SOCIAL PERSPECTIVES ON AN INTER-AQUIFER WATER TRANSFER PROJECT: THE VISTA RIDGE PIPELINE IN CENTRAL TEXAS

A Thesis

by

SYDNEY STARR BECKNER

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Chair of Committee,	Wendy Jepson
Committee Members,	Christian Brannstrom
	John Tracy
Head of Department,	David Cairns

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ABSTRACT

As municipal demand for water grows, large cities are seeking sources of water from more distant places. In the last century, large-scale water supply projects have become the predominant model of securitizing water resources for growing cities. In Texas, areas with groundwater supplies lie between the major urban centers and are largely low density, agricultural based communities. These areas, targeted because they present the path of least resistance because of legal and institutional weakness governing groundwater, are likely to experience an increase in water transfer projects in the coming decades. The Vista Ridge Pipeline (VRP) is the most recent of these projects. Currently under construction and highly controversial, the VRP will be capable of transporting 50,000 acre-feet annually of fresh groundwater from two rural counties in Central Texas to the state's second largest city, San Antonio. The project represents a 20% increase in water supplies for San Antonio and is estimated to cost $3.4 billion, making it the largest transfer pipeline to date in Texas. Thus, to understand the controversy, I used Q-Method, an approach capable of quantifying individual stakeholder's qualitative viewpoints, and had stakeholders representing rural landowners, journalists, lawyers, NGO members, prominent business owners, and municipal utility employees sort statements on the perceived impacts of the VRP project. The study revealed three social perspective clusters: two groups strongly oppose the project and one group of support. An emergent fourth group of individuals did not statistically load into the other groups but were found to also oppose the project. Overall, analysis revealed that opposition to the VRP project is not homogeneous and these differences are important to include in larger policy discussions regarding water governance and water security for all. The perspectives found are not unique to

the VRP project and are likely to appear in the development of other water securitization projects.

DEDICATION

To my family and friends

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NOMENCLATURE

ACP	Aquifer Conservancy Program
ASR	Aquifer Storage & Recovery
CPR	Common Pool Resource
CTWSC	Central Texas Water Supply Corporation
DFC	Desired Future Condition
DOR	Drought of Record
EAA	Edwards Aquifer Authority
EAHCP	Edwards Aquifer Habitat Conservation Plan
GCD	Groundwater Conservation District
GMA	Groundwater Management Area
GPCD	Gallons per capita per day
MAG	Modelled Available Groundwater
PCA	Principle Components Analysis
PPP	Public-Private Partnership
POSGCD	Post Oak Savannah Groundwater Conservation District
RFCSP	Request for Competitive Sealed Proposals
SAWS	San Antonio Water System
TWDB	Texas Water Development Board
VRC	Vista Ridge Consortium
VRP	Vista Ridge Pipeline
WMP	Water Management Plan

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1. INTRODUCTION

> *The fear of going dry has driven many communities to extraordinary efforts, provoking in them the deepest anxiety, the sorriest desperation, forcing them to make radical changes in their behavior and institutions. It has stirred them out of lethargy to undertake the most difficult labors: building enormous engineering works to bring water from distant places and stave off their thirst. That reaching out to establish control over a river, often driven by the raw instinct to survive, has had profound implications for the course of history.*
>
> - *Donald Worster, Rivers of Empire*

In the last century, large-scale water supply projects have become the predominant model of securing water resources. Pipelines and other water transfer projects are seen as standard solutions to move water from where it is to where demand exists. The subsequent social and ecological impacts of such projects have led many to reexamine how our built society relates to water. Technical solutions for securing quantities of supply often leave little room for considering the social, cultural and ecological dimensions of water. Development of water in the American West has been critically examined by writers for years (Worster 1985; Reisner 1986; Glennon 2002). Born out of an unrelenting pursuit of life in an arid climate, laws developed to dictate rules for manipulation of Western water overtime produced a powerful hierarchy of social control in the region with lasting effects (Worster 1985). Doctrines of prior appropriation and rule of capture were established early in the development of the American West and subsequent analysis of these principles indicate each promotes exploitation and hinder the ability to collectively use common water resources by expediting their depletion (Worster 1985; Kaiser and Skillern 2001).

Texas faces similar challenges as other iconic western states as its groundwater is governed by the rule of capture. Known as ‘the law of the biggest pump,’ rule of capture law is

"an unqualifiable right of a landowner to withdraw unlimited amounts of water beneath his land" (Kaiser and Skillern 2001, 263). Following the doctrine to its logical conclusion has led many state officials and water managers to consider the consequences of unrestrained pumping to be antiquated and inadequate for long-term sustainability (Welles 2013). In recent decades, legal cases have challenged this doctrine but Texas courts have continued to uphold the existing law. Understanding the rule of capture provides important context for the project discussed in this thesis.

The Vista Ridge Pipeline (VRP) is a controversial water transfer project capable of transporting 50,000 acre-feet (16 billion gallons) annually of fresh groundwater 142 miles from two rural counties in Central Texas to San Antonio, the state's second largest city. The project, currently under construction, represents a 20% increase in water supplies for San Antonio and is estimated to cost $3.4 billion, making it the largest transfer pipeline to date in Texas. The San Antonio Water System (SAWS), the city's public water utility, is using a public-private partnership (PPP) with a consortium of private firms to finance, construct and operate the pipeline. For some, the VRP project is a crucial opportunity to continue growth and prosperity for current and future San Antonio residents. Others view the project as an urban water grab benefiting local developers but at the expense of existing water ratepayers and rural landowners. The decision to use a PPP is an important aspect informing much of the controversy around this project. One contribution of this thesis is a discussion of the intersection between groundwater governance and PPPs, an under analyzed area in existing literature.

The study presents empirically determined and statistically significant social perspectives which reveal the place-based local and regional factors that structure and inform acceptance of an inter-aquifer water transfer project by key stakeholders in Central Texas. Using the Q-

Methodology, which allows for the quantitative measure of individual's qualitative subjectivities, the study provides an in-depth analysis of the various positions and debates related to the Vista Ridge Pipeline. Key stakeholders include municipal employees, landowners, ratepayers, prominent local business and community leaders. Three statistically significant social perspectives were identified, two of which shared strong opposition to the water transfer project and one cluster of significant support for the project. A fourth group of individuals opposed the project but did not statistically load into the other factors. Their reasons for opposition were split between the other groups and indicate the existence of more ways to say 'no' to the pipeline project. The thesis not only serves as an entry point to understanding the perspectives on the VRP project but also reveals underlying conflict and political dynamics of water securitization developments more broadly in Texas.

The thesis is organized as follows. Chapter 2 provides a review of the relevant literature, with special concern for informing the debate on water security on issues related to groundwater. Chapter 3 explains the Texas water security problem and provides background to the case study discussed. Chapter 4 outlines my research objectives, data and methods. Chapters 5 and 6 present results and discussion, respectfully. Chapter 7 offers a conclusion and areas for continued research.

2. BACKGROUND AND SIGNIFICANCE

The importance of water is undeniable and our relationship to it is dynamic. To put it simply, "water is what we make of it" (Linton 2010, 3). Prior to modern science, *waters* were understood in their plurality as having different manifestations and influences in different cultures and places. Jamie Linton (2010), geographer and water scholar, writes how waters operate in many different cultures. Premodern folklore and religion believed waters had a sacred presence. For the Greeks different waters inspired prophesy and later the Romans believed they inspired poetry. Mineral springs of premodern times transitioned waters from holy to healing as medicine men described different waters in proto-scientific terms. It was not until the eighteenth century when the founders of modern chemistry discovered the molecular structure of water as two atoms of hydrogen and one of oxygen that society's relationship began to shift. This new age of science homogenized water to "an essential substance," coined "modern water" by Linton (2010, 76). Linton describes how modern scientific practices presume a fundamental separation between the natural and the social. The separation of water in scientific and physical terms reduces its meaning to a basic chemical compound, as he argues, removing any socially specific qualities. Water is no longer seen as unique to any one place, rather it is universal and singular. The emblematic scientific discoveries and the technological innovations of the late nineteenth and early twentieth centuries (urban water systems, indoor plumbing, etc.) produced a new way of "knowing and relating to water" (Linton 2010, 98).

The paradigm of modern water, described by Linton, is the predominantly Western notion of uncomplicated, quantifiable and controllable water void of historical and cultural context. Modern water "diverts attention from the political and social dimensions and frames their solutions in predominantly technical and hydrologic terms" (Linton 2010, 7).

Modernization reduced water to an abstract quantity and a mathematical formula allowing for the prioritization of water as an economic good. The concept of modern water appears in Karen Bakker's "state hydraulic" paradigm, which is characterized by a sharp increase of state promoted water resource projects in the early twentieth century (Bakker 2003; Bakker 2010). State-led water development projects further promoted state ideologies of citizenship, nation building and modernization (Birkenholtz 2014). Bakker attributes the rise of large-scale infrastructure projects to the view of water as a "strategic resource - …an essential lubricant of urbanization, agriculture modernization, and industrialization" which justified methods of securing supply and planning for growth (Bakker 2010, 34).

Applied to common pool resources (CPRs), like water, these actions can lead to "accumulation through dispossession" (Harvey 2003; Birkenholtz 2014). This explains the widespread centralization of wealth and power into the hands of a few by dispossessing others wealth or land. Parallels are present in the rule of capture doctrine, which emerged as a way to govern groundwater resources in Texas. For issues of water quantity, rule of capture allows for a landowner to pump unrestricted amounts of groundwater from beneath their land with no liability for harm caused to neighbors or surrounding ecosystems (Kaiser and Skillern 2001). Commonly referred to as the 'law of the biggest pump,' the logical conclusion of rule of capture is rapid accumulation of groundwater by those with the ability to afford large pumps and subsequently the dispossession of resources from small scale landowners and natural ecosystems. There are five common law exceptions to the rule of capture that allow a landowner the ability to take legal action which include situations of trespassing, theft, waste of well water, water contamination and land subsidence (Dowell 2013).

Over time, the underlying presumption of the state hydraulic paradigm predicated on increasing water consumption to feed economic growth fell under criticism (Bakker 2010). As new technologies increased the appeal of alternative solutions and post-war urbanization rates increased, reforming issues related to the systematic exclusion of social and ecological impacts of water control became a major priority (Bakker 2010). Concept of water security and governance have emerged to reframe and challenge the conventional notion of water management realized across the globe by the modern water and state hydraulic paradigms.

To further develop these themes, I introduce the concepts of water security, governance and the use of practical politics, as they relate specifically to groundwater, to highlight the broader conversation occurring around more effective and equitable water resource management.

2.1 Groundwater Security

Water security is a means of understanding the risks associated with poor quality or a lack of water, along with how these risks are distributed across space and effect human health and ecological needs. It is important to distinguish between the concepts of water security and water securitization. Securitization of water focuses on strictly securing water in volumetric terms to meet the demand driven by some. In fact, securitization of water resources in response to public and political favor may "exacerbate existing problems or even trigger unintended consequences by reducing the number of options available in the future" (Zeitoun et al. 2013, 3).

Water security contrasts to the widespread notion of security and does not mean water should be appropriated and safeguarded in volumetric terms (Lankford et al. 2013). It is important when discussing water security to acknowledge that water is in a constant state of flux and has an estimated residence time of only 2 weeks once brought to the surface. In that context,

there is no possibility of securing the resource and safeguarding in volumetric terms. Also, water security accomplished through cooperative governance rather than appropriation is more likely to produce collective water solutions. Following this logic, water security expert Mark Zeitoun and colleagues, argue that water security cannot be achieved at the expense of the water security of others (Zeitoun et al. 2013, 3). They argue that major shortcomings in science related to water resources have led to mis-informed policy decisions that have further jeopardized our resources. Shifting policy attention away from short-term water security and seeking answers to the question "water security for who" by pinpointing areas of water insecurity are steps toward addressing the root causes of insecurity for the long-term (Zeitoun 2013, 20).

Much of the water security dialogue and research focused on surface water. The visible and more tangible nature of surface water is attributed to why it has attracted more management attention (Famiglietti 2014). However, groundwater is a critical component of the global water supply. Increases in groundwater use are driven by many factors. First, the physical aspects of aquifers make for an extremely attractive resource. Most aquifers are geologically suited for storage and provide natural buffers to climate variability, such as droughts, which otherwise plague surface water resources (Foster et al. 2013; Foster and MacDonald 2014). In terms of quality, groundwater is generally superior to surface water sources due to its natural buffer from surface contamination (Glennon 2002; Conti, Kukurić, and Gupta 2016). Groundwater is also typically available in the precise location in which need exists and, therefore, can be developed quickly and applied more precisely (Birkenholtz 2014).

Second, advances in well drilling technology allowed for the expansion in use of groundwater resources. Increased access to drilling and borehole technology in the late 20th century contributed to the widespread uptake in groundwater (Shah et al. 2007). Prior to such

advances, groundwater extraction was costly in terms of human and animal labor. Drilling technologies and the spread of electricity to more rural communities allowed for direct use of groundwater leading to improved livelihoods and agricultural production (Shah et al. 2007).

Third, the gap between groundwater law and hydrologic science has left the legal door open to exploitation in the name of economic progress (Glennon 2002; Famiglietti 2014). During the twentieth century, when most state initiatives focused on controlling and allocating surface water resources, groundwater science advanced and made significant gains (Birkenholtz 2014). However, legal ambiguity of the connection between surface- and groundwater lags behind in many areas (Birkenholtz 2014). Across the globe, surface water is commonly considered a collective property, while groundwater is considered private property. Establishment of a system in which groundwater is bound to the property above it has provided an avenue for privatization (Birkenholtz 2014, 3).

Fourth, groundwater financing is largely dominated by private investments (Giordano 2009). This is a stark contrast to surface water supplies which are largely governed by state agencies and considered a public good. The financialization of groundwater by private interests has "important implications for efforts to regulate groundwater" (Giordano 2009, 157).

The importance of groundwater resources is undeniable. Groundwater use has important connections with economic factors subsequently creating jobs and allowing for more efficient agricultural production (Giordano 2009). Döll et al. (2012) modelled groundwater resources across the globe and found it supplies 42% of irrigation, 36% of potable household water, and 27% of manufacturing water. However, persistent myths of limitless groundwater are creating a culture of exploitation and unsustainable abstraction. Intense use of groundwater can cause issues of aquifer depletion, land subsidence and saltwater intrusion (Zhou 2009). While resilient

to climate variations, large storage aquifers are considered virtually non-renewable due to negligible recharge rates (Foster and Loucks 2006). These aquifers are susceptible to permanent depletion, or "groundwater mining," when inactive groundwater is pumped (Gleeson et al. 2012). While most aquifers have a large capacity to store water, measuring extraction as a ratio of total volume is a poor indicator of aquifer health. As aquifers deplete, energy and pumping costs increase. The portion of groundwater that is economically viable to reach is a much smaller portion than total storage. Aquifer depletion not only disproportionately impacts poorer, small-scale agricultural operations but can affect riparian and aquatic ecosystems. The resiliency of surface water resources and ecosystems depend on the resiliency of groundwater and for many stakeholders this is more important than the water itself (Foster and MacDonald 2014).

Aquifers are also difficult and costly to monitor creating a lack of consistent data collection (Giordano 2009). Well design can even impact monitoring success. An extraction well built without monitoring in mind requires modification and removal of the pump to allow for the lowering of monitoring equipment. This is a costly endeavor falling to the private well owner. Gaps in aquifer data weaken the output of groundwater models attempting to predict future impacts of extraction. Models are the primary tool used to assess the long-term implications of groundwater use and rely on historical pumping data, as well as, precise hydrogeological characteristics. There is increasing evidence that aquifer depletion is approaching – or in many places have surpassed – its limit (Giordano 2009). Proper groundwater security would seek to establish management techniques which increase long-term resiliency as much as possible.

Famiglietti (2014) also stresses the importance of groundwater in his published commentary entitled "The Global Groundwater Crisis," in which he lays out five essential steps that "warrant immediate, international attention":

1. *Recognition that water demand far exceeds water supply*. This includes eliminating the myth of limitless water that persists around groundwater.
2. *Increase knowledge of aquifers through more physical explorations and hydrogeologic studies*.
3. *Combine surface and groundwater management*.
4. *Share data across political boundaries*. Linton and Brooks (2011) also argue for cooperative management at the aquifer scale due to its nature as a common-pool resource.
5. *International recognition of the importance of groundwater in total water supplies*. There exist agreements between nations for surface water management, the same must occur for groundwater.

Famiglietti addresses issues of groundwater depletion from the perspective of a geoscientist, not a water manager. From the perspective of water managers more hydrogeologic information has done little to aid long-term planning. Rather, a more important piece of information is water fluxes, of which accurate information on groundwater pumpage is key. In the East Snake Plain aquifer in Idaho, the accurate estimation of groundwater extraction through the use of LANDSAT satellite data allowed for the development of a useful planning model (Johnson et al. 1999; Cosgrove and Johnson 2004).

There are even examples of effective groundwater management that were achieved with only management linkages, but not legal requirements. That is, water management plans were developed that recognize the connection between surface and groundwater resources, but there were no explicit legal (or policy) requirements that required this recognition. One such example in Texas is the use of surface water indicators, such as spring or river flow, by some groundwater

conservation districts and hence manage groundwater usage in their jurisdictions in a conjunctive manner. There are also examples where water laws and politics explicitly require the linkage of surface and groundwater rights, yet there are substantial problems with both surface and groundwater flows. In Kansas, groundwater pumpage led to the complete depletion of stream flows in West Walnut and Rattlesnake Creeks in the mid 1980s (Peck 2002). Kansas state water law is explicit in regards to the conjunctive administration of surface and ground water rights, yet the water management in these basins resulted in groundwater pumpage adversely impacting senior surface water rights, with right holders having little recourse (Peck 2002). The state of Kansas has spent a fair amount of time trying to remedy the situation, but the bottom line is that even if there is a policy stating that surface and ground water rights have to be administered conjunctively, water management practices can still result in undesirable outcomes that undermine the goals of the policy, especially when there is little though given to how to implement the policy.

Foster and MacDonald (2014) urge hydrogeologists to articulate the need for political debate to be more informed to the role and importance of groundwater resources. In volumetric terms groundwater use is dominated by agriculture but this focus understates groundwaters crucial role in domestic supplies (Giordano 2009). Depletion of aquifers have aspects of physical groundwater security overlap with aspects of human security, like politics, power, and decision-making and are discussed in more detail in the following section on groundwater governance.

2.2 Groundwater Governance

Governance refers to "the fundamental question of how organization, decisions, order and rule are achieved in heterogeneous and highly differentiated societies" and "addresses the

problem of economic and political co-ordination in social life" (Bridge and Perreault 2008, 476). Governance differs from government and "includes the actions of the state and, in addition, encompasses actors such as communities, businesses and NGOs" (Lemos and Agrawal 2006, 298). The production and exercise of regulatory and administrative power is an explicit focus at the core of governance (Bridge and Perreault 2008).

Water governance is "the range of political, social, economic and administrative systems that are in place to develop and manage water resources, and the delivery of water services, at different levels of society" (Rogers and Hall 2003, 7). Water governance informs the allocation and distribution of water resources and ultimately determines the efficiency and equity of management systems (UNDP-SIWI 2016). An important aspect of water governance is the interplay between politics and power in decision-making. Water's central importance in all aspects of society can create a desire by some to consolidate power through control of resources. For example, in examining the question of why societies chose to take on social, political and economic risks to secure more water, Worster (1985, 47) explains that in some cases "the decisive impulse undoubtedly was more a matter of ideas than hunger, of ambitions more than survival, of a thirst for power more than for water." Turton et al. (2007) encourages opening an explicit dialogue in water governance regarding the implications of power and politics to expose political agendas.

Groundwater governance follows the same principles of water governance but applied specifically to underground resources. A significant difference between governing surface water and groundwater is that the latter is invisible. Creating governance structures for an invisible resource is inherently more difficult proposition. Foster et al. (2009, 3) define groundwater governance as the fulfillment of "appropriate authority and promotion of responsible collective

action to ensure sustainable and efficient utilization of groundwater for the benefit of humans and dependent ecosystems." Competition over groundwater resources present management challenges. There is an urgent need to understand the requirements of groundwater governance to determine long-term sustainable policy strategies (Knüppe and Pahl-Wostl 2011). Megdal et al. (2015, 678) describe good groundwater governance as transparent, responsive, efficient and accountable, and incorporates local or regional sociocultural values of water. Environmental requirements are also considered under good governance regimes. Mukherji and Shah (2005) assess two steps they deem important for groundwater governance. The first is attaining adequate and high-quality information regarding hydrogeological and socioeconomic factors. The second step is the information collected must be shared openly with scientists, policy makers and the general public. There remain questions regarding the legal, financial, and administrative abilities of state agencies to implement effective groundwater governance in light of decreasing budgets, competing interests, and gaps in scientific information (Megdal et al. 2015).

Governance of transboundary aquifers presents its own unique challenges in coordinating management between two or more sovereign nations. Milman and Scott (2010) analyze the governance challenges of the Santa Cruz aquifer system which spans the border between Mexico and the state of Arizona. The authors identify that differences in intranational institutions give rise to ambiguities, gaps and overlaps that "hinder the ability of the US and Mexico to enact formal cooperation over transboundary aquifers" (Milman and Scott 2010, 544). In both countries, poorly defined legal and political authority undermines competence, while institutional capacity is limited by insufficient resources. However, an intranational agreement established in 2007 between the two counties strives to foster binational cooperation in data and information

sharing, as well as, analysis of each countries' national and subnational management (Milman and Scott 2010). That is, cooperation is a vital component of collective resource management.

Of particular importance to the research discussed in this thesis is the governance of a large aquifer system. Ostrom (1990) outlined eight design principles for self-governing common pool resources. Her principles serve as a good starting point for understanding collective groundwater governance but empirical examples are limited to small-scale resources. Ross and Martinez-Santos (2010) apply Ostrom's principles to four large-scale aquifer systems in Spain and Australia. Their study suggests that Ostrom's principles are relevant to the examples presented but that "sustainable groundwater management depends on a flexible and adaptive management approach, with strong collaboration between scientists, policy makers, water supply agencies and water users" (Ross and Martinez-Santos 2010, 308). Large aquifers present unique hydrogeologic and management challenges compared to small-scale aquifers. Physical responses to pumping are different for large aquifers due to their size and formation complexity and these delays can occur in time and space (Ross and Martinez-Santos 2010). Users of small aquifers are more likely to have clear understanding of the implications of certain pumping techniques, whereas management complexity is increased in large-scale, multi-user aquifers. Coordination and cooperation among users are an important aspect of groundwater management that remains a challenge (Eckstein 2009; Ross and Martinez-Santos 2010). As Ross and Martinez-Santos (2010) argue, it is important for attempts by water managers to consult and engage with stakeholders are genuine rather than symbolic and truly take their views into account in policy decisions (Ross and Martinez-Santos 2010).

Good water governance seeks to meet the needs of particular development goals such as water availability and sanitation, equitable sharing of water between users, or goals related to

food, energy and conservation of ecosystems (UNDP-SIWI 2016). In theory, good water governance incorporates multiple stakeholders and strives to make decisions that are socially equitable and ecologically sustainable. The Global Water Partnership (2003) outlines necessary conditions of good governance which include accountability, transparency, inclusiveness and responsiveness.

Of course, examples of governance shortfalls exist. Literature on the topic agrees that many of the challenges in groundwater management are associated with governance failures rather than insufficient water supplies (Bakker 2010; Knüppe and Pahl-Wostl 2011; Foster et al. 2013). Baker (2010, 45) uses the term 'governance failure' to describe "how the institutional dimensions of water management and decision making do not effectively take into account the needs of all citizens." Failing to acknowledge the variety of values and meanings of water held by multiple stakeholders and local ecosystems can lead to decisions which increase socio-economic and environmental inequity. Knüppe and Pahl-Wostl (2011) found cooperative and integrated management at all active levels of use, from local to international, is crucial for sustainable groundwater governance. They created a framework, based on the concepts of adaptive management and ecosystem services, which identifies cooperation structures, information transfer and degree of influence across local, regional and national scales. This analysis highlights how issues with groundwater management arise when crucial stakeholders are excluded from decision-making processes. A critical component of adaptive management is the vertical integration of different administrative and agency levels involved in groundwater management, as well as, the active involvement of stakeholders (governmental and non-governmental) within the various administrative levels (Knüppe and Pahl-Wostl 2011, 3387). Basins that lack the necessary agencies for facilitating effective stakeholder participation,

providing transparency of information and promoting an understanding of groundwater constraints among stakeholders are likely to struggle with sustainably managing their groundwater resources (Knüppe and Pahl-Wostl 2011; Foster et al. 2013). Successful management of groundwater will involve influencing individual's groundwater use behavior rather than a top-down policy strategy (Foster and Garduño 2013). The goal of participation, thus, is to create a sense of responsibility on the part of stakeholders in their decision-making and water use habits.

Solutions to collective CPR management will not be 'one-size-fits-all,' rather problems of resource overuse must address issues specific to the particular context (Ostrom 1990; Knüppe and Pahl-Wostl 2011; Foster et al. 2013). The case study discussed in this thesis contributes to discussions at the intersection of groundwater governance and the use of public-private partnerships (PPPs) to assist in providing water system services and delivery. In the following section, I provide a review of literature pertaining to the use of PPPs and potential challenges in their application.

Public-Private Partnerships

Public-private partnerships are mechanisms for the construction of infrastructures built and financed by private firms who enter long-term contracts to provision services in return for payments by a public entity. They have gained popularity in a number of countries, yet differ in terms of organizational arrangements even within the same country. There exist many configurations of PPPs but most include combinations of: design – build – own – operate – transfer (Johnston and Gudergan 2007). PPPs are common for infrastructure projects including: roads and tollways (Grimsey and Lewis 2004; Hodge 2004; Johnston and Gudergan 2007),

sewage and wastewater infrastructure (Grimsey and Lewis 2004), hospitals (McKee, Edwards, and Atun 2006), prisons (Bloomfield, Westerling, Carey 1998), and sport facilities (Jefferies, Gameson, and Rowlinson 2002).

Definitions of PPPs are multifarious and emphasize a broad spectrum of intersectoral initiatives. For this study, the definition provided by Bovaird (2004, 200) is appropriate:

> [Public-private partnerships are] working arrangements based on mutual commitment (over and above that implied in any contract) between a public sector organization with any organization outside of the public sector.

Contracts between governments and private sector firms are not a new phenomenon. Rather, what is new and fundamental to PPPs is "the use of private finance arrangements, the use of highly complex contracts to provide the infrastructure or services and the altered governance and accountability assumptions accompanying this" (Hodge 2004, 37). The private sector has long operated under the economic assumption that competition through markets cut costs and improves product and service quality (Bovaird 2004). PPPs, in essence, create an immediate shift from the traditional state-hydraulic paradigm of water management to the privatization process behind "market environmentalism" (Bakker 2005). Increasingly, this idea has been applied to the public sector leading to a rise in privatization and outsourcing experiments (Bovaird 2004). An important component of the above definition is that the partnerships should go above and beyond typical contractual relationships to achieve joint outcomes based on mutual commitment and competence (Brinkerhoff and Brinkerhoff 2011).

PPPs are described as "innovative, flexible collaborations" which place "emphasis on capturing the benefits of private sector techniques such as market-driven competition and performance contracting" (Bloomfield 2006, 400). For governments struggling to maintain or

implement expensive infrastructure, PPPs are often viewed as a collaborative, responsive method using private finances and expertise to improve service delivery and reduce risks. Analyzed critically, however, many PPPs have structural issues regarding risk allocation, affordability, transparency and public accountability, efficiency and sustainability. While examples of effective intersectoral agreements working to achieve a common goal exist, literature on the subject reveals that our understanding of configuring PPPs to be a form of good governance remains rudimentary. Effective, equitable and sustainable PPPs are context-specific and require partnerships built on mutual accountability and trust.

