

THE PROTRACTED DISPUTE OVER THE EDWARDS AQUIFER: REVISITING
AND REFRAMING MULTIPARTY STAKEHOLDER CONFLICTS IN
MANAGEMENT, REGULATION, ALLOCATION, AND PROPERTY RIGHTS

by

William Gene Adams, Jr., B.S., M.S., M.B.A.

A dissertation submitted to the Graduate Council of
Texas State University in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
with a major in Environmental Geography
December 2016

Committee Members:

Denise Blanchard, Chair

Richard A. Earl

Jason Julian

Howard R. Balanoff

COPYRIGHT

by

William Gene Adams, Jr.

2016

FAIR USE AND AUTHOR'S PERMISSION STATEMENT

Fair Use

This work is protected by the Copyright Laws of the United States (Public Law 94-553, section 107). Consistent with fair use as defined in the Copyright Laws, brief quotations from this material are allowed with proper acknowledgment. Use of this material for financial gain without the author's express written permission is not allowed.

Duplication Permission

As the copyright holder of this work I, William Gene Adams, Jr., authorize duplication of this work, in whole or in part, for educational or scholarly purposes only.

DEDICATION

I dedicate this dissertation to my mother and father, Betty Jo and William Gene Adams, Sr., my children Taylor Elizabeth and Matthew Calvin Adams. Most importantly of all, I dedicate this project to my loving wife, Irma Serna Adams, who has steadfastly stood with me throughout this process and encouraged me to embrace the challenge and to complete the task.

ACKNOWLEDGEMENTS

I would like to acknowledge the faithful service of my advisor, Denise Blanchard-Boehm, and committee members, Richard Earl, Howard Balanoff, and Jason Julian, whose unwavering support saw me through this project. I would also like to acknowledge and thank Robert Larson who got the ball rolling for me in my research, and recommending potential committee members. I would also like to acknowledge and thank my good neighbor Richard Croker and colleague Zacariah Hildenbrand who provided proof and edit support throughout this project.

Also, last, but certainly not least, I would like to acknowledge in memory, former City of San Marcos Mayor Billy Moore who convinced me from the beginning of this endeavor that I would be a good fit for groundwater planning in Texas.

TABLE OF CONTENTS

	Page
ACKNOWLEDGEMENTS	v
LIST OF TABLES	ix
LIST OF FIGURES	x
LIST OF ILLUSTRATIONS	ix
LIST OF ABBREVIATIONS	xi
ABSTRACT	xvi
CHAPTER	
I. INTRODUCTION	1
Conflict Origins Over the Edwards Aquifer.....	2
Statement of the Problem	4
Edwards Aquifer Physical Boundaries.....	6
Purpose and Objectives.....	10
Research Questions.....	11
General Hypothesis Guiding This Research	11
II. TEXAS WATER BACKGROUND	14
Introduction.....	14
Riparian Water Rights.....	16
Appropriative Rights Doctrine.....	17
Evolution of Water Rights in the West.....	18
Texas Drought History.....	21
Water for Texas Planning	23
Groundwater Background.....	24
Texas Groundwater	26
Edwards Aquifer – Physical Boundaries	30
Texas Water Supply.....	33
Edwards Aquifer Controversy	35

Mediation and the Threat of Federal Intervention	40
Edwards Aquifer as an Underground River.....	42
Sierra Club V. Lujan	44
Edwards Aquifer Authority (EAA)	46
Sierra Club V. Babbitt.....	52
Sierra Club V. Glickman.....	56
Sierra Club V. San Antonio	57
Edwards Aquifer Authority—1997-2000	61
Edwards Aquifer: What has changed since 1997?.....	63
 III. EDWARDS AQUIFER AUTHORITY: WHAT HAS CHANGED SINCE 2000?	 70
Climate of Texas	71
Overview of the State’s Climate	73
Drought Severity in Texas	75
Climate Variability.....	76
Climate of South Central Texas	78
Edwards Aquifer Permitting and Allocation Issues	80
Property Rights – Two Perspectives	81
Legal Insight – Russell Johnson	83
Facts of the <i>Day</i> Case	87
Procedural History	88
The Argument at the Supreme Court.....	90
The Supreme Court Answers the Question of the Nature of Landowner Groundwater Rights.....	91
Impacts on Surface and Groundwater Management and Regulation.....	94
The Takings Analysis	95
What Constitutes a Taking?	97
A New Day? District Perspective	99
Synopsis – Greg Ellis.....	99
Facts	100
Procedural History and Claims	100
<i>Bragg v. Edwards Aquifer Authority</i> – Filed Nov. 21, 2006	113
Other Potential Lawsuits According to Ellis	118
Ellis Conclusions	119
Voting Rights Issue.....	120
What Has Changed?.....	123
The Edwards Aquifer Habitat Conservation Plan (EAHCP).....	134

IV.	LITERATURE REVIEW - THEORETICAL FOUNDATIONS OF INTRACTABLE CONFLICT	138
	Justification for a Qualitative Approach	138
	Underpinning Theory for Intractable Conflicts	142
	What is the Nature of Frames?.....	143
	Edwards Aquifer Authority: Identity And Characterization Frames	144
	Conflict Framing	145
V.	RESEARCH DESIGN	149
	Sample of Participants and Data Collection	149
	Constant Comparative Method of Data Analysis	151
VI.	ANALYSIS AND RESULTS.....	156
	Research Interview Analysis.....	159
	Identity Frame Theory	167
	Characterization Frame Theory	171
VII.	CONCLUSIONS.....	176
	What issues still remain?	177
	What has changed?	177
	What is new?.....	178
	Is the Edwards Aquifer to continue to be an “intractable conflict?	180
	Broader Impacts	181
	Public Outreach and Stewardship	181
	Groundwater Conservation Districts (GCDs).....	182
	APPENDIX SECTION.....	184
	LITERATURE CITED	189

LIST OF TABLES

Table	Page
1.1 Key Agencies and Stakeholders Involved in the Edwards Aquifer Dispute 1983-1997	6
3.1 Rankings of Palmer Drought Severity Indices Based on Drought Duration and Drought Intensity for Climate Divisions of Texas	76
3.2 Previous Court Decisions Prior to 2000 Affirming rule of Capture for Groundwater	82
3.3 Day, Bragg, and LULAC/SAWS Cases 2014	123
3.4 Primary Significant Edwards Aquifer Events Prior to 1997	130
3.5 Legislative Water Law Changes Since 1997 Relevant to the Edwards Aquifer	134
5.1 Comparison of Previous Research-Different Conflict Characteristics	150
5.2 Definitions of Framing Categories.....	154
6.1 Hierarchy Node Coded Reference Data.....	157
6.2 Node Code Data Analysis of Participant Frame Categories	158
6.3 Research Participant Data for All Research Study Groups 1997 - 2014	159
6.4 Frequency Analysis Comparison 1997 to 2014 Research Data Results	164

LIST OF FIGURES

Figure	Page
1.1 The Edwards Aquifer - San Antonio and Barton Springs Section.....	7
2.1 Major Aquifer and Rivers of Texas	29
2.2 The Edwards (Balcones Fault Zone) Aquifer	31
2.3 The Edwards Aquifer Region	32
2.4 Typical Cross Section of the Edwards Aquifer.....	32
2.5 Texas Reservoir Storage Capacity per Capita	34
2.6 Groundwater Conservation Districts of Texas.....	65
3.1 Texas historical and projected population growth* and percentage change	72
3.2 The geographic location of Texas within North America and its interaction with seasonal air masses affects the state’s unique climate variability	74
3.3 Annual Precipitation Based on Post Oak Tree Rings for the San Antonio Area	77
3.4 Seven-Year Running Average of Precipitation Based on Post Oak Tree Rings for the San Antonio Area.....	78
3.5 South-Central Texas Planning Region L	79
6.1 Node Code Analysis of Participant Frame.....	158
6.2 Research Comparison Graph – Stakeholder Groups 1997 – 2014.....	160
6.3 Research Comparison – Duration & Individual Participant Comparison	160
6.4 Relative Frequency Analysis Graph Comparison 1997 to 2014 Research Data Results	165
7.1 Texas Historical Rural and urban Populations, 1950 – 2005.....	181

LIST OF ABBREVIATIONS

Abbreviation	Description
AAG	Association of American Geographers
AG	Attorney General's Office
APA	Aquifer Protection Association
ASR	Aquifer Storage and Recovery
Bexar Met	Bexar Metropolitan Water District
BRAC	Base Closure and Realignment Commission
BSEACD	Barton Springs-Edwards Aquifer Conservation District
CFR	Code of Federal Regulations
CFS	Cubic feet per second (ft ³ /s)
CPMP	Critical Period Management Plan
CRWA	Canyon Regional Water Authority
DOD	Department of Defense
DOI	Department of the Interior
DOJ	Department of Justice
EAA	Edwards Aquifer Authority
EAHCP	Edwards Aquifer Habitat Conservation Program
EARIP	Edwards Aquifer Recovery Implementation Plan
EDF	Environmental Defense Fund

EPA	Environmental Protection Agency
ESA	Endangered Species Act
ETJ	Extraterritorial jurisdiction
EUWCD	Evergreen Underground Water Conservation District
EUWD	Edwards Underground Water District
EWRP	1994 Emergency Withdrawal Reduction Plan for the Edwards Aquifer
FR	Federal Registry
FT	Feet
GAL/MIN	Gallons per minute
GBRA	Guadalupe-Blanco River Authority
GPCPD	Gallons per capita per day
GPM	Gallons per minute
HCP	Habitat conservation plan
ITP	Incidental Take Permit
LCRA	Lower Colorado River Authority
MALDEP	Mexican American Legal Defense and Education Fund
MCWE	Meadows Center for Water and the Environment
MCUWCD	Medina County Underground Water Conservation District
MGD	Million gallons per day
Mi ²	Square Miles

MSL	Mean sea level
NBU	New Braunfels Utilities
NFH&TC	San Marcos National Fish Hatchery and Technology Center
NMFS	National Marine Fisheries Service
NRA	Nueces River Authority
NRCS	Natural Resource Conservation Service
Panel	Incidental Take Permit Application Panel
PDSI	Palmer Drought Severity Index
PHDI	Palmer Hydrological Drought Index
REWRP	1995 Revised Emergency Withdrawal Plan for the EA
RWMP	Regional Water Management Plan
SARA	San Antonio River Authority
SAWS	San Antonio Water System
SCS	Soil Conservation Service
SSA	Sole Source Aquifer
SPI	Standard Precipitation Index
SWTSU	Southwest Texas State University
TAC	Texas Administration Code
TBWE	Texas Board of Water Engineers
TCEQ	Texas Commission on Environmental Quality

TOES	Texas Organization for Endangered Species
TNRCC	Texas Natural Resource Conservation Commission
TPWD	Texas Parks and Wildlife Department
TSU	Texas State University
TWC	Texas Water Commission
TWDB	Texas Water Development Board
TWQB	Texas Water Quality Board
UCUWCD	Uvalde County Underground Water Conservation District
USC	United States Code
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UTSA	University of Texas at San Antonio
UST	Underground storage tanks
YTBD	Yet to be determined
WSP	Withdrawal Suspension Program
WWTP	Wastewater treatment plant

ABSTRACT

The 2011 drought was the worst single-year climatic occurrence in Texas' recorded history. Texas must meet residential and economic development requirements of a population that will nearly double state wide over the next 50 years, and potentially grow over 300 percent along the IH 35 corridor between Austin and San Antonio and the Hill Country where the Edwards Aquifer is located. Extreme population growth increases stress on existing natural resources and will require dramatic improvements in water conservation and reuse, as well as preservation of land held in conservation to protect water quantity and quality. Located in the south-central region of Texas, the Edwards Aquifer is an underground karst formation with water flowing through it that has been at the center of controversy for over 60 years. As the sole source water supply for nearly two million people in San Antonio and the Edwards Aquifer region, the controversy over the use of the Edwards Aquifer water centers on four major concerns: its limited physical structure, its multiple users, its potential contamination, and the potential loss of endangered species. This research revisits and builds on a previous study by Putnam and Peterson (2003) who explored a multi-issue protracted debate from 1980 to 1997 by diverse stakeholders concerning management and water allocation of the Edwards Aquifer. The Putnam and Petersen study inspired and guided this research which examines multi-party issues surrounding the Edwards Aquifer since 1997, and assesses

the degree to which the original debate has changed. In doing so, this research provides substantial background to the evolution of the dispute, and centers it within the history of changing climate patterns unique to the State of Texas. The research approach is primarily qualitative in nature and employed “Interactional Frame Theory” to demonstrate “characterization” and “identity” framing of stakeholders’ issues surrounding the aquifer from 1997 to present day. In addition, the concept of “framing” allowed for shaping, organizing, and focusing on new agendas of today’s stakeholders. The results of this study identified key stakeholder groups in the Edwards Aquifer region that, as a result of Texas Senate Bill 3 in 2007, through a consensus-based approach have successfully mitigated the intractable environmental conflict of the aquifer. The stakeholder process has implemented a Habitat Conservation Plan to protect spring flows, downstream economic interests, and endangered species. However, lingering problems related to property rights issues and potential “takings” liability, as well as a voting rights lawsuit brought by the League of United Latin American Citizens and enjoined by the San Antonio Water System, threaten to unravel the process. This research is significant in that it demonstrates how different stakeholder groups use the same repertoire in describing their “frames” and perspectives on managing an environmental natural resource. Ostensibly, understanding how different stakeholder groups frame environmental issues will facilitate consensus building and engender success in establishing agreements and common purposes for natural resource management.

Understanding how past and present conflicts arise and evolve will also contribute towards mitigating “intractable” environmental conflicts concerning all aspects and issues of land and water resource management and conservation.

Key Words: water resource management, aquifer management, intractable environmental conflicts, water conservation, water conflicts, interactional frame analysis

I. INTRODUCTION

The 2011 drought was the worst single-year climatic occurrence in Texas' recorded history. Estimates by the Texas AgriLife Extension Service put Texas agricultural losses for the year at \$5.2 billion (Texas AgriLife, 2011). A December 2011 economic analysis by BBVA Compass Bank found that indirect drought losses to the state's agricultural industries could add another \$3.5 billion to the toll (BBVA, 2011). Understandably, the recent years' severe drought experiences in Texas places a spotlight back on the fact that the state's water future is endangered. The state's available water supplies are expected to remain fixed or decline in the future (TWDB, 2012). Drought is an ever-present concern in many parts of the state, leading to pressure on our water infrastructure. According to the Texas Water Development Board (TWDB), demand for water will rise by 22 percent by 2060. In addition, the Board says that, should we experience another multi-year "drought of record" such as that of the 1950s, it could cost Texas businesses and workers \$116 billion in income by 2060 (TWDB, 2012). Part of the problem is that the state's water storage infrastructure hasn't grown as fast as its population. Since 1970, per capita water storage in reservoirs in the state has decreased approximately 50 percent. With traditional water sources finite at best, population growth will demand an increase in water to support agriculture, industry, energy production, and basic human needs. Without cooperation in allocating water supplies, or new solutions for water provision conservation, growth will be limited by water scarcity, and future droughts will have an economic impact far more damaging than any traditional recession (Reible, 2012, 5).

Meeting residential and economic development requirements of a population that will nearly double over the next 50 years will require dramatic improvements in water conservation and reuse, as well as developing new sources of water. Since additional water is unlikely to come from nature in the form of precipitation, the development and implementation of innovative technologies for conservation, reuse, and new supply is critical to Texas' water future. New conservation and reuse paradigms are especially important for agricultural irrigation and municipal water systems since together these consume 85 percent of the water in Texas (TWDB, 2012). New supplies may come from upgrading poor quality water, such as brackish groundwater (or wastewater reuse) if some of the limitations of current technologies can be overcome. The challenges in tapping new resources and the technologies that make this possible will require finding robust, scalable systems for desalination and advanced treatment that minimize operational energy consumption while avoiding excessive waste streams (Reible, 2012, 5).

Conflict Origins Over the Edwards Aquifer

Located in the south-central region of Texas, the Edwards Aquifer (EA) is an underground karst formation with water flowing through it which has been at the center of controversy for over 60 years. The land surrounding the springs at the headwaters of the San Marcos River which flows from the EA are claimed to be the longest, continuously inhabited region in North America. Investigations by Dr. Joel Shiner during the 1970s and 1980s demonstrated a nearly continuous sequence of occupation at this site spanning over 13,000 years from Clovis times through the Spanish Colonial era, into the

historic and modern period (Shiner, 2011). The perception that the EA is so prolific has resulted in the City of San Antonio had not had a need to develop alternative surface water sources to supply its citizens and industry. A number of modern cities, including San Antonio, the second largest city in Texas, and seventh largest in the U.S., have been located at springs flowing from the aquifer.

The controversy over the use of the Edwards Aquifer water centers on its limited physical structure, its multiple users, its potential contamination, and the potential loss of endangered species. Agricultural and urban communities have completely relied on the Edwards to supply their water needs. As an added complication, groundwater in Texas has historically been considered “private property” and subject to “rule of capture,” or as may be the case, “rule of the biggest pump.” Since the early 1980s, this legal definition has been in flux. Edwards Aquifer water has not only sparked disagreement on the amount and mode of water allocation, but also on legal ownership, and how the water should be governed (Putnam and Peterson, 2003, 118).

Until recently the Edwards Aquifer had been the major water source for San Antonio and, in fact, was the first water source in the United States to be designated as a “sole source of aquifer” (SSA) for the city. The SSA designation is one tool to protect public water supplies in an area where there are few or no alternative sources to the groundwater resource and where, if contamination occurs, using an alternative source would be extremely expensive (EPA, 1974).

The San Marcos and Comal Springs that generate surface water for the rivers bearing the “name” provide at least 60 percent of the water flow of the Guadalupe River. In addition, both rivers are home to eight endangered species. In times of drought the

percentage of aquifer water that is contributed by the San Marcos and Comal Rivers to the Guadalupe River is much higher. Because of lawsuits brought about by the Sierra Club beginning in the early 1990s, a U.S. district court ruled that the Secretary of the Interior, via the U.S. Fish and Wildlife Department, had allowed “takings” under the Endangered Species Act (ESA). The alleged “taking” was a result of inadequate surface water flows in the San Marcos and Comal Rivers due to pumping for irrigation during periods of drought. Thus, action by the Texas Legislature in 1993 resulted in a federal court-mandated deadline to protect surface water spring flow under threat of federal intervention and, in response, the state legislature created the Edwards Aquifer Authority (EAA) to regulate its groundwater allocation (Votteler, 1998).

Severe drought once again began to affect the region in 1996 resulting in the Texas Supreme Court overturning a state trial court ruling that the EAA was unconstitutional. Later on, in a second ESA lawsuit filed by the Sierra Club charging that landowners pumping of groundwater were causing “takes” of endangered species, the EAA directed by a court order by the U.S. District Court for the region, implemented a plan to reduce pumping. The court’s order was later vacated and the litigation continued (Votteler, 1998, 1-2).

Statement of the Problem

In 2003, Linda L. Putnam and Tarla Peterson produced a chapter entitled, “The Edwards Aquifer Dispute: Shifting Frames in a Protracted Conflict” that appeared in the book, *Making Sense of Intractable Environmental Conflicts* (Lewicki, Gray, and Elliott, 2003). The authors’ case study of the “intractable” conflicts surrounding the use and management of the Edwards Aquifer extended over the time period from 1980 to 1997. A

critical tipping point was reached concerning long-standing and protracted feuds between stakeholders over private property rights and protection of the common good. Multiple levels of group stakeholder ideas and demands on how best to appropriate groundwater created widespread disagreement about the management and use of this finite water resource. Putnam and Peterson (2003, 117) identified four key issues in the EA dispute: (1) the management of a scarce environmental resource limited by physical structure and used by many independent stakeholders; (2) concerns for property rights; (3) the regulation and distribution of water, and; (4) the effects of water shortage both on the endangered species that live within the aquifer's associated springs and on the quality of the aquifer's freshwater zones (2003, 118).

Groundwater laws in Texas are derived from the English common law of "absolute ownership" and state that landowners have the right to "take for use or sale" all the water they can capture from water resources beneath their land, unless the pumping deliberately harms other users, contaminates the wells of others, wastes artesian water, or causes surface injury to adjacent property (Getches, 1990; Kaiser, 1987). Common property resources are situations where many users can exploit and pump the water. No one single party or group owns or controls the resource and users will utilize the common pool resource on a first-come, first-use basis to their own individual betterment, but often to the ruin of the commons (Hardin, 1968). For the protection of the commons, restrictions are often developed to regulate access and allocate the resource across the commons. The Edwards Aquifer creates both situations in that it is an underground water system, private property, and at the same time common property with multiple users.

Putnam and Peterson (2003) listed the multiple users into clusters of eight broad based groups of stakeholders that crossed local, regional, state, and federal levels: environmentalists, industry and developers, farmers and irrigators, citizen activists, governmental officials and policy makers, water agencies, judicial authorities, and media (see Table 1.2).

Table 1.1 Key Agencies and Stakeholders Involved in the Edwards Aquifer Dispute 1983-1997 (Putnam and Peterson, 2003, p. 120)			
Local Organizations	Regional Organizations	State Organizations	Federal Organizations
San Antonio Water System (SAWS)	Edwards Underground Water District	Texas Legislature	U.S. Fish and Wildlife Service
Living Waters Artesian Springs LTD.	Edwards Aquifer Authority	Texas Natural Resources Conservation Commission	U.S. Secretary of Interior
Barton Springs Water District	The Guadalupe Blanco River Authority	Texas Farm Bureau	U.S. Department of Agriculture
Bexar Metropolitan Water District		Texas Water Commission	U.S. Fifth Circuit Court of Appeals
Medina-Uvalde Water District		Texas Supreme Court	U.S. Justice Department
		Texas Water Development Board	U.S. Department of Defense
		Texas Justice Foundation	U.S. Geological Survey

Edwards Aquifer Physical Boundaries

The Edwards Aquifer is divided into three sections that stretch from north of the City of Austin in Williamson County, to south of the City of Austin along the Balcones Escarpment Fault, located roughly along IH-35, to San Antonio, and then west. In

Putnam and Peterson’s research (2003) as well as in this proposed study the focus will be on the San Antonio Section of the Edwards Aquifer. This section of the Edwards is the southern portion of the aquifer that begins in Hays County between the Buda–Kyle city limits which extends south to San Antonio and west about 100 miles through Medina, Uvalde, and Kinney Counties. As Figure 1.1 illustrates, the EA has boundaries that are well-defined, occurring in a band which is five to 30 miles wide and stretches 176 miles through portions of six counties (Harden, 1986).

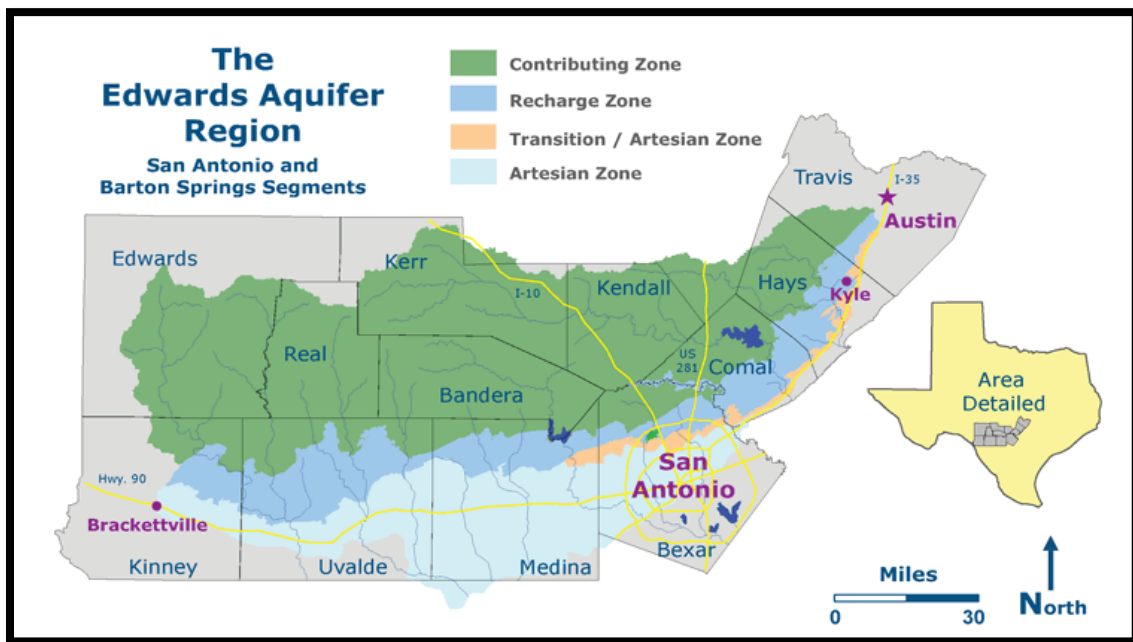


Figure 1.1: The Edwards Aquifer San Antonio and Barton Springs Section. Adapted from Gregg A. Eckhardt, 2013

The large EA is continually replenished with rapid “recharge” from the Hill Country of south central Texas and contains, on average, about 40 million-acre feet of recoverable water, or about 10 percent of total estimated volume of water contained in the aquifer. Water disappears, reappears as some water remains to contribute as surface flow, and some disappears again to flow down into the aquifer through fissures, faults,

and crevices in the karst limestone features that crisscross the Hill Country termed the “recharge zone” (Votteler, 1998). Votteler describes the pressure levels of the confined water in the EA as highly responsive to rainfall and drought. In the drought of record in the 1950s, water decline due to over pumping caused the aquifer level to drop and, in the case of Comal Springs, to stop flowing for an extended period of around 144 days (1998).

Approximately 75 percent of the recharge is considered in situ from its extensive network of faults and fractures. The remainder, approximately 25 percent, is from stream transition seepage where the stream cross the recharge zones. From 1934 to 1997 the average recharge to the aquifer was 676,000 acre-feet per year, while annual pumping from the aquifer averaged close to 500,000 acre-feet (Harden, 1986; USGS, 1998). The result is that in years of major drought pumping for irrigation often exceeded recharge (Votteler, 1998). The period 1950 to 1980 irrigators were the fastest-growing users of the EA in volume increase of water withdrawn (Votteler, 1998). West Texas irrigators implemented significant improvements in irrigation techniques, but the region still experienced a steady increase in the number of wells dug and overall consumption from the aquifer increased until as recently as 1996 (TWDB, 1996). In addition, urban area growth during the late 1990s for municipalities included military bases, shopping malls, and housing developments in both the Cities of San Antonio and Austin areas. Growth in these urban areas affected both the quantity of pumping, particularly during drought, as well as the quality of water. To complicate matters in the southern portion of the EA lie a boundary that separates usable groundwater from highly saline water of the Edwards that forms what has been termed a “bad water line.” During times of extreme drought there is

evidence that the higher withdrawal rates would lead to an intrusion of bad water into the freshwater zone and degrade the water quality (Perez, 1986; Votteler, 1998).

Underlying the four key issues Putnam and Peterson identified were five key events that caused a crisis over the management of the EA: (1) the demise of the Edwards Aquifer Water District; (2) mediation and threat of federal intervention over allocation disputes of the EA; (3) the declaration of the EA as an underground river that made the EA subject to state regulation; (4) the entrance of environmental groups to support and defend endangered species found in and around the EA, and the establishment of the Edwards Aquifer Authority (EAA), and; (5) the actions of the EAA from 1997-2000 (2003, 120, Votteler, 1998, 65-77; Wolff, 1997, 369-395).

In Putnam and Peterson (2003, 117) the authors further describe management of the Edwards Aquifer that provides an excellent example of how competition among multiple users of a limited, renewable, common-pool resource generates fierce and protracted disputes within and between communities (Blomquist, 1992; Ostrom, 1990; Ostrom, Gardner, and Walker, 1994). The major focus of Putnam and Peterson's study spans the years of 1980 to 1997 when feuds between private property rights and protection of the common good powered decades of disagreements and lawsuits about the management of this finite water resource. The goal of this research is a continuation of Putnam and Peterson study ending in 1997, the year the Edwards Aquifer Authority was granted authority by the State of Texas to govern the use, quality, and best allocation of this natural, common-pool resource.

Purpose and Objectives

The purpose of this study was twofold. First, Putnam and Peterson's original case study was revisited to re-evaluate the nature of the conflict since that time and to re-examine and reframe any lingering unsolved arguments by the original stakeholders included in the 1980-1997 conflict. Secondly, this research sought to discover the extent to which new conflicts (1998 to present) have arisen from today's stakeholder groups, as well as assessing the intensity of newer conflict compared to the 1980-1997 period of legal turbulence. The third purpose of this study was to analyze the transcribed text data from interviews from a sample of diverse stakeholder groups, to determine if disputants within the same group did or did not rely on a similar repertoire for making sense of what has evolved over time. For example, many disputants in Putnam and Peterson's (2003) previous study traversed their traditional groups by using repertoires that resembled ones used by members of other stakeholder groups. A number of government agency officials and elected officials relied on the same repertoire and, therefore, were grouped together (thus, emphasizing positive identity and positive characterization of others). Brummans *et al.* (2008, 45) points out that while "reframing" (Putnam and Holmer, 1992) is often presented as an important activity for mediating intractable disputes, mediation is likely to fail if third parties are unaware of the subtle framing processes that unite certain disputants. Thus, this research employed the concept of "framing" to shape, organize, and focus on new agendas generated by today's stakeholders. This research stayed mindful as to similarities between groups for "reframing" of the issue for a better understanding toward the future direction of EA use and management.

Research Questions

The questions that guided this research were as follows:

1. After revisiting the 1980-97 intractable conflict, as presented by Putnam and Peterson (2003), to what extent did issues and disagreements still remain surrounding the original 1980-97 intractable conflict?
2. What has changed since the 1980-97 period of “intractable conflict,” as defined by Putnam and Peterson in the way of new legislation, regulations, management, and use of the Edwards Aquifer?
3. After instituting new measures from 1997 on, what new conflicts have come to the forefront, and how should they be “framed?”
4. Is the future of the Edwards Aquifer as a valuable natural resource likely to continue to be an “intractable conflict?”

General Hypothesis Guiding This Research

Through this study, the objective was to seek and provide evidence for the hypothesis that, the permitting, allocation of water rights, and police actions of the Edwards Aquifer Authority since 1997 have enabled the eight primary stakeholder groups to better achieve consensus. This fact was the result of improved management of the EA for the allocation, mode of delivery, and best practices for protecting the quality of the Edwards Aquifer water for downstream, upstream and environmental concerns. Present-day evidence suggests that the intractability of the multiple stakeholder group disagreements has “smoothed” and subsided. The logic that reinforced this hypothesis recognized the ever-present threat of federal intervention through draconian measures to take over the direct management of the EA to limit pumping and use, as well as, protecting the quality of EA water in times of drought. Furthermore, the threat of federal

intervention created the driving force and loomed over stakeholders' responsibilities in reaching consensus and smoothing the intractability of this environmental conflict.

Before investigating and answering the research questions that guided this study (Chapter I), the background and history of Texas water law pertaining to both surface and groundwater is presented in Chapter II. This chapter concludes by narrowing the background discussion to focus on the Edwards Aquifer and the issues surrounding this valuable life-providing resource over the last 60-plus years. Chapter II also addresses the first two study questions by examining what has changed since Putnam and Peterson's (2003) study of the original "intractable" conflict from 1980 to 1997. Chapter II also provides a general discussion of the Edwards Aquifer Authority (EAA) and its management from 1997 to 2000, in addition to, what has stayed the same, and what has changed since 1997. Chapter III provides general background of Texas' unique climate patterns, and history of prior drought occurrences throughout the state—occurrences which have increased in severity and set the stage for surface and groundwater legislation, policy and management. Chapter III ends by focusing on how legislation, regulation, and litigation has impacted the EAA since its inception, and discusses what has changed in these matters over time, especially since the establishment of the Edwards Aquifer Habitat Conservation Plan (EAHCP). Chapter IV discusses the research design for this study which is primarily qualitative in nature employing "Interactional Frame Theory" for informing and guiding the text data analysis from a sample of diverse stakeholders. This research design was inspired by Putnam and Peterson's original study, and builds on their conclusions. These researchers also utilized frame theory in the analysis of environmental conflict from 1980 to 1997. By way of explaining what frame

theory is, Chapter IV also provides a definition of “frame theory,” its nature, development, and application in similar research. The literature review of “Interactional Frame Theory” discusses how “characterization” and “identity” framing is determined, and provides an explanation of how it is applied to analyze the evolution of conflict surrounding the Edwards Aquifer. Chapter V describes the rationale for compiling a sample of 30 key stakeholders for interview selection, as well as, how the interview protocol was developed. This chapter also provides a description of the software used for analysis of interviews, NVivo11, and its general process for coding key words and phrases for understanding present-day conflict issues, as well as, how it provides a “constant comparative analysis” for the two time periods. Chapter VI further discusses identity frame theory, characterization frame theory, conflict frame theory, and discusses results from the analysis of stakeholders’ interviews. The results focus on issues of intractability and conflict framing of the Edwards Aquifer in 2014, and provides answers to Question #3 posed in the Introduction. Chapter VII reviews conclusions and provides insight into the final question posed that, in the future, will conflicts surrounding the Edwards Aquifer’s use and management remain “intractable?”

II. TEXAS WATER BACKGROUND

Introduction

Texas water law has proven to be a contentious and grudgingly stubborn struggle as recorded throughout Texas history books and court records. Ronald A. Kaiser, J.D., in the *Hand Book of Texas Law: Problems and Needs* (1986) explains that stakeholder participants forming these multiparty stakeholder groups might include foreign nations, the federal government, other states, state agencies, municipalities, environmentalists, agricultural, and urban parties. Conflict over water use has been staged in diverse locations: at the nation's capital in the halls of Congress, boardrooms, courtrooms, the state capitol, at watering holes, and at well sites. Litigation on Texas water law continues unabated guided by the skeletons of the past from Spanish, Mexican, and English laws with their resolutions shaped by the unique history of Texas. Water law will continue to evolve as conditions of society, politics, population, economics, environment, and drought influence the water resource needs of the state (Kaiser, 1986, 17).

Solutions are undertaken in accordance with state water policy, interstate compacts, international treaties, federal, state, and local law, established water institutions, physical and economic conditions, as well as public opinion, preferences, and choices. Fundamental considerations governing water use include: 1) the distinctly different types of ownership relative to ground and surface water, 2) the responsibility to protect water quality, and 3) the local, state, and federal agencies having jurisdiction in these areas of water management (Kaiser, 1986, 5).

Kaiser (1986, 6) points out that Texas law recognizes four distinct classes of water:

1. Natural surface water,
2. Diffused surface water,
3. Percolating groundwater,
4. Underground streams.

In Texas, depending on the type of “container” that holds water determines how the law applies. For example, some water laws in Texas have remained unchanged, while other water laws have been and are still being argued and modified in the legislature and courts. For instance, surface water in an established watercourse is owned by the state. However, a private property owner not only retains the right to capture and use diffused surface water flowing over their property, but also has the right to pump groundwater underneath their property. The challenge for Texas is to provide a legal system that deals with competing claims for water as a common resource on the one hand, while on the other hand attempting to address private interests and resistance to government regulation over an individuals’ property rights (Kaiser, 1986).

There are two basic legal doctrines of surface water law recognized in Texas today – riparian doctrine, and the prior appropriation doctrine (Kaiser, 1986, 17). Prior to independence of the Republic of Texas in 1836, Spanish law defined, granted, and allocated water rights. Under Spanish and Mexican law, all natural resources belonged to the sovereign, including water in a natural watercourse. A landowner did not have the right to use surface water unless his land grant specifically provided for its usage (Dobkins, 1959). Soon after Texas won independence from Mexico in 1836, the legal community of the republic became increasingly Anglicized. In 1840, the Republic of

Texas adopted English common law if it did not deviate too far from the Texas constitution or statutes. Thus, state courts began to apply the common-law doctrine of riparian rights (Melvin and Mason, 2012).

Riparian Water Rights

Riparian water rights work best in humid regions with an abundance of precipitation and streamflow such as the eastern United States, east Texas, or even the United Kingdom. However, in areas that receive an average of 30 inches or less of rain per year. Application of English riparian rights, which includes Texas and the West, has proven difficult. From the 1856 case of *Haas v. Choussard*, [17 Tex. 588] where the Texas Supreme Court first recognized riparian water rights, *Kent's Commentaries* illustrates a classic statement first enunciated in the English doctrine of riparian rights in the following statement:

Every proprietor of lands on the banks of a river has naturally an equal right to use of water which flow in the stream adjacent to his lands, as it was wont to run, (*currere solebat*,) without diminution or alteration. No proprietor has a right to use the water to the prejudice of other proprietors above or below him, unless he has a prior right to divert it, or a title to some exclusive enjoyment. He has no property in the water itself, but a simple usufruct while it passes along. *Aqua currit et debet currere* is the language of the law [Water runs and ought to run as it has used to run]. Though he may use the water while it runs over his land, he cannot unreasonably detain it, or give it another direction, and he must return it to its ordinary channel, when it leaves his estate. Without the consent of the adjoining proprietors, he cannot divert or diminish the quantity of water which would otherwise descend to the proprietors below, nor throw the water back upon the proprietors above, without a grant or an uninterrupted enjoyment of twenty years, which is evidence of it (*Haas* as quoted in *Kent's Commentaries*, 589-590).

This holding set the stage for creating a dual system of water rights that prevailed in Texas until the adoption of the Water Rights Adjudication Act of 1967. Melvin and

Mason (2012) point out that a strict application of the riparian doctrine prevented the diversion of even moderate quantities of water for irrigation, because it prohibited the diminution or alteration of streamflow and the use of water on non-riparian lands. For years the Texas Supreme Court struggled with how to apply the riparian rights doctrine to the diversion of water for irrigation purposes, while encouraging the legislature to adopt law and policy concerning the use of water in areas of the state in which irrigation was needed to produce crops.

Appropriative Rights Doctrine

The Texas Legislature did adopt legislation in 1889 and 1895 regarding the use of water for irrigation. The 1889 and 1895 Irrigation Acts added the appropriative system of acquiring water rights to the riparian and Spanish law systems already in place (Melvin and Mason, 2012). Both bills encouraged irrigation, and provided for the acquisition of the right to the use of water. In addition, the acts called for the construction and maintenance of canals, ditches, flumes, and reservoirs as well as wells for irrigation, including mining, milling, and stock raising in the arid districts of Texas (LRLT, 2013).

Originally developed in the U.S. by miners in California, the Appropriative Rights Doctrine specifies that the first person to divert a specific quantity of water from a source of supply and put it to beneficial use at a definite place have the right to use that water when it is available as against all others. Thus, the classic statement of the appropriative rights doctrine is: "First in time, is first in right." Many of the problems associated with the application of the doctrine of riparian rights in arid areas as applied to irrigation, were solved through the application of the doctrine of appropriative rights in the arid West. As long as water use was deemed beneficial, a water user could count on continued

diversions of large quantities of water as being deemed permissible. Water could be used off of riparian land; therefore, all lands to which water could be transported could be irrigated. Because of this fact it is not surprising that the appropriative rights doctrine came to be recognized in all of the western states as governing the diversion of water for all purposes (Trelease, 1954, 27-29). Also known as *prior appropriation* doctrine, (Kaiser, 1986) the appropriative rights doctrine is controlled by statute. Applied to the western states, prior appropriation is not related to land ownership, but instead water rights are acquired through compliance with statutory requirements.

Evolution of Water Rights in the West

Western states failed to control rivers and streams in their early development, thus, water in the watercourses were treated as if it belonged to no one. Without any rules to govern the use and ownership of water, people took what they needed from the watercourse and used it, or in other words, they *appropriated* the water. This practice eventually was legalized through the state's legislature and courts and became known as the "Doctrine of Prior Appropriation" (Kaiser, 1986).

Texas water law categorizes surface water into one of two general types: diffuse surface water and water in a natural watercourse. Diffuse surface water belongs to the landowner until it reaches a natural watercourse at which time it becomes property of the sovereign, and the right to use it must be granted by the sovereign. The following section deals with water that has reached a natural watercourse (Melvin and Mason, 2012).

In Texas, there are three unrelated movements that resulted in the historical antecedents of the doctrine. First, Spanish law defined water rights prior to Texas independence in 1836. Melvin and Mason (2012) discuss that under Spanish and

Mexican law, water in a natural watercourse belonged to the sovereign. Unless specifically allowed under their land grant, a landowner did not have rights to use the water (Dobkins, 1959). These facts led to the Spanish influence in the Southwest whereby early settlers introduced the *acequia system*. *Acequias* were community-controlled water ditches that supplied water to the settlement. This system required community participation to keep the acequia system operating properly thus binding the community into social units. An appointed ditch master, called the *mayordomo*, was assigned to regulate the use of water and assign duties to maintain ditch operation. *Acequias* were the forerunner of governmental control over water, with rights of use dispensed by a public permit (Kaiser, 1986, 18).

The second event that influenced current water law was the migration in 1847 of Mormon pioneers, led by Brigham Young, to the Great Basin of Utah (these were the first settlers to use large-scale water irrigation in the West). In that desert region irrigation was, and is, essential for growing crops. Because these were religious colonies, the Church of Jesus Christ of Latter-day Saints dictated the water rights in the region. The church established the principle that settlers who first made beneficial use of the water were entitled to preference for the water over those who came later, and this distinction is eventually sanctioned by the Utah Legislature and courts (Kaiser, 1986).

The third event to influence water rights in the West was the California Gold Rush in 1849 as miners diverted water away from natural watercourses to wash away soil that covered the gold they were mining. In 1872 the California Legislature passed many of the appropriative practices that were initiated in the mining camps (Kaiser, 1986).

Riparian water law was the primary measure of water rights in Texas until 1889. Legal difficulties began to occur due to the problems associated with irrigation issues in the dryer sections of the state. Droughts in the late 1880s and early 1890s halted the expansion of agriculture in the dryer sections of Texas. The Texas Legislature sought relief by reviewing the methods of water allocation practiced in neighboring states as well as searching for antecedents of its Spanish law for solutions. Based on the experience of adjacent states in the use of the prior appropriation doctrine, Texas began to refine and adopt the laws of these states into their own prior appropriation doctrine through a series of statutes in 1889, 1893, and 1895. In 1904 a constitutional amendment was adopted authorizing the first public development of water resources. The Doctrine of Prior Appropriation was extended by the 1913 act to the entire state and required every person who had constructed diversion works to file a description of those works with the county clerk, and a certified copy of that document with the Board of Water Engineers. The Board of Water Engineers were authorized to supervise the acquisition of appropriative water rights and other water matters of statewide importance. The “conservation amendment” of the Texas Constitution was passed in 1917 giving the Board of Engineers the power to adjudicate, i.e., to determine the scope of all existing water rights, and the power to administer the use of those water rights., establishing the state’s right to regulate and conserve natural resources, including water. However, the Texas Supreme Court struck down the adjudication provision of the 1917 Act in 1921 on the grounds that it gave an executive agency the power to adjudicate private property rights, a judicial function (Melvin and Mason, 2012). Through these actions the

legislature extended the doctrine to the state and evolved its application through several legislative enactments into the Texas Water Code (Kaiser, 1986).

