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The Preparedness of Suffolk County's Emergency Managers For Drinking Water Disruptions

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Abstract

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Richard A. Rotanz

MA, John Jay College, 1996

BS, Empire State College 1984

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

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Abstract

For many years, a chronic issue within Suffolk County, New York, one of the most populated counties in the country, is the deterioration of its drinking water along with its polluted beaches, lakes, and rivers, which are imperative for tourism and the fishing industry. However, little is known regarding the awareness of, and the preparedness towards, any disruptions of drinking water by the community of emergency managers. Narrowing this gap of knowledge was the purpose of this study. The research question examined the knowledge of, the attitudes, and the preparedness levels of the emergency management community of Suffolk County involving any disruption to drinking water. A case study was developed with a sample of 14 interview participants from village, town, and county, state and federal governments. Semi-structured interviews were conducted that stemmed from various areas, derived from the literature review of Chapter 2. As a result of the interviews, themes emerged through descriptive coding regarding the attitudes and the preparedness levels. The analysis of Suffolk County emergency management operations identified the lack of coordinated perceptions of infrastructure; not understanding specific disaster terminology; lack of coordinated planning; and a consensus that not enough is being done to protect Suffolk County's drinking water. The resultant findings could be used by the emergency management community as well as municipal leaders to promote more effective policies to protect drinking water leading to positive social change.

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Dedication

For my fellow responders and military personnel who gave the ultimate sacrifice during our wars; while fighting crime and fires, while helping those in medical emergencies, who without their dedication to protecting our way of life, we would live in anarchy. This is especially for my father Richard Rotanz and uncle J. Maxwell, who both died in the line of duty as NYPD police officers, and for my sons who now take up the torch in the USMC, US Army, NYPD, FDNY, SCPD, and NCPD.

And for my wife, Patricia, this represents one of the many challenges we have faced together. No matter how the obstacle is shaped or where it originates, we both always overcome it. Thank you for your precious and everlasting love.

Acknowledgments

First and foremost, special thanks to the many scientists, emergency managers, fire chiefs, manufactures, and medical professionals of Long Island, New York. Your dedication to our community is truly remarkable. To the exceptional professionalism of Vincent Palmer of the NYS Department of Environmental Control, thank you for your support and assistance with this project. Your participation and insight were critical to my success.

To Dr. Donald McLellan and Dr. Mark Stallo, Dr. Donna Daniels, Dr. Tricia Wachtendorf and Dr. James Kendra, thank you for your outstanding guidance and support. A dissertation can be a daunting endeavor, but you helped me keep things in perspective, and your leadership through the process was exceptional. I will always be grateful.

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List of Abbreviations

Abbreviations	Explanation
ASCE	American Society of Civil Engineers
CCE	Citizens Campaign for the Environment
CERT	Community Emergency Response Team
CREAT	Climate Resilience Evaluation and Assessment Tool
CWS	Community Water Supplies
DHS	Department of Homeland Security
DOW	Department of Water
DRC	Disaster Research Center
DWSRF	New York Drinking Water State Revolving Fund
EOC	Emergency Operation Center
EPA	Environment Protection Agency
EWG	Environment Working Group
FEMA	Federal Emergency Management Agency
GAO	Government Accounting Office
IBM	Industrial Business Machines
LEPC	Local Emergency Planning Committee
LICAP	Long Island Commission for Aquifer Protection
LIP	Long Island Press

LIPBS	Long Island Pine Barrens Society
MTBE	Methyl Tertiary Butyl Ether
NIPP	National Infrastructure Protection Plan
NCWS	Non-Community Water Supplies
NYSDEC	New York State Department of Environmental Conservation
NYSRISE	New York State Resiliency Institute for Storms and Emergencies
PFOA	Perfluorooctanoic Acid
PPCP	Pharmaceutical Personal Care Products
SCWA	Suffolk County Water Authority
USGS	United States Geological Survey
VOC	Volatile Organic Chemicals
WARN	Water and Wastewater Agency Response Network

Chapter 1: Introduction

Introduction

During his tenure as a professor at Bryn Mawr College, Woodrow Wilson, our 28th President, presented an article in *Political Science Quarterly* (1887) entitled "The Study of Administration." His writing's main emphasis was for public administrators to be given authority to address issues specific to their respective fields, where it became the foundation for public administration as we now know it. Various other and more recent definitions of public administration come from scholars such as Denhardt (2009) that public administration is "the management of public programs," while Kettl and Fessler (2009, p. 53) state that "public servants can be considered to be public administrators." Some examples of government agencies charged with administrative functions are the Office of Management and Budget, law enforcement, the fire service, child protective services, and emergency management.

Typically, emergency management, whether federal, state, or local, conducts the planning, organizing, directing, and coordination of government operations towards the threats and concerns we face as a society. The practical implementation and administration of emergency management programs is a critical role of government and cannot be accomplished without the involvement of nonprofit organizations, private firms, and individual volunteers (Waugh, 2007). The official definition of emergency management is "the managerial function charged with creating the framework within communities to reduce vulnerability to hazards and cope with disasters" (Drabeck & Hoetmer, 1991, p. xviii; Kiernan & Waugh, 2007, p. xvi).

Part of what emergency management performs is identifying, planning, and coordinating responses to the various threats from nature, technological accidents, and terrorism. The most important emergency management function is to collect current situation awareness for a municipality's political leaders. Some of the information that feeds situation awareness is weather conditions from local meteorologists, traffic conditions from the department of public works, the status of electric power, infrastructure, crime rates, patient loads at hospitals, and more.

When addressing threats, such as from mother nature, emergency management creates plans and coordinates an all hazards approach such as the mitigation and response to earthquakes and hurricanes, to name a few. Technological accidents generally involve transportation incidents, blackouts, and infrastructure failures. Commonly, these events occur somewhat rapidly, such as the spread of a disease or a hazardous material release.

Recent technological and manmade events involving drinking water have demonstrated a serious lack of preparedness for those responsible for our water supply. One such example is the lead contamination in Flint, Michigan, in 2014 (AP, 2016 & Kennedy, 2016) due to ineffective drinking water treatment, in which thousands of Flint residents were exposed to high levels of lead. Jacobson et al. (2018), from the School of Public Health at the University of Michigan, presented a report, "Learning from the Flint Water Crisis," which details the failures in both the legal structure and how the implemented laws failed to stop the crisis. Flint and Michigan state officials failed to coordinate agencies and use their legal authority to mitigate the crisis effectively. Preparedness functions are core to emergency management mission areas, namely protection, mitigation, response, and recovery.

After 2 years and numerous requests to the Federal government by state and local officials, President Obama declared a state of emergency for the City of Flint (FEMA, 2016). This action set in motion the coordination of disaster relief for Genesee County citizens and the provision of appropriate assistance under Title V of the Stafford Act (FEMA, 2018). Although the water quality in Flint's distribution system is now considered acceptable by state and local health officials, residents are still advised to continue using filtered water until all the lead pipes have been replaced—the expected completion is 2020 (Kennedy, 2016).

Unfortunately, the event in Flint is not unique. In 2004, levels of lead contamination in Washington, D.C.'s drinking water was found to be 83 times higher than the acceptable limit (Edwards, Triantafyllidou, & Best, 2009*).* The rise in lead levels was attributed to the District of Columbia Water and Sewer Authority's decision to switch their treatment chemical from chlorine to chloramine. This ill-conceived policy decision was similar to Michigan's decision to divert water from a treatment plant to the Flint River supply, another critical infrastructure mismanagement.

An example of infrastructure failure was the catastrophic rupture of a 7-year-old water main in Weston, Massachusetts, pouring its fresh drinking water into the Charles River, Massachusetts, on May 2nd, 2010. This event resulted in the loss of access to drinking water from the Quabbin and Wachusett Reservoirs (approximately eight million gallons per hour lost), affecting two million residents from nearly three dozen municipalities, including Boston. (Levenson, Daley, 2010).

The leak was stopped on May 4th by the Massachusetts Resource Water Authority. While repairs were underway, President Barack Obama signed an emergency

disaster declaration authorizing the Department of Homeland Security and Federal Emergency Management Agency to coordinate disaster relief efforts for the state of Massachusetts and the affected communities (DHS 2010). On May 4th, 2010, the boiling water order was lifted after the water main system was thoroughly flushed clean (MWRA, 2010).

Infrastructure mismanagement and the structural failures in Flint, Massachusetts, and Washington, D.C., illustrate the lack of preparedness among government emergency management agencies and several private sector organizations. Their failure was rooted in a delayed recognition of all potential hazards (mismanagement, structural, and terrorism as examples). When identified, they were inadequately prepared to provide drinking water in a redundant and expedient capacity. Couch and Kroll-Smith (1987) cite Professors E.L. Quarantelli and Russel Dynes of the Disaster Research Center of Delaware University regarding the nominal definition of "chronic technical disasters." These disasters are slow in their occurrence that produces the deterioration in human system-ecosystem relations, where an entire community incurs danger to health and safety and the disruption of ongoing patterns of social and cultural relations.

Unlike the previous infrastructure events, a chronic technical disaster occurs in Suffolk County, NY, with identified contaminants of "emerging concern," according to the Environmental Working Group (2013), which includes nitrates and various volatile organic chemicals (VOC) in the drinking water. Chemicals such as methyl tertiary butyl ether (MTBE) and perchlorate combined with pharmaceuticals and personal care products (PPCPs) are increasingly found at an alarming rate calling for a rigorous strategy to protect Suffolk's drinking water (Esposito, 2013).

This study identified the extent of the situation awareness and the level of preparedness initiatives by emergency management officials regarding the disruption of Suffolk's drinking water from any hazard. The hazard occurring in Suffolk County, New York, is a chronic technical disaster in the making. Interviews were conducted to evaluate emergency management functions of awareness, the level of urgency, what protection, mitigation, preparedness, and response policies are being undertaken by county, town, village, and other organization emergency management officials towards water disruptions. This chapter will provide the context, the problem statement, the purpose for this study, examples of research questions, a conceptual framework, definitions of terms, assumptions, limitations, and the implications for long-term social change.

I procured the assessment of situational awareness by emergency management, knowing the preparedness toward using and protecting drinking water through responsive interviews of emergency managers within Suffolk County. After completing my data collection and findings, my recommendations for significant and positive social change regarding Suffolk County's water safety and integrity is presented in Chapter 5.

Background of the Problem

Globally, freshwater is not evenly distributed geologically and is not made available and consumed equitably (Feldman, 2012). Our planet's surface is 71% water and 29% land. Ninety six percent of the water is found in our oceans and seas, 0.9% is other saline sources, and the remaining 2.6% of the total water is fresh drinkable water. The United States Geological Survey (USGS, 2017) estimates that 30.1% of the world's fresh water is found and drawn from groundwater, while our ice caps and glaciers hold 68.7 % of the remaining drinkable water. Several factors threaten our freshwater supply,

including competition among numerous countries and our own country's states and counties. This scenario is further complicated by climate change, wreaking havoc by causing shifts in rain patterns. Weather pattern changes from climate shifts have created dangerous droughts in many areas leading to exceeding drinking water demands.

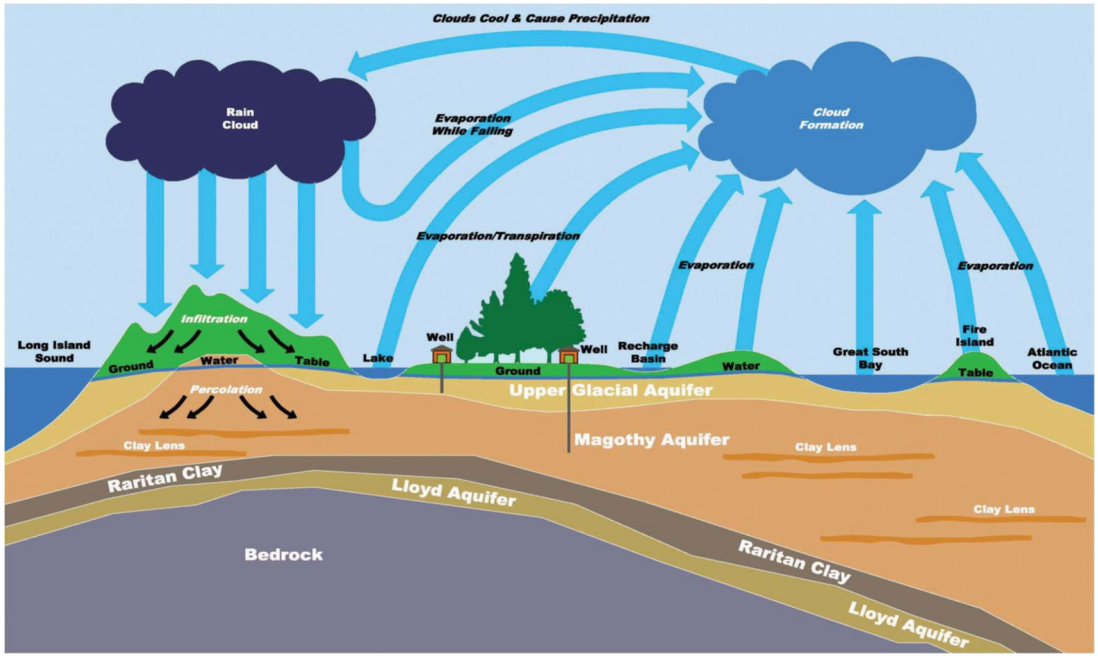
Most drinking water sources come from rivers, lakes, streams, ponds, reservoirs, springs, and aquifers. The drinking water supply for Suffolk County comes from the groundwater below and is stored in a sandy geological formation known as the aquifer system (Suffolk County Water Authority, 2017). The ground-water location in Suffolk County varies in depth from the northern to the southern parts of Long Island. The system consists of the upper glacier aquifer, considered the newest water supply, and the Magothy aquifer with water hundreds of years older and more in-depth. The deepest and oldest water source under Suffolk County is the Lloyd aquifer, separated from the upper Magothy and Upper glacier aquifers by the Raritan clay layer.