Grimsey and Lewis (2004) state a PPP is primarily a mechanism for developing appropriate strategies for assessing, allocating and management risks of large infrastructure projects. They outline several categories of risk infrastructure projects face, including: technical risk, construction risk, operating risk, revenue risk, financial risk, regulatory/political risk, environmental risk, and project failure. They see an advantage of PPPs over tradition procurement arrangements is taking the time to ensure that all risks are valued and accounted (Grimsey and Lewis 2004). Mitigating for these risks over the course of long-term projects requires defining risks explicitly and "agreeing on [which partner] is in the best position to bear the responsibility for the risks in the partnership" (Forrer et al. 2010, 479). It is important for partners to clearly identify and allocate project risks. Literature pertaining to risk assessment suggest risk should be allocated to the partner best suited in terms of expertise and knowledge to control and manage the risk (Forrer et al. 2010).

Risk shifting is often seen as an attractive feature of PPPs for many public agencies as well as providing a financial option for large projects without legally incurring debt. As Bloomfield (2006, 403) states, "local governments can enter into long-term leases without

having to obtain voter approval, comply with statutory debt limitations, or report the long-term lease obligations as debt" (Bloomfield 2006, 403). However, she goes on to explain, "it should be recognized that avoiding restrictions on debt is not the same as avoiding debt" (Bloomfield 2006, 403). PPPs are typically more expensive than conventional agreements that lack thorough risk analysis. Plus, when risks are not properly assessed, allocated or managed serious financial woes can befall the project partners and taxpaying citizens (Bloomfield, Westerling, and Carey 1998; Greve and Ejersbo 2003). For governments seeking to allocate as much, if not all, project risk on the private sector there are heavy risk premiums which can dramatically increase the overall price of the project (Hodge 2004; Forrer et al. 2010).

In practice, there remains major questions regarding the successful implementation of PPPs and their impact on transparency and public accountability (Bloomfield 2006). These issues are "all the more acute when the partnership is reluctant to divulge information to outsiders on the grounds of 'commercial confidentiality'…or on the grounds of 'data protection'" (Bovaird 2004, 203). Misleading stakeholders or outright concealment of information only serves to reduce public confidence regarding the governance and accountability of PPPs.

Hodge's (2004, 37) examination of risk shifting and sharing of an Australian PPP constructing a public toll road reveals how commercial risks were managed well while major governance risks related to the transparency remained. When economic and financial evaluations were withheld from the public and excluded from typical Freedom of Information requests, the toll road development project became politically divisive (Hodge 2004, 41). Melbourne citizens became angered at the apparent favoritism granted to the private consortia. Hodge (2004, 47) concludes that in the absence of democratic debate and transparency "it is not so much a case of

risk shifting or risk sharing with PPPs, but one of shirking stewardship responsibilities in governance."

There is a major need of open and transparent sharing of financial models and project interest rates to citizens who inevitably pay. Of course, transparency is not just the *availability* of documents but includes the ability of stakeholders to understand the complex and specialized information. Bloomfield (2006, 408) argues that "the sheer complexity of long-term contracts demands that local governments, aided by their expert consultants, commit to providing accurate, complete information to the public regarding the financial and operational implications of major contracts entered into on the public's behalf." Project contracts are highly specialized, legal documents and a truly transparent process would provide details suitable for the general public.

Despite the growth of PPPs in the water sector, research on the social, political, economic and environmental impacts of this form of development lags behind other infrastructure developments (Ameyaw and Chan 2013). Advances have been made in understanding the impact of water supply PPPs in developing countries (Marin 2009; Ameyaw and Chan 2013; Chan et al. 2014), as well as, comparisons of the implementation constraints of PPPs in developing and developed economies (Osei-Kyei and Chan 2017). These studies identify many of the same shortcomings previously mentioned: insufficient or absent risk allocation mechanisms, transparency and accountability issues, concerns regarding affordability and access for all citizens, and weak regulatory and monitoring systems.

Analysis of water sector PPPs through the lenses of water security and governance is an area lacking in existing literature. This thesis contributes to the literature by presenting an analysis of a project at the intersection of groundwater governance and PPPs. Before I introduce the case study, there is one more aspect of groundwater security and governance to be explored:

politics. It is important to understand the barriers of practical politics and the importance of politics in establishing good governance because it is through politics that sustainable water security is achieved.

2.3 Groundwater Politics

John Agnew's Presidential Address, "Waterpower: Politics and the Geography of Water Provisioning," makes two points about water and politics. First, water problems are political and democratic politics are capable of achieving outcomes other than "destruction and despair" as commonly assumed. Second, the view of politics as corrupt, trivial and comprising is unhelpful in accomplishing much needed solutions. In politics, 'compromise' is often viewed negatively with many stubbornly adhering to "all-or-nothing" deterministic behavior. Often lost is the understanding that politics mediate between the arguments and evidence about the physical science of water and the social, economic and institutional management of water for human access (Agnew 2011). Agnew's goal is to challenge the conventional deterministic ideas of politics and reveal the opportunity for effective water management through practical democratic political processes.

Uncompromising, all-or-nothing policies formulated on scientific certainty often lead to problems when the necessary tentativeness of scientific conclusions is not acknowledged (Agnew 2011). Claims affixed to the "mantle of science" and certitude play a role in the reason for ignoring politics as a practical process. Science is upheld as a disinterested force that guides political decisions by providing appropriate facts. However, in complex environmental debates where cause-and-effect relationships are not well-established, all uses of facts can be selected and used to justify even divergent actions. Yearley (1992) in his examination of the use of

science in arguments for green social movements, claims "science is an unreliable friend" for empirical and epistemological reasons. Scientific knowledge is open to revision and does not reveal support for any particular proposition. Yearley (1992) uses the example of scientific studies indicating an un-sustainable decline in whale populations may offer the grounds required to stop whaling. However, when it is discovered that certain whale populations are increasing their numbers, science does not say if whaling should be resumed (Yearley 1992). The scientific process begins by identifying a problem, but "the recognition that something is a 'problem' demands a pre-existing framework of values and interests within which problems can be recognized" (Sarewitz 2004, 386). The natural world, in its complexity and richness, lends itself to a wide range scientific expertise, disciplines, methodologies, and institutional diversity (Sarewitz 2004). Upholding the certitude of 'expert knowledge' rather than acknowledging that science is a co-production of the society and politics within which it is embedded is the reason for "the widespread denigration of politics itself" (Agnew 2011, 465).

It is also unhelpful that politics has widely become synonymous with corruption, inefficiency, and duplicity (Agnew 2011). The view that politics favor particular classes or groups of people and reflect the interests of systematic and structural forces has important implications on its effectiveness in a democratic society. Politics ideally are used in a democracy as a way to increase public participation and resolve issues without resorting to violence. Sarewitz (2004, 399) would agree that "progress in addressing environmental controversies will need to come primarily from advances in political processes, rather than scientific research." It is important to incorporate trust back into the process of practical politics. Agnew (2011) highlights two important features of politics: information and choices. Informed citizens ideally make informed decisions. Of course, many factors complicate one's ability to inform his or her self,

such as access to information, capacity to understand the information presented, and the willingness of agencies or firms to provide information. There is more to transparency than simply offering public meetings or releasing information. Public meetings held at inconvenient hours or the release of documents with little to no time for review and reflection impact stakeholders' ability to become informed. The ability to make choices, the second important feature of politics, relates to access of information. "Choices are made," Agnew (2011, 469) states, "even in the absence of participation. If you want to make or influence them you must participate politically…by voting, attending meetings, demonstrating, rioting, or striking." Politics is about social influence affecting choices through the mobilization of different groups. Barriers to political engagement exist and cause challenges but should not be debilitating to the process of practical politics. Historically, politics have extended participation beyond just societal elites to the general public who use it to champion for rights and control (Agnew 2011). Practical politics should not be viewed as a zero-sum game but as a mechanism for cooperation, negotiation and compromise.

Agnew (2011) presents three examples of the practical application of politics with regard to water resources. The first is the work of Aaron Wolf (1998, 255) who could not find a single example of "a war fought over water" in 4,000 years of cases. Wolf's (1998) findings illustrate the capacity for compromise and negotiation over shared water resources even between rivaling nation-states. At another scale, Megan Mullin's (2009) study of special districts and their increasing role in water provisioning in the United States illustrates the impact of politics on improving household water supply as opposed to technological fixes. Finally, an example of a controversial water bill in California illustrates how the first real attempt at compromise may not

adequately address underlying issues, therefore, many situations require continued negotiation and reassessment.

There exist many challenges in the politics of water. One challenge is how territorially water has been treated impacts collective action problems. Water is a global CPR and "if the institutional domains within which most politics today operates remain largely territorial by design, may of the dimensions of such problems are increasingly transnational or networked" (Agnew 2011, 472). Expanding participation to incorporate larger groups is a challenge that should be solved less technocratically and more politically and ecologically.

Another challenge is identifying the methods of cooperation that are the most legitimate. Some view water pricing as an effective way to curb water consumption while others are concerned about the impact on affordability for those who cannot pay. Critics of human behavior presume external sanctions as the only effective way to curb resource consumption (Hardin 1968), while examples of real social compromise despite such sanctions are prevalent (Ostrom 1990, 1998). Related to this is the challenge of establishing "the hierarchy of interstate relations" into water geopolitics (Agnew 2011, 473). While many disputes over water between neighboring territories have resulted in treaties and compacts, equality should not be presumed present in these agreements. Rethinking the concept of sovereignty and its impact on equitable outcomes is important for the geopolitics of water provisioning.

Language and how we talk about water have its own implications and challenges in politics. The word 'scarcity' emphasizes the physicality of water (or the perceived lack thereof) rather than framing water in terms of political values (Kaika 2003; Sarewitz 2004; Agnew 2011). Phrases like 'river-basin planning' define the parameters of political disputes (Agnew 2011).

Agnew (2011, 474) makes the case for the use of practical politics as the focus for "analyzing the actual ways in which water provision is subject to dispute and as a normative commitment to actively shaping the world through popular participation." His address presents a critical argument for the art of politics as truly a democratic action in which people of various perspectives are able to non-violently work toward compromises. The reputation of politics needs restoration, but the process has the potential to achieve solutions to collective action problems, such as surface and groundwater management.

In this section I have highlighted the ongoing conversation occurring in scholarly literature around groundwater security, governance and politics. The purpose to provide the necessary background which informed my case study analysis described in the following section. Questions remain from the literature regarding the use of PPPs as a mechanism for water supply infrastructure and the implications on public accountability, transparency, and groundwater governance. This thesis seeks to add to areas currently missing from the literature through empirical analysis of stakeholder perspectives which highlight areas for future policy deliberations. Next, I introduce the Vista Ridge Pipeline project after providing more specific historical and legal context to groundwater management in Texas.

3. THE VISTA RIDGE PIPELINE

The world is quickly urbanizing while simultaneously water resources are being depleted, degraded and mismanaged at astonishing rates. Meeting human demand while protecting ecosystems is stated by some researchers as "one of the most difficult and important challenges of this century" (Mekonnen and Hoekstra 2016, 4). Experts have attributed the increase in water scarcity to population and economic growth, poor management of water supplies, and climate change (Vörösmarty et al. 2000). This dilemma has come to be known as the urban water security problem. Massive infrastructure projects for securing water supply which dominated in the 20th-century, such as pipelines, dams, and aqueducts, led to the expansion of hydropower, irrigated agriculture and brought economic and health benefits to billions of people (Gleick 2003). Peter Gleick, a leading scientist on water resource issues, refers to these projects as "hard path" approaches for water supply (Gleick 2003, 1524). Gleick argues that while this approach "brought tremendous benefits to billions of people…the hard path also had substantial, often underappreciated social, economic, and environmental costs" (Gleick 2003, 1524). In response to these impacts, Gleick argues for soft path approaches which "strive to improve the overall productivity of water use rather than seek endless sources of new supply" (Wolff and Gleick 2002, 1). Soft path approaches should also: deliver water in quantities and qualities matched to user specific needs; utilize markets and pricing while encouraging equitable, sustainable and efficient use of water; and include local communities in decision making about water management, allocation and use (Gleick 2003, 1526).

In this chapter, I describe the Vista Ridge Pipeline, a hard path strategy for securing water resources. I contextualize the project by offering a summary of Texas groundwater law

along with a description of San Antonio's water supply portfolio comprised of hard and soft path supplies.

3.1 Texas Groundwater Law

The hydrologic interconnections between surface and groundwater are not reflected in current Texas water law which predates modern scientific understanding. As a result, the legal system governing surface and groundwater differ. Surface water is a public good governed by the state, while groundwater is a landowner's private property right governed by the rule of capture. Groundwater law has been contested by landowners for being unfair, yet Texas courts have continually deferred action to the Legislature.

Many early US cases ruling on groundwater disputes viewed the resource as "so *secret*, *occult* and *concealed* that an attempt to administer any set of legal rules in respect to them would be involved in hopeless uncertainty, and would therefore be practically impossible" (Frazier v. Brown 1861). Following English common law, it was the courts' belief that groundwater and surface water were too distinct to be governed in conjunction because doing so was seen as, at the time, impossible (Welles 2013). Therefore, any contests brought forward by a landowner regarding the excessive pumping of another landowner would be denied (Welles 2013). The foundation of groundwater law in Texas was established on this very principle after the Supreme Court ruling of *Houston & T.C. Railway v. East* in 1904. In short, Mr. East's homestead well went dry after the Texas Central Railroad Company began pumping nearby. Mr. East sued the railroad company for damages and the case appealed to the Texas Supreme Court. In their decision, the court adopted the rule of capture and granted "absolute ownership of captured water" to the landowner (Welles 2013, 486). At the time of this decision, the science of aquifer

hydrology was non-existent. While even today science can be inconclusive, we are far from "secret" or "occult" in terms of our understanding of the impacts of pumping on groundwater systems and surrounding areas.

In 1917, after two severe droughts, the Texas legislature adopted the Conservation Amendment giving the Legislature power to enact appropriate laws for "the preservation and conservation of all such natural resources of the State" (Welles 2013, 487). Texas courts continued to uphold the absolute ownership of groundwater in cases brought forward but stated in their decisions that with the passage of the Conservation Amendment the authority to preserve water rested with the Legislature (Welles 2013).

The Legislature used the Conservation Amendment to establish groundwater conservation districts (GCDs) as a way to modify the rule of capture. GCDs will be discussed in more detail in the section to follow but in short, districts allow local communities to establish permitting rules to mitigate against the exploitative effects of unregulated pumping. Even as the number of GCDs increased into the 1990s and 2000s, the decentralized system remains "vulnerable to capture by local interests that favor unsustainable pumping for short-term economic gain" (Welles 2013, 493). It is unlikely, however, that Texans will seek a more centralized system of groundwater management as there are advantages to the decentralized system. For one, districts are better able to respond to local needs and desires and offer rural stakeholders a place at the negotiation table in regional planning that otherwise could be dominated by urban interests. However, improvements to the system must be made to address ongoing challenges.

The case of *Edwards Aquifer Authority v. Day* is one such example. For background, the Edwards Aquifer Authority (EAA) is different from other GCDs governed by Chapter 36 of the

Texas Water Code. The EAA derives its legal power from its establishment out of the Endangered Species Act in the early 1990s. The Authority has an established cap on groundwater pumping to protect the many springs and endangered species which rely heavily on the Edwards Aquifer. Two men, known collectively as "Day," purchased land in the EAA's jurisdiction and applied for a permit to pump 700 acre-feet a year based on the prior owner's historic use (Welles 2013). When the permit was denied, Day sued claiming their property had been taken without just compensation, a violation of the Texas Constitution's takings clause (Welles 2013). The Court ruled with Day affirming the validity of prior use. Justice Hecht authored the opinion on *Day* and stated his support for more effective groundwater regulation but remained firm in his belief that the Legislature can craft such a system within the confines of the takings clause (Welles 2013).

A particularly significant outcome of the *Day* decision is a new emerging judicial frame that groundwater ownership mirror oil and gas ownership. Mineral rights in Texas are also governed by rule of capture and while a landowner does not own particular molecules of gas as it flows through geologic formations, he or she has a right to specific volumes relative to the amount of land owned. After *Day*, this principle was applied to groundwater "despite the fact that [the court] acknowledged that the differences between oil and water would provide justification for different regulatory strategies" (Welles 2013, 498). The analogy relating hydrocarbons and groundwater used in the *Day* decision has troubled many water managers. It illustrates "the difficulties courts have incorporating increasingly sophisticated scientific knowledge into outdated common law frameworks" (Welles 2013, 506). As a result, Texas water managers and legislative officials have attempted to adjust Chapter 36 of the Texas Water Code

to provide a more robust regulatory system based on conjunctive management. GCDs are the fundamental piece of that system and are disused below.

Groundwater Conservation Districts

Groundwater conservation districts (GCDs) emerged as a way to mitigate against the negative and exploitative effects of rule of capture. Districts offer a form of decentralized management with the goal of responding to local needs and desires along with offering rural areas a seat at the negotiation table. Today, there are 98 GCDs and 2 subsidence districts across the state of Texas. These locally governed districts are tasked with managing groundwater resources within their jurisdiction defined in Chapter 36 of the Texas Water Code (TWC). Districts can be created one of three ways: 1) voluntarily organized by members of a county or group of counties; 2) annexation into an existing District; or 3) deemed an area of importance by Texas Commission on Environmental Quality (TCEQ) who can mandate their creation. There remain areas of the state which have not established GCDs and therefore continue to exercise unmonitored rule of capture. These areas continue to present management challenges for neighboring areas with GCDs.

GCDs are governed by a local board of directors whose members are either elected or appointed by County Judges (TWC §36.016, §36.017). Districts are tasked with development and implementation of management plans with the purpose of conserving and protecting groundwater resources. Most GCDs span one or two political county boundaries, with a few exceptions in the panhandle and over the Edwards Aquifer. Therefore, one aquifer can be managed by multiple districts. Neighboring districts sharing the same aquifer can adopt different rules which can lead to local disputes. Groundwater management areas (GMAs) were established

to coordinate the planning of multiple districts and mostly follow the shape of major aquifer boundaries (Figure 1).

GCDs are the foundational piece to a system of joint and regional planning designed around cohesive management of groundwater. In fulfillment of their management plans, GCDs must make and enforce rules for permitting and pumping within the district. GCDs are given full autonomy over the regulations they choose to adopt, such as requirements of well spacing, production limits, and transport permits (TWC §36.101). Each district outlines the desired condition of groundwater over a specific time horizon in terms of water level, spring flow, or total volume. This is referred to as setting the district's desired future conditions (DFCs). The GMAs ensure each district's DFCs are technically feasible and adopts a regional average. The Texas Water Development Board (TWDB) uses the DFCs to determine modelled available groundwater (MAG) estimates which are used in the regional planning process.

The GCDs funding structure is laid out in the initial paperwork filed to establish the district. Districts can generate funding through taxes, production fees, or a combination of the two (TWC §36.201, §36.207). A change in the funding mechanism is only possible if approved by voters within a district's jurisdiction. Many GCDs choose to be funded by production fees rather than taxes which are generally less popular. Production fees are based on the amount of water a well uses or its capacity and include local and export fees. There exists financial disparity between districts across the state. Some are well funded and able to divert resources to science or even lawsuits, yet many others struggle with limited funds.

Ultimately, GCDs are left with a difficult balancing act between protection of landowner rights to access groundwater beneath their property and the long-term protection, conservation and preservation of the aquifer. They also, by law, cannot prevent the sale and export of water

outside their boundaries (TWC §36.122 c, §36.122 e). Issuance of transfer permits for users outside of the district can be based on the amount and purpose of water in proposed area, existing users, and the effect on the aquifer. However, GCDs may not implement transfer rules that are stricter than the rules for in-district users.

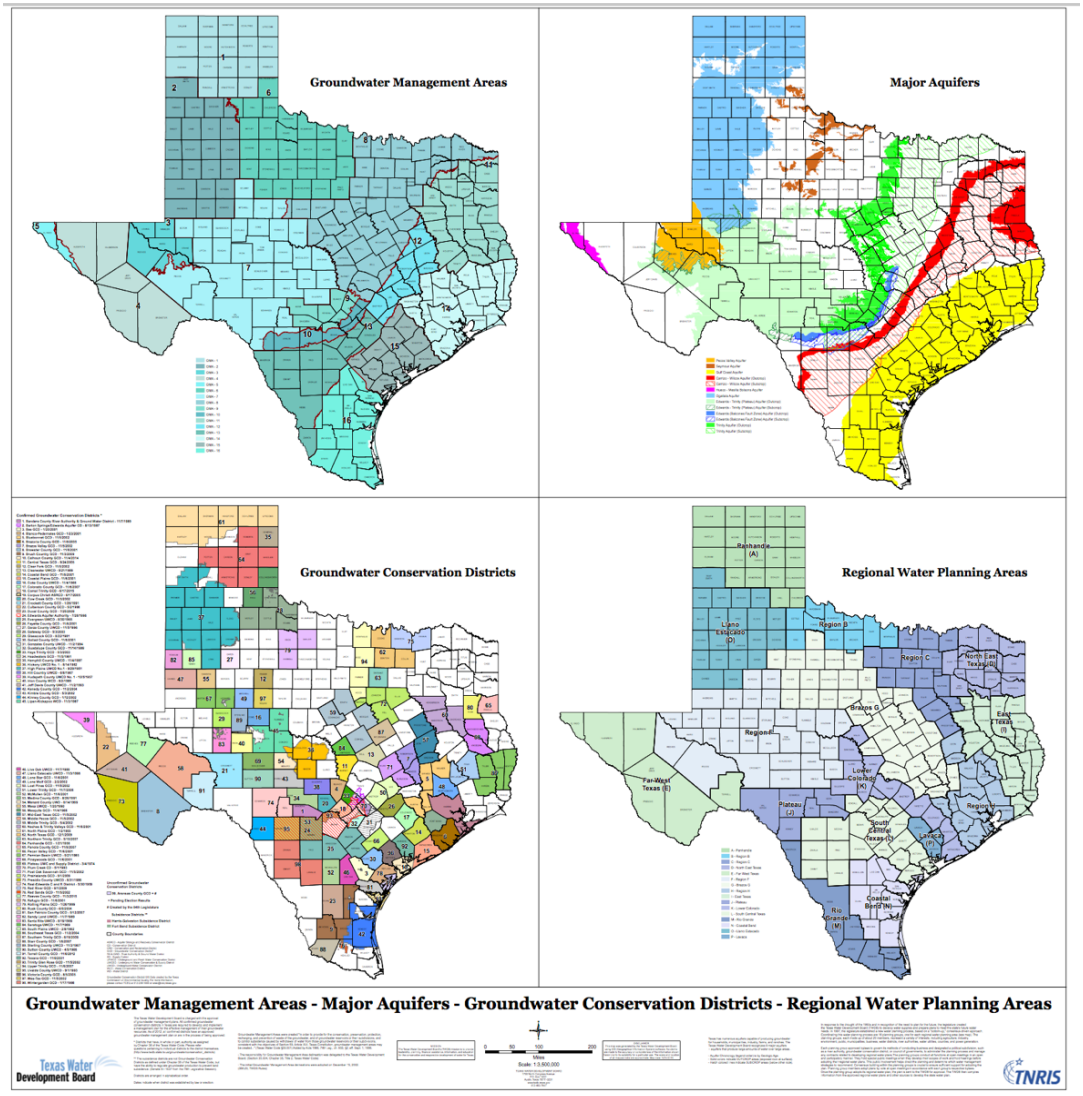

Figure 1: Regional groundwater planning. Major aquifers (top right), groundwater management areas (top left), groundwater conservation districts (bottom left), regional water planning areas (bottom right) (Reprinted with permission from Schlessinger 2018).

Urban Demand and Water Security Problem

As municipal demand for water grows, more GCDs are caught in the middle of controversy. Since DFCs are legal requirements, a GCD can be sued for the validity of the conditions or for prematurely reaching the conditions prior to the planning horizon. Many pending legal cases involve districts being sued by landowners unhappy with the their permitting or by landowners and private companies unhappy with being denied permits. GCDs are experiencing issues with public perception and stakeholder trust as they navigate groundwater management. Questions remain if rule of capture is the most effective legal framework to underpin GCD governance. If Texans are unwilling to transition away from rule of capture, strides must be made in multi-stakeholder discussions and management. One area in which this conflict is occurring is in the communities surrounding the growing metropolitan area of San Antonio.

3.2 San Antonio's Water Portfolio and Security Strategy

San Antonio is situated in the southcentral, semiarid region of Texas in Bexar County. It is the seventh-largest city in the US and the second-largest in Texas with a population just under 1.5 million (U.S. Census Bureau 2016). San Antonio lies on the edge of the vast Chihuahuan Desert where annual rainfall fluctuates from year to year, with the potential of more than 102 cm (40 in.) in wet years to less than 51 cm (20 in.) during dry years.

Not long ago, San Antonio was 100% dependent upon the day-to-day pumping of the Edwards Aquifer. A 1990s-lawsuit brought forward by the Sierra Club changed all of that. In 1993, a Senior US Judge ruled in favor of the Sierra Club's claims that San Antonio was in violation of the Endangered Species Act (ESA). This ruling declared the Edwards Aquifer as an

underground river and forced the state to adopt plans to preserve spring flow during droughts. Therefore, the Texas Legislature of 1993 adopted the Edwards Aquifer Authority (EAA) Act which created a regional water management entity by the same name. To address the concerns of unregulated groundwater pumping, the EAA capped annual withdrawal of the Edwards at 450,000 acre-feet per year and determined that permits would be issued based on historic use (prior appropriation rights). After all permits were accounted for, historic user demand totaled 572,000 acre-feet per year. In order to raise the permitting cap to meet the demand from users, a Habitat Conservation Plan (EAHCP) was established to provide protection to habitats covered in the ESA. During drought years, the EAA has the authority to cut back permit holders' withdrawal to protect spring flow and endangered species.

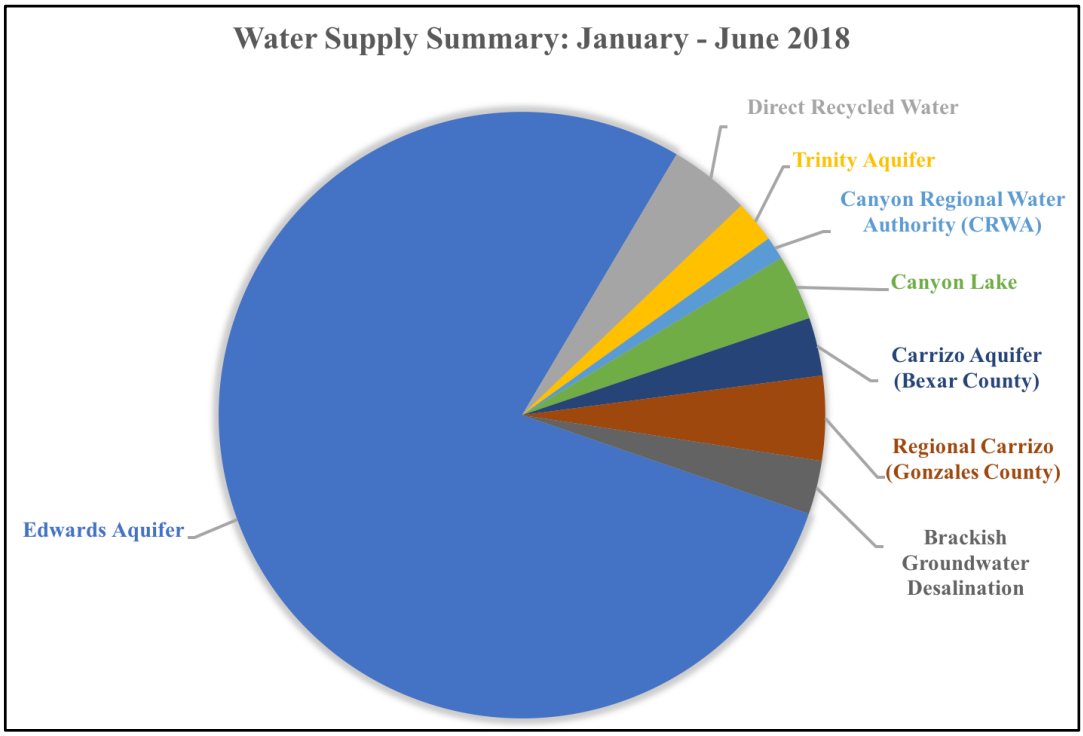

Figure 2: SAWS' water supply summary for January – June of 2018 (Data from SAWS 2018).

