Name of Project:	**Regional Carrizo Project**
Duration of Project:	**50+ Years**
Amount of Water Available Annually:	**11,688 acre-feet/year**
Cost per Acre-Foot:	**$1,519**
Date Benchmarking Commenced:	**August 16, 2016**
Date Benchmarking Completed:	**October 18, 2016**
Managing Staff:	**Darren Thompson, Steven Siebert**

San Antonio Water System Mission Statement
Sustainable Affordable Water Services

Executive Summary

The Regional Carrizo Project, SAWS' largest non-Edwards Aquifer supply, was initiated November 12, 2013, and SAWS commenced production at its Buckhorn wellfield in Gonzales County in January 2014. The Project is permitted to export up to 11,688 acre-feet per year from the Carrizo Aquifer into the SAWS distribution system through 2060. This is a firm volume available during both average and drought conditions and gives SAWS a source other than the Edwards Aquifer, providing diversification as identified in the *2012 Water Management Plan*. Through cooperation with local governments and sharing of pipelines and treatment facilities, the Project cost was reduced by approximately $100 million, benefiting SAWS' ratepayers while providing needed infrastructure support for communities within Gonzales and Guadalupe Counties. As the second largest water source in SAWS' portfolio, this Project ranks favorably with other SAWS Projects in terms of cost, volume of water produced and impact on natural resources. The positive outcome of this project is due in no small part to the role played by SAWS staff members who skillfully cultivated the trust and cooperation of landowners, water groups, and municipal agencies. The staff's innovative, pro-community solutions should serve as a model for future water projects.

Benchmarking Document

1. How does this Project reflect a cooperative relationship with neighboring communities?

SAWS initially considered construction of a 59-mile pipeline to deliver Carrizo Aquifer water to the Twin Oaks Aquifer Storage and Recovery (ASR) facility for treatment and introduction into SAWS' delivery system. This pipeline would have been funded entirely by SAWS at a capital cost estimated at $100 million. However, SAWS also saw an opportunity to save money while at the same time provide some additional benefits to the counties where the wells and pipeline are located.

In February 2011, SAWS executed a historic Agreement with the Cities of Schertz and Seguin, the Mutual Regional Water Supply Contract (Contract). The purpose of the Contract was to enable the Schertz-Seguin Local Government Corporation (SSLGC) to treat and transport SAWS' Carrizo Aquifer water from SAWS' Buckhorn wellfield in

Gonzales County to Schertz in Guadalupe County where it is delivered to SAWS for transport to SAWS' distribution system in Bexar County. The Contract also enables SAWS to purchase additional water from the SSLGC system when it is available, and to provide water to SSLGC during an emergency.

In addition to the savings to SAWS customers through renting capacity in the SSLGC pipeline rather than constructing a new pipeline, SAWS' purchase of additional water from SSLGC has stabilized rates for the Cities of Schertz and Seguin which have forgone a rate increase for five years with their first rate increase expected for FY2017.

In Gonzales County, SAWS leases Carrizo Aquifer water from 22 families totaling 16,101 surface acres about seven miles northeast of Nixon, Texas. The landowners are the foundation of the Regional Carrizo Program providing the water rights available for the Project but also the land and easements for the wellfield and collection system. SAWS issues water payments to the landowners which adds to the local economy.

Additional collaborative efforts undertaken by SAWS include:

- A special provision in SAWS production permit mitigates the City of Smiley's well number one upon request by the City of Smiley.

- City of Nixon received a one-time power cost payment of $328,300 to offset increased energy costs of producing water at lower levels attributed to SAWS production. In addition, SAWS paid for lowering of well pumps and installation of new motors for those wells.

- Gonzales County Water Supply Corporation (WSC) - SAWS drilled and equipped a new Carrizo Aquifer well called the Saturn well during summer 2016 fulfilling a requirement of the Settlement Agreement between SAWS and the WSC. Additionally, SAWS is reviewing interconnect options and has the option to purchase 1,000 acre-feet of Carrizo Aquifer water providing an additional volume for SAWS customers and economic benefit to the WSC customers to improve infrastructure.

