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Analyzing Public Engagement Strategies for Drinking Water Policy of Water

Conservation: A Phenomenological Approach

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Doctor of Public Administration

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Department of Public Administration

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Analyzing Public Engagement Strategies for Drinking Water Policy of Water

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## ABSTRACT

**Purpose.** The purpose of this qualitative phenomenological study was to investigate the perception of experts of water policy in South Florida. Water conservation has been, and continue to be, an issue for South Florida. Low water levels of the Biscayne Aquifer, because of excessive water pumping, increase the chances of saltwater intrusion; and combined with the increase of sea-level rise and population growth, water managers and officials look to make impactful changes. Governments across the region have implemented plans to create change by amending ordinances and creating water restrictions to reach residents in a way that will save the Biscayne Aquifer. And although the aquifer is recharged through the miles of canals, weather in South Florida is unpredictable: dry times during the rainy season and some wet times during the dry season.

**Theoretical Framework.** This study was based on the theory of planned behavior theoretical framework. This theory proposes that attitude, subjective norm, and perceived behavioral control coincide, which together shape an individual's behavioral intentions.

**Methodology.** The methodology for this study focused on semistructured interviews that were conducted using elite interviewing. The researcher used surveys deployed to the experts of water policy to determine the top issues the region faces regarding water conservation. All data were transcribed and put through data analysis to determine consistency.

**Findings.** Examination of qualitative data returned surprising results. Even though some of the experts felt that parts of their region were doing well, all agreed that there is no consistency to achieve the results for wide-scale improvement. Low-income residents saved water to save money, but higher income homes were habitual in bad practices.

Furthermore, the participants felt that all residents were not being educated because of different factors, which scales down environmental benefit.

**Conclusions and Recommendations.** This study adds to the body of knowledge by using qualitative data to establish the perception of water experts. It also recognizes the psychological impacts finances have on one's ability to form better water conservatory practices needed for a long-term positive change and recognizes the importance of continually educating and reminding the public about water policy.

*Keywords:* water policy, water conservation, groundwater, drinking water, reclaimed water, alternative water supply, saltwater intrusion

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## DEDICATION

This research is dedicated to my family. Nilla Williams, when I began this journey, you were carrying our youngest son, Amani, and I felt horrible flying to California to start without you by my side. But throughout the years, you made sure I was well taken care of. Where I lacked or came up short, you always filled the gap. You truly are my good thing, as God intended it to be. You saw me lose sleep, take off of work, or sacrifice quality time, all for this moment. Yet you never judged me and always pushed me. And I cannot forget our little ones: Anniyah, AJ, and Amani. Anniyah, you have always been bright and loved to show-off your dad. Well now here's another reason. AJ, you were always in my corner, wanting to follow what I do. Well don't stop now. And Amani, although you're too young to understand everything, know that I put in thousands of hours to earn a degree that one day you will look back on and know that there is so much more to Daddy other than "Echo" and "Ready, Set, Go!"

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## CHAPTER 1: INTRODUCTION

### **Background**

This study focused on the strategies currently implemented by water policy experts and their perception of residents' attitudes and behaviors toward water conservation. The study's framework was guided using the theory of planned behavior (TPB) and followed a qualitative approach. The underlying problem is that many residents within the studied region may know of the current policy and follow it at times or know the policies yet choose to defy them. They may also lack the proper knowledge of the regulations that make up the compliance for safe drinking water from the federal level down to the local level. Historical trends, monitored by various governmental agencies in the studied region, have shown that many South Florida municipalities have issues conserving water as they should. This problem has led to the need to cease drawing water from the more superficial Biscayne Aquifer and transition to the deeper, artesian Floridan Aquifer. Without proper water conservation taking place with the growing population, the overdrawing of water increases saltwater intrusion.

### **Statement of the Research Problem**

Water is crucial to the support of life on earth. Although most of the planet is covered in water, only 3% is freshwater (Lamm et al., 2015). Understanding the importance of water is not something that many people understood until recently. Levy and Sidel (2011) referred to water as one of the most contentiously debated current social issues.

The general problem is the lack of water conservation in the region because of many contributing factors. Many of the South Florida region's drinking water production

wells are grandfathered to pull groundwater from the Biscayne Aquifer. Because of population increase and economic development, this overproduction leads to heightened saltwater intrusion in the aquifer, which would fill in the gaps created by over drafting the aquifer. Groundwater is also pulled through private wells and pipes that are used for irrigation. This study specifically addressed the need to educate and engage the public to conserve water or make changes to the already implemented education. Although there are websites that provide some information, this study worked with experts in the region to understand what could be causing this lack of conservation and what strategies could be used to achieve solutions.

Chaudhary et al. (2018) proposed that water is a scarce resource in Florida. There is an immediate need to reduce the stress on water resources and make water availability more sustainable by encouraging water conservation engagement among Florida residents. Furthermore, McKee et al. (2017) suggested that a possible solution to water scarcity is reducing water demand by changing consumer preferences for water use—this is water conservation.

### **Purpose Statement**

This study expanded on the knowledge of experts in water policy for water conservation and sought to understand what could be causing the residents' lack of conservatory practices. Although the entire region is advised to practice water conservation, this study did not assume that water conservation lacked in every area of the studied region. This study explored the policies implemented in the region and lived experiences of the experts. It also considered the behaviors and attitudes of residents perceived by the experts and what they are doing in response to the lack of water

conservation and the practices used. Current literature revolving around water conservation focuses on the need for irrigational uses or mostly comes from the resident's perspective. Therefore, this study would help advance the understanding of this topic from an administrative perspective by considering the experts in water conservation and water policy.

### **Research Questions**

The following questions are asked to guide this study after considering the literature:

1. What is the perception of the water experts concerning residents' lack of water conservation?
2. What methods are used by environmental agencies and water experts to assist consumers in understanding water policy?
3. How can water experts use the strategies that have been implemented to impact the lack of water conservation in the region?

### **Significance of the Problem**

Water conservation is one of the hot topics concerning the environment today. This is due to the scarcity of the commodity stemming from over usage and population growth (Onuoha, 2019). Because of the shortage of supply and necessity of the commodity, many families pay higher rates for this necessity (Zamudio & Craft, 2019).

The lack of water conservation in the studied region is a problem. Over time, the Biscayne Aquifer's primary aquifer has been running lower than experts expected (Miami-Dade County, 2016). This loss of water has heightened the chances of saltwater intrusion. Reports show this could lead to an increase in possible saltwater contamination

because of the low-lying water table of South Florida (Tully et al., 2019). The low-lying water table could lead to an even bigger issue as saltwater would contaminate the production wells that utilize this aquifer (Chaudhary et al., 2018). Considering that the South Florida region is also home to the large agriculture industry, this can pose a threat through irrigation. This study turned to the regional experts to understand what behaviors could be causing this lack of water conservation. This study aimed to find whether the current strategies for water conservation through written policy have been effective in flattening the curve that shows high water loss.

This study's outcome could lead to results that can benefit the experts as they can better understand the reasons behind the current problem. Also benefitting would be those being served domestically as they can be shown what they are or could be doing, eliminating deficiencies and leading to becoming a better water conservationist. There may be the possibility that this study could lead to techniques and education for the public and the chance to engage more active participation within each home and business in the region.

### **Definitions**

For this study, and to remain within the scope of environmental issues related to drinking water, the following definitions were adopted or applied to commonly used words or phrases.

**Consumers.** Used interchangeably with the resident, neighbor, or stakeholder, this group may be considered those individuals, groups, or organizations most interested, involved, or affected by a given project or action toward resource use (Munro et al., 2017).



**Expert (water or environmental).** A reputable and professional person who is considered qualified with relevant knowledge and experience of a topic (Cantrill et al., 1996).

**Residential attitudes and behaviors.** The actions individuals take or their reaction toward water policy or water conservation.

**Safe Drinking Water Act (SDWA).** Congress initially passed a landmark law in 1974 to protect public health by regulating its available drinking water supply. It was amended in 1986 and 1996 to include many actions to protect drinking water and its sources—rivers, lakes, reservoirs, springs, and groundwater wells (U.S. Environmental Protection Agency [USEPA], 2020c).

**Saltwater intrusion.** According to the U.S. Geological Survey (USGS), this is the process when too much freshwater is pumped from the aquifer system causing saltwater to migrate landward (Tully et al., 2019).

**Water conservation.** Efficient water use to prevent or reduce waste without causing reductions in economic benefits, without causing impairment to current users, and without being detrimental to public welfare (Fleming & Hall, 2000).

### **Theoretical Analysis**

This study based its framework on the theory of planned behavior (TPB). This theory was fine-tuned by Ajzen (1991) after being proposed by Ajzen (1985, 1987), because research showed some unresolved issues. The theory is an extension of the theory of reasoned action, which Fishbein and Ajzen (1975) developed and began as the framework used to predict an individual's behavior because of their intentions at a specific time (Sniehotta et al., 2014). A central factor in the TPB is an individual's

intention to perform a given behavior. Intentions are assumed to capture the motivational factors that influence behavior; they indicate how hard people are willing to try and how much of an effort they are planning to exert to perform the behavior. Generally, the stronger the intention to engage in conduct, the more likely its performance (Ajzen, 1991). Thus, the TPB was used in this study to investigate water users' actions and their effect on water conservation through expert analysis.

### **Organization of the Study**

In this chapter, the study's background was discussed, and definitions of standard terms that appear throughout the study were defined. This chapter also discussed the significance of the problem and problem statement, provided an overview of the study's purpose, and paved the way for the research questions through the theoretical framework. This study discusses literature in Chapter 2, methodology within Chapter 3, results and findings in Chapter 4, and the discussion and recommendations within Chapter 5.

## CHAPTER 2: REVIEW OF THE LITERATURE

Much of the literature regarding water conservation and public engagement discuss specific topics, such as irrigation, and the South Florida area is not one where many are focused. The aquifer that serves this study area is located only within the study region, and many of the articles found that relate to this study's location are research conducted through the University of Florida Institute of Food and Agricultural Sciences, by way of professionals from the USDA Extension program through classrooms and workshops (Chaudhary et al., 2017). These articles focus on a generalized population within the United States and use the public as their study participants. However, much of this work develops through voluntary efforts, and the focus can be more on irrigational conservation than on general conservation from the household. The classes taught do not focus on any specific policy or consider anything from an administrative standpoint, which increases the need for more engagement by water experts in the region for this selected study.

Lee and Tansel's (2013) research focused on a portion of the region, with the study participants being the public. They focused on a specific income level and age range; however, they conducted their research using water conservation within the homes to show how conscious participation makes a difference. By considering this research, this study would bridge the gap and investigate water experts' perceptions in this region. Most of the literature used in this study focuses on irrigational conservation, or it is too broad of an area with the studies happening over a long period. The regions are also widespread. Therefore, this study aimed to get the experts more involved in these efforts

to understand what is best for the public of South Florida and use their knowledge of public perception to mesh what can become an opportunity for change.

The succeeding sections discuss the water policies, water conservation, and sources of water specific to South Florida; examples throughout the United States; public participation in the context of water conservation; and the theory of planned behavior, which is the framework of this study.

## **History of the Subject Being Studied**

### **Water Policy**

For drinking water to remain safe, policies are implemented at the federal level down to the local level. The following sections provide a background to some of the policies, legislation, and regulations concerning drinking water and water conservation that apply to Palm Beach, Broward, and Miami-Dade Counties. It is important to note that the following information focuses directly on drinking water and water conservation. From the perspective of consumption, the only portion of water discussed directly is related to drinking water and water conservation is reclaimed water sources.

#### ***Federal Level Water Policy***

On the federal level, water policy comes from over 30 agencies, including the Fish and Wildlife Service, U.S. Geological Survey (USGS), the Office of Water via the U.S. Environmental Protection Agency (USEPA), and Army Corps of Engineers. One of the first laws to be enacted by Congress to provide regulation for any type of water was the Federal Water Pollution Control Act of 1948, which became better known as the Clean Water Act (CWA) with its amendments in 1972 (USEPA, 2019). However, this law primarily focused on wastewater and pollution, and the need to address groundwater

as it pertains to drinking water was covered in later legislation. All federal policy serves as the minimum each state and local levels below must meet to follow federal regulation. State-level and local-level governments have been allowed to reserve the right to be more stringent on the area they serve, but they cannot be more relaxed with the higher authorities' direction.

**The U.S. Environmental Protection Agency.** The USEPA is the highest level of authority for rules, regulations, and legislation that concern environmental issues, such as drinking water, in the United States. Although they are considered an independent agency with the federal government, Congress awarded them the power to enforce those laws passed down. Former President Richard Nixon signed the National Environmental Policy Act of 1969, which was signed into law in 1970. This law created the Council on Environmental Quality, which worked closely with the President's Cabinet. Within 6 months of its creation, this Council recommended consolidating many environmental responsibilities, which led to the creation of the USEPA, made official in the latter part of 1970 (USEPA, 2018b). The USEPA began with 4,000 employees in its first year and an annual operating budget of over \$1 billion; today, the USEPA has a yearly budget of over \$9 billion and a workforce of more than 14,000 workers (USEPA, 2020a). With the CWA enactment in 1972, the USEPA established regulations on drinking water quality and pollution (USEPA, 2019). This legislation was one of the landmark laws that paved the way for other federal legislation to come and created the framework that many states have used to determine water's safest quality.

Through 10 regional offices work throughout the United States, the USEPA delegates authority to these offices to enforce all compliance that comes from within.

These regional offices collaborate with state departments, such as the Florida Department of Environmental Protection (Florida DEP), to create, amend, and enforce all policies. The law that primarily pertains to drinking water is the Safe Drinking Water Act (SDWA).

**Safe Drinking Water Act.** This federal law is the principal law that regulates all standards for drinking water (USEPA, 2020d). Under this law, the USEPA must set safety standards for drinking water quality for public health and consumption. This law was made effective in 1974 and regulates all public water systems. Standards are placed under the SDWA as National Primary Drinking Water Regulations (NPDWRs) or primary standards, National Secondary Drinking Water Regulations (NSDWRs), or secondary standards. A primary regulation, officially known as National Primary Drinking Water Regulations (NPDWRs), is considered contaminants that are known to cause adverse health effects, respectively, of different quantities (USEPA, 2020b). These contaminants considered primary include microorganisms, disinfectants, disinfectant byproducts (DBPs), inorganic chemicals, organic chemicals, and radionuclides.

Secondary standards are contaminants with nonenforceable guidelines that may cause cosmetic effects, such as tooth discoloration, or aesthetic effects, such as taste (USEPA, 2020b). Although not enforced federally, each state determines how to implement secondary standards. The USEPA leaves it up to state and local regulators to consider enforcing possible secondary standards violations although the minimum guidance they provide is acceptable.

Because states are left to monitor all contaminants associated with the SDWA, regular reporting is required to ensure public safety. When states and local-level

governments exceed any of the limits outlined in the SDWA, the USEPA guides them to ensure that proper protocol necessary to protect the public's health is appropriate in removing, isolating, and neutralizing the contaminant(s). Exceeding limits may require those water systems affected by the contaminant to release public notices so consumers can make informed decisions (USEPA, 2019).

### ***State-Level Water Policy in Florida***

Authorized by the state, water policy regulations are enforced through the Florida DEP (n.d.-b) through the Office of Water Policy. This office manages statewide water management issues and develops the policy and rulemaking regarding anything related to water. There is also a cooperative working relationship with the state's different water management districts (Florida DEP, n.d.-b).

**Florida Water Resources Act.** In the 1950s, water resources regulation was handled by a single district tasked with handling issues within its boundaries (i.e., flood district, water district, etc.). Once the 1960s came, the population increased the demand and problems associated with water usage and demand. These issues led policymakers to develop a better solution to solve issues, creating a law that satisfied this (Davis et al., 2018).

Like the SWDA on a federal level, Florida's law that protects water and enforces water conservation regulations is the Florida Water Resources Act (Chapter 373, Florida Statutes; Davis et al., 2018). The legislation created this law through guidance from *The Model Water Code*, a scholarly review of Florida's surface waters, ground waters, and pollution, published by Dean Frank Maloney and the University of Florida (Davis et al.,

2018). This code discussed many of the common law doctrines that existed throughout much of the state before the state government created laws to satisfy conflicts.

Florida Water Resources Act establishes that all ground or surface water is considered a public resource and provides management to the Florida DEP and other water management districts. Enacted in 1972 as Chapter 373 of the Florida statutes, critical components of this law included (a) ownership of land does not carry license of or the right to use water, (b) Florida's water is held in trust for the benefit for the people of the state, and (c) the law provides an administrative structure for water regulation through permits and water shortage restrictions (Fumero, 2003).

**Florida Department of Environmental Protection.** The Florida DEP is the state's department for environmental management. This department is responsible for protecting the state's natural resources: land, air, and water (Florida DEP, n.d.-b). According to the Florida DEP's (n.d.-b) website, it is responsible for monitoring water quality, implementing state law to protect drinking water, and providing funding to local governments regarding drinking water projects through the Division of Water Resource Management. Receiving much of its direction from the USEPA, the Florida DEP works independently in enforcing federal regulations and state regulations throughout Florida.

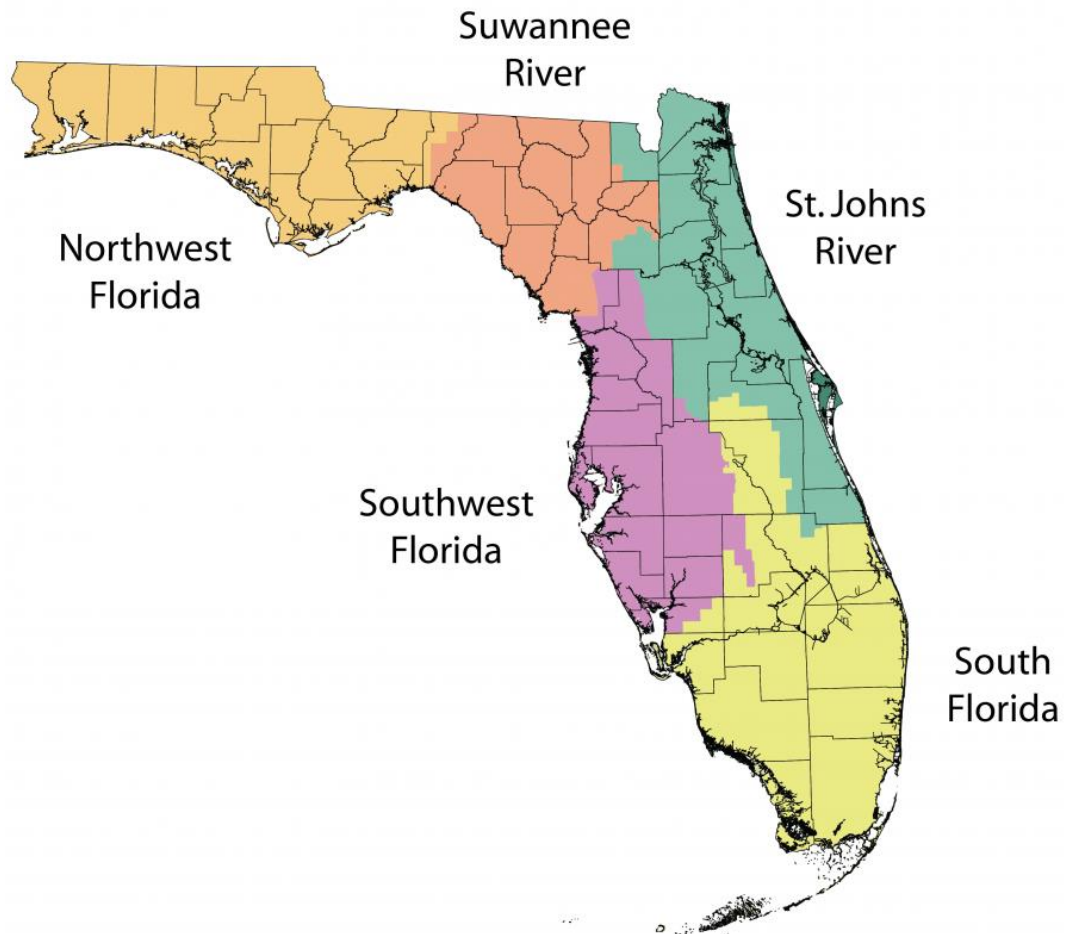
Per the state Legislature policy, water resources must be managed at the state and regional levels (Florida DEP, n.d.-a). The Florida Statutes, Chapter 403, Part IV, gives the Florida DEP its authority to manage and oversee all public water systems servicing 25 or more people for at least 60 days a year (Florida DEP, n.d.-a). It also allows for the creation of regional districts to assist with the enforcement of state environmental legislature (see Figure 1). These districts are the Northwest Florida Water Management



District, the Suwannee River Water Management District, the St. Johns River Water Management District, the Southwest Florida Water Management District, and the South Florida Water Management District. Each oversees the main vision of the Florida DEP yet completing their plans made specific to the boundaries that each oversees (Florida DEP, n.d.-c).

**Figure 1**

*Florida Water Management Districts*



*Note.* From “Water Management Districts,” by Florida Department of Environmental Protection (<https://floridadep.gov/water-policy/water-policy/content/water-management-districts>).

Because it is difficult to oversee the entire state's water resources and other divisions that are umbrellaed under this department, the Florida DEP passes the baton to each of its water management districts for different environmental enforcement and compliance applicable to the counties within each district. These include

1. Water quality: performing significant monitoring activities and assessments on water bodies and aquifers. Each district is responsible for the plans regarding waterbodies within their boundaries. It also oversees the construction and funding of any projects. Each district is responsible for administering any programs necessary for compliance with federal and state water quality parameters.
2. Water supply: developing reasonable water plans to sustain natural resources and water supply through 20-year plans. These plans discuss projects, costs, and projections over the next 20 years.
3. Flood protection and floodplain development: the construction and planning of the appropriate structures and procedures necessary to prevent flooding.
4. Natural systems: evaluating and protecting the state's biological systems through different programs and reservation systems.

Aside from these four major components, each water management district assists local governments and municipalities as regional branches of the Florida DEP regarding environmental issues, regulation, and compliance (Florida DEP, n.d.-c).

**South Florida Water Management District.** The Department of Environmental Protection, responsible for the administration of the water resources at the regional state level in Florida, exercises general supervisory authority over the state's five water management districts, which are responsible for the administration of the water resources

at the regional level (Florida DEP, n.d.-c). The South Florida Water Management District (SFWMD) is one of five water management districts and oversees the tri-county area. As a regional governmental agency, SFWMD manages the water resources in the southern half of Florida, a total of almost 9,000,000 residents (SFWMD, n.d.-c). Of the 67 counties in the state, SFWMD is responsible for managing and protecting water resources in its assigned region by balancing and improving flood control, water supply, water quality, and natural systems. The area includes Broward, Collier, Glades, Hendry, Lee, Martin, Miami-Dade, Monroe, Palm Beach, and St. Lucie Counties and portions of Charlotte, Highlands, Okeechobee, Orange, Osceola, and Polk Counties (SFWMD, n.d.-c). SFWMD is also responsible for permitting, well construction, and water use programs.

**Collaboration With Local Agencies.** For nearly 2 decades, the SFWMD has provided funding to local governments, special districts, utilities, homeowners associations, water users, and other public and private organizations. This funding focuses on three areas: stormwater, which shares the cost of local projects that address water quality and flooding issues caused by stormwater runoff; alternative water supply (AWS) project, which supports the development of AWS projects that will diversify supply while reducing dependence on freshwater resources; and water conservation, which supports water conservation efforts of public and private water providers or users regardless of hardware or technological measures used. These projects are consistent with the agency's core mission through the Cooperative Funding Program (SFWMD, n.d.-a).

### ***South Florida Water Restrictions***

Within each county, ordinances are in place to enforce the restriction of water. Any laws or regulations that guide water conservation follow what comes from the state level. Therefore, what residents follow can be stricter in some areas compared to requirements from the state. Likewise, other regions may follow guidelines that are aligned with the government. In no place are there regulations that conflict or become looser than what is advised from the Florida DEP or SFWMD. With a combined population of over 6,000,000 residents, each county has a structure to regulate and promote water conservation. The next sections provide information on the regulations within each of the three counties in the tri-county area. These restrictions are permanent and do not account for emergency orders that are put into effect based on a specific weather pattern or phenomenon. Cohen (2002) discussed the fact that there are disparities between those using manual and those using automatic sprinkler systems for irrigation. These disparities are one of the significant reasons regarding the need for water conservation and just one of the many ways South Florida can change. The following sections discuss ordinances in place for the tri-county region of South Florida.

**Palm Beach County.** Palm Beach County covers its water conservation framework in its county ordinance (Palm Beach County, n.d.). This ordinance is designed to be the governing document for the entire county regardless of municipalities having their water treatment facilities. The most current version, which has changed as of 2020, discusses what is allowed by residents and businesses; however, “Article VI—Water and Irrigation Conservation” was enacted in 1991 and went into detail regarding

the restrictions, prohibitions, and constraints that must be in place to ensure proper water usage. The restrictions in place are the following:

- (a) Irrigation of any residential, commercial, institutional, governmental, or industrial landscape areas shall be restricted to the hours of 5:00 p.m. to 9:00 a.m.
- (b) It shall be unlawful to operate or cause . . . any irrigation system or device [to be used] in a manner [where water is being] wasted.
- (c) New installations of automatic irrigation systems must be equipped with a water-sensing device which will automatically discontinue [lawn watering] during periods of rainfall. (Sec. 27-114)

Although some exceptions are made, not following any of these restrictions where applicable can lead to enforcement of the local ordinances, resulting in fines and violations that reference Florida Statutes (Palm Beach County, n.d.).

**Broward County.** Similar to the state level, where different districts are created to maintain a set number of counties, Broward County uses a similar system to support water conservation within its region by allowing the creation of districts to create, install, and operating water conservation plans (Broward County Board of Commissioners, 1976). Each district within the county has the authority to create plans designed to meet that specific district's needs.

Some restrictions that apply countywide regardless of each district's plan are in place from the board of commissioners (Broward County Government, n.d.). These include the following:

- No watering of lawns and landscapes is allowed on Monday, Tuesday, and Fridays
- Residences and businesses with an odd-numbered street address may water lawns and landscapes on Wednesdays and/or Saturdays, only before 10:00 a.m. or after 4:00 p.m.
- Residences and businesses with an even-numbered street address, no street address, or those who irrigate both even and odd addresses within the same zones, which may include multi-family units and homeowners' associations, may water lawns and landscapes on Thursdays and/or Sundays, only before 10:00 a.m. or after 4:00 p.m. [or both days during the same hours]. (p. 1)

Like Palm Beach County, noncompliance with these restrictions can lead to penalties, fines, and violations covered in the Broward County ordinances.

**Miami-Dade County.** First created in 1957 and expanded in 1992 to be the current ordinances, the Miami-Dade County Board of Commissions discussed water conservation restrictions and allowances in their rules within Article V- Section 32 (Miami-Dade County Board of Commissioners, n.d.). Like their neighbors in Broward, Miami-Dade allows water conservation plans to be submitted not by districts but by any publicly owned or operated water distribution system that receives its water from the County. These plans are required to be aligned with objectives from SFWMD and the Florida DEP (Miami-Dade County Board of Commissioners, n.d.).

Aside from the ordinances in place, Miami-Dade has the following restrictions to promote water conservation:

- Watering of lawns is prohibited between 7 a.m. and 7 p.m. any day of the week;

- Hand-watering is allowed only with an automatic shut-off nozzle (limited to 10 minutes daily, and only landscape stress relief and to prevent die-off);
- Odd-numbered addresses can water ONLY on Wednesday and Saturday using the time frame mentioned;
- Even-numbered addresses, structures with no address, or communities containing both numbering types may water on Thursday and Sunday using the time frames mentioned (Miami-Dade County, n.d.).

Not complying with any portion of these ordinances carries the risk of receiving violations or citations if found liable.

### ***Issues with South Florida Water Restrictions***

As noted through the referenced local laws within the region, water restrictions are in place to promote proper water use. Although each county has a schedule that allows select locations and homes to water on specific days at certain times, this schedule is not as helpful as much as it is problematic. Survis (2016) argued that it is essential to evaluate historical rainfall trends weekly and seasonally to optimize lawn water conservation strategies like outdoor water restrictions. Through her studies, she determined that weekly rainfall and climate changes are not considered in water restriction strategies, which leads to the promotion of unintentional overwatering of lawns by residents. This is because residents tend to use water for their yard and directly tie the water demand to weekly rainfall totals, not to a select number of watering days per week (Survis, 2016).

The wet season in the South Florida region is officially from June 1–October 31, the dry season being from November 1 and lasting through May 31 (Lascody, 2002).

The water restrictions' upside is that this strategy may be beneficial to residents during the dry months. It ensures their lawns are adequately cared for, receiving an adequate amount of water. However, this portion of the law's negative impact is that these restrictions can cause overwatering of lawns during the wet season, leading to an unintentional waste of water. This region receives an average of over 50 inches a year, and the majority is due to the wet season. Because of this, residents can consider these restrictions as much of an issue as they are a solution. It is important to note that because Florida has a stable climate year-round with higher temperatures than most of the United States, the restrictions are not considered seasonal.

### **Water Policy Examples Outside of Florida**

Although water conservation can lead to higher water scarcity if not done within the recommended parameters of government officials and water managers in the state, the issue exists elsewhere. Whether policies are in place for agricultural reasons or in place to control drought, it all comes to the same conclusion: an increased disparity between water availability and sustainable water supply needs have been recognized because of population growth, urbanization, industrialization, increased agricultural irrigation, and climate change (Chaudhary et al., 2018). Because of these reasons, water is a scarce resource in many places around the country. The next portions of this section discuss different laws or regulations that create water conservation policy across the continental United States.

#### ***California***

If there is any state with similarities to Florida, ask anyone, and the answer would be California. Sitting out west, California has a similar climate in many regions; it sits on



the coast, has a Disney-themed attraction, is known for citrus crops, and has a city named Hollywood. But if there is one thing that both California and Florida share, many people may not think of their water conservation issues. The problems of groundwater overdraft and water quality degradation have been an ongoing issue that has led to increased engagement of local, state, and federal policy and decision makers (Harter, 2015).

In California, many different laws and regulations relating to quality, quantity, and water conservation exist. One of the primary laws to be enacted was the California Porter-Cologne Act of 1969. Like the Florida Water Resources Act, this law is the principal law that governs water quality in this state and governs everything related to surface and groundwater (Jones et al., 2003). This law also provides for the designation of the State Water Resources Control Board and nine regional boards that were put in place before the law's existence. This is like Florida's DEP and the five agencies put in place (e.g., SFWMD). This law also lays the foundation for the water conservation policies and plans each county creates.

