FINAL REPORT
Fair Oaks Ranch
Water Policy Analysis

Prepared for: The City of Fair Oaks Ranch

Texas Water Resources Institute
make every drop count

TEXAS A&M IRNR
Institute of Renewable Natural Resources

FINAL REPORT
Fair Oaks Ranch
Water Policy Analysis

Prepared for:
The City of Fair Oaks Ranch

Texas Water Resources Institute

Texas A&M Institute of Renewable Natural Resources

Texas Water Resources Institute Technical Report TR-492
College Station, Texas
April 2016

(updated version)

Table of Contents

Executive Summary

The overarching goal of this report was to review and assess factors relevant to implementing water policies in the City of Fair Oaks Ranch (FOR) to serve as a tool for decision-making regarding water resource projects and city planning strategies that address key water management issues. Analyses were based on readily available data regarding city policies, regulations, and initiatives, to include costs and water reliability/supply for the 2015-2060 period.

Report History and Science Review Panel

The final report is based on the contributions of many (e.g., original authors, institute staff, sponsors, and a science review panel) and captures the best available scientific approach given limitations (e.g., available data, time constraints, draft work). The original author (Dr. Calvin Finch, Principal Investigator) conducted the assessment for the city prior to his retirement. A Science Review Panel (SRP) then provided an independent assessment of the draft report and offered further recommendations and policy considerations. The SRP was comprised of five water experts, each with 20+ years of experience and extensive scientific publishing experience. This final report is a compilation of the collective recommendations of both original authors and the SRP.

Findings and Recommendations

Three water resources were assessed and assigned a water-supply uncertainty index (risk score), ranging from High to Low (See Table A). The risk score may be interpreted as a summary of several measures used to assess water project supply uncertainty based on the best available information (i.e., city data), which may range from reliability of supply (e.g., analysis described in this section), project costs analysis, and water project performance, to name a few. Several factors were assessed in determining a water-supply uncertainty index (See Table B).

The city's overall performance with respect to general water issues, such as water planning, water management, water quality, regulatory agencies, and water costs, was assessed and assigned a letter grade. The water issues grades served to provide insight into how prepared FOR is regarding the different water-supply issues (See Table C) and how to improve that preparation. For application purposes, the suggested interpretation for A and B grades is "continue efforts in this direction" and for C and D grades the interpretation is "areas of improvement or potential gain." "Not applicable" ratings refer to those with limited available data to fully determine the nature of the issue, such as not appearing to have much history on which to base a determination (See Table D).

Table A. Assessment of uncertainty ratings for water resources (from High to Low).

Projects	Average Rating	Ranking	Category
Canyon Lake Water	0.688	3	High
FOR Recycled Water Program	0.250	2	Medium
Trinity Aquifer Groundwater	0.188	1	Low

Table B. List of assessed water uncertainty factors for the City of Fair Oaks Ranch.

Rating Criteria
Ownership of Water
Endangered Species
Cost Certainty
Length of Contract
Drought Sensitivity
Contamination Threat to Source Water
Regulatory Certainty
Total Water Yielded

Table C. List of assessed water issues by category for the City of Fair Oaks Ranch.

Categories and Issues
Water Planning
Population Estimates
Drought-of-Record Conditions
Climate Change
Water Management
Water Conservation
Drought Management
Lost/Non-revenue Water
Water Quality
Relationships with Neighboring Communities
Regulatory Agencies
Trinity Glen Rose Groundwater Conservation District
Texas Water Development Board
Texas Commission on Environmental Quality and Environmental Protection Agency
Water Costs
Residential/Commercial Rates
Impact Fees

Table D. Overview of water issues by grades for City of Fair Oaks Ranch.

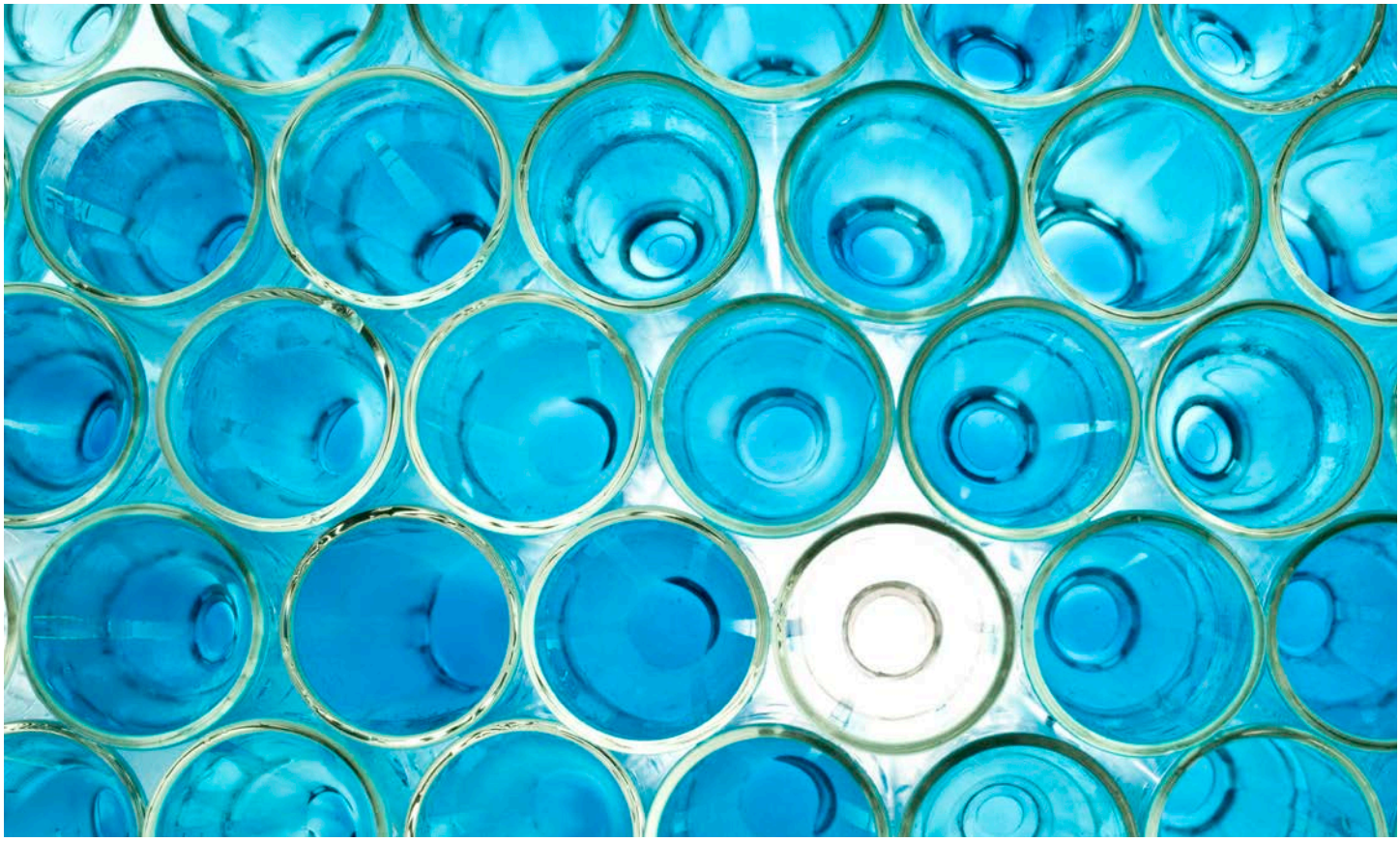
Water Issue	Grade
Population Estimates	**A**
Climate Change	**A**
Lost/Non-revenue Water	**A**
Drought-of-Record Conditions	**B**
Trinity Glen Rose Groundwater Conservation District	**B**
Texas Water Development Board	**B**
Relationships with Neighboring Communities	**B**
Texas Commission on Environmental Quality	**N/A**
Drought Management	**C**
Residential and Commercial Rates and Impact Fees	**C**
Water Conservation	**C**

Report Use—This final report serves as a comprehensive reference document for key water projects and issues influencing city water planning. Use of the scorecard format provides descriptions, considerations, grade or risk value assignments, and recommendations/actions for use in decision-making. In summary, the report provides

- broad descriptions of both water projects and water issues;
- validation and improvements to water project "risk" assessments;
- validation and improvements to water issue grading;
- recommendations and considerations from a diverse panel of water experts.

List of Tables

List of Figures



List of Acronyms

Acronym	Definition
AF	Acre Feet
ACRE FOOT	325,851 gallons
AFY	Acre Feet Per Year
AMR	Automatic Meter Reading
AECOM	An International Professional Technical Services Firm
ASR	Aquifer Storage and Recovery
BMPs	best management practice(s)
CCC	Community Conservation Committee
CCGCD	Cow Creek Groundwater Conservation District
CCN	Certificates of Convenience and Necessity
CECs	Contaminants of Emerging Concern
COSA	City of San Antonio
CWA	Clean Water Act
EAA	Edwards Aquifer Authority
EPA	Environmental Protection Agency, see US EPA below
ETJ	Extraterritorial Jurisdiction
FOR	Fair Oaks Ranch
GPCD	gallons per capita per day
GPD	gallons per day
GCD	Groundwater Conservation District
GBRA	Guadalupe-Blanco River Authority
MAG	Modeled Available Groundwater
MSL	Mean Sea Level
SAWS	San Antonio Water System
SRP	Science Review Panel
SDWA	Safe Drinking Water Act
SWIFT	State Water Implementation Fund for Texas
TCEQ	Texas Commission on Environmental Quality
TGRGCD	Trinity Glen Rose Groundwater Conservation District
TWDB	Texas Water Development Board
US EPA	United States Environmental Protection Agency

Introduction

Overview

The *City of Fair Oaks Ranch Water Policy Analysis* reviews and assesses factors relevant to implementing water policies. The **purpose** of this report is to provide the City of Fair Oaks Ranch (FOR) with a tool for decision-making regarding water resources/projects to pursue and for the integration of city planning strategies in addressing key water management issues. The report is divided into three sections: Introduction, Methods, and Results/Discussion.

The policy assessment reviews water resources/projects and water management issues. Water resources or projects were assessed and assigned a numeric "risk" value based on an uncertainty analyses "score card." Three water projects were evaluated for the City of Fair Oaks Ranch: Canyon Lake water, FOR Recycled Water Program, and Trinity Aquifer groundwater. Additionally, 11 water management issues were evaluated and assigned a letter grade (e.g., A, B, C, D, and F). Examples of water management issues include population estimates to use in water planning, mitigation strategies for addressing climate change impacts, and drought management, among others. Both water-supply projects and water issues were assessed based on available data of city policies, regulations, and initiatives, to include cost, quantity, and quality, for the 2015-2060 period.

Methods

Objectives

The overarching goal of the study was to assess water resources (actual and planned) and water issues relevant to future city policy decisions for the 2015-2060 period. The assessment used existing data on city policies, regulations, and initiatives involving cost, quantity, and quality of water from the Trinity Aquifer, Canyon Lake, and FOR Recycled Water Program. Specific contract tasks included:

- Work with FOR, FOR Utilities, and other participants to integrate findings for various parts of project.
- Describe FOR water resources (actual and planned) to include the amount of water produced, environmental characteristics, regulatory status, sustainability of the source, regulatory agencies involved, relationship to the distribution system, and relationship to drought.
- Describe special characteristics of FOR water security including drought management, distribution system, dependence on the Trinity Aquifer and Guadalupe-Blanco River Authority (GBRA) regional status, relationship to municipal utility districts, water treatment, geography, and water conservation.
- Assign numerical risk value to each water source based on its comparison to obtaining water from the Trinity Aquifer and GBRA.
- Describe and provide a letter grade for each of the number of organization and management characteristics for FOR, Trinity Glen Rose Groundwater Conservation District (TGRGCD), and other state, regional or local entities granted water regulatory authority.

Risk Analyses – Water Resources

The term "risk" is the "probability of an unwanted event or unintended consequence." The initial assessment was not a risk assessment in the classic sense but instead was an attempt to measure uncertainty or reliability of water supply. For purposes of this report, water-supply uncertainty is defined as "water-supply resource characteristics that expose the supply to some degree of unreliability, threat, or challenge." Several uncertainty factors were evaluated in this report. The three FOR water-supply resource projects assessed include Trinity Aquifer groundwater, Canyon Lake water, and FOR Recycled Water Program (Table 1).

Table 1. Water Resources evaluated for City of Fair Oaks Ranch.

