GOOD FOLKS AND WATERSHED VALUES: AN ASSESSMENT OF THE COLLABORATIVE APPROACH TO WATERSHED MANAGEMENT IN FIVE CENTRAL TEXAS WATERSHEDS

By

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DEDICATION

The woods are lovely, dark, and deep,

But I have promises to keep

And miles to go before I sleep

And miles to go before I sleep.

-Robert Frost

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First and foremost, this thesis is dedicated to my mother. Mom, you encouraged me to follow my dreams, to travel the world, and to make a difference in my little part of it all. You inspired me to be a strong, independent woman, and, most importantly: to laugh, especially in the face of hardship. I would not be here without my sister, Kristin, for listening to my struggles day in and day out and for inspiring me with her grit and perseverance. I am grateful to my niece, Lexi, who brought the family together and who continues to be a bright spot in our lives. Thank you to my Dad, for guiding my pursuit of environmental science and agriculture, and for urging me to keep my feet on the ground.

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LIST OF ABBREVIATIONS

Abbreviation **Description**

BMP – Best Management Practices

CBRM – Community-Based Resource Management

CCP – Cypress Creek Project

CWA – Clean Water Act

EPA – Environmental Protection Agency

GAC – Geronimo and Alligator Creek

MCWE – Meadows Center for Water and the Environment

NNSP – National Nonpoint Source Program

NPS – Nonpoint Source

OSSF – On-site Storage Facility

PWM – Participatory Watershed Management

R/C/I – Residential/Commercial/Industrial

TCEQ – Texas Commission on Environmental Quality

TIAER – Texas Institute for Applied Environmental Research

TNSMP – Texas Nonpoint Source Management Program

TSSWCB – Texas State Soil and Water Conservation Board

TWRI – Texas Water Resources Institute

WAF – Wastewater Application Fields

WAP – Watershed Action Plan

WPP – Watershed Protection Plan

WWTF – Wastewater Treatment Facility

ABSTRACT

The value of the collaborative approach to watershed management is widely accepted, yet evaluative techniques to measure the effectiveness of this approach remain underdeveloped. In order to contribute to a standardized methodology, this study develops a survey that coalesces evaluative criteria from previous works and can be generally applied to participatory watershed management programs. A mixed-methods approach is used to test this framework in five watersheds administered by the Texas Nonpoint Source Management Program. Results of the survey suggest that in these watersheds, characteristics of the planning process such as representativeness and plan quality can be linked to positive social outcomes such as an increase in legitimacy and social learning. These social outcomes influence stakeholder perceptions of ecological improvement. However, no linkage was found between process characteristics and ecological outcomes, suggesting the need for greater emphasis on stakeholder management in planning stages and a re-characterization of stakeholders prior to the implementation of watershed protection plans. A descriptive analysis details the strengths and weaknesses of these programs and recommendations are made accordingly.

I. INTRODUCTION

Participatory watershed management (PWM) in the state of Texas has altered the landscape of resource conservation in recent years. Traditional attempts at conservation were characterized in the mid- to latter half of the twentieth century by what some consider excessive regulation. This top-down approach, also called command and control, proved to be at best contentious and at worst, unsuccessful (Sabatier et al., 2005). The backlash to these policies led to the widespread adoption of the participatory practice of resource management that is inclusive of the concerns of stakeholders in a given region and lends itself to a higher degree of legitimacy than more traditional regulatory management approaches. The aim of this thesis is to understand how PWM is implemented locally, in watersheds across Central Texas. This study evaluates these collaborative watershed management projects using qualitative and quantitative methods. As evaluation is an ongoing and integral part of the PWM process, I have selected five groups that have reached or surpassed the initial phase of implementation. Following previous PWM evaluation, I hypothesize that positive results from an evaluation of the stakeholder-led planning process predict success in the implementation of these plans, which in turn leads to water quality improvement.

Academically, this study is an attempt to consolidate methods used in PWM literature related to evaluation. There exists a wide body of literature underpinning a variety of ways in which to measure successes in the planning phase of WPP development and implementation. Many of these studies isolate a set of predictors that seek to indicate water quality improvement prior to the years of implementation, monitoring, and adaptation to compounding water quality concerns that can pose

challenges to gauging the effectiveness of these programs. The previous studies largely focus their efforts in one of two ways: (1) gauging the accuracy of a set of indicators in predicting success or (2) defending either a statistical or qualitative approach for the measurement of the validity of generally accepted indicators. While this exploration is critical to the measurement of current practices in resource management, it can be impractical for the application of evaluative measures by practitioners in the field. There is not currently a standard form of social process evaluation (stakeholder management and planning) to draw from as there is for ecological monitoring and evaluation.[1] This study will develop a comprehensive methodology for social process evaluation in watershed planning, drawing from case studies that have previously isolated appropriate indicators of program success. It is an attempt to combine these indicators into one survey which can be distributed amongst stakeholders independent of region and analyzed using quantitative and descriptive analyses.

This consolidated methodology will be applied to a case study in Texas. The state of Texas has several existing watershed protection plans and is without an evaluation of its social processes to date. Such an evaluation will assist facilitating organizations in executing future projects. This study contributes to a body of information for the initiatives that will aid in the success of the watershed projects via the social aspects of stakeholder management in the region, and to the greater academic conversation regarding the participatory approach to watershed management. The purpose of this research is two-fold: (1) to qualitatively and quantitatively evaluate Central Texas

[1] This statement is not entirely accurate, as ecological monitoring standards continue to evolve. Nevertheless, most ecological monitoring practices are generally accepted and can be translated as context requires, for example, in the case of certain environmental integrity indices.

watershed protection programs; and (2) to devise a comprehensive framework for process evaluation and, inversely, a tool-kit for planning.

My hypotheses for this research are adapted from Young et al. (2013, p. 362) and reflect general assumptions about watershed planning:

Hypothesis 1. Process characteristics of stakeholder planning influence perceived ecological outcomes.

Hypothesis 2. Process characteristics of stakeholder planning influence social outcomes.

Hypothesis 3. Social outcomes derived from stakeholder planning influence perceived ecological outcomes.

II. LITERATURE REVIEW

Participatory Watershed Management

Community-based resource management (CBRM) has risen to the forefront of resource management over the past several decades and has been used widely in watershed planning in the United States. CBRM is a democratic form of policy-making, its tenets advocating sustainable, resilient, and adaptive resource protection. A division of CBRM, participatory watershed management has emerged in response to command and control policies that looks to integrate the entirety of a riverine ecosystem (a basin-scale or watershed approach). The watershed approach defines its scope based on ecological boundaries and incorporates the diverse set of human actors that hold a stake in the well-being of the system. A watershed is any land area that drains into a body of water, which is why it is also called a drainage basin or catchment.

The history of watershed management contextualizes how the need for community-based management of local watersheds matured in the United States. CBRM developed in response to the inefficiencies of top-down governance which proceeded without regard to local social, economic, and environmental systems. As stated by Lubell, "instead of the centralized, command-and-control policies that characterized environmental legislation of the 1970s, collaborative management is designed to facilitate consensus and cooperation among competing stakeholders at the watershed level" (2004, p.341). Benefits of this type of resource management include a reduction in litigation resulting from stakeholder disagreement with environmental regulation and an increase in the uptake of management practices because local residents actively contribute to the formulation of a management plan.

Participatory, or collaborative, watershed management in the United States, like CBRM, solicits a group of stakeholders through a variety of methods. Stakeholder committees are devised to address varying aspects of a watershed depending on each stakeholder's area of expertise (Luyet, Schlaepfer, Parlange, & Buttler, 2012; Sabatier, et al., 2005). These committees participate in a decision-making process that designates executable actions for improving the health of a watershed that might address organization, funding, public policy, economic development, agriculture, regulation, education and outreach, best management practices (BMPs), and water quality and quantity monitoring and evaluation. There are typically three stages in a participatory process: planning and design, implementation, and evaluation. The planning stage identifies the scope of the problem(s) in a watershed through scientific inquiry and the methods it will utilize to address the problem. The implementation phase enacts the various policies, BMPs, and educational activities addressed in the planning stage. Evaluation usually involves quantitative and qualitative approaches to determining effectiveness of implementation and the decision-making process itself. Another benefit to the collaborative process is that a stakeholder group is adaptive and typically builds into its platform ways to address issues that might arise. A primary criticism of PWM is that remedial effectiveness can be compromised in the drive to appeal to a variety of interests.

A watershed collaboration can assume several forms. It may convene for the short-term or the long-term, can address specific or general issues, and can involve varying degrees of participation. A common example of a short-term, specific collaboration is the case of point-source of pollution. When a specific point of pollution

into a stream is identified, a group emerges to address the issue, and dissolves when a satisfactory solution has been reached and implemented. A more general (and more common) collaboration might assemble to address the general health of a watershed for resilience to current and future threats with adaptive policies. Such a group is usually retained indefinitely.

PWM is consensus-based and seeks to enlist conflict resolution measures, at times involving a third-party mediator, facilitator, or coordinator (Sabatier et al., 2005). This approach has a partial philosophical history tracing its roots to theories of direct democracy and civic environmentalism. The approach involves generating trust between co-participants and helps to legitimate the function and recognition of the group in the broader community.

Social Process Evaluation

With the rise of the use of the participatory process from the 1990s onward, a literature has evolved surrounding the evaluation of community-based or collaborative resource management programs (Ferreyra & Beard, 2007). As management plans mature and collectively reach greater rates of implementation, efficacy increasingly reaches measurability. Thus, continual monitoring and evaluation seeks to ensure that appropriate measures are implemented, and that participation is active and reflexive. The relative success of a project can be determined by the quality of the planning process, the quality of the resulting plan and its implementation, the level of resilience and adaptation a group maintains in the face of newly developed challenges to a watershed, and finally, the resulting ecological improvements.

Much of the PWM evaluative literature emphasizes that comprehensive ecological evaluation is resource-intensive and not feasible given the limited funding available to resource management (Lurie, 2007, p.6; Leach & Sabatier, 2005, p. 237). Instead, participant perception surveys utilize the knowledge of active stakeholders who communicate their experience with the process. While quantitative data collection techniques that address ecological outcomes such as water quality monitoring are requisite and performed internally by PWM alliances, evaluation of the PWM social process seeks to link process with outcome by examining what elements of participation lead to success in watershed protection. As a result, much of the first generation of evaluative literature focused on the social outcomes of the social process, or planning stage, of a PWM project for one or two local projects (Sabatier et al., 2005). These studies measure factors such as levels of trust between participants, perceived legitimacy of the process, fairness, conflict resolution, attitudes regarding PWM and so on (Sabatier et al., 2005). Increasingly, scientists have undertaken large comparative studies that detail "lessons learned," (Sabatier et al., 2005, p. 11), levels of implementation (Beierle & Konisky, 2001), and general "measures of partnership success" including level of agreement reached, implementation of agreements, and perceived effects on environmental and social conditions (Leach & Sabatier, 2005, p. 237), which shed light on larger trends and efficacy of PWM. However, it is important to note that while meta-analyses are a valuable contribution to the literature, evaluation necessarily aids individual watersheds and adaptation of generalizable frameworks depends upon local demographics, social, political, and economic dynamics, and watershed characteristics (Hassenforder, Pittock, Barreteau, Daniell, & Ferrand, 2016).

As such, Alexander Conley and Margaret A. Moote (2003) initiated a framework of evaluation for collaborative resource management that is generalizable across projects and has been adopted by evaluators of watershed management processes and adapted to local regions. Conley and Moote set forth a set of evaluation criteria that can be adapted to local demographics and program goals which researchers have since utilized and amended. Using their research as a platform, Lisa Lurie adapted a comprehensive set of criteria and indicators used to evaluate PWM programs (2007). She found that the literature outlines seven criteria of ""successful" programs: process design, process execution, program administration and funding, ecological impacts, management impacts, personal experiences, and changes in observable behavior" (Lurie, 2007, p. 6). She places these criteria into three analytical categories, process (the treatment, or independent variable), ecological outcomes (natural capital), and social process outcomes (social capital) (the dependent variables); indicators are subcategorized from there.

There is some coherence in the literature regarding overarching indicators of program success, such as trust and legitimacy-building. However, the results of individual evaluations and meta-analysis do no form a clear picture as to the best methods for formulating the stakeholder process or for appropriate evaluation metrics. A major challenge to this type of standardization is the breadth of variability in social and ecological systems. A review of the current literature identifies the significant indicators of PWM success that have been observed with the advancement of evaluative methods since the early 2000s. Reed (2008), Luyet et al. (2012), and Young et al. (2013) include the following indicators in their exhaustive lists of evaluative criteria that are found in the literature: trust, legitimacy, social learning, institutionalization, conflict resolution, early

involvement, transparency, equity, influence, stakeholder representativeness, integration of all interests, definition of rules, capacity building, emergent knowledge, impacts, degree of involvement, level of participation, facilitation and leadership, integration of local and scientific knowledge, participatory techniques, adequate resources, independence, cost-effectiveness, creation of new structures, and clear objectives. Other studies include quality of decision-making (Beierle & Konisky, 1999), plan quality, factual basis, implemented policies, interorganizational cooperation (Brody, 2003), formalization, and participation in implementation (Scott, 2015).

Level or degree of participation (or engagement or involvement) is a key factor in the evaluation of effective PWM and is often gauged as low, medium, or high and varies depending on frequency of meetings and the level of inclusion of the general public (Reed, 2008). Scientists measure this indicator differently from one study to the next depending on the objective of the evaluator and the goals of a project. Participation is the "most addressed" variable in the evaluative literature (Hassenforder et al., 2015, p. 87) and is not usually measured beyond the planning process. However, Beierle and Konisky conduct a study comparing participation in the planning stage with that in implementation (2001). They find from their case surveys that "it is just as easy to find cases that suggest a link between good stakeholder involvement in the planning process and good implementation as it is to find cases to refute it" and go on to suggest possible reasoning for this point including complexity of implementation, time, and potentially that the "stakeholder processes failed somehow in a way that is particularly relevant to implementation" (Beierle & Konisky, 2001, p. 524-525). Later, I briefly discuss linkages

between participation and implementation, which, from conversation with stakeholders and watershed coordinators, appears to be a concern for Texas watersheds.

Social evaluation criteria are often categorized as being either a contribution to the planning process (the independent variable) or as social outcomes of this process (the dependent variable) (Conley & Moote, 2003; Ferreyra & Beard, 2007; Lurie, 2007; Luyet et al., 2012; Rowe & Frewer, 2004; Young et al., 2013). While many of these evaluations divide the categories even further, I am choosing to simplify the categorization of the social aspects into these two segments. Perhaps part of the problem with program evaluation is the lack of a common language with consistent terminology to speak of observed phenomena. Several of the aforementioned indicators are similar conceptions of the same occurrence, and categories often overlap. For example, Beierle and Konisky (2001) measure capacity-building as the level of influence the organization has on policy (while others might consider influence to be the power one stakeholder has over another, in a form of network analysis (Young et al., 2013)), the number of organizations established to continue implementation, and whether the program successfully educated the public about watershed matters. However, on the latter measure, recent studies isolate social learning as its own indicator outside of capacity-building (Luyet et al., 2012; Muro & Jeffrey, 2006), while others speak of the adaptation of local knowledge (Sabatier et al., 2005).

Process characteristics include those that involve acute executable actions: representation, leadership/facilitation, staffing, funding, cost-effectiveness, participation techniques, conflict resolution, early involvement of stakeholders, transparency, clear objectives, adequate resources, integration of local and scientific knowledge, definition of

rules, and quality decision-making. Social outcome measures include those that are conceptually abstract or derive from actions such as trust, legitimacy, influence, social learning, impacts, capacity-building, social networking, institutionalization, creation of new structures, and independence.

An additional element I briefly address here is stakeholder characterization. The stakeholder characterization in this study informs a descriptive analysis of the relative influence of psychological and demographic variables on the social process. This section of the survey provides insight into which types of watersheds see improvement and vast implementation and which do not – leading to suggestions on how to anticipate conflict and improve outcomes. Also included are questions about the level of engagement stakeholders have with their stream's natural environment, including the amount of time interacting with the environment, whether through volunteering, recreation, or leisure, or spiritual and emotional connection to the landscape. This analysis might correlate with how an individual assigns value to the stream and can contribute to overall program success.

Linkages with Ecological Outcomes

The Beierle and Konisky (2001) study is one of the few examples of research that links the success of a planning process with level of implementation, an indicator of future ecological improvement, and actual ecological outcomes such as water quality improvement. Beierle and Konisky were unable to find a connection between implementation and ecological improvement and cite many common issues with watershed management that have been further dissected since this study was published (2001). Some of these challenges include funding, socioeconomic representation, wide

public participation, representation of important interest groups, and the possibility that comprehensive implementation can take many years beyond what stakeholders believed the case to be. Here, implementation progress is considered an ecological outcome, as it is assumed that with a quality plan involving scientifically and technically appropriate BMPs, we should see improvement in water quality.

Further, Tyler Scott links social process to water quality improvements, testing the "relationship between collaborative governance and watershed quality for 357 watersheds" (2015, p. 537). He measures the social process variables of group responsibility (participation in implementation), diverse representation, and formalization (presence of a coordinator and clear program goals) against water quality indicators. Scott's study includes groups that do not engage in management activities (implementation), while for my watershed groups, implementation is assumed. Regardless, Scott finds that those watersheds of which the participants engage in implementation have a better ecological outcome.

The ultimate measurement of ecological outcome for most studies is based on participant perception. As stated previously, improvement takes time. Social process evaluation depends on the respondent's knowledge of their watershed program to communicate water quality improvements in their region.

