

**SURROUNDED BY WATER, BUT NONE TO DRINK:
WATER CRISIS IN SAN ANDRÉS, A COLOMBIAN CARIBBEAN ISLAND**

by

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A dissertation submitted to the Faculty of the University of Delaware in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Disaster Science and Management

Fall 2020

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**SURROUNDED BY WATER, BUT NONE TO DRINK:
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by

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ACKNOWLEDGMENTS

I would first like to thank God for all the strength, wisdom, perseverance, and patience He has given me to complete this dissertation.

My deepest gratitude to my husband, Fady Ortiz, for his support, sacrifice, encourage, and endless patience with me during this time.

Thank you to my daughter Sophie Aimé, for waking me up every morning with love, and at the end of the day with endless hugs. She gave me peace, strength, and energy to see this research through completion.

Thank you to my family, my mother Isabel Calderon, and my sister, Liliana Velásquez, who were there for the long haul and gave me continuous support, friendship, and distractions along the way. Thanks to my father, Ramiro Velasquez, who has taken care of me and illuminated this academic path from heaven.

I offer my sincere thanks to my University advisor, Tricia Wachtendorf, for her patience, support, critical feedback, and insightful guidance throughout my studies.

My sincere thanks to Victor Perez and Gerald Kauffman, two of my committee members, for your value questions and guidance, and thank you to Adriana Santos-Martínez for her support, encouragement, and guidance. She supervised my Master's research, and now she is a member of my doctoral dissertation committee.

Thank you to my good friend Michael Brook for long conversations and zoom meetings since the beginning of this dissertation, and my friend, Silvia Mantilla, for extended discussions and encouragement, and many enjoyable and thought-provoking conversations on a wide range of topics.

I particularly acknowledge and thank my case study interviewees in San Andrés island for their contribution to my research. Their openness and experiences brought this research to life and gave me the inspiration and motivation to tell their stories.

Thank you to the Ministry of Science, Technology, and Innovation in Colombia, for the financial assistance that made my doctoral studies possible (Convocatoria Doctorados en el Exterior, 646).

Thanks to the University of Colorado Natural Hazards Center, this study was funded, in part, by the Quick Response Grant Program, grant number CMMI1030670.

Thank you to the University of Delaware Biden School of Public Policy and Administration and the Disaster Research Center for funding in sharing the preliminary research results.

DEDICATION

A mi esposo e hija

Fady Ortiz Roca

Sophie Aimé Ortiz Velásquez

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ABSTRACT

The world is living through a simultaneous water crisis that is far from being solved. Crises are worsening. San Andrés, a Colombian Caribbean island, experienced water problems resulting in a State of Public Calamity in 2016. The water crisis affected more than 14,000 people. This research addresses how different stakeholders perceive and talk about nature and causes, the response, the desalinization technology as the leading solution proposed, and water injustices involved. This study began in 2016, and, subsequently, in 2018, fieldwork was again carried out. The research adopts a social constructionist approach, drawing on 79 semi-structured interviews with a variety of stakeholders. Findings show that the crisis produced uneven impacts due to pre-existing social inequities in water quantity and distribution.

Findings point to a discrepancy between the crisis's public official framing as a solely natural event and residents appealing to the unjust social processes as the crisis's roots. Residents, mainly Raizales, the ethnic minority group, claim water injustices in the water supply system that have been perpetuated, intensified, and legitimated through the water operation agreement signed with the private water company, Veolia. Their view is that the prioritization of tourism has resulted in water distribution preferences for urban over rural areas. During the crisis, residents relied on their social capital by sharing and requesting water resources. Officials framed the

crisis as a water supply problem caused by the reduction of precipitation due to the Niño phenomenon and a drought. The crisis was portrayed as a water supply-side crisis; thus, reinforcing the technocratic paradigm and the use of a conservative management strategy. Participants widely believed that desalination is a risk-free solution that will reduce vulnerabilities to water-related hazards. It was found that San Andrés is moving toward a technological water dependence, disconnected from traditional local forms of collecting water, and desalination is becoming a maladaptive strategy. The results suggest that the crisis response did not lead to a reform or a significant improvement in residents' water access. The crisis in San Andrés became a new normal. Findings point to the crisis as an opportunity for profitmaking by Veolia, who officially expanded its water infrastructure management and, in consequence, its corporate control over more water resources. San Andrés' water crisis is of global and regional significance, indicating critical overlap and convergence among scarcity, technology, inequality, and climate change. Finally, this study argues that the water crisis was not marked by absolute scarcity, but rather specific forms of variable scarcity created through multiple forms of water injustices. This study suggests that to invoke transformation to avoid ongoing water crises, policy-makers should: 1) incorporate traditional Raizal knowledge; and 2) commit to more democratic crisis management in which socio-historical and diverse alternative strategies are integrated. Recommendations for future research and policy reform are included

Chapter 1

INTRODUCTION

The local freshwater supplies in the Caribbean islands are not as abundant as the saltwater that surrounds them, and fresh water is becoming the most critical natural resource in the world. In particular, Caribbean islands are experiencing deepening and ongoing water crises. Socio-economic and technical problems – such as limited capacity to store water, low aqueduct coverage, poor governance in water management, high levels of unaccounted-for water, social inequities, and prohibitive cost of accessing water – paint a picture of increasing vulnerability to water crisis in the region. The challenge has become greater and more complicated in the face of climate change (IPPC, 2018). The main impacts of these global changes are in precipitation patterns, which result in the occurrence of more frequent and more severe droughts (Tompkins et al., 2005; Cashman, 2014). In this way, vulnerable islands under prolonged drought episodes are facing serious crises characterized by multiple social and natural causes, sometimes undetectable and with multiple consequences (Kendra, Knowles, and Wachtendorf, 2019). For instance, Bermuda, the Bahamas, and the Cayman Islands have aquifers that are approaching an emergency status, where water tables are lowering and conflicts over water are more frequent (Gössling, 2001).

Dividing the natural and the social is no longer a viable option in crisis studies. Kendra, Knowles, and Wachtendorf (2019) indicate that failures in the relationship between nature and society, in the context of global change, are posing new challenges that demand more comprehensive solutions. Particularly, crises are social processes having their foundation in economic, cultural, and political structures (Blaike et al., 2003; Fothergill et al., 1999). Water crises reveal historical failures in water policies and social power differences between water managers and users (Belmar, McNamara, and Morrison, 2016). Equally important, they show the dominant political and economic powers in play, as this power structure defines and legitimizes the policy actions taken in the name of solving a crisis. In the middle of this global-local complex crisis management, decision makers are often using traditional narratives to portray climate change as merely natural and uncontrollable, hiding the governmental responsibility in the configuration of crises and disasters.

Boin and 't Hart (2003) add essential information that connects the modernization process with the crisis configuration. Modernization comes with new technology, and advances in science and technology are often accompanied by the creation of new hazards. Boin and 't Hart (2003) emphasize that technological advances, deregulation, and globalization, makes crises no longer confined to their site of origin as its roots are connected to global dynamics. For instance, as global water companies now start managing water resources through desalination technologies in the Caribbean, they are putting freshwater resources in danger and commodifying the

ocean. In the long run, new future problems are expected when the main goal is profits and not conservation.

Boin, Ekengren & Rhinard (2009) point out the significance of the social construction in crises investigations. They believe that is important to take into account how people in society construct the crisis and how their interpretations vary because of diverse experiences and knowledge. In this sense, the intensity of the crisis depends on how people make sense of it. This perspective recognizes the relationship of power among stakeholders, and thus calls attention that the focus in crisis must be expanded beyond the organization-centric view (Zhao, Falkheimer, & Heide, 2017). In this way, it is fundamental to understand who and how, at the end, determine whether a crisis exists.

Specifically, in water crisis the technocratic paradigm is commonly used. For instance, when water-related natural-hazards are largely blamed for causing crises, technological solutions become the main way to address the problem. Water crises have been studied predominantly by the natural and engineering sciences, typically overlooking social, political, organizational roots to the crises. In other words, the problem to solve should not only relate to water availability for the needs of a rapidly increasing population, but rather consider how, by whom, and for what purpose the existing water resources have been managed. The complexity of water crises becomes clear as it requires a transdisciplinary dialogue not only between different stakeholders, but also in which social, emergency and engineering sciences together begin to establish a better framework for crisis management.

In the last decade, social inequities in the access to water have gained more attention. There are critical connections between water crisis and water injustices, but little is known about how people form justice judgments in crises. A study done by Wutich et al. (2013) about perception of justice in water institutions recommends analyzing three forms of justice within local community perceptions: distributive, procedural, and interactional. In this vein, researchers in crisis studies who want to produce deeper and alternative understandings of crisis should concentrate on asking how stakeholders perceive water injustices, such as distributional and procedural types of justice.

San Andrés, Colombia, a small Caribbean island, has historically been a drought-prone region and has suffered problems in water management for more than 30 years. It suffered, for the first time, an officially recognized water crisis from April 2016 to August, 2017. On April 2, 2016, there were 11 road protests spread throughout the south-center of the island, where the Raizales, the native ethnic minority group, and people from poor neighborhoods held up signs saying “*We need water.*” At that point, the water crisis had affected more than 14,000 people (Action Plan Report, 2016). On April 15, the local Government declared a State of Public Calamity, attributing the lack of water to the Niño phenomenon. The crisis response was directed mainly to water trucking distribution and the acquisition of two desalination plants. Generally, it is difficult to determine and evaluate the causes and consequences of this type of situation. Although the government established the Niño

phenomenon as the primary trigger, the way in which the community framed and understood the water crisis was different and was ignored.

This study, rather than adhering to an expert-driven, top-down understanding of water crisis, recognizes the relevance of the socially constructed nature of local discourses on water crisis. The research approach prioritizes listening to not only the voices of the emergency managers and top organizational leaders and but also to the voices of people “on the margins”, like Raizales, whose voices have rarely been heard before in crisis studies on San Andrés. In this sense, this research works to facilitate the expression of marginalized voices and attempts to represent their experiences and views of the water crisis both genuinely and authentically (Smith, 2012).

In this vein, a social constructionist framework appears as an alternative philosophical lens for studying the water crisis on San Andrés Island. This framework contributes to this research by understanding the crisis, but also how courses of action are decided upon and sustained. This standpoint allows this research to see things from the perspective of those who inhabit them, both public and private officials as well as Raizales and non-Raizales citizens.

Phase 1 of the study took place in 2016 and focused on how different segments and sectors framed the 2016 water crisis, including causes, experiences and governmental response. Phase 2 took place in 2018 and involved in-depth examination of issues related to changes in the water situation as well as further data collection on crisis causes and justice issues in relation to water access. This overall study included 79 semi-structured interviews: 34 in 2016 and 45 in 2018. Participants were residents

from several neighborhoods, including Court House, Little Hill, Barkers Hill, Loma Linval- Loma Cove, Smith Channel, Elsy Bar, San Luis, Sound Bay, Davi Hill (commonly Buenos Aires – Atlántico), Sarie Bay, Cabañas Altamar, los Almendros, and Sagrada Familia. Officials were interviewed from the public services secretariat, the risk management office, the fire department, the Colombian Civil Defense office, the environmental corporation -CORALINA. Managers and personnel from the private water company, owners of the water truck companies, and maintenance managers of different hotels on the island were also interviewed.

The central argument of this research challenges conventional assumptions about the crisis: those that are organizational-centric, top-down, linear, naturally induced, and “event” type. It involves an emphasis on this recognition: It is necessary to capture multiple understandings to define, explain, and solve the water crisis. The significance of exposing how narratives converge and diverge reveals the difficulty and complexity of the water crisis management. Indeed, even when narratives differ diverse stakeholders may come together to support dominant ideologies and paradigms, which, in turn, reflect political and economic interests at work (Estes, 1983). This dominance may lead to an avoidance of taking responsibility for a crisis that could have been avoided, to overlook water inequalities in water allocation, and to disregard water supply technical failures. In the end, it maintains old power and economic relations (e.g., tourism and water market) that continue to disfavor vulnerable groups.

Illustrating the above mentioned, this research is divided into nine chapters covering different aspects of the water crisis. Overall, the chapters seek to provide an understanding of the crisis response and the role of justice in the configuration of the crisis.

Chapter Two, “*Water crisis and water justice*,” provides a literature review around the crisis concept and perspectives, and a reflection on the characteristics of crises. It includes a brief overview of different kinds of water crisis around the world, including a special section for crisis in the Caribbean region. The chapter closes with an analysis of justice in water crisis studies.

Chapter Three, “*Methodology*,” outlines the social constructionism theoretical framework. It also describes the qualitative methods used in this research, including the research questions, study design, the collection and analysis of the data. Overall, it presents the tools, procedures and materials used to gather data and the rationale to select participants.

Chapter Four, “*The water crisis*,” presents the case study of the social, physical, and climatological characteristics of San Andrés island. The chapter contains a description of the water crisis, a critical analysis of the contract that directs the management of water on the island, and a critical account of the history of water management on the island.

Chapter Five, “*Local voices constructing the water crisis*,” describes and analyzes how public officials and the people affected made sense of the 2016 water crisis differently.

Chapter Six, “*Framing the water crisis response*,” focuses on contrasting the ways institutional leaders and the people affected framed the crisis response in the short term. Emphasis is on the sense-making process.

Chapter Seven, “*Desalination expansion to end the water crisis*,” describes and analyzes in what ways and why the majority of the interviewees (2016 and 2018) perceive saltwater desalination as the main solution to end the water crisis.

Chapter Eight, “*Recognizing water injustices in the water crisis*” explains the relationship between water injustice and water crisis, answering: 1) How do different stakeholders conceptualize water justice? and 2) To what extent do perceptions of water justice focus on distributive, procedural, and interactional issues?

Finally, Chapter Nine, “*Conclusions*,” summarizes the main findings and limitations of the study, outlines recommendations, and identifies areas for future research. Overall, the findings of this study expose the complexities of the crisis and the role of justice, technology, and management in understanding many of the perplexing issues associated with water crisis management in San Andrés.

Chapter 2

WATER CRISIS AND WATER JUSTICE

2.1 Crisis

Studying crises has implications for life-safety and wellbeing of societies. It is to look for understanding, preventing, and minimizing the impact of diverse kinds of threats – endogenous or exogenous – to a social unit. The crisis field is relevant to many natural, engineering, and social sciences (Boin, Ekengren and Rhinard, 2009; Pursiainen, 2018). The empirical and theoretical findings of disaster research are particularly relevant to crisis studies (Boin, Ekengren, and Rhinard, 2009). Moreover, there is a historical relationship between crisis or disaster approaches and field of sociology, including early studies that emerged in the post-World War II environment (Quarantelli, 2005).

One of the initial approaches applied to study disasters was the structural/functionalist perspective in which a disaster constitutes a crisis for social systems (Tierney, 2019). According to Wachtendorf (2017), this approach was about understanding the structuring and restructuring that occurs during crisis responses. Many of the studies that use this perspective are concerned with community coordination during acute “on the ground” response operations (Nohrstedt et al.,

2018). The focus includes achieving multi-organizational, cross-sectoral, and intergovernmental collaboration.

Another approach is a collective behavior perspective, in which studies focus on the emergence of new forms of social behavior during disasters and crises. This approach analyzes the nature of the crisis and crisis dynamics (Tierney, 2019; Wachtendorf, 2017; Rodriguez et al. 2006 in Boin, Ekengren, and Rhinard, 2009). Crisis researchers have long been interested in how managers make critical decisions under stress as well as understand the relationship between human error, technology, organizational culture, and the development of crises (Boin, Ekergren, and Rhinard, 2009). Crises faced by organizations often have their roots in malfunctions within an organization. From an organizational perspective, Perrow (1999), the author of the book *Normal Accidents: Living with High-Risk Technologies*, proposed, analyzed, and applied two comprehensive sociological concepts, complexity and coupling, to explain organizational breakdown.

In the 1980s, disasters and crises increasingly were considered from a social constructivist perspective. Reality is construed through collective or individual assigning of meaning to social phenomena (Boin, 't Hart, and Kuipers, 2018; Wachtendorf, 2017; Young and Collin, 2004). In other words, crisis exist when society interprets that it does. It is important to mention that interpretations of and responses to the crisis reflect both the individual's world views and the dominant paradigms (Tierney, 2007).

There is a growing nexus between crisis and politics. In crisis studies there is a shift of attention to “institutional crises” where the occurrence of unwanted and unacceptable events triggers intense public concern and critical scrutiny (Boin and ‘t Hart, 2000). Crises are perceived as dynamic and highly politicized processes. According to Rosenthal & Kouzmin (1997) crises are occasions for a restructuring of power relations. Crises are processes where tension and conflict are central features. Conflict can be a way to intensify the crisis or gain sufficient societal and political attention for the situation to be recognized as a crisis (Boin and ‘t Hart, 2000; Boin, ‘t Hart, and Kuipers, 2018). Conflict may be considered a driver influence a turning point of the status quo in the policy sector; and it can be used by stakeholders to seek reforms than in regular times would be impossible.

Crises are linked with power, legitimatization, and conflict (Boin, McConnel, and ‘t Hart, 2008). Political action of all kinds becomes more controversial during a crisis. As a result, it is common for tensions between people and organizations to become accentuated. Members of society cast doubt about what they have previously accepted as right and proper (Estes, 1983). For instance, after the September 11st 2001 terrorist attacks in the U.S. and following the failures during and after Hurricane Katrina (2005), profound questions emerged around the structure and effectiveness of government and the performance of law and policy areas of emergency management and homeland security (Landahl, Bennet, & Phillips, 2019).

2.1.1 Crises characteristics

Disaster and crises are related and treated similarly. In some cases, they overlap and have similar characteristics; in others, they are considered differently. Some authors think about disaster as a crisis with a bad ending (Boin, 2005). Overall, crisis refers to the moment in which the danger of a threat is more imminent than on other occasions, but it does not always result in a disastrous situation. A disaster might be comprised of multiple types of crises or vice versa, and everything depends on the scale of the crisis. Each social phenomenon demands different theories and frameworks to answer particular questions (Boin and 't Hart, 2003).

There are as numerous definitions of crises as there are to disasters. It is necessary to recognize that both disasters and crises are ambiguous concepts that can be understood or interpreted in various ways. An important aspect that characterizes and differentiates crises from disasters is that a crisis opens the door to a possible devastating situation but at the same time creates a 'window of opportunity' to avoid it (Tierney, 2005; Quarantelli, Lagadec, Boin, 2007; Boin and 't Hart, 2003).

Crises can be seen as a sudden or a slow-onset phenomenon. The first implies a crisis occurring quickly and unexpectedly or without warning; the second refers to a crisis that emerges gradually over time that combines different events in its configuration. Also, a crisis can be considered as an event or as a process. When a crisis is considered as a specific event, the response is directed to a specific moment. Rosenthal & Kouzmin (1997) claim that contrary to being clear-cut episodes or events,

crises may be considered as circular and evolving, involving mitigation and preparation, response as well as recovery, and rehabilitation.

If, on the other hand, the crisis is considered as a process, the response will be involved and more comprehensive, dealing with the multidimensional causes that trigger the crisis (Williams et al., 2017; Wolbers and Boersma, 2019; Roux-Dufort, 2016). Williams et al., (2017) argues that considering a crisis as a process allows the organizational leaders to look back and to look forward; in other words, to analyze the sociohistorical process that contributed in the configuration of the crisis and to analyze the longer-term effects of the solutions proposed.

In social sciences in the 1960s and 1970s disaster and crises were treated in the same category as some social crisis phenomena. Scholars distinguish between them based on the presence of riots and civil disturbances. In this vein, regarding the emergent behavior during the crisis, crises were classified into two types: Crisis-conflict and crisis consensus (Quarantelli, 1993). Crisis-conflict is characterized by civil disturbances that can be planned or be spontaneous, in which looting maybe widespread, and consensus crises include almost all-natural and most technological disasters in which looting and conflict are sporadic (Quarantelli, 1993; Quarantelli, Lagadec, Boin, 2007). According to Tierney (2007), conflicts appear mainly in a post-disaster and recovery phase; on the contrary social solidarity characterizes disasters.

Quarantelli (1993) states that all crises have three inter-related features: they are a threat, are unexpected, and lead to an urgent situation. 1) threat, related to the nature to the threat and the impact to diverse core values, 2) urgency in relation to time

constraint to make decisions and formulate and execute responses under severe time pressure, 3) being unexpected depends on a human failing to note the onset of crises alerts or red flags. This inability to recognize crisis origination depends on the human perspective. In this sense, crisis becomes a situation that goes beyond institutional capabilities and thus there is 'no one to blame' (Boin, 't Hart, Stern & Sundelius, 2016). This view is related to the traditional thinking that a natural hazard cannot be foreseen, controlled, nor anticipated (Boin, McConnell and 't Hart, 2008). As a result, crisis managers have not seen a definite necessity to change institutional structures because the crisis was not due to human error.

Stern (2009), instead of using unexpected, sudden, or surprising, emphasizes uncertainty as a crisis feature which concerns both the nature of the threat and the potential consequences. Uncertainty is related to information and is reduced by acquiring it. Successfully detecting, processing, and resolving uncertainty is essential for crisis management. Uncertainty can be reduced by past experiences and knowledge gaining. It can be understood as an expected or unexpected, the first happened when a crisis manager is conscious that future scenarios will happen and may be unknown, is to understand the uncertain future of changing environmental demands. The second happened when some changes and choices taken by crisis managers are entirely new, resulting in a new experience. In current crises, the unexpected characteristic continues playing a central role due to the levels of complexity and the multi-agent nature of the crises, as some of them continue being unpredictable. This view advocates and forewarns the importance of crisis prevention and preparation and the

necessary process of interpretation of the crisis, including natural and social factors, to prevent repeated and more severe crises.

Time is especially a factor in crisis definitions. A crisis is frequently defined as an isolated period in which a social unit is affected. Time compression is a critical element of crises: the threat is here, it is real and must be dealt with it now (Boin, 't Hart, and Kuipers, 2018). 't Hart and Boin (2001: 32) suggest that crises can be distinguished along two primary dimensions: (1) the speed of their development (fast/instant vs. slow/creeping) and (2) the speed of their termination (fast/abrupt vs. slow/gradual). Boin, McConnell and 't Hart (2008, p. 41) have identified for an analytical purpose: (1) fast-burning crises with instant development and abrupt termination; (2) cathartic crises with creeping development and abrupt termination; (3) long-shadow crises with instant development and gradual termination; and (4) slow-burning crises with creeping development and gradual termination.

Some threats can create a crisis and others not. For instance, climate change does not pose immediate difficulties, and there is no widespread sense of crisis to policymakers, whose political life has a specific time. Climate change does not require immediate action or attention, or at least, its abstraction and global scale make it difficult for crisis managers to understand its urgency - does it exist? How bad is it now and how much worse will it become? What is causing it? (Boin and 't Hart, 2003). Besides, Wilhite and Pulwarty (2001) state that the uncertainty associated with climate change is not playing a significant role in crisis configuration because most policymakers have difficulty thinking beyond their term of office or the next election.

From an anthropological point of view, in which crisis mainly has its roots in social factors. Vigh (2008) perceives crises as continuous and ongoing processes, embedded in the social fabric such that they become indistinguishable from it. In some places, mostly those with higher levels of poverty and conflict, crises are experienced as a persistent condition in which society has continuous and familiar alertness and where people have learned how to live in crisis. Vigh (2008) understands crisis not in context, but instead crisis as context. He argues that crisis “is not a short-term explosive situation but a much more durable and persistent circumstance. Not a moment of decisive change but a condition (p 6).” For instance, people who live with constant water needs may normalize the crisis in which they live. This idea of crisis in context is challenging when a sudden natural phenomenon happens and must be placed in the configuration, considered as hybrid crisis in where there are both social vulnerabilities and natural hazards (Trottier, 2008).

Another common characteristic is crisis as a rupture in the order of things (Boin and ‘t Hart, 2003). In early disaster research, systems theory was the most frequent perspective used, in which extreme events were seen as disrupting ongoing societal systems (Tierney, 2007). Many disasters and crises scholars now argue that there is no a normal order of things in a social system before a crisis happens; in fact, crises are part of the social system itself and are configured by political, natural, socio-economic, and cultural forces that shape societies (Tierney, 2007). Vigh (2008) explicates that in some places, mainly those in the midst of war and conflicts, a crisis is no longer seen as an exception but as a recurrent event. It has become a cyclical and

expected situation, and ‘disorder’ characterizes these societies. Crises are born and live in the middle of social problems, including gender imbalance, hierarchical inequality, environmental injustices, and in some cases, there are not pre or post-crisis phases. Far from being situations in which social inequities are erased, disasters and crises expose and often magnify those inequities (Tierney, 2007).

Crises lend themselves to diverse and alternative interpretations, and also can create a collective sense that a crisis exists. Also, politics and institutional practices influence the social construction of disasters and crises (Tierney, 2007). Crises are the product of shared perception and according to Boin and ‘t Hart (2003), “crisis is a semantic construction which people use to characterize situations or epochs that they somehow regard as extraordinary (Boin, ‘t Hart, and Kuipers, 2018, p34). The authors explain that “it is the perception of threat that matters. A threat may cause widespread fear, which will force authorities to act (p25).”

Social action is inseparable from the socially constructed ideas that define and interpret the phenomena, ideas, that in turn, are affected by dominant ideologies and paradigms. Social constructionism is a key, but less developed approach in disaster and crisis studies (Tierney, 2007). The depiction of these social images and the actors and mechanisms involved should be the focus of the new crisis studies.

What we see through these different characteristics is the importance of understanding the implications of each one in crisis management. For example, is it a static event, an ongoing process, a hybrid phenomenon with natural (hazards) and social (vulnerability) components, or an isolated or global phenomenon? Studying a

crisis must acknowledge these multiple ingredients. Social factors, including social, political, technological, and economic factors, play a central role in the configuration of any crisis. However, it is crucial to take into account the relationship with natural factors. Moreover, it is critical to take into account different perceptions (community vs. organizations) of the features of the crises in order to find the right problem and formulate and implement the right solution.

Finally, when one looks at the different characteristics, there are at least three central criteria to study crisis. First, the threat. Second, the time for crisis development and termination and decision-making. Third, numerous unpredictable events or uncertainties connected to the situation, and hence it is not very easy to formulate a clear picture of the outcomes of the decisions and actions taken (Pursiainen, 2018).

2.1.2 Crises as an opportunity for change

According to Boin and 't Hart (2003), crises can produce rapid changes in the policy sector at stake. During a crisis, there is a widespread sense by citizens that after hitting bottom, recuperation or a process of renewal may be possible. When regulatory failures precipitate a crisis, it is typical to expect subsequent reform of these regulatory systems to reduce the risk of new crises situations (Schwartz and McConnell, 2009).

