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Organizational Adaptation in Local Stormwater Governance

Andrea Armstrong
Utah State University

ORGANIZATIONAL ADAPTATION IN LOCAL STORMWATER GOVERNANCE

by

Andrea Armstrong

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_____	_____
Dr. Douglas Jackson-Smith Major Professor	Dr. Peggy Petrzelka Committee Member
_____	_____
Dr. Richard Krannich Committee Member	Dr. Courtney Flint Committee Member
_____	_____
Dr. Charles Sims Committee Member	Dr. Mark R. McLellan Vice President for Research and Dean of the School of Graduate Studies

UTAH STATE UNIVERSITY
Logan, Utah

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ABSTRACT

Organizational Adaptation in Local Stormwater Governance

by

Andrea Armstrong, Doctor of Philosophy

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Major Professor: Dr. Douglas Jackson-Smith
Department: Sociology

Local water governance is a growing challenge for local organizations responsible for water resources and water quality. This project adds to our understanding of how local water management organizations (LWMOs), including irrigation and canal companies and municipal stormwater agencies in small and urbanizing cities, adapt to changes in social, environmental, and policy contexts. In this research, I asked *how do local water management organizations adapt to change?* To address this question, I conducted a series of analyses that drew on a mixture of qualitative and quantitative methods. In 2013, I conducted a series of meeting observations (n=18) and semi-structured interviews (n=18) within a case study analysis of LWMO collaboration in two irrigated valleys of northern Utah. In 2014, I designed and implemented an online survey of municipal stormwater managers throughout the state of Utah (municipal-scale n=67; individual-scale n=97). Also in 2014, I conducted 30 follow-up interviews of municipal survey respondents. The studies, in aggregate, consider adaptive mechanisms such as

inter-organizational collaboration between irrigation company and municipal water managers, privatization of stormwater governance activities within the context of decentralized national water quality policy, and a theory-driven analysis of the mechanisms that encourage adaptation among LWMOs that are embedded within bureaucratic institutional arrangements.

My research findings, on a whole, suggest that LWMOs are taking on a wide range of adaptations in response to urbanization, changing water availability associated with climate change, and devolution of environmental policies. The conditions that encouraged LWMOs to collaborate with one another include a mixture of social and physical mechanisms, including overlapping water infrastructure (e.g. irrigation canals and city stormwater ditches), shared liabilities associated with infrastructure failure, and the rise of professionalism within local water management. I found that municipal stormwater programs take on adaptations to their guiding documents that are motivated by a range of change mechanisms, beyond the coercive forces that are expected under resilience thinking approaches. I also find that municipal stormwater programs regularly use consultants in their program administration and external implementation activities. In Utah, intermunicipal collaborations are not an alternative to private contracts, as increasingly posed in the literature. Rather, private consultation is intertwined with intermunicipal collaborations, particularly surrounding information-sharing and public engagement activities.

(271 pages)

PUBLIC ABSTRACT

Organizational Adaptation in Local Stormwater Governance

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Much of the past research and policy analysis on issues of western water has focused on inter-basin river agreements, large infrastructure that captures and distributes water, and conflict between agricultural and urban water demands. My dissertation asks a set of different questions:

How is water governed and managed within communities of Utah?

How are the organizations that manage water responding to changes in population, water availability, and water quality policy?

The answers to these questions are essential for understanding the ways in which changes to water quantity and quality will be addressed in the present and coming years. To better understand the ways in which local water management organizations, including irrigation groups and municipalities, manage water in Utah, I conducted three major types of research activities. First, in 2013, I attended 18 meetings of local water management organizations and conducted 18 interviews of organization representatives that managed water within the Heber and Cache Valleys of northern Utah. In 2014, I built upon the knowledge learned in the 2013 observations and interviews, and conducted an online survey of stormwater managers throughout the state of Utah. To build upon survey responses, I then conducted 30 follow-up interviews of stormwater managers that represented municipal stormwater programs. This research was funded with a combination of support from the National Science Foundation's iUTAH EPSCoR project

(iutahepscor.org) and funds from the Utah Storm Water Advisory Committee, a group that represents municipal stormwater programs at the state level.

My findings suggest that local water management organizations are already responding to growth and expansion in urban land use, rising uncertainties in water supplies, and shifting responsibilities for stormwater governance and management toward local governments. To cope with these changes, organizations are using a combination of strategies, including working with private consultants and collaborating with one another. With increasing pressures from environmental change and added responsibilities through decentralized water policies, it is expected that these adaptive strategies will persist or even spread to other local water management organizations yet to take on these behaviors.

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CHAPTER I

INTRODUCTION

In the Intermountain West, local water management organizations such as municipalities and irrigation groups make key decisions surrounding the development, conveyance, access to, and quality of local water resources (Freeman 2000). The water resources of the region are changing in terms of availability, quality, and use. Climate change is bringing forth warmer temperatures, which are leading to earlier spring snowmelts and less runoff, with the greatest reduction in water availability occurring in Utah between May and September (Bardsley et al. 2013). Concurrently, the Utah population is projected to double by 2040 (Governor's Office of Management and Budget 2012), which will encourage further land conversion from agricultural to urban uses, and increase urban water demand. Here and elsewhere in the urbanizing areas of the Intermountain West, population increase also represents the conversion of agricultural land to urban uses. In Utah, agriculture uses 80 percent of freshwater resources (Utah Division of Water Resources 2010). Therefore, agriculture and urban water uses are facing the interconnected threat of increased water demands and reduced water availability that already is, or is anticipated to be, experienced throughout the western U.S. Utah represents a compelling context for studying organizational adaptation, given the range and extent of environmental changes faced currently, and in the immediate future.

Stormwater governance is also a growing challenge for municipal governments, which represent the local water management organizations that partake in stormwater

governance. With accelerated urbanization, impervious surfaces expand, increasing the volume and contamination of urban runoff (Booth, Hartley, and Jackson 2002). Changes in the local environment associated with urbanization are occurring at the same time that climate change presents uncertainty in local weather patterns, storm intensification, and increasing uncertainty in water availability. As local water groups strive to address the rise of stormwater volumes, they also are coping with increasing stormwater governance responsibilities in the context of decentralized stormwater policy.

The ways in which future patterns of urbanization, climate change, and policy will shape water resources quality and availability aren't entirely clear; however, adaptations to these shifting conditions will most certainly be made at the local scale, and will likely include changes in local water governance. It is essential to understand how local water management organizations adapt in order to ensure freshwater quality, adequate water resources, and healthy aquatic ecosystems in the coming decades.

The overarching goal of my research is to explain how local water management organizations adapt to changes in Utah. In the following sections, I describe local water management organizations and the ways that they manage water on the urbanizing landscape of northern Utah. I then summarize the decentralized policy context in which stormwater is governed in the United States. Last, I present three theories that are useful for thinking about organizational adaptation: organization rationality, organizational ecology, and resilience thinking.

Local Water Management Organizations

In the Intermountain West, or lands between the Sierra-Cascade and Rocky Mountains of the United States, thousands of independent or loosely coordinated municipal governments and irrigation organizations (i.e., canal companies, water user associations, and acequias) make critical decisions that determine the delivery and management of nearly all water in the region (Freeman 2000). These local water management organizations (LWMOs) are the "orphans of water policy discourse," (Freeman 2000: 483), with little attention paid to their activities or institutional arrangements in western water governance (Blomquist, Heikkila, and Schlager 2004). LWMOs are intermediary linkages between larger water institutions and individual water users (Bretsen and Hill 2006; Freeman and Lowdermilk 1985). LWMOs also have a close relationship to the biophysical conditions that structure water quantity and quality. If the water governance and infrastructure systems are to become more sustainable, these organizations are likely to be part of that change (Freeman 2000).

Most surface water in the Intermountain West originates as snowpack from high elevation mountain ranges. Early LWMOs in Utah were irrigation organizations formed by groups of farmers to facilitate early settlement and agriculture (Ricks 1956). Their primary activities included the diversion of surface water from mountain runoff and investment in the infrastructure necessary to deliver water to users. Irrigation groups still hold water rights to the vast majority of water used in Utah. Most irrigation LWMOs have direct ownership of water rights and issue water use shares to their stockholders, while others manage water rights owned by their individual members. Freeman (2000) estimated that as of 1969, the last year that the U.S. Census of Agriculture recorded the

number and types of irrigation organizations, there were over 8,000 irrigation groups in the American West (including irrigation companies, canal companies, mutual companies, irrigation districts, and acequias), and that these LWMOs managed 92 percent of irrigation water in the region. At the time of this writing, there are 1,124 irrigation organizations just within the state of Utah (Utah Division of Water Rights (UDWR) 2014).

LWMOs also include municipal governments that are responsible for providing water to residential, commercial and industrial users and for coordinating stormwater and wastewater management. Municipal LWMOs are usually agencies of city or county governments, with most water management duties assigned to public works departments. In Utah, there are 475 municipal water providers that supply drinking water to 98.5 percent of the state's population (Utah Division of Water Resources 2010). Many Utah municipalities also have access to secondary (non-potable) water that is used for outdoor irrigation. As of 2014, there were 86 municipal stormwater programs within city and county governments in Utah that have state-issued stormwater discharge permits. There are also dozens more small municipalities that manage stormwater within their boundaries, but are below the population threshold to necessitate a state-issued discharge permit.

Through an extensive system of built infrastructure, water law and policy, and knowledge of local landscapes, LWMOs have long determined the timing, amount, and allocation of water within river and tributary systems, across agricultural landscapes, and even within urban or suburban neighborhoods. Nevertheless, the empirical literature on LWMO governance in the American West, particularly on irrigation companies and the

processes through LWMOs collaborate with one another, is rather sparse (Baker et al. 2014). Accordingly, I address local water governance and collaboration in Chapter II.

Decentralized Stormwater Governance

Stormwater

A major threat to freshwater quality is urban stormwater. Stormwater is the surface runoff generated during precipitation or snowmelt events that does not infiltrate the ground. Urban runoff, as stormwater is also termed, contains pollutants that are detrimental to natural waterways and hazardous to public health. The negative impacts of stormwater can occur at the watershed scale with as little as ten percent impervious surface landcover (Booth and Jackson 1997). Urban runoff events include the "first flush," or drainage of nutrients, heavy metals, salts, and organic compounds deposited on urban surfaces from vehicles, roadways, and materials deteriorate water quality for natural and human uses (Sansalone and Buchberger 1997). Stormwater discharges into natural water bodies lead to higher peak flows, thus increasing channel erosion and degradation. Aquatic and riparian habitat necessary for fish, macroinvertebrates, semi-aquatic wildlife, and important biochemical processes such as in-stream nutrient processing and carbon uptake may be degraded from alterations to storm-driven stream discharges and water qualities. The benefits of conventional stream restoration methods, typically riparian corridor stabilization and re-vegetation, fail to correct for the stormwater-related impacts as long as impervious surface and drainage infrastructures remain in place (Imberger et al. 2013; Walsh, Fletcher, and Ladson 2005). The most effective strategy to reduce stormwater impacts on natural waterways and to protect water

quality after impervious surfaces are present on the landscape is, to date, to increase stormwater infiltration (Ladson, Walsh, Fletcher 2006).

Stormwater Policy

In the U.S., stormwater governance is highly decentralized and involves three levels of government: federal, state, and municipal. The authority to govern stormwater originates at the federal level, where the Clean Water Act authorizes the U.S. Environmental Protection Agency (EPA) to set standards for allowable amounts of stormwater discharge as part of the National Pollutant Discharge Elimination System (NPDES). The EPA issues permits, which specify practices and controls necessary to reduce stormwater discharges. Three broad types of stormwater discharges are regulated: industrial, construction, and municipal separate sewer stormwater systems (MS4s). MS4s, or the municipalities that build and operate many public stormwater infrastructure systems, are required to have stormwater discharge permits, as the city is responsible for infrastructure such as sidewalks, roads, curbs, and gutters that convey stormwater to natural waterways. NPDES Phase I regulations began in 1990 and required MS4 stormwater discharge permits from municipalities with populations over 100,000 or more people. The NPDES Phase II began in 1999, and extended the MS4 permitting process to all 'urbanized areas,' defined by the U.S. Census Bureau as municipalities with 50,000 or more people and surrounding urban areas with high population densities. Additionally, small MS4 systems within urbanized areas are subject to Phase II regulations (U.S. EPA 2014).

Stormwater regulation also involves significant state-level oversight. Most states are authorized to serve as the official EPA permitting authority, meaning that the state governments oversee the development, implementation, and enforcement of stormwater discharge permits consistent with federal stormwater regulations. State regulations may be more stringent than those of the federal regulations, and can be somewhat tailored to regional conditions. Municipal governments are required to develop stormwater management plans, local stormwater regulations, and to enforce these regulations within their jurisdictions.

The Utah Division of Water Quality (DWQ), within the State's Department of Environmental Quality, is responsible for issuing and enforcing stormwater discharge permits under the Utah Pollution Elimination Discharge System (UPEDS). The EPA authorized the State of Utah to regulate stormwater discharges pursuant to the Utah Water Quality Act in 1987. The State of Utah has stormwater regulatory jurisdiction in all areas except for tribal lands. Federal facilities (e.g. Hill Air Force Base) are required to obtain permits from the state for industrial and construction activities. Consistent with the federal stormwater program, there are three types of state-level stormwater permits: construction, industrial, and MS4. Construction and industrial permittees are required to obtain a permit from the municipality in which the discharge occurs and submit a Storm Water Pollution Prevention Plan (SWPPP) that outlines best management practices (BMPs) that will be used, such as silt fences, other structural controls, vegetative buffers, engineering designs for industrial sites, as well as BMP inspection and maintenance protocols (Utah Department of Environmental Quality 2013). Construction activities undergo monthly inspections by MS4 inspectors (who may be private contractors hired

by the municipality), and sites may also undergo random inspections. The primary difference between industrial and construction stormwater management activities is that organizations that manage industrial facilities are required to conduct water monitoring or even sampling activities, and to keep records of these monitoring activities. The extent and methods of water quality sampling vary based upon the facility and the permit.

Municipalities are regulated under the UPDES General Permit for Discharges from MS4s. Under the General Permit, Phase I and Phase II municipalities are required to, among other actions, develop a Storm Water Management Program (SWMP). SWMPs must discuss the procedures through which permittees implement the following six Minimum Control Measures: public outreach and education, public involvement and participation, illicit discharge detection and elimination, construction site storm water runoff control, long-term water management in new development or redevelopment, and extensive pollution prevention and good housekeeping for municipal operations (Utah Department of Environmental Quality 2013). These pollution control measures require numerous municipal actions and documentation. The DWQ specifies that municipalities must prioritize and monitor areas likely to experience illicit discharge, to develop and enforce requirements for construction activities, and inspect these construction sites for compliance with SWPPPs, among other activities. Under the "good housekeeping for municipal operations" pollution control measure, municipalities are also required to maintain their facilities in a manner that minimizes stormwater discharges, including using structural best management practices (BMPs), regular inspections, and recordkeeping of these procedures. The EPA enumerated requirements that apply to the

"good housekeeping" category in 2010, while the other pollution control measures were specified when the EPA General Permit was issued in 2002.

In practice, an increasing number of Utah municipalities are required to develop, implement, and enforce local stormwater ordinances, pollution control measures, and maintain extensive records of these actions. Municipalities are regularly audited by the state, and are subject to fines and penalties when violations are uncovered. The state is also accountable to the EPA, which has the authority to remove state authority if they do not implement EPA regulations effectively. The state therefore represents an intervening layer between the EPA and the municipal governments.

Decentralization and Privatization

U.S. stormwater governance is a prime example of decentralized environmental policy. Decentralization, or devolution of fiscal and, or, administrative responsibilities to local levels of government, offers the benefits of local control and decision-making authority that is more closely tied to the users of services. However, decentralization also raises questions of local capacity to finance and implement programs that may be technical or intricate, and concerns about inequalities in service provision across communities (Warner and Pratt 2005). Most studies of decentralization in rural or small governments focus on the impacts of decentralization on local economies (Hammond and Tosun 2011; Lobao and Kraybill 2012; Morgan 2010), inequality among local governments (Quark 2008), or local efforts to address poverty (Lobao et al. 2012). Compared to the privatization of social services such as welfare and Medicaid programs (Romzec and Johnson 2005), or administrative activities within the government like

billing or payroll (Mohr, Deller, and Halstead 2010), the processes through which local governments provide environmental services under decentralized policies, such as the services required under the federal Clean Air and Clean Water Acts, are not as well understood. I explore the use of private consultants and intermunicipal collaborations (an increasingly popular alternative) in Chapter IV.

Theoretical Approaches to Organizational Adaptation

The overarching goal of my research is to understand how local water management organizations make decisions in the face of social and biophysical changes in their environment. In doing so, I explore the tension between sociological theories of the organization and thinking on organizational adaptation from a popular, emerging approach: resilience thinking. In the sections that follow, I briefly summarize these theories.

Resilience Thinking

At the time of this research, the leading theory of social-ecological system (SES) change and adaptation is resilience thinking. Resilience thinking aims to understand how SESs can withstand or cope with major, detrimental transformations in environmental conditions, and how adaptations are made to attain or maintain such resilience. Resilience thinking is a set of theses that originate from systems theory and mathematical ecology (Gunderson and Holling 2002; Holling 1973). This body of thought and research is institutionalized within the Resilience Alliance based in Stockholm, Sweden, and has gained popularity through international conferences and a journal *Ecology and Society,* dedicated to research on resilience.

Resilience thinkers identify adaptation as the primary path to remaining resilient against major, detrimental transformations of coupled social-ecological systems. Resilience thinkers recognize that social actors possess adaptive capacity, but that this capacity is highly structured by conditions within the social-ecological system, and outside of the social actor (Walker et al. 2006). Institutions are increasingly considered to be key determinants of organizational adaptive capacity (Adger et al. 2009; Matthews and Syndeysmith 2010), with governmental bureaucracy thought of as a barrier to adaptation in resilience approaches (Gunderson and Holling 2002; North 1994).

Resilience theorists critique existing social science theories of institutions and organizations for "…not attend[ing] to the processes that control and maintain these institutions dynamically, the kind of dynamic causation that is present in economics and ecology" (Gunderson and Holling 2002:9-10). Therefore, resilience approaches to understanding coupled social-ecological change have not been quick to draw upon the tradition of social science theory and research developed in isolation from the environmental sciences.

A growing number of social scientists have critiqued the ways in which resilience thinking treats social aspects of the social-ecological system. Hatt (2012) asserts that resilience thinking's extension of ecological relationships into social systems is highly functionalist, and overlooks the important tensions existing in society that encourage adaptation. Matthews and Sydneysmith (2010) argue that resilience approaches have focused on the conditions that determine adaptive capacities and have not adequately developed an understanding of the dynamic mechanisms and processes of adaptation. In that vein, Davidson (2010) points out that resilience theorists do not adequately recognize

the sociological concept of agency within theories of adaptation. These critiques and others point to the need for more integration of existing social science theories with resilience approaches (Brown 2014; Cote and Nightingale 2012; Davidson 2010; Hatt 2012; Shwom 2009).

Organization Rationality

Weber considered organizations to be components of bureaucracies,[1] either as formal subsections of the mega-organization or as independent entities working within the larger institutional system. The bureaucracy, and organizations that serve the bureaucracy's functions, are highly intertwined: "The development of modern forms of organization in *all* fields is nothing less than identical with the development and continual spread of bureaucratic administration…The whole pattern of everyday life is cut into fit this framework" (1978:223; emphasis in original). As such, the bureaucracy is a dominant mode of social organization within modern society.

Organizations are usually led and managed by rational actors, seeking to accomplish the goals or purposes of the organization. Rationalities, in general, guide how individuals and organizations make sense of and determine the appropriateness of their actions. Many sociologists recognize different 'forms' of rationality. Formal rationality reflects the rise of bureaucratic forms and procedures, and often focuses on the 'means' by which organizational decisions are made. This is distinct from substantive rationality,

[1] The term "bureaucracy," used in this context, refers to the mode of operation that emphasizes formally rational procedures. The term "bureaucracy" can also mean the laws, policies, and regulations that form an overarching complex of governmental and corporate actors. "Bureaucracy" in the first sense is a mode of operation (with "bureaucratization" the process of coming under this process), while "bureaucracy" in the second sense signifies a conglomerate of actors (including organizations) and rules.

which focuses more on the "ends" or ultimate outcomes of organizational actions. Substantive rationality tends to be guided more by social norms and values. Substantive rationalities may or may not be aligned with formal rationalities. Formally rational procedures originally adopted to achieve substantively rational outcomes can become so engrained within the organization the formal rationalities develop into a new set of substantive goals (Espeland 1998). Weber emphasized the association between formally rational procedures and the bureaucracy in his writings on the "iron cage of bureaucracy," a cage in which all members of society are situated and must pursue rational searches for efficiency, driven by market competition. Yet as Espeland (1998) points out, there is a place for the substantive within the bureaucracy, and these rationalities can co-exist with one another, even in highly bureaucratic contexts.

Formal and substantive rationalities are well suited to inform resilience-based concepts of adaptation and bureaucracy. Organizational change in the adaptive cycle is already attentive to the concept of rationality, albeit not by name. Also, both resilience and organization rationality approaches acknowledge that organizational rationalities are malleable. In contrast, organizational rationalities as considered within the sociological approach diverge from resilience thinking's use of rationality when considering the processes through which rationalities change. From the sociological approach, rationalities can be fluid, and there are not fixed paths or phases in which organizational rationalities change or progress.

Organizational Ecology

Organizational ecology is another sociological concept that I draw upon to inform resilience approaches to organizational change. In a foundational paper of organizational ecology, DiMaggio and Powell (1983) argued that organizations adapt their forms, functions, and goals based upon how they relate to other organizations. Organizational change is premised upon an organizations' connections to their "organizational field," or "a recognized area of institutional life: key suppliers, resource and product consumers, regulatory agencies, and other organizations that produce similar services or products" (DiMaggio and Powell 1983:148). Organizational fields include rather fixed relationships in that there are networks and power dynamics between and among organizations, and that the organizations within the same field are very much aware of one another and routinely exchange information (DiMaggio 1982).

With the concept of the organizational field, DiMaggio and Powell expanded upon Weberian explanations for rationality to explain the stages and processes through which organizations have come to generally resemble one another—a process they refer to as "institutional isomorphism." DiMaggio and Powell argued that there has been a transition in the ways in which bureaucracy and rationalization shape organizations. In the early stages in the rise of the bureaucracy (around the time of Weber's writings highlighted above) organizations adapted out of the drive for formally rational modes of operation in order to improve their competitiveness in the market. With technical efficiency and the minimization of costs, organizations took on similar forms that were consistent with the rational goals of bureaucratic modes of operation (Weber 1978). DiMaggio and Powell argued that modern society has reached a new stage in which

corporations and the state have been completely bureaucratized, and there are fewer efficiencies to be gained from these organizational forms alone. Therefore, to gain efficiencies within the contemporary bureaucracy, the state and professions have emerged as the main areas through which rationality is expressed and pursued.

Organizations become sensitive and responsive to one another based upon their co-location in an organizational field through three distinct mechanisms—mimetic, normative, and coercive (DiMaggio and Powell 1983). Described at length in Chapter III, several decades of research has shown that these three mechanisms encourage shifts in organizational forms, values, and behaviors (see Heugens and Lander 2009 for a review). As originally theorized by DiMaggio and Powell (1983), these three mechanisms produce a pattern of adaptation that encourages similarities among organizational forms and activities. Organizational adaptations are dynamic and reoccurring in that organizations shape, and are shaped by, change in their field. As such, a finite set of adaptations may be legitimate at any given point, but because other organizations in the field are also constantly adapting to change, the set of potentially legitimate adaptive responses is not fixed. In sum, the organizational field is dynamic and constantly encourages adaptation.

Outline for Chapter II

Local water governance is often overlooked in discussions of western U.S. water policy, with more attention paid to governance and collaborations at the watershed or river basin scale. Within the highly fragmented western water system, it is important to understand the ways in which local water management organizations are connected to one another, and how their collaborations shape water governance. Ingram, in a review of

water governance approaches, asserts that "there simply are no universal remedies for good water governance," and that the water resources governance must consider local context (2011:257). Chapter II focuses on local water management organizations, primarily small to medium sized cities and irrigation organizations, and the ways in which they are connected to one another on the urbanizing landscape. I draw upon qualitative case study and statewide survey data to illuminate the processes through which these organizations come to collaborate with one another. My research considers the connections among LWMOs as a local, contextual dimension of water governance in the Intermountain West. Specifically, I ask the following questions: How are local water management organizations connected to one another? Under what conditions do inter-organizational connections lead to different forms of collaboration? I develop a framework for understanding inter-organizational collaborations, with particular focus on shared water infrastructure and organizational linkages in two settled, irrigated valleys of northern Utah.

Outline for Chapter III

In Chapter III, I ask, in what ways can sociological theory inform the increasingly popular theoretical approach of resilience thinking? I highlight the ways in which two sociological approaches can inform resilience thinking on organization adaptation: organization rationality and organizational ecology. These three theoretical frameworks connect to one another in their shared focus on rationality and organizational change. In Chapter III, I offer a case study of municipal stormwater program adaptation that illustrates the ways in which organizational rationality and organizational ecology may

inform resilience approaches. I draw upon data from a 2014 online survey of stormwater program officials in cities throughout Utah. I focus on the ways in which these cities adapt their stormwater program guiding documents, and explore the relationship between program adaptation and organization rationality. Within the case study, I compare the expected empirical outcomes from both resilience and sociological theories, and I highlight the ways in which the sociological theories help explain empirical observations of organizational adaptation within a highly bureaucratic stormwater policy arrangements.

Outline for Chapter IV

In Chapter IV, I consider organizational adaptation from a different approach—the strategies through in which municipal organizations cope within decentralized stormwater policy. There is extensive research on the ways in which municipalities have sought private contracts as a way to adapt to increasing service provision responsibilities, and to minimize costs (Hefetz and Warner 2012; Warner 2003). More recently, municipalities have exhibited an alternative adaptation strategy: the formation of intermunicipal collaborations (Bel and Warner 2014; Hefetz, Warner, and Vigoda-Gadot 2012; Warner 2009). To date, there are no studies (to my knowledge) that examine the use of private consultants in municipal stormwater management or governance activities. My research addresses the gap in the academic literature surrounding the privatization of municipal stormwater services. I ask in what ways and under what conditions do small and urbanizing municipalities take on private consultation in their stormwater programs? In turn, how does privatization shape municipal collaborations in stormwater

governance? And finally, how does the use of consultants influence municipal engagement with the public? To address these questions, I take a mixed methods approach and draw upon three types of data: (1) 2014 online survey of municipal stormwater managers (the focus of the research findings), (2) thirty semi-structured interviews of municipal stormwater managers, conducted in 2014, and (3) observations made at eight monthly meetings of municipal stormwater officials. These methods are described further below.

Methods

My research takes a mixed methods approach in addressing the research topics outlined above. I combine quantitative survey data, qualitative interview data, and observational data to offer a range of perspectives on stormwater governance and adaptation. All materials used in the data collection are included in the Appendices section.

Mixed methods research has grown in acceptance and popularity over the last twenty years. There are many benefits to mixed-methods research, three of which I will highlight here. First, mixed methods allow for triangulation of knowledge, or the corroboration of meanings and findings across data that were collected with different methods (Singleton and Straits 2005). Each methodological approach represents a different perspective on the topic(s) of the research. With new perspectives, different aspects of the same phenomena may be revealed, affording the research more extensive knowledge of the phenomena at hand. The different perspectives may then be brought together to corroborate or invalidate one another. Corroboration theoretically increases

internal and external validity in that the research is more likely to account for a broader range of potential causal relationships (internal validity) and may be more accurately generalized to the appropriate populations not directly observed in the research (external validity). That is, a finding is more likely accepted as "correct" or "true" if it is observed using a variety of methods. The use of multiple methods offsets biases within other methods, further strengthening the validity of results (Greene, Caracelli, and Graham 1989). The research is not necessarily invalid without corroboration between the methods. Rather, different perspectives may offer a broader suite of understandings, all of which may not necessarily fit into one coherent narrative.

Second, mixed methods are a realistic reflection of the actual research process. Mixing research methods strengthen researchers observations and interpretations in that the observations from one approach inform one another in ways that strengthen researchers' perceptions of phenomena and the processes that underlie them (Johnson and Onwuegbuzie 2004). Third, mixed methods can strengthen and inform one another about the most appropriate or effective ways to measure and understand a certain social process. For example, qualitative interviews can inform the development of quantitative instruments by capturing local phraseology, taboos, and norms, thus increasing construct validity in quantitative instruments. Through this very practical step, researchers avoid possible misinterpretations (e.g., misunderstood survey questions), and advance more accurate understandings of social phenomena. Mixed methods research has the potential to expand the range of researchable knowledge.

I use a mixed method design within all three of the papers presented herein. The primary purpose for using a mixed methods design was data triangulation, or the

combination of data collected from separate studies that "…provide a more comprehensive picture of the results than either study could do alone" (Morse 2003:190). The triangulation of data may lead to confirmatory, complimentary, or divergent results. Confirmatory outcomes occur in instances when results from different studies support one another. Complimentary data are found when results from two different methodological approaches lead to a furthered understanding of a process or phenomena that may not be understood as readily with a stand alone approach. Last, the divergence of results are found in situations in which the findings from different studies to not support one another. In the instance of divergent findings, theoretical assumptions may be revisited, or even expanded to explain the observed outcomes: "Thus, divergent empirical findings should not always be considered as an indicator of a poor research design; instead, they may be considered as a pointer to new theoretical insights" (Erzberger and Kelle 2003:475). I use mixed methods for triangulation purposes in Chapter III, where I assess the motivations for organizational adaptation. Reliance upon the quantitative survey data alone would have suggested that the coercive and environmental mechanisms of change (explained in detail below) were distinct; however, the interview data revealed that environmental outcomes were most commonly interpreted within the lens of regulatory expectations. Therefore, the conclusions that I drew from this research emphasized the complexity of and interplay between organizational change mechanisms.

I also used a mixed methods approach to supplement different data types. Supplemental data are "collected to enrich or confirm the original data" (Morse 2003:190). Supplementation allowed me to address a broader range of research questions

than any stand-alone method. I used mixed methods for supplemental purposes in Chapter II, where I brought together data from meeting observations and water manager interviews with quantitative data from my statewide online survey. I was able to assess with detail the types of collaborations occurring within specific geographic regions of Utah, as well as measure the extent of these collaborations occurring throughout the state.

I mixed three methodological approaches in my dissertation research. Here, I describe the sequence of the mixed methods and the rationale for their arrangement. The individual data collection activities are described in detail below. First, I conducted interviews and meeting observations of local water organization leaders (see Appendix A for 2013 qualitative data collection materials). The interviews and meeting observations were initially considered to be "preliminary," but quickly proved to contain important themes and findings in and of themselves. I used these qualitative data to identify important themes within local water management, and to familiarize myself with water governance in the western U.S. context. The meeting observations and interviews were also used to build relationships to the local water management community, and to therefore gain access to other water management organizations in the subsequent data collection steps. The second data collection activity consisted of an online and mail survey of municipal stormwater managers (see Appendix B for online survey materials). The survey question topics, wording, and implementation were largely made possible by the initial meeting observations and interviews conducted in the previous step. Last, I drew upon survey responses to sample stormwater managers for in-depth, follow-up interviews (see Appendix C for interview materials). While the survey and interview stages occurred in sequence with one another, I consider these data to be part of the same

initiative, given that the interview sample frame is dependent upon survey outcomes and they occurred within the same six month period. Additionally, survey data analysis took place in part concurrent to but primarily after the interview data collection effort, meaning that the survey responses only shaped interview sampling parameters and were not incorporated into interview content.

Interviews and Meeting Observations

To identify the connections and collaborations among local water management organizations, I used qualitative observation and semi-structured interview methods within a case study of local water management organizations of two irrigated valleys of northern Utah: Cache Valley and Heber Valley. The case study locations were selected as part of a larger research project on water systems on urbanizing, mountain landscapes.

Qualitative methods followed standard ethnographic procedures commonly used in the social sciences and are discussed further below (Creswell 2013). Interviews and meeting observations were conducted between October 2012 and November 2013. I supported qualitative findings with responses to a statewide, 2014 online survey of municipal stormwater managers. The statewide data grounded my qualitative data within broader local water governance patterns. The survey methods are described above, so I focus on the qualitative methods below.

Meeting observations. In total, 18 meetings were attended over approximately 27 hours. During the meetings, I took extensive notes about topics of discussion and interactions among organizations. Decisions and activities that involved connections

across organizations were noted, with observations also made about the nature of the relationship between groups.

Municipal meetings. Nine monthly meetings of municipal stormwater managers and one meeting between municipalities and local developers were attended. During meetings, the approaches to managing water were observed and analyzed. To understand patterns of physical and social organizational collaborations, three meetings of the Utah Stormwater Advisory Committee, a statewide group of stormwater managers from municipal, industrial, and construction sectors, were also attended.

Irrigation meetings. I attended five meetings of irrigation organization shareholders. Meetings were selected based upon accessibility. A public meeting of the Utah State Board of Water Resources, to which irrigation organizations may apply for infrastructure improvement financial assistance, was also attended.

Semi-structured interviews. Interviews were conducted with municipal employees and irrigation organization leaders in both study areas. Interviewees were selected to represent different levels of urbanization occurring in their service areas.

An interview instrument was used to guide interviews. The instrument consisted of questions organized around three topics: organization goals and management, infrastructure, and challenges encountered. Each area included numerous sub-questions about the types of infrastructure managed, management with other local organizations, and collaborative efforts surrounding major infrastructure changes in the present and future.

Eighteen in-person interviews were conducted, with the average interview lasting about one hour. Overall, municipal water managers (n = 11) consisted of staff with a

variety of responsibilities within city government, including public works directors and employees and city engineers. Irrigation representatives (n = 7) held diverse positions within the organizations, including board members, watermasters or "ditch riders," and presidents.

Meeting observation and interview data analysis. Qualitative data were analyzed using an iterative process that included both the settings in which observations were made or interviews conducted, as well as the content of field notes. Handwritten meeting and interview notes were typed and augmented within one day proceeding the meeting or interview session to allow for expansion of observations and documentation of nuances detected during the meeting. This process allowed for more details to emerge from the observations, and for greater accuracy on the types of inter-organizational linkages observed during meetings and interviews. Augmented notes often contained the observations that I made in writing with additional material that was seen or heard but not necessarily noted at the time of the meeting. Over the course of field note expansion, I also made preliminary, in-process memos that began to analyze the meeting or interview content (Emerson, Fretz, and Shaw 2011). These preliminary memos were noted in a way that clearly distinguished my thoughts from the original and expanded observations.

As data collection unfolded over 13 months, I made frequent efforts to summarize my observations and to note reoccurring themes in memos that synthesized responses and patterns to date. These intermediate notes represent incremental analyses, which were revisited as the data collection progressed. Within these intermediary notes, I began to operationalize key concepts pertinent to the research questions at hand, with emphasis on the types of connections that LWMO organizations shared with one another, and the

range of collaboration between LWMOs. I defined LWMO "connections" to broadly represent any form or time in which LWMOs shared space, material goods, knowledge (across many domains), personnel, oversight, responsibility, or some recognition of the existence of other LWMOs within the region. I recognized that meetings, in and of themselves, qualify as LWMO connections, and therefore expanded the analysis of connections within meeting contexts to discern the motivations for participation in meetings, and the conditions that LWMO representatives operated in that encouraged (or discouraged) meeting participation.

I defined organizational "collaborations" as instances in which inter-organizational connections were, in any way, mobilized to enable or facilitate some effort in which two or more organizations were involved. Here, inter-organizational effort could represent a broad range of actions that included more basic discussions of actions that could or should be taken, to more intermediary collaborations of sharing financial, human, or water resources, to more permanent collaborations that transformed governance arrangements and formalized inter-organizational procedures.

My goal of the qualitative data analysis process was to distill the vast amount of information into a few propositions (Lofland et al. 2006), within which the relationships between organizations' connections and collaborations could be illustrated and supported with examples from the data. To analyze meeting observation and interview data, I built upon my previous memoing activities within an open coding process, in which I read field notes at least one time through to identify broad topics, or categories of similar concepts that were brought up during interviews and meetings (Corbin and Strauss 1990; Glaser and Strauss 1967; Strauss and Corbin 1990). The broad categories often aligned

with meeting agenda items and questions asked during interviews, but also accounted for the space in which meeting and interview participants expanded the discussion to include their insights, experience, or to draw connections between a concept at hand, and other areas that I, as a researcher, had not considered.