More recently, California has also been dealing with over pumping groundwater and water conservation, which eventually lowers the water table and increases saltwater intrusion; this has led to policymakers' action. In 2014, Governor Jerry Brown signed into law the Sustainable Groundwater Management Act (Harter, 2015). This legislation created the framework for managing groundwater supply and created regional agencies to assist with the management process. In addition to that, California added the Water Conservation Act and Assembly Bill (AB) 1668 in 2009 and 2018 respectively (California Department of Water Resources, n.d.-b). These laws required all water supplies to increase efficiency and directed the State Water Resources Control Board, in

coordination with the Department of Water Resources, to adopt long-term standards concerning water efficiency and performance measures for commercial, industrial, and institutional water users (California Department of Water Resources, n.d.-c). These two laws are addressed again in a later section.

### ***Pennsylvania***

Water conservation is fast becoming a way of life in many parts of the country, and water is becoming a limited resource in Florida and California (Fletcher & Sharpe, 1978). As with any other state, some laws or regulations discuss the “how tos” or “what to do or not to do” to guide residents into making proper decisions regarding safe water and water conservation. The foundational laws include the Clean Streams Act and the Sewage Facilities Act (Fletcher & Sharpe, 1978). It was once thought that creating a new water-pricing scheme would greatly aid the conservation effort. However, it may target mostly low and middle-income groups, leaving the higher income bracket to be careless and continue to use water wastefully and pay higher prices (Fletcher & Sharpe, 1978). And there are adequate public education programs, mostly during crisis periods such as droughts, but people tend to return to their usual way of water use before a crisis.

In Pennsylvania (PA), droughts may occur when there is a lack of rain, high temperatures, wind, and low humidity. When this happens, the state’s Department of Environmental Protection (PA DEP) guides the Pennsylvania Emergency Management Agency (PEMA) to assign drought status in each county using different indicators and groups (Krohn, 2019). These include normal conditions, watches, warnings, or an emergency.

When three or more of the drought indicators signal a drought watch, the PA DEP issues press releases to water suppliers and the media, asking that customers reduce water by 5%–10%. Under conditions deemed a warning, the voluntary restrictions increase to 10%–15%. These restrictions are completely voluntary at this point, and therefore no violations occur if they are not followed. However, once PEMA determines the conditions call for emergencies to be ordered, mandatory restrictions are imposed. These restrictions require nonessential uses of water to be reduced to up to 25%. These restrictions are most applicable to irrigating lawns, gardens, shrubs, washing vehicles or paved surfaces, filling swimming pools, and water for ornamental purposes (Krohn, 2019).

One of the methods available to residents and business owners is water-efficient devices and technology. Water-saving tools are not only cost-effective but serve a purpose to conserve water as well (Fletcher & Sharpe, 1978). These can include shower-flow controls, toilet inserts, and dual cycle modifications for toilets—all designed for retrofit operations in existing housing and new construction.

### ***Colorado***

In addition to California and Florida, another state familiar with the issues associated with water conservation is Colorado. Colorado is home to some of the most beautiful winters in the United States. But with the winter comes snow, and after winter, that snow must melt and go somewhere. Most of the snow that melts becomes recharge for the tributary groundwater systems where most of the state gets its freshwater.

Tributary groundwater is a system in which an aquifer is connected to a stream, and interaction occurs in one of three ways:

1. Streams gain water from the inflow of groundwater;
2. Streams lose water to the aquifer through outflows from the stream
3. A combination of gaining and losing water occurs through outflows and inflows from the aquifer (Hobbs, 2015).

The difference between this type of groundwater system and the type used in Florida is that the Floridan and Biscayne aquifers (of Florida) are nontributary groundwater systems because they do not impact any surface water. In the 1860s, Colorado's people adopted the Colorado Doctrine, a set of laws regarding land and water use (Hobbs, 2015). The legal framework, known as a "prior appropriation system," is what regulates the use of the water connected to the streams, and today, the provisions of the 1965 Groundwater Management Act and 1969 Water Right Determination and Administration Act are what contain the laws concerning anything water related for the state (Hobbs, 2015). The prior appropriation doctrine has not always encouraged water to be used in ways that would promote conservation and efficient use, hence the need for the 1965 and 1969 laws (Fleming & Hall, 2000).

Like the Florida DEP having the different districts to assist with policymaking regarding water, the Colorado General Assembly (the state's congress) appoints 15 members to the Colorado Water Conservation Board. They work closely with the four conservation districts in the state. This board of individuals is responsible for developing state water policy, flood control, and water projects. Simultaneously, the conservation

districts maintain the power to issue bonds, levy taxes, and fees while protecting and developing the waters the state is entitled to according to state statutes (Hobbs, 2015).

### **Sources of Water in South Florida**

Depending on geography, water can come from different sources to supply residents with this commodity. For example, the New York City area receives its water supply from streams in the Catskills Watershed (Gianfagna et al., 2015). This water is considered so pure that water coming from this source is not filtrated and delivered directly to residents. Streams, rivers, and lakes are examples of surface water. In San Diego County, about 8% of residents receive purified drinking water through ocean water (San Diego County Water Authority, n.d.). This process is costly and required a specialized treatment facility designed to filtrate saltwater.

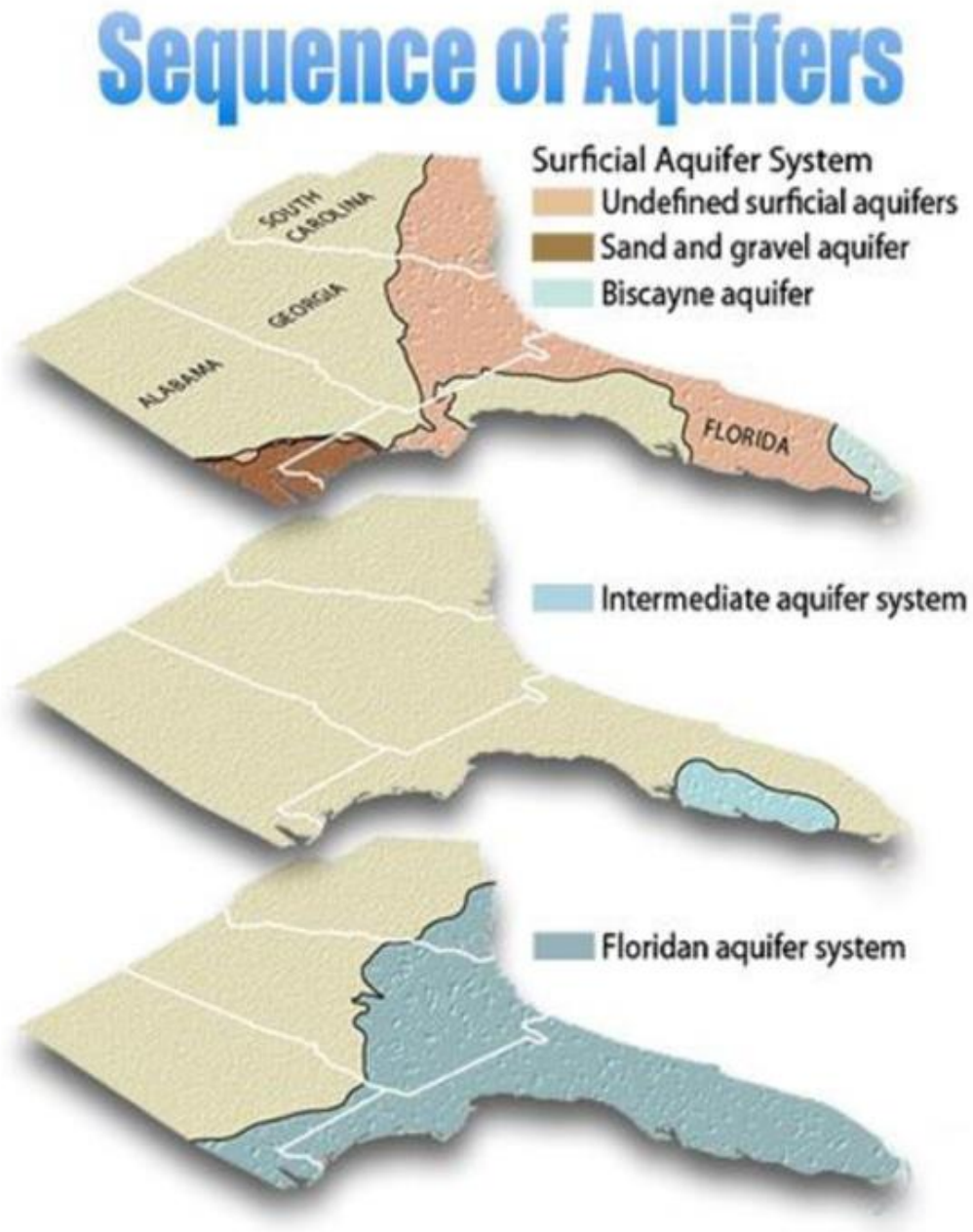
In South Florida, the only source of water comes from groundwater. The two groundwater aquifers that serve the region are the Biscayne Aquifer and the Floridan Aquifer. The latter is at a lower depth and more massive, which allows it to supply a larger population for many more years.

#### ***Biscayne Aquifer***

The Biscayne Aquifer underlies about 4,000 square miles and is the principal source of water for all Miami-Dade and Broward Counties and Palm Beach County's southeastern part in Southern Florida (see Figure 2). Because the Biscayne Aquifer is highly permeable and lies at shallow depths everywhere, it is very susceptible to contamination from saltwater (USGS, 1990). According to one report, the Biscayne Aquifer has a depth of 50 feet in Miami-Dade County and 170 feet in Palm Beach County (Bradner et al., 2005).

**Figure 2**

*Aquifer Systems of Florida*



*Note.* From “Aquifer Essentials,” by Florida Department of Environmental Protection (<https://floridadep.gov/fgs/geologic-topics/content/aquifer-essentials>).

The climate of the studied area plays a significant part in water conservation for the aquifer. During the months of late May through the end of October, this region sees its wettest days (Langevin & Zygnerski, 2013). This rainwater is collected throughout the 2600 miles of canals and waterways, monitored, and controlled through a partnership from the SFWMD and the U.S. Army Corps of Engineers. During the driest seasons, the canal system is manipulated to provide recharge to the aquifer. During hurricanes or very wet seasons, much of the water is released into the Atlantic Ocean (Langevin & Zygnerski, 2013).

### ***Background of Biscayne Aquifer***

The Biscayne Aquifer was named after the Biscayne Bay, a lagoon of water that sits to Miami's east. According to the USGS, the aquifer's upper level is known as the water table. Because of this characteristic, geologists have labeled this as an unconfined aquifer. Unlike the lower lying Floridan Aquifer, the Biscayne Aquifer does not have a layer of impermeable material such as clay above it. The absence of this layer allows the aquifer's levels to increase or decrease with environmental conditions (e.g., drought; USGS, n.d.-a). Because of this fact, possible human-made or environmental contamination has always been a concern.

### ***Floridan Aquifer***

The Floridan Aquifer is one of the world's most productive aquifers, providing water for over 10,000,000 people. It covers over 100,000 square miles and sits below the Southeastern United States, primarily Florida, Georgia, Mississippi, South Carolina, and Alabama (see Figure 2; USGS, n.d.-a). This aquifer's depth sits under pressure, and water is pumped using artesian wells. Although the vast majority of South Florida uses

the Biscayne Aquifer (partly because of its being more superficial, which would not require as deep of a production well), the region is beginning to convert to the production of wells that span far enough to pump water from this aquifer system.

This aquifer system consists of two layers: The Upper Floridan, which has a depth of 1,000 feet, and the Lower Floridan, which has a depth of over 3,000 feet. The upper level, which has recently been used to produce drinking water in South Florida, contains brackish water, a mixture of fresh and salt, and undergoes the reverse osmosis process at water treatment facilities to purify and distribute to residents (Williams & Kuniansky, 2015). This water is typically mixed with groundwater from the Biscayne Aquifer because it is not brackish. The groundwater found in the lower levels in the South Florida region is saline. Because it cannot be used for drinking water purposes, it is used as recharge from effluent discharge facilities in South Florida.

### ***South Florida Canal System***

The canals are part of a highly controlled water-management system that has contributed to the growth of one of the United States' largest urban areas (Barlow & Reichard, 2010). In South Florida, the canal system was constructed in the early 1900s to connect Lake Okeechobee's water to different water conservation areas located in what used to be the "old" Florida Everglades (Carter et al., 2010). It was also used between the lake and the Atlantic Ocean to drain the Everglades for agricultural and urban development among other reasons (Barlow & Reichard, 2010). Although these canals had different purposes upon creation, ranging from light transportation to drainage to irrigation, today these canals mainly assist with flood control, drainage, and water storage (Florida Fish and Wildlife Conservation Commission, n.d.). One of the canal system's



primary functions is to provide groundwater control (or recharge) for the Biscayne Aquifer, which helps lower the chances of saltwater intrusion on some occasions (Carter et al., 2010). The lowering of the canals is also becoming the reason saltwater intrusion is an issue (Barlow & Reichard, 2010). These canals catch much of the rainwater throughout the year and allow for runoff from the region's saturated soil, which also alleviates flooding troubles.

This system consists of four significant canals: West Palm Beach, Hillsboro, North New River, Miami canals, and 27 coastal basin canals within the tri-county area (Carter et al., 2010). Many of the coastal basin canals were created because there was no watercourse, and others were created to connect the significant canals and designated water conservation areas. Without the canal system and its associated pumps and control structures, it would be almost impossible to move water through the region effectively. The modern landscape of agricultural and urban development would not exist. Depending on the region's need, water can flow through the canal, stream, or sit stable as a reservoir (Carter et al., 2010).

### **Water Conservation**

Florida's relationship with water has been a complex one over the many decades of its existence. From early attempts to drain swamplands and everglades to making attempts to preserve natural resources, the state has seen many approaches from residents and commercial industries (M. R. Taylor & Lamm, 2017). Today, water conservation is one of the more promoted environmental topics surrounding this state's natural resources. The overpumping of the aquifers has led to recent and future emergencies in every region of the state. For example, South Florida has an increased chance of saltwater intrusion,

Central Florida is known to develop sinkholes and dried-up wells, and North Florida experiences bone-dry lakes (Swihart, 2008). Water conservation can be the fix to all these problems.

So, what does one think of when one thinks about conserving? When it comes to water conservation, it is more than just turning off the faucet. Conservation is a catchword and national policy (Michelsen et al., 1999). However, there are some locations where policies for water conservation are nonexistent. For example, Fleming and Hall (2000) argued that New Mexico's water law has neither a definition of water conservation nor a set of coherent policies for water conservation. The state follows the Colorado Doctrine when considering what to do concerning all matters relating to water. The state further recommended that if a policy is to include a definition, it should be specific to include one or more of the following elements:

- 1 Efficient use of water to prevent or reduce waste without causing reductions in economic benefits, without causing impairment to current users, and without being detrimental to the public welfare;
- 2 Use that prevents or reduces water pollution;
- 3 Use with presently available and economically feasible technologies;
- 4 Reduced water uses, including diversions, conveyance losses, incidental depletions, and return flows (Fleming & Hall, 2000).

The definition of water conservation, for this study, would best be aligned using Fleming and Hall's (2000) definition. It focuses on efficient water use to prevent or reduce waste without causing reductions in economic benefits, without causing impairment to current users, and without being detrimental to public welfare. Water

conservation is not meant to prevent homeowners, residents, farmers, and business owners from using water or living life where it is necessary. Still, it is meant to be something that in many regions should be a part of people's lifestyles to protect future generations.

As many trends have indicated, the population of Florida is expected to grow continuously. And as the population increases, the need for resources will continue to increase as well. Many studies on the state show that as the increase in population happens, the amount of water pumping from the aquifer will increase. Therefore, it is essential to continue to promote water conservation and put restrictions in place where they do not exist. Although many households across the United States can find ways to improve efficiency, hydrologic and agronomic studies have indicated that the agricultural sector, not the domestic sector, typically dominates water withdrawals (Ruiz et al., 2020). And while Florida depends on the aquifer systems located under the state, other U.S. portions depend on different means to supply fresh water to homes and businesses. Regardless of the source, Ruiz et al. (2020) concluded that the agricultural sector can find ways to reduce its water footprint just as much as the residential and industrial users. Their study concluded that there are ways to be economically and agriculturally efficient with this natural resource.

So, what would have to happen to effectively and efficiently achieve the necessary results? Some studies believe that just as the energy sector promotes the amount of energy that different appliances use to save residents money on electrical bills, the same should be touted with appliances and devices that utilize water (Lee & Tansel, 2013). In New Jersey, a study conducted by Palmini and Shelton (1983) demonstrated

that a program to reduce water consumption by distributing water conservation kits would effectively reduce water reduction and costs. But will residents be willing to participate in such programs if the devices come at their expense? Other studies conclude that significant change is associated with nonvoluntary mechanisms such as price increases (Alajmi, 2008; Ratnasiri et al., 2018). The issue with these types of changes is that there could be some backlash to the change because residents do not choose, considering that water is a necessary resource, when used at a minimum and not so much a luxury.

For this cause, Michelsen et al. (1999) mentioned that conservation definitions should be specific when implementing policies and plans. The definitions proposed should be as follows:

- Beneficial use: Water, like other resources, should be developed and used for the benefits it brings to society. Wasted water is water that is not used.
- Hydrologic efficiency: Maximize output from water use and thus eliminate evaporation, transpiration, and ocean returns.
- Economic efficiency: Water is neither a free good nor a priceless commodity but rather a resource that may be developed or conserved based on the benefits and costs to society.
- Preserve and protect: Preserve and protect water for aesthetic and environmental values outside of human use.

Because the USEPA and many state governments do not determine how conservation should take place, many of the plans and policies that are created are done with the permission to have those plans submitted for review and adopted, if approved,

from governing authorities (USEPA, 2018c). The next section covers information about water conservation specific to the South Florida region.

### ***Water Conservation in South Florida***

Different ways of implementation have been used in the region to conserve water. For example, through cooperation with the U.S. Army Corps of Engineers, Florida developed the miles of canals to recharge the aquifer. One of the more beneficial features of this canal system is using the canal water for irrigation by the agricultural community (Langevin & Zygnerski, 2013). This becomes very helpful in seasons of drought when drinking water restrictions are tightened. According to statistics from SFWMD (n.d.-b), approximately 90% of the water used in homes and businesses comes from the groundwater source. The other 10% comes from surface water sources, such as the canal system. However, both systems can be recharged through the abundance of rain in the area (SFWMD, n.d.-b). But when that does not happen or there is uncertainty, South Florida has restrictions, applying to all boundaries within SFWMD, that can be placed in the event of a drought or little rainfall. Each county has its ordinances customized to regional needs as well. The restrictions from local officials and those of SFWMD are different. Some of the restrictions put in place can be temporary for a season or can last long-term as policymakers and water managers see fit.

Homeowner associations (HOAs) are prevalent in South Florida with new communities still under construction in the western portions of South Florida. Statistics from a report obtained by the *Palm Beach Post* show that the tri-county region of South Florida has massive numbers of HOAs throughout the country, with the Broward, Palm Beach, and Miami-Dade sitting in the top three spots respectively (Staff Writer, 2017).

They are also some of the larger water users on the residential side. HOAs are the governing body created to oversee homeowners in a community (Chaudhary et al., 2018). They have the power to enforce water conservation because of the rules the boards decide on for residents to abide by regarding lawns and landscapes throughout the community. These can include mandated irrigation times and days and restrictions to certain types of grasses and plants that can be low in maintenance. Likewise, they can also inhibit water conservation practice, especially in common areas not directly related to the landscape affiliated with a resident's home (Huang et al., 2016). In either instance, HOAs can be used as an entry point to introduce water conservation among the community (Chaudhary et al., 2018).

Chaudhary et al. (2018) strongly believed that extension programs and water managers should not focus so much on the general public when considering water conservation but focus their attention more on the high-users of water. This is further supported by a study conducted by Huang et al. (2016), which found that high water users, compared to the general population, were wealthier, obtained a high education, and resided in HOAs.

According to the USEPA, the average American family uses as much as 300 gallons of water a day (USEPA, 2018a). Of that, 70% is used indoors, with the largest consumers of this amount being in the bathrooms when people shower and turn on faucets. For reasons like this, many governments and water distributors have created water conservation programs to encourage saving water (USEPA, 2018a).

### ***Background of Water Conservation in South Florida***

It was not until the late 1960s when the state went through a population boom that it required laws and conservation. Before the 1970s, many of the water laws that Florida has today did not exist; neither was there an issue with a water supply and the increased need for conservation efforts. During that time, Florida water law was based on common law doctrines that evolved in the eastern United States (Davis et al., 2018).

After the Florida Water Resources Act was established in the state, each county used this legislation as a framework to implement different regulations locally. Although there is not much information on how water was conserved between the 1970s and 1990s, there are some indications that something was attempted. For example, in the 1980s, automatic flushing devices, such as toilets and faucets, made their way to public restrooms. What is unknown is the number of devices that were implemented in the earlier days. Besides lower aquifer levels throughout the region, South Florida has also experienced many dry seasons, which amounted to lower amounts of rainfall (Abiy et al., 2019). Over the decades, the weather patterns have caused many water managers and officials to restrict water usage. Most of the actual data to show the trends of rainfall and water use are kept in archives from the USGS and SFWMD.

Although water use in different portions of the country could be headed in the direction policymakers preferred, water use in Florida has increased on both an absolute and per capita basis (Greene, 2010). This direction could be due to the population increases. And while more residents are expected to use more water, the increase in droughts in the recent past has led to more state problems. From 1999 to 2001 and again from 2006 to 2008, Florida experienced a drought that led to more residents using more

water, primarily for irrigation uses (Greene, 2010). When looking at records dating back to 1932, Florida saw its driest years in 2006 and 2007. The state has many water conservation initiatives and plans in place, but much can be done to increase efficiency and effectiveness, particularly landscape irrigation (Greene, 2010).

### ***Reclaimed Water***

One of the more popular methods to conserve drinking water that has been promoted through many municipalities is reclaimed (or recycled/reused) water. This type of water is wastewater that has been recycled and then favorably treated for irrigational use, recreational use, wetland reclamation, or groundwater recharge (Archer et al., 2019). It is treated raw sewage water that has been brought up to the standards of safe quality. It is considered nonpotable, and therefore, it has been advised by health departments that it should not be consumed. This type of water conservatory method dates to the late 1800s for agricultural use and to when California was fighting off saltwater intrusion in 1962. It was introduced in Florida in the mid-1960s to produce recycled water for agricultural spray irrigation for 120 acres at the Tallahassee Reclaimed Water Farm (Archer et al., 2019). It is important to note that although reclaimed water is treated and safe for the environment, it should never be consumed or used for sanitary purposes (Lusk, 2017).

Today, reclaimed water is also being used in many ways not concerning agriculture. Because the toilet is the largest water user in a home, many public spaces are refitting their bathrooms with low flush toilets and using reclaimed water to flush it (Florida DEP, n.d.-c). Water reuse allows regions to become less dependent on groundwater and surface water sources and can decrease water diversion from sensitive ecosystems (Oniki et al., 2018). The public generally opposes the use of reclaimed water



because of psychological repugnance, also known as the “yuck factor,” which is the instinctive disgust associated with the idea of recycling sewage and the fear that exposure to reclaimed water is unsafe (Garcia-Cuerva et al., 2016). However, with the growing concerns of water shortage, water conservation is essential, and reclaimed water can alleviate the pressure being put on the current groundwater supply. One of the reasons that there may be some public resistance to using recycled water is the lack of knowledge and perception of the risks associated with using the substance.

In many instances, the use of reclaimed water involves the treated wastewater, known as effluent, going through reverse osmosis, which would raise the reclaimed water to standards that surpass those of drinking water and tap water (Garcia-Cuerva et al., 2016). A study conducted by Garcia-Cuerva et al. (2016) showed that public perception has a lot to do with reclaimed water not being accepted to sustain water supply and shortages. Surveys showed that only a small portion of the population was concerned about water shortages, and of the portion that took the time to conserve, 43% agreed with the use of reclaimed water. Water managers and city officials would need to have available and accessible information about public attitudes toward water reuse to select appropriate and sustainable strategies. Aside from trying to get the public to accept it and considering projects to extend pipelines to offer it to residential areas, many governments, municipalities, and water suppliers should first consider using reclaimed water more on large-scale irrigational areas, such golf courses or athletic fields, as well as offer it to the agricultural sector. As people become more aware of the benefits of using reclaimed water and the technology that goes into the process, opposition to additional

applications and more significant water savings through widespread implementation of water reuse programs can be expected (Garcia-Cuerva et al., 2016).

### ***Water Conservation Around the United States***

Every state may have policies or regulations that differ from those of South Florida regarding water conservation. Some of the factors may include the source of the water as well as the demand. One of the more common issues seen in the literature concerns drought. In one example, related to geography, Woltemade and Fuellhart (2013) proved that when replacing older washing machines with more highly water-efficient models, savings ranged from 30 liters per day (LPD) in Denver, Colorado, to 136 LPD in Miami, Florida. One thing for sure, regardless of the source or region, everyone benefits. The next sections consider some of the methods used by other states to conserve water.

**Colorado.** The Colorado River System Conservation program is one of the established programs to test different approaches to reduce overall water demands to protect water users' rights and compensate them for implementing water-saving measures (Hawes, 2016). In 2010, Colorado WaterWise, an organization representing the water conservation community, created the *Guidebook of Best Practices for Municipal Water Conservation in Colorado* (Colorado WaterWise, 2010). Although it was created for water conservation and directly related to Colorado's issues, the guide discusses the best practices different states and utilities can implement within their water conservation plans. This guidebook offers a detailed description of specific water conservation measures, program elements, regulations, policies, and procedures that can be implemented by water providers anywhere in the

United States (Mayer, 2011). These practices are not specific to any state but more generalized and tailored to fit each state's population's needs.

Another way this state attempts to conserve water is by using annual audits on the outdoor irrigation systems. Done through the Slow the Flow Colorado, the most extensive outdoor irrigation program in the state, annual audits are conducted on 1,500–2,500 residents (Shimabuku et al., 2016). Trained technicians go to resident homes, evaluate and analyze the current irrigation system, take measurements of the landscape, and provide detailed, customized reports to the homeowner. Proper irrigation is necessary: watering outside of the rainy conditions or setting a timer during the times suggested by local officials. Through a 5-year study, Shimabuku et al. (2016) proved that when residents were trying to conserve through proper irrigation, savings came with it, and the average resident conserved 20,000 gallons of water; however, this amount only represented 37% of those who continued study habits during the postaudit. Results confirmed it is possible; however, it would take every resident doing their part.

**California.** Water conservation within the Golden State is controlled by the 2009 enactment of the Water Conservation Act and the 2018 enactment of Senate Bill 606 and Assembly Bill 1668 (Luna & Koseff, 2018). The governor signed the 2009 law because of drought conditions, and this set permanent targets for water use both indoors and outdoors. This created restrictions that allowed 55 gallons per day by 2022, with that amount dropping to 50 gallons per day by 2030. This water conservation law's primary purpose was to encourage residential and agricultural water providers to implement water conservation strategies, monitor water usage in the state, and report all data to the state's Department of Water Resources.

The latter law allowed more flexibility to water districts and implemented fines up to \$1,000 that can be imposed if water use is not met. However, these fines fall directly on water agencies and not residents (Luna & Koseff, 2018). The state created the “Save Our Water” program to help residents save water at home and reduce the effects of drought as well as provide information on other water-related products aimed at improved water quality (California Department of Water Resources, n.d.-a). Some of the tips recommended for indoor and outdoor use at a minimum include:

- Fix leaks
- Install high-efficiency toilets, aerators on bathroom faucets, and water-efficient shower heads
- Take shorter (5 minute) showers
- Track your water bill and meter to curtail water use
- Turn off water when brushing teeth or shaving
- Use dishwashers and washing machines with full loads only
- Plant drought-tolerant/resistant plants and trees
- Recycle indoor water to use on plants
- Refrain from watering your home landscape when it rains
- Replace your grass/turf with water-wise plants
- Use a broom to clean driveways, patios, and sidewalks instead of water from a hose. (California Department of Water Resources, n.d.-a, para. 4-5)

Residents of the state are encouraged to use water wisely regardless of seasonal precipitation. Although some of the recommendations may be difficult to perform because of social or cultural norms, making the decisions from the recommendations can make a difference over time.

**Pennsylvania.** Within the state, residents' water use is more within the homes with very little outdoor or irrigational use (Woltemade & Fuellhart, 2013). Different public utilities conduct different methods to conserve water, but all lead to the same ecological and financial benefits. In Shippensburg, a city in Southern Pennsylvania located between Philadelphia and Pittsburgh, the water conservation is achieved through several ongoing programs. One of those is a leak detection program in the distribution system (Woltemade & Fuellhart, 2013). This program accounts for unnecessary water loss after leaving the treatment facilities. Another opportunity to conserve comes on the residential side where customers are metered, and water rates are based on a conservation-oriented increasing block rate structure. Block-rate structures are known to increase prices as the usage increases, and therefore, it is nonvoluntary for residents from the policy side, but the conservation is voluntary. The city's utility also produces information on its website and sends out newsletters every quarter (Woltemade & Fuellhart, 2013).

### **Public Participation**

When it comes to water conservation, the policy can be viewed as the foundation of the matter. Fischer and Bliss (2008) determined that the public's behavior can be promoted and inspired by policies. This decision is through ethical and moral

obligations, violations of rules, reward systems, and the need for flexibility and autonomy (Fischer & Bliss, 2008).

Without a policy, many people may not have a sense of direction. What happens when the policy is created, in this instance, as the first portion of a solution? How does residents get to the conclusion of a problem? The solution to that question can be viewed in the eyes of the public. Public participation is encouraged on many levels with water conservation. Aside from in-home and outdoor water conservation, the residents' behavior and attitude play a pivotal role in the policy's success. It is not enough for just one resident to conserve although it is a start. However, in a system where there are millions of water users, a few doing good will get lost in the mix. This example would be like trying to find a "needle in the haystack."