City of Fair Oaks Ranch
1. Trinity Aquifer Groundwater
2. Canyon Lake water
3. FOR Recycled Water Program

Uncertainty Analysis

Water-supply uncertainty was measured and defined as characteristics of water-supply resources that expose the supply to some degree of unreliability, threat, or challenge. Assigning a numerical "uncertainty" value reflects the estimated degree of unreliability, threat, or challenge for that water resource (Table 2). Values can then be used to compare water-supply projects and even assign water projects into qualitative categories of uncertainty (e.g., low, medium, and high uncertainty). The basic rating criteria used to evaluate each water resource attempted to reflect uncertainty and/or unpredictability of that water resource (Table 2). Rating criteria viewed as "low" uncertainty were assigned a 0 value; those with a "medium or moderate" uncertainty were assigned a 0.5 (*note*: may vary for some measures with more than three categories); and those viewed as "high" uncertainty were assigned a value of 1. Thus, the scale for each criteria measure was standardized and ranged from 0 to 1 (low to high uncertainty) for all measures in the project evaluation. Definitions for each rating criteria are described in Table 2 and defined in the *Rating Criteria* section below. Once the uncertainty "score card" was applied for all water projects, the criteria measures were averaged to calculate an "uncertainty" value. Water projects were then ranked (highest to lowest) for comparison.

Risk Factors

Rating Criteria

Cost Certainty – The *total cost for water* (e.g., $/AFY) is not a measure of water project uncertainty. Typically, water costs in project assessments are evaluated separately (i.e., non-commensurate) but can be considered a measure of water-supply reliability or uncertainty if water costs prevent the procurement of water. We defined water projects with known, fixed costs (e.g., even if water costs increase during the time period, but cost increases are known) over one-half of the planning horizon (i.e., 22½ years, total 45-year planning horizon) as "low uncertainty" compared to projects with unknown or uncertain future costs, which were assigned a "high uncertainty" value (Table 2).

Total Water Yield – Like cost certainty, the *total water yield* is commonly assessed in water project evaluations separately (i.e., non-commensurate); however, the size of the water-supply project relative to others can be considered important when planning to meet the overall water demands of the future. Large projects provide a greater portion of the overall water need; thus, it can be argued that they provide additional certainty for the planning entity while small projects do not provide the same level of certainty. For rating purposes, the projected water amount produced for each water project was ranked and rated as large (>1,000 AFY) versus small (<1,000 AFY) based on total water yield (Table 2).

Ownership of Water – Water-supply projects include owned and leased water. Water ownership can be viewed as an indicator of supply uncertainty or supply reliability with owned water considered less uncertain (value of 0) and leased water considered more uncertain (value of 1). Water projects with mixed ownership were given an intermediate value (moderate uncertainty = 0.5, Table 2).

Length of Contract – Water supplies contracted for longer periods result in less uncertainty because contract negotiations are avoided or considerably delayed. In this assessment, contract length is evaluated based on the mid-point of the 45-year planning horizon (i.e., 22½ years) of this report. Water contracts shorter than 22½ years are considered to have greater uncertainty and assigned a rating value of 1. Water contracts longer than 22½ years are considered lower uncertainty and assigned a rating value of 0.

Drought Sensitivity – Water resource projects are affected differently by drought situations in the region based on the nature of the project. Projects with little or no change in yield (>90% of normal yield available in drought) received a rating value of 0 or "most reliable." Moderately reliable projects that yield 51% to 90% during a drought year received a rating score of 0.5. Projects with yields of 50% or less are considered least reliable and given a rating of 1 (Table 2).

Endangered Species – Water projects that impact the habitat of known endangered or threatened species are considered highly uncertain and assigned a rating value of 1. If there are no known endangered species or if the issue has been addressed with the completion of an Incidental Take Permit, the project received a low uncertainty rating value of 0 (Table 2).

Contamination Threat to Source Water – The contamination of water sources is complex. Thus, this measure should be applied with caution. The rate of recharge (fast versus slow) along with land cover can collectively give a reasonable measure of risk to water-supply contamination. Surface water sources are considered most vulnerable and receive a rating value of 1. Groundwater sources that recharge quickly and/or have recharge areas that are greater than 10% developed are deemed more threatened and receive a 0.5 rating value. Groundwater sources that recharge slowly and/or contain less than 10% developed land cover are considered less vulnerable to contamination and receive a 0 rating value. A water-supply project that includes several sources of varying vulnerability may receive an uncertainty rating of 0.5 (Table 2).

Regulatory Certainty – The characteristics of regulatory concerns facing a water project and the ability to address those concerns can provide considerable uncertainty to project assessment. Similarly, the presence or absence of local representation within the regulatory process can add or detract from the level of project certainty. For projects with few regulatory concerns or those that contain local representation within the regulatory framework, project certainty is considered high and a rating value of 0 is applied. For projects with a considerable number of regulatory concerns or lack of local representation in the regulatory framework, project certainty is considered low and a rating value of 1 is applied (Table 2).

Average Rating – Uncertainty analysis for each water-supply project was qualitative. The uncertainty measures for each project were averaged, ranked, and categorized based on rank order as Low, Medium, and High. Assignment of water projects to uncertainty categories was determined by dividing the ranked projects into three equal parts. Water projects with the scores closest to 0 are considered to have the lowest uncertainty while those with scores closest to 1 are considered to have the greatest uncertainty (Tables 2 and 3).

Table 2. Risk score card metrics used in analyses.

Rating Criteria	Scale	Description
Cost of Water	N/A	Provided for informational purposes only
Cost Certainty	0	Costs certain (i.e., costs already known or costs likely to decrease) – (>½ planning horizon*)
	1	Costs uncertain (i.e., uncertain costs or future costs may increase) – (>½ planning horizon)
Total Water Yielded: FOR Projects	0	> 1,000 AFY
	1	< 1,000 AFY
Ownership of Water	0	Owned
	0.5	Mix of Owned and Leased
	1	Leased
Length of Contract	0	Longer Contract Length (>½ planning horizon)
	1	Shorter Contract Length (<½ planning horizon)
Drought Sensitivity	0	Most Reliable (>90% of normal year during drought)
	0.5	Moderately Reliable (51-90% of normal year during drought)
	1	Least Reliable (<50% of normal year during drought)
Endangered Species	0	None known or Incidental Take Permit in place
	1	One or more known endangered species concerns
Contamination Threat to Source Water	0	Low – (e.g., groundwater, slow recharge and/or undeveloped land cover [<10%])
	0.5	Moderate – (e.g., groundwater, high recharge and/or developed land cover [>10%])
	1	High – (e.g., surface water, developed land cover [>10%])
Regulatory Certainty	0	Certain (e.g., few regulatory concerns, local representation with agency)
	1	Uncertain (e.g., significant regulatory concerns, absent or limited representation with agency)

Average Rating: Sum of rating points divided by the number of metrics used; based on 0 – 1 scale
Overall Uncertainty Rating: Qualitative level of perceived project uncertainty for meeting water-supply needs; Low, Medium, or High

*Planning horizon is 45 years (2015–2060)

Results and Discussion

We found FOR water supply/resources had uncertainty values ranging from 0.188-0.688 (Tables 3 and 4). Canyon Lake water has the highest degree of uncertainty (0.688) among the three projects, whereas Trinity Aquifer ranked as the least uncertain water project. It is important to note this assessment has several limitations. First, the report only used readily available data or other easily accessed data sources. Measures that are more informative could be included with a comprehensive assessment not limited by this constraint. Second, time constraints prevented this assessment from thoroughly validating and obtaining aforementioned data necessary for ideal measures in project evaluation. Acquiring additional data would also allow inclusion of cost certainty, drought sensitivity, and regulatory certainty as additional measures of overall source reliability.

Water Resources

Canyon Lake water ranks highest in water production compared to the other water sources (Table 5). Because it appears FOR's main water supply is relatively high-risk compared to the other two water sources, FOR may consider protection of present resources and diversification efforts to provide for growing water needs. Planning and collaborative efforts may be avenues for ensuring viable water resources. An individualized score card for each water resource is provided, along with a brief description and assessment.

Table 3. Risk ratings for Fair Oaks Ranch water resources (from high to low).

Project	Average Rating	Ranking	Category
Canyon Lake Water	0.688	3	High
FOR Recycled Water Program	0.250	2	Medium
Trinity Aquifer Groundwater	0.188	1	Low

Table 4. Uncertainty value and ranking for FOR water-supply projects.

	Ranking Criteria										
Project Name	Cost Certainty	Total Water Yielded	Ownership of Water	Length of Contract	Drought Sensitivity	Endangered Species	Contamination Threat to Water	Regulatory Certainty	Average Project Rating	Project Uncertainty Ranking
City of Fair Oaks Ranch Projects										
Canyon Lake Water	1	0	1	1	0.5	0	1	1	0.688	3
Fair Oaks Ranch Recycled Water	0	1	0	0	0	0	0	1	0.250	2
Trinity Aquifer Water	0	1	0	0	0.5	0	0	0	0.188	1

Table 5. Fair Oaks Ranch water resources (both current and future) in order of water production.

Project	Water Amount (AFY)	Ranking
Canyon Lake Water	1,850	1
Trinity Aquifer Groundwater	543	2
FOR Recycled Water Program	224	3

Trinity Aquifer Groundwater

Trinity Aquifer Groundwater – Score Card		Rating
Cost of Water	$30/AF if Trinity Aquifer groundwater is >50% of the city's water supply, which is paid to the Trinity Glen Rose Groundwater Conservation District (TGRGCD). There is no cost if use is <50% of total supply. The legislative TGRGCD Board has granted permission to increase the fee to $40/acre foot in the future; potential future rate increase is known. There is small uncertainty in the cost associated with the energy need for groundwater pumpage, which at the current time is quite low, but could rise, especially during droughts where a simultaneous drop in aquifer levels and rise in energy prices could occur.	
Cost Certainty	Prices are stable.	<0.25
Total Water Yield	543 AFY	1
Ownership of Water	Wells owned by the city.	0
Length of Contract	N/A	
Endangered Species	None	0
Contamination Threat:	Sources state 4-5% of rainfall recharges the aquifer. Recharge described as slow, although there is localized uncertainty; large-scale contamination threat is low.	0
Drought Sensitivity	The Trinity Aquifer is described as an inconsistent water source and the most stressed water source in the area.	0.5
Regulatory Certainty	Fair Oaks Ranch has a representative on the TGRGCD Board.	0
Average Rating		0.188
Overall Rating		**Low Uncertainty**

Description

Water from the Trinity Aquifer is more than 50% of the total FOR water supply. FOR's destribution system primarily relies on GBRA water. By 2040, the 543 AFY will be 23% of total supply. The decade of 2040 is a key period for FOR because according to a 2011 Water and Wastewater Planning Study, the city will be built out by that year. Unless fluctuations occur, supply for 2040 appears adequate for 2060 and beyond.[1] TGRGCD reports there are several reasons to expect the Trinity Aquifer groundwater source to be a reliable source for FOR.[2]

- The projected water use for the Bexar County portion of the Trinity/Glen Rose Aquifer is only 50% of the modeled available groundwater (MAG).[2]
- The remaining land over the Trinity Aquifer in Bexar County is all within the San Antonio Water System (SAWS) Certificates of Convenience and Necessity (CCN), where there is an expectation there will not be additional wells drilled into the Trinity Aquifer. Water for new homes in the area will be part of the SAWS municipal system.[2]

Although the Trinity Aquifer groundwater supply is considered low-risk, careful water management is recommended due to its performance during drought periods.[3] Homeowners in developments such as Cross Mountain Ranch and other parts of Kendall County, for example, have observed shortages during drought periods due to falling well levels (potential impact varies based on region and well depth).[4] The degree of reliability depends on which Trinity Glen Rose pool being pumped is impacted by SAWS' Water Management Plan.[5]

The rural and unorganized areas over the Trinity Aquifer north and adjacent to FOR in Kendall and Comal counties rely almost entirely on Trinity Aquifer groundwater. Boerne has a surface water treatment plant and uses

Canyon Lake water, Trinity Aquifer groundwater, and other resource supplies (e.g., Esperanza and Cordillera Ranch).[6] Boerne and the surrounding rural areas continue to grow, likely increasing water needs throughout the area.[2]

Considerations

We recommend FOR develop strategies to diversify water source supplies beyond the Trinity Aquifer. Though its rank is a low-risk source (e.g., Eckhardt[7]) for FOR, the high-risk measure for drought sensitivity should be a precautionary concern. Overall, the FOR water-supply demands should be adequate through 2060.[8]

Grade Assessment

The Trinity Aquifer project is rated as a low-risk, though challenged, water source based on its geology and the pressure from growth in the area.