I then proceeded to conduct a more-focused coding effort in which these general topics guided my search for organizational connections and collaborations (Strauss and Corbin 1990). I focused on the categories of connections and collaborations as they connected to theories of organizational collaboration in past research, and in part because these connections and collaborations were prominent topics of discussion during preliminary LWMO meetings. I specifically looked for instances in which connections and collaborations were directly discussed, or were implied as "normal" modes of operation. I coded for the existence of connections as defined above, and within these connections I noted the conditions under which these connections were occurring, including any apparent motivations for the connections (if sought out), or the situations that brought these connections into existence (if unintentional). I assessed the relative number of instances in which connections and collaborations were taking place, and tracked the types of organizations engaging in both of these. I also assessed the magnitude of these connections relative to the collaborations, and in doing so, was able to gauge the impact that collaborations had on LWMO decisions and actions. Over the course of memoing and coding, meeting and interview notes were read and noted at least three times, over which I considered interpretative consistency.

To develop a coherent and distilled analysis of LWMO connections and collaborations, I considered the coded dimensions noted above in detail, and developed

an analogy between the types of connections and the distinction between social and biophysical dimensions of the environment. I then drew upon theoretical cornerstones in the collaborative management literature to illuminate the types of LWMO collaborations occurring within the case study. In illustrating LWMO collaborations, I drew upon the range of collaborations, and offered examples that signaled the depth (or lack thereof) of collaborations.

Survey of Municipal Stormwater Managers

All of the chapters presented herein draw upon data collected in my 2014 survey of municipal stormwater managers, who were defined as city or county employees that were in a decision-making or leadership capacity in a stormwater program that had a Utah Pollutant Discharge Elimination System (UPDES) permit from the Utah Department of Environmental Quality. In October 2013, names and contact information of current stormwater permit holders were retrieved from the Utah Division of Water Quality, which oversees NPDES permitting and regulation. To develop an accurate sample frame and to expand the number of potential survey respondents, this list of potential survey participants was compared to program personnel information on stormwater program websites. In instances where primary contacts provided by the state were not directly affiliated with stormwater programs (e.g., a mayor), then this contact was replaced with managers who more closely oversaw the program (e.g., a public works director). For municipalities in which only one individual was included in the state list, I included up to two additional individuals, who were identified from websites, public documents, or provided by experts in the field of stormwater management. In total, the

sample frame included 142 individual stormwater personnel within 72 municipal programs. All stormwater managers in the sample frame were invited to complete the survey.

Prior to survey implementation, the instrument was pre-tested by five stormwater managers: two from municipalities in Cache Valley, two from municipalities along the Wasatch Front, and one consulting engineer in a private firm. The pre-test feedback improved survey readability and interpretation of questions.

The online survey was designed and implemented using Qualtrics software. The software includes many design features promoted by Dillman, Smyth, and Christian (2009) that enhance survey flow and readability, including white space, alignment, pleasing colors, and progress bars that indicate percent completion. To ensure that survey distribution was working properly, the survey sample frame was randomly divided into two sub-sections, with ten percent of respondents in the "test group," which received the first email invitation approximately one hour prior to the second group, consisting of the remaining 90 percent of the sample frame (Sue and Ritter 2012). The test group procedure was only used in the first email contact; subsequent contacts were issued to the full sample frame at the same time.

The initial survey email invitation was distributed to the test group and majority group sample frames on Monday, February 28th. The test group received the email at 9:30am and the larger group received the email at 10:15am. In total, ten emails were undeliverable. The appropriate contact information for the intended recipients was obtained, and the ten participants were contacted to complete the survey the same day. The second email contact was distributed to the entire sample frame on Thursday,

February 27th at 10:00am. A hardcopy post card reminder was intended to bolster response at the second email contact and was delivered to potential respondents on the 26th or 27th. The third email contact was distributed Monday, March 3rd at 9:45am. The fourth and final email reminder was issued on Thursday, March 6th at 9:30am. In the final email reminder, participants who were not involved in stormwater program decisions, or felt like they did not have enough information to complete the survey, could "opt-out" from completing the survey (no one did).

To ensure that non-respondents had the opportunity to complete the survey in spite of internet limitations or online survey inconvenience, I mailed 67 non-respondents a hardcopy of the survey with pre-paid return envelopes. The hardcopy was received approximately five days after the final email contact. The hardcopy version of the survey included all of the questions posed in the online version, with only minor adjustments made to question order to improve the survey format. On the cover of the survey, I included an opt-out/reference option so that members of the sample frame who were not in decision-making capacities could indicate as such. No one "opted out" in the paper survey format.

In total, I received 96 completed responses, with a 68 percent response rate (online responses: n=79, 82 percent of total; mail responses: n=17, 18 percent of total). Responses included stormwater managers from 67 of the 72 Utah municipal stormwater permittees (93 percent municipal response rate). The research questions discussed herein focused upon small and urbanizing municipalities; therefore, responses from county-level municipalities or cities permitted under the large municipal stormwater program (n = 4)

were removed from the dataset. Sixty-three cases remained in the municipal-level survey dataset.

To appropriately analyze statistical relationships in a dataset of this size, I used exploratory factor analyses techniques to minimize the number of independent measures. The size of the dataset was, as described by VanVoorhis and Morgan (2007) considered as "very poor" for factor analyses (300 is "good"). However, factor analyses with high (greater than .80) factor load values do not require as many cases (Guadagnoli and Velicer 1988). As shown in the results sections of Chapters III and IV, a vast majority of items considered in the factor analysis have loadings higher than the 0.80 threshold. Items that aligned on the same dimensions were then analyzed for inter-item reliability, and responses were averaged as scales. The factor analysis and reliability procedures minimized the number of independent measures and thus respected the limited degrees of freedom.

The second analysis strategy that I used in this dataset of limited size was to minimize the number of independent measures used in regression analyses. There are a number of "rules of thumb" in the literature for the appropriate number of independent measures to be used in linear regression models; none of which are wholly supported (VanVoorhis and Morgan 2007). In the regression analyses in Chapter IV (privatization), I minimized the number of independent measures replacing multiple variables representative of distinct dimensions with an aggregate scale (when the aggregate scale is conceptually sufficient for the relationships under question). Again, this reduced the number of independent measures and allowed for the analyses to retain some statistical power.

Interviews of Municipal Stormwater Managers

I conducted thirty interviews of municipal stormwater managers between March and July 2014. The first criteria for selection to participate in interviews was based upon whether or not municipalities used a private consultant for their program activities, as determined within their responses to the online survey (roughly two-thirds of the interview participants used private consultants in some way). I also considered whether or not the municipality had a working relationship with irrigation organizations (the purpose of which is unrelated to the research questions presented in Chapters III or IV). I created a stratified sampling criteria that consisted of four groups: cities partnered with both irrigation groups and contracted with consultants; cities partnered with irrigation groups but not contracted with consultants; cities that contracted with consultants but did not partner with irrigation groups; cities that did not partner with irrigation groups or contract with consultants. Within each of these groups, I randomly sampled five cities for participation, with two additional cities selected as "backup" in each group. I analyzed these cities for representativeness across the range of city sizes, with the twenty cities included in these four groups reflecting the distribution of cities throughout stormwater-permitted municipalities in Utah (except for Salt Lake City, which was excluded from the analyses because it is a Phase I permitted city and because it is conceptually distinct from smaller municipalities in Utah). I also created two additional groups of cities: cities that were recently (as of February 2014) permitted under the statewide stormwater permit but that did not have stormwater programs established, much less guiding documents in place (the "just-permitted" group), and cities that were below the population threshold to come under stormwater regulation, but that were likely to be regulated in the near future (the

"soon-to-be-permitted" group). At the time of the interview sample selection it was not known whether or cities in the "just-permitted" group had developed partnerships with irrigation or private organizations, and as such they could not be included in the primary sampling strategy.

In total, I selected thirty cities for participation in the semi-structured interviews, with twenty of these cities having at least one individual who responded to the online survey. Individuals who represented either the "just-permitted" or the "soon-to-be permitted" groups were identified as potential interview participants by their position titles as posted on the municipalities' websites, or by calling a relevant municipal department and asking for the person who oversaw stormwater management. In the event that no one from a city was willing to speak with me (four declined), I replaced that city with the next randomly selected city belonging to the sample group. In total, the municipal interview participation rate was eighty-eight percent.

Interviews were conducted in-person or over the telephone, and were recorded and transcribed. Interviews lasted, on average, 40 minutes. I made extensive notes while conducting interviews, which were also reviewed at the time of interview analysis. Interview data were analyzed in Chapters III and IV. While the data analysis procedures for these distinct research chapters slightly differed, I will summarize the general process here and leave the specifics of each data analysis procedure for the relevant chapters.

The general interview analysis procedures consisted of content analysis, in which I focused on the meaning of interview content through coding, condensation, and interpretation procedures (Kvale and Brinkmann 2009). In the first stage of interview data analysis, I conducted an open coding of interview transcripts to gather general

impressions and identify the broad topics that were covered. This step allowed me to identify the areas in which participants' thoughts were associated with the topic of the interview question, and where these thoughts intersected with one another throughout the duration of the interview. The operationalizations of the open code topics are described in Chapters III and IV. In the interview analysis second step, I focused on the passages pertaining to the primary topics of interest for each of the two research questions (and corresponding chapters), and conducted a more focused coding of the topics of interest. Within the second step, I noted the frequency of comments made on a particular topic, and within interviews, I considered the extent to which this topic was of interest and of knowledge to the interviewee(s). In the third and final stage of analysis, I sought to interpret the meaning of key passages. The meaning interpretation phase was an iterative process of distilling described actions, attitudes, and goals into condensed, identifiable patterns, and relating these patterns to the broader suite of stormwater program objectives. I checked for consistency in the meaning interpretation by checking my interpretation of important passages with the broader meanings expressed on the whole of the interview. I was careful to note evidence in support of and in contrast to the literature and quantitative data in my corresponding survey analyses. Nonetheless, the qualitative data interpretation was conducted after that of the survey data, and therefore it is likely that my interpretations of the interview data were made with some understanding of the quantitative findings. This may pose a possible bias in my data interpretation; however, it could also benefit the integration of qualitative and quantitative findings within my multiple methods research design.

Units and Levels of Analysis in Organization Research

The primary level of analysis in my research is the stormwater organization, which may consist of a sub-section of municipal government (for small municipalities) or a more independent wing of a municipal department (in larger city governments). It is well acknowledged in the organizational research literature that research on organizations is inherently mixed-level (Drazin, Glynn, and Kazanjian 1999; Meyer, Tsui, and Hinings 1993). Organization researchers typically conduct research at many levels—the individual, workgroup, and organization—in their investigation of organizational behaviors and underlying processes. According to Rousseau (1985),

> …the issue of level is of paramount importance in the field of organizational behavior. Its sets the field apart from its parent disciplines in that most of what we study in and about organizations are phenomena that are intrinsically mixed-level. Learning, decision making, structure, technological systems, productivity and effectiveness, all of these and other major topics in the field are neither strictly micro or macro in character (P. 2).

Rousseau (1985) recommends that organization researchers should distinguish a between the focal unit, level of measurement, and level of analysis in thinking about questions of research design and representativeness. The focal unit is "the level to which generalizations are made" (Rousseau 1985). The level of measurement is the unit to which data are derived (i.e., what is actually measured), while the level of analysis represents the level at which the data are attributed (by the researcher) for statistical or synthetic analysis and hypothesis testing (Rousseau 1985). Table 1 summarizes these three concepts for the three papers included herein. The focal units and the levels of

analysis for all three papers are the organization, with a mixture of methods to extend these individual-level observations to the organizational scale.

Previous empirical research on organizational decisions also straddles individual and organizational levels. A meta-analysis of organizational innovation research found that 60 percent of studies used supervisor reporting methods on organizational practices and innovations, while the remaining 40 percent of studies relied on the individuals most credited with the innovation (Anderson, De Dreu, and Nijstad 2004). The only survey of stormwater managers published in the academic literature (to my knowledge) similarly identified individual-level survey participants from contact information within program paperwork submitted to the regulating state (White and Boswell 2007).

I am employing multiple strategies to address validity and reliability within the multi-level research and analyses. First, in the survey data collection efforts, I identified multiple individuals within each stormwater organization to invite to complete the survey (the methods I used to do that are described in the survey data collection section, above. I selected interview participants based upon a sample of survey respondents that were stratified across the types of partnerships that organizations had (emphasizing partnerships with private contractors or irrigation groups), and the extent to which the municipality was experiencing urbanization.

Individual interview contacts were individuals who had already responded to the survey, and thus felt knowledgeable enough about their programs to represent the organization. In the instances where cities were selected for interview participation and there were more than one survey respondents within the municipality, I invited both individuals to participate in the interview.

Second, I am attentive to the multi-level nature of my survey data within the data aggregation process. The municipal stormwater survey data aggregation took a key informant and aggregation approach (Krannich and Humphrey 1986) to identify stormwater program activities at the municipal level. The advantages of using key informants to identify community or municipal-level occurrences are twofold. The first advantage is that, in assessing multiple individuals within one group, knowledge unique to a specific individual regarding programs, policies, activities, or events may be represented within aggregations of the survey data at an organizational scale. The second reason for using multiple key informants is to "eliminate idiosyncratic observations," including responses that are factually incorrect (Schwartz, Bridger, and Hyman 2001:230).

I received responses from two or more individuals within 22 of the 67 responding municipalities; individual responses within those 22 cities were aggregated to the municipal level using measures of central tendency, as employed in earlier analyses of key informants (Krannich and Humphrey 1986; Schwartz et al. 2001; Sharp, Jackson-Smith, and Smith 2011). Survey items that were mostly factual, such as the whether or not the city used a private contractor, were aggregated using the response mode, or the most common response among individuals within the municipality. I reconciled disagreement in instances of multiple modes by aggregating responses using the "any yes" rule, in which if there was a "yes" response to the presence of an activity or event, the aggregate measure would take on the "yes" response (Schwartz et al. 2001). Schwartz et al. (2001) found that the "any yes" aggregation method resulted in the highest percentage of

Table 1. Organizational Research Design and Strategies for Three Papers

	Paper I: Local water management organizations	Paper II: Organizational adaptation	Paper III: Privatization and intermunicipal collaboration
Focal unit	organization	organization	organization
Level(s) of measurement	Individuals *interview data* Irrigation and municipal organizations *meeting observations*	Individuals *interview data*; *survey data*	Individuals *interview data*; *survey data* Private organizations *meeting observations*
Level of analysis	organization	organization	organization
Strategies employed	Noted areas of differing opinions within meeting observations (few); compared responses of individuals within same organization	Survey data collection of multiple individuals (attempted); aggregation using established key informant aggregation procedures[1]; instances of multiple representatives within the same municipal interview	Survey data collection of multiple individuals (attempted); aggregation using established key informant aggregation procedures[1]; instances of multiple representatives within the same municipal interview

[1] Krannich and Humphrey 1986; Schwartz et al. 2001; Sharp et al. 2011

valid aggregated values. I employed this "any yes" aggregation method in combination with the "investigator judgment" procedure used by Krannich and Humphrey (1986) and supported by Schwartz et al. (2001) to further increase validity in factual responses. With the investigator judgment approach, responses to other questions are considered in determining the best value for aggregation. For example, in instances of disagreement between respondents of different levels of involvement within their stormwater program

(based on position title), responses were aggregated to reflect the response of the senior-ranking individual.

Finally, these procedures are supported here with an empirical analysis based upon the online survey data. Participants were asked to indicate the extent to which they believed that their views on stormwater were similar to those of other managers within their stormwater program. Respondents had the options to select "not at all similar," "somewhat similar," "very similar," or "not sure." The data provide reasonable support for aggregation of individual responses to the municipal scale, and for individual responses to represent the stormwater organization. Twenty-five percent of individual respondents indicated that their views were "somewhat similar," while over two-thirds (68 percent) said that their views were "very similar" (6 percent said that they were "not sure"). No one responded that their views were "not at all similar" to other managers within their program.

Summary

Local water management organizations play important roles in water governance in the Intermountain West. These organizations are responding to major shifts including urban land development, changing water availability with climate change, and decentralized stormwater governance. In the present and coming decades, organizations will continue to respond to these changes. The research presented herein offers some insights on the ways in which local water management organizations in Utah are adapting to these changes. Qualitative methodology allows me to explore the activities and adaptations of local water management organizations, while quantitative survey methods

let me measure the strength of the phenomena that I observed, and let me compare the experiences of municipalities across the state.

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CHAPTER II

CONNECTIONS AND COLLABORATIONS IN LOCAL WATER GOVERNANCE OF NORTHERN UTAH

Introduction

Water in the western United States is often framed as a story of powerful water bureaucracies, large dams with rivers and conveyance pipelines that transfer water across hundreds of miles, and conflict between urban and rural interests over scarce water resources (Reisner 1993; Worster 1985). In contrast, my research focuses on local water management, where irrigation organizations and public utility managers working for small or medium-sized cities manage much of the water before it reaches individual users.

In the Intermountain West, or lands between the Sierra-Cascade and Rocky Mountains of the United States, thousands of independent or loosely coordinated municipal governments and irrigation organizations (i.e., canal companies, water user associations, and acequias) make critical decisions that determine the delivery and management of nearly all water in the region (Freeman 2000). These organizations may be focused on irrigation water, municipal water delivery, and the removal of stormwater from the urban landscape. Boundary organizations represent another type of meso-scale actor that do not have direct management authority over water resources, but who may facilitate water management and governance to an extent that these boundary groups become very influential. LWMOs are intermediary linkages between larger water institutions (the macro-scale) and individual water users (the micro-scale) (Bretsen and

Hill 2006; Freeman and Lowdermilk 1985) (Figure 1). LWMOs also have a close relationship to the biophysical conditions that structure water quantity and quality.

LWMOs are the "orphans of water policy discourse," (Freeman 2000:483), with little attention paid to their activities or governance arrangements compared to the micro and macro dimensions of western water governance (Blomquist, Heikkila, and Schlager 2004). If the water governance and infrastructure systems are to become more sustainable, these organizations are likely to be part of that change (Freeman 2000). Within the highly fragmented western water governance system, it is important to understand the ways in which LWMOs are connected to one another, and how their collaborations shape water governance. Ingram, in a review of water governance approaches, asserts that "there simply are no universal remedies for good water governance," and that the water resources governance must consider local context (2011:257). My research considers the connections among LWMOs as a local, contextual dimension of water governance in the Intermountain West. Specifically, I ask the following questions:

1) How are local water management organizations connected to one another?
2) Under what conditions do inter-organizational connections lead to different forms of collaboration?

I develop a framework for understanding inter-organizational collaborations, with focus on shared water infrastructure and organizational linkages in two settled, irrigated valleys of Northern Utah. These areas are excellent locations for studying LWMO connections, given the extent of urbanization taking place in these areas, which reflect broader patterns of urbanization occurring at the state and regional levels. LWMOs

within these study areas are facing a number of challenges associated with urbanization, including the interconnected threat of increased water demands and reduced water availability that already is, or is anticipated to be, experienced throughout the western U.S.

While many LWMOs historically worked in a disconnected and fragmented manner, my research suggests that both physical and social connections among LWMOs encourage organizational collaboration.

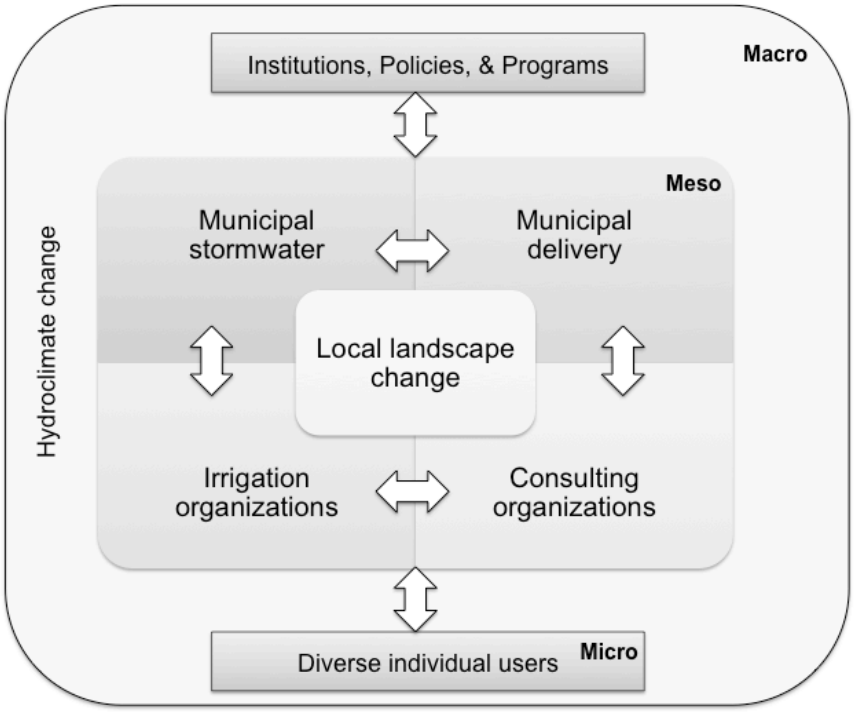

Figure 1. The western water management structure, highlighting local water management organizations at the meso-scale.

Local Water Management Organizations (LWMOs)

In the Intermountain West, most surface water originates as snowpack from high elevation mountain ranges. Early LWMOs in Utah were irrigation organizations formed by groups of farmers to facilitate early settlement and agriculture (Ricks 1956). Their primary activities included the diversion of surface water from mountain runoff and investment in the infrastructure necessary to deliver water to users. Irrigation groups still hold water rights to the vast majority of water used in Utah. Most irrigation LWMOs have direct ownership of water rights and issue water use shares to their stockholders, while others manage water rights owned by their individual members. Freeman (2000) estimated that as of 1969, the last year that the U.S. Census of Agriculture recorded the number and types of irrigation organizations, there were over 8,000 irrigation groups in the American West (including irrigation companies, canal companies, mutual companies, irrigation districts, and acequias), and that these LWMOs managed 92 percent of irrigation water in the region. At the time of this writing, there are 1,124 irrigation organizations just within the state of Utah (Utah Division of Water Rights (UDWR) 2014).

LWMOs also include municipal governments that are responsible for providing water to residential, commercial and industrial users and for coordinating stormwater and wastewater management. Municipal LWMOs are usually agencies of city or county governments, with most water management duties assigned to public works departments. In Utah there are 475 municipal water providers that supply drinking water to 98.5 percent of the state's population (Utah Division of Water Rights 2010). Many Utah municipalities also have access to secondary (non-potable) water that is used for outdoor

irrigation. As of 2014, there were 86 municipal stormwater programs within city and county governments in Utah that have state-issued stormwater discharge permits. There are also dozens more small municipalities that manage stormwater within their boundaries, but are below the population threshold to necessitate a state-issued discharge permit. All of this is to say that LWMOs are prevalent in number and in the extent of their decisions surrounding much of the available water in the state, and possibly the region.

Through an extensive system of built infrastructure, water law and policy, and knowledge of local landscapes, LWMOs have long determined the timing, amount, and allocation of water within river and tributary systems, across agricultural landscapes, and even within urban or suburban neighborhoods. Nevertheless, the empirical literature on LWMO governance in the American West, particularly on irrigation companies and the processes through LWMOs collaborate with one another is rather sparse (Baker et al. 2014).

Most of the research on LWMOs has focused upon the internal organizational characteristics of successful common pool resource organizations (Mollinga, Meinzen-Dick, and Merrey 2007), with less attention to how organizations collaborate with one another (Ingram 2011). Local irrigation organizations are a quintessential example of a common pool resource organization, in which individual access to water resources is governed by institutions that establish a set of norms, rules, and rights to use the resource (Cody et al. 2015; Lepper and Freeman 2010; Ostrom 1990). There is an extensive research literature on the emergence and evolution of collective irrigation systems in India, China and other historically agrarian societies (Coward 1979; Freeman and

Lowdermilk 1985; Harrower 2009). In comparison, the literature on local irrigation in the United States is limited, with the exception of the acequia organizations of the southern Intermountain West, which have unique organizational and social characteristics that structure the water system (Cox and Ross 2011; Krannich and Eastman 2002).

LWMOs in the Fragmented Water Governance Structure

A growing number of historians and social scientists recognize that fragmented decisions made by thousands of LWMOs are key elements of the modern regional water system. In a study of the Denver, Colorado water supply system, Limerick (2012) notes that Denver Water, the primary water supply agency for the city, was not always a powerful entity; rather, the agency had to compete among many organizations—local, regional, and federal—throughout the 20th century to obtain its current dominant role. Limerick concludes that "…the acquisition, development, allocation, and management of western water have been processes characterized by fragmentation and competition as much as (if not more than) the exertion of centralized power" (2012:265). Despite the considerable overlap of municipal and irrigation groups in local land and water governance (Baker et al. 2014; Gober et al. 2013), there is fairly little research that considers how these groups collaborate, with one another. One area that offers some insights on the rationales for conflict and collaboration is economic game theory, which Madani (2010) extended to water management decisions, and has explored the application of game theory (Madani and Hipel 2011) and systems dynamics (Mirchi et al. 2012) to water resources decision-making.

Fragmentation can be considered both in terms of the number of organizations involved in local water policy (as evidenced in Utah), and the institutional arrangements within which local water management groups are nested across many levels of government. One institutional form that received attention surrounding local water service provision is the specialized district, which coordinates water management among LWMOs of discrete, bounded locations. Special districts increasingly coordinate the provision of drinking water (Mullin 2009), flood management and in the western U.S. and basin-wide irrigation water delivery (Cody et al. 2015; Lepper and Freeman 2010). Special districts may reduce fragmentation by consolidating local water management organizations or disparate water users (Lepper and Freeman 2010), but raise questions about responsiveness and democratic participation (Mullin 2009). Alternatively, special districts may add complexity to the water governance system with their operation as an independent, additional layer of governance (Mullin 2009).

Not all collaborative governance efforts are responsive to top-down, policy requirements. Another type of water organization that is distinct from the LWMOs discussed herein, but that nonetheless has an important role in water management and governance, is represented by collaborative watershed organizations. Watershed organizations are thought to represent diverse and wide-ranging interests located within a watershed, although it is well noted that eco-hydrologic boundaries do not necessarily align with political or community boundaries (Barham 2001). Watershed organizations represent a venue through which local actors, including LWMO representatives, may act upon on issues that they identify as relevant to the region (Stedman et al. 2009). Watershed organizations often represent a level of organization in the water governance

structure that is akin to specialized districts, but with more focus on protecting water quality and watershed health rather than water quantity management.

Urbanization also magnifies fragmentation in local water management and governance. As cities expand and convert agricultural to residential land, municipal jurisdictions overlap with irrigation service areas, often using the same infrastructure to convey water. In the fragmented western water system, how do organizations work with one another?

Collaborations in Local Water Governance

Collaborative management is a well-studied response to the problems of fragmented water governance (Margerum 2008; Margerum 2011; Sabatier et al. 2005). Collaborative management most often includes coordination among organizations, stakeholders, and key decision-makers to develop collective strategies to address watershed, water quality, and to a lesser extent, water quantity issues (Margerum 2011). Collaborative management arrangements gained popularity as a mechanism to formalize collaboration among loosely connected actors (Lach, Ingram, and Rayner 2004). Formal collaborations are now a common approach to facilitate organizational coordination on environmental issues.

Many collaborative management efforts surrounding water governance are arranged at the watershed-scale, which connects diverse interests across space (Margerum 2008; Sabatier et al. 2005), and brings together organizations at many levels of governance (Margerum 2011). Several typologies of collaborative management are found in the academic literature. Gray (1989) identified four forms of inter-organizational

activities, including policy discussions, public information forums, and negotiated settlements that involve topic-specific partnerships. The fourth form of collaboration is collective strategies, in which organizations co-identify and implement shared goals (Gray 1998; Margerum 2011). Another framework developed to analyze collaborative efforts considers different leadership models, with government-led, citizen-led, and hybrid approaches providing different outcomes (Moore and Koontz 2003).

The empirical research on collaborative water governance suggests that LWMOs are increasingly attentive to their collaborative relationships. In an analysis of three regional collaborations (that included local, regional, state, and federal agencies), social connections among organizations were prioritized to distribute risk across organizations within the water system, and to improve adaptive management (Lach, Rayner, and Ingram 2005). Examples of coordinated management efforts included the integration of new knowledge or practices into their operations; however, innovative management strategies were found to conflict with organizational missions (Lach et al. 2004). In light of these challenges, many LWMOs seem hesitant to take on innovative collaborations, and instead continue to operate in isolation from one another (Lach et al. 2004).

In the sections that follow, I describe LWMOs of northern Utah, and discuss the drivers that encourage small municipalities and irrigation groups to engage with one another.

Connections among LWMOs

LWMOs are connected to one another through material and social conditions. I conceptualize material connections to represent material linkages between LWMOs

based upon dependence on the same water resources and overlapping built water infrastructure. LWMOs operate within a larger hydrologic context made up of both watershed hydrology and built water systems. The built water infrastructures managed by LWMOs are the physical manifestations of past water policies and goals, and represent rigid structures that can be difficult to change, even after the conditions or policies that brought the infrastructure into existence are obsolete (Wilson 2015). A shared location on the landscape can also be a material point of connection.

LWMOs are more than the infrastructure that they manage—they also have social connections with a larger community of water organizations (Freeman 2000). Organizational theorists have long studied organizational fields, or the social networks in which organizations operate as communities or sets of organizations that, "produce similar services or products" (DiMaggio and Powell 1983:148). Irrigation groups and municipalities make up distinct organizational fields, given the differences in the waters that they manage and the differences in their relationships to the public at large. Organizations within a field are responsive to one another's actions through three mechanisms: coercive, normative, and mimetic, which help explain why organizations within a field exhibit similar characteristics and behaviors (DiMaggio and Powell 1983; Heugens and Lander 2009).

Coercive mechanisms shape organizations' behaviors. These mechanisms usually include rules and sanctions designed to encourage organizations to take on certain forms or actions (Simmons, Dobbin, and Garrett 2007). Coercive mechanisms encourage organizations to avoid negative outcomes, and they enable certain benefits. For example, organizations within a field may be given control over defined geographic boundaries of

their authority. Conversely, organizations might collaborate with one another as a requirement to receive grant funding.

Normative mechanisms associated with organizational interconnections include the values, practices, and conventions that are recognized (explicitly or implicitly) as the "correct" or standard modes of operation within a field. LWMOs can be expected to generate a shared culture that defines and redefines the legitimate purposes and normal modes of operation for organizations of their type. Normative mechanisms also include professionalization and formal training that stresses particular logics (DiMaggio and Powell 1983), as well as the informal shared notions of values and appropriate practices that become routinized within operational procedures (Barley and Tolbert 1997). One example of a normative mechanism of organizational behavior is participation in training seminars.

Mimetic forces are at play when organizations emulate other organizations in their field. Mimicry is common when organizations face high levels of uncertainty (DiMaggio and Powell 1983) and often takes place without a formal recognition that it is occurring (Oliver 1997). For example, LWMOs may display mimetic behavior when adopting similar water monitoring technologies as organizations in a shared conveyance system.

Collaborations among LWMOs

To understand the processes through which LWMOs may transition from connections to collaborations, I draw upon Gleick's (2003) notion of "hard" and "soft" paths to sustainable water governance. The hard paths consist of the physical water

infrastructures that store and convey water (Gleick 2003). The soft paths to sustainable water systems represent the policies, procedures, and relationships through which water infrastructure is managed. I extend this analogy to consider the mechanisms through which organizations develop collaborations with one another. Collaborations based on physical organizational connections consist of inter-organizational efforts or agreements that focus on a shared material aspect of the water system. For example, residential development alongside irrigation waterways in Idaho prompted information exchanges between irrigation organizations, land use planners, and housing developers (Baker et al. 2014). Collaborations between organizations may also be based upon social connections. LWMOs may collaborate with one another to lobby for reduced state government oversight based on shared beliefs of local control, even if these LWMOs do not operate in the same watershed. Within this framework of physical and social connections, I ask, what conditions produce inter-organizational connections, and how do these connections encourage LWMOs to collaborate with one another?

Methods

My research uses a mixed-methods approach that focuses on a case study in irrigated, urbanizing valleys of northern Utah: Cache Valley and Heber Valley. The case study observations are supplemented by findings from a statewide online survey of municipal stormwater managers. The statewide findings corroborate the qualitative findings with patterns observed at the state scale.

Case Study

The Cache and Heber Valleys were settled for agricultural production in the 19th century. Since the 1990s, both areas experienced extensive urbanization in which irrigated agricultural land is converted into residential uses. My case study locations were also selected as part of a larger research project on water systems in urbanizing, mountain landscapes.

Cache Valley is located within Cache County, Utah and Franklin County, Idaho (Figure 2). There are 114 registered irrigation organizations within Cache County, with extensive variation in the service area size and number of shareholders. As of 2010, there were 112,656 residents and 19 municipalities within Cache County, the largest of which is Logan City (2010 population: 48,174). Cache Valley experienced a 23 percent population growth between 2000-2010 (U.S. Census Bureau 2010).

The second study area is the Heber Valley, located within Wasatch County, with a 55 percent population increase between 2000 and 2010 (2010 population: 23,530). The Heber Valley is transitioning from an agricultural to recreational economy. Heber City and Midway City are the major incorporated areas in Heber Valley, with 35 percent of residents living in unincorporated areas under County jurisdiction.

The Heber Valley sits between two major reservoirs connected by the Provo River and operated by the Central Utah Project (CUP), a division of the US Bureau of Reclamation (Figure 3). Ten out of twenty-four irrigation companies operating in Heber Valley, including the largest canal companies with the most extensive conveyance infrastructure, are affiliated with the CUP. Affiliated irrigation organizations are independent with distinct boards of directors and shareholders, but receive water from a

CUP-managed reservoir based upon a coordinated delivery schedule. The Central Utah Water Conservancy District includes a staff of water engineers and facilitates coordination between LWMOs and the CUP.

Data Collection

To identify the connections and collaborations among LWMOs, I used qualitative observation and semi-structured interview methods. Qualitative methods followed standard ethnographic procedures commonly used in the social sciences and are discussed further below (Creswell 2013). Interviews and meeting observations were conducted between October 2012 and November 2013. I support findings from my qualitative data with responses to a statewide, 2014 online survey of municipal stormwater managers. The statewide data grounded my qualitative data within broader local water governance patterns.

All data collection activities focused on relatively small municipalities (populations under 50,000) and the irrigation organizations within or near their jurisdictions. Other types of local-scale organizations such as boundary organizations (White, Corley, and White 2008) or private consultants may participate in inter-organizational collaborations; however, these types of organizations do not have direct governance responsibilities and were therefore not the focus of the work reported here.

Meeting observations. In total, 18 meetings were attended over approximately 27 hours. During the meetings, I took extensive notes about topics of discussion and interactions among organizations. Decisions and activities that involved connections across organizations were noted, with observations also made about the nature of the relationship between groups.

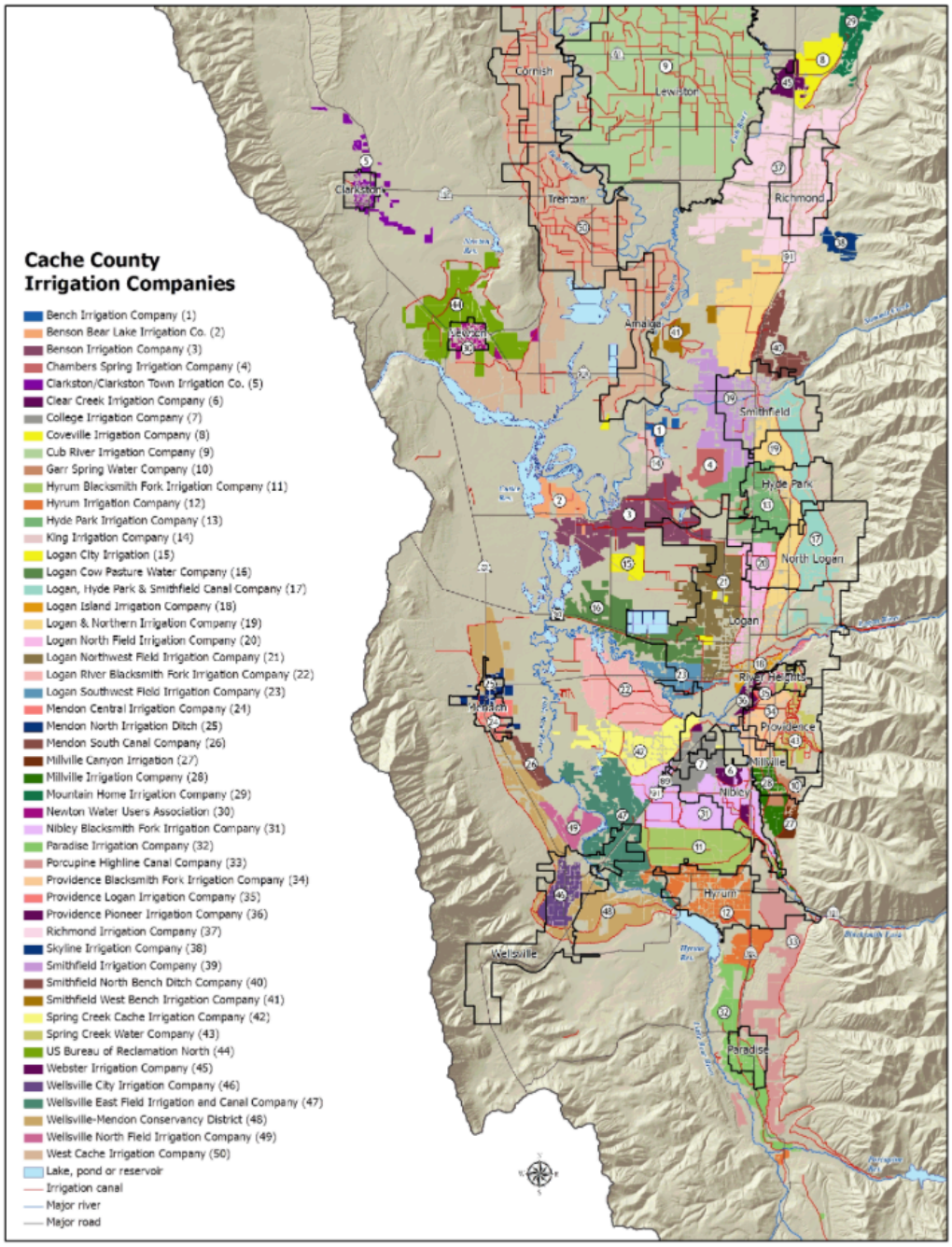

Figure 2. Cache County Irrigation Groups (colored) and Municipal Boundaries (solid dark line) (Utah Association of Conservation Districts 2011).

