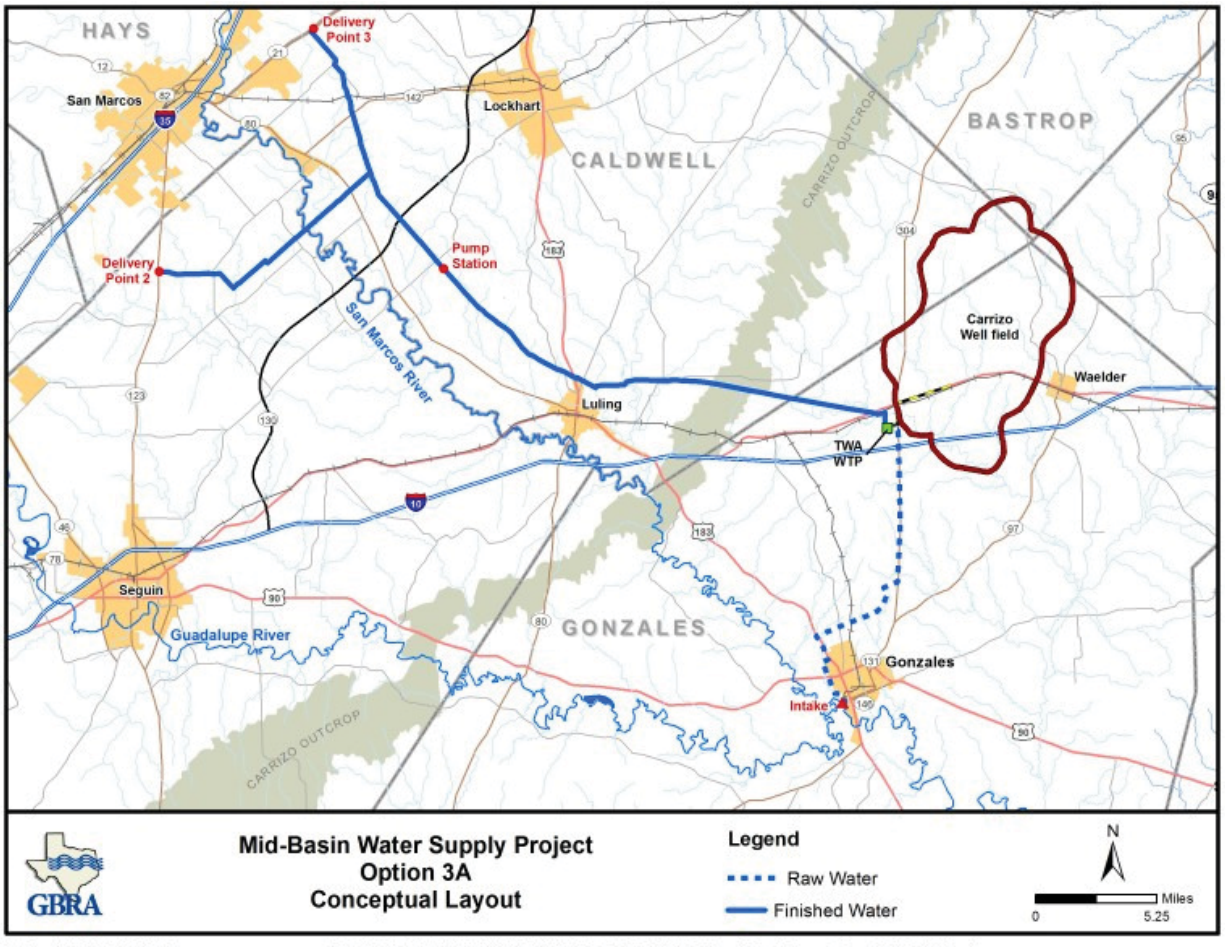
5.2.32 GBRA Mid-Basin Water Supply Project – Conjunctive Use with ASR

5.2.32.1 Description of Strategy

The Guadalupe-Blanco River Authority (GBRA) Mid-Basin Water Supply Project (MBWSP) Conjunctive Use with Aquifer Storage & Recovery (ASR) strategy (Option 3A) incorporates surface water from the Guadalupe River near Gonzales with a Carrizo well field that produces groundwater and stores treated surface water. The strategy is configured to include an ASR well field that is co-located with the Carrizo well field on Texas Water Alliance (TWA) leased property in northern Gonzales County and eastern Caldwell County. The overall project map is shown in Figure 5.2.32-1.