Dawes and Messick (2000) defined social dilemmas as situations in which each group member has a clear and unambiguous incentive to choose. These incentives provided poorer outcomes for everyone than they would have if the decision was made by all members if no choices were made. This definition is followed by a great example of how these social dilemmas can be the cause of the lack of progression. One example is how a group goes out to a restaurant to have a meal and decides beforehand to split the bill evenly among everyone. If one person sits down and orders an expensive glass of wine and entrée, that person may come out spending less collectively than if they were alone. However, if the entire group has the same mindset, it may be shocking to see the bill at the end of the night. This is how the issues of water conservation can be viewed (Dawes & Messick, 2000).

Because many homes and businesses are not receiving reclaimed water, more basic practices to conserve water are recommended by the different water conservation programs throughout the region (SFWMD, n.d.-b). Joining these will not fix South Florida's problem, but experts trust it will slow it down. These include the following:

- Replacing aerators in kitchen and bathroom sinks with models rated for 1.5 gallons per minute or less
- Watering lawns based on actual need
- Following the SFWMD regulations or local municipalities ordinance regarding watering conservation
- Installing low-flow appliances and water fixtures.

Although this list does not include everything that can be done to conserve water within the home, it does help to a degree. However, it would take more than just one home on the street to make a difference on a broad scale, and this is just a portion of what can be done. Following restrictions during the dry months and proper land irrigation during the wet season improves conservation's chances.

### ***Residential Attitudes and Behaviors***

Growing up in sunny South Florida, children were taught in schools that it was essential to save the Earth. One of the ways to do this was through water conservation. Educators placed posters around the classroom to encourage students of this, and they even held public assemblies during the famous Earth Day. As time progressed, historical records show that what Floridians (and Americans in general) have been taught has not

been so much applied in our daily lives, and the footprint left is evident. Why is it that some people decide to conserve water while others decide not to pay it any attention?

The decision to water lawns has a lot to do with why many families do not conserve the way they are asked. For example, in many parts of Florida and throughout the Southern United States where warmer weather dominates the year, the use of St. Augustine grass can be found in many of the HOAs and different neighborhoods (G. Taylor & Gray, 1999). This type of grass is known for staying green if it is watered and an excellent choice to crowd out weeds. It does, however, come at a cost to the earth and residents. High maintenance is required to keep the grass looking healthy, which makes conserving water almost impossible.

### ***Determinants of Attitude and Behavior***

One of the answers to why is it that some people decide to conserve water while others decide not to pay it any attention is embedded within one's sociodemographics, including household size and education (Fielding et al., 2012). Studies show that the higher the education in a home, the stronger the family's intentions to conserve water. This notion is also tied into studies showing that households with higher income levels are more deliberate to not conserve water by relying on water-efficient appliances and products. Therefore, the intent to conserve is present to show the efforts. When considering lower income families, the intent to conserve is not present based on the same conservatory efforts, but more on spending less on water usage (Fielding et al., 2012). For this reason, Fielding et al. (2012) used their research to connect income to water usage.



Another factor that can contribute to answering the question on why some people conserve has to deal with an individual's attitude, which is directly connected to one's intention and household size. Russell and Fielding (2010) considered that the main factors determining the attitude held for water conservation are strongly tied to one's beliefs, personal capabilities, and habits. The theory of planned behavior, used in this study, is one of the most widely used frameworks to connect individuals' attitudes to their intention. This theory has shown through many studies that although the intentions to conserve are present, the outcome may not always reflect this. If one household member is committed to conserving water and does what is necessary but lacks the support to perform this, that individual may back out of these efforts because of the lack of social support (Fielding et al., 2012).

Psychological literature has also shown that intentions are inhibited from becoming behaviors because of one's habitual nature, directly connected to household use. Steg and Vlek (2009) provided insight into this, showing that many homes have automatic behavioral tendencies because of the routines that become habits. The more a household does something, the more it becomes second nature to consider a different way of completing this task. This change would mean that habits can become positive or negative depending on the outcome. For example, ensuring that everyone takes shorter showers and does not overload washing machines creates positive water conservation habits. In contrast, longer showers and smaller loads have the opposite effect. However, this comes at a cost because the more people living in a home who do not conserve affects financial and environmental aspects.

### ***Pricing Concerning Water Conservation***

Many studies have investigated the way pricing can affect water conservation. Depending on other factors, pricing may or may not play a role in conserving water. Gilbert et al. (1990) concluded that when pricing is considered and other factors are taking place, such as drought, studies done to examine price elasticity are limited because the consumers of water are driven more by the drought as opposed to the pricing. Because the resource is necessary and there are no substitutes, the only price entering the water demand is the price of water. Like gas, when a car needs it, consumers are willing to continue to pay for it regardless of the increase in oil prices. This demand categorizes water pricing as inelastic because some studies show that people are not affected by the price. L. D. Taylor (1975) and Nordin (1976) were the first to propose models that considered increasing or decreasing block rate structures.

The long-run marginal cost for water in urban areas should reflect the full economic cost of providing the water including the cost of energy for pumping, costs associated with storage, costs associated with the treatment and distribution, the opportunity cost of using water for other uses (such as natural and ecological uses), and future costs of water depletion (Griffin, 2016). However, Griffin (2016) argued that the reality is that water rates are mostly lower than long-run marginal cost and utility priced water with other objectives in mind. Liebman and Zeckhauser (2004) extended this reasoning with a clear explanation of utility pricing. According to Liebman and Zeckhauser, utility pricing has several features that make it difficult for consumers to know their accurate marginal price, such as (a) pricing schedules are not always published or presented clearly on the bill for consumers, (b) consumers vary their

consumption based on season, (c) pricing schedules can change relative to season, (d) bills aggregate many disparate individual decisions and are typically presented in units that are not directly observable to the consumer, and (e) the link between a consumer's choices and consumption is difficult to reconcile (Liebman & Zeckhauser, 2004).

### ***Recommendations and Incentives of Water Conservation***

Although not required by water distributors and local municipalities with publicly owned systems, it is recommended to reduce water use to prevent stress from being put on the aquifers and water sources. Aside from the environmental effects of high water usage, financially, it can be burdensome on residents' pockets. So to help the environment and the pockets of residents, high-efficiency toilets, showerheads, and faucets are available (Lee & Tansel, 2013). In some areas, such as Miami-Dade County, rebates are being offered to customers who change their fixtures to EPA WaterSense Certified or fixtures that have a flow rate of fewer than 1.5 gallons per minute (GPM) (Miami-Dade County, n.d.).

One way to encourage households to conserve water may come in the form of different types of incentives. In a study done in Singapore, Goette et al. (2019) used informative, normative, and monetary incentives to consider, which would lead to water conservation. When all three are put together in a single field experiment, results showed that the incentives' water conservation effect was significant. For that reason, Goette et al. (2019) believed that receiving periodic information with water-saving tips or such a "regular reminder" plays a role in promoting household water conservation.

Another study, conducted with limitations to using a shower in Spain and Switzerland, considered the scarcity of water as a variable to whether an incentive would be beneficial (Garrone et al., 2020). Results determined that increases in pricing do not necessarily affect whether or not residents will want to save water. Still, when water is considered scarce or restrictions are in place, residents tend to pay more attention to their bills. For this reason, Garrone et al. (2020) determined that incentives such as monetary vouchers did make a difference in the amount of water a resident used related to specific water conditions.

Closer to the targeted region for this study, Lee et al. (2011) conducted a 4-year evaluation of residents who used high-efficiency fixtures and appliances. The study focused on voluntary registration from Miami-Dade County, the supplier of water in this studied area. Results proved that to see the incentive of money savings, using high-efficiency appliances and fixtures must be used over a long period, because of the lack of quantifiable results in a short period (Lee et al., 2011). Although changing just one item to high efficiency in a home made a difference for this study, the impact was more widespread when combined with multiple appliances and fixtures. Residents saw significant changes to their water bills (usage and cost) by Year 2, with more savings in Years 3 and 4, respectively.

### ***Public Education and Awareness***

Although conserving water is a choice in many places, protecting the natural resource has its benefits. Studies have shown that conserving water should fall on the water suppliers' shoulders, water management, and the government. If the public is adequately educated on the issue, it can raise more awareness to receive proactive results

(McKee et al., 2017). Experience is an essential component in formal and informal educational settings (Huang & Lamm, 2017).

In Florida, the University of Florida has a partnership with the U.S. Department of Agriculture (USDA) to provide education through its extension program, a voluntary environmental program (VEP). According to the USDA's website, cooperative extension (also simply known as extension)

Provides non-formal education and learning activities to people throughout the country—to farmers and other rural communities as to people living in urban areas. It emphasizes taking knowledge gained through research and education and bringing it directly to the people to create positive change. (National Institute of Food and Agriculture, n.d., para. 1)

McKee et al. (2017) concluded in a study done with the extension of Florida that the more consumers are exposed to farming practices, the more likely they are willing to pay for more robust conservation practices. It did not matter whether the farmer was perceived as an inferior or strong conservationist of water resources. Huang and Lamm (2015) also conducted a study that showed that the public's engagement level was low because of the lack of knowledge of policies and the limited number of water issues. The study results revealed that respondents were willing to engage in water conservation behaviors, but that came with a clause. They were more willing to conduct alternative landscaping practices than civic behaviors or water conservation actions that harmed either their landscape quality or required purchasing products such as new plant materials or water-efficient utilities (Huang & Lamm, 2015).

By using personal experiences and turning them into educational programming, participants can directly see the relevance of water issues in their daily lives, resulting in a higher tendency to take proactive environmental actions such as conserving water resources (Huang & Lamm, 2015). Huang and Lamm (2017) did just that by conducting a study with participants from different U.S. regions. The study was focused on each respondent's experiences. Each respondent was asked three sets of questions regarding their water use behaviors, water conservation practices, and willingness to act on water conservation. The results of this study showed that individuals' application of water conservation practices and intention to conserve water might be associated with their experience of water issues and experience gained through performing certain water use behaviors (Huang & Lamm, 2017). The actual results varied by region, but one statistic that stood out among the others was the number of respondents from the South (Florida included). It was the highest among the four regions surveyed, but it had the highest number of low water quality experiences at home.

For voluntary programs, such as those offered through Extension, to be effective and successful, results would have to be achieved, and they would preferably need to show consistency. Some scholars have argued that the benefits of VEPs can extend beyond direct measures of environmental improvement (Hughes, 2012). VEPs allow for negotiated targets and flexibility in implementing policy and procedures, both of which can be attractive for agencies and municipal governments. However, there has been very little research focused on using VEPs in the public sector, and work in the private sector has not produced conclusive results about the effectiveness of VEPs (Hughes, 2012).

By assessing three different communities within California and Nevada, Trumbo and O’Keefe (2001) concluded that for residents to conserve water, providing information intentionally is not enough, even through programs as the Extension Program. If information alone will can have any influence over someone’s ability to conserve, then targeting self-efficacy may be the way to go. Although attitudes, qualities, and norms across communities differ, it should not be enough to negate community involvement in decision-making regarding water conservation (Trumbo & O’Keefe, 2001).

### ***Issues Due to Lack of Water Conservation***

Because water conservation is touted as something of high importance in South Florida, many problems have arisen because of this lack. Overusage of the Biscayne Aquifer has led to lower groundwater levels, resulting in the elevation of saltwater intrusion becoming more of a concern alongside flooding because of saturation when water sits on the grounds and is not collected in the canal system as runoff. When too much water is pumped from this superficial aquifer and not replenished at a rate proportionate to the usage, the chances of saltwater intrusion increase.

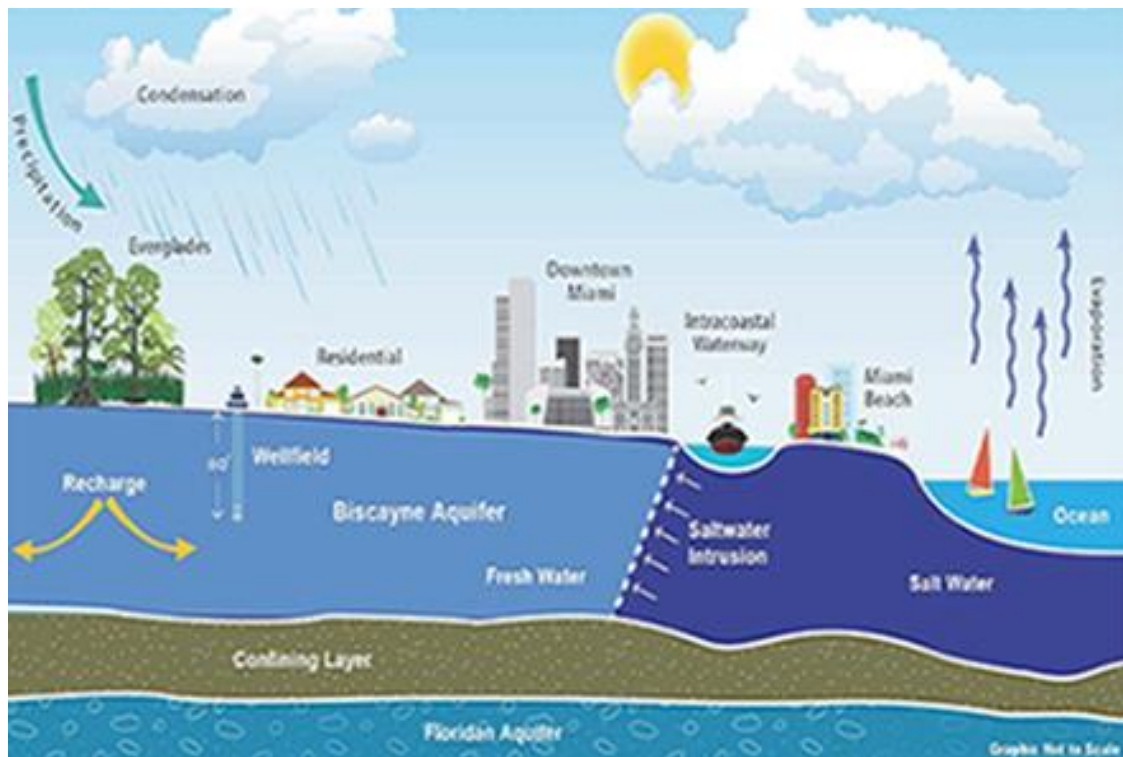
**Saltwater Intrusion.** According to the USGS, this is the process when too much freshwater is pumped from the aquifer system, causing saltwater to migrate landward (Tully et al., 2019). The easiest way to explain the process of what happens is that saltwater intrudes groundwater supply because of water levels being normal and the empty pockets becoming filled with seawater (see Figure 3).

This issue has been a concern in the Biscayne aquifer over the years. This process allows higher gradient water to flow toward the freshwater and “fill the gap” (USGS,

n.d.-b). The USGS monitors the increased chances of saltwater intrusion in the area through a specialized division known as the Caribbean-Florida Water Science Center (CFWSC) and at state-level through the SFWMD. Because many municipalities have wells that are grandfathered to pump from the Biscayne Aquifer, they may also conduct localized monitoring.

**Figure 3**

*Explanation of Saltwater Intrusion*



*Note.* From “Saltwater Intrusion,” by Miami-Dade Water and Sewer Department (<https://www.miamidade.gov/global/water/conservation/saltwater-intrusion.page>).

Saltwater intrusion has been documented along the coasts of the United States for more than 150 years. Still, the literature indicates that the extent of saltwater intrusion varies widely among localities and hydrogeologic settings (Barlow & Reichard, 2010).



Once a freshwater production well is contaminated with saltwater, it is costly to undo this. One of the required processes is to take that specific production well out-of-service and disinfect it. Not only can this process be expensive, but it can also be very time consuming, resulting in some water agencies and municipalities losing this well and its becoming abandoned.

According to Tully et al. (2019), saltwater intrusion can be driven by five main factors: (a) the position of sea-level relative to the land and water table, (b) the frequency and magnitude of storms and tides, (c) the frequency and duration of drought, (d) water use (e.g., surface and groundwater withdrawals for drinking water and irrigation), and (e) hydrologic connectivity (e.g., tide gates, levees, agricultural, diversions, and roadside ditches, and canals). Studies have also shown that one of the reasons for saltwater intrusion along the southeastern Florida coast is lowering the water table via the canal system (Barlow & Reichard, 2010).

Before 1945, the canal system was uncontrolled, which caused over drainage of the aquifer. It periodically allowed seawater to move inland along the canals; this inadvertently made its way into the groundwater aquifer system. Since 1946, gated canal control structures have been used to prevent inland migration of seawater along the canals and to control canal stages and groundwater levels (Barlow & Reichard, 2010).

**Flooding.** Flooding is always a concern in South Florida. Because the region sits at sea level, much of the water from the wet season, high tide, and storm surge saturate the grounds, causing flash flooding (Wdowinski et al., 2020). This flooding not only becomes an issue in the utility arena for drinking water, but it also becomes an issue in departments of transportation, public works, and risk management. Local officials and

managers have been put in positions to determine the best course of action for this ongoing issue. On the one hand, the decision to lower the canal levels to prevent inland flooding is considered. On the contrary, the option to keep the canal levels high could prevent possible saltwater intrusion.

In recent years, studies on the impact of flooding have increased in coastal areas in the tri-county area. Wdowinski et al.'s (2020) most recent study of Miami Beach provided valuable information. Statistics proved that the amount of flooding doubled in the last decade because of increased tide. As more studies are being conducted on this issue alone, local officials are making decisions today that can impact tomorrow. And here is the obvious: something must be done. For this reason, Czajkowski et al.'s (2018) study showed why policymakers and water managers need a better understanding of what the trade-offs are associated with their decisions. Their study provided evidence that losses because of flooding created insurance claims that averaged as high as \$8 million in 1 month and were all due in part to the groundwater-level decisions.

### **Water Distribution System Structure**

Before water makes it to every customer's home, much goes into the process of pumping the water and treating it to the quality required for safe use and consumption. Every water distribution system comprises different components, all specific to the treatment, water source, and geography. In the South Florida area, because the water source is groundwater (aquifers), most of the treatment involves using a lime-softening process or membrane filtration. Regardless of the facility's capacity, both are effective means of water softening during the treatment process and have proven useful for removing microorganisms and organic matter (Van Leeuwen et al., 2011).

### ***Water Treatment Facilities***

Since the beginning of time, pure drinking water has been considered essential for everyday life. In the early days, the Bible discusses, in Exodus 7:24, how the Egyptians did not drink directly from the Nile River but dug holes alongside it. Even then, without the world's technologies today, God gave them enough knowledge to understand the process of sand filtration. In the studied region, all water comes from the same source: aquifers. Unlike in some parts of the country, South Florida relies only on the groundwater from an aquifer. One of the primary water distribution sources is the water treatment facility, also known as a drinking water plant. At these facilities, all untreated groundwater is pumped and treated for human consumption and use.

In this region, drinking water facilities are operated through either a membrane filtration process or a coagulation-filtration system. Membrane filtration is most effective in purifying saline water, usually pulled from the Floridan Aquifer (Ray & Jain, 2011). Expensive to operate and effective in treating, this type of technology involves filtering the water through a semipermeable membrane layer that allows water to pass through but traps contaminants, chemicals, and bacteria (Ray & Jain, 2011). This advanced technology involves using the “beginning of time” sand-filled layers and gravity and pressure to filtrate the harmful components not suitable for consumption properly.

In a coagulation-filtration system, groundwater is pretreated at a drinking water plant. This process involves rapid mixing, chemical coagulation, and flocculation, which forms filterable floc particles (Odell, 2010). The water is filtered to remove particles and sent through a process of clarification systems. The water then passes through different types of media filters. These filters perform the process's biological component through

aeration and oxygen addition (Odell, 2010). Throughout this process, chlorine is added (based on each facility's operations) for disinfection purposes as well as fluoride (to raise levels appropriate for human consumption) and ammonia (to achieve chloramine-based disinfection).

### ***Distribution System***

Water distribution systems make up almost 1,000,000 miles of infrastructure in the United States (National Research Council, 2006). These systems are made up of pipes, pumps, storage tanks, meters, valves, and other hydraulic parts. They are specifically designed to take potable water from the water treatment facilities and redirect it into the homes of the businesses and residents connected via meters. Although many water plants are monitored daily for compliance and water quality, it is within the distribution that more regulations should take place. Many pipes and parts of a distribution system are designed to last 30 years, and when parts begin to fail, they must be replaced (National Research Council, 2006).

Within much of South Florida, as with many systems across the United States, this is the case. Whenever any part must be replaced, a lot can happen to affect the water's quality and integrity. Public water systems across South Florida are required to release boil-water notices in affected areas as a part of compliance to safeguard public health; this eventually is cleared through laboratory testing, which confirms no contamination. And depending on the type of distribution system involved, additional precautions may be taken, such as hydrants flushing for days or weeks.

Distribution systems can be classified as any combination of the grid, ring, radial, and dead-end, with each of these having its advantages and disadvantages (Adeosun,

2014). According to Adeosun (2014), a distribution system has certain traits that help classify it as safe. With proper maintenance activities, water quality can be maintained and prevent deterioration within the distribution pipes. Additional traits that Adeosun mentioned are as follows:

1. Proper supply to all connected locations,
2. Capable of supplying the required amount of water during firefighting,
3. Layout should be in a way that no consumer would be without water supply (including during the repair of any section of the system),
4. All the distribution pipes should be preferably laid approximately one meter away or above the sewer lines to prevent cross-contamination,
5. Maintain proper chlorine residuals to prevent microorganisms from developing.

### ***Production Wells***

Regardless of which aquifer a water system is drawing water from, all water systems in the tri-county area have active production wells drilled. The maintenance of each well is overlooked by SFWMD and the county where the well is located. The rules and regulations governing all activities concerning production wells can be found in the *Florida Administration Code 62-555*, found through the Florida DEP website (<https://floridadep.gov/>). This regulation also directs that construction and oversight of wells shall be done by one of the regional government agencies. For the purpose of this study, that would be SFWMD. Although each well can have its customizations (because of location, drilling activities, or age), all wells' significant components are the same. According to Waller (1988), all wells require a well-casing, the opening, which is the primary source of water from the well. Water wells also require a well-cap, whose

primary purpose is to prevent contamination; a well-screen, which filters some of the contaminants in the aquifer from entering the well; and a pump, which uses gravity and pressure to draw and direct water. Once water is extracted from the aquifer, it is pumped through a pipe and redirected to the water treatment facility that serves that well.

Most wells are made of steel although some may have plastic or PVC components. The depth of the well is determined by the aquifer being used in production. For pumping associated with the Biscayne Aquifer, a depth of approximately 60 feet would suffice because this aquifer is superficial (St. Johns River Water Management District, n.d.). However, because of saltwater intrusion's growing concerns, it is recommended to draw farther at about 100 feet. For the Floridan Aquifer, a depth of 2,000 feet or more would be needed.

### **Theory of Planned Behavior**

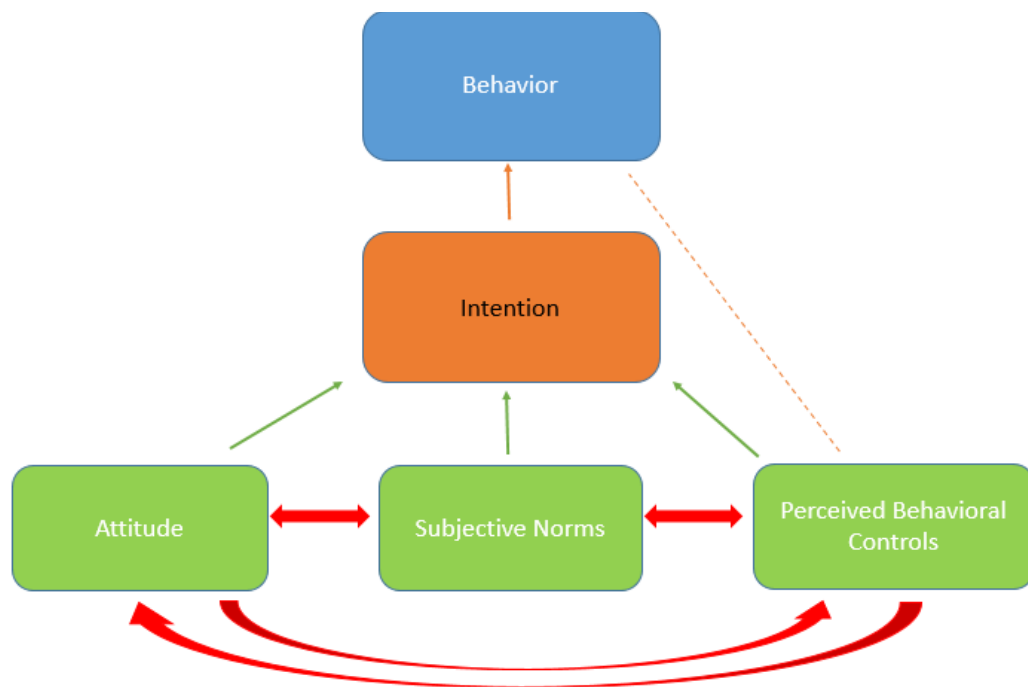
Discussion of planned behavior theory cannot happen without discussing the theory of reasoned action (TRA). The TRA was developed by Fishbein and Ajzen (1975) and began as the framework used to predict an individual's behavior because of their intentions. These intentions were based on a conscious personal choice and not the result of external factors or forces (Untaru et al., 2016). In this theory, intention, which is the immediate precursor of behavior, indicates an individual's readiness to engage in a behavior (Ajzen, 1985). Untaru et al. (2016) also addressed how the TRA has been widely applied to predict behavioral intentions in environmental behaviors (Bagozzi & Dabholkar, 1994; Kim et al., 2013).

As stated in Chapter 1 of this study, this study's framework was guided using the theory of planned behavior (TPB; see Figure 4). This theory was first proposed by Ajzen

(1985) under the current model and honed during later work (Ajzen, 1987, 1991). The theory has been considered an extension, or the successor, to TRA. A central factor in the TPB, as with its predecessor, is an individual's intention to perform a given behavior. Intentions are assumed to capture the motivational factors that influence behavior; they indicate how hard people are willing to try and how much effort they are planning to exert to perform the chosen behavior. Generally, the stronger the intention to engage in a specific behavior, the more likely it is to be performed and become actions (Ajzen, 1991). These intentions are predicted by the attitudes toward the behavior, the subjective norms, and the perceived behavioral controls. These three components have been used to predict water conservation (Chaudhary et al., 2017).

**Figure 4**

*Main Variables for Theory of Planned Behavior*



The critical difference between the TRA and the TPB is the addition of the perceived behavioral control. Perceived behavioral control relates to self-efficacy or the extent to which a person believes he or she can carry out a behavioral change (Liang et al., 2018). The behavioral change is dependent on the barriers an individual has present, which can affect their perception. Since its creation, the TPB has also been used in many other studies outside of environmental studies, such as the intent to commit driving violations (Parker et al., 1992), deer hunting intentions (Hrubes et al., 2001), and student intentions to attend college classes (Skoglund et al., 2020).

Many studies have been conducted using the TPB as the theoretical framework in the context of water conservation. There is empirical evidence that people in a festive mood tend to evaluate behaviors more favorably, and less favorable behaviors are more likely to occur among people associated with a negative mood (Diaz et al., 2020). Research has also connected generalized emotions and mood states related to the perception of well-being in decision-making. In a recent study, Diaz et al. (2020) used the TPB. They found that individuals with higher levels of happiness and well-being were willing to demonstrate more engagement in water conservation behaviors. In that study, well-being also played a significant role as a predictor of future behavioral intent and the connection to the TPB. Although stress was considered a factor, it was not significant enough to predict future behaviors or the likelihood of following current water conservation practices (Diaz et al., 2020).

Using water-use perception is one of the many factors found in the literature for many studies focused on the TPB. For example, Attari (2014) investigated water-use perception and concluded that improving the public's understanding of how they use



water can impact strategies implemented to improve water conservation. Residents were more likely to decrease water use from curtailment actions than efficiency actions because there was a perception that efficiency came with upfront costs (Attari, 2014).

Furthermore, Ali et al. (2018) argued that many of the studies done using the TPB did not consider potential factors, such as personal norms and perceived water costs, that influence water conservation behaviors. They are important considerations that can impact the outcome of many studies. Results showed that social norms, perceived behavioral controls, perceived costs, and personal norms were influential in conserving water. Although attitudes were also considered, it was not statistically significant in one of the models used; however, it negatively correlated with intent to engage in water conservation in the second model (Ali et al., 2018).

## CHAPTER 3: METHODOLOGY

This chapter describes the research methodology of the study. Specifically, this chapter describes the rationale for a qualitative research design, research instrumentation, which will include a survey and elite interviewing of eight participants, and a description of the way data were collected and analyzed. The chapter concludes with the limitations of the study.

### **Purpose Statement**

This study expanded on the knowledge of experts in water policy for water conservation and sought to understand what could be causing the residents' lack of conservatory practices. Although the entire region is advised to practice water conservation, this study did not assume that water conservation lacked in every area of the studied region. This study explored the policies implemented in the region and lived experiences of the experts. It also considered the behaviors and attitudes of residents perceived by the experts and what they are doing in response to the lack of water conservation and the practices used. Current literature revolving around water conservation focuses on the need for irrigational uses or mostly comes from the resident's perspective. Therefore, this study would help advance the understanding of this topic from an administrative perspective by considering the experts in water conservation and water policy.

### **Research Questions**

The following questions are asked to guide this study after considering the literature:

1. What is the perception of the water experts concerning residents' lack of water conservation?
2. What methods are used by environmental agencies and water experts to assist consumers in understanding water policy?
3. How can water experts use the strategies that have been implemented to impact the lack of water conservation in the region?

### **Research Design**

This study was guided using a phenomenological qualitative approach. Because this study focused on water conservation and expert perception, reports and logs used from agencies monitoring the issue were used. Thus, a historical approach is tied in using a survey design. This study used the experts' lived experiences as they pertained to what they focus on concerning water conservation and water policy.

For the research design of this study to be successful, a collection of documents was analyzed. These included geographical maps, official reports, data logs, and records focusing on the historical perspectives of water conservation. The researcher also conducted in-person semistructured interviews and deployed questionnaires via electronic surveys based upon the literature's issues. Using these methods allowed participants to speak up and have their voices heard (Creswell & Creswell, 2017).

### **Population**

The population for the study encompassed the tri-county area of South Florida. This region is made up of 39 municipalities in Palm Beach County (see Figure 5), 37 municipalities in Broward County (see Figure 6), and 36 municipalities in Miami-Dade County (see Figure 7). It is important to note that each municipality can operate its own

publicly owned water treatment system. Each has individuals who may be considered environmental or water conservation experts in these specific divisions or departments. This population also contains satellite offices from the Florida DEP and is home to the headquarters of SFWMD. However, for this study's purpose, the focus was primarily on those individuals within the county governments of Palm Beach, Broward, and Miami-Dade, and SFWMD.