Groundwater resources define San Antonio's supplies. The security afforded to the city by groundwater is unmatched by its surface water supplies. The city's public water utility, the San Antonio Water System (SAWS) is the EAA's largest permit holder (295,000 acre-feet per year) and became motivated to diversify their water portfolio due to the mandatory capped permitting system. SAWS was established in 1992 as a merger of three city agencies: the previous water utility, City Water Board; the city Wastewater Department; and an independent city agency, the Alamo Water Conservation and Reuse District ("History and Chronology," accessed July 2018). Over the next twenty years, SAWS became a national leader in water innovation for the purposes of reducing the city's reliance on the Edwards Aquifer. Figure 2 illustrates the semi-annual water supply produced by SAWS between January and June of 2018. Every five years, since 1998, SAWS has produced their Water Management Plan (WMP) outlining past, current and future demand, as well as, current and planned supply projects. Below I summarize SAWS' water supply portfolio presented in their 2017 WMP and describe each source in terms of hard and soft path water supplies.

Conservation and Edwards Aquifer Protection

While San Antonio's population has grown 150 percent over the past 35 years, the city's total water consumption has decreased fifty percent over the same time period (SAWS 2017). Educational and tax rebate programs developed by dedicated employees in the Conservation Department have helped incentivize the conservation of household water use with measurable results. Per capita water consumption decreased from 225 gallons per capita per day (GCPD) in 1982 to 117 GCPD in 2016, with a goal of reaching 88 GPCD for total consumption by 2070 (SAWS 2017). SAWS combines per capita consumption with population projections to estimate

total water demand by 2070. Projections are based on a "hybrid Drought of Record, which merges the duration of the drought of the 1950s with the intensity of the 2011-2014 drought" (SAWS 2017, 8). The population projections used in the 2017 WMP assume a full-migration scenario, in which "the growth rates experienced since 2000 are predicted to continue in the future" (SAWS 2017, 26). The full-migration scenario is used until 2040, beyond that a half-migration scenario is used. In total, SAWS estimates its service population will increase from approximately 1.8 million in 2017 to approximately 3.3 million by 2070 (Figure 3).

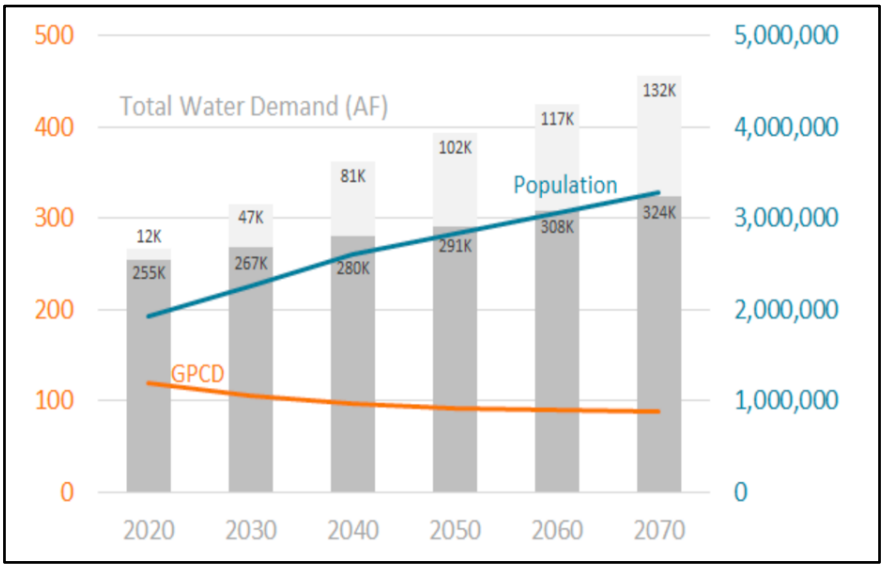

Figure 3: Estimated population and per capita consumption values used in the 2017 Water Management Plan. The dark gray bars depict estimates for total water demand in acre-feet. The light gray bars approximate the total demand if per capita consumption remained at 124 gallons/day (Reprinted from SAWS 2017, 7).

To meet this goal, SAWS commits to improving residential irrigation efficiency, upgrading landscapes with native, drought tolerate plants, and higher water rates to motivate conservation. SAWS can also implement drought restriction stages which regulate when outdoor watering is allowed. The supply and demand scenarios included in the 2017 WMP only include

Stage 1 and 2 restrictions, however SAWS states Stage 3 and 4 restrictions can be implemented "if an occurrence of a drought worse than the hybrid Drought of Record or in a circumstance where planned water sources are insufficient to meet customer demand" (SAWS 2017, 36).

As part of the Edwards Aquifer permits, SAWS must develop and implement a habitat conservation plan (EAHCP). SAWS works with a diverse group of stakeholders and interest groups to ensure that endangered aquatic species which rely on springs and rivers fed by the Edwards Aquifer remain healthy and protected (SAWS 2017). The utility also works to protect water quality of the Edwards Aquifer through its Sensitive Land Acquisition Program. This program, widely supported by San Antonio citizens provides 1/8-of-a-cent addition to sales tax and is used to purchase land easements over the sensitive recharge and contributing zones of the aquifer. These initiatives of SAWS are clear examples of soft path approaches that have made the utility a statewide leader in water conservation and aquifer protection.

H_2Oaks Center

The H2Oaks Center houses three water supply projects for SAWS: the aquifer storage and recovery (ASR), Carrizo Aquifer groundwater, and the brackish groundwater desalination (BGD) plant. At the ASR facility, excess Edwards Aquifer water is treated and stored in the Carrizo Aquifer for later use. Unlike surface reservoirs, the ASR is less susceptible to evaporation and surface contamination (ASR 2018). Total annual recovery is estimated to be 57,000 acre-feet and total capacity is approximately 200,000 acre-feet (SAWS 2017). By 2017, approximately 143,000 acre-feet of water had been stored at the facility.

SAWS also owns land in southern Bexar County where the utility can access 9,900 acre-feet per year of Carrizo Aquifer groundwater. The newest addition to the Center is the BGD

facility which through reverse osmosis, freshens brackish groundwater from the Lower Wilcox Aquifer (SAWS 2017). The BGD is currently in Phase I and capable of providing 13,440 acre-feet per year of water (SAWS 2017). The facility includes twelve production wells (1,600 feet deep) capable of producing nine gallons of freshwater for every ten gallons of brackish water and two injection wells (5,000 feet deep) used to dispose of excess concentrate and brine nearly a mile beneath the surface (Brackish Groundwater Desalination 2018). Phase II and III will be capable of providing an additional 13,440 acre-feet and 6,720 acre-feet, respectfully, and will be brought on as potential supply gaps are anticipated (SAWS 2017).

The ASR and BGD operations while technologically innovative represent hard path water supply approaches. ASR technologies focus on storing water for later use when water from other sources are cutback, particularly in times of drought. Desalination is also a hard path approach which many scholars argue should only be pursued after exhausting other conservation and reuse strategies (Gleick 2015; Wilder et al. 2016).

Aquifers, Lakes, and Reservoirs

Other SAWS supplies include various surface and groundwater sources. SAWS can receive 16,100 acre-feet during average years from three contracts over the Trinity Aquifer, however, during drought years the yield is reduced to 4,000 acre-feet (SAWS 2017). The Carrizo Aquifer in Gonzales County permits SAWS to use 11,688 acre-feet per year (SAWS 2017). SAWS also has contracts for surface water from Canyon Lake, Lake Dunlap, and Medina Lake. All of these sources, except for the Gonzales County groundwater, will expire between 2035 and 2049. The 2017 WMP assumes each of these contracts are not renewed and incorporates their termination in the supply calculations.

Recycled Water

The nation's largest recycled water system is owned by SAWS. The system is capable of delivering 35,000 acre-feet per year of treated, non-potable recycled water to parks, golf courses, and industrial customers (SAWS 2017). The recycled water also supplements the flow of the famous San Antonio River. Currently, the recycled water is not suited for drinking (non-potable). SAWS has discussed possible plans to either expand the current recycling program or implement a direct potable reuse system in the future (SAWS 2017). The recycled water system is an example of a soft path water supply. By recognizing the different qualities of water and recycling effluent water to non-potable standards for irrigation is a recognition that multi-pipe distribution systems can be practical and cost-effective technologies (Wolff and Gleick 2002, 5).

New Supplies

Current innovations in water supply have greatly reduced San Antonio's dependence on the Edwards Aquifer and as a result produced one of the most diverse water supply portfolios of any other major city in the United States. SAWS' mission, however, is not complete. The 2017 WMP proposes a goal to reduce current Edwards Aquifer reliance from current 42% to 31% of water needs during a drought year by 2070 (SAWS 2017). In order to accomplish this goal, SAWS is bringing new supply projects online.

The Vista Ridge Pipeline (VRP) is SAWS' newest project currently under construction. SAWS refers to the VRP as a "game-changing project [that] will satisfy 20 percent of SAWS demand, and serve as added protection for the Edwards Aquifer during drought conditions" (SAWS 2017, 5). Below, I provide a chronology of events that led up to the development of the VRP project.

3.3 What is the Vista Ridge Pipeline?

This section summarizes events assembled from numerous news articles and official reports. It is important to emphasize that in relying on secondary data sources the details presented here do not represent the full story. Due to challenges related to informal sources of data, certain events and perspectives are not present here but exist elsewhere. The purpose of this section is simply to provide the context necessary to understand the development of and the controversy around the VRP project. When SAWS is mentioned in this section, this is a simplified way of referring to the organization's leadership.

Prior the development of the VRP project, attempts to diversity San Antonio's water supply have been challenging. Two attempts to secure water resulted in different outcomes, one ultimately unsuccessful and the other resolved through compromise. I briefly describe both projects to provide insight into the social and political trials associated with securing water for a large city. Following the Drought of Record (DOR) in the 1950s and increased water consumption through the 1970s, construction of a dam southwest of the city and the subsequent creation of a reservoir was proposed in 1979. Ten years later, the necessary local, state, and federal permits were received allowing for construction to commence ("History & Chronology," accessed July 2018). During the long wait for approval, opposition to the Applewhite project grew. Opponents emphasized the projected water yield did not justify the cost of the project and indicated concern over the impacts of submerging the proposed location (Blanchard-Boehm et al 2008). Citizens eventually overturned the decision to pursue the dam project with a popular referendum in 1991 and again in 1994. Researchers from Texas State University sought to understand how a project twenty years in the making with $45 million in taxpayer money already invested could be supported by local, state and federal agencies yet be voted down twice by the

public (Blanchard-Boehm et al 2008). After surveying 400 randomly selected citizens, the researchers found that "77% of respondents were aware that the Edwards aquifer was the source of the city's water supply and that water levels of the aquifer were dictated by fluctuations in precipitation" (Blanchard-Boehm et al 2008, 302). This large percentage is attributed to the extensive educational efforts by the recently formed SAWS and EAA. However, the study also found that "almost two-thirds [of respondents] said that they were not aware that the demands for water usage in the San Antonio region would eventually exceed the recharge capacity of the aquifer" (Blanchard-Boehm et al 2008, 306). The study concluded that voters likely underestimate future impacts of water shortages when city leaders do not adequately communicate or plan solutions openly. The authors suggest San Antonio leaders and planners better educate citizens on the impacts of water shortages and create an open dialogue for additional feedback, not only so citizens can make informed decisions but also improve planning processes through stakeholder engagement.

Another project designed in the early 2000s proposed acquisition of 56,700 acre-feet of groundwater in Gonzales County as a part of SAWS diversification away from Edwards Aquifer water. According to the rules of the Gonzales County Underwater Conservation District (GCUWCD), for every acre of land, 2 acre-feet of water could be permitted for pumping. The SAWS Board approved the lease of more than 10,000 acres in Gonzales County over the Carrizo Aquifer for the purpose of extracting about 20,000 acre-feet of water annually. The cities of Schertz and Seguin and the Bexar Metropolitan Water District also leased similar acreage for water production (Eckhardt, accessed July 2018). The number of projects seeking to extract groundwater in the area, concerned many local citizens especially after models showed different potential impacts. Eventually, GCUWCD adopted a more conservative prediction model and

voted to reduce SAWS' permits to 11,687 acre-feet per year. SAWS did lose some upfront investment costs but further negotiations established a regional partnership between the utility, conservation district and the neighboring cities of Schertz and Seguin. SAWS agreed to mitigate any impacts on neighboring wells through a GCUWCD administered fund and partnered with the cities of Schertz and Seguin to rent pipeline capacity to purchase surplus water (Eckhardt, accessed July 2018). The project began delivering water in 2013 and while much less yield is received from Gonzales County than originally planned, the compromise reached between SAWS, GCUWCD, residents of Gonzales County, and two neighboring cities illustrates, as SAWS put it, "overcoming issues through local and regional cooperation" (Eddy 2013). According to the 2017 WMP, the mitigation fund established has generated approximately $1.8 million for the communities in Gonzales County, going toward rehabilitating wells and assistance to local landowners. SAWS also saves money by renting pipeline from the Schertz-Sequin Local Government Corporation. However, the need for more water remained and SAWS took away from the experience the desire to avoid directly taking on the risk of groundwater districts reducing supply after initial investments are made.

The foundations for a potential water transfer project began in 1999. At that time, W. Scott Carlson, an oil and gas landman, began purchasing leases to water rights from landowners in Burleson, Milam and surrounding counties living above the Carrizo-Wilcox Aquifer. Carlson believed that one day this water, which lies between Dallas-Fort Worth, Houston, Austin and San Antonio, would be extremely valuable ("About Metropolitan Water"). Over the next 15 years, Carlson, President of the Metropolitan Water Company, L.P. (MetWater), purchased an estimated 3,000 leases from Burleson County landowners and another 1,600 groundwater leases from Milam County landowners (Stroud 2006). In 2000, Carlson was accused of stealing $2.3

million from two oil and gas companies and plead guilty (Tilghman 2004). After falling behind on restitution payments, he was jailed. Ross Cummings, owner of BlueWater Systems in Austin, posted Carlson's $500,000 bail, as a way of leveraging a deal for the leases owned by MetWater. Carlson and Cummings signed an agreement allowing BlueWater Systems to help find a buyer for the water owned by MetWater in what Cummings would later refer to as "a very detailed business transaction" (Gibbons 2017). Included in the agreement was a requirement that the two companies split 50/50 any "reservation fees" they receive from potential buyers (Gibbons 2015a).

One of the worst droughts in Texas history began in October 2010. The next year would be the driest year ever for the state breaking records for lowest rainfall and high temperatures (NOAA 2012). In January 2011, after receiving less than originally anticipated from the compromise with Gonzales County the previous decade, SAWS sent out a Request for Competitive Sealed Proposals (RFCSP) asking for bids from private companies with projects that would bring "20,000 acre-feet per year beginning in 2020 and may gradually increase the quantity by 1,500 acre-feet per year beginning in 2021" (RFCSP 2011, 1). The RFCSP specifies that the water projects cannot be from the Edwards Aquifer and that "all risk associated with the permitting, production and transportation of the water …would be the responsibility of the water provider" (RFCSP 2011, 3).

By July, nine projects across the state offered proposals. At this point, BlueWater Systems had obtained 3,400 groundwater leases (1,300 from MetWater) over the Carrizo-Wilcox Aquifer in Burleson and Milam Counties. Interested in the opportunity to capitalize on their leases, BlueWater Systems partnered with a Spanish company, Abengoa, and submitted the Vista Ridge project proposal to SAWS. In March of 2013, an addendum increases the project's

specifications from 20,000 AF/year by 2020 to 50,000 AF/year by mid-2018 (RFCSP 2011). By October of 2013, SAWS had narrowed the search to three projects: V.V. Water Company in Del Rio; a project from Dimmit County; and the Vista Ridge project by Abengoa/BlueWater. At the time, the one from Del Rio had the largest public opposition from environmentalists and neighboring communities to San Antonio (Jefferson 2014). The protesters claimed that by pumping from the Edwards-Trinity Aquifer and "reducing the water flowing in the Rio Grande would exacerbate the water shortages that already exist, harming border cities" (Hicks and Huddleston 2014).

Early in 2014, SAWS CEO Robert Puente presented the utility's plan to pursue brackish desalination over a water supply pipeline project because the desalination facility "carries less risk" (Huddleston 2014a). In a letter to Mayor Julian Castro, members of the business community questioned SAWS claims that brackish desalination was less risky and urged SAWS to renegotiate with top-rated water vendors (Huddleston 2014b). The San Antonio Chambers of Commerce agreed and released a study linking water shortages to economic instability arguing that more water supply projects were necessary (Hockenyos 2014). Two weeks later, Puente advised the Board to reconsider the water supply proposal from the Vista Ridge Consortium (SAWS Board Minutes 2014). The sudden reversal to pursue both brackish desalination and the VRP raised questions from critiques regarding SAWS' connection with business interests (Chasnoff 2014).

As the four-year drought continued into the summer of 2014, SAWS avoided Stage 3 watering restrictions with stored ASR water and began determining the rate increases necessary to fund the new water supply projects. For the VRP project alone, San Antonio water bills would need to increase 15% by 2018 (Huddleston 2014c). SAWS planned to seek buyers for excess

Vista Ridge water for the first 30-year phase as a way to alleviate the impact of rate increases on ratepayers (Huddleston 2014e).

In the days leading up to the SAWS Board vote on the VRP contract, critics, including those who originally were against the Del Rio supply project and landowners near the VRP pumping, began voicing their concerns regarding cost and environmental impact of the project. Some were concerned that selling excess water would not only lead to an increase in development over a fragile aquifer recharge zone, but also create an unfair economic structure wherein current San Antonio residents pay for the wealthier subdivisions north of the city (Huddleston 2014d). Rural landowners in attendance worried about the impact of over pumping on "residents who can't afford to drill deeper wells" (Huddleston 2014d). Some pointed out the combined pumping from the numerous other pipeline projects near Burleson and Milam Counties could harm the sustainability of the aquifer (Huddleston 2014f). Others presented the argument that the project "could lead to costly lawsuits and an empty pipeline" (Huddleston 2014g). Concerned citizens even requested the utility slow the decision process down and answer more questions. Most public meetings were held during morning hours of weekdays, making it difficult for interested parties to attend. SAWS apologized for the hours at which they held their meetings but maintained the position that the contract negotiation process was "open and transparent" (Huddleston 2014h). On September 29, 2014, SAWS Board voted unanimously in support of the VRP contract sending the final decision to a City Council vote a month later.

The debate between proponents and opponents of the VRP intensified leading up to the City Council vote (Huddleston 2014i). Landowners from Burleson and Milam Counties attended the City Council meetings some to voice support, others to voice their dissent (Huddleston 2014j). After listening to weeks of debate surrounding the pipeline and a 4-hour deliberation,

City Council followed the SAWS Board's in unanimously voting to approve the VRP contract (Huddleston 2014k). With the necessary approval received, planning commenced on the VRP project in late 2014.

During 2015, the VRP project was a major talking point in the Mayoral races in San Antonio. All candidates stated their support of the project but some held a more critical tone with regards to the financial status of Abengoa, the project's lead company (Huddleston 2015a). Abengoa had recently failed to secure legislation to aid with the sale of private activity bonds, a method of financing under the public-private partnership (PPP) agreement with SAWS (Huddleston 2015b). Company representatives were confident that another opportunity for financing the $3.4 billion VRP would be found soon.

Nearly a year to the day since City Council's approval of the VRP project, opposition organized en masse to again voice their concerns before City Council voted on the necessary rate increases to fund the project. Protesters chanting "my water, my life, my right to fight" included Latino social justice activists, indigenous people, religious leaders, environmental advocates, and landowners from Burleson and Milam Counties attempting to meet with Council members in the days leading up to the vote (Gibbons 2015b). The protesters opposed the pipeline "based on fears it would deplete the aquifers below Central Texas counties, pave the way for sprawl in sensitive ecosystems and put an unfair burden on low-income ratepayers" (Gibbons 2015b). Despite their efforts, City Council again unanimously supported rate increases to fund the VRP, meaning residential water users will see a 50% rise in water bills by 2020 (Gibbons 2015c).

Financial troubles continued for Abengoa when its parent company in Spain entered bankruptcy proceedings in November 2015, days after San Antonio City Council approved VRP funding. Representatives of Abengoa Vista Ridge assured the other project partners that their

finances were in good standing and in response to concerns, SAWS leadership reiterated how the original project contract negotiations had built in financial protections (Gibbons 2015d).

In February 2016, Abengoa, through its affiliated non-profit, submitted a loan application for $885 million to the Texas Water Development Board's State Water Implementation Fund for Texas (SWIFT) to provide low-interest funding for the VRP project (Gibbons 2016d). Abengoa's non-profit, the Central Texas Water Supply Corporation (CTWSP) was created in September 2014 to acquire pipeline easements from landowners (Gibbons 2016e). The Water Development Board denied Abengoa's request (Kofler 2016). During this time, Save Our Springs Alliance, an Austin-based advocacy group, sued the CTWSC to reveal "meeting minutes, correspondence and records related to pump stations locations and rights of way negotiations with landowner" (Gibbons 2016e). Staff attorneys for the Alliance stated the VRP project was "exploiting this public-private partnership to avoid real public scrutiny despite the fact that the public is going to be paying for this project in one way or another" (Gibbons 2016e). The use of PPPs as a mechanism for water supply infrastructure and the concerns regarding accountability and transparency became important aspects of this project and will be discussed in more detail in the following section.

In March 2016, Abengoa Vista Ridge sought a buyer for 80% of their project share after several unsuccessful attempts to secure funding (Gibbons 2016a). The project contract at the time stipulated that Abengoa could seek outside investors for 49%, therefore lowering its share would require approval from only the SAWS Board. SAWS leadership assured council members the financial issues of Abengoa would not threaten the VRP project, while critics argued the utility was making light of a serious situation (Gibbons 2016b). Abengoa announced their decision to give 80% of their share to Garney Construction, a Kansas City based firm (Gibbons

2016c), and it was later approved by the SAWS Board (Gibbons 2016d). Garney was Abengoa's construction contractor for the VRP and has a history of working with SAWS on other projects. As Garney sought financing from foreign investment banks previously assisting Abengoa, news surfaced of a $120 million bridge loan given to Abengoa for pipe materials (Gibbons 2016e). The responsibility of paying back the missing $120 million bridge loan fell on Garney (Gibbons 2016f). With a change in project leadership, the VRP contract was renegotiated with Garney. Garney, a construction company, lacks the expertise necessary to operate a large transfer pipeline. The contract was altered to include a provision allowing Garney to "propose an unnamed operating service provider to run and maintain the pipeline after Garney builds it" (Gibbons 2016f).

Concealed by the discussion of Abengoa's finances was the ongoing litigation between Scott Carlson's MetWater and Ross Cummings' BlueWater Systems. The day after SAWS and Abengoa celebrated the VRP contract in December 2015, Carlson's MetWater sued Cummings' BlueWater Systems for $5.5 million in unreceived payments (Gibbons 2015f). MetWater's case relied on an alleged agreement in 2006 between the two companies to find a buyer for their groundwater leases and split reservation fees 50/50. Litigation continues today.

In September 2016, it was revealed the missing $120 million bridge loan had been routed by Abengoa through its non-profit company, the CTWSC (Gibbons 2016g). The bankruptcy filings which reveal the money transfer also claimed "Abengoa Vista Ridge and the City of San Antonio formed the non-profit water supply corporation," however, SAWS representatives denied the city or SAWS had any role it its creation (Gibbons 2016g). The money, intended for pipe material, was then sent to another Abengoa-affiliated company and no pipe was purchased. In total, Garney assumed approximately $128 million in Abengoa's debt (Gibbons 2016g).

Meanwhile, the process of obtaining rights of way from the 435 landowners along the pipeline route was progressing. Landowners received letters beginning in the summer of 2015 which did not mention SAWS or the VRP (Gibbons 2016h). The land agent distributing the letters was employed by an Abengoa subsidiary and worked closely with the CTWSC to obtain "by voluntary acquisition or condemnation certain property deemed necessary for the Project" (Gibbons 2016h). Some landowners along the proposed route were less than pleased with the easement attainment process. Letters stipulated an 85-foot easement was required even though the pipe is only 4.5 feet in diameter; it also included restrictions stating no trees or permanent structures can exist on the above land. Landowners expressed their confusion and concerns regarding the easement process, including the devaluation of property, being told how to use the land, and the fact that even refusing the agreement could mean condemnation of the land through eminent domain (Gibbons 2016h).

Continued concerns regarding the pipeline project's impact on the conservation ethic established in the city and resulted in City Council requesting an independent study examining the impact of limiting outdoor watering to once a week year-round, essentially implementing permanent Stage 2 drought restrictions (Gibbons 2016i). The capital city of Austin had recently implemented a similar policy. After releasing a new campaign titled "Making San Antonio Waterful," SAWS faced more criticism for the mixed messages of promoting the city as water abundant while also promoting constant conservation from customers (Gibbons 2016j). SAWS leadership clarified the campaign was a play on "wonderful" not "water-full," and defended its new water supply sources as essential for current and future economic development (Gibbons 2016j). Critics questioned the logic that companies would overlook San Antonio because of water, pointing to states like Arizona and California as evidence of the contrary (Gibbons 2016j).

The 2017 WMP produced by SAWS states in the Conservation and Demand Projections section that "additional policy discussions on year-round once per week watering will continue among the SAWS Board of Trustees, [City Council], and community organizations" as a way of reducing demand during normal weather conditions (SAWS 2017). Disagreements regarding the effectiveness of conservation became a major theme of this project.

Debate continues today regarding this project. It was again a topic of discussion during the 2017 mayoral races. Over the course of the project's development a few aspects emerged as particularly fundamental to the controversy. Particularly, aspects related to the use of conservation, accountability and transparency of PPPs, eminent domain and groundwater leases, and scientific uncertainty. These aspects are discussed in more detail below.

3.4 Controversy

There exists a culture around water in San Antonio that is quite rare among other large cities. New water initiatives and projects are almost immediately scrutinized and meeting rooms filled with citizens voicing their questions and concerns. It is not surprising the same occurred after the VRP project was announced. Controversy is common around pipeline projects of any kind. They are economically and energy intensive projects with real implications on both urban and rural residents along the pipeline. In the seven years since this project's inception, several events and aspects around the project have stirred controversy. Figure 4 provides an opposition poster for the VRP project created by members of the League of Independent Voters of Texas. Signs such as these appeared in the lawns of homes in counties along the pipeline's route.

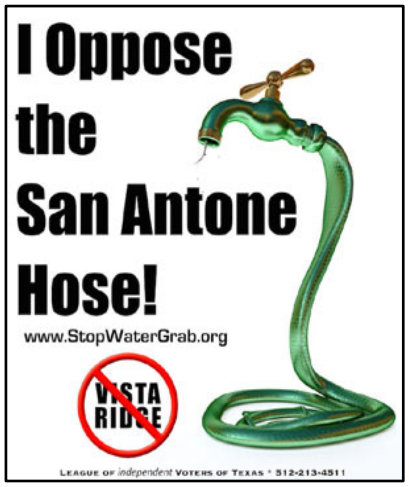

Figure 4: Opposition poster for the Vista Ridge Pipeline (Reprinted from League of Independent Voters of Texas 2015)

Contested Calculations

Future predictions of population growth and water consumption are always accompanied by uncertainty, and reliance on past trends may be a poor indicator for future use and growth. It is important for water utilities and mangers to plan for the future. But different courses of action can be justified depending on specific calculations used. For example, projections in the 2012 WMP held per capita consumption constant at 135 gallons/day beyond 2020 based by averaging historic use data. Yet, this ignored the fact that per capita consumption fell to an all-time low of 116 gallons/day in 2016. The 2017 WMP considered this reduction and commits to ambitious conservation targets of reducing total GPCD to 88 by 2070.