Recommendations—Work more collaboratively with TGRGCD to manage use of the aquifer and protect its water quality. Develop closer relationships with the City of Boerne, Comal County, and Kendall County via increased involvement with Groundwater Management Area 9 issues.

1. Collaboratively discuss and develop a process of regular communications with the City of Boerne, Comal County, Kendall County, Cow Creek Groundwater Conservation District (CCGCD), and TGRGCD and seek a path to better protect Trinity Aquifer groundwater quality and recharge quantity.
2. Initiate collaborative discussions to organize a regional Edwards Aquifer contributing zone initiative. Work with regional partners to integrate protection for the Trinity Aquifer recharge system into that effort.
3. Investigate the cost variability to pump water from the Trinity Aquifer during drought periods.

References

1. Reem Zoun and David Parkhill. Kendall County and the City of Fair Oaks Ranch Water and Waste Water Planning Study. Feb. 2011, AECOM for Guadalupe-Blanco River Authority Page 3-12.
2. George Wissman Interview, January 7, 2015. Wissman is the General Manager of the TGRGCD.
3. Ron Emmons, FOR Public Works Director, Q&A Meeting with FOR and TGRGCD officials at the FOR offices on December 18, 2014.
4. Colin McDonald "Thirsty for Water in Kendall County" *San Antonio Express-News,* C. McDonald. Express-news.net, July 1, 2011, and conversation with George Wissman on January 7. 2015.
5. San Antonio Water System 2012 Water Management Plan. www.saws.org.
6. Ron Emmons, FOR Public Works Director, electronic communication, March 11, 2015.
7. Gregg Eckhardt, "The Trinity Aquifer," The Edwards Aquifer Website, http://www.edwardsaquifer.net/trinity.html.
8. Grant Snyder. 2015. Pumping and drawdown analysis at Fair Oaks Ranch. Intera Incorporated Final Report. 21 pages.

Fair Oaks Ranch Recycled Water Program

Fair Oaks Ranch Recycled Water Program – Score Card		Rating
Cost of Water	$0	
Cost Certainty	Prices are stable.	0
Total Water Yield	Up to 560 AFY (500,000 GPD)	1
	Averages 224 AFY (219-251 AFY)	
Ownership of Water	Owned by Fair Oaks Ranch	0
Length of Contract	N/A	0
Endangered Species	None	0
Contamination Threat:	None. Used for the golf course	0
Drought Sensitivity	No	0
Regulatory Certainty	Texas Commission on Environmental Quality, state agency	1
Average Rating		0.250
Overall Rating		**Low Uncertainty**

Description

The FOR Recycled Water Program provides the least amount of water relative to other water sources (i.e., 224 AFY) yet it is a reliable source that reduces potable water needs to irrigate the Fair Oaks Ranch Golf Course.[1] A permit from Texas Commission on Environmental Quality (TCEQ) allows FOR to apply up to 500,000 gallons per day (GPD) of treated effluent to FOR golf course.[1] The permit requires that all water be applied as irrigation (no discharge permit) and that none be released into the Cibolo Creek, an important Edwards Aquifer recharge feature.[1]

The Fair Oaks Ranch Golf Course is a desirable feature in the water management strategies of FOR because the 280-acre facility is capable of using the entire amount of available wastewater. Treated wastewater produced in the winter can be stored in the golf course storage ponds for use at other times of the year. Cost of the water is $0 because it would have to be treated whether it was reused or not. The 224 AFY reflects the entire potential and allowed amount in the permit. FOR generally has less wastewater to treat than the 500,000 GPD.[1] The amount of available reuse water means FOR also requires a contract to provide Trinity Aquifer groundwater annually to be mixed with the reuse water as needed (e.g., times of drought, 2011).[1]

Considerations

The FOR Recycled Water Program is as much a water-quality issue as it is a water-supply project. The 224 AFY used by the golf course in an average year replaces potable water. Using the water to irrigate the golf course also eliminates the need for the wastewater to be placed into Cibolo Creek. There are legitimate questions of whether FOR wastewater is a contamination threat to Cibolo Creek, espeically since it is an Edwards Aquifer recharge feature. This suggests that using the treated wastewater to meet landscaping irrigation demands may be best option for utilizing this water supply.

Grade Assessment

The FOR Recycled Water Program is considered a medium-risk water resource. The relatively small water-supply project is significant as it uses the entire FOR treated wastewater production to replace potable water in irrigating the Fair Oaks Ranch Golf Course.

Recommendations—The reuse program is important as both a water-supply and water-quality project and should be more aggressively promoted to the public as part of FOR's water policy. This is a proactive activity for FOR in promoting the stewardship of water resources for the city.

1. Detail the recycled water program and how it works on the FOR website.

2. Work to identify and secure future recycled water users to utilize any excess recycled wastewater.

References

1. Ron Emmons, FOR Public Works Director, email communication, Reuse Water, March 11, 2015.

Canyon Lake Water

Canyon Lake Water – Score Card		Rating
Cost of Water	$943/AF in 2015, price adjusted based on inflation and operating costs	
Cost Certainty	Price can change by GBRA with 60 days' notice.	1
Total Water Yield	1,850 AFY	0
Ownership of Water	Bought annually from GBRA via contract. Contract extensions available through 2077 assuming costs are acceptable.	1
Length of Contract	Decision point in 2037 (for renewal) and thereafter	1
Endangered Species	None	0
Contamination Threat	Lake in Comal County	1
Regulatory Certainty	Surface water permitted by TCEQ (state agency) to GBRA and CCN to FOR from TCEQ[5]	1
Drought Sensitivity	Yes, but liberal.	0.5
Average Rating		0.688
Overall Rating		**High Uncertainty**

Description

Canyon Lake provides FOR the greatest amount of water though it is ranked as the most uncertain water resource among the three water projects. GBRA currently delivers water through a contract last amended in 2012 and extending at least to 2077.[3] The current contract provides a commitment of 942 AFY of treated potable water to be delivered to the city, and up to 1,850 AFY available with notice on or before December 31 of the previous year.[1]

The Canyon Lake agreement is desirable in that it has an upper volume (1,850 AFY) that is 78.5% of FOR's estimated needs once the community is built out to its ultimate size. The city also has the option to use only a portion of the Total Available Yield because SAWS has agreed to purchase any excess supply not used by FOR in a given year.[4] The cost of the Canyon Lake water is re-calculated as GBRA determines necessary, with a 60-day notice to FOR. The 2015 value was $943/AF.[2]

Considerations

The price of Canyon Lake water might be evaluated or negotiated based on city management budgeting. SAWS involvement in purchasing the difference between the water FOR needs in the current year and its full entitlement may be helpful, thus maintaining collaborative efforts with SAWS and the City of San Antonio (COSA). Another consideration is that FOR Utilities continue collaborating with the GBRA Project Management Committee to maximize its use of this water resource.

Grade Assessment

Canyon Lake received a high-risk value primarily due to the contracting uncertainty for both supply and cost. Despite this risk value assignment, the water-supply source is important to FOR, and efforts to maintain positive relationships with external partners is recommended.

Recommendations—FOR budget management might assess whether additional collaborative efforts with GBRA regarding water costs would be beneficial. Developing additional sources suggested in this report (water conservation practices, increased reuse), a SAWS interconnection, and Trinity Aquifer protections may provide additional measures for balancing dependence on Canyon Lake water.

1. Continue collaborative efforts with GBRA Project Management Committee regarding price, quantity, and quality of the water supply.

2. Encourage GBRA to analyze the impact that climate change will have on the Canyon Lake water-supply resources. Impact of climate change on refilling of the reservoir and evaporation from the reservoir may need to be quantified.

3. Continue collaborative efforts with GBRA and SAWS to maintain current Canyon Lake water resources and their purchase by SAWS.

References

1. Third Amendment to Agreement Between City of Fair Oaks Ranch, Texas and Guadalupe-Blanco River Authority, January 1, 2012. Provided by Christina Picioccio at the December 12, 2014 meeting at the FOR offices.

2. GBRA Invoice date February 1, 2015 was provided by Christina Picioccio of the FOR Utilities on February 17, 2015. The information on the invoice was used to calculate the water rate. Corrected by Ron Emmons March 11, 2015.

3. Agreement between City of Fair Oaks Ranch, Texas and Guadalupe-Blanco River Authority, Regional Water Supply Project for portions of Comal, Kendall, and Bexar counties, September 16,1999. Hard copy provided by Christina Picioccio of the FOR Utilities February 17, 2015. Page 19.

4. Dave Pasley, SAWS Supports Sprawl: Western Canyon Pipeline, March 28, 2006. Available at http://sawssupportssprawl.blogspot.com. Page 2.

5. Certificate of Convenience and Necessity, Certificate No 11246 Texas Natural Resource Conservation Commission.

Water Issues

In this section, results and discussion for water management activities or issues for FOR are presented. The evaluation is based on available data of city policies, regulations, and initiatives, to include cost, quantity, and quality, for the 2015-2060 period.

Grade Assessment – Water Issues

As part of the project, FOR requested assignment of letter grades for water management activities or issues within the community (Table 6). Water management activities/issues were addressed within five broad categories: water planning, water management, water quality, regulatory agencies, and water costs (Table 7). The grades provided insight into how prepared FOR is regarding the different water-supply issues and how to improve that preparation. For application purposes, the suggested interpretation for A and B grades is "continue efforts in this direction" and for C and D grades, the interpretation is "areas of improvement or where potential gains exist" (Table 8). Eleven water issues were assessed and graded with background information and rationale for grading provided for each water issue.

Table 6. Overview of 11 water issues for City of Fair Oaks Ranch.

Category and Issue	Synopsis	Grade
Water Planning		
Population Estimates	Update population estimates and incorporate into new water plan as characterized by the AECOM Water and Wastewater Report of 2011.	**A**
Drought-of-Record Conditions	Water supply based on conditions such as drought of record, climate change, high gallons per capita per day (GPCD) levels, and population estimates. Water deficits may need to be addressed.	**B**
Climate Change	FOR recognizes the potential for climate change to have an effect on water demand and supplies and seeks strategies to mitigate its impact.	**A**
Water Management		
Water Conservation	FOR's Water Conservation Plan presents a goal to reduce GPCD from 200 to 160 by 2060. Alternative scenarios are evaluated.	**C**
Drought Management	FOR uses surcharges as a drought management tool but may benefit by adding drought enforcement. Drought restriction rules may be more effective with increased education to the community.	**C**
Lost/Non-revenue Water	FOR manages lost/non-revenue water appropriately with an average monthly rate of 7.8%. It allocates the loss between line flushing and estimated calculation of leaks.	**A**
Water Quality		
Relationships with Neighboring Communities	FOR cooperates on Extraterritorial Jurisdiction (ETJ) and other issues with San Antonio, and may consider an interconnection. Recommend increased collaboration with the City of Boerne, and Comal and Kendall counties to protect the Trinity Aquifer.	**B**
Regulatory Agencies		
Trinity Glen Rose Groundwater Conservation District (TGRGCD)	Cooperation between FOR and TGRGCD is evident. Consider jointly reviewing TGRGCD fees and FOR's relationships with other Trinity Aquifer stakeholders.	**B**
Texas Water Development Board (TWDB)	Increase involvement with TWDB programming and pursue available funding with the potential benefit to FOR interests via TWDB policies.	**B**
Texas Commission on Environmental Quality (TCEQ)	FOR works closely with TCEQ on its recycled water program. The relationship may be expanded in developing a regional water quality protection effort.	**N/A**
Water Costs		
Residential and Commercial Rates and Impact Fees	Consider evaluating rate structure in terms of system expenses, water use goals, and assessing water-pricing structure with respect to economic efficiency and other city goals.	**C**

Table 7. Overview of water issues evaluated for the City of Fair Oaks Ranch by category.

Categories and Issues
Water Planning
Population Estimates
Drought-of-Record Conditions
Climate Change
Water Management
Water Conservation
Drought Management
Lost/Non-revenue Water
Water Quality
Relationships with Neighboring Communities
Regulatory Agencies
Trinity Glen Rose Groundwater Conservation District
Texas Water Development Board
Texas Commission on Environmental Quality and Environmental Protection Agency
Water Costs
Residential/Commercial Rates and Impact Fees

Table 8. Water grade descriptions.