In the Suffolk County government, the Office Water Resources abides by the Safe Drinking Water Act and sanitary codes of both New York State and Suffolk County Sanitary Codes. This office enforces such regulations to 39 community water supplies and 254 non-community water suppliers (Suffolk County Government 2018). The largest supplier, the Suffolk County Water Authority (SCWA). The SCWA is a public-benefit corporation, Markell, Gov. Jack (2013-07-22), regulated by the State of New York's Public Authorities Law. The authority operates without taxing power on a not-for-profit basis, 503(c)1. Its organizational structure begins with a board of directors, a chief executive officer, and various directors overseeing functions such as laboratory services, strategic initiatives, communications, safety and environment, and deputy directors.

Every year, SCWA conducts laboratory tests at various treatment stages and the distribution (hydrant) system for bacteria and inorganic and organic chemicals, based on local, state, and federal regulations (SCWA 2017). Water quality projects conducted are consistent, such as water main replacement and the installation of emergency generators. Funds for this come from the New York State Drinking Water State Revolving Fund, the U.S. Environmental Protection Agency, New York State, and user rates.

Figure 1

The Water Cycle in Suffolk County



Note. From SCWA Drinking Water Quality Report, 2017.

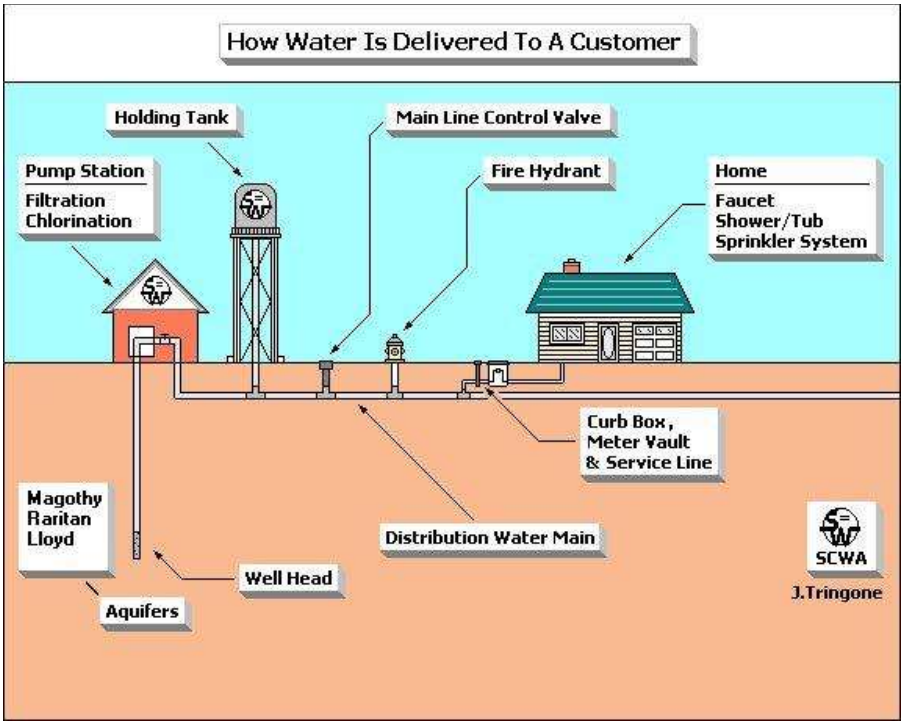
As pictured in Figure 1, rainfall over Suffolk County travels over the land surface, then infiltrates and dissolves naturally through the ground and eventually down to the water table (upper glacial aquifer). This rainfall movement travels along the ground, collecting minerals and substances from animals and the local populations.

Unfortunately, aligned with these activities is the collection of radioactive waste and VOCs from factories, pesticides from our farms and lawns, and the massive amounts of nitrates from tens of thousands of cesspools.

The SCWA maintains numerous pumping stations that are aligned with one or more wells. Raw water is pumped from the aquifer, then chlorinated and treated to raise the pH levels and conserve disinfection through the distribution system. Figure 2 shows that the 6000 miles distribution system is the same piping grid as fire hydrants.

Figure 2

How Water is Delivered to a Customer



Note. From SCWA Drinking Water Quality Report, 2017, p. 4.

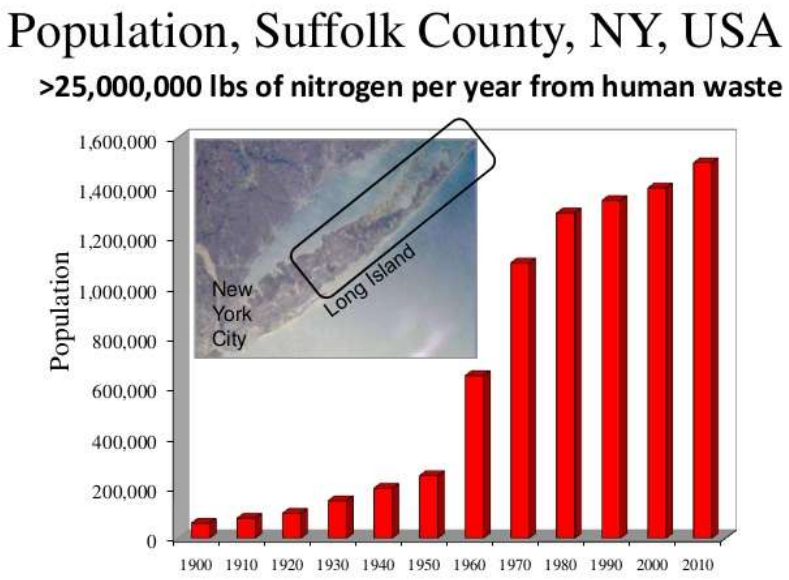
Further, eutrophication processes, the enrichment of an ecosystem with chemical nutrients, typically compounds containing nitrogen, phosphorus, or both, (*Science Daily*, 2019), naturally occurs throughout Suffolk County waters. The anthropogenic activities

have fast-tracked this process through point-source discharges such as sewer disposal pipes from industry and non-point discharge of water movement over lawns, streets, and parking lots (Carpenter et al., 1998). According to the Suffolk County Department of Health (2018), an estimated 360,000 septic systems and cesspools discharge wastewater into the ground from residential and commercial occupancies. Nutrient pollution occurs with compounds such as phosphorus, creating algal blooms (Bennet, 2017) that increase anoxia, fatal to fish and other animals.

Below in Figure 3., the relationship between the increase of population and the increase of nitrates from human waste provides graphic evidence. These septic systems do not remove nitrogen, which, combined with naturally occurring phosphorus increases algal blooms and "threatens our valuable natural resources, coastal defenses, and human health" (SCCWRMPL, 2014). Presently and in alignment, the New York State Department of Environmental Conservation, based upon the Clean Water Act, has listed the entire length of Long Island's South Shore Estuary (approximately 60 miles) as impaired.

Figure 3

The Rapid Increase of Nitrates From Human Waste From Suffolk County's Increase In Population



Note. From Water Worries - Nature Conservancy, 2018.

It is important to recognize the institutional responsibilities of our local, state, and federal governments, municipal agencies, businesses, and non-profits towards these issues. Our society expects such institutions to effectively perform their duties for the public. The institution of emergency management from villages, towns, and the county will focus on its prevention, protection, mitigation, response, and recovery functions.

Problem Statement

The disruptions to our drinking, whether from drought, mismanagement of water systems, or infrastructure failure, is critical to the survival of our society and economy (AP, 2016; Kennedy, 2016). Lead poisoning and the misuse of water purification have led to serious health issues among our young in some of our large cities (Jacobson et al., 2018). Additionally, the effects of climate change on our water levels have positioned

municipalities to mandate water use restrictions in many western states. Involving the drinking water of Suffolk County, New York, a chronic technological disaster is evolving due to the immense discharge of nitrates from hundreds of thousands of cesspools and various other chemicals from factories and pesticides, which will potentially lead towards large disruptions. In 2017, Governor Cuomo of New York and federal government agencies identified over 250 state and federal Superfund cleanup sites in the contiguous Long Island counties of Nassau and Suffolk from the vestiges of the region's aerospace and manufacturing industries (Dooley, 2017). Many contaminants come from landfills, dry cleaners, and the agriculture industry.

The government research, academic studies, and news articles cited in this study document water contamination levels in Suffolk County. There have been minimal attempts to explore emergency managers' activities and their concerns about fresh drinking water disruptions. In the field of emergency management, the institutional responsibility to mitigate, protect, respond, and recover from natural, technological, and man-made disasters is paramount. This problem of potential drinking water disruptions led to specific research questions as to what institutional activities are being carried out, if any, by the emergency manager community of Suffolk County and its townships and villages.

Purpose of the Study

The purpose of this qualitative study was to analyze current institutional activities of emergency managers of Suffolk County, New York, towards disruptions of drinking water, regardless of cause, through relevant research questions. This study revealed what

the institution of emergency management is aware of and how it addresses threats through its mission of protection, mitigation, response, and recovery.

Responsive interviewing (Rubin & Rubin 2012) will facilitate "the gathering of narratives, descriptions, and interpretations from conversations, and placing them together in a way to re-create the culture (the field of emergency management) in a way that the participants would recognize as real" (p.7). The results assist emergency managers and similar public administrators' practices, specifically concerning drinking water disruptions.

Research Questions

This study has addressed the problem through a thorough evaluation of emergency managers' responses to interview questions regarding drinking water disruptions and the evolving threat of what disaster research scientists refer to as a "chronic technical disaster." Gramling and Krogman (1997) objectively portrayed that these disasters are predicted on and mitigated, or not, by deliberate human decisions and resulting policies or lack thereof. Further, researchers describe these disasters as a process rather than an event. The following central research question in this study was used in describing and explaining this complex issue:

Emergency managers have traditionally projected their efforts on prevention, protection, mitigation, response, and recovery from events such as hurricanes, terrorism, and large chemical spills. In line with these mission areas, what institutional preparedness practices are being implemented by emergency managers from Suffolk County, the townships, and villages for any disruption and/or the deterioration of drinking water?

Theoretical Framework

This study's framework was reflective of W. Richard Scott's research into institutional theory. He declared that this theory dives deep into our social structure, considering schemas, rules, norms, and routines for acceptable behavior. Further, he claimed that society creates institutions and processes to attend to societal needs (Scott, 2004). In Scott's numerous studies, he examined the discrepancies among authority systems and between workers to the degree of power to enforce their inclinations. Scott (2001, 2005) concluded such studies that (not limited to):

1. Work arrangements are not destined by natural economic laws but are fashioned by social and political processes;
2. institutions such as emergency management are comprised of normative and regulative elements with associated activities and required resources to provide stability;
3. institutions are made up of diverse elements; and,
4. institutions differ in bases of order and compliance.

Institutional theory was selected here based on the idea that institutions should act in accordance with societal needs and demands. The institution of interest here was emergency management and the responsibility to perform mitigation, protection, response to, and recovery from emergencies and disasters. This study's purpose was based upon the required activities towards what is conceived as a problem with Suffolk County's drinking water and potential disruptions, regardless of cause.

Nature of the Study

This qualitative study assessed the required institutional activities of protection, mitigation, response, and recovery of emergency managers, the villages, towns, and the county towards any disruptions and the chronic technological disaster occurring in Suffolk County's drinking water. McNabb (2015) offered insight and useful guidance from both evolutionary and current practices in the field.

Data collected from interviews with emergency managers conveyed how they perceive emergency management institutions and how they construct and perform their responsibilities toward threats. Such in-depth qualitative interviewing explored their experiences, motives, and opinions of the institutional process. The data for the interviews were evaluated through the coding process listed in EXCEL software.

Operational Definitions

Chronic technological disasters: disasters that are predicted on and mitigated, or not, by deliberate human decisions and resulting policies or lack thereof and are defined by the interplay of various stakeholders involved. For a chronic technological disaster to occur, decisions had to be made to allow the potentially dangerous activity to go forth, or at a minimum, not to oppose it (Gramling & Krogman, 1997).

Community factors: infrastructure, business, environment, and housing that influence elected official policy decisions. The term is interchangeable with social capital.

Contaminants of emerging: compounds that may impact aquatic life (EPA 2017).