A wide variety of indicators can be used to measure PWM success and the results found in the literature present logical categories for a comprehensive evaluation. However, each study measures a small segment of these variables. This study consolidates these variables and looks at the influence of process characteristics on social and ecological outcomes.

III. CASE STUDY

Texas is a state wherein PWM can provide a meaningful approach to improve stream conditions and water availability. Considering the state's water allocation laws and extent of private land ownership, environmental regulation has traditionally been met with serious challenge by commercial and private interests. Here, stakeholder management can create win-win solutions for multiple parties.

National Nonpoint Source Program

Nonpoint source (NPS) pollution, or runoff that collects contaminants as it makes its way across the land to water sources, is a major cause of pollution in our waterways. This wide dispersion of pollutants, with urban development and agriculture being the primary contributing factors, can make it difficult to maintain clean aquatic ecosystems. As a result, nonpoint source pollution contaminates at least 85% of streams in the United States (Environmental Protection Agency [EPA], n.d.). To address this problem, in 1987, the U.S. Congress enacted Section 319 of the Clean Water Act (CWA), establishing the National Nonpoint Source Program (NNPS) (EPA, n.d.). The NNPS, under the jurisdiction of the EPA, relies on a watershed approach to NPS pollution control, which involves stakeholder-led watershed planning in the formulation of watershed protection plans. Section 319, requires states to institute NPS management programming and submit annual updates. Local WPPs are funded in part by §319(h) grants from the EPA through the CWA, and the NNPS provides a body of resources for technical guidance. Notably, the Central Texas Coastal subregion, which encompasses the Guadalupe Basin (Cypress, Plum, and Geronimo-Alligator Creeks) is one of three watersheds receiving the most

§319(h) funding in Texas, also ranking high in funding receipt across the nation, between $6.5 and $11 million from 2008 to 2013 (EPA, n.d.).

Texas Nonpoint Source Management Program

Two agencies in the state of Texas, the Texas Commission on Environmental Quality (TCEQ) and the Texas State Soil and Water Conservation Board (TSSWCB), administer the official watershed protection programs for the Texas Nonpoint Source Management Program (TNSMP) designated by §319 (Texas Commission on Environmental Quality [TCEQ], 2017). Figure 1 illustrates the location of these WPPs across the state.

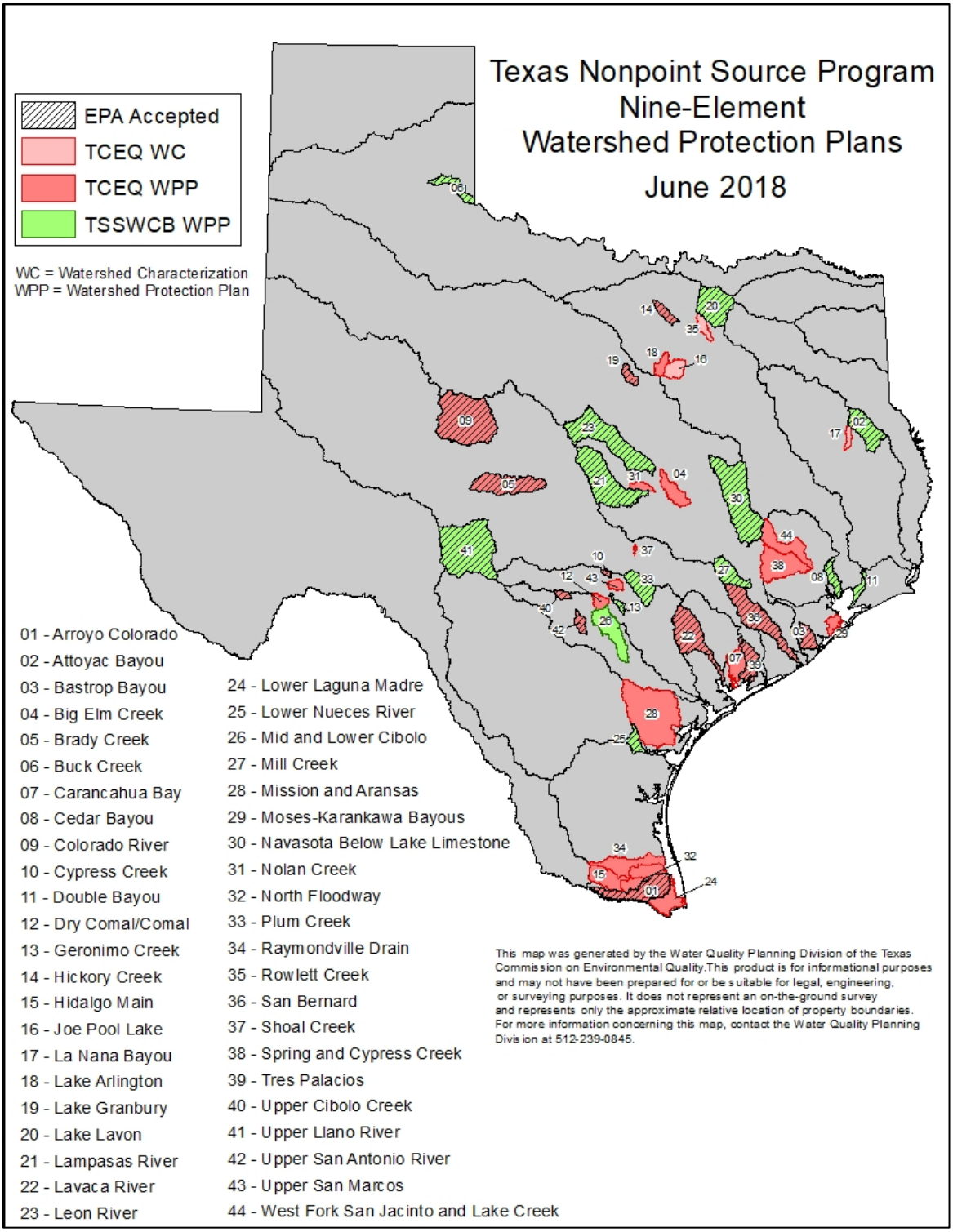

Figure 1 – Texas Nonpoint Source Management Program watershed protection plans (TCEQ, 2018)

Three major institutes in the state facilitate these programs: Texas State University's Meadows Center for Water and the Environment (MCWE), the Texas A&M University system including Texas AgriLife Research and Extension Service and Texas Water Resources Institute (TWRI), and Tarleton State University's Texas Institute for Applied Environmental Research (TIAER). WPPs are also facilitated by various river authorities, municipalities, and watershed associations, independently and in conjunction with the aforementioned parties. The EPA's "nine elements" for successful WPPs, which includes identification of causes, estimated load reductions, BMPs, budget guidelines, an information/education component, monitoring, and ecological evaluation, govern watershed projects that fall under this assignment (Florida Department of Environmental Protection [FDEP], 2003/2018). According to the TSSWCB, "this approach to watershed management recognizes that solutions to water quality issues must be socially acceptable, economically bearable, and based on environmental goals" (Texas State Soil and Water Conservation Board [TSSWCB], n.d.). The listed institutions have well-developed programs for watershed planning projects including education programs and training for coordinators and stakeholders, and regular roundtable discussion groups for coordinators. Figure 2 outlines a process for formulating these groups in Texas. However, this instruction underemphasizes two important components of watershed planning, stakeholder characterization and social process evaluation, and my research aims to close this gap.

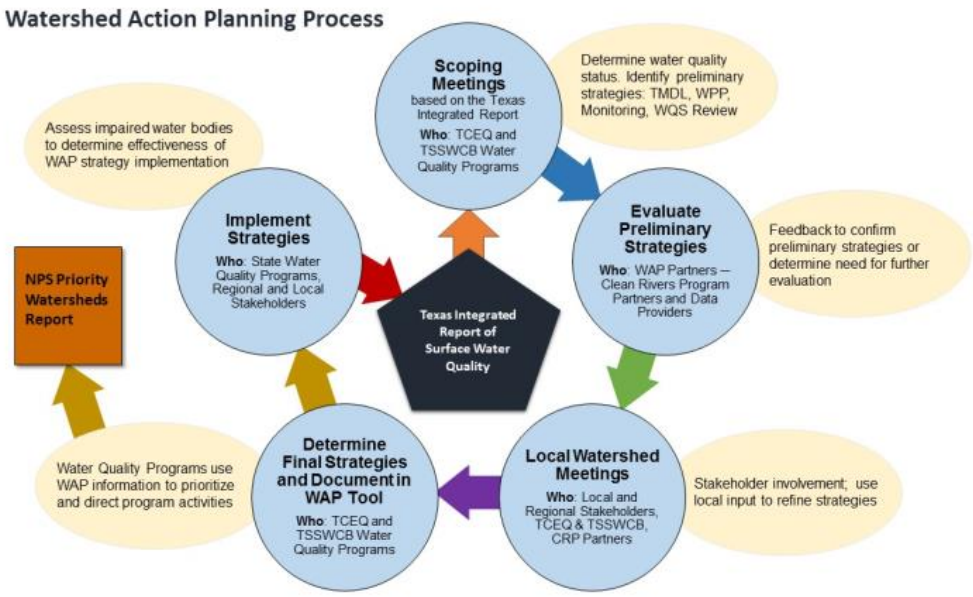

Figure 2- The State of Texas watershed action planning process as outlined by TCEQ (2017)

Central Texas Watershed Protection Programs

Five watersheds participated in this project, Cypress Creek, Plum Creek, Geronimo and Alligator Creeks, Leon River, and the Lampasas River. Watershed selection was determined by participation in the WPP program and is based on time spent in implementation. Watersheds have had their WPP accepted by the EPA, which officially places the project into the implementation phase. The longer the amount of time a watershed program has spent in implementation, the more significant the obtainable results, however, many of these projects in Texas are relatively young and might not have seen much advancement in the implementation phase. Analysis prior to or in the beginning of implementation can aid in tracking progress for adaptation throughout the process rather than waiting to gauge ecological outcome.

All WPPs include partial EPA funding through the CWA's §319(h) grant, the hiring of a watershed coordinator, BMP development and implementation, water quality monitoring, and an education and outreach component. Each WPP program is typically comprised of a body of stakeholders who participate in workgroups to devise a watershed plan. A smaller steering committee is selected from this larger group to make major decisions. Once the WPP is accepted by the EPA and implementation begins, the steering committee is the group making future decisions to meet adaptive needs. Semi-annual meetings are held to update the public on changes and educational and demonstrative events are held throughout the year.

Physiographical and biological watershed characteristics are not necessarily controlled for to gauge applicability of the evaluation across watersheds, though most are near-subtropical regions of Texas and are either suburban, small urban, or rural. Social process evaluations are often trans-regional (Leach, Pelkey, & Sabatier, 2002; Lurie, 2007; Beierle & Konisky, 2001; Young et al., 2013; Scott, 2015) and due in part to the human-oriented nature of such an analysis, and any geographical diversity among watersheds should not diminish the quality of the study but rather add to its richness and comparative capacity.

Central Texas Geography

Central Texas is a broadly defined area that encompasses several ecoregions and diverse human and wildlife populations. Land use is largely agricultural, with each watershed containing between two and five small urban centers.

The study area spans the Edwards' Plateau, Blackland Prairie, and Cross Timbers and Prairies ecoregions. Cypress Creek is fully contained in the Edwards' Plateau, also known as Texas Hill Country; Geronimo and Alligator Creeks cross the Balcones Escarpment, the Faultline demarcating the Edwards' Plateau and Cross Timbers from the Blackland Prairie ecoregions; and Plum Creek lies within the Blackland Prairie, interspersed by Post Oak Savannah (see Figure 2). The Limestone Cut Plain, a subdivision of the Cross Timbers and Prairies ecoregion encompasses most of the Leon and Lampasas Rivers (Parsons Water & Infrastructure Inc. & the Brazos River Authority [Leon WPP], 2015; Prcin, Srinivasan, & Casebolt, [Lampasas WPP], 2013).

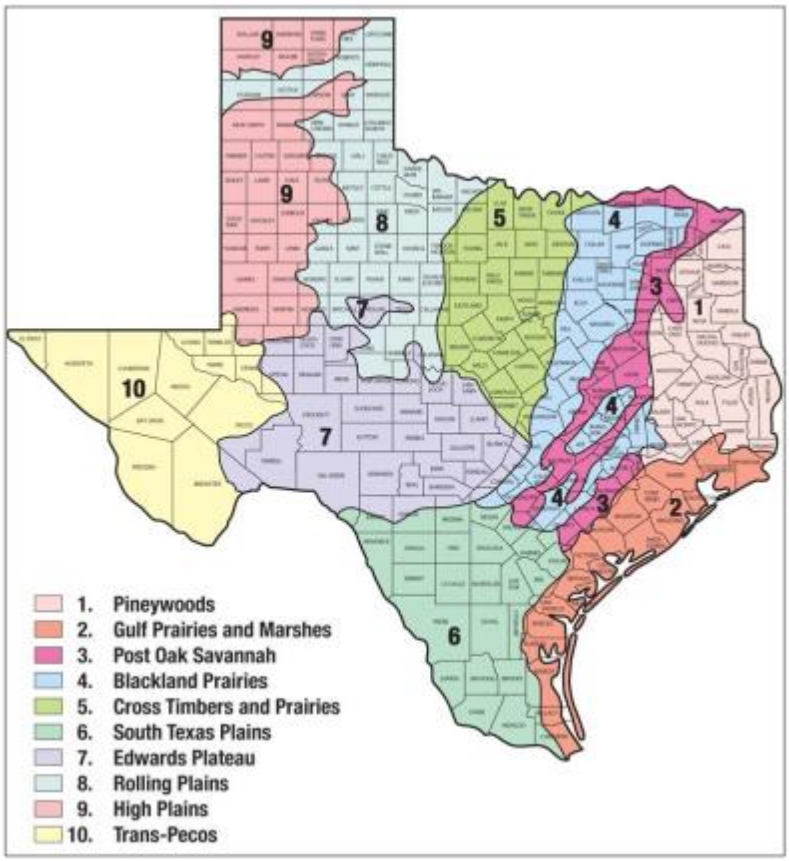

Figure 3 - Ecoregions of Texas (Lampasas WPP, 2013)

The Edwards Plateau ecoregion is comprised of clays and clay loams and includes limestone outcroppings (Eckhardt, n.d.). The Edwards region is noted for its karstic limestone features, where sinkholes and underground caves collect groundwater which forms the Edwards Aquifer (Eckhardt, n.d.). Grasslands, juniper, oak, and mesquite savannah characterize the Edwards Plateau while black, fertile soil and tallgrass prairies dominate the Blackland Prairie ecosystem (TPWD, n.d.). Much of the Geronimo and Alligator watershed, however, contains a variety of soils with clays featured prominently, and include limestone remnants (Ling, McFarland, Magin, Warrick, & Wendt, [GACWPP], 2012). Native animals include javelina, coyote, squirrel, white-tailed deer, beaver, bobcat, fox, skunk, raccoon, and turkey (GACWPP, 2012), and the Hill Country is home to an array of endemic and endangered species, while the Prairie is seeing an increase in feral hogs (TPWD, n.d.). Both regions see agriculture as a prominent industry.

The Cross Timbers ecoregion is characterized by sandy loam and clay subsoil while the Glen Rose Formation and Walnut Clay underlie the Limestone Cut Plain (Leon WPP, 2015). The vegetation of the former includes post and blackjack oak, cedar, and hickory with the latter having similarities to the Hill Country with less diversity (Leon WPP, 2015). Some consider the Limestone Cut Plain to be an extension of the tallgrass prairie, distinguishing it from the Edwards' Plateau, with a mix of bluestem, Indiangrass, sideoats grama, common curly mesquite, and Texas wintergrass (Lampasas WPP, 2013).

The climate in the three regions is generally similar, with temperatures ranging from average lows of zero degrees Celsius (32 ˚F) in January to 34 ˚C (94 ˚F) and above in July (GBRA 2013, p.2; Lampasas WPP, 2013; Leon WPP, 2015). Most of the area is considered subhumid to humid subtropical (Larkin & Bomar, 1983; Berg, McFarland, &

Dictson, [Plum WPP], 2008; Leon WPP, 2015), with yearly rainfall averaging around 737 mm (29 in.) (extremes ranging from 470 mm (18.5 in.) in the north-westernmost portion of the Leon watershed to 889 mm (35 in.) in Cypress Creek), with wide variation from year to year (Lampasas WPP, 2013; GACWPP, 2012; Leon WPP, 2015; Plum WPP, 2008; River Systems Institute [RSI], 2010). Due to this variation, regular and prolonged droughts affect streamflow in the region and watersheds are prone to flash flooding.

The Leon and Lampasas Rivers comprise the larger of the five watershed areas. Both are subwatersheds of the Brazos River basin. Cypress Creek, Plum Creek, and Geronimo and Alligator Creeks are subwatersheds of the Guadalupe River basin and the greater Central Texas Coastal (CTC) subregion, to the south of Leon and Lampasas. Table 1 describes these characteristics of the five watersheds.