Over the years there have been numerous battles between court-created riparian water rights and legislatively created appropriative rights. It became increasingly complicated to determine the extent of water claims on Texas streams and to keep track of water rights because of the nature of riparian water rights. In 1967 with the passage of the “Water Rights Adjudication Act,” the Texas Legislature merged the systems of riparian water rights and prior appropriation. Any person claiming a riparian water right was required by the act to file a claim for the water right by 1969 with the Texas Water Commission (today known as the Texas Commission on Environmental Quality). Because of this requirement, 11,500 claims were filed by 1969 with the commission, whereas, prior to this date, none existed. Because of passage of the 1967 act, Texas consolidated the allocation of surface water into a unified water permit system. Today, all rivers in Texas have certificates filed for the surface water that flows through them (Kaiser, 1986, 19).

Texas Drought History

The primary message of the 2012 State Water Plan for Texas is: “In serious drought conditions, Texas does not and will not have enough water to meet the needs of its people, its businesses, and its agricultural enterprises” (TWDB, 2012, iii). As an example, in 2011 the state experienced what John Nielsen-Gammon has described as the worst one-year drought since weather records have been taken in Texas. According to Nielsen-Gammon, Professor of Atmospheric Sciences at Texas A & M and Texas’ State Climatologist, in his article titled *Winter Outlook for Texas Drought: Limber Up Those*

Fingers-September 28, 2012, drought conditions were affecting almost 80 percent of the state, with at least 50 percent experiencing drought conditions since December 2010. It was feared that the current drought conditions could last for five to ten years, well into 2020 (1). At the time of this statement, the climatic patterns underlying this warning related to the Pacific Decadal Oscillation (PDO) which, at the time remained strongly negative; meaning that temperatures were tending to run cool in the tropics and warmer at higher latitudes. The Atlantic Multidecadal Oscillation (AMO) was still strongly positive, meaning that temperatures were tending to run warm in the North Atlantic. The last time large-scale conditions were equivalent was during the 1950s during the period for the drought of record for Texas (Texas Water, 2013).

The relatively short instrumental climatic record prevents appropriate statistical and historical characterization of extreme weather events such as the extent, duration, and severity of multiyear droughts. The further back in time one looks the less information is available. The best solution is to extend climatic records through well-understood proxies of climate. The use of climate-sensitive annual tree rings is a critical proxy of climate extension because they can be dated precisely to the year, are easy to sample, and are widely distributed throughout a region. Cleaveland *et al.* (2011) created three bald cypress chronologies for South Central Texas along with existing Douglas-fir chronologies from West Texas along with a composite post oak chronology in Central Texas. With these chronologies Cleaveland was able to calibrate the period 1931-2008 and reconstruct the June Palmer Drought Severity Index (PDSI) in Texas climate divisions 5 (Trans Pecos), 6 (Edwards Plateau), 7 (South Central), and 8 (Upper Coast)

1500-2008. The authors validated the reconstructions against observed data not used in calibration (Cleaveland *et al.*, 2011, 54).

Water planners in Texas use the drought of record to benchmark a period in time when they expect water supplies to be at their minimum flows for both surface and groundwater. Tree ring studies indicate that the drought of record used in Texas for the period 1948 to 1956 may not be the worst-case scenario and demonstrate accurately that there are a number of times over the past 500 years where there are several periods of extended drought that were longer and/or more intense than the 1950s drought. Indeed, indications are that the extended droughts are more the norm than the exception and have been a consistent feature of the southwestern climate since the 800s, including at least four mega-droughts for periods of 15- to 30-years long centered in central or northern Mexico (Stahle *et al.*, 2009; 2011b). Several studies indicate that severe decadal-scale droughts have occurred in Texas at least once a century since the 1500s, and that the current use of the drought of record for the 1950s by water planners as a worst-case scenario probably is inadequate. Taking into account past drought events over hundreds of years, expansive population growth, and unknown climate change, the probability is high that the future provides for unprecedented challenges for water management in Texas, especially during drought (Cleaveland, 2011, 54).

Water for Texas Planning

Every five years since 1961 the State of Texas has required a water plan to allocate resources in anticipation of drought and increased population growth. The *Water for Texas 2012* state water plan, the ninth such plan compiled by the Texas Water Development Board (TWDB) starts at the regional level with 16 regional water planning

groups identifying water needs and recommending water management strategies to meet regional needs (Figure 4.1). The groups represented in the regional plans are the public, counties, agriculture, industry, environment, municipalities, small businesses, water districts, river authorities, water utilities, groundwater management areas and electricity-generating utilities. Each planning group adopts its respective regional water plan and it is then sent to the TWDB for approval. The TWDB develops the state water plan based on information from the regional water plans and other sources. Once the plan is finalized it is submitted for approval to the Governor, the Lieutenant Governor, and the Texas Legislature (TWDB, 2013).

In addition to incorporating the regional water plans, the state water plans serve as a guide to develop policy and includes legislative recommendations that the Board believes is needed and desirable to facilitate voluntary water transfers. The plan also identifies river and stream segments of unique ecological value and sites especially adaptable for the construction of reservoirs that the Board recommends based on the five-year regional plans (TWDB, 2013).

Not meeting water supply needs may well result in annual economic losses of approximately \$11.9 billion. As current drought conditions approach the drought of record and extended out through 2060 economic losses could be as much as \$115.7 billion annually, with over a million lost jobs (Water Plan, 2012).

Groundwater Background

The study of groundwater hydrology began through the construction of civil works in the nineteenth-century with the development of roads, urban expansion, and railroads. By 1900, writes Craig Colten (1998) in his article *Industrial Topography*,

Groundwater, and the Contours of Environmental Knowledge, the systems were somewhat refined, and Cosgrove (1990, 5) adds, “understanding the modern metaphor of a hydrological cycle and the significance of aquifers and groundwater were preconditions for large-scale environmental engineering of the modern world”. LeGrand (1990) and Hart (1995) point out that engineers (i.e. Corp of Engineers), hydrologists, and other water management made significant contributions to the study of hydrology before the 1970s, and contradicts the popular belief that their solutions “were often inept and piecemeal” (Sheail 1982, 406). By the 1940s and 1950s Colten (1991) suggests there was a substantial amount of literature on groundwater processes available.

Hydrologists and engineers began to build on a firm understanding of the basic theoretical physics of fluid movement through porous media over the last two hundred years. Sheng (2005) writes that artificial recharge of groundwater (alluvial and karst) has been utilized globally for over fifty years as an integrated water resource management mechanism, while the aquifer storage and recovery (ASR) concept has seen prominent exploration for application during the last twenty years (ASCE, 2001; Bouwer, 2002; Dillon, 2002; Johnson and Pyne, 1994). Zektser, *et al.* (2005) states that groundwater overdraft, or mining, “develops when long-term groundwater extraction exceeds aquifer recharge.” When groundwater overdraft occurs aquifer levels and volume decrease, and head pressure is reduced. Overdraft declines in surface-water levels and stream flow often occurs in conjunction with reduction and possible elimination of vegetation, land subsidence, and seawater intrusion into fresh water aquifers are well documented in many aquifers of the southwestern United States. Zektser, *et al.* 's (2005) work is a review of case studies for groundwater overdraft in this region with a focus on the causes of

groundwater mining, effects of aquifer overdraft, and mitigation methods applied to reverse the trend.

Asano and Cotruvo (2004) provide a discussion of groundwater recharge and its management with special reference to health and regulatory aspects of groundwater recharge with reclaimed municipal wastewater. The authors suggest that problems related to population growth and expansion of urban areas put severe stress on the water supply. Pollution of surface waters and groundwater, varied distribution of water resource, and climate change with extreme variations in drought and deluge represent serious contemporary issues affecting municipalities, industry, agriculture, and the environment worldwide. Asano and Cotruvo discuss the proposed State of California criteria for groundwater recharge as an example of a conservative approach to ASR. The authors also summarize the “methodology used in developing the World Health Organization’s *Guidelines for Drinking Water Quality* to illustrate how numerical guideline values are generated for contaminants that may be applicable to groundwater recharge” (Asano and Cotruvo, 2004, 1941).

Texas Groundwater

In Texas groundwater is a significant source of water for Texas as it is the source of 60 percent of all water supplied and approximately 85 percent of all water used in agriculture (Kaiser, 1986; Water for Texas, 2012). Groundwater rules and legislation development contrasts significantly with surface water because of economic accessibility of the resource, such as digging a well, as opposed to, the cost of drawing water from a reservoir, or another watercourse. In terms of legal development, Brown (2006) argues groundwater is a latecomer. The first judicial decision in Texas occurred in 1904 and the

first legislative action occurred in the 1913 Water Code. In comparison, Texas surface water law as we know it today began with the Spaniards settlement in the early 1700s, and legislative action since the time of Texas independence in 1836. Brown goes on to write, however, that as slow as initial groundwater legislation occurred, in contemporary times the amount of legislative action has substantially increased.

The critical issue in dealing with Texas groundwater is the unresolved question of who owns groundwater. The courts have consistently avoided opportunities to definitively address the issue (Brown, 2006, 14). In terms of groundwater, Texas follows what is known as the “rule of capture.” Texas stands alone from the other states in the United States, which follow rules such as correlative rights and the “American” rule of “reasonable use” with respect to groundwater (Hutchins, 1971; Brown, 2006). The rule of capture is also known commonly as the “law of the biggest pump.” The practical effect of Texas groundwater law is that one landowner can dry up an adjoining landowner’s well and the landowner with the dry well is without a legal remedy (Kaiser, 1986, 32). This principle was reaffirmed as recently as 1999 by the Sipriano decision in which the court refused to award damages to a person whose wells went dry due to his neighbors’ groundwater use. Many would say that Texas’ rule of capture is antiquated and unfair. Under Texas law, groundwater is privately owned, not owned by the state. Individual local groundwater conservation districts regulate groundwater, whereas surface water is regulated by the Texas Commission on Environmental Quality (TCEQ) (Melvin and Mason, 2012).

The Texas Supreme Court over the years has declined to make changes, deferring to the Legislature. The State Legislature has only in recent decades begun to make rules

placing limits on pumping groundwater but emphasizes that groundwater conservation districts are the preferred method of regulation for groundwater. On February 24, 2012, in the Day decision, the Texas Supreme Court issued a new opinion that better defines private property rights for groundwater, but still leaves several open questions that need to be resolved (Melvin and Mason, 2012).

Kaiser (1986, 31) describes water found below the Earth's surface in the interstices of soil and rock as percolating water, or more commonly groundwater. In most cases, except as in limestone formations, groundwater does not flow in underground rivers nor is it contained in underground lakes as is sometimes believed. Instead it slowly moves via gravity and resistance, and is usually filtered through porous and permeable subterranean geologic formations termed aquifers.

Groundwater is often thought of as separate from surface water, and that groundwater is not affected by water flowing above ground; however, the two are naturally linked together and are interrelated. Groundwater seeps provide springs and surface streams with their flow, and surface water recharges the groundwater aquifers through gravity flow pulling the water through faults, fractures, and fissures from the surface (Kaiser, 1986).

Although science and hydrologists have long ago abandoned the "separation myth," legislators and the courts continue to treat groundwater separate from and somehow unrelated to surface water flows. Figure 2.1 illustrates how complex surface water and groundwater and the obviously complex interconnection of surface tributaries and aquifers intermingle through drainage of the various watersheds. According to Kaiser, this myth "has been a major hurdle in the development of an integrated and

conjunctive body of water law for Texas” (1986, 31). Texas groundwater law is judge-made law, derived from the English common law rule of "absolute ownership."

Groundwater belongs to the owners of the land above it and may be used or sold as private property. Texas courts have adopted, and the legislature has failed to modify, the common-law rule that a landowner has a right to take for use or sale all the water that he can capture from below his land (Texas Water, 2013).

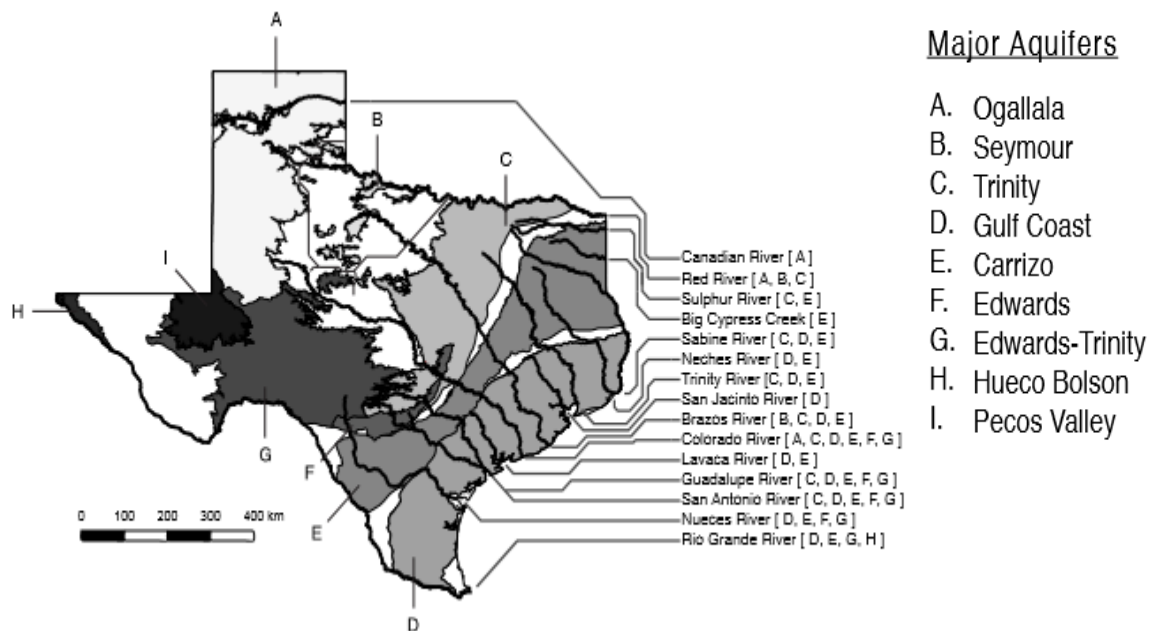


Figure 2.1 – Major Aquifer and Rivers of Texas. Created by Sam R Massey, Independent GIS, October 2016.

Bloome, *et al.* (2008) provides research results of a five-year USGS project, funded primarily by the National Cooperative Geologic Mapping Program (NCGMP) in partnership with federal, state, and municipal agencies to conduct geologic mapping, hydrologic studies, and geophysical surveys of the Edwards and southern Trinity aquifers in south-central Texas. The study was:

[a] multidisciplinary effort has successfully produced results to help characterize the geohydrologic framework of two critically important ground-water systems: (1) the Edwards Aquifer extending from south of Austin to west of San Antonio and (2) the southern fringe of the Trinity Aquifer in the Texas Hill Country west and south of Austin. Digital geologic map compilations and subsurface well data have provided the foundations for constructing 3-D EarthVision™ geologic models of the Edwards's Aquifer recharge and catchment areas.

Edwards Aquifer – Physical Boundaries

The Edwards Aquifer stretches from Brackettville in Kinney County, east to San Antonio in Bexar County, and north through the City of Austin in Travis County to Mills County northwest of Salado (Figure 2.2). It consists of three segments: the northern segment, the Barton Springs segment, and the southern or San Antonio segment. The boundaries of the northern segment are Mills County northwest of Salado and Austin to the south. The Barton Springs segment is the center segment, bounded by Austin to the north and the City of Kyle in Hays County to the south. The southern or San Antonio segment (hereinafter referred to as the Edwards Aquifer) stretches about 200 miles from Brackettville, east to San Antonio, and north to Kyle. The Edwards Aquifer shown in Figure 2.3 is one of the most permeable and productive carbonate aquifers in the United States (U.S. Geological Survey 1997, 1). It is a complexly faulted karst groundwater formation (Figure 2.4) encompassing a contributing zone of 4,400 square miles, recharge zone of 1,500 square miles, and confined zone of 2,100 square miles, totaling some 8,100 square miles (Edwards Aquifer Authority, 2013).

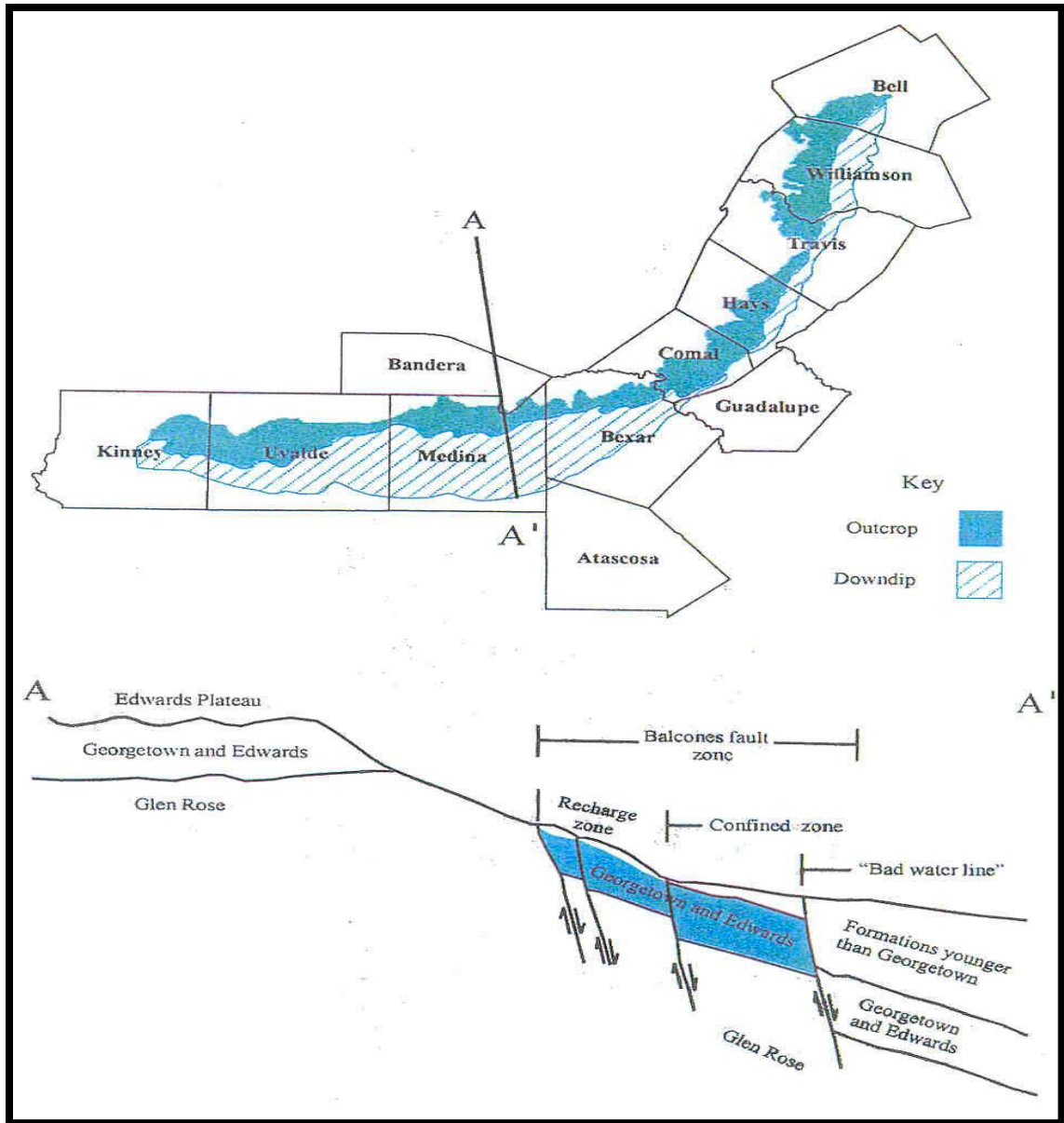


Figure 2.2. The Edwards (Balcones Fault Zone) Aquifer. Adapted from Ashworth and Hopkins, 1995

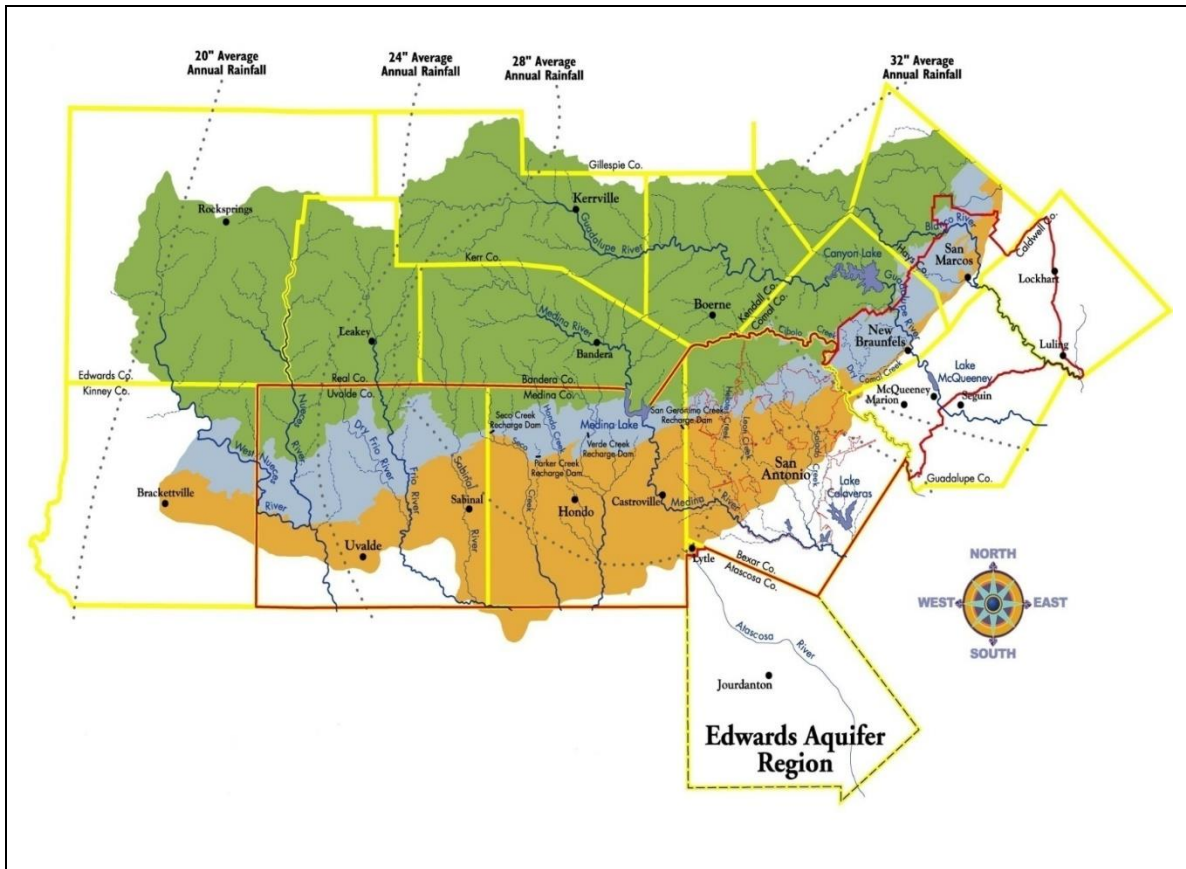


Figure 2.3. The Edwards Aquifer Region. Edwards Aquifer Authority, 2016

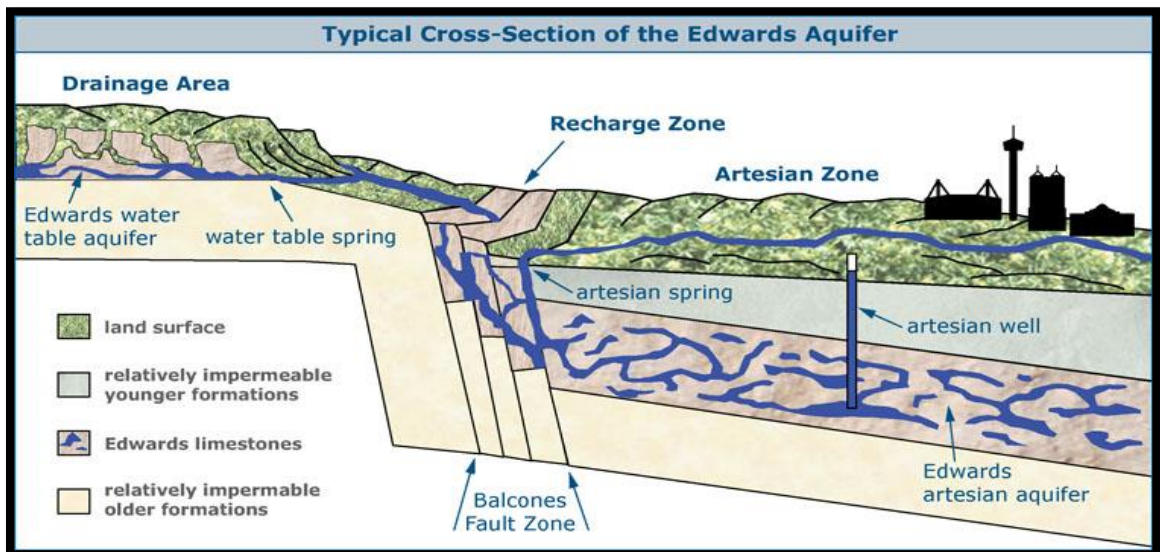


Figure 2.4. Typical Cross-Section of the Edwards Aquifer. Adapted from Gregg A. Eckhardt, 2013

The Edwards Aquifer is the primary public water supply for more than two million people in south central Texas and services domestic, agricultural, industrial, and recreational needs of the area. The San Marcos and Comal Springs are the largest remaining springs in Texas. The springs are the primary tributaries to the Guadalupe River and provide vital freshwater inflows downstream to the bays and estuaries at the Gulf of Mexico on the coastline (Gulley and Cantwell, 2013; Votteler, 2000).

Texas Water Supply

As a rural¹ state, Texas has generally had an adequate supply of water for its diverse agricultural industry. Population growth led to increases in water demand as the population grew from 5.8 million in 1930 to more than 16 million in 1985 (Kaiser, 1986, 9) to over 25 million in 2010 (Water for Texas, 2012, 2). With that population growth the thirst for water has also grown, although not nearly as much as the population by percentage. Water usage in Texas increased from about 2 million acre-feet annually in 1930 to 18 million acre-feet in 1985, and has remained steady throughout to 2010 to around 18 million acre-feet (Water for Texas, 2012, 2). However, by 2060 the population of Texas is expected to increase greater than 80 percent to around 46 million inhabitants, while water demand is expected to increase by about 22 percent to a little over 22 million acre-feet annually.

¹ Rural community means: (A) a municipality or county with a population of less than 5,000; (B) any portion of a political subdivision with a service population of less than 5,000 that is located outside the boundaries or extraterritorial jurisdiction of a municipality; or (C) a predominately residential area with a population of less than 5,000 that is located outside the corporate boundaries of a municipality (Section 15.901(5), Water Code).

Surface water supplies approximately 40 percent of the state's water needs. To save floodwaters and guarantee a more reliable supply of the state's streams have major water storage reservoirs. Most of these reservoirs were built between 1930 and 1970.

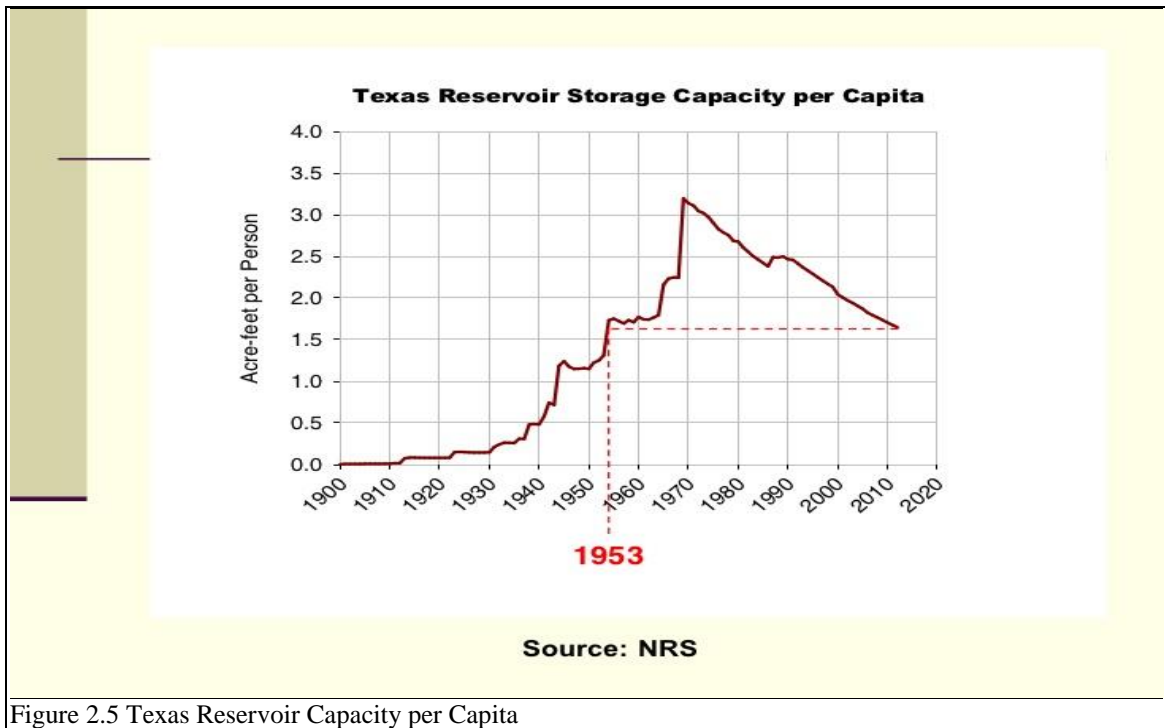


Figure 2.5 Texas Reservoir Capacity per Capita

Surface water storage via reservoirs per capita has fallen dramatically since the drought of record (Table 2.5) and the capacity in 2012 is equal to that of 1953.

Meeting residential and economic development requirements of a population that will nearly double over the next 50 years will require significant improvements in water conservation and reuse, as well as tapping new sources of water. Since additional water is unlikely to be provided by increased precipitation, the development and implementation of innovative technologies for conservation, reuse, and new supply is critical to Texas' water future. New conservation and reuse paradigms are especially important for agricultural irrigation and municipal water systems since together these consume 85

percent of the water in Texas. New supply may come from upgrading poor quality water, such as brackish groundwater [or wastewater reuse] if some of the limitations of current technologies can be overcome. The challenges in tapping new resources and the technologies that make this possible will require finding robust, scalable systems for desalination and advanced treatment that minimize operational energy consumption while avoiding excessive waste [water] streams (Reible, 2012, 5).

Edwards Aquifer Controversy

The drought of record occurred between 1948 and 1957, during which aquifer levels across the state declined to the point that many springs dried up. The Edwards Aquifer Comal Springs ceased to flow for 144 days (Votteler, 1998; Eckhardt, 2013; TWDB, 2013). Because of this crisis the Texas legislature in 1957 established the Edwards Underground Water District (EUWD). The EUWD was established with representatives from the five major counties that relied on the aquifer, but lacked authority to regulate and limit pumping, and were without the authority to require people to register their wells (Wolff, 1997). The following statements collected by Putnam and Peterson (2003, 130-131) from one environmentalist and one farmer/irrigator, respectively, appropriately frame stakeholder belief regarding the EUWD authority:

The EUWD did not have the regulatory authority that even some other groundwater districts had to be able to manage withdrawal of water from the aquifer. They had many conflicting interests—political interests in San Antonio, agricultural interests in Uvalde and Medina, and springs interests in Hays and Comal counties—and no overall mechanism to reach any conclusions about how the aquifer should be managed. So it was pretty chaotic.

My favorite description of the EUWD is The Gutless Wonder. They were out there to conserve and protect, but they had no power and no rule-making

authority. It was like a Magnavox TV—great big beautiful tube that gets a good picture, but you look behind it and there's not a whole lot in there.

The EUWD continued to operate through several more periods of drought between the years 1970 and 1984, during which the public began to consider that perhaps some regulation might be required for the aquifer. In order to conserve water instead of allowing it to flow freely downstream, the District built four small recharge dams over the aquifer. Secondly, agricultural irrigation demands increased dramatically and thus placed more demand on the aquifer. At the same time the City of San Antonio rejected a plan to purchase water from the Canyon Reservoir; and pumping from the Edwards averaged over 500,000 acre-feet per year. Thus, flows at the Comal and San Marcos Springs reached critically low levels in 1984 (Votteler, 1998; Putnam and Peterson, 2003; Eckhardt, 2013).

Because of several critical droughts (Johnson, 2012) during the 1980s, stakeholders took several measures to respond to the crisis. The City of San Antonio instituted a voluntary water-rationing plan (*San Antonio Express-News*, June 25, 1988) and Mayor Henry Cisneros along with the EUWD chair, Bobby Hasslocher, appointed a regional ad hoc task force to develop a water plan that would regulate aquifer use throughout the region (Putnam and Peterson, 2003, 131). The task force group began to develop an awareness of the Edwards limits and one member stated:

There were five of us from the City Council (San Antonio), five from the eastern interests and six from the western interest, and five people from the springs. We met once a week in the fall of 1987. It was the first of many, many negotiations as we began to consider the severity of the Edwards Aquifer issue (Putnam and Peterson, 2003, 131).

After five years of meetings in 1987, the committee reached consensus on a policy that would manage pumping from the Edwards so that annual volume of water did not exceed the average in situ recharge and stream percolation.[‡] The committee also decided to pursue development of additional water sources that the entire region would pay for including a plan for the reuse of wastewater through the development of new reservoirs and lakes (Blanchard-Boehm *et al.*, 2008; *San Antonio Light*, July 29, 1988; Wolff, 1997).

In keeping with the recommendation, The San Antonio City Council approved the regional water plan and voted to construct the Applewhite Reservoir on the Medina River in southwest Bexar County that would supplement current supplies from the Edwards Aquifer (Blanchard-Boehm *et al.*, 2008; *Austin-American Statesman*, July 24, 1988). The committee sought support from the farmers and ranchers, local and regional water agencies to come together to approve the Regional Water Management Plan (Jensen, 1988). With a split vote of eight to six, with the dissenting votes coming from all six of the western representatives, the Regional Water Management Plan was approved by the EUWD and forwarded to the Texas legislature for approval (Putnam and Peterson, 2003, 132; *San Antonio Light*, July 29, 1988; Wolff, 1997).

Although the rough draft of the plan passed with an 11 yes, zero no, two abstain vote, after five years of negotiations the Regional Water Management Plan failed to pass. “For the last year, San Antonio Mayor Cisneros had prodded the farmers in the west,

[‡] Stream percolation refers to the recharge of the Edwards from surface streams in the western part of the aquifer. Many surface streams cross over the aquifer and recharge it rather than flowing downstream (Jensen, 1988, 2).

spring flow advocates in the east, and local politicians in Bexar county” to hammer out a “delicate, technical, and intricate 212-page document” that Mayor Cisneros termed, “the finest example of consensus building,” (*San Antonio Light*, July 29, 1988) yet there was no agreement.

The farmers and the ranchers in the western counties of Uvalde and Medina began to circulate a petition to withdraw from the EUWD because they felt the Regional Water Resources Plan favored the more populated counties of Hays, Comal, and Bexar, and was costlier to the western counties, according to statements by the president of the Southwestern Property Rights Association. A state senator weighed in commenting that that the urban areas had a greater need for drought management than did the rural communities. The farmers and ranchers began to base their position on private property rights and according to a San Antonio government official and others interview responses by Putnam and Peterson (2003):

The farmers were unyielding in their belief that it is their right to pump water from underneath their own land. This “property right principle” held an almost sacred status in the western counties. We tried compromise, but it did not work and may never work.

Former governor Dolph Brisco had this to say:

I urged fellow Uvalde citizens and residents of adjoining Medina County to secede from the EUWD to protect their rights to pump unlimited amounts of water from the Edwards Aquifer for irrigation.

A consultant from San Antonio added this about the situation:

A lot of them [irrigators] see it [the aquifer] the way they see gun control—you can have my water when you peel my cold, dead hands off my pump. It’s that level of emotion.

According to the chairman of the EUWD after the western counties had secured 1000 signatures on a petition and pulled out of the EUWD in January 1989:

The eastern counties forced Uvalde farmers to raise funds to fight proposed legislation that would erase their right to drill wells on their own land and pump unlimited amounts of water from the Aquifers.

In reaction to the western counties withdrawal from participation, a coalition was formed by the City of San Antonio, the EUWD, other eastern municipalities, and the two major water agencies; Guadalupe-Blanco River Authority (GBRA), and San Antonio River Authority (SARA). The impetus was to urge the legislature to allocate groundwater as part of the Regional Water Resources Plan. The EUWD also approved a plan for regulating springflow during rainfall shortage (Putnam and Peterson, 2003).

In May 1989 the legislature reached an impasse. “Scuttled by intense infighting over a proposed Regional Water Resources Plan, the legislature adjourned without acting on an aquifer bill” (*San Antonio Light*, May 28, 1989). In frustration with the process, the lieutenant governor and the Speaker of the House established a legislative committee composed of both House and Senate members to study the aquifer (Putnam and Peterson, 2003, 133). A San Marcos/New Braunfels government official described it this way:

Yea, we made an agreement on how we’d divide the Edwards up. We made a contract and that’s the pen that I signed it with and then they [the legislature] didn’t honor it. We fought for approval of the plan, but the rural interests that dominated the legislature defeated it. No, the plan and the EUWD were destroyed. However, the farmers were right about one thing—we would be in the courts for years to come.

In June 1989 the EUWD pulled its bank deposits from the Uvalde State Bank and the conflict escalated. In response to that action the Uvalde and Medina Counties created their own underground water districts, which were later declared illegal (Wolff, 1997).

As noted by Putnam and Peterson (2003, 134) stakeholders began to polarize—pointing fingers, blaming the other parties, and escalating the conflict through heated attacks. The general manager of the EUWD “charged that San Antonio is down playing the problem in order to preserve its lucrative tourist industry and not scare away corporate relocations” (*San Antonio Light*, June 28, 1990).

Putnam and Peterson (2003, 134) notes that the media cast the conflict as a war between urban and rural factions, with the rural communities blaming the urbanites for poor planning and the urban constituents chiding the rural stakeholders as demanding, unrealistic, and refusing to compromise (*Dallas Morning News*, August 19, 1990). The media portrayed the conflict as a “fight for water rights” (*San Antonio Express-News*, June 30, 1990), “feuding interests” (*San Antonio Light*, June 28, 1990), “latest shots in the regional water battle” (*San Antonio Express-News*, June 30, 1990), and “a face off” (*San Antonio Express-News*, May 6, 1991).

Mediation and the Threat of Federal Intervention

The chairman of the Texas Water Commission (TWC) met with different stakeholders to negotiate a “miracle agreement” in an attempt to avoid drawn-out, contentious court battles (*San Antonio Express-News*, July 1, 1990). The idea proposed by the chairman was to replace the EUWD with countywide districts to be overseen by a regional board. The Joint Legislative Committee on the Edwards Aquifer hired a professional mediator after the hoped for miracle agreement negotiations resulted in a stalemate in June 1990. This action involving private discussions provided hope that a compromise among the major aquifer stakeholders by the fall and winter months of 1991 (*San Antonio Light*, March 9, 1991). These talks did create a better understanding among

the participants, but to no avail, these talks also ended in March 1991 with no agreement (Putnam and Peterson, 2003, 134).

Two critical events that occurred concurrently with the Edwards' debate were the drought during the summer of 1990 that pressed the City of San Antonio into an emergency action plan and the beginning of construction on the Applewhite Reservoir by the City Water Board that December. Both actions were major turning points during the dispute. During the voting process on May 4, 1991 the voters rejected the Applewhite project, provoking Texas' highest-ranking water official to comment, "San Antonio's decision to abandon the Applewhite reservoir has blown the city's credibility in resolving an Edward Aquifer dispute" (*San Antonio Express-News*, May 6, 1991; Putnam and Peterson, 2003, 135).

Another example of what else can go wrong, and a vivid test of "the rule of capture" approach to managing the aquifer was the case of Living Waters Artesian Springs Ltd. catfish farm that began operations southwest of San Antonio in September 1990. Its operations required pumping an estimated 40 million gallons of aquifer water per day and discharging it into the Medina River. "On an annual basis, this usage equaled approximately 25 percent of the City of San Antonio's total pumpage" (Votteler, 1998, 855). In October 1991, EUWD and the Texas Water Commission (TWC) filed suits in the state district court to shut down the catfish farm for violations of wastewater discharge regulations; and in 1992, the courts prevented the catfish farmer from resuming operations. When it seemed all was as complicated as it could possibly get, it got more complicated. In February and April 1990, respectively, the Guadalupe-Blanco River Authority and the Sierra Club delivered separate notices warning the U.S. Department of

the Interior of possible violations of the Endangered Species Act. As a final effort to achieve a compromise among the stakeholders, Austin's mayor, Bruce Todd, in October 1991 intervened to mediate negotiations. Although these efforts also failed to produce a regional solution for managing the aquifer, they created more mechanisms for negotiation and mediation in the dispute (Putnam and Peterson, 2003, 135).

Edwards Aquifer as an Underground River

In a desperate attempt to protect the spring flows and the endangered species, the Texas attorney general declared that the TWC (later to become the Texas Natural Resources Conservation Commission, and later the Texas Commission on Environmental Quality) had authority to regulate groundwater in the state. In February 1992, the TWC released a concept paper for managing the Edwards Aquifer, instituting emergency rules for drought periods, and declaring the aquifer an underground river subject to state regulation (Putnam and Peterson, 2003, 135). As might be expected this action pitted east against west, with Bexar, Uvalde, and Medina Counties joining forces to oppose the TWC strategy against Hays and Comal Counties. In the words of an Uvalde County judge "This just indicates that the people downstream are more important than the people upstream . . . I don't think this is good news for anybody" (*San Antonio Express-News*, April 16, 1992; Putnam and Peterson, 2003, 135-136).

Putnam and Peterson (2003, 136) noted that San Antonio and Austin residents were "stunned," "surprised," and "alarmed" by the actions of TWC. "Shockwaves from Wednesday's decision continue to rock the state from city hall, to Austin, to a West Texas federal judge" (*San Antonio Light*, April 17, 1992). The legality of TWC's action and its power to make this decision was being questioned, and the Texas Farm Bureau

sued to obtain a restraining order against TWC. State legislators were concerned that property might be taken without just compensation and property values would drop (*San Antonio Light*, April 17, 1992).

Uvalde and Medina Counties scheduled meetings to plan a counter offensive, vowed to raise taxes to fight a legal battle, and hired a lawyer to fight the TWC's declaration. Agriculture officials believed that a "seizure" of the Edwards represented a statewide coup to control all the natural resources. They threatened to join with San Antonio and file a suit against TWC to preserve the property rights and local economies of their communities. According to the Medina Underground Water District, "TWC's action is ridiculous. They're just grabbing straws. The end result will be lawsuits" (*San Antonio Express-News*, April 16, 1992; Putnam and Peterson, 2003, 136)."