Figure 5.2.32-1 MBWSP – Conjunctive Use Conceptual Layout



Surface water from the river diversion point near Gonzales is pumped 15.3 miles to a water treatment plant (WTP) located adjacent to the Carrizo well field. Treated surface water will generally be delivered to meet daily participant needs, however, when WTP capacity exceeds daily participant needs, the excess treated water will be injected into the Carrizo using dual-purpose ASR/production wells. This WTP will also treat water

produced from the well field because the well field will generally produce a blend of raw Carrizo groundwater and treated surface water. This is necessary because the Carrizo groundwater contains iron and manganese.

Potable water supplies are conveyed to two delivery points which would include a meter and two storage tanks with sufficient capacity for 15% of average daily demand. MBWSP participants will be responsible for construction of any facilities required to connect to the delivery locations. Additionally, some treated supply could be made available to customers along the transmission line.

The total finished water pipeline route length is 45.6 miles, paralleling existing right of way for nearly 29 miles. The transmission line is sized to deliver supply at a peak rate that is 2.0 times that for uniform delivery of annual supply. Three pump stations are required to deliver supplies along the finished transmission main. A High Service Pump Station (HSPS) will pump from the clear well located at the WTP and will provide sufficient head to deliver supplies to the first booster pump station. This pump station will boost pressures to convey supplies to Delivery Point 3 and part way to Delivery Point 2. The second booster pump station will boost pressures to convey supplies to Delivery Point 2.

5.2.32.2 Available Yield

The operational concept for the MBWSP – Conjunctive Use with ASR strategy is summarized as follows: (1) when demands can be met with water rights in the Guadalupe River at Gonzales, the water is treated and delivered directly to participants; (2) when surface water supplies available from the river exceed demands and there is unused capacity in the water treatment plant and delivery system, the excess surface water is treated and stored in the Carrizo Aquifer through ASR wells; and (3) when available surface water supplies cannot meet participant demands, native groundwater or surface water previously stored in the aquifer is produced or recovered to meet the balance of the participant demands. The loss of ASR water is assumed to be zero. The introduction of ASR water adds to the volume of storage and allows for greater withdrawals to stay within GCUWCD drawdown limits. From a quantity perspective, it makes no difference whether the water withdrawn is native groundwater, finished surface water, or a blend of both.

Surface Water Modeling

Estimates of surface water available for diversion under a new appropriation from the Guadalupe River at Gonzales were computed subject to senior water rights and environmental flow standards recently adopted by the TCEQ. Surface water availability was computed in conformance with GBRA's Application No. 12378, which includes a maximum annual diversion of 75,000 acft/yr from the Guadalupe River at Gonzales and maximum instantaneous diversion rate of 500 cfs. The models used to determine availability and yield include the Guadalupe-San Antonio River Basin Water Availability Model (GSA WAM) and the Flow Regime Application Tool (FRAT).

Major modeling assumptions in applications of the GSA WAM and FRAT include:

- Water availability computed subject to full use of senior water rights for consumptive uses and environmental flow standards adopted by TCEQ on August 8, 2012.

- Treated effluent discharges were excluded throughout the river basin (similar to TCEQ Run 3), except when specifically addressed in a water right (e.g., INVISTA, Kate O'Connor Trust, etc.).
- Springflows from the Edwards Aquifer were based on aquifer management in accordance with full implementation of the Edwards Aquifer Habitat Conservation Plan (EAHCP) approved by the U.S. Fish and Wildlife Service (USFWS). Two Edwards Aquifer simulation models (GWSIM-IV for the 1934-1946 period and MODFLOW for the 1947-2000 period) were used to estimate springflow.

In order to calculate surface water available from the Guadalupe River at Gonzales for the MBWSP, a new water right (junior to all existing water rights) was modeled in the GSA WAM to obtain monthly unappropriated and regulated flows for the Guadalupe River at Gonzales. The portion of streamflow allocated to downstream senior water rights was calculated by subtracting the unappropriated flow from the regulated flow. Monthly regulated flows were then disaggregated to daily values using gaged or estimated daily streamflows for the Guadalupe River at Gonzales. Monthly amounts allocated to downstream senior water rights were then taken uniformly out of the base of the daily hydrograph such that the sum of daily pass-through amounts in each month equals the total monthly amount allocated to downstream senior water rights.

Daily senior water right pass-throughs and daily regulated flows are incorporated into the FRAT model, along with the TCEQ environmental flow standards for the Guadalupe River at Gonzales. These environmental flow standards consist of seasonal subsistence and base flows, two tiers of seasonal pulses, and a pulse exemption provision under which pulses may be excluded if the magnitude of the maximum diversion rate of the water right is less than or equal to 20 percent of the pulse peak. For example, if the maximum diversion rate for the MBWSP is 116 cfs, all small and large seasonal pulse diversion restrictions would be excluded and the MBWSP would not be required to honor those pulses. Additionally, the environmental flow standard for the Guadalupe River at Gonzales includes a provision for diversions that are made between the base flow and the subsistence flow, such that when streamflow is between the base and subsistence flows, only 50 percent of the difference between the streamflow and the subsistence flow can be diverted.

