10.2 City of College Station ASR

10.2.1 Description

The concept for the City of College Station (College Station) ASR project is to:

- Utilize existing wastewater effluent as the source of water for ASR. For 2005-2007, the average effluent discharges from Carters Creek WWTP and Lick Creek WWTP were 5.75 and 0.68 million gallons per day (MGD), respectively.
- A new Advance Water Treatment Plant (AWTP) would be located near the Carters Creek WWTP. Effluent from the much smaller Lick Creek WWTP would be transported to the AWTP through a new pipeline.
- The AWTP would treat the treated wastewater effluent with: (1) Low Pressure Membrane, (2) Reverse Osmosis, and (3) Oxidation before the water would be recharged into the aquifer.
- Recovered water would be disinfected before being delivered to the existing potable water distribution system.
- New Sparta and Queen City ASR wells would be located southeast of the AWTP. The Sparta and Queen City wells would be about 1,700 and 2,500 ft deep, respectively. An estimated 16 wells would be required at 8 sites.
- The recharge cycle of ASR would occur from October to March. Recovery would occur from April to September to supplement summer peaking demands.

A schematic showing the location of the project is shown in Figure 10.2-1. New facilities required for this option are the ASR wells, well field distribution and collection pipelines, pump station and wastewater transmission pipeline from Lick Creek WTP and Carters Creek WTP, advanced water treatment plant, interconnects between AWTP and the ASR well field and the AWTP and College Station's distribution system, and a two-way pipeline between the AWTP and the ASR well field

Brazos G projected water supplies and demands are illustrated in Figure 10.2-2. For purposes of this ASR project, an assumed supply of 5.5 MGD of treated wastewater would be made available for storage in the ASR project during the months of October to March and recovery would be at a rate up to 5.0 MGD during April to September.