Table 1 – *Major Characteristics of Surveyed Watersheds*

	Leon River	Lampasas River	Plum Creek	Geronimo and Alligator Creeks	Cypress Creek
Basin	Brazos River	Brazos River	Guadalupe/ CTC	Guadalupe/ CTC	Guadalupe/ CTC
Length (km)	306	121	84	27	24
Size (km²)	3561	3238	1028	181	98
Ecoregions	Cross Timbers	Cross Timbers	Blackland Prairie	Edwards' Plateau/ Blackland Prairie	Edwards' Plateau
Primary Land Use	Agriculture	Agriculture	Agriculture/ Urbanizing	Agriculture/ Urbanizing	Undeveloped/ Urbanizing
Average daily mid-range Streamflow (cfs)	Unavailable	~60	< 1	~30	~6
Primary Stream Classification	Intermittent/ Perennial	Intermittent/ Perennial	Intermittent/ Perennial	Intermittent/ Perennial	Intermittent/ Perennial
Associated Major Aquifer	Edwards-Trinity	Edwards-Trinity	Carrizo-Wilcox	Edwards	Edwards-Trinity
Annual Rainfall (mm)	470-813	737	838	787	879

Leon River

The Leon River watershed pictured in Figure 4 is the largest in this study, covering 3561 km² (1375 sq. mi) and flowing 306 km (190 mi) through five counties. The Leon is a perennial stream beginning at Proctor Lake in Comanche County and

ending at Belton Lake in Coryell County, though its tributaries are intermittent (Leon WPP, 2015). While the Leon River continues to form the Little River along with the Lampasas and Salado Creek, this segment extending past Belton Lake is in a watershed that is not directly considered in the WPP.

Agriculture dominates the economy in this watershed, accounting for nearly 85% of its area (Leon WPP, 2015). For much of the region, the major economic activity includes agribusiness, hunting, and limited manufacturing and oil production. The City of Gatesville in Coryell County is the largest urban area in the watershed with a population of 15, 591 as of 2010 (Leon WPP, 2015). The Fort Hood U.S. Army base contributes to the economy along with the Gatesville population center, contributing economic services such as public administration, trade, manufacturing, and professional services (Leon WPP, 2015).

In 1996, the Leon River was placed on the CWA's §303(d) List for Impaired Waters due to intermittent high bacteria counts (Leon WPP, 2015). The TCEQ subsequently ordered a total maximum daily load (TMDL) for this segment. Stakeholders soon began to advocate for "a more locally driven process," and instituted a WPP in place of the TMDL (Leon WPP, 2015, p. 9).

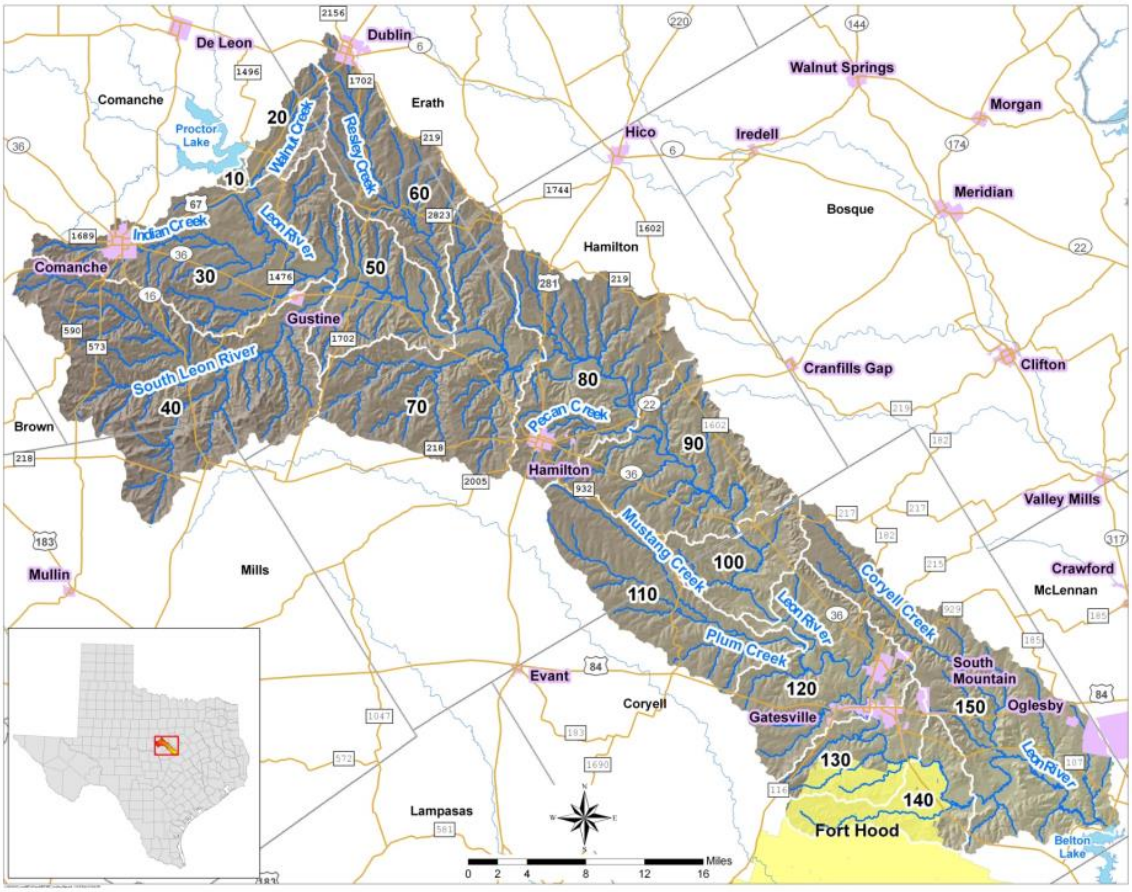

Figure 4 - The Leon River watershed between Proctor and Belton Lakes (Leon WPP, 2015)

Lampasas River

The Lampasas River drainage area (Figure 5) extends from western Mills County, flowing for 121 km (75 mi) southeast to its confluence with Salado Creek and the Leon River in Bell County (Prcin, L., n.d.). The Lampasas subbasin is approximately 3238 km² (1250 sq. mi) (Prcin, L., n.d.). It is an intermittent stream until it is joined by several tributaries, becoming a low-flow perennial river by its mid-reaches (Lampasas WPP, 2013).

The cities of Lampasas, Copperas Cove, and Killeen are the dominant urban centers in the Lampasas watershed. Like Leon, the Fort Hood Army base straddles the

watershed, contributing to the economy, population growth, and land usage. Killeen saw a 32% increase in population between 2000 and 2010 (Lampasas WPP, 2013). Even so, agriculture accounts for 73% of land use in the Lampasas watershed, with forest contributing 21% (Lampasas WPP, 2013).

The Lampasas River was first listed on the §303(d) list in 2002 for fecal coliform bacteria and low 24-hour dissolved oxygen (Lampasas WPP, 2013). Since this time, various segments of the watershed have been delisted, while others have been added to the list. The Lampasas River Watershed Partnership was formed in 2009 to craft a WPP in response to these water quality concerns.

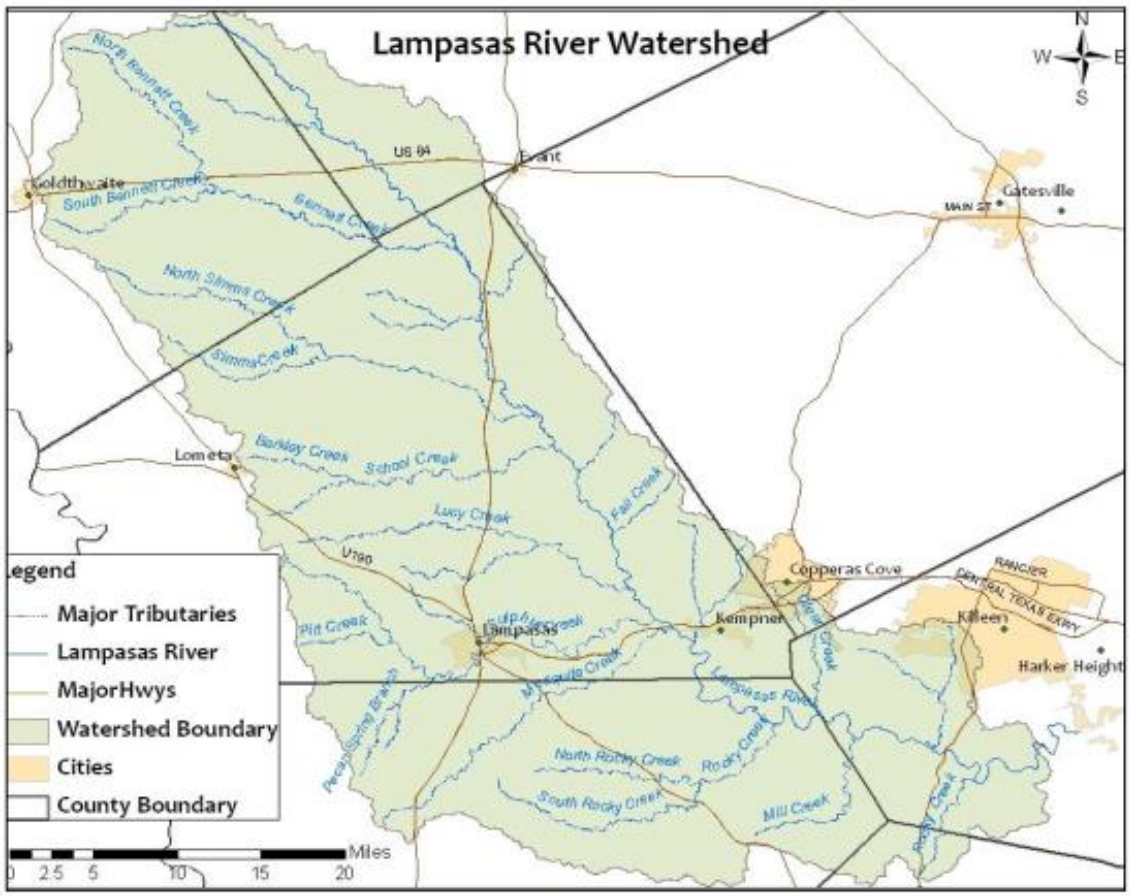

Figure 5 - The Lampasas River watershed (Lampasas WPP, 2013)

Plum Creek

The Plum Creek basin shown in Figure 6 covers 1028 km² (397 sq. mi) in Caldwell and Hays Counties, with a small portion in Travis County (Plum WPP, 2008). The northern reaches of the stream are largely intermittent, becoming perennial south of Lockhart where springs contribute to flow (Plum WPP, 2008). Plum Creek flows for 84 km (52 mi) until it reaches the San Marcos River. The Creek begins near the cites of Kyle and Buda along Interstate 35, a major transportation corridor running north and south from Laredo on the border of Mexico through the state of Texas. The I-35 interstate corridor travels alongside the Balcones Fault for a time, attracting urban development, and leading to increasing concerns for water quality management. The largest population centers in the Plum Creek watershed include Kyle, Buda, Lockhart, and Luling, with Kyle having the greatest population at 19,335 in 2006 (Plum WPP, 2008). This city saw a 264% population increase between 2000 and 2006, while Buda's population grew 84% during the same period (Plum WPP, 2008). However, nearly 50% of the land area in the watershed is agricultural, with 11% of that dedicated to cropland due to the fertile soils of the region. Oil production is another significant industry in the watershed.

Plum Creek was listed on §303(d) in 2004 for bacteria, with additional segments added in 2006 for high nutrient concentration (Plum WPP, 2008). The TSSWCB selected this watershed to participate in the statewide WPP program in 2005.

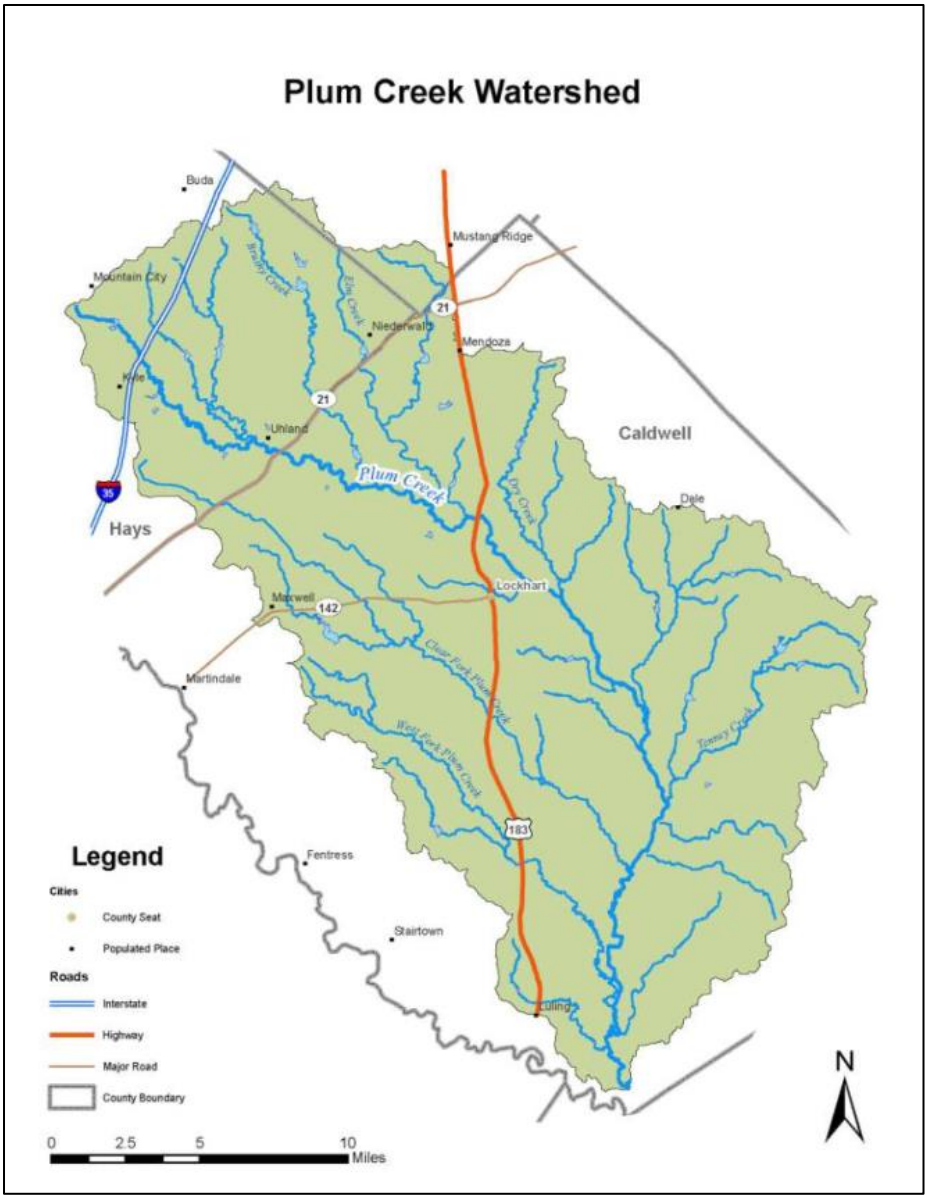

Figure 6 - The Plum Creek watershed (Plum WPP, 2008)

Geronimo and Alligator Creeks

The Geronimo and Alligator Creeks (GAC) watershed (Figure 7) comprises approximately 181 km² (70 sq. mi) of territory in Comal and Guadalupe Counties (GACWPP, 2012). Alligator Creek is intermittent until it reaches Geronimo Creek. Geronimo Creek is intermittent at its headwaters but becomes perennial downstream after

it meets with Alligator Creek, where it travels for 27 km (17 mi) to the Guadalupe River (GACWPP, 2012).

New Braunfels and Seguin are the major urban areas in this watershed. The GAC lies almost completely within the extra-territorial jurisdiction of these two cities, though the cities lie on the outskirts of the watershed. I-35 also transects GAC, with New Braunfels and Seguin seeing growth of 47 and 20 percent, respectively, between 2000 and 2008, with a total combined population of 75,505 in 2008 (GACWPP, 2012). Nonetheless, 92% of land use in the region is agricultural.

The GAC watershed was listed in 2006 for bacteria and nutrients and the Geronimo and Alligator Creeks Partnership was formed in 2009.

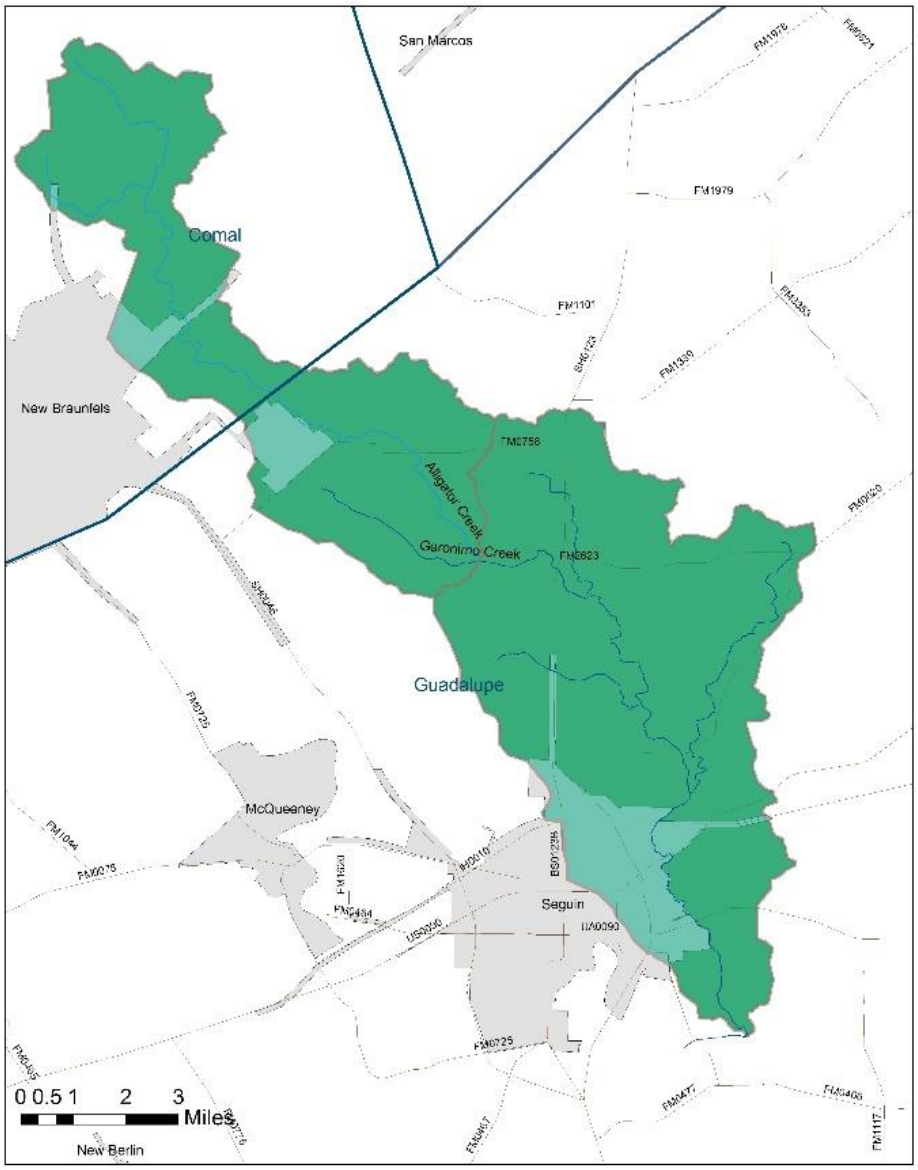

Figure 7 - The Geronimo and Alligator Creeks watershed (Geronimo and Alligator Creeks Watershed Partnership, n.d.)