This action brought immediate responses from the water consumers in the region. Lawmakers vowed to pass legislation reversing the TWC's takeover of the Edwards Aquifer and threatened "to force a water plan down the throats of environmentalists" (*San Antonio Express-News*, May 6, 1991). An irrigation farmer was quoted in the media as exclaiming, "I would expect action such as this from Hitler and Stalin, but not the Texas Water Commission" (*San Antonio Express-News*, May 6, 1991). The state representative and other legislative committee members "faced off against [the] TWC Chairman . . . in a raucous five-hour hearing . . . called to review the commission's takeover of the aquifer on grounds it is an underground river subject to state regulation" (*San Antonio Express-News*, May 6, 1991). To counter this opposition, the TWC held hearings in May 1992 in San Antonio, Uvalde, and Austin about its recent rulings (Putnam and Peterson, 2003, 136).

From these hearings, Putnam and Peterson (2003, 137) write, TWC struck a deal that guaranteed San Antonio rights to the Edwards while allowing the state to control the ‘underground river.’ The Medina County Underground Water Conservation District (MCUWCD) reacted by insisting that the TWC has no authority over their county’s water. As the president of MCUWCD commented, “We have filed as an intervener in the farm bureau suit as the only governmental agency authorized by the Texas legislature to conserve and regulate the use of water [in Medina County]” (*San Antonio Express-News*, August 5, 1992).

Although Medina County acknowledged that rules and regulations were needed for the aquifer, it challenged the TWC’s plan and solution. In Uvalde, a landowner and his sister, supported by the Uvalde County Water Conservation Association and the Uvalde Bar Association, filed a lawsuit in the thirty-eighth District Court challenging TWC. The battle of the lawsuits against the TWC ended in September 1992 when an Austin district court and a state court invalidated the TWC’s declaration of the Edwards as an underground river (Putnam and Peterson, 2003, 137).

Sierra Club V. Lujan

The federal government became a party in the dispute when the Sierra club filed a suit with the U.S. District Court in May 1991, claiming that the U.S. Fish and Wildlife Service (USFWS) and the Department of the Interior failed to protect the endangered species that lived in the San Marcos and Comal Springs. They alleged that the USFWS allowed over pumping of the aquifer, causing the endangered fountain darter fish to die when the springs almost went dry in 1984, 1989, and 1990. The plaintiffs requested that the court determine the minimum springflows needed to sustain the fountain darter and

implement a plan to limit aquifer pumping to guarantee that flow (*San Antonio Express-News*, November 20, 1992). When the suit went to trial in November 1992, four parties joined the side of the Sierra Club while six parties, including the City of San Antonio, united on the federal government's side. As described by a lawyer for the plaintiffs,

The case grew into a fairly large controversy with multiple parties on both sides who were probably the folks you are thinking of as the stakeholders. It was enough of a dramatic event to finally get people's attention.

On the defendant side, San Antonio claimed that the Sierra Club's demands would cost the city's economy "billions of dollars in reduced spending and thousands of lost jobs." (*San Antonio Express-News*, November 20, 1992)

On January 30, 1993, U.S. District Judge Lucius Bunton III ruled in favor of the plaintiffs and directed the U.S. Fish and Wildlife Service (USFWS) to set standards for minimum acceptable flows; the state was instructed to enact a plan to regulate pumping and guarantee springflows. San Antonio appealed this ruling to the Fifth U.S. Circuit Court of Appeals, but an appellate court dismissed this appeal, claiming the city was not directly affected by Bunton's ruling. The USFWS also appealed Bunton's ruling, but they withdrew their appeal negotiating a settlement with the Sierra Club to determine the springflow requirements for avoiding "taking" and "jeopardy" of the listed species in the Comal and San Marcos Springs (Putnam and Peterson, 2003, 138).[§]

[§] The term "take" means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect (or attempt to engage in any such conduct) of any species declared endangered or threatened. "Jeopardy" refers to threatening the continued existence of any endangered species or leading to destruction or adverse modification of the habitat of such (Endangered Species Act of 1973).

Edwards Aquifer Authority (EAA)

Throughout the Sierra Club suit, stakeholders continually challenged the establishment of a regional authority to regulate the aquifer. Although they agreed that the aquifer needed to be managed, stakeholders differed as to how regulation should occur. In 1993, after marathon bargaining sessions and pouring over dozens of pieces of legislation, a senator from Victoria spearheaded a compromise proposal in the Senate “among the feuding parties in the Edwards Aquifer war” (*San Antonio Express-News*, April 28, 1993). The agreement, however, lacked the blessing of the irrigators or the Texas Farm Bureau, as evidenced by statements from the president of the Uvalde County Underground Water Conservation Association (Putnam and Peterson, 2003, 138):

This is absolutely a violation of people’s constitutional rights to own property. (*San Antonio Express-News*, April 28, 1993)

And the Texas Farm Bureau, Public Affairs Office:

Under this plan the western counties take it in the neck. They are going to lose their water. (*San Antonio Express-News*, April 29, 1993)

Farmers would support a drought plan to limit pumping, but they opposed a permanent cap on pumping and marketing provisions for buying and selling water rights. As stated by the president of the Uvalde County Water Conservation Association, “You start buying water rights up and you are going to kill the economy” (*San Antonio Express-News*, April 29, 1993). The Natural Resources Committee of the Texas Senate voted 8 to 3 to approve the compromise bill, and the Senate approved the measure on a non-record voice vote (Putnam and Peterson, 2003, 139).

A representative from San Antonio took the Senate bill and worked with legislators to get it through the 150-member House of Representatives. It passed the

House after four hours of debate and went to a joint committee to hammer out a final agreement in a marathon session that ended at 4:30 A.M. on the Friday prior to Judge Bunton's Monday deadline. The many compromises led the Sierra Club to question the ability of the created EAA to protect the endangered species, particularly under the House version of the bill (*Austin-American Statesman*, May 25, 1993; Putnam and Peterson, 2003, 139).

The bill, which was passed and signed into law on May 31, 1993, created the EAA as a nine-member appointed board to limit pumping and manage the aquifer in the six-county region. It also abolished the EUWD and granted the EAA the power to regulate and enforce pumping limits among all well owners and the power to issue annual water rights based on historic claim. Under the new legislation, pumping limits could not surpass 450,000 acre-feet of water annually through 2007. Subsequent withdrawals were to be reduced to 400,000 acre-feet by 2008. The EAA would be collecting pumping fees to finance its endeavors and would begin operations with \$10.2 million in reserves from the defunct EUWD (*San Antonio Express-News*, August 24, 1993; Putnam and Peterson, 2003, 139).

But before the new EAA members could be sworn into office, the Mexican American Legal Defense and Educational Fund (MALDEF) filed a claim with the U.S. Justice Department contending that the bill violated the Voters Rights Act by switching from an elected to an appointed board. The Justice Department requested a lengthy list of documentation, including the composition of the EUWD. On November 19, 1993, the U.S. Justice Department rejected the new state plan as a violation of the Voters Rights

Act, thus leading to further delays in state management of the aquifer situation (*San Antonio Express-News*, November 20, 1993; Putnam and Peterson, 2003, 139).

The Justice Department's intervention triggered a rash of actions that fueled additional battles. The secretary of state and the governor sent a letter to the Justice Department on December 30, 1993, suggesting that the EAA and the EUWD could coexist—EAA as the appointed regulatory body and EUWD as the elected educational agency. The letter was attacked by the western counties as “underhanded” and “a back room deal in which the EUWD would serve as a token agency to meet the act's one person, one vote provision.” The chairman of the Uvalde County Underground Water District described it this way (Putnam and Peterson, 2003, 140):

This letter to the Justice Department is just another case of San Antonio going to Austin with their money and we all know that money talks. We are going to fight this thing. We are going to develop our own response to the state's action and send it to Washington. (Uvalde (Texas) Leader News, January 6, 1994)

Thus the western counties, which opposed the compromise bill that established the EAA, sided with MALDEF against the state. The EUWD, which was fighting for its existence, also sided with the Justice Department. As the chair of the EUWD remarked, “We decided to get involved to protect voting rights and to be at the table in case there is to be any kind of proffered settlement” (*San Antonio Express-News*, March 30, 1994). After the Justice Department denied the request for the coexistence of the EAA and the EUWD, the state filed a suit objecting to the Justice Department ruling. Both the governor and the mayor of San Antonio blasted MALDEF actions, claiming they were “vicious” and “insane” and could result in loss of federal funds and the closure of military bases. But the attorney for MALDEF retorted that state officials were also at

fault for wanting an appointed board that they could control (*San Antonio Express-News*, April 24, 1994; Putnam and Peterson, 2003, 140).

A San Antonio councilwoman branded the governor and the mayor as “divisive . . . in a multicultural community that ordinarily prides itself on exhibiting racial harmony” (*San Antonio Express-News*, April 28, 1994). Although the mayor claimed he understood the desire for an elected board, he contended that the political reality of the one person, one vote meant that Bexar County would be in control of the EAA with virtually no representation from the eastern and western counties. In response to the mayor’s justification, Representative Rodriquez pointed out that the state had forty-four water boards and all but two of them (including the EAA) had elected members. Growing weary of the verbal volleys, Representative Romo called for a cooling of tempers and the realization that both sides were blaming the people who were not at fault for this problem (*San Antonio Express-News*, April 28, 1994; Putnam and Peterson, 2003, 140).

In another heated, action-packed legislative session the aquifer bill passed with just twenty-four hours remaining in the session on May 28, 1995. In the House, the bill was rescued when the San Antonio mayor and a councilman broke up a deadlock between two San Antonio representatives who disagreed on the number of elected EAA members. The Senate approved a fifteen-member EAA board elected from single-member districts in the region. The legislature, however, killed a separate bill that established deadlines for the EAA to impose pumping limits during drought conditions—an action that would bring the courts right back into the middle of the fight (*Austin-American Statesman*, May 29, 1995). Senate Bill 1477 as signed by Governor Bush on May 31, 1995, established an elected EAA board composed of seven members from

Bexar County, four from the western counties and four from the eastern counties. Two nonvoting members, one appointed by the Medina and Uvalde county commissioners and one representing the downstream users, would also serve on the board (*San Antonio Express-News*, May 30, 1995; Putnam and Peterson, 2003, 141).

Before the board could be sworn in on August 28, 1995, a state district judge, in response to arguments from Medina attorneys, issued a temporary restraining injunction that forbade EAA operations until the issue of constitutionality of the board was addressed. On November 29, 1995, the state district judge ruled that the law that created the EAA was illegally retroactive and violated landowners' constitutional rights to draw as much water from beneath their land as they need. The state, the EAA, and San Antonio appealed this decision to the Texas Supreme Court with the argument that the constitution allowed regulation to protect broad public interests. The issues are aptly reflected in the words of an attorney for the EAA (Putnam and Peterson, 2003, 141):

The "us against them" mentality has won the day, but we are confident that the Texas Supreme Court will tell us that we have the capability under the constitution to manage and safeguard our natural resources.

The attorney for the Medina County Underground Water Conservation District begged to differ:

It's people's property. You can't take it without due process or compensation. (*San Antonio Express-News*, October 28, 1995)

Judge Bunton reacted by noting that on two separate occasions the legislature had passed bills that were challenged, and now the state was back to square one. The senator who coauthored the bill remarked, "that's how politically charged this issue is. You have to get it to the Texas Supreme Court to make a decision of what's good for the entire state" (*San Antonio Express-News*, October 28, 1995).

On June 28, 1996, the Texas Supreme Court ruled unanimously (9-0) that the EAA was a constitutional entity. Supreme Court Justice Greg Abbott noted that the court centered on whether the law is constitutional on its face, not whether it is unconstitutional when applied to a particular landowner. Reactions to the Supreme Court decision varied. In the words of the Medina District general manager (Putnam and Peterson, 2003, 142):

The Supreme Court left the door open for individual . . . suits. I think they [EAA] are going to have to proceed with caution.” (*San Antonio Express-News*, June 29, 1996)

And in the opinion of the EAA attorney,

This decision creates a big table for everyone to sit down at and work out their problems politically through compromise and consensus building instead of . . . running off to various courts seeking judicial interventions. (*San Antonio Express-News*, June 29, 1996)

The attorney for San Antonio Water System (SAWS) was also positive:

This act provided the basis for the development of a market for water rights and a market for conservation incentives. (*San Antonio Express-News*, June 30, 1996)

One of the EAA’s first actions in July 1996 was to produce, in less than two weeks, a drought management plan that all counties could accept. The EAA held three hearings throughout the state on whether current drought conditions posed an imminent peril to public health, safety, or welfare. Although there was no question that the region faced a drought of epic severity, demonstrating the potential peril to public health was difficult. The western counties opposed any plan to adopt emergency rules that would limit pumping. Thus, in a decision that split along regional lines, the EAA voted seven to six not to implement emergency rules. They drafted proposed rules that would be

modified over thirty days and then voted on the rules (*San Antonio Express-News*, August 1, 1996; Putnam and Peterson, 2003, 142).

Sierra Club V. Babbitt

With the EAA in limbo during 1994-1995, the Sierra Club requested that Judge Bunton appoint a water monitor to gather, summarize, and evaluate aquifer data; present monthly reports; and advise the court as to whether plans for regulating pumping complied with the Endangered Species Act. Judge Bunton agreed and ordered the City of San Antonio, the State of Texas, and the USFWS to share equally in paying the \$125 per hour salary of the monitor and warned them that if they failed to protect the aquifer-fed springs, he would impose new measures to enforce his 1993 ruling (*San Antonio Express-News*, March 2, 1994; Putnam and Peterson, 2003, 142-143).

The Sierra Club asked Judge Bunton on April 15, 1994 to declare an aquifer emergency and to draw up a plan to limit pumping, which the judge would impose in place of state legislation to protect aquifer species. The Sierra Club also proposed to expand its original 1991 lawsuit to include the City of San Antonio, the Department of Defense, and other municipal, agricultural, industrial, and domestic users. Lawyers for the utilities and other water users, who had fought the Sierra Club in its suit, characterized the motion as an “environmental scorched-earth policy” (*San Antonio Express-News*, April 16, 1994). Should the plan become stalled, the Sierra Club also requested that the judge order an immediate halt on federal funds for home loans, highway construction, transportation projects, and agriculture programs. The Sierra Club also asked the U.S. Department of Defense Base Realignment and Closure Commission to consult with the Environmental Protection Agency and the USFWS on possible

violations of the Endangered Species Act and to consider closure of several military bases if violations have occurred (*San Antonio Express-News*, April 16, 1994; Putnam and Peterson, 2003, 143). One San Antonio attorney expressed dismay:

This is an unfortunate effort to derail Senate Bill 1477. It's the nuclear option.

And in the words of an Uvalde attorney,

They're calling for no new wells, no more lawn watering and no more irrigated agriculture all for a little fish that you can grow in a hatchery without too much trouble. (*San Antonio Express-News*, April 16, 1994)

San Antonio leaders, including the mayor, responded with a "verbal firestorm":

The Club's actions are a vicious attack on the city's [San Antonio] economy, creating a potential loss of as many as 150,000 jobs. (*San Antonio Express-News*, April 30, 1994)

But the Sierra Club's state director retorted:

We did not attempt to do a basic economic analysis and identify the ripple effects on the area . . . we wanted to jolt people out of their denial . . . We characterized the base closures as an option of last resort. It was not our preferred legal option. (*San Antonio Express-News*, April 30, 1994)

On May 5, 1996, Judge Bunton ruled against the Sierra Club's request. The plaintiffs then filed an amended suit dropping the additional defendants, but persisting in a plea for a management plan to limit pumping (Putnam and Peterson, 2003, 144).

In response to these actions, three water agencies, the EUWD, the Medina, and the Uvalde Underground Water Conservation Districts, signed an agreement on May 24, 1994, to renew talks on a regional water management plan and to formulate proposed legislation to support this plan. The *Texas Weekly* pointed out the irony of this agreement; that is, two of these water districts contributed to the problem in the first place through blackballing the original 1988 regional management plan, which they now agreed to

support with modifications in October 1994. Moreover, the EUWD, officially abolished through Senate Bill 1477, “is not only acting like it is going to live forever,” but it attempted to hire a lobbyist to assure its continued existence (*Texas Weekly*, June 6, 1994; Putnam and Peterson, 2003, 144)

However, in the summer of 1994, flow at Comal Springs decreased substantially and the Sierra club again filed a request for an emergency plan to reduce pumping from the aquifer. This time Judge Bunton ordered the monitor to prepare an Emergency Withdrawal Reduction Plan (EWRP) to educate the public as well as to develop staged reductions of pumping to maintain springflows at Comal above 150 cubic feet per second (Votteler, 1998). With the onset of heavy rains in the fall of 1994, the court had no need to implement the emergency withdrawal plan, but the plan served as a dire warning that federal control of the aquifer was imminent (Putnam and Peterson, 2003, 144).

Later in August 1994 the citizens of San Antonio voted against completion of the Applewhite Reservoir for the second time (Blanchard *et al.*, 2008). This action capped a series of defeated efforts to develop alternative water sources for the city of San Antonio. Hence, both the Sierra Club and the court-appointed monitor intervened to assist San Antonio in reducing its reliance on the aquifer. Sierra Club representatives engaged in informal talks with San Antonio leaders about reusing wastewater, developing surface water alternatives such as a pipeline to the Guadalupe River, and other measures to reduce reliance on the aquifer. Their proposal, however, “put the group on a collision course” with citizen activists who claimed San Antonio did not need additional surface

water if it used recharge dams and springflow augmentation** (*San Antonio Express-News*, August 24, 1994; Putnam and Peterson, 2003, 144-145).

To extend these deliberations, the court asked the monitor to convene eleven panels throughout the Guadalupe River region to discuss the available water supply, hear presentations on methods to conserve water, and explore alternatives for new water sources for the region. The panels, consisting of the monitor as chair and professional staff members from nine major water districts in the region, collected information to develop a habitat conservation plan released in June 1995 and aimed at “conservation and reuse of existing water supplies and the introduction of 250,000 to 350,0000 acre-feet of additional water supplies to the region” (Votteler, 1998, 863; Putnam and Peterson, 2003, 145).

Thus, from March to June 1995, several proposals were put on the table—a revised Emergency Withdrawal Reduction Plan produced for the court in anticipation of a drought; a brief concerning the ability of the court to implement the monitor’s plan; a letter of intent by five water purveyors to transport 15,000 acre-feet of Guadalupe River water to the military bases in San Antonio; and a lawyer’s panel plan, developed by attorneys of stakeholders with suggestions for maintaining the springflow above 150 cubic feet per second through a 10 percent reduction in water consumption by municipalities (Putnam and Peterson, 2003, 145).

** Springflow augmentation is supplementing and artificially maintaining springflow levels by pumping water into the aquifer by various means; for example, injecting water directly into the aquifer through deep wells and underground retention dams (*San Antonio Express-News*, September 2, 1994).

While these proposals were still under consideration, *Sierra Club v. Babbitt* was resolved in February 1996 when the Fifth Circuit Court of Appeals ordered Bunton to end the litigation; Bunton and the water monitor were blocked from taking control of the aquifer; the USFWS published a recovery plan for the endangered species; and the U.S. District Court stood poised to take control of the aquifer if the EAA was declared unconstitutional. Despite the difficulty in determining who should be in control of the aquifer, this litigation established limits on the rule of capture and affirmed the aquifer would be regulated—by either the EAA or by the federal government (Putnam and Peterson, 2003, 145).

Sierra Club V. Glickman

On April 28, 1995, the Sierra Club filed a second complaint in the U.S. District Court against U. S. Secretary of Agriculture Dan Glickman and the U.S. Department of Agriculture (USDA) for a three-count violation of the Agricultural and Water Policy Coordination Act and the Endangered Species Act. This suit, officially filed in September 1995, contended that the USDA had fostered adverse environmental impacts stemming from irrigation, had failed to develop programs to conserve water and protect the endangered species, and had subsidized irrigation from the aquifer without consulting with the USFWS. The suit requested a halt in the use of federal tax dollars for grants, loans, and below cost insurance to irrigators, claiming that these programs led to increased pumping from the aquifer. Reactions to the lawsuit varied; the Texas attorney general had this to say (Putnam and Peterson, 2003, 145-146):

[It is] a misguided and extremist effort by the Sierra Club that could harm farmers and ranchers in Central Texas. I favor environmental protection but I oppose the Sierra Club's ultimate objective: the prohibition of all

federally funded projects over the Edwards Aquifer. (*Austin-American Statesman*, May 11, 1996)

An Austin attorney for the plaintiffs retorted:

That statement is purely false. The lawsuit is targeted at the U.S. Department of Agriculture and programs that may harm the aquifer's environment. (*Austin American-Statesman*, May 11, 1996)

In May 1996, the Fifth District Court of Appeals reversed Bunton's decision that barred the State of Texas and the Texas Farm Bureau from intervening in this lawsuit, and on July 2, 1996, Judge Bunton ruled in favor of the Sierra Club and ordered the USDA to (1) develop and implement a program for preserving natural resources and protecting fish and wildlife through land conservation and utilization, (2) implement an intra-agency program to protect waters from contamination, and (3) consult with the USFWS in developing a program to conserve endangered species in the aquifer. But this judgment was appealed and the U.S. Fifth Circuit Court of Appeals granted a stay on October 23, 1996 (Putnam and Peterson, 2003, 146).

Sierra Club V. San Antonio

When the springflows reached critical levels and the USFWS did not take action to reduce pumping, the Sierra Club filed a class-action suit on June 10, 1996, alleging that pumpers were causing a taking of the seven federally protected species of fish, salamanders, and rice by reducing aquifer springflows that formed the habitat for the species. The suit was filed against all aquifer pumpers, "as many as one thousand individuals, organizations, and corporation" including municipal, commercial, domestic, and agricultural users (Votteler, 1998, 869). The USFWS admitted that Comal Springs

was down 40 percent of its normal flow, but their field supervisor for ecological services contended (Putnam and Peterson, 2003, 146-147):

We're going to spend every dollar we have trying to work with you to find solutions rather than being in court. That's very expensive and I don't think anyone gains in that. (*San Antonio Express-News*, June 1, 1996)

The attorney for the Sierra Club's Lone Star Chapter responded that the USFWS was not doing their job:

We definitely think the U.S. fish and Wildlife Service should be doing that. It's the federal agency that's supposed to be protecting the species. They're just bowing to politics despite their responsibility. (*San Antonio Express-News*, June 1, 1996.)

In July 1996, the flow at both Comal and San Marcos Springs fell below levels necessary to maintain the habitat and survival of the listed species, and the Sierra Club asked Judge Bunton to grant a temporary restraining order targeting everyone except agriculture since these users would not require water for irrigation after July (*Tyler [Texas] Morning Telegraph*, July 12, 1996).

According to the state director of the Sierra Club,

What is at stake here is not simply the survival of several endangered species . . . but the protection of a resource, the Edwards Aquifer, which is critical not only to the environment but also to the well-being of over two million people. (*Dallas Morning News*, June 12, 1996)

This view was countered by one of the defendants in the lawsuit, the general counsel for San Antonio Water System:

We're in the third stage of a very mandatory program that has drastically curtailed discretionary water use . . . We've done everything a city can reasonably do consistent with preserving the health, safety, and welfare of the people . . . we can't just turn the valve down by 50 percent and have water in the lines to take care of human needs and put out fires. (*Dallas Morning News*, June 12, 1996)

Judge Bunton withheld ruling on the Sierra Club suit until the new Edwards Aquifer Authority met to consider emergency pumping limits (*San Antonio Express-News*, July 18, 1996). One day after the EAA failed to declare a drought emergency, Judge Bunton denied the Sierra Club request, but he appointed two water masters and gave them ten days to develop a drought management plan. They proposed the 1996 Emergency Withdrawal Reduction Plan (EWRP) that consisted of staged reductions triggered by declines in springflows. Judge Bunton, hoping that the restrictions would be voluntary and would allow municipalities flexibility in achieving the required limits, asserted:

I am convinced there is an emergency . . . I don't think we can sit here and twiddle our thumbs and not do anything. (*Austin-American Statesman*, August 2, 1996)

Let's don't blow it like we did 40 years ago when God tried to call this to our attention, and we tended to ignore it. We can't go on like this. We're not going to have any surface water available. (*San Antonio Express-News*, July 26, 1996)

On August 23, 1996, when no agencies had intervened to reduce aquifer pumping, Judge Bunton set a deadline of October 1 to activate the 1996 EWRP and to implement a reduction on pumping restrictions that would remain in effect until the EAA put into operation a critical management plan. In response, lawmakers from San Antonio challenged the constitutionality of Judge Bunton's proposed plan (*San Antonio Express-News*, August 22, 1996) and filed an appeal in the Fifth U.S. Circuit Court of Appeals in New Orleans on August 27. Mayor Cisneros of San Antonio was in attendance:

My presence here is a statement that this is not just a legal, technical issue. This is a community issue. Our citizens are just frustrated with what they are going through . . . [Bunton's] requirements for aquifer pumping limits

would cause extraordinary and irreparable harm to the city and its inhabitants. (*San Antonio Express-News*, August 27, 1996)

Moreover, the Texas attorney general petitioned Bunton to allow the State of Texas to intervene on behalf of the defendants, alleging the State had a right to safeguard the interests of four water and wildlife agencies. Bunton granted the State's motion to intervene in its capacity as a pumper through a prison in Hondo, but he denied the State permission to intervene on behalf of the four agencies (Putnam and Peterson, 2003, 148).

On September 10, 1996, the Fifth Circuit Court of Appeals stayed Judge Bunton's August 23 order until a hearing was held on December 2. The following April after the crisis had passed, the Fifth Circuit Court of Appeals vacated Judge Bunton's order, reasoning that the federal court should have abstained from becoming involved in a matter that the state regulatory agency, the EAA, should handle. In response, the Sierra Club appealed the Fifth Circuit Court's decision to the U.S. Supreme Court, stating the EAA had done nothing to limit aquifer withdrawals; but on January 26, 1998, the Supreme Court denied the Sierra Club's appeal, letting the Fifth Circuit Court's ruling stand (Putnam and Peterson, 2003, 148-149).

Although the Sierra Club state director was disappointed that the EAA was postponing action to deal with an immediate crisis, several EAA members felt that declaring an emergency with no action to support it would provide ammunition for the plaintiffs in the *Sierra Club v. San Antonio* suit. The drought ended through heavy spring rains and the Fifth Circuit Court ruled that Bunton should have abstained from acting on a matter that fell under the EAA's jurisdiction (Putnam and Peterson, 2003, 149).

Edwards Aquifer Authority—1997-2000

Amidst continual filing of lawsuits, the EAA took several actions in 1997 and 1998 that paved the way for eventual adoption of permitting and regulatory rules. They approved a critical period management plan to develop stages for water conservation aimed at slowing the decline of springflow in times of drought. They also implemented the Agriculture Water Conservation Loan Program to help farmers purchase water-saving irrigation equipment and approved the Irrigation Suspension Program, aimed at reducing irrigation in drought periods by paying farmers not to irrigate (*San Antonio Express-News*, July 20, 1997). Other actions included drilling wells in San Antonio's recharge zones to document pollution and check water quality on a continual basis; developing a Precipitation Enhancement Program (PEP) to increase rainfall over the EAA recharge region; approving a habitat conservation plan; and establishing the Authority Groundwater Trust to provide access for the selling and leasing of water rights (Putnam and Peterson, 2003, 149).

Also, the EAA spent three years conducting surveys and making site visits for field verifications of water permit applications, and by February 2001, they issued 1084 municipal, industrial, and irrigation permits based on historical use and 383 initial permits to new users (EAA, 2001). Of major importance, in October 2000 the EAA received final approval of the Texas Administrative Codes for assessing aquifer management fees and issuing permits for withdrawal. They also successfully managed a drought period in the summer of 2000 through enacting emergency drought management rules when flow levels at Comal Springs dropped below 150 cubic feet per second.

Overall, the EAA has asserted its authority and moved forward amidst continual opposition (Putnam and Peterson, 2003, 149-150).

Opposition still continued, including several court suits that challenged the EAA's actions and decision-making process. In *Wells v. EAA* in 1997, Wells charged that the EAA engaged in acts that caused harm to plaintiffs and violated the enabling statute. In 1998, the Sierra Club and the Environmental Defense Fund notified EAA and USFWS of their intent to sue for violations of the Endangered Species Act, and the Travis County Court invalidated the EAA permit rules and their drought management plan. These suits were dropped when further actions were taken by the EAA. Also, in 1998, the catfish farmer challenged the EAA to proportionally reduce each applicant's permitted groundwater withdrawal amount and petitioned the courts to delay issuing groundwater withdrawal permits. This action was also overturned. One case that has continued through the appeal process to the Texas Supreme Court is *Braggs v. EAA*, filed July 1998 as an objection to the EAA denial of a well withdraw permit. Although a district court issued a temporary injunction preventing the EAA from proceeding with the well permitting process, this decision was overturned at the State Court of Appeals in January 2000. After Braggs appealed the overturned decision, the Texas Supreme Court ruled that the judgment of the State Court of Appeals stood, but Braggs filed a motion for a rehearing in December 2000 (Putnam and Peterson, 2003, 150).

Although the EAA continues to wrestle with how to allocate water effectively, it has made major strides in issuing permits and regulating the aquifer. Based on historic use, the current regulatory policy as established in Senate Bill 1477 suffers from problems in penalizing stakeholders who conserved water versus those who were heavy

users in the past. This policy has led to criticism of the law and the EAA. Overall, the Edwards Aquifer Authority has forged important inroads in establishing agency jurisdiction and claims for legitimacy. Its credibility continues to be challenged through objections to actions that it takes, but the EAA has brought optimism that this conflict is now manageable through negotiation with a legitimate decision-making body (Putnam and Peterson, 2003, 150).

Edwards Aquifer: What has changed since 1997?

Since 1997, efforts have been made to mitigate the half-century-old and seemingly intractable conflict generated by stakeholders of varied interests in the Edwards Aquifer. The legislature first authorized the creation of groundwater districts in 1949. A number of the original groundwater districts were organized to regulate wells drilled in the Texas Panhandle to exploit the Ogallala Aquifer where a rapid fall in groundwater levels were occurring as a result of irrigation (Green, 1973). As a result of this action groundwater districts already existed in 1997.

Senate Bill 1477 was voted into law and became effective on September 1, 1993 by the 73rd Legislature and related to the creation, administration, powers, duties, operation, and financing of the Edwards Aquifer Authority and the management of the Edwards Aquifer. The law provided for granting the power of eminent domain; authorizing the issuance of bonds; providing civil and administrative penalties; and validating the creation of the Uvalde County Underground Water Conservation District. This landmark legislation brought about by Federal lawsuit (see *Sierra Club v. Lujan* under that listing for 1993) created authority as a Special Groundwater District; provided for a jurisdiction area across 8 counties in South Central Texas, and created to manage

and regulate the San Antonio Segment of the Balcones Fault Zone Edwards Aquifer.

[Note: other legal challenges pertaining to the Voting Rights Act prevented the Authority from operating until 1996] (LRLT, 2013).

When Senate Bill 1 was adopted and made effective September 1, 1997 in the 75th Legislature it related to the development and management of the water resources of the state, and provides for penalties through police action of the Groundwater Conservation Districts (GCD). The Legislature restructured the process of water planning by creating 16 regional water planning groups through enabling legislation SJR 17 and provided for change to the interbasin transfers (IBT) permitting process (LRLT, 2013). Furthermore, the legislature confirmed that “groundwater conservation districts . . . are the state’s preferred method of groundwater management through rules developed, adopted, and promulgated by districts in accordance with the provisions of [Texas Water Code Chapter 36].” Texas Water Code § 36.0015. As of September 1, 2016, there are now 99 GCDs, 98 confirmed with one GCD pending confirmation by voters through local elections that cover all or part of 173 out of 254 counties in Texas (see Figure 2.6).

that are governed almost exclusively by the provisions of their own created statutes (Melvin and Mason, 2012).

Since Putnam and Peterson's (2003) study for the period 1980 to 1997, there have been a number of laws enacted by the Texas legislature to address allocation and protection of groundwater. For example, Senate Bill 2 created by the 77th Legislature relates to the development and management of the water resources of the state, including the ratification for the creation of certain GCDs and providing for penalties. Senate Bill 2 was the follow-up to Senate Bill 1 (75th Legislature) and enacted significant amendments to regional water planning. It also established the Rural Water Assistance Fund (RWAFF) and the Water Infrastructure Fund (WIF). Both the RWAFF and WIF are to be supported by future appropriation created by the Texas Water Advisory Council (LRLT, 2013).

The Environmental Flows Advisory Committee created through Executive Order No. RP-50 by Governor Rick Perry was charged with developing recommendations to establish a process that will achieve a consensus-based, regional approach to integrate environmental flow protection into the water allocation process while ensuring that human water needs are satisfied (LRLT, 2013).

Senate Bill 3, enabled in the 80th Legislature, took effect in full on September 1, 2007, and relates to the management of the water resources of the state, including the protection of in-stream flows and freshwater inflows as well as to the management of groundwater in the area regulated by the Edwards Aquifer Authority, and to the operations and oversight of the authority (LRLT, 2013). Senate Bill 3 was enacted into law by the 79th Legislature and relates to the development and management of the water resources of the state, including the creation of GCDs and imposing fees and providing

penalties. SB 3 is based on recommendations from the 2004 Senate Select Committee on Water Policy and focused on further implementation of a water planning system set in place by Senate Bill 1 (75th Legislature) and Senate Bill 2 (77th) (LRLT, 2013). The intent of the Senate Bill 3 process is to address three major questions:

1. How much water is needed to sustain a sound ecological environment in the state's rivers and estuaries?
2. How can this water be protected?
3. What is the appropriate balance between water needed to sustain a sound ecological environment and water needed for human or other uses?

Senate Bill 3 science teams are tasked with using the best available science to address the first question and are to consider only the environmental needs of their respective basins and bays. The second and third questions are to be considered by Senate Bill 3 stakeholder committees and by the TCEQ. The process also involves a statewide Environmental Flows Advisory Group and a statewide Science Advisory Committee to oversee the basin-specific efforts.

Senate Bill 332 enacted by the 82nd Legislature in the Regular Session relates to the ownership of groundwater below the surface of the land, the right to produce groundwater, and the management of groundwater in the state, effective September 1, 2011 (LRLT, 2013).

There are two property rights cases that began at the time of Putnam and Peterson's research that dealt with groundwater ownership and have only recently been decided in court, with ongoing ramifications still unclear, and will be discussed at length in the following chapter.

Edwards Aquifer Authority v. Burrell Day and Joel McDaniel in the Supreme Court of Texas, February 2012, held that land ownership includes an interest in groundwater in place that cannot be taken for public use without adequate compensation guaranteed by Article I, Section 17(a) of the Texas Constitution (LRLT, 2013).

Edwards Aquifer v. Glenn and JoLynn Bragg is the first instance of a state appeals court finding that groundwater regulation resulted in a violation of property rights under the Texas Constitution. This decision comes after nearly a century of avoiding a ruling on the issue of groundwater and property rights. In 2012 the Texas Supreme Court finally ruled in the historic EAA v. Day case that regulations limiting groundwater pumping rights could result in “taking” property rights under the state Constitution. The Fourth Court of Appeals’ decision in the Bragg case in August 2013 found that such “taking” had occurred in Central Texas (Texas Tribune, 2013).

The *Texas Tribune* (2013) wrote that the very existence of the authority, as one of the largest and most powerful groundwater regulation bodies in the state, illustrates Texas’ groundwater dilemma. In 1993 Judge Bunton found that over-pumping of the aquifer without proper management was threatening endangered species. But in the case of Glenn and JoLynn Bragg, they had invested more than \$2 million to grow pecans on 100 acres over the aquifer before the EAA had been authorized to regulate the Edwards Aquifer allocation of water. When the EAA restricted the amount of water they could pump to irrigate their pecan orchard, the Braggs sued on the basis their property rights had been violated and that a “taking” had occurred. Justice Sandee Bryan Marion stated in her ruling the restriction “forces the Braggs to purchase or lease what they had prior to the regulation—an unrestricted right to the use of the water beneath their land.” That

outweighs even “the importance of protecting terrestrial and aquatic life, domestic and municipal water supplies, the operation of existing industries and the economic development of the state.” EAA stated it would appeal the ruling (*Texas Tribune*, 2013).

The decision has prompted groundwater managers, environmentalist, and water lawyers across the state to fear that any regulations they impose will land them in court. But at the same time, failing to impose regulations could harm the aquifers to the point of depletion, or threaten area wildlife.

III. EDWARDS AQUIFER AUTHORITY: WHAT CHANGED SINCE 2000?

In 1839, Alphonse Karr created the epigram, “plus ça change, plus c’est la même chose,” translated into English “the more things change, the more they stay the same” (Karr 2015a). In other words, what seems like significant change over time, turns out to be nearly the same as it ever was. No matter what new issues arise, there are some truths that appear to never change (Karr 2015b). Texas groundwater policy may be summed up in that statement, particularly when it comes to the Edwards Aquifer permitting and allocation of water rights, property rights, and board structure. Since Putnam and Peterson’s (2003) frame analysis study of the Edwards Aquifer stakeholder groups in the 1980s and 1990s, a number of issues have changed, although much has remained the same. The primary independent variable in all of the issues surrounding water policy of the Edwards Aquifer region, and Texas in general, is climate. Perhaps Texas weather extremes can be attributed to climate change, but as a matter of fact, Texas weather is erratic and naturally prone to extremes. Texas weather is frequently described as having extended periods of drought, interspersed by periods of severe flooding. A second point of contention focuses on permitting issues for allocating and mediating water pumped out of the Edwards Aquifer, juxtaposed against those issues of property rights. And last, but certainly not least in level of importance of these three highly contentious issues is the continuing saga of voting rights litigation surrounding the composition of the board of trustees that govern the Edwards Aquifer Authority. In the analysis that follows, the discussion focuses on issues that have remained the same before 1997, and what appears to have changed since 1997 through 2016.

Climate of Texas

In the article “Texas Water Policy Appendix: The Weather,” Carlos Rubinstein² (2015, 122) quotes Mark Twain in the 1892 published novel, *American Claimant*, where Twain announces: “No weather will be found in this book.” It was reportedly the first work of fiction without mention of the weather; all weather was contained in an appendix at the back of the book, which the reader was encouraged to consult from time to time.

Fittingly, the book was published near the beginning of the modern era of weather recordkeeping. As Mark Twain concedes, despite being relegated to an appendix, “. . . weather is necessary to a narrative of human experience.” This observation holds true for the weather in Texas, which has not only informed how we manage our water and various other natural resources, but weather has also helped shape the course of Texas history. Knowledge of these weather events is essential to a thorough understanding of Texas water policy (Rubinstein 2015, 122) and thus, water policy as it relates to the Edwards Aquifer region.

Much has changed since the late 1800s in our lives. Texas has not only witnessed the onset of scientific record keeping of the weather, but how the state manages its’ water resources in living the daily lives of the general population as a whole has changed a great deal. Rubinstein (2015) notes that prior to 1900, most Texans obtained their water from privately developed and owned wells, natural flowing springs, rainfall, or running

² Carlos Rubinstein is former Commissioner of the Texas Commission on Environmental Quality, Chair of the Texas Water Development Board, and currently a principal as a consultant on environmental activities in private practice.

tributaries and rivers. Indoor plumbing was practically non-existent, and there were no sewage treatment plants. Drinking water was not potable, and there were no significant flood control systems, or infrastructure related to supplying water supply (Freese and Sizemore, 1994). Over the last 50 years of the 19th century, Texas experienced vast population growth from just over 200,000 to over 3 million people (Figure 3.1). Growth of this nature set the stage for stringent progress in Texas water management over the entire twentieth century and continues to do so today. Texas weather undoubtedly played a significant role, and will continue to be important, in that progress (Rubinstein, 2015).

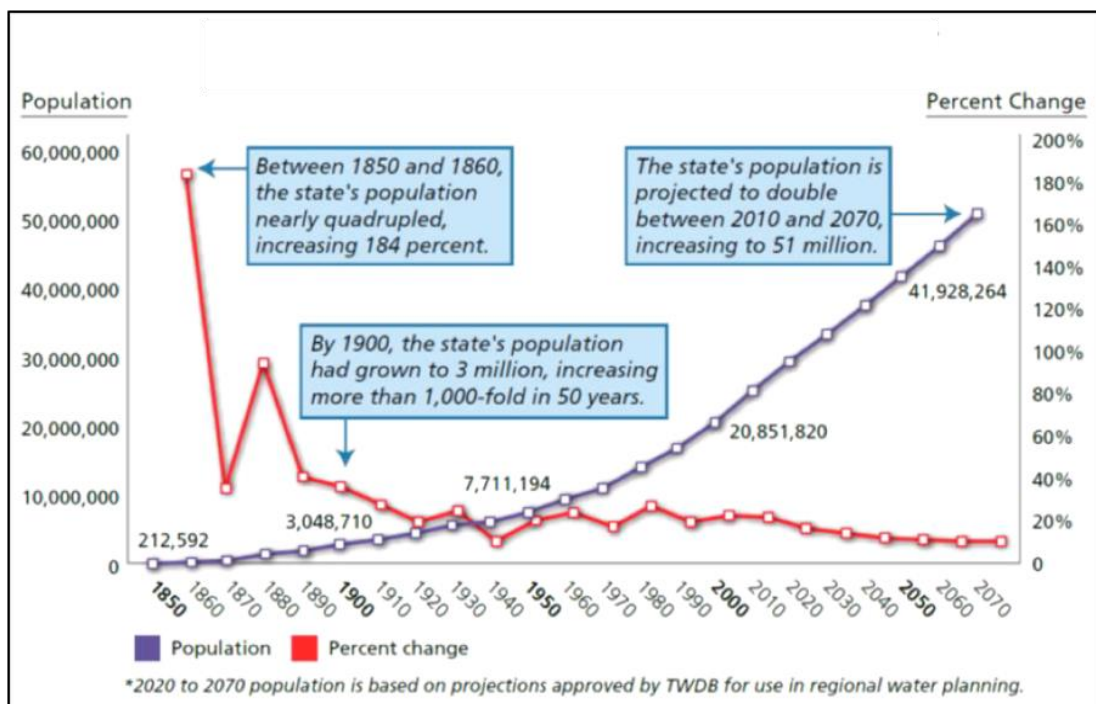


Figure 3.1. Texas historical and projected population growth* and percentage change (Rubinstein, 2015)

Because of the size of Texas, spanning over 800 miles both north to south as well as east to west, the state experiences a wide range of climatic conditions over a number of diverse geographic regions. Climate is an important consideration in water supply planning because it ultimately determines the state's weather and, consequently, the

probability of drought and the availability of water for various uses. The variability of the state's climate introduces both risk to the populace due to uncertainty in available water supplies that must be evaluated by regional water planning groups when developing their regional water plans every five years (TWDB 2012, 145).

Overview of the State's Climate

The variability of Texas' climate is a consequence of interactions between the state's unique geographic location on the North American continent and several factors influenced by the state's location (Figure 3.2) (TWDB 2012, 145). These factors include:

- The movements of seasonal air masses such as, arctic fronts from Canada.
- Subtropical west winds from the Pacific Ocean and northern Mexico.
- Tropical cyclones or hurricanes from the Gulf of Mexico.
- A high pressure system in the Atlantic Ocean known as the Bermuda High.
- The movement of Jet Streams.