Figure 10.2-1 Location of College Station's ASR Project

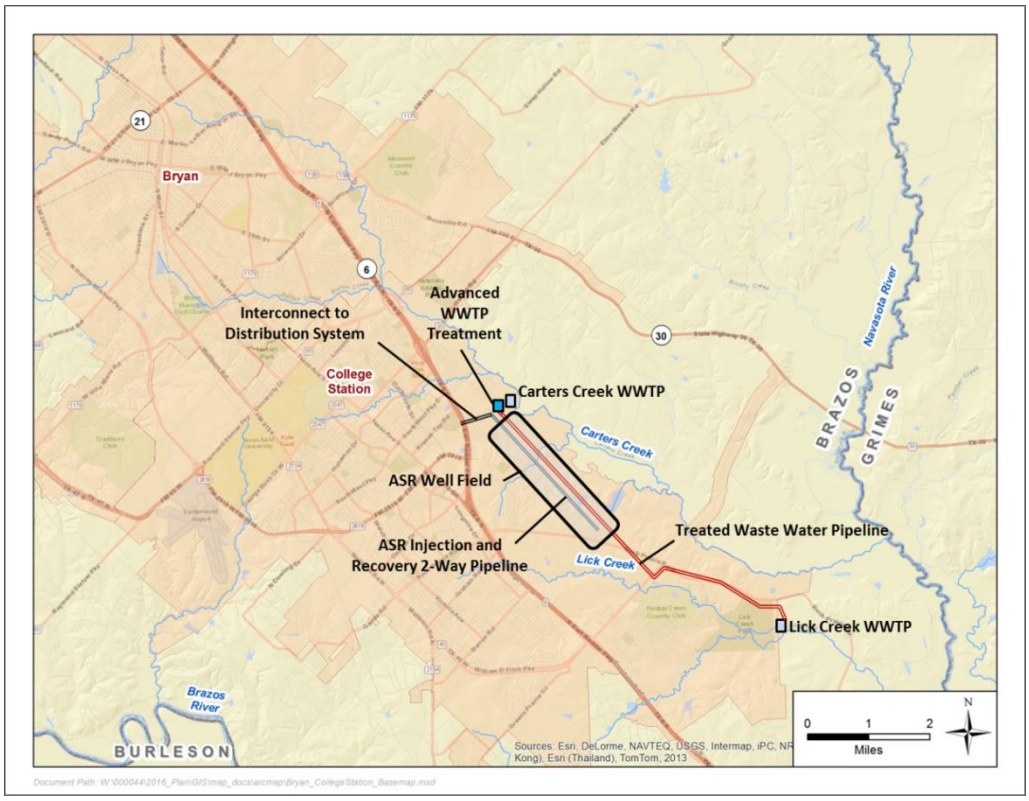
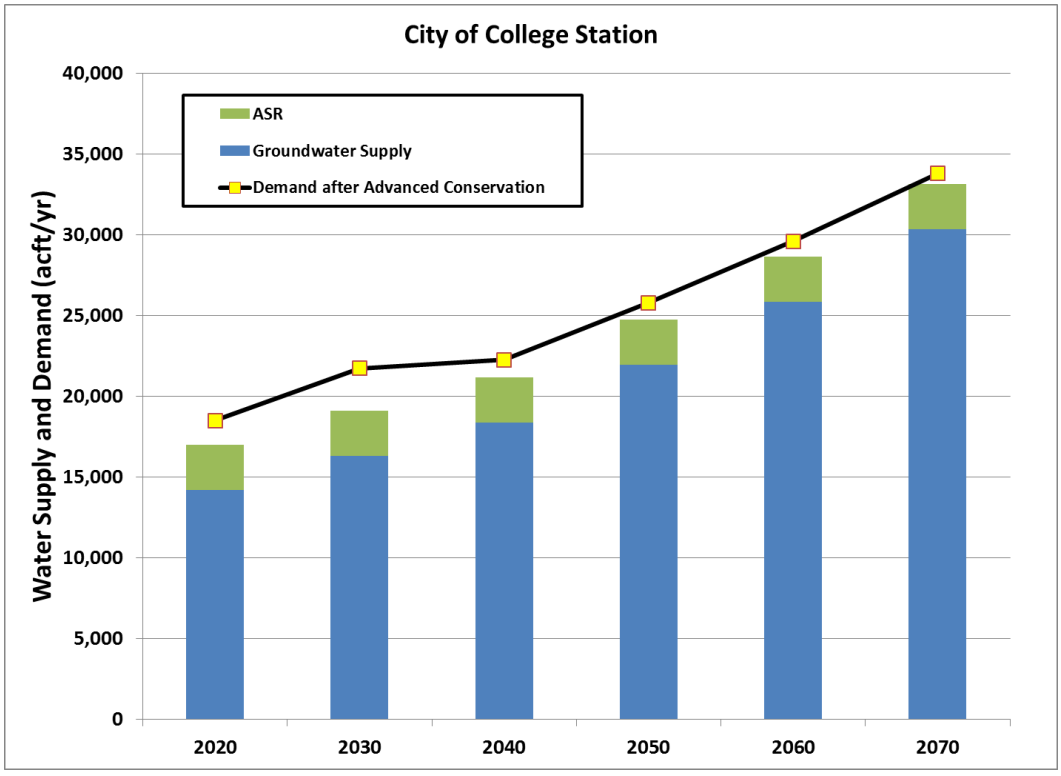