Cypress Creek

The Cypress Creek watershed (Figure 8) in Hays County, Texas contains two segments, the upper, an ephemeral stream, is dry except during and after rainfall; the lower segment is fed primarily by Jacob's Well, a notable artesian spring north of the towns of Wimberley and Woodcreek, along with baseflow that allows for perennial status. Together, these segments flow for a total of 24 km (15 mi) through the cities of Woodcreek and Wimberley to the creek's confluence with the Blanco River, encompassing a 98 km² (38 sq. mi) area (RSI, 2010).

Due to its proximity to the major urban centers of San Marcos, San Antonio, and Austin, Hays County is also seeing elevated levels of growth, with projections as high as 300% by 2040 (RSI, 2010; Meadows Center for Water and the Environment [CCPWPP], 2014). Between 2000 and 2009, the county expanded at a rate of 21%. The population in 2009 was 118,083 (RSI, 2010). Seventy-five percent of the land use in the watershed is agricultural, with 9% undeveloped and 11% residential.

Cypress Creek was listed on the Impaired Waters List in 2000 due to low dissolved oxygen from drought and suspected well draw-down and the Cypress Creek Project was formed in 2008 (CCPWPP, 2014). Low streamflow especially affected Jacob's Well. Nutrients, bacteria, suspended solids, biochemical oxygen demand, and oil and grease are of particular concern for the WPP, though the Creek currently meets TCEQ water quality standards (RSI, 2010).

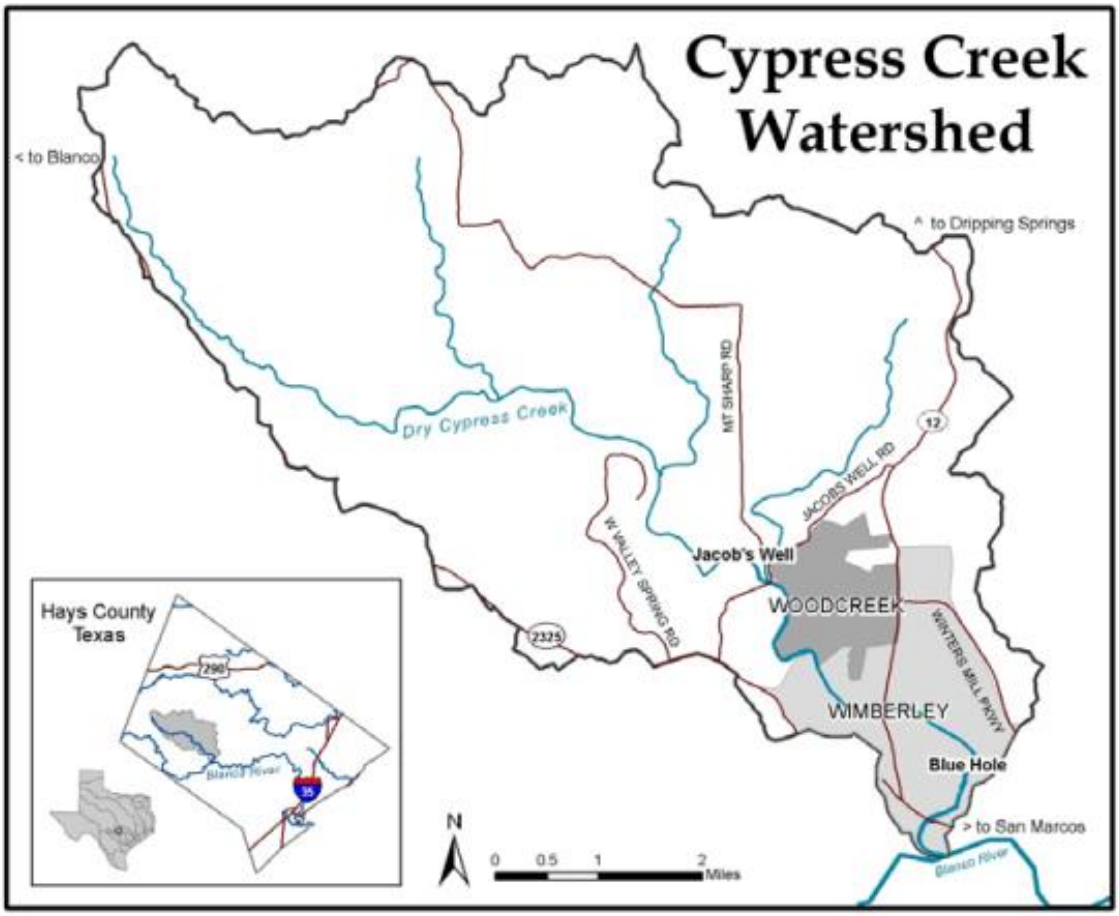

Figure 8 - The Cypress Creek watershed (CCPWPP, 2014)

IV. METHODOLOGY

Using a mixed methods approach, I collected qualitative and quantitative data for this study. From March 2018 through March 2019, I engaged in participant observation with the Cypress Creek Project at meetings and events in and around Wimberley, Texas, as a baseline for understanding the process for the WPP programs in the Central Texas, and to support the descriptive analysis. At WPP meetings and events and via email and face-to-face with contacts generated at meetings and events, I conducted informal interviews and conversations with participants to gather this reference data. Documents produced by and about the watershed protection programs were also reviewed. Finally, a survey based on the literature and locally relevant material was developed and used to assess partnerships in the TNSMP.

Survey

Between October 2018 and February 2019, an online survey was distributed to email addresses of partnership members by watershed coordinators in the five watersheds. Most coordinators upon my prompt emailed monthly reminders to potential respondents. Responses were also solicited at committee meetings in Cypress and Plum Creeks. Email listservs include program participants who signed up for correspondence from their watershed partnership when attending an event or a meeting. The online survey screened respondents for the extent of their participation in the project. Only those who routinely attended meetings, and therefore had a certain level of familiarity with their partnership, were allowed to proceed to the remainder of the survey. The survey solicits participant perceptions regarding their experiences and knowledge of their watershed partnership (See Appendix C).

Survey questions are adapted in large part from Lurie (2007) with permission from the author. Criteria categorization is based on Conley and Moote (2003) who sought to generate a broad set of criteria by which local projects could insert the particularities relevant to their region. The framework found in Young et al. (2013) also aided in the conceptualization of categories for this analysis. Many additional indicators were considered and either included or excluded based on similarity or difference among themes from previous studies, applicability to this case study, or theoretical basis.

Within a stakeholder-led management project there are a set of outcomes expected which are either outlined explicitly or are anticipated to result implicitly as part of civic-oriented group dynamics. As such, I have outlined three major criteria by which to cognize the participatory process and its benefits, *process characteristics*, *social outcomes*, and *ecological outcomes*. The terminology for these criteria was coined by Conley and Moote (2003) and is used for the same purpose by a variety of later studies (see Young et al., 2013; Lurie, 2007; Luyet et al., 2012; and Ferreyra & Beard, 2007). The term *process characteristics* is used here to refer to the actionable attributes of the planning process that can vary amongst groups and that influence the goals and objectives of a given program. *Social outcomes* are group traits that improve social and intra-network relationships and are presumed to influence ecological outcomes. *Ecological outcomes* reflect the ultimate goal(s) of a watershed management program and the measures in which to gauge them; in this case, water quality.

The survey contains a total of twenty-nine substantive questions, with the addition of three screening questions and eleven demographic questions. Three watersheds chose to opt-out of the demographic section citing a distrust in some

communities of social science-related investigation. Therefore, demographics were only included for Cypress Creek and Geronimo and Alligator Creeks. Nine questions (Qs 4a, 6a, 7a, 11a, 12a, 16a, 17a, 23a, and 26) are open-ended and include the option to respond with additional text. Two questions ask about overall benefits and respondents' experiences within the program (Q25 and Q26). Three questions address what Newman and Fernandes (2016) call social psychological factors: values, beliefs, and attitudes related to the natural environment (Qs 27, 28, and 29).

Twenty-four survey questions correspond with indicators attributed to the three criteria (Qs 1-24). Of these questions, two ('my program adequately involves the public in the following stages of the decision-making process...' (Q2 a-g) and 'because of my involvement I have a better understanding of...' (Q19 a-f)) contain a battery of additional questions corresponding to specific processes. I formulated fourteen questions into seven indicator constructs associated with an indicator that represents the questions in the grouping. I found some of the indicators associated with each construct in this study to be redundant in the literature, with each paper focusing on one or more subsets of the grouping. Individual indicators are more accurately represented by collapsing the indicators into conceptual categories. In total, I compiled a set of twelve indicators to measure the success of the five watershed protection planning processes in Central Texas, according to criteria, which represent the evaluative framework I devised for this study. The process model in Figure 9 outlines a conceptualization of the anticipated linkages between criteria attributes and their associated indicators. A list of the criteria and the indicators along with their associated constructs and batteries are presented in Table 2. The following section describes this process in greater detail.

Table 2

Indicators for Evaluating Participatory Watershed Management Programs and Associated Constructs and Batteries

Criteria	Indicator Construct	Indicator*	Battery
Process Characteristics	Participation	Degree of involvement (Q1), Public involvement in various stages (Q2)	Public Involvement in problem identification, research, planning, education and outreach, implementation, monitoring, and evaluation (Q2 a-g)
	Plan Quality	Scientific and technical accuracy (Q10), problem identification (Q9), socioeconomic concerns (Q11)	
	Representativeness	Representativeness (Q4), integration of interests (Q5), local knowledge (Q6)	
	Cooperation	Conflict management (Q7), Consensus-building (Q8)	
	Clearly defined rules and objectives (Q3)		
Social Outcome	Social Learning	Education and Outreach (Q20), Better understanding of...(Q19)	Better understanding of technical aspects, policy, major issues, factors contributing to major issues, strategies for change, perspectives of others (Q19 a-f)
	Legitimacy	Influence (Q18), Public Support (Q17)	
	Shared Values	Shared values in general (Q15); Shared values in relation to the watershed (Q16)	
	Social Capital	I interact with parties I otherwise would not (Q14)	
	Trust	Trust among members (Q12); I trust others in decision-making (Q13)	
Ecological Outcome	Water Quality Improvement	Quality Improvement (Q21), Improvements are the result of the plan (Q22)	
	Implementation	Progress of implementation (Q23), public is engaged in implementation (Q24)	

Note. Sources: Conley & Moote, 2003; Lurie, 2007; Young et al., 2013; Beierle & Konisky, 2001; Leach et al., 2002; Luyet et al., 2012; Reed, 2008; Reed et al., 2010; Ferreyra & Beard, 2007; Samuelson et al., 2005; Sabatier et al., 2005; Scott, 2015; Brody, 2003; Arnstein, 1969

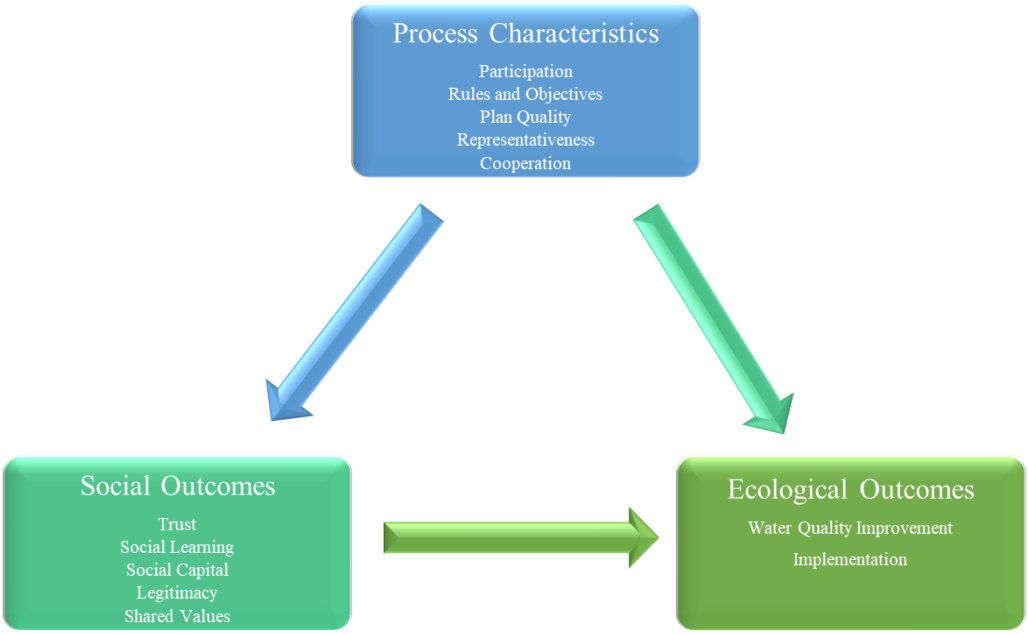

Figure 9 – The social process evaluative framework

Indicators

Many studies contradict each other regarding the association of indicators to criteria and in the language used to define concepts and to ask questions about a program. In the following section I attempt to make sense of these categorizations and to streamline evaluative criteria.

As mentioned previously, several of the common indicators associated with program evaluation are inherent to the planning process within the Texas Nonpoint Source Management Program and therefore they are excluded from this study. For example, several studies address formalization or institutionalization (Scott, 2015; Reed, 2008). Scott associates formalization in part with the inclusion of a watershed coordinator (and many others emphasize strong leadership (Reed, 2008)) suggesting this leads to a "stronger institutional presence" (2015, p.540). Scott does not ultimately find a strong

correlation between a group having a coordinator and water quality improvements, though other studies do (Schwartz, 2016). Reed (2008) suggests the need for the institutionalization of participation. As our partnerships discussed here have both a coordinator and a systematic structure of leadership, these and similar variables are excluded. However, a warning for consideration from Reed (2008, p. 2426):

> Many of the limitations experienced in participatory processes have their roots in the organisational cultures of those who sponsor or participate in them. For example, although non-negotiable positions are often the result of regulatory constraints, they may simply be the result of pre-determined positions decided at higher levels within the organization prior to participation in the process, that representatives do not feel able to negotiate. Decision-makers may feel uncomfortable committing themselves to implement and resource the as-yet unknown outcome of a participatory process. In many cases, to do so would represent a radical shift in the organisational culture of government agencies and other institutions.

Process Characteristics.

Participation. Two variables are used to gauge this indicator. First, I use the degree of involvement framework from Luyet et al. (2012). This framework is based on Arnstein's seminal ladder of citizen participation (Arnstein, 1969, as cited in Luyet et al., 2012). The question (Q1) asks respondents to identify the overall type of involvement they experienced in their watershed program from the following categories (Luyet et al., 2012, p. 215):

- Informative = Involved the explanation of the project to the stakeholders.
- Consultative = Involved the presentation of the project to stakeholders, collection of their suggestions, and then decision making with or without taking into account stakeholder input.
- Collaborative = Involved the presentation of the project to stakeholders, collection of their suggestions, and then decision making, taking into account stakeholder input.
- Co-decision = Involved cooperation with stakeholders toward an agreement for solution and implementation.

- Empowering = Involved the delegation of decision-making over project development and implementation to the stakeholders.

Next, I unpack participation a bit more using a construct from Lurie (2007). This question asks the respondent about each particular phase of the project and whether involvement was adequate (Q2 a-g).

Rules and objectives. Studies show that the clear and early definition of rules for and objectives of the group along with clearly defined roles for participants can improve outcomes (Scott, 2015; Reed, 2008; Conley & Moote, 2003; and Lurie, 2007). The associated question (Q3) asks respondents about their experiences accordingly.

Plan Quality. Though plan quality (Brody, 2003; Conley & Moote, 2003; Beierle & Konisky, 2001) might also be considered an outcome, it is attributed here as a process characteristic because the WPP is created during the planning stage, and decisions made in the plan's genesis influence both social and ecological outcomes. For example, whether a plan has socioeconomic benefits is a social outcome. However, whether a group decides to incorporate socioeconomic concerns into its plan is a process characteristic. Whether the WPP addresses socioeconomic concerns (Q11) is included in the plan quality construct along with scientific and technical accuracy (Q10) and problem identification (Q9).