Groundwater Modeling

Groundwater availability analyses utilized the Texas Water Development Board (TWDB) Central Groundwater Availability Model (GAM) for the Carrizo-Wilcox Aquifer. Groundwater availability was based on an acceptable level of drawdown in the GCUWCD rules. The assumed maximum acceptable drawdown for the Carrizo and Wilcox aquifers in the artesian zone is 100 feet, which is measured in monitoring wells that are more than 6,000 feet from the nearest production well in the well field.

Surface Water, Groundwater, and ASR

Using monthly water availability and daily disaggregation procedures described above, an accounting model was used to simulate surface water diversions to a WTP and ASR well field as well as groundwater production from which a firm supply of treated water could be delivered to project participants. Simulations indicate that a firm yield of 42,000 acft/yr can be obtained assuming a maximum instantaneous river diversion rate and ASR

WTP capacity of 116 cfs (75 mgd) and maximum long-term drawdown in the Carrizo Aquifer near the well field on the order of 100 feet.

5.2.32.3 Environmental Issues

Environmental issues for the proposed GBRA MBWSP - Conjunctive Use with ASR project are described below. 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. Compensation would be required for unavoidable adverse impacts involving net losses of wetlands.

The GBRA MBWSP- Conjunctive Use with ASR water management strategy involves the construction of an intake on the Guadalupe River with a raw water transmission pipeline to the new TWA WTP site, a well field in Gonzales County, a raw water transmission pipeline from the well field to the TWA WTP, a potable water pipeline to a delivery point near San Marcos through Luling with an additional booster pump station, and a potable water pipeline section to a delivery point near Seguin. The pipelines traverse both the Blackland Prairie and Post Oak Savannah ecoregions[1] and are within the Texan biotic province[2]. Vegetation within the project area is dominated by a mosaic of post oak woods, forest, and grassland to the east and cropland along the western portion of the pipeline.

The Guadalupe River intake has the potential for localized negative ecological impacts as the site area consists of over 90% riparian woodland. Riparian woodlands, especially those located within floodplains, are ecological features that contribute to the natural and traditional character of waterways. These areas help protect water quality, wildlife habitat, and aquatic resource functions and services. However, the well field, transmission pipelines and the TWA WTP site are anticipated to have a low negative impact to terrestrial habitat. Approximately 60-80% of these areas occur within grassland, cropland and disturbed areas. Any remaining habitat which includes woody species within these areas has been highly fragmented by existing land uses and disturbances including roads, utility rights-of-way and cropland. Outside the maintained right-of-way, land use would not be anticipated to change due to pipeline construction. Herbaceous habitats would recover fastest from impacts and would experience low negative impacts. Impacts to woody vegetation would be permanent due to pipeline and WTP maintenance. The proposed well field would have a minimal impact on vegetation within the project area due to limited surface exposure.

The transmission pipelines and water treatment plant site are anticipated to have minimal impact on existing terrestrial habitat. Many pipeline segments are co-located along existing rights-of-way, fencerows, and other disturbances, which would reduce their overall vegetative impact. Pipelines, including collection, raw, and finished water transmission, would require multiple crossing of roads, railroads, and other utilities, as well as being in close proximity to structures, but no adverse effects are expected. The

[1] Gould, F.W. 1975. The Grasses of Texas. Texas A&M University Press. College Station, Texas.
[2] Blair, W.F., "The Biotic Provinces of Texas, "Tex. J. Sci. 2:93-117, 1950.

TWA WTP is located on undeveloped grassland. Impacts to land use would be limited to the removal of existing vegetation and temporary impacts during construction.

With numerous miles of raw and finished water pipelines, crossings of many jurisdictional waters would occur. Intermittent waters, which in this area primarily include streams and impoundments, would occur frequently and make up the majority of the jurisdictional areas crossed. Major intermittent waters potentially affected by this strategy include Buck, Crooked, and Salt branches; Callihan, Cottonwood, Dickerson, Kerr, Long, McNeil, Morrison, Seals, and West Fork Plum creeks; Dry Run; and Sandy Fork. Impacts from pipelines to these waters are anticipated to be minor, would be restorable and temporary, and occur during construction.