Comprehensive Emergency Operation Plan (CEMP): confirms that all municipal government levels will be functional under a unified organization to safeguard its

residents and businesses. The plan should comply with the National Incident Management System (NIMS). The CEMP applies the strategic vision of the municipality. (FEMA, 2017)

Emergency Management: managerial function charged with creating the framework within communities to reduce vulnerability to hazards and cope with disasters. (FEMA, 2017)

Emergency Operation Center (EOC): facility that houses government agencies, businesses, and non-profit organizations to coordinate the response management for large scale emergencies, disasters, and planned events (FEMA, 2017)

Eutrophication: process by which a body of water becomes enriched in dissolved nutrients (such as phosphates) that stimulate the growth of aquatic plant life, usually resulting in the depletion of dissolved oxygen (Merriam / Webster, 2017) (NOAA, 2017)

Local Emergency Planning Committee (LEPC): federally mandated but not funded program for committee developments by the state and local governments to prepare and respond to hazardous material critical incidents. The LEPC membership includes (and is limited to) government officials, the first responder community, facility members who own and operate sites that handle hazardous materials, and community groups. (EPA, 2014).

Mitigation: actions to prevent damage to housing, infrastructure, and the environment. The federal level mitigation guidance focuses on identifying and minimizing community risk and vulnerabilities from a natural or man-made disaster (FEMA, 2015).

Pharmaceuticals and personal care products: also known as PPCPs; unique group of emerging environmental contaminants due to their inherent ability to induce physiological effects in humans at low doses. An increasing number of studies have confirmed, the presence of PPCPs in different environmental compartments, which raises concerns about the potential adverse effects on humans and wildlife (Ebele, Abdallah, & Harrad, 2017).

Planning-P: common management process performed by emergency management planners that utilize a large P displaying planning phases such as (1) identifying the potential incident, (2) objectives, (3) planning to counteract the effects, (4) dissemination, and (5) executing the plan (FEMA, 2017).

Policy decision: conditions for the development of new policy or programs, non-action, adherence to existing policy, or revision of policy (Carney & Heikkila, 2010).

Predictable Surprises: situation or circumstance in which avoidable crises are marginalized to satisfy economic and social policies. (Bazerman & Watkins, 2004).

Preparedness: actions taken to prepare for a critical incident. The federal level preparedness guidance covers natural and man-made disasters within the Federal Emergency Management Program (FEMA) protection mission area (FEMA, 2017).

Prevention: actions to deny, delay, or stop a terrorist act (FEMA, 2017). This study does not address the prevention mission area within the context of terrorism but rather natural disasters.

Public Values: public sector, stakeholder, and citizens involvement and the contributions to society (Kim, 2013).

Public-benefit corporation: a specific type of corporation that allows for public benefit to be a charter purpose in addition to the traditional corporate goal of maximizing profit for shareholders.

Recovery: short-term and long-term actions to revitalize housing, infrastructure, the economy, and the environment (FEMA, 2017).

Response: action immediately following a critical incident (FEMA, 2015a).

Social Capital: economic, institutional, and infrastructure restoration and the role of local level stakeholders (Johnson et al., 2014; Storr & Smith, 2012). Social capital and community factors will be interchangeable.

Situational Awareness: the perception of environmental elements and events concerning time or space, the comprehension of their meaning, and the projection of their future status. (Endsley, 2000)

Stakeholders: those who are involved or affected by the course of actions and/or perform as contributors to the execution of the mission and decisions (DHS, 2017). Emergency management participants from emergency management, agency heads, first responders, citizen advocates, non-profit organizations, and businesses (Marley, 2014).

Stafford Disaster Assistance and Emergency Relief Act: signed into law November 23, 1988; amended the Disaster Relief Act of 1974, PL 93-288. This Act constitutes the statutory authority for most Federal disaster response activities especially as they pertain to FEMA and FEMA programs that allow the President of the United States to authorize federal assistance to states during disasters and emergencies (FEMA 2017).

Transferability: the degree to which qualitative research results can be generalized or transferred to other contexts or settings. (Social Research Methods, 2007)

Up-conning: a condition where saline water (saltwater such as our oceans and rivers) replaces freshwater during droughts or over pumping of freshwater from aquifers adjoining saltwater such as oceans, lakes, or sounds (EPA 2018).

Volatile Organic Compounds (VOC): emitted as gases from certain solids or liquids. They include a variety of chemicals, some of which may have short- and long-term adverse health effects. Concentrations of many VOCs are consistently higher indoors (up to ten times higher) than outdoors. VOCs are emitted by a wide array of products numbering in the thousands. They are widely used as ingredients in household products. Paints, varnishes, and wax all contain organic solvents, as do many clean, disinfecting, cosmetic, degreasing, and hobby products (US Environmental Protection Agency, 2017).

Assumptions

I assumed that all material had been analyzed accurately when collected. The knowledge base of emergency management officials was key to receiving accurate information. Therefore, I understood that the group of emergency management professionals with experience managing disasters before, during, and after was informative. Consequently, I expected that all participants would be forthright in their responses, and their information would not lead to any less-than-factual conclusions. These officials were from the county, 10 townships, 32 villages, and one state and one federal research organization for 45 emergency managers (See Appendix B). Given the uncertainty of natural or anthropogenic causes of emergencies and disasters, the

challenge was to qualify the preparedness activities for water interruption at the consumer level regardless of cause.

Scope and Delimitations

The scope of this research included an array of emergency management officials in Suffolk County, New York. The selection was from the county's emergency management offices, the 10 townships, 32 villages, one state, and one federal research organization. Further, the study did not involve the dozens of other state and federal agencies nor the 1.4 million residents of Suffolk County.

Set boundary variables such as geography, geology, and populations are similar to different locations within the state and United States that are available for additional studies. This study is one of transferability (Social Research Methods, 2018), permitting further efforts nationally to heighten critical discussions in further research into this dangerous issue.

Limitations

Limitations of this qualitative study included the following considerations: (a) the interviewee may have had a bias (negative or positive) towards his/her municipality, (b) the interviewee may have had a personal agenda that may have skew responses, and (c) the interviewee may not have had enough experience in the field of emergency management. Such bias, lack of expertise, or self-promotion could have affected the outcome of the interview. To reduce these limitations, all interview inquiries developed had such considerations in mind.

Significance

The emergency management institutions is a broad field, performing prevention, protection, mitigation, response, and recovery functions for natural and manmade disasters. Various funding sources from state and federal grants, disparate levels of resources (skill sets and equipment), and authorities and regulations contribute to this discipline's complexities. This research evaluated the functions and activities of the Suffolk County municipalities' emergency management community and highlighted significant responsibilities necessary to improve capabilities to face any disruptions to fresh drinking water, regardless and cause.

While Suffolk County, New York, the United States, and the international community face more and more issues involving available fresh drinking water, it more important for our institutions to assure the safety and the continuity of access to this precious asset. This current study's implications are the enhancements to prevention, protection, mitigation, response, and recovery functions towards any form of water disruptions.

This research aimed to develop resilient communities of Suffolk County, capable of managing disruption of drinking water. The social change elements will help reinforce the efficacy of the emergency management community's activities and reinforce relationships among disparate groups, all working together to provide a safer, more secure community.

Summary

This study expanded on emergency management and public administration research regarding institutional factors that influence policy decisions for a safer

infrastructure of Suffolk County's drinking water. Chapter 2 addresses the evidence-based research of emergency management tenets, current government documents reflecting the contaminants of emerging concern, existing policies, and public value depicted in printed media. This literature aligns with the problem, questions, and methodology of the research questions described in Chapter 3. The literature and the investigative instrument have expanded upon public administrators' current awareness and preparedness and Suffolk Environment Working Group County's drinking water users.

Chapter 2: Literature Review

Introduction

Policies and theories presented in this literature review address emergency management of the chronic technical disaster occurring with Suffolk County's drinking water. How emergency management prevents and mitigates disastrous events, what their level of preparedness is, and how to respond and recover is critical to any community, region, or country.

Generally, society and its government agencies attempt to confront challenges associated with a disasters' impact after the event. Based on interviews with emergency management personnel, most departments focus on planning and response while generally weak on protection, mitigation, and recovery. FEMA (2019) suggests that local, county, and state emergency management should be prepared for and aware of threats to homes, schools, businesses, and municipalities. Ways of mitigating such threats include fire prevention, securing structures, and providing vaccines. In Suffolk County, government administrators work to protect the local drinking water.

The following government and academic papers and media reports will demonstrate the many challenges facing Suffolk County, the awareness of threats from natural and manmade mishaps, and the procurement of needed funding. Has our society learned from events such as the attacks upon the World Trade Center of both 1993 and 2001, the landfalls of Hurricanes Katrina, Hugo, Ivan, and Sandy, the 2003 North Eastern Blackout, and the water contaminations of Washington DC of 2004 and the polluted waters of Flint Michigan in 2016? In "Managing Crisis" by Rosenthal, Boin, and Comfort (2000), the authors described the various types of crises that create a sense of

urgency for a decision. They discuss exhaustive crises as those that drag on, increasing the need for a solution. Their "creeping" crisis term is related to environmental issues such as soil salinization and heavy use of fertilizers, such as part of the case for Suffolk County's drinking water.

Chapter 2 concludes with a summary of the chief themes identified and the gaps in the current literature. This will show how this research can enhance public policy and emergency management knowledge while providing a transition to Chapter 3, the research method.

Literature Search Strategy

My research included government publications, scientific texts, and other forms of written media focusing on Suffolk's drinking water safety. Resources were procured from the SAGE Full-Text Collection and SAGE Premier 2010 of Walden University's portal. Examples of key words used in my search include *water, disruption, drought, mitigation, response, preparedness, recovery, planning, situation awareness,* and *disasters.* The concepts of the developing theory of emergency management were addressed by David A. McEntire and Thomas E. Drabek from the University of Texas and Denver, respectively. More importantly, the theoretical framework of institutional theory is presented in numerous papers.

Relevance of Research Questions

The environmental events involving the extreme lead levels of Flint, Michigan, and Washington D.C's drinking water, and the failed infrastructure in Massachusetts, are aligned with the ongoing media reports of Long Island infected water, which prompted my interest in studying the activities of emergency managers. I was interested in the

prevention, protection, mitigation, response, and recovery policies conducted to face these emerging threats to Suffolk County's drinking water.

The attacks upon the World Trade Center in 2001 greatly influenced the need to create the US Department of Homeland Security and increase security within our states and counties. For example, in 2002, I was asked by the County Executive of Nassau County, NY, to create their Emergency Management and Homeland Security Office. In line with these government agencies' emergence is the exploding amounts of academic programs, mostly coordinated by FEMA's Emergency Management Institute, in Emmitsburg, MD. In the early 1990s, only a handful of programs existed covering emergency management concepts. Today, hundreds of institutions throughout our nation provide excellent academic programs from an associate degree up to the terminal programs of a Ph.D. (Emergency Management Institute, 2019). These programs and the litany of government entities such as the FEMA, the Government Accounting Office, and much more, have produced an abundance of research, reports, and papers addressing the universe of emergency management.

In this study, I aimed to understand the preparedness levels regarding the emergency management institutions of Suffolk County regarding the threats to their drinking water. I analyzed levels of awareness, preparedness levels, and mitigation, distinguishing gaps in what is being accomplished and what must be done to educate emergency managers of the threats and how to mitigate and prepare for them.

Theoretical Framework

W. Richard Scott of Stanford University produced numerous papers on institutional theory, the theoretical framework used in this study. One prominent paper is

Institutional Theory: Contributing to a Theoretical Research Program (2004). Some of his findings are “work arrangements are not preordained by natural economic laws, but are shaped as well by cultural, social and political processes; society creates institutions and processes to attend to societal needs, and that institutions are comprised of specific elements 1: regulations - the rules, laws and social expectations, 2: being normative as being expected as the proper way to behave and perform, and 3: cognitive – the way things get done” (p. 4). Finally, Scott and Levitt observed that joint ventures and cooperatives are complex projects similar to disaster response. Examples of projects include dams, transit systems, and buildings. At times, it is observed that there may be conflicting cultural, regulative, and normative prescriptions. These findings and conclusions apply to the emergency management culture in which the problem, the purpose of this study, and the central research question addressed.

Harris (2019) oriented his discussion of this theory towards universities. He suggested that institutional theory helps understand the pressures to become similar, decreasing diversity and describing how choices, accidental or intentional actions lead to mirror the field's norms, values, and ideologies. Harris cited institutional theorists such as DiMaggio, Powell, and Scott, regarding technical and institutional organization types. Technical institutions follow designed technologies with discernable productions, while institutional organizations use research and teaching to produce new knowledge.

DiMaggio and Powell (1983) discussed the mechanism of isomorphic institutional change. Such mechanisms are coercive processes, mimetic process, and normative pressures. Organizations are, in some ways, coerced by contracts, laws, and regulations. Emergency management institutions in New York must abide by New York State

Disaster Law, Article 2b (New York Law, 2019) while being regulated to a degree by standard mission areas by the Federal Emergency Management Agency (2019). Emergency management agencies were developed nationwide in a mimetic process after the World Trade Center attacks of 2001. I was fortunate to be asked by Nassau county's county executive to create their emergency management agencies.