Representativeness. Representativeness is a primary consideration in social process evaluations (Sabatier et al., 2005; Luyet et al., 2012; Conley & Moote, 2003; Reed, 2008; Samuelson et al., 2005). Representativeness is determined in several ways. It is important for all interests to be involved in a PWM group, including citizen groups, real estate and development, environmental non-profits, academic institutions,

municipalities, industry, and agriculture, to name a few. Demographics are another important category that is less often considered in watershed planning, along with political affiliations, values, beliefs, and attitudes. According to Sabatier et al., "when adequate representation is not achieved, democratic processes at best fail to meet normative criteria and at worst lead to ineffective policies that do not affect the attitudes and behaviors of excluded stakeholders" (2005, p. 8). The representation construct collapses two additional themes found throughout the literature, integration of all interests and local knowledge. Local knowledge is the knowledge accumulated about an ecosystem or community through the experience of an individual, which is sometimes passed down through generations or communicated amongst friends or colleagues. Three questions are included in the representativeness construct. Using the knowledge of the stakeholders, we ask whether their partnership is representative (Q4), whether public values were incorporated into decision-making (Q5), and whether local knowledge was considered (Q6).

Cooperation. For this attempt at survey standardization, I created a new indicator which is a composite of two common themes, conflict management (Q7) and consensus-building (Q8). Capacity-building is a goal of many watershed groups, to the extent that Luyet et al. (2012) outline a number of 'participation techniques' recommended for and utilized by these programs. These techniques are a means to develop the capacity of a watershed group to reduce conflict and develop consensus, among other things.

Social Outcomes.

Social Learning. Social learning is "change in understanding that goes beyond the individual to become situated within wider social units or communities of practice through social interactions between actors within social networks" (Reed et al., 2010, n.p.). This phenomenon is encouraged in watershed conservation. Social learning is considered an outcome here in order to discover if it has taken place rather than to test whether the concept was emphasized through specific techniques during planning. I use a construct from Ferreyra and Beard (2007) to ask respondents if they have gained a better understanding of watershed science and the perspectives of fellow stakeholders (Q19 a-f), leaving the social network analysis for future research. However, one additional question about public education and outreach attempts to glean information about the reach of watershed learning (Q20).

Trust. Entangled in the processes of many of the listed indicators is trust. Trust is regarded as a primary indicator of program success, and the variable can influence group dynamics (Sabatier et al., 2005). A two-question construct asks about general trust among members (Q12) and trust as it relates to decision-making in the watershed (Q13).

Social Capital. The idea of social capital further implicates trust, social networking, and the spread of watershed-related ideas to the greater public. While Lisa Lurie (2007) conflates social capital with social outcomes in general, I decouple these categories in this study. Here, I associate social capital with Lurie's "improved stakeholder interactions/creation of social networks" (2007, p. 7) (Q14), though intentionally exclude social network analysis again, as it is not within the scope of this study.

Legitimacy. For a watershed partnership to succeed, it needs public support. To garner public support, a partnership must maintain a sense of legitimacy in the eyes of the community. Several variables can indicate legitimacy including institutionalization and influence. The survey asks about general public support for the WPP (Q17) and whether the planning process influenced relevant decision-makers (Q18).

Shared Values. Beierle & Konisky includes a question about the incorporation of public values into decision-making as an indicator of the "quality of decisions," which can also be conflated with "plan quality" (2001, p.518). 'Shared values' is an example of an indicator that might be used as a process characteristic, but only if pre-testing were possible, using a questionnaire that would be distributed prior to long-term participation and then compared with data surveyed after a number of years. Typical attribution of shared values to the process characteristic criterion occurs because it is difficult to interpret after the planning process whether group members have seen an aggregation of values amongst members after working together toward a common goal for a long period. However, because pre-test data is not available, this survey categorizes the construct as a social outcome. Two questions are asked relating to this construct: whether other members share similar values to the respondent in general (Q15), and in relation to the watershed (Q16).

Ecological Outcomes.

Water quality improvement. The measurement of ecological outcomes in this survey is perception-based. Because water quality is the focus of the five watershed protection plans and of the National Nonpoint Source Program, I ask respondents

whether water quality has improved in their watershed (Q21) and whether perceived improvements are the result of the WPP (Q22).

Implementation. Higher rates of BMP implementation should indicate improvements in water quality. However, because NPS pollution is diffuse and many of the major issues that compound these stream contributions over time are difficult to manage (development due to population increases, inevitabilities of erosion, etc. from commercial agriculture, and industry), I have included implementation as a separate indicator in this analysis, as it is found in others (Beierle & Konisky, 2001). Prior to seeing improved water quality, we can look at the progress of implementation throughout a watershed and make predictions about future NPS amelioration. Respondents are asked whether the progress of implementation is adequate and reasonable (Q23) and whether the public is adequately engaged in implementation (Q24).

Analysis

Descriptive statistical analysis was performed on survey response data (mean and standard deviation) using IBM's Statistical Package for the Social Sciences (SPSS). In total, 23 responses were completed and recorded (n=23). Table 3 shows the frequency of response from each watershed. Survey respondents were given the option not to respond to individual questions, therefore each question has a different response rate. Aside from open-ended questions, most questions were recorded on a 5-point Likert scale (1=strongly disagree, 2=somewhat disagree, 3=neither agree nor disagree, 4=somewhat agree, 5=strongly agree). Stakeholder involvement is measured on a 5-point scale with one representing the lowest degree of involvement (informative) and five representing the highest (empowering).

In order to test the three main hypotheses, variables were collapsed in three stages based on their attributes using un-weighted means (Table 2). Incomplete responses were removed for composite statistical analysis (n=17). I collapsed the two batteries into variables by finding the mean for each set of questions. Then, variable means were averaged according to construct grouping, construct according to indicator, and indicator according to criteria. Pearson correlation was performed on the three criteria to generate results for the three general hypotheses. Individual indicators and variables are then analyzed descriptively with basic statistics to expose response trends.

Table 3

Frequency of Response for Watersheds Participating in the Social Evaluation Survey

Participating Watersheds	**Frequency**
Cypress Creek	11
Plum Creek	6
Geronimo and Alligator Creeks	1
Leon River	4
Lampasas River	1
Total	23

V. RESULTS

Evaluative criteria were analyzed for the Texas Nonpoint Source Management Program as a whole. Participation was solicited from five watersheds participating in this program, the Leon River, Lampasas River, Geronimo and Alligator Creeks, Cypress Creek, and Plum Creek. Forty-six people participated in the study, though many were screened out after responding 'no' to the statement 'I served on a steering/stakeholder committee or working group' for their watershed. With 23 total and 17 complete responses, and 16 respondents explicitly either currently serving or having served on a committee in the past 5 years, I contend that there is a representative sample of the estimated 50 to 100 current or recently involved committee members in the five surveyed watersheds. Due in part to higher degrees of outreach and involvement on the part of the researcher in Cypress and Plum Creeks, response was greater in these watersheds. However, due to the general applicability of this survey (not reliant on watershed-specific context), some of this potential bias is reduced. This sampling is similar to the way in which a random sampling of demographic data in a state includes a variety of urban and rural respondents from many counties: some counties might have higher response rates. Here, there are higher response rates in the Cypress and Plum watersheds. To further decrease potential bias, quantitative survey scores are mostly used in the aggregate. Qualitative text responses and participant observation is at times watershed-specific, to add depth to the analysis.

Hypotheses

H1. Process characteristics of stakeholder planning influence perceived ecological outcomes

This analysis did not find a significant relationship between process characteristics and perceived ecological outcomes in Central Texas watersheds. The direct effect of process characteristics of watershed planning on ecological outcomes, perceived or otherwise, cannot be generalized from this case study. A summary of hypotheses results is found in Table 4.

H2. Process characteristics of stakeholder planning influence social outcomes

Results of the Pearson correlation indicate that there is a strong, significant, positive association between process characteristics and social outcome ($r(16) = .672$, $p = .003$). Process characteristics predict 45.2% of social outcomes ($r^2 = .452$).

H3. Social outcomes derived from stakeholder planning influence perceived ecological outcomes

We find here a significant, positive association between social outcome and ecological outcome ($r(16) = .580$, $p = .015$). As social outcomes increase, so do perceived ecological outcomes. Social outcomes predict 33.6% of ecological outcomes ($r^2 = .336$).

Table 4

Demonstration of Relationships Among Evaluative Criteria Using Pearson Correlation

	(1)	(2)	(3)
1. Process Characteristics	1.00		
2. Social Outcome	.672**	1.00	
3. Ecological Outcome	.426	.580*	1.00

* significant at α<.05
**significant at α<.01

Descriptives

Process Characteristics

Process characteristics overall were favorably scored by respondents (n = 17, M=4.36, SD=.54). The representativeness indicator construct rates the highest of the five process characteristics, with little variability (n = 17, M=4.69, SD=.36). The minimum mean score for representativeness is a 4, indicating that respondents believe their partnerships are highly representative of the greater watersheds and are inclusive of local knowledge and values. The incorporation of local knowledge is especially salient in this study, with 78.9% of respondents (n=19, M=4.79, SD=.42) agreeing strongly that local knowledge was incorporated into decision-making and 21.1% agreeing somewhat. Refer to Table 8 for the results of all criteria, constructs, indicators, and batteries.

Rules and objectives had the lowest minimum score (2) of this evaluative criterion (n=21, M=4.29, SD=.92), reflecting some disagreement that rules and objectives were defined clearly and early in the process. Two respondents said they somewhat disagree that rules and objectives for decision-making and participation were defined clearly and early in the process and two neither agreed nor disagreed.

Perceptions of cooperation (n = 17, M=4.47, SD=.60) and plan quality (n = 17, M=4.43, SD=.69) were similarly favorable, with mean indicator score ranges between 3 and 5. When broken out, 90.4% of respondents agree that when decisions were made they included the input and consensus or agreement of all interests (n=21, M=4.52, SD=.98). One person strongly disagreed that decisions were agreed upon by consensus. Fewer (84.2%) agree that when there was conflict it was resolved among stakeholders (n=19, M=4.21, SD=.86). Two respondents neither agreed nor disagreed to this statement about conflict while one somewhat disagreed. The responses for this indicator are reflected in Table 5. The socioeconomic factor lowered the score for the plan quality construct, with three respondents remaining neutral and one somewhat disagreeing that their WPP adequately addresses socioeconomic concerns in the region (n=19, M=4.16, SD=.90)).

Table 5

Frequency of Stakeholder Response to the Question 'How Strongly Do You Agree or Disagree That When There Was Conflict, it Was Resolved Among Stakeholders?'

Conflict Resolution	**Frequency**	**Percent**
Somewhat disagree	1	5.3
Neither agree nor disagree	2	10.5
Somewhat agree	8	42.1
Strongly agree	8	42.1
Total	**19**	**100**

Notably, the participation indicator received relatively lower scores than other constructs throughout the survey (n = 17, M=3.90, SD=.70). When asked to demarcate a degree of involvement provided a list of terms and definitions (n=21, M=3.62, SD=1.071), 52.4% of respondents considered their group to be in the category of ‘co-decision,’ an identity corresponding with a level 4 rating on the Likert scale. Meanwhile,

23.8% responded with ‘collaborative,’ 14.3% ‘empowering,’ and 9.5% ‘informative.’ Table 6 demonstrates respondent perceptions of overall degree of involvement in watershed partnerships.

Table 6

Respondent Perceptions of Overall Degree of Involvement in Partnerships

	Frequency	**Percent**
Informative	2	9.5
Consultative	0	0
Collaborative	5	23.8
Co-decision	11	52.4
Empowering	3	14.3
Total	**21**	**100**

There was some variation within the public involvement battery among program stages. 19% doubted (81% found acceptable) the adequacy of their program at involving the public in problem identification, planning, monitoring, and evaluation, and 23.9% disagreed to this same question in the research stage (M=3.90, SD=1.04). 100% of respondents agreed that the public is adequately involved in implementation and education and outreach.

Social Outcomes

Social outcomes were viewed positively by surveyed watershed participants. The social learning construct received the highest mean score (n=17, M=4.63, SD=.36), while the trust construct was rated the lowest (n=17, M=4.29, SD=.71).

Most respondents strongly agree that social learning occurred in their watershed. Every respondent agreed that the public is better educated and informed about watershed protection as the result of the WPP (n=17, M=4.65, SD=.49) and that because of their involvement with the stakeholder committee, they have a better understanding of the

perspectives of other stakeholders (n=17, M=4.76, SD=.44). Within each of the other categories in the 'understanding' battery, one respondent replied with neither agree nor disagree citing that they are "educated as a water resource planner, so [they were already versed in] ...policy and... the science of watershed management."

Fewer participants surveyed cited trust as a prominent characteristic of their watershed partnership (n=17, M=4.29, SD=.71), with some variability. Scores within this construct range from 2 to 5. Fewer respondents strongly agree that there is trust among the stakeholder committee members in their watershed than those who somewhat agree, at 47.4% (n=19, M=4.32, SD=.82). Only one, however, somewhat disagrees and one neither agrees nor disagrees, while 94.1% trust other stakeholders of the committee(s) to make decisions related to the watershed (41.2% strongly agree), with one somewhat disagreeing (n=17, M=4.29, SD=.77).

Ecological Outcomes

With the lowest score across constructs, there is less agreement regarding whether water quality has improved in the region and whether if there is improvement, this is attributed to the WPP (n=17, M=3.77, SD=.79). Perceptions about implementation rates are more positive (n=17, M=4.00, SD=.53).

There is general agreement that the progress of implementation of BMPs is adequate and reasonable, though with lower confidence, with 21.1% in strong agreement and 73.7% somewhat agreeing (n=19, M=4.16, SD=.50). One person neither agreed nor disagreed. The perception of adequate public involvement in implementation is not as strong, with three respondents remaining neutral about the relevance of this attribute to their watershed and one person somewhat disagreeing (n=17, M=3.88, SD=.78).

Stakeholders surveyed are less confident about whether water quality in their watershed has improved since passage of the WPP (n=17, M=3.76, SD=.90), with 58.8% agreeing to this statement. Six respondents neither agree nor disagree (35.3%) while one somewhat disagrees. Table 7 demonstrates the perception of water quality improvement among respondents in surveyed watersheds. When asked if water quality improvements are a result of the program's decisions and actions, 58.8% agree (41.2% somewhat agree), while 41.2% neither agree nor disagree (n=17, M=3.76, SD=.75).

Table 7

Stakeholder Response to the Statement 'Water Quality in the Watershed has Improved Since Passage of the WPP'

	Frequency	Percent
Somewhat disagree	1	5.9
Neither agree nor disagree	6	35.3
Somewhat agree	6	35.3
Strongly agree	4	23.5
Total	**17**	**100**

Nevertheless, respondents were in strong agreement that their watershed programs are of overall benefit to the community and ecology of their watersheds (n=17, M=4.71, SD=.47). Every participating watershed partnership member responded that they agree to this statement, with 70.6% in strong agreement and 29.4% somewhat agreeing.

Table 8

Statistical Results for the Social Process Evaluation Survey

Indicator Construct	Indicator	Battery	n	Mean	Std. dev.
Process Characteristics			17	4.36	.54
Participation			17	3.90	.70
	Degree of Involvement		21	3.62	1.07
	Public Involvement (PI)		17	4.21	.64
		PI Problem Identification	21	4.19	1.08
		PI Research	21	3.90	1.04
		PI Planning	21	4.24	.89
		PI Education/ Outreach	21	4.33	.48
		PI Implementation	21	4.48	.51
		PI Monitoring	21	4.10	.83
		PI Evaluation	21	4.14	.96
Rules			17	4.29	.92
Plan Quality			17	4.43	.68
	Scientific Accuracy		21	4.52	.93
	Problem Identification		21	4.52	.81
Representativeness			17	4.69	.36
	Representativeness		18	4.61	.61
	Socioeconomic inclusion		19	4.16	.90
	Value inclusion		21	4.48	.93
Cooperation			17	4.47	.60
	Conflict Resolution		19	4.21	.86
	Consensus		21	4.52	.98

Table 8 Continued

	Indicator Construct	Indicator	Battery	n	Mean	Std. dev.
Social Outcomes				17	4.48	.41
	Social Learning			17	4.63	.36
		Public Education		17	4.65	.49
		Understanding		17	4.62	.54
			Understanding of...technical aspects	17	4.59	.62
			...policy	17	4.59	.62
			...major issues	17	4.59	.62
			...contributing factors	17	4.59	.62
			...strategies	17	4.59	.62
			...perspectives	17	4.76	.44
	Trust			17	4.29	.71
		Trust in general		19	4.32	.82
		Trust in making watershed decisions		17	4.29	.77
	Legitimacy			17	4.41	.59
		Influence		17	4.35	.70
		Public Support		19	4.47	.61
	Social Capital	**Improved Interactions**		17	4.59	.51
	Shared Values			17	4.47	.62
		General Values		21	4.38	.74
		Watershed Values		19	4.47	.51

Table 8 Continued

	Indicator Construct	Indicator	Battery	n	Mean	Std. dev.
Ecological Outcomes				17	3.88	.55
	Water Quality Improvement			17	3.77	.79
		Water Quality Improvement		17	3.76	.90
		Improvement Attributed to Plan		17	3.76	.75
	Implementation			17	4.00	.53
		Progress of Implementation		19	4.16	.50
		Public Engagement in Implementation		17	3.88	.78

VI. DISCUSSION AND RECOMMENDATIONS

This thesis examines linkages between stakeholder management characteristics, or social processes involved with planning, and social and ecological outcomes. The hypotheses are based on the vision that intentional attributes of decision-making processes (especially in planning, but this can also occur in any stage of water protection programming that involves public participation) affect both social and ecological outcomes, and that social outcomes such as the legitimacy of a plan in the eyes of the community can also predict ecological outcomes.