**Figure 5**

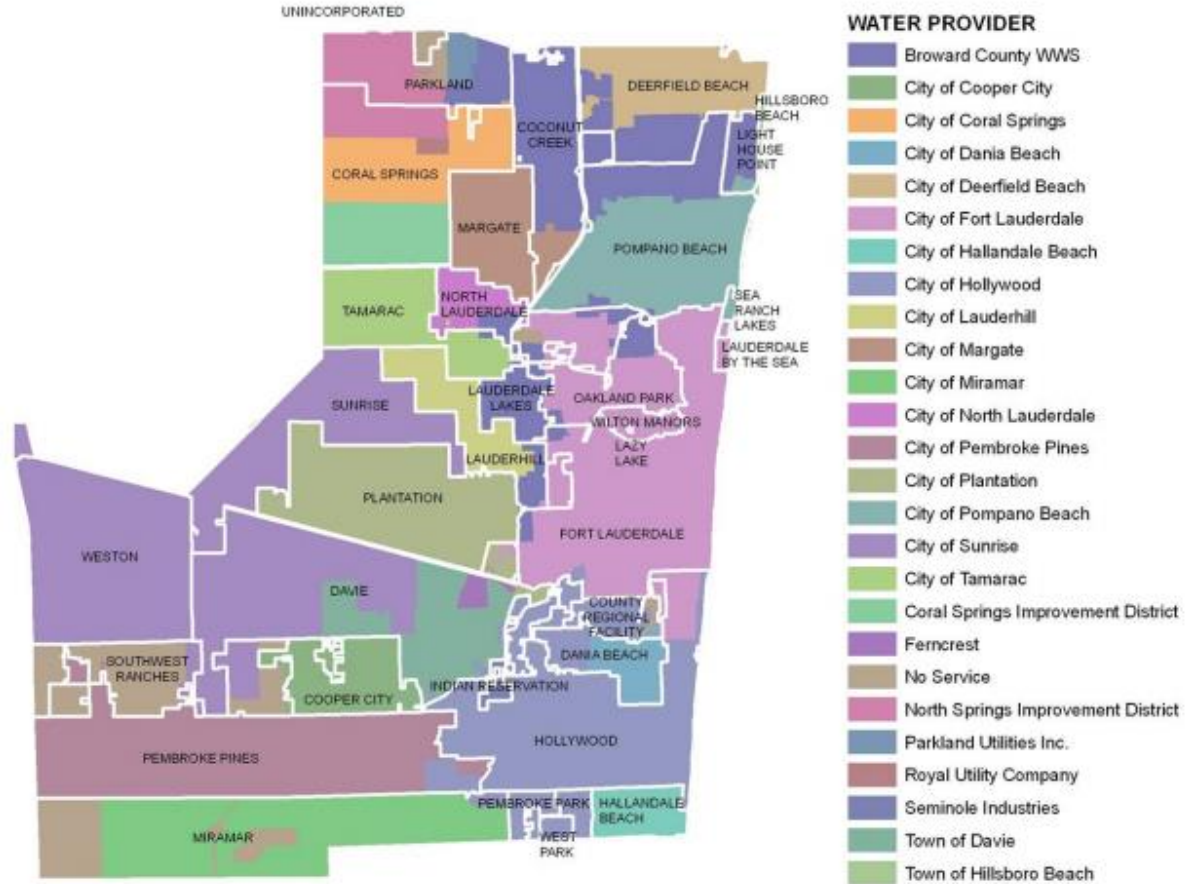
*Palm Beach County Municipalities*



*Note.* From Palm Beach Relocation Guide, 2016 (<https://palmbeachrelocationguide.com/housing/choosing-the-right-palm-beach-neighborhood/>).

**Figure 6**

*Broward County Municipalities*



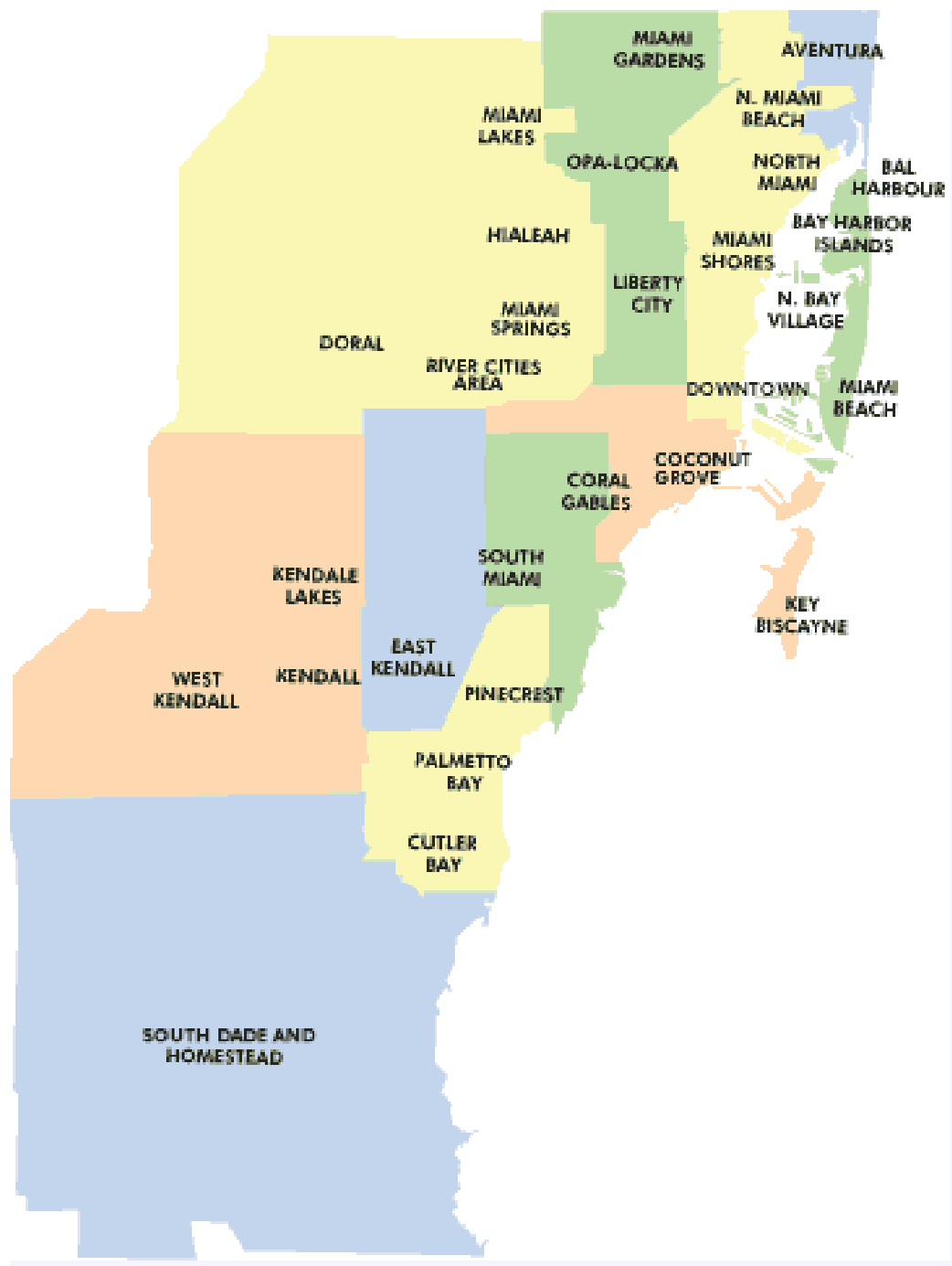
*Note.* From South Florida Water Management District, 2010 ([https://www.sfwmd.gov/sites/default/files/documents/bwrtf\\_report\\_061010.pdf](https://www.sfwmd.gov/sites/default/files/documents/bwrtf_report_061010.pdf)).

**Sample**

For this study, the sample was made up of experts representing the largest regulating agencies in the studied region, known as the “Big 4.” This sample consisted of three from SFWMD (as a representative of Florida DEP), two from Palm Beach County, two from Broward County, and one from Miami-Dade County (each county has

**Figure 7**

*Miami-Dade County Municipalities*



*Note.* From City-Data, 2008 (<https://www.city-data.com/forum/miami/127417-miami-vs-miami-beach-3.html>).

departments that govern and create the policy framework for the study topic). Miami-Dade, Broward, and Palm Counties control their water distribution systems and create water policy; SFWMD has no distribution. Instead, it enforces state policy and assists other agencies with their water conservation plan permits. The sample selection was collected using purposive sampling to ensure that each expert met the criteria needed for more reliability of the results. For this study, the criteria included (a) expert's title must contain any combination or variation of the word(s) manager, director, supervisor, or specialist; (b) expert must have worked in water conservation or water policy for a minimum of 5–10 years; (c) expert must have at minimum a degree in a field related to environmental science, engineering, or public administration; and (d) expert must be over the age of 18 years.

As discussed by Moore (1987), this type of social research is more beneficial when a group is used rather than an individual. Some of the reasons listed for this include (a) it is logical that if one properly combines the judgments of several people, there is a better chance of receiving more truth; (b) groups are desired to understand social phenomena by obtaining the views of the actors; (c) it is often beneficial to use groups if one is concerned about the consequences of the research; (d) complex, ill-defined problems often can be addressed only by pooled intelligence.

### **Instrumentation**

Mears (2009) suggested that if one prefers to achieve depth rather than breadth, a smaller number of interviews may be conducted, usually six to nine. Therefore, for this study, a total of eight interviews was conducted. This study's instruments consisted of expert interviews through elite interviewing with at least one member from each of the

big four agencies in the region. The aim of participation was closest to the maximum of the intended range, both in-person where allowed, and online meeting (e.g., Zoom) because of social distancing measures; the examination of existing (historical) records and reports was necessary for the creation of additional questions to interview the experts. Audio and video equipment was also being used as an instrument for the recording and analysis of the interviews. The surveys were planned to be delivered electronically, and the interviews were aimed to be in-person or in a face-to-face virtual format (i.e., Zoom).

### **Data Collection**

Data were collected using in-depth and in-person semistructured interviews of the experts from SFWMD, Palm Beach County, Broward County, and Miami-Dade County, where allowed. These interview questions were delivered in person or virtually. Where permitted, audio and video equipment was scheduled to compose later additional researcher notes regarding the interviews and to code open-ended questions to look for comparisons in the themes. Aside from verbal responses, body language was considered in understanding the perception of each sample participant. Closed-ended questions were used in the interviewees' surveys to focus on each expert's beliefs and perceptions. In contrast, open-ended questions were asked during the interviews and derived from the survey responses. The use of the survey questionnaires closed the gap within the interviews (Ilyas, 2019).

### **Elite Interviewing**

As mentioned in the previous section, this study consisted of elite interviewing using expert perception for water conservation analysis. One of the main benefits of



using elite interviewing is that it provokes individual thought processes by straying away from the “round-table” type of discussions. Using such methods can have an impression on other study participants, which can affect their responses. Dalkey and Helmer (1963) believed that a method that causes confrontation of decisions could lead to close-minded and preconceived ideas. The use of elite interviewing is typically done using open-ended questions. This method allowed room for diversity with different perspectives to be discussed. Aberbach and Rockman (2002) mentioned how this can maximize response validity and allow the experts to organize their responses in their framework.

### **Ethics**

The selection of the sample and population was conducted using the highest morals and ethics, not excluding anyone in an ungodly or unlawful manner. Acting in this type of faith allowed selections to be aligned with what the Belmont Report (1979) recommended. Consideration was given in instances where positions were political (e.g., elected officials) to prevent possible decision-making through the pressure of coercion. No study participant knew any information regarding another participant’s information, demographics, or organization used for the study unless participants were referred by one who authorized consent. All participants’ identities remained undisclosed to avoid participants getting involved in subject or observer bias. No information regarding the interview and survey results was discussed with anyone other than the participant.

### **Data Analysis**

A combination of semistructured interviews and surveys were deployed to understand the perceptions of these experts better. The first portion began with an electronic survey to locate themes tied to the literature review and asked many of the

closed-ended questions that are not typical during elite interviewing. These survey questions can be found in Appendix A, and a sum of all participants' responses for each question can be seen in Appendix B. Interviews consisting of open-ended questions took place to follow up with the survey results and allowed for expert comments and conversation. These questions can be found in Appendix C.

Once interviews were complete, transcripts were created using transcription software such as NVivo or TranscribeMe. The purpose of transcribing was to provide a valid and reliable process to establish themes associated with the interviews. The interview coding served as validation for a comparative analysis of the findings in the literature.

### **Limitations**

In research, limitations can come as shortcomings, influences, or conditions that the researcher cannot control. For this study, some of those include the following:

- 1 Gatekeepers can be in place. These are individuals who can block access to the elites, such as assistants. Hunter (1993) stated this can be expected with elites in senior-level positions.
- 2 The expert participants may not be truly independent as many may network across the industry.
- 3 Possible limited views or an uneven spread of expertise among the participants' specific agenda and geographic/cultural location can be possible.
- 4 The discretion is given to the researcher to select quality feedback of the results.; this can be considered researcher bias.

- 5 Because of the extent of the pandemic happening during the research process and the need to practice social distancing, there are always technological issues.
- 6 With technology comes a cost. The coding cost can be considerable to transcribe the interviews, depending on the number of open-ended questions used and the responses given (Aberbach & Rockman, 2002).

### **Summary**

This chapter discussed the research methodology of the study. Specifically, the purpose and the research questions, which were introduced in Chapter 1, were described; this section reiterates the study's focus, which sought to explore the experts' perception concerning the lack of residents' conservatory practices. Next, the study's research design was described. The study's qualitative design opened a lane of communication to discuss the population, a tri-county area located in South Florida. Out of this population, the researcher explored a sample size of eight participants from four agencies. These participants received the survey instrument utilized for initial data collection and then participated in interviews inclusive of 10 open-ended questions regarding perception. Additionally, this chapter included a description of how the collected data were analyzed and transcribed. The analysis of the data implemented the elite interviewing method in addition to ethical considerations. Finally, the limitations of the study, which included time, variables/controls, and potential bias, were reported. The next chapter provides an in-depth analysis of the interview process, deployment of the surveys, and analysis of data.

## CHAPTER 4: RESEARCH, DATA COLLECTION, AND FINDINGS

### Overview

This chapter of the study discusses the research, data collection, and qualitative research findings. The primary method of research was through data collected via elite interviewing of experts from four of the largest agencies of water distribution in South Florida: Miami-Dade County (through its Water and Sewer Department); Broward County (via its Water and Wastewater Services Department), Palm Beach County (via its Water Utilities Department); and the Florida DEP through SFWMD. After the electronic deployment of the qualitative tool *Expert Perception on Water Conservation Survey*, these interviews concluded. All interviews were recorded for research purposes and then transcribed to compare each expert's similar themes.

Within this chapter, the purpose statement is discussed as it was in previous chapters. This chapter continues with the research questions that guided the study, which were addressed through the research interviews. Additionally, the discussion of the research methods and data collection procedures are then followed by presenting and analyzing data. This chapter concludes with a summary of all the findings of this study.

### Purpose Statement

This study expanded on the knowledge of experts in water policy for water conservation and sought to understand what could be causing the residents' lack of conservatory practices. Although the entire region is advised to practice water conservation, this study did not assume that water conservation lacked in every area of the studied region. This study explored the policies implemented in the region and lived experiences of the experts. It also considered the behaviors and attitudes of residents

perceived by the experts and what they are doing in response to the lack of water conservation and the practices used. Current literature revolving around water conservation focuses on the need for irrigational uses or mostly comes from the resident's perspective. Therefore, this study would help advance the understanding of this topic from an administrative perspective by considering the experts in water conservation and water policy.

### **Research Questions**

This study began out of the belief that residents are not doing their part to help conserve water, which is causing the heightened threats of sea-level rise, saltwater intrusion, and lower aquifer levels in the Biscayne Aquifer. In the phenomenological qualitative research design, the following questions were asked in this study:

1. What is the perception of the water experts concerning residents' lack of water conservation?
2. What methods are used by environmental agencies and water experts to assist consumers in understanding water policy?
3. How can water experts use the strategies that have been implemented to impact the lack of water conservation in the region?

In addition to the research questions used to guide this study, the following open-ended interview questions were asked each participant to gather data to answer the research questions:

1. How long have you worked in water conservation? How long have you worked in your current position?
2. Based on your knowledge, how would you define water conservation?

3. How effective is it for residents to all conserve water on purpose annually?
4. Have you ever been involved in a public awareness strategy for water conservation (i.e., conference)?
5. How would the help of other government agencies and municipalities change your perception of how consumers conserve?
6. Do you converse (or network) with other individuals outside of your organization concerning more efficient methods for water conservation?
7. What is your perception of how consumers conserve water? In what ways do you feel consumers can be more efficient in water conservation?
8. What is your perception concerning the amount of educational material available to the public for water conservation in South Florida?
9. What are the major shortcomings of the current approach(es) used by regulators to conserve water?
10. Are you aware of any water conservation management strategies (in Florida or outside of the state) that your region can emulate? If so, who?

A phenomenological approach was appropriate for this study because it allowed the researcher to obtain valuable information regarding the importance of following water policy and water conservation protocol as mentioned by the industry experts. A phenomenological study's primary objective is to expound the meaning, structure, and essence of the lived experiences of study participants through conversations in which the researcher and participant are fully interactive (Simon & Goes, 2017). Through phenomenological approaches, researchers attempt to comprehend human behavior through the eyes of those participating in the study and have experienced the

phenomenon under investigation (Simon & Goes, 2017). Further, a phenomenological design attempts to obtain information about a particular phenomenon. The phenomenon investigated in this study focused on the experts' perception of water conservation and policy.

### **Research Methods and Data Collection Procedures**

This research study's instrumentation included elite interviewing using 10 open-ended questions that followed a closed-ended electronic survey. A pilot study of the survey was deployed to a CBU faculty member to address potential practical issues in the research procedures and test the questions' reliability and validity.

The research was done on the different organizations to recruit participants. The search began on each organization's human resource page where the researcher could locate organizational charts. In addition to this, some organizations had a directory, which showed who the executive level professionals were. Based on the department or division, individuals were selected and sent emails from the researcher's CBU email account, requesting their participation in the study. Each email contained the study's title, the researcher's information, institution information, and how to contact the researcher. Upon receiving written or verbal consent from different recruits, an official consent form was emailed, under IRB approval number #024-2021, which explained the details of the study, the role of the participant, the role of the research, and how the researcher would ensure ethics are upheld (National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research, 1979). This consent form can be seen in Appendix D. For this study, each participant's identity and organizations were coded, where O represented the organization and the subsequent number was the code of

that organization; likewise, the identity of each participant, P, contained a subsequent number to identify him or her.

Upon receipt of the consent forms, participants were sent a link to the electronic survey to complete. It was at this point that participants also received their coded identity. Electronic surveys were designed using Typeform, a registered surveying website, which tracks participants' responses through different questions. All questions on the survey were closed ended, requiring participants to select from the given answers. The survey can be viewed in Appendix A. The summary of the results is discussed in a subsequent section. Once each participant completed a survey, an automated email with results was sent to the researcher's CBU email account. These results were also stored on the survey website. After the surveys were completed, the expert participants were then emailed a follow-up response to request an interview regarding their perception of current water policy issues and water conservation techniques performed by residents. It is crucial to understand that this study's aim was not to correct what residents were doing. The intent was to understand how the experts viewed the results of water conservation historical data in conjunction with the plans and goals previously set in the previous years by various agencies, officials, and water managers.

Although an in-person interview would have been the preferred method, interviews were conducted online using camera meeting software via Microsoft Teams or Zoom. One interview did not utilize a camera meeting method and was held through a phone call at the participant's request. All interviews were conducted virtually because of the issues caused by the COVID-19 pandemic. Each interview was recorded through the Microsoft Teams or Zoom software's capabilities, and the phone interview was



recorded using audio equipment located directly next to the phone. Regardless of the unforeseen nature of the pandemic and delivery of each interview, the interview protocol and ground rules were still adhered to. The interview protocol and script can be seen in Appendix E. Before each interview, all equipment was tested for accuracy and clarity.

Each interview was scheduled to last no longer than 60 minutes, absent consent from the participant allowing time to be extended. All but one interview stayed within the allotted time frame. The one interview that exceeded the 60-minute limit was due to participant P06's passion for the topic and the discourse created through the interview process. A total of eight participants agreed to the study and were interviewed. At the start of each interview, the researcher provided an official introduction and gave details regarding the study using the approved interview protocol script. The researcher reminded all participants that their participation was strictly voluntary and informed them of the confidentiality that would be adhered to, allowing them to freely provide their perception without penalty, judgment, guilt, or fear. The researcher reminded all participants that all organizations' identities and names of participants would remain undisclosed and all data linking the participant to the study would be removed at the study's completion.

### **Sample Description**

The sample was determined using a purposive sampling method. Doing so allowed for the qualifications to be met for the study. The sample was selected using three of the larger agencies in the region and the state regional agency. These were Miami-Dade County, Broward County, and Palm Beach County. In addition to these three, the regional agency participants who represented Florida's state came from the

water management district. These three counties were selected because they have one of the largest drinking water distribution systems in their respective county and oversee the cities' regulations and smaller municipalities within it. All three counties contain ordinances that serve as the law or framework for their county's cities. The sample can be seen in Table 1.

**Table 1**

*Organizations and Participants Interviewed*

Organization	Number interviewed
Organization 1 ( <i>O1</i> )	1
Organization 2 ( <i>O2</i> )	2
Organization 3 ( <i>O3</i> )	2
Organization 4 ( <i>O4</i> )	3

For this study, participants were categorized into three professional experience tiers to prevent exposure of their identities. These categories were determined using organizational charts from the human resources departments of each. These categories are as follows: Executive-level management, senior-level management, and midlevel management. Executive-level management included those at the top of a department or division, making the day-to-day decisions for that section (i.e., department director, deputy director, division chief). Senior-level management included those professionals just below executive-level management, usually supervisors (i.e., senior engineers, water managers, environmental managers). Midlevel managers are under the senior-level managers but still play a pivotal role in policy and projects concerning the water policy

and water conservation for their region (i.e., project managers, water coordinators, lab managers).

### **Participant Demographics**

The selection criteria for the participants were based on specific demographics to qualify each participant for the study. For this study, these criteria included (a) expert's title must contain any combination or variation of the word(s) manager, director, supervisor, or specialist; (b) expert must have worked in water conservation or water policy for a minimum of 5–10 years; (c) expert must have at minimum a degree in a field related to environmental science, engineering, or public administration; and (d) expert must be over the age of 18 years. All participants met the qualifications mentioned, and the ranges of years of service, gender, and degree levels can be seen in Table 2.

**Table 2**

*Participant Demographics*

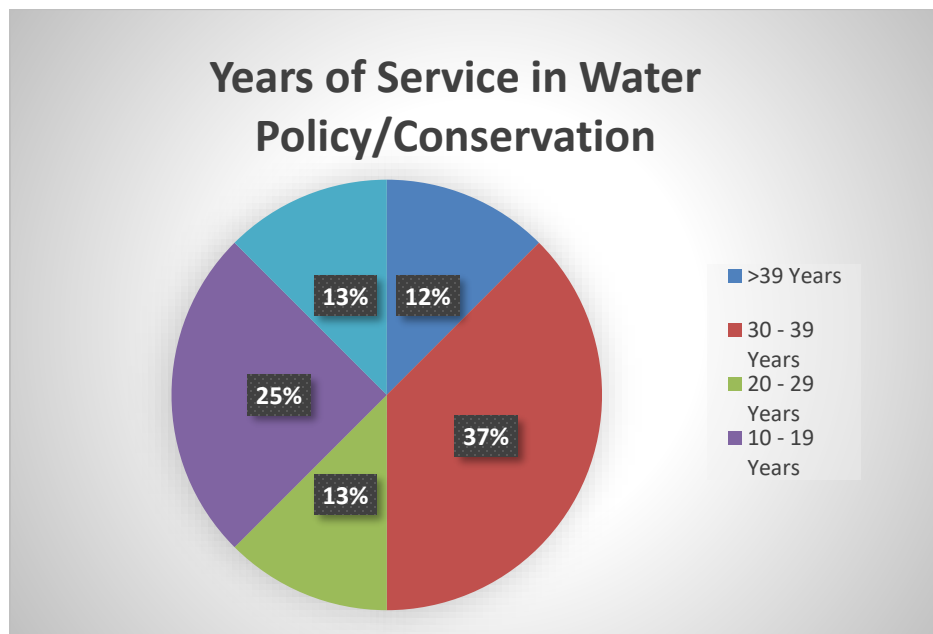
Identifier code	Organization	Professional level	Years of experience
P01	O1	Senior level	10
P02	O2	Executive	18
P03	O2	Midlevel	7
P04	O3	Executive	21
P05	O3	Executive	40
P06	O4	Executive	35
P07	O4	Midlevel	30
P08	O4	Senior level	30

### *Years of Service*

The first demographic category was years of service. The highest number of years of service of all participants came from participant P05, who had worked directly in water policy and water conservation for 40 years. The lowest number of years of service was participant P01 with 7 years of service. All participants met the study's qualifications, and the average number of years of experience was just under 24 years, as noted in Figure 8.

**Figure 8**

*Years of Service for Study Participants*



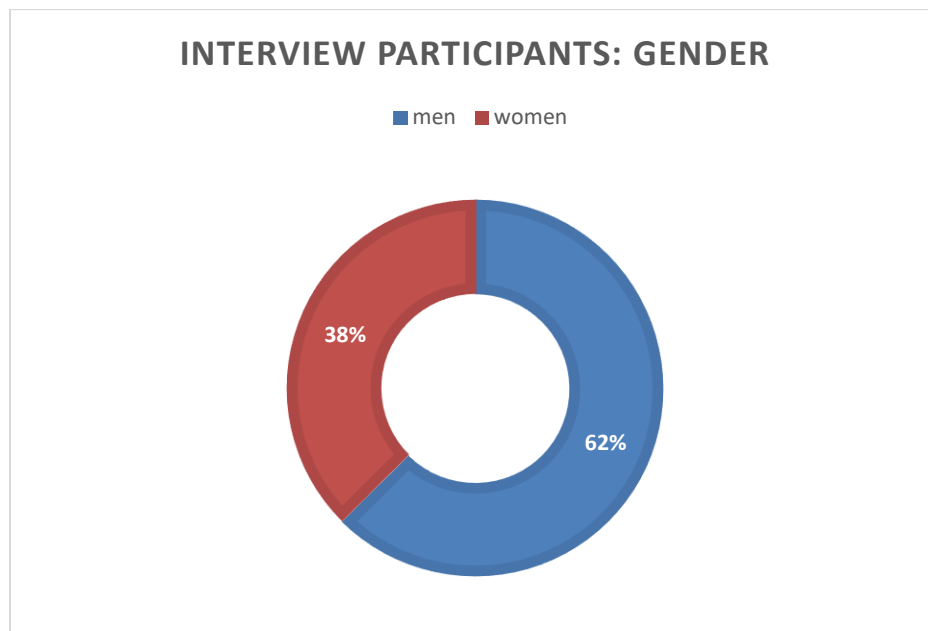
### *Gender*

Although this was not a qualification of the study, this information is deemed pertinent. It shows that regardless of gender, water conservation and water policy experts

can be men and women. Of the eight participants, three were women, and five were men. These results can be viewed in Figure 9.

**Figure 9**

*Gender of Study Participants*



### ***Educational Level***

All participants met the educational requirement concerning the degree for this study. It is important to note that only the highest degree related to the study was considered (e.g., a participant with a B.S. in chemistry and M.A. in finance would only be counted under the bachelor level). As seen in Table 3, this can vary as different organizations write their job descriptions based on their needs. Considering these factors, this study's participants were required to have any variation of a degree that considers water conservation and water policy, such as environmental sciences, life sciences, engineering, or public administration degrees. Education levels were not connected to

participants' coded identities, considering these are connected to the coded organizations for confidentiality reasons. Fifty percent of participants, or four, earned a master's degree in a field related to the study, and the highest degree in the study was a doctorate, which one participant earned.

**Table 3**

*Education Levels of Participants*

Highest academic level related to study	Total number of participants
Doctoral	1
Masters	4
Bachelors	2
Graduate certificate (postbachelor)	1

### **Presentation and Analysis of Data**

Data collected from the interviews and surveys helped the researcher understand the experts' perception concerning water conservation and water policy. Although the surveys opened the opportunity for additional discourse during the interview process, the interviews provided the researcher with a better understanding of their perception regarding the current methods used for water conservation and whether a policy should be written or changed altogether. All interviews were conducted in a manner that kept identities confidential and allowed all participants to respond to the questions freely.

### **Electronic Survey Results**

This section highlights a summary of the survey, *Expert Perception on Water Conservation* (2020), taken by the eight participants. Participants were sent the survey

electronically to complete before being interviewed. Doing this allowed the researcher to gauge the perception many had coming into the interview by answering closed-ended questions. Although the ability to skip a question was optional, all questions were responded to by all participants. As some of the questions were asked to understand how much background knowledge each participant achieved, this section provides an excerpt of the main questions concerning their perception of water conservation and water policy issues. A summary or compilation of the results can be found in Appendix B.

*1. What is your assessment of the current procedures regarding municipal water loss when it comes to water conservation (i.e., hydrant flushing for main breaks)?*

The responses to choose from for this question were poor, needs improvement, average, good, and excellent. Of the eight respondents who took the survey, 75% of these respondents, or six, felt the assessment of the current procedures regarding municipal water loss when it comes to water conservation needs improvement, and two respondents agreed it was average.

*2. What is your assessment on how accessible education of water conservation is in your region?*

The choices allowed for the following responses: poor, needs improvement, average, good, and excellent. Of the eight participants who took the survey, all eight answered. A total of three participants felt the accessibility of water conservation education was average, two participants felt it needed improvement, and two felt it was good. One participant did believe the accessibility was excellent and rated it as such.

Because it contained multiple parts, the next question was broken up into multiple questions to allow the experts to assign a rating to each issue.

3. Please assign a rating 1-5 (1 being least of concern, 5 being very concerned) to the following water conservation techniques or issues:

A. *Changing toilets, faucets, and showerheads to water-efficient fixtures*

Fifty percent of respondents rated this as “very concerned,” averaging a total score of 4.1 using the scale of 1 (being of least concern) to 5 (being very concerned).