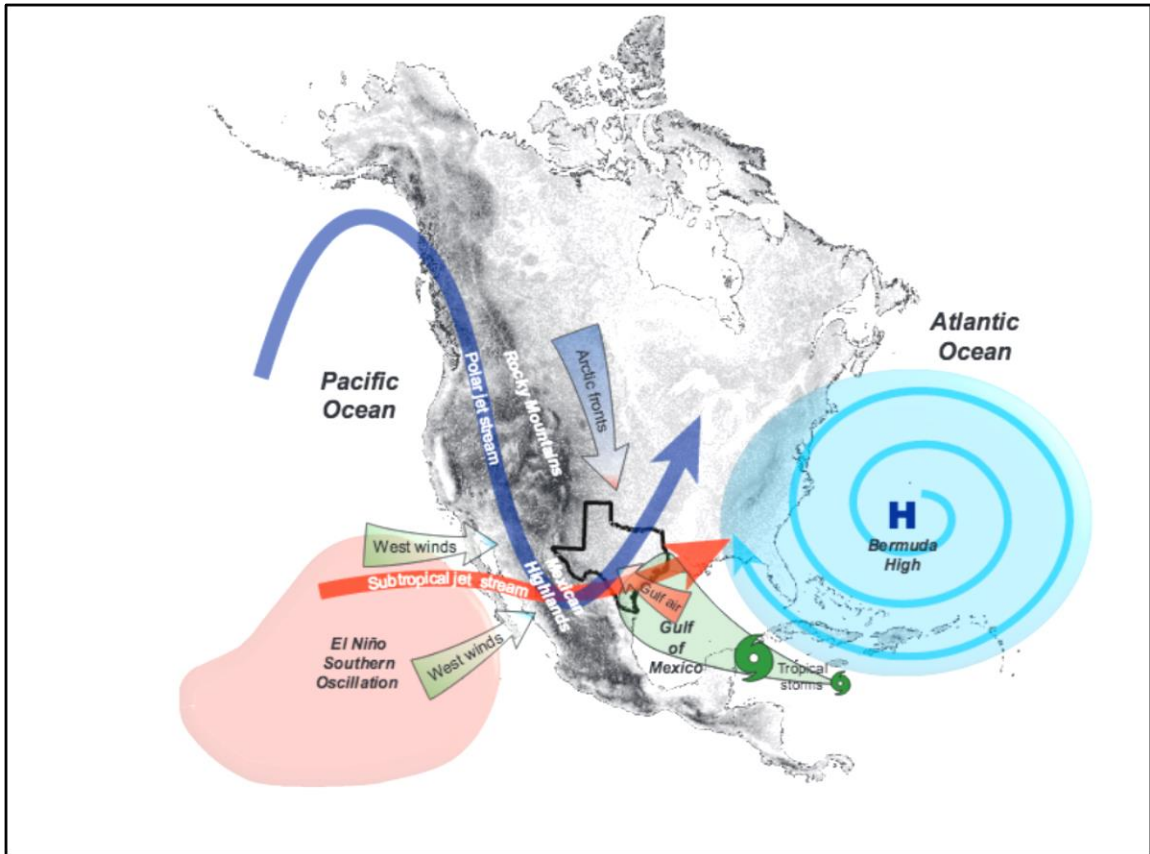


Figure 3.2. The geographic location of Texas within North America and its interaction with seasonal air masses affects the state's unique climate variability (source digital elevation data for base map from USGS, 2000)

The Gulf of Mexico is the predominant geographical feature affecting the state's climate, moderating seasonal temperatures along the Gulf Coast and more importantly, providing the major source of precipitation for most of the state (TWDB, 1967; Larkin and Bomar, 1983). However, precipitation in the Trans-Pecos and the Panhandle regions of Texas originates mostly from the eastern Pacific Ocean and from land-recycled moisture (TWDB, 1967; Slade and Patton, 2003). The 370 miles of the Texas Gulf Coast creates a significant target for tropical cyclones that make their way into the Gulf of Mexico during the hurricane season. The Rocky Mountains guide polar fronts of cold arctic air southward into the state during the fall, winter, and spring (TWDB 2012, 146).

During the summer, the dominant weather feature in extreme west Texas is the North American (or Southwest) Monsoon, as the warm desert southwest draws moist air northward from the Gulf of California and the Gulf of Mexico producing summertime thunderstorms. In the rest of Texas, summertime thunderstorms form along the sea breeze or in response to tropical or subtropical disturbances. Warm dry air masses from the high plains of northern Mexico are pulled into the state by the Jet Stream during the Spring and Fall seasons which collide with humid air from the Gulf of Mexico. The newly formed combinations of air masses are then funneled by the western limb of the Bermuda High system, producing destabilized inversions between the dry and humid air masses that eventually generate severe thunderstorms and tornadoes (TWDB, 2012, 146-147).

Drought Severity in Texas

Droughts are periods of less than average precipitation over a period of time. The Palmer Drought Severity Index is often used to quantify long-term drought conditions and is commonly used by the U.S. Department of Agriculture to assist in policy decisions such as, when to grant emergency drought assistance. The severity of drought depends upon several factors, though duration and intensity are the two primary components. The drought of record during the 1950s ranks as the highest in terms of both duration and intensity (Table 3.1). However, it should be noted that drought rankings may be misleading since a single year of above average rainfall can interrupt a prolonged drought, reducing its ranking. Nonetheless, on a statewide basis, the drought of the 1950s still remains as the most severe drought the state has ever experienced based on recorded measurements of precipitation. Other significant droughts in Texas occurred in the late 1800s and the 1910s, 1930s, and 1960s. At the end of 2011, this most recent drought may

rank as being among one of the most intense occurrences on record in many of the state's climatic divisions (TWDB, 2012, 151).

Climate Division	Duration Ranking			Intensity Ranking		
	1	2	3	1	2	3
1	1950 to 1956	1962 to 1967	1933 to 1936	1950 to 1956	1909 to 1911	1933 to 1936
2	1950 to 1956	1909 to 1913	1963 to 1967	1950 to 1956	1909 to 1913	1916 to 1918
3	1951 to 1956	1909 to 1913	1916 to 1918	1951 to 1956	1916 to 1918	2005 to 2006
4	1962 to 1967	1915 to 1918	1936 to 1939	1915 to 1918	1954 to 1956	1951 to 1952
5	1950 to 1957	1998 to 2003	1962 to 1967	1950 to 1957	1933 to 1937	1998 to 2003
6	1950 to 1956	1909 to 1913	1993 to 1996	1950 to 1956	1916 to 1918	1962 to 1964
7	1948 to 1956	1909 to 1912	1896 to 1899	1948 to 1956	1916 to 1918	1962 to 1964
8	1950 to 1956	1915 to 1918	1962 to 1965	1950 to 1956	1915 to 1918	1962 to 1965
9	1950 to 1956	1909 to 1913	1962 to 1965	1950 to 1956	1916 to 1918	1988 to 1990
10	1945 to 1957	1960 to 1965	1988 to 1991	1945 to 1957	1999 to 2002	1988 to 1991

Climate Variability

The climate of Texas is, has been, and will continue to be variable. Since variability affects the availability of the state's water resources, it is recognized as being highly significant by the regional water planning groups when addressing needs for water during a repeat of the drought of record. More discussion on how planning groups address climate variability and other uncertainties may be found in Chapter 10 of the "2012 State Water Plan for Texas, Challenges and Uncertainty" (State Water Plan. 2012, 151).

Records of climate data are generally available in Texas from the late 19th century to the present, but this is a relatively short record that limits our understanding of long-term climate variability. Besides the variability measured in the record, historic variability may be estimated through environmental proxies such as, by the study of tree rings, while future variability may be projected through the analysis of global climate models. Annual tree growth, expressed in a tree growth ring, is strongly influenced by

water availability. A dry year results in a narrow growth ring, while a wet year results in a thick growth ring. By correlating tree growth ring thickness with precipitation measured during the period of record, scientists may extend the climatic record back hundreds of years (State Water Plan, 2012, 151).

In Texas, scientists have completed precipitation data reconstructions using Post Oak and Bald Cypress trees. In the San Antonio area (Cleaveland, 2006) reconstruction of precipitation using Post Oak trees from 1648 to 1995 (Figure 3.2) indicates that the highest annual precipitation occurred in 1660 (about 212 percent of average) while the lowest annual precipitation was in 1925 (about 27 percent of average) (State Water Plan, 2012, 151).

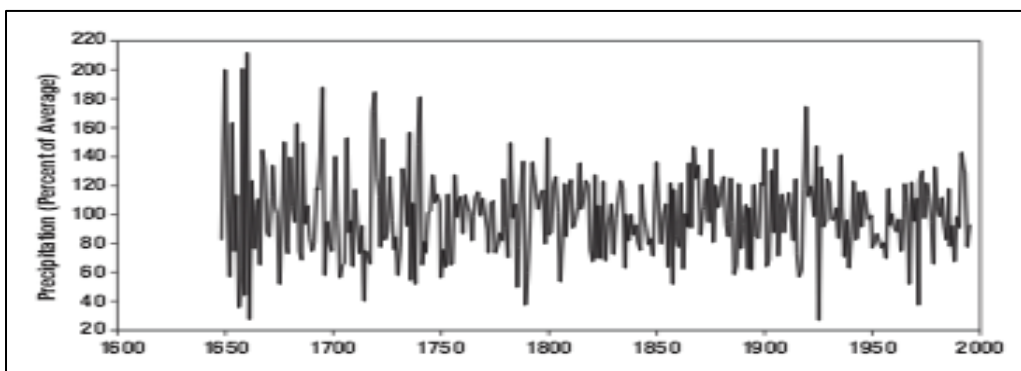


Figure 3.2. Annual Precipitation Based on Post Oak Tree Rings for the San Antonio Area (Data from Cleaveland, 2006)

Drought periods in this dataset may also be evaluated with seven-year running averages (Figure 3.3). The drought of record that ended in 1956 may be seen in this reconstruction, with the seven-year precipitation during this period about 79 percent of average. This record shows two seven-year periods that were drier than the drought of record: 1) the seven-year period that ended in 1717 having precipitation amounts of about 73 percent of average, and 2) the seven-year period that ended in 1755 having a seven-

year average precipitation level of about 78 percent. There have been about 15 seven-year periods where precipitation amounts were below 90 percent of average, indicating an extended drought (State Water Plan, 2012, 151).

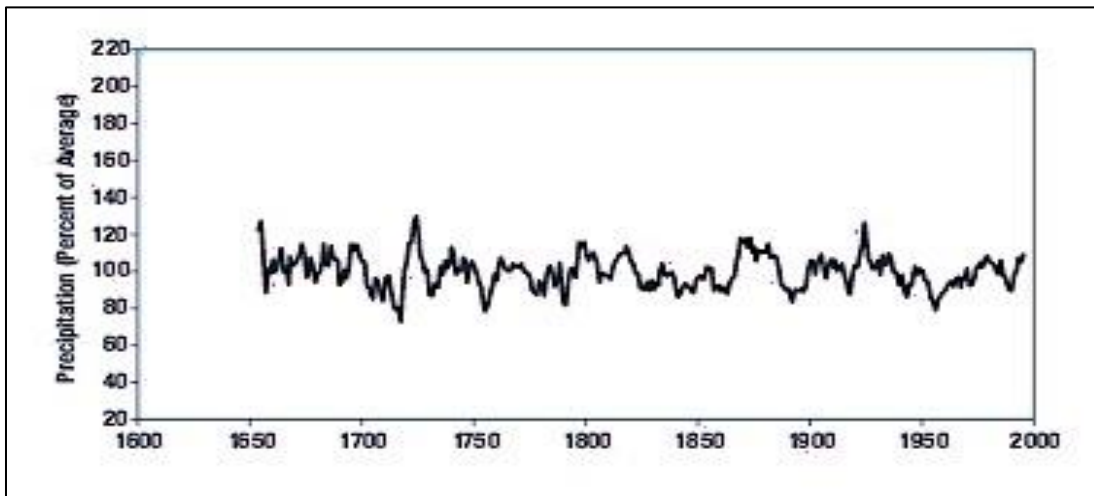


Figure 3.3. Seven-Year Running Average of Precipitation Based on Post Oak Tree Rings for the San Antonio Area (Data from Cleaveland 2006)

Climate of South Central Texas

South-Central Texas (Water Planning Region L) is one of the fastest growing areas in the United States with its 2010 population at almost 2.1 million and expected increases to 4.3 million in 2050, and 5.2 million in 2070 (Texas Water Development Board, 2016). The climate of the region is sub-humid but its high variability causes alternating floods and droughts (Earl and Votteler, 2005). Legislative mandates require drought planning and management which as forces cities in the region to work hard in consensus to create reliable water supplies (Moore, 2005).

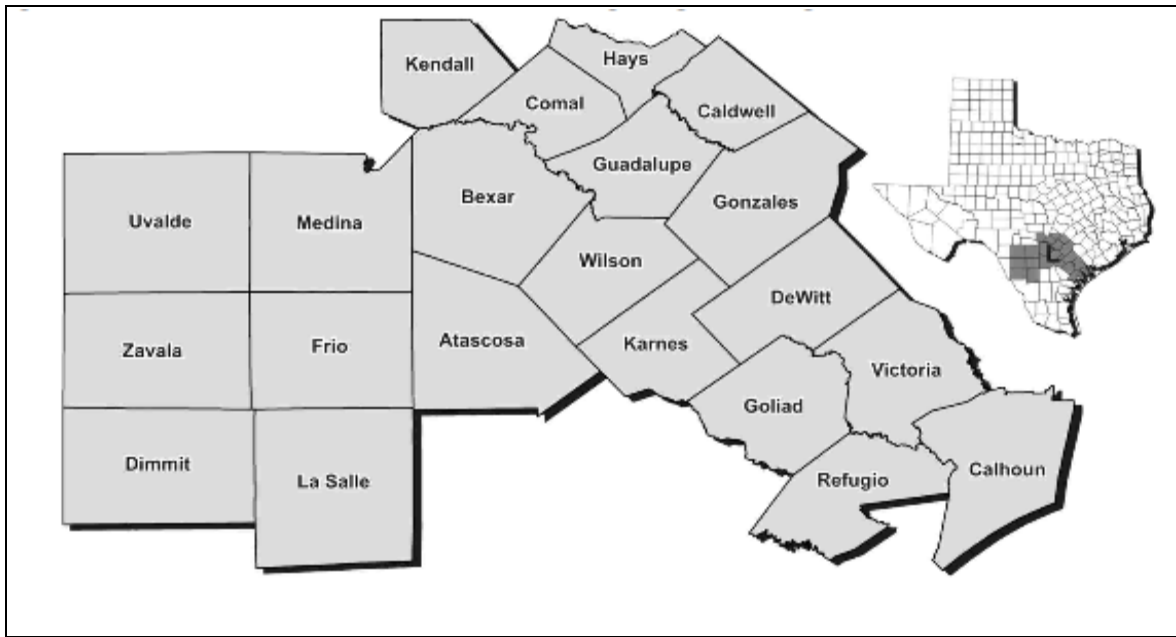


Figure 3.4 South-Central Texas Planning Region L. Adapted from the Texas Water Development Board, 2016

The primary fact about the climate in Texas, and south-central Texas specifically is the substantial variability in precipitation and water supply in the region. In the Earl *et al.* (2006) their research provides evidence it is as likely for a year with 60 percent of the mean annual precipitation to be followed by a year with 160 percent of the mean annual precipitation as it is to be followed by another year of drought. There are times when wet years are followed by more wet years, yet droughts tend to be more persistent than wet periods. A case in point is characterized by the historic drought of record in the 1950s used as the benchmark for water planning in Texas. Water supplies are even more variable than precipitation, with the annual standard deviation being nearly as large as the mean value for both groundwater recharge and stream flow (Earl *et al.*, 2006, 20-21). While acknowledging the limitations for tree-ring based correlations, the tree-ring based record going back to the 1600s provides a picture of this wide variability accentuated by droughts as severe, if not longer, for that of the drought of record. Although we may not

fully understand the driving mechanisms for climatic variability and change, variability is an inherent component as much as the mean, or average values in terms of characterizing the regions' climate. This variability forces water and energy utilities to accommodate peak demands that are often difficult, and expensive to provide (Earl and Kimmel, 1995, 37).

Edwards Aquifer Permitting and Allocation Issues

Water planners and managers in the Edwards Aquifer region have developed a water management plan as a tool and basis for monitoring and evaluating environmental water flows for endangered species and downstream users of interest. Landmark legislation in 1992 brought about by “Sierra Club v. Lujan,” early on, initiated a need and planning process for water management. In the resulting outcome of the case, it was ruled for the Texas Legislature to enact a regulatory system for limiting withdrawals from the Edwards Aquifer by May 31, 1993. As a result, the Edwards Aquifer Authority (EAA) was established as a water management agency. However, soon after the authorization of the EAA, the Texas Legislature as per the federal courts became mired in controversy with legal wrangling throughout the development of the mandated management process. Controversy surrounding the Edwards Aquifer's water pertained to how the resource should be allocated, permitted, and managed, particularly during times of drought when pumping significantly increased due to agricultural and urban landscaping irrigation requirements. As an example, although the EAA was mandated by state legislation in 1993, because of legal challenges pertaining to the composition of the Edwards Aquifer Authority's Board of Director Trustees via the Voting Rights Act, lawsuits prevented the Authority from officially beginning operations and performing its duties until 1996. This

specific issue was but one example of several earlier attempts by the courts and the state legislature to form a special groundwater district for the Edwards Aquifer.

As a whole, the state agencies whose responsibilities are to oversee the aquifer (the EAA and Texas Parks and Wildlife Department), have made various attempts at developing such a plan, but have fallen short. An example of changes made to the EAA's management plan for permitting, allocating, and regulating pumping in the aquifer is demonstrated through the pumping limit target set in 1997 of 450,000 acre-feet (AF) per year, with reductions to 400,000 AF per year to occur by 2008, and further reductions to 350,000 AF per year soon thereafter. However, in 2007 with the passage of Senate Bill 3, the Texas State Legislature increased total allocated permitted pumping to nearly 573,000 AF per year.

Property Rights – Two Perspectives

Groundwater ownership in Texas, as discussed in this research, has been a contentious and hotly debated issue in regards to limits on pumping of Edwards Aquifer water (see Table 3.2). Many in Texas have waited years for the Texas Supreme Court's decision on *Edwards Aquifer Authority v. Day and McDaniel*, and according to the *Texas Water Journal*, its' editors noted in their 2013 article by Johnson and Ellis on the subject, that this case was arguably the most important decision on Texas groundwater law in a generation and, undoubtedly, produced a significant impact on the management of groundwater resources in the state (TWJ, 2013, 35), and particularly for the Edwards Aquifer Authority. The decision was complicated, and in places, appears to be contradictory. By opening groundwater management to regulatory takings, another door to a complicated area of law was opened. While some questions in the Day case are

answered, other questions remain unanswered. There are strong opinions on both sides about what the Day case means, and does not mean (TWJ, 2013, 35). In chapter 4 the *EAA v. Day/McDaniel* case was briefly touched on. The following discussion goes into depth and breadth as to the contentious debate from both the landowners and the conservation districts side of the issue.

Table 3.2 - Previous Court Decision Prior to 2000 Affirming Rule of Capture for Groundwater		
Case Name	Date	Decision
Houston & Texas Central Railroad Co. v. East	1904	Texas Supreme Court adopted the Rule of Capture
City of Corpus Christi v. City of Pleasanton	1955	Texas Supreme Court reaffirmed the Rule of Capture
Friendswood Development Co. v. Smith-Southwest Industries	1978	Texas Supreme Court reaffirmed the Rule of Capture
City of Sherman v. Public Utilities Commission of Texas	1983	Texas Supreme Court reaffirmed the Rule of Capture
Sipriano v. Great Spring Waters of America, Inc.	1999	Texas Supreme Court reaffirmed the Rule of Capture

Two widely recognized legal experts on surface and groundwater law in Texas are Russell Johnson, a Partner with the firm McGinnis, Lochridge and Kilgore in Austin and former attorney with the City of San Antonio in the late 1980s and 1990s, and Greg Ellis, an Attorney-at-Law in League City, Texas and the first General Manager of the Edwards Aquifer Authority, 1997-2001. Both provide their perspectives and opinions about what the Day case means.³ Russell Johnson provides the landowners' perspectives of the Federal Court's decision, and Greg Ellis provides a perspective leaning more towards the view of the managers of the groundwater conservation districts. The following

³ Russell Johnson and Greg Ellis were interviewed as stakeholder participants for this research, although their responses in the comparative analysis section of this research remain anonymous.

information provides their perspectives surrounding this landmark court decision for groundwater in Texas to date (TWJ, 2013, 35).

Legal Insight – Russell Johnson

Russell Johnson (2013, 36) states that although the Rule of Capture has been the law in Texas since 1904, and has been consistently described as a property right incident to ownership, the courts were never required to define the exact nature of the right until recently. Beginning with the 1904 court case, *Houston & T.C. Ry. Co. v. East* case (referred to as *East*, and briefly discussed in chapter 4 regarding Texas water law background), the courts described the Rule of Capture as a real property right but the courts never clearly defined when, or if, the right was vested. This is particularly important in the context of regulating the exercise of that right, as discussed later (Johnson, 2013, 36). In *East*, the Texas Supreme Court, citing New York law, said:

An owner of soil may divert percolating water, consume or cut it off, with impunity. It is the same as land, and cannot be distinguished in law from land. So the owner of land is the absolute owner of the soil and of percolating water, which is a part of, and not different from, the soil. [Houston and T.C. Ry. Co. v. East, 81 S.W. 279, 281 (Tex. 1904) (quoting Pixley v. Clark, 35 N.Y. 520 (1866))].

Similarly, in another court case related to the Rule of Capture, in Pecos County, the El Paso Court of Appeals stated:

It seems clear to us that percolating or diffused and percolating waters belong to the landowner, and may be used by him at his will . . . These cases seem to hold that the landowner owns the percolating water under his land and that he can make a non-wasteful use thereof, and such is based on a concept of property ownership. [Pecos County Water Control & Improvement District No. 1 v. Williams, 271 S.W.2d 503, 505 (Tex. Civ. App.—El Paso 1954, writ ref'd n.r.e.)].

Further, in the same vein, the Texas Supreme Court in *Friendswood Development Co. v. Smith-Southwest Industries, Inc.* refused to abandon the Rule of Capture, noting that it had become, “an established rule of property law in this State, under which many citizens own land and water rights” [576 S.W.2d 21, 29 (Tex. 1978)] (Johnson, 2013, 36).

In spite of these statements, which imply that groundwater is owned by the landowner, the Texas Supreme Court had not provided, prior to its recent decision in *Edwards Aquifer Authority v. Day and McDaniel*, a description of the nature of the ownership’s right embraced by the absolute ownership rule. For example, in *Sipriano v. Great Spring Waters of America, Inc.*, 1 S.W.3d 75 (Tex. 1999), the Texas Supreme Court deftly avoided a discussion of the nature of the ownership’s right and, instead, held that it was inappropriate for the Court, given the state Legislature’s efforts to expand the powers of groundwater conservation districts, to insert itself into the regulatory mix by substituting the rule of reasonable use for the Rule of Capture (*Sipriano*, 1 S.W. 3d at 90). The Texas Supreme Court noted that any modification of the law would have to be guided by constitutional and statutory considerations, implying that ownership of groundwater is a property right and protected by the Texas Constitution (Johnson, 2013, 36).

In another case where the issue was argued to be directly relevant, *Barshop v. Medina County Underground Water Conservation District*, the Texas Supreme Court avoided making a definitive decision on the issue [925 S.W.2d. 618 (Tex. 1996)]. In *Barshop*, landowner plaintiffs filed suit prior to the implementation of the Edwards Aquifer Authority Act (EAAA or EAA Act), claiming that the EAA Act violated the Texas Constitution by taking their rights to use Edwards Aquifer groundwater. The

plaintiffs claimed that the EAA Act deprived landowners, within the jurisdiction of the Edwards Aquifer Authority's (the Authority) jurisdiction, of their vested property rights in groundwater and was in violation of the Texas Constitution. Plaintiffs conceded that the State had the right to regulate the use of groundwater but maintained that they had a vested property right in the water which was forfeited by the EAA Act. The State countered that groundwater under the Rule of Capture, while an ownership right in real property, was not vested until the water was actually reduced to possession and, therefore, the EAA Act, which provided for regulation of use, could not result in a "taking" (*Id.* at 618) (Johnson, 2013, 6).

Without resolving these conflicting arguments or deciding the nature of the ownership right, the Texas Supreme Court held that the EAA Act was not unconstitutional on its face, ruling that the plaintiffs had failed to establish that, under all circumstances, that the EAA Act would deprive landowners of their property rights. Therefore, the Texas Supreme Court did not have to resolve the clash between property rights in water and regulation of water—that is, whether the EAA Act, as it might be applied, could result in an unconstitutional taking (Johnson, 2013, 36).

While our prior decisions recognize both the property ownership rights of landowners in underground water and the need for legislative regulation of water, we have not previously considered this point at which water regulation unconstitutionally invades the property rights of landowners. The issue of when a particular regulation becomes an invasion of property rights in underground water is complex and multi-faceted. The problem is further complicated in this case because Plaintiffs have brought this challenge to the (EAA) Act before the (EA) Authority has even had an opportunity to begin regulation the (Edwards) Aquifer.

Despite these problems and competing interests, this case involves only a facial challenge to the (EAA) Act. Because Plaintiffs have not established that the Act is unconstitutional on its face, it is not necessary to the

disposition of this case to definitively resolve the clash between property rights in water and regulation of water (*Id.* At 626).

Recently the issue of the nature of the groundwater right was squarely before the Fourth Court of Appeals of Texas in two cases. In both cases, the Court was confronted with questions of law requiring analysis of the ownership interest in groundwater. In both decisions, the Court concluded that groundwater was owned as real property (Johnson, 2013, 36).

In the *City of Del Rio v. Clayton Sam Colt Hamilton Trust*, the issue was whether a seller's reservation in the conveyance of "all water rights associated with said tract" prevented the buyer from drilling a well and producing groundwater on the tract conveyed [269 S.W.3d 613, 614 (Tex. App.—San Antonio 2008, pet. denied)]. Litigation was initiated after the buyer, the City of Del Rio, drilled a water well on the purchased tract. The city argued that the Trust's reservation of water rights could not be effective and that under the Rule of Capture, the corpus of groundwater cannot be owned until it is reduced to possession (*Id.* at 616). The Court reviewed the Supreme Court's authority holding that percolating water is part of and not different from the soil, that the landowner is the absolute owner of it, and that it is subject to barter and sale like any other species of property [*Id.* at 617 (*et al.*)]. The Court distinguished the Absolute Ownership Rule from the Rule of Capture, holding that the Rule of Capture is a tort rule denying a landowner any judicial remedy and was developed as a doctrine of nonliability for damage, not a rule of property (*Id.* at 617-618). The Court concluded that "under the Absolute Ownership theory, the Trust was entitled to sever the groundwater from the surface estate by reservation when it conveyed the surface estate to the City of Del Rio."

(*Id.* at 617). The city's petition to the Texas Supreme Court was denied (Johnson, 2013, 37).

Shortly thereafter, in *Edwards Aquifer Authority v. Day*, [274 S.W.3d 742 (Tex. Appl.—San Antonio 2008)], the Fourth Court of Appeals reviewed a summary judgment in favor of the Authority on Day's and McDaniel's claim that the operation of the EAAA (EAA Act) and the (EA) Authority's decision to deny Day and McDaniel a permit to produce groundwater constituted a taking under the Texas Constitution. The (EA) Authority petitioned the Texas Supreme Court to review this decision, and Day and McDaniel sought review of the decision denying them a permit. The Supreme Court granted the petitions for review (Johnson, 2013, 36).

Facts of the *Day* Case

Under the EAAA (EAA Act), landowners who had historically used Edwards Aquifer groundwater for irrigation purposes were assured by the legislation of a minimum permit amount of 2 acre-feet of production per year per acre irrigated. Mr. Day and Mr. McDaniel (Day) jointly owned a tract of land located within the (EA) Authority's jurisdiction that had a well that flowed under artesian pressure. Day's predecessor in title irrigated a portion of the property directly from the well and a much larger portion of the property from an impoundment on a creek to which the artesian flow had been directed by a ditch constructed by the landowners. The (EA) Authority granted Day a permit for 14 acre-feet of groundwater based upon irrigation of land directly from the well but denied the request for a permit for land irrigated from the impoundment. The (EA) Authority determined that the water pumped from the impoundment on the property

was surface water and therefore owned by the State and did not constitute historical use of groundwater from the Edwards Aquifer (Johnson, 2013, 37).

Procedural History

Day appealed the decision to state District Court, claiming error by the (EA) Authority. In the alternative, they argued that the actions of the Authority constituted a constitutional taking and an inverse condemnation of their groundwater rights and sought damages. The Authority then sued the State in the same proceeding, alleging that the State should be liable in the event the Court found there was a taking (Johnson, 2013, 37).

The trial court granted the Authority's and the State's motions for summary judgment on the constitutional takings claims, finding that the plaintiffs had no vested right to groundwater under their property and granted a take-nothing summary judgment on all of Day's constitutional claims. The trial court disagreed with the Authority's decision to deny Day a permit (Johnson, 2013, 37).

The parties appealed to the Fourth Court of Appeals. The Court agreed with the Authority's conclusion that the water used from the lake was state water and not groundwater, and reversed the trial court's judgment granting a permit for acres irrigated with water from the impoundment. The Court reversed the take-nothing judgment granted on summary pleadings on the takings claim and remanded to the trial court for further proceedings on the constitutional claims. The Court of Appeals concluded that landowners have ownership rights in groundwater, that those rights are vested and are therefore constitutionally protected, and reversed the trial court's grant of summary judgment on these issues. The Court held that the landowners' "vested right in the

groundwater beneath their property is entitled to constitutional protection.” (*Id.* at 756) (Johnson, 2013, 37).

Both the State and the Authority filed petitions for review of the Court of Appeal’s decision that plaintiffs have a vested and constitutionally protected interest in groundwater beneath their property. Day filed a petition for review, claiming error by the Court of Appeals in denying a permit for acres irrigated with water from the impoundment. The Texas Supreme Court granted all petitions for review (Johnson, 2013, 38).

While the case was still awaiting a decision, the 82nd Texas Legislature passed legislation addressing the ownership issue. Senate Bill 332 amended section 36.002 of the Texas Water Code to clarify the Legislature’s view of the nature of the ownership interest and rights of landowners while recognizing that regulation and management of groundwater resources under the Conservation Amendment is a matter of public interest. Section 36.002 now provides that landowners own the groundwater below the surface as real property, which entitles the landowner to drill for and produce the groundwater below the surface, subject to the common law limitations against waste, malice, or negligent subsidence and the regulatory authority outlined by the Legislature in chapter 36 (Johnson, 2013, 38).

Specifically, within amended section 36.002, subsection (c) provided that nothing in chapter 36 should be construed as granting authority to deprive or divest a landowner of the ownership and right described by section 36.002. Subsection (d) states that the section does not prohibit a district from limiting or prohibiting the drilling of a well not in compliance with district rules for spacing or tract size or affect the ability of a district to

regulate groundwater production authorized by chapter 36. Subsection (d)(3) clarifies that districts are not required to allocate to a landowner a proportionate share of available groundwater based on acreage owned, in effect stating that the ownership right does not require the application of a correlative rights rule to groundwater. Subsection (e) exempts certain water management entities from the section. Specifically, it provides that the section does not affect the ability to regulate groundwater as authorized by the laws creating and governing the Edwards Aquifer Authority, the Harris-Galveston Subsidence District, or the Fort Bend Subsidence District (Johnson, 2013, 38).

The Argument at the Supreme Court

At the Supreme Court, Day and numerous Amici argued that the ownership right of landowners in groundwater beneath their land is a vested real property right protected by the U.S. and Texas Constitutions from taking without compensation. Several Amici argued that the absolute ownership rule as applied to minerals had created a vested property right protected from uncompensated taking, finding that the minerals were owned in place (Johnson, 2013, 38).

The (EA) Authority argued that the rule lacked attributes essential to the ownership of property: the right to exclude others and enforce those rights. The Authority also argued that groundwater should be treated differently because the law recognizes correlative rights in oil and gas but not in groundwater. Finally, it argued that groundwater is so fundamentally different from oil and gas that ownership rights in oil and gas should not bind the Court to apply those rights to groundwater. The State argued that while landowners do have some ownership rights in groundwater, they were not, in this case, sufficient to support a takings claim (Johnson, 2013, 38).

The Supreme Court Answers the Question of the Nature of Landowner
Groundwater Rights

On February 24, 2012, the Texas Supreme Court issued a 50-page, unanimous opinion in *Edwards Aquifer Authority v. Day* affirming the Fourth Court of Appeals and confronting and answering for the first time the question of whether a landowner's groundwater rights are a vested real property right protected by the Texas and U.S. Constitutions' prohibitions against uncompensated taking [369 S.W.3d 814 (Tex. 2012)]. The opinion, written by Justice Hecht, begins with a succinct summary of the issue presented in the decision:

We decide in this case whether land ownership includes an interest in groundwater in place that cannot be taken for public use without adequate compensation guaranteed by Article 1 § 17(a) of the Texas Constitution. We hold that it does (Id. at 817).

The opinion reviews the history of the (EA) Act and its key provisions and summarizes the facts leading up to the Authority's decision to deny Day a permit for groundwater use from an impoundment on a water course. The Authority found that the water used from the impoundment had become surface waters of the State and that Day were therefore not entitled to a groundwater production permit for water withdrawn from the impoundment and used for irrigation (Johnson, 2013, 38).

The Supreme Court affirmed the Authority's decision, finding that Day had failed to prove that their use of water was groundwater and not state water. This statement of the law has profound implications for any landowner using groundwater to supplement water in an impoundment on a water course. As stated by the Court:

We do not suggest that a lake can never be used to store or transport groundwater for use by its owner. We conclude only that the Authority

could find from the evidence before it that that was not what had occurred on Day's property (Id. at 823).

The Supreme Court then provided a detailed summary of the history of the Rule of Capture from its adoption in *East* to the decision in *Sipriano*, finally concluding that ownership of groundwater in place had never been decided by the Court. The Court noted that while it had never addressed the issue with regard to groundwater, it had done so long ago with respect to oil and gas, to which the Rule of Capture also applies. The Court noted that while ownership of gas in place did not entitle the owner to specific molecules of gas, which could be diminished through drainage, with proper diligence they could be replenished or obtained. The Court stated that while the molecules are in the ground, they constitute a property interest. The Court, quoting its previous decisions, noted that the right to the oil and gas beneath a landowner's property is an exclusive and private property right inherent in land ownership, which may not be deprived without a taking of private property (Johnson, 2013, 38-39).

The Supreme Court found that there was no basis in the differences cited between groundwater and oil and gas to conclude that the common law allows ownership of oil and gas in place but not groundwater. Specifically, the Court quoted itself regarding the ownership of oil and gas in place, before affirming this was its holding:

In our state the landowner is regarded as having absolute title and severalty to the oil and gas in place beneath his land. The only qualification of that rule of ownership is that it must be considered in connection with the law of capture and is subject to police regulations. The oil and gas beneath the soil are considered a part of the realty. Each owner of land owns separately, distinctly and exclusively all the oil and gas under his land and is accorded the usual remedies against trespassers who appropriate the minerals or destroy their market value. We now hold that this correctly states the common law regarding the ownership of groundwater in place (Id. at 831-832).

The court cited the legislative revisions to section 36.002 described above as demonstrating the Legislature’s understanding of the interplay between groundwater ownership and groundwater regulation (Johnson, 2013, 39).

The Supreme Court then analyzed whether Day had stated a viable takings claim. In so doing, the Court rejected the argument that the Authority’s regulatory action could be considered a *per se* taking for Fifth Amendment purposes and instead applied the regulatory takings analysis originally adopted by the U.S. Supreme Court in *Penn Central Transportation Co. v. New York City*, 438 U.S. 104 (1978). In *Penn Central*, the Court identified several factors that have particular significance in determining whether the regulation rises to the level of a taking under the Constitution. Primary among those factors are the economic impact of the regulation on the claimant and the extent to which the regulation has interfered with distinct investment-backed expectations. In addition, the character of the governmental action—in essence an analysis of their reasonableness of the regulation in light of the goals to be achieved and the impacts reasonably expected—must be considered (Johnson, 2013, 39).

Because this factual inquiry was not developed in the summary judgement proceeding, the Texas Supreme Court agreed with the Fourth Court of Appeals of Texas that summary judgment against Day’s taking claim should be reversed and the issue remanded to the trial court (Johnson, 2013, 39).

As a side note, the Supreme Court rejected Day’s complaint that section 36.066(g) of the Texas Water Code, which authorizes an award of attorneys’ fees and expenses to a groundwater conservation district that prevails in a suit like the underlying action,

violated equal protection. The Court found the State has a legitimate interest in discouraging suits against groundwater districts to protect them from costs and burdens associated with such suits and that a cost-shifting statute is rationally related to advancing that interest. Landowners who file takings claims should be aware of this provision (Johnson, 2013, 39).

Impacts on Surface and Groundwater Management and Regulation

The opinion in *Edwards Aquifer Authority vs. Day* resolved decades of conflict concerning the nature of the ownership right held by landowners in groundwater in Texas. By applying the case law applicable to oil and gas, the Texas Supreme Court has determined that groundwater is “owned in place” by the landowner and that this ownership right can support a claim for uncompensated taking under the state and federal constitutions. The Courts’ decision profoundly affects the interface between groundwater and surface water law on the landowner’s property and outlines the current Court’s view on the law that should be applied when a takings claim is brought by a landowner against a groundwater conservation district (Johnson, 2013, 39).

First, the Supreme Court concluded that the groundwater produced by Day from the well lost its character as groundwater and became surface water of the State of Texas when the water from the well reached and entered the intermittent creek on the Day and McDaniel property. Day had constructed a conveyance mechanism to move the groundwater from the well to the creek and assumed that they could withdraw their “groundwater” from an impoundment on their property without obtaining a permit from the State. The Supreme Court found that the (EA) Authority correctly determined that the groundwater became surface water when it entered the creek, therefore losing its

character as groundwater and extinguishing the ownership interest of Day in the groundwater (Johnson, 2013, 39).

By so finding, the Supreme Court has likely inadvertently converted what so many landowners assumed was their lawful use of groundwater into unlawful diversions of state water without a permit. Many rural properties have groundwater wells and facilities constructed so that the groundwater can be used from an impoundment on the landowners' property. If the impoundment is on a watercourse, or the groundwater is withdrawn and used by the landowner after entering a watercourse, the Supreme Court's opinion implies that this will be viewed as an unlawful diversion of state water, even though the water diverted would not have been there but for the actions of the landowner. The Court made mention of the fact that Day had not measured the amount of water flowing from the well to the lake or the amount pumped from the lake into the irrigation system, that there was no direct transportation from source to use, and that the withdrawal was only periodic, as needed, to irrigate the adjacent acreage. The Court made much of the fact that the lake was apparently not used to store water for irrigation but was primarily used for recreation. However, landowners should be aware of this decision and the potential impact it may have on their ongoing water use on their property (Johnson, 2013, 39-40).

The Takings Analysis

After determining that landowners do have a constitutionally compensable interest in groundwater, the Texas Supreme Court could, and probably should, have simply reversed and remanded to the trial court for consideration of Day's taking claim. Instead, the Court wrote on whether the Authority's regulatory scheme had resulted in a

taking of that ownership interest. Given the procedural history of the case (a takings claims denied on Motion for Summary Judgment by the (EA) Authority, the Court was not obligated to address this issue; the issue was not directly before it (Johnson, 2013, 40).

Despite this, the Court engaged in an extensive analysis of regulatory takings claims. As described by the Court, 3 analytical categories of takings have been developed under Texas and federal law. Two categories of regulatory action generally deemed to be *per se* takings are (1) situations where the government requires owners to suffer a permanent physical invasion of their property and (2) regulations that completely deprive owners of all economically beneficial use of their property. The Court noted that outside of these 2 relatively narrow categories, regulatory takings challenges are governed by the standards set forth by the U.S. Supreme Court in *Penn Central*. *Penn Central* holds that there is not a set formula for evaluating regulatory takings claims but identified several factors that had particular significance. Primary among those factors are the economic impact of the regulation on the claimant and the extent to which the regulation interferes with distinct investment-backed expectations. In addition, the Supreme Court indicated that the character of the government action may be relevant in discerning whether a taking has occurred. Quoting its own decision in *Sheffield Development Co. vs. City of Glenn Heights*, the Court noted that all the surrounding circumstances must be considered in applying a reasonableness test so that, in the end, whether the facts are sufficient to constitute a taking is a question of law, *Day* at 839 [quoting *Sheffield Dev. Co. v. City of Glenn Heights*, 140 S.W.3d 600 (Tex. 2004)] (Johnson, 2013, 40).

Noting that the case before it was on summary judgment, the Supreme Court examined the evidence and concluded that the 3 *Penn Central* factors did not support summary judgment for the Authority and the State and that a full development of the record may demonstrate that the Authority's actions were too restrictive of Day's groundwater rights and without justification in the overall regulatory scheme (*Id.* at 838-843). The Court rejected the Authority's argument that if groundwater regulation can result in compensable takings, the consequences will be disastrous (*Id.* at 843-844) (Johnson, 2013, 40).

What Constitutes a Taking?

The Day Court did not answer the question of what actions will or will not be considered a taking under the *Penn Central* analysis. In fact, the Court could hardly pronounce such an absolute rule given that all takings analyses are fact dependent. So, what is a groundwater conservation district to do (Johnson, 2013, 40)?

The short answer is that groundwater conservation districts must consider the goals they seek to accomplish by regulation in comparison to the economic impact on landowners within their jurisdiction. Specifically, groundwater districts should consider the impact on investment-backed expectations of subsequent regulation and the economic impact to landowners of the application of those regulations. This analysis has particular application to groundwater users who have made investments based upon their ability to produce groundwater, which are interfered with by the regulations. Interference alone, or negative economic consequences alone, are not sufficient, by themselves, to support a takings claim. A deciding court must measure the regulatory goals against the economic impacts (Johnson, 2013, 40).

Despite claims to the contrary, the *Day* decision does not mandate a correlative rights approach to be used by groundwater conservation districts to avoid takings claims. A strict correlative rights system would inevitably have negative economic consequences for those already using groundwater inconsistent with whatever correlative rules are developed by the district. This is particularly true if the district assumes that all correlative rights will be exercised since these situations do not and have not occurred historically (Johnson, 2013, 40).

Groundwater conservation districts should be particularly concerned about the basis for their decision establishing a desired future condition. Specifically, absent findings of adverse consequences associated with less restrictive desired conditions, districts will be challenged if the restrictions levied cause severe economic dislocation and are designed to meet a laudable goal—one that, if not met, would not result in catastrophic consequences (Johnson, 2013, 40-41).

In conclusion, Johnson (2013, 41) states that prior to the decision in *Edwards Aquifer Authority v. Day and McDaniel*, many groundwater conservation districts in Texas were advised that regulations restricting access to ground water could not support a takings claim. After the decision, these groundwater districts will need to reconsider their approach to establishing limits and, in particular, examine and justify the reasons for those limits. Absent such justification, proof of economic dislocation or loss of investment-backed expectations will undoubtedly result in takings claims that could be successfully pursued (Johnson, 2013, 41).

