ($ per acft), based on PF=1	$1,964
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$912
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$6.03
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$2.80
Note: One or more cost element has been calculated externally	
Kiera Brown	*9/24/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Dripping Springs - Direct Potable Reuse

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	***Estimated Costs for Facilities***
Advanced Water Treamtent Facility (0.5 MGD)	$8,736,000
TOTAL COST OF FACILITIES	**$8,736,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$3,058,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$325,000
TOTAL COST OF PROJECT	**$12,119,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$853,000
Operation and Maintenance	
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$593,000
Pumping Energy Costs (0 kW-hr @ 0.08 $/kW-hr)	$0
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$1,446,000**
Available Project Yield (acft/yr)	560
Annual Cost of Water ($ per acft), based on PF=1	$2,582
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$1,059
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$7.92
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$3.25

Kiera Brown *9/25/2019*

Cost Estimate Summary ***Water Supply Project Option*** ***September 2018 Prices*** ***Llano - Llano Direct Potable Reuse***	
Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018	
Item	***Estimated Costs for Facilities***
Primary Pump Station (0 MGD)	$798,000
Transmission Pipeline (0 in dia., miles)	$134,000
Advanced Water Treamtent Facility (0.25 MGD)	$6,500,000
TOTAL COST OF FACILITIES	**$7,432,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$2,595,000
Environmental & Archaeology Studies and Mitigation	$70,000
Land Acquisition and Surveying (9 acres)	$39,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$279,000
TOTAL COST OF PROJECT	**$10,415,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$733,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$1,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$20,000
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$297,000
Pumping Energy Costs (39426 kW-hr @ 0.08 $/kW-hr)	$3,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$1,054,000**
Available Project Yield (acft/yr)	280
Annual Cost of Water ($ per acft), based on PF=1	$3,764
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$1,146
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$11.55
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$3.52
Note: One or more cost element has been calculated externally	
Erin Hynes	*1/28/2020*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
West Travis County PUA - Direct Potable Reuse

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	***Estimated Costs for Facilities***
Primary Pump Station (0 MGD)	$870,000
Transmission Pipeline (0 in dia., miles)	$82,000
Transmission Pump Station(s) & Storage Tank(s)	$1,679,000
Advanced Water Treamtent Facility (0.3 MGD)	$2,975,000
TOTAL COST OF FACILITIES	**$5,606,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$1,958,000
Environmental & Archaeology Studies and Mitigation	$13,000
Land Acquisition and Surveying (5 acres)	$2,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$209,000
TOTAL COST OF PROJECT	**$7,788,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$548,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$9,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$44,000
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$356,000
Pumping Energy Costs (193185 kW-hr @ 0.08 $/kW-hr)	$15,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$972,000**
Available Project Yield (acft/yr)	336
Annual Cost of Water ($ per acft), based on PF=1	$2,893
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$1,262
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$8.88
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$3.87

Kiera Brown *9/25/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Blanco - Direct Reuse

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	Estimated Costs for Facilities
Primary Pump Station (0.1 MGD)	$739,000
Transmission Pipeline (8 in dia., miles)	$0
Storage Tanks (Other Than at Booster Pump Stations)	$31,000
TOTAL COST OF FACILITIES	**$770,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$270,000
Environmental & Archaeology Studies and Mitigation	$0
Land Acquisition and Surveying (16 acres)	$40,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$30,000
TOTAL COST OF PROJECT	**$1,110,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$78,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$0
Intakes and Pump Stations (2.5% of Cost of Facilities)	$18,000
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (88471 kW-hr @ 0.08 $/kW-hr)	$7,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$103,000**
Available Project Yield (acft/yr)	146
Annual Cost of Water ($ per acft), based on PF=1	$705
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$171
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$2.16
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$0.53

Note: One or more cost element has been calculated externally

Kiera Brown *10/6/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Horseshoe Bay - Direct Reuse - Horseshoe Bay

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	*Estimated Costs for Facilities*
Primary Pump Station (0.1 MGD)	$781,000
Transmission Pipeline (8 in dia., miles)	$0
TOTAL COST OF FACILITIES	**$781,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$273,000
Environmental & Archaeology Studies and Mitigation	$0
Land Acquisition and Surveying (14 acres)	$0
Interest During Construction (3% for 1 years with a 0.5% ROI)	$30,000
TOTAL COST OF PROJECT	**$1,084,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$76,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$0
Intakes and Pump Stations (2.5% of Cost of Facilities)	$20,000
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (93541 kW-hr @ 0.08 $/kW-hr)	$7,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$103,000**
Available Project Yield (acft/yr)	154
Annual Cost of Water ($ per acft), based on PF=1	$669
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$175
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$2.05
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$0.54

Kiera Brown *9/11/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Marble Falls - Direct Reuse

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	Estimated Costs for Facilities
Primary Pump Station (0.5 MGD)	$887,000
Transmission Pipeline (8 in dia., miles)	$0
Storage Tanks (Other Than at Booster Pump Stations)	$93,000
TOTAL COST OF FACILITIES	**$980,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$343,000
Environmental & Archaeology Studies and Mitigation	$13,000
Land Acquisition and Surveying (17 acres)	$14,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$38,000
TOTAL COST OF PROJECT	**$1,388,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$98,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$1,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$22,000
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (335267 kW-hr @ 0.08 $/kW-hr)	$27,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$148,000**
Available Project Yield (acft/yr)	500
Annual Cost of Water ($ per acft), based on PF=1	$296
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$100
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$0.91
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$0.31

Note: One or more cost element has been calculated externally

Kiera Brown *9/12/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Fredericksburg - Direct Reuse

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	***Estimated Costs for Facilities***
Integration, Relocations, & Other	$7,335,000
TOTAL COST OF FACILITIES	**$7,335,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$2,567,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$273,000
TOTAL COST OF PROJECT	**$10,175,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$716,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$73,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (0 kW-hr @ 0.08 $/kW-hr)	$0
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$789,000**
Available Project Yield (acft/yr)	132
Annual Cost of Water ($ per acft), based on PF=1	$5,977
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$553
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$18.34
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$1.70

Note: One or more cost element has been calculated externally

Kiera Brown *9/11/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Dripping Springs WSC - Dripping Springs - Direct Reuse

Cost based on ENR CCI 11170.28 for September 2018 and
a PPI of 202.4 for September 2018

Item	***Estimated Costs for Facilities***
Primary Pump Station (0.6 MGD)	$952,000
Transmission Pipeline (8 in dia., miles)	$0
Storage Tanks (Other Than at Booster Pump Stations)	$93,000
TOTAL COST OF FACILITIES	**$1,045,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$366,000
Environmental & Archaeology Studies and Mitigation	$0
Land Acquisition and Surveying (19 acres)	$0
Interest During Construction (3% for 1 years with a 0.5% ROI)	$39,000
TOTAL COST OF PROJECT	**$1,450,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$102,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$1,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$24,000
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (530424 kW-hr @ 0.08 $/kW-hr)	$42,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$169,000**
Available Project Yield (acft/yr)	672
Annual Cost of Water ($ per acft), based on PF=1	$251
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$100
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$0.77
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$0.31

Note: One or more cost element has been calculated externally

Kiera Brown *9/12/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
West Travis County PUA - Direct Reuse - West Travis County PUA

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	Estimated Costs for Facilities
Primary Pump Station (0.2 MGD)	$0
Transmission Pipeline (6 in dia., miles)	$0
Storage Tanks (Other Than at Booster Pump Stations)	$31,000
TOTAL COST OF FACILITIES	**$31,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$11,000
Environmental & Archaeology Studies and Mitigation	$76,000
Land Acquisition and Surveying (17 acres)	$83,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$6,000
TOTAL COST OF PROJECT	**$207,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$15,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$0
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (146007 kW-hr @ 0.08 $/kW-hr)	$12,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$27,000**
Available Project Yield (acft/yr)	224
Annual Cost of Water ($ per acft), based on PF=2	$121
Annual Cost of Water After Debt Service ($ per acft), based on PF=2	$54
Annual Cost of Water ($ per 1,000 gallons), based on PF=2	$0.37
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=2	$0.16

Note: One or more cost element has been calculated externally

Kiera Brown *9/12/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Lago Vista - Direct Reuse

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	***Estimated Costs for Facilities***
Primary Pump Station (0.6 MGD)	$0
Transmission Pipeline (8 in dia., miles)	$0
Storage Tanks (Other Than at Booster Pump Stations)	$93,000
Water Treatment Plant (0.6 MGD)	$60,000
TOTAL COST OF FACILITIES	**$153,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$53,000
Environmental & Archaeology Studies and Mitigation	$0
Land Acquisition and Surveying (20 acres)	$0
Interest During Construction (3% for 1 years with a 0.5% ROI)	$6,000
TOTAL COST OF PROJECT	**$212,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$15,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$1,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$36,000
Advanced Water Treatment Facility	$0
Pumping Energy Costs (521696 kW-hr @ 0.08 $/kW-hr)	$42,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$94,000**
Available Project Yield (acft/yr)	673
Annual Cost of Water ($ per acft), based on PF=1	$140
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$117
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$0.43
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$0.36

Note: One or more cost element has been calculated externally

Kiera Brown *9/10/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Lakeway MUD - Direct Reuse

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	***Estimated Costs for Facilities***
Primary Pump Station (0.8 MGD)	$0
Transmission Pipeline (8 in dia., miles)	$0
Transmission Pump Station(s) & Storage Tank(s)	$0
Storage Tanks (Other Than at Booster Pump Stations)	$1,952,000
TOTAL COST OF FACILITIES	**$1,952,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$683,000
Environmental & Archaeology Studies and Mitigation	$13,000
Land Acquisition and Surveying (20 acres)	$14,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$74,000
TOTAL COST OF PROJECT	**$2,736,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$192,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$20,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (791395 kW-hr @ 0.08 $/kW-hr)	$63,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$275,000**
Available Project Yield (acft/yr)	900
Annual Cost of Water ($ per acft), based on PF=1	$306
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$92
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$0.94
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$0.28

Kiera Brown *9/30/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Travis County WCID 17 - Direct Reuse

Cost based on ENR CCI 11170.28 for September 2018 and
a PPI of 202.4 for September 2018

Item	***Estimated Costs for Facilities***
Primary Pump Station (0 MGD)	$1,246,000
Transmission Pipeline (0 in dia., miles)	$0
Storage Tanks (Other Than at Booster Pump Stations)	$5,264,000
TOTAL COST OF FACILITIES	**$6,510,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (35% for pipes & 35% for all other facilities)	$2,278,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$242,000
TOTAL COST OF PROJECT	**$9,030,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$635,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$53,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$31,000
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (0 kW-hr @ 0.08 $/kW-hr)	$0
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$719,000**
Available Project Yield (acft/yr)	510
Annual Cost of Water ($ per acft), based on PF=1	$1,410
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$165
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$4.33
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$0.51

Note: One or more cost element has been calculated externally

Kiera Brown *9/11/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Steam Electric, Matagorda, Colorado - Alternate Canal Delivery

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	***Estimated Costs for Facilities***
Primary Pump Station (0 MGD)	$3,704,000
Transmission Pipeline (0 in dia., miles)	$732,000
TOTAL COST OF FACILITIES	**$4,436,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$1,516,000
Environmental & Archaeology Studies and Mitigation	$21,000
Land Acquisition and Surveying (5 acres)	$20,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$165,000
TOTAL COST OF PROJECT	**$6,158,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$433,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$7,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$93,000
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (931970 kW-hr @ 0.08 $/kW-hr)	$75,000
Purchase of Water (12727 acft/yr @ 135 $/acft)	$1,718,000
TOTAL ANNUAL COST	**$2,326,000**
Available Project Yield (acft/yr)	12,727
Annual Cost of Water ($ per acft), based on PF=4	$183
Annual Cost of Water After Debt Service ($ per acft), based on PF=4	$149
Annual Cost of Water ($ per 1,000 gallons), based on PF=4	$0.56
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=4	$0.46

JB *2/13/2020*

Cost Estimate Summary *Water Supply Project Option* *September 2018 Prices* *LCRA - Alternative Expand Use of GW in Bastrop County (Carrizo-Wilcox Aquifer)*	
Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018	
Item	***Estimated Costs for Facilities***
Primary Pump Station (0 MGD)	$4,768,000
Transmission Pipeline (0 in dia., miles)	$6,715,000
Well Fields (Wells, Pumps, and Piping)	$15,756,000
TOTAL COST OF FACILITIES	**$27,239,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$9,198,000
Environmental & Archaeology Studies and Mitigation	$496,000
Land Acquisition and Surveying (27 acres)	$185,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$1,021,000
TOTAL COST OF PROJECT	**$38,139,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$2,683,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$225,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$119,000
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (17850223 kW-hr @ 0.08 $/kW-hr)	$1,428,000
Purchase of Water (25000 acft/yr @ 11.4 $/acft)	$285,000
TOTAL ANNUAL COST	**$4,740,000**
Available Project Yield (acft/yr)	25,000
Annual Cost of Water ($ per acft), based on PF=1	$190
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$82
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$0.58
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$0.25
Kiera Brown	*12/26/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
LCRA - LCRA Brackish Groundwater Desalination Strategy

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	*Estimated Costs for Facilities*
Primary Pump Station	$8,881,000
Transmission Pipeline	$20,020,000
Well Fields (Wells, Pumps, and Piping)	$69,033,000
Storage Tanks (Other Than at Booster Pump Stations)	$1,736,000
Water Treatment Plant (25 MGD)	$65,377,000
TOTAL COST OF FACILITIES	**$165,047,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$56,766,000
Environmental & Archaeology Studies and Mitigation	$806,000
Land Acquisition and Surveying (57 acres)	$257,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$6,130,000
TOTAL COST OF PROJECT	**$229,006,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$16,113,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$908,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$222,000
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$11,887,000
Advanced Water Treatment Facility	$0
Pumping Energy Costs (25862457 kW-hr @ 0.08 $/kW-hr)	$2,069,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$31,199,000**
Available Project Yield (acft/yr)	22,400
Annual Cost of Water ($ per acft), based on PF=1	$1,393
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$673
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$4.27
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$2.07

Erin Hynes *10/15/2019*

Cost Estimate Summary ***Water Supply Project Option*** ***September 2018 Prices*** ***LCRA - Alternative Supplement Environmental Flows with Brackish Groundwater***	
Cost based on ENR CCI 202.4 for September 2018 and ***a PPI of for November 1932***	
Item	***Estimated Costs for Facilities***
CAPITAL COST	
Well Fields (Wells, Pumps, and Piping)	$26,073,000
TOTAL COST OF FACILITIES	**$26,073,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (externally calculated; includes mobilization)	$19,293,000
Environmental & Archaeology Studies and Mitigation	$570,000
Land Acquisition and Surveying	$137,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$1,196,000
TOTAL COST OF PROJECT	**$47,269,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$3,142,000
Reservoir Debt Service (3.5 percent, 40 years)	$0
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (3% of Cost of Facilities)	$782,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Well Pump Replacement	$657,000
Pumping Energy Costs (7500636 kW-hr @ 0.08 $/kW-hr)	$600,000
WR Royalty Payment (12000 acft/yr @ 100 $/acft)	$1,200,000
TOTAL ANNUAL COST	**$6,381,000**
Available Project Yield (acft/yr)	12,000
Annual Cost of Water ($ per acft), based on PF=1	$532
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$270
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$1.63
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$0.83
Note: One or more cost element has been calculated externally	
Kiera Brown	*8/26/2019*

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices
Alternative Aqua WSC - Carrizo-Wilcox Aquifer - Expand Local Use of Groundwater

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018

Item	**_Estimated Costs for Facilities_**
Primary Pump Station (23.9 MGD)	$8,227,000
Transmission Pipeline (42 in dia., miles)	$2,532,000
Well Fields (Wells, Pumps, and Piping)	$16,077,000
TOTAL COST OF FACILITIES	**$26,836,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$9,266,000
Environmental & Archaeology Studies and Mitigation	$421,000
Land Acquisition and Surveying (32 acres)	$150,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$1,009,000
TOTAL COST OF PROJECT	**$37,682,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$2,651,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$186,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$206,000
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (11985938 kW-hr @ 0.08 $/kW-hr)	$959,000
Purchase of Water (19121 acft/yr @ 11.4 $/acft)	$218,000
TOTAL ANNUAL COST	**$4,220,000**
Available Project Yield (acft/yr)	19,121
Annual Cost of Water ($ per acft), based on PF=2	$221
Annual Cost of Water After Debt Service ($ per acft), based on PF=2	$82
Annual Cost of Water ($ per 1,000 gallons), based on PF=2	$0.68
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=2	$0.25

Kiera Brown *8/15/2019*

APPENDIX 5E

TWDB DB22 REPORTS

WUG Unmet Needs Summary

WUG Unmet Needs

WUG Recommended Water Management Strategies

Recommended Projects Associated with Water Management Strategies

WUG Alternative Water Management Strategies

Alternative Projects Associated with Water Management Strategies

Major Water Provider Water Management Strategy Summary

Region K Water User Group (WUG) Unmet Needs Summary

WUG supplies and projected demands are entered for each of a WUG's region-county-basin divisions. The unmet needs shown in the WUG Unmet Needs Summary report are calculated by first deducting the WUG split's projected demand from the sum of its total existing water supply volume and all associated recommended water management strategy water volumes. If the WUG split has a greater future supply volume than projected demand in any given decade, this amount is considered a surplus volume. Before aggregating the difference between supplies and demands to the WUG category level, calculated surpluses are updated to zero so that only the WUGs with unmet needs in the decade are included with the Needs totals. Unmet needs water volumes are shown as absolute values.

WUG CATEGORY	NEEDS (ACRE-FEET PER YEAR)					
	2020	2030	2040	2050	2060	2070
MUNICIPAL	0	0	0	0	0	0
COUNTY-OTHER	0	0	0	0	0	0
MANUFACTURING	0	0	0	0	0	0
MINING	449	3,947	4,557	3,220	0	0
STEAM ELECTRIC POWER	4,971	4,971	4,971	4,971	4,971	4,971
LIVESTOCK	0	0	0	0	0	0
IRRIGATION	75,896	84,490	70,054	62,648	53,500	44,455

Region K Water User Group (WUG) Unmet Needs

WUG supplies and projected demands are entered for each of a WUG's region-county-basin divisions. The unmet needs shown in the WUG Unmet Needs report are calculated by first deducting the WUG split's projected demand from the sum of its total existing water supply volume and all associated recommended water management strategy water volumes. If the WUG split has a greater future supply volume than projected demand in any given decade, this amount is considered a surplus volume. In order to display only unmet needs associated with the WUG split, these surplus volumes are updated to a zero and the unmet needs water volumes are shown as absolute values.

	WUG UNMET NEEDS (ACRE-FEET PER YEAR)					
	2020	2030	2040	2050	2060	2070
BASTROP COUNTY - COLORADO BASIN						
MINING	449	3,947	4,557	3,220	0	0
COLORADO COUNTY - BRAZOS-COLORADO BASIN						
IRRIGATION	2,886	2,811	1,217	0	0	0
COLORADO COUNTY - COLORADO BASIN						
STEAM ELECTRIC POWER	228	228	228	228	228	228
IRRIGATION	1,124	635	0	0	0	0
COLORADO COUNTY - LAVACA BASIN						
STEAM ELECTRIC POWER	4,743	4,743	4,743	4,743	4,743	4,743
IRRIGATION	1,761	1,055	0	0	0	0
MATAGORDA COUNTY - BRAZOS-COLORADO BASIN						
IRRIGATION	34,428	37,223	33,935	31,579	27,033	22,537
MATAGORDA COUNTY - COLORADO-LAVACA BASIN						
IRRIGATION	33,487	36,071	32,689	30,228	25,623	21,070
MILLS COUNTY - BRAZOS BASIN						
IRRIGATION	829	833	837	841	844	848
WHARTON COUNTY - BRAZOS-COLORADO BASIN						
IRRIGATION*	0	3,173	380	0	0	0
WHARTON COUNTY - COLORADO BASIN						
IRRIGATION*	1,381	2,689	996	0	0	0

*A single asterisk next to a WUG's name denotes that the WUG is split by two or more planning regions.

Region K Recommended Water User Group (WUG) Water Management Strategies (WMS)

						WATER MANAGEMENT STRATEGY SUPPLY (ACRE-FEET PER YEAR)					
WUG ENTITY NAME	WMS SPONSOR REGION	WMS NAME	SOURCE NAME	UNIT COST 2020	UNIT COST 2070	2020	2030	2040	2050	2060	2070
AQUA WSC*	K	DOWNSTREAM RETURN FLOWS	K | COLORADO INDIRECT REUSE	N/A	$145	0	0	0	0	0	1,200
AQUA WSC*	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	1,971	2,558	3,380	4,321	5,670	7,447
AQUA WSC*	K	EXPANDED USE OF LOCAL GROUNDWATER	K | CARRIZO-WILCOX AQUIFER | BASTROP COUNTY	N/A	$1001	0	300	350	550	800	800
AQUA WSC*	K	LCRA - IMPORT RETURN FLOWS FROM WILLIAMSON COUNTY	G | BRAZOS RUN-OF-RIVER	N/A	$145	0	0	2,500	6,000	12,000	18,800
AQUA WSC*	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$3167	N/A	464	274	128	36	0	0
AQUA WSC*	L	MUNICIPAL WATER CONSERVATION	DEMAND REDUCTION	$770	$770	8	13	20	30	45	63
AUSTIN	K	AUSTIN - AQUIFER STORAGE AND RECOVERY	K | CARRIZO-WILCOX AQUIFER ASR | BASTROP COUNTY	N/A	$2234	0	0	7,900	10,500	13,200	15,800
AUSTIN	K	AUSTIN - BLACKWATER AND GREYWATER REUSE	K | DIRECT NON-POTABLE REUSE	N/A	$2534	0	1,450	3,450	5,400	7,340	9,290
AUSTIN	K	AUSTIN - BRACKISH GROUNDWATER DESALINATION	K | EDWARDS-BFZ AQUIFER SALINE | TRAVIS COUNTY	N/A	$2995	0	0	0	0	0	2,700
AUSTIN	K	AUSTIN - BRACKISH GROUNDWATER DESALINATION	K | TRINITY AQUIFER FRESH/BRACKISH | TRAVIS COUNTY	N/A	$2995	0	0	0	0	0	2,300
AUSTIN	K	AUSTIN - CAPTURE LOCAL INFLOWS TO LADY BIRD LAKE	K | COLORADO RUN-OF-RIVER	N/A	$213	0	0	3,000	3,000	3,000	3,000
AUSTIN	K	AUSTIN - CENTRALIZED DIRECT NON-POTABLE REUSE	K | DIRECT NON-POTABLE REUSE	$995	$995	500	2,990	10,250	14,583	18,917	23,250
AUSTIN	K	AUSTIN - COMMUNITY-SCALE STORMWATER HARVESTING	K | RAINWATER HARVESTING	N/A	$645	0	66	158	184	210	236
AUSTIN	K	AUSTIN - CONSERVATION	DEMAND REDUCTION	$1343	$1343	4,910	14,890	24,870	30,120	35,370	40,620
AUSTIN	K	AUSTIN - DECENTRALIZED DIRECT NON-POTABLE REUSE	K | DIRECT NON-POTABLE REUSE	N/A	$366	0	1,400	4,160	8,330	12,510	16,680
AUSTIN	K	AUSTIN - INDIRECT POTABLE REUSE THROUGH LADY BIRD LAKE	K | COLORADO INDIRECT REUSE	N/A	$457	0	0	11,000	14,000	17,000	20,000
AUSTIN	K	AUSTIN - LAKE AUSTIN OPERATIONS	K | COLORADO RUN-OF-RIVER	$436	$436	1,250	1,250	1,250	1,250	1,250	1,250
AUSTIN	K	AUSTIN - LONGHORN DAM OPERATION IMPROVEMENTS	K | COLORADO RUN-OF-RIVER	N/A	$36	0	3,000	3,000	3,000	3,000	3,000
AUSTIN	K	AUSTIN - OFF-CHANNEL RESERVOIR AND EVAPORATION SUPPRESSION	K | AUSTIN OFF-CHANNEL LAKE/RESERVOIR	N/A	$1018	0	0	0	0	0	25,827
AUSTIN	K	AUSTIN - ONSITE RAINWATER AND STORMWATER HARVESTING	K | RAINWATER HARVESTING	N/A	$1165	0	790	1,880	2,890	3,890	4,900
AUSTIN	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	8,266	9,708	11,281	12,423	13,389	14,666
BARTON CREEK WEST WSC	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	79	71	64	58	52	47
BARTON CREEK WEST WSC	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$429	$429	39	76	109	139	167	193
BARTON CREEK WSC	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	119	127	131	130	125	121
BARTON CREEK WSC	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$397	$397	47	110	183	258	330	409

*A single asterisk next to a WUG's name denotes that the WUG is split by two or more planning regions.

Region K Recommended Water User Group (WUG) Water Management Strategies (WMS)

						WATER MANAGEMENT STRATEGY SUPPLY (ACRE-FEET PER YEAR)					
WUG ENTITY NAME	WMS SPONSOR REGION	WMS NAME	SOURCE NAME	UNIT COST 2020	UNIT COST 2070	2020	2030	2040	2050	2060	2070
BARTON CREEK WSC	K	WATER PURCHASE AMENDMENT - BARTON CREEK WSC	K | HIGHLAND LAKES LAKE/RESERVOIR SYSTEM	$1629	$1629	90	90	90	90	90	90
BASTROP	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	372	471	631	849	1,143	1,534
BASTROP	K	LCRA - IMPORT RETURN FLOWS FROM WILLIAMSON COUNTY	G | BRAZOS RUN-OF-RIVER	N/A	$145	0	0	0	1,000	2,500	4,000
BASTROP	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$1109	$1109	184	355	433	558	744	992
BASTROP COUNTY WCID 2	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	24	35	49	68	94	129
BASTROP COUNTY WCID 2	K	LCRA - IMPORT RETURN FLOWS FROM WILLIAMSON COUNTY	G | BRAZOS RUN-OF-RIVER	N/A	$145	0	0	0	0	500	1,500
BASTROP COUNTY WCID 2	K	MUNICIPAL CONSERVATION - BASTROP	DEMAND REDUCTION	N/A	$250	0	0	0	0	93	125
BAY CITY	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	583	594	597	606	615	622
BAY CITY	K	EXPANDED USE OF LOCAL GROUNDWATER	K | GULF COAST AQUIFER SYSTEM | MATAGORDA COUNTY	N/A	$53	0	75	75	75	75	75
BERTRAM	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	78	85	88	89	94	101
BERTRAM	K	EXPANDED USE OF LOCAL GROUNDWATER	K | ELLENBURGER-SAN SABA AQUIFER | BURNET COUNTY	N/A	$1235	0	750	2,000	2,000	2,000	2,000
BERTRAM	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$541	$541	39	85	142	205	238	257
BLANCO	K	DIRECT REUSE	K | DIRECT NON-POTABLE REUSE	N/A	$705	0	146	146	146	146	146
BLANCO	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	63	55	60	63	65	66
BLANCO	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	N/A	$5265	0	27	23	21	21	21
BOLING MWD	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	12	9	7	6	6	6
BRIARCLIFF	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	60	68	76	85	93	106
BROOKESMITH SUD*	F	WATER AUDITS AND LEAK - BROOKESMITH SUD	DEMAND REDUCTION	$2569	$2711	1	1	1	1	1	1
BROOKESMITH SUD*	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	1	1	1	1	2	2
BUDA*	K	DIRECT POTABLE REUSE	K | DIRECT POTABLE REUSE	N/A	$1440	0	2,240	2,240	2,240	2,240	2,240
BUDA*	K	DIRECT REUSE	K | DIRECT NON-POTABLE REUSE	N/A	$0	0	920	520	520	880	680
BUDA*	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	322	443	607	813	1,045	1,309
BUDA*	K	EDWARDS / MIDDLE TRINITY ASR	K | TRINITY AQUIFER ASR | HAYS COUNTY	$1398	$1398	150	600	600	600	600	600
BUDA*	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$1148	$1148	159	292	382	499	636	793
BUDA*	K	SALINE EDWARDS DESALINATION AND ASR	K | EDWARDS-BFZ AQUIFER (SALINE PORTION) ASR | TRAVIS COUNTY	N/A	$1951	0	0	800	800	800	800
BUDA*	L	ARWA - PHASE 2	L | CARRIZO-WILCOX AQUIFER | CALDWELL COUNTY	N/A	$200	0	0	1,067	1,067	1,067	1,067
BUDA*	L	ARWA - PHASE 3	L | DIRECT NON-POTABLE REUSE	N/A	$1995	0	0	0	0	157	157
BUDA*	L	ARWA/GBRA PROJECT (PHASE 1)	L | CARRIZO-WILCOX AQUIFER | CALDWELL COUNTY	$1430	$358	762	762	762	762	762	762
BUDA*	L	MUNICIPAL WATER CONSERVATION	DEMAND REDUCTION	$681	$681	11	42	61	90	126	172
BURNET	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	302	329	339	362	397	427

*A single asterisk next to a WUG's name denotes that the WUG is split by two or more planning regions.

Region K Recommended Water User Group (WUG) Water Management Strategies (WMS)

						WATER MANAGEMENT STRATEGY SUPPLY (ACRE-FEET PER YEAR)					
WUG ENTITY NAME	WMS SPONSOR REGION	WMS NAME	SOURCE NAME	UNIT COST 2020	UNIT COST 2070	2020	2030	2040	2050	2060	2070
BURNET	K	LCRA - EXCESS FLOWS RESERVOIR	K | LCRA NEW OFF-CHANNEL RESERVOIR (2030 DECADE)	N/A	$719	0	1,000	2,000	2,000	2,000	2,000
BURNET	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$684	$684	150	330	545	694	757	813
CANEY CREEK MUD OF MATAGORDA COUNTY	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	26	19	13	13	13	13
CANYON LAKE WATER SERVICE*	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	11	14	16	20	23	27
CANYON LAKE WATER SERVICE*	L	GBRA - MBWSP	L | CARRIZO-WILCOX AQUIFER ASR FRESH/BRACKISH | GONZALES COUNTY	N/A	$442	0	0	0	0	0	3
CANYON LAKE WATER SERVICE*	L	MUNICIPAL WATER CONSERVATION	DEMAND REDUCTION	N/A	$681	0	0	0	1	6	9
CEDAR PARK*	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	410	393	393	393	393	393
CEDAR PARK*	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$824	$824	203	420	590	586	583	582
CIMARRON PARK WATER	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	18	12	12	11	11	11
COLUMBUS	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	206	194	180	169	157	146
COLUMBUS	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$537	$537	102	195	286	384	484	581
CORIX UTILITIES TEXAS INC*	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	77	82	86	89	93	98
CORIX UTILITIES TEXAS INC*	K	EXPANDED USE OF LOCAL GROUNDWATER	K | GULF COAST AQUIFER SYSTEM | COLORADO COUNTY	N/A	$50	0	0	0	1	2	4
COTTONWOOD CREEK MUD 1	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	5	5	6	6	7	7
COTTONWOOD SHORES	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	45	53	61	68	75	80
COTTONWOOD SHORES	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$2512	$2512	22	26	27	28	29	32
COUNTY-OTHER, BASTROP	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	258	283	332	398	489	610
COUNTY-OTHER, BASTROP	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$1264	$1264	128	204	225	263	317	392
COUNTY-OTHER, BLANCO	K	BRUSH MANAGEMENT	K | TRINITY AQUIFER | BLANCO COUNTY	N/A	$1190	0	708	708	708	708	708
COUNTY-OTHER, BLANCO	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	123	114	103	98	95	94
COUNTY-OTHER, BURNET	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	683	759	759	834	904	968
COUNTY-OTHER, BURNET	K	LCRA - EXCESS FLOWS RESERVOIR	K | LCRA NEW OFF-CHANNEL RESERVOIR (2030 DECADE)	N/A	$779	0	3,141	5,397	5,397	5,397	5,397
COUNTY-OTHER, BURNET	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$2090	$2090	175	253	198	190	195	205
COUNTY-OTHER, COLORADO	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	170	135	106	92	92	93
COUNTY-OTHER, COLORADO	K	EXPANDED USE OF LOCAL GROUNDWATER	K | GULF COAST AQUIFER SYSTEM | COLORADO COUNTY	N/A	$1218	0	133	133	133	133	133
COUNTY-OTHER, FAYETTE	K	DEVELOPMENT OF NEW GROUNDWATER SUPPLIES	K | SPARTA AQUIFER | FAYETTE COUNTY	$1693	$1693	400	400	400	400	400	400
COUNTY-OTHER, FAYETTE	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	189	177	161	156	159	163
COUNTY-OTHER, FAYETTE	K	EXPANDED USE OF LOCAL GROUNDWATER	K | GULF COAST AQUIFER SYSTEM | FAYETTE COUNTY	$49	$49	1	1	20	41	41	41

*A single asterisk next to a WUG's name denotes that the WUG is split by two or more planning regions.