2. What are the water sources related to this Project?

All water for the Regional Carrizo Program comes from the Carrizo Aquifer in western Gonzales County, a non-Edwards Aquifer water source. This water is produced at the SAWS' Buckhorn Wellfield. Through SAWS' partnership with the SSLGC, SAWS water is being treated at SSLGC's Nixon Water Treatment Plant (WTP) in Gonzales County. SSLGC's source water also comes from the Carrizo Aquifer and is treated at their WTP. Carrizo Aquifer water from both the SAWS Buckhorn wellfield and the SSLGC wellfield are blended at the SSLGC treatment plant for delivery to SAWS and SSLGC customers. (Appendix 1)

3. What volume of water will be available during both average and drought of record conditions?

SAWS holds a production permit for 11,688 acre-feet of Carrizo Aquifer groundwater from the Buckhorn wellfield which is a firm volume available during average and drought conditions. This provides a source other than the Edwards Aquifer providing diversification as identified in the *2012 Water Management Plan*.

The approximate maximum volume of water the Project can produce is the following:

Water Category	Volume
SAWS Permitted Water	11,688 acft/yr
Water Loss 6.3%	(736) acft/yr
Projected SAWS Water Delivered	**10,952 acft/yr**
2017 SSLGC Water Option Purchase	2,500 acft/yr
2017 Total Projected Water Delivered	**13,452 acft/yr**
GCWSC Water Option Purchase	1,000 acft/yr
Water Loss 6.3%	(63) acft/yr
Maximum Potential Water Delivered	**14,389 acft/yr**

The Regional Carrizo Project, the largest non-Edwards Aquifer supply, was initiated November 12, 2013, when SSLGC began delivering SSLGC water to SAWS. SAWS commenced production at the Buckhorn wellfield in January 2014. SAWS has received the following water volumes since Project inception:

Year	SAWS (AF)	SSLGC (AF)	Total (AF)
2014	5,582	2,464	8,046
2015	10,753	3,394	14,147
2016*	7,393	77	

* YTD through August 31, 2016

4. Is water available for the duration of this Project in adequate quantity to justify the Project?

Yes. The current Desired Future Condition (DFC) for the Carrizo Aquifer as of September 1, 2016, which was adopted April 2010, is 23 feet average drawdown across the entire Groundwater Management Area 13 (GMA 13) by 2060. In Gonzales County, the Modeled Available Groundwater (MAG) fully supports permit production of 11,688 acre-feet per year for the 50-year planning period 2020-2070 except the 2030 decade where permitted groundwater exceeds the MAG due to other non-SAWS Projects coming on line in Gonzales County. For planning purposes only, SAWS on paper is reduced 270 acre-feet (2.3%) to 11,418 acre-feet per year for the 2030-2039 decade. (Appendix 2)

GMA 13 is in the process of the second round of setting DFCs. GMA 13 proposed the following DFC for the Carrizo Aquifer in March 2016:

- "The first proposed desired future condition for the Carrizo-Wilcox/Queen City/Sparta Aquifers in Groundwater Management Area 13 is that 75 percent of the saturated thickness in the outcrop at the end of 2012 remains in 2070. This desired future condition is considered feasible despite model predictions to the contrary as detailed in Technical Memorandum 16-08.

- In addition, a secondary proposed desired future condition for the Carrizo-Wilcox/Queen City/Sparta Aquifers in Groundwater Management Area 13 is an average drawdown of 48 feet for all of GMA 13. The drawdown is calculated from the end of 2012 conditions to the year 2070. The desired future condition is consistent with Scenario 9 as detailed in GMA 13 Technical Memorandum 16-01 and GMA 13 Technical Memorandum 16-08."

A new MAG is expected to be released during 2017 that fully supports SAWS permit production for all decades through 2070.