A New Day? District Perspective

After the review from legal expert Russell Johnson, we move to the next legal expert with a district perspective on the *Day/McDaniel* case. The discussion continues with the Texas Supreme Court issued opinion for *Edwards Aquifer Authority v. Day and McDaniel*, 55 Tex. Sup. Ct. J. 343, 369 S.W.3d 814 (Tex. 2012) holding that there is a vested property right in groundwater prior to capture, and the Courts must now consider whether a particular government action rises to the level of a regulatory taking. The following discourse lays out the background of the Day case, the Courts' opinion, and the impact the opinion will have on future litigation and groundwater regulation generally (Ellis, 2013).

Synopsis⁴ - Gregg Ellis

Farmers Day and McDaniel applied for an Initial Regular Permit (IRP) from the Edwards Aquifer Authority (the Authority) claiming 700 acre-feet of water rights. They presented evidence of having an Edwards Aquifer well and that they irrigated 150 acres of pasture from a lake on the property and an additional 7 acres directly from the well. The lake was filled by artesian flow from the well that discharged to a ditch and included intermittent surface water flows. The Authority issued a permit for 14 acre-feet based on the 7 acres irrigated directly from the well; Day and McDaniel appealed the permit decision and filed multiple constitutional claims, including a takings claim for the groundwater lost. The Texas Supreme Court upheld all the permitting decisions made by

⁴ Sections of this text were taken from a December 2010 paper co-authored by Gregory M. Ellis and Russell S. Johnson presented at the University of Texas School of Law 2010 Texas Water Law Institute (December 2-3, 2010, Austin, Texas).

the Authority, including limiting the permit of 14 acre-feet for the land irrigated directly from the well, but also held that landowners have a vested property right in groundwater prior to capture and Day and McDaniel were therefore entitled to have the Court consider whether any of their property was taken through this permitting action (Ellis, 2013, 42).

Facts

The Authority conducted a contested case hearing on the application by Day and McDaniel. During the contested case hearing, the evidence concerning when and how many acres were irrigated was disputed. Testimony ranged from a low of 150 acres to a high of 300 acres irrigated plus recreational use of 50 acre-feet in a lake on the property that was an impoundment on the creek. In addition, the evidence demonstrated that Day and McDaniel had diverted water directly from the well to irrigate 7 acres of property adjacent to the well site (Ellis, 2013, 42).

The Authority does not regulate any formation other than the Edwards Aquifer, and the record does not indicate if Day and McDaniel attempted to access any formations other than the Edwards Aquifer. Day and McDaniel have not applied for a Term Permit as provided by Section 1.19 of the Authority's enabling Act⁵ (Ellis, 2013, 42).

Procedural History and Claims

At the conclusion of the contested case hearing, the Authority determined that the water pumped from the impoundment on the property was surface water and therefore owned by the state and did not constitute historical use of groundwater from the Edwards

⁵ A compilation of the EAA Act including all amendments can be found on the Authority's website, at <http://www.edwardsaquifer.org/legislation-and-policy/the-eaa-act>

Aquifer. Thus, the Authority denied the permit application for the acres of the property irrigated from the impoundment of the property. The Authority found that Day and McDaniel had shown historical use of groundwater on the 7 acres adjacent to the well and issued a permit to withdraw 14 acre-feet of water per year from the aquifer (Ellis, 2013, 42).

Day and McDaniel appealed to state District Court claiming error by the Authority. In addition, and in the alternative, they argued that the actions of the Authority constituted a constitutional taking and an inverse condemnation of their groundwater rights and sought damages. The Authority interplead the State as a third-party defendant seeking contribution and indemnity from the State on the takings claims made by Day and McDaniel (Ellis, 2013, 42).

The District Court held that the water pumped from the impoundment on the Day and McDaniel property was not state surface water. The Court found that the water used was groundwater from the aquifer and found, based on the record, that this water had been used to irrigate a 150 acres of the Day and McDaniel property, and that Day and McDaniel were entitled to a permit to withdraw 300 acre-feet of aquifer groundwater per year in addition to the 14 acre-feet authorized by the Authority. The Court granted the Authority's and State's motions for summary judgment on the constitutional takings claims finding that the plaintiffs had no vested right to groundwater under their property, and granted a take nothing summary judgment on all of Day's and McDaniel's constitutional claims (Ellis, 2013, 43).

Both parties appealed to the Fourth Court of Appeals in San Antonio. The Court of Appeals agreed with the Authority's conclusion that the water used from [the] lake

was state water and not groundwater and reversed the District Court's judgement granting a permit for acres irrigated with water from the impoundment. The Court of Appeals affirmed the Authority's decision granting plaintiffs' permit only for the 7-acre tract that was irrigated with groundwater directly from the well. The Court of Appeals reversed the take nothing judgment granted on summary pleadings on the takings claim and remanded to the District Court for further proceedings on the constitutional claims. The Court of Appeals concluded that landowners have some ownership rights in groundwater, that those rights are vested and therefore constitutionally protected, and reversed the District Court's grant of summary judgment on these issues (Ellis, 2013, 43).

Both the State and the Authority filed petitions for review of the Court of Appeals' finding that plaintiffs have a vested and constitutionally protected interest in groundwater beneath their property. Day and McDaniel filed a petition for review claiming error by the Court of Appeals to deny a permit for acres irrigated with water from the impoundment and making several constitutional claims. Eventually all 3 petitions were granted and answered by the Texas Supreme Court (Ellis, 2013, 43).

The Texas Supreme Court's opinion, issued February 24, 2012, affirmed the opinion of the Fourth Court of Appeals on the primary issues and remanded the case back to the District Court for a full hearing on the takings issues raised by the plaintiffs. The opinion covers a number of issues and includes a comprehensive discussion of Texas groundwater and property law. Both sides filed motions for rehearing that were denied on June 8, 2012 (Ellis, 2013, 43).

The first 8 pages of the opinion provide a recitation of the facts and procedural history of the case, including the findings of the administrative law judge during the

original permit hearings, the decision of the Authority's Board of Directors, the holdings of the District Court judge on appeal from the Board decision, and finally the opinion of the Court of Appeals. Of course, the biggest question was the nature of the property right in groundwater prior to capture, to which the Supreme Court devotes most of its discussion (Ellis, 2013, 43).

Before reaching the discussion of the property right, however, the Supreme Court reviewed the Authority's permit decision. Because the Authority held that the water allowed to flow into the creek became state water, the Board denied that portion of the application based on acres irrigated out of the creek-fed lake. First the Supreme Court determined that groundwater flowing into a surface-water course loses its nature as groundwater and becomes surface water owned by the State, citing the definition of state water as any "water of ordinary flow, underflow, and tides of every flowing river, natural stream, and lake, and of every bay or arm of the Gulf of Mexico, and the storm water, floodwater, and rainwater of every river, natural stream, canyon, ravine, depression, and watershed in the state" [citing § 11.021(a), Water Code]. The Supreme Court also noted that the Legislature specifically declared surface water "when put or allowed to sink into the ground . . . loses its character and classification . . . and is considered percolating groundwater." [citing § 35.002(5), Water Code]. The lone exception it cited is a situation where the owner of the groundwater obtains a "bed and banks" permit to use the water course as a conduit for privately owned water [citing § 11.042(b), Water Code]. However, there is no mention of the Chapter 36 definition of "waste," which includes "willfully or negligently causing, suffering, or allowing groundwater to escape into any river, creek, natural watercourse, depression, lake, reservoir, drain, sewer, street,

highway, road, or road ditch, or onto any land other than that of the owner of the well unless such discharge is authorized by [a wastewater discharge] permit . . . [§ 36.001(8)(E), Water Code]. That definition should require the Supreme Court to find that the groundwater discharge to the creek was wasteful, and therefore could not form the basis of a permit.⁶ Either way, the Supreme Court held the Board reached the correct decision on the permit (Ellis, 2013, 43).

Having determined the permit decision was correct, the Supreme Court turned its attention to the takings issue. The District Court decided that Day and McDaniel failed to meet the threshold issue of having a vested property right that could be taken. Then the Supreme Court held that groundwater should be “owned in place” the same as oil and gas property. The Supreme Court then inexplicably spends 10 pages of the opinion discussing prior groundwater cases and how the Supreme Court had never before held that groundwater was owned in place. It cited the original groundwater case, *Houston & T.C. Railway v. East*, saying, “No issue of ownership of groundwater *in place* was presented in *East*, and our decision implies no view of that issue” (emphasis in original). The opinion then discusses 4 cases decided since *East* (*City of Corpus Christi v. City of Pleasanton*, *Friendswood Develop Co. v. Smith-Southwest Industries, Inc.*, *City of Sherman v. Public Utility Commission*, and *Sipriano v. Great Spring Waters of America, Inc.*), finding that “[i]n none of them did we determine whether the water was owned in place” (Ellis, 2013, 43-44).

⁶ “To the extent water is available for permitting, the board shall issue the existing user a permit for withdrawal of an amount of water equal to the user’s maximum beneficial use of water **without waste** during any 1 calendar year of the historical period.” § 1.16(e), Edwards Aquifer Authority Act (emphasis added).

The discussion on ownership ends with comparisons to oil and gas cases and early holdings that oil and gas is owned in place. An important statement that appears to be dicta is that the ownership interest is based on “volumes that, while they could be diminished through drainage, with ‘proper diligence’, could also be replenished through drainage.” This statement ignores one of the major differences between oil and gas formations and aquifers; almost all the aquifers in the state are replenished through recharge from the surface. Any drainage that occurs may be fully replaced during the next rain event (especially true for the Edwards Aquifer, which measures well levels on a daily basis⁷). The “volumes” of oil and gas formations may be determined by measuring the formation; the same cannot be said for rechargeable groundwater formations (Ellis, 2013, 44). (*See* discussion of these difference on page 24 of the *Day* opinion.)

The opinion also addresses a recent Supreme Court decision in *Coastal Oil & Gas Corp. v. Garza Energy Trust*, where the Court denied an action for trespass liability based on “fracing” (sic) operations that may have extended onto the plaintiff’s land. The majority opinion in that case was that the plaintiff failed to state a claim for damages:

In this case, actionable trespass requires injury, and Salinas’s only claim of injury—that Coastal’s fracing (sic) operation made it possible for gas to flow from beneath Share 13 to the Share 12 wells—is precluded by the rule of capture. That rule gives a mineral rights owner title to the oil and gas produced from a lawful well bottomed on the property, even if the oil and gas flowed to the well from beneath another owner’s tract. The rule of capture is a cornerstone of the oil and gas industry and is fundamental both to property rights and to state regulation. Salinas does not claim that the Coastal Fee No. 1 violates any statute or regulation. Thus, the gas he claims to have lost simply does not belong to him [Coastal Oil 268 S.W.3d 1, 9 (Tex. 2008)] (emphasis added).

⁷ See <http://www.edwardsaquifer.org/>

The majority re-iterates this reasoning a few pages later in the same opinion:

[A]llowing recovery for the value of gas drained by hydraulic fracturing usurps to courts and juries the lawful and preferable authority of the Railroad Commission to regulate oil and gas production. Such recovery assumes that the gas belongs to the owner of the minerals in the drained property, contrary to the rule of capture. While a mineral rights owner has a real interest in oil and gas in place, “this right does not extend to *specific* oil and gas beneath the property”; ownership must be “considered in connection with the law of capture, which is recognized as a property right” as well. The minerals owner is entitled, not to the molecules actually residing below the surface, but to “a fair chance to recover the oil and gas in or under his land, *or* their equivalents in kind” [*Coastal Oil* 268 S.W.3d 1, 9 (Tex. 2008)] (emphasis added). The Day opinion makes all of this applicable to groundwater (Ellis, 2013, 44).

Finally, the comparison to oil and gas is concluded with a reference to *Elliff v. Texon Drilling Co.* and the following quote, in which the phrase “oil and gas” has been replaced with “groundwater”:

In our state the landowner is regarded as having absolute title in severalty to the [groundwater] in place beneath his land. The only qualification of that rule of ownership is that it must be considered in connection with the law of capture and is subject to police regulations. The [groundwater] beneath the soil [is] considered a part of the realty. Each owner of land owns separately, distinctly and exclusively all the [groundwater] under his land and is accorded the usual remedies against trespassers who appropriate the [groundwater] or destroy [its] market value [210 S.W.2d 558, 561 (internal citations omitted in original)].

Section IV of Justice Hecht’s opinion discusses whether Day and McDaniel had properly stated a takings claim, in light of the Court’s decision that groundwater

represents a constitutionally protected, vested property right. That discussion begins with a lengthy recitation of the history of groundwater regulation and the powers and duties of groundwater conservation districts. Then the Supreme Court held that facts in the record could not support a “physical invasion” taking; specifically, having been granted a permit for 14 acre-feet and could potentially drill a well for exempt uses up to 25,000 gallons per day⁸, Day and McDaniel could not claim a permanent physical invasion of their property. Justice Hecht added some interesting dicta by stating, “It is an interesting question, and one we need not decide here, whether regulations depriving a landowner of all access to groundwater—confiscating it, in effect—would fall into the category.” Presumably that would require district rules (or perhaps permit decisions) deny any possible permit for any amount of groundwater, along with a prohibition on wells even for exempt use. Until an actual case arises, however, this issue remains just “an interesting question” (Ellis, 2013, 45).

The Supreme Court then held that the “summary judgement record” was inconclusive on the issue of whether the permit decision denied Day and McDaniel “of all economically beneficial use” of their property. In reviewing the 3 *Penn Central* factors, the Supreme Court held the record was incomplete on the first factor (the regulation’s economic impact on the property) and the second factor (the owner’s investment-backed expectations) but concentrated most of its effort on the third factor: the character of the governmental action (Ellis, 2013, 45).

⁸ The opinion assumes each landowner may only drill 1 well for exempt uses, but there is no such limitation in either the Edwards Aquifer Authority Act, the Authority’s Rules, or Chapter 36 of the Water Code.

The discussion of groundwater regulation in terms of takings analysis began with a strong endorsement of the need for regulation. Citing both *East* and the “Conservation Amendment”⁹ the court said, “Groundwater provides 60% of the 16.1 million acre-feet of water used in Texas each year. In many areas of the state, and certainly in the Edwards Aquifer, demand exceeds supply. Regulation is essential to its conservation and use” (emphasis added) (Ellis, 2013, 45).

The opinion then differentiates between the goals and methods of regulating groundwater and regulating oil and gas, concluding that while oil and gas regulation may generally be based on surface acreage, groundwater regulation “that affords an owner a fair share of subsurface water must take into account factors other than surface area.” Reviewing the Authority’s statutory regulatory scheme and its emphasis on historic use, Justice Hecht made a comparison to surface-water statutes that also awarded permits based on historical use and found that there are fundamental differences. Specifically, she said that riparian surface water rights are “usufructuary,” and did not represent an ownership interest. “Furthermore, non-use of groundwater conserves the resource, ‘whereas the non-use of appropriated waters is equivalent to waste.’ To forfeit a landowner’s right to groundwater for non-use would encourage waste.” (citing *In re Adjudication of the Water Rights of the Upper Guadalupe Segment of the Guadalupe River Basin*). This argument ignores the fact that groundwater in the Edwards Aquifer flows from property to property and eventually out one of many springs.¹⁰ Just as water

⁹ Art. XVI, Section 59, Texas Constitution.

¹⁰ The opinion cites Amicus brief filed by the Canadian River Municipal Water Authority, which is located in the Texas panhandle over the Ogallala Aquifer, a very different aquifer.

flowing down a river is lost either to the next landowner or to the sea, groundwater in the Edwards Aquifer cannot be “conserved” through non-use. If landowners could conserve all their groundwater by not producing it, no regulation would be necessary. The Justice also argues that historical use regulations “would have been perversely incentivized to pump as much water as possible” had they known the historic use regulations were imminent. Of course that is exactly why the Legislature set the historic period from June 1, 1972, to May 31, 1993—to prevent people from “gaming the system” by pumping groundwater to inflate their historical claims. Sec. 1.16(a), EAA Act. It is also why the Legislature required the permits be based on “user’s maximum beneficial use of water **without waste.**” Sec. 1.16(e), EAA Act, emphasis added. Pumping groundwater without putting it to beneficial use would accomplish nothing. Although there may be incentives to overproduce, there are adequate safeguards to prevent it (Ellis, 2013, 45).

It is at this point in the opinion the Supreme Court attempts to interpret the meaning and intent of the recent amendments to Section 36.002 (S.B. No. 332 from the 82nd Legislature), a task made difficult by the compromises afforded to pass the legislation. The Supreme Court concluded that “deprive” and “divest” as used in subsection (c) of Section 36.002 “does not include a taking of property rights for which adequate compensation is constitutionally guaranteed.” The constitutional protection for taking private property is adequate compensation; there is no prohibition against the government taking property for public uses. Therefore, the prohibition in Sec. 36.002 (c) against depriving or divesting someone of their property goes beyond the constitutional protection. One could easily argue that a groundwater conservation district (other than the Authority, the Harris-Galveston Subsidence District, or the Fort Ben Subsidence District)

is prohibited from denying a landowner permission to drill at least 1 well for some beneficial purpose. The Supreme Court's interpretation seems to be that even if that 1 well is allowed, there must still be a complete takings analysis to see if that regulation goes too far. Indeed, the Court goes on to say, "a landowner cannot be deprived of all beneficial use of the groundwater below his property merely because he did not use it during an historical period and supply is limited."¹¹ The Supreme Court affirmed the opinion of the Fourth Court of Appeals that the case must be remanded to fully explore the takings claims (Ellis, 2013, 45).

The Supreme Court then addressed various other constitutional issues raised by the plaintiffs. First, an administrative body has no authority to decide constitutional issues, so it is improper to raise them as part of an administrative hearing process. Second, there is no constitutional requirement that the Board of Directors personally conduct hearings as opposed to referring them to a hearings examiner. Third, the Court did not need to address the "open courts" and "due process" arguments against the provision in the Administrative Procedures Act that allows *ex parte* communications between the administrative law judge and agency staff not involved in the contested case because Day and McDaniel did not claim any such contact occurred. Fourth, the plaintiffs' other due process claim against the substantial evidence rule is dismissed because they did not present any evidence that they were prevented from presenting at the hearing. The Court also pointed out that the substantial evidence rule does not "operate to

¹¹ It is interesting to note that the Court did not address Term Permits as authorized by Sec. 1.19, EAA Act, as a means of allowing some beneficial use of the groundwater.

restrict Day's evidence on his takings claim." The only interpretation of that statement must be that a party to an appeal of an administrative decision is allowed to present new evidence regarding constitutional takings claims without being bound by the substantial evidence rule (Ellis, 2013, 45-46).

Finally, the Supreme Court dismissed the plaintiffs' equal protection argument against application of Sec. 36.066(g), Water Code, which requires payment to a groundwater conservation district all attorneys' fees and court cost in a suit in which that district substantially prevails without affording the same consideration to any other party to that suit. The Court upheld the Fourth Court of Appeals decision on that issue because the State's interest in discouraging lawsuits against groundwater conservation districts is rationally related to the cost-shifting provision in the statute (Ellis, 2013, 46).

This unanimous decision by the Supreme Court may open the door to any number of suits against any number of groundwater conservation districts. The immediate impact may be that districts shy away from protection for historical uses and more toward either a correlative rights or reasonable-use regulatory plan, both of which will likely prove to be very expensive for cities and others with high demand. The most interesting aspect of the decision is its derision for protecting historical uses. Because takings litigation is generally centered around investment-backed expectations, one would think historical users would deserve the most protection and any regulation that is aimed at protecting those investments would be the most likely to pass constitutional muster. Instead, the Court turned that analysis on its ear by deriding protection of historical uses to the potential detriment of landowners who have yet to invest a dime (beyond the purchase price of their property). Mr. A. Dan Tarlock, in his well-known reference *Law of Water*

Rights and Resources, 2012 ed., discussed the *Day and McDaniel* decision in §4:29 as follows:

[T]he Texas Supreme Court . . . adopted the oil and gas rule of ownership in place for groundwater which inverts the usual objective of takings law—the protection of investment backed expectations—because the regulation of future uses may be more likely to be a taking compared to the restriction of existing uses!

Tarlock provides further analysis of the decision in **§4:36:**

Lower Texas appellate courts rendered a series of decisions suggesting that the [EAA] Act was not a taking. However, the Texas Supreme Court opened the door to taking claims by unnecessarily hardening the state’s doctrine of capture by adopting the oil and gas rule of ownership in place for groundwater and thus inverting the usual objective of takings law—the protection of investment backed expectations. The oil and gas rule is a fiction to allow landowners to lease the right to extract oil and gas, and no other state has applied it to groundwater [A. Dan Tarlock, *Law of Water Rights and Resources* §§4.29, 4.36 (2012 ed.)].

The Supreme Court’s decision would allow several parties to raise takings claims in future permitting decisions: the applicant, an existing well owner, and a landowner with a desire to “conserve” his groundwater through non-use. Once an aquifer has reached its limit (meaning the aggregate of all withdrawals meets or exceeds the amount the aquifer can sustain or the amount that will achieve the chosen desired future condition for that aquifer), what decision should a groundwater conservation district make? If the district denies an application because all available groundwater supply has already been permitted and is being produced by others, the applicant will surely sue. If the district grants the application but then reduces the permits for all other existing users, the existing users will certainly sue. If the district grants the application and does not reduce any other permitted uses thereby allowing aquifer levels to decline, surely the landowner, in

attempting to “conserve” his water, will sue because the district’s actions are allowing his vested property rights to be confiscated by others (Ellis, 2013, 46).

It may well turn out that after all the litigation is said and done very few plaintiffs will have prevailed. An “inverse condemnation” or “regulatory taking” is difficult to prove, and even if the plaintiff prevails he must pass the additional hurdle of proving up damages. Until these issues are settled through multiple lawsuits over multiple aquifers testing multiple regulatory methodologies, groundwater conservation districts will be diverting resources towards litigation defense and away from where they are most sorely needed: data collection and aquifer modeling. Although Sec. 36.066(g), Water Code allows districts to recoup their costs in suits where they prevail, that does not mean they will actually recover any funds (Ellis, 2013, 46).

When these suits are filed, how they will be prosecuted and what arguments may be raised are complicated issues. Regulatory takings are fact-dependent and addressed on an ad hoc basis, even though they are ultimately considered as legal matters to be decided by a court. Each new suit will require a complete analysis (Ellis, 2013, 46).

Bragg v. Edwards Aquifer Authority, Filed Nov. 21, 2006

Glenn and Jolynn Bragg (“Braggs”) applied to the Edwards Aquifer Authority for Initial Regular Permits to irrigate 2 pecan orchards: the “D’Hanis” orchard and the “Home Place” orchard. In both cases the Braggs requested 6 acre-feet of groundwater per acre, citing the higher water demand for pecan trees, although neither well had ever produced that amount of groundwater either during the historical use period or during any year prior to filing the litigation. However, under the Edwards Aquifer Authority Act permits may only be granted for the amount of water withdrawn and beneficially used

during an historical use period (1971-1992). The well at the Home Place orchard had historical use, but the D'Hanis Orchard well was drilled in 1995 and did not qualify for an Initial Regular Permit¹² (IRP). As a result, the Authority denied the D'Hanis permit application on the basis that there was no irrigation during the historical use period. The Authority granted the Home Place permit application at the statutory minimum for agricultural irrigation wells of 2 acre-feet of water per acre (which is more than the amount ever actually produced from that well) for each acre of land actually irrigated during any 1 year of historical use period. The Braggs claimed a constitutional taking of their common law water rights and sought compensation from the Authority. The Braggs originally sued the Authority for federal civil rights violations as well, but all of those claims were denied in federal court and the state takings claim was remanded to state court (Ellis, 2013, 53).

Following a bench trial, the Court ruled that Edwards Aquifer Authority Act's enactment and implementation did not deprive plaintiffs of all economically viable use of their property and concluded that:

- the Act's enactment and implementation "substantially advance the government's legitimate interest" in protecting the Edwards Aquifer and the associated springs;

¹² EAAA § 1.16(a) ("An existing user may apply for an initial regular permit by filing a declaration of historical use of underground water withdrawn from the aquifer during the historical period from June 1, 1972, through May 31, 1993."); id. § 1.16(e) ("To the extent water is available for permitting, the board shall issue the existing user a permit for withdrawal of an amount of water equal to the user's beneficial use of water without waste during any one calendar year of the historical period. If a water user does not have historical use for a full year, then the authority shall issue a permit for withdrawal based on an amount of water that would normally be beneficially used without waste for the intended purpose for a calendar year.").

- no statute of limitations bar actions brought for takings claims raised as part of the permitting process;
- the Authority’s denial of the D’Hanis Initial Regular Permit application “unreasonable impeded the Plaintiff’s [sic] use of the D’Hanis Orchard as a pecan farm, causing them a severe economic impact; interfered with their investment-backed expectation, and constituted a regulatory taking of the Plaintiff’s [sic] property” under the *Penn Central* and *Sheffield* (Texas) cases for which the compensation owed the Braggs is \$134,918.40 (calculated from the difference, per acre, in the value of dry land farm land and Edwards Aquifer-irrigated farm land in Medina County); and
- the Authority’s granting of the Home Place Initial Regular Permit for less than the amount requested “unreasonable impeded the Plaintiff’s [sic] use of the Home Place Orchard as a pecan farm, causing them a severe economic impact; interfered with their investment-backed expectations, and constituted a regulatory taking of the Plaintiff’s [sic] property” under the *Penn Central* and *Sheffield* (Texas) cases for which the compensation owed the Braggs is \$597,575 (current market value of \$5,500 for the 108.65 acre-feet of EAA permitted rights that were requested, but not granted).

The total amount of compensation found owed was \$732,493.40 (Ellis, 2013, 53).

The judge’s findings of fact and conclusions of law found, among other things,

that:

- “the Authority acted solely as mandated by the Act and without discretion in denying the D’Hanis Application and in granting a permit on the Home Place Property for 120.2 acre-feet of annual Edwards Aquifer water withdrawals” in an Initial Regular Permit; and
- the Authority requested attorney’s fees were reasonable.

Notably, the Bragg court considered whether the relevant parcel for a taking could be limited to the groundwater estate in the regulated Edwards Aquifer and accepted such an approach with respect to the Home Place Property, though that same calculus was rejected for the D’Hanis Property. Further, the Court determined that the Braggs should be compensated for the Home Place Property not based on the value of their groundwater rights but based on the

groundwater rights the Braggs requested from the Authority but did not receive (Ellis, 2013, 53).

The Authority and the Braggs each filed notices of appeal and the parties' briefs have all been filed with the Fourth Court of Appeals in San Antonio. In addition, 3 amicus briefs were filed, 1 by the San Antonio Water System in support of the Authority and 2 filed in support of the Braggs by the Pacific Legal Foundation and the Texas Farm Bureau, *et al.*¹³ (other amicus briefs are likely to be filed in the near future). The Court of Appeals heard oral argument on March 28, 2013 (Ellis, 2013, 53-54).

The Medina County District Court held that the Authority took the Bragg's property through 2 actions:

1. denying a permit to withdraw non-exempt groundwater from a well and
2. granting a permit for an amount less than the landowners requested.

Neither approach considered alternative groundwater supplies still available to the Braggs, thereby creating law that grants a vested property right in each and every aquifer formation beneath a property as a severable estate. Neither approach considered the Edwards Aquifer groundwater still available to the Braggs through exempt-use domestic and livestock wells or Section 1.19 term permits, thereby creating law that grants a vested property right in each and every type of permit offered by a district. The Fourth Court of Appeals must clarify just

¹³ Other Amici on the Texas Farm Bureau brief: Texas and Southwest Cattle Raisers Association, Texas Forestry Association, Texas Association of Dairymen, Texas Wildlife Association, and Texas Cattle Feeders Association.

how takings analysis should be applied to groundwater regulation, and provide a regulatory path that groundwater conservation districts may follow to avoid taking private property in the future (Ellis, 2013, 54).

In May of 2015 almost 18 years of litigation reached a decision point when the Texas Supreme Court declined to review an Appeals Court ruling in *Edwards Aquifer Authority v. Glenn and JoLynn Bragg*. It marked the first time that a landowner in Texas had a ruling that groundwater rights were taken by a groundwater conservation district. The decision clouded the future of regulated pumping in Texas, but the long term impacts may be far less significant for the Edwards region than for other areas in Texas. This is because of a 10-year statute of limitations on takings claims after an Edwards permit is issued. There are not many Edwards permits for which the clock has not already run out. For other groundwater districts, however, the decision may lead to litigation over existing permits and may have a chilling effect on their future permitting activities (Eckhardt, 2016).

In January of 2016, a mediation session was scheduled where parties tried to agree on the amount of compensation owed to the Braggs. The mediation failed, and the case was scheduled for a jury trial on February 16. On February 22, after hearing closing arguments, jurors deliberated throughout the afternoon and found that Glenn and JoLynn Bragg were owed \$2,551,490 by the EAA for unconstitutionally taking their private property. In May of 2016, Judge Tom Lee of the 38th Judicial District Court awarded the Braggs compounded daily interest on their \$2.5 million, adding \$1.97 million to the total award (Eckhardt, 2016).

As groundwater conservation districts approach the limits on the amount of groundwater that may be produced and still achieve that aquifer's desired future condition each Board of Director will be faced with a choice of denying new applications (highly unlikely in light of the *Day* decision) or reducing existing permits. Under this District Court's analysis, every groundwater conservation district would be potentially liable for money damages for every denied application *and* for every reduced permit. There is no path to nonliability other than foregoing any regulation according to Ellis (2013, 54).

Other Potential Lawsuits According to Ellis

The potential for takings lawsuits filed against groundwater conservation districts is virtually limitless. Because each aquifer is different the regulations addressing who gets permits and for how much is different. Potential plaintiffs include those who are denied permits, those whose permits are reduced and any landowner who watches aquifer levels decline over time. Not only will production limitations be challenged, but spacing limitations as well (Ellis, 2013, 54).

Key questions include:

- Does this mean every urban and suburban lot owner is entitled to a water well and some amount of groundwater (or compensation)? What is the "fair-share" due to a small lot landowner?
- Can a landowner file suit against a groundwater conservation district for allowing groundwater beneath his property to decline (caused by permits for withdrawal on other properties)?
- Are municipalities that prohibit or restrict water wells now also facing takings liability?
- Is there a potential for federal takings claims in addition to state takings claims?

- Can groundwater conservation districts say “no permit this year” without takings liability, or would they face liability for a temporary takings? How will this affect water conservation requirements and drought restrictions?
- Do historical users, who have investment-backed expectations, have the best claim for a takings?
- Is domestic and livestock use enough of a “fair share” or is that going to depend on how many acres the landowner controls?
- Is there a vested property right to each aquifer or formation, or as long as the landowner has access to some reasonable amount of groundwater can restrictions on tapping other formations avoid takings liabilities?

Ellis Conclusions

The argument over groundwater regulation in Texas will be settled as groundwater conservation districts all over the state continue to tighten controls on groundwater production and landowners begin filing takings claims. Cities will continue to look for plentiful, affordable water supplies for their growing populations and rural areas will continue to worry about their long-term supplies as aquifer production increase. People who are looking to protect future supplies often speak of aquifers as “our water,” while those who are seeking to sell water supplies only refer to “my water.” In fact, groundwater is neither “ours” nor anybody’s “mine,” which is exactly why reasonable regulation is so necessary. Landowners cannot fence their groundwater, cannot quantify the water that flows past their property underground, and cannot prevent anyone from drying up their well. Landowners’ only “fence” is a strong groundwater conservation district permit quantifying their ability to capture groundwater and the requirement that their neighbors obtain permits. Fighting against that regulation through

takings lawsuits will only weaken everyone's claim to ownership of groundwater (Ellis, 2013, 54).

Voting Rights Issue

If the Edwards Aquifer Authority were a routine governmental agency, the composition of the Board of Directors in the districts, clearly, would be in violation of the Texas Constitution. The one-man, one-vote principle is not, currently, in effect, and minority voters in the district do not have equal clout on the 15-member Board because most live in Bexar County, which is represented by seven board members. But the EAA is a special case, created by an agreement involving the League of United Latin American Citizens (LULAC) and other entities including the San Antonio Water System (SAWS). In 1995, an agreement was reached after a previous incarnation of the EAA's appointed board was ruled in violation of the Voting Rights Act. The U.S. Justice Department approved the deal that modified the EAA (*San Antonio Express News*, 2014).

The agreement was designed in consideration of the water/property rights of agricultural interests and more sparsely populated counties in the Edwards Aquifer region that share use of the aquifer with the City of San Antonio. Property rights – specifically the rights of landowners to pump water from beneath their property – were hotly contested issues as the region struggled to control (over) use of the aquifer. The debate was intense, and the agreement that gave birth to the EAA, as we know it today, was testament to goodwill and regional cooperation. However, in 2012, LULAC sued the EAA for violating the Equal Rights Protection Clause of the 14th Amendment of the U.S. Constitution, and SAWS intervened in support of LULAC. The move pitted SAWS

against regional partners at a time when regional water planning became more crucial by the day (*San Antonio Express News*, 2014).

The Edwards Aquifer Authority was not created as a traditional political subdivision such as, a county or a city or a district. It was created as a regulatory authority to manage and balance competing interests in a finite shared resource. To its credit, the Texas Legislature devised a regulatory plan that took into consideration the interests of the two counties upstream (Medina and Uvalde); the two counties downstream (Comal and Hays); and the largest populated county (Bexar) in the middle. It also protected the agricultural interests, environmental concerns, and the far downstream counties along the rivers served by the Edwards Aquifer. By establishing a Board of Directors for the EAA, the legislative framers assured stakeholders that not one of these competing interests, by itself, could gain complete control of this scarce and valuable water resource. This negated the motivation of the lawsuit brought forth by LULAC and SAWS which sought to overturn the delicate balance and seize control by only one interest group (*San Antonio Express News*, 2013).

Even though Medina and Uvalde counties were smaller than the SAWS customer base, they still had a large agricultural sector as well as public interests to be protected; and, even though Comal and Hays counties combined were smaller than Bexar County in which SAWS operates, they, too, had pressing environmental concerns impacted by use of the aquifer, as well as, citizen's interest to be protected. Very few of the residents in any of those four counties were SAWS customers (*San Antonio Express News*, 2013).

It was the opinion of Medina County Judge James E. Barden, that we need to be extremely careful in overthrowing protection of minority interests in seeking to answer

the siren call of giving total control to the place with the most votes. This lawsuit is not about racial or ethnic discrimination. It's about how we manage our shared water resource for all of those who share, not just those with the most votes (*San Antonio Express News*, 2013).

The *LULAC v. EAA* case worked its way through a federal district court in San Antonio and was scheduled to go to trial in 2014. At the time of this paper, the case had yet to be heard (Table 3.3). If the plaintiffs are successful, 14 of the 15 districts would be placed in all, or part of, Bexar County, according to an EAA analysis. It is duly noted that the SAWS, which holds most of the pumping permits for the Edwards Aquifer and provides the vast majority of the EAA's revenue, is not happy with the EAA's Board of Directors composition. The lawsuit has the potential to lead to the demise of the EAA, which already has established pumping allocations for the aquifer. The other seven counties involved in the EAA will have no incentive to participate in the agency if the City of San Antonio (SAWS) holds the overwhelming majority number of seats on the EAA's Board of Directors (*San Antonio Express News*, 2014).

At issue, according to those stakeholder participants interviewed for this research that commented on the issue of EAA Board's composition, is the fact that the voting jurisdictions were decided on by the court. The court required the Board's districts to be set up by LULAC in 2000. At the center of the discussion (and those parties bringing the complaint) are the permit holders who pay the majority of the pumping fees and are responsible for funding the Edwards Aquifer Authority. Based on interview responses from SAWS, the EAA, and groundwater attorneys, the pumping fees paid by the majority stakeholder (SAWS) range from 70 percent to 85 percent of the EAA's budget, while

agricultural permit holders pump the majority volume of Edwards' water used for irrigation of crops.

Table 3.3 Day, Bragg, and LULAC/SAWS Cases 2014		
Edwards Aquifer Authority v. Burrell Day and Joel McDaniel	Issue began in 1997 and decision by court in 2012	Supreme Court of Texas held that land ownership includes an interest in groundwater in place that cannot be taken for public use without adequate compensation guaranteed by Article I, Section 17(a) of the Texas Constitution.
Edwards Aquifer Authority v. Glenn and JoLynn Bragg	Began 1998, decision reached in 2016	In January of 2016, a mediation session was scheduled where parties tried to agree on the amount of compensation owed to the Braggs. The mediation failed, and the case was scheduled for a jury trial on February 16. On February 22, after hearing closing arguments, jurors deliberated throughout the afternoon and found that Glenn and JoLynn Bragg were owed \$2,551,490 by the EAA for unconstitutionally taking their private property. In May of 2016, Judge Tom Lee of the 38th Judicial District Court awarded the Braggs compounded daily interest on their \$2.5 million, adding \$1.97 million to the total award.
League of United Latin American Citizens (LULAC) v. Edwards Aquifer Auth.	Filed 2012, no decision as of 2016	LULAC brought suit against the Edwards Aquifer Authority challenging the EAA's board apportionment based on the "one-man/one-vote" basis. Both sides have filed motions for summary judgement, and those motions were heard by the court in June 2014. The federal court has not yet ruled on the case.

What has changed?

The Edwards Aquifer Recovery Implementation Program (EARIP) requirement of a Habitat Recovery Plan (HCP) as mandated by Senate Bill 3 (SB 3) was a significant achievement for the region considering decades of disagreement by all the stakeholder groups with a vested interest, and/or resource reference for characterization and place

identity frame, in how the Edwards Aquifer would be managed. These stakeholder groups consist not only of the agriculture community to the west of the City of San Antonio in Uvalde and Medina Counties, but also the communities in San Marcos and New Braunfels who have a large part of their revenue stream supported by those communities through tourism and recreation. Included as well is the City of San Antonio as a primary participant with its rapidly growing population of more than two million residents who rely on the EA for their primary water supply. Other key stakeholder groups are the downstream interests who need adequate stream flow to support their estuaries and bays in support of the fisheries, which in turn support the fishing and recreation communities, as well as, the industries who rely on ample stream flows to support their various enterprises. Last but certainly not least, the primary motivation for developing an aquifer resource management plan, to avoid the blunt ax of federal intervention and takeover, includes an ample water flow in streams and rivers for supporting the habitat required by an endangered species, or as aptly referred by many stakeholders as “indicator species.” These species reflect the overall health of rivers and water sources, as well as the overall health of the entire community including human health and welfare. Since 1990, before SB 3, several attempts at creating and developing a Habitat Conservation Plan (HCP) were tried, however, until the Texas Legislature specifically set deadlines and guidelines, the planning process did not gain any traction in those previous attempts. John Hall, Judge Bunton, along with Todd Votteler and Joe Moore all had the best interest at heart for the health and welfare for all stakeholder groups involved, but their previous efforts simply did not work. What these individuals did succeed at, in working together, was to lay the foundation of subsequent legislation. Gulley (2015) discusses the efforts put forth

by these four individuals as instrumental in laying the foundation to the current HCP in place today. Starting with John Hall, Gulley emphasizes that John Hall's efforts stand out because of how close it came to succeeding in 1991-1992 with Hall as chair of the Texas Water Commission. Gulley singles out Hall's work in laying the groundwork for developing a management plan for the Edwards Aquifer and dedicates a chapter of his book, *Heads Above Water*, in describing his work because of the importance of his efforts to subsequent events surrounding the Edwards Aquifer management process.

Robert Gulley (2015) describes how John Hall deserves credit for attempting to resolve one of the most contentious issues surrounding management of the Edwards Aquifer – the absence of any regulating body as a state agency with the ability to regulate with policing authority groundwater from the aquifer and to bar the imminent trial in Judge Lucius Bunton's U.S. District Court that threatened to impose draconian measures for all stakeholder groups involved to limit their over pumping of the aquifer during extended periods of drought. Hall did not appear to feel the need to expand the jurisdiction of the Texas Water Commission, or create any new direction in following up on the question of what constituted an underground river, as others had attempted. By all indications he and the commission he chaired would have been happy to have the legislature create a regional agency to regulate the aquifer. In Gulley's words, John Hall was a problem solver. Table 3.4 list some of the significant events that laid the foundation and led up to the eventual creation and implementation of the Edwards Aquifer Authority.

Just like the Regional Water Resource plan before, the plan drawn by Hall and the Texas Water Commission came precariously close to working out a solution to the

Edwards Aquifer issue, but came up short due to strong opposition from the agricultural interest. In looking back, Hall believed that because of the two-acre-foot allocation in the rules may have been the deciding factor in reaching consensus.¹⁴ However, Luana Buckner, current and longtime chair of the Edwards Aquifer Authority Board of Directors, and was deeply involved with the debate in 1992 on the side of Medina County aquifer users, said she did not think including the two-acre-foot allocation in the final analysis made a difference; the sentiment for the rule of capture was too strong, particularly in Uvalde County.¹⁵

Early on in April 12, 1990, and while the Edwards Aquifer region was in a severe drought, the Sierra Club served notice of intent to sue with respect to protect the endangered species because of violations of the Endangered Species Act. A period of time passed and on May 19, 1991, and within days of the first failed vote to go forward with the Applewhite project by the citizens of San Antonio, and with the Texas Legislature showing no inclination to act during the 1991 session to protect diminished springflow from the Edwards Aquifer, the Sierra Club filed suit in the 2nd U.S. District Court for the Western District of Texas against the U.S. Fish and Wildlife Service under the Department of Interior via the Endangered Species Act for failing to protect the federally listed species in the Comal and San Marcos Springs. The case was assigned to Judge Lucius Bunton in Midland, Texas (Gulley, 2015).

¹⁴ John Hall in a personal interview by Robert Gulley in Austin, Texas, September 19, 2013.

¹⁵ Luana Buckner in a personal interview by Robert Gulley, San Antonio, Texas, January 6, 2014.

Judge Bunton grew up in Marfa, located in Presidio County, Texas, and he was appointed to the bench in 1979 by President Jimmy Carter. He gained a reputation as a no-nonsense environmental judge who was hard-driving and did not steer away from hard decisions (Smith, 1996). Judge Bunton had a method of rapidly dispensing of evidentiary findings hearing, and per Russell Johnson, who witnessed his style first hand, dispensing of what was thought to be enough material to take weeks to review, in mere hours. As per an Austin newspaper article, “Bunton had even been known to use a squirt gun on lawyers who were testy or too long-winded.” In a now legendary *San Antonio Express-News* photograph, Judge Bunton posed, barefoot and in his robes, while appearing to walk on water (Gulley 2015).¹⁶

Robert Gulley (2015, 59) writes that when the Department of Justice decided that the Edwards Aquifer Authority Act violated the Voting Rights Act, Judge Bunton found himself in an awkward position. His initial order made it clear that he intended to allow the plaintiff and plaintiff-intervenors an opportunity to seek additional relief if the state did not have a regulatory system “in effect” by May 31, 2003. The state appeared to have established this system with the enactment of Senate Bill 1477. But, the decision of the Justice Department placed the viability of the act in doubt. Judge Bunton reacted cautiously at first:

I’ve never wanted to take control of the aquifer, but I may have to, if something else doesn’t get done on it. . . I’ll just have to tread water for a while, maybe appoint a monitor to oversee the thing in case the situation gets bad. That was my choice to begin with—to give the state a chance to

¹⁶ Ralph K. M. Haurwitz, “Judge’s speedy manner, wit make court a breeze,” *Austin American-Statesman*, July 22, 1996. The “walking-on-water” photograph accompanied a feature entitled “The water crisis,” which appeared in the *San Antonio Express-News* on July 24, 1994. Roy Bragg wrote the article on Bunton.

handle the matter—and I am still inclined that way. I think it is a state matter and it ought to be handled by the state.