With regards to the VRP project, stakeholders remain concerned that inaccurate per capita consumption calculations were used to justify the need for a large-scale supply project. As the chronology mentioned, San Antonio's Chamber of Commerce requested an analysis of the economic impact if water supply was not increased. In 2014, an Austin consultant released a report entitled, "*The Economic Impact of Potential Water Shortages on San Antonio's Economy*"

(Hockenyos 2014). The report ran two scenarios: 1) utilized a constant per capita rate of 135 based on the 2012 WMP; and 2) used a consumption rate of 169 based on the city's historical use. The report found that with a consumption rate of 135 GCPD by 2040 San Antonio would experience a 28.9% decrease in economic shortfall. The findings paint a "worst case scenario" of water shortages and subsequent economic loss using "simplifying assumptions that are unlikely to occur as actual events unfold" (Hockenyos 2014, 10). However, the report concludes: "While there is good reason to believe that gains can continue to be made in [conservation], there is also little doubt that additional supply is critical to insuring that San Antonio has adequate water to meet future needs" (Hockenyos 2014, 10). Today, the use of a constant GPCD is odd considering the success of conservation initiatives in decreasing per capita consumption dramatically the last 35 years. Scholars have defined this phenomenon as 'demand hardening,' in which communities which have experienced severe or extended droughts do not return to their original per capita use (Howe and Goemans 2007). There is also evidence of the decoupling of water and economic growth decoupling as improvements are made in the productive use of water (Gleick 2002). The authors of the report should have foreseen this result to some extent. However, this report and its findings were championed by the Chambers of Commerce to persuade SAWS leadership to pursue not only desalination but a water transfer project, leading many to question leadership's commitment to water conservation.

Burleson and Milam Counties – Landowners and Leases

Groundwater leases form the backbone of the Vista Ridge project and the techniques behind their acquisition are contested. As mentioned, Scott Carlson acquired thousands of groundwater rights from landowners in Burleson and Milam Counties. Maps of where water

leases were bought revealed Carlson largely targeted low-income, small acreage housing communities to acquire the leases. Landowners who hesitated or denied Carlson were told that he would "get their water anyway" (Participant 15 Interview, 8 March 2018). A landowner's refusal to sell their water rights when a neighbor agrees to do so does not stop the water beneath their property from being pumped by the nature of groundwater. Some landowners saw themselves as trapped either way, so they sold.

The transport of water outside of GCD boundaries is outlined in Chapter 36 of the Texas Water Code. It states that a "district may not impose more restrictive permit conditions on transporters than the district imposes on existing in-district users" (TWC §36.122c). The Code goes on to explicitly outline the period for which water may be transferred as:

> (1) At least three years if construction of a conveyance system has not been initiated prior to the issuance of the permit; or
> (2) At least 30 years if construction of a conveyance system has been initiated prior to the issuance of the permit (TWC §36.122i).

Therefore, upon establishment in 2002, the Post Oak Savannah Groundwater Conservation District (POSGCD) adopted these rules for transport permits (Rules of POSGCD, 51). The district also adopted rules allowing for the issuance of permits within the district to "be set by the Board," but will "generally be for a period not to exceed forty years from the date of issuance" (Rules of POSGCD, 27). Neighboring districts have identical rules for transport permits, however only issue production permits for 5-year periods. The longer-term production permit coinciding with long-term transport permits offers more security for companies seeking water from POSGCD's jurisdiction.

Much of the controversy around the VRP project has focused attention in San Antonio and the impact on its residents and surrounding environments. However, from the start a vocal

group of critics from Burleson, Milam and neighboring counties have adamantly opposed to the VRP project (Burleson County Tribune 2015). They have voiced concern with how the VRP project companies have represented project support. While 3,400 leases have been signed in Burleson and Milam Counties, this number does not represent individual landowners (Burleson County Tribune 2015). Rather, approximately 1,800 landowners have leased and equates to about eight percent of the total land area in the two counties (Burleson County Tribune 2015). During an interview with a local news agency, one landowner stated that by misrepresenting project support, "it makes it look like there is more landowner support than there actually is" (Horne 2016). Another landowner, whose family has owned a legacy farm in Burleson County since 1894, petitioned the POSGCD Board to delay approving the VRP permits (Curtis 2017). At the meeting, the landowner stated, "I'm here for myself and the 83% of county landowners who chose not to sell their water. What about our rights to ensure the next generation has water, and what about our duty to protect this treasured aquifer?" (Curtis 2017). In her statement, the landowner reiterates how those landowners who did not lease their water rights (non-leasing) are a majority yet feel threatened by the potential impact of the VRP pumping.

Representatives of POSGCD are of the position that the district's rules are strong and will protect landowners and the aquifer by cutting back production permits when impacts on drawdowns warrant such actions. Districts are allowed under the Texas Water Code to limit and cutback production permits if there is evidence that DFCs have been met. Some residents believe Post Oak's current DFCs are not conservative enough and that detrimental impacts to those in the shallow portion of the aquifer could occur much earlier. Many have also pointed out that while POSGCD has the power to cut back they are limited as to how much they can and with unused leases from extra acreage held by BlueWater Systems, the company could add new

acreage to the pool of leases and increase their production that way. This could go on and on for some time given the excess acreage accumulated by the company. Landowners remain skeptical of Post Oak's ability to weather the political storm that is likely to ensue if the district attempts to change permit rules or cutback production after San Antonio becomes dependent on the water. If the fight over groundwater turns legal, one landowner believes, "San Antonio will run right over us in a heartbeat" if the legislature steps in (Participant 17 Interview, 8 March 2018). Other GCDs are facing similar challenges as Post Oak as they try to balance aquifer preservation when by law they are unable to deny production or transport permits. The outcome has led to a dissolution of stakeholder trust in their GCDs ability to truly protect the aquifer and those within the district.

Water Supply Corporations and Eminent Domain

Another area of controversy is how eminent domain has been used for this project. Eminent domain is the power granted to a public entity or non-profit to declare unutilized land for the purposes of public use. This power was particularly useful of water supply corporations, which are typically established in small rural areas that lack a centralized water supply system. Once created these water supply corporations are granted eminent domain powers and board members, typically people with a personal stake in the local water resources and consider local interests when making decisions, are appointed by County judges. The issue many have with the CTWSC working to obtain the pipeline easements for the VRP project is its accountability to local stakeholders. The board of the CTWSC changed many times within its first months and many members were previous Abengoa employees. This signaled a grave conflict of interest to groups like the Save Our Springs Alliance who ultimately sued for information regarding the

corporation's actions and motives. The power to condemn property and the significant implications of it in the hands of larger water supply corporations is so far untested by Texas Courts and unregulated by the Legislature.

Transparency and Public-Private Partnerships

The VRP project is unique because of it is one of the first PPPs in the Texas water sector. Typically, water projects done by public utilities are subject to public approval. SAWS has done this before with many of its past projects, several of which have been voted down. However, the VRP project is being constructed as a public-private partnership (PPP) meaning that the pipeline will be owned and operated by private firms for 30 years. Citizen requests for financial documents and hydrologic reports regarding the VRP project have been denied. Some citizens turned to the Public Information Act (PIA) for assistance. The PIA grants the right to access government records and public information from governmental bodies. Critics of the pipeline requested hydrologic reports conducted by private hydrology and geology firms and even the financial model behind the VRP project from SAWS and were denied. The Attorney General of Texas ruled in the decision that the Vista Ridge Consortium had competitive advantage over the information and therefore did not have to release the documents. Opponents have claimed that the use of a PPP for the VRP project serves only to shield the project from the companies being publicly accountable.

Scientific Uncertainty

Hydrologists differ on their assessments regarding the potential impacts of VRP pumping. Groundwater availability models (GAMs) provided by TWDB have been used by

project representatives and independent hydrologists with mixed results. Modelers understand that mixed results are common due to the high degree of uncertainty associated with the models. However, it is important to ask if the scientific uncertainty associated with groundwater models is sufficiently understood and been properly explained to stakeholders less experienced with the nuances of groundwater modelling? The highly specialized nature of groundwater models requires constant engagement between laypersons and scientists (Ross and Martinez-Santos 2010). Of course, measures to avoid conflicts of interest are necessary. Including independent hydrologists and scientist unaffiliated with companies involved in the project is important for maintaining public trust. Also, left unexplained, scientific uncertainty can lead to insufficient governance decisions based on a false understanding. Colvin and Saayman (2007) discuss how the government-science interface is a crucial component of good governance. They state that the knowledge gap between science and government "may be due to managing uncertainty and institutional instability which increases government resistance to innovation" (Colvin and Saayman 2007, 145). The certainty of groundwater models and the politics engrained in science remained a theme of this project during research.

This chapter has offered an introduction to Texas groundwater law and urban water security challenges that can arise. Also, a chronology presented the events behind the development and controversy on the VRP project. The following chapter, provides a description of the Q-Methodology, outlines three research objectives and presents data used for this research.

4. METHODS, OBJECTIVES, STUDY REGION, AND DATA

This study aims to investigate the range of perspectives around a particular water governance strategy and the associated socio-economic impacts held by key stakeholders in the city of San Antonio, Texas along with those in Burleson and Milam Counties, Texas. This study will provide an in-depth analysis of the various positions and debates related to the Vista Ridge Pipeline and seeks to understand the ways in which someone says 'yes' or 'no' to a water transfer project. This thesis not only serves an entry point for understanding the perspectives on the VRP project but also reveals underlying conflict and political dynamics of water securitization developments more broadly in Texas.

San Antonio is the state's second largest city and growing. According to the Census Bureau, San Antonio topped the list of the Fastest Growing Large Cities with a growth rate of 1.6% between July 1, 2016 and July 1, 2017 (US Census Bureau 2018). However, the historic city is located in a semi-arid region of Texas and has experienced many fluctuations in water supply over the years. The Vista Ridge Pipeline is the latest attempt to secure water for the growing city. I focus my research on how stakeholders view the impacts of the VRP project on the local community, landscapes, water bill rates, property values, and livelihoods. To determine subjective positions of key individuals, Q-Methodology is used. Q-Method combines qualitative and quantitative techniques to assess stakeholder subjectivities and in doing so "[emphasizes] both the interpretive experience and the concrete context of subjectivity" (Robbins & Krueger 2000, 636). Considerable detail is devoted to describing the steps of the Q-Method because it has not been widely used in human geography and there exist various ways in completing each step. Q-Method has the ability to engage stakeholder on "opposing sides of contentious topics, in order to move beyond polarization, understand other viewpoints, identify areas of consensus and

divergence, and negotiate conflict" (Lehrer and Sneegas 2018, 134). For this reason, Q was chosen to analyze the VRP project in Central Texas.

4.1 Q-Methodology

Q-method (hereafter Q) allows for the quantitative measure of individual's qualitative subjectivities on a particularly controversial or divisive topic. The methodology was created by Stephenson (1935) who felt there was a need for a different type of factor analysis, one that focused on *people* rather than their responses. Q provides a methodology that does not seek to remove a respondent's frame of reference about a topic but instead seeks to preserve it (Robbins and Krueger 2000). Q is not focused on "prevalence of discourses across a population," but instead focused on the subjectivities that inform the individual (Brannstrom, Jepson, and Persons 2011). This is the main point of difference between Q and other approaches to studying traits, like questionnaires. In typical surveys, respondents are subjects while the survey questions are variables. Q inverts subjects and variables. Subjects in a Q study are the statements extracted from interviews with stakeholders and the variables are how participants' sort or place the statements on a scale from agree to disagree. Robbins and Krueger (2000) discusses a paper which used both questionnaires and Q techniques and discovered that, while the survey method proved public participation to be important to stakeholders, "Q method explained *why*" the stakeholders held their views (emphasis in original).

Recent studies have used Q to access stakeholder perspectives regarding the use of pesticides and best management practices in agriculture (Lehrer and Sneegas 2018; Schall et al. 2018). With regards to pesticide use, Lehrer and Sneegas (2018) found three significant social perspectives: 'the skeptic' concerned with environmental and human health impacts of pesticide

use; ‘the accepter’ who understands the risks but believes they are small and properly mitigated; and ‘the incrementalist’ who falls somewhere between the other two clusters and believes in opportunities to improve human capital and technological improvements. The third group reveals a potential avenue for mutual agreement which “imply places where disagreements are muted enough to be able to make progress towards common goals” (Lehrer and Sneegas 2018, 140).

Schall et al. (2018, 22) utilize Q to analyze “the ways in which the identities and values of land user have come to shape their attitudes toward environmental regulation,” like best management practices. Through interviews with farmers in Maryland, the authors identify two significant social perspective clusters. One group of respondents accept scientific discourse that farming practices impact aquatic life in the Chesapeake Bay, while another group are skeptical of scientific expertise and attributes quality degradation of the Bay to runoff from urban areas. The authors found a “striking polarization along lines based on occupation and geography” which informed respondents views on the subject (Schall et al. 2018, 29).

Q has also been used to access stakeholder perspectives around different water management strategies. Pagnussatt et al. (2018) used Q to analyze the perceptions of hydroelectric dams. Five significant social perspectives were found: those who are critical of the environmental impacts of hydropower dams, those who see regional development benefits, those who expect more from development, those whose primary concern is social well-being and a final group who perceive both the positive and negative aspects of dams. The authors identify the price of energy and the absence of leisure areas as major negative consequences revealed through analysis. The authors conclude that their study can help “guide the formation of public policy regarding energy management” (Pagnussatt et al. 2018, 379). Iribarnegaray et al. (2014) also used Q to analyze water management decisions and discovered that the lack of success of certain

awareness campaigns to educate consumers to conserve water are linked to ignorance or disregard of social perspectives held by stakeholders. The water supply company in Salta, Argentina sought to address the large net consumption of residents by implementing a metering system to encourage conservation. While implemented water management strategies target consumer behavior, there are tremendous amounts of water lost due to inefficiencies and leaks in the water system. Through interviews with twenty-nine people representing government officials, water managers, members of non-governmental organizations (NGOs), general water users, scholars and researchers, and environmental engineers, the authors identified four significant social perspectives. Each perspective disagrees with a belief held by another. Participants in Factor A favor a more rights-based consumption and a belief "that the problem of inadequate water and sanitation services is related to a lack of management capacity on the part of profit-oriented water companies and inadequate control by the state" (Iribarnegaray et al. 2014, 907). Factor B, consisting of three water managers, a researcher and a regulatory official, disagree with Factor A and represent the perspective which supports the current water administration's technical approach to water management and believes it is economically affordable. Factor C also disagrees with Factor A in their belief that end users should practice rational water use despite system leaks, and disagrees with Factor B on the fairness and impact of water tariffs. The fourth group, Factor D, represent a perspective in favor of "hierarchical, state-led, needs-oriented governance" (Iribarnegaray et al. 2014, 909). Despite such disagreement, the four groups agreed that water saving practices are necessary and appear sensitive to water injustices. Each group considers access to water and sanitation a human right and agree that cooperation between public and private sectors is important for solving their

problems. This study presents complex social perspectives but reveal areas of consensus toward solutions.

Q traditionally has stakeholders sort statements obtained directly from interviews, but some studies have utilized other means. For example, Alexander et al. (2018) used photographs in conjunction with statements to aide semi-literature rice farmers in their ability to perform the sorting exercise. Photographs represented the many options that rice farmers in Lao could use to improve their livelihoods. The authors discovered two significant social perspectives. One in favor of modernization and maximizing labor production, and another in favor of traditional techniques. Their analysis reveals that approaching farmers personally, especially those "who are unsure about or are concerned about the risks of changing their agricultural production systems may lead to greater uptake" of more modern and productive techniques (Alexander et al. 2018, 8). Another example is Forrester et al. (2015), who paired Q with participatory GIS mapping to analyze views on the optimal flood management from three communities in England and Scotland. Stakeholders participated in group discussions and mapping exercises to design a community response to mitigate future flooding events. The authors stated that the combination of Q and GIS addressed the challenge that "maps alone lack the ready inclusion of social values and beliefs that are necessary for understanding socio-environmental, and therefore socio-political elements" (Forrester et al. 2015, 204).

4.2 Structure of Q-Method

Selecting Participants and Initial Interviews

Interviews are a fundamental step to Q-Method. Brannstrom (2011) considers Q-method research to be an end and means. Q is able to quantify social perspectives (the end) and the

ability to create "an interview setting that allows researchers new insight and rapport with respondents and an additional means to pose confrontational questions in a relatively neutral setting" is Q's means (Brannstrom 2011, 533). Interviews are an important way for Q to be "driven mainly by the participants, rather than (as it might seem from the outside) by the researcher" (Eden, Donaldson, and Walker 2005, 416). While it is possible to perform Q research with only the use of secondary materials, the literature strongly suggests combining such data with new, primary source interviews (Robbins and Krueger 2000; Eden, Donaldson, and Walker 2005; Webler, Danielson, and Tuler 2009). Aside from contributing to the development of the statement concourse, interviews with knowledgeable stakeholders can provide history and context to the study not gained through secondary materials (Webler, Danielson, and Tuler 2009). Q is not a large-n methodology, therefore between twenty and thirty participants who have a rich knowledge of the topic would suffice (Webler et al. 2009). Participants are purposively selected with some identified during research of secondary sources.

Developing the Concourse

The first step of Q involves creating a concourse of statements. A concourse is defined as "a set of interrelated claims about the domain in question" (Robbins and Krueger 2000). Construction of the concourse begins with statements collected from existing print media, such as news articles, web sites, and public records. Another way is by interviewing key stakeholders who are informed on the topic. It is possible that a concourse might consist of 100-500 statements once interviews and secondary data searches conclude. The concourse statements must then be organized by themes derived from the discourse, which will also guide the process for selecting the Q-sample.

Semi-structured interviews of key stakeholders offer a more robust analysis of social perspectives because statements come directly from those being studied (Webler, Danielson, and Tuler 2009). The naturalistic approach to obtaining statements directly from stakeholders seeks to reduce overall researcher bias, but does not eliminate it (Robbins and Krueger 2000; Webler, Danielson, and Tuler 2009). Before development of the Q-sample can begin, the researcher should ask if the concourse is complete. Eden, Donaldson, and Walker (2005) offer the idea of a "saturation point" in qualitative data collection which is the moment statements on the topic begin to repeat. This process is highly subjective due to data and resource constraints.

Developing the Q-Sample

After all statements are thematically organized and the saturation point reached, the process of narrowing the statements to the final Q-sample may begin. Statement narrowing is not a trivial process and researchers should take their time to complete. It is the job of the researcher to decide from upwards of 500 statements which twenty to sixty are the *best* statements.

While large-*n* surveys seek statements that will be interpreted the same way across respondents, Q seeks statements with "excess meaning" and can be interpreted in a number of ways by among the participants (Webler, Danielson, and Tuler 2009). The only similarity between survey statements and Q statements is they should "stand alone" as a complete sentence and thought. (Webler, Danielson, and Tuler 2009). Along with being short and easy to read, saliency of statements is important (Webler, Danielson, and Tuler 2009). The statements should be meaningful to the participants doing the Q-sorts. Sufficient knowledge and understanding of the topic certainly help a researcher in deciding the best statements.

In addition, it is important to include positive and negative statements in the Q-sample. This does not mean that there must be an equal amount of positive and negative statements. The amount of each should be determined by the discourse surrounding the topic of interest. However, determining whether a statement is positive or negative is highly subjective and is based on individual perceptions of each statement.

Care should be taken in editing any Q statement for clarity. Ideally, verbatim quotes from interviews would be used with very little editing. However, Q statements may require editing or paraphrasing when taken out of context. Statements should be de-personalized by eliminating personal pronouns and to clarify interviewee references.

Typically, twenty to sixty statements make up the final Q-sample. Webler, Danielson, and Tuler (2009) argues that any fewer than twenty statements do not allow for proper expression of viewpoints across a topic. On the other hand, too many statements can create a challenge for participants during the sorting process.

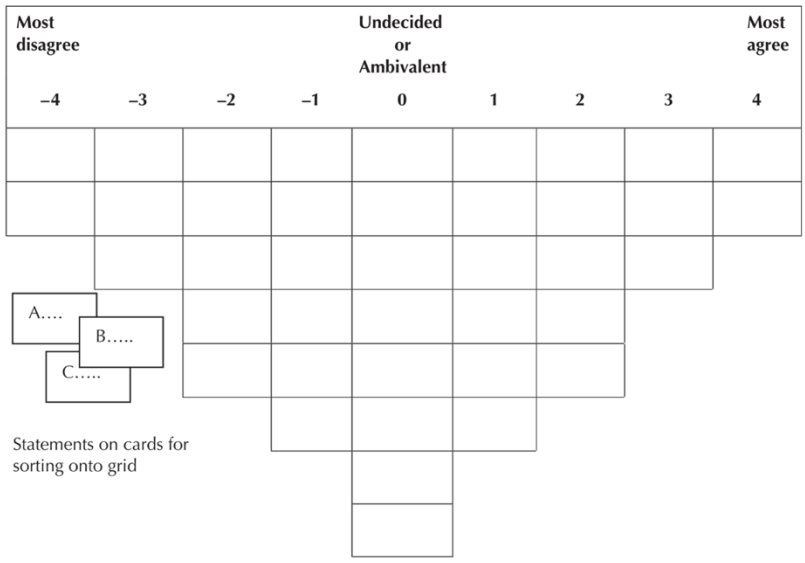

Figure 5: Example of a Q-Sort Grid (Reprinted from Eden et al. 2005)

Conducting Q-Sorts

Participants are asked to rank the Q-sample statements from most agree (+5) to most disagree (-5) on a normal distribution. Figure 5 provides an example of a Q-Sort grid. The quasi-normal distribution formation forces participants to compare each statement in context with the other statements. In doing so, the formation reveals participants preferences while also establishing a relationship between statements (Webler et al. 2009). Statements sorted under zero (0) are considered to be neutral or undecided. Forcing statements into a normal distribution assumes that each participant will sort the same number of statements as having positive, negative, and neutral salience (Webler, Danielson, and Tuler 2009). While this is very unlikely, it is impossible to predict a person's perceived connotation of a statement.

Factor Analysis

Once all Q-sorts are complete and results recorded, the factor analysis statistics may begin. Factor analysis is a defining feature of Q-method research and offers a "mathematical technique that reveals underlying explanations for patterns in large sets of data" (Webler, Danielson, and Tuler 2009, 25). Factor analysis is a way to understand a range of perceptions and how stakeholders cluster around certain perspectives. A fundamental knowledge of the topic is necessary for interpreting the factor analysis, particularly when it comes to determining factor rotations. Factor rotation allows for the reveal of more meaningful relationships. Generally, the algorithm-based varimax rotation is used rather than manual, or judgmental rotation (Webler, Danielson, and Tuler 2009). Rotating and deciding on the final number factors are subjective processes. Literature has yet to fully address this aspect of Q-method. Typically, two to four

factors with eigenvalues greater than 1.0 are chosen for analysis (Webler, Danielson, and Tuler 2009).

Factor Interpretation and Validation

Factor analysis does not mean Q-method is not an unbiased quantitative methodology. Rather, the quantitative results should be used "in a more qualitative, interpretative setting in order to raise questions and interrogate data" (Eden, Donaldson, and Walker 2005, 421). Names for each factor should be derived from the aspects flagged as important to the participants who loaded into the factor. Next, each factor is compared and contrasted with the other factors. Correlation values are typically calculated during the analysis stage and can be used to quantify the differences or commonalities between factors. However, it is possible to have participants who do not load into any factor to a significant degree. These "non-loaders" will not show up in the quantitative statistics but can instead be qualitatively described and explained.

After the researcher has interpreted the results, factor descriptions should be validated with interviews by participants (Webler, Danielson, and Tuler 2009). The researcher may choose to meet with only those who loaded highly into each factor or group, or with all the participants. Robbins & Krueger (2000, 640) explain the goal of validation "is to gain the respondent's own interpretation of the factor structure and their opinion of the researcher's claims about the respondents."

4.3 Study Region

Chapter 3 provides a detailed description of the events leading up to the decision to proceed with the Vista Ridge Pipeline project. Here I will provide only a brief overview of the region's geography and economy and explain where the VRP project is as of today.

This study focuses on two rather different communities: San Antonio and Burleson and Milam Counties. Table 1 provides a comparison of the community characteristics. The areas largely differ on total population, median household income, percent unemployed and below poverty level, and in the industry breakdown. Agriculture and manufacturing have more economic importance in the two rural counties compared to the urban city, while finance, retail trade and arts/recreation employ a larger percentage of San Antonio residents than the rural counties. Another noticeable difference exists between the two neighboring rural counties in terms of income, employment, and poverty.

Figure 6 below illustrates the approximate pipeline route connected the water well field in northwest Burleson County to northern San Antonio. In total, twelve wells either newly drilled or leased are connected to the main well field where water, once pumped, will be treated to specified quality standards and stored until transport. Water will travel mostly by gravity except at three points along the route where pump stations will push the water over inclines to the next gravity fed section.

Table 1: Community characteristics for the study region (U.S. Census Bureau).

	San Antonio, Principle City	Burleson County	Milam County
Total population	1,327,407	17,187	24,757
Percent high school graduate or higher	81.6	80.4	80.3
Median household income (dollars)	48,183	52,513	39,213
Unemployment (percent)	4.5	3.5	5.2
Percent population below poverty level	19.5	13.6	15.5
Industry breakdown			
Agriculture, forestry, mining	1.1	9.6	10.0
Manufacturing	5.8	13.3	8.9
Construction	8.0	7.9	8.5
Finance, insurance, real estate	8.7	3.3	5.4
Retail trade	12.1	9.6	9.9
Educational services, health care, social assistance	23.1	25.9	23.8
Arts, entertainment, recreation	12.0	6.2	7.3

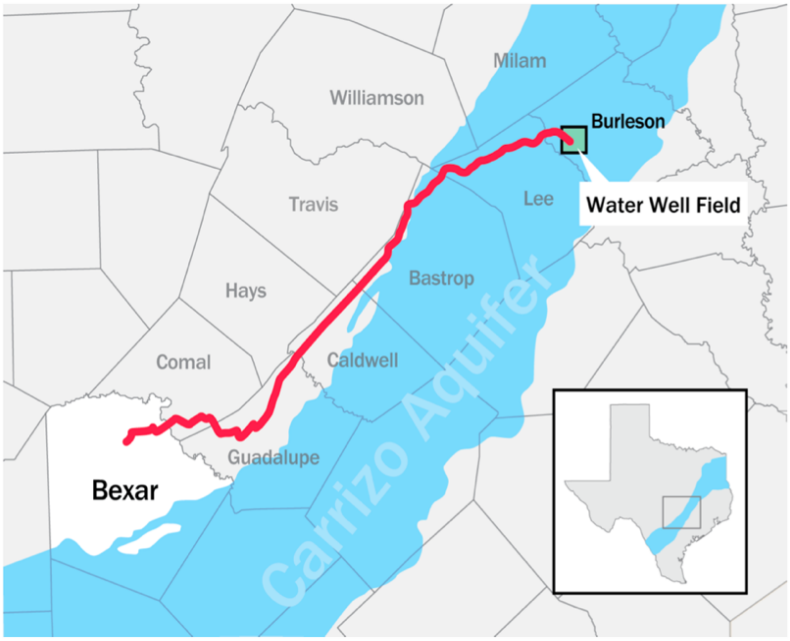

Figure 6: Illustration of the approximate route of the Vista Ridge Pipeline (Reprinted from SAWS 2017, 42)

4.4 Research Objectives

My study aims to accomplish three Objectives:

Objective 1: Develop a concourse of statements on the stakeholder perspectives of water governance and associated social economic impacts of water transfer in San Antonio and Burleson/Milam Counties in Texas.

Between December 2017 and February 2018, I obtained several statements from local newspapers (*San Antonio Express News*, *Rivard Report*). Other statements were collected from government documents and websites on the VRP project. A majority of statements came from twenty-two semi-structured interviews of key stakeholders in the region. These stakeholders included municipal employees, prominent community leaders, journalists, advocacy group members, and rural landowners Interviews were carried out between March and May of 2018 and lasted between 30 and 60 minutes each. Interviews were audio recorded and transcribed to extract verbatim statements.

From these sources, 324 statements were obtained and narrowed to thirty-six final statements to create the Q-Sample. These statements encompassed reoccurring themes in the existing discourse on the topic, including but not limited to governance, development, public-private partnerships, and hydrology. During the interviews, respondents were asked open-ended questions relating to their perspectives on water transferring, Texas groundwater law, environmental impacts, transparency of involved agencies, economic implications for urban and rural residents, and possible effects on rural property values. My research was deemed "Not Human Subjects Research" by TAMU IRB (Appendix A).