5. Is this Project based on reliable scientific data?

Yes. The DFC for the District is 97 feet of drawdown through 2060. The new DFC of 48 feet of drawdown averaged throughout GMA 13 will allow a District drawdown greater than the 97 feet currently permissible. The Project is based upon site-specific data gathered through a SAWS test drilling and monitoring program that installed two test pumping wells and 11 monitoring wells prior to the Project coming on line. Water level measurements are taken three times per year from the SAWS, SSLGC, and CRWA wellfields. June 2016 water level measurements show 50 to 60 feet of drawdown in this area. SAWS' wellfield also showed a five-foot rebound in water levels in the Carrizo Aquifer in response to above-average spring rains.

6. Is there any adverse impact to groundwater? If so, what types of mitigation are possible and what will they cost?

The District allows for a maximum drawdown of 97 feet after 50 years. If the maximum drawdown is reached, the District has the authority to impose restrictions or adjust the DFC accordingly. SAWS' own hydrologic modeling indicates the drawdown created by the Regional Carrizo Project and other surrounding Projects will be less than 97 feet, thus ensuring compliance with the rules.

In 2010, the GCUWCD passed a resolution establishing the Western Gonzales County Dedicated Mitigation Fund as a condition of permit acceptance for export pumpers that are permitted for more than 3,000 acre-feet per year in western Gonzales County. The GCUWCD will administer the fund and provide mitigation support for local permitted or registered wells with the exception of municipal wells.

SAWS signed on to the Mitigation Fund Agreement September 22, 2010. SAWS' initial contribution to the fund was $30 per acre-foot of water authorized to be produced which totaled $350,640. In addition, SAWS is required to pay a surcharge of $0.0175 (one and

three-quarters cents) per thousand gallons that are exported. Mitigation payments from SAWS to date total $91,579.

7. Is there any adverse impact to surface water? If so, what types of mitigation are possible and what will they cost?

This Project does not involve surface water. Therefore, water production from groundwater sources in this Project is not anticipated to impact existing surface water sources.

8. What are environmental impacts of this Project other than those related to groundwater and surface water?

No known listed/threatened/endangered species are impacted by this Project. An additional incidental benefit of the Carrizo Project for the near to mid-term is that it reduces SAWS' dependence on the Edwards Aquifer in NE San Antonio. As a permitee to the Habitat Conservation Plan (HCP), SAWS diversified water supply portfolio contributes to maintaining spring flow during times of drought for endangered and threatened species in the springs.

9. How does this Project ensure quality of the delivered water supply?

Some treatment is necessary to ensure the water from the Project is compatible with the existing high quality water in the SAWS network. Water quality treatment is performed at the SSLGC Nixon WTP in western Gonzales County. The Buckhorn wellfield water is treated with green sand to assist in the removal of excess iron, and manganese and treated with sodium hydroxide to increase pH. After treatment, the water is then blended at the Naco pump station with Edwards Aquifer water to make it fully compatible with SAWS water supply and distribution system.

10. Does this Project document a long-term hydrologic balance between recharge and discharge of any aquifers involved?

The Carrizo Aquifer is a geographically large sand aquifer that stretches from Arkansas and Louisiana southwest through Texas to Mexico. Within the confines of Gonzales County, the Carrizo Aquifer is estimated to contain approximately 200 million acre-feet of water in storage. Recharge occurs over a large area and, unlike recharge to the Edwards Aquifer, the movement of water into the Carrizo is slow. Movement of water out of the aquifer is also slow, making it relatively drought resistant. The amount of water to be withdrawn by the Carrizo Project will adhere to the District's rules and thus be unlikely to significantly impact the aquifer. The citizens of Gonzales County, will be assured of the same quantity and quality of water, and rights of withdrawal as before SAWS production began. SAWS has agreed to the District's mitigation plan to help address impact concerns that may occur due to SAWS production. Recharge and water use in the Carrizo is not as directly related to rainfall or as easy to define as it is in the Edwards Aquifer. Over 50 years, SAWS could potentially produce 534,000 acre-feet of water which amounts to only 0.27% of the estimated 200 million acre-feet* reported to

be available in storage in Gonzales County. ***GAM Task 13-036 (Revised): Total Estimated Recoverable Storage for Aquifer in Groundwater Management Area 13 Shirley Wade, Ph. D, P.G. and Robert Bradley, P.G., TWDB, July 15, 2013.***

11. Is this Project in accord with the SAWS Water Management Plan?

Yes. This Project was identified as the preferred choice to fill a portion of the mid-term supply gap in the *2009 Water Management Plan Update*. In the current *2012 Water Management Plan*, the Regional Carrizo Water Supply Program is identified as a current supply that is helping to meet the water demands of an increasing population and vibrant economy.