During and immediately after a crisis, governmental actions that ordinarily have been strongly resisted by citizens may be readily accepted. This idea of possible renewal has informed crisis researchers to how policymakers and politicians exploit crises to bring about changes that would be impossible in more stable times (Boin, 't

Hart, Stern, & Sundelius, 2016). Sometimes, crises might be deliberately created to benefit some economic interests; for instance, creation or preservation of companies and the implementation of new services and business. Therefore, it is central to investigate who will benefit and why from the crisis. It is vital to understand not only public officials' performance but also how they affect the distribution of societal and natural resources across different groups and sectors in the society (Estes, 1983). Crises are extremely political. Negotiations, protests, and demonstrations are part of the crisis. Planning organizations are political actors. When political scientists refer to a crisis, an automatic question is: whose crisis are we talking about? (Boin, 't Hart, and Kuipers, 2018). A crisis can be created consciously in order to take advantage of it.

Boin and 't Hart (2003) explained that although crises "expose the status quo as problematic, making changes depends on the ability of public leaders to reform institutional structures." This idea puts leaders into the center of the picture on crisis management. Organizational leaders play an essential role in the configuration and continuity of the crisis, establishing individually or collectively a vision of the crisis, sharing appropriate knowledge, coordinating the situation, and acting in a proactive instead of a reactive way.

Effective policy change or reform is difficult to achieve. In a crisis, leaders defend themselves as not being responsible for the crisis and usually play the blame game. The problem presents itself when leaders, in order to promote reform, are forced into a self-critical position in protecting the institutions and policies that they

represent (Boin and 't Hart, 2003). In this way, the requirements to fulfill people's expectations for an 'appropriate' crisis management demand that leaders play in-and-out during a crisis, is something challenging to achieve. In other words, people can blame leaders for the crisis as they have to make drastic decisions to change structures in which they were participating, recognizing they were part of the problem. The authors sustain that there is a substantial gap between citizen expectations and leadership efforts in preventing and containing crises (p 546). Leaders or crisis managers need to offer some "learning" commitment to ensure that never again will society be exposed to the same risks, but they also need to offer reassurance that existing frameworks are inherently robust. There is a latent tension between reformism and conservatism in the aftermath of a crisis; the crisis is both an enabler and a constraint on policy change (Schwartz and McConnell, 2009).

Organizational leaders can take a conservative or reformative approach to respond to the crisis. On the one hand, a conservative approach consists of restoring order and bringing the sector back to the pre-crisis period; in other words, to "normalcy." It is the idea to work on incremental improvement rather than a radical redesign of existing processes. It can be characterized as a deep institutionalization of rules, practices, and budgets, which makes it extremely hard to make a change.

According to Boin, McConnell, and 't Hart, (2008), adopting a conservative approach means that crisis managers may eventually come to realize that the crisis is more profound than they had initially estimated. It seems that the crisis has never ended, and then, a long period of stagnation follows. On the other hand, the reformist

approach is about renewal, adaptation, and institutional redesign features of the policy sector; it looks for restoring faith in the sector at stake (Boin, McConnell, and 't Hart, 2008; Wolbers and Boersma, 2019). According to Boin, McConnell, and 't Hart, (2008), it is not easy and not usual that policy changes occur after a crisis, it is usual to observe minor changes and only in a limited number of cases.

Changes are difficult when institutional inertia and embedded practices serve to limit problem recognition, constrain choices, and inhibit new thinking (Head, 2014). The crisis response will be satisfactory when people perceive that it is, so leaders have to fulfill people's expectations to complete this task. To this, leaders must congregate strong political and societal support and hold continuous dialogue with people about how the crisis response should evolve, something that hardly happens.

In general, crises may open windows of opportunity for reform and change (Boin, McConnell 't Hart, 2008; Stern, 2009; Bellamy, Head, and Ross, 2017). However, in the aftermath of a crisis, there are multiple factors that influence policy change that changes hardly occur. Some of the factors are: 1) the way the water crisis is understood and portrayed by organizational leaders (e.g., sense-making and meaning-making); 2) the approach and paradigm used during crisis response (e.g., conservative or reformative); 3) the history of the policy sector; and 4) political will to make structural changes.

2.1.3 A brief review of crisis management frameworks

After recounting some of the leading crisis characteristics, it is also important to briefly review through the various frameworks proposed by different scholars to manage the crisis. Stern (2009) proposes a crisis navigation framework for preparing leaders for and coping with crises. There are six crisis dimensions: 1) back, that is analyzing the past of the crisis; 2) forward, checking the future directions of the crisis, trying to not create new crises anticipating possible future problems; 3) vertical, concerning multilevel coordination; for example, local, regional and national levels; 4) horizontal, concerning to sectoral coordination; for example, industry, government, cultural sectors; and 5) and 6) in and out, concerning appropriate information flow to reduce uncertainties.

Boin, 't Hart, and Kuipers, (2018) using a post crisis perspective and focusing on emergency manager's performance, defining crisis management as the set of efforts aimed at minimizing the impact of an urgent threat (p 29). For compelling and legitimate crisis management, the authors propose seven "managerial functions" that expose the dynamic evolution of the crisis. The first is early detection, or a shared recognition that a threat has emerged which requires immediate attention. Two conditions are highlighted for this function: a) extensive experience among first responders and system operators with incidents and their dynamics and b) organizational preparation activities in order to stimulate rapid detection. Second, sense-making, which refers to the collective understanding of the crisis. Boin, 't Hart, and Kuipers, (2018) argue that an accurate picture of the causes of the crisis rarely

emerges. Therefore, crisis managers must determine how threatening the events are, create a common operational picture, analyze mid- and long term consequences, and articulate and adequately address specific information needs. The third function involves making critical decisions in crises. This is the time to think, consult, and gain acceptance for decisions that are not popular; critical decisions must emerge from new or established networks. Fourth is crisis coordination. As decisions are the result of a set of organizations, it is necessary to observe a balance between persuasion and “command and control” forms of coordination. A fifth function is meaning-making, which refers to the communication of the definition of the crisis by the organizational leaders. This is the moment in which leaders frame the crisis and share its meaning effectively. Two problems may occur: a) in a crisis, there are diverse actors giving meaning to the crisis, and the message sent by organizational leaders can be different from other actors who disagree with their message; or b) organizational leaders do not promptly send the message. A sixth function is accounting for performance. Crisis leaders have to explain what happens and why. This process may make them avoid responsibility and play a blame game between them. Seventh, and finally involves learning lessons. Crisis leaders have the opportunity to rethink the preexisting policies and rule systems in which the crisis happened, to reflect on which can be improved. A crisis is seen as an excellent time to clean up and start anew.

Schwartz and McConnell (2009) question why, in some crises response, there is a successful policy change and why not in others. The authors use the “policy streams frame” to analyze the different policy responses. It consists of three

propositions. 1) the problem stream: “the greater the perception that a flawed regulatory regime presents a tangible and widespread risk to public health and safety, the greater the likelihood of significant regulatory policy reform.” 2) the solutions stream: the more that proposed regulatory regime changes are perceived as technically and economically viable, the higher the chances they will be adopted. 3) the politics stream: a) the more a government is under political pressure for reform (e.g., in the media or public opinion), is vulnerable in its capacity to govern (e.g., about looming elections or slides in opinion polls), and reform does not challenge dominant governing values, the more likely it is that policy reform will occur in the wake of crisis; and b) the more influential the stakeholders lobbying for change, the more likely it is that policy change will occur. Schwartz and McConnell (2009) found that political context plays a significant role in regulatory failures and policy change.

Coordination is a critical factor in crisis management. To analyze one of the most crucial factors in crisis response, Boin and Bynander (2015) developed a framework that explains both the failure and success of crisis coordination. A coordinated response is marked by collaboration between a network and authorities responding. In this study, the authors use the classic typology offered by Dynes (1970) to distinguish between the various types of actors that we may find in such a network. They are: 1) emergent organizations that perform new tasks within novel organizational structures; 2) established organizations such as police and firefighters who conduct business as usual, performing routine tasks within their conventional institutional structure. 3) Expanding organizations that move the implementation of

their regular tasks into new and untested organizational structures. 4) Extending organizations that perform new tasks within their prevailing organizational structures (Boin and Bynander, 2015).

Traditionally, crisis management studies focus on the post-crisis stage, searching for learning from organizational performance during and after a crisis, analyzing community behaviors and decision-making under time pressure. Traditional approach is based in a linear planning model and has focused on functional-managerial dimensions: prevention, decision making, policies and planning (Boin, McConnell, & 't Hart, 2008). Mostly, one can distinguish between research using narrower definitions that emphasizes the crisis response and broader definitions that emphasize the importance of management before, during, and after the crisis (Pursiainen, 2018).

In traditional approaches, stakeholders are viewed as a rather homogenous group but rarely seen as interpretative actors in diverse contexts and situations (Zhao, Falkheimer & Heide, 2017). These research limitations have led to a simplification of crisis understanding, in which stakeholders and the situational factors are overlooked. Later on, the focus moved forward, studying stakeholders as pivotal in understanding the crisis, as they actively seek to make sense of crises and may influence the organizations' decision-making process (Zhao, Falkheimer & Heide, 2017). Changes in crisis studies, although slow, are in line with the development of holistic and comprehensive approaches integrating organizational dimension and considering the importance of context, space, and time. In this vein, there is an alternative crisis

approach that embraces the whole crisis process, and it is grounded in social constructionism. It is seriously engaged in the perception and understanding of a situation produced by different stakeholders, as this will strongly influence how they react in the face of a crisis.

2.1.4 Facing the new crises

According to Quarantelli (1993) and Stern (2009, 2013), every crisis has its unique features and causes. Crises are social processes having their foundation in economic, cultural, and political structures (Blaikie et al., 2003; Fothergill et al., 1999; Fothergill and Peek, 2004). Crises transform accordingly to society and nature changes. Likewise, the threat, a central factor in the configuration of the crisis, is varying over time (Quarantelli, Lagadec, Boin, 2007). Therefore, crises are dynamic and not static situations.

The “newer crises” like COVID19 are additions to older forms; they recombine elements of old threats with new vulnerabilities. Quarantelli, Lagadec, Boin, (2007) point out six characteristics of the new crises. First, there are no political boundaries. A crisis can jump and multiply to different places and organizational sectors at different scales, from local to global. Second, a crisis can spread rapidly because the world is more interconnected than ever before. Third, crises escalate and transform in each new place. Therefore, there are larger numbers of direct and indirect victims. Fourth, solutions are not limited to local communities. On the contrary, solutions can be found in broader scales. And fifth, there will be more stakeholders than

organizations. Then, the social network plays a major role in information sharing. New crises begin, mutate, reproduces and shape in different social systems. Boin and 't Hart (2003) explain that the new crises are 'modern' crises as they are connected with the modernization process, which is characterized by human dominance over nature and constant competition for natural resources. Globalization has spread modernization to the entire world, creating profound differences between the rich and the emerging countries, and then, divides the world between safe and unsafe countries. Modernization comes with new technology, and advances in science and technology are often accompanied by the creation of new hazards.

Boin and 't Hart (2003) emphasize that current crises find their roots in the global modernization dynamics, which makes crises more complex and no longer confined to their site of origin. The authors also emphasize that modern crisis does not confine itself to a particular policy area (say health or energy or public services or agriculture); it jumps from one field to the other, uncovering issues and recombining them into unforeseen mega-threats' (Boin, 2004, p. 166)

Complex technological systems configure some of the current crises. The more complex a system becomes, the harder it is for crisis managers to understand the whole system and its functionality (Boin 't Hart, Stern and Sundelius, 2016). Charles Perrow's (1984) study of the Three Mile Island nuclear incident expounds on how the complexity of technological systems increases the system vulnerability but also emphasizes the significance of applying the "right" response to the "right problem" in order to avoid crisis escalation. In this way, the process of understanding the crisis is

central to crisis aftermath. In the same way, Perrow (1984) highlights the way small errors or small incidents can generate major crises.

Kendra, Knowles, and Wachtendorf (2019) further argue that now the world is living an environmental crisis where hazards become challenging to detect and track, as they intersect natural, social, and technical systems. The authors indicated that failures in the relationship between nature and society, in the context of global change, are posing new challenges that demand more comprehensive solutions. It becomes quasi impossible to trace a crisis on a graph, along predefined lines (Topper and Lagadec, 2013). The relationship between vulnerable communities and the effects of climate change are beginning to emerge. Vulnerable populations are less prepared, suffer more losses, and have a more difficult path to recovery if a disaster happens.

The challenge to understand, prevent, and manage these new crises is in unraveling the multidimensional vulnerabilities created by human societies (Kendra, Knowles, and Wachtendorf, 2019). It is not sufficient to view places prone to natural hazards, but also to analyze the actions of modernity that create their threats, with technical systems prone to failure, susceptible to attack, or insufficient in design against actual rigors of the planet.

Currently, the variety of crises is enormous. According to the above mentioned, current horizons in crisis studies need to be broadened to incorporate not only the narrowness of a natural disaster focus, but also include a wide range of critical events, the problems for decision making, and the numerous social vulnerability factors and environmental problems that modern society is creating.

Today, organizations and complex technological systems are playing a central role in the crisis configuration and solutions.

The combination of climate change, conflict, social tensions, political negotiations and contests, and social injustices are some of the new crisis characteristics. It is the era for a more common gradual escalating crisis such as sociopolitical and environmental crises, which take some time to develop into a more evident level. Now is the time to think about technology resilience, how easy it is to restart the system, and the autonomy of the system from other systems that may be down; it is a time that requires urgent, innovative and creative institutional and citizen's responses (Kendra, Knowles, and Wachtendorf, 2019).

2.2 Water crises

By the second half of the 1990s, most water managers had accepted that the world was heading to a water crisis that will be unprecedented in human history (Biswas, 1999). In the '90s, Biswas (1999) argues, more and more countries were becoming rapidly water stressed because of increasing scarcities. The author claims that by 2025 the water sector will undergo significant changes from diverse global forces, such as globalization, desalination, information, and communication, that will shape the future of availability of the water resource. Currently, water crises are happening in Australia, the United States, Canada, India, the Caribbean region, and Africa, among other countries and regions.

The World Economic Forum in its Global Risk report (2019) indicated that water crises are among the Top 5 Global Risks in terms of impact. Water has become a contested resource both among local communities and between old and new users and a central resource for the economy (Menga & Swyngedouw, 2018). Water is no longer just a vital natural resource of life, livelihood, and cultural identities, but has turned into a source of power, subject to conflicts, and struggle for water justice (Roth, Boelens, Zwarteveen. 2005; Boelens et al. 2016; Seemann, 2016).

Freshwater scarcity is now one of the most increasing constraints on development in many countries. Biswas and Tortajada (2019), summarize some of the predictions generated by international organizations that have consistently warned of the water problems around the world. For instance, in 2009, the Water Resources Group projected that the world would experience a 40% water deficit by 2030 under a business-as-usual climate scenario. In 2016, the United Nations Environment Program (UNEP) claimed that by 2030 almost “half of the world's population would suffer from severe water stress.” In 2017, UN Secretary-General Ban Ki-moon proclaimed that by 2030 the "world might face a 40% shortfall in the water." The World Bank has claimed that by 2050, about 1.8 billion people will be living under severe water scarcity. In 2018, the World Bank and the UN stated that 36% of the global population lives in water-scarce areas.

Mostly, water crises have been related to a problem of water availability. The explanation given is often referred to as a reduction of water supply availability and a growing population. For instance, in the Global Risk Report, water crises are

considered as “a significant decline in the available quality and quantity of freshwater, resulting in harmful effects on human health and economic activity (WEF, 2015).”

However, the two UN World Water Development Reports (WWAP, 2017, 2016) alert that the global water crisis results from profound failures of in water governance, contrary to the claims of problems in resource availability. Moreover, the two latest UN World Water Development reports (2019, 2020) highlight the needs of working on equitable water access and emphasize the growing water stress amplified by climate change. International initiatives are moving forward to change their main engineering approach to comprehensive forms of water governance, which characterizes by bottom-up demand-driven approaches and combines the experience, knowledge, and understanding of various local groups and people and the climate change challenges.

The majority of researchers agree that the world is experiencing the impacts of water crisis; however, they disagree about the causes of the crisis. According to Tundisi (2008), the water crisis is a management issue. Tundisi (2008) argues that crisis is due to problems of availability and increased demand and as a result of inefficient technical management that responds to problems without preventive approaches. Institutions and organizations are shaping policy action affecting water resources, and in consequence, creating unsafe conditions.

In contrast, Zwarteveen and Boelens (2014), argue that the world's water crisis is not only an issue of physical scarcity and declining water quality; instead, it is a multidimensional crisis in which social, political, and economic factors are deeply embedded in power relations. Syme, Nancarrow, and McCreding (1999) claim that the

heart of the global water crisis is rooted in power, poverty, inequality, and failure in water policies. In other words, water crises are manufactured through political and economic processes and institutions that intentionally or inadvertently the poor and ethnic minority groups (UNDP, 2006). Trottier, 2008 in a more straightforward way, says that “water is short only when social actors have decided it.”

Crises are intrinsically connected with vulnerability analysis which can contribute to uncovering the social causes of water crises: identifying who is managing, regulating, and distributing risk in an area, investigating why some communities are more susceptible to harm, and categorizing who has the highest adaptive capacity (Boone, 2008). Vulnerability is usually expressed in terms of a society's capacity to anticipate, cope with, resist, adapt to, and recover from the impact of a treat. Although the vulnerability framework has been applied mainly to the disaster studies, it contributes to comprehends causes of crises as internal to the social order, as inherently social. Also, it contributes to analyzing crises as being experienced differently by different social units within society and to see society not as integrated systems characterized by consensus, but instead characterized by inequality and the potential for conflict (Cutter, Boruff, & Shirley, 2003).

For these purposes of remedying vulnerability in the crisis management field, water management, and political ecology can take advantage of each other, helping to reduce severe impacts. As in others socioenvironmental problems, the people who suffered frequently the water crisis impacts are the poor, indigenous people, blacks, women, the elderly, and children (Bullard, 2000; Vandermarker, 2012; Fothergill et

al., 1999). According to The United Nations (2009), these people are the world's most vulnerable groups in access to water.

Water inequalities plays a central role in water crises causes and impacts. For example, unequal distribution of water resources, unequal amount of water supply, differences in water prices, and the lack of political representation in decision making processes exclude some people from water resources. It is in each water local supply system, water policy, and historical water arrangements where inequalities are rooted. In most countries water policy has prioritized the use of water for industrial and commercial purposes, primarily through large-scale water development, such as desalination plants, and in doing so, has disregarded water rights and a range of impacts on specific communities and the environment.

Nowadays, water justice concept is used more frequently; however, rarely link to water crisis analysis. Water justice is concerned with rights and inequities in water management. It is an important analytical and political concept that invite to understand that water problems cannot be resolved through technical solutions alone but require broader recognition that there are inherently ecological, political and social issues simultaneously creating water unsafe conditions (Sultana, 2018).

Water inequalities are increasing worldwide and causing cumulative impacts that lead to water crises. Water is becoming a scarce natural resource, not as a result of a problem of availability but instead due to lack of accessibility, affordability, and reliability. All these aspects are part and parcel of the ongoing crises. Inequalities in

water access, use, management, and control, exacerbate the water problems that already exist (Sultana, 2018).

Overall, although scholars have become increasingly interested in understanding how and why water crises are simultaneously happening in different parts of the world, research on water crises has mostly been explored separately from the disaster and crisis management studies; perhaps due to fact that the approach is relatively new. In sum, broadly, water crises have two blurred sides in understanding the causes of water availability problems around the world. At one side, water availability is made scarce by the growing population, climate change, and natural hazards like drought; the other side, the issue is centered around social issues in which water management is deeply rooted in technical malfunctions, unequal distribution of water resources.

2.2.1 Insights from some water crises around the world

The broad term of crisis helps capture multiple phenomena such as pandemic viruses, droughts, tsunamis, terrorist bombings, school shootings, urban riots, water contamination and water scarcity episodes, policy failures, and institutional fiascos. Specifically, water-related crises range from drought impacts on agriculture and tourism to problems in access to safe drinking water in cities and regions (Wilhite and Pulwarty, 2017). The following paragraphs provide a short description of the scope and some lessons learned from various water crises experienced in different parts of the world, including the case of Flint, Michigan; Walkerton, Canada; Atlanta, Georgia;

and Southeastern Queensland, Australia. Some of the points underlined in the various crisis review includes weaknesses in early detection, failures in water policy, the intervention of political interests in water decisions, and federal and state involvement to solve the crisis.

Water crises in relation to drought, such as in Atlanta and Southeastern Queensland, do not always result in direct deaths but represented significant economic losses and affect the daily lives of millions of people. On the contrary, water contamination crises result in significant fatalities. When water crises are tied to drought and seasonal rainfall patterns, the prevailing paradigm becomes that a short-term shortfall requires a temporary fix (Williams, 2016). Likewise, droughts crises are regional. On the other hand, crises related to water contamination are linked with human error in water plant operation.

There are multiple frameworks applied for each water crisis example. This section shows one framework per crisis which gives some insights to the purpose of this study. In the Flint crisis, it is the environmental justice framework (Mohai, 2018); in Walkerton, a crisis sense-making (Mullen, Vladi, and Mills, 2006) and water policy analysis is used (Schwartz and McConnell, 2009); in Atlanta and Southeastern Queensland (Head, 2014), the 2009/2010 Caribbean drought in Grenada (Peters, 2015), and the Southeastern Brazil crisis the disaster risk reduction framework is used (Soriano et al. 2016).

Governmental bodies react in a variety of different ways, ranging from careful analysis and planning to a purely political and superficial response and the approach

taken to address a water crisis can directly influence the long-term viability of the selected solution (Head, 2014). Peters (2015) explains that the governmental crisis response generally represents the technocratic approach, that frames the problems and structure of the water crisis solution.

2.2.2 The Flint, Michigan crisis: Water contamination crisis

Mohai (2018) studied of Flint crisis from an environmental justice perspective, in which injustices are recognized in a broader social context and where injustices exist at many interconnected levels. The framework fundamentally identified problems in environmental justice principles and identified distributive, procedural and interactional types of injustices.

The Flint Water Crisis received national and international attention. In 2016, the city of Flint, Michigan, in the United States, experienced a water crisis because of lead contamination. Flint residents, whom are majority African American and among the most impoverished of any metropolitan area in the United States (Mohai, 2018), were severely affected by the crisis. 6,000 to 12,000 Flint citizens were found to have high blood lead levels. The crisis started in 2014, but it was not declared as a federal emergency and public health emergency until 2016. According to Masten, Davies, & McElmurry (2016) the crisis had its roots in historical decisions. Five historical key events and main governmental decisions led to the crisis.

It is important to note that Mohai (2018) claims that no single decision was responsible for the catastrophe, but rather it was the collection of disastrous decisions,

mostly by State officials who configured the crisis. On July 8, 1897, the City of Flint passed an ordinance requiring lead pipes: “all connections with any water mains shall be made with a lead pipe.” The City of Flint built its water treatment plant in 1954 to treat the Flint River water, a well-known source of bad quality of water, and challenging to treat. In 1967, the City of Flint began purchasing wholesale treated water from the Detroit Water and Sewage Department (DWSD) from a different water source, Lake Huron. In 2013, searching for reducing costs, the City of Flint decided to work with the newly formed Karegnondi Water Authority (KWA), which was constructing its pipeline to transmit raw water from Lake Huron. In the interim the City of Flint failed to agree on a short-term contract with his old water partner DWSD; therefore, the City decided to use its water plant and take water from the Flint River (Masten, Davies, and McElmurry, 2016). The Flint water treatment plant had not been fully operational in almost 50 years, it was understaffed, and some of the staff were undertrained (Masten, Davies, and McElmurry, 2016). The plant was not sufficiently upgraded and prepared to treat the Flint River (Mohai, 2018). The process of removing contaminants from the water is complex and requires accurate information and adequate pilot testing. Corrosion studies were not commissioned and completed before April 2014, which is when the switch of source waters occurred. The City of Flint's failure to recognize the corrosivity in the water and to add a corrosion inhibitor had devastating effects for Flint citizens.

The Flint water crisis is, in general, an example in which technical and expert knowledge, business and political negotiations, the lack of detection of early warning

recommendations, and insufficient information lead to a water crisis. All of these factors can be best described in an environmental justice framework. Mohai, (2018) highlights that the Flint water crisis is considered as an example of environmental injustice in recent U.S. history, reflecting all the dimensions of injustice: Distributive injustice - the concentration, and underrepresentation of poor people and people of color in a geographical area; Procedural injustice - the most critical violation of which was the imposition of the Emergency Managers and a lack of participation of the Flint community in political processes; and Corrective injustice - detailed state plans for repairing harms experienced by the residents of Flint and compensation for their losses had unspecified timelines, as were essential sources of funding for the reparations.

2.2.3 The Walkerton, Canada crisis: Water contamination crisis

Schwartz and McConnell (2009) study of the Walkerton crisis used a policy stream framework that examined “problems, solutions, and politics streams,” while Mullen, Vladi, and Mills, (2006) used Weick’s (1995) sensemaking framework to understand the relationship between accidents and sensemaking. The following paragraphs describe the crisis and how each framework analyze the crisis.

In May 2000, the town of Walkerton (Ontario, Canada) experienced a water contamination crisis revealing failures in the operation of water treatment facilities, particularly in terms of microbiological sampling and chlorination. The crisis has been described as Canada’s deadliest E. coli outbreak. There were three wells supplying water to the town of Walkerton. The wells were very close to agricultural land;

therefore, there was the possibility of contamination. Yet no water protection zone was implemented to protect the water. Days before the crisis unfolded, Walkerton experienced a heavy rainfall that created runoff water contaminated with E. coli from farms surrounding the wells. The oversight of chlorination procedures resulted in seven deaths, and more than 2300 illnesses. The crisis revealed severe deficiencies in the regulatory system in Walkerton. As regulatory failure is identified as being mostly responsible for the crisis, Schwartz and McConnell (2009) see the Walkerton crisis as an opportunity for policy change. In the aftermath of the crisis, Walkerton produced a swift and decisive response, swinging the regulatory pendulum from deregulation to re-regulation.

Schwartz and McConnell, (2009) use the “policy streams frame” to analyze the policy response. The framework consists of three propositions: 1) Problem stream: perception of the risk and its challenge to public health and safety; 2) Solutions stream: technical and economic viability of proposed regulatory regime change; and 3) Politics stream: conducive political context. The authors found that there is high importance of political context in comprehending the aftermath of a crisis in which regulatory failures are heavily implicated. For instance, policy reform will occur in the wake of crisis if a government is under political pressure for reform, is vulnerable in its capacity to govern and have poor public support, and reforms proposed do not challenge the dominant governing values (Schwartz and McConnell, 2009).

Mullen, Vladi, and Mills, (2006) used and adapted the Weick sensemaking framework to understand the actions taken by the general manager of the Walkerton

water plant. The sensemaking framework they analyzed includes three key properties: identity construction, enactment and plausibility. First, grounded identity construction refers to the multiple identities an individual can have related in particular situations and in relation with past experiences (e.g. technical experience). “The identity that an individual assumes to deal with a situation will then determine what the situation means to them” (p 211). For an emergency manager this point means that the more “identities that an individual has, the more meanings they should be able to extract and impose in any situations, and the less likely an individual will be surprised by a situation.” According to Mullen, Valdi, and Mills (2006), the identity of the manager of the Walkerton plant was constructed based on his previous work experiences at Walkerton, most of which appeared to be unsafe work practices adopted from his predecessors (e.g. false recording of chlorine levels, pumping unchlorinated water, etc.). When the crisis began to escalate, and more individuals were falling ill, the manager’s response was derived from past those particular experiences. Since the general manager did not have meaning or appropriate experience to draw upon to make sense of the situation, he was unsure and confused about decisions that had to be made in that situation.