Grade	Description
A	Exemplary, recognized as a leading example, and accomplishing the goals for the effort
B	Effective, generally accomplishes goals for the effort, but not exemplary, lacking in one area
C	Seems to be accepted by local ratepayers without any special recognition outside, meets goals, but not exemplary
D	Does not meet goals and effort to correct not adequate
F	Failure to meet goals without much effort to address or correct

Water Planning

Population Estimates

Overview	Grade
Update population estimates and incorporate into new water plan as characterized by the AECOM Water and Wastewater Report of 2011.	A

Description

FOR has had an average GPCD of 200 over the last 10 years.[1] The highest GPCD was 235 in 2011 (dry year), and the lowest was 148 (very wet year).[1] The 2011 AECOM Water and Wastewater Study forecasts that FOR and its ETJ will be completely built out by 2040 and the population will reach 10,301 people in 2040.[2] In contrast, FOR leadership estimate the population may reach 16,411 in 2040, requiring approximately 60% more water.[1],[4] In 2040, based on a dry-year GPCD of 207 and a total population of 10,301, the water needs of the community will be 2,389 AFY and is expected to remain constant through 2060.[3]

FOR's water sources include groundwater from the Trinity Aquifer, surface water from Canyon Lake, and recycled water from the FOR Recycled Water Program. The 2011 AECOM Water and Wastewater Study reports there will be no shortage of water through 2040 and beyond.[5] A recent water availability study (Snyder 2015) conducted for FOR reaffirms this assessment.[6] The Region L Water Plan reflects that FOR per-capita water use will decrease from 207 to 204 by 2040. If the 16,411-population projection proves more accurate, there would be a water-supply shortage well before build-out is complete, unless the GPCD or other factors in the water-demand calculation are reduced or supplies are increased. There is potential to mitigate this issue if estimated growth occurs within the SAWS CCN (though >2,000 acres are within FOR's ETJ), and SAWS addresses this demand.

Considerations

FOR should resolve uncertainty regarding projected population estimates at build-out. Estimates from the 2011 Water and Wastewater planning study suggests that FOR is well situated to meet future water needs.

Grade Assessment

A high grade was given to FOR because of its use of multiple estimates and recognition of the need for updated estimates. To meet its water needs for a 10,301 population, FOR has a contracted commitment of 2,393 AFY (543 AF from the Trinity Aquifer and 1,850 AF from Canyon Lake). If the estimate of 16,411 is more accurate, then considering the potential impact of drought-of-record conditions, climate change, and the vulnerability of water supplies from the Trinity Aquifer, the FOR water situation may not be as secure.

Recommendations—Improved overall population estimates are strongly recommended in water planning for FOR. Below is a list of specific recommendations for consideration.

1. Determine the most accurate population estimate for FOR build-out.
2. If the number is the 10,301, then the nature of the FOR water plan becomes one of blending protection of the Trinity Aquifer and Canyon Lake projects with water conservation and a SAWS interconnection.
3. If the 16,411 population is the more realistic, create new water plan and work to include the addition of new water sources.

References

1. Ron Emmons, FOR Public Works Director, email communication, March 11, 2015. Based on calculations completed by the mayor and three city council members.

2. Reem Zoun and David Parkhill. Kendall County and the City of Fair Oaks Ranch Water and Wastewater Planning Study, February 2011. Prepared for Guadalupe Blanco River Authority in association with Texas Water Development Board by AECOM Page 1-1 for 2009 population and pages 2-4 (Table 2.2) for 2040 population estimate.

3. Calculated by multiplying GPCD in Kendall County and Fair Oaks Ranch Water and Wastewater Planning Study (page 3-1) by population at 2040 when build-out is reached (Page 3-11).

4. Information provided via email by Mayor Landman, June 4, 2015.

5. AECOM report. Page 3-11.

6. Grant Snyder. 2015. Pumping and drawdown analysis at Fair Oaks Ranch. Intera Incorporated Final Report. 21 pages.

Drought-of-Record Conditions

Overview	Grade
Water supply based on conditions such as drought of record, climate change, high gallons per capita per day (GPCD) levels, and population estimates were calculated. Water deficits may need to be addressed.	**B**

Description

When calculating water needs, water purveyors in Texas generally use firm yield during drought-of-record conditions to determine what portion of their water supply will be available. In Texas, drought of record refers to the severe dry weather conditions that existed during the eight-year period of 1950-1957, with 1956 being the worst. For comparison, conditions in 1956 did not quite match the high temperatures and low rainfall experienced in 2011; however, the cumulative impact of eight years of drought was more severe than 2011.

It is difficult to determine the potential impacts of reduction of water supplies from the Trinity Aquifer and Canyon Lake during drought-of-record conditions. Using data for the Trinity Aquifer from the drought of record (1950-1957), the average recharge was 24% of the overall recharge for the period of 1934-2011.[1] Future models suggest that a repeat of the drought of record would cause the Trinity Aquifer to fall as much as 100-150 feet and a large part of the aquifer would be depleted by 2030.[2] In recent years, wells drilled into the upper layers of the Trinity by developments such as Cross Mountain Ranch have gone dry. Even Jacobs Well, an artesian well near Wimberley that flowed throughout the drought of record, quit flowing for a period in 2008.[4] Another significant change since the 1950s is that population has increased by more than 800% over much of the Trinity Aquifer.[3] SAWS has contracts for 8,800 AFY of water from Trinity Aquifer sources, but in its 2012 Water Management Plan, only firm yield rates at 2,000 AFY are projected or approximately 23% of the contracted yield.[5] Given the historic and projected demands, FOR should plan for severe water-supply reductions in its water planning to include potential drought-of-record conditions. How conditions such as drought of record, climate change, high GPCD levels, and increased population estimates may affect water supply and demand are illustrated (Table 9).

Grade Assessment

Drought-of-record conditions play a major part in determining how much water a community requires to meet its needs long term. Although the AECOM 2011 Water and Wastewater Study describes the water-supply situation as adequate to handle the population at build-out, that may be an optimistic outlook. There are several scenarios where a water deficit may occur before 2040 if drought-of-record conditions were to occur (Figures 1-2, Table 9).

Recommendations—FOR should include drought-of-record conditions in its water planning. Specific recommendations include:

1. Prepare a new water plan based on a water-balance type of analysis that accounts for impacts to existing water sources and effects of the drought on usage (e.g., Table 9). Such an analysis considers the water supply and demand conditions due to population, GPCD, drought-of-record conditions, and climate change. Furthermore, consider including a water-supply/time-interaction graph. The analysis in Table 9 does not account for the impact of timing in planning for needed water supplies for FOR.

Table 9. Drought of record, climate change and other factors for Fair Oaks Ranch water balance.

	Current Conditions	Build Out Conditions
Population estimate	10,301	16,411
Water requirement at 207 GPCD in AF (GPCD from AECOM paper)	2,390 AFY	3,808 AFY
Requirement at 160 GPCD	1,847 AFY	2,932 AFY
Climate change		
1.5% Increase in demand in 2030	1,871 AFY	2,970 AFY
Drought of record reduces Trinity Aquifer supply by 77%	2,289 AFY	3,388 AFY
Total water available at this point	1,973 AFY	1,975 AFY
Deficit	314 AFY	1,413 AFY
Ideas for addressing deficit		
Graywater initiative – 8% of landscape watering	96 AFY	152 AFY
Drought restrictions – 20% reduction	478 AFY	762 AFY
Remaining deficit	+ 260 AFY	499 AFY

References

1. Robert Gulley, "Heads Above Water," Texas A&M Press, Page 3, 2015.
2. Robert Mace, Ali H. Chowdhury, Roberto Amayas, Shao-Chih (Ted) Way, Groundwater Availability of the Trinity Aquifer, Hill Country Area, Texas: Numerical Simulation through 2050, Report 353, Texas Water Development Board.
3. Colin McDonald, "Thirsting for Water in Kendall County," San Antonio Express-News, July 1, 2011 http://www.mysanantonio.com/living_green_sa/article/Thirsting-for-water-in-Kendall-County-1448553.php.
4. Gregg Eckhardt, "The Trinity Aquifer," The Edwards Aquifer website http://www.edwardsaquifer.net/trinity.html.
5. San Antonio Water System 2012 Water Management Plan, Page 25 www.saws.org.

Climate Change

Overview	Grade
FOR recognizes the potential for climate change to have an effect on water demand and supplies and seeks strategies to mitigate its impact.	A

Description

Local communities should consider climate change as a factor in preparing water-need estimates. Climate change impacts are not extensively mentioned in the Region L Water Plan for 2011 or the 2012 state water plan, which may be related to the difficulty in obtaining data for water demand, evaporation rate, and rainfall that translates to the local level. A recommended starting point to illustrate how climate change-related estimates can be incorporated in community planning is the paper "Effects of Climate Change on a Water Dependent Regional Economy: A Study of the Texas Edwards Aquifer."[1] The paper reports that forecasted climate change temperatures and rainfall might contribute to an increase in municipal demand by 1.5% in 2030 and increase to 3.5% by 2090.[1] Furthermore, the paper reports that Edwards Aquifer recharge might decrease, which in turn would reduce pumping to maintain spring flows for the protection of endangered species.[1] FOR can include these basic assumptions into its water planning to provide a wider range of potential scenarios related to projected water demands/needs.

Considerations

Climate change information is relevant to FOR's water planning because it predicts an increased demand and reduced recharge not currently captured in the city's water planning. This suggests the Trinity Aquifer, for example, may become an even more challenged water source for FOR in future years.

Grade Assessment

Further evaluation of climate change impacts should be considered to determine potential impacts to water supplies and water demand. An outline of climate change strategies within the water plan may be beneficial.

Recommendations—Climate change strategies should be incorporated in the next FOR water management plan and consider the effects climate change on existing supplies and water demands in future planning. Specific strategies would include:

1. Evaluate work done by neighboring water-related agencies such as SAWS, Edwards Aquifer Authority (EAA), or Region L Water Planning Group to update the local climate change impacts on demand, recharge, evaporation rate, and rainfall for use in FOR's water planning.

2. Consider potential impacts on Trinity Aquifer groundwater availability as it relates to a possible reduction in recharge flows. Furthermore, evaporation-rate increases and rainfall totals may impact Canyon Lake due to climate change and should be factored in water planning efforts.

References

1. Chi-Chung Chen, Dhazn Gillig, and Bruce A. McCarl, Effects of Climatic Change on a Water Dependent Regional Economy: A Study of the Texas Edwards Aquifer, National Assessment of Climate Change, Agricultural Focus Group supported by U.S. Global Climate Change Office, 2000.

Water Management

Water Conservation

Overview	Grade
FOR's Water Conservation Plan presents a goal to reduce GPCD from 200 to 160 by 2060. Alternative scenarios are evaluated.	C

Description

In the FOR Code of Ordinances (Article 13.06), the city proposes to achieve 160 GPCD by 2060.[1] Its current GPCD averages 200 and has reached 235 during dry years. The high water use is largely because of landscape watering, with a reported 2.5-3.0 ratio of summer water use to winter water use.[2] The high summer peak use characterizes a community with large residential lawns and limited industrial or commercial water use. In contrast, San Antonio has a 1.5 ratio of summer water use to winter water use, reflecting its more diverse mix of multi-family housing, smaller landscapes, and business water use. If the landscape watering season is nine months, then approximately 50% of FOR's water use is landscape irrigation. The reasons to continue to work toward a 160 GPCD goal reflected in the FOR Water Conservation Plan include:

- Trinity Aquifer groundwater supplies may be variable during drought conditions, and Canyon Lake water has several decision points starting in 2037, when costs and conditions may make the water source more challenging to use.
- A per-capita water use level of 140 GPCD is generally viewed as optimal for efficient water use; therefore, a 200-207 GPCD may not necessarily reflect a level that is efficient or environmentally appropriate.
- If the built-out population estimate of 16,411 is more accurate than the 10,301 population estimate, the increased use of SAWS water would require the users to meet more ambitious water conservation goals.

There are a number of community characteristics that suggest the city could reach the 160 GPCD goal ahead of 2060:

- FOR citizens are environmentally aware and involved in the issues of their community and region, suggesting community residents would work with FOR officials to adopt "water smart" landscaping practices. A community goal may include converting well-watered, large lawn areas to more natural Hill Country landscapes.
- FOR is approximately 60% built out according to the 2011 Water and Wastewater Planning Study. Development rules for 40% of new homes can include recommendations to promote water conservation.