Perennial waters are less commonly encountered in the project area and include the Guadalupe River (intake), San Marcos River, Artesia Creek, Mule Creek and Plum Creek. Avoidance and minimization measures, such as horizontal directional drilling, construction best management practices (BMPs), and avoiding perennial and /or sensitive aquatic habitats (e.g., the San Marcos River, Plum Creek, etc.) would reduce the potential impacts from pipelines.

The TCEQ 2010 Texas Integrated Report for Clean Water Act Sections 305(b) and 303(d) lists Sandy Fork as a Category 5b water body. This listing indicates Sandy Fork is impaired because it “does not meet applicable water quality standards or is threatened for one” and “a review of the water quality standards for this water body will be conducted before a Total Maximum Daily Load (TMDL) is scheduled.” Bacteria levels are the parameter on which TCEQ bases this designation. The designation applies to TCEQ Segment ID 1803G_01, which occurs from the confluence with Peach Creek up to the confluence with Scruggs Creek (NHD Reach Code 12100202021868). The raw water transmission line from the well field to the TWA WTP site and the finished water transmission pipeline both cross this designated segment, but the potential negative impact is anticipated to be negligible. Impacts from construction of these project components would be temporary and available avoidance and minimization practices could further reduce potential impacts. The TWA WTP site has limited potential water body impact with one small, potentially jurisdictional ephemeral stream located on the site.

The surface water intake is located along the Guadalupe River within a flood hazard area, and would require the placing of structures and fill material into the river. Impacts resulting from this action would include possible localized impacts to the riparian buffer, bank condition, and possibly instream habitat depending on the final intake design. However the intake is not expected to have an adverse effect on the river’s overall chemical, physical, or biological functions, such as water/sediment transport, access to floodplains, water supply, habitat, and recreation. The WTP site and wells are not located within flood hazard areas.

Coordination with the U.S. Army Corps of Engineers would be required for construction within waters of the U.S. Impacts from this proposed project resulting 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 unless there are significant impacts to the aquatic environment by other project components.

The Texas Parks & Wildlife Department (TPWD) has identified a number of stream segments throughout the state as ecologically significant on the basis of biological function, hydrologic function, riparian conservation, exceptional aquatic life uses, and/or threatened or endangered species. Currently, 21 stream segments in Region L are considered ecologically significant by the TPWD[3]. Pipelines associated with this water management strategy do not cross any of these stream segments. The section of the Guadalupe River from U.S. 183 (near the Gonzales diversion point) upstream to Lake Gonzales Dam, however, is listed as ecologically significant as it contains two of four known remaining populations of the golden orb, a rare, endemic mollusk.

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 available GIS datasets, there are ten cemeteries, five national register properties, two national district properties, and 42 historical markers located within a 0.5-mile buffer of the proposed pipeline route. Additionally, there are seven cemeteries and four historical markers within the potential well field area.

Based on a review of soils, geology, and aerial photographs, there is a high probability for undocumented significant cultural resources within the alluvial deposits and terrace formations associated with waterways, specifically the intermittent and perennial aquatic resources. The intake has a high potential impact for cultural resources, primarily due to its location in an area with known cultural resources within one-half mile. The well field collection and transmission pipelines potentially are considered to have low negative impact to cultural resources. For the most part, the pipelines would cross areas of low probability for cultural resources, but those probabilities increase near waterways and associated landforms. However, Thompsonville cemetery is located in the well field near proposed collection piping. The WTP site and wells potentially have negligible negative impacts. No known cultural resource sites occur within these areas, but these components are sited in low probability areas.

A review of archaeological resources in the proposed project area should be conducted during the project planning phase. Taking into consideration that 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 regarding impacts to cultural resources. The project sponsor will also be required to coordinate with the U.S. Army Corps of Engineers regarding any impacts to waters of the United States or wetlands.

The species listed by USFWS, and TPWD, as endangered or threatened with potential habitat in Gonzales, Caldwell, and Guadalupe counties are listed in Table 5.2.32-1. The Texas Natural Diversity Database, maintained by TPWD, which documents the occurrence of rare species within the state was included in this analysis. Available data did not reveal the occurrence of any listed species within the project area, but the absence of data does not imply the absence of occurrence. Depending on the final design of the intake and resulting impacts to instream habitat, this portion of the project includes potential impacts to federal-candidate/state-listed mollusks and the Cagle's map

[3] TPWD, "Ecologically Significant River and Stream Segments," http://www.tpwd.state.tx.us/landwater/water/environconcerns/water_quality/sigsegs/index.phtml accessed February 6, 2014.

turtle based on known occurrences of these species near the intake site. The well field, pipelines, and WTP site include limited potential impacts to listed species.