Second, enactment is a process in which individuals act, then they think ‘retrospectively’ about their action in order to make sense of what has occurred. “When individuals face a crisis situation they tend to take action without thinking, and it is only after the action has been carried out are they able to make sense of it (Mullen, Valdi, and Mills, 2006, p 213).” “This implies that the general manager could

not have completely understood the problem until he acted and then retrospectively made sense of his action by making sense of the situation (Mullen, Valdi, and Mills, 2006 p 213).” The public inquiry into the Walkerton disaster makes possible to identify many unexplainable actions that were carried out by the general manager. Factors such as acting without necessary training, his previous experiences, and lack of knowledge about contaminants and bacteria all contributed to how the general manager made sense of his actions.

Third is commitment to action. Weick (1988) suggests that when people act, and those actions are public, they are hard to undo. Also, once a person becomes committed to an action, and then builds an explanation that justifies that action, the explanation tends to persist and become transformed into an assumption that is taken for granted (Weick, 1988: p310 in: Mullen, Valdi, and Mills, 2006). An example of commitment to action property in the Walkerton crisis is when the general manager justified his decision for leaving the chlorine concentration below acceptable levels. He said that community members were complaining about the high chlorine levels which were making the water taste bad.

Fourth, plausibility is about a story that is socially acceptable and credible. The general manager created a story that committed both himself and others that recording false chlorine levels and failing to chlorinate the town water supply was acceptable.

This study concluded that factors such as lack of training, lack of technical knowledge, and lack of proper regulation all influenced how the victim made sense of

his actions. Also, the authors stated that the sensemaking framework has limitations because does not take into account issues related to power and organizational culture.

2.2.4 The Atlanta, Georgia crisis: A drought crisis

Atlanta, Georgia, United States, suffered an extended drought from 2004 until 2008, in which Lake Lanier suffered severe impacts. The lake is a reservoir in the northern portion of Georgia. It was created by the completion of Buford Dam on the Chattahoochee River in 1956, and it is fed by the waters of the Chestatee River. The Buford Dam is 192 feet high and 2,360 feet long, contains machinery for producing hydro electrical energy and regulating the flow of water into the Chattahoochee River (Missimer et al., 2014). The states of Georgia, Alabama, and Florida all have rights to the water of the reservoir, as it feeds rivers going through those areas

According to Missimer et al. (2014) the drought and an environmental lake management error caused the Lake Lanier water level to drop below 4.6 m, its minimum historical level, in October 2007. The U.S. Army Corps of Engineers (USACE), which has responsibilities to regulate flow for flood control and water use, replaced the lake stage-gauge in December 2005 but made an error in the calibration of the gauge, causing the stage to be overestimated over half a meter higher than the actual level. Because of this error, additional water releases were allowed that caused more than 83 million m³ of excess water to pass downstream through the Buford Dam in Lake Lanier (Missimer et al., 2014).

The reduction of water levels on the lake triggered a level 4 drought emergency. Lake Lanier had indeed become completely depleted as a supply source, and there was no backup water supply. This reduction in the volume of stored water pushed the region into a severe water crisis, having only about 35 days of water supply in reserve for its population (Missimer et al., 2014). Drought is not new to northern Georgia, so questions arise concerning why the 2004–2008 drought had such a significant impact.

The Chattahoochee river basins are shared by the states of Georgia and Florida and by Georgia and Alabama, respectively, and both are under dispute about water rights. The dispute began innocuously in September 1988 and continue going on nowadays. As the water demand in the Georgia increased, the severity of drought events intensified, and the reliability of using a sole source of water made Georgia more vulnerable to droughts. As a result, Georgia start a search for new water source that could introduce a new surface water source into the system.

As a pending crisis emerged, the Atlanta Metropolitan area continue being reliant strictly on surface water for water supply. Planners and politicians are focusing on providing the least expensive solution to water consumers, for example not taking into account desalination. Missimer et al., (2014), recommends implementing an adaptive and diverse water management strategy in which Georgia includes more diverse water supply sources. For instance, this could include the development of additional groundwater supplies, increased water storage, implementation of desalination with connections into the distribution system, an increase in the amount

of water reuse, rainfall harvesting, and water transfers (p 684). However, the political bodies in the region have strongly resisted the diversification of the water supply sources.

2.2.5 Southeast Brazil crisis: A drought crisis

Under a disaster risk management perspective, Soriano et al. (2016) analyzed the 2014-2015 water crisis in southeast Brazil. Using this approach, they found that the combination of both natural and social processes caused a crisis in the water supply. Studying disasters must evaluate not only the risks to which communities are exposed, but also the different levels of vulnerability of different group of people. In this study, crisis and disaster are perceived similarly; therefore, the disaster risk management framework is used. As Soriano et al. (2016) states a water crisis-scarcity can set up a disaster.

The southeast of Brazil in 2014 to 2015 suffered from a severe drought that began in São Paulo in October 2013 and extended to other states of the Brazilian southeast over 2014 and 2015. The state of São Paulo, in the southeastern region of Brazil, is extremely impacted not only because of droughts but also because is densely populated, it has only 6% of the country's available water resources, and a high demand for industry, agriculture, hydropower generation and public supply (Soriano et al. 2016 p 23).

The consequences of the lack of rainfall, coupled with poor planning in supply and irregular land use management of the springs, resulted in a water crisis and severe

reduction of the main water supply systems (Soriano et al., 2016). SABESP and the government assumed the cause of the problem was mainly in relation to environmental variables, putting aside other significant factors such as the lack of promotion of equitable distribution of water among users in the water basin; information poorly provided to the population about the real situation, about the water crisis and information about the water system; and failure to promote campaigns for the rational use of water.

Political aspects of the crisis that influence the Brazilian scenario and worsened the water crisis throughout 2014 are: 1) Confidence in scenarios based on the assumption of normal precipitation regimes, even without scientific basis; 2) difficulty in access to information and highly technical language used in communications; 3) delay from the government in recognizing the severe situation and predominantly reactive governance to the problem, rather than preventive; 4) excessive interference of electoral issues in dealing with the crisis, distorting the measures taken and the information disclosed about the problem to be faced; 5) difficulties involving state and federal governance, so that the problem could not be solved by conventional institutional processes, requiring action from media and public opinion to foster practical cooperative institutional actions (Soriano et al., 2016, p30).

Soriano et al., (2016) applied the disaster risk management view of the five steps in the Sao Paulo water crisis. With respect to prevention, municipal management of the urban space occurred in a disintegrated way with little preventive action planning. These limited technical views do not consider the main issues of a city's

Master Plan, such as sewage, solid waste, land use, and fountains, urban drainage, and flooding. According to the United Nations International Strategy for Disaster Reduction (UNISDR) (2009), the disaster risk management framework comprises the following steps or phases (UNISDR, 2009): prevention, mitigation, preparedness, response and recovery. With respect to mitigation, in São Paulo, the measures to mitigate the water crisis were mainly bonus payments for customers as a result of water consumption, which resulted in a 20% drop in demand. This was a poor alternative to rationing, as the reduction of consumption was deficient. Soriano et al. (2016; p34.) point out that there were multiple mitigation activities that the company and the government could take. For instance, restrictions for sidewalks and car washing, to implement individual systems of rainwater use and water reuse. For preparedness, the company – SABESP – had a contingency plan and emergency plan in place. For response, the government decided to use the water reserve and reduced the water pressure in the network distribution facilitating the raising of the reservoir level during the rainy season. However, this decrease in pressure left the population temporarily without water. Emergency water supply were distributed to schools, kindergartens, hospitals and clinics, as well as water for human consumption, livestock and others activities. For recovery, there were structural efforts to reduce losses during distribution, legislative review on the subject, planning for water extraction and wastewater reuse, as well as restructuring of the economy and support for socio-economic improvement of the affected population. Regarding the way, the crisis was managed, the recovery represented a return to the first step of prevention, in

which there were insufficiently actions conducted and Sao Paulo in 2016 was having same water problems.

2.2.6 Queensland, Australia crisis: A drought crisis

The study done by Head (2014) explains how Southeast Queensland, Australia has been subject to significant cycles of drought and flood, and how the state government responded to both kinds of cyclical crises. Exploring the evolving policy dynamics of water-related problems of drought and flood. The author used the resilience framework that it refers to identify key forms of adaptive management for responding effectively to changing conditions. The author argues that the water-related policies and regulatory regimes are a form of examination of the capacity of policy systems to deal with simultaneous challenges arising from climatic change and variability. In this vein, the major issues studied were in relation to the identification of the major water-related crises, interpretation by decision-makers of these crises, analysis of policy innovations and adaptive frameworks for the region.

In 1974 a major flood happened. Later on, from 2001-2008, a severe drought occurred affecting urban water supplies, and in 2010 there was again a major flood. The crisis response in 1974 centered on flood mitigation engineering and the construction of a new large dam. In 2001-2008 the contrary happened with a severe drought affecting urban water supplies. The response was slow and led to a wide range of expensive supply-side projects. Two important supply-side options were announced in 2006–2007: a desalination plant and a potable recycled water facility.

This severe drought was cataloged as a creeping crisis rather than a sudden event. The crisis was exposed by the state government as a supply-side crisis that only can be resolved by securing additional supplies of drinking-quality water, strengthening the technocratic paradigm of water planning with centralist solutions driven by project financing. As seasonal normal conditions return, in 2009 the government abandoned water restrictions and water-recycling initiatives.

In 2010 there was again a major flood, with 20,000 homes inundated and infrastructure destroyed. There was a focus on explaining why the large dam infrastructure had not saved the city and the solution mainly was identified as a flood mitigation improvement through infrastructure protection. The conclusion was that a single dam on one river was insufficient to harness a massive rain event. Prevention strategies and greater attention to land uses in flood-prone areas were ignored. In general, in both crises, the water experts who provided policy advice were drawn from the same networks of civil engineers, hydrologists, and infrastructure consultants – in other words, those who had shaped and maintain the technocratic paradigm of solving problems through large infrastructure projects.

Head (2014) suggests that under conditions of emerging water crises, whether in flood or drought, the government turned first to technical experts such as civil engineers, hydrologists, and infrastructure consultants, those who had shaped the orthodox paradigm of solving problems through large infrastructure projects in the past.

Floods provoke sudden crises; in contrast, drought a slow-onset crisis. These characteristics mark a difference in emergency and policy response in where the second requires a larger and more comprehensive response. With respect to policy change, Head (2014) found that the shift between types of crises makes the policy attention change, creating a cycle of dissipating crisis response, making evident the difficulty of maintaining focus on important strategic issues from one to another crisis response.

Also, Head (2014) stated that social memory of the crisis tends to shift over time as the immediacy of the experience fades, and this makes the society find comfort in business-as-usual solutions in the period between different types of crises. Ultimately the study found that traditional infrastructure options remained the starting point in crisis response, but these were eventually shown to be insufficient when a new crisis appears. Drought and flood crises sparked new options and undermined old assumptions, but did not generate and consolidate the institutional capacity to plan collaboratively for the future.

The crisis triggered significant policy changes such as demand management and conservation measurements. Although, there was not consolidate institutional changes. Ultimately, Head (2014) calls attention to the capacities of leaders to take timely and appropriate actions under crisis conditions and weaknesses in recognizing learning opportunities.

2.2.7 Water crises in the Caribbean region

The Caribbean region contains multiple small islands that are environmentally fragile and geographically and economically isolated, they have limited resources (e.g., water), and they are vulnerable to climate change and the occurrence of disasters (Association of Caribbean States-AEC, 2012). There is a growing literature on how Caribbean small islands suffered from water problems. For instance, Cashman (2014) illustrated the water supply problem in different Caribbean islands: Barbados, St. Lucia, and Nevis, Trinidad, at different levels, have had a water supply deficit. Jamaica is projected to experience deficits in supplies for tourism and agriculture by 2015; Antigua and Barbuda are reliant on desalination to meet their demands for water whilst in Dominica, Grenada, and St Vincent and the Grenadines demand exceeds supply during the dry season due to reduction in stream flows. Many of the islands mentioned above have sufficient water resources to meet their demand but not the infrastructure or institutional frameworks to close the supply-demand gap (Cashman, 2014).

An increasing threat impacting surface water, in the Caribbean, is land use change and urbanization; and over exploitation of aquifers above safe levels, saline intrusion, and pollution pose major threats to groundwater resources, turning them into non-renewable sources (Cashman, 2014). Prolonged periods of low rainfall affect both sources of water, surface and ground water.

The level of vulnerability of these islands is high; this has been noticed in the severity of the impacts of various types of meteorological systems over the years,

especially hurricanes, tropical storms, and droughts (Association of Caribbean States-AEC, 2012). Drought is already causing severe impacts and provoking frequent water crises. The cumulative impacts of droughts make them more severe every year, progressively impacting the community and economic sectors, like tourism and agriculture.

There is a vast literature about water supply problems and droughts in the Caribbean; however, research about water crisis is scarce. Water crises is a recurrent situation; yet an issue that has received little attention is with regard to water related crisis and crisis response. Until recently there have not been many studies on the assessment and management of the impacts of droughts in the Caribbean, and where these studies have been undertaken, they are often limited and focused on immediate and short-term responses (Peters, 2015).

Generally, studies point out drought as the main cause of water problems but the study of the water crisis from a crisis management perspective is limited. Studies are wide-ranging about the water problems in the region, some of them emphasizing in climate change predictions, and technical water management problems; although, there is a difficulty to find specific studies focused on water crisis case studies in small island. Overall, studies tend to focus on technical problems and solutions and how societies should use and manage their water resources, but set aside the study of the social roots of the problem.

2.2.7.1 Water crises and droughts

Since 2000, the world is experiencing the impacts of droughts in greater magnitude. In 2005, Wilhite and Pulwarty put drought at the heart of the water crises. Drought is a complex hazard, and it can be defined as an exceptional dry period that is difficult to recognize, especially in the early stages, and results in water shortages (Wilhite, 2000; Smith, 2013). Drought is a frequent hazard for Australia, South Africa, the United States, and the Caribbean region, a situation that has contributed to the widespread sense of urgency in each country at different levels. Indeed, each country and region has struggled to manage drought events effectively and have suffered from acute water crises.

In the United States, droughts in 1996, 1998, and 1999 resulted in more than 10 billion dollars of severe economic losses in more than seven states (Wilhite, 2000). The 2011–2012 drought occurred over six states of the Central Great Plains. The total losses were estimated at about \$35 billion dollars, and it was rated as the second largest of global disasters in 2012 (Grigg, 2014). Subsequent droughts caused cumulative impacts that multiplied the damages and increased the vulnerability (Wilhite, 2000).

During the eighties, the first approach developed in the United States was crisis management, which was defined as a reactive approach that only addresses the symptoms of drought with emphasis on the response phase. Wilhite and Pulwarty (2005) argue that this approach has been mostly ineffective, and instead of reducing has increased the vulnerability levels of drought, driving the United States to more

severe drought impacts. The authors state that there is an urgent necessity to move to a more proactive approach. Therefore, the authors recommend the risk management approach that includes mitigation actions, higher institutional capacity, and better monitoring systems. In other words, risk management works on the pre-crisis stage. The approaches do not exclude each other; risk management favorably complements the crisis management approach and vice versa.

Droughts in the Caribbean

The Caribbean region contains multiple small islands that are environmentally fragile and geographically and economically isolated; they have limited resources and high costs of transportation and energy, and they are vulnerable to climate change and the occurrence of disasters (Association of Caribbean States-AEC, 2012). The level of vulnerability of these islands is high, and it has been noticed in the severity of the impacts of various types of meteorological systems over the years, especially hurricanes, tropical storms, and droughts (Association of Caribbean States-AEC, 2012). Drought is already causing severe impacts; however, the emphasis given by the government and researchers is to tropical cyclones, and droughts have been overlooked.

The cumulative impacts of droughts make them more severe every year, progressively impacting the community and economic sectors, like tourism and agriculture. Drought is a complex hazard, and it can be defined as an exceptional dry period that is difficult to recognize, especially in the early stages, and results in water

shortages. Precipitation deficiency is recognized as the trigger and its impacts as its characteristics (Smith, 2013).

Droughts in the Caribbean region are different than those in other parts of the world due to the bimodal nature of the Caribbean's climate. Meteorological drought, which exclusively study the reduction of precipitation, can happen at various periods over the year, annually, or multi-year. Studies indicate that global warming might induce a change in the seasonality of precipitation over the western Caribbean (including San Andrés island), resulting in a longer MSD which begins earlier in the rainy season. It is hypothesized that “an overall decrease in annual precipitation may increase the occurrence of drought throughout the year, whereas the uneven decrease in early wet season rainfall may cause a midsummer dry spell to begin earlier in the year” (Gamble 2014, p 230).

For drought to become a disaster requires its intersection with a vulnerable and exposed social system. The level of exposure and vulnerability determine the severity and magnitude of the drought. Social factors such as poverty, population shifts (from urban to coastal areas), demographic characteristics, technology, government policies, environmental awareness and degradation, water use trends, and social inequity makes a community more prone to face, and more fragile to cope with droughts (Wilhite, 2000). For instance, access to water is worsened in some communities when inappropriate practices, driven by for political forces, lead to cyclical shortages in times of drought, a situation that results in a huge increase in the price of water that many poor families cannot afford.

For example, Jamaica has been frequently impacted by drought. During 1997 and 1998 the island experienced a 17-month drought that resulted in US \$4.7 M damage to the agriculture sector (Campbell, Barker, and McGregor, 2011). Later, in 2004-2005, a seven-month drought, accompanied by a number of bush fires, caused tremendous damage that resulted from the combination of simultaneous hurricanes and drought; before and after the drought Jamaica suffered the impacts of hurricanes Charley and Ivan (2004), Tropical Storm Wilma, and Hurricanes Dennis and Emily (2005) (Campbell, Barker, and McGregor, 2011). During this drought, inefficiency in government was evident, there were poor relief efforts, and a poor water trucking program influenced the increase in prices in accessing water from the informal water trucking operations (Rhiney, 2015).

Water crisis causes and impacts in the Caribbean region are not well documented. Crises has been studied from different approaches. Wilhite (2005), in his book about drought and water crises, recognizes that drought has both a natural and a social dimension; thus, he argues that natural, biological, and social scientists must be involved in the formulation and implementation of drought preparedness plans and policies. He highlights that drought mitigation actions would contribute to the reduction of crises. In this study, the focus was on drought and the crisis reactive approach was considering ineffective in reducing societal vulnerability and in the prevention of future droughts. Studies tend to focus on technical problems and solutions and how societies should use and manage their water resources, but typically do not address the social roots of the problem. For example, Tundisi (2008) argues

that the deepening water crisis are due to problems of availability and increased demand, and a result of inefficient technical management that responds to problems without preventive approaches. However, during a crisis, the lack of water is felt primarily by the poor and ethnic minorities, reinforcing that water access is not just a technical problem but also a social issue

2.2.7.2 The 2009/2010 Caribbean drought in Grenada

This crisis was regional and impacted multiple Caribbean islands, including Trinidad y Tobago, Saint Vincent and the Grenadines, and Grenada and Carricao. Peters (2015) analyzed and described the water crisis in Grenada. The onset of an El Niño weather pattern commenced in June 2009 and lasted for approximately 12 months.

At the end of November 2009, the Ministry of Carriacou and Petite Martinique Affairs established the Water Crisis Management Committee, comprising of representatives from the local Disaster Management Unit, the Division of Agriculture, and the representative of the National Water and Sewerage Authority (NAWASA) (Peter, 2015). This committee created valuable opportunities for collaboration among institutions and facilitate Grenada's response to the 2009/2010 drought (Peter, 2015).

There were many impacts and responses in Grenada. During the first three months of 2010, the Fire Department had to respond to 411 bush fires. The direct crop losses were valued at USD 555.919.95. Grenada's agricultural production is mainly rain-fed with less than five percent of the arable lands under irrigation. Water had to

be trucked to all the major hotels on the island to meet basic tourist needs and few of the larger hotels in Grenada were forced to purchase a high prices water truck delivered. The drought of 2009/2010 sparked some antisocial behavior, including water theft and the sale of contaminated water. Water sources used during the drought incuded well water, ponds, and cistern. Price gouging took place, and therefore, there is a need for governments to regulate the price of water in crisis situations (Peters, 2015).

As a result of the drought, the water utility company had difficulties providing a reliable supply to customers. At the same time, the drought opens an opportunity for entrepreneurs to sell water. The drought resulted in the creation of a small private water business for water truckers; although they charged exorbitant rates for water delivery. Institutional responses result in a concentration of efforts on short-term solutions.

According to Peters (2015) the drought demonstrated the difficulties associated with guaranteeing supply in the region. The crisis shows that there is an inability to predict the duration and intensity of an El Niño event once it has begun. Also, this study shows that there is a low level of priority given to drought in overall disaster management; as a result, there is a little preparation for eventual water crisis.

2.3 Water crisis and justice

Issues of justice become evident when water resources are perceived to be scarce. In these situations, citizens are concerned about getting their fair share, and

they question water policies and institutions that decided over their water resources (Neil et al., 2016). According to Zwarteveen and Boelens, (2014), “water (in)justices involve both quantities and qualities of water, the modes of accessing and distributing water, and the meanings, discourses, truths, and knowledge that shape water control (p14).” The dimension of justice plays a significant role in water crises, as distributional imbalances of the ecological resources can all create or exacerbate unsafe conditions putting people at risk from hazards such as drought. Water justice is based on principles of fairness, equity, participation and justice. It raises awareness of the social issues linked to water, highlighting global connections, and claimed the right to water in the face of current dispossession, exclusion, and inequity (Sultana, 2018).

Despite the importance of the justice concept and principles, they have received limited attention in water crisis studies. Most of the ideas resolving water crisis have centered on creating new technological infrastructure rather than addressing more complex socio-political dynamics of redistribution (Aggestam, & Sundell, 2016). There is a widespread debate about the adverse effects of the technological paradigm in the deterioration of the environment, loss of local autonomy, and negative changes in a society's lifestyle. To this point, it is important to note that a technocratic framing gives power to water managers and experts because their expertise is viewed as objective, unbiased and apolitical. Thus, there is a secured spot for water engineers in the crisis response committee. Although engineers are central in this discussion, this subordinates other kinds of knowledge, including

indigenous knowledge and emergency management perspectives (Aggestam & Sundell, 2016).

Zwarteveen & Boelens, (2014) argues that justice has to be consider as connected and related with others factors. Its meaning depends on the context or circumstances, and it is not a universalistic concept which has a universal application or applicability. Equally important, Syme et al., (2006) emphasize that water injustice is related to limited participation by the community in distribution of the use, impacts, and the rights to water resources. The lack of participation may produce policy failures to fully recognize the diverse needs and vulnerabilities experienced by the community. Also, community participation is typically neglected widely both in terms of water problems and solutions, and it is community voices that are needed to help understand the complexity of water problems fully and propose public water policy recommendations (Movik, 2014). As Nancarrow et al. (2002) explain, usually, water managers assume that the water system implemented would be accepted by consumers just based on the managers' knowledge and the apparent necessity for more water, and thus they do not embrace any participatory process.

The justice approach search to uncover social causes and imbalances in water crises: identifying who is managing, regulating, and distributing risk in an area, investigating the justice in regulatory response to natural hazards, understanding why some communities are more susceptible to harm, and categorizing who has the highest adaptive capacity (Bullard et al., 2007; Boone, 2008). Some of the questions that a justice framework deals to improve water resources and reduce repetitive crises

include: What justice rule is used to make a water allocation decision? Have both distributional and procedural justice rules been taken into account? Which justice theory is used as an argument for how the water resource is shared? Does the argument draw from the economic, social, rights-based or environmental family of justice theories, and how does this potentially influence the outcome? Who or what has been included and excluded from the decision-making process, and for what reasons? (Neil et al., 2016, p 269). How is water, in relation to justice, framed and how are these framings are tied up with particular conceptions of distributive justice in water allocation? (Movik, 2014).

Justice framework calls attention to how power and politics significantly work through invisible norms and rules that present themselves as naturally or technically ordered in which at the end, water injustices became invisible or normalized (Boelens, Perrault, and Vos, 2018). In this sense, understanding how water injustices are embedded and situated in water crisis configuration and reproduction is central for this research. Approaching this question requires an understanding of the concept of “justice.”

The term justice is frequently used interchangeably with fairness; although, justice is considered being a more comprehensive concept. According to Emami et al. (2015), social justice means creating a fair and equal society in which each individual matters and their rights are recognized and protected when decisions are made (Emami et al. 2015 p5). The concept of social justice provides insights to planners and

managers in how to deal with complicated resource allocation decisions, such as those relating to water resources (Emami et al., 2015).

The literature highlights four main rules that determine how resources could be distributed to achieve justice. Neal, Lukasiewicz, & Syme (2014) summarize some of them as follow: 1) proportionality, when a person's rewards or outputs are perceived to be in proportion to that person's inputs or contributions; 2) contributions rule where a person whose contributions are more significant should receive higher rewards or outputs; 3) needs rule where a person who has a greater need should receive higher rewards or outputs; and 4) egalitarian rule, where everyone should be treated equally. These rules or principles focus on the ways water might be distributed, but not in the way decisions are made and by whom to allocate water resources.

In this sense, during the late 1970s and 1980s, research shifted from distribution to procedural justice issues (Neal et al. 2016). Procedural justice allows that the concept of participation started being included in discussions and studies concerning equity issues. The process of inclusion and exclusion of specific stakeholders or interests has been examined in the justice literature and falls within the discourse of procedural justice and public participation. Some of the common problems are that local communities' interests are not taken into account; therefore, problems are arising because procedural justice rules have not been adhered to (Neil et al., 2016).

The focus moves from the outcome to the decision sphere. Procedural justice is about analyzing the arguments behind decisions, to identify who has the power to

make those decisions and who was excluded from this decision-making process.

Another part of justice is interactional justice in which the concern moves to deal with values such as trust and respect, and how stakeholders are treated by decision-makers.

According to the above mentioned, justice is frequently discussed and analyzed with respect to distributive justice, procedural justice, and interactional justice. The study done by Wutich et al., (2013) about the perception of justice in water institutions, analyzes the three forms of justice within local community perceptions. Distributive justice concentrates on outcomes and in how group members share water. It depends on the type of resource being shared and the context of the distribution; distributive justice is also based on community norms such as needs, desires, and required outcomes. Procedural justice is defined as the fairness of the political, legal, market, and other processes that determine the allocation of harms and benefits among sectors of society (Bornstein and Poser, 2007). Interactional justice deals with fairness in social interactions, conduct, and treatment-related to discriminatory practices and systems that can become unjust (Wutich et al., 2013). In this sense, these three kinds of justice could significantly predict individuals' satisfaction and the sense of entitlement about how they should be treated when they encounter authorities (Wutich et al., 2012; Cohen-Charash, & Spector 2001). Wutich et al.'s (2013) research in Bolivia, Fiji, Arizona, and New Zealand applied this conceptualization and concluded that water studies would benefit from an expanded concept of environmental justice, including the three forms of injustice and also a more explicit analytic focus on the way communities face resource scarcity.