In contrast, states throughout the country created their own state Department of Homeland Security and emergency management. Furthermore, finally, the profession of emergency management is being legitimized by many academic programs, mostly coordinated by FEMA's Emergency Management Institute in Emmitsburg, MD. Today, hundreds of academic institutions throughout the country provide emergency management programs, from an associate degree to the terminal programs of a Ph.D. (EMI 2019).

Cornelissen, Durand, Fiss, Lammers, and Vaara (2015) argued that,most social reality is defined by rules and conventions in the world of organizations. They further provided a cognitive focus to distinguish between the new and the old institutionalism by observing individual and collective cognition to explain institutions' macro-level features. This is accomplished by the common thought structures that legitimize ways of acting socially in an organization.

Their report heart is a special topic forum (STF) placing communications at the center of institutional theory, indicating that communications are the interaction that builds on speech, texts, gestures, and more. This STF attended to communications dynamics such as speech and other forms of interactions found influential institutional theory. The forum collected 60 submissions, and many focused on speech, which

provided a window into the cognitive process of the institutional changes or maintenances.

Their brief conclusion was that institutional theory is an important theoretical perspective of management and organizational research that would benefit from a strong communication dimension shift. Such dimension would entail the linguistics and discourse analysis, or the theory of communication.

Oliver Schilke (2018) depicted how institutional theory shifts from a macro-level scheme to a multilevel paradigm incorporating individual organization members. The intent here was to make the theory more precise and general. Schilke questioned why organizations facing the same environmental pressure resist conforming to isomorphic templates while others conform. What was discovered was that decision-makers exercise discretion in deciding as to what level their organization becomes isomorphic with the environment. The decision-makers' ability has great potential to significantly broaden the understanding of institutionalized prescriptions.

Further, Schilke (2018) elaborates that whether isomorphic templates are adopted or not can have major implications for that organization's social evaluation and its technical efficacy and differentiation from the competition. Glynn (2008) states that organizational identity develops links between the environment and the decision-makers' behavior. The author stated that institutional theory's core question is why organizations adopt practices whose material benefits are difficult to assess, even in retrospect. Further research is needed to understand why various mimetic, normative, and coercive pressures will cause organizations to adopt templates and become isomorphic with their environment.

Other reports and documents used in this project were gleaned from various commissions, such as the Long Island Commission for Aquifer Protection, which described the elaborate water supply system. This chapter discusses these commissions followed by papers from multiple non-profit organizations, government reports, and other printed and digital media elaborating on this topic.

Literature Review

Commissions

In 2013, the Long Island Commission for Aquifer Protection (LICAP) was created to assess the long-term health and the protection of Long Island's (Suffolk and Nassau Counties) water. The group is represented by a scientist, water utility officials, and political leaders. LICAP (2016) provides insight into the use of Long Island's groundwater for public consumption, withdrawn from the Islands' aquifer system. For example, in 2014, the average consumption from public water utilities was 413 million gallons per day (mgd), while 200,000 people connected to their private wells (estimated at 47,000) raise the consumption to 450 mgd. It is important to note here that not all water pumped is necessarily used in areas equipped with sewers, allowing the water to return to the groundwater unfiltered. Additionally, there are seasonal stressors to the aquifer system between April and October from high use from farmers, golf courses, and residential and commercial lawn sprinklers.

Besides the stressors mentioned in the extracting of water from Long Island's primary source, events such as upcoming are occurring where saline water is rising through the aquifer's drinking water zone in various areas of Long Island. This upcoming occurs when excess pumping of freshwater is replaced by seeping saltwater from

adjoining bodies of water. These events have occurred in the Great Neck and Manhasset Neck peninsulas of the west end of the aquifer and Montauk, the east part of the Island. This salinization is compounded by road salting throughout Long Island roads during winter months (LICAP 2016).

One term commonly used throughout the environmental community, such as this commission, is the 'precautionary principle,' Wingspread (1998). This principle allows policy makers to justify discretionary decisions to prevent harm or damage when there is a lack of comprehensive scientific knowledge. Once scientific evidence emerges, protection policies can be enhanced or relaxed. In alignment with this principle, and with emerging scientific evidence, the Citizens Campaign for the Environment (CCE), Esposito (2011) disputes the levels of anti-degradation that the New York State Department of Environment Conservation (NYSDEC) established for what they classify as GA, fresh groundwaters (Class GSA waters are saline groundwaters). Esposito stresses the need for a "water protection plan for the next generation passionately." One of the steps needed for this plan is a holistic water pollution protection plan, consolidating the disjointed forty water districts, and emulating the SCWA towards a Long Island Water Authority (for both Nassau and Suffolk Counties). The intent is to develop and enforce a special groundwater protection plan; land preservation, stop pesticide contamination; address volatile organic chemical contamination, toxic algae blooms, along with the handling of personal care products and unused pharmaceuticals.

Non-Profits

Suffolk County's Comprehensive Water Resources Management Plan was published in 2015. Some of the critical comments made from this report were:

1. We have a million and a half people who are not severed.
2. The County is probably the only place in the world with that large a density in this tight space where the waste is going into a sole source aquifer immediately beneath us that we are drinking.
3. Nitrate concentrations in the Upper Glacial aquifer rose by over 40% between 1987 and 2013, while the Magothy aquifer, a deeper aquifer, rose by over 80%.

This document has been reviewed by various non-profit organizations, such as the Long Island Pine Barrens Society (LIPBS), with various disputes to the report. Richard Amper of LIPBS (2016) claims that the report does not point to the seriousness of the decline in drinking and surface waters, while not providing guidance to not point to the severity of the decline in drinking surface waters not guiding mitigating the diminishing water quality. His group demands that the County create a workable protection plan to mitigate such contamination and maintain the drinking and surface water quality. Below are important quotes retrieved in Water Worries (p. 3).

1. This increase represents a 40% increase in harmful nitrates in the aquifer closest to the surface and a 200% increase in nitrates in the heretofore.
2. Pesticides have been found in 1 of 4 community supply wells.
3. Currently, the Great South Bay clam fishery is operating at one percent of its peak potential.
4. Water demand in Suffolk is sharply rising due to irrigation demand for residential and commercial lawns and landscapes.

Similar to and in alignment with LIPBS, and previously mentioned, is from the Citizens Campaign for the Environment, commenting that planning must be enhanced; mentioned by A. Esposito in Water Worries (pg. 6):

- That volatile organic chemicals are increasing in the Upper Glacial and Magothy Aquifers
- Methyl Tertiary Butyl Ether (MTBE) (an additive to gasoline) in groundwater is widespread; and
- Pharmaceutical Drugs and Personal Care Products are an emerging contaminate of concern in Suffolk groundwater supplies.

Kevin McDonald of the Nature Conservancy criticizes the report for doing a poor job in linking quality standards to protect surface water quality (Rauch Foundation 2017). McDonald proclaims the paradigm of users benefiting from such a precious commodity. When contaminated, the public and private entities are left to pay for restoring such resources or suffer a degraded natural environment.

Emergency Response Planning Template for Public Drinking Water Systems

Founded in 1978, the Rural Community Assistance Partnership is a 501(c)(3) nonprofit organization that provides training, technical and financial resources, and advocacy so rural communities can achieve their goals and visions. This organization has developed emergency response plans for water systems that may be modified to fit each system's specific needs and can be adopted based on what is relevant for the type, size, and complexity of the system.

Institutes and Groups

In November of 2013, the New York State Resiliency Institute for Storms and Emergencies (NYS RISE) (2014) held a consortium addressing the vulnerabilities of the Long Islands' infrastructure and its' natural environments to extreme weather such as hurricanes. In this gathering, there is 'no single point of failure' regarding the water supply, meaning that water districts have redundancies and interconnectedness throughout and backup electrical power. The deficit found was that during a local and/or regional power outage, communications would rely on cell phones that eventually fail, leaving Citizen Band and walkie-talkie radios to request fuel replenishment and other assistance. Noted in this consortium is the Climate Resilience Evaluation and Assessment Tool (CREAT), created by the Environmental Protection, and discussed how water suppliers can assess any risks from future climate events. This program should be adjusted or downscaled to the local area being evaluated. Some additional lessons were learned, such as recommending emergency workers be educated and trained in groundwater delivery basics and imposing water restrictions to control demand after an event.

The Environmental Working Group (EWG) an organization whose mission is to empower people to live in a healthier environment and dedicated to protecting human health and the environment. In their report, Water Treatment Contaminants (2013) provides insight and opinions of the unintended side effect of chlorinating water, which are chemicals known as trihalomethanes. The EPA now considers these chemicals as 'toxic trash' and as a probable human carcinogen. In 2011, this group analyzed water quality in 201 large American municipal water systems and determined that they detected

trihalomethane contamination within each of these systems. With the current EPA regulation of 80 ppb of trihalomethane and the evidence in the rise of bladder cancer, the limits are now being lowered. In their study of the 201 systems nationwide, Suffolk County's current trihalomethane levels are at 7.4 ppb. As such, EWG made an array of recommendations, some of which are:

- The EPA should reevaluate its legal limits for water treatment contaminants in light of the latest scientific research indicating that lower limits are well justified to protect human health,
- Congress should reform farm policies to provide more funds to programs designed to keep agricultural pollutants such as manure, fertilizer, pesticides, and soil out of tap water and;
- The EPA must reevaluate how it measures water treatment contaminants so that consumers cannot be legally exposed to spikes of toxic chemicals.

The Water and Wastewater Agency Response Network (WARN) is a network of water utilities assisting other suppliers during emergencies. The organizations' purpose is to help water utilities sustain damages from disasters with mutual aid and assistance in personnel, equipment, and materials from other water/wastewater utilities. In their 2013 after-action-report (AAR) of Super Storm Sandy, several items were discussed, such as:

1. Intra and interstate mutual assistance
2. Elevating the priority status of water infrastructure with a key action for emergency management to elevate their water sectors to a top-level priority when involving response and recovery

3. Power back-up as the single most factor affecting water operations

4. Site access and

5. Coordination.

Cited examples were that Bethpage Water District of Long Island provided a neighboring community utility, Mill Neck Estates Water Supply, with chlorination equipment by boat and that crews were provided by the Onondaga County Wastewater Agency (upstate New York) to support needed access to an NYCDEP facility. Other action items were to create effective damage assessments and observe system status by all levels of governments. All data should be available in states' emergency operation centers through the national incident management system.

Finally, to add to the urgency of our declining infrastructure nationwide is a report published every four years by the American Society of Civil Engineers (ASCE) (2017). Its most recent report, "Failure to Act: Closing the infrastructure investment gap for America's Economic Future," was published this summer. The report grades all of our national infrastructure categories on a scale from A through D for gradations of excellent to poor; and F for failing. In the past two gradings, our Nation's infrastructure was rated D collectively. Regarding our wastewater treatment plants with over 14,000 throughout our country that protect our health and the environment, this sector was rated D. The report predicts that more than 56 million new users will be connected to these systems over the next two decades with hundreds of billions of dollars needed to address current issues and the expected demands of the future. Some recommendations are to raise the awareness of the true cost of wastewater treatment, establish a federal Water Infrastructure Trust Fund to fund infrastructure systems under the Clean Water Act, and

Fully fund the Water Infrastructure Finance and Innovation Act (WIFIA) at its authorized level to cite a few.

In addressing our drinking water, rated D-, the ASCE (2017) presents that many pipelines are supplying our water installed nearly a hundred years ago and are near the end of their lifespan. With nearly a quarter of a million water main breaks every year, that not only wastes over two trillion gallons per year but causes billions of dollars of physical damage as well. In this report, the ASCE cited the American Water Works Association providing an estimation of 1 trillion dollars needed to sustain and increase the services to address drinking water demands up until 2042.

Government

As mentioned earlier, the US Department of Homeland Security has categorized our infrastructure into seventeen sectors. In the sector of water and wastewater, the agency has identified 153,000 public drinking water systems and more than 16,000 publicly owned wastewater treatment systems. Further, they have cited that 80 % of our population uses such systems for drinking water, and 75 % of us utilizes the existing wastewater systems.

Recognizing that all sectors are vulnerable to impacts from natural, technological, and manmade disasters, each sector has a sector-specific-plan, all part of the National Infrastructure Protection Plan (NIPP). The planning is accomplished through a risk management framework addressing the unique features of that sector. The planning is done through a coordinated process among the private sector and the assigned federal agency such as the Environmental Protection Agency, assigned to the water and wastewater sector.

What is profound about this planning process at the federal level is recognizing that this sector's attack can seriously impact our economy, public health, and the Energy and Transportation sectors. This sector plan sites four goals aligned with ten objectives, some of which are:

- The goal to sustain the protection of public health and the environment. One objective is to integrate physical and cybersecurity into daily business operations at utilities to foster a security culture
- The goal to recognize and reduce risk. One objective is to for identification of vulnerabilities through the best available information, to increase overall protection posture,
- A goal to maintain a resilient infrastructure,
- Finally, the goal to increase communication, outreach, and public confidence.

On the state level in New York, the Department of Environmental Conservation (NYDEC) subdivision, the Department of Water (DOW), develops watershed plans and quality reports in the protection of the states' water bodies. Within these plans are processes that address pollution as well. NYSDEC works closely with all sixty-two counties in various planning and response activities such as dam safety, coastal erosion, and flooding.