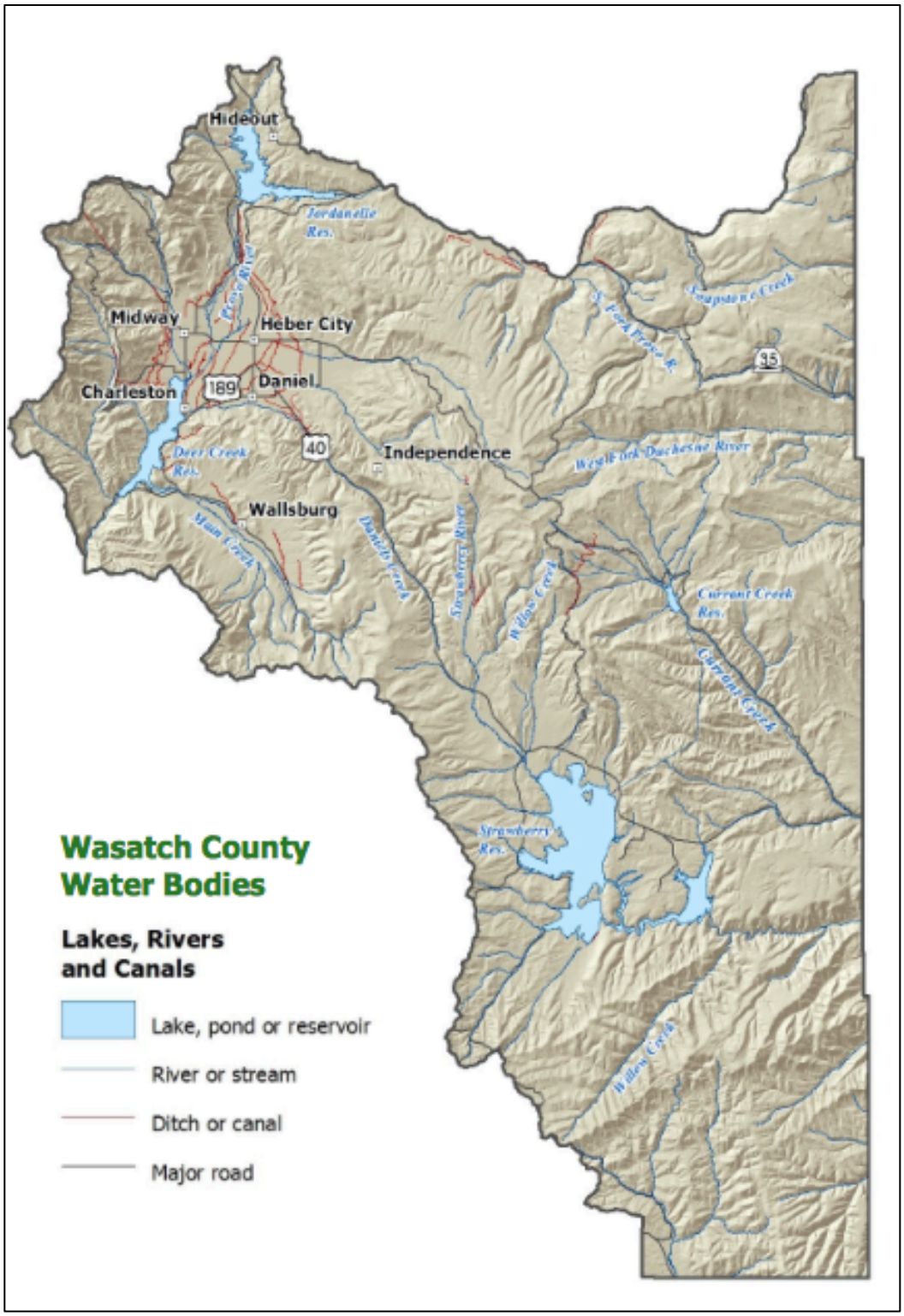

Figure 3. Wasatch County Water Bodies (Utah Association of Conservation Districts 2013).

Municipal meetings. Nine monthly meetings of municipal stormwater managers and one meeting between municipalities and local developers were attended. During meetings, the approaches to managing water were observed and analyzed. To understand patterns of physical and social organizational collaborations, three meetings of the Utah Stormwater Advisory Committee, a statewide committee of stormwater permittees, were also attended.

Irrigation meetings. The first author attended five meetings of irrigation organization shareholders. Meetings were selected based upon accessibility. A public meeting of the Utah State Board of Water Resources, to which irrigation organizations may apply for infrastructure improvement financial assistance, was also attended.

Semi-structured interviews. Interviews were conducted with municipal employees and irrigation organization leaders in both study areas. Interviewees were selected to represent different levels of urbanization occurring in their service areas.

An interview instrument was used to guide interviews. The instrument consisted of questions organized around three topics: organization goals and management, infrastructure, and challenges encountered. Each area included numerous sub-questions about the types of infrastructure managed, management with other local organizations, and collaborative efforts surrounding major infrastructure changes in the present and future.

Eighteen in-person interviews were conducted, with the average interview lasting about one hour. Overall, municipal water managers (n = 11) consisted of staff with a variety of responsibilities within city government, including public works directors and employees and city engineers. Irrigation representatives (n = 7) held diverse positions

within the organizations, including board members, watermasters or "ditch riders," and presidents.

Qualitative Data Analysis

The goal of the qualitative data analysis process was to distill the vast amount of information into a few propositions (Lofland et al. 2006), within which the relationships between organizations' connections and collaborations could be illustrated and supported with examples from the data. Qualitative data were analyzed using an iterative process that included both the settings in which observations were made or interviews conducted, as well as the content of field notes. Handwritten meeting and interview notes were typed and augmented within one day proceeding the meeting or interview session to allow for expansion of observations and documentation of nuances detected during the meeting. This process allowed for more details to emerge from the observations, and for greater accuracy on the types of inter-organizational linkages observed during meetings and interviews. Augmented notes often contained the observations that I made in writing with additional material that was seen or heard but not necessarily noted at the time of the meeting. Over the course of field note expansion, I also made preliminary, in-process memos that began to analyze the meeting or interview content (Emerson, Fretz, and Shaw 2011). These preliminary memos were noted in a way that clearly distinguished my thoughts from the original and expanded observations.

As data collection unfolded over 13 months, I made frequent efforts to summarize my observations and to note reoccurring themes in memos that synthesized responses and patterns to date. These intermediate notes represent incremental analyses, which were

revisited as the data collection progressed. Within these intermediary notes, I began to operationalize key concepts pertinent to the research questions at hand, with emphasis on the types of connections that LWMO organizations shared with one another, and the range of collaboration between LWMOs. I defined LWMO "connections" to broadly represent any form or time in which LWMOs shared space, material goods, knowledge (across many domains), personnel, oversight, responsibility, or some recognition of the existence of other LWMOs within the region. I recognized that meetings, in and of themselves, qualify as LWMO connections, and therefore expanded the analysis of connections within meeting contexts to discern the motivations for participation in meetings, and the conditions that LWMO representatives operated in that encouraged (or discouraged) meeting participation.

I defined organizational "collaborations" as instances in which inter-organizational connections were, in any way, mobilized to enable or facilitate some effort in which two or more organizations were involved. Here, inter-organizational effort could represent a broad range of actions that included more basic discussions of actions that could or should be taken, to more intermediary collaborations of sharing financial, human, or water resources, to more permanent collaborations that transformed governance arrangements and formalized inter-organizational procedures.

To analyze meeting observation and interview data, I built upon my previous memoing activities within an open coding process, in which I read field notes at least one time through to identify broad topics, or categories of similar concepts that were brought up during interviews and meetings (Corbin and Strauss 1990; Glaser and Strauss 1967; Strauss and Corbin 1990). The broad categories often aligned with meeting agenda items

and questions asked during interviews, but also accounted for the space in which meeting and interview participants expanded the discussion to include their insights, experience, or to draw connections between a concept at hand, and other areas that I, as a researcher, had not considered.

I then proceeded to conduct a more-focused coding effort in which these general topics guided my search for organizational connections and collaborations (Strauss and Corbin 1990). I focused on the categories of connections and collaborations as they connected to theories of organizational collaboration in past research, and in part because these connections and collaborations were prominent topics of discussion during preliminary LWMO meetings. I specifically looked for instances in which connections and collaborations were directly discussed, or were implied as "normal" modes of operation. I coded for the existence of connections as defined above, and within these connections I noted the conditions under which these connections were occurring, including any apparent motivations for the connections (if sought out), or the situations that brought these connections into existence (if unintentional). I assessed the relative number of instances in which connections and collaborations were taking place, and tracked the types of organizations engaging in both of these. I also assessed the magnitude of these connections relative to the collaborations, and in doing so, was able to gauge the impact that collaborations had on LWMO decisions and actions. Over the course of memoing and coding, meeting and interview notes were read and noted at least three times, over which I considered interpretative consistency.

To develop a coherent and distilled analysis of LWMO connections and collaborations, I considered the coded dimensions noted above in detail, and developed

an analogy between the types of connections and the distinction between social and biophysical dimensions of the environment. I then drew upon theoretical cornerstones in the collaborative management literature to illuminate the types of LWMO collaborations occurring within the case study. In illustrating LWMO collaborations, I drew upon the range of collaborations, and offered examples that signaled the depth (or lack thereof) of collaborations.

Online Survey Analysis

To document the extent of inter-organizational collaboration between irrigation and municipal water organizations throughout Utah, I also analyzed responses from a statewide survey of municipal stormwater managers. The survey was part of a broader study on stormwater management and policy and included questions on organization collaboration.

Survey recipients were defined as all city or county employees that were in a decision-making capacity in a stormwater program for a municipality that had a Utah Pollutant Discharge Elimination System permit. For municipalities in which only one individual was included in the state permittee list, I included up to two additional program employees, who were identified from public documents or provided by stormwater management experts. In total, the sample frame included 142 stormwater managers within 72 municipal stormwater programs. All stormwater managers in the sample frame were invited to complete the survey. I asked participants about municipal collaborations with irrigation organizations, including the types of activities and agreements.

Online survey implementation followed the tailored design method (Dillman, Smyth, and Christian 2009) and occurred over two weeks in March, 2014. Implementation consisted of three email contacts requesting online completion of the survey, a reminder post card, and a hardcopy issued by mail. In total, I received 96 completed responses, with a 68 percent individual response rate (online responses: n=79; mail responses: n=17). At least one response was received from 67 of the 72 municipalities, representing a 93 percent response rate at the municipal scale. Multiple individual responses were consolidated into municipal-scale data using the modal response category and key-informant validations (Krannich and Humphrey 1986; see Chapter I). Survey data were analyzed in SPSS.

Findings

Physical Connections

I found evidence of three types of physical connections among LWMOs: water infrastructure, expanding municipal jurisdictions, and hydrologic flows. Urban storm drains and irrigation canals were connected to one another throughout the study valleys, with irrigation canals serving as the primary stormwater conveyance channels. Many cities in the study area have multiple canals within their urban core and urbanizing jurisdictions, so that city stormwater infrastructure connected to the infrastructure of multiple irrigation organizations. As urban development extended onto formerly irrigated areas, stormwater and irrigation infrastructure connections also expanded, with surface runoff from new pavement and rooftops draining into irrigation canals.

These water infrastructure linkages exist throughout Utah. The survey results indicate that irrigation canals are found within 95 percent of Utah municipalities with stormwater permits, and 79 percent of these cities use canals for stormwater conveyance. Additionally, irrigation groups use city curb-gutter infrastructure and storm drains to deliver irrigation water in 42 percent of stormwater-permitted cities. Overlapping infrastructure generated hard linkages between cities and irrigation groups. As urbanization expands impervious surface coverage, more points of connection between municipalities and irrigation groups are present.

Hydrological connections are also associated with urbanizing land use. The hydrological linkages between stormwater collection systems and irrigation canals change the flow and quality of water in irrigation canals. Canals were designed to carry less water as they move away from the irrigation water sources, while stormwater collection channels (including natural rivers) grow in size closer to the discharge location. Nearly half (46 percent) of the city representatives that responded to the stormwater manager survey noted the occurrence of a flood associated with a canal breakage or canal overflow within the last five years.

Social Connections

The social relationships between cities and irrigation companies were, as one city representative described them, “not always the best,” and often involved bickering between the two types of groups. Many organizational leaders reported having as little as possible to do with nearby cities or irrigation organizations as recent as two decades ago. Nonetheless, I found evidence of social connections between LWMOs, primarily in the

form of shared culture and politics, membership in regional organizations, and the professionalization of the water governance sector through consultation with the same engineering firms.

LWMOs in the study valleys, in general, shared cultural backgrounds and political orientations. Many of irrigation organization meetings included references to their heritage, accrediting "our forefathers" with the vision to establish water rights and develop the irrigation conveyance systems currently used. In one such meeting, awards were presented to irrigation group leaders in honor of their dedication to the irrigation group, much like that of the group's founder. In another example, one irrigation meeting consisted of a project update pertaining to an infrastructure upgrade that was occurring on their system. During the introduction of the private engineer, whose firm was hired to manage the upgrade, the irrigation group leader went out of his way to note that, "[First name of engineer] is from Cache Valley." This was "...a major reason why they [the irrigation group] went with [name of firm] as the project management team," as written in observation field notes. The shared history and sense of place within was one aspect in which the LWMOs had a social connection to other organizations.

Irrigators and municipal managers also shared culture-driven beliefs, primarily those of self-sufficiency and minimal governmental oversight. Some irrigation groups refused to apply for state-sponsored water infrastructure grants, even when that sacrificed their ability to make imperative infrastructure changes: "Rather than burden the taxpayer or the shareholder I will try to work within our own budget." In making these municipal representatives reflected such fiscal austerity in terms of municipal budgets for water infrastructure—both in terms of what they were willing to propose to city councils, and

what city councils had approved in the recent past. This sentiment of fiscal consciousness and responsibility was echoed during a municipal council debate over whether or not to pay off a state-issued bond with an extensive portion of the financial reserves. While one council member equated this situation to a politically conservative position, saying, "Don't borrow before you have the money to pay it back," the remaining council members, "…evoked claims on the importance of saving, preparedness, and having enough money to do what you have to do—all which resonated with the principles of household management…[and] a Mormon theme of saving and preparedness" (meeting notes).

Another observed social connection among LWMOs was professionalization. The professionalization social connection was manifested in three ways: extensive knowledge of other water managers in the region, consulting organizations (a type of boundary organization) that served to standardize water system designs and management plans and to facilitate information sharing on the types of practices and physical connections among organizations.

Municipal and irrigation group representatives were very familiar with one another, even if their water systems were not adjacent to one another, and if they were widely different water systems. In one example, a municipality that *did* share a boarder with another municipality indicated that they had little to do with one another's water management strategies. When I asked them how they work with one another, the manager replied, "we talk a lot, but we're not really helping each other." However, this manager went on to recite a water project that was happening in the other municipality's jurisdiction, and referred me to a number of other water managers (municipal and

irrigation) in the region. In the absence of both conflict and collaboration, the water managers of the region were very knowledgeable of one another.

Irrigation groups reported that they outsourced their water infrastructure upgrades and operational design on an increasingly regular basis. Many irrigation groups reported an interest in the pressurization of their irrigation systems as a way to minimize water losses and increase the productivity of water rights within the company. Most irrigation group leaders did not have special education in engineering sciences—they were agricultural producers who were involved in LWMOs to ensure their water rights and to serve their communities. As such, the irrigation company leaders did not have the necessary expertise to design, construct, and maintain a complex infrastructure system that met new efficiency interests. Therefore, many organizations in Cache Valley noted that they hired consultants to carry out the design, and to establish the operation protocol, for new irrigation systems. This was certainly the case in Heber Valley as well, where most irrigation systems were reconfigured and optimized by the same federal civil engineers up to three decades ago, when the Central Utah Project (CUP) was implemented. There, irrigators reported consulting with the CUP engineers on a regular basis regarding the timing and amount of their water flows. Sometimes, additional private consultants were used. In one example, the leader of a very small irrigation group mentioned a private engineering firm "that they've worked with a few times." The interview notes went on to say the following:

> - the main individual works well with the city and lives in the…irrigation district,
> - he helped them with a study on their pressure problem, and this is how they decided that nozzle replacement was the most feasible [inefficiency] fix

> - it was with this individual that [the irrigation group] also worked with the city to convert a water main (city supply) to an irrigation supply line; this too helped to pressurize their system.

Other types of boundary organizations also connected disparate LWMOs to one another. In Cache Valley, irrigation group representatives attend an annual meeting of the Northern Utah Water Users Association. Organized by the local conservation district and the Cache County municipalities (a similar meeting is convened at the state level), this meeting is attended primarily by irrigation groups operating in the region, with presentations ranging from late snowfall and snowmelt forecasts to discussions of water rights law adaptation, to a talk on water quality in tile-drained fields, to a presentation from the Utah State Engineer. During the 2014 meeting, an insurance company representative discussed the financial liabilities and risk of losing water rights that were associated with canal breaches: "If you are ever involved in one of these [canal breach] actions, the plaintiff's council will know exactly how valuable your water right is." My meeting notes indicate that, this representative went on to use, "…this as an incentive/leverage for the water companies to understand, in dollars, exactly the risks and values of these [insurance] protections." There are also examples of boundary organizations that facilitate information and social exchanges among municipalities such as the Utah Chapter of the American Public Works Association. The boundary organizations connect organizations within municipal and irrigation fields, and serves as entities through which coercive, normative, and mimetic forces may structure the opportunities for and acceptance of organizational collaborations.

The professionalization of local water systems management led to a diffusion of the norms and standards of the water engineering profession into LWMOs. Longstanding

engineering practices such as mapping systems were not embedded within irrigation group practices. In one example, a small irrigation group translated the user-based knowledge of their system into standard information formats. As summarized in my interview notes:

> - Throughout the interview, he had binders of maps, Google images, charts, diagrams, tables, and schedules of the irrigation system. He referred to these documents for many of the examples [that we discussed], but also noted repeatedly how this information, in the form that he had in his lap, did not exist prior to 4-5 years ago. Up to that point, the system was operated (daily) and managed (long-term) entirely by knowledgeable users who had [operated] the system for 50 years. [This irrigation group leader] stepped into this position and did not have that knowledge [of the entire system], nor was it conveyed to him. So, he has spent a lot of time over the last 2-3 years compiling the binders of information that he currently uses.
> - He noted that his friend and a [fellow] board member…were very instrumental in compiling this information. The board member is a retired hydrologist from Utah State University.

In this example, which can be supported by many others, the irrigation group translated the working knowledge of their system into maps, pressures, diagrams, and delivery schedules in accordance with the procedures used in the engineering profession, that were conveyed to the irrigation group by a retired engineer.

With the social connections noted above, and the extent of physical connections in the form of hydrologic flows, expanding jurisdictions, and shared water infrastructure, I turn to the second part of my research question: How do these connections bring about LWMO collaborations?

Collaborations Based on Physical Connections

I found extensive evidence of inter-organizational collaboration based on physical connections. A majority of the collaborations that were observed resembled Gray's

(1989) "negotiated settlements" type of inter-organizational partnership, and consisted of agreements that focused on immediate and specific problems. At the most basic form of organizational collaborations, LWMOs recognized their shared obligation to control infrastructure-related risks. Municipal public works officials reflected on contentious discussions with irrigation group leaders surrounding canal infrastructure maintenance, with the main point of disagreement focused upon financial obligations. Irrigation organizations argued that stormwater runoff generated on city streets made up a large portion of the water conveyed in their system, and thus city budgets should cover infrastructure maintenance costs. I noted during one irrigation representative interview that, "at times when there is a heavy spring rain, the [canal] would flood but there was no [irrigation] water flowing. The irrigators and city now have an agreement: if flooding occurs when there is water in the canal and if the canal overtops, then the city and the canal companies are culpable." The irrigation representative also noted that, "In the past, this extent of collaboration wouldn't have happened. If something bad happened, we'd turn around and point to them," meaning the city. In a different instance, municipal officials noted that in the absence of an agreement between the irrigation group and the city, "the canal company will often identify the problem, the city responds to this problem, and the parties negotiate on how to fix the infrastructure problem" (interview notes). One public works director attributed the absence of irrigation-municipal agreements to the notion that the irrigation groups resisted working with cities, "…because they are fearful of the city. They have this attitude that 'you're going to take our water and like it.' They're still upset about things that happened 20 years ago. I hear it every time I go out there, that 'this and this happened 20 years ago.'"

This form of conflict persisted until the mid 2000s, when a series of canal failures occurred in Utah. Those events triggered public awareness of water infrastructure safety, and encouraged organizations to assess their infrastructure for liabilities. One response to infrastructure liability awareness was that organizations initiated discussions with their connecting LWMOs. The purpose of these discussions was to clarify infrastructure maintenance arrangements and to assess shared infrastructure liabilities. City and irrigation group leaders expressed mutual concern about the risk of flood, injury, and property damage—a risk that they believed increased with the development of land proximate to canals. One irrigator noted, with a diagram of the canal system in hand, that there was a subdivision that was built not too long ago, and one of their lateral pipes flowed along the eastern edge of the development. The irrigation group decided to "fix" (meaning pipe) this lateral line to reduce their liability: "If that thing breached it would become a priority in a pretty big hurry. There would be basements and yards flooded." In other instances, development alongside canals was framed more as an inconvenience than a risk or liability. One irrigation representative showed me a photograph of residential backyards alongside the canal with fences that extended into the canal right of way, saying, "If I was [still] the president, I would have run my backhoe right through their properties to clean out the ditch." Both increased liabilities and increasingly limited access posed by canal-side developments suggest a lack of coordination between developers and city planners, and the irrigation groups that maintain rights of way. Both types of LWMOs faced lost credibility, financial penalties, and possibly criminal charges if irrigation infrastructure was not maintained, and led to a breach.

The coercive pressure of infrastructure liability encouraged collaborations. Inter-organizational infrastructure collaborations varied in the scope of the agreement and the extent to which agreements were formalized. Some agreements consisted of "handshakes," while more formal, signed documents outlined responsibilities and obligations. Some cities favored informal agreements and did not pursue written agreements because they believed the communication channels for basic system management were already in place: "The company reps and I have each others' cell phone numbers and if something goes wrong, I know the other will pick up." Other cities maintained "lower-level" agreements in which municipal public works staff and irrigation watermasters coordinated with one another, but did not involve formal assessments of responsibility.

An outcome of LWMO collaborations to reduce risk in the water system was the transfer of resources among organizations. Many cities reported collaborating with irrigation groups by way of labor or financial investments. Nearly half (49 percent) of the stormwater program coordinators surveyed indicated that their city helps to pay for irrigation canal maintenance, and 63 percent of cities contribute labor and equipment for canal maintenance.

The following LWMO collaboration illustrates a more complex inter-organizational arrangement based upon physical connections. According to accounts from both of the organizations within this collaboration, written arrangements between the LWMOs outlined infrastructure maintenance commitments. Key to these maintenance obligations was a springtime a fact-finding walk held each spring, when representatives of both organizations traverse canals together. The annual walk included the mapping of

new infrastructure, and identification of "trouble areas" in need of resources. Leaders reported that the spring walks have reduced tensions between the organizations. Overlapping infrastructure and jurisdictions created operational overlap such that these LWMOs to engage with one another. Liability was a coercive force in the development of inter-organizational social connections, while normalized procedures of inspection and mapping encouraged collaboration.

Collaborations Based on Soft Connections

The professionalization of local water systems has encouraged inter-organizational connections. Representatives from insurance and legal offices have spoken at annual meetings of irrigation groups to promote the formalization (or at least clarification) of infrastructure liabilities. With exposure to water system professionals, LWMOs standard engineering practices and risk minimization procedures incorporated into their infrastructure and operations. Reconfiguration of water infrastructure in many instances required that LWMOs communicate infrastructure changes to adjacent organizations.

There is also some evidence that mimetic forces encourage LWMOs to pursue infrastructure agreements with one other. A few LWMOs have experienced successes in developing more formal collaborations, and other LWMOs have followed suit. The survey findings support the widespread presence of agreements between city and irrigation LWMOs. Seventy percent of cities in which stormwater drains into irrigation infrastructure have informal agreements, while just over half (55 percent) of the same cities have formal agreements with their irrigation collaborators. The rates of formal and

informal agreements are higher where irrigation companies use city stormwater infrastructure to convey irrigation water, in which 82 percent of cities have informal agreements, and 75 percent of cities have formal agreements with one or more irrigation organization collaborators.

A collaborative LWMO arrangement from the Heber Valley illustrates how hard and soft connections can interact to lead to collaborative water governance. The early 1990s were full of conflict for a small city and the only irrigation group in the town. Land sales occurred rapidly and without assurance that there were adequate water rights to satisfy needs. The irrigation organization feared takeover from the city and loss of water for agriculture. The two organizations challenged each other's water rights claims in court, "until we were spending more on attorney's fees than on keeping water in our system," according to the irrigation group president.

A tipping point in the "constant push and shove" between the two organizations was the municipality's application to the Utah State Engineer to attain one-half of an existing water right to a nearby spring, held in full by the irrigation group. Before this claim was decided, the organizations recognized this conflict and created a formal water advisory committee to review all water rights transfers within their jurisdictions. The committee, which has been in place since 1995, is a board of three representatives from each organization, including the president of the irrigation company and the mayor of the city. The committee reviews all proposed development projects and assesses water rights claims during monthly meetings. As noted by a committee member, "we serve the same people and get our water from the same sources, so we should work with one another."

The shared geographic location of the irrigation group and municipality was, prior to 1995, a characteristic of fragmented water governance. The fragmentation was transformed such that the geographic overlap became a linkage between the two groups. In turn, the organizations built upon their social connections (their clientele, embedded within which are cultural and political similarities) to formalize the collaboration. The city-irrigation company partnership now represents an institutionalized process through which the organizations may take a more integrated governance approach.

Since the Heber Valley LWMO collaboration has taken hold, formal collaborative management has become more commonplace, which may be due in part to the success of the early collaboration. More recent LWMO collaborations mimic the integrated municipal-irrigation format. For example, Wasatch County recently developed a countywide water advisory committee in the image of the municipal-scale collaboration noted above. Cities and irrigation groups also acknowledged a stronger presence of municipalities on irrigation organizations' boards of directors. Shared governance arrangements were detected at the statewide scale. Over one-third (38 percent) of the municipal stormwater programs that use irrigation infrastructure to convey stormwater participate in collaborative advisory groups with irrigation organizations.

Discussion and Conclusions

A third organizational field is emerging in local water governance, one in which irrigation and municipal fields overlap and share duties and decisions surrounding local water management and governance. My findings suggest there is a two-step process through which LWMOs become interconnected and may potentially develop

collaborative arrangements. Physical infrastructure, land use, and hydrological connections are the ties that bind northern Utah's LWMOs to one another. These physical connections are the outcome of the built water system and patterns of landscape development that began with pioneer settlement. Physical connections are also expanding in number and in scope with urbanization. Within the past two decades, issues of liability have come to the foreground, and social mechanisms, such as the coercive responsibility for water infrastructure and public safety, have forced LWMOs to recognize and, to various extents, act upon their physical connections.

What encouraged some LWMOs to move beyond the most basic inter-organizational connection and form collaborations? My findings suggest that the conditions that encourage LWMO collaborations include a mixture of social and physical mechanisms. In many instances, organizations looked to one another to share risk and to reduce financial burdens. In these shared governance activities, coordination became routinized, and organizational actors developed relationships with one another. Normative forces such as professional engineering consultations and affiliations with boundary organizations expanded the idea that collaboration was a valid method for addressing water management situations. Sometimes, engineering firms consulted for multiple LWMOs, and as such the private firms transmitted information sharing and coordination between groups. In observing the benefits of LWMO collaborations, other organizations that perhaps were not the earliest adopters of collaborative strategies (but still had connections to other organizations) mimicked collaborative behaviors.

LWMO collaborations offer an alternative to fragmented water governance, yet there may be limitations to collaborative arrangements. The collaborations examined

herein exist between municipal and irrigation organizations, and do not regularly incorporate interests that are outside of those groups. There is therefore potential for powerful actors within organizations to dominate collaborative decision-making pressures, perhaps without public knowledge or input. LWMO collaborations are also very focused on maximizing water availability to serve organizational purposes, and do not necessarily seek input from other groups that might want to access water for other purposes or to pursue other goals. One example may be local environmental groups that wish to protect ecosystems that are supported by irrigation return flows. Future research should further document the ways in which voices from outside of collaborating organizations are (or are not) represented within co-management arrangements.

Unlike collaborative river-basin arrangements in which top-down, formalized processes encourage inter-organizational collaboration, or watershed organizations that bring together disparate conservation interests within a catchment, collaborative efforts among LWMOs in northern Utah have emerged organically over time, and with persistence. The difficult tensions between irrigation groups and small cities have not entirely disappeared, but leaders from both types of organizations recognize that working together in some fashion is more commonplace than it was even a decade ago. A critical outcome of even the most basic LWMO connections is a framework for communication and trust building. In the words of one public works director, "A year later, they [irrigation organizations] see the partnership and understand that the city is going to help with new things—that the city will bring money to show their responsibility." With shared obligations and formalized communication, these organizations established the groundwork for future collaborations.

My research sheds light upon the types of LWMOs that routinely structure the quality and quantity of water across the northern Utah landscape. Water management in northern Utah remains fragmented; however, I found substantial evidence that LWMOs are increasingly interconnected with one another. Their infrastructure linkages are the basic physical connections among LWMOs, which are socially drawn together through coercive incentives, and normative processes of professionalization. Most LWMO collaborations were initiated among the participating organizations, in the absence of top-down requirements or watershed-scale groups. I encourage researchers to further consider the process of water management and governance at the local scale. How do these organizations engage with one another under conditions of water scarcity? How do they collaborate on topics not related to water resources or water quality? Further information on collaborative decision-making processes will illuminate the ways in which organizations are moving water across the landscape, and could reveal potential opportunities for improving water sustainability. Perhaps with more knowledge of and attention to these local decision-makers, a more accurate and comprehensive depiction of the western water system may be achieved.

My findings are of course limited to one case study within northern Utah, and broader patterns of collaboration throughout the state. However, given similar settlement patterns, histories of irrigation, and widespread urbanization, similar LWMO linkages could be expected elsewhere in the Intermountain West. I encourage future research on local water governance in the western U.S. LWMOs control a majority of the water in this region, and shape the access and availability of water on the landscape. Additional research may assess the effectiveness of LWMO collaborations, and identify the types of

interests represented within these partnerships. For water sustainability goals to be achieved, it is time to integrate the context of local water governance within a broader understanding of western water policy.

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CHAPTER III

ORGANIZATIONAL ADAPTATION: BRIDGING RESILIENCE AND SOCIOLOGICAL APPROACHES

Introduction

Resilience thinking (Carpenter and Gunderson 2001; Gunderson and Holling 2002; Gunderson, Holling, and Light 1995; Holling 1973) has emerged as a popular set of concepts used to understand change in coupled social-ecological systems[2] (Angelstam et al. 2013; Folke et al. 2005; Liu et al. 2007). Resilience thinking originated in the field of mathematical ecology, which was developed to model ecological system change. Resilience thinking aims to understand how social-ecological systems can withstand or cope with major environmental stressors or shocks, and how social-ecological components within the system adapt to maintain their ongoing functions and character (Gunderson and Holing 2002). Many scholars have extended these ecological concepts into analyses of changes in social systems. Resilience scholars that study institutions define resilience as the "capacity to deal with stress through adjustments that stop short of a transformative change" (Young 2010: 379). Resilience theorists critique existing social science theories of institutions and organizations for ignoring the role of natural

[2] The term "social-ecological system" is routinely used in the resilience literature, but is difficult to find a concrete definition behind this term. I therefore consider the "social-ecological system" along the same lines as a "coupled human-natural system" in which the interconnections between social and environmental actors or conditions are embraced, modeled, and theorized at many scales. Many of the authors of the foundational *Science* paper (cited above) on coupled human-natural systems are the primary authors of resilience-based writings. While the term "social-ecological system" has been given much attention in the environmental sciences and resilience literatures (cited above), it is not my intention to revisit that debate here. Rather, I specify the type(s) of environment(s) to which I am referring to throughout this chapter.

environmental conditions (e.g. the quality, quantity, and relationships among biophysical dimensions) in social change, and for "…not attend[ing] to the processes that control and maintain these institutions dynamically, the kind of dynamic causation that is present in economics and ecology" (Gunderson and Holling 2002:9-10). Therefore, resilience approaches to understanding coupled social-ecological change have not been quick to draw upon the tradition of social science theory and research developed in isolation from the environmental sciences.

Resilience-based approaches to understand social-ecological change offer some utility. Resilience thinking privileges the interconnections between social and ecological components of the social-ecological system—connections that are often neglected in the social sciences, even those that focus on human-environment relationships (Buttel 2002; Catton and Dunlap 1978). Davidson (2010) notes that one strength of resilience thinking is that it encourages scholars to consider dynamics and causal mechanisms of social-ecological change, rather than focusing on principles of equilibrium and sustainability that were popular paradigms of the recent past.

A growing number of social scientists have critiqued the ways in which resilience thinking treats the social within the social-ecological system. Human agency within resilience approaches is "woefully insufficient" in that humans, unlike the ecological entities that the body of resilience thinking was originally modeled after, have the abilities to make decisions and pursue activities in ways that ecological entities cannot (Davidson 2010:1145). Hatt (2012) asserts that resilience thinking's extension of ecological processes into social relationships is highly functionalist, and overlooks the important tensions existing in society that encourage adaptation. Matthews and

Sydneysmith (2010) argue that resilience approaches have focused on the conditions that determine adaptive capacities and have not adequately developed an understanding of the dynamics of adaptation processes.

These critiques and others point to the need for more integration of social science theory with resilience approaches (Brown 2014; Cote and Nightingale 2012; Davidson 2010; Hatt 2012; Shwom 2009). The purpose of this paper is to develop a bridge between resilience theories of organization adaptation and two sociological concepts that address organizational behavior and change. In this paper, I ask, in what ways can sociological theories inform resilience approaches? To address this question, I draw on Weber's notion of organizational rationality to better understand the relationship between the organization and bureaucracy.[3] I illustrate how organization rationalities may be a mechanism to overcome barriers to adaptation, as these barriers are posed in resilience thinking. I then turn to organizational ecology, a body of theory from new institutional analysis (i.e. neoinstititionalism) that offers theoretical and empirical support for the ways in which organizational adaptations are shaped by their connections to a broader "organizational field." To illustrate the relevance of these concepts, I explore the case of municipal stormwater program adaptation in Utah, United States.

Adaptation and Resilience Thinking

Resilience thinkers identify adaptation as the primary path to remaining resilient against major, detrimental transformations of the coupled social-ecological system.

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[3] To Weber, the term "bureaucracy" refers to the mode of operation that emphasizes formally rational procedures. The term "bureaucracy" can also mean the laws, policies, and regulations that form an overarching complex of governmental and corporate actors. Both dimensions are discussed further below.

Adaptations are a "process, action, or outcome in a system…in order for the system to better cope with, manage or adjust to some changing condition, stress, hazard, risk, or opportunity" (Smit and Wandel 2006:282). Thus, adaptations are major or minor adjustments made in response to changes within the (predominantly) natural environment.