Table 5.2.32-1 Endangered, Threatened, and Species of Concern for Caldwell, Gonzales, and Guadalupe Counties

Common Name	Scientific Name	Impact Value	Multiplier Based on Status	Adjusted Impact	Summary of Habitat Preference	USFWS Listing	TPWD Listing	Potential Occurrence in County
BIRDS								
American peregrine falcon	*Falco peregrinus anatum*	0	2	0	Migrant and local breeder in West Texas.	DL	T	Possible Migrant
Artic peregrine falcon	*Falco peregrinus tundrius*	0	1	0	Migrant throughout the state.	DL		Possible Migrant
Bald eagle	*Haliaeetus leucocephalus*	0	2	0	Found primarily near rivers and large lakes.	DL	T	Possible Migrant
Henslow's sparrow	*Ammodramus henslowii*	1	1	1	Found in weedy fields or cut-over areas			Resident
Interior least tern	*Sterna antillarum athalassos*	0	3	0	Nests along sand and gravel bars in braided streams	LE	E	Resident
Mountain plover	*Charadrius montanus*	1	1	1	Non-breeding, shortgrass plains and fields			Nesting/ Migrant
Sprague's pipit	*Anthus spragueii*	0	1	0	Migrant in Texas in winter mid Sept. to early April. Strongly tied to native upland prairie.			Possible Migrant
Western burrowing owl	*Athene cunicularia hypugaea*	1	1	1	Open grasslands, especially prairie, plains and savanna			Resident
Whooping crane	*Grus americana*	0	3	0	Potential migrant	LE	E	Potential Migrant
Wood stork	*Mycteria americana*	1	2	2	Forages in prairie ponds, ditches, and shallow standing water formerly nested in TX		T	Migrant
FISHES								
Blue sucker	*Cycleptus elongatus*	1	2	2	Major rivers in Texas.		T	Resident
Guadalupe bass	*Micropterus treculi*	1	1	1	Endemic to perennial streams of the Edwards Plateau region.			Resident
Guadalupe darter	*Percina sciera apristis*	1	1	1	Guadalupe River Basin. Usually found over gravel or gravel and sand raceways of larger streams and rivers.			Resident

Common Name	Scientific Name	Impact Value	Multiplier Based on Status	Adjusted Impact	Summary of Habitat Preference	USFWS Listing	TPWD Listing	Potential Occurrence in County
INSECTS								
A mayfly	*Campsurus decolaratus*	0	1	0	In Texas and Mexico, possibly clay substrates, found in shoreline vegetation.			Potential Resident
MAMMALS								
Cave myotis bat	*Myotis velifer*	0	1	0	Roosts colonially in caves, rock crevices			Resident
Plains spotted skunk	*Spilogale putorius interrupta*	1	1	1	Prefers wooded, brushy areas.			Resident
Red wolf	*Canis rufus*	0	3	0	Extirpated.	LE	E	Historic Resident
MOLLUSKS								
Creeper (squawfoot)	*Strophitus undulates*	1	1	1	Small to large streams. Colorado, Guadalupe, and San Antonio River basins.			Resident
False spike mussel	*Quincuncina mitchelli*	1	2	2	Substrates of cobble and mud. Rio Grande, Brazos, Colorado and Guadalupe river basins.		T	Resident
Golden orb	*Quadrula aurea*	1	2	2	Sand and gravel, Guadalupe, San Antonio, Lower San Marcos, and Nueces River basins	C	T	Resident
Palmetto pill snail	*Euchemostrema leai cheatumi*	0	1	0	Known only from Palmetto State Park.			Resident
Texas fatmucket	*Lampsilis bracteata*	1	2	2	Streams and rivers on sand, mud and gravel, Colorado and Guadalupe River basins.	C	T	Resident
Texas pimpleback	*Quadrula petrina*	1	2	2	Mud, gravel and sand substrates, Colorado and Guadalupe river basins		T	Resident
PLANTS								
Big red sage	*Salvia pentstemonoides*	0	1	0	Texas endemic, found in moist to seasonally wet steep limestone outcrops on canyons or along creek banks.			Resident