Considerations

FOR can benefit from taking advantage of its water conservation assets and developing a formal program to achieve the 160 GPCD goal by 2040. Reducing GPCD from 207 to 160 at the projected population of 10,301 in 2040 decreases annual water need by ≈577 AF (2,390 AF vs. 1,812 AF) of water, equal to 23% of total water needs and approximately the amount of water that will be extracted from the Trinity Aquifer (Figures 1-2). Key features of a FOR conservation program may include:

- Maintain current water use regulations, which require leak repairs, and limit sprinkler irrigation to periods of the day when evaporation and winds are lowest. FOR has an automated meter-reading (AMR) system in place, so there is potential for early leak detection, irrigation-pattern analysis, water budgeting, drought-restriction enforcement, and other water conservation related activities.
- Establish a Community Conservation Committee (CCC) made up of citizen volunteers to support city council and staff conservation activities and bridge communication with community members.
- Consider a city graywater-use initiative. Graywater is water recycled from the shower, clothes washing machine, and bathroom sinks. The average household produces 100 GPD of graywater that could replace a portion of the potable water currently used on the lawn. If 50% of households used 50 graywater gallons per household per day, it may save approximately 84 AF of water in 2015 and 100 AFY by 2040.

- Promote water-friendly landscaping for new homes. The new ordinance, which limits sodded and irrigated landscapes to only 55 feet in all directions, will affect 40% of new homes built by 2040.3 The average new home can potentially use 50 percent less water and overall could reduce GPCD to 182 by 2040.
- Expand water conservation education through partnership with organizations such as TGRGCD and the Texas A&M AgriLife Extension Service. Courses on rainwater catchment and water use audit programming are some examples of targeted educational opportunities. Consider including outreach/education information in utility inserts.
- FOR has an increasing block system of water rates, with monetary penalties for high water use. The rates for the upper tiers may not be high enough to change user behavior during periods of drought restrictions and may need further evaluation.

Grade Assessment

- Current FOR water conservation efforts can be improved significantly resulting in greater water conservation. Over the last 10 years, FOR has had an average GPCD of 200 and a goal of reducing consumption to 160 GPCD by 2060. The goal of reducing water demand by 577 AFY would be a benefit under a build-out scenario (Figures 1-2).
- FOR could access TWDB's State Water Implementation Fund for Texas (SWIFT) funds if an ambitious water conservation program is implemented. Advantages of obtaining SWIFT funds include access to planning, design and construction funds at a low interest rate, with payments being able to be deferred for planning, design and permitting activities until the conservation projects come on-line.

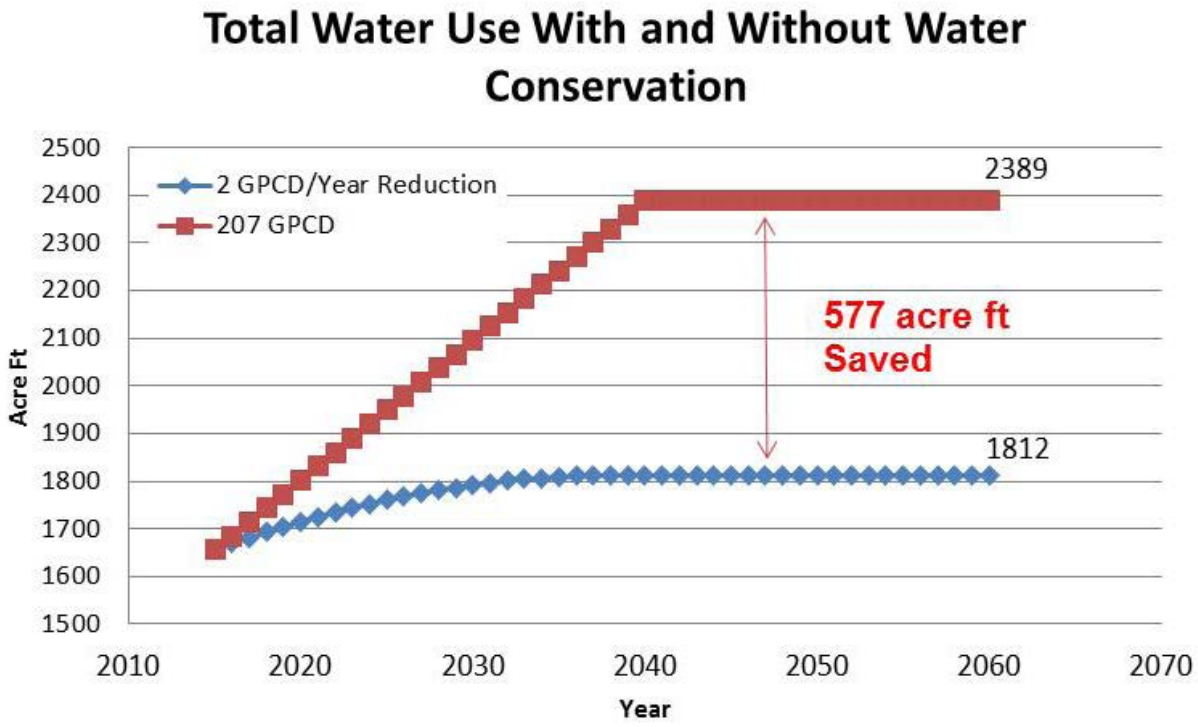


Figure 1. Total annual water use with and without conservation, City of Fair Oaks Ranch.

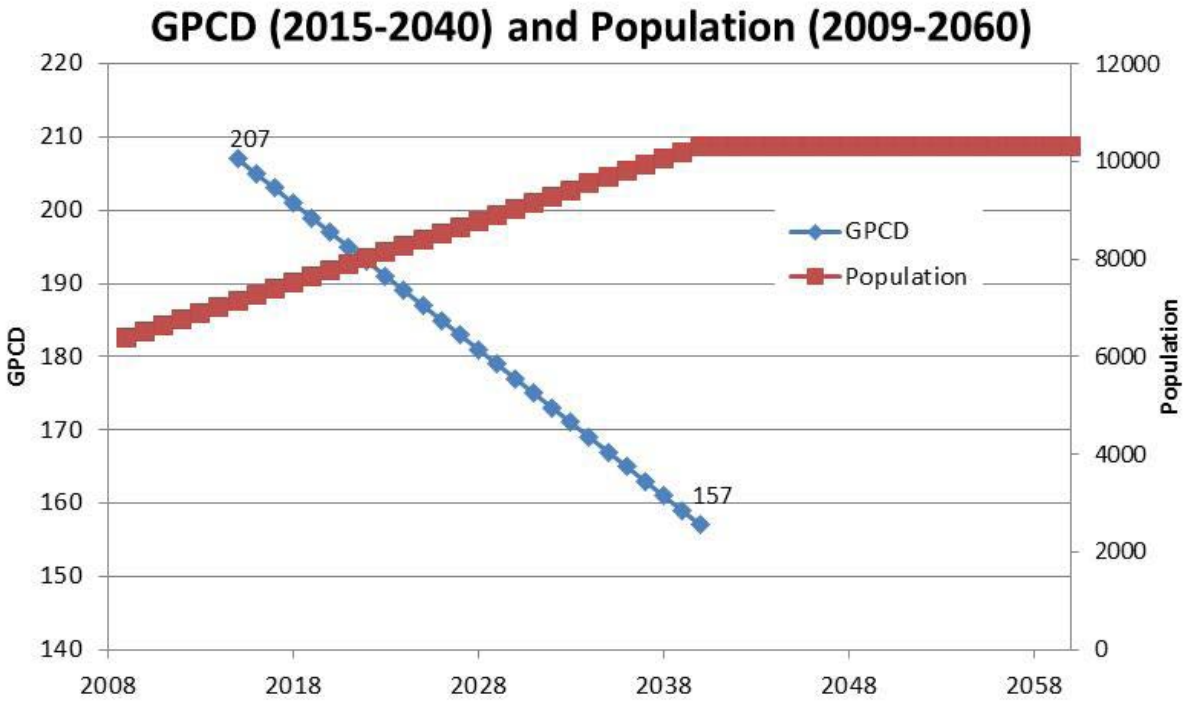


Figure 2. GPCD (2015-2040) and population (2009-2060).

Recommendations—FOR should make achieving the 160 GPCD threshold its goal by 2040. Additionally, water conservation should be viewed as a 'new source' of water and should be promoted as such. FOR should look to SAWS and other entities for examples of effective water conservation strategies and implement a water conservation plan that includes a budget and annual programming. Annual GPCD reduction targets should be determined. Specific recommendations include:

1. Consider organizing a CCC to support a water conservation program and serve as a communications link to the rest of the community.

2. Consider preparing a plan that lists activities to be implemented to achieve a 2 GPCD reduction each year from 2015 through 2040. Water conservation best management practices (BMPs) on the TWDB website describe potential savings and costs.

3. Consider implementing a water conservation monitoring process to adjust activities for greater yield as needed.

References

1. Article 13.06 Water Conservation Plan from the Fair Oaks Ranch Code of Ordinances, Page 1. This document was provided at the December 18, 2014 meeting with Mayor Cheryl Landman, Public Works Director Ron Emmons, and others from FOR and TGRGCD.

2. Ron Emmons provided the winter/summer watering ratio at the December 18, 2014 meeting.

3. Article 13.06 Water Conservation Plan, Section 13.06.004(d).

Drought Management

Overview	Grade
FOR uses surcharges as a drought management tool but may benefit by adding drought enforcement. Drought restriction rules may be more effective with increased education to the community.	C

Description

FOR appears well positioned with its water supply compared to water demand. Even at a 207 GPCD, FOR has enough water to meet its needs in 2040 and beyond when it reaches its fully build-out status, according to the 2011 AECOM Study.[1] Although the area may be prone to drought, assessing current drought and emergency management plans may assist in meeting future water demands. FOR has a drought management system in place with an escalating surcharge system as an enforcement tool[2] and a once-per-week sprinkler irrigation limitation.[3] Despite these strategies, there has not been an overall reduction in water use as anticipated.[4] Below is an outline of FOR's current drought management system:

Stage 1

Two of three conditions must be met:

- Test well averages less than or equal to 1,045 feet for 15 consecutive days
- Water system's average daily production of Trinity Aquifer groundwater for the same 15 consecutive days exceeds 1.2 million gallons per day
- GBRA implements Stage 1 from its Drought Contingency Plan

Stage 2

Two of three conditions must be met:

- Test well averages less than or equal to 1,030 feet for eight consecutive days
- Water system's average daily production of Trinity Aquifer groundwater for the same eight consecutive days exceeds 0.7 million gallons per day
- GBRA implements Stage 2 from its Drought Contingency Plan

Stage 3

One of three conditions must be met:

- Test well averages less than or equal to 1,015 feet
- Water system's normal production of 1.2 million gallons per day of Trinity Aquifer groundwater cannot be maintained for seven consecutive days
- GBRA implements Stage 3 from its Drought Contingency Plan

FOR officials are considering an alternative three-stage drought management program that relies on rate surcharges as outlined below (Ordinance Section 13.03.117).[4]

Stage 1 – Monthly surcharge is $5/1,000 gallons for water use of 25,000 to 40,000 gallons with increases to $12.50/1,000 gallons for water use over 100,000 gallons.

Stage 2 – Monthly surcharge increase starts at 18,000 gallons. The surcharge is $30/1,000 gallons for use over 100,000 gallons.

Stage 3 – Monthly surcharge stays the same as the charge for Stage 2.

Although surcharges do not seem severe enough to accomplish the goals described in each drought stage, city officials report the surcharges were effective.[4] In contrast, imposing and enforcing once-per-week watering did not appear to reduce water use.[5]

Considerations

An effective drought and emergency management scheme benefits FOR. If FOR is subjected to a severe drought or infrastructure emergency, the following suggestions might reduce water use:

- Review the need for a CCC and any proposed drought management strategies it may suggest in consultation with city officials (See the Water Conservation Section above).
- Provide stakeholders with simple rules so everyone understands them, buys into them, and understands enforcement.
- Review surcharge amounts to ensure they will be effective in reducing water use.
- Determine and assess an enforcement mechanism (e.g., certified police officers working part-time to enforce drought restrictions).
- The availability of the AMR system may offer an enforcement strategy assuming there is available staff in real time. It might be useful to assess ratepayer response to once-per-week sprinkler irrigation limitations. Data collected through the AMR system may show individual compliance and detect reductions in weekend use.