However, the prolonged delay that the Voting Rights Act issue introduced played an important role in many of the court's subsequent actions in the case.

Joe G. Moore was appointed as a court monitor for the Edwards Aquifer after the Sierra Club filed a motion on November 12, 1993 for Judge Bunton to act, primarily as a result of a severe drought during the summer threatened reduce stream flow. Judge Bunton had allowed ample opportunity for all parties to agree on a monitor, and failing to do so, the Judge acted accordingly and appointed Joe G. Moore to serve as court monitor. Even though the Texas Legislature had passed Senate Bill 1477 creating the agency of the Edwards Aquifer Authority to regulate the water resource, there was a gap in authority because there was “No plan in effect by any Federal, State, or local government entity that adequately protects against violations of the ESA [Endangered Species Act] caused by unregulated pumping from the Edwards Aquifer.”¹⁷ As court monitor, Moore was expected to collect information about the use and status of the Edwards Aquifer by analyzing plans to reduce withdrawals from the aquifer, monitor efforts to conserve water, and advise the court on the need to implement remedial actions. Through this action, Judge Bunton strongly urged the City of San Antonio to take all actions necessary to supply its citizens with alternative sources of water other than from the Edwards Aquifer as soon as possible. In this respect Judge Bunton was sending a clear message that the court was willing to take over management of the aquifer if the drought situation

¹⁷ Sierra Club v. Babbitt, “Order on motion to appoint a monitor,” December 10, 1993.

got worse and San Antonio failed to take adequate precautions to protect the spring flows from the aquifer (Gulley, 2015).

During yet another period of severe drought in May 1996, spring flow at the San Marcos and Comal Springs had fallen below “jeopardy” levels identified by the U.S. Fish and Wildlife Service and as noted by Judge Bunton the newly formed Edwards Aquifer Authority had twice “failed to recognize the current emergency in votes it had taken.”¹⁸ As a result on August 1, 1996 Judge Bunton appointed Todd Votteler as special master with instructions to develop a new Emergency Withdrawal Reduction Plan within ten days. When that plan developed by Votteler was delivered on August 23, 1996, the court dropped the blunt axe of federal intervention the Edwards Aquifer region had been working to avoid. Judge Bunton expressed that it was not the intention of the court to frustrate or impede the efforts of the Edwards Aquifer Authority to create and enact a management plan, but the fact is the court cannot ignore a federal statute designed to protect the endangered species simply because the Edwards Aquifer Authority is not prepared to properly manage its charged duty. Until the Authority is ready to do its job, “it is the duty of this Court to follow Congress’ directive that the endangered species and their critical habitat must be protected.”¹⁹

¹⁸ Sierra Club v. San Antonio, “Order,” August 23, 1996, 4.

¹⁹ Ibid

Table 3.4 Primary Significant Edwards Aquifer Events Prior to 1997		
Prior 1997 Events	Date	Description
Edwards Underground Water District	1957	Developed in response to drought of record in 1957 to protect, conserve water in the region, but lacked authority to limit pumping or even to require people to register their wells.
Applewhite Reservoir	1988	San Antonio began construction in 1990 but the project was eventually voted down twice by citizens of San Antonio in 1991 and 1994.
Living Waters Artesian Springs Ltd. (catfish farm)	1990	Began operations southwest of San Antonio by pumping 40 million gallons (equivalent to 25 percent of San Antonio's total water use) of Edwards Aquifer water per day and discharged into Medina River. Texas Water Commission was able to shut down through the state district court for violations of wastewater discharge regulations in 1992.
Guadalupe-Blanco River Authority and Sierra Club	1990	Filed separate notices warning the U.S. Department of the Interior of possible violations of the Endangered Species Act.
Edwards Aquifer as an Underground River	1992	Texas attorney general declared the Texas Water Commission had authority for regulating groundwater in the state, who declared the aquifer an underground river subject to state regulation to protect the springflows and endangered species. Uvalde and Medina Counties objected, while Hays and Comal Counties rejoiced. San Antonio joined forces with Uvalde and Medina, who were previously in opposition.
Sierra Club v. Lujan	1991	Sierra Club filed suit alleging U.S. Fish and Wildlife Service and Department of Interior failed to protect the endangered species in the San Marcos and Comal springs by allowing over pumping of the aquifer. San Antonio joined the side of the Federal government.
Senate Bill 1477	1993	Created the Edwards Aquifer Authority as a nine-member appointed board to limit pumping and manage the aquifer in the six-county region. The Edwards Underground Water District was also abolished and granted EAA the power to regulate and enforce pumping limits among all well owners in the region and the power to issue annual water rights based on historic use claim.
Mexican American Legal Defense and Educational fund (MALDEF)	1993	Filed a claim with the U.S. Justice Department contending the EAA Act violated the Voters Rights Act with an appointed board, and should be an elected board instead. Lead to further delays in state management of the aquifer situation as a water resource.

3.4 Continued		
Sierra Club v. Babbitt	1994	Sierra Club requested that Judge Lucius Bunton appoint a water monitor to gather, summarize, and evaluate aquifer data, present monthly reports, and advise the court as to whether plans to regulate pumping complied with the Endangered Species Act, request declaration for aquifer emergency to draw up plan to limit pumping. Sierra Club proposed expanding lawsuit to include San Antonio, Department of Defense, other municipal, agricultural, industrial, and domestic users. Those named by SC termed the action as “environmental scorched-earth policy.”
House Bill 3189	1995	Authored by Representative Robert Puente and sponsored in the upper chamber by Senator Ken Armbrister, HB 3189 enlarged the Edwards Aquifer Authority board to 15 members who were elected rather than appointed. Bexar County would elect seven members, the western counties would elect four members, with the eastern counties getting four members. Two non-voting directors would be appointed with one member to represent the South Central Texas Water Advisory Committee and one member to represent Medina and Uvalde Counties.
Sierra Club v. Glickman	1995	Filed complaint against in U.S. District Court against Secretary Dan Glickman and U.S.D.A. for a three-count violation of the Agricultural and Water Policy Coordination Act and the Endangered Species Act. Requested halt of federal tax dollars for grants, loans, and below-cost insurance to irrigators, claiming that these programs led to increased pumping from the aquifer. 1996 Judge Bunton ordered the USDA to comply.
Sierra Club v. San Antonio	1996	Sierra Club filed a class-action suit on June 10 when springflows reached critical levels and USFWS did not take action to reduce pumping. SC alleged pumpers were causing a taking of the seven federally protected species of fish, salamanders, and rice by reducing aquifer springflow that formed the habitat for the species.
Emergency Withdrawal Reduction Plan (EWRP)	1996	One day after EAA failed to declare drought emergency Judge Bunton directed two appointed water masters to develop EWRP with staged reductions triggered by declines in springflow to be activated by October 1 and remain in effect until EAA put into operation a critical management plan (CMP).

While Judge Bunton’s decision did not require the issuing of permits to meet the withdrawal caps pertinent to prevent over pumping, or “mining” the aquifer, his decision did provide the primary regulatory issue for protecting the species as well as how to accomplish that strategy while maintaining continuous minimum springflows. The mandate of the Edwards Aquifer Authority directed an elected Board of Directors to address that goal. This created a point of contention that has divided the region for years. The question that arose was: “Could the members of the EAA Board who were elected from the various districts, with seemingly opposing interests, put their differences aside to talk to each other rather than past each other, and accomplish the tasks that Senate Bill 1477 that created the Edwards Aquifer Authority in 1993. Senate Bill 1477 includes three principal provisions on how to manage the Edwards Aquifer. First, with certain limited exceptions, withdrawals of water are limited from the aquifer unless a permit has been issued through the EAA. It also places a cap on the maximum amount of water to be permitted while at the same time establishes guaranteed statutory maximum amounts that each qualified permitted participant could withdraw as part of their permit. The second required feature provides for measures to be implemented to ensure continuous minimum springflow to protect the federally-listed endangered species. The third feature requires the EAA to develop and facilitate implementation of a “critical period” management plan for times of drought (Gulley 2015; Putnam 2003).

As the year 2000 arrived, the EAA had yet to implement Senate Bill 1477, and thus, faced increased pressure for failing to operationalize the legislative mandate which called for developing a plan within nine months of creation of the Authority on how to

manage continuous minimum springflows. Even after facing intense pressure in 1998 from notices of intent to sue by the Sierra Club, Environmental Defense Fund, and National Wildlife Federation for alleged violations of section 9 of the Endangered Species Act for failure to take action, the EAA still did not instigate plans for a program to maintain minimum springflows (Gulley, 2015).

After 2007, when SB 3 legislation was passed and deadlines were set, the Texas Legislature did something that seemed to mimic two steps forward and three steps backwards. Instead of setting pumping limits at 400,000 AF per year by December 31, 2008 as originally called for, with reductions in pumping to bring overall annual pumping down to 350,000 AF per year, the Texas Legislature set pumping limits at a level to avoid litigation associated with property takings. To attain this goal, the legislature set pumping limits at 573,000 AF per year—a number set to cover the number of requests by landowners who applied for groundwater pumping permits during the historical period.

Senate SB 1 was authorized in 1997 establishing Groundwater Conservation Districts (GCDs) whereby the Texas Legislature pronounced that GCDs would be the preferred method for groundwater management in Texas, declaring that groundwater decision management would primarily be made at the local level of government. In 2015 there were approximately 98 GCDs authorized throughout the state, with several others pending.

A significant shortcoming of GCDs is that they do not follow aquifer boundaries, and only somewhat follow county lines. The result of this arbitrary method of delineating GCDs means that several GCDs might cover a single aquifer, perhaps even with several aquifers layered upon each other (i.e., the Edwards Aquifer over the Trinity Aquifer in

Hays County) with widely differing budgets and financial resources based on the number of well permits per district and the pumping fees collected on those permits. In addition to the varied budget constraints, each GCD is required to create a 50-year water management plan every five years. In 2001, SB 2 was enacted by the Texas Legislature to reinforce the idea that GCDs would be the preferred method of groundwater management throughout the state. In 2007, SB 3 addressed the need for environmental and instream flows for Texas surface water streams and rivers (Table 3.7).

The Edwards Aquifer Habitat Conservation Plan (EAHCP)

Senate Bill 3 also provided requirements for a recovery implementation program known as the Edwards Aquifer Habitat Conservation Plan (EAHCP) to manage Texas groundwater resources' firm yields during drought conditions and provide protection for the federally-listed endangered species and their habitat in the Comal and San Marcos Springs areas.

Table 3.7 Legislative Water Law Changes Since 1997 Relevant to the Edwards Aquifer		
Bill Name	Date	Action
Senate Bill 1	1997	Launched extensive regional water planning districts, and required that TWDB publish a comprehensive state water plan every five years. Restructured the process of water planning by creating 16 regional water planning groups; changes to interbasin transfers (IBTs) permitting process. This bill also consolidated all the different specialized funds operated by TWDB into a single financial assistance fund, the Texas Water Development Fund II. Established the Texas Water Trust. Donation into the trust allows private water rights to be left in the state's rivers and used for the benefit of the environment.
Senate Bill 2	2001	Relating to the development and management of the water resources of the state, including the ratification of the creation of certain groundwater conservation districts; providing penalties. Established an instream flow program under which state environmental agencies would collaborate to study river and stream flow conditions necessary to support a sound ecological environment. Follow-up to SB 1 (75th Legislature); enacted significant amendments to regional water planning; established Rural Water Assistance Fund (RWAF) and the Water Infrastructure Fund (WIF), both of which were intended to be supported by future appropriations; created Texas Water Advisory Council.

3.7 Continued		
Senate Bill 3	2007	Relating to the development, management, and preservation of the water resources of the state; providing penalties. SB 3 would create an administrative process to determine the environmental flow needs in Texas' rivers, bays, and estuaries. After establishing these environmental needs, the bill would require TCEQ to adopt rules to provide environmental flow standards, including set-asides in basins where unappropriated water was available.

The Edwards Aquifer Habitat Conservation Plan (EAHCP) was developed through a consensus-based process by a diverse body of stakeholders that included individuals within the eight broad-based stakeholder groups interviewed for this research. This group includes participants from industrial, agricultural irrigators, municipality officials, water purveyors, river authority decision makers, environmental organization leaders, several state agencies and elected officials, as well as other groups of individuals vested with down-stream interests. The idea is to manage pumping that maintains adequate flows in the rivers and its tributaries towards protecting endangered species and ensuring that downstream residents are economically viable with enough water to maintain their livelihoods through tourism, fisheries, industry, or available enterprises employed. At the authorization of SB 3, the Edwards Aquifer region was provided a timeline through December 2012 to finalize a recovery implementation program through a Habitat Conservation Plan whereby minimum stream flows are ensured for environmental needs, especially during times of drought to meet firm yields, thus protecting endangered species and their habitats.

The person hired to facilitate the process of developing a Habitat Conservation Plan was Dr. Robert Gulley, an environmental attorney with previous experience in Washington, D.C. working through contentious environmental issues. Dr. Gulley's credentials and experience ensured that he was perfectly adapted to handle the challenges

of bringing the various stakeholder groups together in this seemingly contentious intractable environmental conflict.

Several process mechanisms that would be needed for this plan to become a reality are: 1) a voluntary irrigation suspension program option (VISPO) that is a voluntary program open to irrigators with groundwater withdrawal rights from the Edwards Aquifer. It encourages farmers to use less water in times of severe regional drought by financially compensating them when they suspend their groundwater pumping. This conservation program helps protect springflows by keeping much needed water in the aquifer; 2) an Aquifer Storage and Recovery (ASR) system, in which daily, routine operations and infrastructure are developed and managed through the San Antonio Water System (SAWS). The ASR system is designed to minimize the impacts of extended drought to the protected species through a three-step leasing program. In addition, the ASR system is an option, whereby, groundwater during times of abundance, such as, when heavy rains occur, would be placed into storage in an aquifer (in this case the Carrizo-Wilcox Aquifer) other than the Edwards Aquifer and stored until needed during dry times. When water supplies are needed, pumping is reversed and stored water is used to satisfy industrial needs in lieu of increased pumping to meet pumping permits held by an entity, and; 3) an initiative to conserve water through the EAHCP emanates from the Regional Water Conservation Program where the goal is to conserve 20,000 acre-feet per year of permitted Edwards Aquifer withdrawals through incentives to municipalities that encourage water conservation. These programs include low-flow toilet distribution, leak detection, and other community specific efforts. Another EAHCP initiative surrounds the utilization of a five stage water use curtailment, known as the

Stage V “critical period” management for various stakeholder groups (municipalities, counties) within the EA region based on specified aquifer level readings at the J-17 well (located at Fort Sam Houston in San Antonio) and J-27 well (located in Uvalde County).

There is much confusion about what the reported Aquifer level readings mean for the J-17 and J-27 wells. When weather forecasters report the Aquifer stands at 650 feet, it does NOT mean there is 650 feet of water left or that the water level has reached 650 feet from the top of the Edwards formation. The number is simply an indication of relative pressure exerted on water at the location of the test well (Eckhardt, 2016). At certain elevation levels a specific percentage of water use curtailment is required for a municipality or water utility to implement, ranging from 15 percent at Stage 1, to 44 percent water usage reduction at Stage 5.

Several other initiatives for EAHCP management are obtained through utilizing applied research as an integral way in providing reliable knowledge about the spring systems and the species protected. The EAHCP also contains an Applied Research Program component that calls for conducting a variety of studies each year to evaluate the ecological dynamics of the springs systems. In addition, a Biological Monitoring Plan has been implemented since 2000, and has gathered baseline and critical period data to better understand the ecological conditions of both the Comal and San Marcos springs systems. Additional monitoring during low-flow periods will provide a better understanding of critical changes in new and existing threats as well as habitat tolerances. Water quality monitoring on a consistent basis will provide data that is useful for both systems to better understand the dynamics of the systems and potential threats existing for protected species and their habitats.

IV. LITERATURE REVIEW - THEORETICAL FOUNDATIONS OF INTRACTIBLE CONFLICT

Justification for a Qualitative Approach

Anfara and Mertz (2006), as well as other researchers that employ qualitative methods of inquiry, point out that there is little argument about the important role and acceptance that is placed on use of theory in qualitative research in modern times (Creswell, 1994, 2002, 2003; Creswell and Clark, 2007). According to Anfara and Mertz (2006, xix), the amount of literature available leaves one with two basic understandings relevant to this research: 1) that theory in qualitative research relates to the methodology the researcher chooses to use and the epistemologies underlying that methodology (Crotty, 1998; Denzin and Lincoln, 2003a, 2003b; Guba, 1990; Lincoln and Guba, 1985), and to a subset of this position that it is related to some methodologies (Creswell, 1994, 1998, 2002; Gall, Borg, and Gall, 1996; Patton, 1990; Yin, 1993, 1994) and; 2) that theory in qualitative research is broader and more pervasive in its role than in its methodology (Bentz and Shapiro, 1998; Flinders and Mills, 1993; Garrison, 1988; Maxwell, 1996; Merriam, 1998; Miles and Huberman, 1994; Mills, 1993; Schram, 2003; Schwandt, 1993).

In earlier works by Lincoln and Guba (1985) and Guba (1990), the authors discuss paradigms as “what we think about the world” (Lincoln and Guba, 1985, 15), “basic belief systems . . . that have emerged as successors to conventional positivism” (Guba, 1990, 9), that is, post-positivism, critical theory, and constructivism. They speak of theories as emerging from naturalistic inquiry, not framing it, and methods changing in

the process of theory definition. Guba (1990), in particular, called on others to support the paradigm-methodology connection (Eisner, 1990; Schwandt, 1993), and concluded, “If inquiry is not value free, is not all inquiry ideological?” (Guba, 1990, 11).

Interestingly enough in light of later works, Lincoln and Guba (1985) argued “naturalistic inquiry is defined not at the level of methodology but at the level of paradigm.” It is not crucial that “naturalistic inquiry be carried out using qualitative methods exclusively, or at all,” (250) clearly relating to methodology in relatively simple terms, quantitatively and /or qualitatively according to Anfara and Mertz (2006, xx-xxi).

Denzin and Lincoln (2003a, 2003b) equated paradigms with theory and argued that these paradigms contain the researchers’ “epistemological, ontological and methodological premises” that guide the researchers’ actions (2003, 33). These paradigms are identified as: positivism and post-positivism; interpretivism, constructivism, and hermeneutics; feminism(s); radicalized discourses; critical theory and Marxist models; cultural studies models; and queer theory (Denzin and Lincoln, 2003a, 32). The way it works, according to Denzin and Lincoln (2003b), is that the researcher “approaches the world with a set of ideas, a framework (theory, ontology) that specifies a set of questions (epistemology) that one then examines in specific ways (methodology, analysis)” (30). This is clearly linking theory to methodologies; it also suggests, however, that the study is widely affected by the linkage. Interestingly enough, the authors advised that the qualitative researcher should become “bricoleur” (6), taking on pieces of representations (paradigms, methods) to fit the situation. Clearly, paradigms and theories are something to be chosen by the researcher, and with those choices come guiding epistemologies (Anfara and Mertz, 2006, xxi).

To clarify the relationship among the elements identified by those relating methodological approaches and their genesis in and from philosophic orientations (called paradigms by Denzin and Lincoln, 2003b; theoretical traditions by Patton, 1990; theoretical stances by Merriam, 2002; and theoretical traditions by Crotty, 1998), Crotty differentiated among epistemology, theoretical perspective, methodology, and method, and argued that they inform one another. For Crotty, theories of knowledge, or epistemologies (e.g., objectivism, constructionism, subjectivism), inform and are embedded in theoretical perspectives (e.g., positivism, interpretivism, critical inquiry, feminism, postmodernism). He claimed that “the philosophical stance informs the methodology and this provides a context for the process and grounding its logic and criteria” (3). Methodologies—which include a wide range of approaches, from experimental research and survey research, to ethnography, phenomenology, grounded theory, and heuristic inquiry, to action research, discourse analysis, and feminist standpoint research—constitute research designs that affect the choice of methods to be used. For example, observation, case study, statistical analysis, document analysis, and so on. In reality, Crotty framed the reader’s understanding of the relationship the other way around. He perceived that research is constructed from the methods “we propose to use,” to the methodology that “governs our choice and use of methods,” to the theoretical perspective that “lies behind the methodology in question,” to the epistemology that “informs this theoretical perspective” (2) (Anfara and Mertz, 2006, xxi-xxii).

Yin (1994, 28) argued that case study research, in contrast to other qualitative research designs like ethnography, requires identifying the theoretical perspective at the outset of the inquiry, since it affects the research questions, analysis, and interpretation of

findings. In a sense, he argued, “the complete (case study) research design embodies a theory of what is being studied,” drawn from the existing knowledge base. It is interesting to note that whereas Yin categorized case study as a research design on a par with ethnography and grounded theory, Crotty (1998) saw case study as a method to be used in realizing methodologies like ethnography and grounded theory (Anfara and Mertz, 2006, xxii).

Creswell (1994, 1998, 2003) described the role of theory in qualitative research in relation to research designs (methodologies or theoretical perspectives in Crotty’s categorization, 1998). In his earlier book, Creswell (1994, 94) argued that the role of theory varies with the type of research design. In grounded theory, for example, theory is the outcome of the research. In phenomenology, “no preconceived notions, expectations or frameworks guide researchers. In “critical ethnographic” designed studies with “a critical theory component,” one begins with a theory that “informs” the study, although Creswell did not specify what it informs in the study. Interestingly, in referring to ethnographic designs without a critical theory component (his designation), Creswell specified that theories might be drawn from “existing theories of culture” outside of methodological parameters. For example, in referring to social exchange theory and how these theories might inform the study, he indicated that they might “help shape the initial research questions.” Having said this, however, Creswell argued that:

In a qualitative study, one does not begin with a theory to test or verify. Instead, consistent with the inductive model of thinking, a theory may emerge during the data collection and analysis phase . . . or be used relatively late in the research process as a basis for comparison with other theories (94-95).

Indeed, in depicting the research process for qualitative studies, the development of a theory or comparison with other theories comes after the gathering and analysis of data (Anfara and Mertz, 2006, xvii). In a later book devoted to distinguishing among five different “research traditions” in qualitative research—biography, phenomenology, grounded theory, ethnography, and case study—Creswell (1998) acknowledged that researchers bring paradigmatic assumptions (ontological, epistemological, axiological, rhetorical, and methodological) to the design of their studies, and may, in addition, bring ideological perspectives (postmodernism, critical theory, and feminism) that “might guide a study” (78). Although he did not specify how the paradigmatic assumptions or ideological perspectives affect the various research designs (traditions), Creswell spoke to “another perspective” (84). In the social science theories, he referred to as a theoretical lens rather than as an ideological perspective, and that this lens affects each of the research traditions. He contended that with ethnography and phenomenology, the researcher brings “a strong orienting framework” to the research, whereas in grounded theory, “one collects and analyses data before using theory” (86; Anfara and Mertz, 2006, xviii).

Underpinning Theory for Intractable Conflicts

Dewulf and colleagues (2009), in the manuscript, *Disentangling approaches to framing in conflict and negotiation research: A meta-paradigmatic perspective*, discuss the concepts of frames and framing and are said to have regained the attention of researchers in a broad range of disciplines including psychology (Levin *et al.*, 1998), sociology (Benford and Snow, 2000), communication (Scheufele, 1999) and management (Creed *et al.*, 2002; Fairhurst and Sarr, 1996; Stevenson and Greenberg, 1998).

Researchers studying conflicts, negotiations and inter-group interactions will find these concepts relevant. Conflicts are associated with differences in disputants' frames about the issue, what is important and how to respond to problems (De Dreu and McCusker, 1997; Pinkley and Northcraft, 1994; Salipante and Bouwen, 1995; Vaughan and Siefert, 1992). According to Dewulf *et al.*, framing effects influence the type and quality of negotiated agreements (Donnellon and Gray, 1990; Drake and Donohue, 1996; Putnam and Wilson, 1989; Schön and Rein, 1994), the resolution or perpetuation of conflicts (Lewicki *et al.*, 2003; McCusker and Carnevale, 1995; Stevenson and Greenberg, 1998) and the course of institutional change (George *et al.*, 2006). Mediators also rely on reframing as a technique for finding common ground among disputants by removing toxic language and altering the way that messages are conveyed and social accounts of the conflict are constructed (Gray, 2005; Moore, 1986).

What is the Nature of Frames?

Dewulf points out that from an interactional perspective, historically a primary tradition at the origin of the concept of framing is credited to Bateson's (1954) early work on meta-communication in which framing is about exchanging cues that indicate how ongoing interaction should be understood. This framing activity, for example, allows children to engage in rowdy play, wrestling each other to the ground, without treating this pseudo-fight as a real fight. They frame what they are doing as play, but one instance of foul play may be enough to shift their frame from play to a real fight. According to Bateson, it is the ambiguity of how to interpret ongoing interactions that creates the need for framing. However, aligning frames of interaction among the involved participants does not always succeed, for example, when confusion arises over whether a certain

statement was serious or merely a joke. The work of Goffman (1974, 1981) can also be situated in this general tradition that we refer to as interactional.

Bateson's (1954) approach treats frames as interactional alignments or constructions. Through meta-communication that indicates how the situation should be understood these alignments are negotiated and produce ongoing interaction. Frames are communicative devices that individuals and groups use to negotiate their interactions. Dewulf *et al.*, (2009) describes that within this approach, the term framing may be more appropriate since it captures the dynamic processes of negotiators or disputants' interactions. From this interactional view, frames are 'built up piece-by-piece' and constituted as an innumerable number of elements, amalgamated during the ongoing process of interaction (Gonos, 1977, 860). The framing of a situation may develop and shift within even short stretches of interaction, as meaning and order are co-created (Stokes and Hewitt, 1976).

Edwards Aquifer Authority: Identity and Characterization Frames

Putnam and Peterson (2003) studied these questions in the Program for Conflict and Dispute Resolution at Texas A&M University. They joined with scholars at six other universities (The State University of Pennsylvania, Ohio State University, University of Michigan, Cleveland State University, University of Colorado, and Georgia Institute of Technology) to investigate environmental conflicts that had continued for long periods of time. The research, funded by the Hewlett Foundation, consisted of each school selecting a different conflict that was local to each schools' specific location. All the researchers in this consortium used a similar concept to study the conflicts—framing, or the perceptions and worldviews that different stakeholders bring to an environmental situation through

interviews, newspaper articles, documents, and case histories. To draw conclusions about stakeholders in the dispute, researchers developed detailed analyses of the content for interviews and newspaper articles (Putnam, Peterson, and Royer, 2002).

Putnam and Peterson (2003) selected the Edwards Aquifer controversy because historically the Edwards Aquifer surfaced as a protracted conflict. The Edwards Aquifer conflict has persisted for a long period of time without resolution or consensus as to how the resource should be managed. In the evolution of the Edwards case, stakeholders provided lengthy histories of negotiated agreements that were ignored, adjudicated settlements that were appealed, and legislative actions that were, and still are today, being challenged. The Edwards Aquifer Authority grew out of struggles as to whether the aquifers should be managed and if so, who should do it. For many stakeholders the perceived costs of resolving the dispute were greater than the costs of continuing it (Putnam, Peterson, and Royer 2002, 1).

Conflict Framing

Framing refers to worldviews, how people interpret or make sense of experiences, and the way they talk about what is most important or least important in any particular situation. The issue regarding framing is not whether it is accurate or inaccurate, informed or uninformed; but the way people see the world is often how they act within it. People communicate to others how they view the world and often develop a collective or consensual view of events through the way they share their perceptions and actions based on these frames. Moreover, framing of a conflict situation and perceptions of parties in a conflict change over time and with the occurrence of new events. These changes can

assist towards resolution of intractable conflict or further mire various stakeholders into desperate disagreement (Putnam, Peterson, and Royer, 2002).

Framing is also a way that disputants assess blame for who caused a conflict and for who owns the problem. For example, a teenage daughter might frame a conflict with a parent about household chores as constant nagging about tasks that can never be completed, for example, the laundry always has to be done; the room is always dirty. She blames her parents for “never being satisfied with her efforts” and she sees the situation as the parent’s problem for being intolerant of her messiness. The parents, however, frame the situation as the daughter who always claims she will do her chores yet never gets around to them. They blame the daughter for “not keeping her promises and not following through on her chores.” Both clearly see the conflict in different ways and both are correct in their own way—chores are rarely ever completely finished and yet, constantly procrastinating only makes the chores bigger (Putnam, Peterson, and Royer, 2002, 3).

What is needed in this type of situation is a reframing of what “doing a chore means” and “what it means to follow through or complete the chores.” Reframing is providing new interpretations that allow both parties to see the situation in the same way. For example, the two could agree that if the chores are done by a specific date, the parents will not nag the child to do them. Thus, a clean room each Saturday means the chore is done—even if the room gets messy again by Monday. Chores must be done by Saturday each week, or they are not done. Note that in this example the issue is not who is right or wrong or who caused the problem; rather it is developing a common set of

understandings for moving forward to address a problem (Putnam, Peterson, and Royer, 2002, 3).

Framing embodies a number of perceptions or assumptions about ones' identity, opinions about other parties, and ways that the conflict should be managed. Identity frames refer to statements or phrases that reflect how the parties in a conflict describe their own role—who they are, what is important to them, and how their identity becomes vested in the conflict. The daughter's self-esteem is linked to her presumption that the parents think she is messy and irresponsible. The parent's authority is on the line in assuring that their daughter completes her chores. Their identities are intertwined with their interpretations of events and their perceptions of the conflict (Putnam, Peterson, and Royer, 2002, 3-4).

Characterization frames center on the way that parties describe other people involved in the conflict—particularly the way they see them as positive, negative, or neutral. Much like a narrative or a story, parties cast other stakeholders as particular types of characters—villains, heroes, allies, friends, major players, and background supporters. These characterization frames can be linked to escalation of a conflict, finding alternative solutions, or to helping parties work together to resolve a dispute (Putnam, Peterson, and Royer, 2002, 4).

For both identity and characterization frames, Putnam and Peterson (2003) examined the degree to which a person or groups' identity was linked: (1) to their interests or positions that they held about the dispute; (2) to their institutions, agencies, or job affiliations; or (3) to the place or location in which they lived. A representative from a regional water agency might strongly identify with the aquifer dispute because of the

issues of conservation or protection of the natural resource whereas a person from a state agency might identify with the dispute because of his job or his role as a representative of this agency. Thus, he would reflect an agency stance on what the dispute means to him. In contrast, a resident of Uvalde might identify with the aquifer because of the location of the farm that had been in their family for hundreds of years. This statement would reflect a place-linked identity to the aquifer (Putnam, Peterson, and Royer, 2002, 4).

For interactional frame theory, meaning is located ‘between the noses’ of people and ultimately depends on their reactions to or supplementations of each other’s communication (Gergen, 1996). This proposed research, as in Putnam and Peterson’s (2003) work, will rely on interactional frame theory by collecting data on verbal interaction processes and will rely on the analysis of observations in recorded interviews and transcribing that information into a form for comparison to previous analysis. Here the focus will be on variance between episodes in a sequence of interactions – or the ways that the same individuals might frame a conflict at different times in diverse ways (Dewulf *et al.*, 2009).

V. RESEARCH DESIGN

The previous chapter set the stage and provided theoretical rationale for a qualitative approach to this study which was inspired, guided and expanded from the previous work conducted by Putnam and Peterson in 2003. Data collection via interviews was coded for key words and phrases through analysis of stakeholder participants' framing process and perspective on groundwater management in south central Texas, specifically toward the Edwards Aquifer Authority through the period 1997 to 2014.

Sample of Participants and Data Collection

Thirty (30) semi-structured interviews were conducted, approximately 60 to 120 minutes in length. Key representatives from diverse stakeholder groups were selected by identifying their names and leadership roles involving management of the Edwards Aquifer (EA) through newspaper and archival sources. Using a snowball sampling method, these interview participants were asked to identify other important stakeholders in the EA management process for potential interviews who might provide useful and/or important information and perspectives concerning the evolution of conflict surrounding the Edwards Aquifer. Based on an individual's self-description of formal or informal roles in the disputes, research participants were classified into one of eight stakeholder groups that reflected a commonly used role based classification (see Wolfe and Putler, 2002). As Table 5.1 shows, the eight stakeholder groups were classified in the following manner: farmers/agriculture, business and industry participants, environmentalists, citizen activist, elected political officials, government agency officials, media affiliates, and mediators or other neutral third parties (adopted from Brummans, *et al.*, 2008).

The open-ended interview protocol used in this research was originally developed by Putnam and Peterson and appears in Appendix A. The protocol allowed participants to pursue their own themes within the context of broad questions about other individuals' roles in the conflict, their personal views of the issues at hand, their opinions about other stakeholders, and their ideas about how to resolve a conflict. The interviews were audio recorded, transcribed, and then returned to the participants for member checking (Lincoln and Guba, 1985). Additional archival data such as media articles, meeting and court records, memos, and technical reports were collected and analyzed to provide background information on the cases and to triangulate participants' response data (Jick, 1979), (Brummans, *et al.*, 2008).

Table 5.1 Comparison of Previous Research Different Conflict Characteristics						
	Ohio	Drake	Voyageurs	Edwards 1997	Edwards II 2014	Total
Type of Conflict	Water Regulation	Toxic Waste	Natural Resource	Natural Resource	Natural Resource	Totals
Duration of conflict in years	3.0	4.5	39.0	40.0	55.0	
Number of stakeholder groups	4	4	7	8	8	
Number of stakeholder	21	24	40	68	30	183
Farmers	0	1	0	11	2	15
Business and industry people	10	0	12	7	1	31
Environmentalists	7	7	6	8	2	30
Citizen activists	0	0	6	4	2	11
Elected officials	0	5	5	8	2	20
Government agency officials	2	11	7	26	18	64
Media affiliates	0	0	3	2	2	7
Neutrals	2	0	1	2	1	6

Constant Comparative Method of Data Analysis

Interviews were conducted using the resulting questions schedule developed by Putnam and Peterson (2003) to provide consistency in areas to be investigated. The audio recorded interviews were transcribed into text that were uploaded into QSR NVivo11, an established computer program that facilitates the systematic coding of a large set of textual data and the subsequent categorization of coded pieces of text. This program was used to sort and categorize the textual data using a “constant comparative method” of data analysis developed by Glaser and Strauss (1967). Open and axial coding (Strauss and Corbin, 1998) in Putnam and Peterson’s initial research generated five main categories (each with different subcategories) that surfaced regularly in participants’ accounts and suggested specific categories that participants used in their definition of the situations: (1) identity (foregrounding oneself or one’s own role, or own group [‘s role]—in the conflict in a positive or negative way); (2) characterizations of others in the conflict (foregrounding positive or negative characteristics of other disputants[‘s roles]—or groups of disputant [‘ roles]—or groups of disputants[‘roles] in the conflict); (3) conflict management (foregrounding preferred ways to handle the conflict, ranging from collaborative solutions to non-collaborative ones); (4) social control (foregrounding ways in which societal decisions should be made, e.g., hierarchically, in an egalitarian way, or individually); and (5) power (foregrounding different types of control or influence derived from position, information, expertise, resources, etc.). These same five categories were used for this research.

As in Brummans and colleagues' (2008) study, to gain more confidence in these framing categories, this research reviewed the research literature on conflict and intergroup relations. Support for disputants' *identity framing* was found in Crane and Livesay's (2003) work, which suggested that disputants develop a sense of belonging to a particular social, professional, or ethnic group, thus rooting one's social identity in a conflict in a particular way. Characterization frames resonated with Sherif, Harvey, White, Hood, and Sherif's (1961) and Tajfel and Turner's (1979) observations that people cast others as in-group or out-group members and attributes blame or causality to others for the way things are currently. Moreover, this category corresponds with previous research on intergroup conflict, which suggests that disputants' negative characterizations of others often forms the basis of coalition formation. These coalition formations led to the construction of boundaries between groups fueling a dispute's negative characterization of others and fueling a dispute's intractability (see Messick and Mackie, 1989). In line with Keltner's (1994) work, disputants were compared to view the management of conflicts from a collaborative (e.g., joint problem-solving) or non-collaborative (e.g., avoidance) point of view. Furthermore, following Wildavsky and Dake's (1990) idea that individuals vary in their dependence on others when making decisions, as well as in their sense of how much ownership over public decisions they desire, disputants foregrounded particular views of social control:

- 1) Hierarchist (high dependency on others, low self-ownership);
- 2) Egalitarian (high dependency on others, high self-ownership);
- 3) Individualist control (low dependency on others, high self-ownership) (see also Peterson, 2003)

Disputants often define the situation by emphasizing differences in power reflected in statements about expertise, authority, voice, force, threat, or coalitional strength. Support for this category was found in research on position, information, expertise, and resource power (French and Raven, 1959) and work on access to voice and assertions of legal and legitimate rights as mechanisms for exercising power in a conflict (Herrera, 1992). Table 5.2 provides the exact definitions of the framing categories used to conduct the content analysis.

Using the ten inductively derived framing categories as a coding scheme (i.e., positive or negative identity, positive or negative characterization of others, collaborative or non-collaborative conflict management, hierarchist, egalitarian, or individualist social control, and power), the transcripts were coded. Employing QSR NVivo the transcripts were divided into separate coding (“thought”) units (Holsti, 1969), each unit being a piece of text that stated an opinion about the conflict or indicated a particular way of defining the situation. Factual descriptions without the use of adjectives were coded in a “stop” category and not included (about 20 percent) in the content analysis. The remaining approximately 80 percent was divided into coding units and coded into one of the 10 framing categories.

Next, using QSR NVivo, the absolute and relative frequency counts were determined for the 10 framing categories across the four conflicts (Table 5.2). Subsequently, the absolute frequencies of the 10 categories per individual disputant were calculated (e.g., Participant no. 11 in previous research had 35 positive identity thought units, 15 negative identity thought units, 23 power thought units, etc.). To control for

variations in interview length, these frequencies were standardized across all participants by computing ratios. Ratios were computed by dividing a disputant's number of thought units for a particular framing category one's total number of thought units (e.g., if disputant no. 11 in previous research had 23 power units and her interview consisted of 156 thought units in total, this person's power ratio would be $23/156 = 0.15$).

Table 5.2 - Definitions of Framing Categories			
Framing Category	Definition	Absolute Frequency 1997	Relative Frequency 1997
Positive identity	Foregrounding of oneself or one's own group in a praiseworthy or optimistic way, seeing oneself or one's group as constructive, valuable, etc.	1043	0.11
Negative identity	Foregrounding of oneself or one's own group in a derogatory, pessimistic, or diminishing way, seeing oneself or one's group as antagonistic, destructive, etc.	276	0.03
Positive characterization	Foregrounding of other person or group in a praiseworthy or optimistic way, seeing the person or group as constructive, valuable, etc.	1166	0.13
Negative characterization	Foregrounding of other person or group in a derogatory, insulting, or diminishing way, seeing their person or group as antagonistic, destructive, etc.	1763	0.19
Collaborative conflict management	Foregrounding of collaborative ways to manage the conflict such as conducting research to determine facts, letting authority decide after consultation, or joint problem solving through dialogue and trying to reach consensus.	943	0.1
Non-collaborative conflict management	Foregrounding of non-collaborative ways to manage the conflict such as the use of adjudication, avoidance or passivity, appeal to political action, appeal to let the market "decide" what is best, or struggle, sabotage, or violence.	849	0.09
Hierarchist social control	Foregrounding of societal decision making through experts (high dependency on others, low self-ownership).	599	0.07
Egalitarian social control	Foregrounding of societal decision making in a democratic way that involves entire communities or groups (high dependency on others, high self-ownership).	208	0.02

Continued Table 5.2			
Individualist social control	Foregrounding of societal decision making on an individual basis (low dependency on others, high self-ownership).	56	0.01
Power	Foregrounding of oneself or other (or one's own group or other group) as having (or should having) particular kinds of power based on authority or position, resources, expertise, personal traits, coalition, sympathy or vulnerability, force or threat, law or policy, morality or ethics, or communicative dexterity (e.g., being able to represent a group or act as a spokesperson for a particular cause).	2266	0.25

VI. ANALYSIS AND RESULTS

The way that primary stakeholder groups frame the Edwards Aquifer as a resource plays a critical role in mirroring the management and allocation of the aquifer in seemingly perpetual intractable conflict. Issues rooted in identity frames based on interests, place, and institutions trigger positions that are polarized, particularly between rural and urban stakeholders. Reaching consensus among those same stakeholder groups requires agreement about how to best manage the resource in an equitable manner that is fair to everyone with an interest in utilizing the water in a responsible fashion. After decades of intractable discussion on the best use, since 2007 agreement and cooperation seems to be achievable. The research in this study appears to provide insight as to how the region is poised to preserve the region's precious resource into the future.

The 2014 interview respondents consisted of 30 individuals representing groups from the environmentalist (2), citizen activist (2), industry (1), agriculture (2), elected officials (2), state agencies (18), media (2), and neutral (1) facilitator. Most had extensive time associated with the Edwards Aquifer having grown up in the region or living in the area several decades. The least amount of time involved with the EA was five years, but previous employment did involve working with the Texas Commission on Environment Quality. The respondents interviewed for this research have been anonymous and have been classified into their respective stakeholder group based on their role within each group. Table 6.1 is the list of each individual and classification in one of the eight stakeholder groups, along with associated node and number of references for each node. Nodes are the 10 category groups defined in the previous chapter: positive identity,

negative identity, positive characterization, negative characterization, collaboration, noncollaboration, hierarchy, egalitarian, individual, and power. References are the number of times each respondent references in their textual data a node during the course of the interview.

Table 6.1 Hierarchy Node Coded Reference Data				
	Category	Individual Interviewee	Nodes	References
1	Citizen	Citizen	8	33
2	Citizen	Citizen	8	71
3	Elected Official	Elected Official Hays County	8	20
4	Elected Official	Elected Official - State Representative	8	35
5	Environmentalism	Environmentalism - Sierra Club	8	57
6	Environmentalism	Environmentalism - Sierra Club 1	8	57
7	Industrial – Business	Industrial	6	16
8	Irrigator	Irrigator Agriculture	9	20
9	Irrigator	Irrigator Agriculture 2	7	71
10	Media	Media	10	37
11	Media	Media 2	9	22
12	Neutral – Facilitator	Neutral	4	24
13	State Agency	Municipality New Braunfels	7	31
14	State Agency	Municipality San Antonio	5	43
15	State Agency	Municipality San Antonio 2	8	37
16	State Agency	Municipality San Marcos	7	21
17	State Agency	Municipality San Marcos 1	6	29
18	State Agency	Municipality SAWS	9	26
19	State Agency	Research - Meadows Center	9	65
20	State Agency	Research - Water Law - TWRI	6	42
21	State Agency	Research Edwards Aquifer TxState Uni.	7	39
22	State Agency	Research SWRI	6	19
23	State Agency	State Agency EAA	9	61
24	State Agency	State Agency EAA - Board 1	7	38
25	State Agency	State Agency EAA 1	5	23
26	State Agency	State Agency EAA 2	8	49
27	State Agency	State Agency EAA 3	5	32
28	State Agency	State Agency EAA 4	7	36
29	State Agency	State Agency GBRA	8	41
30	State Agency	State Agency TPWD	9	54

Information provided in Table 6.2 titled Node Code Data Analysis of Participant Frame Categories and Figure 6.1, in the graph of that data titled Node Code Analysis of

Participant Frame Categories illustrate the number of times the respondents referenced a specific node through coding of a phrase based on one of the category definitions.