Region K Recommended Water User Group (WUG) Water Management Strategies (WMS)

						WATER MANAGEMENT STRATEGY SUPPLY (ACRE-FEET PER YEAR)					
WUG ENTITY NAME	WMS SPONSOR REGION	WMS NAME	SOURCE NAME	UNIT COST 2020	UNIT COST 2070	2020	2030	2040	2050	2060	2070
COUNTY-OTHER, FAYETTE	K	EXPANDED USE OF LOCAL GROUNDWATER	K | SPARTA AQUIFER | FAYETTE COUNTY	N/A	$1127	0	40	98	145	180	204
COUNTY-OTHER, GILLESPIE	K	BRUSH MANAGEMENT	K | EDWARDS-TRINITY-PLATEAU, PECOS VALLEY, AND TRINITY AQUIFERS | GILLESPIE COUNTY	N/A	$1190	0	1,125	1,125	1,125	1,125	1,125
COUNTY-OTHER, GILLESPIE	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	150	109	94	99	104	109
COUNTY-OTHER, HAYS*	K	BRUSH MANAGEMENT	K | TRINITY AQUIFER | HAYS COUNTY	N/A	$1190	0	83	83	83	83	83
COUNTY-OTHER, HAYS*	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	158	103	132	155	176	243
COUNTY-OTHER, HAYS*	K	EDWARDS / MIDDLE TRINITY ASR	K | TRINITY AQUIFER ASR | HAYS COUNTY	N/A	$2190	0	289	289	289	289	289
COUNTY-OTHER, HAYS*	K	EXPANDED USE OF LOCAL GROUNDWATER	K | TRINITY AQUIFER | HAYS COUNTY	N/A	$1180	0	0	0	0	0	200
COUNTY-OTHER, HAYS*	K	RAINWATER HARVESTING	K | RAINWATER HARVESTING	N/A	$24962	0	16	24	31	36	50
COUNTY-OTHER, HAYS*	K	SALINE EDWARDS DESALINATION AND ASR	K | EDWARDS-BFZ AQUIFER (SALINE PORTION) ASR | TRAVIS COUNTY	N/A	$1951	0	0	500	500	500	500
COUNTY-OTHER, HAYS*	L	GBRA - MBWSP	L | CARRIZO-WILCOX AQUIFER ASR FRESH/BRACKISH | GONZALES COUNTY	N/A	$442	0	1,000	1,000	1,000	1,000	1,000
COUNTY-OTHER, LLANO	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	13	10	11	11	10	9
COUNTY-OTHER, MATAGORDA	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	52	53	52	53	53	53
COUNTY-OTHER, MILLS	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	50	41	32	31	31	32
COUNTY-OTHER, SAN SABA	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	44	44	43	43	43	44
COUNTY-OTHER, TRAVIS	K	BRUSH MANAGEMENT	K | TRINITY AQUIFER FRESH/BRACKISH | TRAVIS COUNTY	N/A	$1190	0	83	83	83	83	83
COUNTY-OTHER, TRAVIS	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	232	221	214	206	197	192
COUNTY-OTHER, TRAVIS	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$7585	$7585	29	55	79	102	123	142
COUNTY-OTHER, WHARTON*	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	315	269	234	239	243	249
COUNTY-OTHER, WILLIAMSON*	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	13	19	18	17	16	15
CREEDMOOR-MAHA WSC*	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	31	33	35	38	41	45
CREEDMOOR-MAHA WSC*	K	EDWARDS / MIDDLE TRINITY ASR	K | TRINITY AQUIFER ASR | HAYS COUNTY	N/A	$2190	0	289	289	289	289	289
CREEDMOOR-MAHA WSC*	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$2506	$2506	32	39	59	92	99	106
CREEDMOOR-MAHA WSC*	K	WATER PURCHASE AMENDMENT - CREEDMOOR-MAHA WSC	K | CARRIZO-WILCOX AQUIFER | BASTROP COUNTY	N/A	$1222	0	0	335	335	335	335
CYPRESS RANCH WCID 1	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	6	6	7	7	7	7
CYPRESS RANCH WCID 1	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$2502	$2502	6	9	14	20	21	20
DEER CREEK RANCH WATER	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	3	3	5	5	5	5

*A single asterisk next to a WUG's name denotes that the WUG is split by two or more planning regions.

Region K Recommended Water User Group (WUG) Water Management Strategies (WMS)

						WATER MANAGEMENT STRATEGY SUPPLY (ACRE-FEET PER YEAR)					
WUG ENTITY NAME	WMS SPONSOR REGION	WMS NAME	SOURCE NAME	UNIT COST 2020	UNIT COST 2070	2020	2030	2040	2050	2060	2070
DRIPPING SPRINGS WSC	K	DIRECT POTABLE REUSE	K | DIRECT POTABLE REUSE	N/A	$2582	0	560	560	560	560	560
DRIPPING SPRINGS WSC	K	DIRECT REUSE	K | DIRECT NON-POTABLE REUSE	N/A	$251	0	390	460	531	601	672
DRIPPING SPRINGS WSC	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	351	580	753	972	1,239	1,380
DRIPPING SPRINGS WSC	K	EXPANDED USE OF LOCAL GROUNDWATER	K | TRINITY AQUIFER | HAYS COUNTY	N/A	$1023	0	0	300	300	300	300
DRIPPING SPRINGS WSC	K	LCRA - MID BASIN RESERVOIR	K | LCRA NEW OFF-CHANNEL RESERVOIR (2030 DECADE)	N/A	$145	0	0	0	1,000	2,000	2,000
DRIPPING SPRINGS WSC	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$1593	$1593	174	289	339	417	522	576
DRIPPING SPRINGS WSC	K	RAINWATER HARVESTING	K | RAINWATER HARVESTING	N/A	$24961	0	34	44	57	73	81
EAGLE LAKE	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	98	86	78	73	75	77
EL CAMPO*	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	1	1	1	1	1	1
ELGIN	K	DEVELOPMENT OF NEW GROUNDWATER SUPPLIES	K | TRINITY AQUIFER | TRAVIS COUNTY	N/A	$953	0	0	0	0	1,000	1,050
ELGIN	K	DEVELOPMENT OF NEW GROUNDWATER SUPPLIES	K | TRINITY AQUIFER FRESH/BRACKISH | TRAVIS COUNTY	N/A	$953	0	0	0	0	0	775
ELGIN	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	254	258	239	190	247	321
ELGIN	K	EXPANDED USE OF LOCAL GROUNDWATER	K | CARRIZO-WILCOX AQUIFER | BASTROP COUNTY	N/A	$80	0	0	0	0	50	50
ELGIN	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$1208	$1208	79	144	271	486	625	807
FAYETTE COUNTY WCID MONUMENT HIL	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	33	32	31	30	30	31
FAYETTE COUNTY WCID MONUMENT HIL	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$563	$563	17	33	50	68	75	78
FAYETTE WSC	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	144	149	151	155	161	166
FLATONIA	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	63	65	64	69	72	74
FLATONIA	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$1154	$1154	31	63	90	92	96	99
FREDERICKSBURG	K	DIRECT REUSE	K | DIRECT NON-POTABLE REUSE	N/A	$5977	0	132	132	132	132	132
FREDERICKSBURG	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	610	589	560	535	508	504
FREDERICKSBURG	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$574	$574	302	598	903	1,234	1,578	1,802
GARFIELD WSC	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	10	12	13	14	15	16
GARFIELD WSC	K	EXPANDED USE OF LOCAL GROUNDWATER	K | TRINITY AQUIFER | TRAVIS COUNTY	N/A	$85	0	0	0	7	26	47
GEORGETOWN*	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	15	17	17	19	20	22
GEORGETOWN*	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$1326	$1326	8	17	28	35	39	41
GOFORTH SUD*	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	8	11	13	17	21	26
GOFORTH SUD*	L	ARWA/GBRA PROJECT (PHASE 1)	L | CARRIZO-WILCOX AQUIFER | CALDWELL COUNTY	$721	$283	115	101	97	130	204	281
GOFORTH SUD*	L	ARWA/GBRA PROJECT (PHASE 1)	L | CARRIZO-WILCOX AQUIFER FRESH/BRACKISH | GONZALES COUNTY	$721	$283	117	102	98	100	103	109
GOFORTH SUD*	L	DROUGHT MANAGEMENT – GOFORTH SUD	DEMAND REDUCTION	$89	N/A	6	0	0	0	0	0
GOFORTH SUD*	L	MUNICIPAL WATER CONSERVATION	DEMAND REDUCTION	N/A	$681	0	0	0	0	0	3

*A single asterisk next to a WUG's name denotes that the WUG is split by two or more planning regions.

Region K Recommended Water User Group (WUG) Water Management Strategies (WMS)

						WATER MANAGEMENT STRATEGY SUPPLY (ACRE-FEET PER YEAR)					
WUG ENTITY NAME	WMS SPONSOR REGION	WMS NAME	SOURCE NAME	UNIT COST 2020	UNIT COST 2070	2020	2030	2040	2050	2060	2070
GOLDTHWAITE	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	73	68	69	72	75	78
GOLDTHWAITE	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$1800	$1800	36	65	61	59	61	63
GRANITE SHOALS	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	29	32	35	38	44	53
GRANITE SHOALS	K	LCRA - MID BASIN RESERVOIR	K | LCRA NEW OFF-CHANNEL RESERVOIR (2030 DECADE)	N/A	$145	0	0	0	0	50	170
HAYS	K	DEVELOPMENT OF NEW GROUNDWATER SUPPLIES	K | TRINITY AQUIFER | HAYS COUNTY	N/A	$3830	0	100	100	100	100	100
HAYS	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	37	47	59	70	87	107
HAYS	K	EDWARDS / MIDDLE TRINITY ASR	K | TRINITY AQUIFER ASR | HAYS COUNTY	N/A	$3842	0	146	146	146	146	146
HAYS	K	NEW WATER PURCHASE - HAYS	K | EDWARDS-BFZ AQUIFER | HAYS COUNTY	N/A	$1536	0	0	0	0	70	140
HAYS	K	RAINWATER HARVESTING	K | RAINWATER HARVESTING	N/A	$24966	0	3	4	4	6	7
HAYS COUNTY WCID 1	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	149	134	121	114	114	114
HAYS COUNTY WCID 1	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$892	$892	74	136	196	226	225	225
HAYS COUNTY WCID 2	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	52	61	70	76	95	117
HAYS COUNTY WCID 2	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$598	$598	26	62	114	169	211	259
HORNSBY BEND UTILITY	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	30	34	38	41	44	47
HORSESHOE BAY	K	DIRECT REUSE	K | DIRECT NON-POTABLE REUSE	N/A	$669	0	154	154	154	154	154
HORSESHOE BAY	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	641	640	601	576	537	495
HORSESHOE BAY	K	LCRA - MID BASIN RESERVOIR	K | LCRA NEW OFF-CHANNEL RESERVOIR (2030 DECADE)	N/A	$145	0	0	400	600	800	800
HORSESHOE BAY	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$542	$542	253	540	815	1,114	1,392	1,645
HURST CREEK MUD	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	313	281	253	228	205	185
HURST CREEK MUD	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$336	$336	155	302	437	560	673	776
IRRIGATION, COLORADO	K	AUSTIN RETURN FLOWS	K | COLORADO INDIRECT REUSE	$11	$11	3,657	3,496	3,328	3,151	2,966	2,768
IRRIGATION, COLORADO	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	8,385	8,159	7,940	7,727	7,519	7,316
IRRIGATION, COLORADO	K	EXPANDED USE OF LOCAL GROUNDWATER	K | GULF COAST AQUIFER SYSTEM | COLORADO COUNTY	$178	$178	8,050	8,050	8,050	8,050	8,050	8,050
IRRIGATION, COLORADO	K	IRRIGATION CONSERVATION	DEMAND REDUCTION	$116	$144	15,408	19,410	23,782	27,254	29,836	32,422
IRRIGATION, COLORADO	K	LCRA - INTERRUPTIBLE WATER FOR AGRICULTURE (LCRA WMP AMENDMENTS)	K | HIGHLAND LAKES LAKE/RESERVOIR SYSTEM	$60	N/A	13,047	6,045	2,659	0	0	0
IRRIGATION, GILLESPIE	K	IRRIGATION	DEMAND REDUCTION	$643	$643	28	28	28	28	28	28
IRRIGATION, MATAGORDA	K	AUSTIN RETURN FLOWS	K | COLORADO INDIRECT REUSE	$11	$11	8,294	8,311	8,336	8,371	8,418	8,479
IRRIGATION, MATAGORDA	K	DEVELOPMENT OF NEW GROUNDWATER SUPPLIES	K | GULF COAST AQUIFER SYSTEM FRESH/BRACKISH | MATAGORDA COUNTY	$180	$180	510	510	510	510	510	510
IRRIGATION, MATAGORDA	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	8,480	8,251	8,030	7,813	7,603	7,400
IRRIGATION, MATAGORDA	K	EXPANDED USE OF LOCAL GROUNDWATER	K | GULF COAST AQUIFER SYSTEM | MATAGORDA COUNTY	$430	$430	300	300	300	300	300	300
IRRIGATION, MATAGORDA	K	IRRIGATION CONSERVATION	DEMAND REDUCTION	$128	$161	13,254	18,765	24,505	29,691	34,316	38,944

*A single asterisk next to a WUG's name denotes that the WUG is split by two or more planning regions.

Region K Recommended Water User Group (WUG) Water Management Strategies (WMS)

WUG ENTITY NAME	WMS SPONSOR REGION	WMS NAME	SOURCE NAME	UNIT COST 2020	UNIT COST 2070	WATER MANAGEMENT STRATEGY SUPPLY (ACRE-FEET PER YEAR) 2020	2030	2040	2050	2060	2070
IRRIGATION, MATAGORDA	K	LCRA - INTERRUPTIBLE WATER FOR AGRICULTURE (LCRA WMP AMENDMENTS)	K | HIGHLAND LAKES LAKE/RESERVOIR SYSTEM	$60	N/A	24,695	8,866	5,026	0	0	0
IRRIGATION, MILLS	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	149	145	141	137	134	130
IRRIGATION, MILLS	K	EXPANDED USE OF LOCAL GROUNDWATER	K | TRINITY AQUIFER | MILLS COUNTY	$403	$403	300	300	300	300	300	300
IRRIGATION, MILLS	K	IRRIGATION	DEMAND REDUCTION	$534	$534	459	459	459	459	459	459
IRRIGATION, SAN SABA	K	IRRIGATION	DEMAND REDUCTION	$382	$382	626	626	626	626	626	626
IRRIGATION, WHARTON*	K	AUSTIN RETURN FLOWS	K | COLORADO INDIRECT REUSE	$11	$11	5,055	4,958	4,862	4,765	4,663	4,562
IRRIGATION, WHARTON*	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	17,139	16,678	16,229	15,793	15,369	14,955
IRRIGATION, WHARTON*	K	EXPANDED USE OF LOCAL GROUNDWATER	K | GULF COAST AQUIFER SYSTEM | WHARTON COUNTY	$174	$174	5,600	5,600	5,600	5,600	5,600	5,600
IRRIGATION, WHARTON*	K	IRRIGATION CONSERVATION	DEMAND REDUCTION	$117	$140	20,813	26,472	32,462	37,643	42,009	46,381
IRRIGATION, WHARTON*	K	LCRA - INTERRUPTIBLE WATER FOR AGRICULTURE (LCRA WMP AMENDMENTS)	K | HIGHLAND LAKES LAKE/RESERVOIR SYSTEM	$60	N/A	25,753	10,886	5,420	0	0	0
JOHNSON CITY	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	64	77	84	87	90	91
JOHNSON CITY	K	EXPANDED USE OF LOCAL GROUNDWATER	K | ELLENBURGER-SAN SABA AQUIFER | BLANCO COUNTY	N/A	$70	0	100	100	100	100	100
JOHNSON CITY	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$3255	$3255	31	28	25	23	23	23
JONESTOWN WSC	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	124	132	141	150	158	165
JONESTOWN WSC	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$3825	$3825	56	47	41	39	40	41
KELLY LANE WCID 1	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	73	66	66	66	66	66
KELLY LANE WCID 1	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$1353	$1353	29	52	48	47	46	46
KEMPNER WSC*	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	32	35	39	42	45	49
KEMPNER WSC*	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$3635	$3635	12	12	11	11	12	12
KINGSLAND WSC	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	48	55	54	51	56	61
LA GRANGE	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	174	196	213	226	237	245
LA GRANGE	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$2835	$2835	86	82	69	63	64	66
LAGO VISTA	K	DIRECT REUSE	K | DIRECT NON-POTABLE REUSE	N/A	$140	0	224	336	448	560	673
LAGO VISTA	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	340	362	373	384	408	446
LAGO VISTA	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$697	$697	168	375	622	914	1,098	1,198
LAKEWAY MUD	K	DIRECT REUSE	K | DIRECT NON-POTABLE REUSE	N/A	$306	0	450	450	900	900	900
LAKEWAY MUD	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	502	478	454	430	409	409
LAKEWAY MUD	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$588	$588	248	492	748	1,015	1,169	1,168
LEANDER*	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	320	594	616	645	659	686
LEANDER*	K	LCRA - MID BASIN RESERVOIR	K | LCRA NEW OFF-CHANNEL RESERVOIR (2030 DECADE)	N/A	$145	0	1,400	1,400	2,600	2,600	2,600
LEE COUNTY WSC*	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	42	43	45	48	58	68
LLANO	K	DIRECT POTABLE REUSE	K | DIRECT POTABLE REUSE	N/A	$3764	0	280	280	280	280	280
LLANO	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	337	296	221	144	150	171
LLANO	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$931	$931	78	147	208	263	285	295

*A single asterisk next to a WUG's name denotes that the WUG is split by two or more planning regions.

Region K Recommended Water User Group (WUG) Water Management Strategies (WMS)

						WATER MANAGEMENT STRATEGY SUPPLY (ACRE-FEET PER YEAR)					
WUG ENTITY NAME	WMS SPONSOR REGION	WMS NAME	SOURCE NAME	UNIT COST 2020	UNIT COST 2070	2020	2030	2040	2050	2060	2070
LLANO	K	NEW WATER PURCHASE - LLANO	K | HIGHLAND LAKES LAKE/RESERVOIR SYSTEM	$45619	N/A	177	0	0	0	0	0
LOOP 360 WSC	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	223	209	196	183	170	161
LOOP 360 WSC	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$324	$324	110	225	339	450	559	679
MANOR	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	161	204	249	302	350	395
MANUFACTURING, FAYETTE	K	DEVELOPMENT OF NEW GROUNDWATER SUPPLIES	K | YEGUA-JACKSON AQUIFER | FAYETTE COUNTY	N/A	$3960	0	100	100	100	100	100
MANVILLE WSC*	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	488	589	687	799	899	993
MANVILLE WSC*	K	EXPANDED USE OF LOCAL GROUNDWATER	K | TRINITY AQUIFER | TRAVIS COUNTY	N/A	$643	0	0	0	0	0	703
MARBLE FALLS	K	DIRECT REUSE	K | DIRECT NON-POTABLE REUSE	N/A	$296	0	100	200	300	400	500
MARBLE FALLS	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	428	567	738	772	759	776
MARBLE FALLS	K	LCRA - EXCESS FLOWS RESERVOIR	K | LCRA NEW OFF-CHANNEL RESERVOIR (2030 DECADE)	N/A	$1436	0	4,000	4,000	4,000	4,000	4,000
MARBLE FALLS	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$473	$473	212	567	1,193	1,801	2,387	2,566
MARKHAM MUD	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	5	5	5	5	5	5
MATAGORDA COUNTY WCID 6	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	6	6	6	6	6	6
MATAGORDA WASTE DISPOSAL & WSC	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	23	23	23	24	25	25
MATAGORDA WASTE DISPOSAL & WSC	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$5140	$5140	12	16	13	12	13	13
MEADOWLAKES	K	DIRECT REUSE	K | DIRECT NON-POTABLE REUSE	$0	$0	75	75	75	75	75	75
MEADOWLAKES	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	155	140	126	113	102	92
MEADOWLAKES	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$582	$582	77	145	210	271	326	377
MINING, BASTROP	K	MINING CONSERVATION - BASTROP COUNTY	DEMAND REDUCTION	$16	N/A	2	243	308	233	0	0
MINING, BURNET	K	DEVELOPMENT OF NEW GROUNDWATER SUPPLIES	K | ELLENBURGER-SAN SABA AQUIFER | BURNET COUNTY	N/A	$534	0	0	0	300	400	700
MINING, BURNET	K	DEVELOPMENT OF NEW GROUNDWATER SUPPLIES	K | HICKORY AQUIFER | BURNET COUNTY	N/A	$432	0	1,000	1,000	1,000	1,000	1,000
MINING, BURNET	K	DEVELOPMENT OF NEW GROUNDWATER SUPPLIES	K | MARBLE FALLS AQUIFER | BURNET COUNTY	N/A	$307	0	0	1,000	1,000	1,000	1,000
MINING, BURNET	K	EXPANDED USE OF LOCAL GROUNDWATER	K | ELLENBURGER-SAN SABA AQUIFER | BURNET COUNTY	N/A	$581	0	1,000	1,000	1,000	1,000	1,000
MINING, BURNET	K	MINING CONSERVATION - BURNET COUNTY	DEMAND REDUCTION	$33	$33	1,300	1,300	1,300	1,300	1,300	1,800
MINING, FAYETTE	K	EXPANDED USE OF LOCAL GROUNDWATER	K | YEGUA-JACKSON AQUIFER | FAYETTE COUNTY	$567	N/A	760	760	0	0	0	0
MINING, HAYS	K	DIRECT REUSE	K | DIRECT NON-POTABLE REUSE	N/A	$1597	0	200	600	600	800	1,000
MINING, HAYS	K	EXPANDED USE OF LOCAL GROUNDWATER	K | TRINITY AQUIFER | HAYS COUNTY	$373	$373	600	600	600	600	600	600
NORTH AUSTIN MUD 1	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	43	41	40	40	40	40
NORTH AUSTIN MUD 1	K	LCRA - MID BASIN RESERVOIR	K | LCRA NEW OFF-CHANNEL RESERVOIR (2030 DECADE)	N/A	$145	0	0	770	770	770	770
NORTH SAN SABA WSC	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	34	32	29	25	23	22

*A single asterisk next to a WUG's name denotes that the WUG is split by two or more planning regions.

Region K Recommended Water User Group (WUG) Water Management Strategies (WMS)

WUG ENTITY NAME	WMS SPONSOR REGION	WMS NAME	SOURCE NAME	UNIT COST 2020	UNIT COST 2070	WATER MANAGEMENT STRATEGY SUPPLY (ACRE-FEET PER YEAR) 2020	2030	2040	2050	2060	2070
NORTH SAN SABA WSC	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$2030	$2030	17	32	46	60	74	85
NORTHTOWN MUD	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	36	42	47	53	59	63
NORTHTOWN MUD	K	LCRA - MID BASIN RESERVOIR	K | LCRA NEW OFF-CHANNEL RESERVOIR (2030 DECADE)	N/A	$145	0	0	900	1,100	1,300	1,300
OAK SHORES WATER SYSTEM	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	27	28	26	23	21	20
OAK SHORES WATER SYSTEM	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$516	$516	14	29	42	54	65	70
PALACIOS	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	70	55	41	34	33	34
PFLUGERVILLE*	G	MUNICIPAL WATER CONSERVATION - PFLUGERVILLE	DEMAND REDUCTION	N/A	$560	0	598	684	789	888	989
PFLUGERVILLE*	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	2,460	3,068	3,748	4,423	5,103	5,103
PFLUGERVILLE*	K	EXPANDED USE OF LOCAL GROUNDWATER	K | EDWARDS-BFZ AQUIFER FRESH/BRACKISH | TRAVIS COUNTY	N/A	$50	0	0	20	20	20	20
PFLUGERVILLE*	K	LCRA - MID BASIN RESERVOIR	K | LCRA NEW OFF-CHANNEL RESERVOIR (2030 DECADE)	N/A	$145	0	0	0	1,300	3,400	3,400
PFLUGERVILLE*	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$1607	$1607	563	549	606	674	754	743
POLONIA WSC*	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	3	4	4	5	6	8
RICHLAND SUD*	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	41	38	35	31	32	33
RICHLAND SUD*	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$974	$974	20	39	55	69	70	72
ROLLINGWOOD	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	70	63	57	52	47	46
ROLLINGWOOD	K	LCRA - MID BASIN RESERVOIR	K | LCRA NEW OFF-CHANNEL RESERVOIR (2030 DECADE)	N/A	$145	0	0	250	250	250	250
ROLLINGWOOD	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$678	$678	34	64	90	116	142	148
ROUGH HOLLOW IN TRAVIS COUNTY	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	107	199	179	179	179	179
ROUGH HOLLOW IN TRAVIS COUNTY	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$750	$750	53	220	319	319	319	319
ROUND ROCK*	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	68	79	88	99	109	118
ROUND ROCK*	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$1489	N/A	6	1	0	0	0	0
SAN SABA	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	214	202	182	162	149	137
SAN SABA	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$623	$623	106	208	300	378	469	556
SCHULENBURG	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	128	131	128	130	136	141
SCHULENBURG	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$828	$828	63	128	199	235	246	254
SENNA HILLS MUD	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	76	82	84	83	80	77
SENNA HILLS MUD	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$365	$365	38	85	142	200	258	321
SHADY HOLLOW MUD	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	144	137	137	137	137	137
SHADY HOLLOW MUD	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$1402	$1402	71	90	74	65	64	64
SMITHVILLE	K	DEVELOPMENT OF NEW GROUNDWATER SUPPLIES	K | YEGUA-JACKSON AQUIFER | FAYETTE COUNTY	N/A	$1887	0	700	700	700	700	700
SMITHVILLE	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	150	198	259	343	456	606
SMITHVILLE	K	LCRA - IMPORT RETURN FLOWS FROM WILLIAMSON COUNTY	G | BRAZOS RUN-OF-RIVER	N/A	$145	0	0	0	0	0	700
SMITHVILLE	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$1736	$1736	69	59	54	59	75	97

*A single asterisk next to a WUG's name denotes that the WUG is split by two or more planning regions.

Region K Recommended Water User Group (WUG) Water Management Strategies (WMS)

						WATER MANAGEMENT STRATEGY SUPPLY (ACRE-FEET PER YEAR)					
WUG ENTITY NAME	WMS SPONSOR REGION	WMS NAME	SOURCE NAME	UNIT COST 2020	UNIT COST 2070	2020	2030	2040	2050	2060	2070
STEAM ELECTRIC POWER, BASTROP	K	LCRA - ENHANCED MUNICIPAL AND INDUSTRIAL CONSERVATION	DEMAND REDUCTION	$262	$262	55	64	73	82	82	82
STEAM ELECTRIC POWER, FAYETTE	K	AUSTIN RETURN FLOWS	K | COLORADO INDIRECT REUSE	$145	$145	4,300	4,300	4,300	4,300	4,300	4,300
STEAM ELECTRIC POWER, FAYETTE	K	LCRA - ENHANCED MUNICIPAL AND INDUSTRIAL CONSERVATION	DEMAND REDUCTION	$262	$262	480	560	640	720	720	720
STEAM ELECTRIC POWER, LLANO	K	LCRA - ENHANCED MUNICIPAL AND INDUSTRIAL CONSERVATION	DEMAND REDUCTION	$262	$262	66	77	88	99	99	99
STEAM ELECTRIC POWER, MATAGORDA	K	AUSTIN RETURN FLOWS	K | COLORADO INDIRECT REUSE	$114	$123	10,696	12,076	12,030	11,984	11,937	11,891
STEAM ELECTRIC POWER, MATAGORDA	K	BLEND BRACKISH SURFACE WATER IN STPNOC RESERVOIR	K | GULF OF MEXICO SALINE	$0	$0	3,000	3,000	3,000	3,000	3,000	3,000
STEAM ELECTRIC POWER, MATAGORDA	K	DOWNSTREAM RETURN FLOWS	K | COLORADO INDIRECT REUSE	N/A	$149	0	3,000	3,000	3,000	3,000	3,000
STEAM ELECTRIC POWER, TRAVIS	K	AUSTIN - CENTRALIZED DIRECT NON-POTABLE REUSE	K | DIRECT NON-POTABLE REUSE	N/A	$995	0	1,750	1,750	1,750	1,750	1,750
SUNSET VALLEY	K	DEVELOPMENT OF NEW GROUNDWATER SUPPLIES	K | TRINITY AQUIFER FRESH/BRACKISH | TRAVIS COUNTY	N/A	$2063	0	0	300	300	300	300
SUNSET VALLEY	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	67	69	72	75	79	82
SUNSET VALLEY	K	EXPANDED USE OF LOCAL GROUNDWATER	K | EDWARDS-BFZ AQUIFER | TRAVIS COUNTY	N/A	$120	0	0	50	50	50	50
SUNSET VALLEY	K	LCRA - MID BASIN RESERVOIR	K | LCRA NEW OFF-CHANNEL RESERVOIR (2030 DECADE)	N/A	$145	0	0	300	300	300	300
SUNSET VALLEY	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$369	$369	33	73	123	183	256	343
SUNSET VALLEY	K	RAINWATER HARVESTING	K | RAINWATER HARVESTING	N/A	$22918	0	2	2	3	3	4
SWEETWATER COMMUNITY	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	82	172	172	172	172	172
TRAVIS COUNTY MUD 10	K	DEVELOPMENT OF NEW GROUNDWATER SUPPLIES	K | TRINITY AQUIFER FRESH/BRACKISH | TRAVIS COUNTY	N/A	$3830	0	100	100	100	100	100
TRAVIS COUNTY MUD 10	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	17	18	19	20	22	23
TRAVIS COUNTY MUD 10	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$925	$925	7	15	25	27	28	30
TRAVIS COUNTY MUD 14	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	9	10	11	12	13	14
TRAVIS COUNTY MUD 14	K	WATER PURCHASE AMENDMENT - TRAVIS COUNTY MUD 14	K | CARRIZO-WILCOX AQUIFER | BASTROP COUNTY	N/A	$1222	0	0	0	35	35	35
TRAVIS COUNTY MUD 2	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	45	46	48	49	52	56
TRAVIS COUNTY MUD 4	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	341	355	360	364	360	351
TRAVIS COUNTY MUD 4	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$399	$399	135	309	507	731	962	1,198
TRAVIS COUNTY WCID 10	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	796	786	766	748	720	688

*A single asterisk next to a WUG's name denotes that the WUG is split by two or more planning regions.

Region K Recommended Water User Group (WUG) Water Management Strategies (WMS)

						WATER MANAGEMENT STRATEGY SUPPLY (ACRE-FEET PER YEAR)					
WUG ENTITY NAME	WMS SPONSOR REGION	WMS NAME	SOURCE NAME	UNIT COST 2020	UNIT COST 2070	2020	2030	2040	2050	2060	2070
TRAVIS COUNTY WCID 10	K	LCRA - MID BASIN RESERVOIR	K | LCRA NEW OFF-CHANNEL RESERVOIR (2030 DECADE)	N/A	$145	0	0	2,300	2,300	2,300	2,300
TRAVIS COUNTY WCID 10	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$389	$389	315	660	1,031	1,440	1,858	2,275
TRAVIS COUNTY WCID 17	K	DIRECT REUSE	K | DIRECT NON-POTABLE REUSE	N/A	$1410	0	510	510	510	510	510
TRAVIS COUNTY WCID 17	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	2,132	2,076	2,056	1,882	1,791	1,848
TRAVIS COUNTY WCID 17	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$549	$549	843	1,748	2,794	3,658	4,317	4,451
TRAVIS COUNTY WCID 18	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	263	304	342	385	423	458
TRAVIS COUNTY WCID 18	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$2129	$2129	75	58	47	43	43	46
TRAVIS COUNTY WCID 19	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	82	74	66	60	54	48
TRAVIS COUNTY WCID 19	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$300	$300	40	79	114	146	176	203
TRAVIS COUNTY WCID 20	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	106	96	86	77	70	63
TRAVIS COUNTY WCID 20	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$400	$400	53	103	149	190	228	263
TRAVIS COUNTY WCID POINT VENTURE	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	46	53	57	62	71	82
TRAVIS COUNTY WCID POINT VENTURE	K	LCRA - MID BASIN RESERVOIR	K | LCRA NEW OFF-CHANNEL RESERVOIR (2030 DECADE)	N/A	$145	0	0	0	0	0	50
TRAVIS COUNTY WCID POINT VENTURE	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$544	$544	23	55	94	146	189	216
WEIMAR	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	91	85	79	76	79	82
WEIMAR	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$849	$849	45	83	122	152	156	161
WELLS BRANCH MUD	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	74	72	70	69	69	69
WELLS BRANCH MUD	K	LCRA - MID BASIN RESERVOIR	K | LCRA NEW OFF-CHANNEL RESERVOIR (2030 DECADE)	N/A	$145	0	0	1,400	1,400	1,400	1,400
WEST END WSC*	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	7	7	8	8	9	10
WEST TRAVIS COUNTY PUBLIC UTILITY AGENCY	K	DIRECT POTABLE REUSE	K | DIRECT POTABLE REUSE	N/A	$2893	0	336	336	336	336	336
WEST TRAVIS COUNTY PUBLIC UTILITY AGENCY	K	DIRECT REUSE	K | DIRECT NON-POTABLE REUSE	N/A	$121	0	224	224	224	224	224
WEST TRAVIS COUNTY PUBLIC UTILITY AGENCY	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	2,038	2,133	2,111	2,215	2,238	2,228
WEST TRAVIS COUNTY PUBLIC UTILITY AGENCY	K	LCRA - EXCESS FLOWS RESERVOIR	K | LCRA NEW OFF-CHANNEL RESERVOIR (2030 DECADE)	N/A	$329	0	2,400	2,400	4,600	4,600	5,500
WEST TRAVIS COUNTY PUBLIC UTILITY AGENCY	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$401	$401	1,008	2,279	3,644	5,460	7,360	9,370
WEST TRAVIS COUNTY PUBLIC UTILITY AGENCY	L	GBRA - MBWSP	L | CARRIZO-WILCOX AQUIFER ASR FRESH/BRACKISH | GONZALES COUNTY	N/A	$2119	0	3,000	3,000	3,000	3,000	3,000
WHARTON	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	306	315	329	343	355	366

*A single asterisk next to a WUG's name denotes that the WUG is split by two or more planning regions.