12. Is this Project in accord with the Region L Plan?

Yes. This Project, known as Regional Carrizo for SAWS, was first identified in the 2006 Region L Plan. The Project was subsequently listed in the 2011 Region L Plan as a recommended water management strategy. This Project was one of only two recommended water management strategies to come on line from the 2011 Plan. In the current 2016 Region L Plan, this Project is identified as one of SAWS' current supplies used to meet customer demand.

13. Will this Project support economic growth in the SAWS service area?

Diverse and stable water resources are essential for supporting economic growth in the SAWS service area. This Project, which reduces dependence on the Edwards Aquifer, is an important part of the *2012 Water Management Plan,* which benefits the region.

14. Is this Project in accord with Texas water law? Are there any unusual risks of litigation?

This Project is in accord with Texas water law and fulfills the requirements of Texas legal and regulatory guidelines. All water Projects, however, are subject to potential legal action by opponents of a particular Project.

15. Is this Project's water suitable for the geographic areas served by SAWS?

The Carrizo Aquifer water is treated, then blended, with Edwards Aquifer water at the Naco pump station and is primarily distributed to the NE portion of the SAWS service area. Overall, this Project strengthens SAWS water supply inventory and ensures that all customers have a high-quality and sustainable water supply.

16. Has a benefit-cost analysis been done in connection with this Project?

Yes. During the initial Project development, BBC Research and Consulting conducted a Benefit-Cost Analysis in 2004 and determined the "Gonzales-Carrizo Project appears to have the best benefit-cost ratio among SAWS' large-scale imported supply options."

(BBC Memorandum, August 16, 2004). It should be noted the total production volume is less than proposed during initial Project development over a decade ago.

SAWS reviews the economics of all water Projects on an annual basis.

17. Has a social and economic impact analysis been done in connection with this Project?

No formal socio-economic analysis has been conducted for this Project. However, benefits derive to the entire Region L area, including Gonzales County, from SAWS having a diversified water supply. This leads to fewer critical period management and fewer restrictions on regional development by reducing reliance on the Edwards Aquifer.

18. What is the cost per acre-foot of water for this Project?

The current cost per acre-foot is estimated to be $1,519 per acre-foot. (Appendix 3)

19. What is the effect on the ratepayer?

Approximately $1.52 of the average residential bill goes towards Regional Carrizo costs. For 2017, the Project will account for approximately 4.87% of projected total Water Supply and Water Production revenues. About $31.17 of the average residential bill goes to Water Supply and Water Production expenses, and 4.87% of this equals $1.52.

20. How does this Project rank, compared to other SAWS Projects?

In terms of volume, the Carrizo Project ranks as the second largest SAWS resource after the Edwards Aquifer. In addition, the Carrizo Aquifer is relatively drought resistant compared to the Edwards, Trinity, and other resources, and will provide a firm supply of water even during low rainfall years when withdrawals from other water resources may be curtailed. As such, the Project expands the diversity of water resources for SAWS and provides a reliable source of affordable, high-quality water that helps to support both current water needs and future development.

21. Are there any other issues that need to be addressed?

The CAP recommends SAWS continues to monitor this Project with an emphasis on cost optimization, water quality/public health, and sustainability. This would include:

- Ensuring that the annual drawdown is within Project parameters;
- Monitoring water quality to ensure compatibility with Edwards Aquifer water and public health standards; and
- Maintaining a strong working relationship at the local and regional level to assure continued resource availability;
- Continuing operational and economic assessments to determine what volume, if any, of water to purchase from SSLGC during dry years, and to refrain from purchases during wet years.

These strategies support a safe and sustainable water supply for San Antonio.

Conclusion

The Carrizo Project has been a successful addition to SAWS' diversified water resources and has been functioning as designed for the past three years. The Project appears to be having a minimal impact on drawdown within Gonzales County, assuring local landowners of sufficient groundwater for the current and future needs.