B. *Running full cycles of a washing machine and/or dishwasher*

This question received at least one of each rating option, which provided an overall average of 3.1.

C. *Watering lawns ONLY in the morning (regardless of the season)*

Scores for this question ranged from 2 to 5, with the highest number of respondents rating this issue as 5. The overall average for this question was 3.8.

D. *Watering lawns ONLY in the evening of the summer months*

This question had a least one response in each rating, showing the differences among the experts’ perceptions. Half of the responses were in the lower end of the rating (1-2), which showed the lowest concern. The average rating was 2.8.

E. *Overwatering of lawns during the rainy season*

This question proved to be one of the most significant issues many respondents agreed on. The average rating was 4.4, and 7 respondents rated this issue between 4 and 5.

F. *Not following recommended irrigation schedules*

This question proved to be the most significant issue of the survey with an average score of 4.6. A total of seven respondents agreed on scores between 4 and 5.

G. *Saltwater intrusion and flooding*



Fifty percent of respondents rated this as “very concerned,” averaging a total score of 3.9.

*H. Treatment facilities overpumping of water from Biscayne Aquifer*

This issue seemed to be of the lowest concern to many experts, as 50% rated this between 1 and 2. The average score for this question was 2.8. There was at least one rating assigned to this question.

*I. Treatment facilities considering all pumping of water from Floridan Aquifer*

At least one rating was assigned to this question by each expert across the scale with an average of 3.1.

*J. Violations and citations being given for improper water conservation or water pumping*

Although the score was just around average, or 2.9, most experts (75%) rated this question between 3 and 4.

*K. Accessibility of water conservation education for the public*

For this question, half of the respondents (50%) rated this as 5. Although there were ratings from 2 to 4, no respondents rated this as 1. The average for this question was 3.9.

## **Data Analysis**

All interviews were recorded, and closed captions were used during the interview sessions. Once interviews ended, transcripts of the interviews were downloaded and read against the actual interviews to ensure accuracy. Upon completion, the data were uploaded with researcher notes into NVivo 12 Pro. NVivo is qualitative analysis software that can identify themes and codes based on each participant’s responses. This

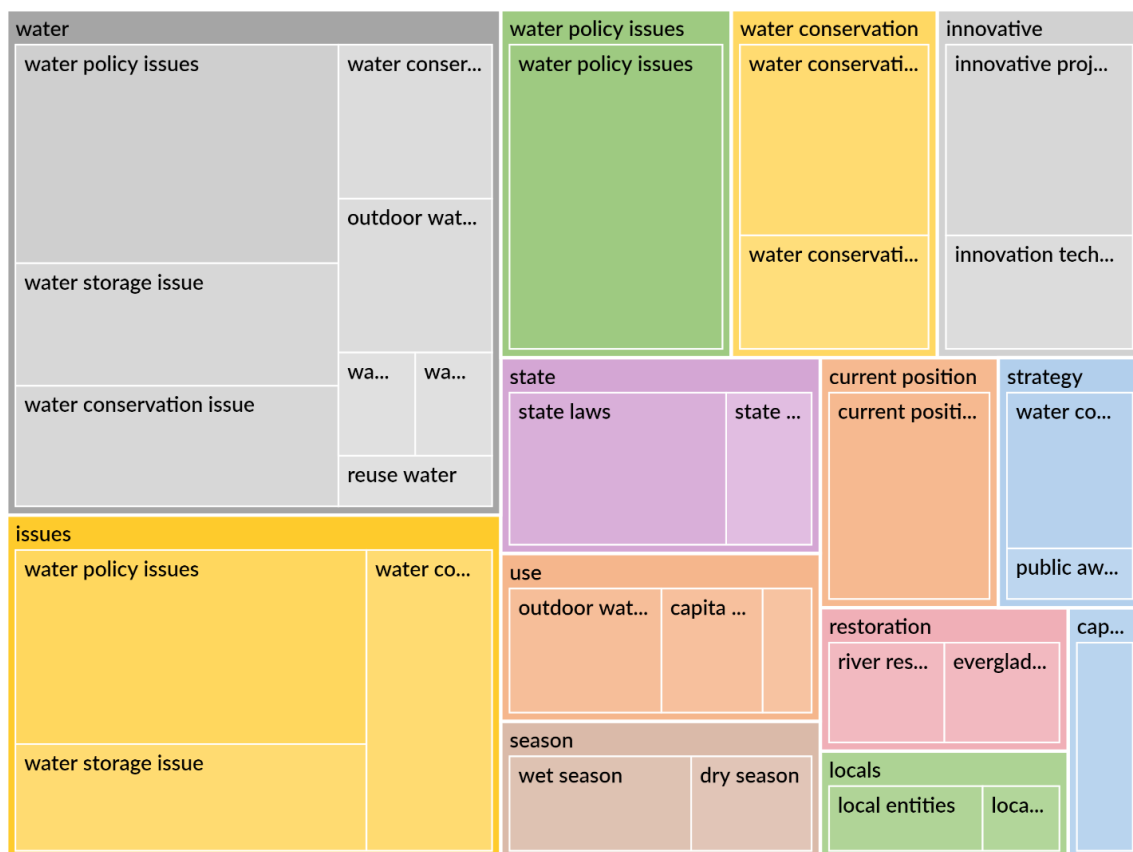
software looks for similarities or relationships that can connect each participant in some form or fashion. No context from the interview transcripts was removed except the questions (to prevent data being skewed). The more popular themes that were mentioned among the participants, as determined by NVivo 12 Pro, included variations of the wording:

- Effective or efficiency—these words came up numerous times when discussing water conservation. Many of the participants dialogued about the need for improvement in residents’ devices and improvement of public outreach programs.
- Water storage issues—some of the participants discussed this issue and felt that improving this area is essential. Although this topic does play a role in the participants’ perception, it is also an issue that would be restricted to utilities and governments.
- Innovation—this would include any form of creation that would cause water conservation to be useful or the practices to be more efficient. Many of the participants discussed changes to building codes and implementation to systems, which would improve what research has shown thus far.
- Restoration—when considering restoration, many of the participants discussed this concerning rebuilding or restoring natural areas. The topic of restoration was mainly applied to the Everglades and different rivers in the region. The connection between restoration and water conservation is at the juncture of the effects the lack of water conservation has had on the region.

The different themes can be viewed in Figure 10.

### Figure 10

### *Interview Themes via NVivo: Different Variation of Words From Participant Interviews*



## Expert Interviews

The following sections present the interview questions as asked to each expert participant,  $n = 8$ , and each participant's responses. A total of 10 open-ended questions were asked to each participant via a virtual delivery platform because of social distancing

measures from COVID-19. With each question, some participants became sidetracked in considering how to respond; therefore, each response may not represent what was said in its entirety, but the researcher applied the portion of each participant's response verbatim most related to answering the question.

### ***Interview Question 1***

Interview Question 1, "How long have you worked within the area water conservation? How long have you worked in your current position?" provided basic demographics of each participant of the study. As shown in Table 2, although every participant held a different position (or title) at different levels within the organization, each position, considering the survey results and the subsequent interview questions, was related to water conservation and water policy. The highest number of years of service related to this question was connected to participant P05, who achieved 40 years. The number of years of service ranged from 7 years to 40 years, and the average number of years was 23.8 years. P06, who has been in the same field for 35 years, was next followed by P07 and P08, who have 30 years each. P04 was the only person who worked over 20 years but less than 30 years, at 21 years. Finally, P01, P02, and P03 had 10 years, 18 years, and 7 years, respectively.

### ***Interview Question 2***

Interview Question 2, "Based on your knowledge, how would you define water conservation?" can be used to address Research Question 1: "What is the perception of the water experts concerning residents' lack of water conservation?" Interview Question 2 explored each expert's view on the definition by having them think outside of what their organization or state legislation considers water conservation. It is important to note

that the Florida statutes do not define water conservation but rather discuss it throughout Chapter 373, focusing on Florida friendly landscapes and water resources. Although responses varied among the participants, all mentioned one of two words that connected their responses: effective or efficient. These words are also used in the state statutes when referring to water conservation.

According to P07, water conservation could be defined as “the efficient use of water resources; would be using water efficiently to maximize and protect water resources.”

P06 shared,

Water conservation must be separate from demand management and source management. The source would be fresh and alternative water; demand is more storage and aquifer related. Conservation is a part of demand management where demand management is used as efficiently and responsibly as possible.

Conservation is more towards efficiency with the lowest amount of water to complete your task, not overusing by encouraging Florida friendly landscapes.

P04 provided his insight on the definition of water conservation and shared,

It is the efficient and cost-effective use of water, using the minimum amount to achieve objectives.

When considering this question, P03 explained how it was possible to become involved in water conservation and how they were the “black sheep” of their family because of a love to save the planet. This caused P03 to change college programs and focus more on open professional opportunities related to environmental conservation.

P03 discussed very similar findings for the definition of water conservation but also added,

I would define water conservation as the ability to use less water to ensure we have water resources for the future.

This statement, coupled with the body language of P03 and the fewest years of service, provided the researcher with a better view of how some experts in the field may do this not just in their professional time but outside of work as well regardless of age, gender, or social status. Participants P01, P02, P05, and P08 gave very brief definitions that targeted effective use and efficient water resources use.

### ***Interview Question 3***

Interview Question 3 asked, “How effective is it for residents to all conserve water on purpose annually?” and addresses Research Question 1: “What is the perception of the water experts concerning residents’ lack of water conservation?” The intent of Interview Question 3 was to gauge how essential experts believe it is for South Florida residents and other parts of the state to be intentional with their behaviors. Although there are restrictions in place for irrigating their lawns, residents may not always seem to follow the orders of higher authorities in this area.

Participant P08 seemed a little frustrated when considering a response to Interview Question 3. P08 expressed,

A lot of people do not understand conservation, which is demand reduction, and how it relates to the water supply or in demand balance and water management in general. You would be surprised how many people say using reclaimed water (source substitution) is the same thing as conservation. From a utility perspective

if it means generating less potable water, that sort of makes sense, I guess. But it isn't accurate.

Additionally, P01 shared,

It is very effective because the change in water use requires a change of habit.

People cannot turn off a bad habit.

The importance of conserving water annually, according to some experts, was not only beneficial for the State and environment, but there were financial incentives for residents as well, which P02 mentioned in the explanation:

It's tricky because there is a wet and dry season in the state. The priority is during the dry season but less of a need during wet season. Water use equates to a cost regardless of it being from a public or from a private well. It's important all year but needs to change especially during wet season.

Besides, P06's passion for this area showed in the response, which stated,

People tend to think more during droughts. Building a conservation culture is important to educating people daily on more efficient practices. Bottom line is if customers do not have an environmental conservationist mentality, they may not do what is right.

For this question, P05 shared,

I think residents should want to conserve water all the time. Aside from having environmental benefits, people who want to conserve water would have lower utility bills. Who would not want to save money? Something must cause residents to save money. In the world of conservation managers, saving the

environment is factor number 1. But for residents who do not share a passion for the environment, money should be a motivation.

P07 asserted,

There are two kinds of conservations: passive and active. Passive is changing appliances or fixtures; active is working with the utility to change water conservation behavior. It is easy to save water if it is effective; what is hard is to make people care enough to do it, not the mechanics of it.

The interviews of P03, P04, and P06 spoke on citations and enforcements not on top of budget agendas because many governments refuse to make it a part of environmental inspectors' or code enforcement officers' priorities.

#### ***Interview Question 4***

Interview Question 4 asked the experts, "Have you ever been involved in a public awareness strategy for water conservation (i.e., conference)?" This question responds to Research Question 2: "What methods are used by environmental agencies and water experts to assist consumers in understanding water policy?" It also responds to Research Question 3: "How can water experts use the strategies that have been implemented to impact the lack of water conservation in the region?"

In answering this question, the experts were put in a position to consider whether they were involved. Still, many began to provide information on how awareness campaigns are only useful if they want the information. This question differed from Interview Question 8 in that it assessed how the experts were directly involved in the promotion of water conservation to the public through their direct involvement. P01 discussed the enjoyment of being a part of the campaigns during the years in water



policy. However, being at the senior-level in the department, P01 does not see them as often as before as planning is the side worked on now, compared to being actively engaged with the residents.

Being in middle-level management, P03 shared the following experience:

Yes, that is 95% of my job. We have an outreach consultant I work directly with to make campaigns for awareness, rebate programs, showerheads, aerators, and general conservation. But outreach and water conservation are majority of the job.

P02, who works in the same organization, shared an experience from an executive-level position:

I have been involved in planning that becomes outreach programs where the public can play games about water conservation, climate change, sea-level rise, and environmental restoration. I have also had the honor to do presentations about sea-level rise and participate in Waters Matters Day and assist in many tree giveaways.

For P06, public awareness strategies are different, which was explained:

We are a regional government, so there are no customers. We put out advertisements to promote water conservation. Around 2000, it was more popular. There was an ad with a man watering his lawn and made it a lake. It was very powerful. As of lately though, advertisements have lowered, mainly because it has become more of the utility's responsibility. The higher priority in my department is focusing on Everglades restoration and alternative water supply. With conservation, you must depend on human behavior. So alternative supply is

what is one of the campaigns being promoted. Local governments are committed to water resources and water resiliency.

Because P04 expressed the newness of water conservation within the organization, it was shared,

Because my organization is new to creating an ordinance for water conservation, there has been a little education from elected officials to educate the public on the issue. I do speak about it when I am out somewhere, but from a professional standpoint, I have not been a part of anything to speak publicly.

P07 expressed a great passion for public awareness. As shared, it was enjoyable being actively involved in educating the public. P07 added,

I have been a part of a program similar to WaterLess, which is a public education campaign on less water use outside. I also did some part-time work with direct outreach with students and with WET (Water Education for Teachers). I worked with teachers mostly as opposed to going classroom to classroom. This would allow the idea of conserving water be reached in a greater capacity.

P08 also shared of a time of being actively involved in a public awareness strategy:

Before I got to where I am now, I worked with The Legacy Program, where myself and others in the field worked with middle and high school kids and brought them to different land spaces to understand land management skills. A part of the learning was caring for the land, which included water conservation and using friendly plants. It was a service- learning program to teach them about

the natural resources and environmental. The focus was more on gifted and lower performing kids because they tended to be more skilled in nature.

P05's response to this question was more involved with speaking in conferences and meetings, but nothing to the extent of being open to the public. P05's experiences were more involved with other managers and directions in the industry. P05 shared,

Through the information I provide to them, I would hope they take it to plan the programs we have and teach others around them.

Although P01, P04, and P05 held positions in their organizations that were higher in their respective professions, all did at least acknowledge that they spoke about saving water or water policy outside of the workplace.

#### ***Interview Question 5***

Interview Question 5 asked, "How would the help of other government agencies and municipalities change your perception on how consumers conserve?" This question responds to Research Question 2: "What methods are used by environmental agencies and water experts to help consumers understand water policy?" When considering the agencies used to find experts, three are more local level in the form of county governments. The municipalities that fall within these three county governments' jurisdictions can interact with their local city and town governments. However, the state-level organization in this study, SFWMD, as a representative of the state, has no jurisdictional restrictions because all three county governments fall within their boundaries.

When asked this question, P08 responded,

I think it is very important to have the help of other governments and agencies involved. I have been in many meetings with utilities, farmers, and irrigation professionals, even other water management, State, County, or municipal staff, where it is clear we just are not on the same page as far as understanding broad concepts of water management and resource protection.

The idea of networking and collaboration seemed to be a broad topic of importance to many experts. Many experts felt that it would make a difference when working with other governments and agencies. P07's response was as follows:

I believe that collaboration is important with conservation. When a permit is issued to pump water from the aquifer, the users are required to come up with a plan regarding water conservation. Everyone in Florida has to implement a conservation plan; you have to explain how and when you're going to do it.

These permits don't state a quantification component. I wish it stated how much water will be saved or the goal to be saved. It is meaningless without a quantity.

Quantification was also something mentioned by other experts. P04 stated,

I think that the County has a certain rule in enforcing its ordinances, but a lot of it comes from the state to control overallocating.

P01 shared,

It makes a difference because when SFMWD partners and controls the water resources available to our area through permits, it is very important because they are versed in water conservation. But the message has to be repetitive: during droughts, it is consistent because everyone is affected. But right now, it is not.

P02 discussed how her organization had been the “helping” government to many other governments. P02 shared,

I have set up a water conservation conference that plans to meet quarterly in the area to assist and network with other governments to learn tips and tricks. I typically try to bring a speaker who can talk on the topic or present to the whole group about what works or don’t works, and it has been very successful in building programs in their regions. There is no [academic] degree in water conservation because we have to figure this out together.

P03, P05, and P06 expressed the importance for governments to assist each other and be in one accord at the different levels. Not following each other’s lead could send mixed messages to the public. P03 expressed how federally, if one agency creates a policy that affects another agency’s response to change, the public’s response may be that they do not care. P03 shared,

WaterSense, a part of the EPA, helps to be a guiding light to set the standards for what is considered efficient fixtures, and with outdoor conservation, they provide tools to do better outreach. Because of that, I feel like I have some “teeth” to help with the message. It gives me a better understanding of water conservation.

From the state, SFWMD provides grant funding and a liaison from the state, and they are a collaborative resource.

P05 expressed,

Having a consistent message is important. Hearing from different sources is important. For example, hearing it from the DEP, then SFWMD, then Broward then the City is important. If local governments can create ordinances, it would

create the change. Issues like saltwater intrusion and sea level rise is not an issue of just the town, but governments everywhere need to come together if anything is going to work.

P06 asserted,

We have model ordinances that we provide to local governments to help with the water conservation policies they want to create, although there is some resistance to it. For us, it is more outreach communication, but local governments have to enforce what they are ordering in their laws, which is more surrounded around funding, and local governments do not have the resources for this.

#### ***Interview Question 6***

Interview Question 6 asked the experts, “Do you converse (or network) with other individuals outside of your organization, concerning more efficient methods for water conservation?” This question answers Research Question 2: “What methods are used by environmental agencies and water experts to help consumers understand water policy?”

Interview Question 6 explored the techniques used by the experts to better their understanding of water conservation and create more opportunities within their organization. During the survey, the experts’ knowledge was assessed, and all eight felt their knowledge was on the level of being very knowledgeable on the issues and policies in their region. So in networking with other professionals in the industry, one can assume that the experts’ perception plays a pivotal role in communication.

P02, P04, P06, P07, and P08 all mentioned in their responses that they networked outside of their organization with other professionals who are a part of the American Water Resources Association (AWRA) where meetings are held throughout the year and

discussions are held on state laws, innovative projects, and ways to improve water resources. Additionally, P04 shared,

We have the County water resources task force which is made up of county commissions, public utilities staff and agricultural residents, and we coordinate with them a lot to organize plans with the commission for future projects.

P02 shared,

I network with other resource management professionals in the county to the extent that we discuss resiliency. We are looking to create more policy for building codes that will require structures over 20,000 square feet to be required to have energy and water-efficient fixtures.

P08 added,

We also converse with local utilities to have a basic package for water conservation for the permit requirements. We also meet monthly with other groups to discuss the topic and how things can become more efficient.

In sharing their networking experience outside of the organization, P01 and P05 and P06 were able to discuss how they network with an outside organization known as Alliance for Water Efficiency (AWE). This organization is known to create tools that assist with water conservation and ways to become better at it.

P06 shared,

These coordination meetings help with utilities who do not have a conservation officer or coordinator.

P03 shared,

I usually attend at least one conference a year to have conversations about environmental conservation or public outreach to get people to change their behavior. This year has been different due to COVID-19, but I have attended many webinars. I have also used other research from other professionals to expand on water conservation behaviors. I have recently started networking more with O4 on water conservation and to understand better water-use.

### ***Interview Question 7***

Interview Question 7 was a two-part question, which asked: “What is your perception of how consumers conserve water? In what ways do you feel consumers can be more efficient in water conservation?” The first part of this question leads to Research Question 1: “What is the water experts’ perception concerning residents’ lack of water conservation?” The second part of this question addresses Research Question 3: “How can water experts use the strategies that have been implemented to impact the lack of water conservation in the region?”

Interview Question 7 was a question that caused the experts to consider what historical data have been reporting recently but also to shed light on what they know from their overall experience. The responses for this question came with mixed perceptions. Much of the data released reports from many of the agencies that contain an overall depiction of the region. Many of the experts decided to praise those regions that have been doing well with conserving water. For example, P01 shared,

Annually, O1 calculates the per capita water treatment plant usage as it is released into our distribution system and this number is divided by household use. From



what I have seen in the last 10 years, the numbers have lowered more than other decades where people have conserved water in the county. I think a major part of that has to do with more water efficient fixtures and appliances being installed, people are becoming more educated on water use through outreach programs, and financially it is becoming more expensive to purchase water.

P04's response seemed to be aligned with P01. P04 stated,

I think, in general, we are seeing a good trend over the decades. People understand how to use water better, such as leaving the water on while brushing your teeth or washing dishes. People have changed their practices and water ethics on how to do better within the house. Outside is a different story, because residents want vegetation that require a lot of water and the practices can be better there.

P05 shared,

I feel like over the years, demand has placed limits the amount of water needed. Over my entire region, it seems like we are doing well as a whole. But if we had to look at it by sections, I would say the biggest users who are not conscience with conserving are the coastal communities, simply because may have larger homes and more wealth; I do believe economic factors play a major role in determining the outcome.

P02, P03, P06, P07, and P08 were the experts who decided to share their perception, so that shows much improvement can be made. P03 expressed,

I do not think most people are saving as much as they can. Based on conservations I have had with people or observations, people act like the water is

never-ending. So, people who are not conservation-minded will leave the water running or rinse the dishes 100% before putting it in the dishwasher. I have friends that always refill their pool for no reason or take 20-minute showers. My perception is that people do not understand how much water they are using because they do not feel they are affected.

Sharing a similar perception, P07 stated,

People are oblivious to conserving water because water is so cheap. When you have a busy life, you tend to take advantage. There is no need to conserve, no motivation to conserve, and in Florida, where it rains a lot, you tend to not focus on water use.

P06 shared,

It is good, but residents can do a lot better. I would say it is location-specific. For example, Miami-Dade and Broward drive a lot of the numbers of water conservation in South Florida. Tailoring a water conservation program to the demographics of your utility would be a start in many cities. Some places, such as Boca Raton, have a “no staining” rule that prevents irrigation from nonpotable water due to the high iron levels in this water, which leaves those brown stains on homes.

P02 shared,

Indoor conservation, if done right and every member does it, will only scratch the surface. Outdoor conservation is more important than indoor because that is the bulk of water use. There is room for improvement, and we are doing ok, but it all depends on specific areas.

P08 expressed frustration as there was passion about their profession in water conservation. P08 shared,

I do not think it is a perception thing; I think it's operating from a common knowledge base, which in many cases is not there for residents.

Although some experts felt that their region was headed in the right direction, survey results showed significant issues concerning water conservation focused on outdoor usage, which was aligned with some of the responses to this question. Overall, this question seemed to allow a consensus that there is work that needs to be done.

### ***Interview Question 8***

Interview Question 8 asked, "What is your perception concerning the amount of educational material available to the public for water conservation in South Florida?"

This question responds to Research Question 3: "How can water experts use the strategies that have been implemented to impact the lack of water conservation in the region?" This question was very similar to the electronic survey question, which considered the accessibility of water conservation material for the public. This topic was asked on both mediums because the survey was closed-ended and received over 62% of the responses stating it was a serious concern. The researcher felt it was important that the experts be more vocal on their perception of this issue.

These questions also garnered many mixed feelings as the experts shared their perceptions. P07 discussed how she did not feel that the way the education or materials are being delivered today is as effective as it once was because of the way technology has expanded. P07 shared,

There is lots of it. In terms of effectiveness, it is not effective. We are just now using social science research to send the message. According to research, people are more influenced by peers and family, so the social circle is important if we will ever get any messages across.

P02 shared,

We have done a poor job in the last couple of years. As a state, Florida can do a better job, and I mean this can be from a policy view, such as changing building codes to be EPA WaterSense labeled, for example, and then placing labels for the public to understand why that fixture is important. I have heard of other places having mandates, such as Georgia and North Carolina. It is unfortunate that Florida is behind the curve.

P04's perception spoke on how social media and technology is the new way to go.

However, agencies would need to draw their audience in. P04 shared,

I think there is so much content out there. I mean, you can Google anything. In the end, it is really up to the resident to take the time to look for it, or agencies sharing it using the right delivery methods. Overall, I would have to say it can be better. Social media helps and sending out flying with bills or reminders, but it can be better. But you have to be careful because people might feel overwhelmed with the amount of content on social media.

P01 shared a similar perception:

There can always be more, and there is never enough; budgets play a major role in this; but overall, I believe water conservation material is available for South Florida, but it can be better.

P05 stated,

I have done some work in my early years in Colorado and California, and compared to areas in the Western U.S., we are doing well; however, during seasons where numbers are off, such as a rainy season where there is not as much rain; or a dry season, where there is more than usual rain, people can learn to not water or water more effectively and efficiently through proper education, such as bills reminders, emails, and website content.

P03 discussed that in one's profession, the topic of education is essential, and this is an area that she is always trying to "figure out." P03 shared,

The amount of material is fine, it's there. It's the people that do not have the desire to want the material. That desire is not there. So that is the challenge for me: how do we reach a larger audience? The idea of conservation has shifted to focus on lower to moderate-income families, in my opinion, due to pricing but do not conserve for the importance and why it needs to be done.

P08 shared,

If I could just grade it, I would give it a "C" or "D," at best. I mean, I have seen that most utilities in this area have nothing on their website, even with permit requirements for water conservation. And very few utilities have an active presence on what water conservation can do, and making that information available is important.

P06 shared,

It needs improvement, especially on making it more available. Googling something is easy, but people need to want that. The problem is with the utilities

and how they try to educate people. Some places will redirect you to the regional agencies, like SFWMD, rather than invest local resources to make it tailored to their areas.

Considering the responses to this question, it was clear why the experts provided the ratings they did on the survey. Once interviews concluded, the researcher took the time to view many local city websites, and much of what was shared was confirmed. Some sites redirect one to SFWMD or even to the USEPA website. Many sites did not provide any information on water conservation.

### ***Interview Question 9***

Interview Question 9 asked, “What are the major shortcomings of the current approach(es) used by regulators to conserve water?” This addresses Research Question 3: “How can water experts use the strategies that have been implemented to impact the lack of water conservation in the region?” Throughout the interviews, many experts openly shared ideas that could be done better or provided ideas that they would like to see implemented. This question allowed the experts to focus only on that and allowed them to share what could improve.

The preinterview survey probed the idea of some topics that have come up throughout the literature many times, such as hydrant flushing by water utilities. Although this example is necessary for system maintenance, using treated drinking water to flush out undesirable particles inside a water main can be difficult for residents to understand and frowned upon because it is more inefficient than residents’ overuse of irrigation systems (Bentley & Wilkinson, 2018).

In this regard, P03 discussed how the federal government added to the list of shortcomings. P03 shared,

I would have to go back to the federal government having some agencies not using science. They have put out information that WaterSense doesn't work effectively when there are clearly studies that show they are efficient. It puts us back 20-something years.

P02 response also discussed the federal level:

The federal government is looking to remove regulations that are in place.

Locally, many utilities are not structuring water rates to encourage water conservations, which would be the preferred thing to do if this is going to work out. They have base rates that are so broad with the structures. The next tier after the base rate becomes cheaper per gallon as it is used, so this doesn't encourage conservation. The district is encouraging a different structure to encourage residents.

P07 mentioned building codes being a topic of importance. P07 added to the discussion of the water rates and shared,

The cost of water is important. Rules require a tiered billing system to be a little more restricted so that water used beyond essential use cost more. And all the conservation in the world isn't going to cause people to save. Unfortunately, there are private utilities in the billing system to make water and money, not to mention that politics play a major role.

P04 discussed how many residents place more emphasis on the front lawns of a home as opposed to the back yards, and this is because this is the area that not only can everyone see, but what homeowner associations (HOAs) regulate. P04 shared,

Obviously, a better ordinance and education for the public is one of the first things that need to be addressed. But approaching it from a nonpenalty standpoint may be best. Regulators should also allow more greywater systems to be used, where buildings can reuse water from certain appliances.

P04 continued to add,

HOA and the landscape requirements in common areas or at homes, such as 80% turf grass in the front yard, needs to be mandated. Now some have those, like where I live, but it's required by the HOA, and a lot of this doesn't exist on a larger scale from the government, so changing those requirements would really help in this region.

P08 shared,

It's about more innovative techniques, and whether it is building construction or new residential homes, it would drive indoor and outdoor water use. There is never a "silver bullet" to solve the problem, so agencies are forced to handle it a little at a time, such as converting an entire city to reuse water is not cost-efficient, although it may be cost-effective. To me, I think Florida has a water storage issue, not so much of a water conservation issue, but when the water isn't stored properly, the issues begin to flow to other areas.



P05 mentioned how the playfield surrounds politics on many things, hence why he believed that the current issues many agencies face is not directly due to operational or administrative issues, but indirectly to politics. P05 expressed,

Politics being involved affects water rates because constituents complain to their officials of high-water rates. Regardless of the price of water is, residents, do not always want to conserve because it's not a priority to them. And if they could be fined, the complaining would continue, and it becomes political all over again.

P01 discussed how one of the significant shortcomings is the lack of attention given to budgets. P01 shared,

Budgets are a factor; money is a limiting factor, and only so much can be spent on water conservation on the utility side; on the consumer, side water is inexpensive and subsidized, so it puts many agencies in a position where our hands are tied. And from the operations side, projects that focus on relocating many wellfields to prevent saltwater intrusion need to be emphasized. But all those need money, money, money.

P06 spoke on what has been seen during their tenure as an expert in the industry. Through experience, P06 spoke on irrigation systems and the rain sensors that come with some systems. These sensors are in place to inform the system to turn on or off and can be deemed necessary in many parts of Florida where rain can happen multiple times a day throughout the year. P06 shared,

In many places, there are no maintenance requirements for things like rain sensors, which is a big problem. These fixtures deteriorate in irrigation systems,

so when residents have timers, the systems don't know when to shut off, or even worse, don't know that it shouldn't come on.

P06 added,

We have not raised conservation high enough to be a goal-based program. We can do a better job promoting conservation and trying to resolve the inefficient use of water. If users meet the five requirements to get a permit in our region, it is allowed, but is what they submit really efficient to conserve water?