Grade Assessment

Opportunities to improve the FOR drought management plan include several considerations. The surcharge program works well in drought situations but might be less effective in other types of water emergencies, such as infrastructure or contamination emergencies. The city may consider using its new AMR system to assess why its drought management rules and enforcement have not been effective and to determine needed modifications that may benefit the city in other types of water emergencies.

Recommendations—Assess and update FOR drought management plan to account for emergencies such as infrastructure and contamination. The plan contains successful, short-term water reduction strategies used in other cities.

1. Work to simplify drought restriction and enforcement rules to make them more effective and efficient.
2. Educate FOR citizens on the simplified drought restriction rules, discuss the importance of these restrictions relative to water-supply sustainability and economic implications of these drought restrictions.
3. Analyze the relationship between water savings and systemwide water conservation efforts based on water use information during minor and severe droughts that have occurred in recent years.

References

1. Reem Zoun and David Parkhill. Kendall County and the City of Fair Oaks Ranch Water and Wastewater Planning Study, February 2011. Prepared for Guadalupe-Blanco River Authority in association with Texas Water Development Board by AECOM. Page 1-1 for 2009 population and Page 2-4 (Table 2.2) for 2040 population estimate.
2. Article A 9.000 Water charges from the FOR Code of Ordinances.
3. Article 13.06 Water Conservation Plan from the FOR Code of Ordinances, Page 1.
4. Rate and Surcharge information is provided by Article A9.000 Water Charges from the FOR Code of Ordinances.
5. Ron Emmons personal communication, December 18, 2014.

Lost/Non-revenue Water

Overview	Grade
FOR manages lost/non-revenue water appropriately with an average monthly rate of 7.8%. It allocates the loss between line flushing and estimated calculation of leaks.	A

Description

Lost water/non-revenue water is the difference between water pumped and water sold. It is important to note that not all non-revenue water is lost, as non-revenue water can include loss (e.g., leaks), theft, or meter inaccuracies. The key issue with lost water is that it is permitted, pumped, treated, and perhaps even distributed, but does not produce revenue for the water purveyor. Every water purveyor has some level of lost/non-revenue water. TWDB and EAA have given lost water recent attention, as it potentially represents a large amount of water not used beneficially. TWDB requires all water purveyors with 3,505 or more connections to complete a water-audit report.[1] The report also is required for any water entity using state funding. Water purveyors with a lost-water rate higher than the rate allowed must use some of the requested funds to reduce lost-water levels. Generally, a lost-water rate <10% is excellent and a rate of >15% merits action to correct the problems. Finally, the cost of correcting water loss may sometimes be greater than the cost of lost water. Thus, identifying the amount and source of non-revenue water is an important first step for a city to determine the best way to correct any issues.

Considerations

With 2,698 connections, FOR is not required to prepare a full-scale lost/non-revenue water determination for TWDB, but the city is conscious of the issue and makes regular calculations to help identify any problems related to lost water.[2] The city produces a non-revenue-water percentage every month by recording water used in dead-end flushes, random flushes, and water purchased for construction projects. To this total, FOR adds an estimate for the volume of water lost through broken water-main leaks. The average FOR total is 7.8% per month, well below the acceptable level outlined by TWDB.[2]

Grade Assessment

FOR received a high grade for managing its water supply with considerable attention paid toward achieving a low lost/non-revenue water rate.

Recommendations—Continue to manage lost/non-revenue water effectively and engage residents in educational opportunities that highlight the benefits of decreasing water loss.

1. Expand education efforts with residents and policymakers about current success in managing this water source and in promoting reductions in lost/non-revenue water sources.

References

1. Water Loss Audit, Texas Water Development Board, http://www.twdb.texas.gov/conservation/municipal/waterloss/index.asp. The web item describes that a water purveyor must have 3300 connections to be required to prepare an audit annually even if they do not have a financial obligation to TWDB.

2. Christine Picioccio, FOR Public Utility, email communications on February 17, 2015, April 10, 2015, April 16, 2015 City of Fair Oaks Lost Water Determination.

Water Quality

Relationships with Neighboring Communities

Overview	Grade
FOR cooperates on Extraterritorial Jurisdiction (ETJ) and other issues with San Antonio and may consider an interconnection. Recommend increased collaboration with the City of Boerne, and Comal and Kendall counties to protect the Trinity Aquifer.	B

Description

FOR cooperates on ETJ and other issues with COSA and may consider furthering collaborative efforts with COSA, City of Boerne, and Comal and Kendall counties to conserve and protect water resources. Furthermore, FOR and COSA work closely with TGRGCD on Trinity Aquifer issues.

Considerations

FOR and COSA have a history of collaborating to include sponsoring this water policy study. Another example of collaboration is SAWS buying surplus Canyon Lake water (Western Canyon project) when FOR and other area communities need it.[1] Based on this history of cooperation, FOR may consider creating a wholesale interconnection between FOR and SAWS water lines. An interconnection can be costly but can serve to provide FOR options for water security or emergency situations. There are several reasons for consideration of this option. First, in the past, FOR provided an interconnection for SAWS at Village Green at no cost.[2] Precedent for such partnerships are in place. Second, COSA relies on the Edwards Aquifer for the majority of its supply, in addition to Carrizo Aquifer water and treated brackish groundwater. COSA's water supplies are more diversified than FOR's supplies. An interconnection serves to expand and diversify FOR sources of water supply. Another collaborative opportunity between the two cities may include land protection over aquifer recharge zones. A significant portion of the rain that falls over the Trinity Aquifer recharge area eventually recharges the Edwards Aquifer.[3] The two cities could find value, for example, in reaching an agreement on land use to govern development and even conservation easements within FOR's boundaries and in the region.

City of Boerne, Comal and Kendall Counties

Although a 2011 AECOM Water and Wastewater Study treated the Trinity Aquifer as if it were a unique FOR water source, unaffected and unrelated to any other communities' water use, in reality the Trinity Aquifer is under pressure throughout its range.[4] Population growth in Kendal and Comal counties may influence the reliability of FOR's Trinity Aquifer groundwater supply long term.[4] As was noted in the Trinity Aquifer supply section of this analysis, the Trinity Aquifer is a challenged water resource for the region.[5]

SAWS reduces the use of the Trinity Aquifer during drought, which allows other pumpers to better rely on the challenged resource.[6] Boerne, the rest of Kendall County, and Comal County are growing at a rapid rate. Although Boerne has several supply sources, unincorporated areas rely almost entirely on the Trinity Aquifer. New development and current Trinity Aquifer pumpers may find it difficult to switch to other water sources during drought conditions; thus, conserving this water resource is important. Strengthening relationships with the City of Boerne and Kendall and Comal counties that rely on the Trinity Aquifer may in turn strengthen current and future water conservation and protection efforts. Cooperation between Cow Creek Groundwater Conservation District (CCGCD) and TGRGCD may also assist with Trinity Aquifer management. Their efforts may be bolstered by HB 2407, which passed in the 2015 Texas Legislative session and created the Comal-Trinity GCD, which also manages Trinity Aquifer resources.[7]

Grade Assessment

FOR is a relatively small community that has done a good job projecting its future water needs and securing required resources. Its task now is to protect those future water sources. Key relationships in that quest are with COSA, the City of Boerne, and Comal and Kendall counties. These four regions significantly influence the integrity of both the Trinity Aquifer and Canyon Lake.

Recommendations—FOR may consider pursuing collaborative efforts with SAWS to better protect both the Trinity and Edwards Aquifer recharge zones. The agreement may include consideration of COSA's annexation

plans for areas near FOR. FOR should consider expanding and creating formal collaborative efforts and policies among FOR, Boerne, Kendall County, Comal County, CCGCD and other entities potentially impacted by population growth over the Trinity Aquifer, both from a water quality and water quantity perspective.

1. Continue collaborative efforts with COSA to provide both entities diversified water resource options.

2. Work collaboratively with COSA to strengthen Trinity and Edwards Aquifer recharge water conservation and protection via joint assessment of Edwards Aquifer Recharge Zone development rules, contributing zone rules, and cooperation on meeting ETJ infrastructure needs, either as part of an interconnection or apart from it.

3. Consider conferring with TGRGCD leadership to extend an invitation to the City of Boerne, Kendall and Comal counties, and the CCGCD to discuss issues relevant to protecting the Trinity Aquifer and other water sources potentially impacted by separate and joint actions of the parties involved. Assess benefits of seeking formal agreements, which jointly address relevant water conservation and protection issues.

References

1. Canyon Lake, SAWS website at www.saws.org.

2. Mayor Cheryl Landman, FOR Mayor.

3. Gregg Eckhardt, "The Trinity Aquifer," The Edward's Aquifer website, http://www.edwardsaquifer.net/trinity.html.

4. Robert Mace; Ali Chowdhury; Roberto Anaya; Shao-Chih (Ted) Way. Groundwater Availability of the Trinity Aquifer, Hill Country Area, Texas: Numerical Simulations through 2050. Page 2. September 2000. Texas Water Development Board.

5. Greg Eckhardt "The Trinity Aquifer," the Edward's Aquifer website, http://www.edwardsaquifer.net/trinity.html. Page 6.

6. San Antonio Water System 2012 Water Management Plan. Page 25. www.saws.org. The 2009 Plan did not consider the Trinity as a firm supply. The 2012 Plan considers it firm for 2000 AF of the 8000 AF of water available in an average rainfall year.

7. Ron Emmons, FOR Public Works Director.

Regulatory Agencies

Trinity Glen Rose Groundwater Conservation District (TGRGCD)

Overview	Grade
Cooperation between FOR and TGRGCD is evident. Consider jointly reviewing TGRGCD fees and FOR's relationships with other Trinity Aquifer stakeholders.	B

Description

The TGRGCD was created by the Texas Legislature in 2001 and was confirmed by area voters in 2002.[1] Its purpose is to develop and implement regulatory, conservation, and recharge programs that preserve and protect underground water resources in the district.[2] In the legislation, TGRGCD was charged with responsibility for Trinity Aquifer resources in northern Bexar County, north of Highway 1604, to the Medina, Bandera, and Kendall county lines.[3] Based on a 2004 election, FOR decided TGRGCD is responsible for the territory within the entire city boundary, to include portions within Kendall and Comal counties (Figure 3).[4] TGRGCD legislation was written to benefit existing Trinity Aquifer pumpers within the jurisdiction by providing guidance for well spacing and other requirements such as water costs. TGRGCD, along with FOR and other municipal pumpers whose Trinity Aquifer use is <50% of their water consumption, are grandfathered into the system and not required to pay the aquifer fee for water used.[4] TGRGCD is a small district with limited income and staff. Although it offers, among other services, residential water use surveys (audits), these are not in high demand.[4] TGRGCD staff reports it maintains close relationships with the CCGCD, District 9 Water Management Area and the Region L Water Planning District[4] as well as with FOR and SAWS.

Considerations

FOR benefits from the current working relationship with TGRGCD. Because of FOR's reliance on the Trinity Aquifer, its suggested participation with the TGRGCD Board may benefit FOR in meeting future water demands, along with assessing present and future funding mechanisms, such as the "under 50% rule."[5] Other benefits of an expanded relationship may include establishing stronger funding opportunities for both entities.

Grade Assessment

The cooperation between FOR and TGRGCD is close, though the two entities could expand their cooperation to protect the Trinity Aquifer groundwater supply even further. If FOR supported TGRGCD funding for a larger staff, increased monitoring/enforcement, and presence in policymaking and regulation, the "under 50% rule" may be revoked and entities grandfathered as existing pumpers when the TGRGCD legislation was initially written would no longer benefit from pumping Trinity Aquifer water at no cost. However, the advantage of an established groundwater conservation district may protect FOR and provide buy-in for the city's interests in the Hill Country Alliance of Groundwater Conservation Districts for the Trinity Aquifer, not unlike the Edwards Aquifer Authority, which monitors and restricts pumping in the Edwards Aquifer. The district represents FOR's Trinity Aquifer interests through interactions with CCGCD and COSA. FOR should assess whether increasing TGRGCD's funding is in FOR's best interest.

Recommendations—FOR may consider strengthening TGRGCD's ability to represent FOR's water-supply interests with CCGCD, SAWS, Boerne and other Trinity-Aquifer stakeholders. FOR officials may seek citizen input to determine potential advantages of implementing TGRGCD fees.