Locally, Suffolk County (2014) has published its Comprehensive Water Resources Management Plan, criticized by many non-profit organizations mentioned earlier. This report's main findings and recommendations were the downward trajectory in groundwater quality, mostly due to nitrate contamination from over 360,000 residential

septic tanks and fertilizers used on our lawns and farms. The discussion was the emerging concerns with PPCPs infiltrating our aquifer, brown tide algae, anoxia, VOCs, and the South Shore Estuary Reserve that was declared impaired NYSDEC. The plan involves many stakeholders such as academia, community activist, businesses, and government. The implementation of this plan for the recommendations is categorized into short term (less than five years, medium (5-10 years), and long term (>10 years). Though some of the planning from Suffolk County has started (2014), most government officials mentioned in this document feel that it will take decades to make any positive changes.

Comprehensive Emergency Management Plan (CEMP) was developed by New York State required under NYS Executive Law, Article 2B. The plan and those developed in all local municipalities are developed and maintained in each locality, Homeland Security and Emergency Services (NYSDSHES 2020). The CEMP's generally contained in three distinct and interconnected volumes for mitigation, response-recovery, and recovery

The Printed and Digital Media

Our printed and digital media provides us with daily, and more recently, immediate

formation on just anything where we are interested. Here on Long Island, New York, and no different from anywhere else in the world, our newspapers and webpages have presented many issues on our drinking water. The most abundant source on Long Island (Suffolk and Nassau counties) issues is Newsday and its associated website, newsday.com.

Authors such as Brand, Brown, Brodsky, Cassese, Dooley, Eidler, Hampton, Kitchen, and Schwartz (2016, 2017) of Newsday have written dozens of articles on Long

Island's drinking water. These articles have started to highlight the efforts, and lack thereof, by government and non-profit organizations. In November and December of 2016, a human-interest story of a Manorville (east Suffolk) resident whose private water well was found levels 25 times that of the state limit of a gasoline additive, MTBE. Though residents routinely test their wells for any contaminants, they made statements that there were no odors and discoloration of the water through further testing in this neighborhood; another two-dozen home and their wells were found positive with this additive. For example, Dooley describes a letter sent to the County Health Department residents that MTBE can irritate the eyes and affect the central nervous system. Sources to Dooley indicated the NYCDEC investigators feel the source of the contaminants is from nearby gasoline stations. In a later article, "New Push to Limit Chemicals," New York State officials are urging the EPA to set standards in limiting the levels of another contaminant, 1,4-dioxine. Though the state of New York has acting to address this contaminant, the acting administrator of the EPA, Lisa McCabe, is quoted saying that the agency is evaluating whether to establish a national primary drinking water regulation. The most poignant point of information in this article is that 7% of water suppliers nationwide detect similar cancer risk concentrations.

In comparison, 71% of Long Island tested water suppliers were shown to pose a cancer risk. New York, as a state, is 20th in beach water quality among 30 states rated. The Long Island Press cites from the New York State Health Department pamphlet on fish and shellfish is for fishermen and women to limit consuming fish with extra precautions urged for children and women under 50 as the primary chemical of concern is chlordane.

Finally, on the discussion of waterways, Morris (2016) of Newsday reported thousands of dead fish found in Centerport Harbor. Based on these results and the EPA administrator's comments, Dooley (2017) says that New York State Senators are presenting a plan to have all water suppliers tested for toxic chemicals. Additional chemicals mentioned was perfluorooctanoic acid (PFOA), a known additive in firefighting foam. Finally, funds are being requested by the state senate for led testing in all schools and updated water infrastructure.

Writers from the Long Island Press (LIP) (2016) present various articles as to who should fund to save Suffolk's drinking water or raise taxes, as well as being cautious while in rivers and beaches. Some articles depict that after heavy rains, stormwater washes pathogens into local waterways such as rivers and beaches, depositing bacteria levels resulting in gastrointestinal illness and infections of the eyes, ears, nose, and throat. The bacteria found in the waterways are from domestic and wild animal feces, partly treated human waste from septic tanks, and the dumping of untreated sewage from boaters, as to the beach closure data by the National Resources Defense Council (NRDCsmall village port of northern Suffolk County. Due to stormwater runoff from recent heavy rains, the level of oxygen had severely decreased in the harbor, combined with a large population of bunker fish, which choked off 11,000 fish. MacGowan (2016) of Newsday reports on Brookhaven, Suffolk County, with an initiative to upgrade sewer treatment systems and create nitrogen protection zones. Also, both Brookhaven and Smithtown town Brookhaven and Smithtown, Brookhaven and Smithtown towns, which border on Lake Ronkonkoma, are coordinating to replace the park cesspool to reduce nitrogen pollution into the lake.

Summary

The literature review presented key associations to institutional theory and the required emergency management obligations towards protection, mitigation, preparedness, and response policies concerning water disruptions. What is demonstrated from this literature is the magnitude of this emerging threat to Long Island's drinking water, the wastewater management processes, and our beaches? Unlike the sudden impact from an earthquake, the expected force of a hurricanes' landfall, the fast and unknowing spread of diseases, the creeping levels of contaminated drinking water, and the slow destruction of our waterways need to be addressed differently from other threats.

The seriousness described in these reports has led to my research investigating and identifying the institution of emergency management achieving or not achieving any disruptions of water. These reports embody the descriptions of what is occurring in Long Island waters, what is being done, or not being at the federal, state, and local levels; the warnings from environmental activists; and the printed media's presages from the printed media's presages at-risk and vulnerable populations. Regardless of this information and the related research, I find a gap in the literature related to what institutional activities towards this coming disaster are identified as a group of emergency managers. The study provided information that helps fill the literature gap by identifying improvements for protection, mitigation, preparation, and response policies for the community of emergency management and Suffolk County residents, manufacturers, government, and the medical community.

David Feldman (2012), a professor for planning, policy, and design at the School of Social Ecology at the University of California at Irvine, has performed extensive

research in drinking water's global crises. In his recent text, Water, he discusses constructs such as distributing global freshwater, availability, usage, and sustainability. What I find profound in his text:

> Global crisis is inter-connected threat to our livelihoods and welfare. What links them is the concept of sustainability: ensuring that the various ways we manage freshwater for growing food and fiber; producing energy; making and transporting goods; and, meeting household needs do not impair the welfare of other living things, or the future of generations. Sustainability means promoting development, protecting the environment, and advancing justice. Yet, the way freshwater is managed often does just the opposite. Moreover, when we abuse other resources that interact with water, we create unsustainable freshwater management conditions.

To compare previous research, in Chapter 3, I conducted a qualitative study via a responsive interview process (Rubin, Rubin 2012) to answer constructed research questions in understanding the levels of awareness and preparations of Long Island's at-risk populations. The research question previously mentioned in Chapter1 and Chapter 3 led to 10 prepared questions in Appendix A.

Chapter 3: Research Method

Introduction

This research evaluated Suffolk County's emergency managers' administrative activities to understand how they mitigate against and prepare for the emerging threats and disruptions to Suffolk County's drinking water. The goal was to produce recommendations and solutions to fill in the gaps of needed education towards protection, prevention, mitigation, and response and recovery programs for the emergency managers regarding drinking water.

This chapter depicts the research method essentials and analysis to describe any insufficiencies regarding a comprehensive approach to confront any disruptions to Suffolk County's drinking water. The goal was to explain the current awareness, mitigation, and preparedness situation and make conclusions regarding emergency management.

In Chapter 1, the problem statement was selected in alignment with an applicable method to study and analyze the issues. Further, my method was generated through careful consideration of the proposed research questions. Rubin and Tubin (2014) used the type of research through responsive interviews. A methods chapter usually contains three sections involving participants, the instrumentation to be implemented, and procedures to be followed (Rudestam, 2015). Creswell (2009) points to Chapter 3 as "the most concrete, specific part of the proposal" while adding sections to Rudestam's design, such as the design, researchers' role, data sources, and analysis.

With many federal, state, and local municipalities developing mitigation and response plans for emergencies and disasters, it is incumbent upon society to perform

similar activities towards chronic technological disasters and disruptions. Community organizations, local emergency planning committees (LEPC), and businesses must participate and contribute to society's survival. The following section set the stage for this research.

Research Design and Rationale

This qualitative study of the institutional responsibilities of emergency managers of Suffolk County, the townships, villages, and state and federal facilities towards planning, preparedness, and response policies was within the research questions' boundaries. Walonick (2015) guided a questionnaire research flow chart to allow an orderly manner in its' efforts. Every step in his chart is dependent on the successful completion of the previous items, avoiding any mistakes, confusion, and assurance of completion. We start with design methods, determine the feasibility, developing ones' instrument, selecting the samples, conduct a pilot test, revise if necessary, conduct the research, analyze your data and prepare the report. Regarding sampling, Babbie (2009) stated that sampling is a critical component for a successful study, while Walonick (2010) indicates that the researcher must plainly define the target population(s), keeping aligned with the objectives of the study.

The targeted populations of Suffolk County, New York, were selected from emergency management agencies from the county, towns, and state and federal facilities. It must be noted here that New York is a Home Rule state, meaning that such local municipalities have the authority to decide for themselves whether to follow a particular course of action, not requiring any county or state approval except for the state constitution. The interview questions collected data from these administrators regarding

their situational awareness, if any, and the protection, mitigation, and response to issues involving drinking water disruptions. This was through a semi-structured process with a limited number of questions, followed by probes to verify the interviewee's understanding. (Rubin, Rubin, 2012). The questions were open-ended, allowing the interviewee to respond appropriately. The burden and the challenge were contacting all participants on the occurring chronic technological disaster and any disruptions to drinking water. The confidence in these selections came from personal involvement in emergency management in Suffolk and Nassau counties and New York City.

The data collected was initially analyzed using codes and nodes from the data collection in part with the Nvivo (Windows) format. Using the Nvivo software was challenging to use. I switched to using an Excel spreadsheet to enter data and organize and analyze themes, trends, and patterns based on participant responses to the interview questions.

Role of the Researcher

My role was managing inquires, data collection, and facilitating all research activities. Developed as a set of interview questions through responsive interviewing (Rubin & Rubin, 2012) that encouraged “the gathering of narratives, descriptions, and interpretations from conversations, and placing them together in a way to re-create the culture (the field of emergency management) in a way that the participants would recognize as real” (p.7). Because of my interest in our infrastructure, specifically drinking water, I initiated my quest into this research. One caveat is the need to counter any bias through inquiries in a specific order and directed towards a subset population of Suffolk

County, NY, the emergency managers. There are no ethical issues within this research and has no relation to my current work or other associated interests.

Research Questions

The research problem being investigated is: To what extent is the emergency management community in Suffolk County aware of this chronic technological disaster? If such awareness is aligned with planning and preparedness, how do specific groups use this commodity, and what are the adverse effects? Further, the intent was to identify themes related to the research problem.

The central research question: In line with the mission areas, what institutional practices of emergency managers from Suffolk County are given towards disruption and/or the deterioration of drinking water?

Methodology

Participant Selection Logic

Participants in this study were selected based on their current functions in administrating emergency management policies and procedures regarding protection, mitigation, response, and recovery missions towards disasters. Contacting these emergency managers involved a list provided by the Fire Rescue and Emergency Services of Suffolk County Long Island. Emergency managers were contacted to provide their level of awareness and planning. Additionally, the selection was noted as to their geographic location from either the northern and southern parts of Suffolk County, as there is a difference in the glacier aquifer's depth.

Procedures

I recorded all responsive interviews by phone. In person, interviews were not conducted due to the limitations set forth during the COVID-19 pandemic. I recorded all responses during the phone interviews after forwarding the questionnaire by email. The participants and their positions and type of municipality are depicted in Table 1.

Table 1

Breakdown of Participants

Participant	Municipality	Position
1	Village	Emergency manager
2	County	Planner
3	County	Emergency manager
4	Town	Police chief
5	Town	Chief fire marshal
6	Town	Emergency manager
7	County	Police emergency manager
8	Village	Mayor
9	Village	Emergency manager
10	Village	Mayor
11	State	Emergency manager
12	Village	Trustee
13	Village	Mayor
14	Federal	Emergency manager

Instrumentation

Responses from the interviews were used for all data collection. The levels of awareness, protection, mitigation, response, and recovery missions towards this emerging drinking water crisis were the main focus during the interviews. The interview began by addressing the overall research problem. When necessary, probing questions were conducted to help manage the interview while extracting important details and conducted to help manage the interview while extracting important details and conducting follow-up questions for verification. The steps taken to transcribe and summarize each interview

marked excerpts of relevant concepts then sorted them into a single data file excerpts; compared, weigh different versions, and combined concepts and themes to generate my results. The qualitative results were displayed in a descriptive and complete picture, utilizing the EXCEL software.

Other Methodologies Considered

Other methods were considered for this research, such as a quantitative process. Surveys involving many participants involving a similar experience would not be aligned with the research questions, as experience in water contamination versus awareness. The process was through responsive interviews to analyze the attitudes and knowledge of the pending crisis. As such, a structured approach was selected instead.