One of the main questions surrounded justice studies is why and how institutions or groups of people make decisions about water allocations? There are many competing principles or perspectives of justice that can be used to make convincing arguments for the advocacy of quite contrary positions (Neil et al., 2016). In most cases, the answer is based on the multiple uses of water. There is a continuous social dilemma in how to prioritize water uses and users; some of the justice philosophies applied for making these decisions are listed by Reddy & Syme (in press) in Neal, Lukasiewicz and Syme, (2014, p8):

- Virtue Theory – where people who already have resources should retain them because they are inherently good.
- Prior Rights – where people who have used the resource in the past first benefit as first in, first served.
- Intergenerational Justice – where the needs of future generations are considered.
- Environmental Rights – where the environment deserves its own allocation and underpin social and economic activities.
- Property Rights – where individuals should be given rights to amounts of water resources based on some contract.
- Economic Good – where water resources should be treated as economic goods with prices and markets. Efficiency is the driving force behind this family of justice theories where maximizing surplus is advocated.

- Utilitarian Theories – where water resources should be managed to maximize community welfare.
- Moral Imperative – where people in one location have a duty to ensure they do not negatively affect people in other locations

Water injustices has a common group of people impacted: the less powerful, not only through the denial or limitless access of a water resource but also from the dismissal of their ideas and worldviews that do not fit into mainstream thinking of how water resources should be managed (Neil et al., 2016). These groups of people are often seen as the “paths of least resistance” by industry and government (Bullard and Wright 2012 in: Mohai, 2018); At the same time, there is a low priority in addressing their concerns, so they expend decades suffering the same issue. There is a strong connection between race, unequal distribution of water resources, and unequal protection from a water crisis.

Environmental justice explains why access to environmental services is so often and so profoundly socially and geographically uneven (Wutich et al., 2012). At its core, environmental justice is about equality of access to positive benefits, equality of protection from negative impacts, and equality of influence in decision making (McDonald et al., 2011). Its primary concern is the equitable distribution of environmental burdens and benefits (Bullard, 2000).

Water justice is environmental justice applied to water. There are three main principles of environmental justice that shows its application to water justice: 1) no community should bear a disproportionate burden of environmental hazards like

hydrological hazards; 2) all communities should have access to environmental benefits/services including access to water resources; and 3) decision-making processes need to be transparent and include community voices (Vandermark, 2012). In this way, water justice signifies the fairness of access to water resources and equality of burden of poor water quality and water hazards (McDonald, et al., 2011). Water injustices can be considered a vulnerability factor making people susceptible to water shortages, putting them at risk, and ultimately contributing in the configuration of water crises.

Blaikie et al., (2003) claim that vulnerability is determined by social, economic and political processes that contribute to the marginalization of these groups. It is unfair that only some groups control the water, benefit from it, and decide who has the right to access it. Water distribution arrangements frequently give water to some communities, and not to others. Pereira, Cardory, and Lacovides (2002) explain that these arrangements are rooted in each water supply system, local conditions, and historical background, and they can create different forms of inequity.

Water policy has prioritized the use of water for economic and commercial purposes, primarily through large-scale water developments, such as desalination plants, and in doing so, has disregarded water rights and a range of impacts on specific communities and the environment. Syme et al., (2006) emphasize that justice issues are related to limited participation by the community in distribution of the use, impacts, and also the rights to ecological resources. Focusing more on public policy analysis, they argue that the lack of participation could produce policy failures to fully

recognize the diverse needs and vulnerabilities experienced by the community. As a consequence, in water crisis situations, the community has even rejected proposed new alternatives or projects to produce and distribute water (e.g. desalination).

Water requires specialized techniques to produce, store, distribute, and calculate cost, therefore, scientific knowledge is commonly prioritized. However, community participation is typically neglected both in terms of water problems and solutions, and it is community voices that are needed to fully understand the complexity of water problems and proposed public water policy recommendations. As Nancarrow et al., (2002) explain that usually, water managers assume that the water system implemented would be accepted by consumers just based on the managers' knowledge, and the definite necessity for more water, and thus they do not embrace any participatory process. Gutierrez and Gerbrandy (1998) explain that by investigating the different ways society distributes water, researchers can analyze the community organizational structure, criteria of justice and equity, and the sense of balance between human inhabitation and environment.

Water issues were and continue to be a piece of many conflicts, but rarely has a comprehensive environmental justice analysis been applied directly (Vanderwarker, 2012). Usually, studies of water crisis are on a global scale and do not combine different knowledge; therefore, they fail to respond to local problems by comprehensive recommendations. For instance, even though Zwarteveen & Boelens (2014) provide an interdisciplinary framework for understanding water problems as

problems of justice, they do not connect natural hazards, like drought, to the understanding of water crisis.

Although, some studies call attention to water justice issues, there are only a few that integrate justice principles or types of injustices (procedural, distributive, interactional) with other factors such as technological and socio-historical factors. In fact, there is minimal research on water justice in the context of small islands. It is recommended by scholars to pay especially close attention to how individuals construct their meanings about what is just and unjust, there is an urgent need to understand local conceptualizations of justice.

Chapter 3

METHODOLOGY

3.1 Theoretical Framework

This dissertation addresses the question of how different stakeholders and groups of stakeholders understand and adopt multiple interpretations of the water crisis and how they perceive differences in the water crisis causes and impacts across San Andrés Island. In line with this question, indicated in chapter 3, this dissertation used a social constructionism theoretical framework that allows capturing and interpreting multiple perceptions that highlight not only the significance of the variable relationships to one another but the overall meaningful explanation as to causes and mechanisms of these relations.

Social constructionism perspectives have been used to support a variety of practices in the fields of community work, conflict resolution, education, health care, crisis and disaster fields (Tierney, 2007; Julie-Anne, 2008, Galbin, 2014; Martins & Arantes, 2019). Specifically, in the disaster field, Tierney (2007) calls for changing traditional ways of conceptualizing and explaining disasters and crisis as she says that it is necessary to move to constructionist approaches that allow to link and focus crisis

studies to core social concerns such as diversity and inequality. Constructionism has influence gradually sociological disaster research at different levels of analysis:

- 1) In the recognition that disasters are socially constructed.
- 2) In the generation of alternative interpretations of crises and disasters, such as taking the naturalness out of 'natural' disasters and hazards (O'Keefe, Westgate, Wisner, 1976).
- 3) In the identification of new disaster effects that allow recognizing additional needs that result in the development of new aid programs (Tierney, 2007).

Estes (1983) studied the social construction of the Social Security crisis in the United States, claiming that crises are socially constructed as a consequence of social perception and definition. The author argues that the Social Security crisis was associated with the 1980's notion of blaming older people for being old. The author argues that defining and characterizing crises is worthy of investigation to understand how this affects the distribution of societal resources across different groups. Also, it serves to make explicit how some understandings are rooted in and reflect the structure of social and power relations.

Charmaz (2006) in Julie-Anne (2008), reminds us that taking a social constructionist approach to research means acknowledging that this subjectivity also applies to the researchers, who are only able to make interpretations and constructions based on those provided by the participants. In this sense, there is an ongoing understanding and construction between the researcher and the participant.

Trottier (2008), on a global scale, examines how three epistemic communities have each one built their science by promoting their understandings of what is a water crisis. First, the epistemic community promoting the idea of the global water crisis has led to the construction of Integrated Water Resources Management (IWRM) as a hegemonic concept; second, the municipal water crisis epistemic community has looked the perception of water equity within the Millennium Development Goals (MDGs). A third epistemic community, concerned with small-scale irrigation and property regimes, portrays both IWRM and MDGs as disasters (p 198). The epistemic communities constructed the crisis differently.

The author argues that how scientists perceive a specific norm over water plays a significant role in shaping the definition of water crisis, legitimizing distinct types of water-power structures. She stresses that the very process of generating scientific facts inevitably involves a social and political construction. Therefore, Trottier (2008) claims that understanding why some epistemic communities promote a specific version of the 'water crisis' requires us to understand the power relations in which they are immersed, the ideas they believe, as well as the actual agency the scientists possess within the bounds of the rules they do not question (p199).

Notably, this research aims to develop a theoretical understanding of how different stakeholders from San Andrés island make sense of the water crisis to draw out pertinent narratives and social processes that shape this social phenomenon. This study listens to the voices of the emergency managers and top organizational leaders as well as the voices of people "on the margins" like Raizales, an ethnic minority

group whose voices have rarely been heard before in crisis studies on San Andrés. In this sense, this research facilitates the expression of marginalized voices and attempts to represent their experiences and meanings during the water crisis genuinely and authentically (Smith, 2012).

The argument of this research challenges conventional assumptions about the crisis: an organizational-centric view, top-down, linear, naturally induced, and "event" type. Rather, it involves an emphasis on this recognition: It is necessary to capture multiple realities to define, explain, and solve the water crisis. The significance in exposing whose narratives converge and diverge reveals the difficulty and complexity of the water crisis management. Indeed, while there can be differences, diverse stakeholders may come together to support dominant ideologies and paradigms, which, in turn, reflect the dominance of specific narratives and social and economic interests that are called into play (Estes, 1983). In this sense, the definition process of the crisis may produce conceptual building blocks that legitimize some actors, delegitimizes others, and makes others simply invisible (Trotier, 2008, p198).

When the lack of water access is defined, by one or more stakeholders as having reached a crisis stage, the situation involves high social, economic, and political dynamics. In this regard, this research makes the following critical point: usually, dominant narratives are prioritized, with the traditional view of natural over social causes of crises, and marginalized narratives are deprioritized (e.g., indigenous voices). This dominant narrative typically results from an effort to avoid taking responsibility for a crisis, to overlook water inequalities in water allocation, and to

disregard water supply technical failures. In the end, it reinforces established power and economic relations (e.g., existing tourism and water market) that continue to disfavor those excluded from the majority.

The social constructionist framework contributes to this research by showing how various stakeholders come to understand, experience, and make sense of the water crisis. The study further points to how courses of action are decided upon and sustained. This standpoint allows us to see things from the perspective of those who inhabit them, both public and private officials and Raizales, and non-Raizales.

Importantly, this framework allows the researcher to take a ‘ground-up’ approach to unveil the elements necessary for the construction of a water crisis by retrieving individual and collective narratives from those who generate and sustain these elements (Julie-Anne, 2008). Also, it exposes how dominant narratives sometimes lead to inequities.

The social constructionist framework favors reflexive postures in the construction of knowledge (Galbin, 2014). It opens the necessary window for inclusion and democratization, moving away from expertise-based, rational, hierarchical, and result-focused models toward to a more participatory, co-creative, and process-centered study (Galbin, 2014).

Generally, social constructionism takes into account the cultural and historical aspects involved in knowledge construction (Martins and Arantes, 2019). In this approach, the research questions do not necessarily aim to create generalizable or replicable knowledge; instead, “the aim is to generate specific, located articulations of

social phenomena that may create deeper, denser, and more varied understandings of the diverse ways the world can be described in (Martins & Arantes, 2019, p 122).” Methodologically, the goal is not to demonstrate and convince the other about the correct understanding of the phenomenon, but to expand the possibilities of comprehending it (Galbin, 2014 p 90).

Finally, our social constructionist viewpoint takes the perspective that the water crisis will mean different things for different people, depending on their roles, interactions, and circumstances meanings (Julie-Anne, 2008). Social constructionism allows multiple voices to emerge to co-create ‘others’ crisis meanings. By placing together diverse realities, new possibilities of understanding are generated.

3.2 Research Questions

Study project focuses on the social aspects that exacerbate or originate the water crisis in San Andrés Island, recognizing that crisis is not just technical or natural or social, but rather are a result of the intersection of all three processes (Castro, 2007). Specifically, this research examines various stakeholders’ understandings of water crisis, water crisis response and water justice.

The research questions for this study are:

- How do institutions, residents (who vary by such factors as ethnicity and geographic location), and private water industry make sense of the water crisis?

- How did different stakeholders frame the crisis response? Was there a change in the water situation in 2018?
- Why do most interviewees (2016 and 2018) perceive saltwater desalination as the primary solution to ending the water crisis?
- How do different stakeholders frame water justice? To what extent do perceptions of water justice focus on distributive, procedural, and interactional issues?

The approaches to addressing the research questions is further explained in the subsequent sections.

3.3 Study Design

This qualitative study explores the individual and collective meanings of a water crisis. A qualitative approach is appropriate because it allows the researcher to answer questions about social meanings, social structures, and social relations aligned with the research question. Guba and Lincoln (1998, as cited in Patton 2002) noted that constructivism is not objective, but instead is epistemologically subjectivist and methodologically interpretative. From the outset of the study, the researcher took into account the importance of Islanders' views about the causes and characteristics of the water crisis.

3.4 Data collection in 2016

The study “Community perceptions of water access in San Andrés Island during the 2016 water crisis”, funded in part by a grant from the University of Colorado Natural Hazards Center through its Quick Response Grant Program, and which is funded by National Science Foundation grant number CMMI1030670 and the Disaster Research Center of the University of Delaware, allowed the researcher to perform exploratory research in the island, gathering important data from different stakeholders in the affected areas. Interviews were conducted with a variety of stakeholders, such as government officials, private company personnel, and residents in water-affected communities, who all provided valuable information through semi-structured interviews. The interview protocol was translated into both English and Spanish for better communication with different cultural groups in the island.

Thirty-four interview were conducted, voice recorded, and transcribed. Questions centered on water access, perception, experience during the drought, and the institutional response. Two semi-structured interview guides were used: one for government officials and private company personnel, and another for residents in water-affected communities.

The semi-structured approach did not adopt a rigid format; instead it allowed for flexibility and for the researcher to create new questions based on new information gathered during the interviews. Interviews were conducted face-to-face. The main benefits from this type of interview are: the promotion of the interviewer-interviewee relationship so that their interaction will more closely resemble a conversation instead

of an interrogation; and the freedom of the interviewees to express their views in their own terms (Cohen and Crabtree, 2006). The emphasis was on capturing multiple participant perspectives rather than looking for consensus. Initially, a purposive sample was used, followed by a snowball sample based on interviewee recommendations.

3.5 Data collection in 2018

Forty-five interviews were conducted in 2018. In-depth interviews provide an opportunity for deep understanding of what people are doing, thinking, and why (Roller and Lavrakas, 2015). As more information was required to fully understand the water crisis, and specially water justice issues, two years later a second phase of data collection took place. In November, 2018, the researcher gathered additional data from more stakeholders, including new neighborhoods on the island and tourist hotels located in the North part of San Andrés.

Again, phase 2 research involved a semi-structured interview guide. The semi-structured interviews were voice recorded and transcribed, and the majority were conducted at the participant's house. Interviews were recruited through a combination of convenience, purposive, and snowball sampling. Some officials were selected because of their organizational knowledge, decision-making power, leadership role in an effort to acquire information to complement the data collected in 2016. Other participants were selected because of the role they played in the water management system and during the water crisis. The researcher is a Spanish-speaker, and previous

connections in some of the neighborhoods affected by the water crisis helped the researcher to get access to the participants.

3.5 Official documentary records and policy relevant documents

Official documents were collected in both 2016 and 2018 to provide historical context for the timeline and understanding of the water management system. Also, it was used as evidence of opinions and attitudes of the government and company officials. It provides useful information to understand how the government disseminated and understood the causes and solutions of the crisis, main points discussed to solve the problem, protesters petitions, decisions taken to respond to the situation, identified main actors involved and decisions around desalination expansion.

At the provincial and municipal level, official documents were gathered from different administrative secretariats, such as risk management, public services, and agriculture offices.

The following official and corporate documents were collected:

Officials and corporate documents selected	Data used
The water contract: The water operation agreement (2005) and its nine amendments (mainly amendments 8 and 9).	<ul style="list-style-type: none"> - Presence of clause related to resident's participation in water decision making processes. - Aqueduct coverage, frequency and continuity terms. - Water consumption.
Minutes of meetings: Regional Risk Council of San Andrés, Providencia y Santa Catalina government minutes: April 14, 2016; April 23, 2016; April 25, 2016; and May 15, 2017.	<ul style="list-style-type: none"> - Arguments and rationales of the State of Public Calamity declaration. - Organizational response - The return to normal declaration.
The Action Plan Report of the State Public Calamity (2016)	<ul style="list-style-type: none"> - The crisis response.

The agreement between the San Andrés, Providencia and Santa Catalina government and the protesters in Barkers Hill on April 19, 2016.	<ul style="list-style-type: none"> Protesters petitions.
PROACTIVA Technical Report Acquisition and installation of Desalination Alternatives on The Island of San Andrés, 2016.	<ul style="list-style-type: none"> Main actors involved and decisions around desalination expansion.

The documents were used as a supplementary data to the semi-structured interviews analysis and interpretation (Bowen, 2009). Documents provide a means of tracking change of the water agreement amendments in relation to aqueduct service goals and water frequency and continuity, comparing them and identify the main changes. Also, documents were used as a way to verify findings or corroborate evidence from semi structure interviews and to find greater confidence in the credibility of the findings (Bowen, 2009).

3.6 Overview of Participants

In 2016, 34 semi-structured interviews were conducted. Participants involved (12) women and (22) men; (19) Raizales and (15) non-Raizales. Interviewees included people from different neighborhoods where road protests took place including: Court House, Little Hill, Barkers Hill, Loma Lynval, Loma Cove, Elsy Bar, Buenos Aires - Atlantico, and Sagrada Familia. Officials were interviewed from the public services secretariat, the risk management office, the fire fighter office, the civil defense office, the environmental corporation, the water public/private company, owners of the water truck companies, and some farmers, as well.

Table 1 *Overview participants in 2016*

Neighborhood/sector	No. Interview
Barkers Hill	3
Court House	2
Sagrada Familia	2
Little Hill	1
Loma Barack	4
Loma Cove	3
Buenos Aires	3
Elsy Bar	1
Simpson Well	2
Subtotal	21
Officials from Public institutions	No. Interview
Environmental authority-Coralina	2
Firefighters	1
Risk management office	1
Governmental Secretariat	1
Colombian Civil Defense	2
Agriculture Secretariat	1
Public Services Secretariat	1
Congress Representative	1
Subtotal	10
Private Institutions personnel	No. Interviews
Water company, Veolia (Proactiva)	1
Water trucks companies	2
Subtotal	3
Total	34

In 2018, 45 semi-structured interviews were conducted. Participants involved (26) women and (19) men; (25) Raizales and (20) Non-Raizales. The new interviews included new neighborhoods of the island, such as Natania, Cabañas Altamar, Sarie Bay, San Luis, los Almendros. Also included were personnel who were not

interviewed during the 2016 field work, like tourism maintenance managers. These interviews did involve some of the same individuals (5) from the same neighborhoods and government administrative secretariats as in 2016.

Overall, twenty-nine semi-structured interviews were conducted with participants who live in different neighborhoods of the island: (21) were women and (8) were men, (18) were Raizales and (11) were Non-Raizales. Some participants have an aqueduct (18); some people reported having problems with water access (24), and (24) participants had lived through the 2016 water crisis. Interviews were conducted to participants from diverse local public (7) and private institutions (9), (2) from the private water company and (7) with participants from both large and small hotels.

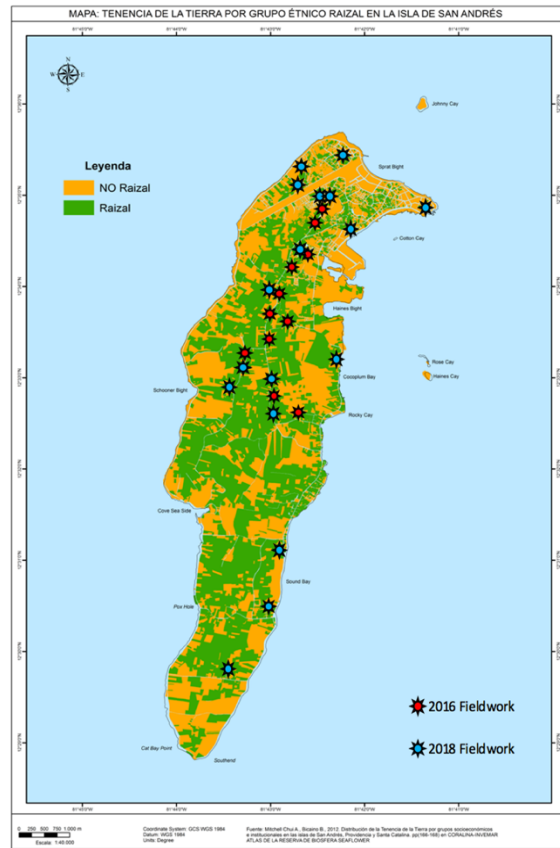
Table 2 Overview participants in 2018

Neighborhood/sector	No. Interview
Tablitas	1
Almendros	1
Natania	2
Los Manguitos	1
Sagrada Familia	3
Sarie Bay	3
Cabañas Altamar	1
Barkers Hill	3
Brooks Hill	1
Loma Claymont	1
Loma-Cove	4
Loma Barack	1
Sound Bay	1
San Luis	2
Smith Channel	2
Elsy Bar	2
Subtotal	29

Officials from public institutions	
Environmental authority, CORALINA	3
Colombian Civil Defense	1
Risk management office	1
Public Service Secretariat	1
Firefighters	1
Subtotal	7
Personnel from private institutions	
Water company Veolia (Proactiva)	2
Hotels	7
Sunrise	1
Acuario	1
Los Delfines	1
Behotel	1
Calypso	1
Mary Inn	1
Posada Cliss Place	1
Subtotal	9
Total	45

In total, in this research were conducted 79 semi structured interviews, 38 women and 41 men. 44 Raizales and 35 Non-Raizales. Figure 1 shows the places where the interviews occurred.

Figure 1 *Location of semi structured interviews, conducted in 2016 and 2018 on San Andrés island, Colombia*



3.7 Data Analysis

An inductive approach to analysis was used. The codes, categories, and themes were directly drawn from the data (Patton, 2002); yet the process involved alternating between inductive and deductive analysis, where codes were drawn first from the data, classified into themes and subthemes according to the literature around water crisis features and different forms of water justice. There were interactive cycles of induction and deduction that drove the coding (Miles, Huberman, and Saldaña, 2014).

3.7.1 Coding process

The data collected in 2016 consists of 34 transcriptions, and the data collected in 2018 consist of 45 transcriptions. In general, data analysis started by reading all data repeatedly to achieve immersion and obtain a sense of the whole (Hsieh & Shannon, 2005). Each group (2016 and 2018) of transcripts was read and re-read and the codes and concepts were reconfigured or redefined, as necessary. Manual coding was used.

During open coding, a contrast and comparison method was used to define themes. Words and quotes related to the research questions were extracted. Questions such as: 1) What words characterize the water crisis and its causes? 2) What words or phrases illuminate views about water justice? What phrases are related to distributional and procedural justice? What words or phrases give insight into the crisis response? and, finally 3) What similarities or differences exist within and between each stakeholder group? The intent was to characterize and compare different understandings of water and the focus was on statements that contained the intersection of water (e.g. quality, frequency, and amount) and justice codes.

The researcher isolated data passages in the transcriptions, then inspected them carefully for the essential information related to the research question. Then, the passages were separated by group (e.g. Raizal and Non-Raizal) and read again to determine codes, checking for similarity and difference. Subsequently, the researcher determined preliminary themes through a compare and contrast technique (e.g. How is this text different from the preceding text? Or what is similar between them?). In

general, the analysis was first divided in two groups, people affected and public and private institutions. Later, the analysis focused on different social groups to facilitate the identification of themes dealing with crisis causes as well as with distributive, procedural, and interactional justice. Next, focus was on three kinds of themes, following Larson et al, (2016): “core themes (interwoven though many interviews; may be broad in meaning); subthemes (unique streams of meaning within a broader theme); and periphery themes (mentioned by a minority; may be narrow in meaning).”

The general goal was to have both sense of the whole and sense of each group to identify important differences in the way stakeholders perceive the water crisis and water justice issues. The coding process was cyclical. The second cycle, where the researcher re-read the interview transcripts, focused on reconfiguring or reconfirming the codes, categories, and themes. This stage focuses the codes into categories (broad groups of similar concepts). Then, a compare and contrast technique was used to find the final themes about perceptions about the definition, causes, and frequency of water crisis and (in) justice, different forms of water justice, and causes of the water (in) justice. The emphasis was on capturing multiple participant perspectives, but also, by social groups.

3.8 Data Quality and Ethical Considerations

Data saturation implies a point when no new themes, findings, concepts or problems are being observed from the data (Guest, Bunce, & Johnson, 2006; Bowen, 2009). Saturation was reached in this study, and the research felt confident that the

extensive and inclusive sample, contributed to generating sufficient data to examine the research questions. The sample contained a variety of knowledgeable, concerned, and representative community leaders in the water crisis affected areas; gender and ethnicity diversity; perspectives from affected citizens as well as public and private institutions related to the water management in the island; and input from the tourist sector located in the north part of the island. The combination of purposive and snowball sampling techniques allowed the gathering of data from community leaders who both have a deep understanding of the issues and have suffered from the lack of water in the island. The use of networking during the 2016 field work helped create strategy to seek out missing perspectives in the 2018 fieldwork. The sampling method included a broad range of stakeholders from different neighborhoods, organizations, and private companies, which ensures representation from multiple social groups.

Confirmability was sought through the multiples dialogues with other researchers who know about water management and justice issues in the island, both to check the findings during the research process and provide feedback on the interpretations and conclusions.

Ethical considerations are fundamental for any qualitative research. Silverman (2000) highlights that researchers should always remember that while they are doing their research, they are entering the private spaces of their participants. Therefore, this study developed an informed consent process that involve considerable transparency. All interviews were recorded with consent from the respondents. The respondents were told that they could stop the interview at any time and that they should ask if they

need clarification or explanation of any question. Finally, the researcher acknowledges potential bias in this study. She is from San Andrés and resident of the island, she has an interest in seeing improvements to water management, which could affect her interpretation.

Chapter 4

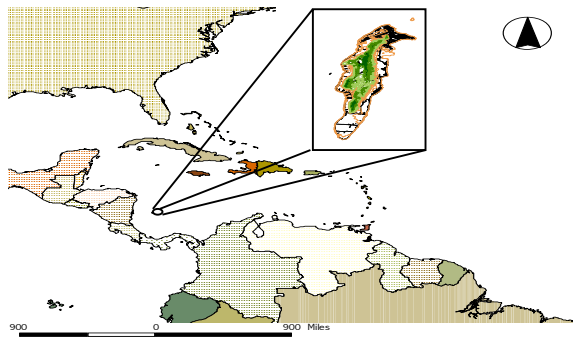
THE SAN ANDRÉS ISLAND WATER CRISIS

In essence we need our past. We are dependent upon it for understanding our present and for molding and adapting to our future, whatever uncertain it may hold
(Oliver-Smith, 1986)

4.1 The Archipelago of San Andrés, Providence and Santa Catalina

The archipelago is a group of small islands located in the Caribbean Sea, between 12° and 16° N and 78° and 82° W. It is located in the southwest of the Caribbean Sea, about 800 kilometers to the north-west of the Colombian Caribbean coast, and 80 kilometers from the Nicaraguan coast. It has an approximate surface area of 300,000 km² and is composed of three major islands: San Andrés, Providencia, and Santa Catalina, as well as several keys (small islands). The capital is San Andrés, which has a surface area of 27 km².