1. Review TGRGCD's ability to represent FOR's water interests and contribute to FOR's water security.
2. Assess whether an increase in funding or representation in the Hill Country Alliance of Groundwater Conservation Districts would make TGRGCD more effective.

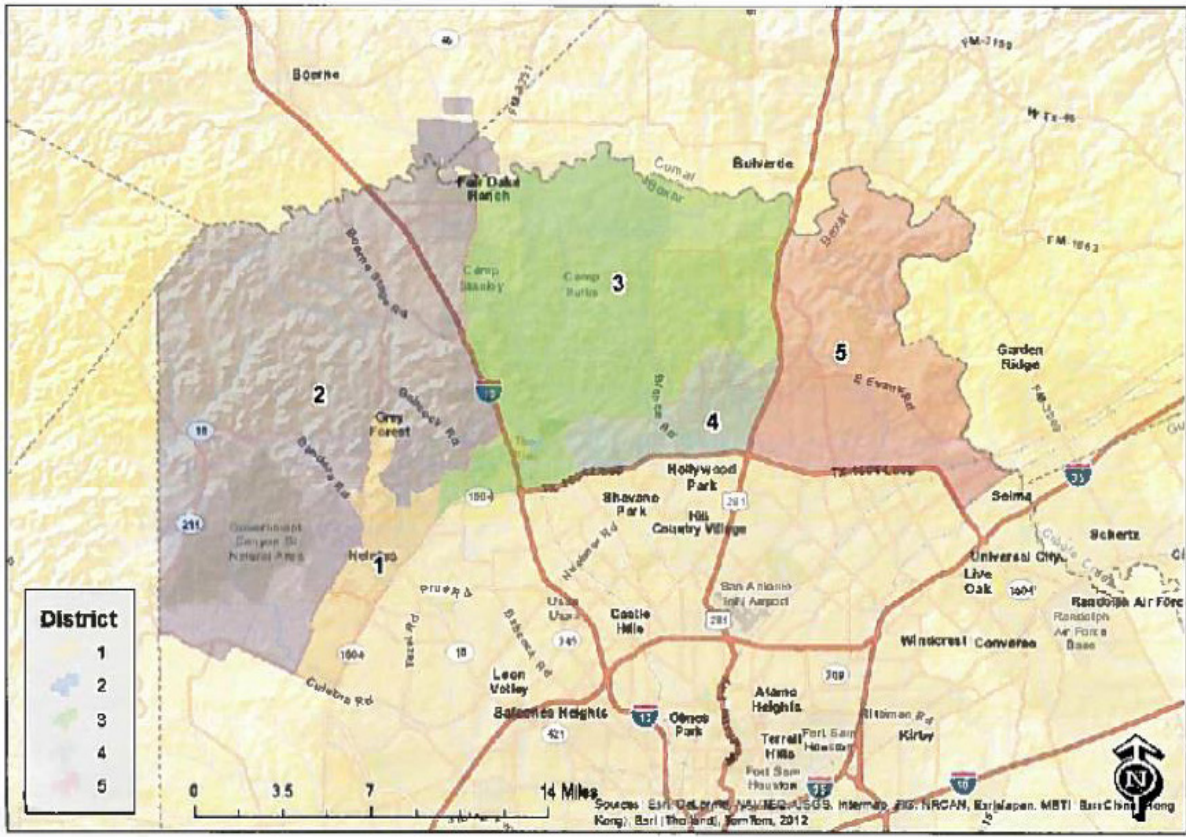


Figure 3. TGRGCD district boundaries.[6]

References

1. TGRGCD Rules Chapter 1. Available on the TGRGCD website at www.trinityglenrose.com/.
2. HB 2005: the legislation creating TGRGCD in 2001. The document was provided in a meeting with TGRGCD General Manager George Wissman on January 7, 2015.
3. Ibid. Page 2.
4. George Wissman, TGRGCD General Manager, in a meeting on January 7, 2015 at his office with Calvin Finch. Date of election correction provided by Mayor Landman, June 4, 2015.
5. The "uncer 50% rule" makes it possible for FOR and other water purveyors to bypass TGRGCD fees as long as Trinity Aquifer groundwater makes up less than 50% of their total water use.
6. Map provided in a meeting with TGRGCD General Manager George Wissman at a meeting on January 7, 2015.

Texas Water Development Board (TWDB)

Overview	Grade
Increase involvement with TWDB programming and pursue available funding with the potential benefit to FOR interests via TWDB policies.	N/A

Description

As the state's primary water planning agency, TWDB's responsibilities include: (1) collecting and disseminating water-related data, (2) planning state water resource development, and (3) administering cost-effective financing programs.[1] TWDB's responsibilities that are important to FOR include:

- Funds state water plan. Local water projects must be incorporated into regional water planning efforts to be considered for TWDB funding. The state water plan is comprised of regional water plans.
- Regulates lost and non-revenue water calculation methods. Reviews these metrics, and those above a 3,500 connection-threshold must be addressed before TWDB funds can be used.
- Reviews water conservation plan. Prior to funding, a purveyor must have an approved water conservation plan.
- Offers funding sources. Possible TWDB funding sources for FOR include the Texas Water Development Fund, Water Research Grant Program, and SWIFT.

SWIFT Funds for Water-Supply Projects

SWIFT funds ($2B) were made possible by the Texas Legislature in 2011 and 2013 and offer low interest, flexible-term loans (not grants) and payment options for water resource projects. Approximately 20% of SWIFT funds are reserved for water conservation or reuse projects, and another 10% are reserved for rural projects.[2] Water conservation projects are defined as those that make new water resources available through practices and technology that use less water,[2] and rural or rural political subdivision is referenced in legislation as

- a non-profit water-supply or sewer service corporation, district, or municipality with a service area population of 10,000 or less, or one that otherwise qualifies for financing from a federal agency; and
- a county in which no urban area exceeds 50,000 in population.[2]

To qualify for SWIFT funds, projects must be sponsored by a local government or public water purveyor and must already be in the current state water plan. TWDB prioritizes water resource projects for funding based on: (1) input from regional water-planning groups, (2) population size, (3) meets regional needs, (4) meets high percentage of water-supply needs, (5) local financial contribution to project, and (6) financial capability to repay loan, among others.[3]

Considerations

Obtaining funds from TWDB is a challenge since all utilities compete for the same limited funds. Being an active participant and staying involved and informed regarding TWDB policies would be beneficial. Supporting FOR policies that reward strong and successful conservation programs, such as water resource innovations, brackish groundwater desalination, aquifer storage and recovery, and direct recycling also would be helpful in better positioning for funding.

Grade Assessment

FOR should continue maintaining the relationship with TWDB to support the potential pursuit of TWDB funding in the future. Promoting projects such as aquifer storage and recovery or water resource innovations can position the city for financial support from the agency.

Recommendations—Further explore TWDB funding opportunities, and establish stronger water conservation and drought management programs to improve chances of obtaining TWDB funds.

References

1. Texas Water Development Board website.
2. Texas Water Code, Title 2, Subtitle C, Chapter 15, Subchapter R, Section 15.992.
3. House Bill 4, Section 15.474(a-d).

Texas Commission on Environmental Quality (TCEQ)

Overview	Grade
FOR works closely with TCEQ on its recycled water program. The relationship may be expanded in developing a regional water quality protection effort.	B

Description

TCEQ is responsible for environmental regulation and enforcement. Its mission includes a wide range of responsibilities to include jurisdiction over

- regulation of water-utility operations to include water quality standards;
- regulation of environmental water quality (e.g., quality of treated wastewater discharge).

TCEQ frequently acts as a state-level delegate for the U.S. Environmental Protection Agency (EPA). Federal laws relevant to the two regulatory agencies include: (1) the Safe Drinking Water Act (SDWA), and (2) the Clean Water Act (CWA). FOR's present water-supply operations are in compliance with SDWA requirements.[1]

Considerations

The potential for future regulatory requirements could be quite costly. One potential area to consider and remain aware of are Contaminants of Emerging Concern (CECs) in both drinking water and environmental waters. CECs include a wide range of substances—pharmaceuticals, antibiotics, industrial chemicals, food additives, and others—and are hypothesized to have a wide range of effects on human and animal health, including disruption of endocrine systems and inducement of antibiotic resistance. We predict that regulatory action in Texas under SDWA or CWA authority is unlikely in the next 10 years due to (1) uncertainty over human and environmental health effects of CECs, (2) uncertainty over effective technologies for CEC removal, and (3) gradual nature of regulatory implementation by TCEQ. The next 10 years will likely see significant gains in knowledge regarding the effects and treatment technologies. FOR should monitor this field of knowledge regularly to anticipate and prepare for any regulatory changes that may eventually occur.

Grade Assessment

TCEQ is responsible for the regulation of water utility operations and regulation of environmental water quality and is the state-level delegate for the EPA. Compliance with SDWA or CWA regulations can be challenging.

Recommendations—FOR should continue to monitor developments regarding CECs. SAWS is currently working with the EPA to evaluate CECs at select potable water pumping stations and wastewater treatment plants, thus communication with SAWS would be beneficial to FOR.

1. Review TCEQ and EPA programming in the same manner as described for the TWDB to ensure FOR is aware of current programs and proposed programs.

References

1. Mayor Cheryl Landman in email correspondence to authors in April 2015.

Water Cost

Rates and Impact Fees

Overview	Grade
Consider evaluating rate structure in terms of system expenses, water use goals, and assessing water-pricing structure with respect to economic efficiency and other city goals.	C

Description

Water rate structure is typically the accumulation of political, economic, and social factors. An appropriate water rate structure should include the costs of: acquisition of raw water, treatment of the raw water to required standards; delivery of finished water to the utility customer; and the depreciation of the associated capital infrastructure. The cost of acquiring raw water has historically been omitted in developing water-pricing structures, which has been a contributing factor to the suboptimal performance of water-supply systems due to problems such as overuse and limited conservation efforts. To account for this, strategies such as the inclusion of raw water costs, billing of water volumetrically, or staggered rate structures are commonly employed.

The two most commonly used water rate structures are uniform pricing and increasing block rate. Although the common view is increasing block rate structures promote water conservation over uniform rates, this depends on the specific rate structures being compared and the demand elasticity for the various water users (i.e. the change in the amount of water used versus the change in the price of water). FOR uses a block rate structure for its water rates, though a notable characteristic is the difference between residential and commercial rates. Both water fee categories include a service fee based on meter size (Figure 4)[1] to include wastewater fees, which are set monthly (Tables 10-11).[1] A reasonable set fee as opposed to a volumetric fee for wastewater treatment may reflect administrative ease and the efficiency of the recycled water program. The use of FOR's AMR system could allow conversion to a volumetric rate structure.[2]

Development impact fees vary in name among communities but are usually one-time charges that aim to raise revenue for new infrastructure construction. Current FOR impact fees appear to be reasonable (Table 11). One estimate of the median price for a single family home in FOR is $396,489.[3] Using the impact fee of $6,950 and the median home price, the percentage increase in the price of a home is 1.75%.[4] FOR may benefit from examining its water-pricing structure, taking into account marginal cost pricing, attributes of the lot size and structure, scarcity value of the water, economic efficiency, and other goals. Uniform rates that are revenue-neutral to the proposed increasing block rates actually may provide higher economic efficiency or proper pricing of the water resource.

Considerations

The current FOR increasing block rate structure appears to promote conservation over the low uniform rate (Figure 4). The result is not so clear when comparing the increasing block rate to the higher uniform rate. At lower usage levels, the higher uniform rate encourages conservation over the uniform block rate structure, but at higher usages the increasing block rate structure encourages conservation.

The overall effect depends on how the lower water users, who are usually lower-income, react relative to the larger water users. Properly set uniform rates can encourage conservation and also are considered economically efficient. Further, a uniform rate that includes scarcity value of the water can be associated with a lower fixed fee, which dominates the water bill of low water users. The steeper the increasing block rate, the more economically inefficient the rates are. From a water bill fairness perspective, the subsidy intrinsic to low price first blocks is more fully captured by high users than is normally recognized.