Figure 10.2-2 Water Supplies and Demand for College Station



10.2.2 Available Yield

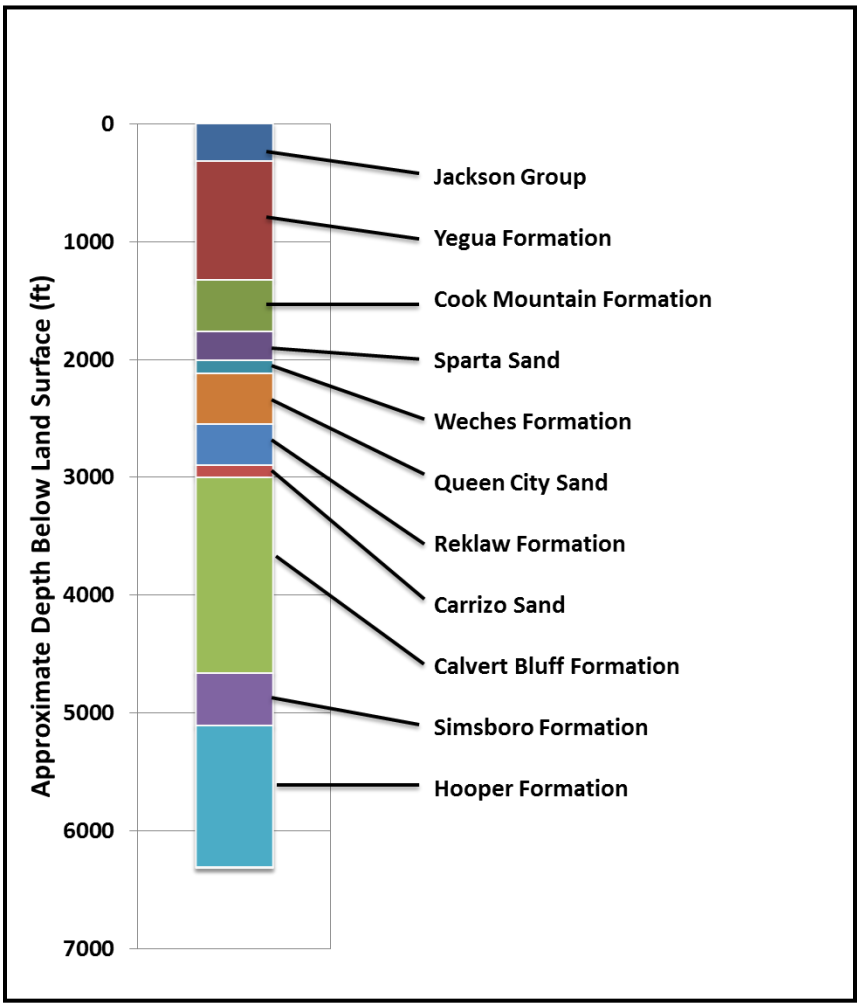
The target area for ASR wells in College Station's project area has four minor and major aquifers, including, from youngest to oldest: Jackson-Yegua, Sparta, Queen City and Carrizo-Wilcox. Water-bearing formations in the Carrizo-Wilcox consist of the Carrizo Sands and Simsboro Formation. A geologic profile showing the approximate depth and thickness of the geologic formations is shown in Figure 10.2-3. The Jackson Group and Yegua Formation, called the Jackson-Yegua Aquifer, are the shallowest, but rather poor productivity limits well capacity. The Sparta Sands are about 250 ft thick and extends from about 1,450 to 1,700 ft below land surface. The Queen City Sands appear to be about 425 ft thick and range in depth from about 1,800 to 2,225 ft. The Carrizo Sands appear to be about 100 ft thick. The Simsboro is estimated to be about 450 ft thick and extend from about 4,500 to 4,950 ft below land surface.

Electric geophysical logs[1] for a geologic cross-section suggest that the Sparta and Queen have rather extensive sands with fresh to brackish water. Electric geophysical logs[2] for another geologic cross-section provide picks for the Simsboro Formation. These logs suggest that the water quality in the Simsboro is brackish to saline. Native groundwater temperatures at these depths for the Sparta, Queen City, and Simsboro at these locations are about 95, 105, and 150 deg F, respectively. For purposes of this study, the Sparta and Queen City Aquifers were selected for the storage because of depths and native groundwater temperature. This approach allows two wells to be constructed at each well site. Average well yields for both formations are estimated to be 300 gpm. One advantage of this well field is that there are few, if any, water wells in the target water-bearing zones.

[1] Follett, C.R., 1974, Ground-water resources of Brazos and Burleson Counties, Texas: Texas Water Development Board Report 185.

[2] Thorkildsen, D., and Price, R.D., 1991, Ground-water resources of the Carrizo-Wilcox Aquifer in the Central Texas Region: Texas Water Development Board Report 332.

Figure 10.2-3 Geologic Profile in Target Area for ASR Well



10.2.3 Environmental Issues

Environmental issues for the proposed College Station ASR Project are described below. This project includes the development of an ASR well field, additional well field distribution and collection pipelines, a pump station and wastewater transmission pipeline, an advanced water treatment plant, and interconnects to existing transmission pipelines. The water source for this project would be existing wastewater effluent from local wastewater treatment plants which would be treated at a new AWTP planned near the existing Carters Creek WWTP. In addition effluent water from the Lick Creek WWTP would be transported through a pipeline to the new AWTP for treatment and injection into the ASR wells. Recovered water from the ASR would be treated before delivery to the existing water distribution system. Implementation of this project would require field surveys by qualified professionals to document vegetation/habitat types, waters of the U.S. including wetlands, and cultural resources that may be impacted. Where impacts to protected species habitat or significant cultural resources cannot be avoided, additional studies would be necessary to evaluate habitat use and/or value, or eligibility for inclusion in the National Register of Historic Places, respectively. The project sponsor

would also be required to coordinate with the U.S. Army Corps of Engineers regarding impacts to wetland areas and compensation would be required for unavoidable adverse impacts involving net losses of wetlands.