Common Name	Scientific Name	Impact Value	Multiplier Based on Status	Adjusted Impact	Summary of Habitat Preference	USFWS Listing	TPWD Listing	Potential Occurrence in County
Bristle nailwort	*Paronychia setacea*	1	1	1	Endemic to south central Texas in sandy soils.			Resident
Buckley's spiderwort	*Tradescantia buckleyi*	1	1	1	Endemic in grassland openings in oak woodlands.			Resident
Green beebalm	*Monarda viridissima*	1	1	1	Endemic perennial herb. Found in well-drained sandy soils in opening of post oak woodlands.			Resident
Elmendorf's onion	*Allium elmendorfii*	1	1	1	Endemic, in deep sands			Resident
Parks' jointweed	*Polygonella parksii*	0	1	0	Texas endemic, primarily found on deep, loose, sand blowouts in Post Oak Savannas.			Resident
Shinner's sunflower	*Helianthus occidentalis ssp.*	1	1	1	Found on prairies on the Coastal Plain.			Resident
Sandhill woolywhite	*Hymenopappus carrizoanus*	1	1	1	Found south of the Guadalupe River. Prefers dense riparian corridors.			Resident
REPTILES								
Cagle's map turtle	*Graptemys caglei*	1	2	2	Endemic to Guadalupe River System. Found near waters' edge.		T	Resident
Spot-tailed earless lizard	*Holbrookia lacerata*	1	1	1	Moderately open prairie-brushland.			Resident
Texas Garter Snake	*Thamnophis sirtalis annectens*	1	1	1	Wet or moist microhabitats			Resident
Texas Horned Lizard	*Phrynosoma cornutum*	1	2	2	Varied, sparsely vegetated uplands.		T	Resident
Texas Tortoise	*Gopherus berlandieri*	1	2	2	Open brush w/ grass understory.		T	Resident
Timber/ canebrake rattlesnake	*Crotalus horridus*	1	2	2	Floodplains, upland pine, deciduous woodlands, riparian zones.		T	Resident

TPWD, 2014. Annotated County List of Rare Species – Gonzales, Guadalupe and Caldwell County revised 8/7/2012.

USFWS, 2013. Endangered Species List for Texas. http://www.fws.gov/southwest/es/ES_ListSpecies.cfm accessed online February 6, 2013.

The project area may provide potential habitat to endangered or threatened species found in Gonzales, Caldwell, or Guadalupe counties. A survey of the project area may

be required prior to pipeline and well field 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 the potential to occur in the project area should be initiated early in project planning.

Based on existing habitat types, the following species have potential to occur near project components. The aquatic species are only of concern at river intake or locations where pipelines cross perennial waters.

A. Federal-Listed Endangered Species

Whooping Crane (Grus americana) — The Whooping Crane is a federally listed species which would occur in Texas only during migration. Whooping cranes use a variety of habitats during migration, including croplands for feeding and large, marshy palustrine wetlands for roosting. Although large wetlands do not exist within the project area, the Whooping Crane could potentially occur in any surrounding cropland habitat during migration.

B. Federal-Listed Candidate Species

Golden Orb (Quadrula aurea) — The Golden orb is a federal candidate for listing and is state threatened. This freshwater mollusk exists in sand, gravel or mud substrates within lake or river systems. The TPWD designates a segment of the Guadalupe River near the intake as an Ecologically Significant Stream Segment based on the occurrence of the golden orb. This species was collected during a fall 2011 survey near Gonzales and could potentially occur in perennial streams, like the Guadalupe River, and near the proposed surface water intake.

Texas fatmucket (Lampsilis bracteata) — The Texas fatmucket is a federal candidate for listing in the state and is state threatened. This freshwater mollusk exists in more shallow rivers or streams with substrates of sand, mud and gravel. This species could potentially occur in perennial streams, like the Guadalupe River, and near the proposed surface water intake.

Texas pimpleback (Quadrula petrina) — The Texas pimpleback is a federal candidate for listing in the state, but not in Gonzales and Caldwell counties, and is state threatened. This freshwater mollusk exists in small to moderate streams and rivers of slow flow rates, as well as moderate size reservoirs with substrates of mixed mud, sand and fine gravel. This species was collected during a fall 2011 survey near Gonzales, Texas and could potentially occur in perennial streams, like the Guadalupe River, and near the proposed surface water intake.

C. State-Listed Species

Bald Eagle (Haliaeetus leucocephalus) — The Bald Eagle is a state-listed threatened species that could occur as a migrant near major aquatic resources. Although they breed primarily in the eastern half of the state, they could potentially occur along rivers or large lakes in this region of Texas during the winter and during migration. This species could potentially occur near perennial waterways.

Interior Least Tern (Sterna antillarum athalassos) — The Interior Least Tern is listed as endangered by the USFWS. They prefer to nest on sandbars, islands, salt flats, and bare or sparsely vegetated sand, shell, and gravel beaches that are associated with braided

streams, rivers and reservoirs. They could potentially occur within these habitats along the San Marcos River, Plum Creek, Salt Branch, or dry, exposed impoundments.