Resilience thinkers often argue that social actors possess greater or lesser amounts of adaptive capacity. Adaptive capacity has been defined as the ability of a bounded social unit to change such that the social unit can persist in the face of major changes (Adger 2006). Matthews and Syndeysmith (2010) argue that this definition is tautological since "capacity" is thought to exist simply because the organization has survived. They offer an alternative definition that considers adaptive capacity to be "the ability of a local area to respond to…challenges" (Matthews and Syndeysmith 2010:10). Adaptive capacity is highly structured by conditions within the social-ecological system, and often operates outside the control of individual social actors (Walker et al. 2006). The conditions that structure adaptive capacity may be found at the local or regional scales and fluctuate over time. A universal list of conditions that enhance adaptive capacity remains elusive (Matthews and Syndeysmith 2010; see Ford and King (2013) for a list of adaptive "readiness factors"), leading resilience thinkers to conclude that adaptive capacity is usually context dependent (Smit and Wandel 2006). As conditions within the social-ecological system interact across space and time, they are thought to shape adaptive capacity.

Institutional contexts are increasingly considered to be key determinants of an organization's adaptive capacity and the patterns of adaptation that one might expect to

see (Adger et al. 2009; Matthews and Syndeysmith 2010). Institutional contexts reflect the habits, norms, and routine dimensions of society, and also the formal rules that allocate property rights and distribute power to certain actors. Organizations are often key actors that both define and are shaped by institutions. According to Matthews and Sydneysmith (2010), "Organizations are the social entities that are created to accomplish tasks. Institutions are the cultural norms, values, and accepted practices that govern how behaviours in and between these organizations take place" (14). In establishing the constraints through which organizations, communities, or individual actors respond to new conditions, institutions impart upon organizations different amounts of adaptive capacity (Dietz, Ostrom, and Stern 2003; Matthews and Sydneysmith 2010).

Adaptive capacity has received much attention within resilience thinking and research. There have been many efforts to understand the conditions that encourage and constrain adaptive capacity (Bettini, Brown, and de Haan 2015; Engle 2011; Hill and Engle 2013; Smit and Wandel 2006; Yohe and Tol 2002). There has been so much focus upon adaptive capacity that some argue that the many studies of adaptive capacity have distracted from theoretical advances to understanding the adaptation processes (Engle 2011; Matthews and Syndeysmith 2010). Juhola and Kruse (2013) argue for more research on the processes through which social actors convert adaptive capacity into adaptive actions.

From the resilience approach, bureaucracies (as political institutions that reflect laws, policies, and the enforcement thereof) are usually seen as major barriers to adaptation. The foundation of this thinking is based on the work of North (1994), who considered the ways in which institutions (as norms, values, or the "rules of the game")

and organizations (as the "players" of the game) have historically restricted innovation (360). The resilience approach takes the perspective that the bureaucracy as a political set of rules and policies structures the relationship between the organization and adaptation, a relationship most evident within the resilience model of a prototypical adaptive cycle. The adaptive cycle was theorized to apply both to social actors (e.g., communities, organizations) as well as ecological components (e.g., ecosystems, organisms). In describing the adaptive cycle below, I draw upon the resilience-based writings that focus on organizations and their adaptive capacities within the cycle.

The adaptive cycle consists of four phases over which organizations evolve along a very predictable process of adaptation, resistance to adaptation, transformation, and reorganization. The greatest shift in organizational adaptive capacity (and thus the focus of my writing here) is found within the two phases of the "front loop" of the adaptive cycle (Gunderson and Holling 2002). The first phase of the front loop is the exploitation phase, in which there may be many loosely connected organizations that are competing with one another for resources. At this point in the cycle, organizations adapt their activities to gain more resources or improve their position within a relatively settled socio-environmental context. Most of resilience thinking surrounding organizational adaptation focuses upon environmental management organizations, which are thought to be tightly coupled to the ecosystems that they are tasked to manage. With their close observation of and connection to the natural environment, organizations at this state are theorized to respond to shifts in the environmental conditions that help to maintain quality and function. It is at this stage of the adaptive cycle when organizations are

thought to develop, implement, and adapt effective environmental management strategies (Gunderson et al. 1995).

As organizations (those focused on environmental management or otherwise) succeed and progress along the adaptive cycle, they formalize the processes through which they acquire resources. Policies, norms, and complex organizations are established, and connections among organizations grow to form more complex arrangements. At this point in the adaptive cycle, organizational attention shifts from competition over resources (as the acquisition of most resources has already been achieved), to increased administrative efficiency. Concerns about organization efficiency intensify and bring organizations to a point on the adaptive cycle when they have "tendencies" to "…become bureaucratized, rigid, and internally focused, losing sight of the world outside of the organization" (Gunderson and Holling 2002:44). Only with deliberate action originating from key managerial actors within the organization is myopia avoided. Yet once in place, the political bureaucracy (again, meaning the regulations, policies, and agencies in place to administer environmental management objectives) is unable to "reinvent itself…because of a lack of external competitors" and because it is interested in self-preservation (Gunderson and Holling 2002:59; Gunderson et al. 1995). Consumed with the political requirements imposed upon them, organizations may become unresponsive to or disconnected from the natural environments they are tasked to manage.

As we can see from the above description of the organizational adaptive cycle, organizations have rather limited adaptive capacity once they are embedded within the complexities of bureaucratic governance arrangements. Adaptive capacity is restricted to organizational efforts to amend or comply with the policies or procedures that govern the

organization. The primary focus of the organization at the conservation phase is the political bureaucracy, not the social-ecological system in which is positioned. As such, environmental management organizations are thought to be pulled away from the natural environments that they are tasked to manage, leaving the external social-ecological system vulnerable to shock or transformation. Within this framework, resilience thinking does not typically account for any contextual factors or pressures that could encourage organizational adaptation to external changes (outside of those mandated by the political bureaucracy); rather, it focuses on the limitations to adaptation.

It should be noted that there is an apparent contradiction within the resilience thinking's treatment of organizational adaptive capacity surrounding multi-level governance. In the 2000s, Elinor Ostrom and colleagues[4] promoted multi-level, layered, and complex institutions as a way to enhance adaptive management, particularly regarding common pool resources (e.g. water, forests) (Dietz et al. 2003; Ostrom 2008; Ostrom and Janssen 2005). With examples from south Pacific irrigation systems and many others from the developing world, Ostrom and Janssen (2005) note that the most resilient systems are those in which there are polycentric governance structures, which allow for local actors to incorporate their knowledge and closeness to a social-ecological system alongside upper-level governmental protections and property rights. The authors also cited research comparing municipal sub-organizations (much like stormwater programs) with municipal divisions that were part of a larger, monolithic agency, concluding that "metropolitan areas characterized by large, medium and small public and

[4] Ostrom published many papers with key leaders of the Resilience Alliance and in resilience-focused publications, but did not hold a position in the organization.

private agencies with considerable autonomy but which also face incentives to seek out opportunities for complementary efforts tend to outperform metropolitan areas served by a few large-scale units" (citations omitted) (Ostrom and Janssen 2005:255).

In the above example and in other publications, Ostrom argues for the presence of multiple layers of government, an arrangement not unlike a political bureaucracy, or the stormwater governance policies in place in the United States. Rather than one, large, top-down, policy-making agency (like the "large-scale units" noted above), a bureaucratic institutional form would rationally lead to the specialization of departments and sub-organizations within the agency. Such specialization, and connections to local social-ecological conditions, with the protections from upper-level laws and regulations, could enhance adaptive capacity (Dietz et al. 2003).

The adaptive cycle of resilience thinking provides a relatively limited set of conceptual tools for understanding how organizations that are embedded within bureaucratic governance arrangements take on adaptations. However, there is evidence that organizations do adapt to changes in the social-ecological system, even in the contexts of complex organizational arrangements (Boons 2013; Busch 2011). It should also be noted that top-down policies, despite being heavily criticized, have led to extensive improvements in environmental quality. The Endangered Species Act and the Clean Air Acts, while not without flaws, have brought forth extensive protections for wildlife, habitats, and air qualities that were most likely not attainable without nation-wide regulation. Therefore, in practical terms, top-down environmental policies do not necessarily inhibit environmental improvements, or hinder the ability of organizations to govern the natural environment. Therefore the question remains, what are the

mechanisms or processes by which organizations positioned within political, environmental management bureaucracies adapt to changes in their social-ecological environments? To develop resilience thinking so that it may address this question, I first describe the case of adaptation in municipal stormwater programs. I then turn to sociological theories of organization rationality and change.

Adaptation in Municipal Stormwater Programs

The case of local stormwater governance is ideal for exploring the relationships between adaptation, organizations, and bureaucracy. First, municipal stormwater programs in the U.S. operate within highly bureaucratic and relatively stable governance arrangements involving state and federal stormwater regulations. Most state governments have the authority to develop, implement, and enforce their own stormwater discharge permits, as long as they are consistent with the policies and procedures specified in federal stormwater standards. One of these required activities is the development of an approved stormwater management program (SWMP), the guiding document that outlines municipalities' program activities, objectives, measurable goals, and the ways the municipality will address federal requirements to monitor industrial stormwater discharges, inspect construction sites, and carry out public education activities.

Another reason that makes municipal stormwater programs ideal for studying adaptation is that state and federal regulations expect municipalities to regularly change their SWMPs in response to information on local social and natural conditions. EPA guidance documents emphasize that SWMP development, implementation, evaluation, and revision should occur on a regular, iterative basis to ensure programs' progress

towards achieving their goals (U.S. EPA 2008). The exact timing of SWMP adaptations is not specified in stormwater policies; however, the most current SWMP documents must reflect ongoing activities and goals. Therefore, it can be expected that municipalities would make changes to their SWMP documents on a fairly regular basis, and these changes can be a mechanism through which detailed activities of the municipality in stormwater management are reflected. The expectation that municipalities will adapt SWMPs is useful in the consideration of organization adaptation processes in that it provides reasonable confidence that adaptations to SWMPs are occurring to some extent.

The third reason that municipal stormwater programs are an intriguing case is that they have many connections to other organizations engaged in stormwater governance (please see Chapter II). These connections among organizations reflect multiple dimensions of the social-ecological system: regulatory connections to higher levels of government, hydrologic connections that link municipalities as stormwater flows across the urban landscape, and formal and informal collaborations among similar municipal organizations that facilitate coordination of a wide range of their activities, including public education, communication with state regulators, and to a lesser extent, compliance with state government requirements. In this way, these local organizations are connected to one another in an "organizational field" (DiMaggio and Powell 1983, described further below).

Sociological theory provides concepts that are helpful in understanding how organizational connections to the political bureaucracy and to the organizational field shape the process of change in individual organizations. Unlike resilience theory,

sociological theories acknowledge the role of social and institutional structures, in addition to the political bureaucracy, as enabling or constraining organizational behaviors. Sociological approaches also recognize that organizations have "agency" (or the ability to pursue their own goals) within the constraints set by institutional contexts. In overlooking organizational agency, the adaptive cycle and resilience thinking omits key social processes through which organizations may respond to social-ecological pressures (Davidson 2010). With resilience approaches in mind, in the following section I explore the ways in which social theories may help explain organization adaptation within highly bureaucratic contexts.

Bureaucracy, Rationality, and Organizational Adaptation

Max Weber noted about 100 years ago that a characteristic of modern industrial society is the rise of bureaucratic forms of decision-making (Weber 1978). Weber considered bureaucracy to be a mode of operation, used in both the public and private sectors, which emphasized calculation and efficiency. For Weber, organizations are the components of bureaucracies, either as formal subsections of the mega-organization or as independent entities working within the larger political or economic system. The bureaucracy as a mode of operation, and the organizations that function as efficient entities within the larger social system, are highly intertwined: "The development of modern forms of organization in *all* fields is nothing less than identical with the development and continual spread of bureaucratic administration…The whole pattern of everyday life is cut to fit this framework" (1978:223; emphasis in original). The bureaucracy is a dominant mode of social organization within modern society.

Contemporary use of the term "rational" reflects Weberian notions of efficiency and calculation. When someone is rational, he or she considers the options at hand, and pursues the path that will lead to attaining a goal with the fewest obstacles. In other words, one is rational when there is an efficient means to attain the ends. In contrast, someone may be irrational by modern standards when he or she is consumed by emotions, "follows their gut," or does not pursue a logical course of action. Such emotion-driven responses are often linked to values or attitudes, and may seem uncalculated, or inefficient.

From the Weberian approach, organizations are usually viewed as rational actors, seeking to accomplish mutually agreed upon goals, or the missions of overarching political bureaucracies, which form and administer rules and policies. Weber strongly associated the organization with an expression of the modern imperative to behave and organize for rational purposes: "If bureaucratic administration is, other things being equal, always the most [formal] rational type from a technical point of view, the needs of mass administration make it today completely indispensible" (1978:223). Here, the "bureaucratic administration" that Weber refers to is an entrenched form of social organization that is difficult to change, or even be apart from. Thus, organizations (and individuals) are locked into the "iron cage of bureaucracy," in which rational forms of organization and action are privileged. He goes on to note "bureaucracy is *the* means of transforming social action into rationally organized action" (1978:987).

Rationalities, in general, guide the ways in which individuals and organizations make decisions, set goals, and take actions. Weber identified two distinct types of rationalities that broadly guide decision-making across many dimensions of society

(including public and private organizations): substantive and formal (Weber 1978). Formal rationalities represent a commitment to formal processes that are designed to help organizations efficiently achieve their missions. Formal rationality prioritizes the "means" through which organizations go about their work, with the rationality representing "…the degree to which the provision for needs, which is essential to every rational economy, is capable of being expressed in numerical, calculable terms, and is so expressed" (1978:85). Formal rationality may represent more than economic or financial dimensions of the "means," so long as the process is emphasized and carried out with calculation. Formal rationalities are embedded within bureaucratic forms of operation. With respect to stormwater management, for example, formally rational behaviors are evident in the development and implementation of a complex suite of plans and policies such as inspection protocols, ordinances, management plans, and audits required under water quality policy.

Substantive rationality reflects a mode of decision-making that is guided more by "ends," or the outcomes of organizational actions. Substantive rationality tends to be guided by social values that help define what things or outcomes are considered "good" or acceptable. Weber characterized substantive rationality as:

> …full of ambiguities. It conveys only one element common to all 'substantive' analyses: namely, that they do not restrict themselves to note the purely formal and (relatively) unambiguous fact that action is based on 'goal-oriented' rational calculation with the technically most adequate available methods, but apply ethical, political, utilitarian, hedonistic, feudal…egalitarian, or whatever *demands*, and measure the results of the economic action…against these scales of 'value rationality' or '*substantive* goal rationality.' (1978:85-6)

Substantive rationalities, in Weber's eyes were complex and reflected the "value spheres" held within the public (and within organizations). The ambiguous note of substantive rationalities made them, for Weber, less predictable or weaker than the dominant formal rationality. Substantive rationalities may or may not be aligned with formal rationalities.

Formally rational procedures originally adopted to achieve substantively rational outcomes can become so engrained within the organization that the formally rational procedures themselves can develop into a new set of substantive goals (Espeland 1998). Returning to the stormwater organization example, municipal programs are required to educate the public on the ways to reduce stormwater pollution. Municipal programs may embark on this requirement with a substantive emphasis on improving water quality, and a formally rational emphasis on public education as the means to water quality improvement. Yet as time passes, the organization may develop a substantively rational drive to simply conduct public education as an "end" in itself. As such, formally rational water quality means are transformed into the substantively rational ends where, in this example, water quality education is done simply for the sake of fulfilling requirements.

The Weberian concepts of formal and substantive rationality are well suited to inform resilience-based concepts of adaptation and bureaucracy. First, organizational change in the adaptive cycle is already attentive to the concept of formal rationality, albeit not always by name. Organizations in the conservation phase of the adaptive cycle are seen as tied to a political bureaucracy where formally rational procedures become the substantive focus of the organization. Second, both resilience and organization rationality approaches acknowledge that organizational rationalities can be malleable. For resilience

thinking, organizations are thought to be substantively rational in the exploitation phase, when they are taking on responsibilities and developing their modes of operation to manage the natural environment. It is in the conservation phase when organizational rationalities shift from substantive notions of (predominantly natural) environmental quality to focus on formally rational processes of meeting policy requirements. Here again, this shift in organizational rationality represents a change from substantively guided outcomes unrelated to organizational procedure, towards the formally rational procedures becoming the substantive endpoint. From this standpoint, the change in rational focus is unidirectional, with rationality changing rather strictly from substantive and outcome-based orientations of into a more rigid and process-driven form that emphasizes the completion of required activities.

Organizational rationalities, as considered within the sociological approach, diverge from resilience thinking's when considering changes in rationality. From the sociological approach, rationalities can be fluid, and there are not fixed paths or phases in which rationalities change or progress. Espeland (1998) examined Weberian notions of rationality (which emphasize bureaucratization and spread of formal rationality into all facets of life) with her analysis of the rise of substantive values within a "new guard" of employees in the Bureau of Reclamation. There, a young cohort of employees seemed to be driven by substantive values that included idealistic notions of representing public interests within the agency's decisions, and compensating certain groups in the public for their losses associated with dam construction. These substantive values clashed with the formally rational focus of the "old guard," long-time bureaucrats who focused on engineering efficient dams to increase water availability for human uses in the Western

U.S. Espeland's work demonstrated that the "old guard," which was thought to be driven by a formally rational quest for efficient water development, strongly identified with and had substantive attachments to constructing dams. Despite the appearance that dam construction was efficient, objective, and process-oriented, the "old guard" valued the dams as achievements in and of themselves. Simultaneously, the "new guard" sought to formalize new procedures to bring public voices and compensation into the agency's dam construction and decision-making process. Within those efforts, the substantive rationalities of the new guard became (with some contestation) formally rational procedures.

Espeland advanced Weberian rationality in two important ways. First, she highlighted the importance of substantive values in organizational decisions, actions, and change. She notes that Weber was pessimistic about the ways in which contrasting rationalities could be reconciled, as he often emphasized (as evident with the "iron cage" label) that formal rationalities would dominate and pervade society. In contrast, Espeland's work demonstrates that there is a place for the substantive within the political bureaucracy, and that these substantive rationalities are not always less powerful than formally rational interests. Second, her work advances Weber's conceptualization of rationality in that substantive and formal rationalities can conflict with one another. She sees that this conflict, and the co-existence of contrasting rationalities when the conflict is not completely resolved, "…might offer solace to those who fear the "irresistible force" of the iron cage," meaning that substantive values can contest and even withstand the widespread force of formal rationality (1998:250). In sociological theory, particular forms of rationality do not necessarily always improve or frustrate adaptive capacity.

Rather, the co-existence of and potential conflict between substantive and formal rationalities can be an engine of organizational change.

Sociological approaches to organization rationalities and resilience-based conceptualizations of rationality may be considered alongside each other. Under resilience thinking, organization rationalities change with progression along the adaptive cycle, particularly the extent to which formal rationalities are emphasized within the later stages of the conservation phase. Substantive rationalities are present in the early stages of the exploitation phase, as environmental management organizations at that time are charged with caring for the natural environment (purportedly out of concern for maintaining its quality). As formal rationalities gain prominence at the conservation stage, subrationalities tend to dissipate. Therefore under resilience thinking, we would expect that stormwater organizations operating within the water quality governance framework would exhibit more intense formal rationalities, and would take on adaptations most connected to regulations and less so to the state of the natural environment. In contrast, sociological theories of rationality would suggest that adaptations could occur within any arrangement of substantive or formal rationalities, and that both forms of rationalities could be present within the same organization at the same time.

Resilience theory argues that individual environmental management organizations are constrained by their larger political bureaucracy. Bureaucratic forms of organization are not the only connections organizations experience within a coupled social-ecological environment. In particular, their relationships with other similar organizations can play an equally important role in shaping organizational behavior. Organizational ecology

provides a theoretically and empirically rich set of concepts that help to illuminate the ways in which organizational connections to one another may shape adaptation.

Organizational Ecology: Organizational Motivations and Mechanisms for Adaptation

Organizational ecology is a sub-branch of neoinstitutional theory. Neoinstitutional theorists focus on the "environmental" conditions that structure organizational actions, with the "environment" usually conceptualize as the social systems within which organizations operate. Modern organizations are highly responsive to social environmental conditions such as non-economic values and societal expectations, which are constantly fluctuating (Scott 2007). For neoinstitutionalists, the "environment" is the context in which organizations are positioned with one another, and in which organizational changes are shaped with their rational search for legitimacy, or their validation of the appropriateness of actions, values, or forms, based upon ever-changing social norms (Meyer and Rowan 1977).

In a foundational paper of organizational ecology, DiMaggio and Powell (1983) argued that organizations adapt their forms, functions, and goals based upon their relationship to other organizations. They argue that organizations respond to changes occurring within their "organizational fields," defined as "a recognized area of institutional life: key suppliers, resource and product consumers, regulatory agencies, and other organizations that produce similar services or products" (DiMaggio and Powell 1983:148). Organizations within the same field are positioned within the same social network and they share similar places within the broader arrangement of organizations. Organizational fields include rather fixed relationships such as power dynamics among

organizations, and the organizations within the same field are very much aware of one another and routinely exchange information (DiMaggio 1982).

With the concept of the organizational field and its relationship to bureaucratic modes of operation, DiMaggio and Powell expanded upon Weberian explanations for rationality to explain the stages and processes through which organizations have come to generally resemble one another—a process they refer to as "institutional isomorphism." DiMaggio and Powell argued that there has been a transition in the ways in which bureaucracy and rationalization shape organizations. In the early stages of bureaucratization (around the time of Weber's writings) organizations adapted to be more formally rational out of the drive to improve their competitiveness in the economic market. Improvements in technical efficiency and the minimization of costs encouraged organizations to take on similar forms and functions that were consistent with the rational goals of bureaucracy (Weber 1978). DiMaggio and Powell argued that modern society has reached a new stage, one in which corporations and the state have been completely bureaucratized, and there are fewer efficiencies to be gained from these organizational forms alone. Therefore, to gain efficiencies within the contemporary modes of operation, governments and professional organizations have emerged as the main areas in which rationality is expressed and pursued.

DiMaggio and Powell illustrate this process within an organizational "life cycle," in which "organizational fields display considerable diversity in approach and form. Once a field becomes established, however, there is inexorable push towards homogenization" (1983:148). Early on in their organizational life cycle, organizations may adopt certain innovations to improve economic competitiveness (a reflection of the bureaucratic engine

of Weber's time). However, certain adaptations or innovations may take on a purpose such that the innovations become expected or normal, and thus have a social value that extends beyond economic advantage. The forces that drive organizations to take on changes have (according to DiMaggio and Powell) expanded beyond bureaucratic-driven rationalities that were emphasized in the early phases of bureaucratic operation, to also include values, norms, and processes that substantiate, or provide legitimacy to organizations. Similar to economic resources, DiMaggio and Powell theorized that there are limits to political (i.e., for power within the state and decisions) and institutional (i.e., cultural and normative) legitimacy. Thus, organizations come to compete against one another within their organizational fields for legitimacy, just as they would compete for economic resources. Within DiMaggio and Powell's organizational life cycle, organizational fields transition from diverse, efficiency-driven forms to more homogenous organizations that are responsive to the ways in which their actions and characteristics align with the social and political interests of other organizations in the field. The competition among organizations for legitimacy encourages them to change in response to shifts within their organizational field: "Organizations in a structured field, to paraphrase Schelling (1978:14), respond to an environment that consists of other organizations responding to their environment, which consists of organizations responding to an environment of organizations' responses" (DiMaggio and Powell 1983:149).

Several decades of research has shown that organizations adapt their forms, values, and behaviors in response to changes that occur within their organizational field (see Heugens and Lander 2009 for a review). While these changes are not described

using the term "adaptation," the changes are in response to shifts that have occurred in the organizations' social environments. With recognition of the shift, organizations are encouraged to "model" themselves after other organizations in their field. There are three distinct and powerful mechanisms that guide how organizations respond to changes occurring in the organizational field: mimetic, normative, and coercive (DiMaggio and Powell 1983). Mimetic forces are at play when organizations make adaptations that emulate those of influential reference organizations. Mimetic forces are particularly prevalent in situations of rapid change, or where organizations must respond quickly with little opportunity for careful consideration of potential adaptive paths. In such situations, mimicking the forms and behaviors of organizations that appear to be legitimate and successful can be a simpler and less costly way to adapt. Mimicry often takes place without formal recognition that it is occurring (Budros 2004; DiMaggio and Powell 1983; Oliver 1997). In some instances, organizations mimic the behaviors of other organizations at their own expense. For example, businesses may expand to locations where their competition exists, even when the expansion isn't profitable (Barreto and Baden-Fuller 2006). Within the example of municipal stormwater programs, organizations may mimic the program activities implemented by more experienced organizations, or those whose work has been held up as exemplary in professional or public settings.

Normative mechanisms of organizational adaptation highlight the role of professional values, practices, and conventions that are recognized (explicitly or implicitly) as standard and appropriate modes of operation. Selznick (1996; 1948) described mechanisms of normative pressure as inter-organizational arrangements

through which norms of professionally recommended behaviors structure and formalize particular types of practices. Professions have lead to the rise of institutional isomorphism through extensive overlap in membership to professional societies (e.g., the American Public Works Association), and training in similar degree programs, even at the same universities. Professional practices may be routinized in formal and informal operational procedures, and thus take on a normative character (Barley and Tolbert 1997). An example of an organizational adaptive response to attain normative legitimacy was the widespread formation of "environmental compliance" units within chemical manufacturing firms as they became a standard industry practice (Hoffman 1999). Creating designated stormwater units within municipal public utilities is a similar adaptation that gained traction in many municipalities, and reflects the growing role of professionally trained stormwater experts and engineers. Once established, ideas of "best practices" within stormwater programs can lead to convergence around behaviors such as setting particular quantitative stormwater runoff limits that reflect standard engineering recommendations.

Lastly, coercive mechanisms represent political or institutional power and social and cultural norms that create incentives or disincentives for certain behaviors. Common formal coercive mechanisms are governmental rules or policies that are imposed upon organizations. Organizations may take on similar behaviors because they are positioned within similar legal frameworks, or may explicitly share a requirement to take on particular actions. An example of this type of coercive force would be the completion and submission of an annual report, as expected of all municipalities governed under the Utah state stormwater program. Informal regulatory coercion may relate to requirements

attached to grant programs or access to other benefits, such as incentives that reward certain types of partnerships or group structures (Simmons, Dobbin, and Garrett 2007).

Coercive mechanisms may also take the form of perceived social or cultural pressures, in which the organization may feel compelled to comply with local societal or political expectations of "appropriate" organizational activities. In stormwater management, an example of this may be limited local political support to fund stormwater program activities, and thus coercively shaping organizational activities and formats in a way that counters the federal and state regulations.

The concepts highlighted above from organizational ecology mesh well with resilience notions of organization adaptation. First, both theoretical approaches recognize that organizational change takes predictable forms. The adaptive cycle of resilience thinking is a complete loop in which organizations may undergo major transformations. The organizational "life cycle" of organizational ecology resembles more of a trajectory than a cycle, as organizational mechanisms of change within bureaucratic operation have shifted from the drive for efficiency, to the drive for political and cultural legitimacy.

Second, both resilience and organizational ecological approaches recognize the importance of bureaucracy in shaping organizational adaptation. Resilience-based thinking on adaptation suggests that the political bureaucracy (meaning the rules and enforcement thereof) greatly restricts adaptation, particularly as organizations later in the adaptive cycle are focused on responding to requirements (and less so of changes in the external social-ecological system). Organizational ecology theory also recognizes that bureaucratic modes of social organization emphasize rationality, with rules and regulations being a characteristic of the political bureaucracy. The rationality embedded

within bureaucratic modes of operation from the organizational ecological perspective encourages adaptation for political or institutional, cultural, and economic reasons. This contrasts the resilience approach, in which political bureaucracies are thought to limit adaptation.

Third, both resilience and organizational ecology approaches recognize that there are forces originating from outside of the organization that shape the abilities to and ways in which organizations adapt. The organizational field is a social environment that influences organizations' adaptive capacities in setting the boundaries on acceptable forms of adaptation, and asserting forces that encourage certain organizational changes. Similarly from the resilience perspective, institutions are thought to shape adaptive capacities by establishing the political and cultural adaptive pathways that are most acceptable (or possible). Organization forums, or arenas for inter-organizational communication and exchange of ideas, were recently recognized as an important feature in the process of adaptation from the resilience perspective, suggesting that resilience scholars are acknowledging the importance of other forms of social organization beyond connections to the political bureaucracy (Bates et al. 2013). The organizational field exists even in the absence of an organized forum, but the idea is the same across both bodies of theory: organizations are connected to one another and they are exposed to the knowledge, norms, and practices of one another that may shape adaptation.

Finally, the mechanisms of organizational change that are not explicitly recognized by organizational ecology may offer insights into the dynamic processes through which environmental organizations adapt. As originally conceived by DiMaggio and Powell (1983), mimetic, normative, and coercive mechanisms produce a rather

specific form of organizational adaption—institutional isomorphism, or a pattern of adaptation that encourages convergence in particular organizational forms and activities within an organizational field. In responding to these mechanisms out of a need to gain or maintain legitimacy, organizations are limited in the types of potential adaptations to those that would be acceptable to the organizational field. Organizational adaptations are dynamic and reoccurring in that organizations shape, and are shaped by, change in their field. As such, a finite set of adaptations may be acceptable at any given point, but because other organizations in the field are also constantly adapting to change, the set of potentially legitimate adaptive responses is not fixed. Resilience thinking may offer insights upon the ways in which environmental management organizations, with close ties to the natural or built environments, may change in response to environmental goals. Resilience thinking recognizes that organizations, particularly those that are not embedded within the political bureaucracy, may be motivated to adapt based on the natural environment.

In sum, both theories recognize that organizations are dynamic and adapt under a range of conditions. To further connect the concepts of the organizational field, mechanisms of organizational change, and resilience thinking, I explore these concepts within the case of municipal stormwater governance. Within the case study, I assess what would be expected under resilience and sociological theories alongside the empirical observations of the case study analyses. I highlight the ways in which the sociological theories may inform resilience-based notions of organizational adaptation within formally rational stormwater policy arrangements.

The Case of Stormwater Organization Adaptation

Case Study

Utah, United States is experiencing rapid and sustained population growth, with associated expansion of urban land uses. The Utah population is projected to double by 2040 (Governor's Office of Management and Budget 2012), with further urbanization expected. Stormwater is associated with impervious surfaces, a predominant feature of the urban landscape. As small and medium-sized municipalities of Utah expand their populations, borders, and impervious surfaces, their local water systems will also change. These biophysical changes, alongside the stormwater governance requirements of urbanized areas, offer a shifting context to which municipal stormwater programs must adapt.

Multiple Methods and Data

I use a mixture of quantitative and qualitative methods to assess recent patterns of adaptation among municipal stormwater organizations in Utah. I first administered an online-mail survey of stormwater organization mangers. I briefly analyzed survey findings on questions pertaining to organizational connections to private consultants, irrigation groups, and secondary information on the size of the population residing within the city. I then used those parameters to sample interview participants, which represented the second phase of the research. Quantitative results did not influence the content of interviews, but helped to shape the interview sample frame. In the data integration stage, I considered how quantitative and qualitative findings supported, complimented, or diverged from themes in organizational ecology, organization rationality, and resilience

concepts of adaptation, as well as how the qualitative and quantitative data related to one another.

Quantitative data were collected using a statewide online survey of municipal stormwater organization managers with decision-making authority in a stormwater program that had a Utah Pollutant Discharge Elimination System (UPDES) permit. Within each municipality, up to three individuals were asked to complete the survey. In total, I received 96 completed responses (68 percent individual response rate representing 67 of the 72 Utah municipal stormwater permittees (93 percent municipal response rate). The individual responses were aggregated to form a set of municipal-level data using measures of central tendency, as employed in earlier analyses of key informants (Krannich and Humphrey 1986; Schwartz et al. 2001; Sharp, Jackson-Smith, and Smith 2011). With the focus of this analysis upon small and urbanizing municipalities at the county-level, four responses were removed, leaving 63 cases in the dataset.

The concepts of organization adaptation, organizational ecology's three mechanisms of change, and organizational rationality were each operationalized in the online survey.

Organization adaptation and change mechanisms. Organization adaptation was measured through a battery of items related to recent changes made to the municipality's SWMP document. Organization representatives were first asked whether or not their program had made a change to their SWMP in the last four years (since 2010). Those that had made changes were then asked what motivated those changes with the question, "How strong of a reason were the items listed below in the changes made to your municipality's SWMP?" with the response scale ranging across four points from "not a

reason," "a small reason," "a major reason," and "the most important reason," with a "not sure" option response. The SWMP adaptation items are summarized in (Table 2).

Embedded within these potential reasons for adaptation were items that represented the mechanisms of organizational change developed by organizational ecology scholars. I operationalized normative, mimetic, and coercive mechanisms of organizational change based upon a literature review including review papers of empirical studies across many topics surrounding organizational change (Heugens and Lander 2009). The 2013 meeting observations and preliminary interviews (Chapter II), as well as feedback from stormwater managers and a private consultant during the survey pre-test phase, were used to further clarify wordings for items included in organizational ecology and environmental goal statements. Accordingly, the coercive, normative, and mimetic items were operationalized to reflect the principles of each mechanism, but from slightly different perspectives as to capture latent dimensions of these concepts.

Measurement of "reasons for adaptation" was also done using items that captured environmental goals pertaining to built and natural components of the environment (i.e., water quality, flooding, etc.). These represented alternative potential drivers of organization adaptations that connect organizational environmental goals to real changes in natural or built environmental conditions. For example, the item "Could buffer our system during big storm events" integrated the built environment (i.e. the types of infrastructures used to control flooding), along with the natural environment (i.e. climate-driven storm events), and these dimensions were related to the goals of the city, and whether or not the stormwater program had considered such built and natural features.

Because of the small sample size, factor analysis techniques were used to identify items that could be clustered to capture measures of coercive, normative, mimetic, and environmental goals. This factor analysis was quasi-exploratory and quasi-confirmatory in that the items designed to capture the three organization ecology concepts were integrated with indicators "environmental" goals (that come from the resilience theory perspective). As discussed further below, a subset of items were included in the final factor analysis solution in order to maximize the factor loadings within each factor, which is a special consideration for datasets of this size. The factors that were identified in the final factor analysis solution were labeled such that they corresponded with the change mechanisms that they represented within organization ecology, and the environmental goals items.

Organization rationality. Organization rationalities were assessed in a block of questions that asked, "Overall, how important are each of the following to your stormwater program?" with a five-point Likert scale ranging between "very unimportant" to "very important." This question set included ten items that reflected a range of interests, including cost minimization, regulatory compliance, environmental stewardship, and technological advancement. These items are summarized in Table 3.

In addition to the online survey, I conducted 30 semi-structured interviews of stormwater managers. Managers were selected for participation in the semi-structured interviews based upon the size of their city, and whether or not they had partnerships with private consultants or irrigation organizations (the partnerships criteria reflected sampling interests for an unrelated research question). To further assess SWMP adaptation, I also selected cities that had just received notification that they were to come under the

Table 2. SWMP Adaptation Items and Principle Components Factor Analysis

"The changes to our SWMP…"	% A major reason	% The most impt. reason	"Major" and "most impt." reason	Factor loadings		
				Regulatory	Mimetic	Environ -mental
Coercive Forces						
Brought our program up to date with our permit requirements	35.2	44.5	79.7	**0.969**	0.081	-0.078
Reflected changes that we believe will be made to our permit in the near future	22.6	5.7	28.3	--	--	--
Mimetic Forces						
Included policies or procedures being used by stormwater programs similar to ours	41.5	1.9	42.4	0.014	**0.862**	0.115
Were recommended by members of our stormwater coalition	30.8	5.8	36.6	-0.075	**0.786**	-0.197
Brought our program in-line with programs similar to ours	24.5	5.7	30.2	0.181	**0.839**	0.136
Normative Forces						
Were recommended by a stormwater consultant	28.3	3.8	32.1	--	--	--
Were encouraged by a professional organization	30.2	3.8	34.0	--	--	--
Reflected updated engineering practices or technical guidelines	26.4	1.9	28.3	--	--	--
Environmental Goals						
Addressed concerns about possible future flooding	13.2	11.3	24.5	-0.197	0.043	**0.800**
Could reduce contaminants in runoff or site discharges	34.6	17.3	51.9	0.193	-0.183	**0.785**
Could buffer our system during big storm events	19.2	9.6	28.8	-0.075	0.012	**0.884**
Let us address a number of environmental challenges	25.0	3.8	28.8	-0.026	0.271	**0.821**

Note: -- indicates that the item was not included in the final solution
Total percent variance explained = 69.496%
Total eigenvalue = 6.254

state's stormwater regulations (a total of 14 municipalities, including cities and counties, received this notification in October 2013). These "just permitted" cities did not have stormwater programs established, much less SWMP documents in place, and were therefore not invited to complete the survey. I also selected five cities that were below the state government's population threshold for stormwater permitting, but that were likely to be regulated in the near future (the "soon-to-be-permitted" group). Individuals who represented either the "just-permitted" or the "soon-to-be permitted" groups were identified as potential interview participants by their position titles as posted on the municipalities' websites, or by calling a relevant municipal department and asking for the person who oversaw stormwater management. Stormwater managers that responded to the online survey were invited to schedule an interview through an email contact letter, which included a letter of information approved by the Utah State University Institutional Review Board.