Region K Recommended Water User Group (WUG) Water Management Strategies (WMS)

						WATER MANAGEMENT STRATEGY SUPPLY (ACRE-FEET PER YEAR)					
WUG ENTITY NAME	WMS SPONSOR REGION	WMS NAME	SOURCE NAME	UNIT COST 2020	UNIT COST 2070	2020	2030	2040	2050	2060	2070
WHARTON	K	EXPANDED USE OF LOCAL GROUNDWATER	K | GULF COAST AQUIFER SYSTEM | WHARTON COUNTY	N/A	$272	0	3,000	3,000	3,000	3,000	3,000
WHARTON	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$2655	$2655	151	165	133	122	123	126
WHARTON COUNTY WCID 2	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	83	80	78	81	84	87
WHARTON COUNTY WCID 2	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$1318	$1318	41	76	97	96	99	101
WILLIAMSON COUNTY WSID 3*	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	20	22	20	19	19	19
WILLIAMSON TRAVIS COUNTIES MUD 1*	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	22	19	18	18	17	17
WINDERMERE UTILITY	K	DROUGHT MANAGEMENT	DEMAND REDUCTION	$66	$66	560	560	560	560	560	560
WINDERMERE UTILITY	K	LCRA - MID BASIN RESERVOIR	K | LCRA NEW OFF-CHANNEL RESERVOIR (2030 DECADE)	N/A	$145	0	0	400	400	400	400
WINDERMERE UTILITY	K	MUNICIPAL CONSERVATION	DEMAND REDUCTION	$2060	$2060	118	62	29	13	8	7
WINDERMERE UTILITY	K	WATER PURCHASE - WINDERMERE UTILITY	G | CARRIZO-WILCOX AQUIFER | BURLESON COUNTY	N/A	$1167	0	500	500	500	500	500
REGION K RECOMMENDED WMS SUPPLY TOTAL						250,682	297,235	372,918	417,672	475,584	564,814

*A single asterisk next to a WUG's name denotes that the WUG is split by two or more planning regions.

Region K Recommended Projects Associated with Water Management Strategies

SPONSOR NAME	SPONSOR IS WWP?	ONLINE DECADE	PROJECT NAME	PROJECT DESCRIPTION	CAPITAL COST
AQUA WSC	YES	2030	EXPANSION OF CARRIZO-WILCOX AQUIFER SUPPLIES - AQUA WSC	CONVEYANCE/TRANSMISSION PIPELINE; MULTIPLE WELLS/WELL FIELD	$9,163,000
AQUA WSC	YES	2020	MUNICIPAL CONSERVATION - AQUA WSC	DATA GATHERING/MONITORING TECHNOLOGY; CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); WATER LOSS CONTROL	$16,162,569
AQUA WSC	YES	2050	NEW SURFACE WATER INFRASTRUCTURE - BASTROP REGIONAL PROJECT	CONVEYANCE/TRANSMISSION PIPELINE; NEW SURFACE WATER INTAKE; NEW WATER TREATMENT PLANT; PUMP STATION; DIVERSION AND CONTROL STRUCTURE; NEW CONTRACT; STORAGE TANK	$132,037,000
AUSTIN	YES	2040	AUSTIN - AQUIFER STORAGE AND RECOVERY	CONVEYANCE/TRANSMISSION PIPELINE; INJECTION WELL; MULTIPLE WELLS/WELL FIELD; PUMP STATION; WATER TREATMENT PLANT EXPANSION	$370,527,000
AUSTIN	YES	2070	AUSTIN - BRACKISH GROUNDWATER DESALINATION	CONVEYANCE/TRANSMISSION PIPELINE; INJECTION WELL; MULTIPLE WELLS/WELL FIELD; NEW WATER TREATMENT PLANT; STORAGE TANK; EVAPORATIVE POND; PUMP STATION	$167,689,000
AUSTIN	YES	2030	AUSTIN - DECENTRALIZED DIRECT NON-POTABLE REUSE	NEW WATER TREATMENT PLANT; STORAGE TANK; WATER TREATMENT PLANT EXPANSION	$7,703,000
AUSTIN	YES	2020	AUSTIN - DIRECT REUSE	CONVEYANCE/TRANSMISSION PIPELINE; PUMP STATION; WATER TREATMENT PLANT EXPANSION; STORAGE TANK; NEW WATER TREATMENT PLANT	$286,031,000
AUSTIN	YES	2040	AUSTIN - INDIRECT POTABLE REUSE THROUGH LADY BIRD LAKE	CONVEYANCE/TRANSMISSION PIPELINE; NEW SURFACE WATER INTAKE; PUMP STATION; WATER TREATMENT PLANT EXPANSION	$35,839,000
AUSTIN	YES	2030	AUSTIN - LONGHORN DAM OPERATIONS IMPROVEMENTS	WATER LOSS CONTROL; DATA GATHERING/MONITORING TECHNOLOGY; DIVERSION AND CONTROL STRUCTURE	$1,388,000
AUSTIN	YES	2070	AUSTIN - OFF-CHANNEL RESERVOIR AND EVAPORATION SUPPRESSION	CONVEYANCE/TRANSMISSION PIPELINE; NEW SURFACE WATER INTAKE; PUMP STATION; RESERVOIR CONSTRUCTION; WATER LOSS CONTROL	$334,642,000
AUSTIN	YES	2030	AUSTIN BLACKWATER AND GREYWATER REUSE	STORAGE TANK	$47,031,000
AUSTIN	YES	2030	AUSTIN COMMUNITY-SCALE STORMWATER HARVESTING	RAINWATER HARVESTING SYSTEM	$288,000
AUSTIN	YES	2020	AUSTIN CONSERVATION	DATA GATHERING/MONITORING TECHNOLOGY; CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); WATER LOSS CONTROL	$719,616,000
AUSTIN	YES	2030	AUSTIN ONSITE RAINWATER AND STORMWATER HARVESTING	RAINWATER HARVESTING SYSTEM	$11,768,000
BARTON CREEK WEST WSC	YES	2020	MUNICIPAL CONSERVATION - BARTON CREEK WEST WSC	DATA GATHERING/MONITORING TECHNOLOGY; CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); WATER LOSS CONTROL	$444,000
BARTON CREEK WSC	YES	2020	MUNICIPAL CONSERVATION - BARTON CREEK WSC	CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); DATA GATHERING/MONITORING TECHNOLOGY; WATER LOSS CONTROL	$956,000
BASTROP	YES	2020	MUNICIPAL CONSERVATION - BASTROP	DATA GATHERING/MONITORING TECHNOLOGY; CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); WATER LOSS CONTROL	$8,306,000
BASTROP	YES	2050	NEW SURFACE WATER INFRASTRUCTURE - BASTROP REGIONAL PROJECT	CONVEYANCE/TRANSMISSION PIPELINE; NEW SURFACE WATER INTAKE; NEW WATER TREATMENT PLANT; PUMP STATION; DIVERSION AND CONTROL STRUCTURE; NEW CONTRACT; STORAGE TANK	$26,407,000
BASTROP COUNTY WCID 2	YES	2050	NEW SURFACE WATER INFRASTRUCTURE - BASTROP REGIONAL PROJECT	CONVEYANCE/TRANSMISSION PIPELINE; NEW SURFACE WATER INTAKE; NEW WATER TREATMENT PLANT; PUMP STATION; DIVERSION AND CONTROL STRUCTURE; NEW CONTRACT; STORAGE TANK	$9,903,000
BERTRAM	YES	2030	EXPANSION OF ELLENBURGER-SAN SABA AQUIFER SUPPLIES - BERTRAM	CONVEYANCE/TRANSMISSION PIPELINE; MULTIPLE WELLS/WELL FIELD; NEW WATER TREATMENT PLANT	$20,829,000
BERTRAM	YES	2020	MUNICIPAL CONSERVATION - BERTRAM	DATA GATHERING/MONITORING TECHNOLOGY; CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); WATER LOSS CONTROL	$868,000

Region K Recommended Projects Associated with Water Management Strategies

SPONSOR NAME	SPONSOR IS WWP?	ONLINE DECADE	PROJECT NAME	PROJECT DESCRIPTION	CAPITAL COST
BLANCO	YES	2030	DIRECT REUSE - BLANCO	CONVEYANCE/TRANSMISSION PIPELINE; PUMP STATION; STORAGE TANK	$1,110,000
BLANCO	YES	2030	MUNICIPAL CONSERVATION - BLANCO	DATA GATHERING/MONITORING TECHNOLOGY; CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); WATER LOSS CONTROL	$1,700,238
BUDA	YES	2020	BS/EACD EDWARDS / MIDDLE TRINITY ASR - BUDA	CONVEYANCE/TRANSMISSION PIPELINE; INJECTION WELL; MULTIPLE WELLS/WELL FIELD; NEW WATER TREATMENT PLANT; PUMP STATION	$7,349,000
BUDA	YES	2040	BS/EACD SALINE EDWARDS DESALINATION AND ASR	CONVEYANCE/TRANSMISSION PIPELINE; INJECTION WELL; MULTIPLE WELLS/WELL FIELD; NEW WATER TREATMENT PLANT; PUMP STATION	$10,332,000
BUDA	YES	2030	DIRECT POTABLE REUSE - BUDA	CONVEYANCE/TRANSMISSION PIPELINE; INJECTION WELL; NEW WATER TREATMENT PLANT; PUMP STATION; STORAGE TANK	$33,503,000
BUDA	YES	2020	MUNICIPAL CONSERVATION - BUDA	DATA GATHERING/MONITORING TECHNOLOGY; CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); WATER LOSS CONTROL	$6,871,000
BURNET	YES	2030	BUENA VISTA REGIONAL PROJECT	CONVEYANCE/TRANSMISSION PIPELINE; NEW SURFACE WATER INTAKE; PUMP STATION; STORAGE TANK; WATER TREATMENT PLANT EXPANSION; CONTRACT AMENDMENT; NEW CONTRACT; NEW WATER RIGHT/PERMIT EXEMPT IBT	$11,828,829
BURNET	YES	2020	MUNICIPAL CONSERVATION - BURNET	DATA GATHERING/MONITORING TECHNOLOGY; CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); WATER LOSS CONTROL	$4,107,000
CEDAR PARK	YES	2020	MUNICIPAL CONSERVATION - CEDAR PARK	DATA GATHERING/MONITORING TECHNOLOGY; CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); WATER LOSS CONTROL	$3,932,000
COLUMBUS	YES	2020	MUNICIPAL CONSERVATION - COLUMBUS	DATA GATHERING/MONITORING TECHNOLOGY; CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); WATER LOSS CONTROL	$2,160,000
COTTONWOOD SHORES	YES	2020	MUNICIPAL CONSERVATION - COTTONWOOD SHORES	DATA GATHERING/MONITORING TECHNOLOGY; CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); WATER LOSS CONTROL	$830,020
COUNTY-OTHER, BASTROP	YES	2020	MUNICIPAL CONSERVATION - BASTROP COUNTY-OTHER	DATA GATHERING/MONITORING TECHNOLOGY; CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); WATER LOSS CONTROL	$4,150,000
COUNTY-OTHER, BLANCO	YES	2030	BRUSH MANAGEMENT - BLANCO COUNTY	BRUSH CONTROL	$10,522,274
COUNTY-OTHER, BURNET	YES	2030	BUENA VISTA REGIONAL PROJECT	CONVEYANCE/TRANSMISSION PIPELINE; NEW SURFACE WATER INTAKE; PUMP STATION; STORAGE TANK; WATER TREATMENT PLANT EXPANSION; CONTRACT AMENDMENT; NEW CONTRACT; NEW WATER RIGHT/PERMIT EXEMPT IBT	$17,057,171
COUNTY-OTHER, BURNET	YES	2030	EAST LAKE BUCHANAN REGIONAL PROJECT	CONVEYANCE/TRANSMISSION PIPELINE; NEW SURFACE WATER INTAKE; NEW WATER TREATMENT PLANT; PUMP STATION; STORAGE TANK; NEW CONTRACT	$11,925,000
COUNTY-OTHER, BURNET	YES	2030	MARBLE FALLS REGIONAL PROJECT	CONVEYANCE/TRANSMISSION PIPELINE; NEW SURFACE WATER INTAKE; NEW WATER TREATMENT PLANT; PUMP STATION; STORAGE TANK; CONTRACT AMENDMENT; NEW CONTRACT	$16,014,200
COUNTY-OTHER, BURNET	YES	2020	MUNICIPAL CONSERVATION - BURNET COUNTY-OTHER	DATA GATHERING/MONITORING TECHNOLOGY; CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); WATER LOSS CONTROL	$4,746,933
COUNTY-OTHER, COLORADO	YES	2030	EXPANSION OF GULF COAST AQUIFER SUPPLIES - COLORADO COUNTY-OTHER	CONVEYANCE/TRANSMISSION PIPELINE; MULTIPLE WELLS/WELL FIELD	$2,003,000
COUNTY-OTHER, FAYETTE	YES	2020	DEVELOPMENT OF NEW SPARTA AQUIFER SUPPLIES - FAYETTE COUNTY-OTHER	CONVEYANCE/TRANSMISSION PIPELINE; MULTIPLE WELLS/WELL FIELD; NEW WATER TREATMENT PLANT	$6,056,000

Region K Recommended Projects Associated with Water Management Strategies

SPONSOR NAME	SPONSOR IS WWP?	ONLINE DECADE	PROJECT NAME	PROJECT DESCRIPTION	CAPITAL COST
COUNTY-OTHER, FAYETTE	YES	2030	EXPANSION OF SPARTA AQUIFER SUPPLIES - FAYETTE COUNTY-OTHER	CONVEYANCE/TRANSMISSION PIPELINE; MULTIPLE WELLS/WELL FIELD	$2,638,000
COUNTY-OTHER, GILLESPIE	YES	2030	BRUSH MANAGEMENT - GILLESPIE COUNTY	BRUSH CONTROL	$16,708,308
COUNTY-OTHER, HAYS	YES	2030	BRUSH MANAGEMENT - HAYS COUNTY	BRUSH CONTROL	$1,238,209
COUNTY-OTHER, HAYS	YES	2030	BS/EACD EDWARDS / MIDDLE TRINITY ASR - HAYS COUNTY-OTHER	CONVEYANCE/TRANSMISSION PIPELINE; INJECTION WELL; MULTIPLE WELLS/WELL FIELD; NEW WATER TREATMENT PLANT; PUMP STATION	$5,975,000
COUNTY-OTHER, HAYS	YES	2040	BS/EACD SALINE EDWARDS DESALINATION AND ASR	CONVEYANCE/TRANSMISSION PIPELINE; INJECTION WELL; MULTIPLE WELLS/WELL FIELD; NEW WATER TREATMENT PLANT; PUMP STATION	$6,332,000
COUNTY-OTHER, HAYS	YES	2070	EXPANSION OF TRINITY AQUIFER SUPPLIES - HAYS COUNTY-OTHER	CONVEYANCE/TRANSMISSION PIPELINE; MULTIPLE WELLS/WELL FIELD	$2,674,000
COUNTY-OTHER, HAYS	YES	2030	HAYS COUNTY PIPELINE - REGION K PORTION	CONVEYANCE/TRANSMISSION PIPELINE; PUMP STATION; NEW CONTRACT	$7,485,500
COUNTY-OTHER, HAYS	YES	2030	RAINWATER HARVESTING - COUNTY-OTHER HAYS	RAINWATER HARVESTING SYSTEM	$10,275,000
COUNTY-OTHER, TRAVIS	YES	2030	BRUSH MANAGEMENT - TRAVIS COUNTY	BRUSH CONTROL	$1,238,209
COUNTY-OTHER, TRAVIS	YES	2020	MUNICIPAL CONSERVATION - TRAVIS COUNTY-OTHER (AQUA TEXAS - RIVERCREST)	CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); DATA GATHERING/MONITORING TECHNOLOGY; WATER LOSS CONTROL	$1,100,000
CREEDMOOR-MAHA WSC	YES	2030	BS/EACD EDWARDS / MIDDLE TRINITY ASR - CREEDMOOR-MAHA WSC	CONVEYANCE/TRANSMISSION PIPELINE; INJECTION WELL; MULTIPLE WELLS/WELL FIELD; NEW WATER TREATMENT PLANT; PUMP STATION	$5,975,000
CREEDMOOR-MAHA WSC	YES	2020	MUNICIPAL CONSERVATION - CREEDMOOR-MAHA WSC	CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); DATA GATHERING/MONITORING TECHNOLOGY; WATER LOSS CONTROL	$2,445,000
CYPRESS RANCH WCID 1	YES	2020	MUNICIPAL CONSERVATION - CYPRESS RANCH WCID 1	CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); DATA GATHERING/MONITORING TECHNOLOGY; WATER LOSS CONTROL	$494,000
DRIPPING SPRINGS WSC	YES	2030	DIRECT POTABLE REUSE - DRIPPING SPRINGS WSC	CONVEYANCE/TRANSMISSION PIPELINE; DIVERSION AND CONTROL STRUCTURE; PUMP STATION; WATER TREATMENT PLANT EXPANSION	$12,119,000
DRIPPING SPRINGS WSC	YES	2030	DIRECT REUSE - DRIPPING SPRINGS WSC	CONVEYANCE/TRANSMISSION PIPELINE; PUMP STATION; STORAGE TANK	$1,450,000
DRIPPING SPRINGS WSC	YES	2040	EXPANSION OF TRINITY AQUIFER SUPPLIES - DRIPPING SPRINGS WSC	CONVEYANCE/TRANSMISSION PIPELINE; MULTIPLE WELLS/WELL FIELD	$3,507,000
DRIPPING SPRINGS WSC	YES	2020	MUNICIPAL CONSERVATION - DRIPPING SPRINGS WSC	DATA GATHERING/MONITORING TECHNOLOGY; CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); WATER LOSS CONTROL	$7,627,247
DRIPPING SPRINGS WSC	YES	2030	RAINWATER HARVESTING - DRIPPING SPRINGS WSC	RAINWATER HARVESTING SYSTEM	$16,867,000
ELGIN	YES	2060	DEVELOPMENT OF NEW TRINITY AQUIFER SUPPLIES - ELGIN	CONVEYANCE/TRANSMISSION PIPELINE; MULTIPLE WELLS/WELL FIELD; STORAGE TANK	$14,774,000
ELGIN	YES	2020	MUNICIPAL CONSERVATION - ELGIN	CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); DATA GATHERING/MONITORING TECHNOLOGY; WATER LOSS CONTROL	$7,130,000
FAYETTE COUNTY WCID MONUMENT HILL	YES	2020	MUNICIPAL CONSERVATION - FAYETTE COUNTY WCID MONUMENT HILL	CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); DATA GATHERING/MONITORING TECHNOLOGY; WATER LOSS CONTROL	$288,000
FLATONIA	YES	2020	MUNICIPAL CONSERVATION - FLATONIA	DATA GATHERING/MONITORING TECHNOLOGY; CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); WATER LOSS CONTROL	$1,106,000
FREDERICKSBURG	YES	2030	DIRECT REUSE - FREDERICKSBURG	PUMP STATION; STORAGE TANK; EVAPORATIVE POND	$10,175,000
FREDERICKSBURG	YES	2020	MUNICIPAL CONSERVATION - FREDERICKSBURG	DATA GATHERING/MONITORING TECHNOLOGY; CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); WATER LOSS CONTROL	$7,476,000

Region K Recommended Projects Associated with Water Management Strategies

SPONSOR NAME	SPONSOR IS WWP?	ONLINE DECADE	PROJECT NAME	PROJECT DESCRIPTION	CAPITAL COST
GEORGETOWN	YES	2020	MUNICIPAL CONSERVATION - GEORGETOWN	CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); DATA GATHERING/MONITORING TECHNOLOGY; WATER LOSS CONTROL	$579,000
GOLDTHWAITE	YES	2020	MUNICIPAL CONSERVATION - GOLDTHWAITE	DATA GATHERING/MONITORING TECHNOLOGY; CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); WATER LOSS CONTROL	$1,229,000
HAYS	YES	2030	BS/EACD EDWARDS / MIDDLE TRINITY ASR - HAYS	CONVEYANCE/TRANSMISSION PIPELINE; INJECTION WELL; MULTIPLE WELLS/WELL FIELD; NEW WATER TREATMENT PLANT; PUMP STATION	$5,673,000
HAYS	YES	2030	DEVELOPMENT OF NEW TRINITY AQUIFER SUPPLIES - HAYS	CONVEYANCE/TRANSMISSION PIPELINE; MULTIPLE WELLS/WELL FIELD; WATER TREATMENT PLANT EXPANSION	$3,719,000
HAYS	YES	2030	RAINWATER HARVESTING - HAYS	RAINWATER HARVESTING SYSTEM	$1,429,000
HAYS	YES	2060	WATER PURCHASE CONTRACTS & AMENDMENTS - HAYS	CONVEYANCE/TRANSMISSION PIPELINE; NEW CONTRACT	$213,000
HAYS COUNTY WCID 1	YES	2020	MUNICIPAL CONSERVATION - HAYS COUNTY WCID 1	CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); DATA GATHERING/MONITORING TECHNOLOGY; WATER LOSS CONTROL	$1,815,000
HAYS COUNTY WCID 2	YES	2020	MUNICIPAL CONSERVATION - HAYS COUNTY WCID 2	CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); DATA GATHERING/MONITORING TECHNOLOGY; WATER LOSS CONTROL	$1,032,000
HORSESHOE BAY	YES	2030	DIRECT REUSE - HORSESHOE BAY	CONVEYANCE/TRANSMISSION PIPELINE; PUMP STATION	$1,084,000
HORSESHOE BAY	YES	2020	MUNICIPAL CONSERVATION - HORSESHOE BAY	DATA GATHERING/MONITORING TECHNOLOGY; CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); WATER LOSS CONTROL	$6,832,000
HURST CREEK MUD	YES	2020	MUNICIPAL CONSERVATION - HURST CREEK MUD	CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); DATA GATHERING/MONITORING TECHNOLOGY; WATER LOSS CONTROL	$1,041,000
IRRIGATION, COLORADO	YES	2020	EXPANSION OF GULF COAST AQUIFER SUPPLIES - COLORADO COUNTY IRRIGATION	CONVEYANCE/TRANSMISSION PIPELINE; MULTIPLE WELLS/WELL FIELD	$14,680,000
IRRIGATION, COLORADO	YES	2020	IRRIGATION CONSERVATION - ON FARM - COLORADO COUNTY	CONSERVATION - AGRICULTURAL	$16,465,031
IRRIGATION, COLORADO	YES	2020	IRRIGATION CONSERVATION - REAL-TIME USE METERING AND MONITORING - COLORADO COUNTY	CONSERVATION - AGRICULTURAL; DATA GATHERING/MONITORING TECHNOLOGY	$9,859,973
IRRIGATION, COLORADO	YES	2020	IRRIGATION CONSERVATION - SPRINKLER - COLORADO COUNTY	CONSERVATION - AGRICULTURAL	$4,671,137
IRRIGATION, COLORADO	YES	2020	IRRIGATION OPERATIONS CONVEYANCE IMPROVEMENTS - COLORADO COUNTY	CANAL LINING; CONSERVATION - AGRICULTURAL; DATA GATHERING/MONITORING TECHNOLOGY	$21,711,976
IRRIGATION, GILLESPIE	YES	2020	IRRIGATION CONSERVATION - DRIP IRRIGATION - GILLESPIE COUNTY	CONSERVATION - AGRICULTURAL; CONVEYANCE/TRANSMISSION PIPELINE	$64,000
IRRIGATION, MATAGORDA	YES	2020	DEVELOPMENT OF NEW GULF COAST AQUIFER SUPPLIES - MATAGORDA COUNTY IRRIGATION	MULTIPLE WELLS/WELL FIELD	$1,195,000
IRRIGATION, MATAGORDA	YES	2020	EXPANSION OF GULF COAST AQUIFER SUPPLIES - MATAGORDA COUNTY IRRIGATION	CONVEYANCE/TRANSMISSION PIPELINE; MULTIPLE WELLS/WELL FIELD	$1,431,000
IRRIGATION, MATAGORDA	YES	2020	IRRIGATION CONSERVATION - ON FARM - MATAGORDA COUNTY	CONSERVATION - AGRICULTURAL	$14,677,716
IRRIGATION, MATAGORDA	YES	2020	IRRIGATION CONSERVATION - REAL-TIME USE METERING AND MONITORING - MATAGORDA COUNTY	CONSERVATION - AGRICULTURAL; DATA GATHERING/MONITORING TECHNOLOGY	$6,154,934
IRRIGATION, MATAGORDA	YES	2020	IRRIGATION CONSERVATION - SPRINKLER - MATAGORDA COUNTY	CONSERVATION - AGRICULTURAL	$2,915,884
IRRIGATION, MATAGORDA	YES	2020	IRRIGATION OPERATIONS CONVEYANCE IMPROVEMENTS - MATAGORDA COUNTY	CANAL LINING; CONSERVATION - AGRICULTURAL; DATA GATHERING/MONITORING TECHNOLOGY	$49,254,266
IRRIGATION, MILLS	YES	2020	EXPANSION OF TRINITY AQUIFER SUPPLIES - MILLS COUNTY IRRIGATION	CONVEYANCE/TRANSMISSION PIPELINE; MULTIPLE WELLS/WELL FIELD	$1,323,000
IRRIGATION, MILLS	YES	2020	IRRIGATION CONSERVATION - DRIP IRRIGATION - MILLS COUNTY	CONSERVATION - AGRICULTURAL; CONVEYANCE/TRANSMISSION PIPELINE	$857,000
IRRIGATION, SAN SABA	YES	2020	IRRIGATION CONSERVATION - DRIP IRRIGATION - SAN SABA COUNTY	CONSERVATION - AGRICULTURAL; CONVEYANCE/TRANSMISSION PIPELINE	$834,000

Region K Recommended Projects Associated with Water Management Strategies

SPONSOR NAME	SPONSOR IS WWP?	ONLINE DECADE	PROJECT NAME	PROJECT DESCRIPTION	CAPITAL COST
IRRIGATION, WHARTON	YES	2020	EXPANSION OF GULF COAST AQUIFER SUPPLIES - WHARTON COUNTY IRRIGATION	CONVEYANCE/TRANSMISSION PIPELINE; MULTIPLE WELLS/WELL FIELD	$11,049,000
IRRIGATION, WHARTON	YES	2020	IRRIGATION CONSERVATION - ON FARM - WHARTON COUNTY	CONSERVATION - AGRICULTURAL	$33,010,253
IRRIGATION, WHARTON	YES	2020	IRRIGATION CONSERVATION - REAL-TIME USE METERING AND MONITORING - WHARTON COUNTY	CONSERVATION - AGRICULTURAL; DATA GATHERING/MONITORING TECHNOLOGY	$8,954,093
IRRIGATION, WHARTON	YES	2020	IRRIGATION CONSERVATION - SPRINKLER - WHARTON COUNTY	CONSERVATION - AGRICULTURAL	$4,241,979
IRRIGATION, WHARTON	YES	2020	IRRIGATION OPERATIONS CONVEYANCE IMPROVEMENTS - WHARTON COUNTY	CANAL LINING; CONSERVATION - AGRICULTURAL; DATA GATHERING/MONITORING TECHNOLOGY	$30,013,756
JOHNSON CITY	YES	2020	MUNICIPAL CONSERVATION - JOHNSON CITY	DATA GATHERING/MONITORING TECHNOLOGY; CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); WATER LOSS CONTROL	$1,131,823
JONESTOWN WSC	YES	2020	MUNICIPAL CONSERVATION - JONESTOWN WSC	DATA GATHERING/MONITORING TECHNOLOGY; CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); WATER LOSS CONTROL	$2,502,106
KELLY LANE WCID 1	YES	2020	MUNICIPAL CONSERVATION - KELLY LANE WCID 1	CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); DATA GATHERING/MONITORING TECHNOLOGY; WATER LOSS CONTROL	$681,000
KEMPNER WSC	YES	2020	MUNICIPAL CONSERVATION - KEMPNER WSC	CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); DATA GATHERING/MONITORING TECHNOLOGY; WATER LOSS CONTROL	$519,566
LA GRANGE	YES	2020	MUNICIPAL CONSERVATION - LA GRANGE	DATA GATHERING/MONITORING TECHNOLOGY; CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); WATER LOSS CONTROL	$2,637,312
LAGO VISTA	YES	2030	DIRECT REUSE - LAGO VISTA	CONVEYANCE/TRANSMISSION PIPELINE; STORAGE TANK	$212,000
LAGO VISTA	YES	2020	MUNICIPAL CONSERVATION - LAGO VISTA	DATA GATHERING/MONITORING TECHNOLOGY; CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); WATER LOSS CONTROL	$6,769,000
LAKEWAY MUD	YES	2030	DIRECT REUSE - LAKEWAY MUD	CONVEYANCE/TRANSMISSION PIPELINE; EVAPORATIVE POND; PUMP STATION; STORAGE TANK	$2,736,000
LAKEWAY MUD	YES	2020	MUNICIPAL CONSERVATION - LAKEWAY MUD	DATA GATHERING/MONITORING TECHNOLOGY; CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); WATER LOSS CONTROL	$4,588,000
LLANO	YES	2030	DIRECT POTABLE REUSE - LLANO	CONVEYANCE/TRANSMISSION PIPELINE; NEW WATER TREATMENT PLANT; PUMP STATION	$10,415,000
LLANO	YES	2020	MUNICIPAL CONSERVATION - LLANO	DATA GATHERING/MONITORING TECHNOLOGY; CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); WATER LOSS CONTROL	$2,619,000
LOOP 360 WSC	YES	2020	MUNICIPAL CONSERVATION - LOOP 360 WSC	DATA GATHERING/MONITORING TECHNOLOGY; CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); WATER LOSS CONTROL	$801,000
LOWER COLORADO RIVER AUTHORITY	YES	2030	EXPANSION OF CARRIZO-WILCOX AQUIFER SUPPLIES - LCRA	CONVEYANCE/TRANSMISSION PIPELINE; SINGLE WELL	$331,000
LOWER COLORADO RIVER AUTHORITY	YES	2030	LCRA - ACQUIRE ADDITIONAL WATER RIGHTS	WATER RIGHT/PERMIT LEASE OR PURCHASE	$125,000
LOWER COLORADO RIVER AUTHORITY	YES	2040	LCRA - AQUIFER STORAGE AND RECOVERY	CONVEYANCE/TRANSMISSION PIPELINE; INJECTION WELL; MULTIPLE WELLS/WELL FIELD; NEW WATER TREATMENT PLANT; PUMP STATION; STORAGE TANK; NEW SURFACE WATER INTAKE; DIVERSION AND CONTROL STRUCTURE	$146,592,000
LOWER COLORADO RIVER AUTHORITY	YES	2040	LCRA - BAYLOR CREEK RESERVOIR	CONVEYANCE/TRANSMISSION PIPELINE; NEW SURFACE WATER INTAKE; PUMP STATION; RESERVOIR CONSTRUCTION; DIVERSION AND CONTROL STRUCTURE; WATER RIGHT/PERMIT AMENDMENT NO IBT	$219,883,000