Peregrine Falcon (Falco peregrinus), including the American peregrine falcon (F. p. anatum) subspecies, is a state threatened bird that could be a possible migrant. They utilize a wide range of habitats during migration, including urban areas and landscape edges such as lakes or large river shores.

Blue sucker (Cycleptus elongatus) is a state threatened fish and exists in large portions of major rivers in Texas. Their preferred habitat includes channels and flowing pools with a moderate current and a bottom of exposed bedrock with hard clay, sand and gravel components.

False spike mussel (Quadrula mitchelli) is state threatened freshwater mollusk. The TPWD county list states the species as possibly extirpated in Texas. This species was collected during a fall 2011 survey near Gonzales, Texas and could potentially occur in perennial streams, like the Guadalupe River, and near the proposed surface water intake.

Cagle's map turtle (Graptemys caglei) is a state threatened reptile and occupies riverine habitat in the Guadalupe-San Antonio river systems. They prefer shallow water with swift to moderate flow and a substrate of gravel or cobble or deeper pools with a slower flow rate and a substrate of silt or mud. This turtle will nest on gently sloping sand banks along rivers. The NDD depicts an approximately 5 mile stretch of recorded Cagle's map turtle observations downstream of the Gonzales Dam, near the intake. This species could potentially occur in perennial waterways.

Texas horned lizard (Phrynosoma cornutum) is a state threatened reptile and is present throughout much of the state. They exist in open, arid, and semi-arid regions with sparse vegetation, which includes grass, cactus, scattered brush or scrubby trees. This species could potentially occur in areas with this type of contiguous vegetation.

Texas tortoise (Gopherus berlandieri) is a state threatened reptile that is active in the warmer months of March through November. They occur in open brush with a grass understory and will avoid areas of open grass or bare ground. This species could potentially occur in areas with this type of contiguous vegetation.

Timber/Canebrake rattlesnake (Crotalus horridus) is a state threatened reptile that occurs in swamps, floodplains, upland pine and deciduous woodlands, riparian zones, and abandoned farmland. They could also be present in limestone bluffs, sandy soil or black clay. This species could potentially occur in areas of abandoned farmland or forested riparian areas.

D. Unique or Rare Species

American eel (Anguilla rostrata) is not a listed species, but is part of a unique community designation within the San Marcos River. The NDD has no recorded occurrences of this species in the location of the proposed assessment area, but the species could potentially occur in perennial streams.

Guadalupe bass (Micropterus treculii) is an endemic game fish to Texas, found in the northern and eastern Edwards Plateau including headwaters of the San Antonio River, the Guadalupe River above Gonzales, the Colorado River north of Austin, and portions

of the Brazos River drainage. Relatively small populations occur outside of the Edwards Plateau, primarily in the lower Colorado River. Although not a listed species, it is the official state fish and considered rare by TPWD. This species could potentially occur in perennial waters.

The primary impacts that would result from construction of the proposed project would include the conversion of existing habitats and land uses within the pipeline right-of-way, WTP site, and well sites to maintained areas. These impacts are anticipated to be minor. The surface water intake would require the placing of structures and fill material into the river which may result in possible localized impacts to the riparian buffer, bank condition, and possibly instream habitat depending on the final intake design.

5.2.32.4 Engineering and Costing

Costs are based on the GBRA's MBWSP Engineering Feasibility Study (Option 3A) and indexed to September 2013 prices and other TWDB costing assumptions. The project is sized for 42,000 acft/yr annual delivery with a 2.0 peaking factor. Total project and annual costs for this option at the stated project yield are included in Table 5.2.32-2.These costs are for all facilities including raw water intake and pump station, raw water delivery pipelines, well field facilities, treatment plant, and potable water facilities up to the customer delivery points (i.e. everything shown in Figure 5.2.32-1). Costs for engineering, legal, and contingencies are estimated as 30 percent of capital costs for the pipeline and 35 percent of capital costs for other facilities (e.g., pump stations). Interest during construction was calculated based on a 3 percent differential between loan payments and earnings with a 2.5 year construction period. The capital costs for all facilities are $462,962,000 (Table 5.2.32-2).

Adding in non-capital costs: engineering/legal /contingencies, environmental, land acquisition and surveying, interest during construction, and groundwater lease payments; the total project costs for all facilities required to provide a firm annual supply of 42,000 acft/yr are $700,897,000. Annual costs which include debt service (5.5%, 20 years), operation and maintenance, and energy costs are $77,054,000, resulting in annual unit costs of $1,835/acft.