In the event that no one from a city was willing to speak with me (four declined), I replaced that city with the next randomly selected city that matched the original city's selection characteristics. In total, the interview participation rate was 88 percent.

Interview topics expanded on the question topics from the online survey. I asked interviewees to discuss their role within the stormwater program, and to describe the range of their activities in addition to stormwater management. We discussed the SWMP document including who the authors of the document were, any changes to the SWMP, and the issues that are considered when changes to the SWMP were made, including how these changes might have been related to the behaviors and goals of other municipalities.

Interviews lasted, on average, 40 minutes and were audio recorded and transcribed verbatim. I made extensive notes while conducting interviews, which were also reviewed at the time of interview analysis. The interview analysis procedures consisted of content analysis, in which I focused on the meaning of interview content through coding, condensation, and interpretation procedures (Kvale and Brinkmann 2009). In the first stage of interview data analysis, I conducted an open coding of interview transcripts to gather general impressions and identify the broad topics that were covered. This step allowed me to identify the areas in which participants' thoughts were associated with the topic of the interview question, and where these thoughts intersected with one another throughout the duration of the interview.

My initial focus was on the interview passages associated with SWMP adaptation and organization rationality. Analysis procedures involved using key word searches and coding of critical passages (with search items including "SWMP," "change," and "document"). These passages were read multiple times to ensure consistency in the interpretation and to form reliable understandings of what participants were saying. To identify key patterns within the qualitative data, I grounded my analysis within the three mechanisms of organizational change offered in organizational ecology (DiMaggio and Powell 1983), and also looked for environmental goals as potential change motivations, as highlighted in resilience approaches. With these types of change motivations in mind, I noted the organizations that were making SWMP adaptations, and the range of motivations mentioned by each organization.

In the third stage of the interview data analysis, I sought to interpret the rationalities of the interviewee's organization. To extract key themes associated with

organization rationality, I considered the goals and types of activities that interview representatives placed emphasis while talking about SWMPs, and more broadly when discussing their organizations' objectives. The rationality interpretation phase was an iterative process of distilling organizations' described actions, attitudes, and goals into condensed, identifiable patterns, and relating these patterns to the broader tone of the interview as a whole. I went about understanding this broader organizational emphasis by reading the interview transcripts multiple times, and by noting areas where the representatives indicated a focus on regulatory procedure, water quality outcomes, or other goals that they identified within their program. I also noted where formally rational goals seemed to contend with substantive goals.

I checked for consistency in the rationality interpretation by checking my interpretation of important passages with the broader meanings expressed throughout the interview. I was careful to note evidence in support of and in contrast to the literature and quantitative data in my corresponding survey analyses. Nonetheless, the qualitative data interpretation was conducted after that of the survey data, and therefore it is possible that my interpretations of the interview data were made with some understanding of the quantitative findings. This may pose a bias in my data interpretation; however, it could also benefit the integration of qualitative and quantitative findings within my multiple methods research design.

Findings

Motivations For Organizational Adaptation

Stormwater programs are adapting their SWMPs, with 56 of the 63 (89 percent) programs making some type of change within the last four years. The five cities that did not adapt their SWMPs did not differ from the cities that had adapted their SWMPs in any obvious way.

The strongest motivation for SWMP changes (considering the combined percentage of respondents who indicated "a major reason" or "the most important reason") represented one of the coercive indicators: "brought our program up to date with our permit requirements" (79.7 percent). The coercive measure that assessed the extent to which SWMP changes were motivated by anticipated regulations received far lower levels of agreement (28.3 percent). The difference in the strengths between the current and anticipated regulations is important to note, as far more organizations were motivated to make a SWMP change in response to the current regulation, already imposed on the organizational field, than regulations that were expected but not yet experienced.

Second to the coercive measure that reflected current regulations, the next-most common motivation for SWMP adaptation was that the changes, "could reduce contaminants in runoff or site discharges" (51.9 percent combined total). This item represented a way in which a change to the natural environment could result from the SWMP change, and was not necessarily connected to a behavior or norm located within the organizational field. Such a strong response from organizations on this item suggests that they considered the ways in which their SWMP policies influence the natural environment, and adjusted their programs accordingly.

The third-most common motivation (and the last one mentioned here that had a combined importance from more than 40 percent of the municipalities) was the mimetic motivation item, "included policies or procedures being used by stormwater programs similar to ours." Here, municipalities indicated that they made a change based upon their knowledge of program components that were already taken on by their peer organizations. The final four items reflected a range of environmental reasons for which municipalities would adapt their SWMPs.

As a group, the items representing normative mechanisms of organizational change received lower rates of agreement that they were important drivers of SWMP change. Roughly one-third of organizations noted that they made changes to their SWMPs based upon recommendations by a stormwater consultant (32.1 percent), a professional organization (34.0 percent), or because of updated engineering practices and technical guidelines (28.3 percent).

The factor analysis[5] on the SWMP change motivation items yielded two distinct change motivations that reflect the mechanisms outlined in organizational ecology: coercive and mimetic. The first SWMP adaptation dimension associated with the mechanisms of organizational ecology represented the coercive force of stormwater regulation. This dimension was represented entirely within the current regulations item (mean = 3.21; std. dev. = 0.317). The second factor was the set of items that represented

[5] I used an iterative process of variable selection for the factor analyses herein. Items that loaded weakly (e.g., less than .500) on multiple factors were removed one-by-one from the analysis. Interim factor solutions were evaluated for the total variance explained, and for the strength of the factor loadings within the rotated factor matrix (please see discussion of factor loadings and small sample sizes in Chapter I). I considered factor analysis solutions to be "final" when remaining items were strongly associated with a factor (e.g., above .600) and the total variance explained was maximized.

mimetic adaptation motivations. These items were averaged into a composite scale (alpha = 0.777), and represented a weaker reason for SWMP change (mean = 2.27; std. dev. = 0.63) compared to regulatory motivations.

The factor analysis also yielded a distinct, third dimension of SWMP change motivations, which was associated with environmental goals. These items were averaged into a composite scale (alpha = 0.843). Organizations indicated that the environmental motivations for SWMP changes were on par with mimetic motivations (mean = 2.24; std. dev. = 0.71), again, of less importance than the coercive mechanisms. While it seems like an obvious point, environmental goals were distinct from coercive mechanisms, suggesting that there could be different organizational logics at play in deciding whether or not to adapt for regulatory or environmental reasons, even though environmental outcomes are the intended "ends" of stormwater policies. I investigate the relationships between organizational motivations and rationalities in a later section. But first, I consider how the mechanisms of organization change associated with organizational ecology and resilience thinking are expressed within the qualitative interview data.

Motivations for SWMP Adaptation as Expressed Within Interviews

As observed in the survey data, many municipalities updated their SWMP documents in response to changes in the state stormwater permit. These changes were commonly brought on by the most recent revision in the state-level municipal permit that occurred in 2009. Many of the cities incorporated these regulatory-driven changes into their 2009 or 2010 SWMP documents. Some municipal managers were slower to adapt their SWMPs to meet the new regulations because these guidelines were confusing:

"…sometimes it gets so cumbersome on what the heck is going on with the state and the EPA and then I just, I go and listen to all the stuff in those meetings but sometimes it goes through the one ear and out the other."

Many other cities did not try to interpret the new regulations themselves, and instead contracted out the writing and revision of their SWMP document to private consultants. One city engineer noted that he worked closely with an engineer at a private firm who knew the new state stormwater permit well, and could readily identify the ways that the city's program and SWMP document needed to adapt. In a different example at a very small (but urbanizing) municipality, the public works director was the only person working on the city's stormwater program, and didn't have the time or expertise to revise the document. During the interview, he was not able to recall many details about the SWMP document, "or whatever you want to call it," and identified the main purpose of the city's SWMP changes as, "basically…that the BMPs [best management practices] that best suit the particular project [are in place]." This director's approach to the SWMP was, compared to other participants, rather disengaged, and that the BMPs were his primary connection to the document suggested that the purpose of the document was, for him, more about satisfying the day-to-day needs of the stormwater program than about setting long-term goals or procedures for water quality improvements. Here, the city responded to coercive, regulatory pressures by contracting-out their SWMP changes, and not reflecting on the implications of these changes for the stormwater program.

Many of the cities that had just been designated as municipal stormwater permittees under the state regulations felt immense coercive pressure to develop their entire stormwater program, which was to be reflected in their SWMP document. These

interviewees expressed regret and frustration that they were selected to be part of the regulations, but many of these cities had also anticipated the regulations. Said one city representative: "We've been aware of it [oncoming state regulations] for several years, but we've been trying to keep up with um, things that other cities have been doing that have been in—cities very close to us." To cope with the coercive pressure, again many of these cities hired private consultants, as, in the case of one city, "to review our plan to make sure that it met the minimum criteria that were established by the state." The city did not hire the firm to author the SWMP plan per say—three individuals within the municipality took this on themselves, feeling empowered by the guidance that they received from nearby cities. As one city employee noted, "Certainly parts of [the SWMP] were taken, from using other cities as examples, but I wouldn't say that we 'plagiarized' but we were 'inspired' by them…that might be a good, good word [to describe it]."

In general, the stormwater managers recognized that the creation of a SWMP was a massive undertaking that probably would not have been taken on in the absence of regulations. Cities that were not yet regulated under a stormwater permit noted that they carried out some of the activities that would be described in a SWMP, such as street cleaning and debris removal, mostly for flood control and cleanliness purposes. However, the incorporation of these and many other activities required of regulated municipalities into a SWMP was an effort involved many people (even in small municipalities) and had implications for city activities well into the future. As said by one stormwater representative from a city that just came under the stormwater regulations, "We will be putting together a program that's gonna be able to meet EPA standards, and so, you

know, you have to have good minds coming together, putting that program together…and then eventually the projects have to be done."

Overall, coercive motivations for changing (and creating) SWMP documents were common throughout Utah municipalities. Those who adapted their SWMP documents primarily in response to new regulations or changes in preexisting regulations often engaged private consultants or drew heavily upon the work of peer municipalities within the SWMP adaptation process.

I also found evidence of mimetic and normative motivations for SWMP changes. Mimetic motivations for SWMP changes were apparent in the early years of stormwater program formation, when cities were grappling with the activities that they should include in their stormwater programs. One city noted, "[Back] then we didn't have much of a public education and outreach program. In fact it was, it was effectively, um, it was ineffective, let's say…what I did was I used the [name of other city]'s program and I, and I believe that many [other] cities followed suit." After this city recovered from the initial shock of the stormwater program requirements, they went on in subsequent years to mimic other dimensions of public education activities that were successful in nearby cities: "There [are now] three specific volunteer programs that people can call. They're out-of-the-box programs and residents can call and say, 'Hey, what can I do?' and we can send them to…a volunteer application and [they can] actually do volunteer [stormwater] work." This city reported a strong connection to their county's "coalition" or a group of municipalities within the same county that met on a monthly basis to share program ideas and management strategies. Many, many city representatives reported that they became aware of viable program activities (that were then incorporated into their SWMPs) based

upon their participation in their county stormwater group: "We can feed off from their information. We can plagiarize all their [SWMP] structures. We cannot reinvent. We can pick up where someone else has done real well."

The most readily-observed form of SWMP changes based upon normative motivations was the use of engineering standards for best management practices that are deemed acceptable for development within city. These standards, as noted by many cities, are fairly uniform throughout the state: "Mainly the first step is to protect your [development] boundary. You're second step is to create some sort of sediment deposition [area]. And then your third step is to have some sort of stabilization plan and that's, that's the basics." The city representatives from this municipality noted that their updated SWMP, "has got like that thirty pages of [BMP-related] documents which, honestly once the…plan is pretty well set the SWMP is kind of more rote. It's not that difficult once we have an acceptable plan there." In other words, the changes to the SWMP that reflected standardized, engineered based stormwater control measures were neither complicated, nor very informative, but more reflective of routine practices expected of cities in enforcing "best" construction control procedures.

Another dimension of normative motivations for SWMP changes were apparent in the use of private consultants. As noted above, the use of consultants was often timed in accordance with the initial development of SWMPs (and stormwater programs more broadly), thus private consultants often set the framework for SWMP documents that cities spent the coming years tailoring to their local interests and activities. In the following example, one city demonstrated how the coercive, mimetic, and normative mechanisms interacted within the creation of their current SWMP document.

The small city was grappling with how to update their SWMP in response to statewide permit changes: "Well we had our deadline, when it had to be filed and I [have] never put one [SWMP] together and [the other municipal employee hadn't], and so we went to an engineering company." After the city had received their updated SWMP document from the consultant, the city employee had a question about the document, and decided to look into the ways that other cities were addressing his question by reading online materials:

> So I thought, well, I've gotta figure this stuff out, so I started looking online and I, I found what they [the firm] had used [for our SWMP] was plagiarized out of like one of the, the University of California or California State. Yeah, and it was the, pictures, verbiage, everything was just like cut and copied and put "[name of his municipality]" in the [title], and they wanted ten thousand dollars, I think.

Embedded within this experience was the city's regulation-motivated response to update their SWMP, the city employee's mimetic activities to look to other programs for answers or procedures, and incorporated within the consulting firm's version of the plan, widespread and standardized procedures for managing stormwater and documenting their practices in SWMPs.

Last, the qualitative findings associated with SWMP change motivations include some environmental goals; however, these considerations appeared to be deeply intertwined with the regulatory process. One municipality explained that they made a change to their SWMP that removed a best management practice associated with the re-vegetation of construction site areas—a practice that they thought was required by the EPA:

> EPA's come out with the standards and they've set that standard for everybody no matter what part of the country they live in. We have

> deserts. There's flora that gets two hundred inches a year [elsewhere] and we get eight. And yet they say, 'You have to do this.' Well it doesn't work here…

Accordingly, the city was in the process of removing the re-vegetation practice from the construction requirements in their SWMP. Similarly, another municipality was considering the natural environmental dimensions of "green infrastructure" that promotes stormwater infiltration and, in some places, has demonstrated water quality benefits. This city removed green infrastructure language from their SWMP:

> We didn't go down the road that the EPA was trying to get us to go down. The EPA was kind of looking at a green scenario, supporting this green infrastructure um, concept. You see a lot of it happens back east, a lot of it is happening in the northwest. It just, it doesn't fit us here.

The city representatives in the previous two examples were relating their SWMP changes to natural environmental dimensions of their system—water quality and the stormwater infrastructure associated with it. However, they sought changes to their SWMPs to remove what they saw as requirements motivated by environmental values from their city's guiding documents, on the basis of a mismatch between the semi-arid conditions of Utah and the infrastructure that performed differently in more humid areas of the country.

In sum, the motivations underlying organizational adaptation identified in the qualitative interview data strongly support the three types of change mechanisms identified in organizational ecology literature. Environmental goals as a motivation for adaptation of SWMPs proved to be a bit more complicated in light of the qualitative data. While environmental goals were apparent, these considerations were more intertwined with municipalities' perceptions of regulatory expectations. Actions such as the removal of green infrastructure goals from SWMPs directly countered water quality

improvements. The environmental goals associated with SWMP changes were, in the eyes of stormwater mangers, not necessarily a way to improve the natural environment or to better follow requirements. Instead, these changes were justified on the basis of practical mismatch between regulatory intentions and the conditions found in areas of Utah.

Organization Adaptation and Rationality

It is clear from the analyses above that organizations may make adaptations to their SWMPs for many reasons that are related to their connections to the organizational field and the natural environment. In this section, I examine how SWMP change motivations are connected to formal and substantive rationalities. In the paragraphs below, I consider the rationalities that organizations expressed in their survey responses, and relate these rationalities to the organizational ecology change mechanisms and environmental goals identified above.

Survey respondents were asked on a scale from "very unimportant" to "very important" to indicate the extent to which ten aspects of their activities were important to their program.

The single-most important activity for stormwater programs was "reducing the chances of flooding" (62.9 percent very important) (Table 3). The high importance of this item may seem intuitive: stormwater poses a major flooding threat, particularly in massive rainstorms or precipitation events on frozen ground. However, the emphasis of this activity within municipal stormwater programs is somewhat surprising in that the stormwater permitting regulations do not address flooding. Rather, the Utah Department

of Public Safety sets flood control standards. The importance of the flood control item therefore signifies that small and urbanizing cities are responsible for many activities, and that they must answer to other requirements, even within the area of stormwater management writ large.

The next most important program activities were "remaining in compliance with state and federal laws" (54.8 percent "very important") and "ensuring that developers follow all rules and regulations" (51.6 percent "very important"). These items represent activities that are required of municipalities within state stormwater regulations. The only other item marked "very important" by more than forty-percent of the respondents was the activity of "reducing stormwater pollution" (40.3 percent).

To facilitate statistical analysis of relationships among core concepts, factor analysis was used to identify which individual survey items measuring organization rationalities best captured the underlying dimensions associated with the theoretical concepts. Specifically, a principle components factor analysis with Varimax rotation and Kaiser normalization was implemented, from which two distinct dimensions of organization rationality emerged. The first dimension was associated with procedural requirements including compliance with regulations, ensuring that developers followed rules within their municipalities, and minimizing costs to the public. The first two of these items listed here were averaged onto an aggregate scale (alpha =0.845) (the minimizing stormwater costs for the public item reduced the reliability of the scale and was therefore excluded). The aggregated scale represented formal rationalities, as these items emphasized the procedures for fulfilling bureaucratic requirements.

The second factor represented items that signified the outcomes of stormwater programs, such as "reducing stormwater pollution" and "improving local water quality regardless of regulations." These items were averaged onto an aggregate scale (alpha = 0.890) and titled "substantive: water quality." I also considered the " reducing the chances of flooding" item as a second type of substantive rationality ("substantive: flooding"), albeit one that is partially related to the stormwater program and partially related to other water management requirements.

I then considered the ways in which the SWMP change mechanisms—coercive, mimetic, normative,[6] and environmental—were related to substantive rationalities. Under resilience theory, we would expect that intense formal rationalities would be positively correlated with coercive SWMP change motivations. We would also expect that organizations with a strong, formally rational focus to be less attentive to environmental goals in adapting their SWMP documents. Table 4 summarizes the correlations among the three rationality measures and the four indicators of SWMP change motivations. Formal rationalities were not significantly correlated with the coercive adaptation motivation. The only adaptation motivation item that was associated with organizations' formal rationalities was the normative indicator (Pearson correlation = 0.352; p = 0.011). This means that the organizations that updated their SWMP documents to reflect changes in engineering standards were also very interested in remaining in compliance with stormwater requirements. The correlation between this normative change motivation and

[6] The normative dimension was represented by the stand-alone item, "reflected updated engineering practices or technical guidelines." This item was selected for this analysis over the other items that represented normative change mechanisms (Table 2) because such standardization of engineering practices was evident in the qualitative interview data.

Table 3. Organizational Rationality Items and Principle Components Factor Analysis

Overall, how important are each of the following to your stormwater program? (Scale: 1 = "very unimportant"; 5 = "very important")	% very important	Factor loading: Substantive: water quality	Factor loading: Formal rationality
Reducing the chances of flooding	62.9	--	--
Remaining in compliance with state and federal laws	54.8	0.198	**0.831**
Ensuring that developers follow all rules and regulations	51.6	0.223	**0.886**
Reducing stormwater pollution	40.3	**0.895**	0.194
Being a good environmental steward	37.1	**0.832**	0.263
Improving local water quality regardless of regulations.	27.9	**0.872**	0.137
Increasing public understanding of stormwater management	22.6	--	--
Minimizing stormwater costs for the public	21.0	0.091	**0.632**
Using voluntary approaches to stormwater management when possible	16.2	--	--
Trying new stormwater management technologies	16.1	**0.808**	0.137

Note: -- indicates that the item was not included in the final solution
Total variance explained = 71.754%
Total eigenvalue = 5.023

formal rationality makes sense, considering that normative standards may be incorporated into stormwater regulations (Barley and Tolbert 1997).

In contrast, substantive water quality rationalities, or the extent to which organizations thought that water quality outcomes were important, are positively associated with SWMP adaptation for environmental goals (Pearson correlation = 0.464; $p = 0.001$). This is to say that the groups that care the most focused on stormwater quality are the same organizations that made environmentally motivated SWMP changes. Also in terms of substantive rationalities, the extent to which municipalities considered flood management important was negatively associated with the extent to which these

municipalities took on SWMP adaptations out of regulatory considerations (Pearson correlation = -0.289; p = 0.036), which is not surprising given that flood control activities may be in competition with stormwater program activities for managers' time and attention.

Another important relationship exists between the two forms of rationalities. Formal rationality was positively correlated with both types of substantive rationality, meaning that organizations with strong commitments to the processes of stormwater governance are also committed to water quality (Pearson correlation = 0.416; p = 0.001) and flood management outcomes (Pearson correlation = 0.416; p = 0.001). This illustrates the notion that formal and substantive rationalities can co-exist within one organization The qualitative findings further identify linkages between organization rationality and SWMP adaptation behaviors. The findings suggest that when stormwater managers consider or perhaps even respond to changes in natural environmental conditions, they do so with the stormwater regulation process in mind. Only five interview participants brought up water quality during their interview, and all five of them referred to water quality in relation to their uncertainty about whether or not stormwater regulations actually achieved water quality outcomes. The most optimistic of these interviewees suggested that,

> [The stormwater program] does improve water quality so I can understand the big [regulatory] push. But quantifying what [the city does] the way they want is tough. I can tell you how many tons of debris we remove from the road in a year, but can I tell you what that did for water quality? No.

Table 4. Pearson Correlations (and Number of Cases) Between Three Dimensions of Rationality and Organization Change Mechanisms

	Rationalities			Adaptation motivations			
	Formal rationality	Substantive: flooding	Substantive: water quality	Mimetic	Environ-mental Goals	Regulatory	Normative: standards
Formal rationality	1 (62)						
Substantive: flooding	.**449**** (62)	1 (62)					
Substantive: water quality	**.416**** (61)	**.481**** (61)	1 (61)				
Mimetic	0.13 (51)	-0.235 (51)	0.024 (50)	1 (52)			
Environmental Goals	0.033 (51)	0.202 (51)	**.464**** (50)	0.081 (51)	1 (52)		
Regulatory	0.176 (53)	**-.289*** (53)	-0.199 (52)	0.134 (52)	-0.098 (52)	1 (54)	
Normative: standards	**.352*** (52)	0.173 (52)	0.054 (51)	0.076 (52)	**.405**** (52)	0.128 (53)	1 (53)

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

This interviewee had a substantive desire to improve water quality in his city's jurisdiction; however, even for this manager, who wanted the program to improve or maintain water quality, the formally rational process of recordkeeping, sweeping streets, program planning, and adapting SWMPs was not entirely justified without evidence of water quality outcomes—evidence that he and many other managers throughout Utah desired but lacked.

The same could be said for the relationship between low impact development (LID) techniques, and how stormwater managers considered these techniques in relation to their ongoing stormwater duties. For one manager, LID infrastructure represented an

overwhelming area that, in light of the other expectations placed upon him and his department, he did not have time to digest. In response to the question about the potential types changes to his program's SWMP document, he responded:

> I think [it] seems…more difficult because of more restrictions and more expectations, it's getting a little bit easier for me because the more I do it, I'm, I'm getting an understanding [of SWMP documents]. I mean just, say one element of our SWMP, like LID…which we really don't have much to do with here, but [I've] just got online and, and research[ed]…how to do that element, the guide is over four hundred pages just for one element of one [practice]…It's like you could spend a lifetime just on that kind of thing…it's very difficult for one guy to encompass the whole, whole spectrum.

For this manager, the competition between dedicating his time to formally rational compliance procedures and learning about (in order to implement) low impact development infrastructure that would improve water quality, presented a conflict. In the end, formally rational compliance dominated, but substantive rationalities remained.

Discussion and Conclusions

In the first half of this paper, I highlighted the ways in which the sociological theories of organizational ecology and organization rationality may inform resilience perspectives on organizational adaptation. Resilience-based notions of organizational adaptation have focused on the relationship between the organization and the political bureaucracy. From the resilience perspective, as the organization-bureaucracy connection strengthens with progression along the adaptive cycle: the organization becomes rigid, focused mostly on meeting regulatory mandates, and less willing to adapt in response to change in the natural environment. I also discussed formal and substantive organization rationality, as conceptualized by Weber (1978), and furthered by Espeland (1998). While

these sociologists recognize bureaucratization as a driver of formally rational thought and action within society, Espeland (1998) notes that substantive rationalities, which are based on values and outcomes, remain important forces within organizations, and may even encourage organizations to behave in ways that contrast with formally rational procedures.

I then examined these theories within the case of stormwater policy, a multi-level governance arrangement that involves federal, state, and municipal governments. Municipal stormwater programs are, in Weberian terms, highly bureaucratized, with many procedural requirements expected of them as organizations within the political apparatus of stormwater governance. From the resilience perspective, I expected to observe that municipal organizations would be myopic and unwilling to adapt for non-regulatory motivations, as theorized by Gunderson and Holling (2002). In contrast, I found that, in addition to regulatory responses, organizations regularly made adaptations to their SWMP documents out of mimetic or normative motivations, and environmental goals. In some instances, I observed that these change mechanisms interact with one another to form a complex process of organization adaptation. The findings represent a departure from the resilience-based notion that bureaucratic forms of governance inhibit adaptations beyond what are required within formal procedures.

In my analysis of the relationships between organizations' rationalities and their SWMP adaptation motivations, I observed no strong connection between reliance on formal rationality and adaptation in response to coercive, mimetic, normative mechanisms, or environmental goals. This suggests that organizations' adaptive

responses are not determined by the processes required of them by the political bureaucracy, even within stormwater governance.

I also found in the survey data a positive association between substantive rationalities and SWMP adaptations for environmental goals, suggesting that substantive meanings may be a mechanism through which organizations adapt, even with the widespread presence of formally rational procedures. The qualitative interview findings revealed that substantive rationalities, with water quality outcomes as an emphasized end-goal, are experienced with regulations in mind. Such substantively rational goals may conflict with formal rationalities, particularly as organizations experience difficulty in keeping up with regulations. Even for organizations and actors within that intently pursued water quality outcomes, these "ends" seemed to be evaluated against challenges within the stormwater governance process. If the formally rational procedures required of stormwater programs connected more directly with observable water quality improvements, perhaps the formal procedures would be more acceptable.

Another point to consider within the relationship between formally rational compliance behaviors and the substantive drive to improve water quality is the anti-federalist sentiment prevalent throughout much of Utah and the Intermountain West. Much of my quantitative and qualitative data support the idea that municipal representatives strongly distrust and dislike the EPA. Time and again, these actors would attribute state policies to the EPA, and in the instance of LID or "green" infrastructure noted above, the supposed "requirements" for these practices are, in fact, recommendations on how to implement and maintain such infrastructures and best management practices. The recommendations-requirements divide is a point of

confusion, through which municipal actors can accuse the EPA (more often than the state) for over-stepping their authority and requiring practices that did not mesh with local biophysical conditions. Within this criticism, municipal representatives then create a space within which they can contest, if not reject, the legitimacy of state and federal governments. The multi-level governance format is supported in part because it allows for interests and knowledge from many geographic scales and locations to take an active role in managing natural resources. However, if local authorities do not recognize their alignment with other governmental actors in this framework, the benefits of local participation in multi-level arrangements are minimized. Multi-level or polycentric governance arrangements may be a highly successful institutional arrangement for coping with social-ecological changes, as promoted by Ostrom and colleagues (Dietz et al. 2003; Ostrom 2008; Ostrom and Janssen 2005). My work suggests that an important component of the multi-level arrangement is sustained legitimation of upper-level policies within the local government scale, so that coordination and support of activities across these governance scales may maximize the actions taken at each level.

Previous critiques of resilience thinking are not unfounded. There are major flaws in how the adaptive cycle approaches organizational adaptation, particularly in that organization adaptation is treated as a fixed path along which organizations respond entirely to the rational need to comply with regulations. Organizational ecology brought attention to another type of social entity that may shape organizational adaptation: the organizational field. The organizational field is an important component of the organizational adaption process in that organizations react to changes occurring within the field based upon three clear and well-tested change mechanisms. Together, the

sociological theories of organization rationality and organizational ecology suggest that there are many reasons that organizations take on adaptations—some of which may be motivated by social connections to other organizations, others of which may be motivated by the need to comply with formally rational regulations. These sociological theories offer dynamic mechanisms of organizational change that compliment the ways in which resilience thinking currently approaches organizational adaptation. On the other hand, resilience thinking highlighted environmental goals as important motivations for organization change that are currently under-theorized in sociological approaches, and one that was found distinct from the three mechanisms of organizational change highlighted in organizational ecology. Further research and theoretical development should consider the natural environment as it may relate to organizational change.

The ideas discussed in this paper were put forth in an effort to fill some gaps in resilience approaches to organizational adaptation. Future work should extend organizational ecological mechanisms to situations outside of multi-level governance arrangements to further examine the ways in which organizations respond to changes in their social and natural environments. The ways in which changes in the natural environment relate to organizational change concepts explored herein should be further considered.

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CHAPTER IV

PRIVATIZATION AND INTERMUNICIPAL COLLABORATION IN LOCAL STORMWATER GOVERNANCE

Introduction

The decentralization movement in the United States, which has gained traction since the 1980s, places emphasis on the local: local administration of state and federal policies, and local funding for such services. Decentralization is often praised in analyses of multi-level environmental governance, as it allows for policies and activities to match local or regional conditions, to meet the needs and interests of involved stakeholders, and to incorporate local knowledge into management efforts (Eckberg and Joas 2004; Newig and Fritsch 2009; Ostrom 1999). For example, the U.S. Clean Air and Clean Water Acts set standards for air and water quality at the national level, but many programs administered under these acts require local governments to implement procedures that address local pollution sources and develop solutions most appropriate for the local context.

Decentralized governance also has raised concerns about the ability of local actors or organizations to take on new administrative and fiscal responsibilities without providing the resources to carry out these roles (Warner 2003; Warner and Pratt 2005). In response, many local governments have looked to privatize some of these services through consultation or contracting arrangements. Privatization involves the provision of government services by for-profit companies or non-profit organizations. In rural and small urban areas, environmental services that are often privatized include solid waste

management (Bel and Mur 2009) and wastewater treatment (Moore 2011). These services have impacts on numerous environmental outcomes, such as water quality and exposure to toxic substances, with major local implications for public health and safety.

Compared to the privatization of social services such as welfare and Medicaid programs (Romzek and Johnston 2005), or administrative activities within the government like billing or payroll (Mohr et al. 2010), the processes through which decentralization has affected local government provision of environmental services under the federal Clean Air and Clean Water Acts are not as well understood. This study examines the process of local environmental governance using the case of municipal stormwater programs in small and rural municipalities of Utah, United States. Within this case, I consider the conditions under which municipalities use private consultants in their stormwater management programs. I then analyze the ways in which the privatization of stormwater management activities shaped intermunicipal collaborations, and may influence the types of challenges that small municipal stormwater programs may encounter.

Background and Literature

Decentralized Stormwater Governance

Decentralization, or devolution of fiscal and, or, administrative responsibilities to local levels of government, offers the benefits of local control and decision-making authority that is more closely tied to the users of services. However, decentralization also raises questions of local capacity to finance and implement programs that may be technical or intricate, and concerns about inequalities in service provision across

communities (Warner and Pratt 2005). Most studies of decentralization in rural or small governments focus on the impacts of decentralization on local economies (Hammond and Tosun 2011; Lobao and Kraybill 2012; Morgan 2010), inequality among local governments (Quark 2008), or impacts on local efforts to address poverty (Lobao et al. 2012). In contrast, few studies consider how decentralization influences municipal provision of environmental services, such as water and air quality efforts mandated under federal environmental policies.

U.S. stormwater governance is a prime example of decentralized environmental policy. Stormwater, or rainfall or snowmelt that does not infiltrate the ground, can impair water quality and expose property owners to potential flooding. Stormwater runoff may contain dangerous concentrations of heavy metals, nutrients, and sediment. Areas with more impervious surface (e.g., rooftops, pavement) are associated with greater stormwater discharges that increase flood intensity, degrade stream channels, and lower aquatic biodiversity, among other negative outcomes (Paul and Meyer 2001). The environmental and public safety problems that stormwater imposes are experienced at the local and regional scales, and are an integral part of urban ecological systems found worldwide (Grimm et al. 2008).

Local governments play an essential role in U.S. stormwater policy, which involves federal, state, tribal, and municipal levels of government. The authority to govern stormwater is located at the federal level, where the U.S. Environmental Protection Agency (EPA) sets standards for allowable amounts of stormwater discharge with the Clean Water Act, National Pollutant Discharge Elimination System (NPDES). The EPA issues permits, or mandatory efforts in exchange for the discharge of

stormwater into natural waterways. Three types of stormwater discharges are regulated: industrial, construction, and municipal separate sewer stormwater systems (MS4s). Within the municipal permit system, the NPDES regulations distinguish between Phase I and Phase II cities. NPDES Phase I began in 1990, when municipalities of 100,000 or more people were required to obtain stormwater discharge permits. The NPDES Phase II began in 1999, in which municipalities with less than 100,000 residents of urbanized areas (contiguous areas with 50,000 or more people and population densities over 1000 per square mile), and smaller municipalities within a buffer of urbanized areas became subject to NPDES regulations (U.S. EPA 2014).

The details of stormwater governance activities are operationalized at the state level in most states throughout the U.S. State governments develop, implement, and enforce stormwater discharge permits consistent with federal stormwater regulations. State regulations may be more stringent than those of the federal regulations, and are usually tailored to regional conditions. Most state governments issue MS4 discharge permits to municipal governments and other special service organizations (e.g., college campuses) that operate stormwater infrastructure, such as roads, gutters, and drainage systems. The EPA authorized the State of Utah (the focus of this research) to regulate stormwater discharges pursuant to the Utah Water Quality Act in 1987. The Utah Division of Water Quality (DWQ), which is nested within the State's Department of Environmental Quality (DEQ), is responsible for issuing and enforcing stormwater discharge permits under the Utah Pollution Elimination Discharge System (UPEDS).

Under the Utah MS4 permit, municipal governments are required to develop stormwater regulations and procedures, to enforce these regulations within their

jurisdictions, and to finance their stormwater programs. Phase II municipalities, which make up the vast majority of municipal stormwater permittees in Utah, are required to develop a Storm Water Management Program (SWMP). SWMPs must detail the procedures through which the municipality implements the following required Minimum Control Measures (as required under the UPDES and NPDES permitting policies): public outreach and education, public involvement and participation, illicit discharge detection and elimination, construction site stormwater runoff control, long-term water management in new development or redevelopment, and pollution prevention and good housekeeping for municipal operations (Utah DEQ 2013). Embedded within these minimum control measures is an extensive range of activities, mandatory documentation, and recommended (but not required) engineering dimensions of infrastructure management and runoff control, all of which involve complex technical detail and administrative terminology (Fletcher et al. 2014). Utah municipalities (and many other municipal governments throughout the U.S.) are required to develop, implement, and enforce local stormwater ordinances and pollution control measures, and maintain extensive records of these actions. Under the "good housekeeping for municipal operations" pollution control measure, municipalities are also required to maintain city-owned facilities in a manner that minimizes stormwater discharges, including regular inspections and recordkeeping of best practice procedures. Municipalities are regularly audited by the state, and are subject to fines and penalties when violations are uncovered. Despite many federal expectations that promote consistency across municipal stormwater programs, state and federal permits are designed to accommodate unique local situations and allow for variation in approaches to stormwater management (Fisk 2015).

Much of the contemporary research on stormwater governance is focused upon the use of "green" or "sustainable" forms of stormwater infrastructure and policy in urban areas in the U.S. and Australia (Brown 2008; Keeley et al. 2013; Kondo et al. 2015; see Fisk 2015 for an exception). In an in-depth analysis of stormwater institutions in Sydney, Australia, Brown (2005) found that the political bureaucracy associated with traditional stormwater governance encouraged conflict, inadequate funding, and an inertia that prevented sustainable innovations in stormwater management. There, the smaller local governments with highest levels of input from their residents had the greatest capacity to implement more sustainable programs with positive impacts on water quality (Brown 2008). By contrast, larger cities with declining populations in the Midwestern U.S. felt forced to implement fees to fund stormwater program activities despite the public's lack of support for (and lack of understanding of) stormwater management and requirements, leading these cities to implement small-scale "green infrastructure" without a comprehensive plan (Keeley et al. 2013).