Data Collection

This study's research site is in Suffolk County, the eastern part of Long Island, New York. The population of Suffolk County is approximately 1.4 million residents. New York state, unlike many other states, is the home rule where each municipality rules upon its own set of laws unless state and federal law supersedes. There are 10 townships, 36 villages, over 100 fire departments, 25 law enforcement agencies, 70 school districts, and all considered separate government entities. Though Suffolk County is home to some of the world's wealthiest people, the average family income is roughly $65,000 per year. Some areas, such as Setauket and Stony Brook, have an average household income of $500,000 per year, while areas such as Wyandanch have income below the poverty line (LIA 2018). The economic viability is roughly 100 billion annually, including over 100 manufacturers, including over 100 manufacturers, including over 100 manufacturers, including over 100 manufacturers and 14 hospitals, all separate business or non-profit

organizations. The county borders the Long Island Sound to the north, the Atlantic Ocean to the south and east, with Nassau County to the west. These shorelines are home to some of the most famous beaches and barrier islands, such as Jones Beach, Fire Island, and the Hamptons (LIA 2018)

This study evaluated the subset, as mentioned above, of Suffolk's population, the emergency managers in Suffolk County. The results of this study will be offered to the County Executive, town supervisors, hospitals, water authorities, fire departments, emergency management officials, manufacturers, and community organizations for their reference.

Data Analysis Plan

In directing the Interview questions, the participants were asked various inquiries that accomplished between 10 to 20 minutes. Participants will be from emergency management officials of Suffolk County and inclusive towns and villages, common among the participant's exposure to the emerging drinking water crisis in Suffolk County. The intention is for themes to evolve when the array of each participants' response is collected, analyzed, and examined for irregularities. The data collected will be analyzed using codes and nodes from the data collection format following EXCEL (Windows) format. This will help facilitate the organization of the data in different categories of themes, trends, and patterns facilitate the organization of the data in different categories of themes, trends, and patterns identified by the study participants.

Analysis Justification

This study involved the analysis of attitudes, opinions, knowledge, and preparedness levels of emergency management. The goal was to procure a greater

understanding of the chronic technological threat at hand and any potential disruptions involving Suffolk County's drinking water. The investigative process used responses to the interview process to measure the participants' knowledge, attitudes, or opinions (Bowling, 1997; Burns & Grove, 1997). Herbert and Irene Rubin of Northern Illinois University wrote "Qualitative Interviewing: the art of hearing data" that provides graduate and postgraduate approaches to their 'responsive interviewing.' This process was performed where the researcher responds to and then ask further questions about what they hear from the interviewees rather than rely exclusively on predetermined questions (Rubin, Rubin 2012).

Before beginning the analysis, questions were reviewed thoroughly with each participant to procure accurate perspectives from each. Data results were examined, summed, at displayed through a descriptive framework.

Sampling

Patton (1990) states, "Perhaps nothing better captures the difference between quantitative and qualitative methods than the different logics that undergird sampling approaches. Qualitative inquiry typically focuses in depth on relatively small samples, selected purposefully" (p.169). Hence smaller sizes are selected than the large number of samples needed for quantitative studies and no specific sampling numbers. The sampling was made from Suffolk County emergency managers, the ten townships, 32 villages, and a state and federal facility. These selections had appropriately represented the research topic, while the design of this study has high integrity and transparency to enhance social justice.

It was anticipated that among the total amount of emergency managers, it was expected that between 25-33% would participate in this study, which 31% did. Each participant was notified via email through the lists provided by Suffolk County Fire and Rescue Services, a great source.

Issues of Trustworthiness

Trustworthiness is an important virtue in the collection of data, its analysis, and review. It was my responsibility to safeguard each participant's information and to keep it secured and confidential. Regarding the data collected, it was crucial to ensure the accuracy of each interview. Creswell (2009) provides criteria for data collection, a process that will be followed.

Establishing Reliability

The research instrument used responsive interviewing, which was a reliable and duplicable process, and that the coding and measurements through the EXCEL software program were valid and transferability. These interviews and related narratives assisted me in my interpretations to describe the processes and events the participants were viewed as real.

Ethical Procedures

While conducting this research, I upheld the highest respect for each participant. Written permission to conduct the proposed qualitative study was collected by each participant and their municipality. Permission was be obtained from the Institution Review Board of Walden University.

Further, the participants were identified by a letter-number scheme and not by their name, position, and municipality. All participants were free to participate or stop at

any given time, without any consequence. It must be stated that there was no risk to participants in the proposed study.

Summary

The purpose of this qualitative study was to explore the awareness of, the mitigation to, and the preparedness towards this emerging crisis of Suffolk County's drinking water by Emergency Managers. This chronic technological disaster affects government agencies such as emergency management, fire departments, and health departments. Analyzing the participants' opinions and knowledge using a responsive interview method will add to the body of literature regarding the government, businesses, and the public's response.

Chapter 4: Results

Introduction

This qualitative study's intent was to expand on current research correlated to emergency management and the institutional responsibilities of situational awareness of and preparedness for drinking water disruptions. The risk population was the society of Suffolk County, New York. The objective was to contribute to social change by bringing awareness and needed evaluation of appropriate emergency management community policies. Further, this study intended to offer recommendations to the establishment of emergency management to enhance preparedness and response policies involving disruptions to Suffolk County's drinking water and any other threats faced. I used references to the US Department of Homeland Security's list of infrastructure sectors, and the definition of chronic technical disasters, various articles, and reports depicted in my literature review as part of my evaluations. Interviews were conducted using either telephone or Skype with emergency management professionals from throughout the County of Suffolk to obtain the qualitative data, which informed this study. The following central research question guided this study:

Central Research Question: Emergency managers have traditionally projected their efforts on prevention, protection, mitigation, response, and recovery from events such as hurricanes, terrorism, and large chemical spills. In line with these mission areas, what institutional preparedness practices are being implemented by emergency managers from Suffolk County, the townships, and the villages to protect the drinking water?

The Skype interviews provided comprehensive data to address the primary research questions.

This chapter will begin by discussing the study's venue, the demographics, and participants' positions. Data collection procedures for this study will be described, followed by the delineation of procedures used to analyze the collected data. I will then discuss implementing the trustworthiness strategies introduced in Chapter 3 of this paper and present the study results, organized by the research question. This chapter will summarize the material presented in this chapter and transition to the final chapter of this paper.

Demographics

Emergency managers with personal experience responding to numerous past disasters such as hurricanes Gloria (1985) and Sandy (2012), and assisting in the World Trade Center attacks of 2001, were selected for this study to determine the current levels of awareness and preparation for any disruption to Suffolk County's drinking water. The participants either served or were currently serving in their respective municipality at the county, town, village level, and state and federal entities. There were three county agencies, three from townships, six from villages, one from the federal, and one from a state government agency. The average number of years in EM was 22, with a mean average age of 42. Of the respondents, 13 were men, and one was a woman. These participants had conducted planning development, recovery, and mitigation activities in line with response experiences.

Suffolk County, New York, important in conducting this study because it is currently being affected by its gradual deterioration. Interviewees came from an eclectic

background, such as the fire service, law enforcement, emergency management, and academia.

Data Collection

I scheduled telephone/Skype interviews with emergency managers from the various villages, townships, and counties. The total amount of interviews was 15. After performing the interviews, I conducted a constant comparative process by transcribing my audio recordings to enable the collected thematic analysis of text data using the constant comparative method (Kolb, 2012) with participants' consent. I used this protocol to conduct the interviews for this study. Scheduling for each interview was set for 20 minutes per session, yet each interviewee's actual time varied.

I developed an original interview instrument consisting of 10 items for proficient data collection. My research questions were based upon my literature review, the problem statement, and the goal of identifying the attitudes and levels of preparedness of the Suffolk County's community of emergency managers regarding threats to the drinking water. This resulted in an effective interview tool, reflecting on my original research objectives and aligning with the study's research question.

Data Analysis

Braun and Clarke's (2006) thematic analysis approach was used to analyze my collected data. My objective in applying such analysis was to discern trends and any commonalities among my collected datasets. Table 2 depicts six steps to assist in the thematic analysis I will describe in full. Note, the use of these phases is colinear in that one can go back to the previous phase at any time.

Table 2

Phases of Thematic Analysis

	Phase	Examples
1	Familiarizing oneself with the data	Transcribing data; read and re-read, noting down initial codes
2	Generating initial codes	Coding interesting feature of the data in a systematic fashion across the data relevant to each code
3	Searching for themes	Collating codes into potential themes, gathering all data relevant to each potential theme
4	Involved reviewing the themes	Checking if the themes work in relation to the coded extracts and the entire data set; generate a thematic map
5	Defining and naming themes	Ongoing analysis to refine the specifics of each theme
6	Producing the report	Final analysis selecting appropriate extracts

Note. Six steps for Thematic Analysis – Braun & Clarke (2006)

My data collection was based on semi-structured individual interviews through a list of 10 questions that allowed each question to be open-ended. Once collected, I used some of the suggested phases from Bruan and Clarke by first reviewing the 10 questions and responses thoroughly from the interviews (first phase), generating opinions of the participants towards the main research question regarding drinking water disruptions. This was followed by coding (second phase) the collected data systematically, while some codes included ‘baby-codes.’ Some codes were found to be semantic, while others were latent. This process helped to find commonly-used phrases and ideas. The phrases and concepts were compared to recognize conceptual similarities assisting in coding. Further examination was performed for contradictions from the participants and was noted and factored into my analysis. At this point, I progressed into the themes of the data.

Using an Excel spreadsheet, this phase (third) organized my developed codes into possible themes. All questions and relevant responses were analyzed with resultant codes and ‘baby-codes’ listed in Table 3 below to procure an insight into themes. With this list and reviewing the data again, I identified initial themes as I searched for emerging patterns and relationships between them. This effort led me into the next phase (fourth) to review and compare themes to codes, asking myself, is this a theme, is there a central concept, is it meaningful. It also led me to theme attributes, reorganizing the themes, and deleting those confirmed by the scribed data. The fifth phase was to define and label each theme resulting in 10 first level and thirteen-second level themes, organized by each question asked of the participants.

The sixth phase was to present an analytic commentary describing my findings, integrating quotations from my interviews, and linking the themes to each question. In the description of my resultant narrative, any discrepancy was mentioned, and compared to the more common opinions, they contradicted. Such efforts served to answer my research questions by depicting themes that will describe emergency preparedness and situational awareness of the threat of disruptions to the drinking water of Suffolk County.

Table 3

Level 1 and Level 2 Themes

Interview question	First level theme	Second level theme
1	Type infrastructure sector	Communications Critical facilities Emergency services Energy Government facilities Health care & public health Information technology Water & wastewater management.
2	Routine situational awareness – drinking water	Procure data
3	Comprehensive emergency management plan	Drinking water policies Input SCWA
4	Understanding water production	Water production
5	Community non-community supply	
6	Chronic technical disaster	Terminology
7	Effects of human activities	
8	Involved with local emergency planning Committees	
9	Level of preparedness	
10	Enough done about water protection	

Evidence of Trustworthiness

Credibility

Credibility is one of the key criteria addressed by researchers for internal validity (Shenton, 2003). Merriam (1998) stated that credibility deals with the question of "how congruent are the findings with reality." My inquiries were credible, and the responses received were congruent to the current situation: the awareness of Suffolk's drinking water. In establishing trustworthiness, one must inspire honest responses (Shenton, 2004). In my consent form, and before I began each interview, it was stated that each participant

was free to provide an answer that they believed correct. Rubin and Rubin (2012) stated that the research's credibility is partially shown in informed discussion with participants.

Transferability

Transferability is the ability of one's findings to apply to other settings (Hanson, Balmer, & Giardino, 2011). Trochim (2006) stated that such results from one's research could be transferred to another context, and the person who wants to transfer the results to a different context is accountable for deciding how sensible the transfer is.

Dependability

Dependability addresses reliability with techniques implemented to imply that if the work is repeated through the same methods, context, and participants, the results will be the same (Shenton 2004). This study is a dependable prototype that will enable future researchers to obtain the same findings.

Confirmability

Trochim (2006) referred to confirmability as the degree to which the results could be confirmed or corroborated by others. Hanson (2011) stated that it is the objectivity of data collection and the findings. As in my study, while gathering the participants' responses, my results reflected the participants/interviewees' opinions, not mine (Morrow, 2005). More importantly, with my over 48 years of experience in the emergency services discipline, I withheld judgment and sanction to avoid any influence from my end. Finally, I detail how the results were derived, showing results precisely from the data (Cope, 2014).

Results

My application of a thematic analysis from the interviews conducted yielded 10 themes and 18 subthemes regarding drinking water disruptions in Suffolk County, New York. My results are presented in the following subsections as they were assessed comprehensively across all participants and interview inquiries. The themes are organized by the questions for which the themes are relevant.