Table 6.2 Node Code Data Analysis of Participant Frame Categories		
Framing Category	Coded Node Reference	Participant Source Code
Positive Identity	61	30
Negative Identity	5	4
Positive Characterization	205	30
Negative Characterization	92	25
Collaborative Conflict Management	340	30
Noncollaborative Conflict Management	173	24
Hierarchist Social Control	38	21
Egalitarian Social Control	157	29
Individualist Social Control	13	9
Power	68	17

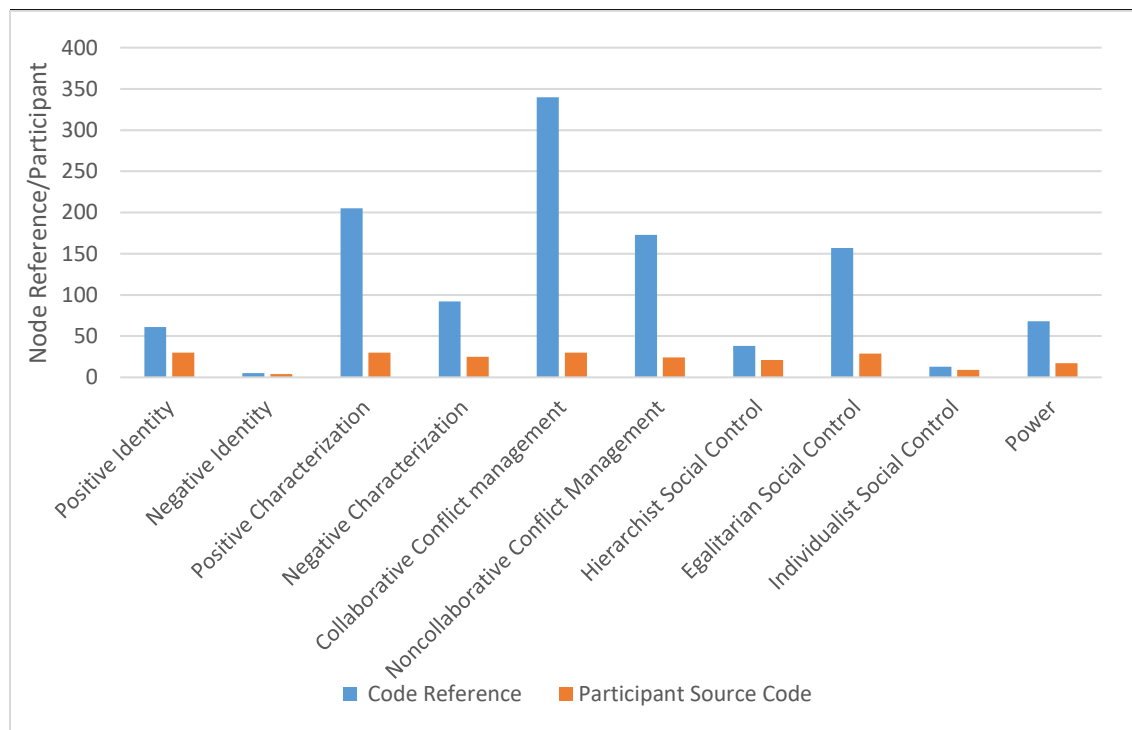


Figure 6.1 Node Code Analysis of Participant Frame

Research Interview Analysis

Putnam and Peterson's research was part of a group of researchers looking at various environmental projects around the country. As discussed earlier all the projects utilized a common theme centered around group stakeholder interactional frame theory. Table 6.3 provides data on the participant stakeholder interviewed for each group of the previous 1997 intractable environmental conflict researched, as well as the respondents in the research interviews for this 2014 Edwards Aquifer key stakeholders group for comparison. Figure 6.2 that follows graphically illustrates the data comparisons for each research site.

Figure 6.3 graphically illustrates the years of duration and number of stakeholder groups in each of the five study areas.

Table 6.3 Research Participant Data for All Research Study Groups 1997 - 2014					
	Ohio	Drake	Voyageurs	Edwards I 1997	Edwards II 2014
	Water Regulation	Toxic Waste	Natural Resource	Natural Resource	Natural Resource
Number of stakeholder groups	4	4	7	8	8
Farmers	0	1	0	11	2
Business and industry people	10	0	12	7	1
Environmentalists	7	7	6	8	2
Citizen activists	0	0	6	4	2
Elected officials	0	5	5	8	2
Government agency officials	2	11	7	26	18
Media affiliates	0	0	3	2	2
Neutrals	2	0	1	2	1

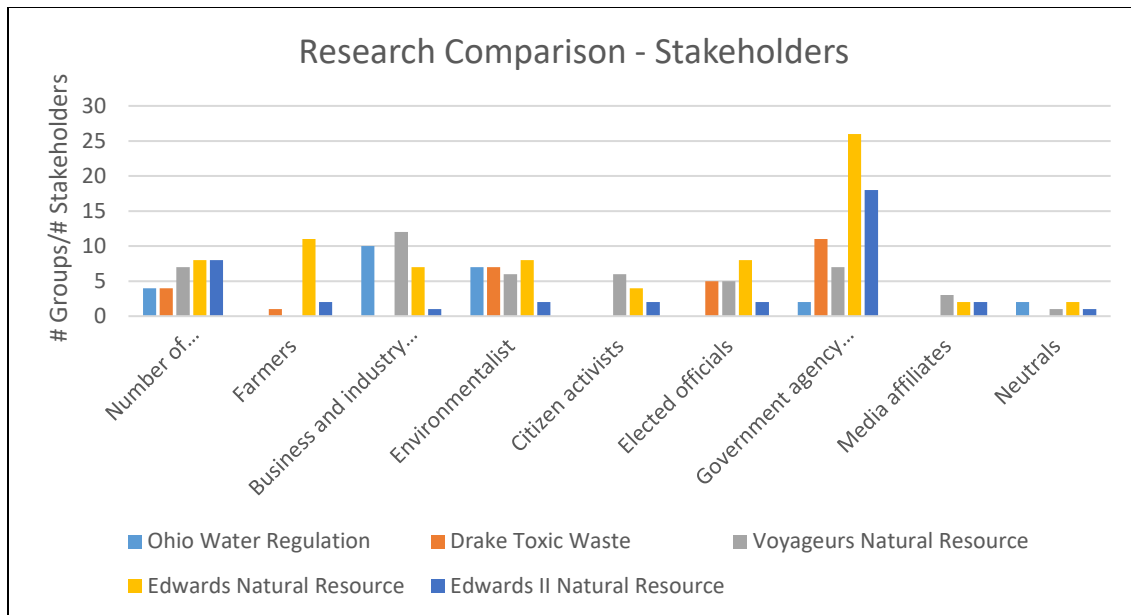


Figure 6.2 Research Comparison Graph – Stakeholder Groups 1997 - 2014

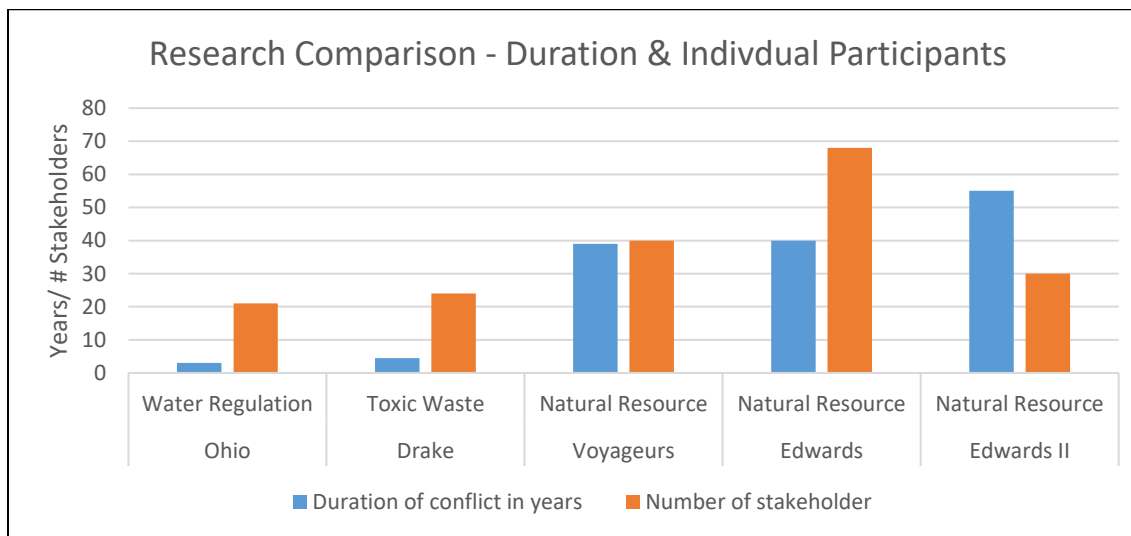


Figure 6.3 Research Comparison – Duration & Individual Participant Comparison

Changes in stakeholder group issue frames for 2014 versus years past prior to 1997 demonstrate substantial changes from the previous research findings. Based on external archive data and the 2014 interview responses, the Edwards Aquifer Authority began to gain traction in the permitting and allocation of water rights for the Edwards

Aquifer region after 1997 once many of the issues postponing action for management of the aquifer were settled. A substantial change since Putnam and Peterson's research over the years are stakeholder's perception of Power as a prevalent category during the 1990s. Statements pertaining to Power has since dropped off substantially in the research presented here for 2014. Stakeholder participants did not speak in terms of San Antonio as holding Power over stakeholders as before, or the threat of the federal government intervention in taking over management of the aquifer, as before. Collaborative conflict management, positive characterization of others, and egalitarian social control were all mentioned at higher levels by the almost all interview participants. Noncollaborative conflict management was also referenced within the top four, although by fewer interview participants. Based on the interview participant responses, the Edwards Aquifer Habitat Conservation Plan is the primary impetus behind the positive coded thoughts and comments creating increased cooperation between stakeholder groups, positive characterization of each other because of increased cooperation as a result of Senate Bill 3, the Edwards Aquifer Recovery Implementation Program, and the resulting Habitat Conservation Plan. A greater number of stakeholder groups believe their voices are being heard and that their input is on a more egalitarian level, or equal footing with each other, more so than in 1997. Statements of noncollaborative conflict management were based on association with two issues discussed in the previous chapters of this research through the research interviews conducted and supported through media sources. Those two issues leading to statements of noncollaboration are, (1) ongoing property rights issues surrounding the separate *Day* and *Bragg* litigation based on the rule of capture, and (2) the ongoing LULAC/SAWS litigation surrounding the makeup of the Edwards Aquifer

Authority Board and the Voting Rights Act, as discussed in earlier chapters for this research.

Table 6.4 provides the data numbers that bear out the improved cooperation and noncollaboration increase discussed, and Figure 6.4 further illustrates those numbers in representative area as a percentage that correlate to each other category's ratio.

The previous research combined all respondents interviewed qualitative data into their quantitative analysis to flush out the various clusters and stakeholder groups that are explored using the same questions developed by Putnam and Peterson in 2003, in this research study. Because the information for each individual study area is not available to provide an accurate comparison, it was decided it is not necessary to pursue the quantitative statistical analysis since it would not be verifiable test. The codes referenced for each category by each of the respondent sources does provide ample information quantitatively to answer the research questions for this project.

The conflict management frame of authority decides based on expertise has prevailed in addressing past Edwards issues. Stakeholders, for the most part, abide by the EAA's rules for assessing aquifer management fees and for issuing permits. Legal challenges to the EAA actions have diminished and the conflict has all appearances of moving in a tractable direction. However, property rights and rule of capture continue to disrupt smooth management by the GCDs and financially threaten those organizations with claims of compensable takings. Senate Bill 3 and the Edwards Aquifer Habitat Conservation Plan and the resulting issuance of Incidental Take Permit is evidence of cooperation of stakeholder groups and mitigation of an environmental debate that is becoming less and less intractable. Those interactional frames are further displayed when

data from 2014 relative frequency ratios are compared to 1997 (Table 6.7, frequency ratios are calculated by taking the total number of reference responses for a specific category, and dividing by the total number of code references, i.e. in 2014 if there were 208 references to positive characterization, we divide by the total number of reference responses to all categories, $208/1164 = 0.18$). Increases from 1997 to 2014 occurred for positive characterization (0.13 to 0.18), collaborative conflict management (0.10 to 0.30), and egalitarian social control (0.02 to 0.14) for the frequency ratios of those interviewed. All three of these categories depict an overall increase for positive statements in stakeholder's interactional framing in regards to other stakeholder groups listening and working collaboratively on an equal basis to create a management process to regulate and allocate Edwards Aquifer water for the region in a cooperative fashion. Figure 6.8 graphically illustrates the changes for all 10 category frequency ratios in Table 6.7. It is worthwhile to note by the specific ratios indicated by shading in Table 6.7, that noncollaborative conflict management increased from 0.09 to 0.15 as a calculated change, while negative characterization of others dropped from 0.19 to 0.08, and power dropped from 0.25 to 0.06. The increase in noncollaborative conflict management increase is attributed, per research interview statements, to the litigation surrounding property rights, takings, and the Voting Rights Act, while the drop in negative characterization and power are attributed, through stakeholder comments, to increased cooperation created through the consensus process among Edwards Aquifer resource users and the Habitat Conservation Plan.

Table 6.4 Frequency Analysis Comparison 1997 to 2014 Research Data Results

Framing Category	Absolute Frequency 1997	Relative Frequency 1997	Absolute Frequency 2014	Relative Frequency 2014	Cumulative Absolute Frequency	Cumulative Relative Frequency
Positive Identity	1043	0.11	61	0.05	1104	0.11
Negative Identity	276	0.03	5	0.004	281	0.03
Positive Characterization	1166	0.13	208	0.18	1374	0.13
Negative Characterization	1763	0.19	92	0.08	1855	0.18
Collaborative Conflict management	943	0.1	346	0.3	1289	0.12
Noncollaborative Conflict Management	849	0.09	173	0.15	1022	0.1
Hierarchist Social Control	599	0.07	39	0.03	638	0.06
Egalitarian Social Control	208	0.02	159	0.14	367	0.04
Individualist Social Control	56	0.01	13	0.01	69	0.01
Power	2266	0.25	68	0.06	2334	0.23
Total Absolute Frequency 2014			1164	1.00		
Total Absolute Frequency 1997	9169	1.00				
Cumulative Total 2014					10333	1.01

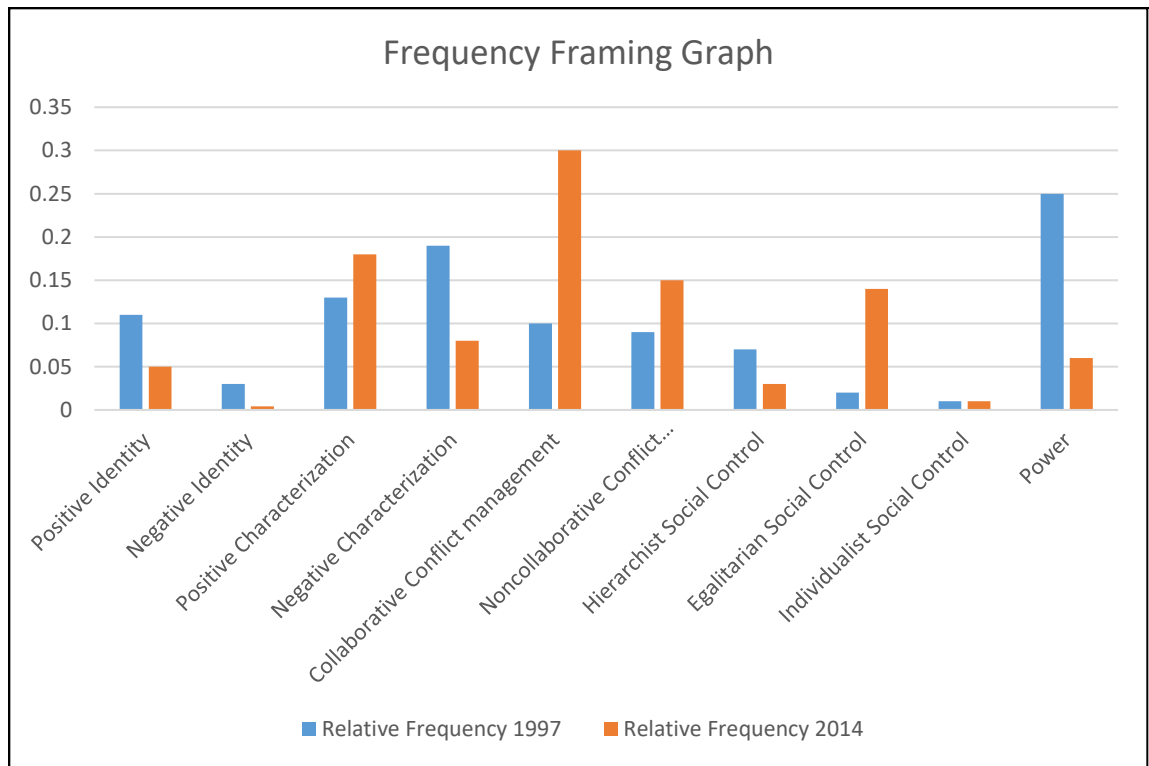


Figure 6.4 Relative Frequency Analysis Graph Comparison 1997 to 2014 Research Data Results

Based on the interview responses for this study in 2014, the tone has softened somewhat, although a number of cases, i.e. *EAA v. Day*, *EAA v. Bragg*, through the courts have ruled property rights for groundwater of the landowner as a “vested” right. One young farmer and irrigator interviewed for this research stated that was how his grandfather viewed the issue, that he (his grandfather) owned the land and the groundwater that is underneath his property. But today, his generation has a different view.

A lot of that was before my time, I was in high school. My family was involved but I didn’t have an active role. It’s hard for me to compare, I can’t really give you an account of that. But my concerns about managing the supply in the region – getting rain! My main concern is getting this drought over with, without rain we don’t have enough water for everybody to pump like they’re use [accustomed] to and for the springs to flow like they should and for the endangered species. So yes, my current concern is

the drought, when it's going to be over, and how do make it through this drought and future droughts.

The same irrigator, when asked "what do you see as the situation of the Edwards Aquifer today? How would you describe it? What narrative or story would you give about it?" replied:

Having a plan in place to secure a plan for all of the pumpers in the environment. Today as a resource you know we have the HCP (habitat conservation plan) in place. It's having difficulty achieving full enrollment or activation of all of its elements. Unfortunately, trying to get it going in the trough of the drought rather than having time to get the ground work laid to prepare for the drought instead of something we're already in the middle of, so pumping is cut back, spring flow is way down. The environmentalists are concerned that we will hit critical trigger (point) this year, so to be ready to address those issues and hopefully we'll have a plan in place to protect those species if the aquifer continues to climb. I hear more and more good things about El Niño (weather pattern) forming this fall and hopefully we'll be there. I think if we look at the probability things that the EAA scientists have done and I think SAWS projections are similar we'll be threatened with getting down to really low levels this year. I don't know if it's total doom but it is troubling. I had a well this morning that started pumping air, and I had to lower my pump, which I've never had to do. My grandpa is 97 and he says he's never seen anything like this and he lived through the drought of the 1950s. My ranch is named for a creek that runs behind the house (Uvalde) and usually is standing full of water, but is now a mud puddle. It's usually been 16 feet deep my whole life but now it's barely ankle deep, lower than it's ever been. It's been part of a ranch from the 1800s and as far as I know it's never run dry. Someone may have seen it but we haven't seen it in a long time. We're having to learn to deal with this somehow.

In the 1990s and years prior, negative characterization frames contributed to intractability through reinforcing stereotypes and shifting blame among stakeholders. Conflict management frames both ignited and mirrored intractability through recurring court battles that led to conflict spirals and win-lose struggles. Therefore, identity, characterization, and conflict management frames intensified stakeholder commitment to

a position and magnified the expense of securing an agreement (Putnam and Peterson 2003).

Identity Frame Theory

The criteria that a stakeholder provides to describe their own roles in a conflict are referred to as identity frames. In other words, who they are and what is important or central about their roles in the dispute identify their view, or frame, of the issue. Putnam and Peterson point out there are three most dominate kinds of identity frames in this dispute and are based on interests, place, and institutional affiliation. Early on in the Edwards dispute the issues were dominated by interest-based frames as demonstrated by defending the sacred principle of private property rights, preserving the spring flow and endangered species, and protecting local economies. These identity frames surfaced when farmers and irrigators pulled out of the Edwards Underground Water district (EUWD), claiming that pumping limits were like gun control— “a violation of basic rights”—and when the municipalities defended their rights to protect their citizens. Any efforts to limit pumping would threaten “the right to drill wells on private lands” or “would cause extraordinary and irreparable harm to the cities and their inhabitants.” Disputants then defined their roles in this conflict through defending and justifying their interest-based claims (Putnam and Peterson, 2003, 151).

Over past years’ place-based frames have been predominate after the western counties withdrew from the EUWD and the media depicted the conflict “as a war between rural and urban factions.” Place identities continued to depict stakeholder frames during the period in which the TWC declared the Edwards an underground river. Eastern counties were pitted against western residents, and upstream users against downstream

users. Place-based identities were associated not just with a city or a community, but with a region of the aquifer that has divided stakeholders by their type of water use. A characteristic of this type of pattern are how stakeholders define their own roles based on whether they are a members of a particular group or looking from the outside of a particular group. For example, in the 1990s one Uvalde judge commented “[The EUWD action] just indicates that the people downstream are more important than the people upstream.” Strong in-group and out-group identities also fuel stakeholders’ intense characterizations of each other during this period and continues throughout the conflict (Putnam and Peterson, 2003, 152).

Some mitigation in contentious feelings between rural and urban communities has been experienced by 2014 in the way some of the interviewed rural community frame their identity with the management issues and their place-based position has changed, as demonstrated by this interviewee’s comment:

I think there has been a change – this is how we’ve been living for 20 years. I’ve only farmed under that situation so I don’t know any different. It’s kind of the way of business out here is now. People in Uvalde don’t like being cut back 44 percent and only having 56 percent of the permit yield when they really need to water, but farmers have made do and they’ve planted either fewer irrigated acres, or they plant crops that may be less valuable but that use less water. People are finding ways to live within their means and hopefully survive both physically and financially through this drought and hoping for better times. It’s become a way of life.

Other longtime residents in the rural community discussed how highly adversarial the situation started out in 1992, depicted by this interviewees statement:

Another story that is the most upside down and backwards example of the times is in 1992 when the peak of the Edwards water wars with the Sierra Club and endangered species was taking place, the president of the TWA (Texas Wildlife Association) and me as CEO heard there was a new man to head up the U.S. Fish and Wildlife Service ecological division in

Austin, so we got in our car and drove to downtown Austin to their office on 6th street, and he was sent here “to put a lid on the fighting taking place,” so we thought we would go talk to him since we were tired of nobody listening to us. So we went in and introduced ourselves to the receptionist, and as soon as we said the words “we are from the Texas Wildlife Association” it was as if we had said we were from the Nazi party. We were ushered into a vacant room with fluorescent lights, and the receptionist brought in three folding metal chairs, and put them in the middle of the room, one for Steve L., one for me, and one for Sam Hamilton, the new guy (U.S. Fish and Wildlife). We sat in there for 20 minutes and twiddled our thumbs before he (Sam Hamilton) came in. He finally arrived to speak with us, and we all exchanged pleasantries, and soon after it did not take long before jaws began to tighten up, and faces began to turn red, and this a direct quote because I have repeated it numerous times at the microphone and I have written about it in TWA magazine, Sam H. looked me straight in the eye and said “we don’t see the problem with you people, if you don’t have habitat, you don’t have a problem.” I about fell out of my chair in a dead faint when I heard that. I said “would you please repeat that?” And he said sure, “if you don’t have habitat you don’t have a problem.” Here is a man high up with the Federal government telling me and Steve L. that if you have property in your family for hundreds of years and had been good stewards and taken care of the land, we are going to regulate you and take your land away from you. However, if you had turned it into a big box mall, you don’t have a problem. So it is upside down and backwards. The people who had already raped the land were the ones who were not penalized and left alone. The ones who had taken care of the land were the ones who were going to have problems. We don’t know if you will be penalized or not but you were going to have problems. So here is a person who has the “nuclear option” with his hand on the button who can put people out of business because they have property with critical habitat, saying, and not understanding that there are people who are on his side, and who’s reward for being on his side, were going to be penalized. So it went from that to where it is today (spirit of cooperation and understanding), and that has been a long trip. Many people have been harmed, to use an endangered species term, who have not recovered. Overall our most bitter opponents, Sierra Club, Environmental Defense Fund, Nature Conservancy, are now, I say our, and I mean TWA (sic Texas Wildlife Association), our best friends. But like in any war, there are unintended consequences, and there was collateral damage. And people got hurt while we were trying to figure out how to get along with one another.

During the struggle over which agency had the authority to regulate the aquifer, identities shifted to institutional domains. For example, in opposition to the TWC’s

ruling, the Medina Underground Water District claimed they were “the only governmental agency authorized to conserve and regulate the use of Edwards water [in their area].” Challenges to institution authority were evident in the restraining orders and lawsuits against the TWC, failed actions of the EUWD, and face-offs in the legislative committees. These challenges over institutional identity culminated with a series of Sierra Club suits in which the U.S. Government became a stakeholder in the conflict through claims against the USFWS, the secretary of the Department of the Interior, and the U.S. Department of Agriculture. These challenges were institutionally based in that they called for the legitimacy of a state-appointed authority to permit, regulate and oversee both the withdrawal limits and the springflow levels of the aquifer. Both the EUWD and the TWC lacked the legal authority to implement permitting and regulating practices (Putnam and Peterson, 2003, 152).

In the past, stakeholders viewed the different jurisdictions of federal, state, regional, and local authorities as a central frame for their own identities in the Edwards conflict. Even though most stakeholders saw the legislature and the EAA as the primary regulatory bodies, they defined the conflict from their own institutional position. That is to say, in the latter days of the dispute, when stakeholders were asked to characterize what this conflict was about, they responded with a strong institutional bias— “it’s about who can regulate and limit pumping from the aquifer,” (Putnam and Peterson, 2003, 153).

Ironically, the one agency that had the constitutional power to regulate the aquifer, the EAA, did not in the past project a strong or consistent institutional image. Many of the EAA members spoke in the voice of their constituents rather than as the

central regulatory agency empowered by the state legislature to manage the aquifer. Born out of legislative strife and amidst lawsuits, the EAA's identity was defined through temporary restraining orders, questions of illegality, and split votes on major actions. In the early years of the EAA, some members assumed a parochial perspective of their role. As one member commented in an interview, "It's a difficult process because of all the lawsuits, getting our rules kicked out, and complying with property issues. That's been a setback for us." The EAA overcame its early years of split decisions and has moved slowly to a state of consensual action, but the agency continues to struggle with its image in the public arena (Putnam and Peterson, 2003, 153).

As of 2014, based on interviews, the EAA still struggles with property rights issues and the make-up of the board as challenged by LULAC and SAWS under the Voting Rights Act, but as one interviewee states:

The Edwards has a variety of tools with which to address each of those issues. The biggest challenge it faces is population growth to the area in providing water. Pollution of the water is usually through municipal entities, so SAWS and the small municipalities that rely on water from the Edwards, they already have received permits, but the challenge will be during times of drought to reduce consumption to protect springflows. That is the overall challenge and charge. When there is plenty of rainfall and the aquifer is full, there are not many issues. It is when water becomes scarce from drought that the issues surface.

Characterization Frame Theory

Characterization of others was the most frequently used frame category in the previous research Putnam and Peterson, and still holds true in 2014. Differentiated as positive or negative, depending on the language that stakeholders used to describe other disputants, characterization frames focused on the labels that disputants used and potential stereotypes they held of other groups. In the early stages of the conflict,

characterization frames were stereotyped into polarized categories; for example, urban versus rural, environmentalist versus property rights, regulators versus anti-regulators. This polarized image of stakeholders is evident in the comments of the director of the Medina Water District who noted, “urban areas have a greater need for drought management than do rural communities” (*San Antonio Light*, May 28, 1989) (Putnam and Peterson, 2003, 153). In the 2014 interviews an EAA board member and Medina resident stated:

The agriculture interest did get some concessions when the act was enacted, and some people feel they may have gotten too good of a deal. They get some concession during the critical period, but you have to look at they are raising a crop (for the public good) and not St. Augustine grass. Sometimes it is hard to get people to think that way.

These polarizations were eventually transformed into characterization frames rooted in challenges to authority and legitimacy of various agencies. For the most part, stakeholders unilaterally saw the EUWD as “The Gutless Wonder,” paralyzed by conflicting political interests and void of regulatory power. The EAA, in contrast, garnered some positive characterizations as evidence in remarks such as, “a step in the right direction,” and changing how the public thinks about water.” These comments, however, were balanced by negative characterizations that centered on internal conflicts within the group, its slowness to act, and its lack of impact. Remarks such as “The EAA has not been very aggressive in managing the Aquifer; it’s too little, too late; the permitting is done too softly” illustrated these perceptions. Where as in 2014 the sentiment for the EAA is one of accomplished progress as provided by this statement by a current board member:

A lot of the EAAs original roles have been fulfilled and we are still evolving in different areas. There are a lot of success stories that can hopefully be told with a lot more to come. Examples are the HCP, getting the permits all issued. We (EAA) have won a lot of lawsuits, and we were winning them all until fairly recently, and I think we are the only agency in the state that has been to the State Supreme Court as many times as we have, I think now we have been all the way through the Supreme Court five or six times. I don't know if that is an accomplishment or not, but it is a fact.

Environmentalists were another group of stakeholders that were cast both positively and negatively. Because they took action to protect water quality and quantity, most stakeholders supported the basic interests of this group. However, on the issue of the endangered species, other stakeholders criticized the motives of the Sierra Club and their readiness to file a suit without even warning the other parties. One stakeholder observed, "the Sierra Club uses the endangered species as a lightning rod for leverage and clout." The U.S. Fish and Wildlife Service had no prior contact with the Sierra Club before they received the official notification of the lawsuit. As an agency official noted, "It caught us by surprise and made us feel backed into a cornered" (Putnam and Peterson, 2003, 154), held in steep contrast to the following statement made by a top environmentalist and Sierra Club stakeholder in 2014:

There has been a lot of progress in the region particularly with the RIP (Edwards Aquifer Recovery Implementation Program) developed by numerous stakeholders and implemented by the requisite stakeholders and approved about a year ago (2012) by the Federal side, so I think there are a lot of positive signs about protection of the aquifer and the springs and steps that can be taken to prevent jeopardy in terms of the species. I think that is in line with what we originally envision with the thrust of the lawsuit that was initially began with the fact that the USFWS had NOT come up with a plan for the species in light of another drought of record. The lawsuit's intention was to force activity that would, if there was not a recovery plan, at least protect the species while a plan was developed. The outcome of the so-called RIP process was what we had hoped for, which was basically a consensus based agreement on how to protect the

aquifer, the springs and the species, and that involves a variety of things. A management plan to basically protect the species is what we had hoped for and is what we seem to have now. I am sure the current continuing drought situation puts more pressure on everybody and may be problematic for implementation of the plan. I do think one of the positive aspects of the plan seems to have been the development of a level of trust of the stakeholders and participants in the process since it has been developed over the past several years and I think that will tend to help in addressing issues in problems that come up in implementation of the plan or anything related to it. Those kinds of outcomes are actually the kinds of things we were hoping for, putting limitations on withdrawals from the aquifer, or boost conservation activity, which we saw with the SAWS or other systems that use the aquifer, and then the implementation of a management plan to protect the species that was based on the consensus of the stakeholders. I think by and large the situation is much more positive today and the outcomes today from our perspective have been good outcomes.

For the most part, stakeholders prior to 1997 characterized the City of San Antonio as well as irrigators and farmers with negative images. The City of San Antonio surfaced as a power broker that had “an insatiable appetite for water and growth.” They surfaced as the “bully who didn’t like the rules and expected all of us to change them.” One farmer noted, “San Antonio was the one that wanted the bill [Senate Bill 1477] in the first place. Now they got it, they are not pleased with it.” Further, a rancher back then noted that “SA folks value water differently. There is so much waste in the city. We worship and cherish it because we rely on it for a living.” In effect, San Antonio emerged as the villain in this dispute—they are large, use the most water for drinking and recreation, and appear to other stakeholders as unwilling to seek out alternative water sources and were not doing enough to reduce their consumption (Putnam and Peterson, 2003, 154).

In comparison, ironically, it was the irrigators and farmers who were also seen as “using a great deal more water than necessary,” not using it efficiently, and “wanting

cheap water.” The municipalities and the City of San Antonio believe that the farmers have “lucked out” in their allocation. As one stakeholder depicted, “the pigs get fat and the hogs get slaughtered.” From their perspective prior to 1997, the agricultural community is the primary beneficiary of Senate Bill 1477. In effect, environmentalists, some government officials, and smaller municipalities blame both San Antonio and the farmers/irrigators for being “greedy,” “misusing the water,” and “being indifferent to other stakeholders” (Putnam and Peterson, 2003, 154). One San Antonio Water System stakeholder in the legal profession interviewed for this research put it like this:

I think it’s far better (2014 versus prior to 1997), there is far more certainty. There of course is some uncertainty, but there is an active market in Edwards water rights, there is some really innovative things that have been done in terms of management of a really limited supply, that to some extent should be a model for other areas utilizing the market approach to addressing future water needs. So that water ultimately finds its way to the highest and best use, which is scary to the farmers because the thing we learned early on is the economic benefit to the farmers of the water that they were using is miniscule in comparison of the economic benefits of virtually every other user. So while a farmer may be able to increase his production yields so that he might make \$100 per acre more using 2 acre feet of water resulting in a net increase of \$50 per acre foot, whereas municipalities selling that water to a business, that business could generate thousands of dollars in return based on that same amount of water. You have got to strike a balance; you don’t want to plunder the agriculture community. One of the brilliant innovations of the Edwards legislation was an incentive to conserve water in the agriculture area (VISPO, voluntary irrigation suspension program option) to free up water to market to the municipal and industrial users, and I think that ought to be a model for other places (in Texas). The circumstances are such, that in particular, what I call “the peace treaty” with the Fish and Wildlife service (U.S Fish and Wildlife Service) over the management of the aquifer reduces the threat of “nuclear warfare” over the endangered species act (ESA).

VII. CONCLUSIONS

The issues involved in the management of Edwards Aquifer analysis are the epitome of an intractable conflict. Long-standing and elusive resolution about how the aquifer may be regulated, and by whom, have been central to the conflict. Continued challenges to management decisions in court cases and interventions that have failed to hold up have escalated the conflict. As discussed in the previous chapters, declarations by the former Texas Water Commission that the Edwards Aquifer be classified as an underground river and the Sierra Club's court filings to sue the Department of the Interior and U.S. Fish and Wildlife for numerous endangered species violations for failing to protect habitat with minimum stream flows have elicited escalated reactions from opposing parties (Putnam and Peterson, 2003). In 2016 the uncertainty of property rights and takings claims associated with denial and/or curtailment of pumping permits and rights will escalate litigation and operating costs. The property rights issues litigation and the EAA Board makeup controversy could unravel the fragile fabric of cooperation among diverse stakeholder groups. These issues are exacerbated by unprecedented population growth coupled with climate uncertainty.

Putnam and Peterson (2003, 158) states that only time will tell, if the Edwards Aquifer conflict has de-escalated and has the potential to empower disputants through the buying, selling, and leasing of water permits. As one stakeholder remarked, "They'll either have to go and buy additional ground water rights from permit holders, or they must abide by the limits that the EAA has set." Overall, most stakeholders feel that the EAA legislation will work, but "it has got to follow the law. If there is no enforcement,

the law is not worth the paper it is written on.” Clearly, this market economy stage could mark a new beginning for a once highly intractable conflict.

What issues still remain?

The first of the research questions to answer, “after revisiting the 1980-97 intractable conflict, as presented by Putnam and Peterson (2003), to what extent do issues and disagreements surrounding the original 1980-97 intractable conflict still remain?” In chapter three the discussion focused on a number of issues and disagreements still, seemingly ongoing. Certainly the weather, as discussed in detail, is the one independent variable that will always be an issue, particularly in the western United States, and specifically Texas. Man-made intractable issues that remain at large since 1997 are property rights as it pertains to rule of capture for groundwater, and the State of Texas method of governing water rights separately for surface water, held by the sovereign in trust for the public. The view of the Texas Legislature that surface water and groundwater are separate mechanisms, and are not hydrologically connected. Science states otherwise.

The other issue still in debate, that has been thought to have been settled, is the makeup of the Edwards Aquifer Authority governing board. While this issue was settled once in 2000, it has reappeared on the scene once again. The *LULAC v. EAA* case should have been decided by the courts in 2015, but the case is still pending, with no known scheduling of a hearing having been set at the time of this writing in October 2016.

What has changed?

The second question, “what has changed since the 1980-97 period of “intractable conflict,” as defined by Putnam and Peterson in the way of new legislation, regulations, management, and use of the Edwards Aquifer?” A considerable amount of change has

taken place since 1997 in the way of new legislation, regulations, management use of the Edwards Aquifer. In 1997 Senate Bill 1 had recently been enacted designating the state legislature's preferred method of management for groundwater in Texas was through Groundwater Conservation Districts. That legislation was followed up by Senate Bill 2 around 2001 to address, among other issues, instream flows for surface water streams, tributaries, and rivers. Six years later in 2007, Senate Bill 3 was enacted into law to specifically address instream flows for surface streams and rivers, and environmental flows for species habitat. Senate Bill 3 set time limits and milestones to reach with a Recovery Implementation Program for the Edwards Aquifer and to develop a Habitat Conservation Plan by 2012. That milestone has been reached, and is currently working.

What is new?

Question three to answer is, "after instituting new measures from 1997 on, what new conflicts have come to the forefront, and how should they be framed?"

In the *Day* case the courts ruled landowners have a "vested" right to the water underneath their property. Although this case has been ruled on, it will be years of future litigation to test what this means. The courts did hold that Groundwater Conservation Districts, if they prevail in a takings litigation of this type, may recover court cost and attorney's fees from the plaintiff. This measure is beneficial going forward to dissuade a property owner from filing frivolously to sue for takings, and protect Groundwater Conservation Districts from financial ruin. The *Bragg* case is another story in that they prevailed in their appeal of their case and were awarded millions of dollars in compensation for a taking of their expected future earnings due of limits placed on their pumping permits for groundwater by the Edwards Aquifer Authority. The Bragg case is

unprecedented in the fact they were awarded damages on groundwater that had not been pumped during the historical period used to decide on allowable permit allotments of groundwater.

The *LULAC v. EAA* case, with the San Antonio Water System joining with LULAC using the Voting Rights Act is another instance of a case that stands to disrupt all progress made to date in the management and allocation of Edwards Aquifer water. San Antonio is by far the largest financial supporter of the Edwards Aquifer Authority, with an estimated 70 to 85 percent of pumping fees use for the EAA budget, comes from San Antonio water users. When the EAA Board was originally set up with four voting representatives from the agriculture western counties of Uvalde and Medina, four voting representatives from the eastern spring cities of San Marcos and New Braunfels, with seven voting representatives from San Antonio, it was never about “one man, one vote.” It was about creating an elected board that would work together in the best interest for all concerned to govern the use of this valuable resource.

The property rights cases have the ability to bankrupt the GCDs for limiting or not allocating groundwater pumping permit. Whichever way a GCD decides will place them in jeopardy of litigation, and substantial financial burdens. The situation has the ability to destroy a management process that has decades to create.

The LULAC case has the same type of disruption capacity, based on if they prevail and San Antonio is allowed to place 13 of the 15 representatives on the board, the other stakeholder groups will not be incentivized to participate in any way.

The way all these circumstances play out are interactional frame theory. How others characterize others and identify with their part in the issues are important. If

individuals excerpt their power in the courts, the threat of federal intervention will return, and the Texas Legislature will once again be called on to act. But that has been an issue for over one hundred years, it will be interesting to see what happens as populations increases by millions of people, and available potable water decreases by millions of gallons.

Is the Edwards Aquifer to continue to be an “intractable conflict?”

The final research question to answer, “is the future of the Edwards Aquifer as a valuable natural resource, likely to continue to be an intractable conflict?” Without a doubt, the Edwards Aquifer, all groundwater, and over allocated surface water rights will continue to be an intractable conflict in Texas.

The research data analysis provided by this research contributed to a recently formed existing body of research (Lewicki, *et al.*, 2003; Putnam and Peterson, 2003; Brummans, *et al.*, 2008) that suggests disputants develop a sense of defining a conflict situation based on their emotional investments in a conflict; their framing of risks and stakes; and their framing of the conflict’s outcomes. This research examined whether this sense of emotional investment was rooted in disputants’ views that are “in it for themselves” or whether they were acting on behalf of a particular group, organization, profession, or in the public good. Through improved management processes and a better understanding of intractable multiparty conflict, disputants in future conflicts may begin a more constructive dispute resolution process and choose pathways that are more open to resolution.

Broader Impacts

Public Outreach and Stewardship

The gap between an urban predominate state versus a rural state has been widening since the 1950s (Figure 7.1). While the rural sector of the state has historically been the largest user of water for irrigation, the urban areas are now exceeding rural water use for irrigation. Although irrigation is one of the largest sectors of public water supply use, now it is being used for watering lawns and shrubs rather than income producing crops that sustain the population with food from crops and livestock. A stakeholder interviewed for this research stated:

I spent the day with a colleague at SAWS a couple of weeks ago, and he was telling me they are facing a horrendous push back as they continue to ratchet down rules for lawn irrigation, people are just screaming at them, because they are telling people they can only water their lawns once a week. To me that is just unconscionable that people do not understand the significance of this issue and willing to let their lawn be a little brown for a little while.