There is reason to believe that small and moderately sized municipalities regulated under the Phase II NPDES policies are systematically different from larger, metropolitan stormwater programs in the United States. Smaller municipalities do not have the organizational structure of large city governments in which entire management units with multiple employees and sizeable budgets are dedicated to stormwater program implementation. Nonetheless, many small cities are coming under the scope of federal and state stormwater regulations, particularly in areas with expanding urban land uses on the periphery of existing urbanized areas. In the sections that follow, I explore another

trend in local government—privatization—and relate this phenomenon to stormwater management in small and urbanizing municipalities.

Privatization and Local Government

Since the 1980s, local governments have encountered dramatic changes in the processes through which public services are provided. Privatization of local governmental services has been promoted extensively as both a political ideology and as a solution to service provision limitations brought forth under decentralization. The decision to privatize services in local government is, at least in theory, related to minimizing transaction costs, or the economic, political, or administrative obstacles incurred in the process of service provision (Hefetz and Warner 2012). In a meta-analysis of the factors explaining local privatization, Bel and Fageda (2007) found that cost considerations such as economies of scale and the overall fiscal stress of service provision to the municipality encouraged private consultant use, but the political ideology of elected leaders or municipal staff was not a consistent determinant of privatization.

Empirical research on privatization of municipal services has called the benefit of cost minimization into question. While there are economic cost savings under certain circumstances, privatization can introduce a wide range of challenges for local governments, including strain on local resources and limited governmental transparency (Bloomfield 2006). Municipalities engaging in privatization must take on new contract negotiation, monitoring, and enforcement activities, which can be technically complex, fluid, and time consuming (Hafetz and Warner 2004) and may challenge the capacity of

employees in small municipalities (Brown and Poteski 2003; Halstead, Mohr, and Deller 2010).

The challenges associated with the privatization of local governmental services are particularly apparent in rural and smaller municipalities (Halstead et al. 2010), where there is a lower rate of private service contracting because there is less market attraction for companies to work in rural areas due to smaller and more spread out customer bases (Bel and Miralles 2003; Warner 2006). Rural municipalities may also face higher transaction costs in contracting-out to private entities, compared to in-house program administration, further limiting the potential benefits of privatization (Mohr, Deller, and Halstead 2010; Warner 2003). In contrast, suburban municipalities engage most frequently in private contracting (Warner 2009; Warner and Hefetz 2002), because the municipalities are small enough to want to outsource the services, but large enough to attract competition within the private sector for their contracts.

Regardless of the size of the municipality in which privatization may occur, the transfer of service provision responsibilities from public to private organizations raises questions of democratic representation, public participation, and accountability. Analyses of privatization from the 1990s and early 2000s suggest that local governments are attuned to citizen satisfaction regarding privatized services, and will return services from the private sector to in-house control in response to citizen complaints (Hefetz and Warner 2004). In fact, municipal recognition of citizen satisfaction played an important role in municipalities' decisions of whether or not to privatize municipal services during the 2000s (Hefetz and Warner 2012). Municipalities monitor new private contracts at higher levels than previously documented, and governments that do not monitor their

contracts are more likely to be dissatisfied and return to in-house service provision (Hefetz and Warner 2004; Warner and Hefetz 2008). In rural New Hampshire communities, for example, municipal representatives with service contracts indicated lower levels of public satisfaction in their privatized services compared to when the local government provided those services (Mohr et al. 2010). Meanwhile, empirical research from the Netherlands found that only about half of the municipalities there routinely evaluate private service provision; rather, these contracts only come under scrutiny after a catalyst event, such as a municipal employee complaint (Wassenaar, Groot, and Gradus 2013). Contracts between the public and private sectors may gain inertia and be harder to dissolve in the absence of powerful objections.

One outcome of more critical engagement with the private sector has been a shift to mixed public-private service provision, in which there is a blend of contracted and in-house responsibilities. Blended service provision has occurred for some time (Miranda and Lerner 1995); however, it is not until recently that the mixed-delivery approach was recognized by scholars as a particular municipal response to inadequate private services (Bel and Warner 2014). In practice, the reality of public service delivery in many municipalities is complex, and may be best conceptualized as a mixture of public and private forms of provision, rather than a dichotomy between the two (Hefetz and Warner 2004).

An alternative to privatization that is gaining traction in practice and in the academic literature is the use of intermunicipal collaborations to coordinate service provision. Municipal cooperation is especially beneficial when private contract enforcement or supervision is difficult, or when there are few competitors within the

private sector. Similar to trends in privatization, claims of minimized transaction costs from collaboration are highly promoted but not as well supported in the empirical literature, and in some instances, intermunicipal collaborations cost more financially than separate in-house service provision (Bel and Warner 2014).

Rural municipalities can also collaborate with one another to create a larger market with more potential to attract competitive private contracts (Hefetz and Warner 2012). In comparisons of municipal collaboration across rural, suburban, and metropolitan areas, Warner (2009) found that suburban municipalities have the highest rate of intermunicipal cooperation, a reflection of the fact that there are a greater number of nearby municipalities willing to cooperate (i.e., lower transaction costs). In areas where collaboration is more difficult or expensive, intermunicipal efforts may only be a partial approach to service provision (Hefetz, Warner, and Vigoda-Gadot 2012). The long-term effects of municipal collaborations with public and private partners on the quality of services and overall municipal cost efficiency are not entirely clear, particularly in the past decade with the global recession (Perez-Lopez, Prior, Zafra-Gomez 2015).

Privatization and Collaboration in Stormwater Management

The privatization of municipal stormwater management has not been examined in the academic literature (see Coyle McCabe (2006) for an analysis of privatization of urban services by home owners associations, a private non-profit organization). There are reasons to believe that privatization of stormwater management is occurring. First, the EPA has promoted public-private partnerships as a viable form for funding the

retrofitting of stormwater infrastructure (U.S. EPA 2014), and has hosted webinar educational sessions for municipal employees in which information on and examples of privatization strategies were offered (Water Environment Federation 2013).

Second, privatization is occurring in many types of municipal services, and is ingrained within modes of local governance across the United States. Two municipal services that are similar to stormwater management that have experienced widespread privatization are wastewater treatment and solid waste removal. In a review of the privatization of solid waste removal services (Bel and Mur 2009), many studies from the U.S. revealed no cost differences between public and private services, or found that private services were more expensive than public provision. Similarly, the privatization of wastewater services has been occurring in the U.S. for some time, and up until recently, most of the municipalities engaging in long-term, private wastewater operation and maintenance contracts were smaller municipalities (Moore 2011).

Third, smaller local governments are particularly challenged to comply with stormwater regulations and may develop private contracts as a strategy to gain access to expertise. While updated research on stormwater program compliance is lacking, studies from the mid-2000s reported that eleven percent of small municipalities did not yet have discharge permits four years after the Phase II program began (U.S. Government Accountability Office 2007), and there were low (less than 30 percent) compliance rates for select Phase II municipalities in Kansas and California (White and Boswell 2006). Also from that study, many municipal officials claimed to lack the financial resources for stormwater program implementation, viewed stormwater regulation as "an unfunded mandate," and focused their management efforts on meeting the minimum requirements,

at best. Small municipalities that implemented stormwater policies prior to the onset of the national Phase II program tended to work regularly with stormwater professionals or engineers in crafting their municipal management plans (note that it is not clear if these "professionals" were in the private or public sectors) (White and Boswell 2007). Even for small municipalities that have implemented a stormwater program, it has been challenging to evaluate the effectiveness of these programs (Galavotti and Kosco 2012).

Meanwhile, intermunicipal collaboration appears to be occurring in the provision of solid waste services, with municipalities that are more dispersed from one another facing greater administrative complexity and higher monetary costs (Bel and Warner 2014). Bel and Warner (2014) note that municipalities may benefit from "economies of density" in that, through collaboration, municipalities near one another can provide more services across many municipalities for the same cost as fewer services over smaller areas.

My research addresses the gap in the academic literature surrounding the privatization of municipal stormwater services. I ask, in what ways and under what conditions do small and urbanizing municipalities take on private consultation in their stormwater programs? In turn, how does privatization relate to patterns of intermunicipal collaboration in stormwater governance?

Methods

The Utah Case Study

Utah, United States, offers an excellent case study area for understanding the relationships between privatization, intermunicipal cooperation, and stormwater

governance. Utah has experienced rapid and sustained population growth and urban expansion over the past 15 years, with the population projected to double between 2013 and 2040 (Governor's Office of Management and Budget 2012). Small cities and urbanized areas will continue to come under stormwater regulations, and those already participating in stormwater governance activities will do so with continued urban development within their boarders. As such, more municipalities within Utah will experience the devolution of stormwater governance responsibilities.

Utah municipalities are also operating in a social environment in which stormwater organizations are acutely aware of one another, and have opportunities to engage in intermunicipal collaborations. The Utah Stormwater Advisory Committee (USWAC) represents municipal stormwater interests at the state level, and acts as an intermediary organization between state regulators and permittees (including municipal, construction, and industrial permittees). Municipal stormwater managers regularly attend these meetings and engage in activities within the USWAC organization. Additionally, Utah stormwater programs regularly meet as county-level "stormwater coalitions," which consist of multiple representatives from each permitted municipality within the area. These meetings serve as a space within which organizations may exchange information, experiences, and management strategies.

There are also many private consultants that offer stormwater governance and engineering services in Utah. While no single list of stormwater consultants exists, my sense from preliminary research (see Chapter II) is that these firms range in geographic location from Richmond to St. George, UT, in size of single-person to multi-unit firms, and extent of services provided from solely stormwater management to a range of civil

and water engineering duties. Under no circumstances did there appear to be a shortage of private consultant availability within the state.

Mixed Methods

I use a mixed methods approach to explore patterns of privatization of municipal stormwater governance in Utah. The majority of this analysis focuses upon results from a quantitative, statewide online survey of stormwater managers. I support the survey analysis findings with data from semi-structured interviews of municipal stormwater employees and observations of a regional "stormwater coalition" that involved managers from municipalities in a Utah county. The integration stage of data analysis procedures accordingly considered the qualitative data as supplemental to the quantitative work. The qualitative data allowed for a new vantage point on the process of privatization. In the meeting observations, I was thus able to see the ways in which private consultants were associated with intermunicipal collaborations—a process that was not detectable in the survey data alone.

Survey of Stormwater Program Managers

The quantitative data comes from an online survey of Utah municipal stormwater program managers conducted in the spring of 2014. Municipal stormwater managers were defined as city or county employees that were in a decision-making position in a stormwater program that had a stormwater discharge permit under the state MS4 program. In October 2013, names and contact information of current municipal stormwater permit holders were retrieved from the Utah DWQ. To develop an accurate

and expanded sample frame, this list of potential survey participants was compared to program personnel information on stormwater program websites. In instances where primary contacts provided by the state were not directly affiliated with stormwater programs (e.g., a mayor), this contact was replaced with managers who more closely oversaw the program (e.g., a public works director). For municipalities in which only one individual was included in the state list, I included up to two additional individuals, who were identified from websites, public documents, or provided by experts in the field of stormwater management. In total, the sample frame included 142 individual stormwater personnel representing 72 municipalities. To maximize the number of survey responses, all individuals in the sample frame were invited to complete the survey.

Survey content was informed by extensive qualitative observations and preliminary interviews conducted by the author (see Chapter II), and in collaboration with leadership in the Utah Stormwater Advisory Committee, which sponsored the survey research. Prior to survey implementation, the instrument was pre-tested by five stormwater managers. Feedback learned from the pre-test improved survey readability and appropriateness of question topics. The online survey was designed and implemented using Qualtrics software. The software includes many design features promoted by Dillman, Smyth, and Christian (2009) that enhance survey completion rates.

The initial survey email invitation was distributed on February 24th, 2014. The second email contact was distributed three days later. A hardcopy post card reminder was delivered to participants at approximately the same day as the second email invitation. The third email contact was distributed March 3rd. The fourth and final email reminder was issued on March 6th. In the final email reminder, participants who were not involved

in stormwater program decisions could "opt-out" from completing the survey (no one did).

To ensure that non-respondents had the opportunity to complete the survey in spite of internet limitations or inconvenience, I mailed 67 non-respondents a hardcopy of the survey. The hardcopy version included all of the questions posed in the online version, with only minor adjustments made to question order to improve the survey format. On the cover of the survey, I included an opt-out/reference option so that members of the sample frame who were not in decision-making capacities could indicate as such (no one did).

In total, I received 96 completed responses, with a 68 percent response rate (online responses: n=79; mail responses: n=17). Responses included stormwater managers from 67 of the 72 Utah municipal stormwater permittees (93 percent municipal response rate).

A key informant and aggregation approach (Krannich and Humphrey 1986) was used to aggregate information about stormwater program activities at the municipal level. The advantages of using key informants to identify community or municipal-level program characteristics are twofold. First, multiple individuals within one organization may have unique knowledge of specific programs, policies, activities, or events and combining their information provides a more comprehensive account of activities at the organizational scale. Second, using multiple key informants can "eliminate idiosyncratic observations," including responses that are factually incorrect (Schwartz, Bridger, and Hyman 2001:230).

I received responses from two or more individuals within 22 of the 67 responding municipalities. In these cases, individual responses were aggregated to the municipal level using measures of central tendency as employed in earlier analyses of key informants (Krannich and Humphrey 1986; Schwartz et al. 2001; Sharp, Jackson-Smith, and Smith 2011). Survey items that were mostly factual, such as whether or not the city used a private contractor, were aggregated using the response mode, or the most common response among individuals within the municipality. I reconciled disagreement in instances of multiple modes by aggregating responses using the "any yes" rule, in which if there was at least one "yes" response to the presence of an activity or event, the aggregate measure would take on the "yes" response (Schwartz et al. 2001). Schwartz et al. (2001) found that the "any yes" aggregation method resulted in the highest percentage of valid aggregated values. This "any yes" aggregation method was complemented by reliance on "investigator judgment" where responses to other questions in the survey can be used to determine the best value for use in the aggregated dataset (Krannich and Humphrey 1986; Schwartz et al. 2001). For example, in instances of disagreement between respondents who have different levels of involvement within their stormwater program (based on position title), responses were aggregated to reflect the response of the senior-ranking individual.

Operationalization of Key Concepts

Scale. The dollar amount budgeted for the 2014 municipal stormwater program activities represented a measure of the size of the stormwater program and fiscal capacity

of the municipality. Budget information was gathered from stormwater program annual reports, which are public records submitted to the Utah DWQ annually (Table 5).

Privatization. Participants were asked if their stormwater program hired private consultants (such as an engineering firm) for any stormwater management or infrastructure activities. In the instance of more than one response per municipality, responses were aggregated using the "any yes" response described above. Respondents were then asked to indicate the frequency with which their program hired private consultants for 13 types of stormwater program activities (items are summarized on Table 6; five-point scale: 1 = "never"; 5 = "always"; "not sure" option provided). Responses to these items from multiple individuals within a municipality were aggregated using the mean score.

Challenges. I asked participants to indicate the extent to which ten types of program activities had been a challenge for the stormwater program over the last five years (items are summarized in Table 7; five-point scale: 1 = "not a challenge," 2 = "a small challenge," 3 = "a moderate challenge," 4 = "a major challenge," 5 = "the biggest challenge we face," "not sure" option provided). Responses to these items from multiple individuals within a municipality were aggregated using the mean score (excluding "not sure" responses).

Collaboration. Municipal stormwater program collaboration was assessed using a similar question sequence to that of privatization. First, respondents were asked if their stormwater program belonged to a stormwater coalition, a term known locally as a group of municipalities, often within the same county, that regularly meet to exchange ideas or plan activities. In the instance of more than one response per municipality, responses

were aggregated using the "any yes" response described above. Respondents were then asked to indicate the frequency with which they discussed or coordinated with other municipal stormwater programs on any of seven[7] types of activities (items are summarized in Table 11; five-point scale: 1 = "never"; 5 = "all of the time"; "not sure" option provided). Responses to these items from multiple individuals within a municipality were again aggregated using the mean score.

Quantitative Analysis Strategy

Given the small sample size (despite high response rates), I used a series of analyses to consolidate survey items and thereby reduce the number of independent variables. First, I created three additive scales that represented total use of private consultants (alpha = 0.925), total extent of municipal collaboration (alpha = 0.818), and total number of stormwater management challenges experienced for each municipality (alpha = 0.854). Then, each of these three question blocks underwent separate principle components factor analyses using Varimax rotation and Kaiser normalization. Items associated with distinct dimensions that emerged from factor analysis[8] underwent reliability analysis and were used to form separate additive scales. In the regression

[7] The original survey consisted of eight items. I did not consider the item, "How to deal with Utah DWQ regulations" because this question was asked at the request of the project sponsor and was not grounded in the preliminary research used to construct survey questions.

[8] I used an iterative process of variable selection for the factor analyses herein. Items that loaded weakly (e.g., less than .500) on multiple factors were removed one-by-one from the analysis. Interim factor solutions were evaluated for the total variance explained, and for the strength of the factor loadings within the rotated factor matrix (please see discussion of factor loadings and small sample sizes in Chapter I). I considered factor analysis solutions to be 'final' when remaining items were strongly associated with a factor (e.g., above .600) and the total variance explained was maximized.

models that I describe further below, I chose to use the aggregate measure over the measures representing multiple dimensions within that factor (or vice-versa) based upon the extent to which the independent measures were effective at differentiating outcomes. Throughout the regression analyses, I limited the number of independent measures to accommodate the smaller dataset size. Additionally, I emphasize the strength of the beta coefficients in my interpretations of the relationship between independent measures and the variation within dependent variables. *P*-values are most appropriate for interpreting the significance of regression coefficients when assessing the probability of finding significant relationships among non-sampled members of the population. As these analyses consider a census of stormwater organizations, the p-value is not as appropriate in assessing statistical significance as in typical regression analyses.

To assess the conditions under which cities use private consultants in their stormwater programs, I estimated three linear regression models—one with the dependent measure of total private consultant use, and one for each major type of private consultant use identified in the factor analysis. To assess how consultant use relates to patterns of collaboration with other municipalities, I then estimated three linear regression models that corresponded to three different forms of intermunicipal collaboration.

Qualitative Data Collection and Analysis

The qualitative data within this chapter are associated with two, related data collection efforts: meeting observations and stormwater manager interviews.

Meeting observations. Between October 2012 and August 2013, I attended nine monthly meetings of a self-identified "stormwater coalition" that was made up of municipal employees from small and urbanizing cities within one Utah county. The meetings were held at and facilitated by a private engineering firm, which also consulted with a number of the attending municipalities on their stormwater program activities.

During meetings, I took extensive notes that focused upon the interplay between meeting facilitators (employees of the engineering firm) and the municipal representatives who attended the meetings. I also noted and analyzed the content of attendees' concerns, obstacles, and approaches to managing stormwater, and the ways in which the private firm representatives addressed those concerns. As soon as possible after the meetings, I expanded my notes to include details I wasn't able to capture during the meeting, as well as any reflections or preliminary analyses. Meeting observation data were analyzed using an iterative process through which notes were summarized, read, noted, and reviewed again for themes on topics to those explored in the quantitative survey.

Qualitative data were analyzed using an iterative process that included both the settings in which observations were made or interviews conducted, as well as the content of field notes. Handwritten meeting and interview notes were typed and augmented within one day proceeding the meeting or interview session to allow for expansion of observations and documentation of nuances detected during the meeting. This process allowed for more details to emerge from the observations, and for greater accuracy on the types of inter-organizational linkages observed during meetings and interviews. Augmented notes often contained the observations that I made in writing with additional

material that was seen or heard but not necessarily noted at the time of the meeting. Over the course of field note expansion, I also made preliminary memos that analyzed the meeting or interview content. These preliminary memos were noted in a way that clearly distinguished my thoughts from the original and expanded observations.

As data collection unfolded over 13 months, I made frequent efforts to summarize my observations and to note reoccurring themes in memos that synthesized responses and patterns to date. These intermediate notes represent incremental analyses, which were revisited as the data collection progressed. Within these intermediary notes, I began to operationalize key concepts pertinent to the research questions at hand, with emphasis on the relationship between the stormwater organization and the private consultants present during the meetings.

Semi-structured interviews. In addition to meeting observations, I conducted thirty in-depth semi-structured interviews of municipal stormwater employees between March and July 2014. Municipalities were selected using a purposive approach to reflect diversity in the geographic location and size of the municipality, and to ensure inclusion of stormwater programs that both used and did not use a private consultant for their program activities as determined by their responses to the online survey (roughly two-thirds of the interview participants used private consultants for some activities). Interviews lasted approximately 40 minutes, were conducted in-person or over the telephone, and were transcribed.

The interview analysis process consisted of content analysis, in which I focused on the meaning of interview content through coding, condensation, and interpretation procedures (Kvale and Brinkmann 2009). In the first stage of interview data analysis, I

conducted an open coding of interview transcripts to gather general impressions and identify the broad topics that were covered. This step allowed me to identify the areas in which participants' thoughts were associated with the topic of the interview question, and where these thoughts intersected with one another throughout the duration of the interview.

Within the second analysis step, I noted the frequency of comments made about private consultants. I considered the extent to which this topic was of interest and of knowledge to the interviewee(s), and noted that, for municipalities that did not work with private consultants, their reasons for doing so. I also considered the range and extent of intermunicipal collaborations that interviewees expressed, and similarly noted their motivations for engaging in such intermunicipal partnerships. Lastly, I identified the outcomes for both types of municipal partnerships, and considered how these related to one another.

In the third and final stage of analysis, I considered the consistency within my meaning interpretation by checking my analysis of important passages with the broader meanings expressed on the whole of the interview. I was careful to note evidence in support of and in contrast to the literature and quantitative data in my corresponding survey analyses. Nonetheless, the qualitative data interpretation was conducted after that of the survey data, and therefore it is likely that my interpretations of the interview data were made with some understanding of the quantitative findings. This may pose a possible bias in my data interpretation; however, it could also benefit the integration of qualitative and quantitative findings within my multiple methods research design.

Results

Utah Stormwater Programs and Their Municipalities

Utah stormwater programs are present in municipalities ranging from just over 1,700 residents to nearly 130,000 residents, with a median of 15,523) (Table 5). Eighty-six percent of municipalities regulated under the statewide stormwater permit had fewer than 50,000 residents, but most are part of urbanized areas. Stormwater program annual budgets varied between $1,000 and $4,000,000, with a median of $195,000 (mean = $600,036).

Table 5. Descriptive Statistics of Stormwater Programs and Their Municipalities

	n	Mean	Median	Std. Dev.	Minimum	Maximum
Total population (2010)	63	26,563	15,523	29,376	1,701	129,480
Budget ($)	58	600,036	194,690	956,751	1,000	4,000,000

Private Firm Consultation: Descriptive Statistics and Factor Analysis

Three-quarters (75 percent) of Utah municipalities report the use of private consultants for stormwater management or infrastructure activities. The most common uses of private consultants were to design city-owned stormwater infrastructure (25 percent of municipalities) and to review proposed residential or commercial development stormwater plans (21 percent) (Table 6). Approximately three-quarters of municipalities never use private consultants for performing stormwater inspections (76 percent) or conducting water quality monitoring activities (73 percent). About one-third of cities use consultants to gather public input, comments, or complaints (5 percent used “most of the

time" or "always"), and 18 percent used consultants to complete annual reports "most of the time" or "always."

Municipalities varied considerably on the scale capturing the overall scope and intensity of private consultant use (mean = 27.1; std. deviation = 11.9; median = 27.0; scale range: 13 to 65). Factor analysis was used to assess whether the individual measures of private consultant use could be collapsed into logical clusters. The analysis yielded two clear dimensions or ways in which private consultants are used: administrative activities and external implementation activities (75 percent variation explained; n=60). Items that loaded onto the administrative activities dimension represented tasks that were conducted for program planning, recordkeeping, or enforcement, as required of municipalities under their stormwater permits. The external implementation activities dimension consisted of tasks that involved the use of private contractors to manage interactions with local private sector permit holders (via inspections) and the public, as well as monitoring water flows and quality within municipal boundaries).

Based on the results of factor analysis, the five items representing the use of private consultants for administrative activities were averaged to form a composite scale (alpha = 0.947), which was log-transformed for normality. The three items representing the use of consultants for external implementation activities dimension were also averaged to form a composite scale (alpha = 0.827). Overall, municipalities contracted with private consultants for external implementation activities (mean = 1.58; std. dev. = 0.798) less often than for administrative activities (mean = 2.70; std. dev. = 1.40).

Table 6. Extent and Types of Private Consultant Use

How often does your municipality hire private consultants to carry out each of the stormwater management activities listed below? Scale: 1 = "Never"; 5 = "Always"	Mean	Std. Dev.	% Never use	% Always use	Factor loading: Admin. activities	Factor loading: External implementation activities
Design city-owned stormwater infrastructure	3.16	1.57	28	25	**0.915**	0.162
Write your stormwater management plan	2.79	1.57	34	19	**0.927**	0.159
Write your stormwater pollution prevention plan	2.70	1.49	33	14	**0.933**	0.183
Review proposed residential and/or commercial stormwater plans	2.61	1.61	40	21	**0.812**	0.261
Write or update municipal ordinances	2.34	1.39	39	10	**0.869**	0.150
Inform your organization of changes in stormwater regulations or policies	2.21	1.30	44	0	--	--
Complete annual reports	1.92	1.39	63	10	--	--
Conduct public education activities	1.87	1.14	53	3	0.195	**0.756**
Communicate your program's concerns to state regulators	1.85	1.06	52	2	--	--
Coordinate stormwater coalition activities	1.79	1.01	52	2	--	--
Gather public input, comments, or complaints	1.59	0.96	66	2	0.130	**0.868**
Monitoring or water quality sampling activities	1.48	0.97	73	7	0.104	**0.752**
Perform stormwater inspections	1.39	0.86	76	3	0.228	**0.796**

Note: -- indicates that the item was not included in the final solution
Total Variance Explained = 75.312%
Total Eigenvalue = 6.778

Program Challenges: Descriptive Statistics and Factor Analysis

Overall, municipalities cited "keeping up with required paperwork" (16 percent), "filling inspection obligations" (13 percent), and "replacing old infrastructure" (12 percent) as the biggest challenges that they faced (Table 7). Program managers also reported that "staying informed about regulations and policies" (39 percent) and "educating contractors and developers" (36 percent) were major challenges. The factor analysis that determined the distinct types of perceived challenges in stormwater program activities yielded three types of program challenges (74 percent total variation explained, n = 60). The first type of challenge related to education activities involving the public, contractors or developers, and officials working within city government itself (three items; alpha = 0.797). The second factor was associated with challenges in meeting requirements of municipalities, as expected under their state permits (three items; alpha = 0.725). The final dimension included infrastructure maintenance and replacement as a distinct challenge for municipal programs (two items; alpha = 0.765).

Under what conditions do municipalities use consultants?

The regression model to identify the factors underlying overall levels of consultant use included of two groups of independent measures: municipal budget, and the three types of challenges faced (including educational, meeting requirements, and infrastructure) (10.6 percent total variation explained) (Table 8). The measure that was most strongly associated with private consultant use was the program budget (Beta = -0.287; p = 0.056), meaning that cities with larger budgets used consultants less

Table 7. Extent and Types of Perceived Stormwater Program Challenges

Over the past five years, to what extent have the items listed below been a challenge for your stormwater program? Scale: 1 = not a challenge; 5 = the biggest challenge we face	mean	Std. dev.	% a major challenge	% the biggest challenge we face	Factor loadings		
					Education	Meeting req's	Infra-structure
Keeping up with required paperwork	3.73	0.87	50	16	-0.015	**0.877**	0.072
Replacing old infrastructure	3.31	1.12	41	12	0.158	0.017	**0.884**
Filling inspection obligations	3.22	1.07	26	13	0.422	**0.710**	-0.073
Educating contractors and developers	3.13	0.91	36	3	**0.860**	0.108	-0.082
Staying informed about regulations and policies	3.08	1.01	39	3	0.149	**0.753**	0.259
Staying within our stormwater program's budget	3.05	1.10	33	7	--	--	--
Educating the public	2.92	0.95	26	3	**0.813**	0.089	0.299
Educating people within the city government	2.90	0.92	24	3	**0.738**	0.201	0.248
Maintaining current stormwater infrastructure	2.90	0.95	22	5	0.299	0.228	**0.831**
Staying up-to-date on the latest stormwater infrastructure practices	2.87	1.00	24	3	--	--	--

Note: -- indicates that the item was not included in the final solution
Total Variance Explained = 73.52%
Total Eigenvalue = 5.883

frequently than cities with smaller budgets. Only one type of perceived challenge was associated with consultant use: programs that perceived that meeting challenges was a greater challenge tended to use consultants more extensively, overall (Beta = 0.216; p = 0.168).

The regression analyses to explore variation in the different types of consultant uses add some depth to this picture. The regression model that identified factors underpinning consultant use for administrative activities (Table 9) consisted of four

Table 8. Linear Regression on Overall Private Consultant Use

	Beta	t	p-value
Budget (log)	**-0.287**	**-1.960**	**0.056**
Education challenge	0.043	0.270	0.789
Meeting requirements challenge	0.216	1.400	0.168
Infrastructure challenge	-0.101	-0.650	0.519
Adjusted R-square	0.106		

independent measures: budget, the three measures of program challenges, and the use of consultants for external implementation activities. The model explained 36.1 percent of variation in contracting for administrative services. The program budget (Beta = -0.368; p = 0.005) remained a significant negative factor underlying consultant use for administrative activities, meaning that cities with larger annual budgets used private consultants at lower rates for program administration, when controlling for other measures. The second significant factor associated with use of consultants for administrative activities was the extent to which education activities were seen as a challenge. Cities that used consultants for program administration activities more frequently also found education activities to be more challenging (Beta = 0.284; p = 0.048). The final significant indicator of consultant use for administrative activities was the use of consultants for external implementation activities (Beta = 0.471; p = 0.000). This finding suggests that the cities which frequently using consultants for external program implementation also frequently use private consultants for administration activities, when controlling for the other measures.

Table 9. Linear Regression on Consultants Use for Administrative Activities

	Beta	t	p-value
Budget (log)	**-0.368**	**-2.977**	**0.005**
Education challenge	**0.284**	**2.036**	**0.048**
Meeting requirements challenge	-0.004	-0.030	0.976
Infrastructure challenge	0.021	0.159	0.875
External implementation consultant use (log)	**0.471**	**3.847**	**0.000**
Adjusted R-square	0.361		

The third regression model (Table 10) identified factors underpinning consultant use for external implementation activities (27.4 percent variation explained). The stormwater program budget was strongly associated with consultant use (Beta = 0.224; p = 0.118), controlling for the other conditions. Here again, the extent to which education was a challenge for cities was associated with the use of consultants to handle external implementation, but in this model educational challenges were negatively associated with use of consultants for external program implementation (which included education activities) (Beta = -0.358; p = 0.018). Again, the extent to which municipalities perceived meeting requirements was a challenge was positively associated with consultant use for external implementation activities (Beta = 0.236; p = 0.100). Similar to the administrative activities regression model, the use of a consultant for external implementation activities was also positively associated with the use of consultants for administrative activities (Beta = 0.535; p = 0.000).

The semi-structured interview data added further insights as to the factors that lead municipalities to work with private consulting firms in stormwater governance. The most apparent condition that encouraged municipal out-sourcing was a restricted municipal budget, which limited the number of staff that could be dedicated to new

Table 10. Linear Regression on Consultants Use for External Implementation Activities

	Beta	t	p-value
Budget (log)	0.224	1.596	0.118
Education challenge	**-0.358**	**-2.453**	**0.018**
Meeting requirements challenge	0.236	1.682	0.100
Infrastructure challenge	-0.094	-0.666	0.509
Administrative activities consultant use (log)	**0.535**	**3.847**	**0.000**
Adjusted R-square	0.274		

stormwater programs. This was illustrated by the stormwater program lead in a small city: "I think we're stretched so thin and there's only four, well five including my boss, full time public works type guys and, and two of them are dedicated to parks, one is water and I'm the building inspector and, and [I do] the stormwater and all the streets." This employee then related his limited time to the main reason why he thought working with a private consultant was beneficial: "I don't know if I'd ever have time to [do all that the program requires]… And if I did, you know, then I would be not giving it the time it deserves." The city's private consultant completed all reports, wrote the city's stormwater program plan, and set activity goals for the city to follow—all as a means for keeping the city in compliance, but not necessarily encouraging the city to take ownership over their program.

Another reason that cities used private consultants was to ease the tensions between the municipality and the construction contractors and developers that the municipality regulated. Municipal-contractor tensions were described in a number of ways, ranging from "improving relationships" to "we're working on this." One municipal official of a small municipality noted that it was very difficult to take regulatory actions against developers, saying, "These people are your neighbors." As such, use of a private

consultant to establish stormwater policies, and in some cases to inspect construction sites, created a degree of separation between the municipal actors and the contractors that they regulated. Municipal-contractor tensions were particularly strong motivations for the small cities and cities new to stormwater regulations. A representative from one of these cities explained the reasons for hiring a private firm to assist with their stormwater management plan writing and implementation: "Our former engineer is well connected in that [engineering] community, I guess you would say...[the private firm is helping us in] dealing with construction companies, just making sure that, that I'm not overstepping my authority I guess you would say, just wanting to know what has been a common practice, what I need to concentrate on as far as…making sure that construction companies that are working within [name of city] boundaries are doing what they need to do…" Here, the private consultant played a role of a policy creator, and a policy translator—a private organization that crafted municipal stormwater regulations and guidelines, and then conveyed these requirements to contractors and developers. In effect, the consultant built the confidence of the municipal representatives because the stormwater program, to some extent, was not that if the city—it was the doing of the consultant. In hiring the consultant to craft and enforce the policy, the consultant served as an intermediary that alleviated some of the social pressures of small-town social ties.

Other small cities had different experiences with private consultants. One small municipality faced similar budget restrictions as the one above and used consultants intermittently to save money. The areas that they contracted out involved setting program goals or establishing certain program procedures that would bring the city closer to compliance. Some of the topics for which this city used a consultant were technical and

took advantage of professional expertise. Other areas sent out for consultation served to support the stormwater manager, who felt a strong duty to keep the program out of trouble with state auditors, from the city leadership, which was fiscally conservative and reluctant to invest in this area. As noted by the public works director, "[The consultant is] not on the payroll per se so he makes an unbiased opinion on what's his feelings are and recommendations and what have you." For this city and others, private consultants were usually successful in convincing cities to dedicate more resources towards stormwater programs.

Other small city representatives highlighted limitations to using private consultants beyond the cost. One pubic works director noted that, though private consultants had a lot of technical expertise, they tended to be engineers that had a particular outlook on stormwater activities that may not reflect city priorities: "It is really good to have engineers involved but I'm telling you right now that the MS4 is not an engineer driven concept…I think that the engineers get involved a little bit too much because [their focus is] one dimensional…I don't have a degree but I understand how [the MS4 program] works, and all you have to do is read that [state] general [stormwater] permit." The public works director, who occasionally still uses consulting firm services, believed that municipal program managers had a stronger feel for what they actually needed do to satisfy state requirements, and that one way to go about satisfying the program requirements was for municipalities to work together: "We have a lot of valuable resources and information out there from the other people in stormwater that aren't engineers, and that's how it works, you know, you pull all your resources together."

How Does the Use of Private Consultants Shape Intermunicipal Collaborations?

All surveyed municipalities belonged to an organized "stormwater coalition," or a group of municipal stormwater program leaders, typically convened at the county level. The activities for which municipalities most routinely coordinated with each other were educating the general public (73 percent "often" or "all of the time"), and educating developers or contractors (69 percent "often" or "all of the time") (Table 11). Municipalities coordinated the least frequently on tracking stormwater flows into or out of their respective city boundaries (31 percent "often" or "all of the time" coordination) and on the content of their municipal stormwater ordinances (34 percent "often" or "all of the time" coordination).

Factor analysis was also used to explore whether collaborative activities clustered into meaningful categories. The factor analysis yielded two dimensions (Table 11) (67 percent variation explained; total eigenvalue = 4.696; n = 62). The first represented a general suite of areas over which stormwater managers may coordinate with those in other municipalities. These five items were averaged onto one aggregate scale, termed "general collaboration" (alpha = 0.794). Stormwater programs exhibited moderate rates of collaboration on these five items (mean = 3.63, std. dev. = 0.544). The second factor identified three items (one of which was also prominent in the "general collaboration" factor), which pertained to enforcement activities conducted in stormwater programs. The "Best management practice recommendations for developers or contractors" item was excluded in the "enforcement collaboration" scale (alpha = 0.803) both to improve reliability and minimize correlation between the two factors. Stormwater programs

collaborated at slightly lower rates over enforcement matters (mean = 3.20; std. deviation = 0.617) than they did on general program activities.