The expanded block rate for residential customers increases significantly as water use increases (Figure 5). The block rates in Figure 4 may be deceiving, because the higher monthly rates, ≈$24/1000 gallons, for example, are applicable only for water use over 100,000 gallons/month. The monthly rate for the relatively high use of 20,000 gallons is less than $5/1,000 gallons. If FOR chooses to use block rates to reduce water use, the rate will likely have to increase for smaller volumes of water. The city may actually be achieving water reduction with its drought management surcharge imposed to reduce water use during a drought emergency.[6]

The rate structure is sympathetic to commercial ratepayers and may reflect FOR economic policy decisions (Figure 5). FOR may consider re-evaluating these policies to equitably distribute costs between residential and commercial ratepayers. The impact fees are reasonable, as long as they cover all infrastructure costs and meet community needs.

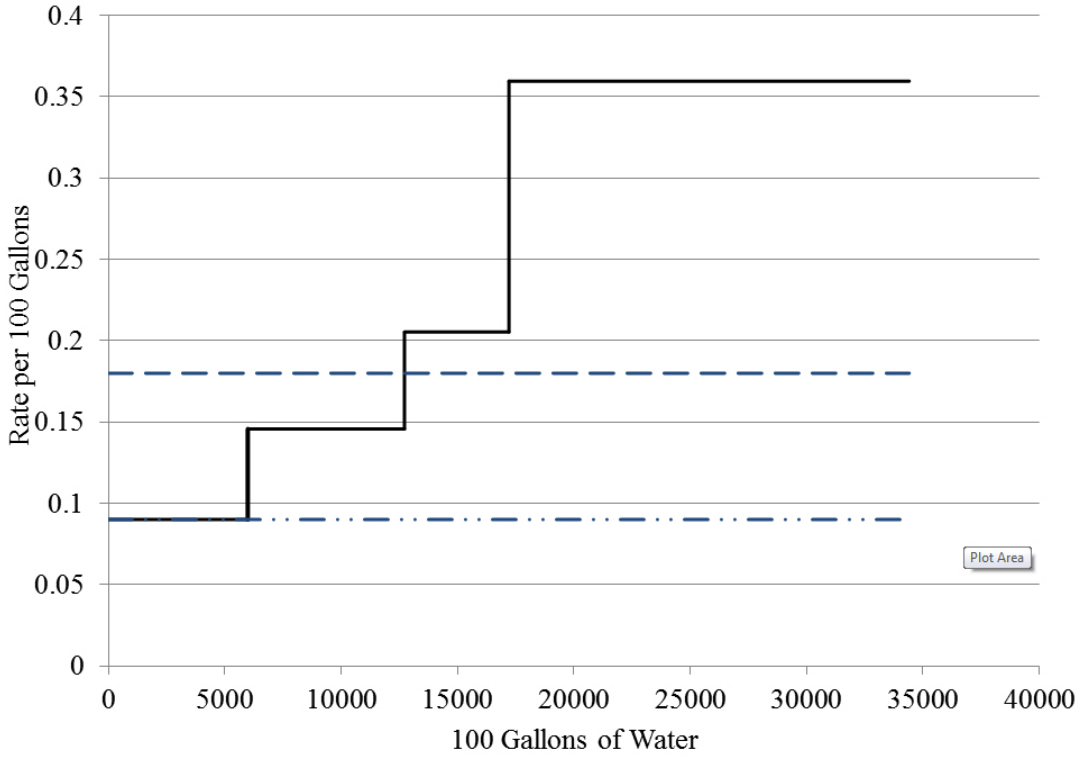


Figure 4. Examples of two uniform water rates and one increasing block rate structure.[5]

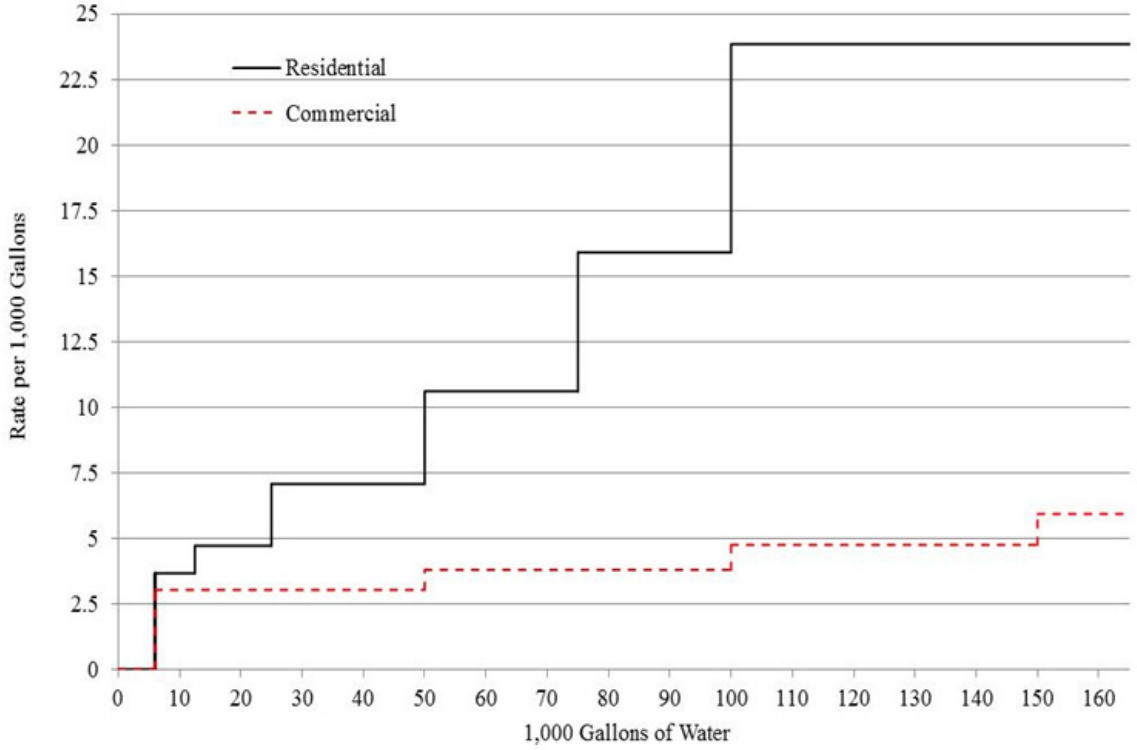


Figure 5. Monthly residential and commercial volumetric water rates for Fair Oaks Ranch.

Table 10. Fixed monthly service charge ($) for Fair Oaks Ranch.

Fixed Monthly Service Charges (dollars) for Fair Oaks Ranch, 3/4 Meter	
Category	**Fee ($)**
Water Fees	
Meter Rental Fee	25.20
Surface Water	13.04
TCEQ	0.17
TGRGCD	0.00
Debt Service	9.27
Capital Reserve	3.36
Total Water Fees	51.04
Wastewater Fees	
Service Availability	35.85
Texas Commission on Environmental Quality	0.07
Debt Service	7.65
Capital Reserve	2.06
Total Wastewater Fees	45.63
Total Water + Wastewater Fees	96.67

Source: http://www.fairoaksranchtx.org/index.aspx?NID=228
http://www.fairoaksranchtx.org/DocumentCenter/Home/View/456 [1]

Table 11. Fair Oaks Ranch impact fees per service unit/living unit equivalent.

Fair Oaks Ranch Impact Fees per Service Unit per Living Unit Equivalent	
Category	**Fee ($)**
Water Facilities	5,400
Wastewater	1,550
Total	6,950

Source: http://www.fairoaksranchtx.org/ [4]

Grade Assessment

FOR recognizes the opportunity to restructure the water rate system and better reflect goals for financial returns, water conservation, and fairness. Residential customers pay water rates based on an increasing block rate. The rates represented in the blocks increase from approximately $3.50/1,000 gallons at 10,000 gallons of water to approximately $23.75/1,000 gallons for use over 100,000 gallons. Commercial rates are charged through an expanded block rate without much difference between the rates/block (Figure 4). These expanded blocks are close to uniform rates. Please note that approximately 1,100 water customers have individual septic systems and are not charged city wastewater.

There is a connection service charge in addition to the volumetric charge. The service charge when the set wastewater fee is included reaches $96.67/month. Impact fees are charged for new construction and connections at a rate that appears competitive. There was a major increase in impact fees in 2015 after a review by the staff and City Council.

Recommendations—FOR may consider reassessing its rate structure in terms of system expenses and water use goals. Of particular interest are the low block rates for commercial customers. Commercial rates may be adjusted to match residential rates.

1. Review the water rate structure to ensure revenues cover water and wastewater expenses and provide funding for desirable programming, such as water conservation activities and participation in regional water quality protection efforts.

2. Review rate structures to ensure increasing rate blocks elevate quickly enough for volume to reduce excessive water use for landscapes. Also consider changing commercial rate structures to provide steeper increases of volumetric rates comparable to residential rates and to encourage water conservation.

3. Examine water-pricing structures with respect to marginal cost pricing, scarcity value of the water, economic efficiency, elasticity of demand for water, and other FOR goals. Uniform rates that are revenue neutral to the increasing block rates would provide higher economic efficiency or proper pricing for a water resource.

References

1. Fair Oaks Ranch Utilities Water and Wastewater Rates. http://www.fairoaksranchtx.org/index.aspx?NID=228 and How to Read Your Utility Bill. http://www.fairoaksranchtx.org/DocumentCenter/Home/View/456.

2. Ron Emmons related the existence of the newly completed automated meter reading system in the December 18, 2014 discussions first noted under #2 in the Trinity Water Source section.

3. City-Data.com Median home price. http://www.city-data.com/city/Fair-Oaks-Ranch-Texas.html.

4. FOR Impact Fees. http://www.fairoaksranchtx.org.

5. FOR Residential and Commercial Volumetric Rates.

6. Ron Emmons, FOR Public Works Director.

Summary

The report provides FOR with an overview of water issues and policy considerations that can be used in decision-making regarding water resources/projects to pursue and for the integration of city planning strategies in addressing key water management issues. Key recommendations from the report include:

Reliance on Canyon Lake Water—Canyon Lake scored a high "unreliability" value as a water source for FOR due to the uncertainty in water cost and supply as a leased water source. We recommend FOR continue working with GBRA to assess price, quantity, and quality of Canyon Lake water, to include incorporating climate change modeling into the management of the water source. In addition to maintaining access to Canyon Lake water, we recommend water-supply diversification through the exploration of a SAWS interconnection and increased Trinity Aquifer conservation strategies and protections outlined in the report.

Population Estimates—Improved FOR future population estimates are recommended for increased confidence in the city's water planning. Efforts to continue determining the most accurate population estimates at build out are recommended as this value directly determines whether future water supplies will be sufficient or insufficient for FOR. Water planning strategies should be reviewed and adjusted, if necessary, based on these improved population estimates.

Climate Change Strategies—The next FOR water management plan should assess climate change impacts on water demand, aquifer/surface recharge, evaporation rates, and anticipated rainfall patterns for the city. Incorporation of climate change strategies into water planning would mitigate or minimize community impacts and increase FOR drought management resiliency.

Aggressive GPCD Goal—FOR should strive to achieve a 160 GPCD goal by 2040 rather than 2060 by implementing a water conservation plan that includes annual programming and dedicated program budget. Annual GPCD reduction targets should be determined (e.g., 2 GPCD/year) as part of this program. BMPs from TWDB and other sources should be reviewed and selected strategies incorporated in FOR's conservation strategy to accomplish this goal. In addition, the water yield, costs, and reliability of the water conservation efforts should be estimated in a manner similar to other water supplies for FOR.

Trinity Aquifer Recharge Zone Protection—FOR should coordinate development efforts with Trinity Aquifer stakeholders to protect the aquifer recharge and contributing zones for both the Trinity and Edwards aquifers. We recommend considering creating formal collaborative efforts and policies among FOR, COSA, SAWS, the City of Boerne, Kendall County, Comal County, CCGCD and other entities potentially impacted by population growth over the Trinity Aquifer, both from a water quality and water quantity perspective.

Engagement with TGRGCD—FOR's water interests can be strengthened through TGRGCD's ability to represent FOR with CCGCD, SAWS, the City of Boerne and other Trinity-Aquifer stakeholders. FOR should consider increased financial support and/or increasing the presence of FOR representatives on the TGRGCD board to bolster FOR's voice among competing stakeholders.

Water Rate Structure—FOR's rate structure should be reassessed for system expenses to ensure city revenues covers water costs, wastewater, and water conservation expenses. FOR should examine whether residential rate blocks increase significantly enough to discourage/deter excessive landscape watering and should evaluate commercial rate structures to resolve the disparity between residential and commercial rates and to encourage water conservation.