By cooperating with governmental entities in the region of the wells and pipeline, SAWS has significantly reduced the cost of the Project while providing tangible benefits to the communities in the vicinity of the wells and pipeline.

The CAP recommends that SAWS limit the purchase of additional water from the Schertz-Seguin Local Government Corporation (SSLGC) during wet years when SAWS has access to Edwards Aquifer water with no or limited critical period reductions. This will result in savings to SAWS' customers.

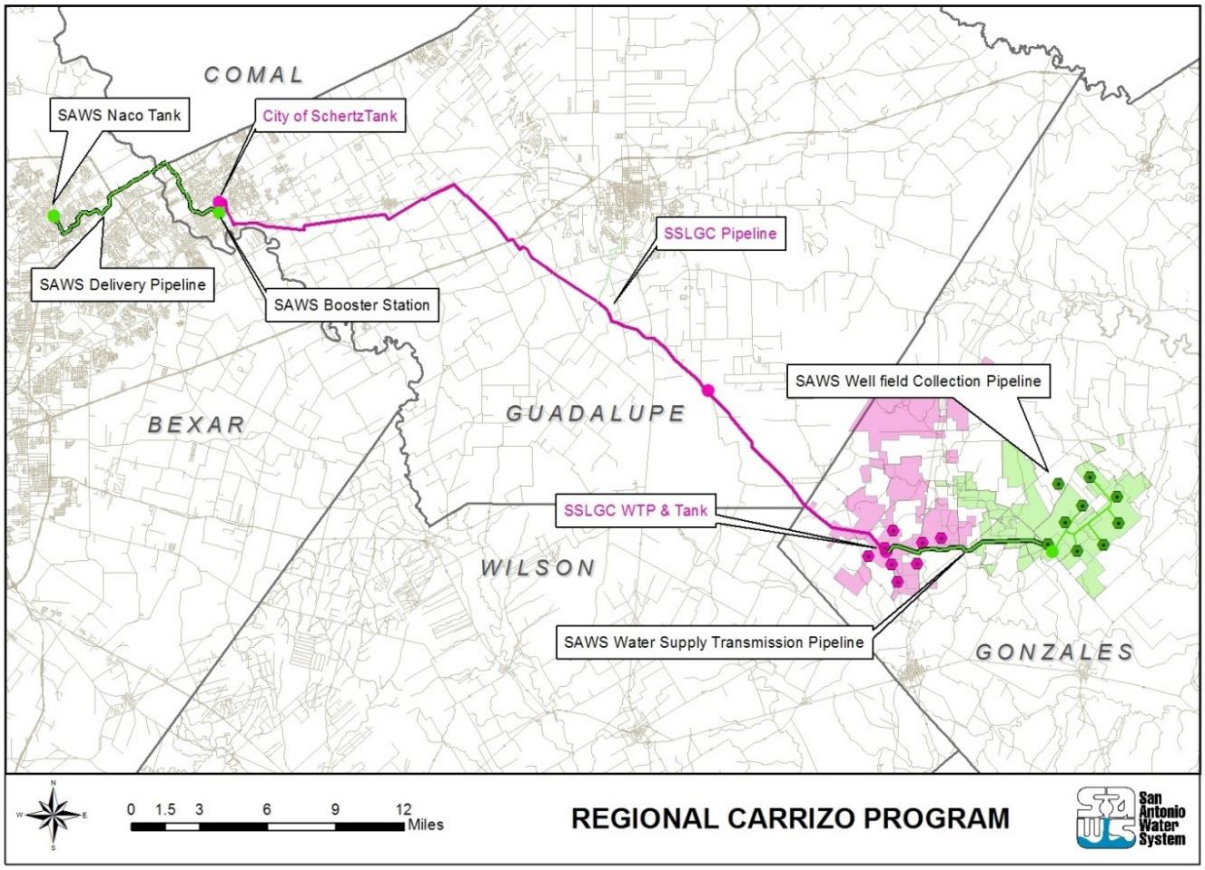
The Carrizo Project stands as an example of how cooperation among government agencies, groundwater management entities, local communities, and groundwater lease holders can yield positive benefits for SAWS's ratepayers and all other involved parties. The SAWS staff is to be acknowledged for their innovative and pro-community solutions that helped to bring this project to a successful completion.