Region K Recommended Projects Associated with Water Management Strategies

SPONSOR NAME	SPONSOR IS WWP?	ONLINE DECADE	PROJECT NAME	PROJECT DESCRIPTION	CAPITAL COST
LOWER COLORADO RIVER AUTHORITY	YES	2020	LCRA - ENHANCED MUNICIPAL AND INDUSTRIAL CONSERVATION	CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); WATER LOSS CONTROL	$74,415,000
LOWER COLORADO RIVER AUTHORITY	YES	2040	LCRA - ENHANCED RECHARGE AND CONJUNCTIVE USE	CONVEYANCE/TRANSMISSION PIPELINE; MULTIPLE WELLS/WELL FIELD; NEW SURFACE WATER INTAKE; PUMP STATION; RESERVOIR CONSTRUCTION; DIVERSION AND CONTROL STRUCTURE; NEW WATER RIGHT/PERMIT NO IBT; WATER RIGHT/PERMIT AMENDMENT NO IBT	$71,125,000
LOWER COLORADO RIVER AUTHORITY	YES	2030	LCRA - EXCESS FLOWS PERMIT OFF-CHANNEL RESERVOIR	CONVEYANCE/TRANSMISSION PIPELINE; NEW SURFACE WATER INTAKE; PUMP STATION; RESERVOIR CONSTRUCTION; DIVERSION AND CONTROL STRUCTURE	$540,110,000
LOWER COLORADO RIVER AUTHORITY	YES	2030	LCRA - IMPORT RETURN FLOWS FROM WILLIAMSON COUNTY	CONVEYANCE/TRANSMISSION PIPELINE; PUMP STATION; STORAGE TANK; WATER TREATMENT PLANT EXPANSION; NEW WATER RIGHT/PERMIT EXEMPT IBT; NEW WATER RIGHT/PERMIT NON-EXEMPT IBT	$75,734,000
LOWER COLORADO RIVER AUTHORITY	YES	2030	LCRA - MID-BASIN OFF-CHANNEL RESERVOIR	CONVEYANCE/TRANSMISSION PIPELINE; NEW SURFACE WATER INTAKE; PUMP STATION; RESERVOIR CONSTRUCTION; DIVERSION AND CONTROL STRUCTURE	$344,259,000
LOWER COLORADO RIVER AUTHORITY	YES	2030	LCRA - PRAIRIE SITE OFF-CHANNEL RESERVOIR	CONVEYANCE/TRANSMISSION PIPELINE; NEW SURFACE WATER INTAKE; PUMP STATION; RESERVOIR CONSTRUCTION; CANAL LINING; DIVERSION AND CONTROL STRUCTURE	$16,690,000
MANUFACTURING, FAYETTE	YES	2030	DEVELOPMENT OF NEW YEGUA-JACKSON AQUIFER SUPPLIES - FAYETTE COUNTY MANUFACTURING	CONVEYANCE/TRANSMISSION PIPELINE; MULTIPLE WELLS/WELL FIELD; NEW WATER TREATMENT PLANT	$3,425
MANVILLE WSC	YES	2070	EXPANSION OF TRINITY AQUIFER SUPPLIES - MANVILLE WSC	CONVEYANCE/TRANSMISSION PIPELINE; MULTIPLE WELLS/WELL FIELD	$5,035,000
MARBLE FALLS	YES	2030	DIRECT REUSE - MARBLE FALLS	CONVEYANCE/TRANSMISSION PIPELINE; PUMP STATION; STORAGE TANK	$1,388,000
MARBLE FALLS	YES	2030	MARBLE FALLS REGIONAL PROJECT	CONVEYANCE/TRANSMISSION PIPELINE; NEW SURFACE WATER INTAKE; NEW WATER TREATMENT PLANT; PUMP STATION; STORAGE TANK; CONTRACT AMENDMENT; NEW CONTRACT	$40,593,800
MARBLE FALLS	YES	2020	MUNICIPAL CONSERVATION - MARBLE FALLS	DATA GATHERING/MONITORING TECHNOLOGY; CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); WATER LOSS CONTROL	$6,780,000
MATAGORDA WASTE DISPOSAL & WSC	YES	2020	MUNICIPAL CONSERVATION - MATAGORDA WASTE DISPOSAL & WSC	CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); DATA GATHERING/MONITORING TECHNOLOGY; WATER LOSS CONTROL	$1,030,000
MEADOWLAKES	YES	2020	MUNICIPAL CONSERVATION - MEADOWLAKES	DATA GATHERING/MONITORING TECHNOLOGY; CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); WATER LOSS CONTROL	$1,706,000
MINING, BURNET	YES	2050	DEVELOPMENT OF NEW ELLENBURGER-SAN SABA AQUIFER SUPPLIES - BURNET COUNTY MINING	CONVEYANCE/TRANSMISSION PIPELINE; MULTIPLE WELLS/WELL FIELD	$4,495,000
MINING, BURNET	YES	2030	DEVELOPMENT OF NEW HICKORY AQUIFER SUPPLIES - BURNET COUNTY MINING	MULTIPLE WELLS/WELL FIELD	$4,863,000
MINING, BURNET	YES	2040	DEVELOPMENT OF NEW MARBLE FALLS AQUIFER SUPPLIES - BURNET COUNTY MINING	MULTIPLE WELLS/WELL FIELD	$3,345,000
MINING, BURNET	YES	2030	EXPANSION OF ELLENBURGER-SAN SABA AQUIFER SUPPLIES - BURNET COUNTY MINING	CONVEYANCE/TRANSMISSION PIPELINE; MULTIPLE WELLS/WELL FIELD	$7,097,000
MINING, FAYETTE	YES	2020	EXPANSION OF YEGUA-JACKSON AQUIFER SUPPLIES - FAYETTE COUNTY MINING	CONVEYANCE/TRANSMISSION PIPELINE; MULTIPLE WELLS/WELL FIELD	$5,463,000
MINING, HAYS	YES	2020	EXPANSION OF TRINITY AQUIFER SUPPLIES - HAYS COUNTY MINING	CONVEYANCE/TRANSMISSION PIPELINE; MULTIPLE WELLS/WELL FIELD	$2,409,000
NORTH SAN SABA WSC	YES	2020	MUNICIPAL CONSERVATION - NORTH SAN SABA WSC	CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); DATA GATHERING/MONITORING TECHNOLOGY; WATER LOSS CONTROL	$2,122,000

Region K Recommended Projects Associated with Water Management Strategies

SPONSOR NAME	SPONSOR IS WWP?	ONLINE DECADE	PROJECT NAME	PROJECT DESCRIPTION	CAPITAL COST
OAK SHORES WATER SYSTEM	YES	2020	MUNICIPAL CONSERVATION - OAK SHORES WATER SYSTEM	CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); DATA GATHERING/MONITORING TECHNOLOGY; WATER LOSS CONTROL	$237,000
PFLUGERVILLE	YES	2020	MUNICIPAL CONSERVATION - PFLUGERVILLE	DATA GATHERING/MONITORING TECHNOLOGY; CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); WATER LOSS CONTROL	$9,804,939
RICHLAND SUD	YES	2020	MUNICIPAL CONSERVATION - RICHLAND SUD	CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); DATA GATHERING/MONITORING TECHNOLOGY; WATER LOSS CONTROL	$680,000
ROLLINGWOOD	YES	2020	MUNICIPAL CONSERVATION - ROLLINGWOOD	DATA GATHERING/MONITORING TECHNOLOGY; CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); WATER LOSS CONTROL	$822,000
ROUGH HOLLOW IN TRAVIS COUNTY	YES	2020	MUNICIPAL CONSERVATION - ROUGH HOLLOW IN TRAVIS COUNTY	CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); DATA GATHERING/MONITORING TECHNOLOGY; WATER LOSS CONTROL	$1,892,000
ROUND ROCK	YES	2020	MUNICIPAL CONSERVATION - ROUND ROCK	DATA GATHERING/MONITORING TECHNOLOGY; CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); WATER LOSS CONTROL	$69,787
SAN SABA	YES	2020	MUNICIPAL CONSERVATION - SAN SABA	DATA GATHERING/MONITORING TECHNOLOGY; CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); WATER LOSS CONTROL	$2,830,000
SCHULENBURG	YES	2020	MUNICIPAL CONSERVATION - SCHULENBURG	DATA GATHERING/MONITORING TECHNOLOGY; CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); WATER LOSS CONTROL	$1,794,000
SENNA HILLS MUD	YES	2020	MUNICIPAL CONSERVATION - SENNA HILLS MUD	CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); DATA GATHERING/MONITORING TECHNOLOGY; WATER LOSS CONTROL	$454,000
SHADY HOLLOW MUD	YES	2020	MUNICIPAL CONSERVATION - SHADY HOLLOW MUD	DATA GATHERING/MONITORING TECHNOLOGY; CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); WATER LOSS CONTROL	$1,132,000
SMITHVILLE	YES	2030	DEVELOPMENT OF NEW YEGUA-JACKSON AQUIFER SUPPLIES - SMITHVILLE	CONVEYANCE/TRANSMISSION PIPELINE; MULTIPLE WELLS/WELL FIELD; WATER TREATMENT PLANT EXPANSION	$13,421,000
SMITHVILLE	YES	2020	MUNICIPAL CONSERVATION - SMITHVILLE	DATA GATHERING/MONITORING TECHNOLOGY; CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); WATER LOSS CONTROL	$1,440,741
SMITHVILLE	YES	2030	NEW SURFACE WATER INFRASTRUCTURE - SMITHVILLE	CONVEYANCE/TRANSMISSION PIPELINE; NEW SURFACE WATER INTAKE; NEW WATER TREATMENT PLANT; PUMP STATION; STORAGE TANK; DIVERSION AND CONTROL STRUCTURE; NEW CONTRACT	$10,589,000
STEAM ELECTRIC POWER, MATAGORDA	YES	2030	ALTERNATE CANAL DELIVERY - STPNOC	CONVEYANCE/TRANSMISSION PIPELINE; PUMP STATION	$18,127,000
SUNSET VALLEY	YES	2040	DEVELOPMENT OF NEW TRINITY AQUIFER SUPPLIES - SUNSET VALLEY	CONVEYANCE/TRANSMISSION PIPELINE; MULTIPLE WELLS/WELL FIELD; STORAGE TANK; WATER TREATMENT PLANT EXPANSION	$5,401,000
SUNSET VALLEY	YES	2020	MUNICIPAL CONSERVATION - SUNSET VALLEY	DATA GATHERING/MONITORING TECHNOLOGY; CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); WATER LOSS CONTROL	$556,000
SUNSET VALLEY	YES	2030	RAINWATER HARVESTING - SUNSET VALLEY	RAINWATER HARVESTING SYSTEM	$739,000
TRAVIS COUNTY MUD 10	YES	2030	DEVELOPMENT OF NEW TRINITY AQUIFER SUPPLIES - TRAVIS COUNTY MUD 10	CONVEYANCE/TRANSMISSION PIPELINE; MULTIPLE WELLS/WELL FIELD	$3,719,000
TRAVIS COUNTY MUD 10	YES	2020	MUNICIPAL CONSERVATION - TRAVIS COUNTY MUD 10	CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); DATA GATHERING/MONITORING TECHNOLOGY; WATER LOSS CONTROL	$261,000

Region K Recommended Projects Associated with Water Management Strategies

SPONSOR NAME	SPONSOR IS WWP?	ONLINE DECADE	PROJECT NAME	PROJECT DESCRIPTION	CAPITAL COST
TRAVIS COUNTY MUD 4	YES	2020	MUNICIPAL CONSERVATION - TRAVIS COUNTY MUD 4	DATA GATHERING/MONITORING TECHNOLOGY; CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); WATER LOSS CONTROL	$2,740,000
TRAVIS COUNTY WCID 10	YES	2020	MUNICIPAL CONSERVATION - TRAVIS COUNTY WCID 10	DATA GATHERING/MONITORING TECHNOLOGY; CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); WATER LOSS CONTROL	$4,498,000
TRAVIS COUNTY WCID 17	YES	2030	DIRECT REUSE - TRAVIS COUNTY WCID 17	CONVEYANCE/TRANSMISSION PIPELINE; PUMP STATION; STORAGE TANK	$9,030,000
TRAVIS COUNTY WCID 17	YES	2020	MUNICIPAL CONSERVATION - TRAVIS COUNTY WCID 17	DATA GATHERING/MONITORING TECHNOLOGY; CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); WATER LOSS CONTROL	$16,270,000
TRAVIS COUNTY WCID 18	YES	2020	MUNICIPAL CONSERVATION - TRAVIS COUNTY WCID 18	DATA GATHERING/MONITORING TECHNOLOGY; CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); WATER LOSS CONTROL	$1,524,479
TRAVIS COUNTY WCID 19	YES	2020	MUNICIPAL CONSERVATION - TRAVIS COUNTY WCID 19	DATA GATHERING/MONITORING TECHNOLOGY; CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); WATER LOSS CONTROL	$187,000
TRAVIS COUNTY WCID 20	YES	2020	MUNICIPAL CONSERVATION - TRAVIS COUNTY WCID 20	DATA GATHERING/MONITORING TECHNOLOGY; CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); WATER LOSS CONTROL	$582,000
TRAVIS COUNTY WCID POINT VENTURE	YES	2020	MUNICIPAL CONSERVATION - TRAVIS COUNTY WCID POINT VENTURE	DATA GATHERING/MONITORING TECHNOLOGY; CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); WATER LOSS CONTROL	$757,000
WEIMAR	YES	2020	MUNICIPAL CONSERVATION - WEIMAR	DATA GATHERING/MONITORING TECHNOLOGY; CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); WATER LOSS CONTROL	$1,203,000
WEST TRAVIS COUNTY PUBLIC UTILITY AGENCY	YES	2030	DIRECT POTABLE REUSE - WEST TRAVIS COUNTY PUA	CONVEYANCE/TRANSMISSION PIPELINE; NEW WATER TREATMENT PLANT; PUMP STATION	$7,788,000
WEST TRAVIS COUNTY PUBLIC UTILITY AGENCY	YES	2030	DIRECT REUSE - WEST TRAVIS COUNTY PUA	CONVEYANCE/TRANSMISSION PIPELINE; PUMP STATION; STORAGE TANK	$207,000
WEST TRAVIS COUNTY PUBLIC UTILITY AGENCY	YES	2030	HAYS COUNTY PIPELINE - REGION K PORTION	CONVEYANCE/TRANSMISSION PIPELINE; PUMP STATION; NEW CONTRACT	$22,456,500
WEST TRAVIS COUNTY PUBLIC UTILITY AGENCY	YES	2020	MUNICIPAL CONSERVATION - WEST TRAVIS COUNTY PUA	DATA GATHERING/MONITORING TECHNOLOGY; CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); WATER LOSS CONTROL	$18,416,000
WEST TRAVIS COUNTY PUBLIC UTILITY AGENCY	YES	2030	SURFACE WATER INFRASTRUCTURE EXPANSION - WTCPUA	CONVEYANCE/TRANSMISSION PIPELINE; PUMP STATION; STORAGE TANK; SURFACE WATER INTAKE MODIFICATION	$35,402,000
WHARTON	YES	2030	EXPANSION OF GULF COAST AQUIFER SUPPLIES - WHARTON	CONVEYANCE/TRANSMISSION PIPELINE; MULTIPLE WELLS/WELL FIELD	$6,354,000
WHARTON	YES	2020	MUNICIPAL CONSERVATION - WHARTON	DATA GATHERING/MONITORING TECHNOLOGY; CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); WATER LOSS CONTROL	$4,681,000
WHARTON COUNTY WCID 2	YES	2020	MUNICIPAL CONSERVATION - WHARTON COUNTY WCID 2	CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); DATA GATHERING/MONITORING TECHNOLOGY; WATER LOSS CONTROL	$1,345,000
WINDERMERE UTILITY	YES	2020	MUNICIPAL CONSERVATION - WINDERMERE UTILITY	CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); DATA GATHERING/MONITORING TECHNOLOGY; WATER LOSS CONTROL	$2,259,450

REGION K RECOMMENDED CAPITAL COST TOTAL	**$4,589,778,633**

Region K Alternative Water User Group (WUG) Water Management Strategies (WMS)

WUG ENTITY NAME	WMS SPONSOR REGION	WMS NAME	SOURCE NAME	UNIT COST 2020	UNIT COST 2070	WATER MANAGEMENT STRATEGY SUPPLY (ACRE-FEET PER YEAR) 2020	2030	2040	2050	2060	2070
AQUA WSC*	K	EXPANSION LOCAL USE OF GROUNDWATER - CARRIZO-WILCOX AQUIFER - ALTERNATIVE VERSION	K | CARRIZO-WILCOX AQUIFER | BASTROP COUNTY	N/A	$123	0	5,500	5,500	5,500	13,385	19,121
REGION K ALTERNATIVE WMS SUPPLY TOTAL						0	5,500	5,500	5,500	13,385	19,121

*A single asterisk next to a WUG's name denotes that the WUG is split by two or more planning regions.

Region K Alternative Projects Associated with Water Management Strategies

SPONSOR NAME	SPONSOR IS WWP?	ONLINE DECADE	PROJECT NAME	PROJECT DESCRIPTION	CAPITAL COST
AQUA WSC	YES	2030	EXPANSION OF CARRIZO-WILCOX AQUIFER - AQUA WSC ALTERNATIVE	CONVEYANCE/TRANSMISSION PIPELINE; MULTIPLE WELLS/WELL FIELD; PUMP STATION	$37,682,000
LOWER COLORADO RIVER AUTHORITY	YES	2030	EXPANSION OF CARRIZO-WILCOX AQUIFER - LCRA ALTERNATIVE	CONVEYANCE/TRANSMISSION PIPELINE; MULTIPLE WELLS/WELL FIELD; PUMP STATION	$38,139,000
LOWER COLORADO RIVER AUTHORITY	YES	2040	LCRA - BRACKISH GROUNDWATER DESALINATION	CONVEYANCE/TRANSMISSION PIPELINE; INJECTION WELL; MULTIPLE WELLS/WELL FIELD; NEW WATER TREATMENT PLANT; PUMP STATION; STORAGE TANK	$229,006,000
LOWER COLORADO RIVER AUTHORITY	YES	2030	LCRA - SUPPLEMENT BAY AND ESTUARY INFLOWS WITH BRACKISH GROUNDWATER	CONVEYANCE/TRANSMISSION PIPELINE; DIVERSION AND CONTROL STRUCTURE; MULTIPLE WELLS/WELL FIELD	$47,269,000

REGION K ALTERNATIVE CAPITAL COST TOTAL	**$352,096,000**

Region K Major Water Provider (MWP) Water Management Strategy (WMS) Summary

MWPs are entities of significance to a region's water supply as defined by the Regional Water Planning Group (RWPG) and may be a Water User Group (WUG) entity, Wholesale Water Provider (WWP) entity, or both (WUG/WWP).'MWP Retail Customers' denotes recommended WMS supply used by the WUG. 'Transfers Related to Wholesale Customers' denotes a WWP or WUG/WWP selling or transferring recommended WMS supply to another entity. Supply associated with the MWP's wholesale transfers will only display if it is listed as the main seller in the State Water Planning database, even if multiple sellers are involved with the sale o water to WUGs. Unallocated water volumes represent MWP recommended WMS supply not currently allocated to a customer of the MWP.'Total MWP Related WMS Supply' will display if the MWP's WMS is related to more than one WMS supply type (retail, wholesale, and/or unallocated). Associated WMS Projects are listed when the MWP is one of the project's sponsors. Report contains draft data and is subject to change.

AUSTIN | AUSTIN - AQUIFER STORAGE AND RECOVERY

DATA DESCRIPTION	WATER VOLUMES (ACRE-FEET PER YEAR)					
	2020	2030	2040	2050	2060	2070
MWP RETAIL CUSTOMERS	0	0	7,900	10,500	13,200	15,800

WMS RELATED MWP SPONSORED PROJECTS	PROJECT DESCRIPTION
AUSTIN - AQUIFER STORAGE AND RECOVERY	CONVEYANCE/TRANSMISSION PIPELINE; INJECTION WELL; MULTIPLE WELLS/WELL FIELD; PUMP STATION; WATER TREATMENT PLANT EXPANSION

AUSTIN | AUSTIN - BLACKWATER AND GREYWATER REUSE

DATA DESCRIPTION	WATER VOLUMES (ACRE-FEET PER YEAR)					
	2020	2030	2040	2050	2060	2070
MWP RETAIL CUSTOMERS	0	1,450	3,450	5,400	7,340	9,290

WMS RELATED MWP SPONSORED PROJECTS	PROJECT DESCRIPTION
AUSTIN BLACKWATER AND GREYWATER REUSE	STORAGE TANK

AUSTIN | AUSTIN - BRACKISH GROUNDWATER DESALINATION

DATA DESCRIPTION	WATER VOLUMES (ACRE-FEET PER YEAR)					
	2020	2030	2040	2050	2060	2070
MWP RETAIL CUSTOMERS	0	0	0	0	0	5,000

WMS RELATED MWP SPONSORED PROJECTS	PROJECT DESCRIPTION
AUSTIN - BRACKISH GROUNDWATER DESALINATION	CONVEYANCE/TRANSMISSION PIPELINE; INJECTION WELL; MULTIPLE WELLS/WELL FIELD; NEW WATER TREATMENT PLANT; STORAGE TANK; EVAPORATIVE POND; PUMP STATION

AUSTIN | AUSTIN - CAPTURE LOCAL INFLOWS TO LADY BIRD LAKE

DATA DESCRIPTION	WATER VOLUMES (ACRE-FEET PER YEAR)					
	2020	2030	2040	2050	2060	2070
MWP RETAIL CUSTOMERS	0	0	3,000	3,000	3,000	3,000

AUSTIN | AUSTIN - CENTRALIZED DIRECT NON-POTABLE REUSE

DATA DESCRIPTION	WATER VOLUMES (ACRE-FEET PER YEAR)					
	2020	2030	2040	2050	2060	2070
MWP RETAIL CUSTOMERS	500	2,990	10,250	14,583	18,917	23,250
TRANSFERS RELATED TO WHOLESALE CUSTOMERS	0	1,750	1,750	1,750	1,750	1,750
TOTAL MWP RELATED WMS SUPPLY	500	4,740	12,000	16,333	20,667	25,000

WMS RELATED MWP SPONSORED PROJECTS	PROJECT DESCRIPTION
AUSTIN - DIRECT REUSE	CONVEYANCE/TRANSMISSION PIPELINE; PUMP STATION; WATER TREATMENT PLANT EXPANSION; STORAGE TANK; NEW WATER TREATMENT PLANT

AUSTIN | AUSTIN - COMMUNITY-SCALE STORMWATER HARVESTING

DATA DESCRIPTION	WATER VOLUMES (ACRE-FEET PER YEAR)					
	2020	2030	2040	2050	2060	2070
MWP RETAIL CUSTOMERS	0	66	158	184	210	236

WMS RELATED MWP SPONSORED PROJECTS	PROJECT DESCRIPTION
AUSTIN COMMUNITY-SCALE STORMWATER HARVESTING	RAINWATER HARVESTING SYSTEM

AUSTIN | AUSTIN - CONSERVATION

Region K Major Water Provider (MWP) Water Management Strategy (WMS) Summary

DATA DESCRIPTION	WATER VOLUMES (ACRE-FEET PER YEAR)					
	2020	2030	2040	2050	2060	2070
MWP RETAIL CUSTOMERS	4,910	14,890	24,870	30,120	35,370	40,620
WMS RELATED MWP SPONSORED PROJECTS	**PROJECT DESCRIPTION**					
AUSTIN CONSERVATION	DATA GATHERING/MONITORING TECHNOLOGY; CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); WATER LOSS CONTROL					

AUSTIN | AUSTIN - DECENTRALIZED DIRECT NON-POTABLE REUSE

DATA DESCRIPTION	WATER VOLUMES (ACRE-FEET PER YEAR)					
	2020	2030	2040	2050	2060	2070
MWP RETAIL CUSTOMERS	0	1,400	4,160	8,330	12,510	16,680
WMS RELATED MWP SPONSORED PROJECTS	**PROJECT DESCRIPTION**					
AUSTIN - DECENTRALIZED DIRECT NON-POTABLE REUSE	NEW WATER TREATMENT PLANT; STORAGE TANK; WATER TREATMENT PLANT EXPANSION					

AUSTIN | AUSTIN - INDIRECT POTABLE REUSE THROUGH LADY BIRD LAKE

DATA DESCRIPTION	WATER VOLUMES (ACRE-FEET PER YEAR)					
	2020	2030	2040	2050	2060	2070
MWP RETAIL CUSTOMERS	0	0	11,000	14,000	17,000	20,000
WMS RELATED MWP SPONSORED PROJECTS	**PROJECT DESCRIPTION**					
AUSTIN - INDIRECT POTABLE REUSE THROUGH LADY BIRD LAKE	CONVEYANCE/TRANSMISSION PIPELINE; NEW SURFACE WATER INTAKE; PUMP STATION; WATER TREATMENT PLANT EXPANSION					

AUSTIN | AUSTIN - LAKE AUSTIN OPERATIONS

DATA DESCRIPTION	WATER VOLUMES (ACRE-FEET PER YEAR)					
	2020	2030	2040	2050	2060	2070
MWP RETAIL CUSTOMERS	1,250	1,250	1,250	1,250	1,250	1,250

AUSTIN | AUSTIN - LONGHORN DAM OPERATION IMPROVEMENTS

DATA DESCRIPTION	WATER VOLUMES (ACRE-FEET PER YEAR)					
	2020	2030	2040	2050	2060	2070
MWP RETAIL CUSTOMERS	0	3,000	3,000	3,000	3,000	3,000
WMS RELATED MWP SPONSORED PROJECTS	**PROJECT DESCRIPTION**					
AUSTIN - LONGHORN DAM OPERATIONS IMPROVEMENTS	WATER LOSS CONTROL; DATA GATHERING/MONITORING TECHNOLOGY; DIVERSION AND CONTROL STRUCTURE					

AUSTIN | AUSTIN - OFF-CHANNEL RESERVOIR AND EVAPORATION SUPPRESSION

DATA DESCRIPTION	WATER VOLUMES (ACRE-FEET PER YEAR)					
	2020	2030	2040	2050	2060	2070
MWP RETAIL CUSTOMERS	0	0	0	0	0	25,827
WMS RELATED MWP SPONSORED PROJECTS	**PROJECT DESCRIPTION**					
AUSTIN - OFF-CHANNEL RESERVOIR AND EVAPORATION SUPPRESSION	CONVEYANCE/TRANSMISSION PIPELINE; NEW SURFACE WATER INTAKE; PUMP STATION; RESERVOIR CONSTRUCTION; WATER LOSS CONTROL					

AUSTIN | AUSTIN - ONSITE RAINWATER AND STORMWATER HARVESTING

DATA DESCRIPTION	WATER VOLUMES (ACRE-FEET PER YEAR)					
	2020	2030	2040	2050	2060	2070
MWP RETAIL CUSTOMERS	0	790	1,880	2,890	3,890	4,900
WMS RELATED MWP SPONSORED PROJECTS	**PROJECT DESCRIPTION**					
AUSTIN ONSITE RAINWATER AND STORMWATER HARVESTING	RAINWATER HARVESTING SYSTEM					

AUSTIN | DROUGHT MANAGEMENT

	WATER VOLUMES (ACRE-FEET PER YEAR)

Region K Major Water Provider (MWP) Water Management Strategy (WMS) Summary

DATA DESCRIPTION	2020	2030	2040	2050	2060	2070
MWP RETAIL CUSTOMERS	8,266	9,708	11,281	12,423	13,389	14,666

LOWER COLORADO RIVER AUTHORITY | AUSTIN RETURN FLOWS

DATA DESCRIPTION	WATER VOLUMES (ACRE-FEET PER YEAR)					
	2020	2030	2040	2050	2060	2070
TRANSFERS RELATED TO WHOLESALE CUSTOMERS	12,600	14,027	14,027	14,027	14,027	14,027
RELATED UNALLOCATED WMS WATER VOLUMES	7,144	15,249	14,560	14,723	12,971	12,510
TOTAL MWP RELATED WMS SUPPLY	19,744	29,276	28,587	28,750	26,998	26,537

LOWER COLORADO RIVER AUTHORITY | DOWNSTREAM RETURN FLOWS

DATA DESCRIPTION	WATER VOLUMES (ACRE-FEET PER YEAR)					
	2020	2030	2040	2050	2060	2070
TRANSFERS RELATED TO WHOLESALE CUSTOMERS	0	3,000	3,000	3,000	3,000	4,200
RELATED UNALLOCATED WMS WATER VOLUMES	3,985	1,969	3,072	4,164	5,267	4,067
TOTAL MWP RELATED WMS SUPPLY	3,985	4,969	6,072	7,164	8,267	8,267

LOWER COLORADO RIVER AUTHORITY | LCRA - ACQUIRE ADDITIONAL WATER RIGHTS

DATA DESCRIPTION	WATER VOLUMES (ACRE-FEET PER YEAR)					
	2020	2030	2040	2050	2060	2070
RELATED UNALLOCATED WMS WATER VOLUMES	0	250	250	250	250	250

WMS RELATED MWP SPONSORED PROJECTS	PROJECT DESCRIPTION
LCRA - ACQUIRE ADDITIONAL WATER RIGHTS	WATER RIGHT/PERMIT LEASE OR PURCHASE

LOWER COLORADO RIVER AUTHORITY | LCRA - AQUIFER STORAGE AND RECOVERY

DATA DESCRIPTION	WATER VOLUMES (ACRE-FEET PER YEAR)					
	2020	2030	2040	2050	2060	2070
RELATED UNALLOCATED WMS WATER VOLUMES	0	0	12,973	12,973	12,973	12,973

WMS RELATED MWP SPONSORED PROJECTS	PROJECT DESCRIPTION
LCRA - AQUIFER STORAGE AND RECOVERY	CONVEYANCE/TRANSMISSION PIPELINE; INJECTION WELL; MULTIPLE WELLS/WELL FIELD; NEW WATER TREATMENT PLANT; PUMP STATION; STORAGE TANK; NEW SURFACE WATER INTAKE; DIVERSION AND CONTROL STRUCTURE

LOWER COLORADO RIVER AUTHORITY | LCRA - BAYLOR CREEK RESERVOIR

DATA DESCRIPTION	WATER VOLUMES (ACRE-FEET PER YEAR)					
	2020	2030	2040	2050	2060	2070
RELATED UNALLOCATED WMS WATER VOLUMES	0	0	18,000	18,000	18,000	18,000

WMS RELATED MWP SPONSORED PROJECTS	PROJECT DESCRIPTION
LCRA - BAYLOR CREEK RESERVOIR	CONVEYANCE/TRANSMISSION PIPELINE; NEW SURFACE WATER INTAKE; PUMP STATION; RESERVOIR CONSTRUCTION; DIVERSION AND CONTROL STRUCTURE; WATER RIGHT/PERMIT AMENDMENT NO IBT

LOWER COLORADO RIVER AUTHORITY | LCRA - ENHANCED RECHARGE (MAR)

DATA DESCRIPTION	WATER VOLUMES (ACRE-FEET PER YEAR)					
	2020	2030	2040	2050	2060	2070
RELATED UNALLOCATED WMS WATER VOLUMES	0	0	14,486	14,486	14,486	14,486

WMS RELATED MWP SPONSORED PROJECTS	PROJECT DESCRIPTION
LCRA - ENHANCED RECHARGE AND CONJUNCTIVE USE	CONVEYANCE/TRANSMISSION PIPELINE; MULTIPLE WELLS/WELL FIELD; NEW SURFACE WATEF INTAKE; PUMP STATION; RESERVOIR CONSTRUCTION; DIVERSION AND CONTROL STRUCTURE; NEW WATER RIGHT/PERMIT NO IBT; WATER RIGHT/PERMIT AMENDMENT NO IBT

LOWER COLORADO RIVER AUTHORITY | LCRA - EXCESS FLOWS RESERVOIR

Region K Major Water Provider (MWP) Water Management Strategy (WMS) Summary

DATA DESCRIPTION	WATER VOLUMES (ACRE-FEET PER YEAR)					
	2020	2030	2040	2050	2060	2070
TRANSFERS RELATED TO WHOLESALE CUSTOMERS	0	10,541	13,797	15,997	15,997	16,897
RELATED UNALLOCATED WMS WATER VOLUMES	0	28,706	25,450	23,250	23,250	22,350
TOTAL MWP RELATED WMS SUPPLY	0	39,247	39,247	39,247	39,247	39,247

WMS RELATED MWP SPONSORED PROJECTS	PROJECT DESCRIPTION
LCRA - EXCESS FLOWS PERMIT OFF-CHANNEL RESERVOIR	CONVEYANCE/TRANSMISSION PIPELINE; NEW SURFACE WATER INTAKE; PUMP STATION; RESERVOIR CONSTRUCTION; DIVERSION AND CONTROL STRUCTURE

LOWER COLORADO RIVER AUTHORITY | LCRA - EXPAND USE OF GROUNDWATER (CARRIZO-WILCOX AQUIFER)

DATA DESCRIPTION	WATER VOLUMES (ACRE-FEET PER YEAR)					
	2020	2030	2040	2050	2060	2070
RELATED UNALLOCATED WMS WATER VOLUMES	0	30	30	30	30	30