### ***Interview Question 10***

Interview Question 10 asked, "Are you aware of any water conservation management strategies (in Florida or outside of the state) that your region can emulate? If so, who?" This interview question responds to Research Question 2: "What methods are used by environmental agencies and water experts to assist consumers in understanding water policy?" It also provides an answer to Research Question 3: "How can water experts use the strategies that have been implemented to impact the lack of water conservation in the region?" This interview question provided the researcher with the accurate perception that these experts had concerning how water conservation is handled throughout the state by making recommendations through a comparative perspective.

By considering the previous responses, many of the experts took the time to elaborate or restate many of the points mentioned before. Many of the experts mentioned, with this response, things that other experts may have mentioned previously. P06 discussed AWE and how he felt many utilities in the region were not a part of the organization. P06 asserted,

There are tools used by the Alliance for Water Efficiency that can be used more to create supply plans. This would be beneficial for every utility. Of course, financial assistance, such as cost, is a driving factor, and many places just don't have the means of doing what needs to be done. I think if we move forward like some states, we can see big changes. Places in California have really innovating programs that they use; They also have saltwater intrusion barriers near their coast. Las Vegas is another place that have buyback programs to buy back grass. Because they sit in a desert, this lowers the need of water to meet economic demand.

P08 shared,

Many technical discussions concerning improvements have devolved until one party figures out the other party just doesn't have good base knowledge on the subject. That is true not just about water but in almost all areas of life. Not sure how we solve that. I think one thing nice to see would be utilities doing leak detection for water loss or reducing the amount of line flushing they have to do to keep their disinfection levels up.

P04 shared,

Enforcement actions is one of the first things out of the gate, somewhat of a non-code violation. In some places, it's either too much enforcement or none at all.

I'd also like to see more attention given to more education from the experts.

P07 expressed concern over HOAs being blamed for the lack of water conservation and policies in the region. P07 shared,

We got to stop displacing responsibilities on places like HOAs and begin enforcing and giving more citations or violations if needed. Every state is unique. So, one is enforcing landscape irrigation rules to be constituent: 2 days a week or 1 day a week rule. Local governments adopt the rule, but no one enforces the rules. Number two is landscape irrigation evaluations: looking at the systems and teaching residents to use the controls in relation to the landscape and proper fixtures. Last, there should be more rebates for smart irrigation controllers, such as those tracking soil moisture or evapotranspiration.

P01 discussed how one would like to see a change in software used by their organization and throughout the region. P01 shared,

AMI meters and customer engagement software– advanced meter infrastructure is the way to go- they use meters that read hourly through a cloud as compared to a monthly read. This would allow consumers to track their own usage, similar to the dashboard for energy used by FP&L. Customers can see real-time use to target engagement to conserve water, and it also provides strategies and tips to lower water usage.

P03 spoke on the recent advancements of technology and what they would like to see implemented. P03 shared,

Outside of Florida, there are a lot of different agencies who have adopted the WaterSense 1.28 gallon for toilets, which is below the federal level. Other places also have turf removal programs that evaluate your lawn and help to get rid of sod and replace them with better plants that use less water.

P02 shared thoughts on better enforcement and felt that HOAs should become better regulated by local governments to assist with water conservation. This was considering the fact that many have large amounts of green space in their common areas.

P02 shared,

Stricter monitoring of outdoor irrigation requirements with code enforcement should be better everywhere. I'd like to see municipalities place more emphasis on this and tighten the rules on repeat offenders and possibly create more education on water conservation. Governments are on a tight budget right now, so it's only a thought, but it would be nice if it became a real plan.

P05 shared,

I would like to see more Florida friendly plants, which should be a program to certify your yard in HOAs. Also, the promotion of water irrigation systems to be used less water in wet seasons and adding more enforcement. I don't know if this exists, but it would be nice to see training programs for landscape businesses so that they can provide education to residents on watering the lawns.

### **Summary**

Chapter 4 discussed the findings from the in-depth interviews of 8 experts in water policy who voluntarily participated in the phenomenological qualitative study on water conservation. The purpose statement and research questions were restated from Chapter 1, and the research methods and data collection procedures were discussed. Within the latter section, the sample description and participant demographics were examined, paving the discussion of the electronic survey results from the qualitative tool *Expert Perception on Water Conservation Survey*. The final portions of this chapter

deciphered the participants' interview, in which 10 open-ended questions were given. These results opened the discussion of different water policy issues and water conservation, which were found in the interviews. Direct quotes from participants were given to corroborate the data collected.

This study's findings illustrate that every agency or form of government does not agree on all matters concerning water conservation. There are many different views and ways issues can be handled, but there is no definite solution to such a wide-scale issue at this time. The experts used in this study expressed how enforcement is vital to water conservation's overall effect; however, budgets play a significant role in determining the amount of enforcement given. Understanding the pillar of Politics–Administration Dichotomy created by President Woodrow Wilson is a necessary one. Montjoy and Watson (1995) discussed the objection of mixing politics and administration because it is twofold: it interferes with the accurate expression of the will of the state, and it interferes with the efficient administration of that will. These problems came from people voting based on discrete personal benefits as opposed to principles.

This study also demonstrates that the experts perceived that education, mandates, and residential lifestyles, or habits, were the drivers to the lack of water conservation. The experts expressed through the survey and interviews how the amount of material available to the public is present; however, two problems exist: the public's desire to receive this education and how this education is given. Living in a time when technology is one of the dominating forces around the world, it must be how many agencies go if they are going to attract residents to the importance of water conservation.

## CHAPTER 5: FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

Water conservation is a heightened concern across Florida, specifically in South Florida, as the population increases with increased water resources demand. Many water departments and utilities have already begun to turn toward alternative water supplies. Still, although that transition is imminent for many, it may be just a mere thought for municipalities that cannot seem to make it a part of their annual budget. As water conservation becomes more of a concern in some areas, more enforcement would have to take place to ensure the practices are taking place. Chapter 4 presented a detailed review of the interview questions and participant responses and an analysis of the findings. Chapter 5 includes the conclusions reached, recommendations for the possibility of additional research, and a summary of the study.

### **Purpose Statement**

This study expanded on the knowledge of experts in water policy for water conservation and sought to understand what could be causing the residents' lack of conservatory practices. Although the entire region is advised to practice water conservation, this study did not assume that water conservation lacked in every area of the studied region. This study explored the policies implemented in the region and lived experiences of the experts. It also considered the behaviors and attitudes of residents perceived by the experts and what they are doing in response to the lack of water conservation and the practices used. Current literature revolving around water conservation focuses on the need for irrigational uses or mostly comes from the resident's perspective. Therefore, this study would help advance the understanding of this topic

from an administrative perspective by considering the experts in water conservation and water policy.

### **Research Questions**

This study was guided by three research questions that were addressed during the data analysis of this study. The following questions were derived from the study's literature and used to guide the research:

1. What is the perception of the water experts concerning residents' lack of water conservation?
2. What methods are used by environmental agencies and water experts to assist consumers in understanding water policy?
3. How can water experts use the strategies that have been implemented to impact the lack of water conservation in the region?

### **Methods**

This study was guided using a phenomenological qualitative approach. Because this study focused on water conservation and expert perception, reports and logs from agencies monitoring the issue were used. In addition to historical data, expert participants were interviewed through elite interviewing. This study used the experts' lived experiences about what they focus on concerning water conservation and water policy through their professional experience in the field. Before conducting the interviews, all participants were sent an electronic survey formed from many of the literature's issues. The survey was designed to provide an insight into their perception of these issues. It also allowed the researcher to compare these expert views.



## **Population and Sample**

The population for the study encompassed the tri-county area of South Florida. It was determined using the Biscayne Aquifer system layout, which underlies and has provided water to this region well before many utilities and water departments decided to switch groundwater wells for the Floridan Aquifer system (see Figure 2 in Chapter 2). The tri-county area region is made up of Palm Beach County, containing 39 municipalities (see Figure 5 in Chapter 3); Broward County, containing 37 municipalities (see Figure 6 in Chapter 3); and Miami-Dade County, which has 36 municipalities (see Figure 7 in Chapter 3). These three counties have governments that serve as the regulating agencies for the municipalities within them. Additionally, they report data to the Florida DEP and the SFWMD, which serves as a regional agency of the FLDEP.

Experts were selected from each county and SFWMD. This sample consisted of one from O1, two from O2, two from O3, and three from O4, two from O1. As mentioned in Chapter 3, Miami-Dade, Broward, and Palm Counties control their water distribution and create water policy. However, because SFWMD has no distribution, they were used in this study because they enforce state policies and assist other agencies with their water conservation plans based on permit requirements. The sample selection was collected using purposive sampling to ensure that each expert met the criteria needed for the results' more excellent reliability. The criteria of the experts for this study were (a) expert's title must contain any combination or variation of the word(s) manager, director, supervisor, or specialist; (b) expert must have worked in water conservation or water policy for a minimum of 5–10 years; (c) expert must have at minimum a degree in

a field related to environmental science, engineering, or public administration; and  
(d) expert must be over the age of 18 years.

### **Major Findings**

Although this study focused primarily on water conservation, one of the more significant issues concerned water policy. Through the adoption or creation of different policies in many regions, water conservation has seemed to get better throughout the years, as noted by the experts; however, there is still room for improvement as many experts noted. Historical reports, although they show some sections of a region headed in the right direction, still show the need for the implementation of a more widescale policy. The need for improvement would have to be on the administrative side, concerning the marketing and promotion and the budget and funding of programs and enforcements.

### **Study Conclusions**

Eight participants responded to the 10 interview questions, which were designed to answer the three research questions. Participants shared their perceptions and opinions on residential water conservation from the administrative standpoint but used information from their own professional experience. Chapter 5 provides a detailed discussion of the study results and recommendations. This phenomenological study aimed to provide information on a vital and under researched area of water conservation. Much of the literature focuses on residents and mainly from the perspective of irrigation or agricultural needs. The results from this study can provide water managers, public officials, and professionals in the utility business with information that can assist in developing strategies and tools that can lead to better practices and habits among residents and businesses concerning water conservation.

Three research questions provided the foundation research for this study. The research questions are as follows.

### **Research Question 1**

*What is the perception of the water experts concerning residents' lack of water conservation?*

This research question was answered through the interviews from Interview Question 2, Interview Question 3, and Interview Question 7. This question provided many different perceptions from the experts as some felt that overall, their region was not doing wrong compared to other regions. However, many of the experts did have opposition. They felt that overall, regardless of the numbers, a need to become more efficient in the techniques being used, apply more effective practices, and educate residents better was critical.

Most of the participants felt that socioeconomics played a significant role in water conservation. For example, P01 discussed how water conservation was tied to one's habits. In areas where the grass is greener and the houses are more extensive, residents are more prepared to pay for high water usage because there are funds to maintain the lifestyles. These same residents tend to lack an understanding of conservation. In comparison, homes in more low-income homes tend to do well with saving water; however, it is not necessarily tied to practicing water conservation. These savings were noted in the Interview of P03 who dealt with many low-income families. Her understanding of these residents is that they do not save on purpose for the environment as the primary reason, but rather save water to keep their water usage down. The lower

usage turns into monthly savings on their utility bills. The environment benefits as a secondary result due to their primary reasons.

Aside from the residents' socioeconomics, many of the participants believed that residents are not always doing the best that can be done when water conservation is the goal. Interviewees spoke on the need for more efficiency in the form of different irrigation devices, one being soil moisture sensors that can measure how moist the soil is. According to the participants in this study, improvements in the technology of these types of devices would allow irrigation devices to know the level of moisture in the soil and whether the grass needs to be watered. Another recommended outdoor device was evapotranspiration sensors, which can detect the amount of evaporation taking place. These would also tell irrigation systems to turn on or change the amount of water being used.

## **Research Question 2**

*What methods are used by environmental agencies and water experts to assist consumers in understanding water policy?*

This research question was answered through the interviews from Interview Question 4, Interview Question 5, Interview Question 6, and Interview Question 10. The participants of this study felt the more important issue here was the allocation of funding. The topic of time and budgets came up in more than one interview, which has caused the researcher to understand that time and money work together to promote water conservation. Participants spoke about their involvement in outreach campaigns although promotion to higher levels restricted this. Those at higher levels in their organization said they were involved in planning the outreach.

Participants indicated that networking outside of their agency was an essential aspect of their job as this helps them to understand better what can be done in their regions. P03 mentioned how she was recently working with SFWMD more to help her understanding of different issues. When speaking with the experts of SFWMD, it was evident that there was a level of frustration coming from the lack of understanding of water conservation. This frustration could be partly because the utility side of water policy views conservation differently because they are more in the business of providing water than an agency like SFWMD that works solely to promote conservation and preserve the State's natural resources.

Many of the participants' public awareness strategies involved more face-to-face contact with residents and the public. These strategies could be challenging even more now as the world transitions to a new normal of social distancing measures from viruses. Reaching the public would need to go back to the planning phase. As mentioned by P04, overwhelming social media with messages of water conservation does not necessarily constitute that the message is getting across.

### **Research Question 3**

*How can water experts use the strategies that have been implemented to impact the lack of water conservation in the region?*

This research question was answered through the interviews from Interview Question 4, Interview Question 7, Interview Question 8, Interview Question 9, and Interview Question 10. Participants shared their thoughts, opinions, and ideas throughout the interview process concerning what was asked. One of the main things concerning this Research Question was the need to educate the public in a better way. Some of the

participants did feel that the material was there. After all, anyone can go on any search engine and be directed to different websites or articles revolving around water conservation. But these experts felt that the need for material could be better in two ways: one is in the delivery; the second is in the content.

During his Interview, P06 spoke on the commercials that were released from his organization in the past. Over time, it was expected that each municipality would deliver this same form of content out of its budgets. In listening to him speak, the researcher understood the need for the advertisements. A water conservation promotion message would have to be necessary for each municipality as it regulates them. It is no surprise that it was also mentioned that each municipality should tailor its water conservation programs specific to its area. This response helped the researcher understand why reports can show a county doing well as a whole, but when put under a microscope, different municipalities and cities were not achieving the same results as some of their neighbors within the region.

Aside from the focus on water conservation through proper irrigational practices, many participants felt the need to express that residents can do a better job in conservation of water in the home. Although it is not as big of a water user as irrigation systems, any change to conserve water would have an impact, mostly if done consistently by many homes. The use of more WaterSense fixtures would be a good start to many homes, as reported by the experts. These have become more effective than when they first were introduced, and according to P03, reports show they work. Implementing proper strategic management in buildings with retail and space could be an essential part of the change recommended by P01 and P04.

Additionally, many of the experts felt that the need for more enforcement was critical. P05 recommended that enforcements be the way to go if voluntary change does not happen consistently. Although Florida-friendly plants' topic is discussed in Florida statutes concerning water conservation, many experts felt it was pointless because residents are being allowed to get away with not using the "friendly" plants. Participants agreed that most local governments are not creating ordinances aligned with the legislation because it is not a problem to them or their budgets do not allow for it. However, it could provide additional funding somehow.

### **Implications for Action**

After careful consideration of the results from the research questions and responses of the eight participants for the survey and interviews, it appears that there is an increased desire from experts in this industry to see a continuous trend that shifts in the direction that benefits the environment while allowing residents to still enjoy the benefits of using waters.

#### **Implication 1**

According to the experts, if residents desire to have lovely green lawns, they should get their irrigation system inspected by a professional and certified to show that it has been checked. These inspections can be one of the many programs that different utilities implement across the region to save water but offer residents the opportunity to receive additional savings. The amounts and frequency of the inspection can be determined on a case-by-case basis, but having something in place could be what many residents need to motivate them to turn the bad habits into the type that experts want to see. Governments across the region should also experiment more with alternative water

supply (AWS), as mentioned by some experts. Using reclaimed water instead of treated drinking water for irrigation would help in conserving the amount of water stored and used, but research shows that the nutrients in reclaimed water can be better for lawns. Because this would come at a cost, officials may want to research the cost of either building reclamation facilities or renovating current wastewater facilities to include this treatment function. Combining this into the education that is recommended for the public could be a way to place this on voting ballots requesting the approval of tax increases to raise the necessary funding.

## **Implication 2**

Another implication that can be drawn from this study would be creating a pilot program by which municipalities with the budget begin to allocate funds to create enforcement plans. Initially, this can come in the form of citations and violations for improper use of water outdoors. This can also be coupled with a more punitive tier-structured system to prevent overwatering. Because there are year-round restrictions in place, the experts in this study confirmed the literature by agreeing that many do not follow the assigned irrigation scheduled for their regions. The experts also confirmed that many residents who can afford the high use of water do not seem to be as conservation-minded, which does not affect them when their water usage moves into high tiers.

Therefore, this could become the start of the necessary change that many participants of this study want to see. Of course, because this could pose long-term financial issues for smaller governments, the state or county governments may want to consider the possibility of allocating funds to create grant programs that would allow the



smaller governments to participate in this enforcement action program. This program could expand to allow governments of all sizes everywhere to apply by creating maximum amounts that can be received based on the amount of population served. These changes can assist in motivating conservation.

Enforcement could turn out to be one of the turning points that would lead to improvement among the list of issues. By enforcing what is contained within ordinances, such as ensuring irrigation systems are equipped with rain sensing devices in Palm Beach County, residents would be more conscious of the idea of intentionally conserving to avoid paying fees or penalties that come from violation (Palm Beach County, n.d.). These enforcements would not only align with what should be legally correct, but ensuring such changes would also confirm what the experts knew would make a difference.

### **Implication 3**

All participants agreed that there is never too much information and education that can be provided to the public. The people are there; the information is there; the real issue is how do utilities get this message to the public in a way that it is received? Utilities across the region would need to invest time into creating programs that educate the public while entertaining them. Consider many of the commercials we see for car insurance. These companies are selling a product but also delivering a message of safe driving. They provide what needs to be provided by grasping the attention of the public humorously. These types of strategies that water managers and public officials would need to grab ahold of are as successful as other industries worldwide.

In addition to the delivery, the content is also essential. Residents do not always have the time to read notes on a bill when many only want to know the balance. Considering creating stories, webinars, or advertisements that show up on different social media platforms can be a start. And with the looming possibility that virtual school may be around longer for students, creating games and interactives for teachers to provide to students could also be a way to inform the growing generation of the importance of this concept of water conservation that studies show has yet to be mastered. Whatever the case is, if the residents do not come to the messages delivered, governments must determine how to get the messages into the residents' homes.

### **Recommendations for Further Research**

Water conservation is vital to the environment, but proper conservation can increase the amount of water being stored during need. Chaudhary et al. (2018) discussed water conservation's importance as the resource becomes scarcer. Increases in population in the state are not helping in conserving but creating more of a need to promote the message across the many different platforms available. This study recognizes that further research is needed for the continuous improvement of water conservation. This study aimed to understand the perception that experts in water policy and water conservation have regarding how residents have been conserving water.

However, responses from this study suggest that additional research may be necessary for the following areas:

- 1 Research should be considered on water conservation and irrigation systems to investigate the effects of different devices that are considered water efficient, such as

soil moisture sensors, and the role these play in limiting the amount of water relative to the weather and how these changes affect experts' perception.

- 2 The gap between residential perception and reality of water conservation. There was much discussion on how behavior plays a significant role in determining residents' actions during times of required conservatory efforts. It would be interesting to understand why residents are more conscious of breaking habitual behaviors during emergencies, such as droughts, and ensuring proper practices are in place.
- 3 Water storage and restoration were two themes that were identified during this research. Future research should consider looking into how the restoration of rivers and the Everglades affect the perception of experts concerning water conservation and what can be done from the administrative side to improve water storage and how or whether this can take the responsibility off residents. With water storage issues also come the issues of flooding in South Florida. As it rains, the water has to go somewhere, and unfortunately, much of it stays on the grounds because of saturation from overwatering of irrigation systems through lack of proper enforcement. This leads to the U.S. Army Corps of Engineers and SFWMD opening floodgates of some canals to release water that can recharge the Biscayne Aquifer. Therefore, further research on this topic would be vital in reducing flooding and improving water storage.
- 4 Saltwater intrusion, alternative water supply, and sea-level rise. These topics could be studied collectively or independently. There was a discourse on each of these topics during the interviews. These issues also were discussed throughout the literature.

Besides considering budgets as a factor, none of the participants could express a more innovative way to approach these issues.

### **Concluding Remarks**

This chapter focused on the findings and conclusions of the study. Specifically, it opened by discussing the purpose statement and research questions as discussed in previous chapters. This led to the exploration of the methods of the study. Following this was the discussion of the population and sample, which then allowed for the major findings of the study to be reviewed. The study conclusions followed, which provided details on three different conclusions that are based on the three research questions asked in Chapter 1. Next, implications for action were discussed, and three different actions were recommended. The chapter concluded with recommendations for further research, which would benefit not only administrators in water policy but also the residents who are served.

### **Reflections**

In conducting this study, a better understanding of water conservation was gained from interviewing the experts who participated. Not only did they provide the information needed to complete this research, but they also provided valuable insight on the issues surrounding water policy. Being able to speak with individuals at different levels of administration was truly a humbling experience, and nothing was taken for granted. Although it would have been preferred to meet with the participants of this study in person, it was truly a blessing that the study came together through the abilities that come from the advancement of technology.

Although this study focused on the perception of experts in water policy and water conservation in one region of Florida, water experts and residents in areas prone to the same issues can use the information contained within. The gap in the literature between the administrative side of water policy and the actual usage of water by residents and the behavior and attitudes historically displayed is what has been driving the issues the region faces today. By utilizing the information of this study, residents would be able to take advantage of expert perception to make a difference in the behaviors taken within the home and with the irrigation systems. It is time for residents to stop waiting on the experts when many are already aware of what to do to correct the issues being faced. It would be in the best interest of the region if residents would not hesitate to become more proactive as opposed to being reactive to what could come from this study. Being proactive, by using the information of this study, would help residents to save the environment, save possible fines, and reduce their water footprint.

One must not forget that although humanity enjoys the luxuries of water, Americans cannot take it for granted, as there are many areas of the planet that struggle to receive a drop of clean water. It is important to remember that the little things people do today can make a big difference for tomorrow. Now is the time to show our Creator that we can be the good stewards that He wants us to be and remember what the Word reminds us in Psalms 24:1 (NIV) – “The Earth is the Lord’s, and everything in it, the world and all who live in it.”

## REFERENCES

- Aberbach, J., & Rockman, B. (2002). Conducting and coding elite interviews. *PS: Political Science and Politics*, 35(4), 673–676. <http://www.jstor.org/stable/1554807>
- Abiy, A. Z., Melesse, A. M., & Abtew, W. (2019). Teleconnection of regional drought to ENSO, PDO, and AMO: Southern Florida and the Everglades. *Atmosphere*, 10(6). <https://doi.org/10.3390/atmos10060295>
- Adeosun, O. (2014, September 29). Water distribution system challenges and solutions. *Water Online*. <https://www.wateronline.com/doc/water-distribution-system-challenges-and-solutions-0001>
- Ajzen I. (1985). From intentions to actions: A theory of planned behavior. In J. Kuhl & J. Beckmann (Eds.), *Action control* (pp. 11-39). SSSP Springer Series in Social Psychology. Springer. [https://doi.org/10.1007/978-3-642-69746-3\\_2](https://doi.org/10.1007/978-3-642-69746-3_2)
- Ajzen, I. (1987). Attitudes, traits, and actions: Dispositional prediction of behavior in personality and social psychology. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 20, pp. 1–63). Academic Press. [https://doi.org/10.1016/S0065-2601\(08\)60411-6](https://doi.org/10.1016/S0065-2601(08)60411-6)
- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50(2), 179–211. [https://doi.org/10.1016/0749-5978\(91\)90020-t](https://doi.org/10.1016/0749-5978(91)90020-t)
- Alajmi, M. F. (2008). *Water conservation knowledge and behaviors of basic college of education in Kuwait* (Publication No. 3317787) [Doctoral dissertation, University of Arkansas]. ProQuest Dissertations and Theses Global.

- Ali, A. D., Ramey, C. N., & Warner, L. A. (2018). Exploring the effect of personal norms and perceived cost of water on conservation. *Journal of Agricultural Education*, 59(3), 169–184.
- Archer, J., Luffman, I. E., Nandi, A. N., & Joyner, T. A. (2019). Florida's recycled water footprint: A geospatial analysis of distribution (2009 and 2015). *AIMS Environmental Science*, 6(1), 41–58. <https://doi.org/10.3934/environsci.2019.1.41>
- Attari, S. Z. (2014). Perceptions of water use. *Proceedings of the National Academy of Sciences of the United States of America*, 111(14), 5129–5134.  
<http://www.jstor.org/stable/23771376>
- Bagozzi, R. P., & Dabholkar, P. A. (1994). Consumer recycling goals and their effect on decisions to recycle: A means-end chain analysis. *Psychology & Marketing*, 11(4), 313–340. <https://doi.org/10.1002/mar.4220110403>
- Barlow, P. M., & Reichard, E. G. (2010). Saltwater intrusion in coastal regions of North America. *Hydrogeology Journal*, 18(1), 247–260. <https://doi.org/10.1007/s10040-009-0514-3>
- Bentley, C., & Wilkinson, C. (2018). Water-saving advances improve hydrant flushing options. *Opflow Online*, 44(6), 16–18.
- Bradner, A., McPherson, B., Miller, R., Kish, G., & Bernard, B. (2005). *Quality of ground water in the Biscayne Aquifer in Miami-Dade, Broward, and Palm Beach Counties, Florida, 1996-1998, with emphasis on contaminants* (Report No. 2004-1438). U.S. Geological Survey. <https://pubs.usgs.gov/of/2004/1438/pdf/ofr20041438.pdf>

- Broward County Board of Commissioners. (1976). Chapter 35: Water conservation districts. Code of Broward County, Florida. [https://library.municode.com/fl/broward\\_county/codes/code\\_of\\_ordinances?nodeId=PTIICOOR\\_CH35WACODI\\_S35-7ADRUREOR](https://library.municode.com/fl/broward_county/codes/code_of_ordinances?nodeId=PTIICOOR_CH35WACODI_S35-7ADRUREOR)
- Broward County Government. (n.d.). Mandatory irrigation restrictions. <https://www.broward.org/waterresources/Pages/IrrigationRestrictions.aspx>
- California Department of Water Resources. (n.d.-a). Conservation tips. <https://water.ca.gov/Water-Basics/Conservation-Tips>
- California Department of Water Resources. (n.d.-b). SB X7-7. <https://water.ca.gov/Programs/Water-Use-And-Efficiency/SB-X7-7>
- California Department of Water Resources. (n.d.-c). 2018 water conservation legislation. <https://water.ca.gov/Programs/Water-Use-And-Efficiency/2018-Water-Conservation-Legislation>
- Cantrill, J. A., Sibbald, B., & Buetow, S. (1996). The Delphi and nominal group techniques in health services research. *International Journal of Pharmacy Practice*, 4(2), 67–74. <https://doi.org/10.1111/j.2042-7174.1996.tb00844.x>
- Carter, K., Redfield, G., Ansar, M., Glenn, L., Huebner, R., Maxted, J., Pettit, C., & VanArman, J. (2010). *Canals in South Florida: A technical support document*. South Florida Water Management District. <https://doi.org/10.13140/RG.2.1.2362.2642>
- Chaudhary, A. K., Lamm, A. J., & Warner, L. A. (2018). Using cognitive dissonance to theoretically explain water conservation intentions. *Journal of Agricultural Education*, 59(4), 194–210.



- Chaudhary, A. K., Warner, L. A., Lamm, A. J., Israel, G. D., Rumble, J. N., & Cantrell, R. A. (2017). Using the theory of planned behavior to encourage water conservation among extension clients. *Journal of Agricultural Education*, 58(3), 185–202.
- Cohen, R. A. (2002). Review: Handbook of Water Use and Conservation [Review of the book *Handbook of water use and conservation* by A. Vickers]. *Electronic Green Journal*, 16. <https://doi.org/10.5070/G311610464>
- Colorado WaterWise. (2010). *Guidebook of best practices for municipal water conservation in Colorado*. <https://coloradowaterwise.org/resources/documents/bp%20project/cww%20best%20practices%20guide%20-%20final.pdf>
- Creswell, J. W., & Creswell, J. D. (2017). *Research design: Qualitative, quantitative, and mixed methods approaches* (5th ed.). SAGE Publications.
- Czajkowski, J., Engel, V., Martinez, C., Mirchi, A., Watkins, D., Sukop, M. C., & Hughes, J. D. (2018). Economic impacts of urban flooding in South Florida: Potential consequences of managing groundwater to prevent salt water intrusion. *Science of the Total Environment*, 621, 465–478. <https://doi.org/10.1016/j.scitotenv.2017.10.251>
- Dalkey, N., & Helmer, O. (1963). An experimental application of the Delphi method to the use of experts. *Management Science*, 9(3), 458–467. <https://doi.org/10.1287/mnsc.9.3.458>
- Davis, J., Borisova, T., & Olexa, M. T. (2018). *An overview of Florida water policy framework and institutions* (#FE1043, pp. 1-8). U.S. Department of Agriculture, Institute of Food and Agricultural Sciences. <https://edis.ifas.ufl.edu/fe1043>

- Dawes, R. M., & Messick, D. M. (2000). Social dilemmas. *International Journal of Psychology*, 35(2), 111–116. <https://doi.org/10.1080/002075900399402>
- Diaz, J., Odera, E., & Warner, L. (2020). Delving deeper: Exploring the influence of psycho-social wellness on water conservation behavior. *Journal of Environmental Management*, 264. <https://doi.org/10.1016/j.jenvman.2020.110404>
- Fielding, K. S., Russell, S., Spinks, A., & Mankad, A. (2012). Determinants of household water conservation: The role of demographic, infrastructure, behavior, and psychosocial variables. *Water Resources Research*, 48(10), 1–12.
- Fischer, P. & Bliss, J. C. (2008). Behavioral assumptions of conservation policy: Conserving oak habitat on family-forest land in the Willamette Valley, Oregon. *Conservation Biology*, 22(2), 275–283. <https://doi.org/10.1111/j.1523-1739.2007.00873.x>
- Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention and behavior: An introduction to theory and research*. Addison-Wesley.
- Fleming, W. M., & Hall, G. E. (2000). Water conservation incentives for New Mexico: Policy and legislative alternatives. *Natural Resources Journal*, 40(1), 69–91.
- Fletcher, P. W., & Sharpe, W. E. (1978). Water-conservation methods to meet Pennsylvania's water needs. *Journal: American Water Works Association*, 70(4), 200-203. <https://doi.org/10.1002/j.1551-8833.1978.tb04149.x>
- Florida Department of Environmental Protection (n.d.-a). Aquifer essentials. <https://floridadep.gov/fgs/geologic-topics/content/aquifer-essentials>
- Florida Department of Environmental Protection. (n.d.-b). *Source & drinking water program*. <https://floridadep.gov/water/source-drinking-water>

Florida Department of Environmental Protection. (n.d.-c). Uses of reclaimed water.