Table 4

A Priori Coding for Interview Questions 1- 10

A priori code	Categories	Participants' identifier	Excerpts
#1 Infrastructure	Communications	P 2	Communication was the most important as without communications, agencies would operate in the dark
	Critical facilities	P-7	Such facilities are key to operate during disasters
	Emergency services	P 1,4,14	Services are key to save lives and property
	Energy	P 10	Energy is key to keep all critical functions running
	Government facilities	P 5, 6	Felt the need of government continuity critical
	Healthcare & public health	P 11,12	Critical especially during pandemics and other large disasters
	Information technology	P 8	Importance in all communications and data

A Priori Code	Categories	Participants'	Excerpts
	Water & Waste Water Management	P 3,9,13	Sustaining life, generating power, and medical issues and procedures
#2 Situational Awareness	Daily Situational Awareness	P4,6,8,9,10,	Do not conduct daily situation awareness
		12,13	When the emergency operation center opens during a disaster = less than half of the participant indicated they include the status of drinking water
		P3,5,7 and 14	
		P 1	Never includes drinking water in situation awareness reports
#3 Comprehensive Emergency Management Plan (CEMP)	Drinking water policies	P-2,3,4,9,11,12 13	Their plans included policies for drinking water disruption
		P-1.5,6,7,8,10 and 12	Indicated that drinking water policies were not included in their CEMP

A Priori Code	Categories	Participants'	Excerpts
#4 Understanding Water Production	Water production	P – 1,2,3,5,6 7,8,9,10,11 13,14	Stated good knowledge of drinking water production
		P- 4, 12	Stated they had little knowledge of water production
#5 Drinking Water Supply Source	Community Source	P- 8,10,11,12 13	Stated that their source of drinking water is from the community source
	Non-community	P - 14	Stated that they have their own wells
	Both Community and non- community sources	P-1,2,3,4,5,6,7	Stated that they receive their drinking from both source types
#6 Chronic Technical Disaster	chronic technical disasters	P - 1 -14	All participants indicated that they never heard of the term

A Priori Code	Categories	Participants'	Excerpts
#7 Human activities	PFOA PFOS PPCP Cesspools Fertilizers	P 1-14	All participants were aware of the hazards to drinking water by such entities
#8 Local emergency committees	local emergency planning committees.	P- 2,3,4,8,14	Either were invited or conducted such meetings
		P- 1,5,6,7,9,10 11,12,13	Stated that they were not invited or involved
#9 Level of awareness and preparedness	Awareness and preparedness	P- 1,3,10	Felt that there is an adequate level of preparedness towards the disruption of drinking water
#10 Enough is being done	Enough is being done	P 3,6,12,13	Feel that enough is being done to protect drinking water source

P 1,2,4,5,7,8,9 10,11,14	Feel that there is not enough being done	

Table # 5

Summative coding table

Codes	Category	Subcategories	Theme
	Infrastructure	Chosen Sectors Communications Critical Facilities Emergency Services Energy Government Facilities Health Care and Public Health Information Tech Water & Waste Water Management	An eclectic list of responses was made to select the most important infrastructure sector, from the chemical sector to water and wastewater management. The selection of water and waste-water management had a minimal response, while selection made of the remaining categories were scattered
	Situational Awareness	Daily Situational awareness	More than half did not conduct daily situation reports. When the emergency operation center opens

Comprehensive Emergency Management Plan	Drinking water policies	during a disaster, less than half of the participants indicated they included such status of drinking water supply; one participant indicated his agency didn't include such status.
		All participants indicated they have a CEMP. Participants were then asked if their CEMP incorporated drinking water policies. Seven participants indicated that they have such policies three do not, three participants did not know if they did have such policies or not; and one participant stated only during events.
Understood how drinking water is produced.	Drinking water production	Twelve participants stated they knew how the production process of drinking water, while two stated they had limited knowledge,
Drinking water supply source	Community supply Non- community Both	Nearly half of the participant indicated that they only receive drinking water from the community source; the others receive water from both source while only one indicated that they received water from their own source
chronic technical disasters	chronic technical disasters	All participants indicated that they never heard of the term

Human activities	PFOA PFOS PPCP Cesspools Fertilizers	All participant were well aware of these activities and the threats to drinking water
Local emergency planning committees.	local emergency planning committees.	Few participants either were invited or conducted such meetings, while most were not involved.
Level of awareness and preparedness	Awareness and preparedness	Very few felt that there is an adequate level of preparedness towards any disruption to drinking water while most feel there is a poor level of awareness and preparedness
Enough is being done	enough is being done	Only few compared to the majority of the participant felt there is enough being done to protect the source of drinking water

Infrastructure

The Department of Homeland Security established sixteen categories of infrastructure, ranging alphabetically from the Chemical sector to Water and Wastewater system management. In reviewing my data, I recognize the first level theme, infrastructure, and eight secondary level themes that depict each participant's importance. They are communication, critical facilities, emergency services, energy, government facilities, health care and public health, information technology, and water & wastewater management.

An eclectic list of responses was made to select the most important infrastructure sector, from the chemical sector to water and wastewater management. The selection of water and waste-water management had a minimal response, while selection made of the remaining categories were scattered. Participant 2 indicated that communication was the most important as without communications, agencies would operate in the dark; participant 7 selected critical facilities stating that such facilities are key to operate during disasters; participants 1, 4, and 14 expressed strong feelings towards emergency services simply stating that such services are key to save lives and property; participant 10 indicated energy is key to keep functions running; participants 5 and 6 selected government facilities as they felt the need of government continuity critical; participants 11 and 12 selected Health care and Public health critical especially during pandemics; participant 8 selected Information Technology for its importance in communication and data; and finally participants 3, 9, and 13 chose the water and wastewater management the most important for reasons such sustaining life, generating power, and medical issues.

Routine Situation Awareness

A key function in emergency management, as well as many responding organizations, is situation awareness. Regarding this function that involves drinking water in their daily situation

awareness reporting, more than half (participants 1,4,6,8,9,10,12,13, 14) did not conduct daily situation reports. When the emergency operation center opened during a disaster, less than half of the participants indicated they included such a status of drinking water supply; one participant indicated his agency did not include such status.

Comprehensive Emergency Management Plan

All participants indicated that their organization has a comprehensive emergency operation plan. Participants 2,3,4,9,11, 13, and 14 stated their plans included policies regarding drinking water, while the remainder said they either did not have such policies or did know.

Understanding Water Production

The majority of the participants stated they know very well how drinking water is produced, where a few, participant 4 and 12, stated they had little knowledge of the process.

Community Non-Community Water Supply

Knowing the source of drinking water, all participant knew their sources of drinking water. Participants 8,10,11,12,13 stated their drinking water source was from community water (Suffolk County Water Authority) only, and participant 14 stated their supply was their source, non-community, while the remainder of the participants, 1,2,3,4,5,6,7 indicated their supply was from both community and non-community sources.

Chronic Technical Disaster

None of the participants ever heard of the term chronic technical disaster. When explained, they then understood and appreciated the terminology.

Effects of Human Activities

Identifying contaminants from human activities, such as from the use of PFOA (a chemical to resist grease stain, etc.), PFOS (Perfluorooctanesulfonic acid – used in firefighting foam), and PPCP (pharmaceutical and personal care products), which is prevalent throughout the nation. Further, nitrates from cesspools and the use of fertilizers in farms and private lawns seep into Suffolk County's water table. All participants were familiar with and understood such hazards of human activities mentioned.

Local Emergency Planning Committees Involvement

A federally mandated government composes state and local officials, such as emergency managers, local businesses, and the press, to discuss hazardous materials preparedness. Participants 2,3,4,8 and 14 either were invited or conducted such meetings, while participants 1,5, 6,7, 9, 10, 11,12, and 13 were not involved.

Level of Preparedness

Regarding the level of preparedness among the emergency management community of Suffolk County toward water supply disruptions, only participants 1, 3, and 10 felt there was an adequate level. Participants 2,4,5,6,7,8,9,11,12,13 and 14 felt there is an inadequate level of preparedness in the case of drinking water disruption.

Enough done about water protection

All participants, except for participants 1,3, and 14 felt there was not enough to protect Suffolk's drinking water in short responses.

Additional Observations

What stands out from the collective results above is a lack of coordinated outlook in infrastructure categories; all the participants require some level of education into disaster-related definitions; and the importance of involvement with LEPCs. From the researchers' perspective, a more coordinated process in all aspects of emergency management is required.

Summary

My qualitative study aims to fill in the gaps of research into the institute of emergency management and its responsibilities while contributing to positive social change. The importance is to bring awareness to the evolving chronic technical disaster involving Suffolk County's drinking water and the threat to the at-risk population. Such threats and the evolving chronic technical disaster fill such gaps in my literature review in chapter 2. Through the themes contrived, such as in infrastructure, chronic technical disaster, awareness, plans, and policies, the objective is to guide the emergency management community to a more efficient level of preparedness, a primary institutional responsibility. Such discoveries to be shared with the emergency management community will hopefully reflect the current strength and weaknesses throughout this community while pointing to opportunities to face such threats, a somewhat basic SWOT (strength – weakness – opportunities – threats).

Chapter 5 will briefly summarize the results of this study and present the conclusions drawn from the findings and recommendations to improve the emergency management of Suffolk County in the preparedness towards disruptions of drinking water. The chapter will close with suggestions for future research, specifically towards the institute of emergency management.

Chapter 5: Recommendation and Conclusions

Introduction

This research intended to evaluate Suffolk County's emergency managers' awareness of how they mitigate emerging threats such as disruptions to Suffolk County's drinking water. The goal was to produce recommendations and solutions to fill in the gaps of needed education and enhance protection, prevention, mitigation, and response and recovery programs for drinking water. The study's theoretical framework was the institutional theory. Scott (2004) declared that this theory dives deep into our social structure, considering schemas, rules, norms, and routines for acceptable behavior. Further, he argued that society creates institutions and processes to attend to societal needs (Scott, 2004), hence emergency management.

This study filled a gap in related research by exploring the activities of the institution of emergency management in Suffolk County, New York, regarding any disruption to drinking water. The literature referred to in Chapter 2 related to infected drinking water and Suffolk County. Chapter 1 introduced technological events that led to the contamination of public drinking water in Flint, Michigan, and Washington, D.C., where malpractice infected water sources. In Massachusetts, an unexpected rupture of a major water main occurred, dumping its massive supply into nearby rivers, leaving millions without drinking water. Some key findings from the results are the lack of coordinated outlook efforts in infrastructure, a level of education into disaster-related definitions, and the importance of involvement with LEPCs. From my perspective, a more coordinated process in all aspects of emergency management is required.

What is being done in Suffolk County is that many environmental advocates are voicing their ire of this developing situation. What is not being done is the full engagement of the politicians. Bazerman and Watkins (2004) stated that predictable surprises stem from a situation

where avoidable crises are marginalized to satisfy economic and social policies. Their prime examples are that of the 911 attacks and the failure of the financial giant Enron. This research's partial intent was to provide an awareness to the emergency management community of water contamination and avoid a predictable surprise.

Interpretation of the Findings

My literature review highlight Suffolk County's existing drinking water evolution and the chronic contamination of the Long Island Sound and the Atlantic Ocean's drinking water supply. The immense discharge of nitrates from hundreds of thousands of cesspools and various other chemicals from factories, pesticides, and agriculture will potentially lead to large disruptions. State and federal agencies identified hundreds of mandatory cleanup sites from the history of Long Island's aerospace and manufacturing industries.

A thematic analysis was used to identify patterned responses to the answers to my interview instrument. The analysis also led me to become familiar with the data, identify codes, code the patterns as themes, and resolve my findings. The following findings will display how they confirm, dis-confirm, or extend knowledge into the institution theory regarding emergency management.

Infrastructure

The US Department of Homeland Security's National Infrastructure Protection Plan (NIPP), which was initiated from Presidential directive 21 (PPD21), identifies 16 critical infrastructure sectors, which are considered so vital that their destruction could have debilitating effects such as economic security and /or public health, hence, the relation to this list involving drinking water (USDHS, 2019). The list of sectors alphabetically are: chemical sector, commercial facilities, communications sector, critical manufacturing, dams sector, defense industrial base sector, emergency services, the energy sector, the financial sector, food and

agriculture, government facilities, healthcare, and public health, information technology, nuclear reactors along with materials, and waste, the transportation sector, and water and wastewater system management.

As one of the basic elements necessary for human survival, the water required for life, growing food, generating electricity, developing medicine, fire suppression, and many other critical functions was not the prime selection; more prevalent, neither sector was considered a majority. With only 21% of the responses identifying water and wastewater management, infrastructure priorities are ill aligned. As an extension to the knowledge of the institution of emergency management, this non-unified response within the community of emergency managers requires a coordinated alignment.

Situation Awareness/Procurement of Data

Endsley (2000) stated that situational awareness is the perception of environmental elements and events concerning time or space, the comprehension of their meaning, and the projection of their future status. Situational awareness is researched here as to if / when it is implemented. What is astonishing is that not one emergency management entity conducts daily situation reporting. However, 42% conducts such data gathering for situation awareness during an event, while 7% do not perform situation awareness. When performed, very few emergency managers inquire about water status during events, while most do not. This is an alarming situation in the emergency management community due to the importance of the water sector. This has provided knowledge that not all emergency managers conduct situation awareness in a uniformed manner.