Objective 2: Conduct and analyze Q-Sorts performed by key stakeholders. Once the Q-Sample of thirty-six statements was developed, each statement was printed on separate cards. These cards were used by participants to conduct Q-Sorts, in which each was asked to rank statements from +5 (most agree) to -5 (most disagree) forced into a normal distribution formation (Figure 7). Participants consisted of the twenty-two originally interviewed stakeholders from Objective 1, plus an additional participant not interviewed. Q-Sorts were conducted between April and June of 2018. Statement placement was recorded for each participant and an open-ended interview conducted immediately after the sorting. The goal of this interview was to elicit a respondent's rationale for their sort. After all Q-Sorts were collected, analysis of the data was performed with a free, web-based program, Ken-Q Analysis. This software, based on PQMethod, accomplishes three essential statistical tasks: calculation of the correlation matrix; extracts and rotates significant factors; calculates factor scores (z-scores). For each respondent, factor loadings and statistical significance were determined. These results formed the basis of the qualitative component, explained in Objective 3.

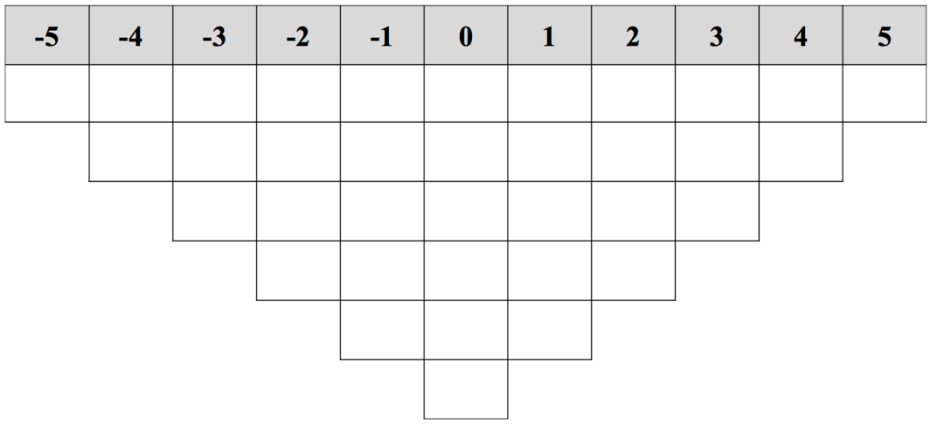

Figure 7: Q-Sort Grid used by participants to sort 36 statements.

Objective 3: Interpretation and validation of preliminary findings with participants. Results validation took place in July 2018 with six high loading respondents. Respondents were asked to reflect on the factors, on their results, and on the ideal statements for other factors. This process allowed for respondents to critically engage with the preliminary findings, questioning both the method and the "types" of perspectives that describe the factor loadings. Suggestions from the respondents were recorded and considered in the final results.

4.5 Data

Several recurring themes were identified in the peer-reviewed literature which include: environmental and ratepayer risk; conservation; transparency and governance; role of developers; and economics/affordability. During research for the study, which began in December 2017 and ended in mid-February 2018, it became clear that these themes and more were prevalent in the case study communities connected by the VRP.

Topic Research and Selecting Participants

Secondary data research through the collection of newspaper articles and websites provided necessary background on the VRP project. Articles were gathered from local newspapers in San Antonio (*San Antonio Express News*, *Rivard Report*) and from articles posted by vocal advocacy groups (Sierra Club Alamo Group, League of Independent Voters of Texas, Hill Country Alliance). Reports and legal filings were also compiled. Key-word searches on social media sites, Facebook and Twitter, revealed comments written by individuals and usually consisted of strong opinions on the VRP project. In total, over 100 articles and reports were used

for background information on the study region and VRP project and aided in determining key actors in the water sector to interview and begin preliminary concourse development.

Perspectives obtained in a Q-method study are from decision makers and key stakeholders, not the general public. Sampling techniques such as systematic, random, convenience, or others are unsuitable for this methodology. To identify key stakeholders purposive and snowball sampling are effective (Webler, Danielson, and Tuler 2009). Snowball sampling refers to initial respondents referencing other relevant stakeholders. Snowball sampling is also important in revealing people's perceptions of who key actors are and are not in relation to the VRP. To ensure confidentiality, the person who made the referral as left unknown to the referred contact, unless otherwise approved by the person who made the referral. For this research, it was important to include stakeholders from all main interest groups: water utility employees, environmentalists, rural landowners, journalists, lawyers, and so on. There were however three representatives from prominent agencies and firms connected to the project who declined interviews.

Developing Questions and Conducting Interviews

Preparing for interviews began by constructing semi-structured, open-ended questions tailored to individual stakeholders. Open-ended questions allow for participants to elaborate on the aspects they deem most important, revealing their subjectivities on the topic. Question categories were informed by emergent themes in the secondary material. Appendix B provides a list of the questions used during interviews. Twenty-two stakeholders were interviewed between mid-February and March 2018. Interviews were conducted in either the stakeholder's place of work or residence at a time and date of their convenience. Generally, interviews lasted between

thirty and sixty minutes with a couple lasting nearly two hours. While time consuming, in-person, open-ended interviews provide insight and connection between participant and researcher that is lost through questionnaire style research or digital forms of communication.

Interviews began with general background questions of the interviewee. Interviewees were given time to elaborate on their background and ask questions of the researcher's, creating a more relaxed interview setting. Following introductions was the question: "From your perspective, what are the challenges of water supply and water security in Texas in general?" This question was to determine their perceptions on state-wide issues as a whole. In many instances, participant's discussion following this question would reveal who/what they perceive as the culprit(s) in exacerbating state-wide water issues. Some participants mentioned worsening droughts predicted by climate change and population growth driving demand as major challenges. One participant, a prominent business leader also from San Antonio, mentioned issues with Texas surface and groundwater law not being conjunctive or related to each other as a major challenge and how politics further complicate matters:

> **Participant 11:** You've got two completely unrelated bodies of law trying to manage this single source, water, and it doesn't work. As we get more people and more demand, it's going to be more and more difficult to continue to operate with these two bodies of law that don't talk to each other. I will tell you that the other major problem in the state of Texas is how at some point, probably in a state of crisis, we will have to coordinate the management of surface and groundwater. If you don't do that you're just continually budding your head against the wall, it won't work. I think most of the legislatures realize that but the minute you talk about touching a property right you just lose them politically right then because they know that their constituency probably are not going to be happy about that.

Another participant, a member of an environmental advocacy group in San Antonio, saw Texas challenges from a more historical perspective, one driven by economics and development:

> **Participant 13:** [Texans] are going to see a recap of what's happened in California if we continue on our present course. There are cities that are growing immensely – Austin, San Antonio, Houston, Dallas – they are requiring ever more water to continue their growth. They will do exactly what California has done for economic reasons. They will pull water from further and further away. We call that model 'Grid-zilla' because it's the water grid that is going to eat up Texas…Because of the economic factors involved in this, because of the way greed drives developers to continue developing, its development at any cost and that is what is wrong with what's going on in Texas.

The role of developers in the VRP project was present in secondary data research and in stakeholder interviews. When the terminus point for the VRP project was changed the decision was scrutinized. For a prominent developer in San Antonio, the reason for the change was to reduce pumping costs of the overall project:

> **Participant 10:** One of the changes we made to the actual project is we moved the point where SAWS is going to take the water to the highest point in the service area. So that when the water gets to SAWS it just flows into their system by gravity. They don't have to pump it again. It saved SAWS a bunch of money over the life of the project from a pumping and electrical standpoint.

Others see the change in the terminus point as a decision imbedded in the desire for continued development:

> **Participant 13:** To me, the whole concept of Vista Ridge was for the developers to ensure a huge and abundant supply of water for San Antonio, to create the perception that growth could continue unabated and uncontrolled to the north. Even the route of the pipeline, if you look at it, coming down the I-35 corridor, you would think if it's coming to San Antonio it would come to central San Antonio. Well no, it veers north and terminates north of [highway] 1604 with the intention, in my opinion, of facilitating and encouraging growth north of San Antonio.

Next, stakeholders were asked to express their thoughts on various types of risk. As identified in the existing dialogue on the VRP project, there are many who are concerned with

the economic risk to San Antonio ratepayers, the risk of the pipeline disrupting the conservation ethic established in San Antonio, as well as, the environmental risk of pumping to the aquifer and surrounding ecosystems. The questions posed here allowed for participants to elaborate on the perceived risks of the project. For example, a representative of SAWS explained how the presence of risk was a determining factor in choosing to use a PPP for this project:

> **Participant 3:** P3s can be a good thing and this is one that we think is structured right. There are a whole lot of ways and reasons to do a P3, some of it is because of just a pure financing mechanism. I mentioned that they [the private consortium] can do it on their balance sheet, we [SAWS] don't have to keep it as a debt coverage. We just pay it as an O&M [operations and maintenance] payment. This is one [the VRP] that is very beneficial because we shift the risk. But P3s are not the panacea, they are not the best thing in the world for every design. If we didn't have this regulatory process in place with the 100 different groundwater districts and all the risks that we face with that, a P3 may not make sense for this kind of project if that risk were not in play. So, there's a price to pay. This P3 is going to cost us more money because of that regulatory structure. We could go out issue Municipal Bonds and do this project a whole lot cheaper than we are doing it for a P3. So, part of it is just by changing regulations you can reduce costs that way…I think the benefit again in this particular P3 project is shift that risk because that's a real risk of groundwater districts and regulations. It may be a higher cost of the project but if we were to build it at a lower cost but then the groundwater district was to shut us off for some reason, now we're paying a whole lot of money – albeit less than what they [the private consortium] are proposing – we are paying a whole lot of money for no water in the pipe. And we think there is a real risk that water will be reduced.

For an environmental lawyer the decision to use a PPP indicates an attempt to not be fully transparent or accountable:

> **Participant 20:** There is already an inherent problem with P3s because usually they are brought in to finance something that's traditionally been public infrastructure so it's something that the public at large relies on and needs…P3s have been proposed in instances when a public entity just doesn't have the funds to do something on their own. So, there's this idea that if we don't have enough public funds then the solution is to somehow bring in private funds and rather than completely privatize it, doing some

> kind of partnership. And sort of based on the assumption that we can't find the public funds to do it, or there is not a will to sort of correct the model that's defunding our public entities that would normally build some kind of infrastructure like this. So first of all, it's based on a flawed model that we're defunding public entities that really should be providing public infrastructure and so we look to these private entities as some kind of saviors, which is really unfortunate. But what we've seen and I think the Vista Ridge project illustrates really well some of the problems with P3 contracts in general, what we've seen is the private entities have a lot of interest in keeping information private and proprietary. And they have been able to exert some influence over the public entities to keep that information private even when it arguably should have been public. Even if it doesn't have to be public, the public entities have an interest in making it public and when they're partnering with an entity that's private and has so much influence and control over this project, then typically even when they're hearing repeated requests from the public for more information, they sort of take the excuse 'oh our hands are tied, there's nothing we can really do about it." And that's a really easy out that is not the kind of out that a public entity should really have available. That's not real accountability.

Another major theme identified relates to aspects of governance and transparency. For example, all participants were asked, "How transparent have agencies (SAWS, POSGCD, the VRC) been with details regarding the VRP process?" This question also resulted in many different opinions and allowed a greater understanding of the various perceptions of water governance in the study region. For example, the two segments of text below come from two participants, the first is from a San Antonio journalist (Participant 18), and the second a Burleson County landowner (Participant 12). These excerpts reveal stark differences of opinion on the topic of transparency:

> **Participant 18:** In my opinion, they [SAWS] have been transparent. If you buy the other argument then we probably don't have much to agree about. I sat in one Board meeting, it went on and on, and I was the only journalist there at one point and I thought 'well, if the public wants to come hear this stuff, hour after hour – it's just excruciating to listen to – they can do it," and that's where it all happened in those open Board meetings. People after the fact, I think, when they saw the dimensions of

> the project and they started to pay attention, it was like 'we could have been at the table.' You could have sat in the same room I sat in and listened to the contract negotiations but you weren't there. But they were transparent.
>
> **Participant 12:** They [Post Oak Savannah GCD] try to be transparent, but I don't think that they are…I have a job, I have a life. I have a family. I can't just monitor this project all the time. So, for the average person, you have to get kind of sophisticated to even understand what's going on. Whether someone is trying to be transparent or not, it just becomes complicated. The average person would just be like "Well, I don't understand what that means." Someone that's a farmer or rancher in Burleson County – do you think they're going to understand all the details of this project? No, they're not. I have a limited understanding about it – I have to have help from an attorney.

It is clear from these quotes that the two respondents differ in their opinions concerning a stakeholder's ability to spare time to attend meetings and understand content. As mentioned before, Participant 12 mentioned how she receives help from an attorney regarding project developments but many stakeholders in the study region communities will most likely not be able to afford an attorney, much less time off work. Bloomfield (2006) in her study of an Australian PPP project argued that public confidence was eroded when stakeholder's ability to understand complex contracts created barriers to transparency. These factors inform stakeholder's perceptions of the transparency of a project and are a recurring theme for the VRP project. Determining if a project's planning process was 'transparent' or not could be enriched by a dialogue on spatial and economic inequality.

Coding Interviews

The coding process began once interviews were transcribed. To assist in data organization and analysis, the qualitative and mixed methods research software MAXQDA Analytics Pro 2018 (version 18.0.8) was utilized (http://www.maxqda.com). Transcription

statements were selected and custom codes created to begin creating the concourse of statements. A statement was deemed significant if it represented a perception or opinion that was either similar or different than what others have stated or emphasized as important during the interview. Emphasis was either made explicit by the respondent or if it evoked a strong emotion which could be evident through their word choice or demeanor. The following statement from a Milam County landowner and farmer illustrates this well:

> **Participant 17:** People have this vision, including the freakin' legislatures, that there's just this vast untapped groundwater and it's never going to run dry, which is exactly what they thought of the Ogallala [Aquifer]. In Texas, there's an emphasis on growth as an unmitigated good. Growth by itself isn't a sign of health, it isn't a sign of human welfare, and it isn't a sign of human happiness. It's a sign of money exchanging hands, which is a tool not an end. But the problem is this is how America views itself, growth and economic growth is the end all be all. So, the sorts of things that need to happen for water conservation, whether it's in the home use or whether it's dealing with fracking and industry – don't spur economic growth and so we don't value them, we don't build for them, we don't policy and structure for them. So, you combine that with a state that is economically booming in an area that it doesn't have enough water and a willingness to just ignore future consequences. That is a disaster in the making. It's a perfect storm of bad factors all in one.

Statements were chosen according to three criteria: the interview question; association with a specific topic; or an extreme opinion. The statements gathered from interview questions deemed significant were automatically added to the list of preliminary statements. This ensured an appropriate range of perspectives were represented by statements.

Statements were collected until a point of saturation, or statements on the topic begin to repeat (Eden et al. 2005). The goal of a statement concourse is to represent the breadth of perspectives held by stakeholders. When no new information is being collected, the next phase of Q may begin. In total, 324 statements were selected based on the interview categories ensuring a

wide range of perspectives. Statements from secondary source research were included in the total. The statements were printed and cut into small strips of paper and physically arranged on a large table into themes and sub-themes (Figure 7). Separating the concourse into themes and sub-themes is known as strategic sampling (Webler et al. 2009, 8-9). Organizing statements revealed several categories or foci based on literature or preliminary research. Initially, a long list of categories emerged: governance, development, economics, risk, aquifer health, morality of water grabbing, urban/rural impacts, politics, water availability, transparency, population growth, water law, private property rights, privatizing water, and groundwater lease validity. Categories were condensed to four major themes or foci, each with related sub-themes: governance, development, public-private partnerships, and hydrology (Figure 8).

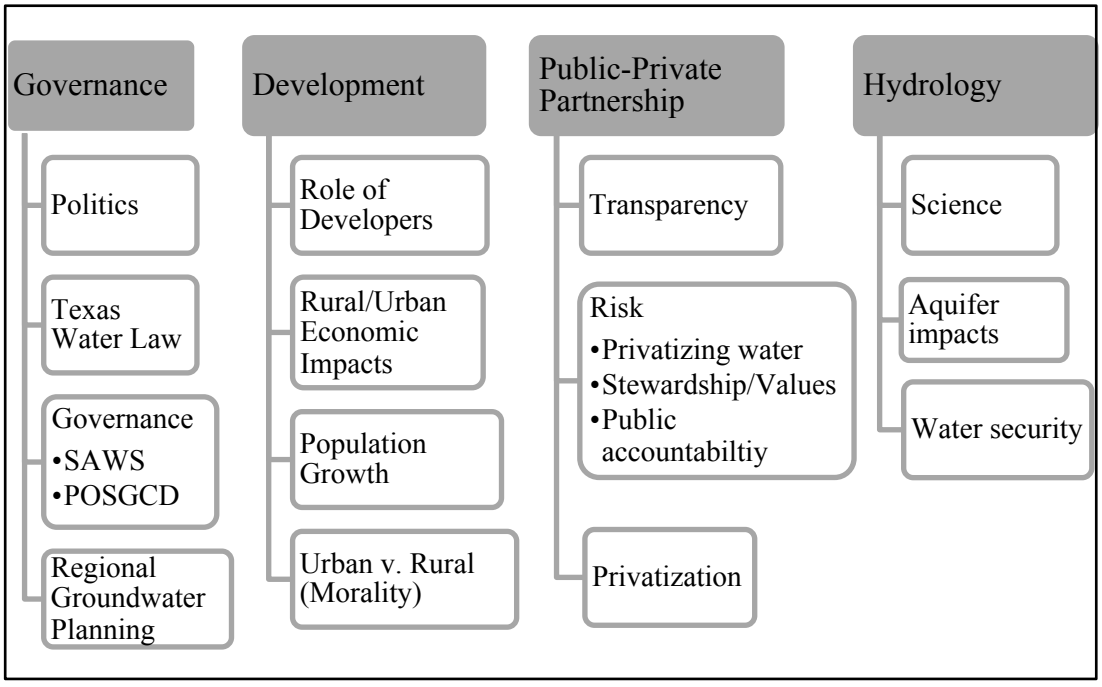

Figure 8: Diagram of the four major foci and associated sub-themes.

The process of narrowing statements depended on many factors. Poorly focused statements were eliminated quickly, while statements which I felt were representative of the emphasis and demeanor of the interviewee were included. Topics of particular focus during interviews were noted and selected.

Establishing the Q-Sample

In total, the Q-sample consisted of 324 statements obtained from the primary source interviews and secondary source news material. The statements were printed and cut into small strips of paper and physically sorted on a large table into themes and sub-themes (Figure 8). Doing so revealed four main foci: governance, development, public-private partnerships and hydrology. Once all statements are sorted, the next step is to determine which statements are good and which can be ruled out. Statements were chosen according to three criteria: the interview question, association with a specific topic; or an extreme opinion.

Aside from one respondent, eminent domain issues were not mentioned, so statements on this topic were not included in the final Q-sample. Once the final Q-sample statements were chosen, each was printed on an index-sized card and laminated to protect the card while being handled. Each card had an identifying number printed in light gray text in the bottom corner, so not to distract the participants. The numbers were printed upside down in relation to the statements. This not only provided increased convenience for the researcher but also reduced recording error while sitting across from the participant. An additional card was printed and laminated which illustrated the formation the participants were to sort the statements.

Step II: Conducting the Q-Sort

Q-sorts were conducted between April and June 2018. The original twenty-two participants were chosen, plus an additional participant who was not originally interviewed. Participants were asked to take time reading through each of the statements. It was encouraged to begin by simply sorting statements into three piles: agree, disagree, and neutral. For example, statement one was a comment made by one of the stakeholders during one of the first interviews: "Groundwater conservation districts can make very arbitrary decisions about when to issue permits. It's not so much based on science as it is based on local politics." During Q-sorts, participants decide if they agree or disagree with the statements. If they neither agree nor disagree, then the statement was placed in the neutral pile. This process was done for all thirty-six statements.

Next, participants decided where each statement would be placed on the normal distribution (Figure 6). Participants were told that each white square represented a statement, therefore only one statement could be placed at -5 (most disagree) and only one at +5 (most agree). Then only two statements could be placed at +4 and -4, three at +3 and -3, and so on. Some respondents had difficulty ranking statements, particularly when they had many statements they either agreed or disagreed with. It was noted by some that they felt because they agreed with so many that they considered neutral for them as -1. Overall, participants found that they either agreed or disagreed with most of the statements. Neutral (0) served for some a place to sort cards they did not know much about. Sorting cards in such a manor forced participants to consider each statement carefully to decide which were the most important to them. The entire sorting process took between twenty and thirty minutes to be completed.

Step III: Factor Analysis

For calculating the factor analysis statistics, a free web-based software was used called Ken-Q Analysis (version 1.0.1, https://shawnbanasick.github.io/ken-q-analysis/index.html). Ken-Q provides a user-friendly GUI interface compatible with most major web browsers, therefore compatible with any Windows or Mac OS systems. Another benefit of the web-based Ken-Q analysis is it allows a researcher the ability to run several variations of analysis quickly and easily. The first step is to input data. Ken-Q allows for many data file types, such as CSV, Excel, PQMethod, and others. For this study, data was placed in the Type 2 Excel format and uploaded using a template provided. Once the sorts are confirmed correct, the factor extraction may begin. Users have the option of Centroid or Principle Component Analysis (PCA). It was determined that PCA, which is the most common form, would be best for this study as there was no intention to utilize judgmental, or hand rotation (Webler, Danielson, and Tuler 2009). By simply pressing the "Principle Components" button, eight factors are extracted automatically. The process of choosing the final number of factors for rotation depends on several indicators. One commonly used indicator is when Eigenvalues are greater than 1.0. For this study, the first four factors produced Eigenvalues larger than one. In a 4-factor scenario, Factor 3 had no distinguishing statements to describe the perspectives of loaders. In the end it was determined that a 3-factor solution was most appropriate.

Once factors are decided, the next step is to decide which type of factor rotation is to use. Factor rotation is another area where researcher judgement can enter. As Webler, Danielson, and Tuler (2009, 10) explain, "rotating the factor changes its meaning, but it can make the factor more relevant or meaningful." Using varimax rotation reduces the amount of researcher judgment that enters the analysis, and "produces the factor solution that maximizes the amount

of variance explained on as few factors as possible" (Webler, Danielson, and Tuler 2009, 10). Judgmental, or hand rotation is another option but, as the name suggests, increases the amount of researcher judgment on the factors. Varimax produces more straightforward and transparent results.

Loadings are produced from the rotation of three factors. The Ken-Q "auto-flag" function set to a criterion of $p < 0.01$ was used to determine significant factor loadings. The "Require Majority of Common Variance" setting was enabled to avoid producing "confounders," participants who load into multiple factors. Three participants did not load significantly into any factor and two loaded significantly negative in Factor 2. It was decided to manually un-flag the two negative loaders to remove their influence from Factor 2 and create a strictly qualitative factor with these five individuals.

Step IV: Validation

Revealing preliminary results to participants is the last step of Q-method. Essential to following good Q-method practices, this step allows participants to review preliminary results and suggest changes to the social perspective names or descriptions. In July 2018, after the factors were identified and tentatively described, results were given back to the participants who loaded highly. Six participants who loaded highly into their respective factors were chosen for this phase. Two participants from each of the significant factors were interviewed a final time. Due to scheduling challenges, a meeting with a non-loading individual did not participant in this step.

Each respondent was given a chart (Appendix E) listing descriptions of each social perspective cluster. The participants were given time to read and analysis the chart before

questions. Once ready, participants were asked to identify the perspective they believe represented their perceptions. Then they were told the social perspective they loaded in according to Q. The participants who loaded into Factor 2 identified their perspective quickly. Three of the remaining four participants felt they were a non-loading individual when in fact they belonged into either Factor 1 or 3. When revealed the factor they actually loaded into they were not surprised but expressed how they share the viewpoint of the non-loaders.

Participants were then asked what changes they would make to the names or descriptions of the perspectives. Overall, respondents agreed with the social perspective descriptions but some suggestions to the names of some factors were provided. Respondents were asked to comment on whether they believed the social perspectives were representative of other perceptions in the community. Suggestions were documented and used to update the chart (Appendix F).

Social Perspectives

Four factors obtained eigenvalues greater than 1, a commonly used precondition to consider potential social perspectives independent (Iribarnegaray et al. 2014). After further analysis, a three-factor solution was deemed more meaningful with regard to local circumstances. Factor four produced results which were difficult to interpret and ascertain any actual meaning. Selecting only two factors, however, meant the loss of a very distinctive third factor. Ultimately, three factors were selected for final interpretation and analysis. Combined, these three factors represented 68% of accumulated variance. Factor analysis reveals distinguishing statements ($P<0.05$) for each statistical factor based on the individual sorts of the participants who loaded into that factor (Appendix I, J, K). Factors are described using

distinguishing statements and analyzing the ‘type’ of respondents who loaded are used to describe each factor.

5. RESULTS

In this chapter, results from ten months of interviews and meetings with stakeholders are presented. Analysis revealed three factors or empirically determined and statistically significant perspectives (Appendix G). Factors were found to be either positively correlated or negative correlated with each other, indicating that somewhat large differences of meaning were present (Appendix H). Distinguishing statements – that is, statements that for each factor were ranked statistically significant – are listed in several tables for each factor (Appendix I, J, K). Rotated factor loadings are given in Appendix L. Consensus statements in which no significant differences were observed between factors are listed in Appendix M. The complete matrix of z-scores and rankings are listed in Appendix N. In this chapter, I summarize each factor according to distinguishing statements ($P < 0.05$), which are used to describe the emergent themes for each social perspective group. Statements will be referenced with a number in brackets preceded by the number sign (#).

Factors were given initial names after preliminary analysis of the Q-sorts. The names for Factors 1, 2 and 3 were as follows: “Landowner Opposition,” “Project Advocates,” and “Governance Failure.” The non-loading cluster was given the name “Non-Loading Project Skeptics.” Factors 1 and 2 could be inferred from a reading of the VRP controversy. Factor 3, however, emerged from the Q-method and was not an obvious part of the debate as portrayed by the news media.

5.1 Factor 1: Landowner Opposition

Six rural landowners, three from Burleson County and three from Milam County, loaded into Factor 1. The Landowner Opposition factor describes stakeholders who oppose the VRP

project in Burleson and Milam Counties. These individuals are frustrated with the management and oversight provided by POSGCD during the project planning phase and are dissatisfied with existing Texas groundwater law. The Landowner Opposition strongly hold the perspective that the VRP project is not for the benefit of people in the area but will only serve to decrease land values and potentially have dramatic impact on the aquifer that many rely on for a living. This group acknowledged the issues faced by San Antonio ratepayers but their opposition focused on the impact of the project as it relates to rural interests. Their proximity to the project's potential pumping impacts inform their opposition.

Factor 1 had the highest eigenvalue (11.799) compared to the other two factors and had the lowest standard error (0.2) (Appendix G). Factor 1 accounted for the highest percent of variance with 51% explained by this factor alone. This factor was positively correlated to Factor 3 (0.6418) and negatively correlated to Factor 2 (-0.4229).

Emergent Themes

Factor analysis revealed thirteen distinguishing statements Factor 1 (Table 2). Emergent themes from Factor 1 sorts include: 1) governance; 2) groundwater ownership; 3) local impacts; and, 4) the relationship between science and politics. A strongly held perspective of Factor 1 loaders is their dissatisfaction in the governance of the local GCD and its ability to protect landowners who did not lease their water rights (non-leasing) from potential negative impacts (#7). Respondents agree that some decisions made by GCDs can be based more in politics than science (#1). Factor 1 respondents disagree with perspectives that SAWS has mitigated against project risks (#10, #20) and that aspects of contract negotiations should be confidential (#16). Respondents also agree that San Antonio city officials did not listen to concerns raised regarding

the project (#34). There exist concerns among Factor 1 loaders that project companies refuse to take responsibility in ensuring the validity of groundwater leases pooled for the project, which has caused the Landowner Opposition loaders to question the use of PPPs as a mechanism for water transfer (#33). Sorting reveals that Factor 1 loaders perceive issues related to accountability, stewardship and transparency of PPPs and contract negotiations (#33, #21, #16). The Landowner Opposition respondents perceive issues with existing groundwater ownership laws. They consider that as non-leasing landowners they are not protected from the effects of pumping. This sentiment is reflected in another strongly held perspective about the VRP project's impact on local livelihoods (#24). Factor 1 loaders acknowledged that, while some local individuals may benefit directly from the VRP project, they perceive that most other residents, leasing and non-leasing, will not benefit from the transfer of water out of the area. Respondents also acknowledge that science is political (#35). Scientific consensus of aquifer pumping is difficult to predict and while there are hydrologists whose models predict the Carrizo-Wilcox aquifer will not be severely impacted, there are other hydrologists who say otherwise. Factor 1 loaders perceive the ability to pick and choose a hydrologist as an intentional political act.