WMS RELATED MWP SPONSORED PROJECTS	PROJECT DESCRIPTION
EXPANSION OF CARRIZO-WILCOX AQUIFER SUPPLIES - LCRA	CONVEYANCE/TRANSMISSION PIPELINE; SINGLE WELL

LOWER COLORADO RIVER AUTHORITY | LCRA - IMPORT RETURN FLOWS FROM WILLIAMSON COUNTY

DATA DESCRIPTION	WATER VOLUMES (ACRE-FEET PER YEAR)					
	2020	2030	2040	2050	2060	2070
TRANSFERS RELATED TO WHOLESALE CUSTOMERS	0	0	2,500	7,000	15,000	25,000
RELATED UNALLOCATED WMS WATER VOLUMES	0	5,460	8,420	9,380	6,840	0
TOTAL MWP RELATED WMS SUPPLY	0	5,460	10,920	16,380	21,840	25,000

WMS RELATED MWP SPONSORED PROJECTS	PROJECT DESCRIPTION
LCRA - IMPORT RETURN FLOWS FROM WILLIAMSON COUNTY	CONVEYANCE/TRANSMISSION PIPELINE; PUMP STATION; STORAGE TANK; WATER TREATMEN PLANT EXPANSION; NEW WATER RIGHT/PERMIT EXEMPT IBT; NEW WATER RIGHT/PERMIT NON-EXEMPT IBT

LOWER COLORADO RIVER AUTHORITY | LCRA - INTERRUPTIBLE WATER FOR AGRICULTURE (LCRA WMP AMENDMENTS)

DATA DESCRIPTION	WATER VOLUMES (ACRE-FEET PER YEAR)					
	2020	2030	2040	2050	2060	2070
TRANSFERS RELATED TO WHOLESALE CUSTOMERS	63,495	25,797	13,105	0	0	0

LOWER COLORADO RIVER AUTHORITY | LCRA - MID BASIN RESERVOIR

DATA DESCRIPTION	WATER VOLUMES (ACRE-FEET PER YEAR)					
	2020	2030	2040	2050	2060	2070
TRANSFERS RELATED TO WHOLESALE CUSTOMERS	0	1,400	8,120	12,020	15,570	17,181
RELATED UNALLOCATED WMS WATER VOLUMES	0	18,600	11,880	7,980	4,430	2,819
TOTAL MWP RELATED WMS SUPPLY	0	20,000	20,000	20,000	20,000	20,000

WMS RELATED MWP SPONSORED PROJECTS	PROJECT DESCRIPTION
LCRA - MID-BASIN OFF-CHANNEL RESERVOIR	CONVEYANCE/TRANSMISSION PIPELINE; NEW SURFACE WATER INTAKE; PUMP STATION; RESERVOIR CONSTRUCTION; DIVERSION AND CONTROL STRUCTURE

LOWER COLORADO RIVER AUTHORITY | LCRA - PRAIRIE SITE RESERVOIR

DATA DESCRIPTION	WATER VOLUMES (ACRE-FEET PER YEAR)					
	2020	2030	2040	2050	2060	2070
RELATED UNALLOCATED WMS WATER VOLUMES	0	19,000	9,500	0	0	0

WMS RELATED MWP SPONSORED PROJECTS	PROJECT DESCRIPTION
LCRA - PRAIRIE SITE OFF-CHANNEL RESERVOIR	CONVEYANCE/TRANSMISSION PIPELINE; NEW SURFACE WATER INTAKE; PUMP STATION; RESERVOIR CONSTRUCTION; CANAL LINING; DIVERSION AND CONTROL STRUCTURE

WEST TRAVIS COUNTY PUBLIC UTILITY AGENCY | DIRECT POTABLE REUSE

	WATER VOLUMES (ACRE-FEET PER YEAR)

Region K Major Water Provider (MWP) Water Management Strategy (WMS) Summary

DATA DESCRIPTION	2020	2030	2040	2050	2060	2070
MWP RETAIL CUSTOMERS	0	336	336	336	336	336
WMS RELATED MWP SPONSORED PROJECTS	**PROJECT DESCRIPTION**					
DIRECT POTABLE REUSE - WEST TRAVIS COUNTY PUA	CONVEYANCE/TRANSMISSION PIPELINE; NEW WATER TREATMENT PLANT; PUMP STATION					

WEST TRAVIS COUNTY PUBLIC UTILITY AGENCY | DIRECT REUSE						
	WATER VOLUMES (ACRE-FEET PER YEAR)					
DATA DESCRIPTION	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
MWP RETAIL CUSTOMERS	0	224	224	224	224	224
WMS RELATED MWP SPONSORED PROJECTS	**PROJECT DESCRIPTION**					
DIRECT REUSE - WEST TRAVIS COUNTY PUA	CONVEYANCE/TRANSMISSION PIPELINE; PUMP STATION; STORAGE TANK					

WEST TRAVIS COUNTY PUBLIC UTILITY AGENCY | DROUGHT MANAGEMENT						
	WATER VOLUMES (ACRE-FEET PER YEAR)					
DATA DESCRIPTION	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
MWP RETAIL CUSTOMERS	2,038	2,133	2,111	2,215	2,238	2,228

WEST TRAVIS COUNTY PUBLIC UTILITY AGENCY | GBRA - MBWSP						
	WATER VOLUMES (ACRE-FEET PER YEAR)					
DATA DESCRIPTION	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
MWP RETAIL CUSTOMERS	0	3,000	3,000	3,000	3,000	3,000
WMS RELATED MWP SPONSORED PROJECTS	**PROJECT DESCRIPTION**					
HAYS COUNTY PIPELINE - REGION K PORTION	CONVEYANCE/TRANSMISSION PIPELINE; PUMP STATION; NEW CONTRACT					

WEST TRAVIS COUNTY PUBLIC UTILITY AGENCY | LCRA - EXCESS FLOWS RESERVOIR						
	WATER VOLUMES (ACRE-FEET PER YEAR)					
DATA DESCRIPTION	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
MWP RETAIL CUSTOMERS	0	2,400	2,400	4,600	4,600	5,500
WMS RELATED MWP SPONSORED PROJECTS	**PROJECT DESCRIPTION**					
SURFACE WATER INFRASTRUCTURE EXPANSION - WTCPUA	CONVEYANCE/TRANSMISSION PIPELINE; PUMP STATION; STORAGE TANK; SURFACE WATER INTAKE MODIFICATION					

WEST TRAVIS COUNTY PUBLIC UTILITY AGENCY | MUNICIPAL CONSERVATION						
	WATER VOLUMES (ACRE-FEET PER YEAR)					
DATA DESCRIPTION	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
MWP RETAIL CUSTOMERS	1,008	2,279	3,644	5,460	7,360	9,370
WMS RELATED MWP SPONSORED PROJECTS	**PROJECT DESCRIPTION**					
MUNICIPAL CONSERVATION - WEST TRAVIS COUNTY PUA	DATA GATHERING/MONITORING TECHNOLOGY; CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); WATER LOSS CONTROL					

APPENDIX 5F

REGION K WATER MANAGEMENT STRATEGIES COMMITTEE MEETING MINUTES

Lower Colorado Regional Water Planning Group
Water Management Strategies Meeting
AECOM, Oasis Conference Room
April 5, 2018

1. Lauri Gillam called meeting to order at 1:18 p.m.

2. Attendees (20)
   Lauri Gillam – Region K Water Management Strategies Committee Chair, Small Municipalities Rep
   Linda Raschke – Region K, Counties Rep Alternate
   Teresa Lutes – Region K, Municipalities Rep
   John Burke –Region K Chair, Water Utilities Rep
   Ann McElroy – Region K, Environmental Rep
   David Wheelock –Region K, River Authority Rep
   David Lindsay – Region K, Recreation Rep (Alternate)
   Karen Haschke – Region K, Public Rep
   Doug Powell – Region K, Recreation
   David Bradsby – Region K, TPWD Rep
   Lann Bookout – TWDB
   Jaime Burke – AECOM
   Alicia Smiley – AECOM
   Rebecca Batchelder – LCRA
   Stacey Pandey – LCRA
   Helen Gerlach – Austin Water
   Richard Hoffpauir – Hoffpauir Consulting
   Christianne Castleberry – Castleberry Engineering, Region K Water Utilities Alternate
   Tim Andrzejak – ResEnTech/Flexible Solutions
   Jorge Lopez de Cardenas – ResEnTech/Flexible Solutions
   Cindy Smiley – Smiley Law Firm

3. Public Comments
   a. None.

4. Water Management Strategies Committee
   a. Purpose and role of committee
      i. Review process for identification of potentially feasible water management strategies (WMS) and recommend any changes to the RWPG.
      ii. Review strategies from 2016 Plan and discuss changes for 2021 Plan.
      iii. Brainstorm new strategies to be included in 2021 Plan.
      iv. Review screening process for selection of strategies for further analysis.
      v. Review evaluated strategies and projects for recommended or alternative status.
   b. Timeline
      i. Current – Work with committee and WUGs to identify potentially feasible strategies to meet water needs
      ii. September 2018 – Submit Technical Memorandum

iii. End of 2018 – Submit scope of work to TWDB to evaluate each strategy
iv. 2019 – Complete evaluation of strategies

5. Background
    a. Committee must follow TWDB guidelines for water management strategies (WMS)
    b. Creating WMS is a bottoms-up approach
        i. Local WUGs and Wholesale Water Providers (WWPs) are encouraged to be involved in process by review, input, and creation of plans/strategies

6. Consultant Outreach
    a. In late February, AECOM sent letters and surveys to municipal WUGs. Survey was to identify existing and new supplies/strategies for 2021 RWP. Follow-up reminders were sent on April 3.
        i. As of April 5, 56% WUGs have responded.
    b. Discussion of how to make the public more aware of the request for input on water management strategies.
        i. Suggestion that TWDB could develop a template that RWPGs could add specific details to and submit to local newspapers.
        ii. Concentrate on utilities for public outreach, Central Texas Water Efficiency Network, and creating coordinated standards for water conservation and drought triggers.

7. Region K Process for Identifying Potentially Feasible WMSs
    a. 2016 Cycle
        i. Process
            1. Define groupings or common areas with supply deficiencies.
            2. Develop a comprehensive list of potentially feasible strategies for each area.
            3. Meet with potential suppliers/WUGs for each area to determine current strategies under consideration.
            4. Prepare qualitative rating based on cost, reliability, environmental impact, and political acceptability for the various strategies.
            5. Select one or more additional strategies for each area, if appropriate.
            6. Present proposed shortlist at Public Meeting during Region K Planning Group meeting for modification and/or approval.
        ii. Qualitative screening spreadsheet and rating criteria were presented.

    b. 2021 Cycle
        i. Committee recommended adding a column in the qualitative screening spreadsheet, rating third party socioeconomic impacts, per TWDB guidelines.
        ii. Teresa Lutes motioned to advise the Region K Planning Group to keep the same process as completed in the 2016 cycle, with the exception of now screening for socioeconomic impacts. Lauri Gillam seconded. Committee passed motion.

8. Identification of Public Input Items for Fifth Planning Cycle
    a. At the end of the 2016 cycle and at the beginning of the 2021 cycle, the RWPG accepted public comments to be considered for the 2021 RWP.
    b. See attached handout.
        i. David Wheelock suggested representatives from each commenting group make a presentation.
        ii. Lauri Gillam and Jaime Burke will come up with a proposed plan to schedule when the items will be reviewed during meetings.

9. New / Other Business
    a. Next meeting date will be determined after April 11, 2018, which is the next RWPG meeting.

10. Public Comments
    a. Cindy Smiley asked that since the committee does not have the magnitude of the needs/shortages (though it will be available before September), how will the committee determine strategies?
        i. We will have identified potentially feasible strategies, but strategies may change based on shortages.

11. Lauri Gillam adjourned at 3:04 p.m.

Lower Colorado Regional Water Planning Group
Water Management Strategies Committee Meeting
AECOM, Treaty Oak Conference Room
October 15, 2018

1. Lauri Gillam called meeting to order at 2:08 p.m.

2. Attendees (18)
   Committee Members:
   Lauri Gillam – Region K Water Management Strategies Committee Chair
   Teresa Lutes – Region K, Municipalities Rep
   David Wheelock –Region K, River Authority Rep
   Jennifer Walker – Region K, Environmental Rep
   David Bradsby – Region K, TPWD Rep
   Barbara Johnson – Region K, Industries Rep
   David Lindsay – Region K, Recreation Rep (Alternate)
   Dianne Wheeler – Region K, Public Rep (Alternate)

   Additional Attendees:
   Ann McElroy – Region K, Environmental Rep
   Daniel Berglund – Region K, Small Business Rep
   Jaime Burke – AECOM
   Alicia Smiley – AECOM
   Lann Bookout – TWDB
   John Q. Barnard IV – TWDB
   Rebecca Batchelder – LCRA
   Stacey Pandey – LCRA
   Helen Gerlach – Austin Water
   Christianne Castleberry – Castleberry Engineering / Region K Water Utilities Rep (Alternate)

3. Public Comments
   a. None.

4. Minutes Approval
   a. Draft of April 5, 2018
      i. David Wheelock proposed to add Lann Bookout to attendee list.
   b. David Wheelock motioned to approve the minutes. Lauri Gillam seconded. Committee passed.

5. Status of Region K Strategy Identification/Evaluation Process
    a. Goal of Meeting: To identify which water management strategies (WMS) from 2016 and which new WMS to include to Scope of Work for 2021 evaluation. TWDB has allocated $319,178 in budget for the 2021 evaluation.
        i. RWPG has already submitted partial scope of work (drought management, conservation, expanded use of local groundwater, City of Austin (COA) return flows). Scope of work remaining budget: $232,178
    b. Jennifer Walker asked for clarification on the strategies process.
        i. RWPG is required to prepare a scope of work for each strategy evaluation they want to perform. This scope of work must be presented for public input and RWPG approval before submitting to TWDB for their approval. Once the scope is approved, strategy evaluation can begin. The committee will then begin looking at qualitative and quantitative analysis for individual WUGs for the applicable strategies. The analysis allows for additional determination of whether a strategy is feasible and should be recommended in the 2021 Plan. Having a goal to have the strategies evaluated by September 2019 will aid in completing the draft plan before the March 2020 deadline.

6. Additional Water Management Strategies for Task 5A Scope of Work
    a. 2016 Planning Cycle Strategies
        i. 2016 Plan General (apply to multiple WUGs) Strategies
            1. **Reuse**. Reuse is to remain in one scoping category, but all types of reuse will be listed in the scope: centralized direct non-potable; decentralized direct non-potable; direct potable; indirect. David Lindsay requested that when the consultant evaluates individual reuse strategies, they are to identify location of discharge and body of water. Committee agreed to recommend to RWPG for inclusion in scope.
            2. **Development of New Groundwater**. David Wheelock noted that a potential updated MAG for the Carrizo-Wilcox may want to be considered when update is complete. Committee agreed to recommend to RWPG for inclusion in scope.
            3. **Aquifer Storage and Recovery**. David Lindsay suggested conducting feasibility studies for aquifers to identify their ability to qualify for ASR. Lann Bookout responded that in the current process of scoping, ASR is a proposed strategy that may or may not be created into a project; feasibility studies are conducted after projects are funded and set into motion. Committee agreed to recommend to RWPG but also separate out 2016 Plan ASR projects into individual scoping items. A separate item for potential new ASR strategies will also be scoped.
            4. **Brackish Groundwater Desalination**. There are currently no known Region K potentially feasible strategies other than LCRA and Austin. Committee agreed to recommend inclusion in scope to RWPG.
            5. **Groundwater Importation**. David Lindsay asked if other Regions were looking at Region K water. The general consensus was that the committee didn't know

specifically, but there is not much groundwater to share. Committee agreed to recommend 2016 Plan strategies to RWPG as separate projects: Groundwater Importation – Carrizo-Wilcox to LCRA System; Groundwater Importation – Hays County Pipeline, Groundwater Importation – HCPUA Pipeline. No new groundwater importation strategies are recommended for inclusion in the scope.

6. **New LCRA Contracts**. Committee agreed to recommend to RWPG to scope as two strategies: New LCRA Contracts and New LCRA Contracts Requiring Infrastructure.
7. **LCRA Contract Amendments**. Committee agreed to recommend to RWPG to scope as two strategies: LCRA Contract Amendments and LCRA Contract Amendments Requiring Infrastructure.
8. **Water Purchase Strategy**. Committee agreed to recommend to RWPG to scope as four strategies: New Water Purchase Strategy, New Water Purchase Strategy Requiring Infrastructure, Water Purchase Amendments, and Water Purchase Amendments Requiring Infrastructure. These strategies would be water purchased from any entity other than LCRA.
9. **Amendment to Existing Water Rights/Permits**. COA requested to be included in SOW. Committee agreed to recommend inclusion in scope to RWPG.
10. **Downstream Return Flows**. Committee agreed to recommend inclusion in scope to RWPG.
11. **East Lake Buchanan Project**. Consultant is to contact Burnet County Commissioner or Judge to verify interest in project. Committee agreed to recommend to RWPG to include in scope if interest is expressed.
12. **Buena Vista Regional Project**. Survey responses from Bertram and Burnet both indicated that they were not interested in the project as part of the 2021 RWP. Committee agreed to recommend to RWPG to scope as a limited update.
13. **Marble Falls Regional Project.** Committee agreed to recommend to RWPG to include in scope.
14. **Brush Management.** David Lindsay asked if the scope could be broadened to include watershed management since the Texas State Soil and Water Conservation Board oversees both programs. Up to 200 acre-feet/year of water can be impounded by ranchers without a permit, which is becoming a concern for downstream inflows as large ranches subdivide into smaller properties. Barbara Johnson suggested including discussion of stock ponds and downstream inflows into Chapter 8 (Legislative Recommendations) instead of adding it to the SOW. Committee agreed to recommend to RWPG to scope brush management as a limited update.

ii. 2016 Plan General Strategies that were not Recommended or Alternative

1. **In-Channel Dams in Lower Basin.** Committee agreed not to recommend evaluation of project in 2021 SOW.

2. **Reduced Lake Evaporation.** Committee agreed to recommend inclusion in SOW to RWPG, though it is agreed to be low in importance.
3. **Surface Water Infrastructure Expansion.** Jaime Burke suggested name change to "Water Supply Infrastructure Development or Expansion" in order to be more inclusive. Committee agreed to recommend inclusion in SOW to RWPG.

iii. 2016 Plan Recommended Entity-Specific Strategies – LCRA

1. **LCRA New Off-Channel Reservoir(s)**. Committee agreed to recommend to RWPG to include in SOW as three strategies: LCRA – Mid-Basin Off-Channel Reservoir; LCRA – Prairie Site Off-Channel Reservoir; LCRA – Excess Flows Off-Channel Reservoir.
2. **Amendments to LCRA WMP**. Committee agreed to recommend to RWPG to include in SOW.

iv. 2016 Plan Recommended Entity-Specific Strategies – Matagorda County Steam-Electric

1. **STPNOC Alternate Canal Delivery.** Jason Ludwig requested project remain in SOW. Committee agreed to recommend to RWPG.
2. **STPNOC Brackish Surface Water Blending.** Jason Ludwig requested project remain in SOW. Committee agreed to recommend to RWPG.

v. 2016 Plan Recommended Entity-Specific Strategies – City of Austin

1. **Longhorn Dam Operations Improvements**. Teresa Lutes is to check with COA if there are additional requested improvements. Committee agreed to recommend to RWPG for inclusion in SOW if interest is expressed.
2. **City of Austin Conservation**. COA requested that conservation include lot-scale blackwater reuse, greywater reuse, rainwater harvesting, stormwater harvesting, and AC condensate reuse, among other conservation measures. Committee agreed to recommend to RWPG to include in SOW.
3. **City of Austin Direct Reuse**. COA requested that the scope separate out Centralized Direct Non-Potable Reuse and Decentralized Direct Non-Potable Reuse. Committee agreed to recommend to RWPG to include in SOW.
4. **Capture Local Inflows to Ladybird Lake**. Committee agreed to recommend to RWPG to include in SOW.
5. **Lake Austin Operations.** Committee agreed to recommend to RWPG to include in SOW.
6. **Rainwater Harvesting**. COA requested name change to "Community-Scale Stormwater Harvesting." Scope for stormwater harvesting would be expanded as compared to the 2016 Plan scope for rainwater harvesting. Committee agreed to recommend to RWPG to include in SOW.

vi. 2016 Plan Alternative Entity-Specific Strategies – LCRA

1. **Supplement Bay and Estuary Inflows with Brackish Groundwater Thereby Replacing Demands on LCRA Highland Lake Firm Yield.** David Wheelock requested strategy remain in SOW. Jennifer Walker expressed concerns over the use of brackish water to replace fresh water. Committee agreed to recommend to RWPG to include in SOW.

2. **Baylor Creek Reservoir**. David Wheelock requested strategy remain in SOW because the permit still exists, although there are no current plans to build the reservoir. Committee agreed to recommend to RWPG to include in SOW as a limited update.
3. **City of Leander Return Flows**. David Wheelock requested name change to "Import Return Flows from Williamson County." Committee agreed to recommend to RWPG to include in SOW.
4. **Enhanced Recharge and Conjunctive Use**. David Wheelock requested strategy remain in SOW. Committee agreed to recommend to RWPG to include in SOW.

vii. 2016 Plan Entity-Specific Strategies that were not Recommended or Alternative

1. **City of Goldthwaite Channel Dam**. Committee agreed not to recommend evaluation of project in 2021 SOW.
2. **Move SAR WWTP Discharge Above Austin Gage**. Committee agreed not to recommend evaluation of project in 2021 SOW.
3. **City of Wharton – Water Supply Strategy.** City requested project be included for this planning cycle. Committee agreed to recommend to RWPG to include in SOW.
4. **HB 1437**. In the 2016 Plan, HB 1437 was determined to be more of a funding mechanism rather than a strategy. While it will be associated with funding mechanisms for Irrigation Conservation projects, the committee agreed not to recommend evaluation of this as a strategy in 2021 SOW.

b. Agenda items 6.b., 6.c., 6.d., and 6e. (New Requested Strategies for this Cycle, Issues to Address, Other Strategy Suggestions, and Budget Allocation) are to be considered at next WMS meeting.

7. Action Taken
   a. Lauri Gillam moved to approve strategies to recommend as listed above. Jennifer Walker seconded. Committee passed.

8. New / Other Business
   a. The next RWPG meeting will be October 24, 2018.
   b. The next WMS meeting will be November 30, 2018 at 1:00 p.m. at the AECOM office (9400 Amberglen Blvd, Building E).

9. Lauri Gillam adjourned at 4:06 p.m.

Lower Colorado Regional Water Planning Group
Water Management Strategies Meeting
AECOM, Treaty Oak Conference Room
November 30, 2018

1. Lauri Gillam called meeting to order at 1:04 p.m.

2. Attendees (18)
   Committee Members:
   Lauri Gillam – Region K Water Management Strategies Committee Chair
   Barbara Johnson – Region K, Industries Rep
   Daniel Berglund – Region K, Small Business Rep
   David Wheelock –Region K, River Authority Rep
   Doug Powell – Region K, Recreation Rep
   Karen Haschke – Region K, Public Rep
   Teresa Lutes – Region K, Municipalities Rep

   Additional Attendees:
   Ann McElroy – Region K, Environmental Rep
   David Bradsby – Region K, TPWD Rep
   Mike Reagor – Region K, Small Municipalities Rep
   Jaime Burke – AECOM
   Alicia Smiley – AECOM
   Lann Bookout – TWDB
   Stacey Pandey – LCRA
   Adam Conner – Freese and Nichols
   Blake Neffendorf – City of Buda
   Cindy Smiley – Smiley Law Firm
   Scott Edmonson – City of Llano, Region K Small Municipalities Rep (Alternate)

3. Public Comments
   a. None.

4. Minutes Approval
   a. Draft of October 15, 2018
      i. David Wheelock motioned to approve the minutes. Lauri Gillam seconded. Committee passed.

5. Status of Region K Strategy Identification/Evaluation Process
    a. Goal of Meeting: To identify which new water management strategies (WMS) to add to Scope of Work for 2021 evaluation. TWDB has allocated $319,178 in budget for the 2021 evaluation.
        i. RWPG has already submitted partial scope of work with 48 strategies. Scope of work remaining budget: $46,178.

6. Additional Water Management Strategies for 5A Scope of Work
    a. 2021 Planning Cycle Strategies
        i. New 2021 Planning Cycle Strategies
            1. **Direct Potable Reuse.** Strategy requested by Buda and West Travis County PUA. Buda is conducting an effluent characterization study and hopes to integrate it by 2026 – confirmed by Blake Neffendorf. West Travis County PUA is looking at DPR through Reverse Osmosis treatment. These requests will be considered when evaluating reuse.
            2. **Off-Channel Reservoir.** Strategy requested by City of Austin and Bertram. Bertram is coordinating with TCEQ to determine whether quarry reservoir is sourced by surface water or groundwater. Committee agreed to recommend two separate strategies to RWPG for inclusion in scope.
            3. **Emergency Transfers.** Strategy requested by Hays, Travis County WCID 17, and West Travis County PUA. Hays is looking for emergency transfers from City of Austin and/or City of Buda. Travis County WCID 17 has agreements with Lakeway MUD, Hurst Creek MUD, West Travis County PUA, and the City of Austin. West Travis County PUA requesting an emergency interconnect agreement with City of Austin. Last cycle, emergency interconnects were included under Drought Response (Chapter 7). Committee agreed to consider subject for Chapter 7.
            4. **Oceanwater Desalination.** Strategy requested by LCRA. Committee agreed to recommend to RWPG for inclusion in scope.
            5. **Dredging.** Strategy requested by Llano for local reservoir. Per Mike Reagor, City of Llano previously dredged approximately 273 acre-feet of storage. With recent flooding, all the sediment has re-settled. To increase capacity, Llano also adds a wooden flashboard system along the reservoir; this may require additional engineering to update the system. Committee agreed to recommend to RWPG for inclusion in scope as Reservoir Capacity Expansion, rather than Dredging.
            6. **Infrastructure Construction.** Strategy requested by Lago Vista, Travis County WCID 17, and Wharton. Lago Visa is looking to expand its wastewater treatment to 1.5 MGD and upgrade to produce Type 1 water. Travis County WCID 17 is looking to install irrigation fields in Serena Hills DA as well as storage tanks with pump stations. Wharton is looking at a new treatment plant. These requests will be considered under already scoped strategies, potentially reuse and/or water supply infrastructure development or expansion.
            7. **Pipeline.** Strategy requested by Fredericksburg, West Travis County PUA, and Windermere Utility. Fredericksburg is looking to construct a new pipeline from well field to treatment facility. This request will be considered when evaluating groundwater expansion. West Travis County PUA is looking to build a second raw water line with a raw water pump station expansion. This request will be

considered when evaluating LCRA contract amendment requiring infrastructure, or water supply infrastructure development or expansion. Windermere Utility is requesting the Blue Water/EPCOR 130 interconnect. This request will be considered when evaluating new water purchase strategy requiring infrastructure.

ii. Public Input Items

1. **Irrigation.** Incorporate innovative water management strategies such as drip irrigation and use of brackish groundwater. Request by Central Texas Water Coalition.
   a. Lann Bookout said that Region K could recommend the TWDB irrigation conservation best management practices, but it would not be eligible for funding without a detailed breakdown.
   b. Doug Powell explained that from some viewpoints, it is perceived that the agriculture community does not implement conservation because there are not standards set by any entity, and there is no concrete reporting of what conservation measures irrigators take. Powell requested that in a future RWPG meeting, Daniel Berglund present a short update of what conservation measures are taken in the rice farming community.
   c. David Wheelock will work with Doug Powell, Daniel Berglund, and Barbara Johnson to evaluate how to approach this request, and whether it should potentially be an additional strategy to scope or added to the evaluation of an already scoped task.
2. **City of Wharton – Water Supply Strategy.** Reevaluate strategy for 2021 plan. Request by City of Wharton. Strategy is already included in previously submitted 5A scope of work.
3. **Decentralized Systems.** Consider evaluating decentralized systems that capture, use and reuse water in place. Request by Hill Country Alliance. Strategy is already included in reuse and conservation and will be considered during evaluation.
4. **LCRA Enhanced Recharge.** Include more detailed discussion on feasibility and legality. Request by Central Texas Water Coalition. Strategy is already included in previously submitted 5A scope of work.
5. **Dredging.** Dredge the Highland Lakes to increase capacity. Request by Joe Don Dockery and Donna Klaeger. Difficulties of dredging – particularly the costs associated with hauling sand – were discussed. There's no long-term availability created. To keep at constant capacity, Lakes Buchanan and Travis would need 750 AF of dredging per year, which is equivalent to 121,000 trucks or 500 trucks per working day. Committee agreed to not recommend to RWPG for inclusion in scope because it is not feasible nor is it sustainable.
6. **Rainwater Harvesting.** Committee agreed to recommend to RWPG for inclusion in scope for WUGs other than Austin.
7. Public input comment for committee to consider **–** Request by Hill Country Alliance: Each WUG should consider alternative supplies such as reuse and rainwater in addition to water conservation before adopting large infrastructure projects to import water long distances.
8. Public input comment for committee to consider – Concern about the Hays County Pipeline from Barbara Hopson, Wimberley resident: According to the

State Plan, Wimberley will not need additional water until 2040 at the earliest, although the Drippings Springs area needs additional water immediately because the City of Dripping Springs continues to approve plats for enormous subdivisions for which there is insufficient water available.

b. Issues to Address
    i. WUGs with Water Need in 2020
        1. The strategies used to meet 2020 needs this cycle are particularly important because strategies and projects given a 2020 decade during this planning cycle should be limited to those projects that can be constructed and delivering water within no more than 12 months from the statutory adoption deadline (January 5, 2022) of the state water plan.
        2. There are WUGs with needs in 2020 after application of drought management and conservation. AECOM will reach out to these WUGs in order to coordinate strategies to meet needs.
            a. AECOM will review the Region K Cutoff Model with respect to the City of Llano water rights and reservoir yield.
        3. Presentation of Lower Basin Irrigation strategies from the 2016 Plan, to determine if any additional types of strategies should be scoped for evaluation. None were suggested at this time.

c. Other Strategy Suggestions
    i. In this cycle, Region K has coordinated with municipal WUGs to determine supplies and strategies. Jaime Burke recommended reaching out to agriculture, particularly those in the rice farming community, in order to coordinate feasible strategies for Irrigation. Daniel Berglund recommended attending the Western Rice Belt Convention in January at El Campo Civic Center. AECOM will follow up with Daniel Berglund.
    ii. Materials provided by Dave Lindsay related to encouragement of strategies to protect the inflows to the river, such as brush removal and the State working with landowners on exempt reservoirs, and irrigation conservation measures were handed out as part of the meeting, but the committee did not have time to address this issue. Discussion will be held at the next committee meeting.

d. Budget Allocation
    i. Teresa Lutes recommends leaving about $25,000 unallocated. Committee generally agreed, if feasible with strategies identified today.

7. Action Taken
    a. Barbara Johnson moved to approve strategies to recommend as listed above. Doug Powell seconded. Committee passed.

8. Open Discussion
    a. None.

9. New / Other Business
    a. The next RWPG meeting will be January 9, 2019 at 10 a.m. at the Dalchau Service Center.
    b. The next WMS meeting will be after the RWPG meeting (date/time/location TBD).

10. Lauri Gillam adjourned at 3:39 p.m.

Lower Colorado Regional Water Planning Group
Water Management Strategies Meeting
AECOM, Treaty Oak Conference Room
March 4, 2019

1. Jennifer Walker called meeting to order at 1:07 p.m.

2. Attendees (19)
   Committee Members:
   Jennifer Walker – Region K, Environmental Rep, Interim Water Management Strategies Committee Chair
   Daniel Berglund – Region K, Small Business Rep
   David Wheelock – Region K, River Authority Rep
   Doug Powell – Region K, Recreation Rep
   Karen Haschke – Region K, Public Rep
   Teresa Lutes – Region K, Municipalities Rep
   Mike Reagor – Region K, Small Municipalities Rep
   John Burke – Region K Chair, Water Utilities Rep

   Additional Attendees:
   David Bradsby – Region K, TPWD Rep
   David Lindsay – Region K, Recreation Rep (Alternate)
   Christianne Castleberry – Region K, Water Utilities Rep (Alternate)
   Jaime Burke – AECOM
   Alicia Smiley – AECOM
   Lann Bookout – TWDB
   Rebecca Batchelder – LCRA
   Stacey Pandey – LCRA
   Helen Gerlach – Austin Water
   Cindy Smiley – Smiley Law Firm
   Danny Bulovas – Public - BCL

3. Public Comments
   a. None.

4. Minutes Approval
   a. Draft of November 30, 2018
      i. Daniel Berglund motioned to approve the minutes. David Wheelock seconded. Committee passed.