Comprehensive Emergency Management Plan (CEMP)

A CEMP of a municipality will confirm that all government levels will be functional

under a unified organization to safeguard its residents and businesses during an event NYSDHSES (2020). The plan should comply with the National Incident Management System (NIMS) and apply the municipality strategic vision. Fortunately, all participants indicated that they have a comprehensive emergency management plan. What is discouraging is that only 50% of the CEMP's include policies toward drinking water; 21% did not know if their CEMP includes such policies, and 21% indicated they would collect data to import into their plan during an event. This eclectic response was indicative that the CEMP's throughout the emergency management community are not aligned and not standard. The findings confirmed what the institute of emergency management performs, but it extends the knowledge of its non-conformity to comprehensive emergency management planning.

Drinking Water Production

Knowledge of how drinking water is produced in one's municipality is important in that such intel will be key in developing plans and policies towards any water disruption, such as the County's Comprehensive Water Resource Management Plan, Suffolk County (2014). Fortunately, most of the respondents, 84%, have a well-rounded understanding of drinking water production, while a few stated they have limited knowledge—this finding confirmed what the community of emergency management performs.

Water Supply

SCWA's report, "The Water Cycle" (2017), is displayed in Figure 1 and shows drinking water production. In line with the importance of knowing how drinking water is produced (previous question), 100% of the responses demonstrated their drinking water source awareness. 35% received their water from only community sources (the SCWA), and 7% receive their water from non-community sources exclusively, while most receive their water from both. This

knowledge is also key to the development of plans and policies for disruptions.

Chronic Technical Disaster

A chronic technological disaster occurs when decisions were made to allow the potentially dangerous activity to go forth, or at a minimum, not to oppose it (Gramling & Krogman, 1997). It was worrisome to discover that 100% of the participants never heard of this term. This is an education issue, but all participants understood the explanation and were appreciative of its meaning. As the need for further research into emergency managers' education, such understandings could lead to more effective planning policies to respond effectively to water disruptions and other potential disasters.

Human Activities

The report presented by the Long Island Pine Barrens Society, in conjunction with the Citizens Campaign for the Environment, "Water Worries" (2013), depicted the multitude of chemicals penetrating Suffolk County's drinking water. All participants indicated that they fully understood the human activities from the discharge of PFOA, aqueous film forming foam (used in firefighting PFOS), PPCP, nitrates from cesspools, and fertilizers into the water table. Understanding such activities could lead to mitigation policies and/or recommendations to municipal policy and decision-makers from the emergency management community. Research is needed to extended municipal policies, if necessary.

Local Emergency Planning Committee

LEPCs are federally mandated but non-funded program for committee developments by the state and local governments to prepare and respond to hazardous material incidents (NYSDHES, 2019). LEPC membership includes (and is limited to) government officials, the first responder community, and industry members who own and operate sites that handle

hazardous materials, and community groups. This program is key in responding to hazardous materials' accidental discharge into our environment, regardless of the substance's physical state, whether solid, liquid, or gas. What is disappointing is that two-thirds of the respondents did not participate in such meetings. These meetings bring to current light conditions and possible threats from hazardous materials. Such findings call for an extension of research as to why these meetings are not fully attended.

Level of Awareness and Preparedness

The results regarding the level of awareness and preparedness among the emergency management community indicate that this community feels that 77% feel inadequate. This is interpreted that the community of emergency management has not given this threat enough attention. It is recommended that further research into such outlooks of emergency managers is required.

Enough Being Done

The question attempts to finalize the participant's attitude if enough is being done to protect Suffolk's drinking water. Interestingly, more than 3/4th of the respondents feel that not enough is being done. It is interpreted that the priority towards the protection of drinking water; identifying that most of this community does not view the infrastructure sector as number one; the minimal attendance at the LEPC meetings; leads one to interpret that the institution of emergency management of Suffolk County municipalities are not coordinated and aligned. It is recommended that further research into such outlooks of emergency managers is required.

Limitations

As mentioned in chapter 1**,** the limitations of this qualitative study had the following considerations: (a) the interviewee may have a bias (negative or positive) towards his/her

municipality, (b) the interviewee may have a personal agenda that may skew responses, and (c) the interviewee may not have enough experience in the field of emergency management. Such bias, lack of experience, or self-promotion could affect the outcome of the interview. To reduce these limitations, all interview inquiries developed had such considerations in mind. A number of the interviewees were critical of all government levels as to the lack of effort to protect Suffolk's drinking water. This limitation is part of the recommendations for more research and coordination among the emergency management community.

Other limitations were the non-alignment of priorities regarding the primary infrastructure. As stated in this chapter under findings, only 21% of the participants chose the infrastructure sector for water and wastewater management, the low participation in local emergency planning committees, the lack of knowledge regarding the term 'chronic technical disasters.' Collectively, the response to my interview questions has led me to present a list of recommendations.

Recommendations

Based upon the interview responses from participants, my recommendation is multifaceted, such that, instead of addressing the issue of disruptions to drinking water alone, my counsel is to establish an all-hazards and an all-organizational coordination among both Nassau and Suffolk Counties. Both counties are contiguous geographically within Long Island, and disaster knows no political boundaries.

Table 6

Hazardous Categories

Natural Hazards	Technological Hazards	Anthropogenic Hazards
Coastal Storms	Hazardous Material Leaks	War
Snowstorms	Power Outages	Terrorism

Draughts	Infrastructure Collapse	Cyber Attack
Water Contamination	Transportation Accidents	Espionage
Flooding	IT Disruptions	Riots
Tornadoes	Comms Disruption	Biological Attacks
Earthquakes	Nuclear Accidents	Denied Access
Tsunamis	Explosions	Arson
Wildfires	EMI	
Heatwaves		
Severe cold		
Pandemic Epidemics		

Drinking water disruptions is part of a litany of threatening hazards to Long Island; it may be from the natural, technological, and anthropogenic origin, or at times, a combination of the three categories. Below is a partial table of hazard categories that many institutions of emergency management refer to and help guide their comprehensive emergency management planning development:

1. What is the level of coordinated and standardizing comprehensive emergency management planning among local, state, and federal agencies?
2. From the institution of emergency management perspective, what policies and programs are needed to enhance the protection and mitigation of threats to Suffolk County?
3. What level of compliance occurs among municipalities towards state statutes such as New York State Article 2B (Disaster preparedness) and federal mandates such as local emergency planning committees (LEPC)?

4. What are education, training, and exercise programs needed within the community of emergency management?
5. What are public education programs warranted for citizens and businesses in Suffolk County?
6. Should there be one consolidated municipal emergency operation center (EOC)?
7. What new technology can be procured for a robust communication system with the ability to interface with state and federal agencies?
8. What level of involvement should be created with the private sector and non-profit organizations?

Social Change Implications

This study aimed to identify and enhance the level of awareness and preparedness of emergency managers of Suffolk County, New York, to benefit all citizens affected by disasters of any origin. The institution of emergency management and its normative responsibilities is coordinating the planning and preparing for, mitigating, responding to, and recovering from dangerous events to save lives and property, restoring services, and protecting infrastructure such as our precious drinking water. What has been further accomplished with this study is closing the research gap into the institute of emergency management towards the level and preparedness by emergency managers of Suffolk County, but to the needed enhancement of standardization of and coordination of critical functions.

My recommendations to emergency management in Suffolk County are to standardize and coordinate services performed by the institution of emergency management within the villages, the townships, and Suffolk County agencies. These recommendations also extend to emergency management's involvement with businesses, education, and academic institutions, hospitals, and tourism to survive potential threats. No one omitted.

This study will contribute to needed social changes in Suffolk County, by advocating for more coordinated activities, not just among all emergency management entities, but among the many sectors of society such as our business, industry, agriculture, education, health, and hospital, to name a few. This considers all races, creeds, ethnicity, religious persuasion, economic status, language limitations, politics, and vulnerable populations because of age or special needs. Through promotion and the advocacy for elevated transparency of our emergency management institution, we should reverse the adverse effect of our deteriorating drinking for the benefit of all through time.

Conclusions

This study, beginning with the first chapter, presents the report with a background of the problem, the research question, the study's purpose, and my theoretical framework, institutional theory. My review of pertinent literature in chapter 2 explores published materials such as those from the government, academia, non-profit organizations, and the printed media on the seriousness of this developing chronic technical disaster towards the at-risk and vulnerable populations of Suffolk County. Chapter 3 depicts the research instrument, the participants, and the methodology used for this study, including data collection and analysis. The research results were defined in chapter 4, and my findings were presented here in chapter 5.

The attacks upon the World Trade Center in 2001, the blackout of 2003, Hurricane Irene and Sandy of 2011 and 2012, and many more events, have challenged all aspects of the institute of emergency management of Suffolk County. Viewing my research from the perspective of institutional theory from researchers such as Scott, Harris, DiMaggio, and Schilke, lay out Institute of Emergency Management framework and the activities required to coordinate needed efforts. Through the lens of institutional theory, my findings lead me to state that there much need for coordination among all emergency managers in the county of Suffolk, New York.

Through a cooperative process depicted in my recommendation, we could achieve much better outcomes before, during, and after disasters, with our businesses and households' support, to name a few. It is not a question of just being successful in this quest but changing our social fabric towards potential and developing adverse threats. Responding to decades of disasters involving nature's wrath, technological failures, and terrorism, I have faith in American strength and resiliency, and I pray that with such success, I could comfortably answer a waiter in a restaurant when asked if I would like a glass of water.

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Appendix A: Interview Questions

Interview Instructions

The following list of questions will be presented through a Responsive Interview process to gather the attitudes and knowledge of emergency managers regarding the emerging threats to Suffolk County's drinking water. Questioning will start with addressing the overall research problem. When necessary, more questions may be conducted to assist with managing the interview while extracting important details, and conduct follow up questions for verification.

Please read the following before making your answers:

Many newspaper articles, government and academic papers are portraying an emerging crisis in our drinking water. One such report, IBM had published their Smarter Cities Challenge Report for Suffolk County in 2014. Quoting two paragraphs from the executive summary:

> The County has noted a decline in the quality of Long Island's surface water as evidenced by brown and red tides, reduced levels of shellfish and marsh lands. Excessive contaminants in the water bodies, particularly nitrogen, are responsible for this degradation, with 69% of this nitrogen production coming from the septic systems of individual properties. Other sources include agriculture, residential fertilizers and sewage treatment plants. p2

And

> This contamination can potentially have a significant impact on not only the quality of life for residents and visitors to Suffolk County, but also the economy on the island. This could result in major economic challenges for the County, leading to reduced industry, reduced coastal resiliency, restrictions on development and lower house prices plus a negative impact on tourism. The County has placed a potential value on this of approximately $2.3 billion, with fishing contributing $900 million, use of beaches $670 million and boating $760 million. p2

And last but not least, a recent report commissioned by the Suffolk County Department of Health Services, indicated an alarming decline in the quality of the drinking water.

The following inquiries will be considered ‘main questions’ regarding emergency management activities. Additional questions may follow if warranted, and, possible follow up questions to verify responses for correct understanding.

1. Based upon the 16 categories of our nation’s infrastructure, where would you place drinking water? 1 through 16, with 1 being the top priority.

   What lead you to this conclusion?
2. As an emergency manager, does your agency include the status of drinking water in your daily situation awareness reporting?
   a. If so, how do you procure such data?
3. Do you have a comprehensive emergency operation plan (CEMP)?
   a. If so, does include response policies towards emergencies / disasters involving Suffolk County’s drinking water?
   b. Does you plan include the input from those who produce drinking water such as the Suffolk County Water Authority?
4. Do you and your emergency management agency understand how drinking water is produced?
5. Does your community procure drinking water from either of the 34 community water supplies, one of the 254 non-community water supplies, or from both sources?
6. Do you understand the concepts of chronic technical disasters?

7. Do you understand how human activities are affecting Suffolk's drinking water?
    a. PFOA - Perfluorooctanoic acid
    b. PFOS - aqueous film forming foam (AFFF)
    c. PPCP - Pharmaceuticals and Personal Care Products
    d. Cesspools
    e. Fertilizers
8. Has your emergency management agency discussed the issues of drinking water during the local emergency planning committees?
9. Do you feel that there is an adequate level of awareness and preparedness among the emergency management community to the issues of Suffolk County's drinking water?
10. As an emergency manager, do you feel that there is enough being done towards protecting Suffolk County's drinking water?

Appendix B: County-Town-Villages – State and Federal Facilities of Suffolk County

County (1)

Suffolk

Townships (10)

Babylon, Brookhaven, East Hampton, Huntington, Islip, Riverhead, Shelter Island, Smithtown

Southampton and Southold

Villages (32)

Amityville, Ashroken, Babylon, Belle Terre, Bellport, Brightwaters, Dering Harbor

East Hampton, Greenport, Head of the Harbor, Huntington Bay, Islandia, Lake Grove

Lindenhurst, Lloyd Harbor, Nissequogue, North Haven, Northport, Ocean Beach, Old Field

Patchogue, Poquott, Port Jefferson, Quogue, Sag Harbor, Sagaponaek, Saltaire, Shoreham

Southampton, Village of the Branch, West Hampton and West Hampton Dunes

State and Federal Facilities (2)

State University at Stony Brook

Brookhaven National Lab