<https://floridadep.gov/water/domestic-wastewater/content/uses-reclaimed-water>

Florida Department of Environmental Protection. (n.d.-d). Water management districts.

<https://floridadep.gov/water-policy/water-policy/content/water-management-districts>

Florida Fish and Wildlife Conservation Commission. (n.d.). Metropolitan southeast

Florida canals. <https://myfwc.com/fishing/freshwater/sites-forecasts/s/metropolitan-southeast-florida-canals/>

Fumero, J. (2003). Florida water law and environmental water supply for Everglades restoration. *Journal of Land Use & Environmental Law*, 18(2), 379–389.

<http://www.jstor.org/stable/42842821>

Garcia-Cuerva, L., Berglund, E. Z., & Binder, A. R. (2016). Public perceptions of water shortages, conservation behaviors, and support for water reuse in the U.S.

*Resources, Conservation & Recycling*, 113, 106–115.

<https://doi.org/10.1016/j.resconrec.2016.06.006>

Garrone, P., Grilli, L., & Marzano, R. (2020). Incentives to water conservation under scarcity: Comparing price and reward effects through stated preferences. *Journal*

*of Cleaner Production*, 244. <https://doi.org/10.1016/j.jclepro.2019.118632>

Gianfagna, C. C., Johnson, C. E., Chandler, D. G., & Hofmann, C. (2015). Watershed

area ratio accurately predicts daily streamflow in nested catchments in the Catskills, New York. *Journal of Hydrology: Regional Studies*, 4, 583–594.

<https://doi.org/10.1016/j.ejrh.2015.09.002>

- Gilbert, J. B., Bishop, W. J., & Weber, J. A. (1990). Reducing water demand during drought years. *Journal: American Water Works Association*, 82(5), 34–39.  
<https://doi.org/10.1002/j.1551-8833.1990.tb06961.x>
- Goette, L., Leong, C., & Qian, N. (2019). Motivating household water conservation: A field experiment in Singapore. *PLoS ONE*, 14(3). <https://doi.org/10.1371/journal.pone.0211891>
- Greene, K. (2010). Tapping the Last Oasis: Florida-friendly Landscaping and Homeowners' Associations. *Florida Bar Journal*, 84(5), 39–43.
- Griffin, R. C. (2016). *Water resource economics: The analysis of scarcity, policies, and projects*. MIT Press.
- Harter, T. (2015). California's agricultural regions gear up to actively manage groundwater use and protection. *California Agriculture*, 69(3), 193–201.  
<https://doi.org/10.3733/ca.E.v069n03p193>
- Hawes, T. (2016). Catalyzing new water management tools in the west through the Colorado River system conservation program. *Journal: American Water Works Association*, 108(2), 14–17.
- Hobbs, G. J., Jr. (2015). *Citizen's guide to Colorado water law* (4th ed.). Colorado Foundation for Water Education.
- Hrubes, D., Ajzen, I., & Daigle, J. (2001). Predicting hunting intentions and behavior: An application of the theory of planned behavior. *Leisure Sciences*, 23(3), 165–178.  
<https://doi.org/10.1080/014904001316896855>

- Huang, P., & Lamm, A. J. (2015). Understanding public engagement in water conservation behaviors and knowledge of water policy: Promising hints for extension. *Journal of Extension*, 53(6), Article 6rb1. <https://archives.joe.org/joe/2015december/rb1.php>
- Huang, P., & Lamm, A. J. (2017). Impacts of personal experience: Informing water conservation extension education. *Journal of Agricultural Education*, 58(3), 37–55.
- Huang, P., Lamm, A., & Dukes, M. (2016). Informing extension program development through audience segmentation: Targeting high water users. *Journal of Agricultural Education*, 57(2), 60–74. <https://doi.org/10.5032/jae.2016.02060>
- Hughes, S. (2012). Voluntary environmental programs in the public sector: Evaluating an urban water conservation program in California. *Policy Studies Journal*, 40(4), 650–673. <https://doi.org/10.1111/j.1541-0072.2012.00468.x>
- Hunter, A. D. (1993). Local knowledge and local power. Notes on the ethnography of local community elites. *Journal of Contemporary Ethnography*, 22, 36–58.
- Ilyas, M. (2019). Determining critical success factors for quality and accreditation through Delphi technique. *International Journal of Higher Education*, 8(3), 148–158.
- Jones, A., Harter, T., Bianchi, M., & Harper, J. (2003). *Water pollution control legislation* (ANR Publication No. 8088). University of California Division of Agriculture and Natural Resources. <https://anrcatalog.ucanr.edu/pdf/8088.pdf>

- Kim, S., Jeong, S.-H. & Hwang, Y. (2013). Predictors of pro-environmental behaviors of American and Korean students: The application of the theory of reasoned action and protection motivation theory. *Science Communication*, 35(2), 168–188. <https://doi.org/10.1177/1075547012441692>
- Krohn, G. A. (2019). Drought status, price, and the effectiveness of water use restrictions in Pennsylvania. *Review of Regional Studies*, 49(2), 222–243. <https://doi.org/10.52324/001c.10040>
- Lamm, K. W., Lamm, A. J., & Carter, H. S. (2015). Bridging water issue knowledge gaps between the general public and opinion leaders. *Journal of Agricultural Education*, 56(3), 146–161.
- Langevin, C. D., & Zygnerski, M. (2013). Effect of sea-level rise on salt water intrusion near a coastal well field in Southeastern Florida. *Ground Water*, 51(5), 781–803. <https://doi.org/10.1111/j.1745-6584.2012.01008.x>
- Lascody, R. (2002, March). *The onset of the wet and dry seasons in east central Florida: A subtropical wet-dry climate?* <https://www.weather.gov/media/mlb/climate/wetdryseason.pdf>
- Lee, M., & Tansel, B. (2013). Water conservation quantities vs customer opinion and satisfaction with water efficient appliances in Miami, Florida. *Journal of Environmental Management*, 128, 683–689. <https://doi.org/10.1016/j.jenvman.2013.05.044>

- Lee, M., Tansel, B., & Balbin, M. (2011). Influence of residential water use efficiency measures on household water demand: A four year longitudinal study. *Resources, Conservation & Recycling*, 56(1), 1–6. <https://doi.org/10.1016/j.resconrec.2011.08.006>
- Levy, B. S., & Sidel, V. W. (2011). Water rights and water fights: Preventing and resolving conflicts before they boil over. *American Journal of Public Health*, 101(5), 778–780. <https://doi.org/10.2105/AJPH.2010.194670>
- Liang, Y. (Jake), Kee, K. F., & Henderson, L. K. (2018). Towards an integrated model of strategic environmental communication: advancing theories of reactance and planned behavior in a water conservation context. *Journal of Applied Communication Research*, 46(2), 135–154. <https://doi.org/10.1080/00909882.2018.1437924>
- Liebman, J. B., & Zeckhauser, R. J. (2004). *Schmeduling*. Harvard University. [https://scholar.harvard.edu/files/jeffreyliebman/files/Schmeduling\\_WorkingPaper.pdf](https://scholar.harvard.edu/files/jeffreyliebman/files/Schmeduling_WorkingPaper.pdf)
- Luna, T., & Koseff, A. (2018, May 31). Get ready to save water: Permanent California restrictions approved by Gov. Jerry Brown. *The Sacramento Bee*. <https://www.sacbee.com/news/politics-government/capitol-alert/article211333594.html>
- Lusk, M. (2017, June 29). Reclaimed water: Frequently asked questions. <http://blogs.ifas.ufl.edu/extension/2017/06/20/reclaimed-water-frequently-asked-questions/>

- Mayer, P. W. (2011). Media pulse: Colorado WaterWise develops Water Conservation Best Practices Guidebook. *Journal: American Water Works Association*, 103(2), 110-111. <https://www.jstor.org/stable/23072383>
- McKee, B. H., Lamm, A. J., & Bunch, J. C. (2017). Encouraging engagement in water conservation: Can trust from extension create change? *Journal of Agricultural Education*, 58(4), 83–97.
- Mears, C. L. (2009). *Interviewing for education and social science research: The gateway approach*. Palgrave Macmillan.
- Miami-Dade County. (n.d.). Outdoor water restrictions. <https://www.miamidade.gov/global/water/conservation/outdoor-water-restrictions.page>
- Miami-Dade County. (2016). *Report on flooding and saltwater intrusion*. <https://www.miamidade.gov/green/library/sea-level-rise-flooding-saltwater-intrusion.pdf>
- Miami-Dade County Board of Commissioners. (n.d.). Miami-Dade County Water and Sanitary Sewer Connection ordinance. Code of Miami-Dade County, Florida. [https://library.municode.com/fl/miami\\_-\\_dade\\_county/codes/code\\_of\\_ordinances?nodeId=PTIICOOR\\_CH32WASERE\\_ARTVWASASECO\\_S32-83.1WACOPL](https://library.municode.com/fl/miami_-_dade_county/codes/code_of_ordinances?nodeId=PTIICOOR_CH32WASERE_ARTVWASASECO_S32-83.1WACOPL)
- Miami-Dade Water and Sewer Department (n.d.). Saltwater intrusion. <https://www.miamidade.gov/global/water/conservation/saltwater-intrusion.page>
- Michelsen, A., Taylor, R. G., Huffaker, R. G., & McGuckin, J. T. (1999). Emerging agricultural water conservation price incentives. *Journal of Agricultural and Resource Economics*, 24(1), 222–238.



- Montjoy, R. S., & Watson, D. J. (1995). A case for reinterpreted dichotomy of politics and administration as a professional standard in council-manager government. *Public Administration Review*, 55(3), 231–239. <https://doi.org/10.2307/3110241>
- Moore, C. M. (1987). *Group techniques for idea building*. Sage Publications.
- Munro, J., Pearce, J., Brown, G., Kobryn, H., & Moore, S. A. (2017). Identifying ‘public values’ for marine and coastal planning: Are residents and non-residents really so different? *Ocean and Coastal Management*, 148, 9–21. <https://doi.org/10.1016/j.ocecoaman.2017.07.016>
- National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research. (1979, April 18). *The Belmont report*. U.S. Department of Health and Human Services. <https://www.hhs.gov/ohrp/regulations-and-policy/belmont-report/read-the-belmont-report/index.html>
- National Institute of Food and Agriculture. (n. d.). Extension. <https://nifa.usda.gov/extension>
- National Research Council. (2006). Summary. In *Drinking water distribution systems assessing and reducing risks* (pp. 1-4). National Academies Press.
- Nordin, J. A. (1976). A proposed modification of Taylor’s demand analysis: Comment. *Bell Journal of Economics*, 7(2), 719–721. <https://doi.org/10.2307/3003285>
- Odell, L. H. (2010). *Treatment technologies for groundwater* [electronic resource]. American Water Works Association.

- Oniki, S., Tsuchiya, S., Tanimoto, K., & Hosoi, Y. (2018). Location planning of wastewater treatment plants for reuse of treated water. *2018 IEEE International Conference on Systems, Man, and Cybernetics (SMC)*, Miyazaki, Japan, pp. 457–461. <https://doi.org/10.1109/SMC.2018.00087>
- Onuoha, C. (2019, August 6). Your top environmental issues. *Island Press*. <https://islandpress.org/blog/your-top-environmental-issues>
- Miami-Dade County. (n.d.). Water conservation: Rebates & indoor conservation. Retrieved from <https://www.miamidade.gov/global/water/water-conservation.page>
- Palm Beach County. (n.d.). Palm Beach County Water and Irrigation Conservation ordinance. Code of Palm Beach County, Florida. [https://library.municode.com/fl/palm\\_beach\\_county/codes/code\\_of\\_ordinances?nodeId=PABECOCO\\_CH27\\_WASESEDI\\_ARTVIWAIRCO](https://library.municode.com/fl/palm_beach_county/codes/code_of_ordinances?nodeId=PABECOCO_CH27_WASESEDI_ARTVIWAIRCO)
- Palmini, D. J., & Shelton, T. B. (1983). Noncrisis use of household water-saving devices. *Journal: American Water Works Association*, 75(7), 336–341. <https://doi.org/10.1002/j.1551-8833.1983.tb05156.x>
- Parker, D., Manstead, A. S. R., Stradling, S. G., Reason, J. T., & Baxter, J. S. (1992). Intention to commit driving violations: An application of the theory of planned behavior. *Journal of Applied Psychology*, 77(1), 94–101. <https://doi.org/10.1037/0021-9010.77.1.94>

- Ratnasiri, S., Wilson, C., Athukorala, W., Garcia-Valiñas, M. A., Torgler, B., & Gifford, R. (2018). Effectiveness of two pricing structures on urban water use and conservation: a quasi-experimental investigation. *Environmental Economics & Policy Studies*, 20(3), 547–560. <https://doi.org/10.1007/s10018-017-0205-6>
- Ray, C., & Jain, R. (2011). Drinking water treatment technology—Comparative analysis. In C. Ray & R. Jain (Eds.), *Drinking water treatment: Focusing on appropriate technology and sustainability* (pp. 9–36). Springer. [https://doi.org/10.1007/978-94-007-1104-4\\_2](https://doi.org/10.1007/978-94-007-1104-4_2)
- Ruiz, D. M., Tallis, H., Tershy, B. R., & Croll, D. A. (2020). Turning off the tap: Common domestic water conservation actions insufficient to alleviate drought in the United States of America. *PLoS ONE*, 15(3), 1–8. <https://doi.org/10.1371/journal.pone.0229798>
- Russell, S., & Fielding, K. (2010). Water demand management research: A psychological perspective. *Water Resources Research*, 46(5). <https://doi.org/10.1029/2009WR008408>
- San Diego County Water Authority. (n.d.). Seawater desalination. <https://www.sdcwa.org/seawater-desalination>
- Shimabuku, M., Stellar, D., & Mayer, P. (2016). Impact evaluation of residential irrigation audits on water conservation in Colorado. *Journal: American Water Works Association*, 108(5), E299–E309.
- Simon, M. K., & Goes, J. (2017). *Dissertation and scholarly research: Recipes for 2018*. CreateSpace Independent Publishing Platform.

- Skoglund, E., Fernandez, J., Sherer, J. T., Coyle, E. A., Garey, K. W., Fleming, M. L., & Sofjan, A. K. (2020). Using the theory of planned behavior to evaluate factors that influence PharmD students' intention to attend lectures. *American Journal of Pharmaceutical Education*, 84(5), 572–581. <https://doi.org/10.5688/ajpe7550>
- Sniehotta, F. F., Presseau, J., & Araújo-Soares, V. (2014). Time to retire the theory of planned behaviour. *Health Psychology Review*, 8(1), 1–7. <https://doi.org/10.1080/17437199.2013.869710>
- South Florida Water Management District. (n.d.-a). Grants/funding opportunities. <https://www.sfwmd.gov/doing-business-with-us/coop-funding>
- South Florida Water Management District. (n.d.-b). Water conservation. <https://www.sfwmd.gov/community-residents/water-conservation>
- South Florida Water Management District. (n.d.-c). Who we are. <https://www.sfwmd.gov/who-we-are>
- Staff Writer. (2017, March 15). In land of HOAs, South Florida still king. *Palm Beach Post*. <https://www.palmbeachpost.com/2017/03/15/in-land-of-hoas-south-florida-still-king/>
- Steg, L., & Vlek, C. (2009). Encouraging pro-environmental behaviour: An integrative review and research agenda. *Journal of Environmental Psychology*, 29(3), 309–317. <https://doi.org/10.1016/j.jenvp.2008.10.004>
- St. Johns River Water Management District. (n.d.). Florida's aquifers. <https://www.sjrwmd.com/water-supply/aquifer/>

- Survis, F. D. (2016). *Beyond water restrictions: Informing effective lawn watering behavior* (Publication No. 10300326) [Doctoral dissertation, Florida Atlantic University]. ProQuest Dissertations and Theses Global.
- Swihart, T. (2008). Mirage: Florida and the vanishing water of the eastern U. S. *Southeastern Geographer*, 48(2), 253–255. <https://doi.org/10.1353/sgo.0.0017>
- Taylor, G. R., II, & Gray, J. (1999). *Maintaining St. Augustine grass lawns* (Publication No. L-5340). Agricultural Communications, The Texas A&M University System. [http://publications.tamu.edu/TURF\\_LANDSCAPE/PUB\\_turf\\_Maintaining%20St.%20Augustine%20Grass%20Lawns.pdf](http://publications.tamu.edu/TURF_LANDSCAPE/PUB_turf_Maintaining%20St.%20Augustine%20Grass%20Lawns.pdf)
- Taylor, L. D. (1975). The demand for electricity: A survey. *Bell Journal of Economics*, 6(1), 74–110. <https://doi.org/10.2307/3003216>
- Taylor, M. R., & Lamm, A. J. (2017). Identifying the needs of opinion leaders to encourage widespread adoption of water conservation and protection. *Journal of Agricultural Education*, 58(4), 269–281.
- Trumbo, C. W., & O’Keefe, G. J. (2001). Intention to conserve water: Environmental values, planned behavior, and information effects. A comparison of three communities sharing a watershed. *Society & Natural Resources*, 14(10), 889–899. <https://doi.org/10.1080/089419201753242797>
- Tully, K., Gedan, K., Epanchin-Niell, R., Strong, A., Bernhardt, E. S., BenDor, T., Mitchell, M., Kominoski, J., Jordan, T. E., Neubauer, S. C., & Weston, N. B. (2019). Invisible flood: The chemistry, ecology, and social implications of coastal saltwater intrusion. *BioScience*, 69(5), 368–378. <https://doi.org/10.1093/biosci/biz027>

- Untaru, E.-N., Ispas, A., Candrea, A. N., Luca, M., & Epuran, G. (2016). Predictors of individuals' intention to conserve water in a lodging context: The application of an extended theory of reasoned action. *International Journal of Hospitality Management*, 59, 50–59. <https://doi.org/10.1016/j.ijhm.2016.09.001>
- U.S. Environmental Protection Agency. (2018a, February 5). How we use water. [https://www.epa.gov/watersense/how-we-use-water#Daily Life](https://www.epa.gov/watersense/how-we-use-water#DailyLife)
- U.S. Environmental Agency. (2018b, November 19). Origins of the EPA. <https://www.epa.gov/history/origins-epa>
- U.S. Environmental Protection Agency. (2018c, March 23). Water conservation plan guidelines. from <https://www.epa.gov/watersense/water-conservation-plan-guidelines>
- U.S. Environmental Protection Agency. (2019, March 11). Summary of the Clean Water Act. <https://www.epa.gov/laws-regulations/summary-clean-water-act>
- U.S. Environmental Protection Agency. (2020a, June 24). EPA's budget and spending. <https://www.epa.gov/planandbudget/budget>
- U.S. Environmental Protection Agency. (2020b, February 14). National primary drinking water regulations. <https://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations>
- U.S. Environmental Protection Agency. (2020c, January 14). Overview of the Safe Drinking Water Act. <https://www.epa.gov/sdwa/overview-safe-drinking-water-act>
- U.S. Environmental Protection Agency. (2020d, February 04). Summary of the Safe Drinking Water Act. <https://www.epa.gov/laws-regulations/summary-safe-drinking-water-act>

- U.S. Geological Survey. (n.d.-a). Floridan aquifer system. <https://fl.water.usgs.gov/floridan/intro.html>
- U.S. Geological Survey. (n.d.-b.). Saltwater intrusion. [https://www.usgs.gov/mission-areas/water-resources/science/saltwater-intrusion?qt-science\\_center\\_objects=0](https://www.usgs.gov/mission-areas/water-resources/science/saltwater-intrusion?qt-science_center_objects=0)
- U.S. Geological Survey. (1990). Groundwater atlas of the United States: Alabama, Florida, Georgia, South Carolina. [https://pubs.usgs.gov/ha/ha730/ch\\_g/G-text4.html](https://pubs.usgs.gov/ha/ha730/ch_g/G-text4.html)
- van Leeuwen, J., White, D., Baker, R., & Jones, C. (2011). Reuse of water treatment residuals from lime softening, Part I: Applications for the reuse of lime sludge from water softening. *Land Contamination & Reclamation*, 18(4), 393–415. <https://doi.org/10.2462/09670513.1012>
- Waller, R. (1988). *Ground water and the rural homeowner* (Publication No. 7000053). U.S. Government Printing Office. <https://doi.org/10.3133/7000053>
- Wdowinski, S., Oliver-Cabrera, T., & Fiaschi, S. (2020). Land subsidence contribution to coastal flooding hazard in southeast Florida. *Proceedings of the International Association of Hydrological Sciences*, 382, 207–211. <https://doi.org/10.5194/piahs-382-207-2020>
- Williams, L. J., & Kuniansky, E. L. (2015). *Revised hydrogeologic framework of the Floridan aquifer system in Florida and parts of Georgia, Alabama, and South Carolina* (U.S. Geological Survey Professional Paper 1807). <https://doi.org/10.3133/pp1807>

- Woltemade, C., & Fuellhart, K. (2013). Economic efficiency of residential water conservation programs in a Pennsylvania public water utility. *Professional Geographer*, 65(1), 116–129. <https://doi.org/10.1080/00330124.2012.658727>
- Zamudio, M., & Craft, W. (2019, February 8). A water crisis is growing in a place you'd least expect it. NPR. <https://www.npr.org/2019/02/08/691409795/a-water-crisis-is-growing-in-a-place-youd-least-expect-it>



## APPENDICES

## APPENDIX A

### Tri-County Water Conservation Expert Survey

1. According to your knowledge, which two (2) areas of a home use the most water (regardless of technology)?
  - A. Dishwasher
  - B. Washing Machine
  - C. Showerheads and faucets
  - D. Toilets
  - E. Irrigation Systems
  - F. Other not listed (please list) \_\_\_\_\_
2. What is your assessment of the current procedures regarding municipal water loss, concerning water conservation (i.e., hydrant flushing, main)?  
  
5. Excellent    4. Good    3. Average    2. Needs Improvement    1. Poor
3. What is your assessment on how accessible education of water conservation is in your region?  
  
5. Excellent    4. Good    3. Average    2. Needs Improvement    1. Poor
4. Please rate your overall knowledge on water conservation issues and policies in Florida?  
  
A. Very Knowledgeable    B. Familiar    C. Not too familiar
5. Please rate your overall knowledge on water conservation issues and policies in your region?  
  
A. Very Knowledgeable    B. Familiar    C. Not too familiar
6. Please assign a rating 1 – 5 (1 being least of concern, 5 being very concerned) to the following water conservation techniques and issues:
  - A. Changing toilets, faucets, and showerheads to water-efficient fixtures
  - B. Running full cycles of a washing machine and/or dishwasher
  - C. Watering lawns **ONLY** in the morning (regardless of season)
  - D. Watering lawns **ONLY** in the evening of summer months
  - E. Overwatering of lawns during rainy season
  - F. Not following recommended irrigation schedules
  - G. Saltwater intrusion and Flooding
  - I. Treatment facilities over pumping of water from Biscayne Aquifer
  - J. Treatment facilities considering all pumping water from Floridan Aquifer
  - K. Violations and citations for improper water conservation/water pumping
  - L. Accessibility of water conservation education to the public

## APPENDIX B

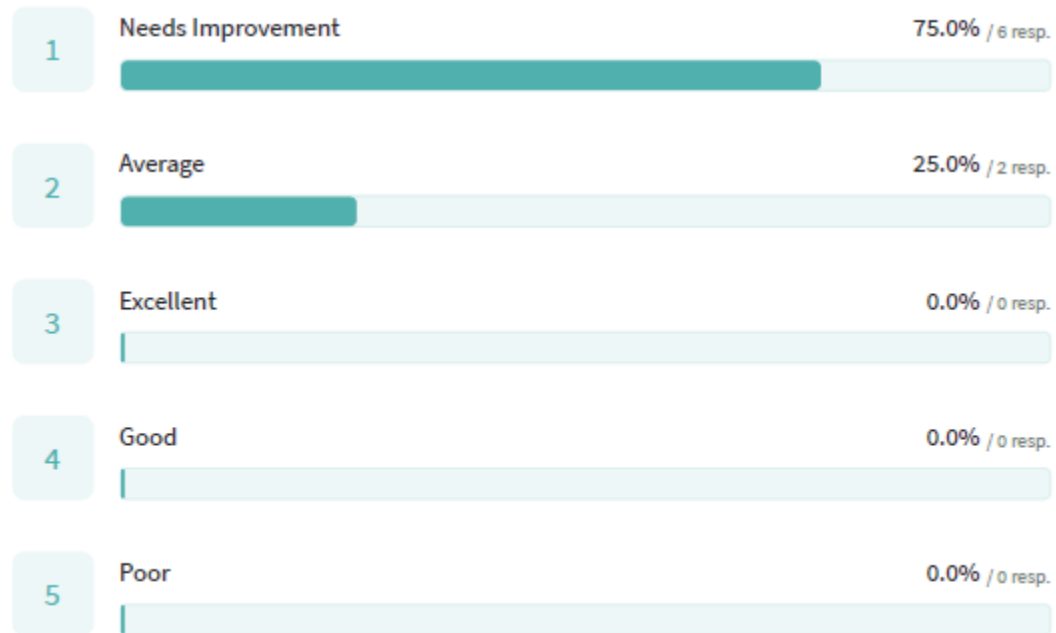
### Expert Perception on Water Conservation

## Expert Perception on Water Conservation

8 responses

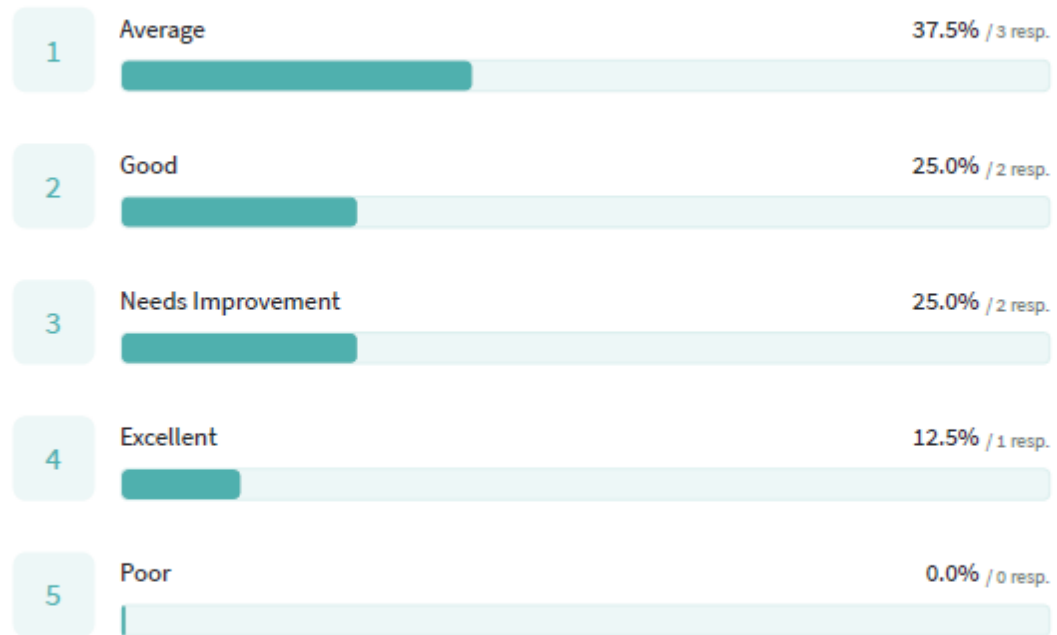
What is your assessment of the current procedures regarding municipal water loss when it comes to water conservation (i.e. hydrant flushing for main breaks)?

8 out of 8 answered



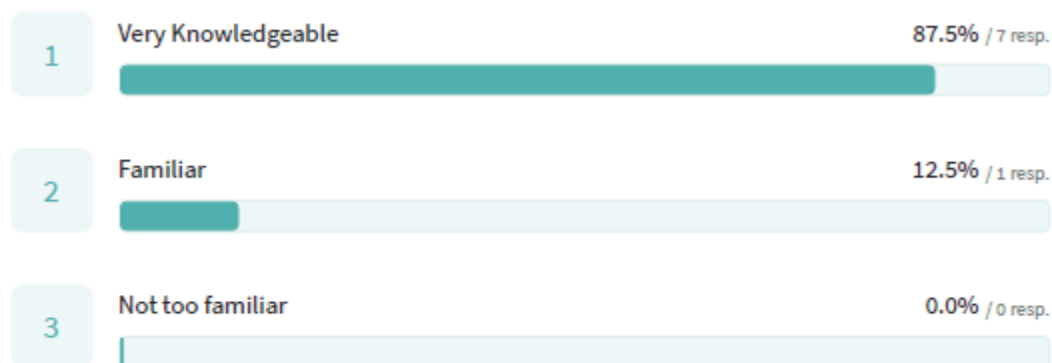
What is your assessment on how accessible education of water conservation is in your region?

8 out of 8 answered



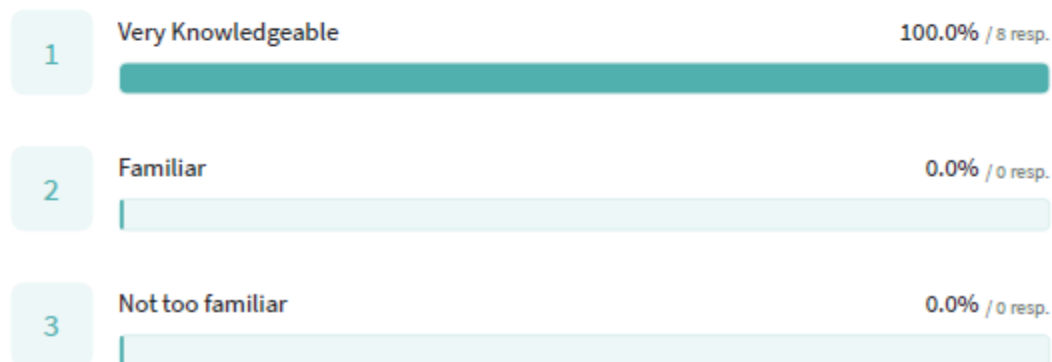
Please rate your overall knowledge on water conservation issues and policies in **Florida**?