5. Status of Region K Strategy Identification and Evaluation Process
    a. Identification: Identify water management strategies (WMS) to add to Scope of Work for 2021 evaluation. TWDB has allocated $319,178 in budget for the 2021 evaluation.
        i. RWPG has already submitted scope of work with 52 strategies. Scope of work remaining budget: $25,178.
        ii. Bertram Off-Channel Reservoir Strategy
            1. Scoping approval was tabled at Jan. 9, 2019 Region K meeting because the source of the water was unclear as to whether it was groundwater or surface water
            2. TCEQ has not determined whether the source is surface water or groundwater. City is comfortable with moving forward as a groundwater strategy. RWPG will not need to scope individually because project can be evaluated under the Expand Local Use of Groundwater or Water Supply Infrastructure Development or Expansion strategies.
    b. Evaluation: Define methodologies, define potential specific measures, and identify strategy candidates.
        i. Meeting goal: Provide information to the committee on general strategies and their methodologies from the 2016 Plan. Get input from the committee on any methodology changes for this cycle in order to move forward in the evaluation process.

6. Agricultural Irrigation Conservation
    a. Agricultural Irrigation Conservation (Memorandum - David Wheelock and Stacey Pandey)
        i. Memorandum requests RWPG update agricultural irrigation conservation to accurately represent water savings for 2021 RWP. This will be accomplished by three tasks:
            1. Gather data on improved acreage and develop projections for potential future water saving improvements.
                a. To develop accurate strategy estimates, it must be determined how many acres have already had conservation strategies applied to them (improved acreage), and how many additional acres are available for potential improvements.
                    i. Improvements include: land leveling, underground conveyance (converting canals to pipeline), and multiple inlets.
                b. Potential avenues of data:
                    i. LCRA – Surface water information
                    ii. NRCS – land leveling data
                    iii. GCD – Wharton County survey information

c. Consultant will work with Stacey Pandey to develop a plan to come up with more current estimates of improved acreage and potential water savings projections.

2. Update savings estimates for existing irrigation conservation strategies.
    a. Consultant will work with Daniel Berglund to update LEPA (low energy precision application) center pivot sprinkler irrigation.
3. Identify new irrigation conservation strategies and develop updated savings estimates.
    a. Daniel Berglund requested to add on-farm real-time conveyance and delivery metering/monitoring with SCADA at the point of delivery. More real-time flow data would mean more efficient practices.
    b. Discussion of tail water recovery. It is expensive. Will consider for qualitative analysis before ruling out for evaluation.

b. Conservation-Related Items (Handout - David Lindsay)
    i. David Lindsay expressed concern on how to ensure the implementation of strategies.
        1. Jennifer Walker suggested the RWPG add discussion into 2021 RWP to emphasize the responsibility of the individual WUGs to implement strategies. By adding context to the importance of implementation (such as the positive effects of savings, priority or urgency of selected strategies, watershed effects, etc.), it stresses the importance of implementation to municipalities.
        2. Stacey Pandey pointed out that half the battle of grant writing is proving the cost-effectiveness of the strategy. Should the recommended strategies provide a savings to the entity, implementation will already be in consideration.

7. Municipal Conservation
    a. Conservation Strategies for 2021 RWP (Memorandum - AECOM)
        i. Major Water Provider Conservation
            1. LCRA and COA will work with Consultant to ensure data is accurate and updated.
        ii. Municipal Water Conservation
            1. 2016 criteria for municipal water conservation and methodology applied to calculate demand reduction:
                a. 2016 Criteria
                    i. Be a municipal WUG.
                    ii. Have a year 2020 per capita water usage of greater than 140 GPCD, indicating a potential for savings through conservation.

        iii. Conservation was considered, regardless of whether a municipality had needs.
    b. 2016 Methodology
        i. If the 2020 GPCD is greater than 200, apply a 10% GPCD reduction per decade (1% reduction per year) until 200 GPCD is reached. Then apply a 5% GPCD reduction per decade (0.5% reduction per year) until 140 GPCD is reached.
        ii. If the 2020 GPCD is greater than 140, apply a 5% GPCD reduction per decade (0.5% reduction per year) until 140 GPCD is reached.
        iii. If the 2020 GPCD is less than 140, no conservation considered.
        iv. Defer to Water Conservation goals, if applicable.

2. Proposed 2021 methodology applied to calculate demand reduction:
    a. Methodology:
        i. If the 2020 GPCD is greater than 140, apply a 10% GPCD reduction per decade (1% reduction per year) until 140 GPCD is reached.
        ii. If the 2020 GPCD is less than 140, no conservation considered.
        iii. Defer to Water Conservation goals, if applicable.
    b. Concerns:
        i. Doug Powell asked if there may be differences in difficulty of implementing reduction down to 200 than down to 140. Implementation depends on individual demographics of WUGs.
        ii. Small municipalities don't have the same resources to reduce GPCD.
        iii. 1% per year may be overestimating the conservation WUGs are/will actually be doing.
        iv. Karen Haschke asked to what extent are other RWPGs applying demand reduction. Consultant will check and report to committee.
    c. David Wheelock motioned to 1% reduction to reach a 140 GPCD with consideration of individual WUG. Daniel Berglund seconded. Committee passed.
3. Jaime Burke suggested separating conservation projects with capital costs (such as water loss infrastructure) from conservation projects without capital costs, like Region H. Additionally, any project listed in the 2021 RWP with a capital cost for 2020 must be implemented by 2023.

b. Water Conservation by the Yard (Presentation - Jennifer Walker)
    i. Sierra Club, National Wildlife Federation, and Texas Living Waters Project created the report *Water Conservation by the Yard: A Statewide Analysis of Outdoor Water Savings Potential*, which quantifies twice-a-week outdoor watering restrictions.
        1. If a WUG implements such restrictions, it can reduce its demands from 3.5% to 8.5%, depending on the effort employed to implement the measure.
        2. Jennifer Walker requests that savings tables from the implementation of the watering restrictions be added to the 2021 RWP so that individual WUGs would be able to see their savings potential.

8. Drought Management
    a. Drought Management Strategies for 2021 RWP (Memorandum - AECOM)
        i. Drought Management for Municipalities
            1. David Wheelock believes that WUGs will exceed the goal of 15% water demand reduction, as they did during the last drought of record. He suggests the RWPG update demand reduction to 20%.
        ii. Drought Management for Irrigation
            1. The LCRA Water Management Plan states that in a period of drought, no ratoon (second) crop shall be planted. Daniel Berglund noted that water savings numbers from such measures may need reconsideration.

9. Expand Local Use of Groundwater
    a. Expand Local Use of Groundwater Strategy Update for 2021 RWP (Memorandum - AECOM)
        i. Expand Local Use of Groundwater involves pumping additional groundwater from an aquifer that the WUG is currently using as a source, either using the WUG's existing wells or drilling additional wells. Memorandum details the feasibility and limitations of strategy recommendation.
        ii. Committee decided to table discussion for next WMS meeting in order to receive input from RWPG groundwater representatives.

10. Open Discussion
    a. None.

11. New / Other Business
    a. The next RWPG meeting will be April 24, 2019 at 10:00 a.m. at the LCRA Dalchau Service Center.
    b. The next WMS Committee meeting will be April 10, 2019 at 1:00 p.m. at AECOM.

12. Public Comments

a. Cindy Smiley asked that since a standard water use exists for municipal WUGs (GPCD of 140), does the RWPG have one for irrigation WUGs? Smiley recommended adding a reference table to Chapter 5 listing how much water is typically needed to grow a specific crop per acre. A table would assist in better understanding of water requirements for irrigation.
   i. The recommendation will be taken into consideration; Mike Reagor added that water requirements for crops depend on external factors such as weather, climate, soil type, etc., so the water needed is a range.

13. Jennifer Walker adjourned at 4:00 p.m.

Lower Colorado Regional Water Planning Group
Water Management Strategies Meeting
AECOM, Treaty Oak Conference Room
April 10, 2019

1. Lauri Gillam called meeting to order at 1:03 p.m.

2. Attendees (24)
   Committee Members:
   Lauri Gillam – Region K, Small Municipalities Rep, Water Management Strategies Committee Chair
   David Wheelock – Region K, River Authority Rep
   Karen Haschke – Region K, Public Rep
   Mike Reagor – Region K, Small Municipalities Rep
   David Van Dresar – Region K, Water Districts Rep
   Ann McElroy – Region K, Environmental Rep
   Barbara Johnson – Region K, Industries Rep
   Teresa Lutes – Region K, Municipalities Rep
   Jennifer Walker – Region K, Environmental Rep

   Additional Attendees:
   David Lindsay – Region K, Recreation Rep (Alternate)
   Christianne Castleberry – Region K, Water Utilities Rep (Alternate)
   Helen Gerlach – Region K, Municipalities Rep (Alternate)
   Lann Bookout – TWDB
   Jaime Burke – AECOM
   Alicia Smiley – AECOM
   Rebecca Batchelder – LCRA
   Stacy Pandey – LCRA
   Steve Box – Environmental Stewardship
   Adam Conner – Freese and Nichols
   Jordan Furnans – LRE Water, LLC
   Cindy Smiley – Smiley Law Firm
   Danny Bulovas – Public – BCL
   Tom Harrison – Public
   Richard Golladay – Public

3. Public Comments
   a. Jordan Furnans from LRE Water, LLC is working on a project studying rainfall response for the TWDB. The draft final report is due at end of June, and the final is due at the end of August. RWPG is interested in hearing a summary of the report once it is released for public consumption.

4. Minutes Approval
    a. Draft of March 4, 2019
        i. David Lindsay motioned to approve the minutes. Karen Haschke seconded. Committee passed.

5. Agricultural Irrigation Conservation
    a. Discussion results from March 4, 2019 meeting
        i. Task 1. AECOM will work with Stacy Pandey to develop a plan to gather data on currently improved acreage, including acreage watered with surface water and/or groundwater, and develop projections for potential future water saving improvements.
        ii. Task 2. AECOM will work with both Stacy Pandey and Daniel Berglund to update savings estimates for existing irrigation conservation strategies.
        iii. Task 3. AECOM will work with Daniel Berglund to consider on-farm SCADA as a new strategy. Also discussed tail water recovery and drip irrigation strategies.
        iv. David Lindsay asked about metrics of tracking accurate water use of individual large farms. Since these water users are large – sometimes larger than municipal WUGs – would it be possible to equate a farm to a WUG in the planning process? David Wheelock responds that naming individual landowners could be a privacy concern. Since the group already considers these large water users when creating the irrigation demands in regional water planning process, they are accounted for.
    b. Irrigation Conveyance Improvements
        i. Committee was asked for feedback on measures included in 2016 RWP.
            1. Stacy Pandey said list is comprehensive, although since last plan, all Gulf Coast gates have been automated.
        ii. Nearly 100,000 acre-feet of built-in irrigation demand are canal losses, as determined by the RWPG for this planning cycle.
            1. Since canals are earth-lined, losses occur mainly through seepage and evapotranspiration.
    c. On-Farm Conservation
        i. RWPG can determine planted acreage for both groundwater and surface water sources, but conjunctive use may skew data.
            1. David Van Dresar noted RWPG can acquire definitive water production from each well for groundwater production.
        ii. RWPG needs to determine improved acreage, likely from the NRCS, and factor in Gulf Coast district priorities on land leveling, due to crop rotation activities.
    d. Other Irrigation Strategies
        i. Sprinkler Irrigation – Recommended in 2016 RWP; RWPG wants to update numbers. Lann Bookout added that Texas A&M has reports on efficiencies.
        ii. Drip Irrigation – Not considered in 2016 RWP; rice farmers cannot grow a second crop with drip irrigation. Could possibly be considered for other crops.

        iii. Tail Water Recovery – Not considered in 2016 RWP; potentially negative environmental impacts and cost may prevent further evaluation.
    e. Expectations and Challenges
        i. Obtaining data such as improved acreage may prove to be difficult, and assumptions may have to be made.
        ii. Question about potential use of brackish groundwater.
        iii. Consultant is to create a spreadsheet, listing:
            1. Strategies for qualitative or quantitative analysis;
            2. Extent of update for 2021 RWP cycle;
            3. Data RWPG needs in order to update.

6. Municipal Conservation
    a. Criteria
        i. The following methodology was applied to all municipal WUGs:
            1. If the 2020 GPCD is greater than 140, apply a 10% GPCD reduction per decade until 140 GPCD is reached.
            2. If the 2020 GPCD is less than 140, no conservation considered.
            3. Defer to individual utility Water Conservation Plan goals, if applicable.
    b. Committee discussed concern: For WUGs with a high GPCD (>300), is it realistic to reduce GPCD almost in half by 2070? Larger WUGs and WUGs with higher water use do/should take more aggressive conservation action. Different WUGs that pull from the same source may have different conservation goal levels, and that is okay. Committee agreed to leave conservation numbers as-is.
    c. Barbara Johnson proposed a policy recommendation for a water use agreement, buying and selling water conservation reduction credits, like carbon credits. Stacy Pandey responded that LCRA has a similar system implemented during drought conditions.
    d. Committee recommended sending methodology and numbers to RWPG.

7. Drought Management
    a. Criteria
        i. Unless indicated by the WUG's Drought Contingency Plan (DCP), the following methodology was applied:
            1. If Base GPCD >100, then 20% Reduction Amount Applied
            2. If Base GPCD <100, then 5% Reduction Amount Applied
        ii. Question asked about the use of 100 GPCD as the cutoff, versus 140 GPCD. Cutoff lower than 140 used based on real-world situations. WUGs with GPCDs lower than 140 still have 20% demand reduction drought restrictions.
    b. Teresa Lutes requested adjustments for City of Austin. COA's regular standard of practice is no more than one day a week watering – along with other reduction measures built into day-to-day use – and it may not be possible to reach an additional 20% reduction with already considerable conservation embedded in standard practice.

8. Expanded Local Use of Groundwater

a. Committee reviewed AECOM Memorandum on Expanded Local Use of Groundwater.
    i. In the 2016 RWP, sixteen (16) municipal strategies and eleven (11) non-municipal strategies were selected for Expand Local Use of Groundwater (also called Expansion of Current Groundwater Supplies). Many of these strategies are likely not potentially feasible as recommended strategies because of limited source availability based on the Modeled Available Groundwater (MAG). David Van Dresar recommends discussing MAG Peak Factor.
    ii. Committee requested AECOM return with tables breaking down each strategy for consideration.

9. Open Discussion
    a. Protecting Inflows to the Colorado River
        i. David Lindsay and Steve Box presented the issue of low inflows: Inflows from the watershed into the Highland Lakes have shown a significant declining trend, even though the 2017 Kennedy TWDB Report found that long-term precipitation volumes at all study sites generally indicated a steady to slightly increasing trend over the 1940-2016 study period. The presentation proposed identifying the protection and conservation of inflows as an important water management strategy for the upper and lower basin.
        ii. David Wheelock responded that data in water supply is based on the drought of record; the supply is already determined during times of low inflows. Additionally, some issues highlighted, such as proliferation of noxious brush, and other items affecting the hydrologic response of the watershed, are included in the measured runoff data used for Region K planning, and this data includes the effects over the most recent eight years of the period of record, which is also the drought of record.
        iii. Jennifer Walker recommended to include this topic of discussion in the Policy Committee meetings based on timeline.

10. New / Other Business
    a. None.

11. Next Meeting
    a. The next RWPG meeting will be April 24, 2019 at 10:00 a.m. at the LCRA Dalchau Service Center.
    b. The next WMS meeting is TBD.

12. Public Comments
    a. None.

13. Lauri Gillam adjourned at 3:36 p.m.

Lower Colorado Regional Water Planning Group
Water Management Strategies Meeting
AECOM, Treaty Oak Conference Room
June 17, 2019

1. Lauri Gillam called meeting to order at 10:11 a.m.

2. Attendees (18)
   Committee Members:
   Lauri Gillam – Region K, Small Municipalities Rep, Water Management Strategies Committee Chair
   Daniel Berglund – Region K, Small Business Rep
   David Wheelock – Region K, River Authority Rep
   Karen Haschke – Region K, Public Rep
   Barbara Johnson – Region K, Industries Rep
   Teresa Lutes – Region K, Municipalities Rep
   Jennifer Walker – Region K, Environmental Rep

   Additional Attendees:
   David Bradsby – Region K, TPWD Rep
   Christianne Castleberry – Region K, Water Utilities Rep (Alternate)
   Helen Gerlach – Region K, Municipalities Rep (Alternate)
   Rebecca Batchelder – Region K, River Authority Rep (Alternate)
   Lann Bookout – TWDB
   Alicia Smiley – AECOM
   Kiera Brown – AECOM
   Shelby Eckols – AECOM
   Stacy Pandey – LCRA
   Heather Rose – LCRA
   Danny Bulovas – Public – Lake Travis

3. Public Comments
   a. None.

4. Minutes Approval
   a. Draft of April 10, 2019
      i. David Wheelock requested changes to 5.b.i. and 9.a.ii.
         1. 5.b.i. Delete the sentences *"Canal seepage can be measured, and it was found that the natural clay barrier has a water loss comparable to that of concrete lined canals. Issues with the canals stem from cattle damaging the clay barrier."*

2. 9.a.ii. Change *"…are already addressed with strategies like Brush Management*" to *"…and other items affecting the hydrologic response of the watershed, are included in the measured runoff data used for Region K planning, and this data includes the effects over the most recent eight years of the period of record, which is also the drought of record."*

ii. David Wheelock requested update to task listed in 5.e.iii. Consultant is currently working on listed spreadsheet.

iii. Jennifer Walker requested change to 6.a.i.3.

1. Change *"Defer to Water Conservation goals, if applicable"* to "*Defer to individual utility Water Conservation Plan goals, if applicable."*

iv. Teresa Lutes requested change to 7.b.

1. Clarify to read, *"Teresa Lutes requested adjustments for City of Austin. COA's regular standard of practice is no more than one day a week watering – along with other reduction measures built into day-to-day use – and it may not be possible to reach an additional 20% reduction with already considerable conservation embedded in standard practice."*

v. Jennifer Walker motioned to approve the minutes with the changes. Lauri Gillam seconded. Committee passed.

5. Municipal Drought Management

a. Criteria

i. Unless indicated by the WUG's Drought Contingency Plan (DCP) or requested by the WUG itself, the following methodology was applied:

1. If Base GPCD >100, then 20% Reduction Amount Applied
2. If Base GPCD <100, then 5% Reduction Amount Applied

b. Discussion

i. Updated public outreach costs from 2016 Plan: $66/ac-ft/year. Consultant is waiting on the TWDB Socioeconomic Impact Analysis of Unmet Needs to determine costs to utilities based on reduced water sold.

ii. Jennifer Walker asked which WUGs did not follow the basic methodology. Consultant indicated the provided spreadsheet of GPCD Reduction Amount by WUG accounted for individual DCPs under "severe" drought restrictions.

6. Austin Requested Water Management Strategy Evaluations

a. Aquifer Storage and Recovery (ASR)

i. Strategy Definition and Cost

1. ASR stores surplus treated water from the Colorado River in the Carrizo-Wilcox Aquifer.
2. Online: 2070; Yield: 60,000 ac-ft/yr; Capital Costs: $363,910,000; Annual Cost: $28,461,000; Unit Cost: $474/ac-ft/yr

ii. Discussion

1. Teresa Lutes requested the startup decade for the strategy be updated from online in 2070 to online in 2040.
2. Danny Bulovas asked how annual costs were determined, and if the listed $28 million annual cost would continue indefinitely.
    a. Consultant clarified the "largest annual cost" was composed of:
        i. Operational costs
        ii. The annualized total project cost (assuming a debt service period of 20 years)
    b. After the end of the period of debt service to repay facility construction costs, the annual cost is composed of only the annual operational cost.
3. Danny Bulovas asked if the $/acre-foot/year was provided for each strategy for comparison purposes. The consultant confirmed that this was correct.
4. Heather Rose asked if the energy pumping costs for both extraction and injection wells were included in the ASR cost estimate. Consultant confirmed that costs were included in the costs provided by the Austin Water Forward plan.
5. David Wheelock asked if the cost of water treatment was included, given that treated water was proposed for injection into the storage aquifer. Wheelock indicated that the provided Cost Summary listed $0 for water treatment. Consultant indicated that O&M costs were taken as a lump sum from the Austin Water Forward Plan and listed as a single line item in the Cost Summary.
    a. Consultant will separate O&M costs by type (e.g. pumping energy, water treatment, pipeline maintenance, etc.) for this strategy and all other Austin strategies.
6. Jennifer Walker indicated that the language provided in the presentation ("Increased pumpage of Colorado run-of-river water maintains SB3 and LCRA WMP environmental flow standards") was not accurate, as these flows are not necessarily continuously present. However, Walker indicated that the language describing environmental flows in the provided strategy write-up text was satisfactory.

b. Off-Channel Reservoir (OCR) and Evaporation Suppressant
    i. Strategy Definition and Cost
        1. Divert surplus Colorado Run-of-River flows to off-channel reservoir and apply biodegradable evaporation suppressant during summer months.
        2. Online: 2070; Yield: 25,000 ac-ft/yr; Capital Costs: $343,937,000; Annual Cost: $32,903,000; Unit Cost: $1,316/ac-ft/yr
    ii. Discussion

1. In 2014, TWDB ran a pilot test of proposed evaporation suppressant by application to Lake Arrowhead in Wichita Falls. The final report suggested that, with an 87 percent statistical level of confidence, the suppressant reduced evaporation.
2. David Wheelock requested that Evaporation Suppression be included in the RWP as its own strategy for any reservoir. Consultant confirmed that a separate scope item for a Reduced Lake Evaporation strategy exists and can be expanded for other reservoirs given a project sponsor.
3. Daniel Berglund proposed solar panel coverage as a potential method for Evaporation Suppression.
4. Daniel Berglund asked why the unit cost ($/AFY) for OCR was greater than the unit cost for ASR. Teresa Lutes clarified that this difference was due to a higher yield for ASR, as compared to OCR. Lutes indicated that the ASR yield (60,000 acre-ft/yr) may need to be adjusted to reflect that, while 60,000 acre-ft/yr could be withdrawn in a single year, the average yield would be lower, assuming extraction over multiple years of drought.
5. Karen Haschke requested to know the location for the wellfields for the ASR strategy and the reservoir for the OCR strategy. Teresa Lutes indicated that the location of these infrastructures was not yet identified.
6. David Wheelock requested that all strategies make clear whether water produced is raw or treated, as the unit cost of untreated water would more often be less expensive.

c. Onsite Rainwater and Stormwater Harvesting
    i. Strategy Definition and Cost
        1. Lot/building-scale capture and storage of roof and other impervious surface runoff.
        2. Online: 2040; Yield (2040): 1,800 ac-ft/yr; Yield (2070): 4,900 ac-ft/yr; Capital Costs: $204,167,000; Annual Cost: $16,393,660; Unit Cost: $3,346/ac-ft/yr
    ii. Discussion
        1. Barbara Johnson asked if developers would be required to implement rainwater and stormwater harvesting. Teresa Lutes indicated that a combination of ordinances and incentives are in development to achieve the desired yields for this strategy. At this phase, ordinance is proposed for developments >250,000 SF.
        2. Teresa Lutes requested the startup decade for strategy be updated from online in 2040 to online in 2030. Lutes indicated that she would provide a 2030 yield to the Consultant.

3. Daniel Berglund asked if rainwater was 100% reliable, given its nature to be inconsistent. Consultant will confirm that rainwater availability is calculated for DOR conditions for consistency with other strategy assumptions.

d. Capture Local Inflows to Lady Bird Lake
   i. Strategy Definition and Cost
      1. Capture available flows through Lady Bird Lake and route to Ullrich water plant intake. Some infrastructure for this strategy would be utilized from the Indirect Potable Reuse (IPR) through Lady Bird Lake strategy. Total capital costs for both strategies are assigned to IPR; total operational costs for both strategies are assigned to Capture Local Inflows.
      2. Online: 2040; Yield: 1,000 ac-ft/yr; Capital Costs: $0; Annual Cost: $6,383,250; Unit Cost: $6,383/ac-ft/yr
   ii. Discussion
      1. City of Austin to provide a sketch of water flow for inclusion in the strategy write-up.
      2. David Wheelock asked why this strategy is separate from Indirect Potable Reuse (IPR). IPR strategy is proposed for use in a drought worse than the drought of record, whereas Capture Local Inflows to Lady Bird Lake would be used in non-drought and drought years.
      3. Jennifer Walker indicated that this strategy could influence environmental flows and that the LCRA may need to supply more water to achieve environmental flows. Walker requested that the strategy write-up be updated to reflect these concerns.

e. Indirect Potable Reuse (IPR) through Lady Bird Lake
   i. Strategy Definition and Cost
      1. Highly treated South Austin Regional (SAR) WWTP effluent is routed to Ullrich water plant intake. Total capital costs for IPR and the Capture Local Inflows through Lady Bird Lake strategies are assigned to IPR; total operational costs for both strategies are assigned Capture Local Inflows. This strategy would only be utilized when combined storage of Lake Buchanan and Travis is below 400,000 ac-ft.
      2. Online: 2040; Yield: 11,000 ac-ft/yr; Capital Costs: $90,405,000; Annual Cost: $6,361,000; Unit Cost: $318/ac-ft/yr
   ii. Discussion
      1. Heather Rose asked if the strategy would cause pollutant accumulation over time, and if annual costs included advanced treatment to address pollutant accrual. Teresa Lutes responded that modeling showed continued dilution and would not impact water quality and the costs

include advanced treatment for removal of pollutants associated with wastewater effluent.

2. Daniel Berglund asked how the IPR treatment system would account for mercury accrual. Teresa Lutes responded that pollutant levels for IPR are a concern that would need to be addressed, but that IPR is only to be used when the total combined storage of Lakes Buchanan and Travis are below 400,000 acre-ft, a condition worse than experienced in the drought of record.

f. Lake Austin Operations
    i. Strategy Description and Costs
        1. Strategy would allow Lake Austin to be operated with a varying level if Lake Travis and Buchanan combined storage falls below 600,000 ac-ft. Local flows would be captured during storm events and stored for use.
        2. Online: 2020; Yield: 2,500 ac-ft/yr; Capital Costs: $0; Annual Cost: $545,000; Unit Cost: $218/ac-ft/yr
    ii. Discussion
        1. No proposed changes.

g. City of Austin Conservation
    i. Strategy Description and Costs
        1. Austin has a more aggressive conservation program than most WUGs and has made significant advances in reducing per capita water use.
        2. Online: 2020; Yield (2020): 4,910 ac-ft/yr; Yield (2070): 40,620 ac-ft/yr; Capital Costs: $514,560,000; Annual Cost: $54,569,000; Unit Cost: $1,343/ac-ft/yr
    ii. Discussion
        1. Stacy Pandey asked if water loss control could be listed separately – either as a separate strategy or a separate line item – from the Conservation strategy. AECOM will coordinate with Austin to see if that information is available.

7. Burnet County Regional Project Strategy Evaluations
    a. Three projects detailed in the 2011 Burnet-Llano County Regional Study were strategies updated for the 2021 RWP:
    b. Buena Vista
        i. Strategy Definition and Costs
            1. Project would use Burnet's existing raw water intake (RWI), water treatment plant (WTP), and 18" transmission main. The RWI, WTP, and pump station would be expanded to serve Burnet and County-Other communities in Burnet County. LCRA contracts or contract amendments would be needed.

2. Project Yield:
    a. Burnet – Online: 2030; Yield (2030): 1,000 ac-ft/yr; Yield (2040): 2,000 ac-ft/yr
    b. Burnet County-Other (Brazos) – Online 2030; Yield (2030): (500 ac-ft/yr); Yield (2040): 1,000 ac-ft/yr
    c. Burnet County-Other (Colorado) – Online: 2030; Yield (2030): 565 ac-ft/yr); Yield (2040): 1,884 ac-ft/yr
3. Capital Costs: $28,886,000; Annual Cost: $5,546,000; Unit Cost: $1,136/ac-ft/yr

ii. Discussion
1. No proposed changes.

c. East Lake Buchanan

i. Strategy Definition and Costs
1. Strategy to provide surface water to portions of County-Other in Burnet County whose current groundwater supplies are unreliable and contaminated with radionuclides. New raw water intake would pump to a regional water treatment plant near Bonanza Beach, along the northeast side of Lake Buchanan. Pump station and transmission mains would deliver water to Council Creek Village and other participants in the area.
2. Project Yield:
    a. Burnet County-Other (Colorado Basin) – Online: 2030; Yield (2030): 498 ac-ft/yr; Yield (2040): 935 ac-ft/yr
3. Capital Costs: $11,925,000; Annual Cost: $1,830,000; Unit Cost: $1,957/ac-ft/yr

ii. Discussion
1. Jennifer Walker asked why no return flows were assumed for this strategy. David Wheelock indicated that TCEQ regulations prohibit discharges into the Highland Lakes.

d. Marble Falls Regional Water System

i. Strategy Description and Cost
1. Strategy to serve growth in Burnet County for Marble Falls and portions of County-Other (Colorado Basin). New raw water intake, pump stations, and water treatment plant upstream of Max Starcke Dam. New transmission mains and new storage tanks to serve future developments.
2. Project Yields:
    a. Marble Falls – Online: 2030; Yield: 4,000 ac-ft/yr
    b. Burnet County-Other (Colorado) – Online: 2030; Yield: 1,578 ac-ft/yr

3. Capital Costs: $56,608,000; Annual Cost: $8,010,000; Unit Cost: $1,436/ac-ft/yr

ii. Discussion

1. Jennifer Walker asked if there are any shared facilities for the strategies covered in the Regional Study like there are for the Capture Local Inflows to Lady Bird Lake/IPR through Lady Bird Lake strategies. Consultant confirmed none are shared.

8. STPNOC Strategy Evaluations

a. Alternate Canal Delivery

i. Strategy Definition and Cost

1. Strategy will allow higher quality water to be pulled from the Colorado River and transported to the STPNOC cooling tower reservoir. Strategy involves construction of pipeline and pump station to transport from existing LCRA irrigation canals to reservoir.
2. Online: 2030; Yield: 12,727 ac-ft/yr; Capital Costs: $18,127,000; Annual Cost: $3,384,000; Unit Cost: $266/ac-ft/yr

ii. Discussion

1. Stacy Pandey recalled a regulatory issue with using the existing pump station for this strategy. Strategies can still be recommended in the Plan if they have legal impediments, but it would be good to note it in the strategy write-up.
2. Jennifer Walker requested that the environmental impacts section be updated to say environmental flows may be impacted as a result of changing the location of the diversion point.

b. Brackish Surface Water Blending

i. Strategy Definition and Cost

1. During an emergency, STPNOC and LCRA will pursue relief from TCEQ to be able to pump brackish surface water to blend in with the existing fresh water in the STPNOC reservoir.
2. Online: 2020; Yield: 3,000 ac-ft/yr; Capital Costs: $0; Annual Cost: $0; Unit Cost: $0/ac-ft/yr

ii. Discussion

1. No proposed changes.

9. Municipal Conservation

a. Progress to-date: WMS Committee and RWPG voted on and approved the following methodology to be applied to all municipal WUGs:

1. If the 2020 GPCD is greater than 140, apply a 10% GPCD reduction per decade until 140 GPCD is reached.
2. If the 2020 GPCD is less than 140, no conservation considered.

3. Defer to individual utility Water Conservation Plan goals, if applicable.

b. Discussion: Costing Assumptions

i. To obtain more realistic costs for municipal conservation, the methodology for the 2016 RWP cycle was updated. Separated into capital and non-capital costs, the assumptions are as follows:

ii. Capital Cost Measure Assumptions

1. Advanced Metering Infrastructure (Smart Meters)

a. 3 people per household; 100% of households will install smart meters in the next 50 years; Installation of smart meters reduces demand by 5%; Smart meter cost is $270 per meter.

b. Daniel Berglund requested justification for the 5% demand reduction achieved by smart meters. Jennifer Walker indicated that there are large water savings from early leak detection and behavioral changes because of live tracking.

c. Stacy Pandey recommended the addition of an online portal to track customer usage, like that used by the LCRA, as a requirement. The LCRA requires customers to use the portal in order to access grants.

2. Leak Detection and Replacement

a. 10% of pipeline is replaced (pipe length from TWDB Water Loss Audit (WLA); 80% of the replaced pipeline is 8", 20% is 12"; Anticipated demand reduction of 3%.

b. Stacy Pandey recommended including 4" and 6" replacements in the costing, as these size lines are common for smaller WUGs. Jennifer Walker suggested this may be due to the WLA only listing WUGs with >3,300 connections.

c. The WLA does not cover all municipal WUGs, so the Region K Consultant does not have pipe length for all WUGs with conservation as a recommended strategy.

iii. Non-Capital Cost Measure Assumptions

1. Remaining per decade reduction is due to non-capital actions. Non-capital cost measures include implementing standards, incentives, and education and outreach. This assumption was used in the 2016 RWP cycle. Consultant assumed $250/ac-ft saved.

iv. A breakdown of capital costs using the TWDB costing tool was provided as an example for West Travis County PUA and Johnson City.