Figure 2 *San Andrés island: Location* (Source: UNAL, 2006)



San Andrés island is both a Department (province) and a Municipality; as a result, it has special regulations that allow it to be flexible with political and economic policies. As a small island, it shares particular inherent vulnerabilities and characteristics with other small islands. These characteristics include: “small size; scarce natural resources; vulnerability to climate change; dependence on external trade; high relative costs of public administration; and limited economic, institutional, and human resource capacity (Belmar, McNamara, & Morrison, 2016).”

San Andrés is one of the fastest-growing areas in Colombia, with significant demands for water, energy, and housing. Rapid growth in population has continued to drive demand for social and physical infrastructure services, resulting in pressure on natural resources, including water quality and water supply. The island had a population density of 2,640 inhabitants/km² in 2015 and a high dependence on the tourism industry, representing 60.7% of its gross domestic product (DANE, 2014). The island’s primary income comes from tourism and commerce, followed by fishing. There are three major sectors on the island: North End, Hill or La Loma, and San Luis. The North End is an urban area where most of the island’s residents live (72% of the total population). Most of the infrastructure, including hotel, commercial, and official entities, are in this sector. The sectors of San Luis and La Loma have the highest concentration of the Raizal people, an ethnic minority group (Gobernación Departamental de San Andrés, Providencia y Santa Catalina, 2013).

Because of its biologic diversity, cultural values, and natural ecosystem, UNESCO declared the islands as a protected nature reserve in November, 2000 called

Seaflower. Its nomination fulfilled a series of specific requirements including high biodiversity, possibilities for testing and demonstration of sustainable development with community participation, sufficient importance for conservation, and administrative capacity to implement a zoning and management plan. According to Mow et al., (2007), this designation turned Seaflower into the world's largest Biosphere Reserve and signified a transformation in the environmental management of the archipelago.

The biosphere reserve established a mandate to

- Carry out actions that improve the communication infrastructure for the interconnection of the islands along with improvement of regional connectivity with Central America and the Caribbean
- Implement actions to conserve, recover, and protect natural resources and the environment with an emphasis on water resources and land use management
- To promote economic growth and the generation of “green jobs” in the islands
- Implement actions aimed at achieving the new model of sustainable development of the archipelago
- To form strategic alliances that promote the active participation of local actors and international cooperation

However, after nineteen years of implementation of the BR (Biosphere reserve) program, the environmental problems have been magnified in quantity and complexity (CORALINA, 2015). The Seaflower biosphere reserve is currently suffering from multiple problems, including poor solid and liquid waste management, groundwater contamination, inefficient water management, deforestation, land invasions in environmentally sensitive areas, land-use change, and loss of ecosystems services (Velásquez, 2014; 2020).

Sociocultural Aspects

San Andrés society has a close family relationship where people know each other: there is a strong cultural heritage, sense of identity, and a sense of place. It has a long history of dealing with social, political, and environmental changes like other Pacific and Caribbean islands (Kelman, 2010).

Historically, on the island have lived an ethnic group, the Raizales or Raizal People, a group that enjoys special protection by the Colombian State and the International Labour Organization (ILO) Convention 169 on indigenous and tribal peoples' rights. Raizal culture is defined by its Anglo-Puritan/African heritage, Protestant religious tradition, and English mother tongue, which now enjoys the legal protection granted to ethnic minorities by Colombia's Constitution of 1991. The Raizales have a strong cultural relationship with the Antillean peoples, such as in Jamaica and in Haiti. Raizales have had a persistent conflict with the central government in Bogota, Colombia. In recent times, they have defended their identity as indigenous people, a category that allows them greater possibilities of cultural defense

against the central government. Raizales primary rights are concerned with territory and self-government (Ortiz, 2016), and since 2016 around water resources management. The majority of this group is located in the center, hilly, and south parts of the island.

Since 1953 there has been uncontrolled population growth on the island. For example, in 1951, there were 5,675 inhabitants; in 1964, there was an increase to 16,731 inhabitants, and in 1985 there were 43,685 inhabitants (CORALINA, 2008). According to the projections of the *Departamento Nacional de Planeación* [National Planning Department] -DNP, (2018), currently, the population of archipelago exceeds 61,000 inhabitants, in which Raizales represent approximately 39.4% (James, 2015). As a result of a continuous migration process, different cultural groups currently cohabit the island. They come from different parts of Colombia, including Medellin, Cartagena, Barranquilla, and the Middle East, like Turkey and Lebanon.

Non-Raizales built their homes and ways of life according to their place of origin, which immediately collided with Raizales' culture. These groups mainly live in the urban and North parts of the island. Non-Raizales have different customs in the way they live; some of the differences are in architecture, water harvesting practices and uses, religion, music, and dance. The neighborhoods in which they live are a small sample of where they previously lived. Few studies exist about the lives of migrants who came to the island since 1953. However, it is known that most migrants and their children, who were born on the island, as a result of cultural mix, are now part of a new generation of islanders creating a new society and culture on the island.

Economic activities

The main economic activity on the island is tourism, posing a steady pressure on water resources (James, 2015; Velásquez, 2015; Guerrero, 2020). Recently (before the COVID-19 world crisis of 2020), the island was visited annually by more than a million tourists (Howard, 2015). According to James (2015), the island has 56 large hotels, which offer direct work to more than 2,600 employees and have more than 3,500 rooms. In San Andrés there is a predominance of hotel chains specialized in all-inclusive tour packages (e.g., Decameron and On-Vacation); Although, between 2012 and 2013, there was a significant increase in tourist homes and rural accommodation (*posadas nativas*-native inns), which went from 16 tourist homes to 97 in just one year (James, 2015).

Tourism has traditionally displaced essential activities such as agriculture and fishing, which are now limited to family consumption. Global and national forces incentivize the growth of this activity, where international and national tourism agencies are becoming more prevalent. Scholars point out that its impact is mostly negative since the benefits and costs are not distributed equally among the population (James, 2015). Therefore, they recommend seeking to change the current economic model of mass tourism to an ecological tourism.

Tourism has had severe environmental consequences for the island: pollution, an increase in solid waste generation, degradation of the ecosystems, and erosion of the beach system caused by massive construction on the coastal zone. The increasing

number of residents and tourists puts pressure, especially on water resources producing over-exploitation and lowering of the groundwater table in aquifers.

The use of water by tourists far exceeds the local's consumption, while a local drink 150 L/day, a tourist drinks more than double, 323 L/day (Guerrero, 2020).

According to Peters (2015), the highest use of water in tourism is during the Caribbean dry season when water production from the surface and groundwater sources are at their lowest. In this context, the community has become more prone to face and more fragile to cope with the lack of water.

Overall, the relationship between tourism and water crisis has been studied from various perspectives:

1. Tourism can increase vulnerability and generate water crisis conditions.
2. Crisis or disasters can severely impact the tourism industry, an economy highly susceptible to external factors.
3. Tourism can help to reduce vulnerabilities and generate resilient touristic destinations.

Generally, studies of tourism have inclined to analyze how disasters can severely impact the tourism industry and what management strategies are necessary to protect the tourist destination (Durieux, Antunes, and Amaral, 2010; Rocha and Matteddi, 2016).

4.2 Water Management: a retrospective

In Colombia, the concept of public water service was created to express that water supply is a basic need, and the government will provide it. Later on, this concept was associated with fundamental human rights, and then, more specifically with water rights (CRA, 1997). Historically, the functions of construction, regulation, and advising the public water service has tended to devolve from the central government to the municipality. Currently, investment and execution tend to be in the charge of municipalities, and advising, investment, and policy directions are at the central government level. Private intervention for the management of public services has been promoted since 1994.

In the 1940s, the Municipal Development Funds (Fondo de Fomento Municipal) was created to promote the municipalities' improvement. However, these objectives were not achieved. In the 1950s, the Municipal Development Institute (INSFOPAL) was founded as an executing and financial body that was the national administrator of public services. The institute was in charge of solving the aqueduct and sewerage problems of all municipalities and rural areas of the country, including the construction, operation, and maintenance of the country's aqueducts and sewers (CRA, 1997).

Before the fifties, on the island, there was no electricity, aqueduct, or sewage services. Islanders supplied their water necessities from family wells (e.g., Rock Hole, Simpson Well) and rain harvesting, which both become a fundamental part of the construction of houses on the island. In 1953 the problem of water supply was very

serious that in the dry period, which sometimes lasts up to four months, the drinking water reserves that were stored in cisterns were completely depleted (El Tiempo, 1953).

In 1953, San Andrés island was declared a tax-free port, which modifies its economic and socio-cultural life. From then, tourism and retail commerce became the main economic activities, and they were located mainly in the north part of the island (Departamento Nacional de Planeación-DNP, 1992).

In 1955 the Colombian president, Gustavo Rojas Pinilla, approved through Decree 2637, 1955, the complete studies and construction of the first stage of the aqueduct of San Andrés island. The free port generated a higher demand for drinking water and required the urgent implementation of an aqueduct.

In 1960, seeking to make San Andrés a famous tourist destination, the local government contracted the Municipal Development Institute (INSFOPAL) to build an elevated tank, a water distribution network, and extraction pumps; these works, also included an electric plant that was finished in 1962. However, multiple technical problems were encountered that resulted in an inefficient water service (Mattos, 2004). Neither the technical infrastructure nor the social services on the island could keep pace with the constant growth of tourism (Abello and Mow, 2008).

In 1961, the aqueduct system took its water from the Rock Hole well located in the north part of the island. Initially, this natural well provided good water quality. Then it was overexploited and began to provide salty water; therefore, its exploitation was reduced to 4m³ per second and complemented with 5m³ per second from the Cove

lagoon to get fresh water (El Tiempo, 1961). In 1962, the San Andrés administration and the Municipal Development Institute (INSFOPAL) signed a contract with ACUASAN, a private water infrastructure company, and the goal was to buy a saltwater transformation plant, which would solve the island water problems (El Tiempo, 1962).

Alvaro Lopez Toro, *intendente* (governor) of San Andrés and Providencia in 1963, proposed multiple recommendations to make the archipelago a touristic place for North Americans. He said that the free port will foster the modernization of the economic life of the island. The natives were facing problems with this new economic model, they felt excluded; indeed, Lopez (1963) said that the natives did not have enough knowledge and experience with touristic business and lacked the ability to obtain loans. Lopez (1963) stated that the water supply was the main problem for the development of international tourism on the island; therefore, he proposed as the first step constructing an aqueduct for the touristic zone. He states that “although the separation of the water supply system between the hotels and the public in general may seem at first an uneconomic, the selection of this alternative presents the advantage to start an international tourist program more rapidly (p 40).” At that time, there was a clear intention for dividing the water provision system between tourists and residents.

In 1964, according to Decree 2118, 1964, the Colombian president created the San Andrés and Providence Public Services Intendent Company, and its objective was the provision of public services of the aqueduct, electricity, sewage, cleaning, and

communications. At this time the Rock Hole well continued operating as the primary aqueduct water source.

According to the newspaper *El Tiempo*, foreign companies from the United States were interested in setting up a desalination plant on the island, which was considered as the only solution despite its high cost (El Tiempo, 1964). By 1968, 8,500 km of aqueduct pipeline had been installed. Likewise, the construction of the first tank pumping plant was completed on the island. The aqueduct had eight wells with their respective water extraction pumps, and the water was collected in large tanks and later distributed by gravity mainly to tourists.

Between 1953 and 1970, there was a concentration of new cultural groups, warehouses, commerce, and hotels in the north part of the island. There were significant land and cultural transformations related to cyclical migrations inflows. A second change took place between 1970 and 1985, where the population was interested in generating residential settlements, and this was the time of the creation of new neighborhoods, also concentrated in the north part of the island (Aguado, 2010). While the hilly-center areas, known as La Loma or The Hill, and the southeast coast, called San Luis, became the Raizal neighborhoods par excellence (Aguado, 2010), the north part became the main area for tourism development and therefore, the part with better aqueduct coverage.

In 1969, Carlos Augusto Noriega, presidential government minister, wrote a report about the measures taken by the central government for the benefit of the archipelago. The first and most crucial problem stated in this report was the lack of

energy and aqueduct services on the island. The problem was stated in this way: the natives were complaining about the allocation of these two public services; in this sense, Noriega (1969) said there is an urgency to amend the absurd injustice in the current aqueduct system in which the aqueduct network goes through the poor neighborhoods, but they have no access to this water. He explained that this was happening because the water was mainly directed to areas with economic development and where wealthy people were living. Later on, Yates (1977) indicated that it was necessary that the central government stop injustices committed by excluding the locals' participation in tourism, public services, and commerce.

The need to construct an aqueduct remained; therefore, a local public company was created, called Empoislás, which managed water and sewage systems from 1968 until 1993. During the 1980s, the first desalination plant was constructed to provide water to the more populated areas – the touristic zones. The aqueduct coverage by that time was 54% of the island.

In 1988, the central energy production plant on the island burned down and impacted the desalination plant operation. In 1989, the local government reported a water deficit in which the water demand was 94 liters per second (70 L/s residents and 24L/s tourism), and the water supply was 67 L/s. In 1990 from 7,679 households, only 4,149 had an aqueduct (54%) (Intendencia Especial de San Andrés and Providencia, 1990). In 1989 the Municipal Development Institute (INSFOPAL) was liquidated.

In 1991, a new political constitution of Colombia established the decentralization of public services assigning greater responsibilities to municipalities. Water was supplied four days a week for the hotel sector and three days per month for the rest of the island (DNP, 1992).

Empoislas had multiple administrative and operational problems, and the majority of islanders did not have access to water from the aqueduct. In 1993, this company was liquidated, and the local government took control of the public utilities (aqueduct, sanitation, and solid waste) and created the Special Administrative Unit for the Control of Public Services (UAECSP) until 2005. In 1996, a water softening plant was constructed, and in 1997, the desalination plant was reconstructed; however, in 2002, the plant stopped working again due to technical problems and high energy prices.

In 1993, National Law 60 directed and regulated the central government's resources to municipalities, and it promoted investments in aqueduct and sanitation in the more populated urban areas which in San Andrés were the touristic zones.

In 1994, the central government enacted Law 142, establishing precise conditions of regulation, operation, control, and supervision of public services. The law favors the provision of public services by private operators (national or foreign) other than local government.

The urbanization on the island did not stop despite the absence of water services, and from 1997 to 2001, there was significant backwardness impeding the development of aqueducts, and sanitation in the island (Mattos, 2004; Arboleda,

2010). Institutional, socioeconomic, environmental, and corruption problems were identified as the causes of this water management problem. In 1997, the Ministry of Economic Development identified as an ongoing threat the multiple and opposite visions about the island future held by the local institutions and the island community. The Ministry identified that some people on the island were neutral observers of the situation, there was a ruling economic class that had interests for the growth of tourism and retail commerce, the immigrants wanted to work, but they did not have leaders' representation, and there was a confrontational group, the Raizales who wish to end tourism and reduce the number of foreigners on the island (Mattos, 2004).

In 2001, Law 715 (and in 2007, Law 1176) eliminated the instruction given by Law 60, 1993, and resource allocation between urban and rural areas was left to the municipalities' decision.

In 2002, the Superintendency of Public Services - SSPD through decree 398 of 2002, intervened the aqueduct and sewerage services on the island because it evidenced severe infringements by the local government in its obligations as a direct provider of these public services (Presidencia de la República de Colombia, 2002). In this sense, the SSPD structured the process for hiring a specialized private operator and defined the future conditions for the provision of the domiciliary aqueduct and public sewerage services on the island.

By 2003, the island had been divided into five sectors to manage the distribution of the water:

1. The North End corresponds to the urban area where 70% of the population is settled, and the commercial and tourist zone was developed
2. San Luis, located in the eastern side where some hotels, and Raizales and other residents were scattered around the coastline
3. The Cove, a rural area located on the western side where Raizales were located
4. La Loma, a rural area, located in the central and high part of the island, where Raizales were located
5. The South End, a sparsely populated rural area located in the south part

There were eight water districts (Plan de Ordenamiento Territorial [Land Use Plan] - POT, 2003):

In the North End or Urban area:

- 1) Hotel circuit with an area of 42.9 ha, a population density 40-50 households per hectare
- 2) El Centro circuit with an area of 48.9 ha, a population density of 30 - 40 households per hectare
- 3) Los Almendros circuit with an area of 51.3 ha, a population density of 30 -40 households per hectare
- 4) Sarie Bay Circuit with an area of 71.4 ha, a population density of 15 - 25 households per hectare
- 5) Natania Circuit with an area of 42.3 ha., a population density of 30 households per hectare

In the Rural area:

- 1) La Loma circuit consists of an open network for a coverage of 15 ha, a population density of 10 –20 households per hectare
- 2) El Cove circuit with a population density of 5 - 15 households per hectare
- 3) San Luis circuit with 58 ha, a population density of 10 - 30 housing per hectare

Overall, there were two systems to distribute water (North and South-Center), and two different systems for water treatment: a softening plant and desalination plant. The first is located in Duppy Gully, which treats the groundwater extracted from the San Andrés aquifer, and the second is located in the North End, which treats brackish water, extracted from the San Luis aquifer, through the desalination plant (POT, 2003).

In 2003, the aqueduct coverage was 49.7%, more than half of the inhabitants did not have a water supply from the aqueduct. The primary sources of water supply were: 40% bottled water, 33% rainwater, 19% aqueduct, and 7% domestic wells. Concerning the water service frequency, 91.6% of homes were unable to have water 24 hours a day, making the need for cisterns much more critical. Also, the water consumed by islanders connected to the aqueduct had poor quality. By 2004, the water was mainly supplied by rainwater and domestic wells, but they did not efficiently complement the public aqueduct service, so each user did not have the necessary amount of water for food and personal cleanliness (Arboleda, 2010).

In 2005, the National Council on Economic and Social Policy-CONPES 3350 (DNP, 2005) established arguments to declare the private sector's participation in household public water and sewerage services on San Andrés island as of strategic importance. Two fundamental causes were identified for the problems in the provision of public water and basic sanitation services: (1) the lack of autonomy of the service providers; and (2) the schedule of central government monetary transfers that do not allow the local government to undertake comprehensive investment plans in the medium and long term.

According to the above mentioned, the central government plays a decisive role in the water resources on the island, structuring the management of water infrastructure and policy. The San Andrés island municipality found it challenging to efficiently manage the water service; then, the solution was to promote operational contracts with the private water industry. The CONPES 3350 established the guidelines for the new water operator on the island. It stated that the operator would give special attention to the less favored population's economic capacity, as well as to the Raizales tradition of collecting and storing rainwater.

In this sense, after more than 40 years of water management difficulties, in 2004, the Superintendencia de Servicios Públicos domiciliarios –SSPD (Superintendent of Residential Public Services) contributed to the creation of Aguas de San Andrés SAESP for the purpose of contracting with the private companies for the provision of the aqueduct and sewerage services on the island of San Andrés (DNP, 2005). This is

a public company where the government owns the majority of shares and chairs on the board of directors.

In 2005, Aguas de San Andrés SAESP, through the Superintendencia de Servicios Públicos -SSPD, selected the private company PROACTIVA Aguas del Archipiélago SAESP (today, Veolia) to be the operator to provide water supply, aqueduct, and sewer services. Aguas de San Andrés and PROACTIVA signed a contract on September 8, 2005, for 15 years (Gobierno Archipiélago de San Andrés, Providencia y Santa Catalina, 2010). After this, the contract became the central core of water policy on the island. In 2019, they signed an extension for another 15 years until 2035.

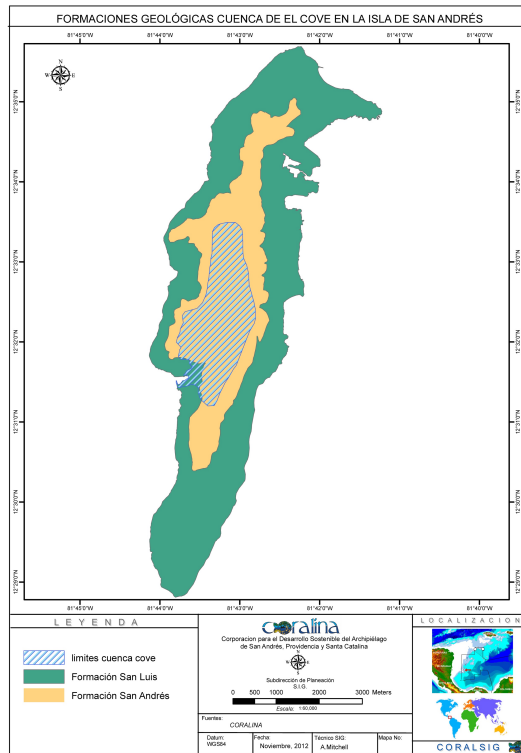
After this brief historical account about the public water service on the island, it is crucial to highlight the following remarks: 1) the idea of the need of a desalination plant to solve the water problems on the island began in the 1960s; 2) there were continuous technical, administrative, and corruption problems around the water supply service in which, in the end, privatization of the water service was encouraged; 3) tourism prioritization since the 1950s has continuously excluded Raizales from the water supply service.

Ultimately, since 2005, privatization has minimized the local government and the community participation, restricting their actions to the water agreement clauses. It appears that the prioritization and the growth of tourism in conjunction with government difficulties have been significant factors that caused an ongoing failure in the water management on the island.

4.3 The current water supply

The water that currently supports life on the island comes from two primary sources: precipitation and desalination. Precipitation is stored in two aquifers, San Andrés and San Luis (Figure 3). San Andrés has 17.3 km² approx., and a natural water supply offer of 175 L/s; and San Luis has 8.89 km² and a natural water supply offer of 65.5 L/s (INGEOMINAS, 1997); the two aquifers are connected (UNAL, 2010). According to the Groundwater Management Plan-PMAS (CORALINA, 2000), the San Andrés aquifer constitutes the zone of inner hills and holds the main reserves of freshwater, and the San Luis formation, located in the flat part of the island, is characterized by predominantly brackish water, partly due to its proximity to the sea. There is low water quality (physicochemical and microbiological) in both aquifers, due to the poor management of wastewater in both urban and rural areas (CORALINA, 2019).

Figure 3 *Aquífer San Luis and San Andrés. CORALINA -INVEMAR, (2014)*



Rainwater storage is a cultural survival technique for Raizales. Different adaptations took place to manage the collection of water and have become a fundamental part of their culture. Those traditions go back in history when the African ancestors of the Raizales faced a similar problem in their land. Since 1700, people started to implement special techniques to build their houses and learn to live with essential tools for the primary goal to conserve rainwater. Raizales have developed a preference for the water that comes from the sky. They have given a religious value to this water; as they say, rain is the water that comes from God (Aguado, 2010). This water is used mainly for the most critical activities such as cooking, bathing, and drinking, and it is stored in individual tanks and family cisterns. The capacity to store

rainwater became a differentiating factor between social classes in all cultural groups on the island. Poverty in San Andrés continues to be linked to the economic capacity to build a house with a cistern and a well.

Two primary sources of water, rainwater, and groundwater, which are not controlled in either quality or quantity, provide the island's water. Although both sources mitigate the existing water deficit, the quality issue becomes of fundamental relevance, especially in the San Luis aquifer (CDM Smith - INGESAM, 2016). Ninety-two percent of the community use bottled water as they believed it is the only water that is safe to drink.

The water supply sector in the island is composed of formal and informal providers. Informal providers, outside the formal piped network system, include water trucks that sell water to households and hotels, and they are not subject to strict regulatory frameworks, and bottled water companies. A formal provider is a government that officially contracted a specialized private company to distribute pipeline water. Each company has different water extraction permissions by the environmental authority, CORALINA.

There is a variety of combinations in the way islanders, Raizales, and non-Raizales, get water, but, in general, it can be classified in three different ways:

(1) Autonomous water supply in which rain and well-water are stored in cisterns: On the island, there are many private wells drilled and managed individually or collectively. In the last census of wells done by the local government health secretariat, a total of 5,837 household wells were reported located mainly in the north

part of the island (CORALINA, 2019). In neighborhoods like Los Manguitos, Las Tablitas, and some illegal settlements, they use communitarian wells serving 25 to 40 houses. The mean volume extraction from domestic wells has been estimated as 945,944 m³/year (CORALINA, 2019)

(2) Water supply through water-trucks: some neighborhoods do not have aqueduct service or have inefficient water supply service; they need to pay for water trucking service repeatedly.

(3) Public household aqueduct: water service currently operated by Veolia (previously called Proactiva) in four districts North End, La Loma, El Cove, and San Luis.

Diverse water systems have become interrelated, making the island have multiple overlapping systems that compete with and complement each other. Together they provide water to islanders; a family may belong to several systems.

Key actors

Several actors play a role in San Andrés' water sector. Among them are: the central government that is represented by the Environmental Ministry; the municipal governments; the environmental authority; the private sector; and the water provider company (Veolia). The table below summarizes the roles played by different actors in both the control and management spheres.

Table 3 *Water management key actors on San Andrés island*

Sector	Actor	Role in water management
Central government	Superintendencia de servicios públicos domiciliarios (Superintendency of Domiciliary Public Services-SSPD)	Control, supervision, and surveillance of entities providing domiciliary public services.
	Ministerio de Medio Ambiente (Ministry of the Environment)	It is in charge of guiding and regulating environmental planning and defining the policies and regulations to which the recovery, conservation, protection, planning, management, use, and sustainable use of natural resources will be subject.
	Ministerio de vivienda, ciudad y territorio, (Ministry of Housing, City and Territory) Viceministerio de agua y saneamiento (Water and basic sanitation vice minister)	Formulate, adopt, lead, coordinate and execute public policy, plans, and projects related to territorial and urban development; consolidation of the city system with efficient provision of public drinking water and essential sanitation services.
	Departamento Nacional de Planeación - DNP (National Planning Department)	Coordination of public water policy formulation, design, and direct the national resources investment.
	Comision de Regulación Agua -CRA (Water Regulation Commission)	The commission issues water rate regulations that must be complied with by all the aqueduct and sewerage companies.
	Financiera del Desarrollo - Findeter (Financial Institution for Development)	Financing infrastructure projects focused on promoting regional and urban progress by granting credits to both public and private entities. The institution also carries out the construction, expansion, and replacement of infrastructure corresponding to the drinking water and primary sanitation sector.
Local government	Secretaria de servicios públicos (Public services secretariat)	Water policy and management; guarantee water service; management of local water resources; water management local plans, water services investment.
Private sector	Veolia	Operate water supply service and infrastructure on the island, and the company is in charge of the distribution and commercialization of water resources.
	Bottled water companies	

Local environmental authority	Corporación para el Desarrollo Sostenible de San Andrés, Providencia y Santa Catalina – CORALINA (Corporation for sustainable development for San Andrés, Providencia y Santa Catalina)	It is in charge of the sustainable and rational use of renewable natural resources and the environment. Monitor and regulate water extraction and enact water local regulations. Guarantee the quality of the water resources.
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4.3.1 General description of the aqueduct system

Veolia, the water operator, currently utilizes a desalination and a softening plant to supply the vast majority of the water. Most of the water is pumped from the aquifer. The following table summarizes the aqueduct system on San Andrés island, divided by sector, type of water treatment plant, and aquifer.