8 out of 8 answered



Please rate your overall knowledge on water conservation issues and policies in **your region**?

8 out of 8 answered

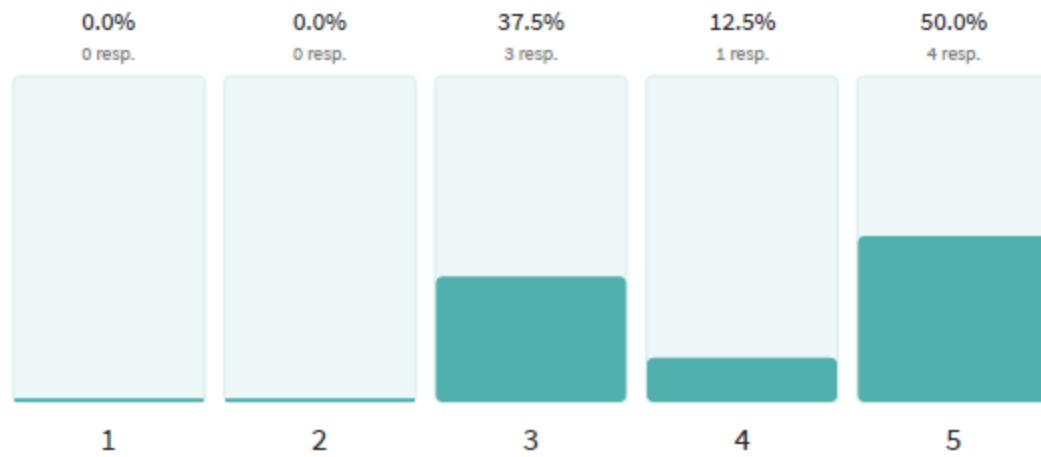


Please assign a rating 1-5 (1 being least of concern, 5 being very concerned) to the following water conservation techniques or issues:

*Changing toilets, faucets and showerheads to water-efficient fixtures*

8 out of 8 answered

#### 4.1 Average rating

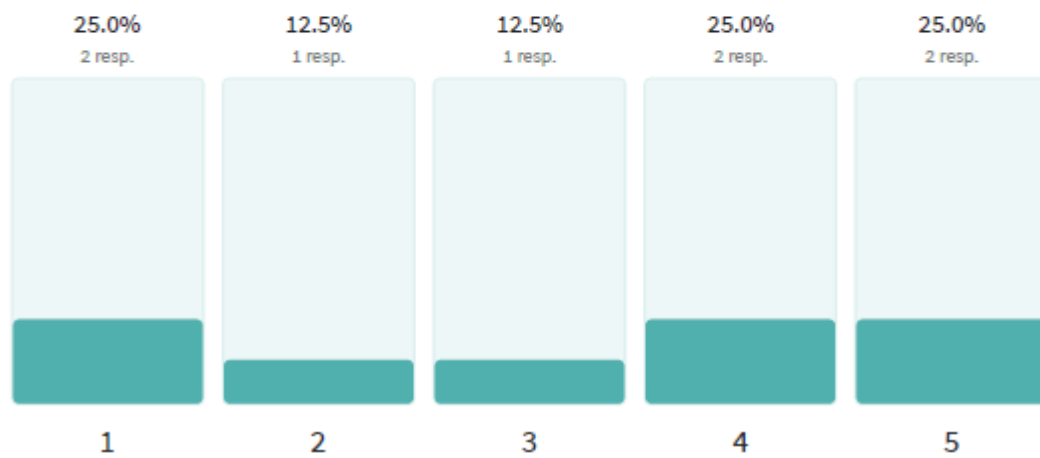


Please assign a rating 1-5 (1 being least of concern, 5 being very concerned) to the following water conservation techniques or issues:

*Running full cycles of a washing machine and/or dishwasher*

8 out of 8 answered

### 3.1 Average rating

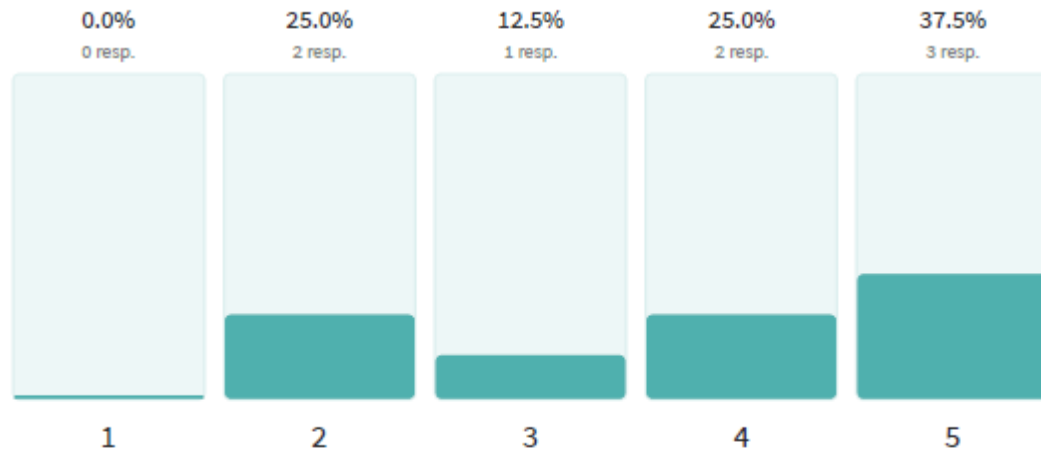


Please assign a rating 1-5 (1 being least of concern, 5 being very concerned) to the following water conservation techniques or issues:

*Watering lawns **ONLY** in the morning, regardless of the season*

8 out of 8 answered

### 3.8 Average rating



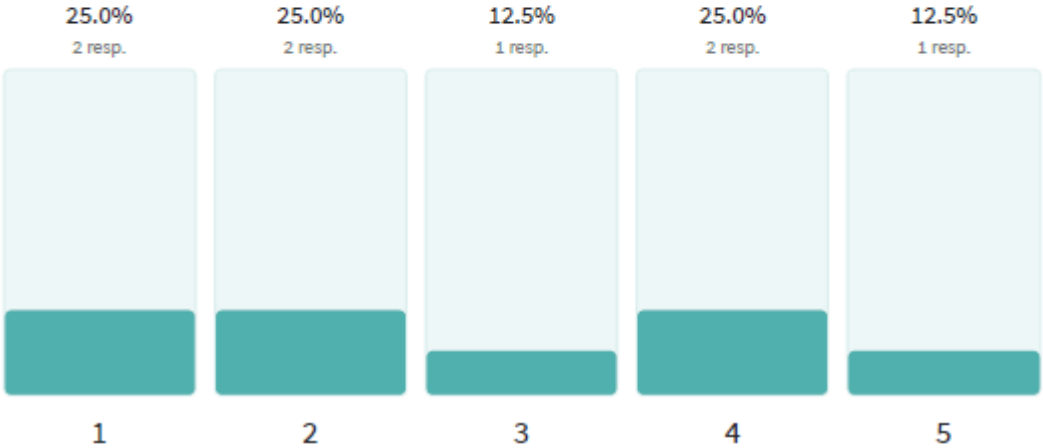


Please assign a rating 1-5 (1 being least of concern, 5 being very concerned) to the following water conservation techniques or issues:

*Watering lawns **ONLY** in the evening of the **summer** months*

8 out of 8 answered

2.8 Average rating

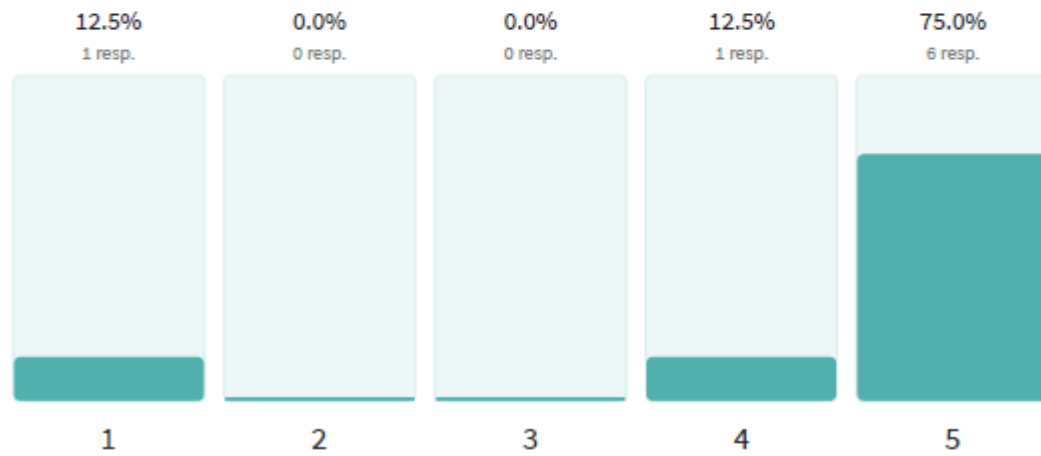


Please assign a rating 1-5 (1 being least of concern, 5 being very concerned) to the following water conservation techniques or issues:

*Overwatering of lawns during the rainy season*

8 out of 8 answered

#### 4.4 Average rating

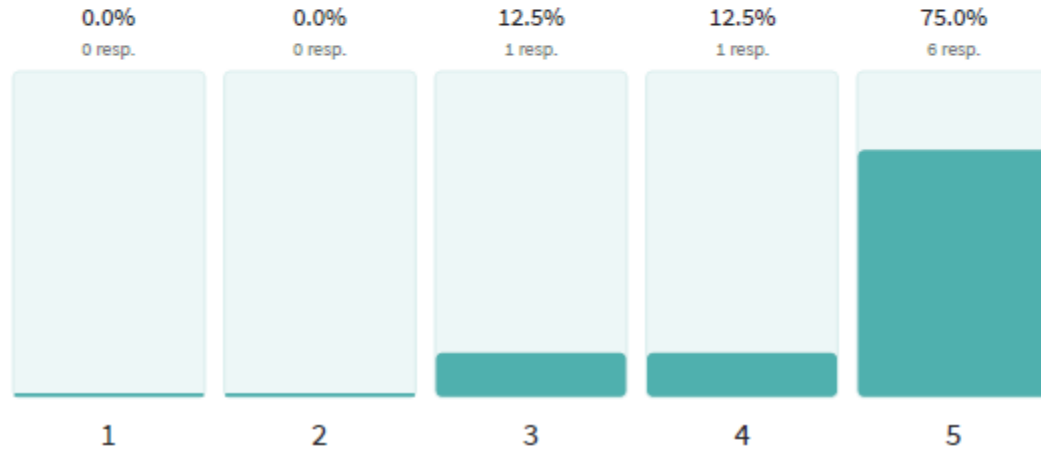


Please assign a rating 1-5 (1 being least of concern, 5 being very concerned) to the following water conservation techniques or issues:

*Not following recommended irrigation schedules*

8 out of 8 answered

#### 4.6 Average rating

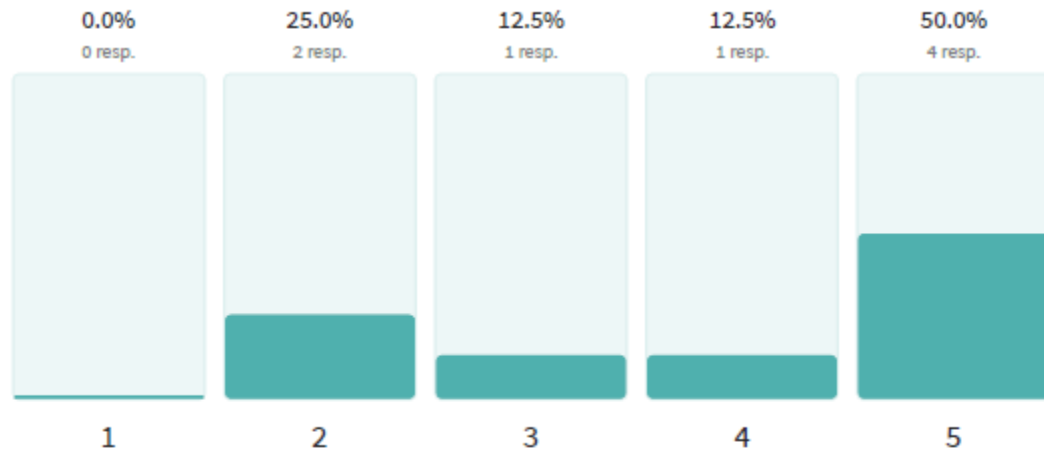


Please assign a rating 1-5 (1 being least of concern, 5 being very concerned) to the following water conservation techniques or issues:

*Saltwater intrusion and flooding*

8 out of 8 answered

3.9 Average rating

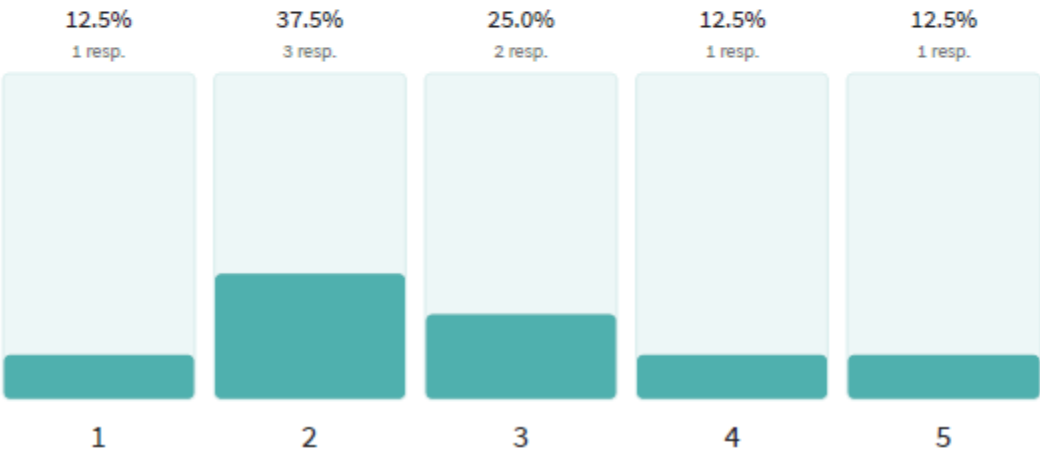


Please assign a rating 1-5 (1 being least of concern, 5 being very concerned) to the following water conservation techniques or issues:

*Treatment facilities* **overpumping of water from Biscayne Aquifer**

8 out of 8 answered

2.8 Average rating

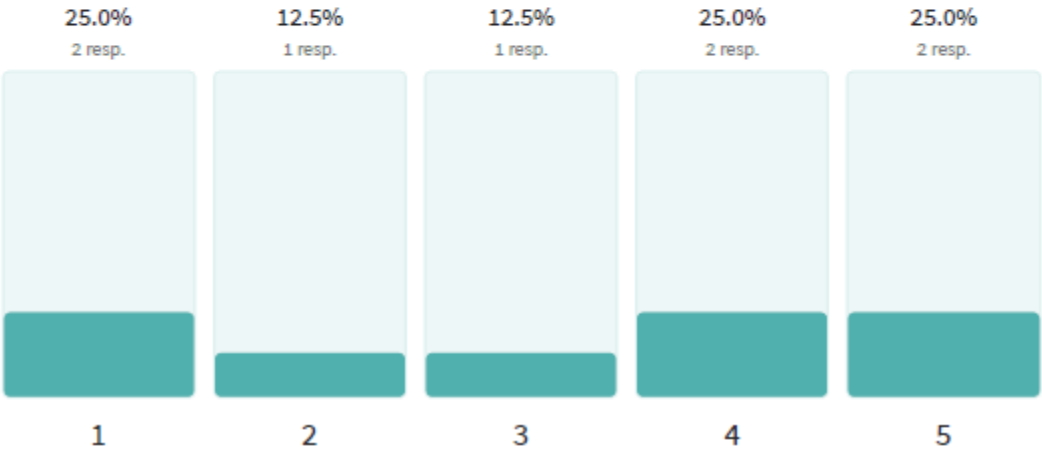


Please assign a rating 1-5 (1 being least of concern, 5 being very concerned) to the following water conservation techniques or issues:

*Treatment facilities considering all pumping of water from Floridan Aquifer*

8 out of 8 answered

3.1 Average rating

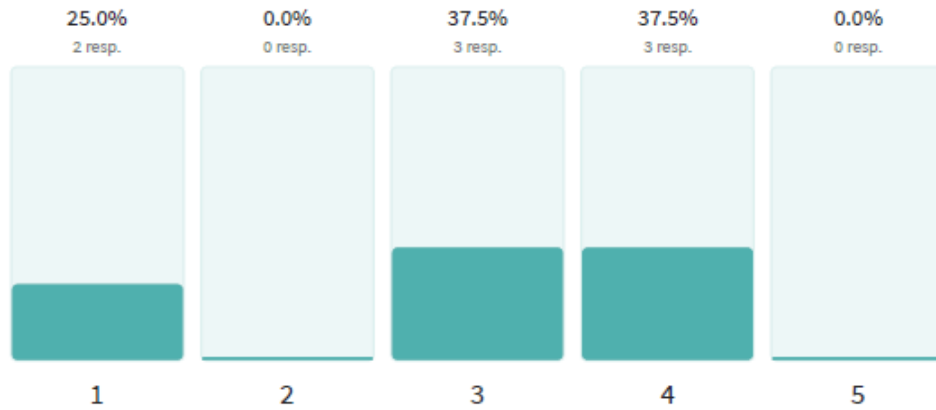


Please assign a rating 1-5 (1 being least of concern, 5 being very concerned) to the following water conservation techniques or issues:

*Violations and citations being given for improper water conservation or water pumping*

8 out of 8 answered

### 2.9 Average rating

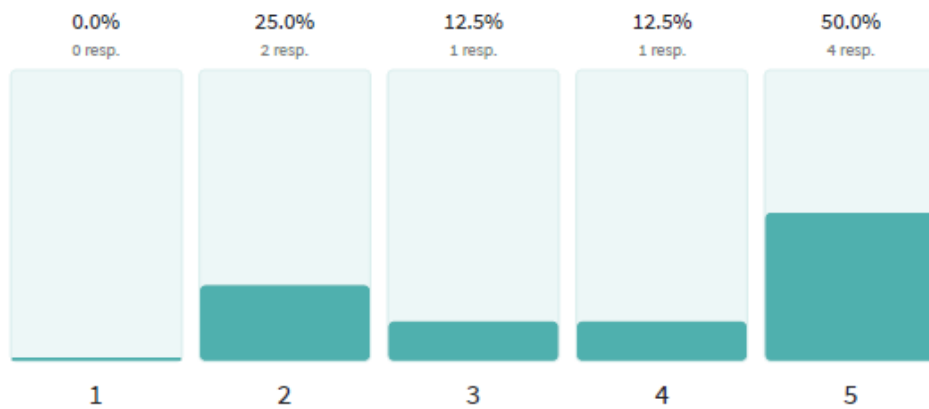


Please assign a rating 1-5 (1 being least of concern, 5 being very concerned) to the following water conservation techniques or issues:

*Accessibility of water conservation education for the public*

8 out of 8 answered

### 3.9 Average rating



## APPENDIX C

### Interview Questions

1. How long have you worked within the area of water conservation? How long have you worked in your current position?
2. Based on your knowledge, how would you define water conservation?
3. How effective is it for residents to all conserve water on purpose annually?
4. Have you ever been involved in a public awareness strategy for water conservation (i.e., conference)?
5. How would the help of other government agencies and municipalities change your perception on how consumers conserve?
6. Do you converse (or network) with other individuals outside of your organization, concerning more efficient methods for water conservation?
7. What is your perception of how consumers conserve water? In what ways do you feel consumers can be more efficient in water conservation?
8. What is your perception concerning the amount of educational material available to the public for water conservation in South Florida?
9. What are the major shortcomings of the current approach(es) used by regulators to conserve water?
10. Are you aware of any water conservation management strategies (in Florida or outside of the state) that your region can emulate? If so, who?



## APPENDIX D

### Participant Informed Consent

#### **PARTICIPANT INFORMED CONSENT**

**Study Title: Analyzing Public Engagement Strategies for Drinking Water Policy of Water Conservation: A Phenomenological Approach**

**Researcher: Anthony C. Williams**

**Dear Prospective Participant,**

You are invited to participate in a research study conducted by Anthony Williams of California Baptist University Online and Professional Studies, Doctor of Public Administration program. I hope to understand the perception of water experts on water conservation. For the purpose of this study, water experts are defined as employees greater than 18 years old, title must contain any combination or variation of the word(s) manager, director, supervisor or specialist; (2) must have been in the current position for a minimum of 5-10 years (where applicable); and (3) have at minimum a degree in a field related to environmental science, engineering, water operations or public administration/public policy. You were selected as a possible participant in this study because I want to focus solely on studying water conservation perceptions from experts working in South Florida for a county government (or South Florida Water Management District on the state-level).

**What are the next steps once you choose to participate in this study:**

- Your participation will involve completing a survey, which will be emailed directly to you
- At some point of the study, upon completion of the survey, an in-person interview, or an online interview, will be conducted to discuss results of the survey, and other topics concerning water conservation. This interview should last no longer than 60-minutes.
  - In-person interviews will be conducted at your office or a small conference room within your organization; otherwise online will be using Zoom.
- Your participation over during the research period will last approximately 2-4 weeks.
- Your participation is strictly voluntary.
  - It is your choice to participate in this research or choose not to.
  - If you choose to participate, you may change your mind and leave the study at any time.
  - You may skip any questions you do not want to answer.
  - Refusal to participate or leaving during the interview process will not cause any negative consequences to you or your organization.
- Strict procedures are in place to protect your privacy and confidentiality.
- Your responses to the questions will never be linked or identified to you or your organization. In the research document, responses will refer to an alphanumeric coding system.
- All interviews will be video recorded for accuracy purposes only.
  - Your recorded interview will be downloaded and saved using a password protected file. The file name will refer only to the assigned alphanumeric code and the date of the interview.
- The researcher is the only one who will have access to the cross reference between the alphanumeric codes and participant names. This information will never be made public.
- The researcher will destroy all electronic and paper documents five years after publishing the study by shredding paper documents and deleting electronic files.

We cannot promise any benefits to you for taking part in this research; however, we believe this research will contribute to the understanding water conservation from the perspective of someone known to be an expert in the field.

There are no reasonably foreseeable risks, discomforts, or inconveniences as a result of participating in this research study. Although I do not anticipate any risks, if you experience discomfort, you may contact me (the researcher), or the CBU Counseling Center (951-689-1120, <https://www.calbaptist.edu/counseling-center/>).

The researcher of the study is Anthony C. Williams. The Chair overseeing this research is Dr. Elaine Ahumada. Please feel free to contact one, or both, if you have questions, concerns, complaints, feel harmed, or would like to talk to any member of the research team. Dr. Ahumada can be reached via email at [eahumada@calbaptist.edu](mailto:eahumada@calbaptist.edu).

This research has been reviewed and approved by the Institutional Review Board at California Baptist University (IRB # 024-2021-EXP). They can be reached at by emailing [irb@calbaptist.edu](mailto:irb@calbaptist.edu) if your questions, concerns, or complaints are not being answered by the research team, if you cannot reach the research team, if you want to talk to someone besides the research team, or if you have questions about your rights as a research participant.

**What are the next steps once you choose to participate in this study:**

The researcher will need a signed **Statement of Consent** which confirms that the researcher has explained the purpose of this research and the intended outcome.

- The Participant understands that upon receiving the signed Statement of Consent, the researcher will contact me by email to confirm participation in the study and a date when to expect the survey to be sent.
- The Participant understands that the researcher will ask questions about experiences as an expert in the field of water conservation.
- The Participant acknowledges that **ALL INTERVIEWS WILL BE VIDEO RECORDED** and that all audio recordings will be used for research purposes and will not be used outside the research project.
- The Participants participation in this study should take about 60 minutes or less.
- The Participant understands that their responses will be confidential and that anonymity will be preserved by using an alphanumeric code in all writings that pertain to the research findings.
- The Participant acknowledges that their name and their organization's name will not be associated with any results of this study.
- The Participant may contact the researchers or [irb@calbaptist.edu](mailto:irb@calbaptist.edu) for additional questions.

By digitally signing this form, you acknowledge that you have read the informed consent, you understand the nature of the study, your interview will be audio taped and the potential risks to you as a participant, and the means by which your identity will be kept confidential. Your signature on this form also indicates that you are 18 years old or older and that you give your permission voluntarily to serve as a participant in the study described.

X\_\_\_\_\_

Please sign here, and date, if you **consent** to participate in the study

Please email this form back to me if you agree to participate. I will then contact you by email when the survey is ready to complete, and follow up with you to set up a mutually agreeable date and time to conduct the post-survey interview.

Thank you for your consideration,

**Anthony C. Williams**

Candidate, Doctor of Public Administration

California Baptist University, Online and Professional Studies

Email: AnthonyC.Williams@CalBaptist.edu

## APPENDIX E

### Interview Protocol and Script

**STUDY TITLE: Analyzing Public Engagement Strategies for Drinking Water Policy of Water Conservation: A Phenomenological Approach**

TIME OF INTERVIEW: \_\_\_\_\_ DATE: \_\_\_\_\_

GENDER: \_\_\_\_\_ HIGHEST EDUCATION LEVEL OBTAINED:

\_\_\_\_\_

YEARS/MONTHS AT THE ORGANIZATION: \_\_\_\_\_

CURRENT POSITION: \_\_\_\_\_ HOW LONG IN CURRENT ROLE:

\_\_\_\_\_

**The following provides an outline to guide the interview process for each participant to maintain consistency.**

#### **I. Introduction**

##### **Welcome and overview of session:**

Hello and Thank you for your participation in my research study on water conservation. My name is Anthony Williams, and I am a doctoral candidate at the California Baptist University, School of Online and Professional Studies. I

am working on a doctorate in public administration. You have read, acknowledged, and signed the Inform Consent letter that explains the intent and characteristics of this study, as well as the authorization form to record this interview. I will ask you 10 questions related to the survey results, as well as questions related water conservation policies, techniques and issues from an expert perspective. Today's discussion will be conducted within a 60-minute timeframe. When we get close to the end time of the appointment, I will let you know. We will not go beyond that time unless you agree to do so. This research will continue into a second round of questions, which will be emailed to you with instructions on how to complete it.

**Background:**

Officials and water managers across the United States and the world are conducting wide-ranging research to improve the efficiency of the natural resource of water, which is becoming scarcer as a result of over-pumping, high population and even climate changes. As a result, many areas across the US have put in restrictions to battle the low water capacity in some aquifers. Closer to home in South Florida, the Biscayne Aquifer is not recharging as quick and the population continues to increase. This heightens the chances of saltwater intrusion and possible contamination of one of earth's natural resources.

**Purpose:**

The purpose of this study is to explore the perception of experts in water conservation and water policy and connect this perception to the methods used by consumers and the

issues they face. Experts in this in this study will be defined a reputable and professional person who is considered qualified, with relevant knowledge and experience of a topic.

**Ground Rules:**

Please be aware, your participation in this study is strictly voluntary, and you may withdraw from the study at any time without fear of penalty or loss of benefit to you. All responses will be kept confidential. Feel free to disclose as much about your experiences as you feel comfortable. Any reference to your responses contributing to the study will be coded to you, and any identifiable information will be removed. I will be the only person who knows your identity and all files recorded will be in a password-encrypted folder.

If there are any questions that you cannot answer or do not feel comfortable answering, we can skip over those questions and return to later. In addition, I may be taking notes during our conversation and audio and video recording it for a transcript. There are no foreseeable risks to you from participating in this study.

There are no incorrect responses; therefore, you may say whatever comes to mind regarding the issue. I will retain all notes and recordings, and no names will appear in the results of the study. Again, our discussion will focus on water conservation and the perception from the experts.

Do you have any questions before we get started?



### III. Interview Questions

1. How long have you worked in the area of water conservation? How long have you worked in your current position?
2. Based on your knowledge, how would you define water conservation?
3. How effective is it for residents to all conserve water on purpose annually?
4. Have you ever been involved in a public awareness strategy for water conservation (i.e. conference)?
5. How would the help of other government agencies and municipalities change your perception on how consumers conserve?
6. In what ways do you converse (or network) with other individuals outside of your organization, concerning more efficient methods for water conservation?
7. What is your perception of how consumers conserve water? In what ways do you feel consumers can be more efficient in water conservation?
8. What is your perception concerning the amount of educational material available to the public for water conservation in South Florida?
9. What are the major shortcomings of the current approach(es) used by regulators to conserve water?
10. What water conservation management strategies are you familiar with (in Florida or outside of the state) that your region can emulate?

### IV. Online Survey Questions

1. According to your knowledge, which two (2) areas of a home use the most water (regardless of technology)?
  - A. Dishwasher
  - B. Washing Machine
  - C. Showerheads and faucets
  - D. Toilets
  - E. Irrigation Systems
  - F. Other not listed (please list) \_\_\_\_\_
2. What is your assessment of the current procedures regarding municipal water loss, concerning water conservation (i.e. hydrant flushing, main)?
  5. Excellent    4. Good    3. Average    2. Needs Improvement    1. Poor
3. What is your assessment on how accessible education of water conservation is in your region?
  5. Excellent    4. Good    3. Average    2. Needs Improvement    1. Poor
4. Please rate your overall knowledge on water conservation issues and policies in Florida?
  - A. Very Knowledgeable    B. Familiar    C. Not too familiar
5. Please rate your overall knowledge on water conservation issues and policies in your region?
  - A. Very Knowledgeable    B. Familiar    C. Not too familiar

6. Please assign a rating 1 – 5 (1 being very concerned, 5 being least of concern) to the following water conservation techniques and issues:

- A. Changing toilets, faucets and showerheads to water-efficient fixtures
- B. Running full cycles of a washing machine and/or dishwasher
- C. Watering lawns in the morning
- D. Watering lawns in the evening
- E. Watering lawns during rainy season
- F. Not following recommended irrigation schedules
- G. Saltwater intrusion
- H. Flooding
- I. Treatment facilities pumping water from Biscayne Aquifer
- J. Treatment facilities pumping water from Floridan Aquifer
- K. Violations and citations for improper water conservation
- L. Water conservation education

## **V. Debriefing**

Thank you for your participation in the study. The information and responses you shared with me today will remain confidential. I will not use your name, your organization name or any other identifying information in the dissertation.