The pipelines and wells needed for the ASR project well field would occur in close proximity to Carters, Bee, Lick and Alum Creeks. Coordination with the U.S. Army Corps of Engineers would be required for construction within any waters of the U.S. Any impacts from this proposed project which would result in a loss of less than 0.5 acres of waters of the U.S. could be covered under Nationwide Permit #12 for Utility Line Activities.

The project occurs within the East Central Texas Plains Ecoregion[3] and lies within the Texan Biotic Province.[4] Vegetation types within the ASR well field area and transmission pipelines as described by the Texas Parks and Wildlife Department (TPWD)[5] include Post Oak Woods, Forest, and Post Oak Woods, Forest and Grassland Mosaic areas. These areas include portions which have been developed or disturbed and now include homes, business, and farms. Avoidance of riparian areas near the creeks or heavily wooded areas would help minimize potential impacts to existing area species from project construction activities.

Table 10.2-1 lists state listed endangered or threatened species, and federally listed endangered or threatened species along with species of concern that may occur in Brazos County. This information comes from the county lists of rare species published online by the TPWD. Inclusion in this table does not mean that a species will occur within the project area, but only acknowledges the potential for its occurrence in the project area county.

Table 10.2-1 Endangered, Threatened, and Species of Concern for Brazos County

Common Name	Scientific Name	Summary of Habitat Preference	Listing Entity		Potential Occurrence in County
			USFWS	TPWD	
AMPHIBIANS					
Houston toad	Anaxyrus houstonensis	Endemic species found in sandy substrate, water in pools.	LE	E	Resident
Southern crawfish frog	Lithobates areolatus areolatus	A species found in abandoned crawfish holes and small mammal burrows in moist meadows and river flood plains.	--	--	Resident
BIRDS					

3 Griffith Glenn, Sandy Bryce, James Omernik, and Anne Rogers. 2007. Ecoregions of Texas. Texas Commission on Environmental Quality.

4 Blair, W. Frank. 1950. The Biotic Provinces of Texas. Texas Journal of Science 2(1):93-117.

5 McMahan, Craig A., Roy G. Frye and Kirby L. Brown. 1984. The Vegetation Types of Texas. Wildlife Division, Texas Parks and Wildlife Department, Austin, Texas.

Table 10.2-1 Endangered, Threatened, and Species of Concern for Brazos County

Common Name	Scientific Name	Summary of Habitat Preference	Listing Entity		Potential Occurrence in County
			USFWS	TPWD	
American peregrine falcon	Falco peregrinus anatum	Resident and local breeder in West Texas. Migrant across the state.	DL	T	Possible Migrant
Arctic peregrine falcon	Falco peregrinus tundrius	Migrant throughout the state.	DL	--	Possible Migrant
Bald eagle	Haliaeetus leucocephalus	Found primarily near rivers and large lakes, migrant.	DL	T	Possible Migrant
Henslow's sparrow	Ammodramus henslowii	Wintering individuals found in weedy or cut-over areas.	--	--	Possible Migrant
Interior least tern	Sterna antillarum athalassos	Nests along sand and gravel bars in braided streams	LE	E	Resident
Sprague's pipit	Anthus spragueii	Migrant in Texas in winter. Strongly tied to native upland prairie.	C	--	Migrant
Whooping crane	Grus americana	Potential migrant	LE	E	Potential Migrant
FISH					
Blue sucker	Cycleptus elongatus	Found in larger portions of major rivers usually in channels and flowing pools with a moderate current.	--	T	Resident
Sharpnose shiner	Notropis oxyrhynchus	Endemic to Brazos River Drainage. Found in large rivers with a bottom of sand, gravel, and clay-mud.	LE	--	Resident
Smalleye shiner	Notropis buccula	Endemic to upper Brazos River system and its tributaries.	LE	--	Resident
INSECTS					
Gulf coast clubtail	Gomphus modestus	Found in medium rivers in streams with silty sand or rocky bottoms.	--	--	Resident
Smoky shadowfly	Neurocordulia molesta	Found in rivers and sometimes large streams. Larvae cling to rocks or logs.	--	--	Resident
MAMMALS					