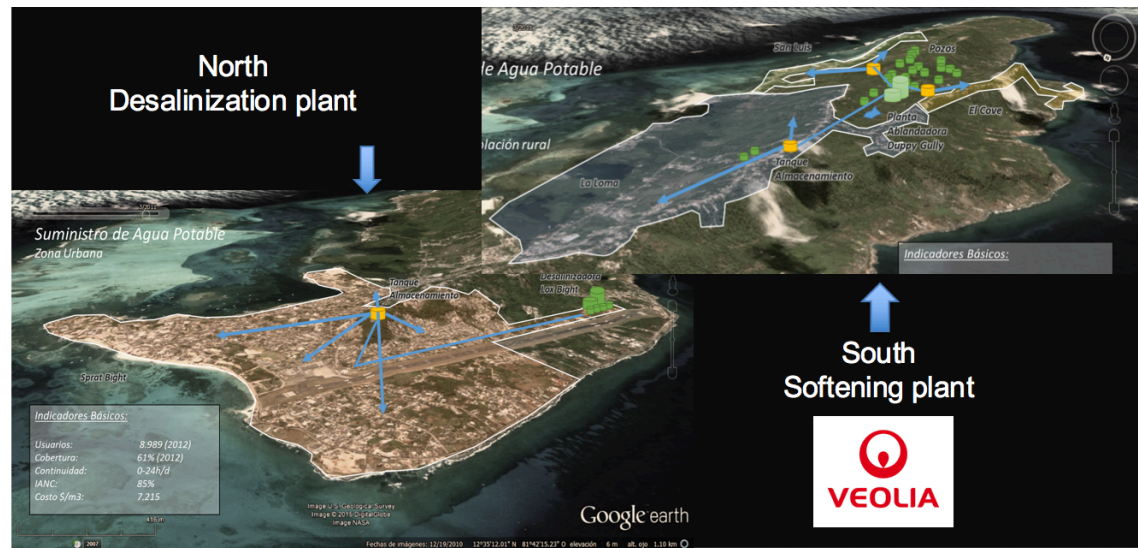
Table 4 *General description of aqueduct system in the island. Prepared by the author base on CDM Smith - INGESAM, (2016) and Bent O. (2019).*

	Subsectors	Component description	Aquifer	Mean value Water production	Aqueduct coverage
North Urban area	Hotels Residential Almendros Natania Sarie Bay	1 desalination plant, 50 L/s capacity, located in the Lox Bight sector	San Luis	42.4 L/s for 2019	34.2%
		4 deep wells			
		3 water storage tanks with 2,339 m ³ capacity			
		5 district water distribution subsectors			
		57.23 km of water pipeline			
South Rural area	La Loma San Luis El Cove	1 softening plant, 60 L/s capacity, located in Loma Cove	San Andrés	15.27 L/s for 2013 16 L/s in 2014 14.4 L/s for 2019	26.2%
		17 wells, only 13 functioning			
		4 water storage tanks with 1,747 m ³ capacity			
		3 district water distribution subsectors, Loma (20 sub districts), San Luis (2 sub			

		districts) and Cove (3 sub districts)			
		55 km of water pipeline			
Rural	South area: Hoyo soplador Elsy Bar	No aqueduct coverage		0%	0%

The following figure shows in more detail the two systems used by Veolia to produce potable water.

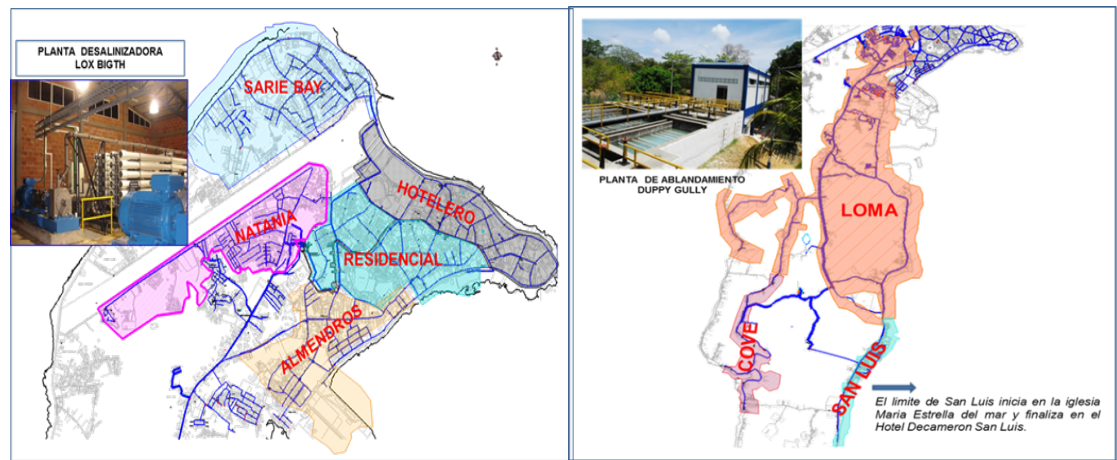
Figure 4 Water supply treatment google earth satellite image. Modified by the author based on FINDETER (2017)



Water distribution, continuity, and frequency

The water distribution system consists of all the components necessary to convey water from the wells or storage tanks to households. There are five circuits in the north part or urban area of the island and three circuits in the rural area. The frequency of the water supply is established in the water agreement and varies by sector (Water agreement, 2005). Figure 5 shows the water distribution per sector and per water treatment.

Figure 5 Water distribution per sector, San Andrés island. Retrieved from (CDM Smith - INGESAM, 2016)



The island is divided into eight sectors to manage the distribution of the water (CDM Smith - INGESAM, 2016, p 8-43):

1) In the North End or Urban area:

- a. Hotel circuit with an area of 51.47 ha
- b. El Centro circuit with an area of 59.37 ha
- c. Los Almendros circuit with an area of 79.68 ha
- d. Sarie Bay circuit with an area of 72.68 ha
- e. Natania circuit with an area of 57.62 ha.

2) In the Rural area:

- a. La Loma circuit with an area of 381.14 ha
- b. El Cove circuit with an area of 92.56 ha
- c. San Luis with an area of 80.36 ha

In table 5 and 6 is presented both the water distribution arrangements since 2005 until 2019, and the water distribution and frequency goals signed in 2019.

Table 5 *Water supply continuity and frequency 2005-2019 (CDM Smith - INGESAM, 2016)*

Water supply continuity and frequency		
Circuit	Goal	Current
Urban area		
Hotels	24 hr	24 hr
Sarie Bay	24 hr	24 hr
Residential	24 hr	6 hr
Almendros (includes Obrero and Gaviotas neighborhood)	1 time/week	2 times / week
Natania	1 time / week	1 time/week
Rural Area		
Loma (20 subsectors)	1 time/20 days	1 time/20 days
Cove	2 times/week	1 time/week
San Luis	24 hr	24 hr

Table 6 *Current water distribution and frequency goals established in Amendment Nine, 2019*

	2019-2020	2021-2025	2026-2029	2030-2035
Hotels	24 hrs	24 hrs	24 hrs	24 hrs
Sarie Bay	24 hrs	24 hrs	24 hrs	24 hrs
Residential	8h/day	12h/day	24 hrs	24 hrs
Almendros	2 times/week (8 hrs)	2 times/week (8 hrs)	8h/day	8h/day
Natania	1 times/week (8 hrs)	2 times/week (8 hrs)	8h/day	8h/day
San Luis*	24 hrs	24 hrs	24 hrs	24 hrs
Cove*	24 hrs	24 hrs	24 hrs	24 hrs
La Loma	1 time /week (8 horas)	2 times/week (8 hrs)	8h/day	12h/day

* Constrained to the availability of the softening plant of a minimum water extraction of 10 L/s for these sectors

Unaccounted-for water losses in the current water system

In 2016, the water network length was estimated at 108.4 km, which includes distribution networks and pipes. Approximately 44% is concentrated in the urban area and 56% in rural areas. Unaccounted-for water losses are one of the most relevant problems in water management on the island. The diagnostic of the water master plan in 2016 stated that the company had significant unaccounted-water losses (69.59%) due to water leaks on the water network. The urban area with 55.86% and rural area with 69% of unaccounted-for water losses (CDM Smith - INGESAM, 2016). The distribution network presents sections in poor conditions that require 66 km of renovation, 33.8 km in rural areas, and 32.3 km in urban areas were identified (CDM Smith - INGESAM, 2016).

Aqueduct coverage

The aqueduct coverage on the island varies in different studies and reports. In 2016 the National Population and Housing Census DANE indicate that the aqueduct coverage was 37.7%. In 2018 the aqueduct coverage was reported as 30.74%, and in 2016 the Water Master Plan (CDM Smith - INGESAM, 2016) reported 50% aqueduct coverage; in 2019 the water agreement amendment number 9 reported 60%. Overall, there is a low aqueduct coverage, and it continues being a significant problem. In table 7, it can be observed the aqueduct coverage per sector and per households. In the eight water district sectors 8,231 independent housing units have aqueduct service from the total of 15,300 dwellings within the aqueduct perimeter, thus obtaining a coverage index of the aqueduct service of 54%.

Table 7 *Aqueduct coverage per sector and number of households, Bent (2019)*

Area	Water sector	Total number of households	Number of households connected to aqueduct	%
Urban	Almendros	1,379	804	58%
	Center	2,702	415	37%
	Hotels	2,130	890	42%
	Natania	1,986	1,253	63%
	Sarie Bay	1,360	338	25%
Subtotal		9,557	3,700	45%
Rural	Loma	4,457	2,615	59%
	Cove	408	213	52%
	San Luis	845	539	64%
Subtotal		5,710	3,367	58%
Total		15,267	7,660	52%

4.3.1.1 Characterization of demand and water availability

Table 8 describes the aquifers' natural supply values in normal¹ aquifer recharge conditions. However, these conditions can vary according to precipitation regimes and land use change. The values reported in the Table 8 show a natural supply of 6,780,243 m³/year. However, the authorized amount of water for exploitation is not fully extracted, a volume of 5,279,209.76 m³/year is exploited; thus, there is a water reserve of 1,501,033.67 m³/year, as shown in the Table.

¹ It refers to a climate standard conditions, in which influential factors, such as temperature, have normal values

Table 8 *Natural water supply vs water extraction, San Andrés island, Colombia; Bent, 2019*

Aquifers	Natural water supply (L/s)	Natural water supply (m³/year)	Total water extracted (m³/year)
San Andrés	40	1,261,440	432,150
San Luis	175	5,518,800	4,847,059.28
Total (m ³ /year):		6,780,243	5,279,209.76

Water demand

In 2016 the environmental corporation CORALINA authorized Veolia to exploit approximately 5,403,240 m³ (for rural and urban sectors). However, the company only could exploit 54% (2,917,749 m³). In 2016 the water demand was approximately 5,138,605 m³; consequently, there was a disequilibrium in water supply and demand (CORALINA, 2016 in Bent, 2019). Table 9 illustrates the water demand for domestic use and the tourist population, and it can be observed that the total volume of water exploited that supplies the public aqueduct network is not enough to supply the total population demand.

The Water Resources Master Plan (CDM Smith - INGESAM, 2016) stated that the private company only reaches 40% of the demand. CORALINA (2016) in Bent (2019) reported that alternative sources (e.g., family wells, rain harvesting, desalination plants) used by the community and the productive sector had compensated this deficit with a volume of 1,867,209 m³/year, this volume covers the water deficit of 1,154,048.52 m³/ year.

According to CORALINA (2019), the natural supply of both aquifers (6,780,240 m³/year) can cover the demand of the total current population (4,566,094

m³/year). However, there are some problems: the volumes of water extraction from the aqueduct system (3,412,000.48 m³/year) and the private wells (43,778.26 m³/year) are not enough to supply the demand; also, there are operational deficiencies and water leaks in the extraction and distribution system that are approximately 55% for 2019.

Table 9 *Water demand for domestic use and touristic population; prepared by the author based on Bent (2019)*

Study reference	Water exploitation by source	San Andrés inhabitants/tourists	(l/Per person/day)	Demand (m ³ /year)
PDRH,CDM Smith - INGESAM, 2016 DANE (2014)	Softening plant: 454,118.4 m ³ /year	52,733 urban residents	120	2,309,705.40
		18,572 rural residents	120	813,453.60
	Desalination plant: 1,337,126.4 m ³ /year	71,305 residents	120	3,123,159.00
		914,369 tourists	298	1,362,409.81
	Total : 1,791,244.80 m³/year			
TOTAL				4,485,569
Water resource Diagnostic CORALINA (2019)- Population projection (DANE, 2018)	Softening plant: 424,266.48 m ³ /year	73,221 residents	120	3,207,080
	Desalination: 2,987,734.00 m ³ /year	1,140,113 tourists	298	1,359,015
	Total : 3,412,000.48 m³/year			
TOTAL				4,566,049

4.3.2 The water agreement operation

Decisions over water allocation are stated in the water agreement signed with Proactiva (now Veolia) in 2005. PROACTIVA is a French company that became the

only operator on the island. Proactiva used to belong equally to Veolia and Spanish Fomento de Construcciones y Contratas (FCC) and was dedicated to environmental services to local companies and entities in Argentina, Brazil, Chile, Colombia, Ecuador, Mexico, Peru, and Venezuela. On June 10 (2013), Veolia announced the acquisition from FCC the remaining 50 percent of the company, thus Veolia became the company's entire owner (Portafolio, 2014).

Veolia is a world leader in water, sanitation, and energy, it has operations in more than 48 countries around the world and serves more than 42 million users on five continents through 220,000 employees (Portafolio, 2014).

The company works in three primary services and utility areas traditionally managed by public authorities: water management, waste management, and energy services (Lobina, 2014). It gets more than half of its revenues from managing municipal and industrial water facilities worldwide (Schneider, 2008). On its web page, the company proclaimed itself as a global leader in desalination with more than 100 years of experience implementing desalination plants. The company has various subsidiaries and associations with local enterprises related to specialized services. In the Caribbean, the standard service provided is desalination. It has a presence in U.S. Virgin Islands, Curaçao, Saint Martin, and Aruba, among others.

In Colombia, the company has been present since 2003, providing water drinking treatment and supply, aqueduct and sewerage services, and solid waste management. Its operations are carried out in different cities of Colombia, including

Boyacá, Córdoba, Valle del Cauca, Santander, Bogotá, and the island of San Andrés (Portafolio, 2018).

The history of the company on the island started with Proactiva in 2005 when a committee formed by the Superintendence of Domiciliary Public Services -SSPD, the Presidency of Colombia, the National Planning Department -DNP, the Ministry of Environment, Housing and Territorial Development, and the Government of San Andrés, determined and selected Proactiva as the contract-operator for water supply infrastructure on the island.

This type of contract is for municipalities where the population's payment capacity allows financing a significant part of the investments with fees that complement public resources. During these fifteen years (from October 3, 2005, to October 3, 2020), the contract has been modified through nine (9) amendments.

Table 10 *Summary of water agreement amendments between Aguas de San Andrés and Proactiva (Veolia) since 2007 to 2019; Aguas de San Andrés S.A.E.S.P. (2019)*

Date	Amendments	General description
April 2, 2007	1	Modification of clause 12.6. The submarine discharge outlet will start its operation not in the eighteenth (18) month but instead in the twenty-first (21) month of the company operation due to issues related to environmental permission problems.
June 28, 2007	2	The operation term of the submarine discharge outlet is extended again for the twenty-third (23) month; due to issues related to environmental permission problems.
October 2, 2007	3	Modification of clause 12.4. Contract extension term for reviewing and evaluating its goals; mainly refers to new subscribers of sewerage services.
December 7, 2007	4	Modification of clause 11.8. Concerning the expedition of residency permits for the company workers.
May 16, 2008	5	The review and evaluation of compliance with the goals of the operation contract was extended again for a term of thirty (30) days.

September 30, 2008	6	<p>The goals of the contract were adjusted. Additional public contributions were agreed to 25,000,000,000 Colombian peso (equivalent 6,839,400.00 USD)</p> <p>It was established that the costs of the home connection, and meter of estrato 1, 2 and 3 will be the responsibility of the local government or the central government.</p> <p>Modification of clauses 12.1, 12.2, 12.3 and 12.4, which are related to the provision and continuity of the aqueduct service.</p> <p>It is established that the operator will be responsible for the design and supervision of the contracted works.</p>
December 29, 2011	7	The execution period of the financial resources assigned to the operation contract by the central government was extended from 2011 to 2014.
March 8, 2014	8	<p>The revision of the contract and its amendments was considered necessary, especially what was agreed in the amendment number 6, specifically in relation with indicators of quality, coverage, and continuity.</p> <p>The parties also accepted the terms and conditions to hire a specialized consultancy to analyze the contract and contribute to future negotiations.</p>

The initial contract signed in 2005 is for a period of 15 years and could be renewed for an additional 15 years. The contract established that Proactiva has to maintain potable water availability continuously, 24 hrs a day, to all aqueduct users in the north end sector, including the center, hotels, Sarie Bay circuits, and in the San Luis sector. For the other sectors (Los Almendros, Natania, Loma, and El Cove), the contract established that the operator is required to maintain a water availability to satisfy the necessary consumption of 8m³ per month. There were no water frequency specifications established for the other sectors.

According to the Comisión de Regulación de agua Potable [Water Regulation Commission] (2001), the basic consumption is the amount of water that meets a family's essential needs; it was established as 20 m³ per month per user. However, in

2005, when the contract was signed, the consumption value that was established (8m³) was well below the one set by the Regulatory Commission (20m³), which undoubtedly generated an inequality for the recognized basic consumption in comparison with people in the rest of the country.

Amendment Six (6)

In 2008, the local government and Proactiva (Veolia) agreed to change the contract. Some of the changes related to the aqueduct and water frequency were: 1) the contract goals were adjusted, including changes on minimum production water capacity per operation year, gradual subscribers increase to reach a total of 11,200 subscribers for the year number 15, incorporation of new sewer users per year until reaching 9,305 subscribers at the end of the contract, and the reduction of the unaccounted for water losses Index (IANC) to reach a value of 37.5% in year 15 (Superintendencia Delegada para Acueducto Alcantarillado y Aseo, 2017). 2) the central and the local government will assume the costs of the aqueduct/home connection and metering connection of socioeconomic *estrato*² 1, 2, and 3. and 3) clauses 12.1, 12.2, 12.3, and 12.4 which are related to the provision and continuity of the aqueduct service were modified (see table 6).

² In Colombia there is a *estrato* system from 1 to 6 scale, with 6 being the highest. The 142 law (1994) mandates a municipality to classify its population in distinct groups or *estratos*, to established subsidies that would help those in the lower *estratos* pay for utilities.

In this amendment it was agreed that the northern area would continue having 24 hrs of water service, each subsector in La Loma and El Cove will receive water once every 20 days, and Proactiva would maintain water availability to satisfy the subsidized basic consumption of up to 8m³. Increases in water frequency would be subject to water plant production levels; in this area this would be the softening plant. Additionally, the contract does not establish goals to increase water frequency in the rural sector. According to this, Amendment Six maintained an unequal distribution of water service, and the water frequency in areas other than the north was insufficient (Ministerio de la Protección social y Ministerio de Ambiente, Vivienda y Desarrollo Territorial, 2007).

Table 11 *Water continuity index scores for the water operator service. Retrieved from Resolution 2115/2007 of the Ministerio de la Protección social y Ministerio de Ambiente, Vivienda y Desarrollo Territorial.*

Water service continuity	Score
0-10 hrs per day (insufficient)	0
10.1-18 hrs per day (no satisfactory)	10
18.1-23 hrs per day (sufficient)	15
23.1-24 hrs per day (continuous)	20

In 2014, the Superintendency of Public Services- SSPD highlighted that the aqueduct service in urban sectors is continuous but not in other residential areas and the frequency there is considered unsatisfactory (Superintendencia Delegada para Acueducto Alcantarillado y Aseo, Dirección técnica de gestión de Acueducto y Alcantarillado, 2014). According to the classification established in Resolution 2115

of 2007, Proactiva gave water less than 10 hrs every 20 days in La Loma and El Cove. The Aguas de San Andrés S.A.E.S.P. supervision report (2016) indicated that although the water company did not comply with the contractual commitments of continuity and frequency of water, this was due to the problems external to the company.

In the period from 2006 to 2014, the central government implemented Plans for Business Management in Water and Sanitation Services (PDAs). The PDA directed and promoted municipalities' investments, mainly for urban areas (Carrasco, 2016); in this way, delaying and putting the rural area at a more considerable disadvantage. The PDA was adopted in San Andrés island in 2008, widening the division between touristic/ urban zones and rural areas.

Amendment Nine (9)

In 2015, the El Niño Northern-South Oscillation (ENSO) and drought impacted the island, and on April 15, 2016 a State of Public Calamity was declared (Gobernación Departamental de San Andrés, Providencia y Santa Catalina, 2016). A few days after the declaration, the government purchased two desalination plants to expand the capacity for water production (Convenio Administrativo de Apoyo financiero No. 9677-SAP11013, 2016). One plant with 25 L/s capacity production scheduled to start its operation in 2019 and a second plant with 50 L/s capacity production that was projected to come into operation in the second half of 2020.

Since there was not enough specialized knowledge on the island about this kind of technology and these plants needed to be put into operation immediately, there was a necessity to legally transfer the desalination plants to Veolia (Proactiva); but the

Veolia-water agreement ends in October, 2020; therefore, in 2019, a new amendment was signed transferring to the company these two plants and the concession for the water supply service for an additional 15 years.

In Amendment Nine, some significant changes were made in water supply. The quantity of subsidized water delivered by the company to Cove and San Luis sectors increased from 8m³ to 10m³, including the 1, 2, and 3 socioeconomic *estrato*. In the 2019-2020 period, La Loma will be supplied one time/week (8 hrs); and by 2035 the frequency will increase to every day for 12 hrs.

Although there were significant improvements in the water supply system, this modification continues to show unequal treatment towards the Loma sector, including its 20 subsectors, in comparison with other sectors on the island, especially the north end. Since 2005, it was established that the northern part would have a guaranteed supply of drinking water 24 hrs a day, while la Loma will still not reach full water supply (24 hrs) by the 2035 horizon since it will only have a 12-hr supply per day. Also, these new arrangements for Loma sector depend on when the desalination plant operations began, and on the expansion and rehabilitation of the water distribution system.

Additionally, the resolution-CRA, 750, 2016 establishes that the basic consumption for a family is 16 m³ per month per subscriber; however, in Amendment Nine is defined 10m³ mainly to the 1, 2, and 3 socioeconomic *estrato*. The average basic water consumption for the different parts of the island was determined differently; higher water consumption was defined for the hotel and commercial sector

and the upper *estrato*. In short, there was a change on the average basic consumption from 2008 (8m³) to 2019 (10m³) resulting in an increase of 2 m³. Even though this seems to be a significant change, there are questions around the way differences in water consumption are calculated.

Table 12 *Average water consumption, Veolia. Amendment Nine (9)*

Estrato	Mean consumption
	(m³)
1	10
2	10
3	10
4	16
5	17.10
6	21.9
Industry/Hotels	21.9
Commerce	21.3
Institutional	16
Special	16

In general, the water privatization process in San Andrés established higher water prices, which the poor and Raizales could not afford it (CD Smith -INGESAM, 2016). There has been widespread resistance from residents to connect and pay for the water service (CD, Smith -INGESAM, 2016). In this vein, the subsidies created in the contract established a way to get enough financial resources to produce and distribute the water to the whole community.

The subsidies generated by taxes on the higher socioeconomic *estrato* 5 and 6, industry, and commerce, together with central and local government resources, secure the additional financial resources. However, during the operation, the company has

claimed multiple financial difficulties in providing the service (Aguas de San Andrés S.A.E.S.P., 2016). The company argued that the goals in the action plan had been changed several times by the government, undermining the company's profitability; also, the company said substantial restrictions on the exploitation of water wells reduced the availability of water resources (Aguas de San Andrés S.A.E.S.P., 2016). Since 2005, the water agreement does not specify the short, medium, and long term goals for the expansion and rehabilitation of the aqueduct network. The aqueduct subscribers' increment is circumscribed to the existing infrastructure and networks that were in place before 2005, in which the Land Use plan -POT (2003) reported less than 50% aqueduct coverage. The goals proposed in 2005 for new aqueduct subscribers have not been met and have been progressively adjusted. Currently, there are multiple technical problems in the water supply system, such as the discontinuity of the aqueduct service due to operational conditions, low aqueduct coverage, and the high rates of water losses. After 15 years of operation, 3.71 km of the aqueduct network and 14.53 km of sewage have been expanded; this evidenced the priority of sewerage over the water supply management. Until 2017, after the crisis, the rehabilitation of 26.1 km of the aqueduct network has been proposed.

4.4 Drought, the Niño phenomenon, and climate change

According to reports from the Universidad Nacional de Colombia [National University of Colombia], (2010), the archipelago has an annual rate of precipitation of 1900 mm, which is distributed irregularly in two seasons: a dry season with 168 mm,

and a wet season with 1509 mm. A wide range of opinions exists about the characteristics of the dry season (which is in the first half of the year). Scientists do not agree about how to designate the dry season on the island (Parsons, 1985; UNAL, 2010; Rojas and Guerrero, 2014), so the range is estimated between 3 and 6 months, and the quantity of precipitation is between 50 mm and 168 mm during this period. Historically, these dry seasons have been reported to turn into droughts, but only a few scientists have confirmed the reality of these reports. According to some historians (Parsons, 1956; 1964; 1985; Barriga et al., 1985), there has been multiple historical episodes of “drought” in the archipelago of San Andrés, Providencia, and Santa Catalina in the twentieth century. According these accounts, drought occurred between 1928 and 1930 with 500 mm total rainfall, causing the decline of coconut production; according to Parsons (1956), “drought was sufficiently severe to linger in the memories of the inhabitants (p3).” Another drought occurred between 1958 and 1959 (1958 with 558 mm total rainfall and 1959 with 1068 mm total rainfall) which affected tourism and commercial activities (Parsons, 1956; 1964; 1985; Barriga et al., 1985). Barriga et al. (1985) reported that the season from 1959 to 1967 the island had in February, March, April, and May a monthly average rainfall below 100 mm. According to Asprey and Robbins (1953), a drought occurred in these months, and vegetation was affected harmfully. The study emphasizes the importance of the number of months in the year in which excessive evaporation leads to drought; for the Caribbean area, this point is reached with a monthly rainfall below 100 mm.

Furthermore, the Institute of Hydrology, Meteorology, and Environmental Studies IDEAM in 2006, reported extreme drought events in 1971-1972, 1982-1984, and 1997-1998, a moderate drought in 1974-1975 and 1993-1995, and a *ligera* (mild) drought in 1989-1990 that affected the entire archipelago (IDEAM, 2006).