The final set of regression models assessed the influence of private consultant use on patterns of intermunicipal collaboration, when controlling for stormwater program budget and the extent of challenges perceived (using the aggregated measure) (Table 12). The three regression models identified the factors underpinning (1) general intermunicipal collaboration, (2) enforcement collaboration, and (3) collaboration on stormwater flows across municipal boundaries. The first dependent measure, general collaboration, was marginally, positively associated with private consultant use for external implementation activities (Beta = 0.216; p = 0.193), meaning that municipalities that used consultants for their external activities also collaborate with other municipalities on implementation activities at higher rates. In the second collaboration regression analysis, more frequent use of consultants for external implementation activities also encouraged municipalities to collaborate with one another on enforcement activities (Beta = 0.314; p = 0.056). The third regression model revealed that municipalities with higher rates of consultant use for external implementation activities more regularly coordinated with other cities on stormwater flows than cities that used consultants less frequently (Beta = 0.429; p = 0.004), when controlling for other measures. Cities that perceived higher levels of program challenges were less likely to coordinate with other cities on stormwater flows, suggesting that coordination on non-required activities is something more often taken on by cities with the time or resources to do so. This was the only regression model pertaining to intermunicipal collaboration with any meaningful, overall explanatory value.

Table 11. Extent and Types of Intermunicipal Collaboration

How often do you discuss or coordinate with other MS4 stormwater programs on the following topics? Scale: 1 = never; 5 = All of the time	Mean	Std. Dev.	% Often use	% Use "all of the time"	Factor loadings[1] General	Factor loadings[1] Enforcement
Educating developers or contractors	3.77	0.612	61	8	**0.852**	0.160
Educating the general public	3.72	0.657	68	5	**0.708**	0.267
How to make overall improvements to your stormwater program	3.56	0.666	55	3	**0.784**	0.291
Best management practice recommendations for developers or contractors	3.44	0.742	44	5	**0.520**	0.642
Stormwater inspection criteria or procedures	3.35	0.680	42	2	0.303	**0.866**
Content of stormwater ordinances	3.24	0.670	32	2	0.099	**0.881**
Stormwater flows into or out of your city boundaries	2.99	0.880	29	2	0.588	0.117

[1]Factor analysis:
Total variance explained = 67.08 percent
Total eigenvalue = 4.70

Qualitative meeting observations provided additional insights on the ways in which private firms are involved in and influence municipal collaborations. The stormwater coalition that I regularly observed consisted of representatives from six city municipalities within the same county. Attendees were city employees who managed stormwater in a variety of capacities, ranging from public works directors, to administrative assistants, to official stormwater inspectors. Usually there were about 15

Table 12. Linear Regression of Private Consultant Use on Municipal Collaborations

	General collaboration			Enforcement collaboration			Collaboration on stormwater flows		
	Beta	t	sig.	Beta	t	sig.	Beta	t	sig.
Budget	0.050	0.298	0.767	0.042	0.257	0.798	-0.133	-0.941	0.352
Challenges (scale)	-0.149	-0.928	0.359	-0.087	-0.560	0.578	**-0.384**	**-2.862**	**0.006**
External implementation consultation (log)	0.216	1.322	0.193	**0.314**	**1.960**	**0.056**	**0.429**	**3.083**	**0.004**
Administrative consultation	0.047	0.246	0.807	-0.019	-0.102	0.919	-0.023	-0.142	0.888
Adj. r-square	-0.007			0.027			0.207		

individuals who attended each meeting, with a core group of 10 regular attendees. As one engineering firm employee described it, the coalition was a, "support group for cities dealing with stormwater issues."

Municipalities paid a private engineering firm to host the monthly meetings. The meeting agenda typically included time for attendees to share recent experiences, problems, and solutions. Often before the meeting began, I observed casual conversations between municipal employees in which they chatted about ongoing projects, or even talked about particular stormwater channels that connected their jurisdictions. Thus, the meeting itself (that the private firm organized) allowed for unstructured coordination between the municipalities. Coalition meetings were also a venue for member municipalities to coordinate their activities for the annual water fair, an educational event for area fourth grade students. Participation in that event satisfied the municipality's public education obligations.

Other coalition meetings involved very focused discussions on specific permits or procedures. In one example, the firm employee highlighted a provision of a draft permit document that specified that only "qualified stormwater inspectors" could conduct inspections. The firm, with licensed inspectors who conducted stormwater inspections for many developers and municipalities, was eager for city representatives to understand and endorse the draft stipulation. Without being contentious or making obvious the connections between the proposed requirement and how the firm could benefit, a city representative mentioned that the engineering firm charged a high price for their inspection services, and implied that the firm stood to gain from the proposed regulation. In response, the firm employees tried to convince the municipal representatives that the proposed requirement could alleviate municipal workload: "This requirement will reduce the amount of time that you spend educating the stormwater inspectors hired by private contractors, because [the inspectors] will already be trained. There will be less hand holding."

In a series of preliminary interviews that I conducted of municipal stormwater representatives, one stormwater manager that regularly attended the municipal meeting noted that he found the meetings somewhat helpful, but often wanted more from these sessions: "If we could meet and actually do an inspection, and got credit for their training on this—it would be very helpful to go through this together." On the whole, this representative "didn't identify any real exciting contribution from [the firm]; that the company provides help and reminders in dealing stormwater regulations, but that the value added isn't that great" (my interview notes).

The private firm was able to, in its position as the leader of the intermunicipal collaboration, select the topics on which the municipalities would collaborate, and within those topics, make clear to the cities the ways in which the firm could be of assistance. In stormwater management of northern Utah, intermunicipal collaboration was not an alternative to privatization; it was a type of privatization.

Discussion and Conclusions

Decentralized modes of implementation for national stormwater policy have extended water quality responsibilities and activities from the federal government to Utah cities, the smallest of which have a population less than 0.3 percent that of the District of Columbia. A vast majority of Utah municipalities use private consultants in their stormwater programs, which reflects the widespread pattern of privatization of municipal services in the United States that has been observed since the 1980s. The conditions under which small and urbanizing Utah municipal stormwater programs engaged with private consultants differed, depending on whether cities were hiring consultants for administrative or external implementation tasks. Without distinguishing between the types of activities for which consultants are hired, the municipalities that use consultants most frequently tend to have smaller program budgets and perceive that meeting stormwater program requirements is more difficult. The municipalities with smaller stormwater program budgets did not have adequate financial support for the additional staff necessary to fulfill the administrative demands expected under stormwater permit requirements, and therefore municipalities with limited financial resources relied more regularly on private consultants.

Municipalities that use consultants for administrative activities tend to have smaller budgets, are more likely to perceive requirements for public education as a challenge, and also use consultants for external activities at higher rates. Municipalities that used consultants for administrative activities also tended to perceive educational activities as more challenging, controlling for how often these cities used consultants for external implementation (which included education). This finding implies that municipal program challenges may not be the impetus for consulting with other cities (as those in need of expertise may contract-out for such (Hefetz and Warner 2004)), but that educational challenges are an outcome of programs' decisions to allocate limited financial resources to consultation for administrative activities. In turn, fewer program resources were dedicated to address educational activities, and programs let education remain a challenge.

Administrative activities establish the processes through which municipalities formulate goals, address stormwater regulations, and provide water quality services to the public and the environment. Consultant use for administrative activities shapes the ways in which municipalities go about their work, and has implications for how much the municipality understands about its own program, the types of activities that they carry out, and the extent to which the program meets local needs. Private implementation of stormwater program administrative activities may ensure that these activities are completed: ordinances will be written, infrastructure will be up to specifications, and stormwater management plans for construction projects will be reviewed consistent with regulations. However, the completion of these activities alone does not mean that these activities are appreciated, or that stormwater management is perceived as an important

thing for municipalities to carry out in a thorough and responsible manner. In contracting-out stormwater administration activities, municipalities are at least ensuring that "the job gets done." In not doing the job themselves, do municipalities understand and value the potential benefits that stormwater programs could bring to their cities?

The use of consultants for external implementation activities was associated with the size of the program budget, the extent to which education and meeting program requirements were perceived to be challenges. The negative relationship between perceived educational challenges and the use of private consultants could reflect that consultants are handling the education program, so education is no longer a challenge. External implementation activities are the means through which municipalities interact with the public and the environment, and consultation for external implementation activities changes how stormwater programs represent themselves. Cities are required to educate the public about stormwater, and many cities chose to emphasize the ways to reduce illicit discharges such as pouring paint down storm drains. As observed by Hefetz and Warner (2012; 2004), citizen satisfaction is an important component of the contract monitoring and renewal processes. Municipalities that use consultants to communicate stormwater program goals and educational activities create the possibility that they lose connections to their citizenry on stormwater issues, and as such, create a space within which private consultants may be less accountable for their activities.

The use of consultants for one type of stormwater program activity (administrative or external implementation) was strongly associated with the use of consultants for the other type of activity. Private consultant use appears to gain momentum. Once cities outsource for one type of activity, they are likely to do so for

other activities more frequently. With this momentum in mind, the use of private consultants in stormwater management may be less dynamic in Utah than in other areas where contracting back-in service provision is more common (Hefetz and Warner 2004).

Intermunicipal collaboration surrounding stormwater programs in Utah does not appear to be an alternative to private consultation; rather, the two are very much intertwined. Findings from both qualitative and quantitative analyses demonstrate that private consultants are active facilitators of intermunicipal collaborations. I observed the interconnections between municipal collaboration and private consultant use at intermunicipal meetings, which were often organized and run by private firm employees. Consultant use was also associated with intermunicipal collaborations surrounding the flow of stormwater across jurisdictions, and with collaboration on enforcement activities. Further research is needed to understand the ways in which private firms gain access to these intermunicipal collaborations, and the ways in which they profit through their involvement in such collaborations. As noted by a stormwater manager earlier in the analysis, private engineering consultants have a specific outlook on stormwater management. How does the involvement of private consultants within intermunicipal collaborations shape the ways in which the municipalities frame stormwater problems, or consider potential stormwater solutions? My findings suggest that consulting firms use these municipal collaborations to make their services known to stormwater program personnel, and use intermunicipal collaborations as a way to remind cities of the benefits to their longstanding public-private relationship.

Lastly, I return to the distinction between public services that are social in nature (e.g. welfare assistance) and services that include environmental outcomes, as required

under the Clean Air and Water Acts. I argue that environmental services are also inherently social services. The public benefits from clean water for drinking and recreating, and from clean air for breathing. The same programs or actions that are carried out to improve water and air quality for human purposes also extend into biophysical realms, with less pollution entering streams and the air. Given the social-ecological overlap within these types of services, the primary distinction between social and environmental services, in my mind, is not the final beneficiary of these services, but the ability to evaluate the provision of public services. For example, additional governmental funding to improve the education system may be evaluated using standardized testing procedures, as is the norm for the evaluation of public schools throughout much of the U.S. Parents, students, teachers, and legislators can readily interpret and understand the differences in student achievement based upon comparisons before and after service provision. This is not to say that the evaluation procedures are perfect, but by comparison to the evaluation of water quality at the municipal scale, the process seems straightforward. The assessment of environmental outcomes, and the attribution of environmental improvements to particular efforts, is very challenging given the range of ongoing activities in any watershed, at any time. Thus, municipalities and the public are challenged to accurately assess how stormwater programs in general, and the administration of stormwater programs (regardless of public or private oversight) in particular, may relate to water quality outcomes. The ambiguities surrounding the relationship between program administration and the processes through which environmental outcomes are achieved are also challenging for the general public, which may not yet accept stormwater management as a core role for local governments. The

assessment process that is key to the process of evaluating the value of private consultant services for environmental services is similarly difficult, and may confuse or even discourage critical assessment of private service providers.

The quantitative findings presented herein are limited by the relatively small sample size of municipalities located within one state. The mixed-methods approach brought forth a coherent understanding of privatization, particularly surrounding the reasons for private consultant use as related to budgetary constraints and the ways that private firms were involved in intermunicipal collaborations. Future research should include larger samples of local governments that represent a greater range of geographic and policy contexts, with a particular focus on how small and urbanizing governments administer environmental services that are mandated under decentralized federal regulations and policies. Further attention should be paid to the implications of privatization for citizen voice and democratic control within stormwater program administration, and the ways in which privatization may shape larger patterns of public involvement in environmental governance.

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CHAPTER V

CONCLUSIONS

Introduction

Local water management organizations (LWMOs) are facing considerable challenges, both in the present, and in the future. It is essential to understand how LWMOs adapt to changes in their social-ecological systems in order to ensure freshwater quality, adequate water resources, and healthy aquatic ecosystems in the coming decades. The overarching goal of my research was to explain how local water management organizations of Utah adapt to change. Within this effort, I considered the ways in which local water management organizations, primarily irrigation groups and municipalities, changed their behaviors or took on new strategies in response to shifts in the policies by which they were governed, or changes in the built and natural environments that they managed.

My research took a mixed methods approach to address the overarching research question noted above. I combined quantitative survey data, qualitative interview data, and observational data to offer a range of perspectives on local water governance and adaptation. Below, I highlight specific adaptations that local water management organizations pursued in response to social-ecological changes: collaboration with LWMOs of different types changes to program documents, and privatization and collaboration within stormwater programs.

Review of Chapter II

In this paper, I make two contributions to our understanding of local water governance. First, I explore and describe the ways in which LWMOs are integrated with one another in an effort to manage local water resources (Freeman 2000; Ingram 2011). This approach contrasts most previous work on water governance in the Western U.S., which focused on macro-scale issues of water transfers, infrastructure, and rural-urban conflict (Reisner 1993; Worster 1985). My findings demonstrate that, even in the context of extensive fragmentation across geographies and scales, LWMOs manage to collaborate with one another. My second contribution in this paper is the identification of a two-step process through which organizations become interconnected and potentially develop collaborative arrangements. Hard infrastructure, land use, and hydrological connections are the ties that bind LWMOs of northern Utah to one another. Within the past two decades, coercive responsibility for water infrastructure has brought forward coercive social pressures, forcing LWMOs to recognize and, to various extents, act upon their physical connections.

Overall, my findings suggest that there is a two-step process through which LWMOs form collaborations. First, the increasing occurrence of physical connections (hydrology, infrastructure, and overlapping jurisdictions), makes organizations aware of one another's goals, actions, and needs. Second, organizations build upon an array of social connections, including professional networks, shared social norms and values, and a longstanding history in the region), to build trust and engage in various degrees of partnerships. In many instances, organizations looked to one another to share risk and to reduce financial burdens. In these shared governance activities, coordination became

routinized, and organizational actors developed relationships with one another. I therefore suspect that as urbanization intensifies in small cities in northern Utah, we will observe a greater range of and frequency in the types of inter-organizational collaborations.

Review of Chapter III

In Chapter III, I considered the ways in which two sociological theories could inform the popular field of resilience thinking (Gunderson and Holling 2002). Resilience scholars have not regularly embraced the existing body of organizational change theory despite calls for resilience thinking to do so (Davidson 2010; Hatt 2012). Within this primarily theoretical project, I outlined the relationships between organizations, bureaucratization, and rationality within the sociological approach of organizational rationality (Weber 1978). I then examined how neoinstitutional scholars identified an important transition in the way in which bureaucracy and rationality shape organizational adaptation (DiMaggio and Powell 1983). Within their organizational ecology approach, I used the concepts of the organizational field and three distinct mechanisms of organizational change to identify ways in which organizations may be motivated to adapt their stormwater programs.

The case study analysis of municipal stormwater program adaptation illustrated the ways in which organizational rationality and organizational ecology may inform resilience approaches. I drew upon data from a 2014 online survey of stormwater program officials in cities throughout Utah. I focused on the ways in which these cities adapted their stormwater program guiding documents, and explored the relationship

between program adaptation and organization rationality. Within the case study, I compared the results to those expected from both resilience and sociological theories, and I highlighted the ways in which the sociological theories helped to explain empirical observations of organizational adaptation. My analyses also demonstrated the importance of environmental goals as a motivation for stormwater program document adaptations, while noting that water quality outcomes are, in the minds of municipal managers, tied very closely to their doubts about the regulatory process.

Review of Chapter IV

Devolution and privatization are two related, well-studied phenomena within the fields of public administration and rural sociology (Hefetz and Warner 2012; Warner 2003). Most of those analyses consider municipal provision of social service in the modern context of decentralized policy, which may include local financing of required activities, and fiscal austerity. An alternative to privatization is intermunicipal collaboration, an adaptation to increasing dissatisfaction within the private provision of public goods (Bel and Warner 2014; Hefetz, Warner, and Vigoda-Gadot 2012; Warner 2009). My third and final paper considers privatization and intermunicipal collaboration within the case of devolved stormwater governance.

In this analysis, I used quantitative survey data supported with qualitative interview and meeting observation data to identify the drivers of private consultant use within Utah stormwater programs. I found that about two-thirds of stormwater programs used consultants, and that consultant use could be categorized into two patterns: use for administrative activities and use for external implementation activities. The conditions

under which small and urbanizing Utah municipal stormwater programs engaged with private consultants differed slightly with whether cities were consulting for administrative or external implementation activities. Consultation with private firms for administrative program activities was most closely associated with cities that have smaller stormwater program budgets; municipalities that used consultants for administrative activates more frequently also perceived that educational activities were more challenging. The use of consultants for one type of activity was highly connected to the use of consultants for the other, suggesting that there is inertia to the consultant-municipality relationship that encourages privatization of more than one stormwater governance activity.

Another major finding in this analysis is that privatization is embedded within intermunicipal collaborations—a finding that contrasts the notion that such collaborations are formed as an alternative to private contracts. In Utah, private consultants are hired to facilitate intermunicipal collaborative meetings, and readily shape the topics over which municipalities exchange information, discuss stormwater flows, and make changes to their overall stormwater programs. This finding has implications for the ways in which municipal collaborations are considered within the range of potential adaptations to decentralized stormwater governance, and indicates that the private sector is deeply intertwined with local stormwater governance.

Future Research

The studies presented herein are limited in the geographic and temporal dimensions of local water governance. It goes without saying that, for the survey research

in particular, the analyses would benefit from additional cases at both the municipal and individual levels. Therefore, the first major area for future research should be an expansion of the Utah-focused stormwater manager survey considered here into the states of Colorado and Idaho. Colorado is undergoing extensive urbanization and population growth, similar to Utah, but in a somewhat more progressive political environment. Idaho provides a compelling comparative context as well in that Idaho stormwater activities are permitted to municipalities directly from the EPA (U.S. EPA 2014). In other words, the State of Idaho is not an intermediate level of stormwater governance. Within these slightly different policy contexts, the relationship between municipalities, their motivations for SWMP adaptations, and their relationship to the formal rationalities of bureaucracy may be examined with much greater detail (and statistical power, with about 100 additional cases at the municipal scale).

Another area for further research is the relationship between municipal adaptation and the environment as a potential mechanism that encourages organizational change. As found in Chapter III, environmental goals played a distinct but complicated role in municipalities' motivations to adapt their SWMP documents. Follow-up qualitative analyses should consider the ways in which stormwater managers engage with the environmental conditions within their municipalities, and how these environmental conditions may be socially constructed within the organizational field.

Last, in Chapter II, I found that irrigation groups and municipal water mangers (stormwater and otherwise) are increasingly collaborating with one another in the face of urbanization and increasingly overlapping infrastructure, hydrology, and land use changes. While these collaborations offer the potential benefits of increased resources

and a more cohesive water governance structure (i.e., limited fragmentation within the local scale), there is also the potential for these collaborations to exclude public or citizen access to decision-making processes surrounding local water governance. Future research on these local water organization collaborations should consider the ways in which these reflect or transform the power dynamics present in local water governance. In what ways do inter-organizational collaborations bring in voices and interests that are not part of the organizational collaboration process?

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APPENDICES

APPENDIX A. 2013 Qualitative Data Collection Materials

LETTER OF INFORMATION
Exploratory assessment of water management

Purpose: Dr. Douglas Jackson-Smith and Andrea Armstrong, a graduate student, in the Department of Sociology, Social Work, and Anthropology at Utah State University are conducting a study and are asking for your participation. The purpose of this research is to find out more about how water management organizations of northern Utah make decisions surrounding water management and infrastructure. You have been asked to take part in this study because you are affiliated with a water management organization in northern Utah. This study is funded by the National Science Foundation's Experimental Program to Stimulate Competitive Research. There will be approximately 50 participants in this study from throughout northern Utah.

Procedures: We are recruiting participants for in-depth interviews, which will take place between October 2012 and May 2013 at a time and place convenient for the participant. The interview will be between one and two hours long. You may be asked to participate in potential brief follow-up conversations or interviews. The researchers may ask participants to provide information in addition to their responses, such s maps or digital data that may be useful to their study.

Confidentiality: All information collected during interviews, including any personal identifiers, will be kept in a locked file or a password protected computer in a locked room. Only the investigators will have access to the data. To protect your privacy, personal, identifiable information will be removed from study documents and replaced with a study identifier. Identifying information will be stored separately from data and will be kept. Information collected in this study will be destroyed after the final analysis and publication of results, or within five years of the interview.

Risks: There is minimal risk or discomfort in participation of this research. Participation in this research study may involve a minimal risk of loss of confidentiality. However, the researchers take steps to limit this risk through measures such keeping research materials on password protected computers. Participants will not be identified in any presentation of findings, unless the participant provides permission.

Benefits: There are no direct benefits or compensation to participants in this research; however, our research will indirectly benefit participants through a greater understanding of water management in the northern Utah region.

Voluntary Nature of Participation and Right to Withdraw Without Consequence: Participation in research is entirely voluntary. If you choose not to participate or decide to

withdraw from the study at any time, you will face absolutely no penalty for doing so. Again, it is always your choice to participate in this study at every point in the process.

Institutional Review Approval Statement: The Institutional Review Board for the protection of human participants at Utah State University has approved this research study. If you have any questions or concerns about your rights or a research-related injury and would like to contact someone other than the research team, you may contact the IRB Administrator at (435) 797-0567 or email irb@usu.edu to obtain information or to offer input.

Investigator Statement: "I certify that the research study has been explained to the individual, by me or my research staff, and that the individual understands the nature and purpose, the possible risks and benefits associated with taking part in this research study. Any questions that have been raised have been answered."

Thank you for your help in this research.

Dr. Douglas Jackson-Smith
Principal Investigator
435.797.0582
doug.jackson-smith@usu.edu

Andrea Armstrong
Student Researcher
607.437.1487
armstrong.usu@gmail.com

Interview Guide

ID_____ Date_____

Review confidentiality information

JUST TO GET STARTED, could I ask you a few questions about yourself?
- Length of residence, education/training [relevant to this line of work], if not full time employment: what else do you do
- Length of time at the job, work in other capacities?
- Primary duties in this company/group?

Please tell me a bit about how this [department/company] is organized?
- who reports to who
- What do you do on a day-to-day basis?
- Are you involved in any long-term planning?
- how often do you make important decisions? Of what kind?
- Do you see any changes in leadership in the next 10 years?

What would you say is the primary [water-related] goal of this organization?
- What is the primary challenge to meeting this goal?

Please tell me a bit about your [irrigation company/municipality] constituents/shareholders.
- Geographic range
- Demographics of water users
- Types uses for water

How have these constituents changed in the last 20 years?
- In response to what?
- What has your company/organization done to adjust?

Water Rights:
- Age of water rights
- held by city/company or individuals?

MAP EXERCISE: with space-based discussion of horizontal linkages
Let's walk through the various components of your water system.
- point out diversions, storage, conveyance, and other important infrastructure
- capture places where information is uncertain or the flows are vague

What are the major challenges for managing a system like this?

What are the other organizations who also manage water in this region where you work?

How does your company/group coordinate with other water managers from the region?
- Specifically irrigation companies or other municipalities
- In what settings? How long has this gone on?
- Have there been any problems with this coordination?

INFRASTRUCTURE

What is the most typical type of infrastructure maintenance that your group performs?

What major infrastructure changes were undertaken in the last 10 years?
- How did that project come to be?
- What were some of the challenges?
- Was there anything in particular that made that change possible?
- Project cost _____

What are the long-term plans for infrastructure changes?
- In about how many years from now will your current infrastructure need replacement or upgrade? _____ years
- In about how many years from now do you think your infrastructure will <u>actually</u> be replaced? _____ years

Specifically, what are the most likely types of infrastructure changes your group will make in the next 10 years? In the next 20 years?
- How do you prioritize these different infrastructure upgrades and/or maintenance?
- Are these infrastructure decisions made with a certain time horizon in mind?

In a perfect world, if you were to make any changes to your infrastructure [current or something that you don't already have], what would you be most likely to change?

What would be your ideal change?

- Why?
- How realistic is this?
- How would this/these projects get funded?
- What are the major road-blocks that prevent this from happening?
- What would need to be done to change these road blocks? Is this anything that your organization can do?

INFRASTRUCTURE SCENARIO:

Let's say that these road blocks [referring to above] have been removed – what would it take to start your most important infrastructure change?

- Who else is involved in making this decision?
- What would they think of your ideal change?
- Who would you turn to for assistance: financial & technical?

How are they involved in identifying new types of infrastructure?

Do you have an example of how you work with them, or how they assist your group?

Has this process changed in the last 10-20 years? Become easier? Harder? Why?

What is the role of regulation or legal requirements in your planning for future infrastructure changes?

MANAGEMENT:

What kinds of decisions do you make with regards to the operation of the water system? - daily/weekly, seasonal, or annual basis
- of decisions – allocating water, altering flows, fixing leaks, controlling weeds

PRICES

How are prices for water set in your organization?

What changes (if any) would you like to make in pricing?

What keeps you from making those changes?

INFORMATION

What types of information do you use on a regular basis to make management decisions? Where does this information come from?

Is there any information that would help you make better management decisions? Why don't you have this information?

How do you organize and manage all the information related to operating this system?

REGULATIONS

When it comes to state and federal regulations, which ones have the biggest impact on how your organization works?

- Which ones do you find helpful in achieving your objectives?
- Which ones make achieving your objectives more difficult?

How much time do you (or does your organization) spend complying with state or federal regulations?

USERS

In what ways do individual water users influence the way you (or your organization) makes water management decisions?

- Could you describe a typical instance of this for me?
- Are these users the most influential in shaping the operation?

FUTURE CHALLENGES

What are other challenges that your group faces?

- how have these changed over time?
- Who helps you with these challenges?

Do you see other organizations in the area dealing with similar challenges?

- Are they doing anything differently than your group? How so?

Have you noticed changes in the amount of water available over time?

- how so? What has your organization done to respond to this?
- What do you think will be done about this in the future?

Scenarios*: I have a few more questions related to more specific scenarios or activities. We'll talk through your thoughts on land use changes, weather patterns, irrigation flows, and water quality.*

Transitioning land uses –agriculture to residential uses:

How have land use changes influenced how you operate?

What are the biggest challenges? How do you address these?

How has this transition played into your infrastructure planning or decisions?

Weather patterns:

Back in the early to mid 2000s, there were noticeably less rainfall/snowmelt and lower water levels. In those years, what did you do different from what you would consider "normal" management?

- What problems did you encounter that were unusual?
- What problems that happen in normal years weren't there in the dry years?

How did you adapt to low water flows this year?

Moving forward to two years ago, when there was more water available than usual, what did you do differently from a normal year?

- What problems did you encounter?
- What problems that happen in normal years weren't there in this wet year?

How do seasonal inconsistencies in water supply play into your infrastructure planning or decisions?

Irrigation canal return flow:

I've heard from a few water managers that they have noticed a difference in the amount of water available at the end of the canal when users have shifted from flood to sprinkler irrigation.

- Have you seen this shift in your area? Have you noticed any changes in flows? Could you describe what happened?
- How has your organization responded to these changes?
- If more of this happens, what do you think will be the outcome?

Water quality: A lot of attention is paid to water quantity, but I'm also interested in water quality.

What does your group do wrt water quality?

What types of water quality regulations do you respond to?

What ways do you see water quality as posing a challenge for your organization down the road? What are the most obvious steps for your organization to address this?

WRAP-UP:

Are there questions that I'm forgetting to ask—things that are critical to your organization's daily operations?

Are there any challenges that you see coming in the future that I haven't brought up?

Thank you.

APPENDIX B. 2014 Survey Materials

LETTER OF INFORMATION
Survey of Utah Stormwater Managers

Introduction and purpose of the study
This research was initiated by the Utah Stormwater Advisory Committee (USWAC) in order to document the challenges and opportunities faced by stormwater managers across the state. We recognize that stormwater management has become a more significant responsibility of municipalities in Utah in recent years. This project is designed to document the activities, experiences, and information needs of stormwater managers across the state. The study is funded by USWAC. Andrea Armstrong, a graduate student at Utah State University, and her supervisor, Dr. Douglas Jackson-Smith are conducting the survey on behalf of USWAC, and as part of a statewide project on water and stormwater management (iutahepscor.org).

Procedures

You are being asked to complete a brief online survey. To ensure our efforts are relevant and beneficial to stormwater managers, we need responses from as many of municipal stormwater managers as possible. Your response is vital to the success of the project.

Your city or company was selected for participation from a publically available list of Utah stormwater permittees.

The survey asks questions about your city's stormwater infrastructure and policies, experiences with state and federal stormwater regulations, and use of various information sources. It is important that participants selected for the study respond so that we gather valid information about Utah stormwater management. Responses to the survey will be compiled and reported as statistical averages. Absolutely no individual responses will ever be publically identified.

Voluntary nature of participation and right to withdraw

Participation in this research is entirely voluntary. You may refuse to participate at any time without consequence or loss of benefits. In addition, you have the right to refuse to answer any specific questions if there is information you are not comfortable sharing with us.

Confidentiality

Throughout our work, we will take steps to ensure your privacy and identity is kept confidential. Individual respondents will be tracked using ID numbers, rather than names or other identifying information. The list that matches that ID number to a particular person will be maintained exclusively with researchers at Utah State University, and will

not be available to any other people or organizations. All electronic data will be kept on a password protected computer with password protected files to prevent unauthorized use. The identity and location of respondents will never be shared with any other researchers, organizations, or agencies. Any reports or publications that result from the information collected in this study will rely on summaries and aggregated tables that cannot reveal the identity of any participating person. The ID number linking you to this research will be kept until the end of the project, approximately December 2015, but destroyed upon completion.

Risks and Benefits

We believe there are very minimal risks associated with participation in this survey. None of the topics are particularly sensitive. There is a small risk of loss of confidentiality but every effort will be made to minimize this risk.

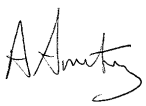
There are a number of potential benefits for participating in the research. The information you provide will help us better understand local stormwater management and managers' perspectives on key stormwater practices and policies. We will use the results to inform policymakers of stormwater managers' concerns and should help ensure future policies are efficient, effective, and reasonable. Results also will be used to guide the development of new stormwater management tools. A summary of the findings from this study will be provided to you at the conclusion of the project if you would like.

IRB Approval Statement

The Institutional Review Board for the protection of human participants at Utah State University has approved this research study. If you have any questions or concerns about your rights or a research-related injury and would like to contact someone other than the research team, you may contact the USU IRB Administrator at (435) 797-0567 or email irb@usu.edu to obtain information or to offer input.

Contact the Researchers

If you have other questions about this project, you may reach Andrea Armstrong by phone (435) 797-7903 or email: armstrong.usu@gmail.com, or Douglas Jackson-Smith at USU at (435) 797-0582 or douglas.jackson-smith@usu.edu.



Andrea A Armstrong, USU

Dr. Douglas Jackson-Smith, USU

Email invitations to complete online surveys

Subject: Utah stormwater: Opportunity to provide feedback
Email Body:

USWAC Logo and USU LOGO

Good morning (first name),

The Utah Stormwater Advisory Committee (USWAC) is conducting an online survey of MS4 stormwater managers. We would like your feedback on Utah's stormwater regulations and policies and information about the challenges you face within your stormwater program.

The online survey should take less than 20 minutes to complete. To take the survey, please click on the link below, or copy and paste it into your web browser:

[%LINK%]

USWAC is conducting this survey in order to learn about the challenges that stormwater managers face, and so that USWAC may communicate these challenges to state and federal regulators. USWAC is partnering with Utah State University in order to collect valid, objective information.

The survey should be completed by a person who is knowledgeable about stormwater management activities in [name of city]. Your name was provided as a contact for stormwater issues in your municipality. If you feel there is a better person in your organization to fill out the survey, please invite them to join you in completing the questions.

All of your responses will be kept confidential, and will only be reported as averages or combined with other individuals' responses. No responses from an individual or his/her stormwater program will be identified at any time. Please see the attached document for more information on the survey and our confidentiality policy.

If you have problems accessing the survey, or have questions about the research, please email Andrea Armstrong at armstrong.usu@gmail.com or (435) 797-7903.

We appreciate your time.

Thank you,

[signature image]
Steve Burgon
USWAC Past-President

[signature image]
Andrea Armstrong
Graduate Student, Utah State University

[signature image]
Douglas Jackson-Smith
Professor, Utah State University

Follow-up email 1:
Subject: USWAC survey: your input requested

Hello (first name),

A few days ago you may have received an email invitation to complete an online survey of stormwater managers in Utah. We would like to extend this invitation to you once again. It is important that we hear from you so that our research findings accurately represent the thoughts and activities of stormwater managers in Utah.

Please take 20 minutes to complete the online questionnaire. To take the survey, please click on the link below, or copy and paste it into your web browser:

[%LINK%]

We maintain strict confidentiality in reporting survey results. That is, no responses from an individual or his/her MS4 will be identified at any time. Please see the [linked] document for more information on the survey and our confidentiality policy.

If you have problems accessing the survey, or have questions about the research, please email Andrea Armstrong at armstrong.usu@gmail.com or (435) 797-7903.

Thank you for your time and response,

[signature image]
Steve Burgon
USWAC Past-President

[signature image]
Andrea Armstrong
Graduate Student, Utah State University

[signature image]
Douglas Jackson-Smith
Professor, Utah State University

Follow-up email 2:
Subject: Please respond to the USWAC survey

Good afternoon,

Last week the Utah Stormwater Advisory Committee (USWAC) invited you to complete an online survey of stormwater managers in Utah. We understand that you are busy, but your response is very important to us, so that we have the most accurate representation of your thoughts and activities.

The survey should take you less than 20 minutes to complete. Please follow the link below, or copy and paste it into your web browser:

[%LINK%]

USWAC is conducting this survey so that it may best communicate the problems and challenges faced by stormwater managers to state and federal regulators.

We maintain strict confidentiality in reporting survey results. No responses from an individual or the MS4 at which he or she works will be identified at any time. Please see the [linked] document for more information on the survey and our confidentiality policy.

If you have problems accessing the survey, or have questions about the research, please email Andrea Armstrong at armstrong.usu@gmail.com or (435) 797-7903.

We appreciate your input!

Thank you,

[signature image]
Steve Burgon
USWAC Past-President

[signature image]
Andrea Armstrong
Graduate Student, Utah State University

[signature image]
Douglas Jackson-Smith
Professor, Utah State University

Follow-up email 3:
Subject: Last chance to participate

Dear [first name],

We are emailing for the last time to encourage you to complete the USWAC online survey:

[%LINK%]

Your response will help USWAC identify the opportunities for improving stormwater regulations, infrastructure, and management activities in Utah. As explained in this document, all responses are confidential.

If you are not involved in making decisions for your stormwater program or do not have enough information to complete the survey questions, please let us know by clicking on this link:

[%opt-out link%]

We appreciate your time in answering our questions.

Thank you,

[signature image]
Steve Burgon
USWAC Past-President

[signature image]
Andrea Armstrong
Graduate Student, Utah State University

[signature image]
Douglas Jackson-Smith
Professor, Utah State University

Cover letter for hardcopy survey mailing

March 10, 2014

Dear MAIL MERGE NAME:

A few days ago you should have received an email invitation to participate in an important study about stormwater management in Utah.

We are contacting you today to ask you to complete the enclosed survey. We know that you are busy, but your response is critical to our study. We have also included a postage paid envelope to return the survey. If you are not involved with stormwater management activities for your municipality, please let us know in the question on the front cover, and returning the survey in the enclosed envelope.

This survey is a chance for you to express your concerns about stormwater regulations or program requirements. It is also an opportunity to demonstrate your stormwater program's activities and accomplishments.

Your participation in this study is completely voluntary. If there is any information on the survey you are not comfortable sharing, you have the right to leave those questions blank. We believe there are very minimal risks associated with participation in this survey. The Institutional Review Boards for the protection of human subjects at Utah State Universities has approved this study.

We also want to assure you that your responses will be treated with the utmost confidentiality. The survey has an identification number that we only use to check your name off the mailing list when you return the survey. Your name will never be placed on the survey itself, and the study results will only be reported in statistical summary tables that cannot reveal the identity of individual respondents.

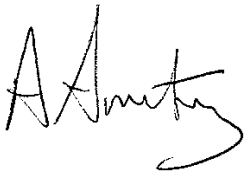
We realize that you are busy, but hope you can find time to complete this survey. Since only a small number of people are involved in stormwater management in Utah, **it is critical we get responses from as many people as possible**.