The findings here suggest that attributes associated with ecological outcome criteria, including high levels of progress in implementation, result from the attributes associated with social outcome criteria in Central Texas watersheds. An assumption made here is that perceived ecological outcomes are informed on the part of stakeholders by a knowledge of and familiarity with monitoring results in their watersheds. This study, however, does not find the attributes associated with process characteristics to contribute to perceived ecological outcomes. However, the findings do indicate that a relationship exists between process characteristics and social outcomes. While linkages are seen from process to social outcome to ecological outcome, these findings imply that there is no direct effect of process characteristics on ecological outcome. The results, rather, suggest an indirect effect of process characteristics on ecological outcome by way of social outcomes. Young et al. (2013) is one study that examines the influence each indicator can have on the construction of an evaluation criterion. Regarding a link between process characteristics and ecological outcome, the authors find that influence, representativeness, and early involvement are less important in the determination of

ecological outcomes (Young et al., 2013, p. 363). If, in this survey of Central Texas stakeholders, indicators were not properly allocated within the process characteristics criteria, this could account for the resulting lack of correlation. Consequently, prior to the use of this survey in other regions, I suggest further research that includes the construction of a statistical model that more clearly identifies the relationships amongst indicators.

However, because of the relationships between H1, H2, and H3, and with corroborating qualitative data, it is likely that process characteristics improved social outcomes, but that ecological improvement requires an increase in attention to the attributes of the decision-making process (process characteristics) in Central Texas watersheds. This result is supported by Young et al. (2013), who also find no relationship between process characteristics and ecological outcomes. They attribute this finding to the complexities of challenges facing the desired outcome itself, reaffirming the need for stakeholder involvement (Young et al., 2013, p. 368). Whereas positive social outcomes are viewed as being capable of producing long-term socio-ecological improvements, process characteristics may not have the same effect (Young, et al., 2013). The following descriptive analysis of individual variables might illuminate this relationship further and expounds upon the strengths and weaknesses of local watershed programs.

Survey

Participant response indicates that the major strengths of the five watersheds within the TNSMP include representativeness and social learning (with mean scores greater than 4.5), though most tested measures received relatively high scores (mean scores of somewhat or strongly agree (between 4 and 5)). Weaknesses of the program include degree of involvement and perceived water quality improvement (mean scores less than 4), with an additional recommendation of placing greater emphasis on generating trust and establishing rules and objectives clearly and early in the process. It must be noted that I use the phrases *relatively* and *lower than* to describe relationships among resultant scores. All indicators are scored by respondents as averaging between neutral and in agreement, with few disagreeing to the positive formulation of indicators reflected in the questionnaire.

Process Characteristics

Indicator constructs included in the process characteristics criterion include participation, rules (establishment of rules and objectives clearly and early on), plan quality, representativeness, and cooperation. The evaluative literature suggests that the incorporation of these process characteristics into the decision-making process for WPPs can predict positive ecological outcomes.

Relatively lower scores for the question of whether rules and objectives for decision-making and participation were defined clearly and early in the process are somewhat of a surprise here due to the institutionalized aspect of this indicator in the surveyed watersheds. At the start of many WPP programs in the state, stakeholder groups

author a set of by-laws or agreed upon rules, and preparatory materials for use in educating watershed coordinators outline how to establish a formal or informal set of rules and group procedure (Gregory & MacPherson, 2017). This degree of formality when it comes to the implementation of rules is context-based, as reflected in one member's commentary: "We have been able to function through consensus rather than voting on specific topics because there is a high level of trust and understanding between members of the Working Committee." Depending on stakeholder composition, some watersheds may agree to informal rules for participation, like those in the Upper Gulf Coast Oyster Waters, a program outside of Central Texas. These less-formal guidelines follow a model of basic cooperation with rules such as 'speak up,' 'disagree respectfully,' 'silence is presumed consent,' and most of all, 'have fun!' (Gregory & MacPherson, 2017).

In order to elucidate further on the scoring for this measure in the survey, I looked at the watersheds associated with the responses 'somewhat disagree' and 'neither agree nor disagree' for the rules measurement and compared responses with the ground rules outlined for each watershed. Cypress Creek and Leon River each received one 'somewhat disagree' and one 'neither agree nor disagree.' Geronimo and Alligator Creeks, Plum Creek, and Lampasas River have formal, and extensive, sets of bylaws containing detailed descriptions and guidelines for each of at least 12 rules. Cypress Creek has an informal list of five general rules that include 'be open to new concepts and be respectful of other points of view, no audio/visual recording of meetings, if workgroup members are absent, a proxy must attend in their place, workgroup decisions are bade by consensus, and professional conduct is expected (CCPWPP, 2014). Ground rules are not established

in the Leon River WPP (Leon WPP, 2015). Upon further investigation, I did not find evidence of the influence of clearly established rules on water quality improvement or ecological outcome overall. However, Pearson correlation did show a significant relationship ($r(16) = .51$, $p < .05$) between rules and implementation, an indicator of positive ecological outcome. In other words, as the definition of rules increases, so does the progress of and involvement of the public in implementation. Definition of rules accounts for 26% of the variability in public engagement in implementation. This finding is consistent with others who find that "...the establishment of clear rules...is essential for a successful participation process" (Luyet et al., 2012, p.216). The relationship between these variables might reflect a communicated sense of legitimacy toward the project between involved stakeholders and the general public, increasing a willingness to participate in BMP activities.

Respondents in this survey scored plan quality and cooperation similarly, indicating that they generally agree that decisions made were based on sound scientific and technical information, included the input and consensus of all interests, and that potential sources of impairment were accurately identified. There was some disagreement regarding socioeconomic concerns and conflict resolution. Hibbard and Lurie point out that a chief concern for watershed organizations is the socioeconomic health of the community (2012, p. 526), and this is especially salient when considering the impact of economic pursuit (or a dearth thereof) on a human community and its natural environment. Only one person in the survey commented about socioeconomic concerns, citing that "in the long term, aquifer sustainability will require more changes to watershed practices." Presumably, the connection made here relates to the intimate relationship

between ground and surface water in the region's limestone aquifers and a concern about whether WPPs include policy addressing competing economic and societal interests (development, agriculture and ranching, and oil and gas) and the increasing pressures on the water supply and surface water quality. This connection is echoed in sentiments regarding conflict within individual watersheds.

Examples of conflict were expressed when respondents were asked to provide examples of trust or lack of trust among stakeholders, highlighting the interrelatedness of indicator qualities. Several participants cited a debate between those opposed to wastewater discharge from wastewater treatment plants (WWTPs) (and a distrust in local wastewater companies) and those prioritizing a concern about bacterial contamination from aging on-site sewage facilities (OSSFs), a contention prevalent in many watersheds throughout Texas. One interlocutor details this dispute as follows:

> Because of the failures of the wastewater treatment plants located in the watershed and the inadequate or lack of response to those failures by the governing agency (TCEQ), the stakeholders did not trust the cities to maintain adequate wastewater treatment or TCEQ to effectively hold the cities to their permit requirements. The stakeholders laid much of the blame of the high bacterial counts on poor effluent quality being discharged at WWTPs. Also, landowners did not trust the purpose of the WPP and were suspicious that the WPP was a means of governmental control.

This comment details several of the challenges faced when attempting to manage conflict in stakeholder groups, both locally and as it applies to community-based resource management in general.

Specific issues can create opposition within groups. The involvement of individual stakeholders associated with what become ideologically opposed organizations once an issue is identified or develops and can obscure trust. Further, developments on a

national or international scale can affect local politics, as one respondent comments that the "current political climate in Wimberley has colored involvement of some stakeholders." Conflict management and the generation of trust through capacity-building are an ongoing necessity in long-term groups, as group dynamics can change based on outside influence. Commenting on a trail in a local nature preserve, a local participant relates changing attitudes: "conflict over where the trail would lead was thought to be resolved by all examining the new trail, but after the new trail was completed there was still disagreement on the flow of traffic...although I thought we had agreed. This issue is yet to [be] resolved."

When respondents were asked how conflict was handled in their watershed program there were varying responses. In Cypress Creek, a participant communicates that "getting City of Woodcreek Council approval of participation in the CCWPP took a three-month effort of listening to concerns...and gaining trust in new personnel." Two respondents echo the importance of communication, with one adding that "mutual respect for positions was key, though at times challenging," and another two also citing methods for conflict resolution, "educat[ing] the stakeholders" and "data presentation, scientific support, [and] occasional compromise." The use of data to manage conflict is not always well received however, as one respondent puts it: "[facilitators] performed probably more research than was actually needed and used scientific methods to prove a point." Another details the incorporation of stakeholders into roles of responsibility while at the same time confirming a mistrust in a certain set of values, "most conflict was avoided by placing members on the Working Committee as elected representatives of various interest groups. The conflicts we experienced were not between stakeholders but were between

watershed stakeholders and the regulatory community." Here, the "regulatory community" likely refers to environmental agencies, who, along with other facilitating organizations, at times use scientific data to alleviate disputes over topics that might not otherwise have a clear consensus within or obvious resolution for the watershed community at large. However, this concern is reflective of some of the common values shared among members in Central Texas watersheds and will be discussed in greater detail in the next section. Here we find that political demographics can influence conflict in local watersheds and there is a high level of tension surrounding wastewater treatment in the region. Facilitators address conflict through discussion, education, and an elevation in the level of involvement in the project of individual stakeholders.

Much of the literature surrounding degree of involvement suggests that the greater the degree, the better the results (Reed, 2008), though appropriate levels of involvement can vary based on context (Reed, 2008; Luyet et al., 2012). In order to take a more generalized approach for the purposes of this survey, I assume the former to be true within explicitly stakeholder-led programs such as the TNSMP WPPs. It is argued that participation (and representativeness) reduces marginalization, in turn increasing the likelihood that objectives chosen during planning are accepted by the community (increasing legitimacy) (Reed, 2008). These types of arguments correspond with an assumption that the higher the degree of involvement, the greater the outcome. The majority of respondents rated the degree of involvement in their watershed to be co-decision (corresponding to a 4), though seven participants perceive their partnership to be either collaborative (3) or informative (2). If the objective is for local WPPs to strive for empowering levels of participation, 85.7% improvement is necessary.

When asked to describe their role or level of involvement with their stakeholder committee, many of those surveyed responded with the way in which their presence represented their respective interest, such as “land owner,” “educator,” “watershed planner,” or municipal leadership. Seven responded with some version of “highly engaged,” while two feel less involved, responding in ways that mirror a general feeling that attending meetings is not reflective of active participation. One member said they are “observant, with occasional comments,” while another related they “mostly at this point just attend meetings.” The latter respondent also commented that they “would like to see more educational opportunities designed to engage people beyond the "choir" (that is people who aren't yet engaged).” The belief that their watershed partnership is ‘speaking to the choir’ is also reflected in some of the surveyed stakeholder perspectives regarding public involvement.

Stakeholders responded that the stage-based location of public involvement was most salient in education and outreach and implementation, but less so in problem identification, planning, monitoring, evaluation, and especially research. One respondent relates that “many people are not aware of the effort,” while another says that the plan was “strongly supported and now virtually forgotten since it has been a few years since this subject was in the public spotlight.” Though most respondents agreed that there are high levels of public involvement in education and outreach and implementation within their partnerships, both comments suggest that involvement has potentially diminished over time or was not present to begin with. The five programs in this case study have completed their planning stages and moved into implementation. Due to the time lapse involved with gaining plan approval through the EPA (often 2-3 years), many watershed

activities wane during this time. Public stakeholder committees are transformed into steering committees (most often reducing in size) who meet to make decisions in response to EPA requests or for other purposes. It is possible that positive response to questions regarding outreach and implementation are due to the nature of these phases, as inherently requiring the involvement of the public, though much of this activity happens behind the scenes by facilitating or associated organizations (such as the creation of watershed signage, rainwater harvesting demonstration construction at community centers, or the implementation of individual agricultural BMPs on private property, for example).

The relatively lower scores on the public involvement battery in monitoring, evaluation, and research are not necessarily problematic. Research, in particular, in the case study watersheds is largely conducted by independent companies, government agencies, and affiliated universities. For the purposes of the TNSMP, involvement for research and M&E is redirected to representatives of these organizations. Luyet et al. (2012) discuss the relegation of degree of involvement to individual stakeholders (including members of associated organizations), suggesting that each stakeholder will participate at their own level. Luyet et al., though, also relate that often the decision of who participates where is determined by leadership, which can be subjective (or, I argue, overly standardized), and suggests following a systematic model (they propose the one outlined in Vroom, 2003) to determine the role of each stakeholder based on the context of each watershed (2012, p. 215). However, one respondent from the Leon River Partnership was notably satisfied with the delegation of degree of involvement in their watershed, commenting that "our plan was developed using a third-party consulting firm

that provided needed technical guidance throughout the development process. [This was] very valuable to our WPP."

Another partnership member communicates their role in the engagement of the public in monitoring in their watershed: "I engage with the public to monitor water quality at multiple sites. I conduct the monitoring for the [Cypress Creek Project] and WPP. [The Wimberley Valley Watershed Association] and City of Wimberley help pay for professional monitoring. [The Guadalupe-Blanco River Authority] helps pay for citizen scientist monitoring." The Texas Stream Team (TST) is a citizen science group that assists the MCWE and Texas State University in conducting water quality monitoring for WPPs and others, including Plum Creek, Leon River, and Cypress Creek. A visual review of the survey data in this study does not indicate that these two watersheds rated degree of involvement in monitoring higher than other partnerships, nor others lower than Plum, Leon, and Cypress, and specific perceptions of this variable appear to be evenly distributed amongst watersheds. A possible disparity between reality and perception on degree of involvement here may indicate either an insufficiency in communication, a lack of interest in monitoring on the part of the stakeholders, or a missed connection between activities of the TST and the WPP.

The representativeness indicator construct scored highly favorably, with some variability, most notably in value inclusion. One participant responded that they strongly disagree that public values were incorporated into decision-making for the watershed project. Another respondent commented about the size reduction of the Lampasas River Partnership steering committee in transition to implementation saying "the original group of stakeholders represented the range of stakeholders in the watershed. The new group is

smaller. I don't think there is a representation of the landowners in the new group." Representativeness in the NNSP is generally considered in regard to public and economic interest groups including land tenure, real estate and development industry/business, non-profit and environmental interests, established community and religious organizations and neighborhood associations, academic institutions, and state and federal agencies, and local municipalities.

There is less evidence that demographic diversity, especially age, race, and income, is sufficiently pursued in Central Texas watershed protection programs. Three WPPs for the watersheds in this study do not include demographic statistics; the Leon WPP demographic section describes population and the economy and the Plum Creek WPP discusses income, education, and the primary language spoken by residents. Ethnicity representativeness may be insufficient in local watershed partnerships, with some indication of this phenomenon here, as 100% of participants in this survey who responded to the question (n = 9) self-identify as 'white.' In conversation with watershed program members in Cypress Creek, a concern about the lack of age diversity in the program was communicated (personal communication, January 7, 2019). Participants in this survey over the age of 51 account for 88.9% of those responding to the question about age (n = 9). Outreach for participation in local watershed partnerships appears to focus on the distribution of materials for advertising meetings and events rather than directed stakeholder characterization and the targeting of underrepresented demographic groups for inclusion, though some level of the latter does occur (Lampasas WPP, 2013; Plum WPP, 2008; Cypress WPP, 2014; GACWPP, 2012; Leon WPP, 2015). A guide for watershed coordinators published by the EPA recommends that "if the community will be

responsible for implementing the management strategies developed, it is vital that a cross section of the community participate in the process" (EPA, 2013).

Demographic diversity is, however, perhaps most applicable in heterogenous, urban or urbanizing watersheds, as related in a case study of two watershed councils in San Antonio, Texas (Samuelson et al., 2005). In order to determine the case for each program, Reed suggests, "relevant stakeholders need to be analysed [sic] and represented systematically," identifying individuals and groups who are affected by or can affect ecosystems and prioritizing them for involvement (2008, p. 2423). Luyet et al. (2012, p. 214) further relates that

> Failing to identify some stakeholders may introduce bias in the subsequent stages of the process. Another consequence of unidentified stakeholders is the possibility for them to appear later and have negative impacts on the project. Performing the identification process with several heterogeneous persons can minimize these risks. On the other hand, involving all possible stakeholders may increase the complexity and the cost of the participation process. The challenge is to find the optimum balance between these risks.

Power imbalance is another related topic often addressed by stakeholder analysis and is observed by one respondent as it impacts trust amongst stakeholders: "there may have been initial distrust of larger, more well-funded members (i.e. municipalities, industry) but over the years the demonstration of shared goals for water quality protection have resulted in trusting relationships." Successful watershed partnerships include a diverse array of stakeholders, engendering trust through the establishment of shared watershed-related values.

Local knowledge, the second variable in the representativeness indicator construct, is well represented in Central Texas watershed programs, with 100% of respondents agreeing to this statement. When asked to describe some examples of local

knowledge that was included in WPPs, both general and very specific cases were communicated. Two respondents discussed the importance of local knowledge for their program, with one elucidating further,

> Local stakeholders knew that the bacteria contributions from wild animals were the primary source of bacteria in the watershed. Local experience told decision makers which BMP's were most likely to have strongest buy-in from watershed stakeholders. Local knowledge in decision making lends credibility to the WPP in the eyes of the average citizen in the watershed.

Another replied that "not all the local knowledge was considered in writing the WPP. That should be improved [in] future WPPs because the people who live in these watersheds are key to success." Several stakeholders in Plum Creek responded that historical information regarding land use, flooding, wildlife concerns, and public contact with tributaries was incorporated into the WPP. A final respondent communicated that as the result of educator experience on a local nature trail, rules for a nature preserve surrounding the trail were incorporated into the watershed protection plan.