Glossary

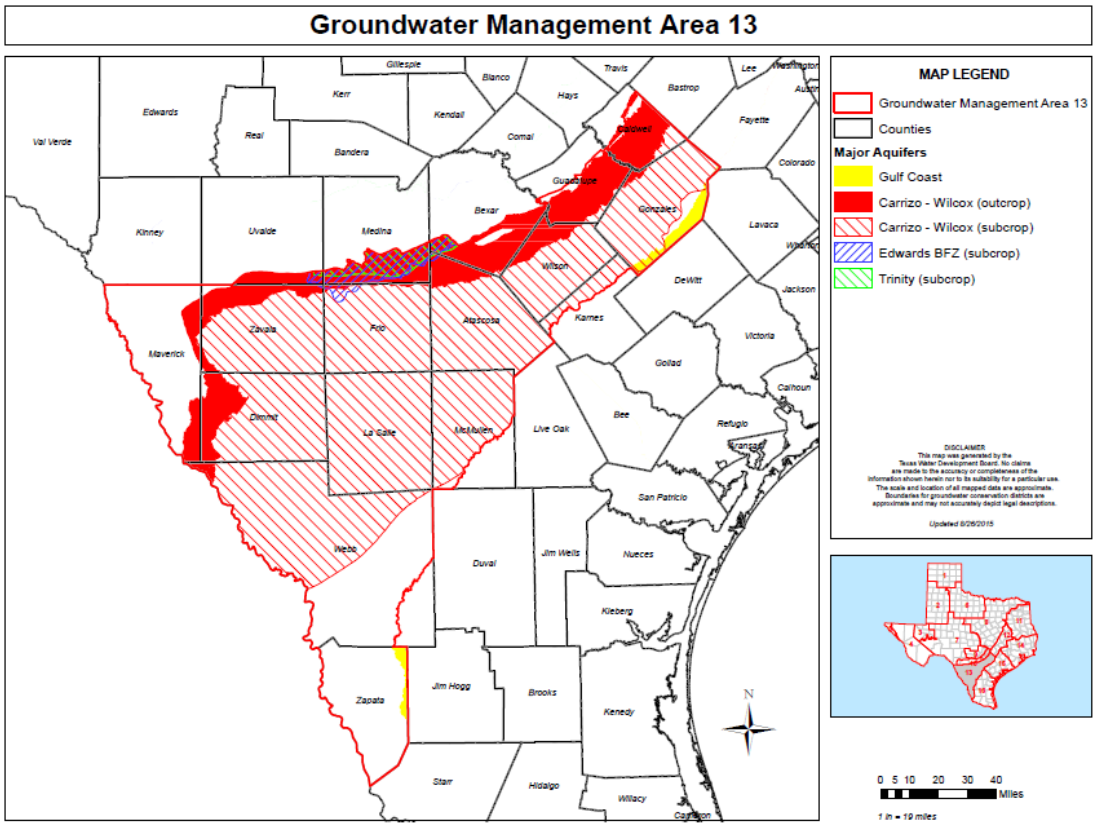
CAP	Citizens Advisory Panel
GAM	Groundwater Availability Model
GMA 13	Groundwater Management Area 13
GCUWCD	Gonzales County Underground Water Conservation District
GCWSC	Gonzales County Water Supply Corporation
RCP	Regional Carrizo Project (The Project)
SAWS	San Antonio Water System
SSLGC	Schertz Seguin Local Government Corporation
TWDB	Texas Water Development Board
WMP	Water Management Plan
WTP	Water Treatment Plant

Appendices

APPENDIX 1
Regional Carrizo Project Area Map



APPENDIX 2
Groundwater Management Area 13 Map



Source: Texas Water Development Board. www.twdb.texas.gov

APPENDIX 3
Annual Cost per Acre-Foot by Project