The survey results will be used to make sure that future policy recommendations are realistic and practical. The results will also be put towards Andrea Armstrong's progress in her graduate degree.

We thank you very much, in advance, for taking the time to answer our questions.

Sincerely,

Steve Burgon
Utah Stormwater Advisory Committee
Past-Chair



Andrea Armstrong
Utah State University
Graduate Student

2014 Stormwater Manager Survey

Survey of Stormwater Managers in Utah

Conducted by the

Utah Stormwater Advisory Committee

USWAC
Utah Stormwater
Advisory Committee
www.uswac.utah.gov

In partnership with Utah State University

Are you involved in making decisions about your city's stormwater program?

O Yes O No

If YES, please continue to the next page.

If NO, please provide us with the name and email address of the primary person who manages stormwater in your municipality.

Name: _____

Email: _____

You can stop here and return the survey in the enclosed envelope.

Thank you for participating in our stormwater manager survey. Your responses will help the Utah Stormwater Advisory Committee (USWAC) address your stormwater program's challenges, activities, and the types of stormwater infrastructure that you manage.

You were selected to complete this survey because you are identified as a person involved in stormwater programs in your municipality. The survey should take no more than 20 minutes to complete.

If you have questions about the survey, please feel free to contact Andrea Armstrong (Utah State University) at (435) 797-7903 or armstrong.usu@gmail.com.

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1. Which statement below best describes your stormwater program?
Please check one.

- ○ My program is currently an MS4 Phase I permittee
- ○ My program is currently a MS4 Phase II permittee
- ○ My program is not yet an MS4 Phase II permittee, but may become one soon
- ○ My program is not yet an MS4 Phase II permittee, and will not become one soon

2. What statement best describes your affiliation with a stormwater program?
Please check one.

- ○ I am employed by a city or local government MS4 stormwater program
- ○ I am a consultant responding on behalf of an MS4 program
- ○ Other (Please describe):_____

3. How would you summarize your duties within your stormwater program?
Please check all that apply.

- ○ I supervise my city's stormwater program
- ○ I conduct the administrative activities in my city's stormwater program
- ○ I conduct stormwater inspections on behalf of my city
- ○ I write stormwater management plans or policies on behalf of my city
- ○ Most of my time is spent working on stormwater topics
- ○ Most of my time is spent working on topics that do not involve stormwater
- ○ Other (please describe):_____

The next set of questions is about your municipality's stormwater management plan (SWMP). SWMPs are documents that address your program's goals and activities. We're interested in your thoughts on topics related to your SWMP, even if you were not involved in writing the document.

4. Does your municipality have a stormwater management plan (SWMP)?
Please check one.

○ Yes ○ No ○ *not sure*

5. Has your municipality updated its SWMP within the last four years (since 2010)?
Please check one.

○ Yes O No O *not sure*

If you answered "No" above, please skip to Question 7 (next page)

6. How strong of a reason were the items listed below in the changes made to your municipality's SWMP?

The changes to our SWMP….

	Not a reason	A small reason	A major reason	The most important reason	*not sure*
…brought our program up to date with our permit requirements	O	O	O	O	□
…reflected changes that we believe will be made to our permit in the near future	O	O	O	O	□
…included policies or procedures being used by stormwater programs similar to ours	O	O	O	O	□
…were recommended by members of our stormwater coalition	O	O	O	O	□
…brought our stormwater program in-line with programs similar to ours	O	O	O	O	□
…were recommended by a stormwater consultant	O	O	O	O	□
…were encouraged by a professional organization *(e.g. USWAC)*	O	O	O	O	□
…reflected updated engineering practices or technical guidelines	O	O	O	O	□
…addressed concerns about possible future flooding	O	O	O	O	□
…could reduce contaminants in runoff or site discharges	O	O	O	O	□
…could buffer our system during big storm events	O	O	O	O	□
…let us address a number of environmental challenges	O	O	O	O	□

We're interested in learning about the types of stormwater infrastructure used in your municipality.

7. To the best of your knowledge, does your municipality have any of the following types of stormwater infrastructure on any city-owned properties, roadways, or buildings?

	YES	NO	NO, but this is being considered	*not sure*
Detention basins *(that collect stormwater and are drained with pipes)*	O	O	O	□
Retention basins *(that collect stormwater and are drained by infiltration)*	O	O	O	□
Bioswales *(including grassy swales)*	O	O	O	□
Constructed wetlands	O	O	O	□
Permeable pavement	O	O	O	□
Native plants *(for ground cover or site restoration)*	O	O	O	□
Vegetative buffer strips	O	O	O	□
Green roofs	O	O	O	□
Rain barrels	O	O	O	□

8. Does your stormwater program currently require retention or detention basins on city property? Please check one.

- ○ Yes, these are required on all city properties
- ○ Yes, these are required on some city properties
- ○ No, they are not required
- ○ *not sure*

9. Does your stormwater program currently require retention or detention basins on new residential or commercial developments? Please check one.

- ○ Yes, they are required on all new residential or commercial developments
- ○ Yes, they are required on some new residential or commercial developments
- ○ No, they are not required
- ○ *not sure*

10. Does your stormwater program maintain a map or list of stormwater retention or detention basins? Please check one.

○ Yes O No O *not sure*

11. Detention and retention basins require maintenance. In your stormwater program's jurisdiction, who is responsible for maintaining detention and retention basins?
Please check all that apply.

- ○ the city or county government
- ○ homeowners associations (HOAs)
- ○ individual private landowners (not HOAs)
- ○ commercial businesses
- ○ other (please describe): _____
- ○ *not sure*

12. Within your municipality, are the following types of stormwater infrastructure used on any privately-owned properties?

	YES	NO	NO, but this is being considered	*not sure*
Detention basins *(that collect stormwater and are drained with pipes)*	O	O	O	□
Retention basins *(that collect stormwater and are drained by infiltration)*	O	O	O	□
Bioswales *(including grassy swales)*	O	O	O	□
Constructed wetlands	O	O	O	□
Permeable pavement	O	O	O	□
Native plants *(for ground cover or site restoration)*	O	O	O	□
Vegetative buffer strips	O	O	O	□
Green roofs	O	O	O	□
Rain barrels	O	O	O	□

13. Does your stormwater program use any of the following techniques to monitor stormwater?

	YES	NO	*not sure*
Visual monitoring *(e.g., check to see if there is cloudy or muddy discharge)*	O	O	□
Grab samples *(e.g., collected by hand for analysis)*	O	O	□
Storm event grab samples *(e.g., collect water samples only during rain events)*	O	O	□
Automated water quantity measurements *(e.g., use of equipment)*	O	O	□
Automated water quality measurements *(e.g., use of equipment)*	O	O	□
Local rainfall measurements	O	O	□
Local weather forecasts	O	O	□
Temperatures to track the timing of snowmelt	O	O	□

14. Compared to three years ago, how has the frequency of monitoring changed in your stormwater program?
Please check one.

- ○ Much less frequently
- ○ Less frequently
- ○ About the same or no change
- ○ More frequently
- ○ Much more frequently

15. Does your municipality experience any of the water quality conditions listed below?

	YES	NO	*not sure*
High levels of sediment in stormwater runoff *(e.g. dirty or muddy runoff)*	O	O	□
High levels of nitrogen or phosphorus in stormwater runoff	O	O	□
High levels of E. coli or bacteria in stormwater runoff	O	O	□
High levels of oil or grease in stormwater runoff	O	O	□

16. Does your stormwater program belong to a stormwater coalition?
Please check one.

○ Yes O No O *not sure*

17. How often do you discuss or coordinate with other MS4 stormwater programs on the following topics?

	never	rarely	sometimes	often	all of the time	*not sure*
Stormwater flows into or out of your city boundaries	O	O	O	O	O	□
Content of stormwater ordinances	O	O	O	O	O	□
Stormwater inspection criteria or procedures	O	O	O	O	O	□
Best management practice (BMP) recommendations for developers or contractors	O	O	O	O	O	□
Educating the general public	O	O	O	O	O	□
Educating developers or contractors	O	O	O	O	O	□
How to deal with Utah DWQ regulations	O	O	O	O	O	□
How to make overall improvements to your stormwater program	O	O	O	O	O	□

18. Does your stormwater program hire private consultants (such as an engineering firm) for <u>any</u> stormwater management or infrastructure activities?
Please check one.

○ Yes O No O *not sure*

19. How often does your municipality hire private consultants to carry out each of the stormwater management activities listed below?

	Never	Rarely	Sometimes	Most of the Time	Always	*not sure*
Perform stormwater inspections	O	O	O	O	O	□
Conduct public education activities	O	O	O	O	O	□
Gather public input, comments, or complaints	O	O	O	O	O	□
Review proposed residential and/or commercial stormwater plans	O	O	O	O	O	□
Design city-owned stormwater infrastructure	O	O	O	O	O	□
Write your MS4's stormwater pollution prevention plan (SWPPP)	O	O	O	O	O	□
Write your MS4's stormwater management plan (SWMP)	O	O	O	O	O	□
Write or updating MS4 stormwater ordinances	O	O	O	O	O	□
Complete annual reports	O	O	O	O	O	□
Coordinate stormwater coalition activities	O	O	O	O	O	□
Communicate your stormwater program's concerns to state regulators	O	O	O	O	O	□
Inform your organization of changes in stormwater regulations or policies	O	O	O	O	O	□
Monitoring or water quality sampling activities	O	O	O	O	O	□

Other (please describe): _____

20. Do any irrigation or canal companies operate canals, pipes, or ditches within the jurisdiction of your city?
Please check one.

○ Yes O No O *not sure*

21. Do any city stormwater drains or outfalls use irrigation canals or ditches to convey stormwater?
Please check one.

○ Yes O No O *not sure*

22. Do irrigation companies or residents use city curb-gutter infrastructure to convey any irrigation water?
Please check one.

○ Yes O No O *not sure*

23. Over the last 5 years (since 2009), has your city collaborated with local irrigation or canal companies to do any of the following:

	YES	NO	*not sure*
Help design new infrastructure for an irrigation company	O	O	□
Help pay for at least a portion of new irrigation infrastructure *(e.g., replacing open canals with pipes)*	O	O	□
Help pay for an irrigation company's infrastructure maintenance costs	O	O	□
Provide labor or equipment to help an irrigation company maintain their infrastructure	O	O	□
Purchased shares in local irrigation companies	O	O	□
Used irrigation company water to irrigate city property	O	O	□

24. Does your city have any of the following stormwater management arrangements with irrigation or canal companies?

	YES	NO	*not sure*
There are formal management agreements in place *(e.g., approved by mayors or councils)*	O	O	□
There are informal management agreements in place *(e.g. verbal agreements, handshakes)*	O	O	□
There is co-management *(e.g., an advisory group with representatives from both the city and irrigation organization)*	O	O	□
We have other management arrangements (please describe): _____			

25. How often has your city experienced each of the following types of flooding events in the last 5 years (since 2009)?

	Never	Occasionally *one or two flood events every 5 years*	Very Often *three or four flood events every 5 years*	Frequently *about one flood event a year*	Very Frequently *more than one flood event a year*	*not sure*
flooding from rainstorms	O	O	O	O	O	□
flooding from snowmelt	O	O	O	O	O	□
flooding from rain on snow-covered or frozen ground	O	O	O	O	O	□
flooding from canal overflows or breaks	O	O	O	O	O	□
street flooding	O	O	O	O	O	□
basement flooding	O	O	O	O	O	□

In the next questions, we will ask you about the problems your program may or may not encounter, the changes that may be happening within your municipality, and your thoughts on possible challenges.

26. Over the past 5 years, to what extent have the items listed below been a challenge for your stormwater program?

	not a challenge	a small challenge	a moderate challenge	a major challenge	the biggest challenge we face	*not sure*
Keeping up with required stormwater paperwork	O	O	O	O	O	□
Staying within our stormwater program's budget	O	O	O	O	O	□
Staying informed on stormwater regulations and policies	O	O	O	O	O	□
Filling our obligations for stormwater inspections	O	O	O	O	O	□
Educating contractors and developers about our stormwater program	O	O	O	O	O	□
Educating the public about stormwater	O	O	O	O	O	□
Educating people within the city government about stormwater regulations	O	O	O	O	O	□
Replacing old stormwater infrastructure	O	O	O	O	O	□
Maintaining current stormwater infrastructure	O	O	O	O	O	□
Staying up-to-date on the latest stormwater infrastructure practices	O	O	O	O	O	□

27. Over the past few years, have you noticed any of the following <u>changes</u> taking place within your stormwater program's jurisdiction?

	much less	less	no change	greater	much greater
Amount of impervious surfaces	O	O	O	O	O
Number of rain events over 1/4th of an inch	O	O	O	O	O
Number of "intense" rain events or storms	O	O	O	O	O
Number of rain events when the ground is still frozen	O	O	O	O	O
Timing of spring snowmelt	O	O	O	O	O

28. In general, how similar are your views on stormwater to those of other managers within your stormwater program?
Please check one.

Not at all similar	Somewhat similar	Very similar	*not sure*
O	O	O	O

29. Overall, how important are each of the following to your stormwater program?

	Very Unimportant	Unimportant	Neither important nor unimportant	Important	Very Important
Minimizing stormwater costs for the public	O	O	O	O	O
Remaining in compliance with state and federal laws	O	O	O	O	O
Ensuring that developers follow all rules and regulations	O	O	O	O	O
Using voluntary approaches to stormwater management when possible	O	O	O	O	O
Being a good environmental steward	O	O	O	O	O
Reducing stormwater pollution	O	O	O	O	O
Reducing the chances of flooding	O	O	O	O	O
Trying new stormwater management technologies	O	O	O	O	O
Increasing public understanding of stormwater management	O	O	O	O	O
Improving local water quality regardless of regulations	O	O	O	O	O

30. In the past three years (since 2011), has your stormwater program conducted any of the activities to gather opinions or comments from the general public about stormwater?

	YES	NO	*not sure*
Collected online comments	O	O	□
Collected written comments	O	O	□
Held a "town hall" or "Q&A" session	O	O	□
Taken comments via telephone	O	O	□
Listened to public comments in non-work settings	O	O	□

31. How satisfied are you with the amount of available information about the technical or engineering aspects of stormwater management?
Please check one.

- ○ Very Dissatisfied
- ○ Dissatisfied
- ○ Neutral
- ○ Satisfied
- ○ Very Satisfied

32. How useful are the following information sources for your stormwater management activities?

	Very not useful	Not useful	Neither useful nor not useful	Useful	Very useful	*not sure*
Utah DEQ - Division of Water Quality website	O	O	O	O	O	□
US Environmental Protection Agency (EPA) website	O	O	O	O	O	□
Utah Stormwater Advisory Committee resources	O	O	O	O	O	□
Conversations with stormwater managers at other municipalities	O	O	O	O	O	□
Stormwater coalition meetings	O	O	O	O	O	□
Conversations with stormwater coalition members	O	O	O	O	O	□
Hired stormwater consultants	O	O	O	O	O	□
University researchers	O	O	O	O	O	□
Professional publications (e.g. *Stormwater Magazine, APWA Reporter*)	O	O	O	O	O	□
Other (please specify): _____						

33. How useful would you find a demonstration site where you could learn more about stormwater technologies or infrastructure?
Please check one.

- ○ Not at all useful
- ○ A little useful
- ○ Useful
- ○ Very useful

Finally, we would like to know a little about your personal experience working on stormwater issues. This information will help us describe stormwater managers in general, and will not identify you in any way.

34. How many years have you worked in your current stormwater program?

_____ years

35. Overall, how many years have you worked in the area of stormwater management or stormwater engineering?

_____ years

36. What kind of formal education have you completed?
Please check one.

- ○ High school diploma
- ○ Associate's degree or some college
- ○ College degree in science or engineering
- ○ College degree in another field
- ○ Graduate degree in science or engineering
- ○ Graduate degree in another field

37. How familiar were you with stormwater management or engineering before you entered your current position?
Please check one.

- ○ not at all familiar
- ○ a little familiar
- ○ moderately familiar
- ○ very familiar
- ○ an expert

Thank you for completing the survey.
Please use the space below to add any additional comments or feedback.

APPENDIX C. 2014 Interview Materials

Interview guide: Current MS4 programs

Intro:

What do you do for this city?

Are there other units within the organization that work with stormwater?

Are any other types of activities (not related to stormwater) done at this office?
What types?
What share of the work is related directly to stormwater management programs (if any)?

How are stormwater-related activities funded here? [revenue streams and allocations]

What do you think of this funding arrangement? Does it suit your needs?

Challenges:

What are the major challenges that the city faces?

What has the city done to address those challenges?

Do you think that these challenges are getting more or less difficult? How so? Why?

Follow-up for each significant change:

- What was the problem that was being addressed?
- Why did your organization decide to adopt this particular policy?
- What other options did you consider?
- organizations or individuals who recommended this change?

Changes:

What are some of the biggest changes your stormwater program has encountered in the most recent years?

How has the city responded to these changes?

If possible: how did the city respond to initial regulations?

Response to growth:

- Has your city has experienced some recent population and housing growth—how is the city responding? Reflected in SWMP?
- How has growth affected other parts of stw management?
- Have you had to deal with issues of flooding here?

SWMP: regulated cities

Who wrote your SWMP?

Has your organization made any changes to the SWMP in recent years?
Why/how:

When you make changes to the SWMP, what is considered?

How were the changes you just mentioned included, or not included in the city's SWMP?

How does your city consider what other cities are doing? Which cities?

Permitting/enforcement:

Do you review stormwater plans/designs? Y/N

- what do you look for?
- How do you make adjustments? – process thereof
- What kinds of outreach or communication do you have with developers, contractors?
- Industrial?

Enforcement: are you involved with permit enforcement? y/n

- How do you go about enforcing stormwater regs?
- What would warrant a warning/citation?
- What is the biggest challenge with enforcement?

Partnerships:

IRRIGATION:

Do any **irrigation or canal companies** operate canals, pipes, or ditches within the jurisdiction of your city: *(Y/N) – info from survey if possible*

How would you describe your relationship with the irrigation company?

To what extent do you coordinate stormwater management with these irrigation companies?

Do you have any formal or informal agreements between your organization and irrigation companies to manage stormwater runoff?

- Has anyone from one group served in a formal capacity in the other's organization, such as on an advisory board or some coordinating group?

Has this partnership been useful in addressing other situations or problems?

PRIVATE FIRMS:

Does your organization ever consult with any private firms?

- Who do you work with?
- How long has your organization worked with this firm/s? _____ years
- How did that relationship start?
- What are the primary things you consult with them about?
- What changed in how the city manages stw since working with the firm?
- What are the benefits and about working with private firms?
- What are the limitations of working with firms?
- Is there any part of stw management that you would not support contracting to a firm?
- Is the city better or worse off with the firm being involved in stw management?

THE PUBLIC:
In what ways are residents or businesses who are involved or interested in local stormwater?

What is the city's relationship with the public about stormwater?

Could you briefly describe your education/outreach activities?

Do you think that these make a difference?

Big picture:

What are your thoughts on stormwater regulations?

What are the biggest strengths in the system? What works?

What doesn't work?

Wrap-up:

LOOKING AHEAD: What do you think is the biggest stormwater challenge that this city is going to face in the next 10 years?

What is the best thing that this city can do to prepare for those challenges?

Is there anything else that you would like to add?

Interview guide: Just-designated MS4 programs

Beginning of meeting:
Review confidentiality; present another copy of IRB approval memo. Discuss recording procedures.

Intro:

What do you do for this city?

Are there other units within the organization that work with stormwater?

Are any other types of activities (not related to stormwater) done at this office?
What types?
What share of the work is related directly to stormwater management programs (if any)?

How are stormwater-related activities funded here? [revenue streams and allocations]

What do you think of this funding arrangement? Does it suit your needs?

What did the city do to manage stormwater before it became MS4 compliant?

What happened after the city learned they became subject to the MS4 permit?

- labor
- inspections
- funding

What are some of the biggest challenges in getting your stormwater program off the ground?

SWMP development: newly regulated cities

How far along on your SWMP is your program?

Who is writing the SWMP? How was that person/unit selected to author it?

What are some of the topics you are addressing with the SWMP?

What is the protocol for updating the SWMP?

What about some of the other specifics of the MS4 permit – how are those being addressed?

Has your city considered what other cities are doing? Which cities?

Permitting/enforcement:

Do you review stormwater plans/designs? Y/N

- what do you look for?
- How do you make adjustments? – process thereof
- What kinds of outreach or communication do you have with developers, contractors?
- Industrial?

Enforcement: are you involved with permit enforcement? y/n

- How do you go about enforcing stormwater regs?
- What would warrant a warning/citation?
- What is the biggest challenge with enforcement?

Response to growth:

- Your city has experienced some recent population and housing growth—how is the city responding to this growth?

- How has growth affected other parts of stw management?

- **Have you had to deal with issues of flooding here?**

Partnerships:

IRRIGATION:

Do any **irrigation or canal companies** operate canals, pipes, or ditches within the jurisdiction of your city: *(Y/N) – info from survey if possible*

How would you describe your relationship with the irrigation company?

To what extent do you coordinate stormwater management with these irrigation companies?

Do you have any formal or informal agreements between your organization and irrigation companies to manage stormwater runoff?

- Has anyone from one group served in a formal capacity in the other's organization, such as on an advisory board or some coordinating group?

Has this partnership been useful in addressing other situations or problems?

PRIVATE FIRMS:

Does your organization ever consult with any private firms?

- Who do you work with?
- How long has your organization worked with this firm/s? _____ years
- How did that relationship start?
- What are the primary things you consult with them about?
- What changed in how the city manages stw since working with the firm?
- What are the benefits and about working with private firms?
- What are the limitations of working with firms?
- Is there any part of stw management that you would not support contracting to a firm?
- Is the city better or worse off with the firm being involved in stw management?

Challenges:

Are there any major challenges that the city faces that we haven't talked about yet?

What has the city done to address those challenges?

Do you think that these challenges are getting more or less difficult? How so? Why?

THE PUBLIC:

In what ways are residents or businesses who are involved or interested in local stormwater?

What is the city's relationship with the public about stormwater?

Could you briefly describe your education/outreach activities?

Do you think that these make a difference?

Big picture:

What are your thoughts on stormwater regulations?

What are the biggest strengths in the system? What works?

What doesn't work?

Wrap-up:

LOOKING AHEAD: What do you think is the biggest stormwater challenge that this city is going to face in the next 10 years?

What is the best thing that this city can do to prepare for those challenges?

Is there anything else that you would like to add?

Interview guide: Soon-to-be MS4 programs

Beginning of meeting:
Review confidentiality; present another copy of IRB approval memo. Discuss recording procedures.

Intro:

What do you do for _____ city?

Are there other units within the organization that work with stormwater?

What types of secondary irrigation are there in _____ city?
- Which units oversee this?
- Have there been any changes to the secondary system in the recent past?
- Do you partner with irrigation companies for this secondary water?

STW funding
How are stormwater-related activities funded here? [revenue streams and allocations]

What do you think of this funding arrangement? Does it suit your needs?

Changes:

What are some of the biggest changes your city has encountered in the most recent years?

How has the city's water system been impacted by these changes?

How did the city respond to these changes?

Why did your organization decide to adopt this particular policy?

What other options did you consider?

Were there other organizations or individuals who recommended this change?

Response to growth:
Your city has experienced some recent population and housing growth—how is the city responding?

Stormwater management – specifically

Have you had to deal with issues of flooding here?

What are some of the challenges you face in managing stormwater at the moment?

SWMPs: for non-regulatees

If the time comes that your municipality becomes subject to STW permit requirements, how do you think the city will react?

What will be the first steps to address this change?

Do you think the requirements will be addressed in-house, or will the city look for assistance?

Any plans to increase staff size?

Are there any hidden opportunities within this regulation?

Partnerships:

IRRIGATION:

Do any **irrigation or canal companies** operate canals, pipes, or ditches within the jurisdiction of your city: *(Y/N) – info from survey if possible*

How would you describe your relationship with the irrigation company?

To what extent do you coordinate stormwater management with these irrigation companies?

Do you have any formal or informal agreements between your organization and irrigation companies to manage stormwater runoff?

- Has anyone from one group served in a formal capacity in the other's organization, such as on an advisory board or some coordinating group?

Has this partnership been useful in addressing other situations or problems?

PRIVATE FIRMS:

Does your organization ever consult with any private firms?

- Who do you work with?
- How long has your organization worked with this firm/s? _____ years
- How did that relationship start?
- What are the primary things you consult with them about?
- What changed in how the city manages stw since working with the firm?
- What are the benefits and about working with private firms?
- What are the limitations of working with firms?
- Is there any part of stw management that you would not support contracting to a firm?
- Is the city better or worse off with the firm being involved in stw management?

THE PUBLIC:

In what ways are residents or businesses who are involved or interested in local stormwater?

What is the city's relationship with the public about stormwater?

Could you briefly describe your education/outreach activities?

Do you think that these make a difference?

Challenges:

Are there any major challenges that the city faces that we haven't talked about yet?

What has the city done to address those challenges?

Do you think that these challenges are getting more or less difficult? How so? Why?

Big picture:

What are your thoughts on stormwater management?

Wrap-up:

LOOKING AHEAD: What do you think is the biggest water-related challenge that this city is going to face in the next 10 years?

What is the best thing that this city can do to prepare for those challenges?

Is there anything else that you would like to add?

CURRICULUM VITAE

Andrea Armstrong

Department of Sociology, Social Work & Anthropology
Utah State University
Logan, UT 84321
607.437.1487
armstrong.usu@gmail.com
(March 2015)

EDUCATION

Ph.D. Candidate, Sociology, Utah State University. GPA: 4.00.
Dissertation Title: "Organizational Adaptation in Local Stormwater Governance"
Major Concentration: Environment & Community Sociology
Minor Concentration: Research Methods
Advisor: Douglas Jackson-Smith

M.S. Natural Resources, Cornell University, 2010. GPA: 3.93.
Thesis: "River of Dreams? Factors of Riparian Buffer Adoption in a Transitioning Watershed"
Concentrations: Rural & Environmental Sociology; Resource Policy and Management; Aquatic Science
Advisor: Richard Stedman

B.S. *cum laude*, Natural Resources, Cornell University, 2006. GPA: 3.71.

AREAS OF INTEREST

Environmental, community, and rural sociology
Interdisciplinary social-environmental research
Environmental and water policy
Community engagement

PROFESSIONAL POSITIONS

2010 - 2011 Research Assistant, Department of Natural Resources, Cornell University; Ithaca, NY.

2006 – 2008 Paralegal Specialist, U.S. Department of Justice, Environment and Natural Resources Division, Law & Policy Section; Washington, DC.

REFEREED JOURNAL PUBLICATIONS

Armstrong, A. and R.C. Stedman. 2013. "Culture clash and second home ownership in the U.S. Northern Forest." *Rural Sociology*. 78(3): 318-345. DOI: 10.1111/ruso.12010

Armstrong, A. R.C. Stedman, B. Rossler*, S. Cuppett*. 2013. "Beyond the trees: Community as a riparian restoration outcome and resource." *Water Resources IMPACT (JAWRA)*.15(2): 6-8. (*non-academic co-author)

Armstrong, A. and D. Jackson-Smith. 2013. "Forms and levels of integration: Evaluation of an interdisciplinary team-building project." *Journal of Research Practice*. 9(1), Article M1. Retrieved from http://www.jrp.icaap.org/index.php/jrp/article/view/335/297

Armstrong, A., R.C. Stedman, J.A. Bishop, P.J. Sullivan. 2012. "What's a stream without water? Disproportionality in headwater regions impacting water quality." *Environmental Management*. 50(5):849-60. DOI: 10.1007/s00267-012-9928-0.

Armstrong, A. and R.C. Stedman. 2012. "Riparian landowner efficacy in an urbanizing watershed." *Society & Natural Resources*. 25(11): 1193-1203. DOI:10.1080/08941920.2012.663066.

Armstrong, A. and R.C. Stedman. 2012. "Landowner willingness to implement riparian buffers in a transitioning watershed." *Landscape and Urban Planning*. 105: 211 – 220. DOI: 10.1016/j.landurbplan.2011.12.011.

Armstrong, A., E.J. Ling, R.C. Stedman, and P. Kleinman. 2011. "Adoption of the Conservation Reserve Enhancement Program in the New York City watershed: The role of farmer attitudes." *Journal of Soil and Water Conservation*. 66(5): 337 – 344. DOI: 10.2489/jswc.66.5.337.

MANUSCRIPTS UNDER REVIEW AT REFEREED JOURNALS

Petrzelka, P. and **A. Armstrong**. Revise & Resubmit. "A typology of absentee landowners and their information uses." *Journal of Soil and Water Conservation*.

Hale, R.L, **A. Armstrong**, M.A. Baker, S. Bedingfield, D. Betts, C. Buahin, M. Buchert, T. Crowl, R.R. Dupont, J. Ehleringer, J. Endter-Wada, C. Flint, J. Grant, S. Hinners, J.S. Horsburgh, D. Jackson-Smith, A.S. Jones, C. Licon, S.E. Null, A. Odame, D. E. Pataki, D. Rosenberg, M. Runburg, P. Stoker, C. Strong. Revise & Resubmit. "iSAW: Integrating Structure, Actors, and Water to Study Socio-Hydro-Ecological Systems." *Earth's Future*.

BOOK CHAPTER

D.L. Osmond, R. Brooks, S. Yetter, R. Carline, K. Boomer, **A. Armstrong**, R. Stedman, D.W. Meals, G.D. Jennings. 2012. "Spring Creek Watershed, Pennsylvania: National Institute of Food and Agriculture—Conservation Effects Assessment Project." Pp. 342 – 357 in *How to Build Better Agricultural Conservation Programs to Protect Water Quality*. D.L. Osmond, D.W. Mills, L.K Hoag, M. Arabi, Eds. Ankeny, IA: Soil and Water Conservation Society.

TEACHING EXPERIENCE

Instructor, SOC 3610: Rural Sociology. Utah State University. Fall 2014.

Co-founder and leader, NTRES 6940: Water in a Changing Climate: Interdisciplinary Discussions on Today's Human-Natural Water Systems. Cornell University. Fall 2009.

Guest lecture, "Environmental Justice." SOC 1010: Social Problems. Utah State University. Spring 2015.

Guest lecture, "Environmental Regulations: The Case of Stormwater." SOC 4350: Political Sociology. Utah State University. Spring 2014.

Guest lecture, "Conducting Interviews." SOC 3110: Research Methods. Utah State University. Fall 2012.

Undergraduate Teaching Assistant, NTRES 4221: Wetland Ecology Laboratory. Cornell University. Fall 2005.

PRESENTATIONS

B.T. Greene, N. Mesner, and **A. Armstrong**. 2015. "Citizen science's broader impacts: Does participation in water quality monitoring provide more than data?" American Association for the Advancement of Sciences Citizen Science Conference. San Jose, CA. Poster presentation.

Armstrong, A. and S. Burgon*. 2014. "Stormwater Program Challenges, Opportunities, and Future Directions: What the Managers Think." Oral Presentation. American Public Works Association, Utah Chapter Fall Conference & Storm Water Expo. Salt Lake City, Utah. (*non-academic co-author)

Armstrong, A. and D. Jackson-Smith. 2014. "Local water management organizations in rural and urbanizing landscapes: Linkages and adaptive responses to changing water regimes." Oral Presentation. Rural Sociological Society Annual Conference. New Orleans, LA.

R.C. Stedman and **A. Armstrong**. 2014. "Rural, urban, and everything in between: Evaluating methodological approaches to understanding place effects among permanent and seasonal residents of the Central Adirondacks." Oral Presentation. Rural Sociological Society Annual Conference. New Orleans, LA.

Armstrong, A. and D. Jackson-Smith. 2014. "The unsung players in western water: Local water management organizations and their adaptive responses." Oral Presentation. Association for Environmental Studies and Sciences Annual Conference. New York, NY.

Armstrong, A. 2013. "Collective actions from within: Municipal stormwater managers' responses to stormwater regulations." International Symposium on Society and Resource Management. Estes Park, CO.

Armstrong, A. and D. Jackson-Smith. 2013. "Fertilized community: Perceptions of dependence and community connectedness as barriers to water quality conservation." Rural Sociological Society Annual Conference. New York, NY.

Armstrong, A. and D. Jackson-Smith. 2013. "The efficiency-ecosystem tradeoff: Constructing a database of water infrastructure changes in Utah." Poster presentation. Annual Spring Runoff Conference, Utah State University.

Armstrong, A. 2012. "Converging thought streams and gauging expectations: Reflections from water resources team science." Rural Sociological Society Annual Conference. Chicago, IL.

Armstrong, A., D. Jackson-Smith, L. Belton. 2012. "Building bridges and digging ditches: Reflections and insights on transdisciplinary water research." Universities Council on Water Resources. Santa Fe, NM.

Armstrong, A. 2012. **"**Good fences make good neighbors: Inequality and culture clash in second homeowner-rich communities of the U.S. Northern Forest." International Symposium on Society and Resource Management. Edmonton, Alberta.

Armstrong, A. and R.C. Stedman. 2012. "Second homeownership in the Central Adirondacks." Adirondack Research Consortium. Lake Placid, NY.

Armstrong, A. and D. Jackson-Smith. 2012. "'You're the expert!' A participatory approach to nitrate pollution research in central Montana." Poster presentation. Annual Spring Runoff Conference, Utah State University.

Stedman, R.C. and **A. Armstrong**. 2011. "Second homes and community resilience in the Northern Forest." Rural Sociological Society Annual Conference. Boise, ID.

A. Armstrong, R.C. Stedman, J.A. Bishop, P.J. Sullivan. 2011. "What's a stream without water? Landowner perceptions of intermittent streams as disproportionate sources of water quality pollution." Poster presentation. National Water Program Annual Conference. Washington, DC.

Armstrong, A. 2010. "Water quality conservation and private landowners: Why landscape matters." Rural Sociological Society Annual Conference. Atlanta, GA.

Armstrong, A. 2009. "Landowner Adoption of Riparian Best Management Practices along the Urban-Rural Gradient." Rural Sociological Society Annual Conference. Madison, WI.

Armstrong, A., R.C. Stedman, J. Shortle, R. Brooks. 2009. "Linking landowners to wetlands: Attitudes and perceptions of riparian buffers**.**" Society of Wetland Scientists Annual Conference. Madison, WI.

Watkins, J., B.T. Greene, **A. Armstrong**. 2009. "Creating a report card for the Cayuga Lake Watershed Network." A capstone presentation of a transdisciplinary report card of lake health. Aurora, NY.

GRANTS & FELLOWSHIPS

Doctoral Dissertation Enhancement Award. 2015. "A longitudinal analysis of stormwater management and adaptation." Utah State University Office of Research and Graduate Studies. Internal Grant.

Dissertation Research Award, Rural Sociological Society. 2014. "Adaptive responses to stormwater management in rural and urbanizing areas." External Grant.

Research Award, Utah Storm Water Advisory Committee. 2014. "A statewide survey of stormwater permittees." External Grant.

Doctoral Fellowship, iUTAH EPSCoR, National Science Foundation. 2013 – 2014. Internal Fellowship.

Research Support Award, Ecology Center, Utah State University. 2013. Internal Grant.

Doctoral Fellowship, iUTAH EPSCoR, National Science Foundation and Utah State University Ecology Center. 2012 – 2013. Internal Fellowship.

Summer Fellow, Department of Natural Resources, Cornell University; 2010. 2010. Internal Fellowship.

Andrew K. Mellon Grant, Cornell University College of Agriculture and Life Sciences. 2009. Internal Grant.

Doris Duke Conservation Fellowship; Woodrow Wilson Foundation. 2009. External Fellowship.

AWARDS & HONORS

Graduate Student Researcher of the Year, College of Humanities and Social Sciences, Utah State University. 2014.

Finalist, Student Paper Competition, Association for Environmental Studies and Sciences, 2014 Annual Meeting.

William R. Freudenburg Graduate Student Travel Scholarship, Natural Resources Research Interest Group, Rural Sociological Society. 2013.

Graduate Enhancement Award, Utah State University. 2013.

Honorable Mention, Best Poster. Society of Wetland Scientists Annual Conference. Madison, WI. 2009.

SERVICE

Graduate student representative, Council, Rural Sociological Society, 2012 – 2014.

Reviewer: *Landscape and Urban Planning, Agriculture and Human Values*, *Society & Natural Resources, Journal of Soil and Water Conservation, Journal of the American Water Resources Association, Journal of Rural Studies, Rural Sociology*.

Member, Utah State University Task Force on Air Quality. 2014 – present.

Member, organizing committee for 2012 and 2013 Annual Spring Runoff Conference, Utah State University.

PROFESSIONAL SOCIETY MEMBERSHIPS

Association for Environmental Studies and Sciences, 2013 – present.

The International Association for Society & Natural Resources, 2012 - present.

Rural Sociological Society, 2009 – present.