Social Outcomes

Following specific characteristics that can be incorporated into decision-making, we should see outcomes benefitting social processes that produce desirable ecological results. In this section we will explore the social benefits produced through stakeholder-led planning in the Leon River, Lampasas River, Cypress Creek, Plum Creek, and Geronimo and Alligator Creeks watersheds.

Overall, the data indicate general agreement that the planning process engendered social learning and improved stakeholder interactions, perceptions of legitimacy regarding the plans within the community, and a feeling that common values are shared

amongst members. While trust was generally engendered within groups, it scored the lowest of the of the indicators within this criterion.

Most respondents agree that other members of the group share similar values to them both in general and in relation to the watershed. One respondent disagreed that other members shared similar values in general. Shared values, as measured solely at the completion of the decision-making process (rather than with a pre- and post-comparison) can indicate that (1) the planning process helped to expose participants to the perspectives of others and in doing so minimized disparity in perspective, (2) that participants within the watershed generally share similar values regardless of their participation, or (3) that members with opposing viewpoints were excluded from or dropped out of participation at some point in the process. Further research is necessary to determine the case here. However, one survey respondent provided a list of values they believe is shared in common amongst members (reported verbatim, bullet points added by author):

- Strong belief in private property rights
- Limited government intervention
- Agricultural background
- Distrust of governmental/regulatory community
- Willingness to challenge regulatory community version of the facts when that information does not make practical sense
- That the outcome of the program must benefit local people without placing unnecessary social or financial burdens on property owners

These are sentiments reflected in previous discussion here regarding representativeness, trust, and conflict resolution. This assertion of common values as a whole is indicative of a watershed that generally shares similar values regardless of participation in the watershed program. There is some evidence that value homogeneity in a watershed can

expedite the planning process (Sabatier et al., 2005; Lurie, 2007) but limit the effectiveness of the resulting plan if problems are not adequately identified (Reed, 2008).

Another respondent communicated shared values in relation to the watershed, saying that "members of the stakeholder's committee, including myself, believe in the value of the water resources in the Plum Creek watershed and we wholeheartedly support the protection of those resources." A set of shared values such as these can improve long-term success of a watershed program, allowing other concerns to be mediated in sight of a common goal. This statement regarding shared watershed values might indicate that either the planning process helped to minimize disparity in perspective or that members with opposing viewpoints were excluded from or dropped out of participation at some point in the process.

Several watershed values were sampled in this study, with the assumption or hypothesis that a set of values is cultivated through shared experience among groups, and that these values can be transmitted throughout a community. The mean was calculated for each value based on rank and occurrence, and the lowest and highest ranked values are communicated here. Regarding their watersheds, respondents highly value aesthetic qualities ($n = 6$, $M = 2.77$), the ability of their stream to provide sustenance for both nature ($n = 10$, $M = 5.56$) and humanity ($n = 4$, $M = 3.2$), and a sense that their watershed will remain intact for future generations ($n = 5$, $M = 2.27$). Surprisingly, cultural ($n = 1$, $M = .33$) and spiritual values ($n = 1$, $M = .50$) are less relevant to those surveyed. While this reporting is informative, it is as of yet anecdotal, and I recommend future research on the topic of watershed values in Central Texas. However, I hypothesize that these results corroborate messages communicated (the cultivation of shared values) in the

development of local watershed protection programs. It would be interesting for future study to unpack the relationship between motivations and values, and how the latter transforms over time and can aid in determining degree of participation and trust.

Social learning also scored favorably in this survey. Respondents agree that the decision-making process was effective at providing participants a better understanding of technical and policy aspects of water management, major watershed issues and the factors contributing to them, potential strategies to effect change in the watershed, and the perspectives of other stakeholders. There is also agreement that the public is better educated and informed about watershed protection as a result of the WPP. It is evident that social learning has occurred in Central Texas watersheds, as these groups have shared local knowledge and learned about issues that affect one another, as is related in the 'perspectives' measurement. Education is a primary component of the TNSMP and watershed protection plans in the state, and according to the stakeholders surveyed, is effective in its goal.

The trust construct scored lower than other indicators, according to stakeholders surveyed. More respondents agreed that they personally trust other stakeholders to make decisions related to the watershed, but to a lesser extent than they agreed with the existence of trust among committee members in general. Trust is very important to the success of a watershed program and relates to several other indicators of program success. Focht and Trachtenberg (2005) link trust, participation, and effectiveness, reiterating the context-dependence of participatory strategies. They define trust in collaborative programs as the "stakeholders' willingness to defer to the competence and discretion of others to manage risk on their behalf" and further distinguish between social

trust (trust in other stakeholders) and official trust (trust in policy officials) (Focht & Trachtenberg, 2005, p.86). Focht and Trachtenberg emphasize the importance of the collaborative approach while establishing that levels of participation will be based on either "trust, which prompts deference toward others, [or] distrust, which prompts vigilance," and that participatory techniques should be determined accordingly (2005, p.87). They find increased participation in regions and at times where stakeholders distrust other members and desire to defend their interests, and a decrease in participation with increasing trust, as stakeholders believe that others can make decisions for them. One stakeholder, as quoted earlier, demonstrates a decreased level of effort required in their watershed due to trust, commenting that "we have been able to function through consensus rather than voting on specific topics because there is a high level of trust and understanding between members of the Working Committee." However, with a successful participatory process, "distrusting stakeholders may learn that their perceived opponents share important values with them, which motivates a greater willingness to collaborate and cooperate" (Focht & Trachtenberg, 2005, p.87). In another comment cited previously, a survey respondent illuminates that at first there was a lack of official trust amongst members in their watershed, but with time, shared values were exposed: "There may have been initial distrust of larger, more well-funded members (i.e. municipalities, industry) but over the years the demonstration of shared goals for water quality protection have resulted in trusting relationships."

Understanding participants' motives for involvement can aid in predicting levels of trust within a watershed and can help anticipate what types of interventions may be necessary in the planning and implementation processes. In surveyed watersheds, three

participants (15.8 %, n = 19) said their motivation was "to prevent the partnership from achieving undesirable changes in law or policy" and 26.3% selected "to help achieve my organization's goals or objectives." Either of these responses might indicate that some group members might lean toward vigilance, with higher rates of participation and lower feelings of trust. The latter response could also correspond with a level of professionality in the group, with an additional three writing in that they are involved because of the requirements of their "job." Five respondents selected that they participate "to improve the watershed," two "to educate myself about watershed issues," and one person "was motivated by a specific event or natural disaster." Due to recent severe flooding in Central Texas, the lack of motivation due to natural disaster was unexpected, as "catalyst events" can inspire communities to unite toward a common goal. At the very least, Prokopy, Mullendore, Brasier, and Floress suggest these events can "help water quality advocates create and/or seize opportunities to nurture a collective action" (2014, p. 1177).

The evolution of trust is a significant phenomenon to keep in mind as Central Texas watersheds transition into implementation phases and consider reducing in size from large interactive groups to smaller steering committees. Watersheds should choose whether this move is appropriate for their context or whether higher levels of participation are needed to maintain cohesion. Levels of trust can also vary at different stages in the decision-making process: "[A]fter the new trail was developed, members of the group blocked (by throwing brush on) parts of the old trail we (several of us also on the committee) understood would be open to the public, [and] mistrust was developed." Due to possible changes in group dynamics, I suggest a systematic analysis of trust twice at minimum, once in the initial stages of planning, through stakeholder characterization,

and again when the partnership is ready to transition into implementation, to adjust for potential necessary changes prior to a stage that requires greater public involvement.

Ecological Outcomes

The determination of what success looks like in a watershed partnership is based primarily on social and ecological outcomes. Due to financial and time constraints, much of the evaluative literature relies on perceived ecological outcomes. Here, I look at both BMP implementation and water quality improvement. The water quality improvement construct scored the lowest of all indicators (with some variation), with implementation following closely behind after participation. More respondents agree that the progress of the implementation of BMPs is adequate and reasonable than that the public is adequately engaged in implementation. Respondents are somewhat ambivalent that water quality has improved since passage of the WPP and that improvements are the result of the program's decisions and actions. These findings are consistent with the literature, in that lower process characteristic or social outcome scores (in this case, participation, rules, and trust) might indicate lower perceived ecological outcomes. This study reifies the hypothesis that perceived ecological outcomes are strengthened by a successful social process.

In order to further illuminate possible causes of a lower ecological scoring, I explored two questions: (1) Were these results skewed in part by one particular watershed? And (2) Can level of implementation affect ecological outcomes? A nonparametric Kruskal-Wallis independent samples test confirms that a relationship is unlikely between either of the four variables and the watershed to which a respondent belongs (sig. > .05). In other words, responses to these variables are evenly distributed

across watersheds and do not indicate higher or lower responses for any particular partnership.

Additionally, Pearson correlation was run between the implementation indicator and the water quality indicator. Implementation and water quality improvement show a significant, positive correlation, with implementation accounting for 25% of the variance in water quality improvement ($r(16) = .495$, $p < .05$). A recent report from the TCEQ looks at the PWM evaluative literature regarding implementation and finds that many of the same indicators for success related during planning and decision-making apply to implementation (Schwartz, 2016). The majority of recommendations for local watershed planning listed in the TCEQ report are institutionalized within the foundation of the TNSMP such as engaging a coordinator, adequate funding and resources, public access to documentation, and relying on scientific acumen. Recommendations from the TCEQ report that are relevant to this thesis include reviewing the group's level of formality and structure at the implementation phase, implementing projects quickly, avoiding participant fatigue, and improved communication (Schwartz, 2016).

Further, the results here might also relate to the difference between perceived and actual water quality improvement. The TCEQ report on implementation cites a study also used here (Leach & Sabatier, 2005) that identifies a halo effect which "cause[s] groups with high levels of trust and cohesiveness to perceive themselves as being more successful" than they actually are (Schwartz, 2016, p.22). The same might apply to the reverse effect, wherein lower levels of trust or other related indicators decrease a perception of success. However, as quoted in Schwartz (2016), Lubell et al. relates that if high scores on social indicators "do not mislead stakeholders into thinking the watershed

is in better condition than it in fact is...they provide additional justification for collaborative institutions" and "to the extent we seek to justify watershed collaborations on the basis of environmental changes...perceptions might simply be the best evidence we have" (2005, p. 285). Perhaps more importantly here, due to the fact that most WPPs are relatively young, it is likely that installed BMPS have not had enough time to reach their full effects, and that more time is needed to complete implementation. It is up to watershed coordinators and partnerships to determine the factual accuracy of perceived ecological outcomes and to highlight individual watershed achievements and monitoring results for the community.

The justification for watershed collaborations in Cypress Creek, Plum Creek, Geronimo and Alligator Creeks, Leon River, and Lampasas River appears to be clear, according to respondents' overall feelings about the groups. While reported ecological outcome figures are low compared to social outcomes, 100% of respondents agree (70.6% strongly) that the watershed program is of overall benefit to the community and to the ecology of the watershed. Several survey participants had commendations to share about their programs and facilitators such as, "Lisa [Prcin] is an outstanding leader," and "great support, direction, and science from Meadows Center." Others applaud fellow stakeholders and the general public:

> I believe the Plum Creek Watershed Partnership is made up of members that understand the impairments and are unified in support of the implementation of the Plan. I also believe that through the support of the plan by their representatives on the stakeholder committee, the general public has become more aware of the watershed and support the protection activities in the implementation plan.

Another respondent speaks to the rewards of the participatory process while recognizing the complicated nature of their aspirations:

> Stakeholders have been good folks to work with. Some folks in the public had specific agendas they wanted fixed right then and there which we had no control over. It's not always easy getting everyone to agree on something. And, it takes everyone working together to make something like this work."

It is clear that stakeholders approve of the ways in which their watershed partnerships contribute to social and ecological capital in Central Texas.

Recommendations

The following recommendations outline some methods by which watershed stakeholders and facilitators can formulate a type of 'what works best when' for their own watersheds, based on the findings of this study. Since partnership 'success' is often determined by social and ecological context, what I have found here is a narrowed list of suggestions tailored to Central Texas watersheds specifically, and more generally, the Texas Nonpoint Source Management Program.

- *Stakeholder characterization*. Stakeholder characterization before planning begins and in successive stages can help to improve several of the weaknesses identified in this study including degree of involvement and implementation. Characterization can also ensure that watershed projects are representative of both demographic diversity and of the variety of interested and affected parties.
    - Representativeness – Stakeholder identification is a precursor to characterization. It is suggested that watersheds identify interested members of the community at "multiple entry points" (Luyet et al., 2012, p. 214). Creighton (1986), Selman (2004), Mitchel, Agle, and Wood (1997), and Mason and Mitroff (1981) offer methods to accomplish identification in a systematic way, alongside the snowball technique

(Luyet et al., 2012). Ensuring representativeness can also increase public uptake in implementation as various population groups see their values and interests reflected in the plan.

  - Degree of Involvement – Vroom's model (Vroom, 2003) is a method of degree of involvement analysis that, with a series of seven questions, can help group members and facilitators determine the appropriate roles for each partnership member (Luyet et al., 2012). This analysis can aid in decreasing power imbalances, ensuring that all interests are represented, and increasing efficiency in decision-making and implementation.
  - Implementation – Some level of characterization is recommended as partnerships move into the implementation phases of their projects, including any of the above approaches. Levels of trust and conflict should be observed in each watershed to understand what types and degrees of involvement are necessary going forward, within committees and among the general public. Focht and Trachtenberg (2005) provide a framework for determining appropriate participation strategies based on levels of trust amongst watershed partnership members.

- *Participatory techniques.* The creation of an expanded encyclopedia of participation techniques is recommended for the TNSMP to actively address conflict management, capacity-building, and trust concerns amongst partnership members. Luyet et al. confers that "participation is often reduced to the dissemination of information and the holding of workshops... These approaches generally do not take into account either the heterogeneity of stakeholders... or the

complexity of the decision-making process" (2012, p.214). With participatory techniques designed for increased levels of participation, a watershed partnership can increase collaboration that improves ecological outcomes and connects process characteristics with ecological outcomes. In highly heterogenous watersheds with low levels of trust, the need for conflict management and trust-building techniques is especially salient. Luyet et al. (2012) provide a list of techniques developed from previous literature to which coordinators might refer to begin this endeavor (see Appendix D).

- *Rules and objectives.* Though watershed partnerships can achieve success with a less formal set of rules, it is recommended that facilitators take a close look at the appropriateness of informality in their watershed and consider a clear and formal set of guidelines. In this way, partnerships can prevent future conflict and miscommunication.
- *Enhanced communication* – Due to the role of perception when it comes to ecological improvement, I recommend that facilitators explore ways to enhance transparent and thorough communication. Some perceptions of success and degree of involvement might be attributed to a lack of communication of achievements, or to ineffective types of communication. Taking a closer look at appropriate participatory and outreach techniques might mediate possible incongruities between actual and perceived outcomes and aid in activities that involve a wider public.

VII. CONCLUSION

Social process evaluation can provide a valuable, and possible sole measurement for comprehensive watershed program success. Through literature review and a consolidation of indicators, I have developed a framework for evaluation that can be generally applied to nonpoint source management programs with institutionalized formality. Future research should consider these new ways of understanding how indicators can be used in evaluation. This study finds a link between process characteristics and social outcomes, and between social outcomes and ecological outcomes in Central Texas watersheds. Previous studies confirm the importance of social capital in watershed partnerships and of civic participation to communities in general (Lurie, 2007; Sabatier et al., 2005). It appears that process characteristics utilized in planning in this region do not influence ecological outcomes, though I recommended future research to verify this assertion involving multivariate analysis that considers both the direct and indirect effects of indicators on ecological outcomes and variance amongst partnerships.

Members of the surveyed Central Texas watershed partnerships relate their satisfaction with their watershed protection plans in this study. Despite some criticisms related to trust and perceived water quality outcomes, respondents generally agreed with the positive statements about their respective watershed partnerships, especially regarding representativeness and social learning. Correspondingly to the strong agreement that the watershed partnership is of overall benefit to each socio-ecosystem, members of these groups believe that despite some conflict resulting from the complexities of stakeholder representation, ecological improvement will be achieved.

Defining what success means for watershed partnerships is complicated at best. The EPA suggests that the nine elements, once complete, should return ecological improvements. Stakeholder participation is reflected in only one of these nine elements, although I have demonstrated that a socially-oriented approach is necessary in each stage of watershed planning and is vital for achieving long-term ecological sustainability in local watersheds. The social process evaluative literature emphasizes the importance of capacity-building for interpersonal relationships in the realm of policy, planning and design, education and outreach, and BMP implementation, but stakeholder management can often be a side note in the day-to-day practice of watershed planning or is simply a byproduct of the planning process. While these byproducts, or social outcomes, provide long-term socio-ecological benefits within a community, the further development of process characteristics can increase these odds. With a directed focus on stakeholder management, improved ecological outcomes are on the horizon.