Table 10.2-1 Endangered, Threatened, and Species of Concern for Brazos County

Common Name	Scientific Name	Summary of Habitat Preference	Listing Entity		Potential Occurrence in County
			USFWS	TPWD	
Louisiana black bear	Ursus americanus luteolus	Possible as transient, found in bottomland hardwoods and large tracts of inaccessible forested areas.	LT	T	Potential Resident
Plains spotted skunk	Spilogale putorius interrupta	Prefers wooded, brushy areas.	--	--	Resident
Red wolf	Canis rufus	Extirpated.	LE	E	Historic Resident
MOLLUSKS					
False spike mussel	Quadrula mitchelli	Possibly extirpated in Texas, probably found in medium to large rivers.	--	T	Historic Resident
Smooth pimpleback	Quadrula houstonensis	Found in small to moderate streams and rivers and moderate size reservoirs.	--	--	Resident
Texas fawnsfoot	Truncilla macrodon	Possibly occurs in rivers and larger streams and is intolerant of impoundment. Brazos and Colorado River basins.	C	T	Resident
PLANTS					
Branched gay-feather	Liatris cymosa	Texas endemic found in somewhat barren grassland openings in post oak woodlands on tight soils.	--	--	Resident
Bristle nailwort	Paronychia setacea	Endemic to eastern southcentral Texas, occurring in sandy soils.	--	--	Resident
Navasota ladies'-tresses	Spiranthes parksii	Texas endemic found in openings in post oak woodlands in sandy loams.	LE	E	Resident
Small-headed pipewort	Eriocaulon koenickianum	In East Texas in post-oak woodlands and xeric sandhill openings on permanently wet acid sands of upland seeps and hillside seepage bogs.	--	--	Resident
Texas meadow-rue	Thalicrum texanum	Texas endemic mostly found in woodlands and woodland margins on sandy loam.	--	--	Resident

Table 10.2-1 Endangered, Threatened, and Species of Concern for Brazos County

Common Name	Scientific Name	Summary of Habitat Preference	Listing Entity		Potential Occurrence in County
			USFWS	TPWD	
Texas windmill-grass	Chloris texensis	Texas endemic found in sandy to sandy loam soils in relatively bare areas in coastl prairie grassland remnants.	--	--	Resident
REPTILES					
Alligator snapping turtle	Macrochelys temminckii	A species found in perennial water bodies in deep water of rivers, canals, lakes and oxbows.		T	Resident
Texas horned lizard	Phrynosoma cornutum	Varied, sparsely vegetated uplands.	--	T	Resident
Timber rattlesnake	Crotalus horridus	Floodplains, upland pine, deciduous woodlands, riparian zones.	--	T	Resident

LE/LT=Federally Listed Endangered/Threatened
DL, PDL=Federally Delisted/Proposed for Delisting
T/SA=Listed as Threatened by Similarity of Appearance
E, T=State Listed Endangered/Threatened
Blank= Species of concern, but no regulatory listing status
Source: TPWD, 2014. Annotated County List of Rare Species – Brazos County revised 12/11/2014.

Because the project will use treated existing wastewater effluent to inject into the aquifer no significant impacts to existing stream flows or aquatic species are anticipated. Potential impacts to listed species within the project area are anticipated to include disturbance of existing habitat resulting from the construction of well fields and their associated pipelines, transmission pipelines and a new water treatment plant. However most of these disturbances would be minimized by the small areas generally required for well field and pipeline construction. After construction is completed the majority of the disturbed areas will return to their previous habitat condition excluding the AWTP site or areas where maintenance activities are required.

A survey of the project area would be required prior to project construction to determine whether populations of or potential habitats used by listed species occur in the area to be affected. Coordination with TPWD and USFWS regarding threatened and endangered species with potential to occur in the project area should be initiated early in project planning.

Cultural resources protection on public lands in Texas is afforded by the Antiquities Code of Texas (Title 9, Chapter 191, Texas Natural Resource Code of 1977), the National Historic Preservation Act (Pl96-515), and the Archeological and Historic Preservation Act (PL93-291).