In a later study, the IDEAM (2018) indicates that the archipelago has been classified as a “*natural water deficit area*.” IDEAM (2018) reported that in San Andrés there has been five droughts: 1988, 1991 to 1992, 1997, 2009, and 2015. Additionally, Guerrero, (2020) stated that the island has suffered precipitation below average in 1965, 1971, 1976-1977, and 1983. The 2015 and 2016 Niño phenomenon has been recognized as one of the strongest and long-lasting phenomena that triggered droughts in San Andrés history, having rainfall measuring approximately less than 1300 mm in 2015 and 1620 mm in 2016 (DNP, 2018).

San Andrés island has an office of risk management in place. However, the El Niño phenomenon and drought as a hazard appear to be of low priority. In the risk management plan, drought was not included sufficiently, and there is not a management protocol in place.

Drought and Niño Phenomenon impacts have rarely been documented on the island. Pathumchai, Honda, and Nualchawee (2001) attribute this problem to the fact that drought as a natural hazard is often underestimated for two reasons: droughts have a slow onset rate and little visual impact. However, the long-term consequences may be widespread and very devastating.

There are no local studies about a drought in San Andrés island, although a dry and wet season have been identified. The wettest month is October, with an average of 338 mm of precipitation and the driest month is March with an average of 22 mm of precipitation (UNAL, 2010). Normally there is a dry and a wet season; however, there can be a year with two dry seasons (lower than average total rainfall across all seasons) (Gamble and Curtis, 2008).

The intensity and territorial extension of the drought are closely linked to the appearance of the El Niño phenomenon, given that the years with the highest incidence are those in which the drought phenomenon occurs. According to Peters (2015), there is a secure connection between ENSO and intense drought in Central America and various parts of South America.

The El Niño Southern Oscillation phenomenon, is a phenomenon of climatic variability, which manifests with abnormal weather behavior. It is related to abnormal temperature changes on the surface of the central Pacific. One of the most evident and vital indicators is the increase in sea surface temperature in the central or eastern part of the equatorial Pacific (UNGRD, 2016).

In San Andrés island, the dynamic conditions of El Niño cause significant changes in the amount of precipitation (e.g., 1991-1992, 1997-1998 and 2015-2016). El Niño strongly influences the annual cycle of precipitation, with notable differences that directly affect the aquifer's recharge. In general, on the island, there is a precipitation reduction of approximately 50 mm from an average normal year (UNAL,

2010); this decrease may increase the occurrence or severity of drought throughout the island.

4.4.1 El Niño phenomenon 2015-2016 and climate change

The most recent El Niño registered by global meteorological entities occurred between October, 2014 and June, 2016. In October, 2014, a temperature increase began in the Pacific, and El Niño conditions were evident (Melo et al., 2017)). After that, in March, 2015, El Niño was declared at a weak level by the National Oceanic and Atmospheric Administration of the United States (NOAA) and IDEAM. In August, 2015, El Niño was declared at a moderate level, and by October 2, El Niño was declared at a severe level. Finally, on July 13, 2016, IDEAM reported the end of the El Niño phenomenon and registered neutral conditions (UNGRD, 2016).

During this Niño period, socio-economic and environmental damages occurred in 28 of the 32 departments of Colombia. The national reports account for 6,388 fires affecting 238,518 hectares of vegetation and 237 municipalities with insufficient drinking water (Melo et al., 2017). According to the report, rural areas were the most impacted because they have little aqueduct coverage and use artisanal water supply systems or community systems. On San Andrés island, there was a deficit of precipitation of 30 to 50%; and 2015 was identified as the year with the second-lowest record of rainfall (1250 mm / year) in 55 years (1964-2016). All agriculture sectors were affected, there were water supply problems, and the aquifers were below its water table levels.

The 2015-2016 Niño phenomenon evidenced a reactive approach by national organizations that only focused on the emergency response (DNP, 2018). The main challenges found were: (1) difficulties in identifying the risk conditions of the territories and in timely communication in the face of the El Niño phenomenon, (2) the vulnerability of the territories and the sectors in the face of the occurrence of this type of phenomenon, (3) nonsystematic monitoring of preparedness and response actions and (4) insufficient evaluation studies regarding institutional action and the effects and impacts of the phenomenon (DNP, 2018).

There is a close relationship between climate change and the Niño phenomenon. Precipitation in the department is influenced by the El Niño and La Niña phenomenon, among others. Climate change occurs in decades or centuries, while climatic variability occurs in periods of years. The regions where an increase in temperature and decreases in precipitation is expected as a result of climate change will experience a more significant impact over the years in which the El Niño phenomenon occurs.

San Andrés island is expected to have a gradual increase in temperature and decreases in precipitation in the next 80 years. A temperature increase of + 0.81C is expected from 2011-2040, + 0.1.44 C (2041-2070), and + 2.01C (2071-2100) along with precipitation reduction of -30.20% (2011-2040), - 32.78% (2041-2070) and - 33.01% (2071 -2100) (IDEAM, PNUD, MADS, DNP, CANCELLERÍA, 2017).

According to the study by Melo et al., (2017), the island needs to take necessary measures to adapt to climate change, manage drought risks, and be attentive

to climate variability impacts. San Andrés has a governmental body, the departmental Council for Risk Management which, enacted the Departmental Risk Management Plan (2013) and, in 2014, enacted the Local Adaptation to Climate Change Plan. However, the island does not have any specific plan for drought and the Niño phenomenon.

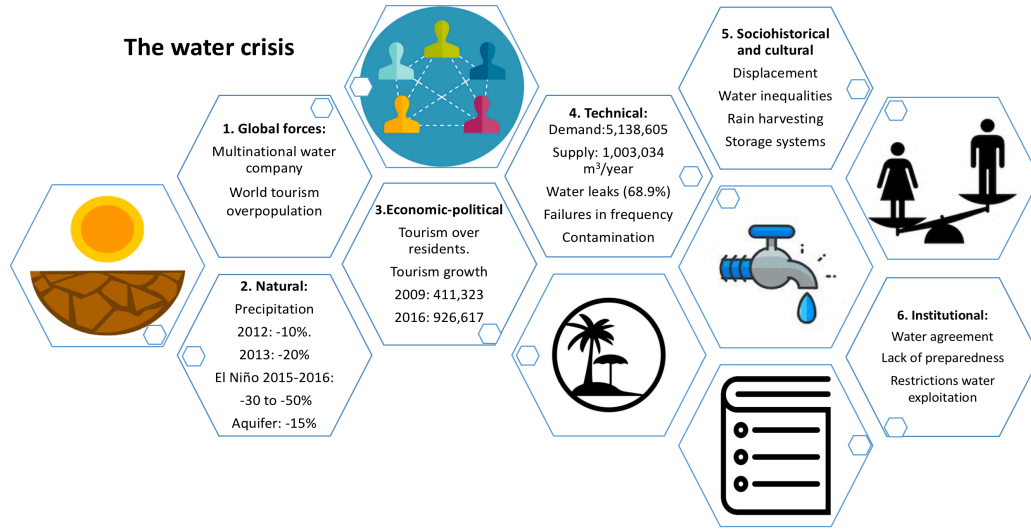
4.5 The Water Crisis

In 2016 the water crisis peaked, affecting more than 14,000 people; however, it did not happen in a specific year and did not end in 2017 despite what official reports indicated (Gobernación departamental de San Andrés, Providencia y Santa Catalina, 2017). The nature and the scope of the crisis are difficult to detect and define. It was a social process that involved multiple dimensions, including global forces, economic, political, technical, natural, socio-historical, cultural, and institutional aspects. In this vein, to present a more comprehensive picture of the water crisis, instead of focusing on a single factor, multiple dimensions are presented. Besides, neglecting the holistic nature of the crisis might be a reason for its recurrence. Figure 6 summarizes the multiple dimensions that play a significant role in the water crisis configuration on the island that have been described in different places through this chapter.

- Global forces: uncontrolled tourism growth and water privatization with high water costs and loss of community participation that have created risky conditions, mainly for Raizales and poor neighborhoods

- Economic-political: historical prioritization by the central and local government of the tourism industry over resident's welfare
- Technical: low water coverage, water leaks and continuous technical problems in the water supply service
- Natural: the occurrence of the Niño phenomenon and drought causing an important reduction of precipitation and the lowering of the aquifers' water tables
- Socio historical and cultural: since the 1950s Raizales has been displaced to rural areas where the development of the aqueduct system has been precarious, there have been inequalities in water distribution and a loss of traditional rain harvesting methods.
- Institutional: the island's institutions were not prepared to face the El Niño phenomenon; and the water agreement clauses prioritized tourism over the residential sector in water allocation.

Figure 6 *Summary of the San Andrés island water crisis dimensions*



In 2014 the Colombian Institute of Hydrology, Meteorology, and Environmental Studies –IDEAM made a national call to use water rationally because there was a risk that the Niño phenomenon would impact Colombia, and it would affect precipitation and thereby the replenishment of the water supply sources. The environmental corporation in San Andrés, CORALINA, the maximum environmental authority, initiated a diagnostic examining possible changes in aquifer hydrology (Rojas & Guerrero, 2014). They found that there was a tendency towards increase in the electrical conductivity (suggesting increase in salt content) in multiple wells in both aquifers, San Andrés and San Luis. Therefore, they mandated suspending the operation in some wells and for others, restricting the pumping time (Rojas & Guerrero, 2014).

They also found that in 2013 the precipitation was 1,565 mm less than the normal (1,922mm), which shows a reduction of 17% precipitation with respect to the annual average (Rojas & Guerrero, 2014). CORALINA inferred that the aquifer's

recharge in 2013 was lower than the mean value; that means that the aquifer began the usual dry period of 2014 and received the impact of the Niño phenomena (CORALINA-INVEMAR, 2014) with already lower water tables, making the impact of water supply more severe.

Moreover, CORALINA found reductions of 30% precipitation in 2013 and 49% in 2014 during the dry periods, providing warning signs of the initiation of possible drought (CORALINA, 2014). At this moment of high uncertainty about precipitation behavior on the island there was a lack of a warning system for progressive precipitation reduction.

Meanwhile, in June 2014, the IDEAM confirmed, with a 75% probability, that in the second half of the year, El Niño will begin. On August 11, 2014, through resolution 693, CORALINA activated a preventive alarm implementing stricter control measures to exploit the water on the island. These restrictions would remain in force until IDEAM officially indicated that the effects of the El Niño phenomenon have ceased, and the aquifers recovered their normal conditions.

In October 2015, the IDEAM declared that the El Niño phenomenon had reached severe conditions, and later, on July 13, 2016, reported that current El Niño phenomenon had ended. The National Unit of Risk Management –UNDGR in 2016 reported a deficit of 47.9 mm of precipitation during the El Niño. There was a reduction of precipitation of 35% having 1250 mm/year less than the normal (1922 mm/year), that means that there was also a reduction of the aquifer recharge of approximately of 15% having 4,909,839 m³/year from an average or normal year of

13,085,028 m³/year (Guerrero, 2020). There was an extended dry season in which the most affected months were February (19 mm), March (24 mm), April (27 mm), May (75 mm), and June (75 mm) (Guerrero, 2020).

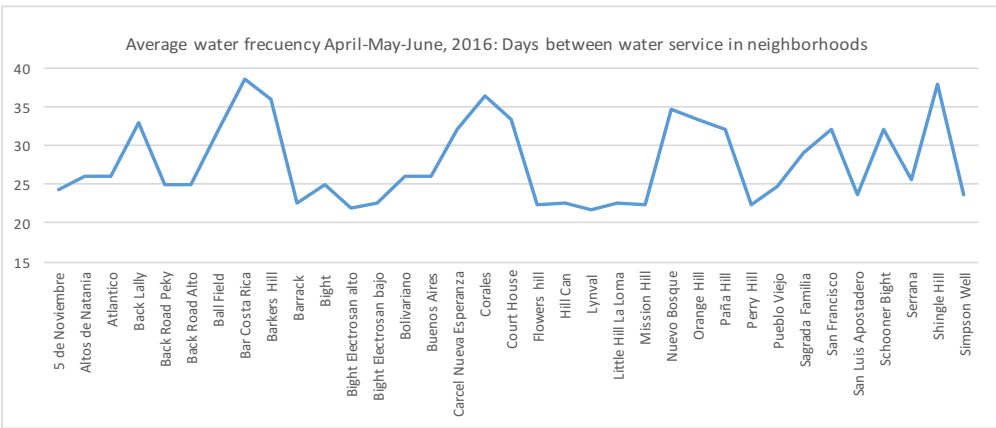
According to this information, the reduction of precipitation in San Andrés did not start in 2016; it may have begun in 2013 and not shown its impact until 2016 (Velasquez, 2015). In short, the climatic variation the El Niño phenomenon reduced the monthly precipitation in 2015 and affect the 2016 water supply system.

This scenario affected the amount of water extracted by the private water company. For instance, in 2014, water production values were higher than 58 L/s, but in 2016, mean values of 54 L/s were reported. Especially in the softening plant, the monthly production values changed from 16 to 15 L/s to 9 L/s in 2016 (CDM Smith-INGESAM, 2016). Overall, there was a change in the amount of water supply offered by the private water company in 2014 (1,071,731 m³), 2015 (1,038,080 m³), and 2016 (1,003,034 m³) (Guerrero, 2020). Considering that the demand for residents and the temporary tourist population was 5,138,605 m³/year, there was a disequilibrium between water supply and demand in 2016.

Technical issues in water production and distribution by the company also play an essential role as contributors to the crisis. Both water treatment plants, desalination, and softening plant, have significant water losses. For instance, in the urban area, the desalination plant rejects 46% of high salted water from the total extracted (Guerrero, 2020), and in the distribution systems, there is a 55.86 % in water leaks. In the rural area, water leaks were 69% (CDM Smith - INGESAM, 2016).

In addition, from April 1 to June 30 (91 days), 2016, there were essential changes in water frequency in some neighborhoods. The following graph shows the mean value of the water frequency (days between water service) in neighborhoods and subsectors. All three months, especially June, shows failures to comply with the water frequency established in the water agreement, which mandates water service every 20 days. For instance, in April, the Sagrada Familia neighborhood received water every 41 days, Barkers Hill every 46 days, and Courthouse every 45 days (Aguas de San Andrés S.A. E.S.P, 2016). The mean frequency days went from every 23 days to every 38 days' water service. During the first half of 2016, the private water company limited the water supply to some areas, and some neighborhoods were two months without water.

Figure 7 *Average water frequency April, May, June, 2016: Days between service in neighborhoods. Adapted from Aguas de San Andrés (2016).*



Another crucial factor in the crisis configuration is tourism. There was a sustained growth of the tourism industry on the island; consequently, there was an increment of the water demand. The following graph shows the tourism growth since

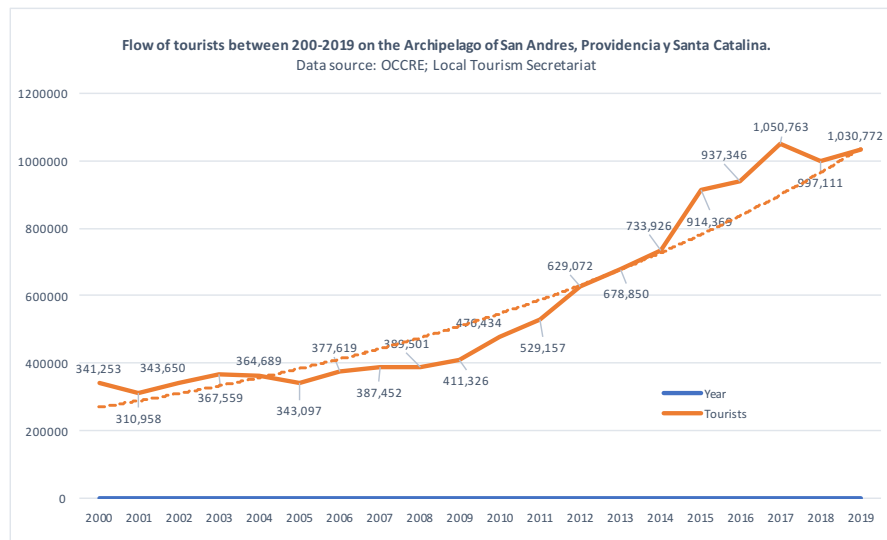
2009, with 411,323 tourists having a growth peak in 2017 with 1,050,763.

Specifically, in 2015 there were 914,369 tourists, and in 2016 there were 926,617.

Tourism is a water-intensive industry, and any water supply reduction can severely affect both tourists and locals.

Additionally, the highest use of water in tourism is during the dry season when water production from groundwater sources is at their lowest (Peters, 2015). Tourism can be affected by the absence of water, but it can also create water scarcity conditions (Gössling, 2001). In this way, islanders in 2016 became more prone to face and more fragile in coping with the el Niño phenomenon and its consequent drought.

Figure 8 *Flow of tourists between 2000-2019 on the archipelago of San Andrés, Providencia y Santa Catalina. Data source: Control, Circulation, and Residency Office – OCCRE and Tourism Secretariat*



On April 2, 2016, a group of people who live in Lynval-Cove neighborhood put up barricades, burned tires, shouted, and put up notices saying, “We need water.” That was the first social road protest for the lack of water on the island. Up to that point in time, water scarcity had never before triggered a social mobilization in San

Andrés. Subsequently, ten additional road protests spread throughout the south-center and hilly part of the island, where most Raizales live and where there are some poor neighborhoods. The last protest occurred on June 10, 2016. As a result, negotiations and agreements took place between each neighborhood and the local government. The areas affected include at one side, mainly Raizal neighborhoods such as Barkers Hill, Courthouse, Cove, Loma-Lynval, Loma Barack, Flowers Hill, Orange Hill, Elsy Bar, South End (Hoyo Soplador), San Luis (Tom Hooker and Four Corner) and Schooner Bight. On the other side, mainly non-Raizal neighborhoods such as Corales, Sagrada Familia, Atlántico, Natania, School House, Las Palmas, Buenos Aires, Vista Hermosa, and Tablitas. Some schools also reported being affected, such as First Baptist School, Brooks Hill, Phillip Beckman, and El Rancho.

Thus far, the crisis has affected 14,000 people (Gobernación departamental de San Andrés, Providencia y Santa Catalina, 2016).

Figure 9 *Road protest in La Loma, Source: Saas, 2016; El Tiempo (2016)*



On April 15, 2016, the first water crisis in the history of the island was officially declared. The local government, supported by the central government, declared a State of Public Calamity in the archipelago, attributing the cause of the lack of water to the El Niño phenomenon. They explained that this phenomenon had adversely affected the population, which does not have sufficient water resources to meet the demand of the inhabitants and tourists, and this, in turn, led to a water shortage, generating social protests (Decree No. 170, 2016). This declaration allows the local government to use its quick response funds to mitigate the effects of the drought/the El Niño phenomenon and directs financial resources to get the necessary assistance to people affected.

The immediate response was coordinated by the central and local government. In 2016, more than 8,666,660 liters of water were distributed, and in 2017, more than 285,075 liters were distributed. Currently (2020), the government is implementing a long-term solution involving the purchase and operation of two desalination plants, the improvement of the water supply system, improvement of firefighters' equipment and procedures to deal with the distribution of water, and the implementation of controls on hotels with high rates of water consumption. In April 2017, the public calamity continued to be in force, and more neighborhoods, high schools, and the hospital were integrated into the affected areas. On March 17 and March 30, 2017, there were two new protests for water in La Loma and Atlantico neighborhoods. However, public officials questioned why protests continued (Velásquez, 2018); generally, they believed they are doing the best they can (Velásquez, 2020).

Figure 10 *Road protest in La Loma and Atlántico neighborhood. Source: R-Youth, (2017)*



In March 2018, there were two new protests for water in La Loma and Brooks Hill neighborhoods, and more than 200,000 liters of water were distributed.

Figure 11 *Road protest in Loma neighborhood in April, 2018. Source: Salcedo, 2018*



In April, June, and July 2019, there were multiple protests in Flowers Hill, Atlántico, Barkers Hill, and Schooner Bight neighborhoods.

Figure 12 Road protest in Flowers Hill Neighborhood in April, 2019. Source: *Gobernación de San Andrés, Providencia y Santa Catalina (2019)*



In April 2020, during the Covid-19 world crisis, there was one protest for the lack of water in Nueva guinea neighborhood.

Figure 13 Road protest in Nueva Guinea Neighborhood in March, 2020. Source: *Noticiero popular de las islas*



Every year after 2016, there have been at least two protests for the lack of water in San Andrés during the first four months of the year. In this sense, the water crisis stops being a static and extraordinary event to become a cyclical and ongoing situation where people suffer for the lack of water, make protests, and the government

responds by distributing water via trucking every year. The return to normality was declared on August 14, 2017 (Gobernación Archipiélago de San Andrés, Providencia y Santa Catalina, 2017). Officially the State of Public Calamity lasted one year and four months. However, people are still having the same water difficulties.

Taking into account the Action Plan Report of the State of Public Calamity (Gobernación de San Andrés, Providencia y Santa Catalina, 2016), the institutional response consisted of (1) immediate response: the distribution of more than 18 million liters of water valued at 200 million Colombian pesos (equivalent 62,473 USD), the acquisition of a new water truck for firefighters exclusively to distribute water, rehabilitation of some household water storage systems, and installation of three 5000 liter capacity tanks. (2) In the short term, buying a desalination plant of 25 L/s capacity to be installed in November, 2016 (but it was installed in December 2018 but it is not operating as of August, 2020). (3) A medium-term and long-term solution by buying another desalination plant of 50 L/s capacity that was to be installed by November 2017 (but has not yet been installed), and (4) the development of educational activities for rational water use.

Complementary to this recount of facts, Velásquez (2015) studied the water access perceptions on San Andrés, indicating that there are complex challenges to overcome in the El Niño phenomenon and drought planning when different stakeholders attribute the cause of the hazard to different processes and sources. Velásquez (2015) claims that the risk to people who live on the island is a consequence of the current limited availability of water – or drought – as well as the

social factors that lead to differential vulnerability (Wisner et al., 2006). Overall, her study found the relationship between water crisis and water justice issues; two factors were identified as necessary to investigate inequality in water distribution: procedural and distributive justice.

James and Barrios (2020), in their study about tourism water-use on the island, identify the conflict over water resources between residents and the tourism sector. This conflict is motivated by inequality in water service provision (Velásquez, 2018; Khan, 2019). Hotels are provided with water more regularly than islanders. Another issue found is that *posadas nativas* (native's inn-like bed and breakfast) are becoming important part of the tourist economy in which residential houses located in the rural area are being converted to a tourist accommodation. James and Barrios (2020) indicate that a change in water use is taking place; some *posadas nativas* closed their cisterns as they preferred piped water over rainwater, resulting an increase of water demand, especially, for the softening plant which supplies water to the rural area.

The study done by Guerrero (2020) argues that the crisis was a sum of factors, including the climatic variation of the El Niño phenomenon that affects aquifer recharge and rainwater availability. Also, the author claims that tourism is exacerbating local water problems during the dry periods, and that there is a disparity in water consumption between locals and tourists, in which tourists consumed more water than the locals. Moreover, there are technical deficiencies in water production and distribution in which the private company has low aqueduct coverage and

significant water losses. Guerrero (2020) claims that desalination is the best solution to solve the crisis.

Sociohistorical construction of the crisis, justice issues, and crisis response were variables not discussed or taking into account in these studies. Overall, the water crisis causes and impacts on the island are not well documented. Studies tend to focus on technical problems and solutions and how societies should use and manage their water resources, but leave aside studying the social roots of the problem. There is gap about how institutions and their experts have constructed the water crisis. Understand the water crisis requires science-society co-production and that co-production is what legitimizes the possibility of an appropriate response to the crisis and a change the current situation.

Chapter 5

LOCAL VOICES CONSTRUCTING THE WATER CRISIS

The first step in crisis management is to identify what happened and why, a process that does not depend solely on the organization's performance. Crises have been managed in a simplified way by assigning a linear-cause-and-effect relationship, emphasizing organizational strategies, and prioritizing crisis managers as the main actors (Spector, 2019). Studies on water-related crises have focused on the technical and engineering aspects of the problem, and community voice and knowledge in the decision-making process have been typically neglected. People affected have been treated as merely passive and not as actors contributing to solving the crisis. These actors, who are not part of institutions and have been categorized as neither experts nor scientists, actively make sense of crises revealing social aspects that are usually invisible to crisis managers (Pergel and Psychogios, 2013). These actors usually uncover underlying vulnerabilities in the sector's policy at stake, for instance, in the water sector. Also, their participation can cast doubt on institutions' capability to prevent and respond adequately to the crisis (Boin and 't Hart, 2000; Boin, McConnell, and 't Hart, 2008). However, they are frequently excluded from the crisis understanding process, in part, because they are viewed as a rather homogenous

receptive group and hardly seen as actively interpretative actors in crisis response situations (Wisner et al. 2006).

The process of making sense is carried out by all stakeholders at different scales and in different spheres; it is a process that has been defined as the attempt to make sense of an ambiguous, complex, and highly uncertain situation in order to make decisions and act (Maitlis and Sonenshein, 2010; Maitlis and Christianson, 2014). Weick et al., (2005) argue that making sense is a process that allows individuals to know how to react and possibly find different solutions to handle the situation. The purpose of making sense is not to predict, but more to guide the post-crisis activities efforts; questions like, “what is happening out there?” “why is it happening?” or “what does it mean?” are frequently addressed through a making sense process (Weick et al., 2005). In this vein, the goal should not be to prioritize one group over another but instead, give a platform to all.

Currently, there are few studies on crisis research that listen to both organizational leaders and people affected in order to capture a complete picture of the crisis. For this reason, this chapter goes beyond the organization-centered perspective and present multiple interpretations of the crisis. It recognizes that people do not always agree on whether a crisis exists or what are the causes and consequences. Multiple types of crises can occur as well as multiple perspectives exist; according to Pergel and Psychogios (2013) “considering each type crisis in itself and interconnected with all the others, constitutes the bases for what it has been argued to

be the systemic view of crisis as well as an integrated crisis management approach (184).”

In this study, a basic premise is that the construction of the crisis is meaningful if it recognizes cultural conditions and respects and includes the diverse views, even when contrary to dominant or alternative perspectives. However, it is known that establishing a collective understanding of a dynamic situation may become problematic when more actors and more institutions are included (Boin & Renaud, 2013). The problem in crisis management is how stakeholders make sense of the crisis, promptly addressing the knowledge, needs, and concerns of people affected to respond appropriately to the crisis.

Considering the research question, the analysis in this chapter centers on making sense of the water crisis. Results are presented from two broad participants groups: Public and private officials, and residents (Raizales and non-Raizales). Results were grouped into three themes: the crisis causes and characteristics, crisis experience, and effects.

The first part of the chapter, “a natural water crisis,” describes the official narrative in which the majority emphasize classic natural hazard types like drought as the leading cause. The second part includes the people affected voices, in which the majority frames the crisis as a long-lasting problem related to tourism activity, where social issues like justice were predominantly named. Residents explained how, in their view, the cause of the crisis was more social than natural. Ultimately, it hopes that this chapter gives insights into the crisis’s configuration in past, present, and future crises.