Table 2: Distinguishing statements for Factor 1 significant at $P<0.05$. (*) indicates significance at $P<0.01$.

#	STATEMENT	RANK	SCORE	THEME
7	I don't think Post Oak Savannah Groundwater Conservation District is doing the proper job to protect the aquifer and the people that live in Burleson and Milam Counties.	5	1.69*	Governance
4	I object to groundwater being called a property right because if it can be drained out from under my land it's not a property right. That's called theft in any other area of property.	4	1.67*	Texas Groundwater Law
24	When this water goes down the Vista Ridge pipeline it is not going to help anybody here in Burleson and Milam County.	4	1.63*	Rural impacts

Table 2: Continued.

#	STATEMENT	RANK	SCORE	THEME
35	There are hydrologists telling SAWS Vista Ridge pumping is going to be fine. There are other hydrologists saying it's going to be a disaster and there are others saying 'I don't know.' So, you get to pick the hydrologist that says what you want to hear.	3	1.15	Science/ Politics
33	Post Oak Savannah Groundwater Conservation District has never reviewed the legitimacy of any of the groundwater leases to see if they are legally recorded and so forth, and that is the reason why SAWS has done this private-partnership deal, where they put that burden of responsibility on BlueWater and that's the way SAWS wash their hands on this.	2	1.12*	Governance/ PPP Accountability
34	San Antonio City Council failed its fiduciary responsibility to obtain an independent analysis of the Vista Ridge project. It did not ask any questions, and it refused to listen to many questions asked by concerned stakeholders.	1	0.39	Governance
1	Groundwater conservation districts can make very arbitrary decisions about when to issue permits. It's not so much based on science as it is based on local politics.	1	0.33	Politics
21	Nobody has ever put together a public-private partnership that behaved as a good steward.	1	0.19	PPP
31	San Antonio has been a leader in conservation, but we got sidetracked by the goal of acquiring abundant water.	-1	-0.23	Water security
16	In my opinion, SAWS has been transparent. When you negotiate a contract there needs to be confidentiality.	-2	-0.94*	Governance/ Transparency
10	SAWS has done its due diligence in ensuring that its ratepayers are protected from major risks while providing San Antonio with the Vista Ridge Pipeline, a new, safe and reliable water source.	-3	-1.01*	Governance/ Risk
20	At SAWS, we've mitigated the risk for San Antonio but have also mitigated the risk for the local folks of Burleson and Milam County. We put all the risk on the private sector.	-3	-1.40	Governance/ Risk
8	SAWS has experienced some controversy but most has been from local Sierra Club types. There are very few in the Burleson and Milam County area who oppose the project.	-4	-2.06	Politics

Respondent Rationale for Q-Sorts

After participants performed the Q-sorts, they were asked questions to assist in understanding their rationale behind particular card placements. Loaders in this factor mentioned having difficulty sorting the cards that dealt with institutional motives, particularly as they related to San Antonio officials. Some loaders also mentioned having difficulty sorting the cards into the required formation because there were more statements they agreed with than disagreed

with. Overall, the Landowner Opposition strongly agreed with Statement 4 (+4), indicating their frustration with existing water law:

> **Participant 12:** [Groundwater] can't be a right because its subsurface. I don't have a right because if adjacent landowners - or even distant adjacent landowners – lease [their rights], I don't have any control. And that is the case I'm in because I didn't lease and I don't have any control.

The Landowner Opposition also disagreed very strongly with Statement 8. Respondent 12 felt a more accurate statement would be, "There are very few in Burleson and Milam who *understand* the project." Other loaders mentioned the difficulty in terms of time and ability to understand the details of this complex project. Some even admitted at times wanting to give up fighting because of the looming feeling that nothing will change the outcome.

Validation Phase

Originally entitled "Rural Opposition," the label was changed to "Landowner Opposition" after results validation with high loading participants. Participant 12 (F1 loading = 0.8381) expressed how even when she lived in the Houston area and identified as an urban resident she was still a landowner which informed her understanding and decisions. Participant 20 (F3 loading = 0.6143) also suggested altering the names of Factor 1 to be more representative of the 'type' of individuals included:

> **Participant 20:** There is a very different opposition, I think, from people that live in rural areas and people that live in urban areas when you're talking about how to plan for water. They are both oppositions so, I wouldn't want to classify it as rural and urban are always on opposite sides of the spectrum. There could be maybe another column that aligns really similarly with the rural opposition in perspectives but maybe not in experiences… I would see maybe the 'Rural Opposition' as 'landowners' or 'people who rely on groundwater' opposition. I think that's what sets us apart as urbanites. It's not that we have a different feeling toward the

> project but we're not as closely aligned with the groundwater itself and what that means for our future as they are. We're able to distance ourselves from that a little bit and they're not and I think that reflects in a lot of the answers that are here.

5.2 Factor 2: Project Advocates

Factor 2 consists of five individuals: two employed by the municipal utility, two are Presidents of private companies affiliated with the project, and one with no direct affiliation with the project. The Project Advocates factor describes stakeholders who significantly support the VRP project and view it as crucial for the future of San Antonio. Four of the five individuals who loaded significantly in this factor have direct associations with an agency or private firm affiliated with the VRP project. These individuals support the PPP deal and believe major economic and political risks are assumed by the private firms involved. The Project Advocates see the water supplied by the VRP as necessary for continued economic and population growth for San Antonio while not impacting the livelihoods of Burleson and Milam County landowners. The Project Advocates also uphold the VRP project planning process was an open, transparent process for stakeholders.

Factor 2 had the next highest eigenvalue (2.584) compared to the other two factors and had the lowest standard error (0.219) (Appendix G). Factor 2 accounted for the next largest percent of variance with 11% explained by this factor alone. This factor was negatively correlated to Factor 1 (-0.4229) and to Factor 3 (-0.5619).

Emergent Themes

Factor 2 revealed twenty-one statically significant distinguishing statements (Table 3). Water security is a major theme held by the Project Advocates. For Factor 2 respondents, the

VRP project represents an important opportunity for San Antonio to meet its growing demand at stable prices (#29, #9). However, respondents consider the control local GCDs have over the groundwater in their jurisdiction as a threat to San Antonio's water security (#25). Respondents disagree with the notion that, in pursuing the VRP project, San Antonio is getting sidetracked from its conservation goals (#31).

Several statements ranked highly by Factor 2 respondents pertain to aspects of governance and risk. Project Advocates firmly disagree with the perspective that public officials failed their fiduciary responsibilities and that concerns from stakeholders went unheard (#34). Specifically, respondents regard the claim that a previous mayor created a soft target of the San Antonio City Council by replacing members as false (#3). Factor 2 respondents feel strongly that this project illustrates good governance on the part of the entities involved in planning and management and that San Antonio ratepayers are protected from major project risks (#10). Respondents also believe that risks have been mitigated for residents of Burleson and Milam Counties as well (#20). Project Advocates see issues with GCD governance in their ability to issue permits and feel that many decisions can be based more on local politics than science (#1). This group also perceives a GCDs autonomy as groundwater regulators as a potential risk to San Antonio's water security (#25). GCDs have the ability to halt production, or 'turn off the tap' if evidence exists that pumping is threatening their ability to meet the DFCs. Through the PPP, this risk is assumed by the private sector.

Development emerged as a major theme defining Factor 2. For instance, Project Advocates see drought restrictions as creating a bad reputation for business development and that projects like the VRP will allow San Antonio to avoid that outcome (#14). However, respondents

disagree strongly with the perspective that developers are the only ones who will benefit from the VRP project and that cities only serve development interests (#19, #13).

Project Advocates consider project process to be transparent and open and that some level of confidentiality is common in contract negotiations (#16). Respondents disagree staunchly with the notion that the PPP nature of the project was used intentionally to avoid public accountability and transparency (#18). Project Advocates hold the perspective that the partnership established to finance and construct the VRP will protect stakeholders and disagree with the idea that involvement of private entities is dangerous for public good (#28).

Project Advocates believe pumping from the Carrizo-Wilcox will not dry up the aquifer due to the large amount of water stored in the aquifer formations (#32, #36). They do acknowledge, however, that science and understanding evolves and if evidence reveals new conclusions then adjustments to management should be made (#30). Project Advocates believe that most of the opposition to the VRP exists locally and that residents of Burleson and Milam Counties broadly support the project (#8). They see the VRP project as a beneficial partnership with landowners who leased their groundwater (#17).

Table 3: Distinguishing statements for Factor 2 significant at P<0.05. (*) indicates significance at P<0.01.

#	STATEMENT	RANK	SCORE	THEME
29	Vista Ridge gives San Antonio the ability to use those water supplies to meet its demand and balance conservation, drought management, and economic development.	5	1.81*	Water security
10	SAWS has done its due diligence in ensuring that its ratepayers are protected from major risks while providing San Antonio with the Vista Ridge Pipeline, a new, safe and reliable water source.	4	1.58*	Governance/ Risk
9	Vista Ridge assures that San Antonio will have guaranteed water security for decades at stable prices. This is a historic opportunity.	4	1.47*	Water security
20	At SAWS, we've mitigated the risk for San Antonio but have also mitigated the risk for the local folks of Burleson and Milam County. We put all the risk on the private sector.	3	1.26*	Governance/ Risk
25	A groundwater conservation district's ability to set their desired future conditions, permit term lengths, and pumping cutbacks poses a risk to San Antonio to receive a reliable supply of water.	3	1.18*	Risk/Water security

Table 3: Continued.

#	STATEMENT	RANK	SCORE	THEME
1	Groundwater conservation districts can make very arbitrary decisions about when to issue permits. It's not so much based on science as it is based on local politics.	3	1.13*	Politics
17	The Vista Ridge project is a true example of Texan helping Texan through a win-win deal that benefits San Antonio and the local landowners who are leasing their private water rights.	2	1.11*	Governance
14	A city always wants to have 50 years of water in front of it. Most big communities have to go out, do a big water project, and get more water than they immediately need so they can grow into the water they get. If you don't do that, then your city is always put under drought restrictions and that creates a bad reputation for business development.	2	1.07*	Development
16	In my opinion, SAWS has been transparent. When you negotiate a contract there needs to be confidentiality.	2	1.02*	Governance/ Transparency
30	I believe the scientists for the state and for SAWS. Their best estimates are that the Carrizo-Wilcox aquifer can afford to carry the burden of Vista Ridge. But they could be wrong. Science improves all the time and you've got to be willing to say if new data shows new conclusions you don't stick to your points of view.	2	0.92*	Science
32	There's this fear base that the Carrizo-Wilcox aquifer is going to dry up like a lake does and it just doesn't happen that way. The aquifer is very deep. Vista Ridge is not going to impact the local landowners.	1	0.65*	Aquifer impacts
8	SAWS has experienced some controversy but most has been from local Sierra Club types. There are very few in the Burleson and Milam County area who oppose the project.	1	0.65*	Politics
36	When we mine coal or pump oil we recognize that at some point that means we are going to run out, but there are substitutions for energy. There are no substitutions for water. And Vista Ridge is nothing more than a mining operation.	-1	-0.41*	Aquifer impacts
28	It is really dangerous when we start putting public utilities in the hands of private actors because those entities don't have the public good at heart. They have a legal right to sacrifice public good for private interest.	-2	-0.71*	PPP Stewardship
15	The key information that was needed to be a well-informed stakeholder was never easily available and became less so.	-2	-0.87*	Transparency
31	San Antonio has been a leader in conservation, but we got sidetracked by the goal of acquiring abundant water.	-2	-0.89	Water security
19	I do not like the fact that we're trying to encourage growth in San Antonio. I don't think that bigger cities serve anyone besides the developers and the builders and the people who make money from growth.	-3	-1.35*	Development
13	The Vista Ridge Pipeline Project is a short-term boon for land developers who want to fill the fragile Hill Country with subdivisions.	-3	-1.35*	Development
34	San Antonio City Council failed its fiduciary responsibility to obtain an independent analysis of the Vista Ridge project. It did not ask any questions, and it refused to listen to many questions asked by concerned stakeholders.	-4	-1.46*	Governance
3	Mayor Julian Castro completely replaced the SAWS Board before the Vista Ridge deal came up to provide a soft target for rubber stamping the deal.	-4	-1.73*	Politics

Table 3: Continued.

#	STATEMENT	RANK	SCORE	THEME
18	The whole Vista Ridge deal was designed to avoid ever giving the people a voice. SAWS wanted to use this public-private partnership as a veil to prevent from having to get public onboard for the project and that was deliberate.	-5	-1.85*	Governance/ PPP accountability

Respondent Rationale for Q-Sorts

After Q-sorts, some F2 loaders mentioned they had difficulty sorting statements into the formation required because they felt there were more statements they disagreed with than agreed with. Participant 11 (F2 loading = 0.8352) stated that he "found some of the statements to be completely untrue" and therefore difficult to sort. Other F2 loaders mentioned that they felt there was a good balance of perspectives they agreed or disagreed with represented by the Q-sort cards. Participant 23 (F2 loading = 0.7649) mentioned having difficulty sorting statements that he half agreed or disagreed with but felt perspectives regarding this project were represented equally.

One individual (18, F2 loading = 0.7111) shared many of the same perspectives with other F2 loaders but also shared perspectives with other factors and remained critical of governance decisions. For instance, Participant 18 individually ranked Statement 4 as highly as the Landowner Opposition loaders. After the Q-sort, when asked to explain the reason for the placement of the strongest held perspectives, he stated:

> **Participant 18:** While there are elements of Vista Ridge I really like, I really am opposed to the fact that groundwater is a private property right. I think it goes back to the bad science that guided the founders of the state and writing the constitution in thinking that surface water and groundwater were two different waters. Surface water isn't a God-given right so I don't think groundwater should be either. I feel strongly about that but I understand that's the law. My opinion is my opinion so, I didn't quite put it up in the five (+5).

The other (+4) statement ranked by Participant 18 was Statement 29 ("Vista Ridge gives San Antonio the ability to use those water supplies to meet its demand and balance conservation, drought management, and economic development."), the strongest held perspective of Factor 2, saying:

> **Participant 18:** I agree pretty strongly with [Statement 29]. I'm not a cynical person and I believe that's what's going on, however you feel about Vista Ridge. I think there is this multi-faceted approach to water management and conservation and it guides SAWS. I think they can do more conservation. I'm completely opposed to gated communities water sprinkler rules and the use of non-native turfs and landscaping. I wish they would take the step…to pass ordinances to regulate that. Other than that, I agree [with this statement].

The perspectives mentioned by Participant 18 after the Q-sort reveal the potential for another social perspective of people who overall support the VRP project but remain critical of other governance decisions. Much like the nuanced view of opposition, Participant 18 indicates that a more nuanced view of project support could be revealed with additional studies.

Validation Phase

Participant 20 also suggested changing the name of this group from "Urban Advocates" to "Project Advocates" to be more representative of the individuals in this group:

> **Participant 20:** I see this more as Project Advocates because you really have to support a significant number of different things just to support the project. You have to support the private nature, you have to really believe that it's not going to hurt the landowners, you have to think it's a good water supply strategy for our future, like you have to support all of these really big things to support the project.

The use of urban and rural simplified the difference between opponents and advocates of the VRP project. I agree that changing the names to "Landowner Opposition" and "Project Advocates" better explains the perspectives expressed in the descriptions of each factor.

5.3 Factor 3: Governance Failure

Factor 3 accounted for the lowest percent of variance with 6% explained by this factor alone. Six of the individuals are residents of either San Antonio or Austin, and one Burleson County resident, loaded into Factor 3. Factor 3 has an eigenvalue of 1.434 compared and a standard error of 0.184 (Appendix G). This factor was positively correlated to Factor 1 (0.6418) and negatively correlated to Factor 2 (-0.5619).

Baker (2010, 45) uses the term 'governance failure' to describe "how the institutional dimensions of water management and decision making do not effectively take into account the needs of all citizens." This term was used to describe stakeholders who believe there is a breakdown of proper water governance regarding the VRP project and therefore oppose the project. These individuals see issues with the oversight provided by POSGCD, SAWS, San Antonio City Council and other city officials during the project planning phase. Some members perceive ulterior motives, such as a pursuit for power and regional control over water sources, for pursuing the VRP project:

> **Participant 19:** One thing that people don't know is when this [the VRP] goes in the San Antonio River doesn't start in San Antonio, it starts in Burleson County. It's 50,000 acre-feet that leapfrogs over two river basins into San Antonio. They [SAWS] have got themselves an enormous network that's gone all the way from Burleson and Milam Counties all the way to the Gulf. Is that what a city water utility should be doing? That seems to me like being a little power hungry - SAWS believes they can do it better than anyone else, they believe they have the conservation ethic down better than anybody else does and they should be the masters of the

> local water region - they'd never say that, but I believe that's kind of how they view themselves. For them I think it's this thirst for power and with power comes this responsibility.
>
> **Participant 20:** [The pipeline is] so big that in order to make financial sense to build something this big they [SAWS] have to then move and sell a lot of water. Its mind boggling that one entity would take something like that on without a partnership with any other entities in the region. I'm not a fan of moving giant amounts of water from one basin to another to provide for the kind of development they're talking about providing for with this, but even on top of that it's just SAWS doing this project all by themselves, when there's all these different entities in the region also looking for water and none of them have partnered to build this infrastructure together. Which I think says something to the point that, there's this layer of control built it. If you have a PPP and you have one entity like SAWS, a pretty big entity, they're going to have control of all this water too. Who they sell it to and for what price is going to be ultimately up to them. They've got the rights to this water for the foreseeable future, so where that water ends up going and who's allowed to tap that aquifer in that area is also going to be up to them.

They have concerns regarding the PPP structure of the project as it relates to accountability of private firms, the transparency of project information, and the incentive it creates to pump water regardless of need. They believe the project has the potential to harm existing San Antonio ratepayers as well as the livelihood of landowners in Burleson and Milam Counties. The individuals of this factor believe the VRP project is unnecessary and will only benefit those interested in continued development and growth. Similar to the Landowner Opposition factor, these individuals believe there are major issues with the existing legal structure of Texas groundwater.

Emergent Themes

A major theme to emerge from is that of governance, PPPs and privatization, risk and groundwater law. Factor 3 loaders agree with the perspectives that San Antonio city officials

failed to obtain independent analysis and improperly justified the VRP project (#34, #5). Respondents therefore disagree with perspectives about the due diligence and transparency of agencies involved in the process (#16, #10). This group also disagrees somewhat that GCDs decision-making is based more on local politics than on science (#1). Factor 3 respondents perceive many issues with the way in which the VRP project was designed and implemented, and consider a more regional stakeholder engaged process as a better solution not being utilized currently (#6).

Similar to Factor 1, the Governance Failure respondents see problems with the PPP nature of the project. In particular, the structure of the VRP deal in which the private companies are paid only for the water that is delivered would seem to create an unsustainable and costly incentive to pump from the start (#27). Factor 3 loaders disagree strongly that all project risk has been placed on the private sector and that ratepayers and landowners are fully protected (#20). Participant 02 (F3 loading = 0.7736) stated explicitly in the post-sort interview, "That unambiguous statement is so clearly wrong to me." Ultimately, respondents in this group take issue more broadly with the commodification of groundwater and the impacts such actions have on its effective collective governance (#26). This sentiment is reflected in the respondents' belief that the VRP project could fall apart early and when San Antonio does need water, this project is unavailable (#22). The strongest perspective held by Factor 3 loaders relates to Texas groundwater law and the rule of capture. Regardless of PPPs or transfer projects, respondents take issue with the very structure of groundwater law and its creation of a 'race to the pump' (#12). During our interview, Participant 19 expressed concerns regarding the role of government and PPPs:

Participant 19: I think government has this valuable function of doing things that are not necessarily going to be profitable, but are good for people. Public-private partnerships always have to have a profit motive in there. How often does the interest of government, which are to really benefit society as a whole, going to align with the interests of private capital, which is to benefit itself? In my mind, that's not going to line up all that often in ways that are good for us. [PPPs are] a very popular thing right now - My own philosophy, it's the same with charter schools and things like that, people want to eat away at the common good to benefit business and they think that's great. I don't think that's great at all… What SAWS really gets from this P3 is a whole half of this operation that's secret, that doesn't have to reveal its information, that has confidential business information that's not subject to the state's open records law...I'm not super pleased with that side of it. I feel like if it's the public's business it should be fully open, and it's different for water, too, then a lot of other things. Water is life. What happens with water should be public information in every given since. I don't think it is something that should ever be private. Even if private corporations are the ones that develop it, I think all of their activities should be open. There shouldn't be business information about an aquifer. They were able to hide hydrology information from me that they studied mainly because it's proprietary. It's not oil and gas. We need this stuff and the environment depends on it too. Why should you be able to treat it like a resource that's not the source of all life?

Table 4: Distinguishing statements for Factor 3 significant at P<0.05. (*) indicates significance at P<0.01.

#	STATEMENT	RANK	SCORE	THEME
12	The Texas system of groundwater rights is a legal structure that doesn't match the reality of the system. You can easily dry somebody else out and it leads to ridiculous water races.	4	1.42*	Governance
27	The nature of the Vista Ridge deal, where the private entities only get paid if they sell water, creates an enormous incentive for them to pump all the water from day one.	4	1.40	Water security
34	San Antonio City Council failed its fiduciary responsibility to obtain an independent analysis of the Vista Ridge project. It did not ask any questions, and it refused to listen to many questions asked by concerned stakeholders.	3	0.96	Governance
26	That to me is the underlying problem with Vista Ridge. It's not moving the water from one place to another, it's not the cost of the water, it's not whether or not a private company built the pipeline, it's the fact that people, even if they don't know it, they feel uneasy to the fact that we're privatizing water and turning it into a commodity and a market.	2	0.93*	Privatization

Table 4: Continued.

#	STATEMENT	RANK	SCORE	THEME
6	It will take the people from San Antonio working with people from Burleson and Milam Counties to come up with a better long-term solution and unfortunately that is not the way water policy is being made.	2	0.91*	Regional planning
5	SAWS used that grossly overestimated per capita demand figure of 135 (gallons per capita per day) to justify acquiring a new, extremely expensive source of water to meet future demand – the Vista Ridge Pipeline.	2	0.84*	Governance
22	Vista Ridge could fall apart numerous different ways, including buying water San Antonio can't use and when we do need it 30 years from now, it is no longer available.	1	0.65*	Risk
31	San Antonio has been a leader in conservation, but we got sidetracked by the goal of acquiring abundant water.	1	0.57*	Water security
1	Groundwater conservation districts can make very arbitrary decisions about when to issue permits. It's not so much based on science as it is based on local politics.	-1	-0.23	Politics
8	SAWS has experienced some controversy but most has been from local Sierra Club types. There are very few in the Burleson and Milam County area who oppose the project.	-3	-1.36	Politics
16	In my opinion, SAWS has been transparent. When you negotiate a contract there needs to be confidentiality.	-4	-1.72*	Governance/ Transparency
10	SAWS has done its due diligence in ensuring that its ratepayers are protected from major risks while providing San Antonio with the Vista Ridge Pipeline, a new, safe and reliable water source.	-4	-1.78*	Governance/ Risk
20	At SAWS, we've mitigated the risk for San Antonio but have also mitigated the risk for the local folks of Burleson and Milam County. We put all the risk on the private sector.	-5	-2.09	Governance/ Risk

Respondent Rationale for Q-Sorts

Each of the Governance Failure loaders sorted a different statement as their strongest (+5) perspective. For instance, Participant 19 (F3 loading = 0.7361) explained after the Q-sort that the strongest held perspectives (-5: #16; +5: #15) pertain to aspects that he felt "most passionately about," which are "access to information and transparency." From his perspective, there were issues with the VRP project with regards to access and availability of information for key stakeholders. Similarly, the strongest perspectives for Participant 14 (F3 loading = 0.6561) (-5: #17; +5: #6) relate to the process of developing water supply projects. From her perspective,

she would like to see water supply plans that involve not only business "employees or the owners but the people who benefit from the water" could reach a compromising agreement.

Validation Phase

Initially this group was labelled "Good Governance Failure." Respondents suggested no changes to this factor's name or descriptions. They believed the label accurately represented this groups' concerns with the structure of the VRP project. However, it was later determined to remove "Good" from the label because it implied that respondents might agree on what 'good governance' means in regard to groundwater and water supply. Given that there was no statement offering a definition of good governance for the VRP project and many offering definitions for governance failure, the name was changed.

Consensus Statements

Analysis revealed two "consensus statements" (Appendix M) which are statements that have no statistically significant differences between any pair of factors. Typically, these statements reveal "points of agreement across perspectives" (Webler, Danielson, and Tuler 2009). Statement 2 ("The economies of Burleson and Milam Counties are dependent on Eagle Ford shale fracking. Without the ability for fracking companies to come in and utilize groundwater then our number one catalyst for jobs in the community is killed. Vista Ridge and the 130 Pipeline Project threaten this ability.") and Statement 11 ("Family incomes in San Antonio have stagnated for more than 10 years; rate increases for Vista Ridge will be a major burden for lower- and middle- income families. That will hurt our economy.") are the consensus statements for this study. Both statements relate to potential direct and indirect economic impact

of the project in both communities. It would be misleading to state that these statements reveal areas of agreement across stakeholders. A more accurate interpretation is that these statements were most likely less polarizing, or similar sentiments were better captured in other statements and therefore, participants sorted these with less weight.

5.4 Non-Loaders: Project Skeptics

The term 'non-loaders' is used in Q-Method to describe individuals who do not load into any statistical factors (Webler, Danielson, Tuler 2009). Five individuals, all from San Antonio, make up the non-loaders group. Using the auto-flag function of Ken-Q, Participant 9 and Participant 13 load significantly into Factor 2 but negatively (P9: -0.5914; P13: -0.5622). These participants significantly disagreed with the perspectives of the other Factor 2 loaders. It was determined to unselect these respondents to preserve the subjectivities of those who loaded positively into Factor 2. These two participants became part of the Non-Loaders group with three other participants (Participants 1, 4, and 7) who did not load significantly into any of the three factors. Members of this group are not reflected in the quantitative portion of results; however, important information can still be obtained from this group. Primarily, this groups existence demonstrates the complexity of opinions regarding this controversial topic. They reveal there are multiple ways to oppose the VRP pipeline and that more 'types' of opposition exist.

Table 5: Factor loadings of the non-loading individuals. (*) indicates significance at P<0.01.

ID	F1	F2	F3
01	0.2686	-0.4453	0.5021
04	0.4471	-0.5334	0.441
07	0.3126	-0.5622	0.4554
09	0.2473	-0.5914*	0.4803
13	0.4906	-0.5909*	0.4209

The individual's factor loadings and Q-sorts of the non-loading participants were isolated for further analysis. From the participants individual factor loadings, it was clear they each disagreed with the sentiment held by Factor 2 loaders (Table 5). While only Participants 9 and 13 loaded significantly on Factor 2, Participants 4 and 7 also have high negative loadings for Factor 2. Participant 1 leans more toward the perspective of the Governance Failure group but also strongly disagrees with the perspectives held by Factor 2. Most of the non-loading individuals have high loadings for Factor 2 and Factor 3. Participants 4 and 13 have high loadings for all three factors, indicating they share similar sentiments with the Landowner Opposition group as well.