1. David Wheelock requested that the O&M for pipeline replacement be 0%, with a footnote indicating that no additional maintenance costs are incurred by replacement lines that would not already be incurred from the existing line.

2. Jennifer Walker requested that water loss control (line replacement) and advanced metering infrastructure be listed separately – either as

separate strategies or separate line items – from the Municipal Conservation strategy. Consultant will investigate separating out the costing in separate tables under the same strategy, as the projects are still municipal conservation.

10. New / Other Business
    a. Jennifer Walker requested a strategy status tracking spreadsheet and a timeline of deadlines, particularly those for WUGs to get information to AECOM, to obtain an overall picture of what remains in the planning cycle.
    b. At the July 10 RWPG meeting, Lann Bookout will present on House Bill (HB) 807, new legislation that affects the regional planning process. Barbara Johnson requested information on HB 2486, which forces Houston to sell its water rights to the Brazos River Authority.
    c. David Wheelock asked for status on Chapter 7, and whether a Drought Management Committee will be necessary for this cycle's process. AECOM is currently waiting on Drought Preparedness Council recommendations to be released for incorporation into the Chapter. Once released, one committee meeting may be desired to go over details of Chapter and make any updated recommendations.
    d. Jennifer Walker and David Wheelock asked when the quantitative analysis will be completed for strategies environmental and socioeconomic impacts, and when Joe Trungale will perform modeling. Joe Trungale is currently developing strategy model for evaluating impacts. He will be performing the modeling over the next few months.
    e. Goal is to complete all draft strategies in time for October Region K meeting.

11. Next Meeting
    a. The next RWPG meeting will be July 10, 2019 at 10:00 a.m. at the LCRA Dalchau Service Center.
    b. The next WMS meeting will be after RWPG meeting in the beginning of August. Consultant will bring additional strategies for WMS committee to review. Potential strategies may include, but are not limited to, LCRA strategies, expand local use of groundwater, development of new groundwater supplies, and municipal conservation.

12. Public Comments
    a. None.

13. Lauri Gillam adjourned at 1:12 p.m.

Lower Colorado Regional Water Planning Group
Water Management Strategies Meeting
AECOM, Treaty Oak Conference Room
August 8, 2019

1. Lauri Gillam called meeting to order at 9:34 a.m.

2. Attendees (20)
   Committee Members:
   Lauri Gillam – Region K, Small Municipalities Rep, Water Management Strategies Committee Chair
   Daniel Berglund – Region K, Small Business Rep
   David Van Dresar – Region K, Water Districts Rep
   David Wheelock – Region K, River Authority Rep
   Doug Powell – Region K, Recreation Rep
   Karen Haschke – Region K, Public Rep
   Mike Reagor – Region K, Small Municipalities Rep
   Teresa Lutes – Region K, Municipalities Rep

   Additional Attendees:
   David Lindsay – Region K, Recreation Rep (Alternative)
   Christianne Castleberry – Region K, Water Utilities Rep (Alternate)
   Helen Gerlach – Region K, Municipalities Rep (Alternate)
   Lann Bookout – TWDB
   Jaime Burke – AECOM
   Alicia Smiley – AECOM
   Kiera Brown – AECOM
   Marisa Flores-Gonzalez – Austin Water
   Joe Trungale – Trungale Engineering
   Richard Hoffpauir – Hoffpauir Consulting
   Heather Rose – LCRA
   Cindy Smiley – Smiley Law Firm

3. Public Comments
   a. None.

4. Status Update on Water Management Strategy Evaluations
   a. 18 strategies under RWPG or committee review
   b. 15 strategies in progress/pending data
   c. 24 strategies not started
   d. Consultant is working to complete strategy evaluation by October 10 Region K RWPG meeting.

e. David Wheelock requests this detailed update either prior to meetings or attached to meeting minutes. Committee requests that consultant sends out strategies as they're completed.

5. Strategy Water Modeling Options
    a. Strategies that may require WAM modeling
        i. LCRA ASR in Carrizo-Wilcox
        ii. Austin Off-Channel Reservoir with Evaporation Suppressant
        iii. Reservoir Capacity Expansion (for Llano and possibly others)
        iv. Austin Return Flows
        v. Austin ASR
        vi. LCRA New Contracts and Contract Amendments
        vii. Amendments to Existing Water Rights/Permits
        viii. LCRA Mid-Basin Off-Channel Reservoir
        ix. LCRA Prairie Site Off-Channel Reservoir
        x. LCRA Excess Flows Off-Channel Reservoir
        xi. Amendments to LCRA Water Management Plan (Interruptible Water)
        xii. Import Return Flows from Williamson County
        xiii. Enhanced Recharge and Conjunctive use
    b. David Lindsay asks if we are using the new LCRA WMP that is waiting on TCEQ approval and Joe Trungale explained we use the 2015 WMP because that's what we got approval for.
    c. WAM Modeling Discussion
        i. Austin has completed extensive modeling for their strategies as part of the Austin Water Forward Plan development. Does RWPG need to do modeling as well with the Region K Cutoff Model for these?
            1. David Wheelock said that Austin modeling needs to comply Region K Cutoff Model specifications. Teresa Lutes agreed, saying RWPG needs to be consistent across strategies.
            2. Richard Hoffpauir, who performed the modeling for Austin's Water Forward Plan, noted that the Cutoff Model assumptions were included, but there are slight differences. For example, Water Forward included snapshots of 2020, 2040, and 2070, while regional water planning is decadal. Different criteria was included for boundary lines, the naturalized flow set, and return flows. Hoffpauir recommended that, for consistency, the RWPG will need to redo Austin modeling.
            3. Teresa Lutes suggested the Water Modeling Committee may need to reconvene to review some of the modeling results.
            4. Lann Bookout mentioned that modeling needs to happen within the next two months, and there may be little time to approach the TWDB with a hydrologic variance request. David Wheelock asked if Austin could provide a proposed modeling methodology to compare with the

approved hydrologic variances. Joe Trungale will coordinate with Austin to input Austin strategies.

ii. Environmental Impacts
   1. TCEQ environmental flow standards are embedded in the modeling.
   2. Lann Bookout confirmed there are no new standards or criteria for regional planning process modeling.
   3. As the TWDB requires numerical quantitative impacts, committee decided to show impacts similar to the 2016 RWP cycle, as either:
      a. Negligible; or
      b. Water diversions to/from river.

iii. Austin Strategies
   1. Committee will review Austin comments at next WMS meeting and approve at October RWPG meeting.
   2. It was noted that environmental impacts will need to remain quantifiable through the editing process.

6. Municipal Conservation
   a. Strategy methodology and costing assumptions were previously presented to both WMS committee and RWPG. WMS committee received first draft of strategy write-up to vote on at next meeting.
      i. Write-up included discussion on potential yields of outdoor watering restrictions.
      ii. Conservation measures included capital and non-capital costs. Capital costs were broken down into Leak Detection and Repair and Advanced Metering Infrastructure. Improvements such as public outreach and enforcement were included in non-capital costs.
      iii. HB 807 goals may be included in Chapter 5 conservation section.

7. ASR Strategy Evaluations
   a. BS/EACD Edwards/Middle Trinity ASR
      i. Strategy Definition and Cost
         1. Water from the Edwards-BFZ aquifer will be pumped, treated, and stored in the Middle Trinity Aquifer for later use.
         2. Project Yield:
            a. Buda – Online: 2020; Yield (2020): 150 ac-ft/yr; Yield (2030): 600 ac-ft/yr
            b. Sunset Valley – Online: 2030; Yield: 100 ac-ft/yr
         3. Project Costs:
            a. Buda – Capital Costs: $9,086,000; Annual Cost: $781,000; Unit Cost: $1,302/ac-ft/yr
            b. Sunset Valley – Capital Costs: $3,825,000; Annual Cost: $449,000; Unit Cost: $4,490/ac-ft/yr

ii. Mike Reagor asked which Trinity aquifer the strategy is planned for, since the Glen Rose has a high sulfur concentration. Kiera Brown responded that per the 2017 City of Buda ASR Feasibility Study, testing will be completed to determine the appropriate location. The strategy is considered viable until testing proves otherwise.

iii. David Wheelock expressed concern whether the unit cost for Sunset Valley is prohibitively high. Sunset Valley's needs could be met through other strategies, but as RWPG does not have all information from the WUG. Consultant will reach out to WUG for feedback.

iv. David Van Dresar requested that an ASR expert come talk to the group for the 2026 planning cycle. Lann Bookout recommended that RWPG reach out to San Antonio Water System (SAWS) for a tour of the H2Oaks ASR facility.

b. BS/EACD Saline Edwards ASR

  i. Strategy Definition and Cost

    1. Water from the Edwards-BFZ aquifer will be pumped, treated, and stored in the Saline Edwards Aquifer for later use. Recovered water will be blended with water directly from the Saline Edwards to increase yield.
    2. Project Yield:
       a. Buda – Online: 2040; Yield: 800 ac-ft/yr
       b. Hays County-Other – Online: 2040; Yield: 500 ac-ft/yr
    3. Project Costs:
       a. Buda – Capital Costs: $17,166,500; Annual Cost: $2,102,100; Unit Cost: $2,629/ac-ft/yr
       b. Hays County-Other – Capital Costs: $10,746,500; Annual Cost: $1,315,900; Unit Cost: $2,629/ac-ft/yr

  ii. Heather Rose asked if RWPG considered including a distillation plant in the strategy. No; information regarding infrastructure for the strategy was obtained from the WUGs.

8. Rainwater Harvesting

  a. Strategy Definition and Cost

    i. Rebates will be provided to private homeowners who construct a rainwater harvesting system on their property to meet a portion of their water needs. Rebates are not assumed to cover the cost of the entire system.

    ii. Project Yield:

      1. Dripping Springs WSC – Online: 2030; Yield (2030): 34 ac-ft/yr; Yield (2070): 81 ac-ft/yr
      2. Hays – Online: 2030; Yield (2030): 3 ac-ft/yr; Yield (2070): 7 ac-ft/yr
      3. Hays County-Other – Online: 2030; Yield (2030): 16 ac-ft/yr; Yield (2070): 50 ac-ft/yr

4. Sunset Valley – Online: 2030; Yield (2030): 2 ac-ft/yr; Yield (2070): 4 ac-ft/yr

iii. Project Costs:

1. Dripping Springs WSC – Capital Costs: $733,000; Annual Cost: $51,600; Unit Cost: $634/ac-ft/yr
2. Hays – Capital Costs: $62,000; Annual Cost: $4,400; Unit Cost: $639/ac-ft/yr
3. Hays County-Other – Capital Costs: $447,000; Annual Cost: $31,400; Unit Cost: $634/ac-ft/yr
4. Sunset Valley – Capital Costs: $225,000; Annual Cost: $15,800; Unit Cost: $4,069/ac-ft/yr

b. Heather Rose suggested write-up change from "some rainwater catchment systems are gravity driven, where pressurized systems are not required" to "some rainwater catchment systems are gravity driven, where pressurized systems may not be required."

c. Heather Rose expressed concern that forecasting implementation would be difficult. Consultant responded that strategy implementation is the responsibility of the individual WUGs. Drippings Springs WSC, Hays, and Sunset Valley all requested Rainwater Harvesting in their Feb. 2018 Strategy survey. Implementation surveys are released in the following planning cycle after strategy is recommended.

d. WMS committee requests that Consultant revisit strategy write-up, including researching a minimum water storage requirement for rebates and potential TWDB funding.

9. Groundwater Strategies

a. David Lindsay asked if water use within the region exceeds recharge rates. David Van Dresar responded that areas that fall under Groundwater Conservation Districts (GCDs) are not presently exceeding recharge rates. Each Groundwater Management Area (GMA) develops Desired Future Conditions (DFCs) that manages groundwater use (and subsequently manages subsidence).

b. Expand Use of Local Groundwater

i. Daniel Berglund noted that regarding irrigation, wells have already been drilled for the 2020 decade due to the large number of wells drilled 2012-2014, so a capital cost in time for the 2020 decade can be justified. He also added that Matagorda County has limited fresh groundwater due to saltwater intrusion, so wells are shallower, and yields are smaller.

ii. Methodology states that if an expand use of groundwater is less than 100 ac-ft/yr of pumping, a new well would not be required. David Van Dresar said that GCDs would be able to tell RWPG if existing wells are at full capacity.

iii. Daniel Berglund added that as more supplies is used on irrigation, there are higher return flows due to saturated soils; this should be included under environmental impacts.

    iv. David Wheelock requested that Consultant develop alternative strategies for entities with groundwater strategies that exceed the Modeled Available Groundwater (MAG).
  c. Development of New Groundwater
    i. Lann Bookout recommended to add a storage tanks to the costing of groundwater strategies, as it is a typical expense.

10. Irrigation Conservation
  a. Tail Water Recovery
    i. Tail water recovery is the capture, storage, and conveyance of a portion of the irrigation field return flows back into the irrigation system.
    ii. New 2021 Strategy. Status: preliminary strategy write-up (in review).
    iii. Daniel Berglund requested a copy of the costing data, as unit costs appear high.
  b. Sprinkler Irrigation
    i. The application of sprinkler irrigation is an alternative to field inundation in rice farming.
    ii. Existing 2016 Strategy. Status: preliminary strategy write-up (in review).
    iii. Strategy Assumed a water savings of 8 inches (0.67 ac-ft/ac) per acre applied, which is a decrease from the 2016 assumption of 12 inches.
    iv. Daniel Berglund requested a copy of the costing data, as unit costs appear low.
  c. Irrigation Operations Conveyance Improvements
    i. Irrigation operations conveyance improvements improve the efficiency of the water delivery canal system.
    ii. Existing 2016 Strategy. Status: preliminary strategy write-up (in progress).
    iii. Daniel Berglund requested that consultant examine NRCS language to determine whether privately-owned canal systems can be added to the strategy and obtain funding.
  d. Real-Time Monitoring
    i. A smart metering program, using a volumetric probe and SCADA, can assess water use in real-time to improve irrigation efficiency.
    ii. New 2021 Strategy. Status: data collection.
  e. Drip Irrigation for Non-Rice Crops
    i. Drip irrigation is the application of micro irrigation to the root zone of non-rice crops through low pressure, low volume devices.
    ii. New 2021 Strategy. Status: Preliminary strategy write-up (in progress).
  f. On-Farm Conservation
    i. Existing 2016 Strategy. Status: data collection.
    ii. Precision Land Leveling
      1. Precision land leveling grades a field to allow a more uniform shallow water depth across the field.

        2. Daniel Berglund noted that once land leveling is completed, water savings stays same, though farmers may perform a cosmetic "dress up" maintenance.
    iii. Multiple Field Inlets
        1. Multiple field inlets at individual cuts or land sections between levees allows for shallow water application and a quick field drain time.
        2. Daniel Berglund added the strategy also allows for improved rainfall management.
    iv. Reduced Levee Intervals
        1. Reducing the contour interval between levees from 0.2 feet to 0.15 feet minimizes the water depth, and therefore water use.
        2. Daniel Berglund recognized that an LCRA savings verification study has shown that reducing contours can result in a similar or increased use of water, but he believes that the study showed such results because the land leveled was leveled completely flat rather than at a slight grade.

11. Reuse
    a. Discussion postponed for next WMS committee meeting.

12. Minutes Approval
    a. Draft of June 17, 2019
        i. Cindy Smiley requested changes to 2., 6.e.i.1., 7.b.i.1., 9.b.ii.2.a., and 10.d.
            1. 2. Change Danny Bulovas's affiliation from "*BCL*" to "*Lake Travis*."
            2. 6.e.i.1. Spell out "*SAR*" to "*South Austin Regional*."
            3. 7.b.i.1. Add abbreviations for "*raw water intake (RWI)*" and "*water treatment plant (WTP)*."
            4. 9.b.ii.2.a. Add abbreviation for "*Water Loss Audit (WLA).*"
            5. 10.d. Delete "*strategies*" so the sentence reads, "*Jennifer Walker and David Wheelock asked when the quantitative analysis will be completed for environmental and socioeconomic impacts, and when Joe Trungale will perform modeling*."
        ii. Teresa Lutes requested changes to 6.b.i.1., 6.b.ii.1., 6.c.ii.1., 6.c.ii.3., 6.d.i.1., and 6.e.ii.2.
            1. 6.b.i.1. Change "*environmental suppressant*" to "*evaporation suppressant*."
            2. 6.b.ii.1. Add "*report*" so the sentence reads, "*The final report suggested that, with an 87 percent statistical level of confidence, the suppressant reduced evaporation.*"
            3. 6.c.ii.1. Change to read, "*Barbara Johnson asked if developers would be required to implement rainwater and stormwater harvesting. Teresa Lutes indicated that a combination of ordinances and incentives are in*

development to achieve the desired yields for this strategy. At this phase, ordinance is proposed for developments >250,000 SF."

4. 6.c.ii.3. Change to read, "*Daniel Berglund asked if rainwater was 100% reliable, given its nature to be inconsistent. Consultant will confirm that rainwater availability is calculated for DOR conditions for consistency with other strategy assumptions*."
5. 6.d.i.1. Change "*surplus*" to "*available*."
6. 6.e.ii.2. Add "*that would need to be address*" so the sentence reads, "*Teresa Lutes responded that pollutant levels for IPR are a concern that would need to be addressed, but that IPR is only to be used when the total combined storage of Lakes Buchanan and Travis are below 400,000 acre-ft, a condition worse than experienced in the drought of record*."

iii. Lauri Gillam motioned to approve the minutes with the changes. Daniel Berglund seconded. Committee passed.

13. New / Other Business
    a. None.

14. Next Meeting
    a. At least two more WMS committee meetings will need to be scheduled to occur before the next RWPG meeting. A Doodle poll will be sent out to determine the best meeting time for the week of September 16, 2019.
    b. The next RWPG meeting will be October 9, 2019 at 10:00 a.m. at the LCRA Dalchau Service Center.

15. Public Comments
    a. None.

16. Lauri Gillam adjourned at 12:44 p.m.

Lower Colorado Regional Water Planning Group
Water Management Strategies Meeting
AECOM, Treaty Oak Conference Room
September 16, 2019

1. Lauri Gillam called meeting to order at 9:36 a.m.

2. Attendees (23)
   Committee Members:
   Lauri Gillam – Region K, Small Municipalities Rep, Water Management Strategies Committee Chair
   Daniel Berglund – Region K, Small Business Rep
   David Van Dresar – Region K, Water Districts Rep
   David Wheelock – Region K, River Authority Rep
   Mike Reagor – Region K, Small Municipalities Rep
   Teresa Lutes – Region K, Municipalities Rep
   Karen Haschke – Region K, Public Rep
   David Lindsay – Region K, Recreation Rep (Alternate)

   Additional Attendees:
   David Bradsby – Region K, TPWD Rep
   Christianne Castleberry – Region K, Water Utilities Rep (Alternate)
   Temple McKinnon – TWDB
   Jaime Burke – AECOM
   Kiera Brown – AECOM
   Helen Gerlach – Austin Water
   Richard Hoffpauir – Hoffpauir Consulting
   Joe Trungale – Trungale Engineering
   Rebecca Batchelder – LCRA
   Stacy Pandey – LCRA
   Leonard Oliver – LCRA
   Jordan Furnans – LRE Water, LLC (representing Goldthwaite)
   Cindy Smiley – Smiley Law Firm
   Daniel Bulovas – Central Texas Water Coalition
   Adam Connor – Freese & Nichols

3. Public Comments
   a. None.

4. Minutes Approval
   a. Draft of August 8, 2019

i. Daniel Berglund motioned to approve the minutes. David Van Dresar seconded. Committee passed.

5. Status Update on Water Management Strategy Evaluations
    a. 25 strategies under RWPG or committee review.
    b. 24 strategies in progress/pending data.
    c. 11 strategies not started.
    d. Consultant is working to complete strategy evaluation by October 9 Region K RWPG meeting.

6. Goldthwaite Strategy Request
    a. Goldthwaite recently purchased part of an irrigation water right for 1,000 ac-ft/yr with a 1956 priority. Total diversion rights will now be 2,500 ac-ft/yr. 250 ac-ft/yr of reuse is currently included in Goldthwaite's water rights permit; this will be removed in amended permit, as reuse should not be included in ROR diversion rights.
    b. Goldthwaite Requests
        i. Requesting 2021 Plan strategies to reflect the following:
            1. Water Right Permit Amendment
            2. Expanding Goldthwaite's reservoir storage capacity - – still 0 AFY yield during drought of record
            3. Direct Reuse
    c. Discussion
        i. Consultant proposed two options for incorporation into the RWP:
            1. Describe Goldthwaite's plans as a sub-category of existing strategies:
                a. Water Right Permit Amendment
                b. Reservoir Capacity Expansion
                c. Reuse
            2. Create a new strategy specifically for Goldthwaite
            3. Committee agreed to include a subsection about Goldthwaite and refer to the other strategy sections, so no scope of work changes are needed.

7. Draft Strategy Review
    a. First drafts of strategy write-ups were previously presented to WMS committee for BS/EACD Edwards/Middle Trinity ASR, BS/EACD Saline Edwards ASR, Municipal Conservation, and Rainwater Harvesting. Consultant incorporated comments from discussion.
    b. Daniel Berglund motioned to send the strategies as-is to the RWPG for review. David Wheelock seconded. Committee passed.

8. Groundwater Strategies
    a. Expand Use of Local Groundwater

i. Expand Local Use of Groundwater involves pumping additional groundwater from an aquifer that the WUG is currently using as a source, either using the WUG's existing wells or drilling additional wells.

ii. General Discussion

    1. David Lindsay suggested that the groundwater write-ups include total strategy volume by aquifer.
        a. Jaime Burke explained that regional water planning allocates groundwater by aquifer/county/basin divisions, and these totals are included in the write-up for each aquifer.
        b. Can look at adding if it makes sense.
    2. Mike Reagor requested an explanation of the drawdown levels listed in the environmental impacts sections. He asked if all areas will experience a 240 ft drawdown in the Carrizo-Wilcox Aquifer, for example.
        a. David Van Dresar explained that Desired Future Conditions (DFCs) are determined by Groundwater Conservation Districts (GCDs). GCDs hold public meetings, which can be attended to learn more about and provide input on groundwater conservation practices.
        b. Mike Reagor requested that language be included in the "agricultural impacts" section of the groundwater write-ups to indicate potential impacts on agricultural users.
        c. Daniel Berglund said that the GCDs assess the potential for increased drawdown in drought conditions when issuing groundwater permits.
        d. David Wheelock requested that GCD language throughout the groundwater strategies be revised: each groundwater strategy will contribute drawdown, but that individual strategies will not result in the maximum drawdown defined by the GCD.
    3. David Wheelock requested that the following sentence be revised: "There are currently no irrigation WUGs with supplies of irrigation water or livestock water from the Carrizo-Wilcox Aquifer in Region K." Wheelock requested that the applicable county be specified (i.e., "…in Bastrop County in Region K").
    4. David Lindsay asked if the Regional Water Plan includes an overview of aquifer status.
        a. David Van Dresar explained that GCDs provide information for overall aquifer management, but that no chapter in the Regional Water Plan is set aside for this purpose. The GCD websites provide a variety of resources for more information on aquifer management.
    5. Expand Local Use of Groundwater - Carrizo-Wilcox Aquifer Strategy

a. David Wheelock asked what is meant by Aqua WSC being supplied from the “Brazos (to Colorado)” river basin.
    i. Consultant explained that groundwater will be supplied from the Carrizo-Wilcox Aquifer in the Brazos basin to meet needs in the Colorado basin.
b. David Wheelock said that unit cost for Aqua WSC (Bastrop County) seemed high and asked for more information.
    i. The consultant clarifies that Aqua WSC is supplied by Carrizo-Wilcox water from two river basins. To accomplish this, additional infrastructure is required, resulting in a higher cost. Additional infrastructure includes two separate well fields (to pull from each basin), each with a contingency pump, connected by a pipeline.
c. David Wheelock requested that an annual GCD permit fee of $11/AFY be included in the Expanded Use of Carrizo-Wilcox Aquifer (in Bastrop County) costs. He suggested putting it under the “purchase of water” line item. Wheelock requested that the consultant check if other GCDs have permit fees as well.
d. David Wheelock requested that treatment costs for removal of iron and manganese be included in groundwater strategy costs.
    i. David Van Dresar suggested including the capital costs of new treatment facilities only for new development of groundwater for municipal and manufacturing users. For expansion of existing groundwater sources, it can be assumed that treatment facilities already exist and that only the additional cost of treatment need be included. Consultant agreed.
e. David Wheelock requested that the applicable decade be added to the DFCs.

6. Expand Local Use of Groundwater - Ellenburger-San Saba Aquifer
    a. Bertram (Burnet County)
        i. Mike Reagor said that the costs for this strategy seem high. Consultant indicated that the Bertram strategy will include treatment of surface water, given that the groundwater is sourced from an old quarry pit that is open to the atmosphere. This treatment infrastructure increases the cost substantially.
        ii. Lauri Gillam noted that Bertram’s 2070 need is 394 ac-ft/yr, but the strategy amount is for 3000 ac-ft/yr. Gillam asked for an explanation for the excess supply.

Consultant will contact Bertram to request more details on their water resource plans.

7. Expand Local Use of Groundwater - Gulf Coast Aquifer Strategy
    a. David Wheelock indicated on error on the summary sheet: Wharton (Wharton County, Brazos-Colorado Basin) should have a unit cost of $272/ac-ft, not $593/ac-ft. Consultant agreed.
8. Expand Local Use of Groundwater – Carrizo-Wilcox Alternative Strategy
    a. David Wheelock requested that a $11/ac-ft/yr GCD permit fee be added to the costs.
    b. David Wheelock requested that the following sentence be removed from the environmental impacts section: "An additional result of the MAG exceedance is the potential for decreased springflows."

b. Development of New Groundwater
    i. Development of New Groundwater involves drilling wells to pump groundwater from an aquifer that the WUG is currently not using as a source.
    ii. General Discussion
        1. David Lindsay requested that the plan specify whether a strategy was requested by a WUG or proposed by the planning group/consultant. Consultant agreed.
        2. David Lindsay asked for the status of the TWDB Groundwater-Surface Water Interaction Study that is being implemented by LCRA.
            a. Rebecca Batchelder indicated that the initial site test wasn't viable, and that a new site is currently being identified for the study. The study is ongoing.
    iii. Development of New Groundwater - Gulf Coast Aquifer Strategy
        1. Daniel Berglund asked how the yield of 510 ac-ft/yr was determined for the Irrigation/Matagorda County WUG and said that the yield seemed low for agricultural users. Consultant explained that only 510 ac-ft/yr was needed to meet the needs of the WUG.
    iv. Development of New Groundwater – Yegua-Jackson Aquifer Strategy
        1. David Van Dresar requested that the costs be updated to include 20 acres of land acquisition, as that is what is required for this district based on the yield.
        2. David Van Dresar requested that the peaking factor be adjusted to 1 instead of 2, as that is what is applicable for the district, based on the yield.
    v. Development of New Groundwater - Hickory Aquifer Strategy
        1. Mike Reagor said that the yield for the Mining/Burnet County/Colorado Basin WUG (1,000 ac-ft/yr) seemed high. Consultant clarified that the specified yield is available under the MAG, and that the WUG has a need greater than this amount (4,626 ac-ft/yr).

9. Oceanwater Desalination
    a. Strategy Definition and Cost
        i. The proposed desalination process would divert seawater from the Gulf of Mexico near the Matagorda Bay, treat the water using reverse osmosis (RO) filtration, and deliver treated water to industrial users in and around Bay City.
        ii. Currently, the strategy has no sponsor. Without a sponsor, it will be placed under the "Considered, But Not Recommended" section of the plan.
        iii. Online: 2060
        iv. Project Yield: 22,400 ac-ft/yr
        v. Project Costs: Total Project Costs: $575,331,000; Annual Cost: $79,072,000; Unit Cost: $3,530/ac-ft
    b. Discussion
        i. Teresa Lutes provided comments and suggested edits for the strategy. Consultant will review comments and provide for committee approval at the next meeting.
        ii. David Wheelock requested that the following sentence in the agricultural and natural resource impacts section be revised: "While this strategy would be too expensive for agricultural users, it could potentially provide a source of water to lower basin users that would otherwise use water from the Highland Lakes or the Arbuckle Reservoir." Wheelock requested that the strategy be revised to not be specific to LCRA's water management plan, as LCRA isn't necessarily the sponsor for this strategy. Additionally, Wheelock requested that the language, "while this strategy would be too expensive for agricultural users," be removed.

10. Direct Reuse
    a. Blanco
        i. Online: 2030
        ii. Project Yield: 146 ac-ft/yr
        iii. Project Costs: Total Project Costs: $1,529,000; Annual Cost: $132,000; Unit Cost: $904/ac-ft
    b. Horseshoe Bay
        i. Online: 2030
        ii. Project Yield: 154 ac-ft/yr
        iii. Project Costs: Total Project Costs: $1,270,000; Annual Cost: $106,000; Unit Cost: $688/ac-ft
    c. Marble Falls
        i. Online: 2030
        ii. Project Yield: 100 ac-ft/yr (2030); 500 ac-ft/yr (2070)
        iii. Project Costs: Total Project Costs: $2,010,000; Annual Cost: $177,000; Unit Cost: $354/ac-ft
    d. Meadowlakes

   i. Online: 2020
   ii. Project Yield: 75 ac-ft/yr
   iii. Project Costs: Total Project Costs: $0; Annual Cost: $0; Unit Cost: $0/ac-ft

e. Fredericksburg
   i. Online: 2030
   ii. Project Yield: 132 ac-ft/yr
   iii. Project Costs: Total Project Costs: $9,280,000; Annual Cost: $720,000; Unit Cost: $508/ac-ft

f. Buda
   i. Online: 2020
   ii. Project Yield: 100 ac-ft/yr (2020); 1,680 ac-ft/yr (2070)
   iii. Project Costs: Total Project Costs: $7,562,000; Annual Cost: $627,000; Unit Cost: $373/ac-ft

g. Dripping Springs WSC
   i. Online: 2030
   ii. Project Yield: 390 ac-ft/yr (2030); 672 ac-ft/yr (2070)
   iii. Project Costs: Total Project Costs: $2,056,000; Annual Cost: $187,000; Unit Cost: $278/ac-ft

h. West Travis County PUA
   i. Online: 2030
   ii. Project Yield: 224 ac-ft/yr
   iii. Project Costs: Total Project Costs: $1,778,000; Annual Cost: $153,000; Unit Cost: $683/ac-ft

i. Lago Vista
   i. Online: 2030
   ii. Project Yield: 224 ac-ft/yr (2030); 673 ac-ft/yr (2070)
   iii. Project Costs: Total Project Costs: $2,140,000; Annual Cost: $229,000; Unit Cost: $340/ac-ft

j. Lakeway MUD
   i. Online: 2030
   ii. Project Yield: 100 ac-ft/yr (2030); 500 ac-ft/yr (2070)
   iii. Project Costs: Total Project Costs: $2,009,000; Annual Cost: $177,000; Unit Cost: $354/ac-ft

k. Travis County WCID 17
   i. Online: 2030
   ii. Project Yield: 510 ac-ft/yr
   iii. Project Costs: Total Project Costs: $10,737,000; Annual Cost: $867,000; Unit Cost: $1,700/ac-ft

l. General Discussion
   i. David Wheelock requested that the discrepancy between costs calculated with the TWDB's costing tool and those calculated externally (e.g., Travis County WCID 17) be investigated, as they differ by up to $1,400/ac-ft.

   ii. Teresa Lutes said that the Austin Reuse Strategy is costed at approximately $1,500/ac-ft.
   iii. Stacy Pandey requested that the Horseshoe Bay description be revised. Pandey requested that the entity be referred to as "Horseshoe Bay," not "The Horseshoe Bay Subdivision of Summit Rock."
   iv. Stacy Pandey requested the Meadowlakes description be revised. Pandey indicated that the infrastructure has already been constructed and requested that the strategy be updated to indicate this.

11. Downstream Return Flows
    a. Strategy Definition and Cost
       i. This strategy accounts for return flows from Pflugerville that are already returned to the Colorado River. Return flows are calculated as 60 percent of the total demand for Pflugerville, post drought management and conservation savings, and reduced by 10 percent, to account for channel losses and evaporation. The strategy allocates Pflugerville's return flows to LCRA and other downstream users.
       ii. Online: 2020
       iii. Project Yield: 3,985 ac-ft/yr (2020); 8,267 ac-ft/yr (2070)
       iv. Project Costs: No capital costs.
    b. Discussion
       i. Mike Reagor asked why no costs for treatment were included.
          1. Any treatment improvements required to maintain return flow/discharge quality are the responsibility of the wastewater plant, and not the downstream water receiver. The wastewater plant will be required to maintain discharge quality regardless of whether the return flows are utilized as a supply, as this strategy proposes to do.
       ii. David Wheelock requested the following language from the environmental impacts section be removed: "During drought years, return flows will have a higher concentration of nutrients and pollutants due to increased conservation and drought management efforts. Additional treatment may be needed to ensure environmental protection and to ensure quality for use as a water supply." The reasoning for this redaction is as follows: while flows into the wastewater plant may become more concentrated during a drought, discharge requirements will remain the same. Thus, the quality of return flows should be maintained during times of drought. Consultant agreed to remove the language.
       iii. David Wheelock requested that the cost of the additional pumping required to intake the return flows be included.