In terms of environmental impacts, the amount and type of impact drives potential surveying, permitting, and mitigation costs. Implementing measures to avoid and limit impacts (e.g., horizontal directional drilling) to sensitive environmental features and aquatic resources may lessen potential costs. Potential environmental and archaeological costs (surveying, permitting, and mitigation) are estimated at $1,064,000.

Table 5.2.32-2 Summary Cost Estimate for GBRA MBWSP- Conjunctive Use with ASR

Item	*Estimated Costs for Facilities*
Intake Pump Stations	$16,348,000
Transmission Pipeline	$115,443,000
Transmission Pump Station(s) & Storage Tank(s)	$23,277,000
Well Fields (Wells, Pumps, and Piping)	$87,097,000
Storage Tanks (Other Than at Booster Pump Stations)	$3,675,000
Water Treatment Plant	$212,959,000
Access Roads	$4,163,000
TOTAL COST OF FACILITIES	**$462,962,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$156,684,000
Environmental & Archaeology Studies and Mitigation	$1,064,000
Land Acquisition and Surveying	$9,073,000
Interest During Construction (4% for 2.5 years with a 1% ROI)	$55,070,000
Advanced Payments for Groundwater Leases	$16,044,000
TOTAL COST OF PROJECT	**$700,897,000**
ANNUAL COST	
Debt Service (5.5 percent, 20 years)	$58,615,000
Operation and Maintenance	
Intake, Pipeline, Pump Station & Groundwater	$4,841,000
Water Treatment Plant (2.5% of Cost of Facilities)	$9,418,000
Pumping Energy Costs (46,441,667 kW-hr @ 0.09 $/kW-hr)	$4,180,000
TOTAL ANNUAL COST	**$77,054,000**
Available Project Yield (acft/yr), based on a Peaking Factor of 2	42,000
Annual Cost of Water ($ per acft)	$1,835
Annual Cost of Water ($ per 1,000 gallons)	$5.63

Note: Unit costs for Option 3A in GBRAs MBWSP Engineering Feasibility Study were estimated at $1635/acft using March 2012 prices, debt service at 5% for 30 years, and $0.12/kwhr.

5.2.32.5 Implementation Issues

For each aquifer in the region, the GCDs have adopted desired future conditions (DFCs). In some GCDs, full use of all groundwater supplies (permitted, grandfathered and exempt) may result in non-achievement of the DFCs for an aquifer. To ensure consistency with the DFCs, TWDB currently requires that groundwater availability for each aquifer be limited for planning purposes to the modeled available groundwater (MAG) for the aquifer. This has resulted, for planning purposes only, in adjustments to permit amounts, and a lack of firm water available for future permits in this plan for some areas for certain time periods. This should not be construed as recommending or requiring that GCDs make these adjustments, or deny future permit applications. SCTRWPG recognizes and supports the ability of permit holders to exercise their rights to groundwater use in accordance with their permits and it recognizes and supports the GCDs discretion to issue permits and grandfather historical users for amounts in excess of the MAG. SCTRWPG may not modify groundwater permits that GCDs have already issued or limit future permits that GCDs may issue. If the MAG is increased during or after this planning cycle, SCTRWPG may amend this Plan to adjust groundwater supply numbers that are affected by the new MAG amount.

Significant implementation issues for the project include TCEQ approval of GBRA's surface water diversion permit application and modifications of or variances to rules from the Gonzales County Underground Water Conservation District (GCUWCD) including:

a. Allowing the maximum production of a well to exceed the average annual production by a factor of 2.0 instead of 1.5; and

b. Modify contiguous acreage requirements to be based on long-term average annual well field production instead of the maximum annual permitted capacity; and

c. Granting recharge credit for injected water through ASR operations; these credits would be used to increase the allowable groundwater production from given leases.

Other implementation issues include:

a. Whether an agreement can be reached with TWA to acquire their groundwater leases;

b. Renewal of GCUWCD 5-year production permits and 30-year export permits for project life;

c. Additional groundwater development in the region will not have a substantial effect on groundwater levels in the well field areas;

d. A test drilling program is recommended during a Pre-Design Phase to confirm aquifer properties and support designs of the wells;

In addition it will be necessary to obtain the following permits and agreements:

e. USACE Sections 10 and 404 Dredge and Fill Permits for the reservoir and pipelines;

f. GLO Sand and Gravel Removal permits;

g. GLO Easement for use of state-owned land;

h. TPWD Sand, Gravel, and Marl permit; and

i. Private land for construction of facilities to be acquired through either negotiations or condemnation.

Permitting may require development of habitat mitigation plan, environmental studies, and/or cultural resources studies and mitigation.

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