Table 6: Isolated Q-Sort rankings of the Non-Loaders

	STATEMENT																	
ID	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**
01	1	0	1	1	-1	1	2	-2	-4	-5	4	3	0	0	2	-4	-3	-2
04	0	-1	-1	0	3	0	2	-5	-3	-2	1	0	1	-3	2	-4	-4	2
07	3	-2	-2	2	2	2	1	-3	-2	-3	3	1	4	-4	1	-5	-3	5
09	1	-1	3	0	2	2	1	-4	-3	-5	1	0	2	-2	3	-3	-3	5
13	1	-1	0	-2	1	0	2	-3	-4	-2	3	0	4	-1	1	-4	-5	5

ID	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**
01	2	-3	-1	5	0	0	3	0	-1	1	-3	-2	4	-2	-1	3	2	-1
04	2	-1	-2	1	-1	4	-2	0	1	3	-3	0	4	-1	-2	3	1	5
07	2	-4	-1	4	-1	0	1	0	-1	0	-1	0	0	-2	0	3	-1	1
09	-1	-4	-2	4	-2	0	3	-1	1	-1	0	-1	2	-2	0	4	1	0
13	3	-3	-1	0	-1	2	1	0	2	2	-2	-2	-1	-3	0	4	1	3

It was determined to name this group "Non-Loading Project Skeptics" to reflect their opposition to the project. While the perspectives of the Project Skeptics are not as crystalized on

any particular social perspective, the members of this group have doubts about the major claims of the VRP project. It became apparent the individuals in this group more cohesively sorted the statements they disagreed on (-5 to -1) and differed more on how they sorted the 'agree' statements (+1 to +5) (Table 6). Many of the statements ranked low by the confounders are perspectives the Factor 2 loaders ranked highly (#8, #9, #10, #16, #17, #20). It can be concluded that the Project Skeptics do not share the same beliefs in the VRP projects ability to provide secure and reliable water while mitigating against risks for ratepayers and landowners.

There is even some agreement among the Project Skeptics regarding the local GCD's ability to protect the landowners and aquifer in the donor region (#7) and issues with transparency impeding the ability to become a well-informed stakeholder (#15). Another perspective the Project Skeptics agree on is the belief that the San Antonio City Council did not act within their responsibilities to vet the project properly or heed questions from concerned citizens (#34).

There exists less consensus in ranking statements highly. Participants 7, 9, and 13 consider the use of a PPP to withhold information from the public as the perspective they most agree with (#18, +5). Participant 1, however, somewhat disagreed with the same statement and ranked it low at (-2). Participant 1 strongly holds the perspective (+5) that the VRP project is fragile and could jeopardize San Antonio's water security in the future if pumping is too intense and water flow is stopped (#22). This perspective is also shared by Participants 7 and 9 who ranked this statement high at (+4), while Participant 13 appears more neutral on for Statement 22. The strongest held perspectives (+4 and +5) for Participant 4, differ from the others in this group (#24, #31, #36). A common theme across these statements is the actual water in question. Participant 4 strongly views the VRP project as no more than a mining operation for

groundwater (#36) and believes San Antonio, a leader among other cities in terms of conservation, is distracted by securing large quantities of water (#31). Participant 4, a resident of San Antonio, is also concerned for the residents of Burleson and Milam Counties and the impact of the VRP on their lives (#24).

Validation Phase

Due to scheduling challenges, a meeting with an individual from the Project Skeptics group did not participant in this step. Prior to validation this group was referred to as "Confounders," which is a Q-sort term for those who do not load into significant factor groups. However, after further consideration of participants' Q-sorts, it was determined to rename this group "Project Skeptics."

6. DISCUSSION

This study found viewpoints clustered around three significant social perspectives. Analysis revealed opposition to the Vista Ridge Pipeline project is not homogeneous. These differences are important to include in larger policy discussions regarding water governance and water security for all. Lehrer and Sneegas (2018) explore the perspectives of agricultural workers on pesticide use in the fruit tree industry in Washington State. Their study also identified three social perspective clusters. Two groups (the skeptic and the acceptor) were in direct opposition with each other and represented viewpoints "commonly [seen] in a generic understanding of the polarized nature of pesticide safety debates" (Lehrer and Sneegas 2018, 139). However, a third group (the incrementalist) revealed that for their study "mutual agreement is possible" (Lehrer and Sneegas 2018, 140). Similar to their study, analysis of the VRP project revealed two groups (Landowner Opposition and Project Advocates) that could have been predicted without field work. A third group (Governance Failure) and an emergent fourth (Non-Loading Project Skeptics) were only revealed through Q-method analysis. Unlike the study on pesticide-use in the fruit tree industry, analysis of the VRP project did not reveal areas of consensus among stakeholders.

The themes that emerged from factor analysis inform the structure of this discussion. Table 7, structured after Figure 8, presents a tally of the emergent themes presented in Chapter 5. Column totals are greater than the total number of distinguishing statements for each factor due to the statements which overlap sub-themes. These statements (#10, #16, #18, #20, #33) pertain to aspects of both governance and PPPs.

Table 7: Emergent themes from factor analysis. Totals are bolded for each major theme. Some statements pertain to more than one theme; therefore, totals are greater than the distinguishing statements of each factor.

	F1: Landowner Opposition	F2: Project Advocates	F3: Governance Failure
GOVERNANCE	**10**	**9**	**9**
Politics	3	3	2
Texas Water Law	1	0	1
GCD Governance	2	0	0
SAWS Governance	4	6	5
Regional planning	0	0	1
DEVELOPMENT	**1**	**3**	**0**
Role of Developers	0	3	0
Urban v. Rural	1	0	0
PPPs	**4**	**7**	**4**
Transparency	1	2	1
Risk	1	3	2
Privatization	0	0	1
Stewardship	1	1	0
Public accountability	1	1	0
HYDROLOGY	**2**	**7**	**2**
Science	1	1	0
Water security	1	4	2
Aquifer impacts	0	2	0

6.1 Governance

Governance emerged as an important theme for stakeholders of the VRP project. In particular, the decision to use a PPP to finance and construct the VRP informed many stakeholder's perceptions about the transparency and public accountability of the project. Scholars agree that a framework of good groundwater governance is based on transparency, accountability, responsiveness, and efficiency (Ross and Martinez-Santos 2010; Knüppe and Pahl-Wostl 2011; Foster et al. 2013), with some adding the importance of acknowledging and

incorporating local and regional sociocultural values of water (Megdal et al. 2015, 678). Overall, the VRP process left many of the aspects of good governance wanting.

One such aspect is that of politics. As mentioned earlier, Agnew (2011) makes the argument that practical politics should not be viewed as a zero-sum game but as a mechanism for cooperation, negotiation and compromise. Statements related to politics in this study conveyed a view of politics as favoring particular groups of people and reflecting the interests of systematic and structural forces. This view has important implications on its effectiveness of politics in a democratic society. It is unhelpful that politics has widely become synonymous with corruption, inefficiency, and duplicity (Agnew 2011). Agnew highlights two important features of politics: information and choices. Information must be transparent and stakeholders allotted time to process, understand, and ask questions. Informed stakeholders can ideally make informed decisions. Of course, this relies on individuals participating in the process. If politics is views at best grid-locked or at worst corrupt, the likelihood of citizens participating is likely to decrease. Therefore, it is important to work toward expanding participation to incorporate larger groups, which is a challenge that should be solved less technocratically and more politically and ecologically.

Feelings of distrust between landowners and GCDs is increasing across the state. GCDs were established to offer local communities' autonomy over groundwater in their region but reality appears to be much more complex. Financial, legal and social constraints play into every decision by a GCD. The Post Oak Savannah GCD, like other districts, is confided by Chapter 36 of the Texas Water Code and is unable to deny permits unless their DFCs are reached. However, districts have controls over their permitting rules and stipulations and the long-term security of the 40-year production permits offered by the district is a major reason SAWS choice the project.

Balancing aquifer preservation and conservation with the private right of groundwater users is a challenge facing all GCDs in Texas. Legal and regulatory constraints placed on the GCD only increase the difficulty of their balancing act. Implementation of more conservative rules and specifications, such as end-use requirements are one way for districts to mitigate groundwater extraction and attempt to appease citizens frustrated by pumping. Of course, the ability to accurately assess and monitor aquifer levels is a financial cost many GCDs cannot pay. In some instances, the price offered by private water marketers is tantalizing to small, poorly-funded districts. This decision may cause social protests from those concerned with the unfair implications of large pumpers. GCDs can adopt more conservative rules and require certain specifications, such as end-use requirements, prior to granting permits but even when a district has these in place, loopholes can be found. Distrust between citizens and water managers "might result from inadequate public information and the absence of adequate interaction spaces for deliberation and debate around water issues" (Iribarnegaray et al. 2014, 913).

In May of 2018, Post Oak Savannah GCD began workshopping a first of its kind Aquifer Conservancy Program (ACP). Representatives of the district have sought direct stakeholder feedback regarding the specifics of the ACP in an attempt to better serve the needs of their community. The ACP is modelled after land trusts and allows a landowner the option to set aside their right to pump groundwater for either five, ten or twenty years. The agreement can be renewed at the landowners request and provides conservative minded landowners the ability to enter their land into a legacy of groundwater conservation. The program also offers a financial incentive to combat the incentive to sell groundwater rights. Landowners who leased their rights have mentioned that the check-in-hand offered by water marketers played a role in their decision to lease. POSGCD estimates offering landowners $5 per acre for a 5-year agreement or at most

$8 per acre for a 20-year agreement. The production fees from the VRP project will be used to fund the conservancy. The ACP also has the ability to disrupt the ability for future transfer projects by reducing companies' ability to obtain contiguous acreage for pooling groundwater rights.

For the most part landowners in Burleson and Milam Counties appear favorable toward the program. There are those who do not like where the money for the conservancy comes from but would like to join the program without taking a financial incentive. While for Burleson and Milam Counties, the ACP may seem a little too late, it could aide in preventing another transfer project from developing in the area. The ACP could also inspire other districts who feel there is a target on their area for transfer projects and implement a conservancy prior to such development. Given the law, GCDs striving to uphold their founding missions of preserving and protecting groundwater resources essentially have one option and that is to develop a counter program to combat water marketers obtaining groundwater rights. The question that remains for those districts who do implement similar programs, is will they have the financial capacity to defend their decisions when brought to court by water marketers?

Even with attempts to modify rule of capture with GCDs, many Texans with a stake in groundwater remain frustrated with existing water laws and desire updating the antiquated legal doctrines to provide a better structure from which to govern. Doctrines based on current and accurate science that acknowledge and are flexible to new or changing scientific developments would be ideal. Currently, attempts to better model the complex interactions between surface and groundwater is advancing in the state, however, science and modelling are only one aspect of good governance. The ultimate goal of good water governance should incorporate multiple

stakeholders and strive to make decisions that are socially equitable, economically efficient and ecologically sustainable.

6.2 Public-Private Partnerships

Aspects of risk, transparency and public accountability were major themes revealed through factor analysis and SAWS' decision to use a PPP to finance, construct and operate the VRP project is a major theme to emerge from this research. Much like the citizens of Melbourne who were denied access to information because PPPs were deemed an exception to Freedom of Information Requests (Hodge 2004), stakeholders of the VRP project have encountered similar obstacles in obtaining information on the financial structure and hydrologic studies performed by the private consortium.

Literature on PPPs confirm the responsibility of the public entity is "to find the right balance between attractive investment opportunities for private parties and the safeguarding of public interests, assuming that this reconciliation is possible in the first place" (Koppenjan and Enserink 2009, 288). SAWS must do the heavy lifting to ensure the private consortium protect the ratepayers of San Antonio, the environment and livelihoods of residents in Burleson and Milam Counties, as well as, ensure the water received is not fostering excessive suburban growth over sensitive recharge zones or ecosystems. The use of a PPP for the VRP project has yet to show the best public and private sectors have to offer. SAWS will continue to be accused of deliberately choosing a PPP to prevent the project being publicly voted on and as a way to withhold financial information unless they support the deliberate transparency of the private consortium. As the facilitator of the partnership, it is no one else's responsibility, except SAWS to do so.

PPPs are growing in popularity as a means for providing public services. Texans must decide, if this is the mechanism they want for water supply and what the necessary regulations should be to force transparency and accountability from PPPs. If private companies and public entities involved in a PPP are unwilling to abide by good governance practices then such projects should not be labeled as "partnerships" and instead operate as traditional contractual relationships.

6.3 Science

With regards to the VRP project, stakeholders remain concerned that inaccurate per capita consumption calculations were used to justify the need for the supply project. The certainty of groundwater models, the politics engrained in science, and the financing of research remains an important aspect of this project. However, the VRP project represents a small microcosm of how the politics around groundwater science will function largely across the state of Texas. The inability to look at studies and discern sources of information from sources of politics was obscured in the VRP process. Policy-wise, Texas must think about ways to improve the role of science in decision-making, while minimizing conflicts of interest and political agendas. A critical step toward that goal is to address the structural unevenness of the political economy of science across the state. Ensuring all GCDs, who are tasked with continual science and research, have sufficient and steady funding is crucial for successful management.

6.4 Development

The role of developers in the VRP project informs many stakeholders' perspectives. SAWS and prominent business leaders hold the view that with an abundant supply of freshwater,

San Antonio will remain attractive to businesses and continue economic growth, despite the lack of immediate need for the water. Others see the decision to acquire more water upfront than is immediately needed only serves those who directly benefit from development. In the meantime, SAWS has plans to find buyers for the water in surrounding areas. However, many speculate a buyer will be difficult to come by given the steep price for VRP water at $2,271 an acre-foot, far greater than other water supplies (SAWS 2017). Given a lack of immediate need for water provided by the Vista Ridge Pipeline and the opportunity to expand other water supply options, it begs the question of why SAWS would choose the more expense, more political, and more controversial option to achieve water security?

Analysis of the project reveals that the VRP project is not a water security project but a securitization project. Rather than modifying growth patterns in a way that would not require such demand, SAWS is capturing water for future anticipated growth and guaranteeing a source for continual capital accumulation by developers. Ultimately, this is a process of accumulation by dispossession. Those dispossessed include Burleson and Milam residents and landowner as well as current urban residents of San Antonio. The VRP project represents an immediate impact on urban residents who are baring the increased water costs and risk of the project. Of course, Burleson and Milam residents and landowner are baring the immediate impacts of a loss of water and the cascading associated impacts.

On the accumulation side, we should ask: what is being securitized? In this case, while water is physically being accumulated, it is really only a mechanism through which power and profit are securitized. Through the VRP project, land developers are assured an abundant supply of water for future development. In order to maximize profits, land developers desire their own imagined pathways for urbanization free from restrictions and regulations. Along with profit for

developers, political power is also securitized for SAWS because of their role in allocating and selling Vista Ridge water. Intra-urban competition is another aspect of the political power assumed by SAWS. Rule of capture creates a 'use-it-or-lose-it' incentive over groundwater production, only offering a value to water once it is extracted and at the surface. The VRP gives SAWS long-term access to a portion of the Carrizo-Wilcox aquifer being eyed by other large urban areas of the state. Water's central importance in all aspects of society can create a desire by some to consolidate power through the control of resources.

The VRP is a clear example of Gleick's hard path approach to water supply. The project's objective is simply to securitize and deliver water despite there being no immediate need and without the utility exhausting all other conservation or reuse strategies. SAWS has shown itself to be a leader in water conservation and aquifer protection initiatives which illustrate well their ability to implement cost effective and practical soft path solutions. This has led many to ask why the utility is not pursuing more of these approaches. Gleick provides insight to the barriers of soft path water by acknowledging that "the emergence of the soft path diminishes the power and influence of entrenched interests" therefore, resistance is likely from the practitioners of hard-path planning (Wolff and Gleick 2002, 9). Opening an explicit dialogue in water governance regarding the implications of power and politics is an important step for Texas. The Vista Ridge Pipeline project is only the latest example of traditional hard-path development. However, the desire to continue growth and development of urban areas beyond the means of their local resources comes at the expense of low-income urban residents and rural communities who have the resources these cities want, and in this particular instance, do not immediately need.

6.5 Limitations of Q-Method

Q allows for the quantification and factor analysis of qualitative social perspectives on a particular issue. One limitation to the methodology is that results cannot be generalized across a population (Iribarnegaray et al. 2014). Unlike surveys which seek a large number of people to identify opinions held across a general populace, Q focuses in on individuals and seeks to understand what informs their perspectives on polemic topics. Q works well for controversial topics because it allows a platform for stakeholders to convey their own opinions regarding a topic. However, despite the researcher's best efforts the methodology is not unbiased. While statements are derived directly from interviews with key stakeholders, the researcher ultimately decides the statements chosen for Q-Sorts and factor analysis. A researcher with a firm understanding of the topic at hand is better equipped to select representative statements, in an attempt to reduce bias. Another limitation of Q is that for this study five individuals did not fit into Factors 1 or 3, yet were all negative on Factor 2. However, a four-factor solution did not improve this issue.

6.6 Water Security

Water security for some should not come at the expense of water security for others (Lankford 2013). Burleson and Milam residents for the most part recognize there is a need for water in other parts of the state and that the aquifer beneath their feet is an important resource. Some of the landowners interviewed for this research acknowledged the need to share supplies but on an incremental basis. However, most feel steamrolled by the VRP project. Central Texas landowners were not consulted and collaboration to define a more working relationship was not sought by representatives of SAWS or the private consortium. The project's PPP did not allow

for regional compromise for this project. Landowners were left feeling the process behind the VRP project was bullish and lacked any stakeholder collaboration.

In closing, I would like to return to the development paradox and ask: why is SAWS, a large public utility known for its conservation and innovative water portfolio, advocating for the Vista Ridge Pipeline, an old-school form of hard-path water supply development? Thinking through what we know about these dynamics and water security, power and profit are two things that can be securitized along with water. Through securitization, future development can be guaranteed by a particular pathway of urbanization set by both SAWS leadership and land developers.

It is clear after analyzing the study presented in this thesis that Lankford's (2013) argument that water security should not come at the expense of others is not a concept shared by everyone. The particularities of groundwater - the legal constraints, the science constraints, and its invisibility - effectively has occluded any systematic public discussion on how do we deal with these challenges of demand for cities when the supplies can be found in the least capable communities for dealing with public engagement. Ultimately, the VRP is an urban water securitization project, not an urban water security project because it leaves many high and dry and a city with more water than it immediately needs.

7. SUMMARY AND CONCLUSIONS

Between January and August 2018, I conducted research regarding the social perspectives of the Vista Ridge Pipeline, an inter-aquifer water transfer project in Central Texas. I identified three significant clusters of opinions and outliers using Q-Methodology. The use of Q-Method on understanding the perspectives of a complex water transfer project are unique to this study. One significant factor, Project Advocates, see the project as a way to secure San Antonio's water future and reducing project risk through the use of a public-private partnership. Two significant factors, Landowner Opposition and Governance Failure, and the one cluster of outliers, Project Skeptics, demonstrate that opposition to the pipeline project is not homogeneous.

The discovery of three social perspectives and an emergent fourth regarding an issue which two views could have been predicted without fieldwork reveals that perceptions of the VRP represent more than a simple dichotomy between project supporters and opponents. Stakeholders from different backgrounds and who relate to groundwater in different ways opposed the Vista Ridge project for some of the same reasons, especially regarding governance practices, concerns about the use of a PPP and the impact on transparency and accountability, concerns regarding scientific uncertainty, and the project's impact on continued urban development. The study not only serves as an entry point to understanding the perspectives on the Vista Ridge project but also reveals underlying conflict and political dynamics of water securitization developments more broadly in Texas. The social perspectives identified could indicate reasons for changing perceptions or declining support of groundwater governance over time in Texas.

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APPENDIX A

INFORMATION SHEET

Introduction
My name is Sydney Beckner, and I am a student at Texas A&M University studying for my Master's degree in Geography. I am conducting a research study on how water is governed in Texas and respectively invite you to participate in this study. Participation is absolutely voluntary and at any time you may end the interview without penalty. This document explains the details about the research, what participants are asked to do, and how information will be used. If you have any questions about this form or about the project, it would be my pleasure to explain any details to your satisfaction.

Purpose of Research
I would like to understand: what the social perspectives are around new forms of groundwater governance in Texas? To answer this question, I would like to describe and analyze the various points of agreement and disagreement around the Vista Ridge Pipeline.

Requirements, Rights, and Confidentiality
As a participant, you will be asked to take part in an in-person interview. I will ask you questions about your opinions and experiences in water governance and management. The interview will take 30 to 60 minutes, depending on your availability. At any time, you may decline to answer a question or end the interview. I would like to audio record the interview in order to review and analyze the information you provide after the interview process is over. But I would like to heavily emphasize, that any information that you share with me about your identity and position of authority, as well as the interview audio will be kept **confidential**.

This is a social science study attempting to understand the different perspectives around a particular water governance strategy. Names of participants will not be used in this study. Quotes may be pulled from interviews but will not be linked to the speaker. Names of all participants will be coded to conceal identity.

My Supervising Professor, Dr. Wendy Jepson has experience with research processes such as this and will help ensure confidentiality is maintained. She and I will be the only people with access to the list of codes and names of participants. I **will not** reveal your personal identity in any future presentation, article, or in my Master's thesis.

If you have any questions about the research, contact Sydney Beckner (researcher: sbeckner@tamu.edu) or Wendy Jepson (Supervising Professor: wjepson@tamu.edu).

If you have any questions about your rights as a research participant, contact Texas A&M University Institutional Review Board at 979-458-4067 or at irb@tamu.edu. This research is assigned the following IRB case number: IRB2017-0913.

APPENDIX B

INTERVIEW QUESTIONS

General

- From your perspective, what are the challenges of water supply and water security in Texas in general? Please explain.
- How and when did you first hear of the Vista Ridge Pipeline? What was your reaction, as an expert and researcher, to the project proposal? Positive, negative, ambivalent? Please explain.
- Why do you think San Antonio Water System (or SAWS) decided to go this route for water supply? Please explain.

General – San Antonio

- What does the Vista Ridge Pipeline mean for San Antonio?

General – Burleson/Milam Counties

- How and when did you first hear of the Vista Ridge Pipeline? What was your reaction, as a landowner, to the project proposal? Positive, negative, ambivalent? Please explain.
- Was your family ever approached to lease water? If so, what went into your decision to not?
- What effect do your neighbors selling of their water have on you and your family?
- Have you spoken with your neighbors about their decision and potentially how it will affect your property? [Their response?]
- What concerns do you have about the Vista Ridge Pipeline?

Risk

- From your perspective, to what extent are San Antonio ratepayers protected from risk?
- From your perspective, what are potential economic risks you see for landowners but also the community of Burleson/Milam Counties as a whole? Please explain.
- From your perspective, how secure of a source of water is the Carrizo-Wilcox aquifer for the planned pumping rates of the VRP?

Governance/Transparency

- What is your perspective on public-private partnerships as a mechanism for water supply infrastructure? Do you have concerns? Please explain.
- From your perspective, how transparent has SAWS been with the public about details related to the project? Has the level of transparency changed/remained the same? Please explain.
- From your perspective, how transparent has the Post Oak Savannah GCD been with the public about details related to the project? Has the level of transparency changed/remained the same? Please explain.
- How responsive has the POSGCD been to concerns from non-leasing landowners or the general public?

Economics

- From your perspective, what role do developers have in formulating this project?

Awareness

- From your perspective, are people in Burleson/Milam Counties generally aware of where their water comes from?
- From your perspective, how aware are the public in Burleson/Milam Counties of this project?
- How would you assess their level of concern? Do people generally seem worried/ambivalent/positive?

APPENDIX C

LIST OF FINAL 36 STATEMENTS FOR Q-SORT

#	STATEMENT	CATEGORY
1	Groundwater conservation districts can make very arbitrary decisions about when to issue permits. It's not so much based on science as it is based on local politics.	Politics
2	The economies of Burleson and Milam Counties are dependent on Eagle Ford shale fracking. Without the ability for fracking companies to come in and utilize groundwater then our number one catalyst for jobs in the community is killed. Vista Ridge and the 130 Pipeline project threaten this ability.	Rural Impacts
3	Mayor Julian Castro completely replaced the SAWS Board before the Vista Ridge deal came up to provide a soft target for rubber stamping the deal.	Politics
4	I object to groundwater being called a property right because if it can be drained out from under my land it's not a property right. That's called theft in any other area of property.	Texas Water Law
5	SAWS used that grossly overestimated per capita demand figure of 135 (gallons per capita per day) to justify acquiring a new, extremely expensive source of water to meet future demand – the Vista Ridge Pipeline.	Governance
6	It will take the people from San Antonio working with people from Burleson and Milam Counties to come up with a better long-term solution and unfortunately that is not the way water policy is being made.	Regional Planning
7	I don't think Post Oak Savannah Groundwater Conservation District is don't the proper job to protect the aquifer and the people that live in Burleson and Milam Counties.	Governance
8	SAWS has experienced some controversy but most has been from local Sierra Club types. There are very few in the Burleson and Milam County area who oppose the project.	Politics
9	Vista Ridge assures that San Antonio will have guaranteed water security for decades at stable prices. This is a historic opportunity.	Water Security
10	SAWS has done its due diligence in ensuring that its ratepayers are protected from major risks while providing San Antonio with the Vista Ridge Pipeline, a new, safe and reliable water source.	Governance/Risk

#	STATEMENT	CATEGORY
11	Family incomes in San Antonio have stagnated for more than 10 years; rate increases for Vista Ridge will be a major burden for lower- and middle- income families. That will hurt our economy.	Urban Impacts
12	The Texas system of groundwater rights is a legal structure that doesn't match the reality of the system. You can easily dry somebody else out and it leads to ridiculous water races.	Texas Water Law
13	The Vista Ridge Pipeline Project is a short-term boon for land developers who want to fill the fragile Hill Country with subdivisions.	Development
14	A city always wants to have 50 years of water in front of it. Most big communities have to go out, do a big water project, and get more water than they immediately need so they can grow into the water they get. If you don't do that, then your city is always put under drought restrictions and that creates a bad reputation for business development.	Development
15	The key information that was needed to be a well-informed stakeholder was never easily available and became less so.	Transparency
16	In my opinion, SAWS has been transparent. When you negotiate a contract there needs to be confidentiality.	Governance/ Transparency
17	The Vista Ridge project is a true example of Texan helping Texan through a win-win deal that benefits San Antonio and the local landowners who are leasing their private water rights.	Governance
18	The whole Vista Ridge deal was designed to avoid ever giving the people a voice. SAWS wanted to use this public-private partnership as a veil to prevent from having to get public onboard for the project and that was deliberate.	Governance/ PPP Accountability
19	I do not like the fact that we're trying to encourage growth in San Antonio. I don't think that bigger cities serve anyone besides the developers and the builders and the people who make money from growth.	Development
20	At SAWS, we've mitigated the risk for San Antonio but have also mitigated the risk for the local folks of Burleson and Milam County. We put all the risk on the private sector.	Governance/Risk
21	Nobody has ever put together a public-private partnership that behaved as a good steward.	PPP Stewardship
22	Vista Ridge could fall apart numerous different ways, including buying water San Antonio can't use and when we do need it 30 years from now, it is no longer available.	Risk
23	The challenge of water supply in Texas is we've done most of our water planning while we have been in severe droughts, rather than planning ahead so that we're more drought resistant and drought tolerant.	Regional Planning

#	STATEMENT	CATEGORY
24	When this water goes down the Vista Ridge pipeline it is not going to help anybody here in Burleson and Milam County.	Urban v. Rural
25	A groundwater conservation district's ability to set their desired future conditions, permit term lengths, and pumping cutbacks poses a risk to San Antonio to receive a reliable supply of water.	Risk/Water Security
26	That to me is the underlying problem with Vista Ridge. It's not moving the water from one place to another, it's not the cost of the water, it's not whether or not a private company built the pipeline, it's the fact that people, even if they don't know it, they feel uneasy to the fact that we're privatizing water and turning it into a commodity and a market.	Privatization
27	The nature of the Vista Ridge deal, where the private entities only get paid if they sell water, creates an enormous incentive for them to pump all the water from day one.	Water Security
28	It is really dangerous when we start putting public utilities in the hands of private actors because those entities don't have the public good at heart. They have a legal right to sacrifice public good for private interest.	PPP Stewardship
29	Vista Ridge gives San Antonio the ability to use those water supplies to meet its demand and balance conservation, drought management, and economic development.	Water Security
30	I believe the scientists for the state and for SAWS. Their best estimates are that the Carrizo-Wilcox aquifer can afford to carry the burden of Vista Ridge. But they could be wrong. Science improves all the time and you've got to be willing to say if new data shows new conclusions you don't stick to your points of view.	Science
31	San Antonio has been a leader in conservation, but we got sidetracked by the goal of acquiring abundant water.	Water Security
32	There's this fear base that the Carrizo-Wilcox aquifer is going to dry up like a lake does and it just doesn't happen that way. The aquifer is very deep. Vista Ridge is not going to impact the local landowners.	Aquifer Impacts
33	Post Oak Savannah Groundwater Conservation District has never reviewed the legitimacy of any of the groundwater leases to see if they are legally recorded and so forth, and that is the reason why SAWS has done this private-partnership deal, where they put that burden of responsibility on BlueWater and that's the way SAWS wash their hands on this.	Governance/ PPP Accountability