Based on the review of publicly available Geographic Information System (GIS) records obtained from the Texas Historical Commission, there are no State Historic Sites, National Register Properties or Districts, cemeteries or Historical Markers within the project area. A review of archaeological resources in the proposed project area should be conducted during the project planning phase. Because the owner or controller of the project will likely be a political subdivision of the State of Texas (i.e., river authority, municipality, county, etc.), they will be required to coordinate with the Texas Historical Commission prior to project construction

10.2.4 Engineering and Costing

Available records indicate that the ASR well depths in the Sparta and Queen City in an area southeast of College Station would average about 1,700 and 2,225 ft. A typical recharge and recovery rate is estimated to be 300 gpm. For a 5.5 MGD injection rate, 8 Sparta and 8 Queen City wells would be required. The well field design has the wells spaced about 1,000 ft apart.

The major facilities required for these projects include:

- Pump Station at Lick Creek WTP,
- Advance Water Treatment Plant,
- Pump Station at AWTP for distribution to ASR wells and existing distribution system,
- ASR well field,
- Collector pipelines,
- Transmission pipeline between AWTP and distribution system, and
- Interconnect to existing distribution system.

Estimates were prepared for capital and project costs, annual debt service, operation and maintenance, power, land, and environmental mitigation. These costs are summarized in Table 10.2-2. The annual costs, including debt service, operation and maintenance, and power, is estimated to be $3,069 per acft for the College Station project.

Table 10.2-2 Cost Estimate Summary: College Station ASR Project Option (Sept 2013 Prices)

Item	Estimated Costs for Facilities
Pump Stations	$2,747,000
Transmission Pipelines	$2,317,000
ASR Well Field (Wells, Pumps, and Piping)	$16,710,000
Water Treatment Plant	$23,100,000
Integration, Relocations, & Other	$250,000
TOTAL COST OF FACILITIES	**$45,124,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$15,678,000
Environmental & Archaeology Studies and Mitigation	$486,000
Land Acquisition and Surveying (47 acres)	$402,000
Interest During Construction (4% for 1 years with a 1% ROI)	$2,160,000
TOTAL COST OF PROJECT	**$63,850,000**
ANNUAL COST	
Debt Service (5.5 percent, 20 years)	$5,343,000
Operation and Maintenance	
Intake, Pipeline, Pump Station (1% of Cost of Facilities)	$261,000
Water Treatment Plant (2.5% of Cost of Facilities)	$2,586,000
Pumping Energy Costs (4463825 kW-hr @ 0.09 $/kW-hr)	$402,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$8,592,000**
Available Project Yield (acft/yr), based on a Peaking Factor of 2	**2,800**
Annual Cost of Water ($ per acft)	**$3,069**
Annual Cost of Water ($ per 1,000 gallons)	**$9.42**

10.2.5 Implementation

Implementation of the ASR water management strategy for College Station includes the following issues:

- Acquiring permits from the Brazos Valley Groundwater Conservation District;

- Acquiring permits from TCEQ for Advanced Water Treatment Plant and ASR facilities construction and operations;
- Chemical and geochemical compatibility of native aquifer water and materials and imported water are chemically compatible;
- Lack of experience to develop confidence in the ability to inject and recover water from an aquifer, which includes the uncertainty about the compatibility of the injected water with native groundwater and aquifer materials;
- Initial and operational cost; and
- Development of a management plan to efficiently use the ASR wells with a balance of injection and recovery cycles.

This water supply option has been compared to the plan development criteria, as shown in Table 10.2-3, and the option meets each criterion.

Table 10.2-3 Comparison of College Station ASR Option to Plan Development Criteria

Impact Category	Comment(s)
A. Water Supply	
1. Quantity	1. Does not fully meet shortages
2. Reliability	2. High reliability
3. Cost	3. High
B. Environmental factors	
1. Environmental Water Needs	1. Low impact
2. Habitat	2. None
3. Cultural Resources	3. None
4. Bays and Estuaries	4. Low impact
5. Threatened and Endangered Species	5. Low impact
6. Wetlands	6. None
C. Impact on Other State Water Resources	None
D. Threats to Agriculture and Natural Resources	None
E. Equitable Comparison of Strategies Deemed Feasible	Option is considered in an attempt to meet municipal and industrial shortages
F. Requirements for Interbasin Transfers	Not applicable
G. Third Party Social and Economic Impacts from Voluntary Redistribution	None

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