Texas Historical Rural and Urban Populations, 1950-2005

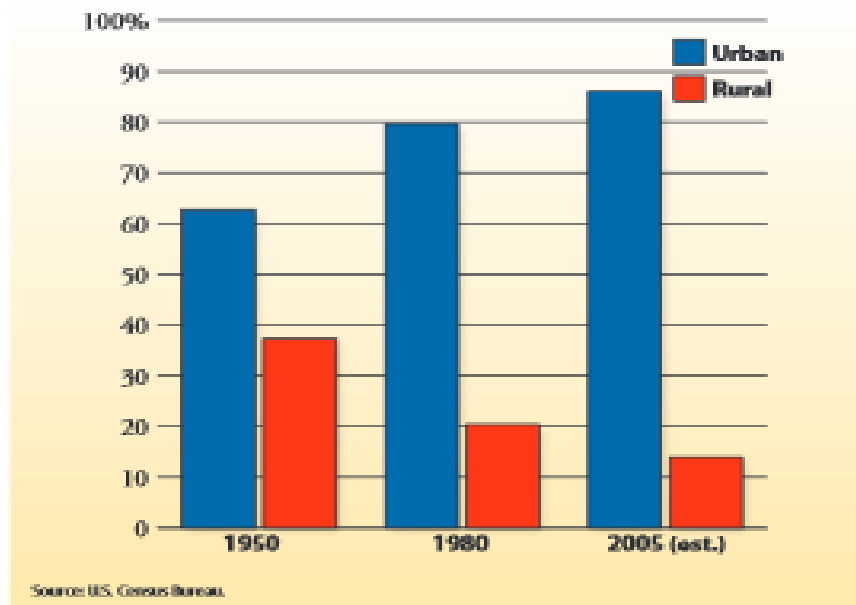


Figure 7.1 Texas Historical Rural and Urban Populations, 1950-2005

Education and outreach for the urban population about where their water comes from and the importance of keeping private lands in conservation are the key to drive state legislation and to preserve Texas' future water supply requirements. Water quantity is the biggest issue faced as populations grow and droughts ensue, but water quality issues are equally affected by lack of attention to stewardship on private property. The primary reason water quality issues are important today is most water pollution originates from non-point source pollution, and not from municipal waste water treatment plants or hazardous chemicals. The land owner who is managing his or her property for good watershed catchment and recharge will also have a benefit in terms of water quality because of the runoff filtration through rural lands in conservation. Because of the twin issues of population growth and drought, water quality issues are just as looming as quantity if Texas does not get a grasp on stewardship of land.

Groundwater Conservation Districts (GCDs)

Most states have one state agency that manages surface water and groundwater conjunctively, while Texas manages surface water through the Texas Commission on Environmental Quality, and groundwater at the Texas Water Development Board, (at least to the extent the state gets involved with groundwater). A centralized state groundwater and surface water agency may not be the best solution to managing groundwater since that type of system would entice big industrial, or business interest to have a greater influence over the system. There is value to local management, or a similar nature of the current system, but overall it appears to be too fragmented. There are many arguments made to continue with the current county type GCD system, but many

respondents interviewed for this research expressed the opinion that the current system is doomed to failure because it is too fragmented. The Edwards Aquifer Authority is a model for other GCDs to manage their groundwater through a regional approach and follow aquifer boundaries, rather than county lines. Examples are the Carrizo-Wilcox and Trinity Aquifers where San Antonio, Austin, and many IH-35 corridor cities will be looking to the rural communities for future water supply to support their burgeoning populations as they are faced with prolonged drought conditions. Many Texas rural communities do not have the budgets to create models of available groundwater in their aquifers for desired future conditions. Benefits of managing groundwater on a regional basis are economies of scale as multiple GCDs combine resources to better model available groundwater, and manage their future public water needs.

APPENDIX SECTION

A. Interview Schedule – Edwards Aquifer Study

Previous researcher: Linda L. Putnam, Texas A&M University (now at University of California-Santa Barbara). Date of Previous Interviews—1998-1999

- 1) How long have you lived in this region and how have you been involved in the Edwards Aquifer situation? We are curious as to who you are, what brought you to this area, and what is your role here?
- 2) Could you tell me about your organization, what it does, and what is its role in dealing with the Edwards Aquifer? What is its concern or role in managing water supply?
- 3) What do you see as the role and primary responsibility of the Edwards Aquifer Authority and how does it relate to your organization? How have these been fulfilled? What are the EAA's most significant challenges in fulfilling these responsibilities?
- 4) What are your concerns about managing the water supply in this region? How should water issues and policies be prioritized? —Probe issues of price, permits, seasons/drought times, etc.
- 5) What do you see as the situation of the Edwards Aquifer today? How would you describe it? What narrative or story would you give about it?
- 6) Who do you see are the key stakeholders in this situation? How would you characterize their interactions and exchanges?
- 7) What is your view of the other stakeholders in the Edwards Aquifer situation/ Probes: What are their interests? Which ones do you see have the best reasons to be involved and what are these reasons? How do you think they view the situation?
- 8) How do you see the media's (e.g., newspapers, TV coverage, etc.) role in this situation? What media coverage have you observed? When does the media typically cover this situation?
- 9) What is your view of the general satisfaction of your constituents and others with the law and the current situation? Is it better or worse?
- 10) What do you think would be the most effective way to handle water issues in this region? What issues seem most important? (E.g., water quality, distribution, etc.). Probes—Most effective way? Who should be involved? What decision methods should be used? If you could have any type of system that you wanted (totally hypothetical), what would it be?

B. Interview Schedule for Media Journalist

- 1) Tell me about your position with the newspaper/media. What is the position?
How long have you been with the newspaper/media?
- 2) What are your duties and what do you cover in your stories? Do you write a regular column on environmental news? If yes, please describe the column, how often it appears, and where it appears in the paper/media?
- 3) How do you select topics for your stories on environmental issues?
- 4) What is your procedure for covering these stories? How do you collect information? How do you decide whom to interview for these stories?
- 5) What is your general philosophy for covering environmental stories?
- 6) What role does the media play in covering environmental controversies? What do you want your stories to do? How do you want them presented?
- 7) Describe your background and experience in covering stories on the Edwards Aquifer situation? Can you recall particular stories related to this topic?
- 8) What issues do you see as important in the Edwards Aquifer situation?
- 9) How should we prioritize water use in this region?
- 10) How do you see the situation with the Edwards today as compared with previous years?
- 11) How has it changed?
- 12) What factors do you think were influential in the change?
- 13) Who do you see as the key stakeholders in the Edward's situation?
- 14) How has the list and type of stakeholders changed in recent years?
- 15) How would you describe the way key stakeholders see the situation? In what ways are they similar and in what ways are they different?
- 16) What do you think are the preferences of different stakeholders in managing this situation?

C. Institutional Review Board Certificate of Approval



Institutional Review Board

Request For Exemption

Certificate of Approval

Applicant: Bill Adams

Request Number : EXP2013S197111J

Date of Approval: 11/04/13

A handwritten signature in black ink, appearing to read "M. Blanks".

Assistant Vice President for Research
and Federal Relations

A handwritten signature in black ink, appearing to read "Jon Lane".

Chair, Institutional Review Board

D.

Consent Form

My name is Bill Adams and I am a doctoral candidate for environmental geography at Texas State University, and I am conducting interviews for my doctoral dissertation research. I am studying how individuals employ the concept of “framing” to shape, organize, and focus on new agendas of today’s Edwards Aquifer stakeholders.

During this study, you will be asked to answer some questions regarding how you view the Edwards Aquifer as a resource. This interview was designed to be approximately one hour in length. However, please feel free to expand on the topic or talk about related ideas. Also, if there are any questions you would rather not answer or that you do not feel comfortable answering, please say so and we will stop the interview, or move on to the next question, whichever you prefer.

All the information will be kept confidential. I will keep the data in a secure place. Only the faculty supervisor mentioned below and I and will have access to this information. Upon completion of this project after five years, the recorded data will be destroyed.

Participant's Agreement:

I am aware that my participation in this interview is voluntary. I understand the intent and purpose of this research. If, for any reason, at any time, I wish to stop the interview, I may do so without having to give an explanation.

The researcher has reviewed the individual and social benefits and risks of this project with me. I am aware the data will be used in a dissertation that will be publicly available at the Alkek Library on the Texas State University Campus. I have the right, and will be provided the opportunity to review, comment on, and/or withdraw information prior to the dissertation’s submission. The data gathered in this study are confidential with respect to my personal identity unless I specify otherwise. I understand if I say anything that I believe may incriminate myself, the interviewer will immediately rewind the tape and record over the potentially incriminating information. The interviewer will then ask me if I would like to continue the interview.

If I have any questions about this study, please feel free to contact the student researcher Bill Adams, bill.adams@txstate.edu, 678-414-0067, or the faculty adviser Professor Denise Blanchard, rb06@txstate.edu, 512-245-3090.

This project, IRB request number EXP2013S197111J was approved for exemption by the Texas State IRB on 11/04/2013. Pertinent questions or concerns about the research, research participants' rights, and/or research-related injuries to participants should be directed to the IRB chair, Dr. Jon Lasser (512-245-3413, lasser@txstate.edu) and to Becky Northcut, Director, Research Integrity & Compliance (512-245-2314, bnorthcut@txstate.edu).

I have been offered a copy of this consent form that I may keep for my own reference.

I have read the above form and, with the understanding that I can withdraw at any time and for whatever reason, I consent to participate in today's interview.

Participant's signature

Date

Interviewer's signature

E.

THE FAR WEST TEXAS CLIMATE CHANGE CONFERENCE

As a result of legislation passed during the 80th Texas Legislative Session, TWDB, in coordination with the Far West Texas Regional Water Planning Group, conducted a study regarding the possible impact of climate change on surface water supplies from the portion of the Rio Grande in Texas subject to the Rio Grande Compact. In conducting the study, TWDB was directed to convene a conference within the Far West Texas regional water planning area to review

- any analysis conducted by a state located west of Texas regarding the impact of climate change on surface water supplies in that state;
- any other current analysis of potential impacts of climate change on surface water resources; and
- recommendations for incorporating potential impacts of climate change into the Far West Texas Regional Water plan, including potential impacts to the Rio Grande in Texas subject to the Rio Grande Compact, and identifying feasible water management strategies to offset any potential impacts.

The Far West Texas Climate Change Conference was held June 17, 2008 in El Paso. Over 100 participants attended, including members of the Far West Texas Regional Water Planning Group and representatives from state and federal agencies, environmental organizations, water providers, universities, and other entities. TWDB published a report on the results of the conference in December 2008. General policy recommendations from the conference included

- continuing a regional approach to considering climate change in regional water planning;
- establishing a consortium to provide a framework for further research and discussion;
- reconsidering the drought of record as the benchmark scenario for regional water planning; and
- providing more funding for research, data collection, and investments in water infrastructure.

LITERATURE CITED

- Agnew, N., S. W. Pyke. 1969. *The science game*. Englewood Cliffs, NJ: Prentice Hall.
- Aldenderfer, M. S., and R. Blashfield. 1984. *Cluster analysis*. Beverly Hills, CA: Sage.
- Alexander, J. C. 1987. The centrality of the classics. In A. Giddens and J. Turner (Eds.), *Social theory today* (pp. 11-57). Stanford, CA: Stanford University Press.
- American Society of Civil Engineers (ASCE). 2001. *Standard Guidelines for Artificial Recharge of Ground Water. EWRI/ASCE 34-01*. New York: ASCE.
- Anfara, Jr., Vincent A., and Norma T. Mertz (Eds.). 2006. *Introduction, In Theoretical frameworks in qualitative research*. Sage Publications, Inc., Thousand Oaks, CA.
- Argyris, C., and D. A. Schon. 1974. *Theory in practice: Increasing professional effectiveness*. San Francisco: Jossey-Bass.
- Asano, T. and J. A. Cotruvo. 2004. Groundwater recharge with reclaimed municipal wastewater: health and regulatory considerations. *Water Resources*. 38(8): 1941-1951.
- Babbie, E. 1986. *The practice of social research* (4th ed.). Belmont, CA: Wadsworth.
- Bartos, Otomar, and Paul Wehr. 2002. *Using Conflict Theory*. Cambridge, University Press, New York.
- Bateson, G. A. 1954. A theory of play and fantasy. *Psychiatric Research Reports*, 2, 39-51.
- BBVA Research, "Texas Drought Impact," Houston, Texas, December 9, 2011, http://www.bbvaresearch.com/KETD/fbin/mult/111209_Economic-WatchEEUU_136_tcm348-282133.pdf?ts=19122011. (Accessed September 24, 2013.)
- Benford, R. D., and D. A. Snow. 2000. Framing processes and social movements: An overview and assessment. *Annual Review of Sociology*, 26, 611-639.

- Bentz, V. M., and J. J. Shapiro. 1998. *Mindful inquiry in social research*. Thousand Oaks, CA: Sage.
- Bernstein, B. 1971. On the classification and framing of educational knowledge. In M. Young (Ed.), *Knowledge and control* (pp. 79-115). London: Collier-Macmillan.
- Bernstein, B. 2000. *Pedagogy, symbolic control and identity: Theory, research and critique*. Lanham, MD: Rowman and Littlefield.
- Best, J. W., and J. V. Kahn. 2003. *Research in education* (9th ed.). Boston: Allyn and Bacon.
- Blanchard-Boehm, R.D., R.A. Earl, J.H. Wachter, E.J. Hanford. 2008. Communicating future water needs to an at-risk population: lessons learned following defeat of the Applewhite Dam and Reservoir Project in San Antonio, Texas. *Population Environmental*, 29:292-312. Springer Science+Business Media, LLC.
- Blomquist, W. 1992. *Dividing the waters: Governing groundwater in Southern California*. San Francisco: Institute for Contemporary Studies.
- Bohman, J. 1999. Practical reason and cultural constraint: Agency in Bourdieu's theory of practice. In R. Shusterman (Ed.), *Bourdieu: A critical reader* (pp. 129-152). Oxford, UK: Blackwell.
- Bourdieu, P. 1990. The logic of practice. Stanford, CA; Stanford University Press. (Reprinted in *Social theory. The multicultural and classic readings*, pp. 52-58, by C. Lemert, Ed., 1999, Boulder, CO: Westview)
- Bourdieu, P. 1993. *Sociology in question*. London: Sage.
- Bourdieu, P. 1999. The social conditions of the international circulation of ideas. In R. Shusterman (Ed.), *Bourdieu: A critical reader* (pp. 220-228). Oxford, UK: Blackwell.
- Bourdieu, P. and J. Passeron. 1977. *Reproduction in education, society and culture*. London: Sage.
- Bouveresse, J. 1999. Rules, dispositions and the *habitus*. In R. Shusterman (Ed.), *Bourdieu: A critical reader* (pp. 45-63). Oxford. UK: Blackwell.
- Bouwer, H. 2002. Artificial Recharge of Groundwater: Hydrogeology and Engineering. *IAH Hydrogeology Journal*. 10: 121-142.

- Brodio, E. M. and K. Manning. 2002. Philosophical foundations and current theoretical perspectives in qualitative research. *Journal of College Student Development*, 43(4), 434-445.
- Brummans, Boris H. J. M., Linda L. Putnam, Barbara Gray, Ralph Hanke, Roy J. Lewicki, and Carolyn Wiethoff. 2008. Making Sense of intractable Multiparty Conflict: A Study of Framing in Four Environmental Disputes. *Communication Monographs*. 75(1): 25 – 51.
- Butler, J. 1999 Performativity's social magic. In R. Shusterman (Ed.), *Bourdieu: A critical reader* (pp. 113-128). Oxford, UK: Blackwell.
- Cleaveland, M.K. 2006. *Extended Chronology of Drought in the San Antonio Area: Tree Ring Laboratory*, Geosciences Department, University of Arkansas.
- Cleaveland, Malcolm K., Todd H. Votteler, Daniel K. Stahle, Richard C. Casteel, and Jay L. Banner. 2011. Extended Chronology of Drought in South Central, Southeastern and West Texas. Texas Water Resources Institute, *Texas Water Journal*, Vol 2:1, 54-96.
- Cohen, J. 1960. A coefficient of agreement for nominal scales. *Education and Psychological Measurement*, 20, 37-46.
- Colten, Craig E. 1991. A Historical Perspective on Industrial Wastes and Groundwater Contamination. *Geographical Review*, 81:2, pp. 215 – 228.
- Colten, Craig E. 1998. Industrial Topography, Groundwater, and the Contours of Environmental Knowledge. *Geographical Review*, 88:2, Historical Geography and Environmental History, pp. 199 – 218.
- Cosgrove, D. E. 1990. *An Elemental Division: Water Control and Engineered Landscape*. In *Water, Engineering and Landscape*, edited by D. Cosgrove and G. Petts, 1-11. London: Belhaven.
- Crane, A., and S. Livesay. 2003. Are you talking to me? Stakeholder communication and the risks and rewards of dialogue. In S. Waddock, B. Husted, S. Rahman, and J. Andriof (Eds.), *Unfolding stakeholder thinking 2: Relationships, communication, reporting and performance* (pp. 39-52). Sheffield, UK: Greenleaf.
- Creed, W. E., J. A. Langstraat, and M. S. Scully. 2002. A picture of the frame: Frame analysis as technique and as politics. *Organizational Research Methods*, 5, 34-55.

- Creswell, J. W. 1994. *Research design*. Thousand Oaks, CA: Sage.
- Creswell, J. W. 1998. *Qualitative inquiry and research design: Choosing among the five traditions*. Thousand Oaks, CA: Sage.
- Creswell, J. W. 2002. *Educational research*. Upper Saddle River, NJ: Pearson Education.
- Creswell, J. W. 2003. *Research design: Qualitative, quantitative, and mixed method approaches*. Thousand Oaks, CA: Sage.
- Creswell, J. W., and Vicki L. Plano Clark. 2007. *Designing and conducting mixed methods research*. Thousand Oaks, CA: Sage.
- Crotty, M. 1998. *The foundations of social research*. London: Sage.
- De Dreu, C. K. W., and C. McCusker. 1997. Effects of gain-loss frames on cooperation in two person social dilemmas: A transformational analysis. *Journal of Personality and Social Psychology*, 72, 1093-1106.
- Denzin, N. K., and Y. S. Lincoln (Eds.). 2003a. *Collecting and interpreting qualitative materials* (2nd ed.) Thousand Oaks, CA: Sage.
- Dillon, P.J. 2002. *Management of Aquifer Recharge for Sustainability*. Proceedings of the 4th International Symposium on Artificial Recharge of Groundwater. Adelaide, Australia: Balkema.
- Dobkins, Betty Eakle. 1959. *The Spanish Element in Texas Water Law*, p 159-62. Austin, The University of Texas Press.
- Donnellon, A., and B. Gray. 1990. *An interactive theory of reframing in negotiations*. University Park: Pennsylvania State University Center for Research in Conflict and Negotiation.
- Drake, L. D., and W. A. Donohue. 1996. Communicative framing theory in conflict resolution. *Communication Research*, 23, 297-322.
- Earl, R. A., R. W. Dixon, and C. A. Day. 2006. *Long Term Precipitation and Water Supply Variability in South-Central Texas*. Proceedings and papers of the Applied Geography Conferences. 29: 11-22.

- Earl, R. A., and T. Kimmel. 1995. Means and Extremes: The Weather and Climate of South-Central Texas. In: *A Geographic glimpse of Central Texas and the Borderlands: Images and Encounters*, eds. J. F. Petersen and J. A. Tuason. A Pathways in Geography. 80th National Council for Geographic Education, San Antonio, Texas October 25-28, 1995.
- Earl, R. A., and T. H. Votteler. 2005. Major Water Issues Facing South-Central Texas. In: *Water for Texas*, ed. J. Norwine, 75-88. College Station, TX: Texas A&M Press.
- Edwards Aquifer Authority. 2014. Edwards Aquifer Habitat Conservation Plan (pamphlet). Last accessed February 1, 2016: www.eahcp.org
- Eisner, E. W. 1993. Foreword. In D. J. Flinders and G. E. Mills (Eds.), *Theory and concepts in qualitative research: Perceptions from the field* (pp. vii-ix). New York: Teachers College Press.
- Ellis, Greg. 2013. A New Day? District Perspective. From A New Day? Two Interpretations of the Texas Supreme Court's Ruling in Edwards Aquifer Authority v. Day and McDaniel. *Texas Water Journal*. 4:1, pages 35-54. Texas Water Resources Institute, part of Texas A&M AgriLife Research, the Texas A&M AgriLife Extension Service and the College of Agriculture and Life Sciences. Accessed December 1, 2015 at: <https://journals.tdl.org/twj/index.php/twj/article/view/6990/6073>
- Fairhurst, G. T., and R. A. Sarr. 1996. *The art of framing: Managing the language of leadership*. San Francisco, CA: Jossey-Bass.
- Festinger, L. 1957. *A theory of cognitive dissonance*. Evanston, IL: Row, Peterson, and Company.
- Flinders, D. J., and G. E. Mills (Eds.). 1993. *Theory and concepts in qualitative research: Perceptions from the field*. New York: Teachers College Press.
- Foucault, M. 1981. The order of discourse. In R. Young (Ed.), *Untying the text* (pp. 51-76). London: Routledge and Keegan Paul.
- Freese S.W., D.L. Sizemore. 1994. *A century in the works, Freese and Nichols Consulting Engineers, 1894-1994*. First Edition. College Station (Texas): Texas A&M University Press. 435 p.
- French, J. R. P., Jr., and R. Raven. 1959. The bases of social power. In D. Cartwright (Ed.), *Studies in social power* (pp. 150-167). Ann Arbor, MI: Institute for Social Research.

- Gall, M. D., W. R. Borg, and J. P. Gall. 1996. *Educational research* (6th ed.). New York: Longman.
- Garrison, J. 1988. *The impossibility of atheoretical science*. *Journal of Educational Thought*, 22, 21-26.
- Gay, L. R., and P. Airasian. 2003. *Educational research* (7th ed.). Upper Saddle River, NJ: Merrill Prentice Hall.
- George, E., P. Chattopadhyay, S. B. Sitkin, and J. Barden. 2006. Cognitive underpinnings of institutional persistence and change: A framing perspective. *Academy of Management Review*, 31, 347-365.
- Gergen, K. 1996. *Realities and relationships: Soundings in social construction*. London: Harvard University Press.
- Gilmore, J. 1971. The effectiveness of parental counseling with other modalities in the treatment of children with learning disabilities. *Journal of Education*, 154, pp. 74-82.
- Glaser, B. G., and A. L. Strauss. 1967. *The discovery of grounded theory: Strategies for qualitative research*. Chicago: Aldine.
- Goffman, E. 1981. *Forms of talk*. Philadelphia: University of Pennsylvania Press.
- Gonos, G. 1977. 'Situations' vs. 'Frame': The 'interactionist' and the 'structuralist' analysis of everyday life. *American Sociological Review*, 42, 854-867.
- Gray, B. Framing in mediation and mediation as framing. In M. Herman (Ed.), *Mediation from beginning to end*. New York: Blackwell, 195-216.
- Guba, E. G. (Ed.). 1990. *The paradigm dialog*. Newbury Park, CA: Sage.
- Guba, E. G., and Y. S. Lincoln. 1994. Competing paradigms in qualitative research. In N. K. Denzin and Y. S. Lincoln (Eds.), *Handbook of qualitative research* (pp. 105-117). Thousand Oaks, CA: Sage.
- Guetzkow, H. 1950. Unitizing and categorizing problems in coding qualitative data. *Journal of Clinical Psychology*, 6, 47-58.
- Haas v. Choussard*. 1856. 17 Tex. 588 (Tex. 1856).

- Harden, R. W. 1986. The Edwards Connection. In *The Edwards Aquifer: An underground stream*. J. Specht (Ed.) p. 13-32. Sequin, Texas: The Guadalupe-Blanco River Authority.
- Hardin, Garrett. 1968. Tragedy of the Commons. *Science*, U.S.A.
- Hart, F. C. 1995. Superfund Reauthorization: It's Not Time to Revise History. *Mealy's Litigation Reports* 9 (29): 17 – 28.
- Herrera, M. 1992. Environmentalism and political participation: Toward a new system of social beliefs and values? *Journal of Applied Social Psychology*, 22, 657-676.
- Holsti, O. R. 1969. *Content analysis for the social sciences and humanities*. Menlo Park, CA: Addison-Wesley.
- INTERA Incorporated, Richard Hoffpauir Consulting, and Jackson, C.S. 2010. Analyzing Uncertainty and Risk in the Management of Water Resources for the State of Texas: Prepared for the Texas Water Development Board. http://twddb.state.tx.us/RWPG/rpgm_rpts/0904830857_Uncertainty_waterResourcegmt.pdf
- IPCC (International Panel on Climate Change). 2007. Climate Change 2007: Synthesis Report: Cambridge University Press. http://www.ipcc.ch/publications_and_data/publications_ipcc_fourth_assessment_report_synthesis_report.htm
- Jensen, R. 1988. A new approach to regional water management: two plans are developed to manage and protect the Edwards Aquifer. *Texas Water Resources*, 14:1-6.
- Johnson, A.I., R.D.G. Pyne. 1994. *Artificial Recharge of Ground Water–II*. Proceedings of the Second International Symposium on Artificial Recharge of Ground Water. Walt Disney World Swan, Florida. New York: ASCE.
- Johnson, Russell. 2012. Personal interview in Russell Johnson's office on June 21, 2012.

- Johnson, Russell. 2013. A New Day? Landowner Perspective. From A New Day? Two Interpretations of the Texas Supreme Court's Ruling in Edwards Aquifer Authority v. Day and McDaniel. *Texas Water Journal*. 4:1, pages 35-54. Texas Water Resources Institute, part of Texas A&M AgriLife Research, the Texas A&M AgriLife Extension Service and the College of Agriculture and Life Sciences. Accessed December 1, 2015 at: <https://journals.tdl.org/twj/index.php/twj/article/view/6990/6073>
- Kaiser, Ronald A. 1986. *Hand Book of Texas Water Law: Problems and Needs*. Texas Water Resources Institute, Texas A&M University, College Station, Texas.
- Karr, Alphonse. 2015a. Accessed last on December 28, 2015: <http://www.clichesite.com/content.asp?which=tip+1370>
- Karr, Alphonse. 2015b. Alphonse Prince de L'Esprit Karr. Accessed last December 28, 2015: http://www.tombes-sepultures.com/crbst_944.html
- Keltner, J. W. 1994. *The management of struggle: Elements of dispute resolution through negotiation, mediation, and arbitration*. Cresskill, NJ: Hampton Press.
- Krippendorff, K. 2004. Reliability in content analysis: Some common misconceptions and recommendations. *Human Communication Research*, 30, 411-433.
- Kuhn, T. 1979. *The structure of scientific revolutions* (2nd ed.). Chicago: University of Chicago Press.
- Ladwig, J. 1994. For whom this reform? Outlining educational policy as a social field. *British Journal of Sociology*, 15(3), 341-363.
- Langenback, M., C. Vaughn, and L. Aagaard. 1994. *An introduction to educational research*. Boston: Allyn and Bacon.
- Larkin, T.J. and G.W. Bomar. 1983. *Climatic Atlas of Texas: Texas Water Development Board Limited Publication 192*. http://www.twdb.state.tx.us/publications/report/limited_printing/doc/LP192.pdf
- Lave, J., and E. Wenger. 1991. *Situated learning*. Cambridge, UK: Cambridge University Press.
- LeCompte, M. D., and J. Preissle, 1993. *Ethnography and qualitative design in educational research* (2nd ed.). San Diego: Academic Press.

- LeGrand, H. E. 1990. *Historical Review of Knowledge of the Effect of Ground Water as Related to Buried Wastes*. Expert Report in the Case *U.S. v. Occidental Chemical Corporation, et al.* U.S. District Court, Western District of New York, Civ. 79-990.
- Lewicki, Roy J., Barbara Gray, and Michael Elliott (eds). 2003. *Making sense of intractable environmental conflicts: concepts and cases*. Island Press, Washington.
- Lincoln, Y. S., and E. G. Guba. 1985. *Naturalistic inquiry*. Beverly Hills, CA: Sage.
- Lombard, M., J. Snyder-Duch, and Bracken C. Campanella. 2002. Content analysis in mass communication: Assessment and reporting of intercoder reliability. *Human Communication Research*, 28, 587—604.
- Lombard, M., J. Snyder-Duch, and Bracken C. Campanella. 2004. A call for standardization in content analysis reliability. *Human Communication Research*, 30, 434-437.
- Maslow, A. H. 1954. *Motivation and personality*. New York: Harper and Row.
- Massey, Sam R. 2016. Major Aquifer and Rivers of Texas map modified Texas Water Development Board “Major Aquifers” & “Major River Basins” [GIS data] accessed 2016: <http://www.twdb.texas.gov/mapping/gisdata.asp>
- Maxwell, J. A. 1996. *Qualitative research design*. Thousand Oaks, CA: Sage.
- McCusker, C., and P. J. Carnevale. 1995. Framing in resource dilemmas: Loss aversion and the moderating effects of sanctions. *Organizational Behavior and Human Decision Processes*, 61, 190-201.
- McGregor, D. 1960. *The human side of enterprise*. New York: McGraw-Hill.
- McMillan, J. H., S. Schumacher. 2001. *Research in education: A conceptual introduction* (5th ed.). New York: Longman.
- Melvin, Robin A., Thomas G. Mason. 2012. *New Developments in Texas Water Law, Planning and Management*. Presented at the Austin Bar Association Real Estate Section Meeting.
- Merriam, S. B. 1998. *Qualitative research and case study applications in education*. San Francisco: Jossey-Bass.

- Merriam, S. B., and Associates. 2002. *Qualitative research in practice*. San Francisco: Jossey-Bass.
- Messick, D., and D. M. Mackie. 1989. Intergroup relations. *Annual Review of Psychology*, 40, 51-81.
- Miles, M. B., and A. M. Huberman. 1994. *Qualitative data analysis* (2nd ed.). Thousand Oaks, CA: Sage.
- Milligan, G. W., and M. C. Cooper. 1987. Methodology review: Clustering methods. *Applied Psychological Measurement*, 11, 329-354.
- Mills, G. E. 1993. Levels of abstraction in a case study of educational change. In D. J. Flinders and G. E. Mills (Eds.), *Theory and concepts in qualitative research: Perceptions from the field* (pp. 103-116). New York: Teachers College Press.
- Moore, C. W. 1986. *The mediation process: Practical strategies for resolving conflict*. San Francisco, CA: Jossey-Bass.
- Moore, J.G., Jr. 2005. A Half Century of Water Resource Planning and Policy, 1950-2000. In: *Water for Texas*, e. J. Norwine, 5-16. College Station, TX; Texas A&M Press.
- Mountain-Prairie Region - Water Resources Division (MPR, 2013). Accessed site October 28, 2013: http://www.fws.gov/mountain-prairie/wtr/hydro_def.htm
- Mutch, C. 1998. The long and winding road: The development of the new social studies curriculum. In *Ten years on: Reforming New Zealand education*. Proceedings of the New Zealand Educational Administration Society Biennial Conference (pp. 340-361). Christchurch, NZ: New Zealand Educational Administration Society.
- Mutch, C. 2000. *The struggle for ideological control over curriculum: Two New Zealand examples*. Paper presented at the American Educational Research Association's Annual Conference, New Orleans, LA.
- Mutch, C. 2004a. Curriculum construction as a social field. Mapping the process of the development of the New Zealand social studies curriculum. *Curriculum Perspectives*, 24(3), 22-33.
- Mutch, C. 2004b. *Educational policy in New Zealand: Who pays the piper?* Paper presented at the New Zealand Association for Research in Education Conference, Wellington, NZ.

- Mutch, C. 2006. Adapting Bourdieu's Field Theory to Explain Decision-Making Processes in Educational Policy. In *Theoretical Frameworks in Qualitative Research*, Vincent A. Anfara, Jr., and Norma T. Mertz (Eds.), Sage Publications, Thousand Oaks, CA.
- NCDC (National Climatic Data Center). 2011. Climate data: Asheville, NC, National Climatic Data Center, national Environmental Satellite Data and Information Services, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, ASCII tabular data files. <http://www7.ncdc.noaa.gov/CDO/CDODivisionalSelect.jsp#>.
- Nielsen-Gammon, J.W. 2011a. The Drought of Record was Made to Be Broken. *Houston Chronicle*. <http://bog.chron.com/climateabyss/2011/09/the-drought-of-record-was-made-to-be-broken/>.
- Nielsen-Gammon, J.W. 2011b. Written communication: comments of the *Draft 2012 State Water Plan*.
- Nielsen-Gammon, J.W. 2011c. The Changing Climate of Texas in Schmandt and others, eds.. *The Impact of Global Warming on Texas*, Second Edition: University of Texas Press. <http://www.texasclimate.org/Home/ImpactofGlobalWarmingonTexas/tabid/481/Default.aspx>.
- Ostrom, E. 1990. Governing the commons: *The evolution of institutions for collective action*. New York: Cambridge University Press.
- Ostrom, E., R. Gardner, and J. Walker. 1994. *Rules, games, and common-pool resources*. Ann Arbor: University of Michigan Press.
- Otis W. Templer. 2011. WATER LAW. *Handbook of Texas Online* (<http://www.tshaonline.org/handbook/online/articles/gyw01>), accessed September 18, 2013. Texas State Historical Association.
- Patton, M. Q. 1990. *Qualitative evaluation and research methods* (2nd ed.). Newbury Park, CA: Sage.
- Perez, R. 1986. Potential for updip movement of saline water in the Edwards Aquifer. *Resource Investigations Report 86-4032*. San Antonio, TX: U.S. Geological Survey.
- Peterson, T.R. 2003. Social control frames: Opportunities or constraints? *Environmental Practice*, 5: 232-238.

- Pinkley, R. L., and G. B. Northcraft. 1994. Conflict frames of reference: Implications for dispute processes and outcomes. *Academy of Management Journal*, 37, 193-205.
- PRISM Climate Group. 2011. Annual high-resolution climate data sets from the conterminous United States (2.5-arc minute 2001-2010 mean annual grids for the conterminous United States): Corvallis, OR, PRISM Climate Group, Oregon State University, ARC/INFO ASCII raster grid files. <http://prism.oregonstate.edu>.
- Putnam L.L., and M. Holmer. 1992. Framing, reframing, and issue development. In L. L. Putnam and M.E. Roloff (Eds.), *Communication and negotiation* (128-155). Newbury Park, CA: Sage.
- Putnam, L. L., and J. Wondolleck. 2003. Intractability: Definitions, dimensions, and distinctions. In R. J. Lewicki, B. Gray, and M. Elliot (Eds.), *Making sense of intractable environmental conflict: Concepts and cases*. 35-59. Washington, DC: Island Press.
- Putnam, L. L., and S. R. Wilson. 1989. Argumentation and bargaining strategies as discriminators of integrative outcomes. In M. A. Rahini (Ed.), *Managing conflict: An interdisciplinary approach*. New York: Praeger, 121-141.
- Putnam, L. L., and T. Peterson. 2003. The Edwards Aquifer Dispute: Shifting Frames in a Protracted Conflict. In *Making Sense of Intractable Environmental Conflicts*. Lewicki, Roy, B. Gray, and M. Elliott, (eds.). Island Press, NY.
- Reible, Danny D. 2012. *2012 Texas Water Summit Report: Securing Water for Texas' Future*. Program chair introduction statement. Available online at: www.tamest.org.
- Riffe, D., S. Lacy, and F. G. Fico. 1998. *Analyzing media messages: Using quantitative content analysis research*. Mahwah, NJ: Lawrence Erlbaum Associates, Inc.
- Rubinstein, Carlos. 2015. Texas water policy appendix: the weather. Texas Water Resources Institute. *Texas Water Journal*. 6:1, pg. 121-135.
- Salipante, P. F., and R. Bouwen. 1995. The social construction of grievances. In D. M. Hosking, H. P. Dachler and K. Gergen (Eds.), *Management and organization: Relational alternatives to individualism*. Aldershot: Avebury, 71-97.

- San Antonio Express News*. 2013. EAA lawsuit about water, not voting rights (April 10, 2013). Opinion editorial by James E. Barden, the Medina county judge. Accessed last on December 22, 2015: <http://www.mysanantonio.com/opinion/commentary/article/EAA-lawsuit-about-water-not-voting-rights-4424743.php>
- San Antonio Express News*. 2014. Voting rights or water politics? Bruce Davidson. Accessed last on December 22, 2015: http://www.mysanantonio.com/opinion/columnists/bruce_davidson/article/Voting-rights-or-water-politics-5318727.php
- Scheufele, D. 1999. Framing as a theory of media effects. *Journal of Communication*, 49, 104-122.
- Schön, D., and M. Rein. *Frame reflection: Towards resolution of intractable policy controversies*. New York: Basic Books.
- Schram, T. H. 2003. Conceptualizing qualitative inquiry. Columbus, OH: Merrill Prentice Halls.
- Schwandt, T. A. 1993. Theory for the moral sciences. In D. J. Flinders and G. E. Mills (Eds.), *Theory and concepts in qualitative research: Perceptions from the field* (pp. 5-23). New York: Teachers College Press.
- Sheail, J. 1982. Underground Water Abstraction: Indirect Effects of Urbanization on the Countryside. *Journal of Historical Geography* 8 (4): 395-408.
- Sheng, Zhuping. 2005. An Aquifer Storage and Recovery System With Reclaimed Wastewater to Preserve Native Groundwater Resources in El Paso, Texas. *Journal of Environmental Management*. 75: 367-377.
- Sherif, M., O. J. Harvey, B. J. White, W. R. Hood, and C. W. Sherif. 1961. *Intergroup conflict and cooperation: The Robbers Cave experiment*. Norman, OK: University of Oklahoma Press.
- Shiner, Joel. 2011. Underwater Archaeology at 41HY147, the Terrace Locality at Spring Lake. Jon C. Lohse, (Ed). *Archaeological Studies Report No. 28*. Center for Archaeological Studies, Texas State University, San Marcos. Accessed September 13, 2013: <http://www.txstate.edu/anthropology/cas/>.
- Shusterman, R. 1999. Introduction: Bourdieu as philosopher. In R. Shusterman (Ed.), *Bourdieu: A critical reader* (pp. 1-13). Oxford, UK: Blackwell.
- Silver, P. 1983. Educational administration: *Theoretical perspectives on practice and research*. New York: Harper and Row.

- Slade, R.M., Jr. and J. Patton. 2003. *Major and catastrophic storms and floods in Texas – 215 major and 41 catastrophic events from 1853 to September 1, 2002: Geological Survey Water Resources Division Open-File Report 03-193*.
- Smith, Kim. 1996. Humor, fairness rule in Bunton's courtroom. *Odessa American*.
- Stevenson, W. B., and D. N. Greenberg. 1998. The formal analysis of narratives of organizational change. *Journal of Management*, 24, 741-767.
- Stokes, R., and J. P. Hewitt. 1976. Aligning actions. *American Sociological Review*, 41, 838-849.
- Strauss, A. 1995. *Qualitative analysis for social scientists*. Cambridge, UK: Cambridge University press.
- Strauss, A. L., and J. M. Corbin. 1998. *Basics of qualitative research: Techniques and procedures for developing grounded theory* (2nd ed.). Thousand Oaks, CA: Sage.
- Suppes, F. 1974. *The structure of scientific theories* (2nd ed.). Urbana: University of Illinois Press.
- Tajfel, H., and J. C. Turner. 1979. An integrative theory of intergroup conflict. In S. Worchel and W. G. Austin (Eds.), *The social psychology of intergroup relations* (pp. 33-47). Monterey, CA: Brooks/Coleman.
- Texas Agrilife Extension Service. "Texas Agricultural Drought Losses Reach Record \$5.2 Billion." <http://agrilife.org/today/2011/08/17/texas-agricultural-drought-losses-reach-record-5-2-billion/> (last accessed September 24, 2013).
- Texas Tribune*. 2013. In Texas, Fight Over Water Spills Underground. Neena Satija, September 16, 2013.
- Texas Water Development Board (TWDB). 1967. *The Climate and Physiography of Texas: Texas Water Development Board Report 53*. http://www.twdb.state.tx.us/publications/reports/numbered_reports/doc/R53/report53.asp
- Texas Water Development Board (TWDB). 1996. Surveys of irrigation in Texas – 1958, 1964, 1969, 1974, 1979, 1984, 1989, 1994. Austin, Texas: Texas Water Development Board.

- Texas Water Development Board (TWDB). 2005. Digital Climatic Atlas of Texas: Texas Water Development Board, Annual high-resolution climate data sets for the state of Texas (2.5-arc minute 1981-1990 and 1991-2000 10 year-year mean annual grids for Texas) raster grid files. http://www.twdb.state.tx.us/GAM/resources/Digital_Climate_Atlas_TX.zip.
- Texas Water Development Board (TWDB). 2012. Water for Texas 2012 State Water Plan. <http://www.twdb.state.tx.us/waterplanning/swp/2012/index.asp>
- Texas Water Development Board (TWDB). 2016. *Water for Texas 2016*. Austin, TX: Texas Water Development Board.
- Texas Water Journal* (TWJ). 2013. A New Day? Two Interpretations of the Texas Supreme Court's Ruling in Edwards Aquifer Authority v. Day and McDaniel. Texas Water Resources Institute. 4:1, pg. 35-54. Accessed December 2, 2015: <https://journals.tdl.org/twj/index.php/twj/article/view/6990/6073>
- Texas Water. 2013. Texas A & M University. Last accessed October 2, 2013 at: <http://texaswater.tamu.edu/water-law>
- Tibshirani, R., G. Walther, and T. Hastie. 2001. Estimating the number of clusters in a data set via the gap statistic. *Journal of the Royal Statistical Society, B63*, 411-423.
- Trelease, Frank J. 1954. *Coordination of Riparian and Appropriative Rights to the Use of Water*. 33 Texas Law Review. 24, p 27-29.
- Turner, J. 1974. *The structure of sociological theory*. Homewood, IL: Dorsey.
- United State Environmental Protection Agency (EPA). 1974. Site accessed September 16, 2013: <http://water.epa.gov/infrastructure/drinkingwater/sourcewater/protection/solsourceaquifer.cfm>
- United States Census. 2010. Site accessed September 16, 2013: <http://quickfacts.census.gov/qfd/states/48/48650001k.html>
- United States Geological Survey (USGS). 1998. Recharge to and discharge from the Edwards Aquifer in the San Antonio Area, 1997. San Antonio, Texas: U.S. Geological Survey.

- USGS (U.S. Geological Survey). 2000. Hydro 1K digital elevation model (DEM) for North America: Sioux Falls, SD, Earth Resources Observation and Science Center, U.S. Geological Survey, U.S. Department of the Interior, DEM file.
http://edc.usgs.gov/products/elevation/gtopo30/hydro/na_dem.html.
- Vaughan, E., and M. Siefert. Variability in the framing of risk issues. *Journal of Social Issues*, 48, 119-135.
- Votteler, Todd, H. 1998. The little fish that roared: The Endangered Species Act, state groundwater law, and private property rights collide over the Texas Edwards Aquifer. *Environmental Law* 28:845-879.
- Votteler, Todd, H. 2000. Dissertation, *Water from a stone: the limits of the sustainable development of the Texas Edwards Aquifer*. Texas State University – San Marcos.
- Votteler, Todd, H. 2004. Raiders of the Lost Aquifer? Or, the Beginning of the End to Fifty Years of Conflict over the Texas Aquifer. *Tulane Environmental Law Journal*. Vol. 15.
- Ward, J. H., Jr. 1963. Hierarchical grouping to optimize an objective function. *Journal of the American Statistical Association*, 58, 236-244.
- Wildavsky, A., and K. Dake. 1990. Theories of risk perception: Who fears what and why? *Daedalus*, 119, 41-60.
- Wolff, N. 1997. Mayor: An inside view of the San Antonio politics, 1981-1985. San Antonio, *San Antonio Express News*.
- Wolfe, R. A., and D. S. Putler. 2002. How tight are the ties that bind stakeholder groups? *Organization Science*, 13, 64-80.
- Yin, R. K. 1993. *Applications of case study research*. Newbury Park, CA: Sage.
- Yin, R. K. 1994. *Case study research* (2nd ed.). Thousand Oaks, CA: Sage.
- Zektser, S., H.A. Loáiciga, J.T. Wolf. 2005. Environmental Impacts of Groundwater Overdraft: Selected Case Studies In The Southwestern United States. *Environmental Geology*. 47, p. 396-404.