#	STATEMENT	CATEGORY
34	San Antonio City Council failed its fiduciary responsibility to obtain an independent analysis of the Vista Ridge project. It did not ask any questions, and it refused to listen to many questions asked by concerned stakeholders.	Governance
35	There are hydrologists telling SAWS Vista Ridge pumping is going to be fine. There are other hydrologists saying it's going to be a disaster and there are others saying 'I don't know.' So, you get to pick the hydrologist that says what you want to hear.	Science/Politics
36	When we mine coal or pump oil we recognize that at some point that means we are going to run out, but there are substitutions for energy. There are no substitutions for water. And Vista Ridge is nothing more than a mining operation.	Aquifer Impacts

APPENDIX D

Q-SORT RESPONDENTS

PARTICIPANT ID	SEX	GENERAL DESCRIPTOR
01	Female	Professor
02	Male	Professor
03	Male	Municipal Employee
04	Male	Attorney
05	Male	Independent Consultant
06	Female	Professor/Advocacy Group Member
07	Male	Advocacy Group Member
08	Male	Independent Hydrologist
09	Female	Advocacy Group Member
10	Male	Business Owner
11	Male	Business Owner
12	Female	Landowner
13	Male	Advocacy Group Member
14	Female	Burleson County Resident
15	Female	County Official/Landowner
16	Male	Landowner
17	Female	Landowner
18	Male	Journalist
19	Male	Journalist
20	Female	Environmental Lawyer
21	Male	Landowner
22	Female	Landowner
23	Male	Municipal Employee

APPENDIX E

PRELIMINARY RESULTS - SOCIAL PERSPECTIVES CHART

F1: Rural Opposition	F2: Urban Advocates	F3: Good Governance Failure	Confounders
Significantly opposes the VRP project	Significantly supports the VRP project – see it as a "win-win" deal	Significantly opposes the VRP project	Opposes the VRP project
Believe the local GCD **has not** done a proper job of protecting the aquifer and the residents of the rural counties	Believe the VRP gives San Antonio the ability to meet future water demand while also promoting conservation and economic development	Believe that city agencies failed their governance responsibilities and used incorrect data to justify the approval of the VRP project	Share the perspectives of both Factor 1 and Factor 3, therefore did not load into either
Believe groundwater laws **do not** protect landowners' water rights as written today	Believe any risks from the VRP have been mitigated and placed on the private sector	Believe the legal system of groundwater rights does not match the reality and leads to water races	Reveal that the true picture of opposition is nuanced – there are many ways to say 'No'
Believe the VRP **will not** be beneficial to the people of Burleson and Milam Counties	**Do not** believe pumping of the Carrizo-Wilcox aquifer will have any impact on local landowners	Believe the PPP nature of the project creates an incentive for the private entities to pump all the water from day one	
Believe agencies choose the hydrologist saying what they want to hear in terms of aquifer impact – *science is political*	Believe GCDs control of groundwater poses a risk to San Antonio's water future and that decisions made by GCDs can be arbitrary and political	Believe the best water security solution is one in which people from the urban and rural communities develop by working together	
		Believe the VRP could fall apart numerous ways, including buying water now in surplus and it's not there when the city really needs it later on	

APPENDIX F

POST-VALIDATION - SOCIAL PERSPECTIVES CHART

F1: Landowner Opposition	F2: Project Advocates	F3: Governance Failure	Non-Loaders
Significantly opposes the VRP project	Significantly supports the VRP project – see it as a "win-win" deal	Significantly opposes the VRP project	Opposes the VRP project
Believe the local GCD **has not** done a proper job of protecting the aquifer and the residents of the rural counties	Believe the VRP gives San Antonio the ability to meet future water demand while also promoting conservation and economic development	Believe that city agencies failed their governance responsibilities and used incorrect data to justify the approval of the VRP project	Share the perspectives of both Factor 1 and Factor 3, therefore did not load into either
Believe groundwater laws **do not** protect landowners' water rights as written today	Believe any risks from the VRP have been mitigated and placed on the private sector	Believe the legal system of groundwater rights does not match the reality and leads to water races	Reveal that the true picture of opposition is nuanced – there are many ways to say 'No'
Believe the VRP **will not** be beneficial to the people of Burleson and Milam Counties	**Do not** believe pumping of the Carrizo-Wilcox aquifer will have significant impact on local landowners	Believe the PPP nature of the project creates an incentive for the private entities to pump all the water from day one	
Believe agencies choose the hydrologist saying what they want to hear in terms of aquifer impact – *science is political*	Believe GCDs control of groundwater poses a risk to San Antonio's water future and that decisions made by GCDs can be arbitrary and political	Believe the best water security solution is one in which people from the urban and rural communities develop by working together	
		Believe the VRP could fall apart numerous ways, including buying water now in surplus and it's not there when the city really needs it later on	

APPENDIX G

GENERAL STATISTICS ON THREE FACTORS

	Factor 1	Factor 2	Factor 3
Eigenvalue	11.799	2.584	1.434
No. of Defining Variables (Loaders)	6	5	7
% Variance Explained	51	11	6
Average Relative Coefficient	0.8	0.8	0.8
Composite Reliability	0.96	0.952	0.966
SE of Factor Scores	0.2	0.219	0.184

APPENDIX H

CORRELATIONS BETWEEN FACTOR SCORES

	Factor 1	**Factor 2**	**Factor 3**
Factor 1	1.000	-0.4229	0.6418
Factor 2	-0.4229	1.000	-0.5619
Factor 3	0.6418	-0.5619	1.000

APPENDIX I

DISTINGUISHING STATEMENTS FOR FACTOR 1

P<0.05, (*) indicates significance at P<0.01.

NO.	STATEMENT	FACTORS 1		2		3	
		RNK	SCORE	RNK	SCORE	RNK	SCORE
7	I don't think Post Oak Savannah Groundwater Conservation District is don't the proper job to protect the aquifer and the people that live in Burleson and Milam Counties.	5	1.69*	-1	-0.484	0	-0.099
4	I object to groundwater being called a property right because if it can be drained out from under my land it's not a property right. That's called theft in any other area of property.	4	1.67*	0	-0.102	-2	-0.612
24	When this water goes down the Vista Ridge pipeline it is not going to help anybody here in Burleson and Milam County.	4	1.63*	0	-0.322	0	-0.059
35	There are hydrologists telling SAWS Vista Ridge pumping is going to be fine. There are other hydrologists saying it's going to be a disaster and there are others saying 'I don't know.' So, you get to pick the hydrologist that says what you want to hear.	3	1.15	1	-0.328	1	0.572

NO.	STATEMENT	FACTORS 1		2		3	
		RNK	SCORE	RNK	SCORE	RNK	SCORE
33	Post Oak Savannah Groundwater Conservation District has never reviewed the legitimacy of any of the groundwater leases to see if they are legally recorded and so forth, and that is the reason why SAWS has done this private-partnership deal, where they put that burden of responsibility on BlueWater and that's the way SAWS wash their hands on this.	2	1.12*	-1	-0.36	-1	-0.121
34	San Antonio City Council failed its fiduciary responsibility to obtain an independent analysis of the Vista Ridge project. It did not ask any questions, and it refused to listen to many questions asked by concerned stakeholders.	1	0.39	-4	-1.461	3	0.959
1	Groundwater conservation districts can make very arbitrary decisions about when to issue permits. It's not so much based on science as it is based on local politics.	1	0.33	3	1.131	-1	-0.233
21	Nobody has ever put together a public-private partnership that behaved as a good steward.	1	0.19	-2	-0.652	-1	-0.423
31	San Antonio has been a leader in conservation, but we got sidetracked by the goal of acquiring abundant water.	-1	-0.23	-2	-0.885	1	0.57
16	In my opinion, SAWS has been transparent. When you negotiate a contract there needs to be confidentiality.	-2	-0.94*	2	1.022	-4	-1.724

NO.	STATEMENT	FACTORS 1		2		3	
		RNK	SCORE	RNK	SCORE	RNK	SCORE
10	SAWS has done its due diligence in ensuring that its ratepayers are protected from major risks while providing San Antonio with the Vista Ridge Pipeline, a new, safe and reliable water source.	-3	-1.01*	4	1.575	-4	-1.781
20	At SAWS, we've mitigated the risk for San Antonio but have also mitigated the risk for the local folks of Burleson and Milam County. We put all the risk on the private sector.	-3	-1.4	3	1.265	-5	-2.091
8	SAWS has experienced some controversy but most has been from local Sierra Club types. There are very few in the Burleson and Milam County area who oppose the project.	-4	-2.06	1	0.65	-5	-1.363

APPENDIX J

DISTINGUISHING STATEMENTS FOR FACTOR 2

P<0.05, (*) indicates significance at P<0.01.

NO.	STATEMENT	FACTORS 1		2		3	
		RNK	SCORE	RNK	SCORE	RNK	SCORE
29	Vista Ridge gives San Antonio the ability to use those water supplies to meet its demand and balance conservation, drought management, and economic development.	-2	-0.72	5	1.81*	-2	-0.728
10	SAWS has done its due diligence in ensuring that its ratepayers are protected from major risks while providing San Antonio with the Vista Ridge Pipeline, a new, safe and reliable water source.	-3	-1.01	4	1.58*	-4	-1.781
9	Vista Ridge assures that San Antonio will have guaranteed water security for decades at stable prices. This is a historic opportunity.	-3	-1.07	4	1.47*	-2	-1.008
20	At SAWS, we've mitigated the risk for San Antonio but have also mitigated the risk for the local folks of Burleson and Milam County. We put all the risk on the private sector.	-3	-1.4	3	1.26*	-5	-2.091
25	A groundwater conservation district's ability to set their desired future conditions, permit term lengths, and pumping cutbacks poses a risk to San Antonio to receive a reliable supply of water.	1	0.2	3	1.18*	0	0.208

NO.	STATEMENT	FACTORS 1		2		3	
		RNK	SCORE	RNK	SCORE	RNK	SCORE
1	Groundwater conservation districts can make very arbitrary decisions about when to issue permits. It's not so much based on science as it is based on local politics.	1	0.33	3	1.13*	-1	-0.233
17	The Vista Ridge project is a true example of Texan helping Texan through a win-win deal that benefits San Antonio and the local landowners who are leasing their private water rights.	-5	-2.07	2	1.11*	-3	-1.661
14	A city always wants to have 50 years of water in front of it. Most big communities have to go out, do a big water project, and get more water than they immediately need so they can grow into the water they get. If you don't do that, then your city is always put under drought restrictions and that creates a bad reputation for business development.	0	0.08	2	1.07*	-1	-0.212
16	In my opinion, SAWS has been transparent. When you negotiate a contract there needs to be confidentiality.	-2	-0.94	2	1.02*	-4	-1.724
30	I believe the scientists for the state and for SAWS. Their best estimates are that the Carrizo-Wilcox aquifer can afford to carry the burden of Vista Ridge. But they could be wrong. Science improves all the time and you've got to be willing to say if new data shows new conclusions you don't stick to your points of view.	-1	-0.3	2	0.92*	0	0.092

NO.	STATEMENT	FACTORS 1		2		3	
		RNK	SCORE	RNK	SCORE	RNK	SCORE
32	There's this fear base that the Carrizo-Wilcox aquifer is going to dry up like a lake does and it just doesn't happen that way. The aquifer is very deep. Vista Ridge is not going to impact the local landowners.	-4	-1.96	1	0.65*	-3	-1.468
8	SAWS has experienced some controversy but most has been from local Sierra Club types. There are very few in the Burleson and Milam County area who oppose the project.	-4	-2.06	1	0.65*	-3	-1.363
36	When we mine coal or pump oil we recognize that at some point that means we are going to run out, but there are substitutions for energy. There are no substitutions for water. And Vista Ridge is nothing more than a mining operation.	3	1.29	-1	-0.41*	3	1.228
28	It is really dangerous when we start putting public utilities in the hands of private actors because those entities don't have the public good at heart. They have a legal right to sacrifice public good for private interest.	3	1.13	-2	-0.71*	5	1.568
15	The key information that was needed to be a well-informed stakeholder was never easily available and became less so.	2	0.91	-2	-0.87*	3	1.316
31	San Antonio has been a leader in conservation, but we got sidetracked by the goal of acquiring abundant water.	-1	-0.23	-2	-0.89	1	0.57

NO.	STATEMENT	FACTORS 1		2		3	
		RNK	SCORE	RNK	SCORE	RNK	SCORE
19	I do not like the fact that we're trying to encourage growth in San Antonio. I don't think that bigger cities serve anyone besides the developers and the builders and the people who make money from growth.	0	0.11	-3	-1.35*	1	0.347
13	The Vista Ridge Pipeline Project is a short-term boon for land developers who want to fill the fragile Hill Country with subdivisions.	1	0.41	-3	-1.35*	2	0.798
34	San Antonio City Council failed its fiduciary responsibility to obtain an independent analysis of the Vista Ridge project. It did not ask any questions, and it refused to listen to many questions asked by concerned stakeholders.	1	0.39	-4	-1.46*	3	0.959
3	Mayor Julian Castro completely replaced the SAWS Board before the Vista Ridge deal came up to provide a soft target for rubber stamping the deal.	-2	-0.37	-4	-1.73*	-1	-0.176
18	The whole Vista Ridge deal was designed to avoid ever giving the people a voice. SAWS wanted to use this public-private partnership as a veil to prevent from having to get public onboard for the project and that was deliberate.	0	0.11	-5	-1.85*	0	0.012

APPENDIX K

DISTINGUISHING STATEMENTS FOR FACTOR 3

P<0.05, (*) indicates significance at P<0.01.

NO.	STATEMENT	FACTORS 1		2		3	
		RNK	SCORE	RNK	SCORE	RNK	SCORE
12	The Texas system of groundwater rights is a legal structure that doesn't match the reality of the system. You can easily dry somebody else out and it leads to ridiculous water races.	2	0.42	0	-0.06	4	1.42*
27	The nature of the Vista Ridge deal, where the private entities only get paid if they sell water, creates an enormous incentive for them to pump all the water from day one.	2	0.84	1	0.49	4	1.4
34	San Antonio City Council failed its fiduciary responsibility to obtain an independent analysis of the Vista Ridge project. It did not ask any questions, and it refused to listen to many questions asked by concerned stakeholders.	1	0.39	-4	-1.46	3	0.96
26	That to me is the underlying problem with Vista Ridge. It's not moving the water from one place to another, it's not the cost of the water, it's not whether or not a private company built the pipeline, it's the fact that people, even if they don't know it, they feel uneasy to the fact that we're privatizing water and turning it into a commodity and a market.	0	-0.21	0	-0.08	2	0.93*

NO.	STATEMENT	FACTORS 1		2		3	
		RNK	SCORE	RNK	SCORE	RNK	SCORE
6	It will take the people from San Antonio working with people from Burleson and Milam Counties to come up with a better long-term solution and unfortunately that is not the way water policy is being made.	0	0.14	0	0.07	2	0.91*
5	SAWS used that grossly overestimated per capita demand figure of 135 (gallons per capita per day) to justify acquiring a new, extremely expensive source of water to meet future demand – the Vista Ridge Pipeline.	-2	-0.65	-3	-1.21	2	0.84*
22	Vista Ridge could fall apart numerous different ways, including buying water San Antonio can't use and when we do need it 30 years from now, it is no longer available.	-1	-0.23	-1	-0.49	1	0.65*
31	San Antonio has been a leader in conservation, but we got sidetracked by the goal of acquiring abundant water.	-1	-0.23	-2	-0.89	1	0.57*
1	Groundwater conservation districts can make very arbitrary decisions about when to issue permits. It's not so much based on science as it is based on local politics.	1	0.33	3	1.13	-1	-0.23
8	SAWS has experienced some controversy but most has been from local Sierra Club types. There are very few in the Burleson and Milam County area who oppose the project.	-4	-2.06	1	0.65	-3	-1.36
16	In my opinion, SAWS has been transparent. When you negotiate a contract there needs to be confidentiality.	-2	-0.94	2	1.02	-4	-1.72*

NO.	STATEMENT	FACTORS 1		2		3	
		RNK	SCORE	RNK	SCORE	RNK	SCORE
10	SAWS has done its due diligence in ensuring that its ratepayers are protected from major risks while providing San Antonio with the Vista Ridge Pipeline, a new, safe and reliable water source.	-3	-1.01	4	1.58	-4	-1.78*
20	At SAWS, we've mitigated the risk for San Antonio but have also mitigated the risk for the local folks of Burleson and Milam County. We put all the risk on the private sector.	-3	-1.4	3	1.26	-5	-2.09

APPENDIX L

ROTATED FACTOR LOADINGS

(x) indicates defining sort; (†) indicates the non-loading individuals; ($x^{\dagger}$) indicates the two participants who loaded significantly negative in Factor 2 but were manually unselected and became non-loading individuals.

ID	RESPONDENT	FACTOR 1		FACTOR 2		FACTOR 3	
01	Professor†	0.2686		-0.4453		0.5021	
02	Professor	0.2128		-0.292		0.7736	*x*
03	Municipal Employee	-0.1538		0.8156	*x*	-0.1902	
04	Attorney†	0.4471		-0.5334		0.441	
05	Independent Consultant	0.0887		-0.4289		0.6997	*x*
06	Professor/Advocacy Group Member	0.2312		-0.5363		0.6041	*x*
07	Advocacy Group Member†	0.3126		-0.5622		0.4554	
08	Independent Hydrologist	0.4722		-0.0865		0.6911	*x*
09	Advocacy Group Member†	0.2473		-0.5914	$x^{\dagger}$	0.4803	
10	Business Owner	-0.2735		0.7640	*x*	-0.3289	
11	Business Owner	-0.2911		0.8352	*x*	-0.1637	
12	Landowner	0.8381	*x*	-0.2151		0.1298	
13	Advocacy Group Member†	0.4906		-0.5909	$x^{\dagger}$	0.4209	
14	Burleson County Resident	0.4158		-0.0864		0.6561	*x*
15	County Official/Landowner	0.7501	*x*	-0.1866		0.2045	
16	Landowner	0.8266	*x*	-0.091		0.0612	
17	Landowner	0.7442	*x*	-0.1542		0.4875	
18	Journalist	0.1489		0.7111	*x*	0.2016	
19	Journalist	0.149		-0.0968		0.7361	*x*
20	Environmental Lawyer	0.5053		-0.1885		0.6143	*x*
21	Landowner	0.7357	*x*	-0.0787		0.392	
22	Landowner	0.6158	*x*	-0.2719		0.4232	
23	Municipal Employee	-0.1079		0.7649	*x*	-0.442	

APPENDIX M

CONSENSUS STATEMENTS THAT DO NOT DISTINGUISH BETWEEN ANY PAIR OF FACTORS

NO.	STATEMENT	FACTORS 1		2		3	
		RNK	SCORE	RNK	SCORE	RANK	SCORE
2	The economies of Burleson and Milam Counties are dependent on Eagle Ford shale fracking. Without the ability for fracking companies to come in and utilize groundwater then our number one catalyst for jobs in the community is killed. Vista Ridge and the 130 Pipeline project threaten this ability.	-1	-0.363	0	-0.148	-2	-0.597
11	Family incomes in San Antonio have stagnated for more than 10 years; rate increases for Vista Ridge will be a major burden for lower- and middle-income families. That will hurt our economy.	0	0.021	-1	-0.48	0	0.035

APPENDIX N

Z-SCORES AND RANK OF EACH STATEMENT BY FACTOR

NO.	STATEMENT	FACTORS 1 z-score	rank	2 z-score	rank	3 z-score	rank
1	Groundwater conservation districts can make very arbitrary decisions about when to issue permits. It's not so much based on science as it is based on local politics.	0.33	13	1.13	6	-0.23	25
2	The economies of Burleson and Milam Counties are dependent on Eagle Ford shale fracking. Without the ability for fracking companies to come in and utilize groundwater then our number one catalyst for jobs in the community is killed. Vista Ridge and the 130 Pipeline project threaten this ability.	-0.36	26	-0.15	20	-0.60	27
3	Mayor Julian Castro completely replaced the SAWS Board before the Vista Ridge deal came up to provide a soft target for rubber stamping the deal.	-0.37	27	-1.73	35	-0.18	23
4	I object to groundwater being called a property right because if it can be drained out from under my land it's not a property right. That's called theft in any other area of property.	1.67	2	-0.1	19	-0.61	28
5	SAWS used that grossly overestimated per capita demand figure of 135 (gallons per capita per day) to justify acquiring a new, extremely expensive source of water to meet future demand – the Vista Ridge Pipeline.	-0.65	28	-1.21	31	0.84	9
6	It will take the people from San Antonio working with people from Burleson and Milam Counties to come up with a better long-term solution and unfortunately that is not the way water policy is being made.	0.14	16	0.07	16	0.91	8
7	I don't think Post Oak Savannah Groundwater Conservation District is don't the proper job to protect the aquifer and the people that live in Burleson and Milam Counties.	1.69	1	-0.48	25	-0.10	21

NO.	STATEMENT	FACTORS 1 z-score	rank	2 z-score	rank	3 z-score	rank
8	SAWS has experienced some controversy but most has been from local Sierra Club types. There are very few in the Burleson and Milam County area who oppose the project.	-2.06	35	0.65	11	-1.36	31
9	Vista Ridge assures that San Antonio will have guaranteed water security for decades at stable prices. This is a historic opportunity.	-1.07	32	1.47	3	-1.01	30
10	SAWS has done its due diligence in ensuring that its ratepayers are protected from major risks while providing San Antonio with the Vista Ridge Pipeline, a new, safe and reliable water source.	-1.01	31	1.58	2	-1.78	35
11	Family incomes in San Antonio have stagnated for more than 10 years; rate increases for Vista Ridge will be a major burden for lower- and middle- income families. That will hurt our economy.	0.02	20	-0.48	24	0.04	18
12	The Texas system of groundwater rights is a legal structure that doesn't match the reality of the system. You can easily dry somebody else out and it leads to ridiculous water races.	0.42	10	-0.06	17	1.42	2
13	The Vista Ridge Pipeline Project is a short-term boon for land developers who want to fill the fragile Hill Country with subdivisions.	0.41	11	-1.35	32	0.80	10
14	A city always wants to have 50 years of water in front of it. Most big communities have to go out, do a big water project, and get more water than they immediately need so they can grow into the water they get. If you don't do that, then your city is always put under drought restrictions and that creates a bad reputation for business development.	0.08	19	1.07	8	-0.21	24
15	The key information that was needed to be a well-informed stakeholder was never easily available and became less so.	0.91	8	-0.87	29	1.32	4

NO.	STATEMENT	FACTORS 1		2		3	
		z-score	rank	z-score	rank	z-score	rank
16	In my opinion, SAWS has been transparent. When you negotiate a contract there needs to be confidentiality.	-0.94	30	1.02	9	-1.72	34
17	The Vista Ridge project is a true example of Texan helping Texan through a win-win deal that benefits San Antonio and the local landowners who are leasing their private water rights.	-2.07	36	1.11	7	-1.66	33
18	The whole Vista Ridge deal was designed to avoid ever giving the people a voice. SAWS wanted to use this public-private partnership as a veil to prevent from having to get public onboard for the project and that was deliberate.	0.11	18	-1.85	36	0.01	19
19	I do not like the fact that we're trying to encourage growth in San Antonio. I don't think that bigger cities serve anyone besides the developers and the builders and the people who make money from growth.	0.11	17	-1.35	33	0.35	15
20	At SAWS, we've mitigated the risk for San Antonio but have also mitigated the risk for the local folks of Burleson and Milam County. We put all the risk on the private sector.	-1.4	33	1.26	4	-2.09	36
21	Nobody has ever put together a public-private partnership that behaved as a good steward.	0.19	15	-0.65	27	-0.42	26
22	Vista Ridge could fall apart numerous different ways, including buying water San Antonio can't use and when we do need it 30 years from now, it is no longer available.	-0.23	23	-0.49	26	0.65	11
23	The challenge of water supply in Texas is we've done most of our water planning while we have been in severe droughts, rather than planning ahead so that we're more drought resistant and drought tolerant.	-0.28	24	0.28	15	0.51	14
24	When this water goes down the Vista Ridge pipeline it is not going to help anybody here in Burleson and Milam County.	1.63	3	-0.32	21	-0.06	20

NO.	STATEMENT	FACTORS 1 z-score	rank	2 z-score	rank	3 z-score	rank
25	A groundwater conservation district's ability to set their desired future conditions, permit term lengths, and pumping cutbacks poses a risk to San Antonio to receive a reliable supply of water.	0.2	14	1.18	5	0.21	16
26	That to me is the underlying problem with Vista Ridge. It's not moving the water from one place to another, it's not the cost of the water, it's not whether or not a private company built the pipeline, it's the fact that people, even if they don't know it, they feel uneasy to the fact that we're privatizing water and turning it into a commodity and a market.	-0.21	21	-0.08	18	0.93	7
27	The nature of the Vista Ridge deal, where the private entities only get paid if they sell water, creates an enormous incentive for them to pump all the water from day one.	0.84	9	0.49	13	1.40	3
28	It is really dangerous when we start putting public utilities in the hands of private actors because those entities don't have the public good at heart. They have a legal right to sacrifice public good for private interest.	1.13	6	-0.71	28	1.57	1
29	Vista Ridge gives San Antonio the ability to use those water supplies to meet its demand and balance conservation, drought management, and economic development.	-0.72	29	1.81	1	-0.73	29
30	I believe the scientists for the state and for SAWS. Their best estimates are that the Carrizo-Wilcox aquifer can afford to carry the burden of Vista Ridge. But they could be wrong. Science improves all the time and you've got to be willing to say if new data shows new conclusions you don't stick to your points of view.	-0.3	25	0.92	10	0.09	17
31	San Antonio has been a leader in conservation, but we got sidetracked by the goal of acquiring abundant water.	-0.23	22	-0.89	30	0.57	13

NO.	STATEMENT	FACTORS 1		2		3	
		z-score	rank	z-score	rank	z-score	rank
32	There's this fear base that the Carrizo-Wilcox aquifer is going to dry up like a lake does and it just doesn't happen that way. The aquifer is very deep. Vista Ridge is not going to impact the local landowners.	-1.96	34	0.65	12	-1.47	32
33	Post Oak Savannah Groundwater Conservation District has never reviewed the legitimacy of any of the groundwater leases to see if they are legally recorded and so forth, and that is the reason why SAWS has done this private-partnership deal, where they put that burden of responsibility on BlueWater and that's the way SAWS wash their hands on this.	1.12	7	-0.36	22	-0.12	22
34	San Antonio City Council failed its fiduciary responsibility to obtain an independent analysis of the Vista Ridge project. It did not ask any questions, and it refused to listen to many questions asked by concerned stakeholders.	0.39	12	-1.46	34	0.96	6
35	There are hydrologists telling SAWS Vista Ridge pumping is going to be fine. There are other hydrologists saying it's going to be a disaster and there are others saying 'I don't know.' So, you get to pick the hydrologist that says what you want to hear.	1.15	5	0.33	14	0.57	12
36	When we mine coal or pump oil we recognize that at some point that means we are going to run out, but there are substitutions for energy. There are no substitutions for water. And Vista Ridge is nothing more than a mining operation.	1.29	4	-0.41	23	1.23	5