APPENDIX SECTION

APPENDIX A: EPA NINE ELEMENTS

Elements and Evaluation Criteria	
1. Identification of Causes & Sources of Impairment	
	a. Sources of impairment are identified and described.
	b. Specific sources of impairment are geographically identified (i.e. mapped)
	c. Pollution loads are attributed to each source of impairment and quantified
	d. Data sources are accurate and verifiable, assumptions can be reasonably justified
	e. Watershed-level estimate of necessary pollution control is provided (i.e. overall load reduction goal)
2. Expected Load Reductions	
	a. Load reductions achieve environmental goal (e.g. TMDL allocation)
	b. Desired load reductions are quantified for each source of impairment identified in Element 1
	c. Expected load reductions are estimated for each management measure identified in Element 3
	d. Data sources and/or modeling process are accurate and verifiable, assumptions can be reasonably justified
3. Proposed Management Measures	
	a. Specific management measures are identified and rationalized (i.e. why this management measure will help achieve goals)
	b. Proposed management measures are strategic and feasible for the watershed
	c. Proposed management measures achieve load reduction goals
	d. Critical/Priority implementation areas have been identified
	e. The extent of expected implementation is quantified (e.g. x miles of streambank fenced, etc.)
	f. Adaptive management process in place to evaluate effectiveness of management measures
4. Technical and Financial Assitance Needs	
	a. Cost estimates reflect all planning and implementation costs
	b. Cost estimates are provided for each management measure
	c. All potential Federal, State, Local, and Private funding sources are identified
	d. Funding is strategically allocated - activities are funded with appropriate sources (e.g. NRCS funds for BMP cost share)
	e. Economic and environmental benefits are discussed and weighed against implementation costs
5. Information, Education, and Public Participation Component	
	a. A Stakeholder outreach strategy has been developed
	b. All relevant stakeholders (i.e. State, Federal, Local, Private) are identified and involved in outreach process
	b. Public meetings and forums have been/are scheduled to be held
	c. Educational/Outreach Materials will be/have been disseminated
6/7. Schedule and Milestones	
	a. Implementation schedule includes specific dates and expected accomplishments
	b. Implementation schedule follows a logical sequence
	c. Implementation schedule covers a reasonable time frame
	d. Measurable milestones with expected completion dates are identified to evaluate progress
	e. A phased approach with interim milestones is used to ensure continuous implementation
8. Load Reduction Evaluation Criteria	
	a. Proposed criteria effectively measure progress toward load reduction goal
	b. Evaluation criteria are measurable and quantifiable
	c. Interim WQ indicator milestones are clearly identified. (The indicator parameters can be different from the WQ standard violation)
	d. Criteria include both: quantitative measures of implementation progress and pollution reduction; and qualitative measures of overall program success (including public involvement and buy-in)
	e. An Adaptive Management approach is in place, with threshold criteria identified to trigger modifications
9. Monitoring Component	
	a. Monitoring plan includes an appropriate number of monitoring stations
	b. Monitoring plan has an adequate sampling frequency
	c. Monitoring plan will effectively measure evaluation criteria identified in Element 8

(from FDEP, 2003/2018)

APPENDIX B: SolVES SAMPLE SURVEY

Part 4: In what ways do people value the Pike and San Isabel National Forests?

Q-20 The PSI holds different values for each person. **We would like to know how important each of the following values of the PSI is to you and where these values are represented on the map.**

Imagine that you could "spend" $100 to ensure that the PSI keep their existing values. You may allocate or spend the $100 in any way you like, but your total spending may not exceed $100. You might spend all $100 on one value (and $0 on all others), or you might spend $50 on one value, $25 on another value, and $25 on yet another value. Remember, the total dollars you spend should equal $100. **(Reference to money is not made to actual money, your own or the USDA Forest Service's budget).**

$____ **Aesthetic value (A) —** I value these Forests because I enjoy the scenery, sights, sounds, smells, etc.

$____ **Biological diversity value (B) —** I value these Forests because they provide a variety of fish, wildlife, plant life, etc.

$____ **Cultural value (C) —** I value these Forests because they are a place for me to continue and pass down the wisdom and knowledge, traditions, and way of life of my ancestors.

$____ **Economic value (E) —** I value these Forests because they provide timber, fisheries, minerals, and/or tourism opportunities such as outfitting and guiding.

$___ **Future value (F) —** I value these Forests because they allow future generations to know and experience the Forests as they are now.

$____ **Historic value (H) —** I value these Forests because they have places and things of natural and human history that matter to me, others, or the nation.

$____ **Intrinsic value (I) —** I value these Forests in and of themselves, whether people are present or not.

$____ **Learning value (L) —** I value these Forests because we can learn about the environment through scientific observation or experimentation.

$____ **Life Sustaining value (LS) —** I value these Forests because they help produce, preserve, clean, and renew air, soil, and water.

$____ **Recreation value (R) —** I value these Forests because they provide a place for my favorite outdoor recreation activities.

$_____**Spiritual value (S) —** I value these Forests because they are a sacred, religious, or spiritually special place to me or because I feel reverence and respect for nature there.

$____ **Therapeutic value (T) —** I value these Forests because they make me feel better, physically and/or mentally.

(from USGS, n.d.)

APPENDIX C: SURVEY QUESTIONS CATEGORIZED BY INDICATOR

(The following questions are adapted from Conley & Moote, 2003; Lurie, 2007; Luyet et al., 2012; Young et al., 2013; Beierle & Konisky, 2001; and Ferreyra and Beard, 2007; Leach, Pelkey, & Sabatier, 2002; FDEP, 2003/2018; Reed, 2008; Reed et al., 2010; Samuelson et al., 2005; Sabatier et al., 2005; Scott, 2015; Brody, 2003; Arnstein, 1969; USGS, n.d.)

Screening Questions

I served on a stakeholder committee, steering committee, or working group for [insert name of watershed project here]

Y/N

I am or was a stakeholder committee member for the following years:

20__ -------2010--------- 2018

[This is a slider where respondents can move the knob to indicate time served]

I would describe my [role in/level of involvement with] the stakeholder committee as:

This survey is being completed by members of several watershed protection plan (WPP) programs across the state. For ease of distribution, the specific project to which you belong will be referred to as 'your watershed program' or 'your watershed project.' The phrase "stakeholder committee" might refer either your stakeholder planning committee or to a steering committee.

Independent Variables

Process Characteristics

Degree of involvement

1. Please select the response that best identifies the overall type of stakeholder involvement in your watershed program from the following categories: (Involvement)

   1-Informative = Involved the explanation of the project to the stakeholders
   2-Consultative = Involved the presentation of the project to stakeholders, collection of their suggestions, and then decision making with or without taking into account stakeholder input.
   3-Collaborative = Involved the presentation of the project to stakeholders, collection of their suggestions, and then decision making, taking into account stakeholder input
   4-Co-decision = Involved cooperation with stakeholders toward an agreement for solution and implementation

5-Empowering = Involved the delegation of decision-making over project development and implementation to the stakeholders.

(Unless otherwise noted, question responses follow a Likert scale)

Thinking back to the planning stage for the WPP for your watershed program,
On a scale of 1 to 5…
5 – Strongly Agree
4 – Somewhat Agree
3 – Neither Agree nor Disagree
2 – Somewhat Disagree
1 – Strongly Disagree
How strongly do you agree that…

2. My watershed program adequately involves the public in the following stages of the decision-making process
    a. Problem identification (PIProbIdent)
    b. Research (PIResearch)
    c. Planning (PIPlanning)
    d. Education and Outreach (PIEdOut)
    e. Implementation (PIImpl)
    f. Monitoring (PIMon)
    g. Evaluation (PIEval)

Clearly defined objectives (including rules and stakeholder roles)

3. Rules and objectives for decision-making and participation were defined clearly and early in the process. (Rules)

Representation (Integration of all interests, local knowledge)

4. The stakeholder committee(s) represents the range of stakeholders in the watershed. (Represent)
    a. Which stakeholders are under-represented or absent from the group? [open-ended]
5. Public values were incorporated into decision-making. (ValueIncl)

Local knowledge is the knowledge accumulated about an ecosystem or community through the experience of an individual, which is sometimes passed down through generations or communicated between friends or colleagues. On a scale of 1 to 5, how strongly do you agree or disagree that…

6. Local knowledge was incorporated into decision-making. (LocalKnow)

b. Can you describe some examples of local knowledge in your area that may or may not have been included?

Cooperation (Conflict management, Consensus-building)

7. When there was conflict, it was resolved among stakeholders. (ConfRes)
    a. Can you tell us more about how conflict was handled in your watershed program?
8. When decisions were made, they included the input and consensus or agreement of all interests. (Consensus)

Plan quality

9. Sources of impairment were accurately identified by the stakeholder committee. (ProbIdent)
10. Decisions made in the planning process were based on sound scientific and technical information. (Science)
11. The WPP adequately addresses socioeconomic concerns of the region. (SocEcon)
    a. If you disagree, which socioeconomic concerns does it not address?

Dependent Variables

Social Outcome

Trust

12. There is trust amongst the stakeholder committee members in my watershed program. (Trust)
    a. Would you like to provide any examples of trust or lack of trust amongst stakeholders?
13. I trust other stakeholders of the committee to make decisions related to the watershed. (ITrust)

Social Capital (positive participant experiences, improved stakeholder interactions, increased social networks)

14. As a result of my participation in my watershed program, I interact with parties I otherwise would not interact with. (Interact)

Shared Values

15. The other members of the group share similar values to me. (GenValue)
16. The other members of the group share similar values to me in relation to the watershed. (H20Value)
    a. Can you tell me more about the values that you do or don't share with other members of your watershed program?

Legitimacy (incl. Influence)

17. There is general public support for the WPP. (PubSup)
    a. Would you like to provide any comments on public opinion of the WPP?
18. The planning process influenced relevant decision-makers. (Influence)

Social Learning

19. Because of my involvement with the stakeholder committee, I have a better understanding of…
    a. Technical aspects of water management (EffTech)
    b. Policy aspects of water management (EffPoli)
    c. Major watershed issues (EffIssue)
    d. Factors contributing to major watershed issues (EffCont)
    e. Main potential strategies to effect change in the watershed (EffStrat)
    f. Perspectives of other stakeholders (EffPersp)

20. The public is better educated and informed about watershed protection as the result of the WPP. (Edu)

Ecological Outcome

21. Water quality in the watershed has improved since passage of the WPP. (EcolImpr)
22. Water quality improvements are a result of the program's decisions and actions. (ImprAttrib)
23. The progress of the implementation of BMPs is adequate and reasonable. (Impl)
    a. Can you tell me more about the progress of implementation?
24. The public is adequately involved and engaged in implementation. (PubEngImpl)

25. The watershed program is of overall benefit to the community and to the ecology of the watershed. (Overall)
26. Would you like to provide any additional comments related to your experiences as a participant? [open-ended]

<u>Social Psychological Variables</u>

The following questions are asked in order to understand the concerns of stakeholders in your region.

Now, thinking about your watershed, tell us the significance of the stream (the main river or creek that is the focus of your program and its tributaries) and its natural environment, to you.

27. Please select the 3 most important statements to you, that define how you interact with your stream, in order of importance with 1 being the most important followed by number 2 and number 3. Drag the statement to move it into the appropriate position. [boxes labeled 1,2,3]
    a. I value the stream and its natural environment because I enjoy the scenery, sights, sounds, smells, etc. (VSens)
    b. I value the stream because it provides sustenance such as fish, wildlife, and plant life. (VSust)
    c. I value the stream because it is a place for me to continue and pass down the knowledge, traditions, and way of life of my family. (VKnow)
    d. I value the stream because it provides goods and services such as, irrigation, hydropower, fisheries, and/or tourism opportunities. (VServ)
    e. I value the stream because it provides a source of drinking water. (VDrink)
    f. I value the stream because it allows future generations to know and experience the stream as it is now. (VFuture)
    g. I value the stream because it has places and things of natural and human history that matter to me, others, or the nation. (VHist)
    h. I value the stream in and of itself, whether people are present or not. (VInher)
    i. I value the stream because we can learn about the environment through scientific observation or experimentation. (VScience)
    j. I value the stream because it helps support its surrounding ecosystem, including flora and fauna. (VEco)
    k. I value the stream because it provides a place for my favorite outdoor recreation activities. (VRec)
    l. I value the stream because it is a sacred, religious, or spiritually special place to me or because I feel reverence and respect for nature there. (VRel)
    m. I value the stream because it makes me feel better, physically and/or mentally. (VSelf)
    n. Other, *specify* (VOther)

Motivations/Interests

28. How often do you interact with your stream for personal enjoyment or recreation?
    o. Once or twice a year
    p. Monthly
    q. Weekly
    r. Daily
    s. I don't/Rarely
29. Please select the statement that best answers the question, what *initially* motivated you to participate in the watershed program?
    a. To improve the watershed
    b. To help achieve my organization's goals and objectives
    c. To educate myself about watershed issues

d. To report back to my organization about what the partnership is doing
e. To prevent the partnership from achieving undesirable changes in law or policy
f. To meet interesting or important people
g. To protect my financial interests
h. I was motivated by a specific event or natural disaster
i. Other, *specify*

Demographic Questions

What is your occupation?
What is your gender?
Are you Spanish, Hispanic, Latino, or none of these?
Choose one or more races that you consider yourself to be:

White, Asian, Black or African American, Native Hawaiian or Pacific Islandere, American Indian or Alaska Native, Other

Information about income is very important to understand. Would you please give your best guess?
Please indicate the answer that includes your entire household income:

Less than $20,000
$20,000 - $39,999
$40,000 - $59,999
$60,000 - $79,999
$80,000 - $99,999
$100,000 and up

To which age group do you belong?

18-35
36-55
56-75
75 and up

Are you religious or spiritual?

Religious
Spiritual
Not religious

Here is a 10-point scale on which the political views that people might hold are arranged from extremely liberal (left) to extremely conservative (right). Where would you place yourself on this scale?

Political ideology 0 – 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 – 9 – 10

Do you own or rent your home?
Do you own land adjacent to the stream?
Do you institute any BMPs from your WPP on your own property?

APPENDIX D: LIST OF PARTICIPATORY TECHNIQUES AND THEIR ASSOCIATED DEGREES OF INVOVEMENT

Some participatory techniques with their degree of involvement, inspired by IAP2, 2009; Tippett et al., 2007, HarmoniCOP, 2005; Richards et al., 2004; Van Asselt et al., 2001; OECD, 2001 and Rowe and Frewer, 2000.

Participation technique	Information	Consultation	Collaboration	Co-decision	Empowerment
Newsletter	X				
Reports	X				
Presentations, public hearings	X	X	X		
Internet webpage	X	X			
Interviews, questionnaires and surveys	X	X	X		
Field visit and interactions	X	X	X		
Workshop		X	X	X	X
Participatory mapping			X	X	X
Focus group			X	X	X
Citizen jury		X	X	X	X
Geospatial/ decision support system	X	X	X	X	
Cognitive map	X	X	X		
Role playing			X	X	X
Multicriteria analysis			X	X	
Scenario analysis		X	X	X	X
Consensus conference		X	X	X	X

(from Luyet et al., 2012, p. 215)

APPENDIX E: INSTITUTIONAL REVIEW BOARD (IRB) DOCUMENTATION

TEXAS STATE UNIVERSITY
SAN MARCOS
The rising STAR of Texas

In future correspondence please refer to 2018424

March 1, 2018

Kylie Beard
Texas State University
601 University Drive.
San Marcos, TX 78666

Dear Kylie:

Your IRB application 2018424 titled "Otherness in Collaboration: Evaluating Central Texas Watershed Initiatives" was reviewed and approved by the Texas State University IRB. It has been determined that risks to subjects are: (1) minimized and reasonable; and that (2) research procedures are consistent with a sound research design and do not expose the subjects to unnecessary risk. Reviewers determined that: (1) benefits to subjects are considered along with the importance of the topic and that outcomes are reasonable; (2) selection of subjects is equitable; and (3) the purposes of the research and the research setting is amenable to subjects' welfare and producing desired outcomes; that indications of coercion or prejudice are absent, and that participation is clearly voluntary.

1. In addition, the IRB found that you need to orient participants as follows: (1) signed informed consent is not required as participation implies consent; (2) Provision is made for collecting, using and storing data in a manner that protects the safety and privacy of the subjects and the confidentiality of the data; (3) Appropriate safeguards are included to protect the rights and welfare of the subjects. (4) Compensation will not be provided for participation.

This project is therefore approved at the Exempt Review Level

2. Please note that the institution is not responsible for any actions regarding this protocol before approval. If you expand the project at a later date to use other instruments, please re-apply. Copies of your request for human subjects review, your application, and this approval, are maintained in the Office of Research Integrity and Compliance.

Report any changes to this approved protocol to this office. All **unanticipated events and adverse events are to be reported to the IRB** within 3 days.

Sincerely,

Monica Gonzales
IRB Regulatory Manager
Office of Research Integrity and Compliance

CC: Dr. Vicente Lopes

OFFICE OF THE ASSOCIATE VICE PRESIDENT FOR RESEARCH
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APPENDIX F: TEXAS A&M UNIVERSITY HUMAN RESEARCH NOT ENGAGED DETERMINATION

DIVISION OF RESEARCH

TEXAS A&M UNIVERSITY

HUMAN RESEARCH, NOT ENGAGED DETERMINATION

8/27/2018

Type of Review:	External Investigator Project
Title:	Otherness in Collaboration: Evaluating Central Texas Watershed Initiatives
Investigator:	Kylie Beard and Vincente Lopes
Investigator's Institution:	Texas State University
TAMU IRB ID:	2018-4011NE
Documents Received:	TSU RB Application and approval packet; Site Letters of Support (4); Surveys; Recruitment documents
Special Determinations:	None
Risk Level of Study:	Minimal (Exempt)

Dear Kylie Beard:

This Institution has determined that the proposed activity is research involving human subjects as defined by DHHS regulations but that this organization is not engaged in the research.

IRB review and approval by this organization is not required. This determination applies only to the activities described in the documents provided by the Investigator and does not apply should any changes be made that create questions as to whether Texas A&M University faculty or staff are engaged in the research. If such protocol changes are made, please submit a new request for a new determination.

This determination letter may be forwarded to the appropriate division officials. This is not guarantee of participation as individuals (e.g. Deans, Department Heads, faculty, staff, students, etc…) may choose not to participate in the study independently of this review determination.

If you have any questions, please contact the HRPP Administrative Office at 1-979-458-4067, toll free at 1-855-795-8636.

Sincerely,
HRPP Administration

750 Agronomy Road, Suite 2701
1186 TAMU
College Station, TX 77843-1186

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