12. Irrigation Conservation
    a. Tail Water Recovery
       i. Status: draft strategy write-up in review – costing.

b. Sprinkler Irrigation
    i. Status: draft strategy write-up in review – costing.
c. Irrigation Operations Conveyance Improvements
    i. Status: preliminary strategy write-up in progress – coordinating with LCRA.
    ii. Daniel Berglund asked if this strategy applies to privately owned canals.
    iii. Stacy Pandey requested that private canals be discussed in their own section in the On-Farm Conservation write-up.
d. Real-Time Monitoring
    i. Status: data collection.
    ii. Daniel Berglund said that his GCD requires that irrigation, municipal, and manufacturing well owners report their usage annually. Berglund requested that Region K propose (in the policy recommendations section of the plan) that all GCDs require their irrigation, municipal, and manufacturing users to report annual groundwater usage.

e. Drip Irrigation for Non-Rice Crops
    i. Status: Preliminary strategy write-up in progress – water savings.
    ii. Consultant hasn't found verifiable water savings. Some studies show that water consumption may increase after implementing drip irrigation. Continue evaluating strategy?
        1. Daniel Berglund said that drip irrigation in the Gulf Coast Aquifer region is difficult to implement because the soil is highly saturated. Berglund said that water consumption may increase when using drip irrigation because, when farmers save on water expenses, they have more financial resources available to grow additional crops. Berglund requested that the consultant's sources be examined to determine if the acreage is held constant for the studies claiming water consumption increases.
        2. Mike Reagor said that he knows of grape, pecan, and peach farmers who are already implementing drip irrigation.
        3. David Lindsay said that this strategy will likely have high costs, due to high maintenance requirements.
        4. Stacy Pandey requested that the strategy include discussion of specific crops, as opposed to generalizing trends and applications for all non-rice crops. Pandey also requested that the write-up include discussion of why drip irrigation is not feasible for rice crops.
        5. Consultant will consider for Mills County Irrigation.
f. On-Farm Conservation
    i. Status: preliminary strategy write-up in progress.
    ii. Sub-strategies include: Precision Land Leveling, Multiple Field Inlets, Conveyance Improvements, Irrigation Pipeline, Reduced Levee Intervals

            1. Daniel Berglund and Stacy Pandey discussed the specifics of Reduced Levee Intervals. Leveling land conserves water by reducing the required volume of water to create the minimum ponding depth. By making levees less steep (reducing the number of elevation steps), land is made more level and water conserved. Because level intervals are related to land leveling, Daniel Berglund and Stacy Pandey requested that Reduced Levee Intervals be included as a subcategory within the Precision Land Leveling Strategy.

13. LCRA Water Management Strategy Evaluations
    a. Notified planning group of the following strategies pending internal review:
        i. LCRA Expand Groundwater in Bastrop County
        ii. LCRA Groundwater for Fayette Power Plant – onsite (smaller yield within MAG)
        iii. LCRA Alternative Groundwater for Fayette Power Plant – onsite (larger yield exceeding MAG)
        iv. LCRA Groundwater for Fayette Power Plant – offsite
        v. LCRA Baylor Creek Reservoir
        vi. Alternative LCRA Supplement Environmental Flows with Brackish Groundwater
    b. No discussion.

14. Water Purchase and Contracts
    a. Notified planning group of assumptions for the following strategies, which are pending internal review:
        i. LCRA New Contracts/Contract Amendments – no details yet
        ii. Water Purchase/Water Purchase Amendments
            1. Barton Creek WSC
                a. Purchase Amendment from Travis County MUD 4
                b. Cost per 1,000 gallons: $5.00 > Cost per ac-ft: $1,629
            2. Creedmoor Maha WSC
                a. Purchase Amendment from Aqua WSC
                b. Cost per 1,000 gallons: $3.75 > Cost per ac-ft: $1,222
            3. Travis County MUD 14
                a. Purchase Amendment from Aqua WSC
                b. Cost per 1,000 gallons: $3.75 > Cost per ac-ft: $1,222
            4. Hays County Mining
                a. New Purchase from Buda (reuse) - Included in 2016 RWP
                b. Cost per 1,000 gallons: $4.90 > Cost per ac-ft: $1,597
    b. No discussion.

15. New / Other Business
    a. None.

16. Next Meeting
    a. The next WMS committee meeting will be held Thursday, October 3, 2019, 10:00 a.m. – 4:00 p.m.
    b. The next RWPG meeting will be October 9, 2019 at 10:00 a.m. at the LCRA Dalchau Service Center.

17. Public Comments
    a. Cindy Smiley requested that the plan specify whether a strategy was requested by a WUG or proposed by the planning group.
        i. Consultant agreed and explained that the plan currently has a section documenting WUG survey responses, however this information could be included in the overall WUG strategy application table as well.
    b. Cindy Smiley requested that the strategy descriptions identify if costs were calculated with the TWDB's costing tool or calculated externally. Consultant confirmed that this is included in strategy write-ups.

18. Lauri Gillam adjourned at 12:16 p.m.

Lower Colorado Regional Water Planning Group
Water Management Strategies Meeting
AECOM, Treaty Oak Conference Room
October 3, 2019

1. Lauri Gillam called meeting to order at 1:07 p.m.

2. Attendees (24)
   Committee Members:
   Lauri Gillam – Region K, Small Municipalities Rep, Water Management Strategies Committee Chair
   John Burke – Region K, Water Utilities Rep
   Daniel Berglund – Region K, Small Business Rep
   David Wheelock – Region K, River Authority Rep
   Jennifer Walker – Region K, Environmental Rep
   Mike Reagor – Region K, Small Municipalities Rep
   Teresa Lutes – Region K, Municipalities Rep
   Karen Haschke – Region K, Public Rep
   David Lindsay – Region K, Recreation Rep (Alternate)

   Additional Attendees:
   David Bradsby – Region K, TPWD Rep
   Christianne Castleberry – Region K, Water Utilities Rep (Alternate)
   Earl Foster – Region K, Small Municipalities (Alternate)
   Lann Bookout – TWDB
   Jaime Burke – AECOM
   Alicia Smiley – AECOM
   Kiera Brown – AECOM
   Helen Gerlach – Austin Water
   Richard Hoffpauir – Hoffpauir Consulting
   Joe Trungale – Trungale Engineering
   Rebecca Batchelder – LCRA
   Stacy Pandey – LCRA
   Valerie Miller – LCRA
   Leonard Oliver – LCRA
   Cindy Smiley – Smiley Law Firm
   Adam Connor – Freese & Nichols

3. Public Comments
   a. Jennifer Walker requested an expanded evaluation of environmental impact on either a cumulative or project-by-project basis. Jaime Burke responded that environmental impacts are assessed as write-ups are provided and a cumulative environmental impacts

analysis is included in Chapter 6 of the RWP. Joe Trungale noted that flow impacts are shown through the WAM, but other impacts are not clearly defined by the RWP process.

4. Minutes Approval
    a. Draft of September 16, 2019
        i. David Wheelock motioned to approve the minutes. Daniel Berglund seconded. Committee passed.

5. Status Update on Water Management Strategy Evaluations
    a. 41 strategies under RWPG or committee review.
    b. 29 strategies in progress/pending data.
    c. 0 strategies not started.
    d. The initially prepared plan (IPP) is due March 3.

6. Draft Strategy Review
    a. First drafts of strategy write-ups were previously presented to WMS committee for: Expand Use of Local Groundwater/Development of New Groundwater Supplies, Downstream Return Flows, Oceanwater Desalination, and Direct Reuse. Consultant incorporated comments from discussion.
        i. David Lindsay motioned to send the Expand Use of Local Groundwater/Development of New Groundwater Supplies strategies to the RWPG for review. David Wheelock seconded. Committee passed.
        ii. As Oceanwater Desalination has no sponsor, David Lindsay said brackish groundwater should be more seriously considered as a recommended strategy. Jaime Burke responded that both Austin and LCRA are sponsors of brackish groundwater strategies. Teresa Lutes suggested that the brackish groundwater discussion in the RWP include the limitations of current brackish water modeling and recognition that application of brackish water is evolving.
        iii. Downstream Return Flows – Teresa Lutes requested changing, "*…return flows from Pflugerville were also taken into consideration*" to, "*…return flows from Pflugerville are considered in the plan as a water management strategy*."
        iv. Lann Bookout requested Consultant note when costs are provided by WUGs as opposed to developed fully by the costing tool.
    b. Lauri Gillam motioned to send the additional strategies to the RWPG for review. Mike Reagor seconded. Committee passed.

7. Direct Potable Reuse
    a. Buda
        i. Online: 2030
        ii. Project Yield: 2,240 ac-ft/yr
        iii. Project Costs: Total Project Costs: $33,503,000; Annual Cost: $4,399,000; Unit Cost: $1,964/ac-ft

b. Dripping Springs WSC
    i. Online: 2030
    ii. Project Yield: 560 ac-ft/yr
    iii. Project Costs: Total Project Costs: $12,119,000; Annual Cost: $1,446,000; Unit Cost: $2,582/ac-ft
c. West Travis County PUA
    i. Online: 2030
    ii. Project Yield: 336 ac-ft/yr
    iii. Project Costs: Total Project Costs: $7,788,000; Annual Cost: $972,000; Unit Cost: $2,893/ac-ft
d. David Wheelock wanted to clarify that the RWPG is assuming the purchase of water is valued at $0, although he believes that in practice, the water transferred from wastewater treatment to water treatment is sold, such as the relationship between the city of Dripping Springs and Dripping Springs WSC. Wheelock requested to add that the valuation of water is assumed to be zero to the write-up. Lauri Gillam requested a line adding that further evaluation may be necessary in future cycles.
e. David Wheelock requested to change language for Dripping Springs WSC and West Travis County PUA to "considering" the strategy as they haven't moved as quickly as Buda in the implementation of DPR. Lann Bookout responded that if a project is only under consideration, it may not be eligible for funding.
f. Daniel Berglund motioned to send the strategy to the RWPG for review. Karen Haschke seconded. Committee passed.

8. LCRA Water Management Strategy Evaluations
    a. No discussion.

9. Austin Water Management Strategy Evaluations
    a. No discussion.

10. Water Purchase and Contracts
    a. LCRA New Contracts/Contract Amendments
        i. Looking at a Bastrop Regional Project for Aqua WSC, Bastrop, and Bastrop County WCID #2
    b. Water Purchase/Water Purchase Amendments
        i. Considering for Barton Creek WSC, Creedmoor Maha WSC, Travis County MUD 14, Hays County Mining, Hays, and potentially Windemere (via the Blue Water 130 Pipeline).
    c. No discussion. Strategy will be reviewed at next WMS committee meeting.

11. Irrigation Conservation
    a. Irrigation Conservation

i. Draft write-ups provided: Tail Water Recovery, Sprinkler Irrigation, Drip Irrigation for Non-Rice Crops, and On-Farm Conservation.
    1. Tail Water Recovery – Daniel Berglund noted strategy yields were not realistic because with the implementation of land leveling, there is less tail water to recover.
    2. Drip Irrigation – David Wheelock asked if unit cost seemed high. Alicia Smiley responded that micro irrigation costs are due to the high annual maintenance costs.
    3. On-Farm Conservation – Stacy Pandey requested data sources be added to write-up and that consultant reach out to NRCS for cost update.

ii. Draft write-ups in progress: Irrigation Operations Conveyance Improvements and Real-Time Monitoring
    1. Consultant is coordinating with LCRA and Daniel Berglund to complete write-ups.

b. Irrigation Drought Management
    i. Stacy Pandey requested strategy include a discussion of the LCRA Water Management Plan (WMP).
    ii. David Wheelock said to clarify that demands assume two crops, and drought management reduces demands by assuming a portion of growers don't grow crops.

c. Mining Conservation
    i. Strategy Definition and Cost
        1. Mining conservation involves taking the existing pumped groundwater, once used, letting it settle, and then recycling it for additional use rather than pumping additional groundwater from the aquifer. Serves mining WUGs Bastrop and Burnet counties.
        2. Online: 2020
        3. Project Yield:
            a. Bastrop Mining: 2 ac-ft/yr (2020); 243 ac-ft/yr (2030); 308 ac-ft/yr (2040); 233 ac-ft/yr (2050)
            b. Burnet Mining: 1,000 ac-ft/yr (2020); 1,500 ac-ft/yr (2070)
        4. Project Costs: Assumed no facilities cost; energy costs included; Annual Cost: Bastrop Mining ($5,000), Burnet Mining ($45,000); Unit Cost: Bastrop Mining ($16/ac-ft), Burnet Mining ($30/ac-ft)
    ii. David Wheelock requested consultant reach out to Mitchell Sodek to review strategy.

12. Hays County Groundwater Importation
    a. Alliance Regional Water Authority Pipeline
        i. Strategy Definition and Cost

1. Withdrawal and transport of groundwater from the Carrizo-Wilcox aquifer in Gonzales County to 1-35 Corridor area near San Marcos, Kyle, and Buda; primarily Region L strategy. Serves Buda.
2. Online: 2030
3. Project Yield: 762 - 2,467 ac-ft/yr
4. Project Costs: Region L to provide updated costing; Total Project Costs: $34,996,869; Annual Cost: $4,751,402; Unit Cost: $1,926/ac-ft

ii. Discussion

1. David Wheelock requested the discussion of the MAG be removed from the environmental impacts, as it is a misrepresentation: the MAG is based on Desired Future Conditions, which is more than just environmental considerations. Additionally, the available yield is different than the MAG yield, and the terminology should be removed from the strategy.
2. David Wheelock requested changing "*Importing groundwater from a more rural area to a more populated area may limit future growth in the water-supplying area*" to "*In general, importing water from rural areas may affect rural users, as described in Chapter 8.*"

b. Hays County Pipeline

i. Strategy Definition and Cost

1. Withdrawal and transport of groundwater from the Carrizo-Wilcox aquifer in Kyle area to western Hays County; strategy shared with Region L. Serves Hays County-Other and West Travis County PUA.
2. Online: 2030
3. Project Yield:
   a. West Travis County PUA: 3,000 ac-ft/yr
   b. Hays County-Other: 1,000 ac-ft/yr
4. Project Costs: Total Project Costs: West Travis County PUA ($22,939,500), Hays County-Other ($7,616,500); Annual Cost: West Travis County PUA ($1,938,750), Hays County-Other ($646,250); Unit Cost: $646/ac-ft

ii. Discussion

1. David Wheelock noted that treated water currently has a zero cost, and a cost needs to be added to the supply purchase. Consultant will coordinate with Region L.
2. Committee requested removal of implementation issues from the environmental discussion and a reference to Chapter 10.

c. Strategies will be reviewed at next WMS committee meeting.

13. Brush Management

a. Strategy Definition and Cost

        i. Convert land that is covered with brush (juniper, mesquite, saltcedar) to grasslands, increasing water availability through reduced extraction of soil water for transpiration and increased recharge to shallow groundwater and emergent springs. Serves Blanco, Hays, Gillespie, and Travis County-Other.
        ii. Online: 2030
        iii. Project Yield: 5,571 ac-ft/yr
        iv. Project Costs: Total Project Costs: $29,707,000; Annual Cost: $2,379,000; Unit Cost: $427/ac-ft
    b. Discussion
        i. David Lindsay and David Wheelock commented that the yield may be too low. The project's yield is based on drought of record (2011) conditions, when inflows were 10% normal inflows. Updates to strategy were limited and based on budget available from scope of work. Next cycle, RWPG can request a more detailed scope of work to potentially model inflows.
        ii. Strategy will be reviewed at next WMS committee meeting.

14. Wharton Water Supply
    a. Strategy Definition and Cost
        i. The 2017 Regional Water Supply Study for the City of Wharton and East Bernard recommended the use of additional groundwater; incorporated into Expand Use of Local Groundwater for Gulf Coast aquifer.
        ii. Online: 2030
        iii. Project Yield: 3,000 ac-ft/yr
        iv. Project Costs: Total Project Costs: $9,100,000; Annual Cost: $817,000; Unit Cost: $272/ac-ft
    b. No discussion. Strategy will be reviewed at next WMS committee meeting.

15. Remaining Draft Strategy Evaluations
    a. Goldthwaite Strategy Request
        i. Water Right Permit Amendment and expansion of Goldthwaite's reservoir storage capacity cannot be recommended as a strategy, as the yield is 0 ac-ft/yr during drought of record.
        ii. No discussion.

16. Austin Strategy Edits
    a. 7/15 strategies are completed and under review by Austin Water. Additional comments may be sent to Jaime Burke.
    b. David Wheelock requested that strategies be consistent with TWDB and hydrologic variance rules.

17. Significant Water Needs

a. Per HB807, “if a RWPA has significant identified water needs, provides a specific assessment of the potential for aquifer storage and recovery projects to meet those needs” (TWC§16.053(e)(10)).
b. RWPG is to define the meaning of “significant needs.” Committee asked if RWPG could parsing the needs so that irrigation does not count as significant. David Wheelock suggested a municipal need of 10,000 ac-ft/yr be considered significant.

18. Scope of Work Amendments
    a. SubTask Budget Amendments
        i. Reuse ($14,000 > $28,000)
        ii. Austin Conservation ($2,000 > $3,000)
        iii. Austin Blackwater and Greywater Reuse ($1,000 > $2,500)
        iv. Austin Onsite Rainwater and Stormwater Harvesting ($1,000 > $2,500)
    b. Amendments will be presented and discussed at Region K RWPG meeting.

19. New / Other Business
    a. None.

20. Next Meeting
    a. A Doodle poll will be sent out to determine the date of next WMS committee meeting for the last week of October.
    b. The next RWPG meeting will be October 9, 2019 at 10:00 a.m. at the LCRA Dalchau Service Center.

21. Public Comments
    a. None.

22. Teresa Lutes adjourned at 4:09 p.m.

Lower Colorado Regional Water Planning Group
Water Management Strategies Meeting
AECOM, Treaty Oak Conference Room
October 31, 2019

1. Lauri Gillam called meeting to order at 12:14 p.m.

2. Attendees (21)
   Committee Members:
   Lauri Gillam – Region K, Small Municipalities Rep, Water Management Strategies Committee Chair
   Ann McElroy – Region K, Environmental Rep
   Daniel Berglund – Region K, Small Business Rep
   David Wheelock – Region K, River Authority Rep
   Doug Powell – Region K, Recreation Rep
   Jennifer Walker – Region K, Environmental Rep
   Karen Haschke – Region K, Public Rep
   Teresa Lutes – Region K, Municipalities Rep

   Additional Attendees:
   John Burke – Region K, Utilities Rep
   David Lindsay – Region K, Recreation Rep (Alternate)
   Christianne Castleberry – Region K, Water Utilities Rep (Alternate)
   Jaime Burke – AECOM
   Alicia Smiley – AECOM
   Helen Gerlach – Austin Water
   Richard Hoffpauir – Hoffpauir Consulting
   Joe Trungale – Trungale Engineering
   Leonard Oliver – LCRA
   Rebecca Batchelder – LCRA
   Stacy Pandey – LCRA
   Adam Conner – Freese and Nichols
   Daniel Bulovas – Central Texas Water Coalition

3. Public Comments
   a. None.

4. Minutes Approval
   a. Draft of October 3, 2019
      i. David Wheelock requested to add Leonard Oliver to attendance sheet.
      ii. David Wheelock motioned to approve the minutes. Lauri Gillam seconded. Committee passed with a hearty "argh."

5. Status Update on Water Management Strategy Evaluations
    a. 42 strategies under RWPG or committee review.
    b. 16 strategies in progress/WUG review.
    c. 0 strategies not started.

6. Draft Strategy Review
    a. First drafts of strategy write-ups were previously presented to WMS committee for: Hays County Pipeline, Brush Management, Mining Conservation, and Irrigation Drought Management. Consultant incorporated comments from discussion.
        i. Irrigation Drought Management – Teresa Lutes requested that cost language be clarified as not being the cost of implementing strategy, but opportunity cost.
    b. Daniel Berglund motioned to send the additional strategies to the RWPG for review. Doug Powell seconded. Committee passed with a hearty "argh."
    c. Consultant met with Alicia Reinmund-Martinez and Blake Neffendorf to update BS/EACD Aquifer Storage and Recovery projects. Write-ups to be provided to the RWPG.

7. Austin Water Management Strategy Evaluations
    a. Discussed Austin Brackish Groundwater Desalination, Austin Blackwater and Greywater Reuse, Austin Decentralized Direct Non-Potable Reuse, and Austin Onsite Rainwater and Stormwater Harvesting + Community-Scale Stormwater Harvesting. Write-ups were not presented as handouts because strategies are still in review with Austin Water.
    b. Austin Brackish Groundwater Desalination
        i. No discussion.
    c. Austin Blackwater and Greywater Reuse
        i. David Wheelock noted there was an inconsistency between strategy costing and the costing for the Rainwater Harvesting strategy, which says costs are borne by the individuals, making the project a "community cost" rather than a WUG cost. Teresa said Austin Water would likely provide an incentive in the form of a rebate, which is a cost to the WUG, but specifics have not yet been determined. RWPG to ask Lann Bookout if the TWDB prefers to see WUG cost or total cost. Strategy costing for these strategies will be revised for consistency.
        ii. John Burke asked if developers would make Municipal Utility Districts (MUDs) for developments to receive incentive payments. Austin Water is working on permit to allow such process.
    d. Austin Decentralized Direct Non-Potable Reuse
        i. Daniel Berglund asked for strategy to clarify that the costs are based on the 2070 decade when a high yield is expected.
    e. Austin Onsite Rainwater and Stormwater Harvesting + Community-Scale Stormwater Harvesting
        i. Teresa Lutes confirmed that rainwater was originally sent to RWPG with rebate costs. Austin Water is refining costs.

        ii. David Lindsay noted strategy assumes adequate rainfall. Teresa Lutes responded that potable backup is available for critical needs. Leonard Oliver asked for consultant to confirm that the 236 ac-ft/yr yield is the drought rainfall yield rather than the average.
    f. Austin Water provided new costs for the Off-Channel Reservoir, Aquifer Storage and Recovery, Indirect Potable Reuse, and Capture Local Inflows to Lady Bird Lake strategies.

8. LCRA Water Management Strategy Evaluations
    a. Expand Use of Groundwater in Bastrop County
        i. Online: 2030
        ii. Project Yield: 30 ac-ft/yr
        iii. Project Costs: Total Project Costs: $331,000; Annual Cost: $25,000; Unit Cost: $833/ac-ft
        iv. David Wheelock said that because LCRA is currently in the process of permitting for this strategy, it may need to be included as an alternate strategy. Despite small yield, though, it should be included in the RWP because it reflects reality.
        v. Teresa Lutes asked why environmental considerations read there were "*no unreasonable impacts to surface water*," and requested a revision to no impact.
    b. Groundwater Supply for Fayette Power Plant (on-site)
        i. Online: 2040
        ii. Project Yield: 40 ac-ft/yr
        iii. Project Costs: Total Project Costs: $342,000; Annual Cost: $27,000; Unit Cost: $675/ac-ft
        iv. Alternative strategy assumes volume of groundwater used would exceed the MAG. Project Yield: 700 ac-ft/yr (online 2030); Unit Cost: $117/ac-ft
        v. David Wheelock asked if the yield was same as 2016 RWP. Consultant confirmed yield.
    c. Groundwater Supply for Fayette Power Plant (off-site)
        i. Online: 2030
        ii. Project Yield: 2,500 ac-ft/yr
        iii. Project Costs: Total Project Costs: $33,618,000; Annual Cost: $3,142,000; Unit Cost: $1,257/ac-ft
        iv. No discussion.
    d. Baylor Creek Reservoir
        i. Online: 2040
        ii. Project Yield: 18,000 ac-ft/yr
        iii. Project Costs: Total Project Costs: $219,883,000; Annual Cost: $16,333,000; Unit Cost: $907/ac-ft
        iv. Teresa Lutes asked if it would be operated similarly to Arbuckle Reservoir. David Wheelock said yes, levels would fluctuate.
    e. Alternative LCRA Supplement Bay & Estuary Inflows with Brackish Groundwater
        i. Online: 2030

ii. Project Yield: 12,000 ac-ft/yr
iii. Project Costs: Total Project Costs: $47,269,000; Annual Cost: $6,381,000; Unit Cost: $532/ac-ft
iv. "Timing and location of delivery of brackish groundwater could have equal or possibly more effective impacts to the bay than releases from Highland Lakes' storage."
1. David Wheelock requested replacing "*impacts*" with "*benefits*."
v. "This strategy could be used by LCRA to help meet environmental needs that would otherwise be met from stored water releases from the Highland Lakes, potentially increasing availability of interruptible water supply by up to 12,000 ac-ft/yr."
1. David Wheelock requested removing "*interruptible*."
vi. David Wheelock requested removing water right royalty payment.

f. Import Return Flows from Williamson County
i. Online: 2030
ii. Project Yield: 5,460 – 25,000 ac-ft/yr
iii. Project Costs: Total Project Costs: $75,734,000; Annual Cost: $6,080,000; Unit Cost: $243/ac-ft
iv. Jennifer asked if the strategy was recommended last cycle. Jaime Burke responded that it was an alternative, but it could be recommended this cycle because there are no interregional conflicts with Region G. The project location is downstream of Austin, it is not affected by the discharge ban on the Highland Lakes.

g. Alternative LCRA Brackish Groundwater Desalination
i. Online: 2040
ii. Project Yield: 22,400 ac-ft/yr
iii. Project Costs: Total Project Costs: $229,006,000; Annual Cost: $31,199,000; Unit Cost: $1,393/ac-ft
iv. No discussion.

h. Alternative LCRA Groundwater Importation from Carrizo-Wilcox Aquifer
i. Online: 2040
ii. Project Yield: 35,000 ac-ft/yr
iii. Project Costs: Total Project Costs: $256,382,000; Annual Cost: $29,031,000; Unit Cost: $829/ac-ft
iv. No discussion.

i. LCRA Amendments to Water Management Plan
i. Online: 2020; Offline: 2050
ii. Project Yield: 63,405 – 0 ac-ft/yr
iii. Unit Cost: $37 – 60/ac-ft
iv. Leonard Oliver noted that this strategy appears different than how LCRA manages their water because it does not include return flows (which is referenced in another section).

v. Jennifer Walker asked why strategy is necessary. Daniel Berglund responded that this strategy sheds light on visibility of availability. Amendments do not fit the definition of a water supply in Chapter 3, so it must be included in Chapter 5 as a recommended change. The outcome is to acknowledge Run-of-River interruptible water from the Highland Lakes.
vi. Joe Trungale noted this is with modifications to trigger levels, so it does not match the current LCRA Water Management Plan. Leonard suggested maybe showing the period of record water for information only.

9. Wharton Water Supply
   a. Strategy Definition and Cost
      i. The 2017 Regional Water Supply Study for the City of Wharton and East Bernard recommended the use of additional groundwater; incorporated into Expand Use of Local Groundwater for Gulf Coast aquifer.
      ii. Online: 2030
      iii. Project Yield: 3,000 ac-ft/yr
      iv. Project Costs: Total Project Costs: $9,100,000; Annual Cost: $817,000; Unit Cost: $272/ac-ft
   b. No discussion – strategy approved to send to RWPG.

10. Water Purchase and Contracts
   a. LCRA New Contracts/Contract Amendments
      i. Jennifer Walker asked if the WUGs requested these strategies and if environmental impacts were considered. Many WUGs did request the strategy, and new contracts were only recommended accounting for LCRA availability.
   b. New Water Purchase
      i. WUGs in the region purchase water from water providers other than the three Major Water Providers.
         1. Hays (purchase from Buda): 70 ac-ft/yr (2060); 140 ac-ft/yr (2070)
         2. Hays County Mining (purchase from Buda reuse): 500 ac-ft/yr (2040)
         3. Windermere (purchase from Blue Water): 2,016 ac-ft/yr (2030)
      ii. Project Costs
         1. Assumed water is sold at retail cost, except for Hays infrastructure
         2. Total Project Costs - Hays: $213,000
         3. Annual Cost: Hays ($215,000), Hays County Mining ($798,335), Windermere ($2,351,758)
         4. Unit Cost: Hays ($1,536/ac-ft), Hays County Mining ($1,597/ac-ft), Windermere ($1,167/ac-ft)
      iii. No discussion – strategy approved to send to RWPG.
   c. Water Purchase Amendments
      i. WUGs in the region purchase water from water providers other than the three Major Water Providers.

        1. Barton Creek WSC (purchase from Travis County MUD 4): 90 ac-ft/yr (2020)
        2. Creedmoor-Maha WSC (purchase from Aqua WSC): 335 ac-ft/yr (2040)
        3. Travis County MUD 14 (purchase from Aqua WSC): 35 ac-ft/yr (2050)
    ii. Project Costs
        1. Assumed water is sold at retail cost
        2. Annual Cost: Barton Creek WSC ($146,633), Creedmoor-Maha WSC ($409,350), Travis County MUD 14 ($42,768)
        3. Unit Cost: Barton Creek WSC ($1,629/ac-ft), Creedmoor-Maha WSC ($1,222/ac-ft), Travis County MUD 14 ($1,222/ac-ft)
    iii. No discussion – strategy approved to send to RWPG.

11. Irrigation Conservation
    a. Tail Water Recovery
        i. Daniel Berglund requested that the RWPG not recommend this strategy. Other strategies utilize rainfall and water more efficiently so that there is less tailwater to recover. Jennifer Walker agreed, noting that return flows from irrigation are beneficial to the streams.
        ii. Stacy Pandey commented that it's important to have it in the plan somewhere. Alicia Smiley responded that it would be in a section describing strategies that were considered, but not recommended.
    b. Sprinkler Irrigation
        i. Costs were updated to account for higher maintenance costs.
    c. Drip Irrigation for Non-Rice Crops
        i. No changes since last meeting – strategy is only applied to Mills County.
    d. On-Farm Conservation
        i. Measures updated based on discussion with Stacy Pandey and Daniel Berglund. Write-up provided for committee to later review.
    e. Real-Time Monitoring
        i. New strategy includes the installation of meters that automatically record and transfer flow data at 15-minute intervals. Strategy assumes 3,500 meters at $6,000 each with a water savings of 0.3 ac-ft/ac.
        ii. David Lindsay suggested revising the name of the strategy for clarification. Suggestions included such as Real-Time Use Metering and Monitoring and Real-Time Flow Metering.
    f. Irrigation Operations Conveyance Improvements
        i. Strategy improvements to the efficiency of the canal system that deliver water to the individual irrigator includes canal lining, vegetation control, gate automation, and other measures.
        ii. Stacy Pandey explained that this is a much different strategy than last cycle. Components have been removed and included under other strategies.

12. Remaining Draft Strategy Evaluations
    a. Goldthwaite Strategy Request
        i. The water right permit amendment and expansion of Goldthwaite's reservoir storage capacity cannot be recommended as a strategy in the RWP, as the yield is 0 ac-ft/yr during drought of record.
        ii. David Lindsay noted there's value in having it in the plan as as considered.
    b. Reservoir Capacity Expansion
        i. During times of drought, Llano installs a flashboard system downstream along the Llano River Lake to raise the reservoir level above the fixed spillway crest level.
        ii. Joe Trungale modeled strategy; assuming the flashboard system added 100 ac-ft capacity, Llano's yield did not change in drought conditions.
        iii. Lauri Gillam noted that the strategy could be considered but cannot be recommended due to the lack of yield.
    c. Development of New Groundwater Supplies – Yegua-Jackson Aquifer
        i. Smithville was added to strategy.
    d. Water Supply Infrastructure Development
        i. No discussion.

13. Remaining Strategy Evaluations in Progress
    a. Alliance Regional Water Authority Pipeline
    b. LCRA Mid-Basin Off-Channel Reservoir
    c. LCRA Excess Flows Off-Channel Reservoir
    d. LCRA Enhance Recharge and Conjunctive Use
    e. LCRA Amendments to Existing Water Rights/Permits
    f. LCRA Aquifer Storage and Recovery (ASR) in Carrizo-Wilcox
    g. LCRA Prairie Site Off-Channel Reservoir
    h. Austin Centralized Direct Non-Potable Reuse
    i. Austin Return Flows

14. Austin Strategy Edits
    a. Daniel Berglund motioned to accept comments provided by Austin Water. Karen Haschke seconded. Committee passed with a hearty "argh."

15. New / Other Business
    a. None.

16. Next Meeting
    a. The next RWPG meeting will be November 13, 2019 at 10:00 a.m. at the LCRA Dalchau Service Center.

17. Public Comments

a. None.

18. Lauri Gillam adjourned at 4:19 p.m.