5.1 A natural water crisis

5.1.1 Understanding the water crisis

Considering Williams et al. (2017) and Roux-Duford, (2016) studies, this research argues that the water crisis was perceived by the public and private officials as an “event” and not as a “process.” The crisis could not be anticipated, and it was considered unimaginable, unscheduled, and unexpected (Williams et al., 2017). A recurrent insight among public officials was that they “have never [previously] seen a protest or fights due to lack of water on the island.” The Colombian Civil Defense (San Andrés branch) director explained that “this was my first experience, and, although there are prospective plans for the El Niño and La Niña phenomena, I never expected that San Andrés could experience that problem.” As well, the risk management office coordinator said that “we were not prepared,” and “this crisis took us by surprise [2016].” Moreover, he added, “this was all new; we had some response protocols for being prepared and respond, but for hurricanes.” These statements suggest a view of drought as deviant, behaving outside normal patterns, making it unpredictable and difficult to manage (Scheba and Scheba, 2018). There was an externalized representation of drought in which there was no social influence and responsibility in its configuration (Scheba and Scheba, 2018).

The government secretary explained that “we did not have an emergency response protocol in place because this never happened before.” In the same vein, the personnel in charge of the risk management project in the environmental authority,

CORALINA, explicated that they also did not have a drought or El Niño phenomenon response plan because “we did not inform ourselves beforehand that a drought could happen in the island.”

However, the environmental management coordinator in CORALINA, claimed that CORALINA foresaw the drought and they reported what was happening but the local government no paid attention. He said that “alerts came early, the guidelines were clear, but the local government and the community did not implement them.” He highlighted that “last year [2015], and at the beginning of this year [2016], we have experienced the most severe drought of the last twenty years.” He said,

We [CORALINA] recommended eight months before this phenomenon happened that both hotels and residents should adopt water-saving practices. Also, we began strict controls on the volume of water extracted from wells; two months before the state of emergency we [CORALINA], issued the first warning call reporting the problems in wells’ conductivity levels [2016].

Overall, the crisis was perceived by public officials as isolated in space and in time. Linearly and straightforwardly, the San Andrés representative to the Colombian Congress explained, “the rains decreased, and then there was a crisis on the island”; likewise, the government secretariat said, “the crisis will last until the rains come back or until the desalination plants will be installed; for now, we are delivering water trucking to the community.”

In conjunction with public officials, personnel from Veolia expanded that “the water system supply has not changed; what has changed is the rainfall, so the problem arose due to the lack of precipitation.” In other words, according to officials, the start

of the wet season delimits the crisis, and solutions will be directed to specific seasonal times (Velásquez, 2018). There were no mentions about socio-historical roots causes and few connections with other sectors such as tourism. Moreover, it appears that officials have not recognized the regional nature of both the drought and El Niño phenomenon.

Public and private officials perceived that the crisis was a local condition, confined to local problems that required outside assistance. The government secretary indicated “this was a local issue requiring consultation with the central government.” He explained, “we asked them [UNGRD], what we should do with this crisis? Later, we received the support of the central government for the Declaration of Public Calamity [2016].” These quotes also suggest that there is a dependency of San Andrés on the central government to manage crisis situations.

The crisis was considered by most to be a serious and decisive situation that endangered the community. The crisis was characterized by conflicts, violence, misunderstandings, and negotiations between the local government and residents, in which it was necessary to act immediately. Throughout the interviews, the majority of officials mention that the crisis was violent and demanded hard work. A firefighter who had to distribute water said, “it was a marathon task; we only could sleep three hours a day.”

To illustrate the severity of the crisis, officials repeatedly referred to “conflicts” and “aggression” aimed to the government, the police, and the private water company (Velásquez, 2018). They indicate that the first big alarm of the crisis

was the multiple community protests in which people put up barricades and burned tires. Some of the protests involved elements of violence, for instance, officials named Barkers Hill, Sagrada Familia, and Atlántico neighborhoods. The firefighter in chief explained that,

There were parts where stones were thrown at the water trucks. In the Botton House sector in El Cove, they attacked the driver; they wanted to ‘kidnap’ the vehicles. In Barkers Hill, people threatened us, they said they are going to cut our hoses, and they were going to attack the firefighters and damage the trucks. On several occasions, we had to run, we had to turn on the water trucks and leave; the situation became risky.

The government representative expressed that “the water crisis became a matter of public order,” and the police needed to intervene. Both institutions, the police, and the government created “negotiation tables” in each neighborhood, trying to resolve conflict and end the protest. They explained that this process was challenging, and when they thought one protest was going to end, a new one cropped up in another neighborhood. Multiple protests for the lack of water have continued to occur from 2016 to 2020. In 2016, there were 11 protests; in 2017, 2018, 2019, and 2020 there have been three to four protests per year.

One of the most worrying facts during the crisis was how misinformation circulated. Conflict typically occurred in escalating levels of seriousness, and misinformation played an essential role in this process. The risk management coordinator said that “there is a rage among Raizales because Veolia is drawing water from their subsoil, and they are not being compensated.” A recurrent topic named by the officials, mainly by Veolia personnel, was that people were confused about the

water system on the island. According to them, this confusion has created tension and anger against the water company, motivating people to protest. The Veolia construction engineer said,

They do not know how the water is distributed in the island, they believe we [Veolia] take water from the aquifer and send it to the tourists, but that is not true; we send desalinized water, that is more expensive, to the touristic and commercial part of the island, and the community receives water from the aquifers, from the Duppy Gully water [softening] plant.

Moreover, the firefighter in chief explained that,

There was disinformation; people were sure that the water consumed by the hotels is from the aquifers [San Luis aquifer] located in the hills; so, people think that the water is taken from the hills and delivered to the hotels. But they [residents] do not know that the touristic area is supplied by the desalination plant.

According to the above mentioned, misunderstandings have likely contributed to the crisis evolution. There is some misinformation among residents about the water production and distribution system. This contributed to the deterioration of the situation. Also, these quotes suggest that there are differences between the type, source, and price of water provided to the tourist and to the residents.

5.1.2 Multiple causes of the water crisis

The crisis is the combination of many factors and there comes a time when it explodes [environmental corporation water project coordinator, 2018].” Public officials point out multiple aspects; however, the majority emphasize classic natural hazard types like drought as the primary cause of the water crisis. Table shows a

tendency to explain “Drought/the Niño phenomenon and climate change” as the main crisis cause

Table 13 *Cause mentioned by participant*

	Niño, drought and CC	Loss of cultural practices	Corruption, negligence	Tourism High demand	Over-population	No storage and wells	Protests	Low aqueduct coverage
Congress representative								
Risk Office								
Fire fighters								
Public services								
Water Company: Veolia								
Water truck companies								
Environmental authority								
Civil Defense								

Note: Gray squares indicate that within the participants answers they mention this aspect; the white squares indicate that they did not mention the aspect.

In this sense, findings of the present study showed that the 2016 water crisis was framed by the public and private voices as a problem triggered mainly by natural factors. In short, officials perceive the Niño phenomenon and the drought as the primary trigger and the protests as the first sign or alarm of the water crisis. The following table listed multiple quotes by kind of cause mentioned.

Table 14 *Quotes by private and public officials concerning crisis causes*

Cause	Interview quote
The El Niño phenomenon and climate change	The government secretary explained, “El Niño phenomenon has been hitting the island of San Andrés since 2012.”
Drought	The Veolia construction engineer indicated that, “a drought is what happened to us during this year [2016] and last year [2015].”
The inefficiency of the private water company to produce and distribute water/ low aqueduct coverage	Colombian Civil Defense operator said, “several factors are influential such as the lack of rain and the lack of coverage of the Veolia aqueduct [2016].” The government secretary argued that, “Veolia must be more efficient, they not only have to manage the system but also make investments, the company must be more efficient or it disappears [2016].”
Mass tourism	San Andrés representative to the Colombian Congress related that, “in 2015 we reached a million visitors, which produced, together with the drought, a very serious water crisis [2016].”
Overpopulation	The public services secretary said, “the main problem is overpopulation, the water is insufficient for the number of people on the island [2016].”
Lack of technology to desalinate water	The environmental management coordinator of CORALINA said, “the main problem is the lack of technologies to make it possible to take advantage of seawater [2016].”
A weakening of cultural water storage techniques	The environmental management coordinator of CORALINA explained that, “now [2016] the houses are built without a cistern and without a well and are highly dependent on the aqueduct [2016].”
Corruption	A water truck company owner claimed that, “fifty years have passed and the government has had enough money for twenty aqueducts and sewers, and we still don't have either [2016].”

Also, participants mentioned aspects concerning inequalities in water distribution as an existing situation going on alongside the crisis, but not as one of the leading causes. The Veolia construction engineer said that,

Let's say that at that time [2016], the water distribution depended on the island's technical conditions; for example, the desalination plant can only

give water to the north, there is no way to deliver the water to the hilly area; there is no water network.

The environmental corporation water project engineer said that, “people are saying that Veolia is giving all water to the tourists; that is true. The desalination plant delivers all water to the tourists, but they also should deliver it to other areas [2018].” In same vein, the environmental corporation risk project coordinator mentioned that, “well, it seems very unfair [water distribution], but I did not know anything about the contract and how they had established the distribution of the water.”

The firefighter in chief indicated that, “Proactiva [Veolia] has a desalination plant, but what I understand is that the plant does not have water network in the entire island, only to the central, touristic parts, and San Luis sector [2016].”

Briefly, officials acknowledge water inequalities within the water supply system; however, they give technical explanations and identify misinformed residents to explain this situation. Although some officials admitted that there are water inequalities they do not equate them to water injustices.

5.1.2.1 The Niño phenomenon and climate change

On April 14, 2016, ten days after the first protest started, the government secretary called an extraordinary risk management meeting. In this meeting, the Risk Management Council discussed the emergency and the necessity of central government support. On April 15, the local government declared the State of Public

Calamity for the first time in San Andrés history, attributing the cause to the Niño phenomenon. The decree 170, 2016, states in its justifications, that

The El Niño phenomenon is adversely affecting the archipelago of San Andrés, Providencia, and Santa Catalina population; [these are] oceanic islands that do not have permanent water resources or enough natural sources for drinking water to meet the demand of the inhabitants and tourists, a situation that has led to water shortages, generating social protests.

The declaration of the State of Public Calamity legitimated the El Niño phenomenon as the leading cause and stated the necessity to produce more potable water. The declaration provided a new and up-scaled political, technical and financial support behind desalination (Scheba and Scheba, 2018), while further restricting the space for alternative solutions.

Climate change (CC) was also mentioned by public and private officials as one explanation of the crisis. The director of Veolia said, “climate change was not as evident as it is now [2018], and that is where the problems begin, and the cause of the public calamity [2018]. The risk management coordinator said, “people have not realized that climate change is real and it is here [2016].” Crises related to this global phenomenon might be considered distant and complex, in which for them preparing might be considered very complicated task because they are beyond the horizon and cannot be seen as something that can happen and manage in the present (Wachtendorf, 2015).

5.1.2.2 The drought

In more detail, public officials explained what made this year different than others, and why they did not see this crisis coming. Officials pointed out that the drought was the most severe, intense, longest, and most extensive in San Andrés history. The Colombian civil defense director said this time was different because “this drought-impacted more than a half of the island,” “it grew and expanded silently,” “the rain was very light, it did not have the duration of the strength necessary to recharge the aquifer and the household’s cisterns, allowing the people to collect enough water.”

A CORALINA water project engineer said that since 2012 San Andrés had suffered a reduction of precipitation. He highlighted that there was a discrepancy between the information given by the Institute of Hydrology, Meteorology, and Environmental Studies (IDEAM) and the state of the climate on the island. He stated that the drought did not actually start in 2016; it began in 2012, but did not show its impact until 2016. The engineer suggested that there was a problem in the warning system and in determining the precise onset of the drought, making it challenging to prepare for it and manage it correctly, which may increase with the uncertainties introduced by climate change.

The CORALINA environmental management coordinator said there was a lack of preparedness for the residents to cope with the drought. He said,

In the past, the community was better prepared to face a drought because all the houses were built with a cistern, but that is no longer the case,

now the houses are built without a cistern or a well, now they depend on aqueduct water supply service [2016].

The San Andrés representative to the Colombian Congress confirmed this statement explaining, “there is a new population in San Andrés who are 20 to 30 years old, they adapted at first, but then, they did not follow the ancient traditions of water management [done by Raizales].” Indeed, currently only 42% of households on the island collect rainwater (CD Smith-INGESAM, 2016). The CORALINA water project engineer explained,

It is different how sectors manage water [San Luis, La Loma, the center]. The most traditional areas of the island are those that best harvest rainwater [La Loma and San Luis]; on the contrary, the center harvests rainwater to a lesser extent because of urban growth and the loss of the island’s cultural tradition of building cisterns.

He suggests that the crisis began in La Loma because it is the sector that most depends on rainwater, and it stopped raining, and consequently the cisterns dried up and the Duppy Gully aqueduct (softening plant) began to decrease its reserve.

Regarding that, only 50% of the island has aqueduct service; the crisis impacted people differently according to the source of water they used. For instance, people who mainly get water from wells and rainwater run dry because of drought. That situation, according to the majority of the institutions, was unanticipated. Actually, during the interviews, it was noted that there is an unidentified water demand created by islanders who have not depended on the private water company during good rain years and had become water self-sufficient to a certain extent. The local government, responsible for providing emergency water, did not know about this

hidden demand of residents who are typically self-sufficient (Peters, 2015). Meeting household water needs and not knowing if there are enough water resources to be prepared and respond during periods of deficient rainfall or localized droughts could become a ‘mission impossible’ without this information.

Some of the personnel in water-related institutions, like Veolia and the water truck companies, talked about the impacts the companies suffered during the crisis. The Veolia personnel explained that five years ago they extracted 35 liters per second of water and currently (2016) they extracted 17 L/ second. Because of the increase in conductivity of the wells (indicating high level of salt content), and of low water tables, CORALINA restricted the water exploitation of various wells. The Duppy Gully water plant, which provides water to the rural- hilly part of the island, where the Raizales are mainly located, reduced water production dramatically. However, water exploitation in coastal wells used by the desalination plant was not restricted. Moreover, an owner of a water truck company said that “everything was chaotic, people called us constantly asking for water, but we only had a single truck and a single well, so people had to wait 20 days.” also, “we already have an obligation to several hotels, so decisions were difficult.” This suggest that the companies were also impacted by the crisis reducing their water resource availability.

5.1.2.3 Tourism

An additional aspect named by some public officials was that the drought coincided with the high season of tourism (the first half of the year), and consequently,

the water demand for tourism increased considerably. Although hotels have access to multiple water sources including wells, rainwater, desalination technology, and aqueduct, the CORALINA water project engineer explained that hotels, nevertheless, do not receive water frequently from the aqueduct, putting more pressure on their other water sources. The manager of a medium size hotel explicated “we do not have permanent water [from the aqueduct], we receive water daily but so little that you cannot fill a cistern [2018].” During the crisis, the wells in the north began to present problems with high salt content, and some were closed by the environmental authority. The manager said “definitely I had to bring water from everywhere and that’s when the aqueduct water was mixed with well water in the cistern. Thus, it was very difficult to control the water quality.” This indicates that in addition water shortages, the crisis provoked water contamination problems as well.

Considering the economic stability of the island, the government secretary said, “we tried to keep tourism away from the problem.” Indeed, it seems that the big hotels did not suffer from water scarcity or contamination, and a maintenance manager of a big hotel said, “we are only affected [by the crisis] if the machinery [desalination plant] is damaged, and then, we can ask water truck companies to supply us water.” In fact, the number of tourist arriving to the island was not reduced (Secretaría de Turismo de San Andrés, 2020; Guerrero, 2020). The environmental corporation water project engineer said,

Everything in San Andrés has been built based on tourism. We have an unplanned tourism with insufficient aqueduct, and without analyzing the island’s natural capacity; so, decisions concerning water supply have been

made based on the tourism sector. [The engineer questioned] who has aqueduct coverage? who has bigger wells? who has sewerage? The tourism sector. Another situation is that due to tourism, the water demand also increased in the

rural area, stressing the softening plant. The engineer related, “before, tourism was concentrated only in the north, [but later on] it became like an octopus that spread throughout the island [2018].” In addition, there is also a new type of tourism, *posadas nativas* (native inns), again affecting the water resources mainly in the rural area.

The absence of water, being a necessary good for multiple uses, generates a series of demands leading to competition among sectors and individuals which becomes greater in the presence of increasing pressure factors like drought or economic interests like tourism. In times of water scarcity, hierarchizing is a common solution, and the criteria to decide who gets water first can cause additional complications. During the water crisis and historically, since 1953 tourism activity has been prioritized (Velásquez, 2020).

5.1.2.4 Failures in aqueduct service and the blame game

According to the interviews done in the present study, residents who got water from the aqueduct spent more than 47 days without water, and when they received it, it was only for less than two hours. This situation, combined with the lack of rain and the inadequacy of the private water company, creates a situation in which residents did not have access to water during almost all of this time. An owner of a water truck company criticized Veolia saying that, “the amount of water the company [Veolia] produces is insufficient, so they [Veolia] deliver water once a week to different

neighborhoods. However, the pipes have leaks or are broken, so the water does not reach the neighborhoods either; as long as there are poor networks, the water problem will not be solved [2016].” Furthermore, the government secretary indicated that, “the company was negligent. The community said they were more than 45 days without water; on the contrary, the company said that it was only 27 days, either way it was a long time without water [2016].”

Officials made special comments about who had responsibility in this situation. Noting the delay in sending water described by the government secretary, they blame the private water company (Veolia) and the agreement as one of the water problems on the island. On the contrary, relying on the contract for justification, the private water company claimed that the government was part of establishing the terms of the agreement and it was not Veolia’s fault. Boin, ‘t Hart, and Kuipers (2018) explained that officials in crisis situations may defend themselves against seeming evidence of their incompetence, and consequently “they must establish beyond doubt that they cannot be held responsible for the occurrence or escalation of a crisis (p).” In this sense, conversations with public and private officials in some cases resulted in the blame game. For instance, the government secretary and the private water company blame each other.

Ultimately, the San Andrés representative to the Colombian Congress said,

The different governors of the island [in the past] have frequently said that the water problem is [solely] a problem of Veolia [previously Proactiva], but this allows the government to evade responsibility. Furthermore, Veolia is a commercial operator and the constitutional obligation belongs to the governor, he cannot avoid that obligation. So, what the present governor [2016] did to

manage the crisis was to assume that the crisis is not a problem of Proactiva, because if they do not provide water, the problem becomes ours, because I do have the obligation to supply water to the people; so, I will demand Proactiva to supply water, because they have to participate in the solution.

5.2 A social water crisis: “Is there really a drought?”

Participants explained that they can have access to water by combining five complimentary water sources: drawing ground water from wells, rainwater, aqueduct or pipe water, bottled water, and water trucks. All participants buy bottled water and also highly dependent on the rain. Having multiple water sources could be advantageous; Wilhite (2000) mentioned that the diversification of water sources is a critical aspect in managing vulnerability to drought, as different sources may be affected differently by rainfall variability. However, according to the participants, there was a collapse in all water sources. Indeed, there are different ways to have access, but there are basically two primary water sources on the island, the rain and the groundwater, which are intrinsically related to each other.

5.2.1 Understanding the crisis

The water crisis brought out a variety of emotions as participants talked about the crisis using words such as *horrible* (horrible), *desesperación* (desperation), *burlados* (mocked) *cansados* (tired of this) *rabia* (upset), *desconfianza* (distrust), *desastroso* (devastating), and *resignados* (resignation). Some residents said, “that time we were determined to change this situation.” A woman from the Barkers Hill

neighborhood said [metaphorically] “we had to burn half of the island to be heard,” this time, “we were desperate.”

Moreover, a man from Courthouse neighborhood explained, “people here are very passive, when you see people from San Andrés [Raizales] do things like that [protests], it is because they cannot take it any longer. They protested because they may not even have water for washing underwear.”

According to the Raizales’s responses, the seeds of the water crisis have existed for several years. This attitude was reported by the risk management office coordinator who stated that,

Raizales residents of the La Loma neighborhood said they do not have an aqueduct water connection and that this has been a recurrent problem for more than twelve years and the government has never provided a solution. They also said that the water is taken from their subsoil, but they do not have access to water.

A man from Loma Barack neighborhood explicated how historical changes in water access have affected them,

Twenty years ago, families take water from certain wells; for example, Sound Bay well, a well near the Morgan cave, Cove well, Simpson well, in Davi Hill well – nearby to Vista Hermosa. Before, there were traditional wells where people got water, but now those wells are inactive. I can say that they no longer exist.

Drought was reported by some participants as one of the roots of the water problem on the island. There were few comments about the El Niño phenomenon. A pastor from Barkers Hill said “it has been three years and six months without rain, it is the most severe drought that ever happen on the island. A pastor from El Cove neighborhood said that, “there was a drought that runs longer than others that we have

had; thus, people started complaining since there was no rain and no water from the tubes [aqueduct].”

The majority of residents perceived that the water crisis was not directly related to natural causes. Some of them did not even identify the presence of drought on the island. A woman from Barkers Hill said, “what is happening here is not part of nature; instead, it is Proactiva [Veolia], they put us in drought even if they have the water.”

A recurrent comment during the interviews was, “there was no drought, you can find water on the island, the problem is that they [Veolia] do not distribute water properly.” A woman from Buenos Aires neighborhood questioned “how did they [Veolia] get water to deliver to the neighborhoods after the protests? [That means that] there was water on the island.”

Residents emphasized that there can be a “drought” caused by Veolia and not a natural one, “they [Veolia] never experience a drought, because they do not depend on rainwater.” This opinion suggests that residents resent the power they believe Veolia has over them. This also suggests how residents reduce the importance of natural causes of the water crisis.

Another view was explained by a farmer in Elsie Bar neighborhood. He made a connection between the drought and Veolia, highlighting the occurrence of drought as a result of water overexploitation. He said that,

Proactiva [Veolia] has 18 wells pumping every day; as a result, Proactiva is leaving the land [aquifer] without water. They commercialized this

water with hotels and commerce. The company is exploiting the water to give it to the hotels, that is why there is drought.

In short, residents do perceive drought as a reduction of precipitation and as an aquifer water reduction. However, the majority believe that the water crisis was created by the water company which generated drought conditions.

In line with the above, participants mentioned shortages, naming environmental, socio-economic, and institutional factors as crisis causes. Regarding environmental reasons, they talked about the increment in water demands due to increased population, deforestation (which directly affects the groundwater levels), water overuse, and water contamination.

Participants mentioned that the wetlands ecosystems are deteriorating, a man from Loma Barack neighborhood said,

Wetlands have been damaged. Many neighborhoods have been built on top of them. Some neighborhoods have one or two wetlands around them, but they do not take care of them; people treat them as garbage dumps. Every time a neighborhood is built there is one less wetland and less water.

Overpopulation was mentioned multiple times; a person from Sagrada Familia neighborhood said, “there are too many inhabitants on the island and each person uses a lot of water.”

Concerning socio-economic issues, they pointed out mass tourism and water injustices. Residents clearly said that the increase in the number of residents and tourists is putting more pressure on water resources and producing over-exploitation of water. They directly blame the private water company and the government for

supplying the water to the tourist enterprises, and not to them. Residents systematically questioned, “do you ever hear a hotel say that they do not have water?”

A woman from Buenos Aires neighborhood said, “it was the company’s fault and its poor organization. How is it possible that they put the water to a neighborhood every other day and to others every 20 days? [2016]”

Mostly all participants see the water situation as unjust, reporting unfairness in distribution, quality, stress-inducing infrequency, and price gouging. They blame the private water company for extracting water from their land and not giving it to them. Participants claimed they were treated as “second level.” An example of this is a quote from a participant who lives in La Loma sector, “The owners of the water are the black people, and [native] people from San Andrés are black; the white people who live down there (in the north and plain part) have water, and we, who live up here (the high hill parts of the island), the owners of the water, we do not have water.”

Referring to institutional shortcomings, participants referenced the lack of planning and the inadequacy of the government and the private water company to produce and distribute water resources among different sectors.

There were differences in the way Raizales and non Raizales talked about the crisis. On the one hand, Raizales experiences in the absence of water were attached to long historical processes in which government policies have marginalized them. They have been deprived of their land and water resources without any compensation. Comments were related to discrimination, as they feel they are treated less favorably in comparison to others such as the hotels. Raizales expressed a conflict with the

tourism industry and, in some cases, with the non-Raizales since “tourists and continentals [non-Raizales] have more water than we do, and the water belongs to us, not them.” Moreover, Raizales highlighted connections, more directly, between the drought and the private water company service. Raizales suggested a systemic social and water injustices, and a continuous physical act of dispossessing their land having huge impacts on water access.

On the other hand, non-Raizales were concerned about their physical household conditions, in which road access for trucks carrying water is difficult. There were multiple complaints about not having cisterns, wells, or enough tanks to collect and store water. Most of them do not collect rainwater. They compared their houses with those that do have a cistern and have the economic possibility of building it.

Overall, both groups referred to water injustices and inefficiencies in water service by Veolia. Residents have different perspectives in the source of water injustices; Raizales highlighted the historical mechanisms and processes of land and water expropriation, and non-Raizales emphasized both the material and economic dimensions. The elements that indicate water injustice are presented in chapter eight of the current research.

5.2.2 Crisis impacts

During the water crisis, residents explained that it did not rain for more than six months, the wells and cisterns were dry, and the water company told them they did not have enough water. In general, interviewees said they did not receive pipe water

from one to four months. Although some houses were connected to the aqueduct, water does not necessarily flow down the pipes because the pressure was extremely weak. Some residents reported that before the crisis “the water flowed for two hours every fifteen days,” but during the water crisis they said that “water only flowed once per month or less.” A resident from Buenos Aires neighborhood said, “I had to wait more than 15 days until my [neighborhood’s] turn to get water”; another participant explained that, “sometimes they [Veolia] said Saturday morning, and I wait, but the water never came.” This suggests impact on resident’s work, school, and household chore schedules.

Some of the difficulties faced by participants are that there were multiple pregnant women and newborns in need of water, children could not go to school, and adults could not go to their jobs, as reported by a participant in the Sagrada Familia neighborhood. A pastor from Loma Cove explained that, “people need water for everything, to go to the school, to cook, to drink. Water is basic need [2016].”

In Barkers Hill, there were daycare centers without water. Generally, all participants complained about the struggle to cook food, wash clothes for their jobs and uniforms for school, the increment in prices for bottled water and water truck delivery, which caused an economic burden for the family. They remarked that they have to reuse the same water two or three times.

5.3 Discussion

Public officials framed the crisis as a problem triggered mainly by technical and natural issues, characterized by conflicts, violence, disinformation, and negotiations. Officials perceived the Niño phenomenon and the drought as the trigger of the crisis, and the protests as the first sign or alarm of the water crisis. In this sense, crisis solutions were directed to technical aspects, ignoring social factors (Velásquez, 2018).

The crisis showed the four interrelated features named by Quarantelli (1993) and Stern (2009): there was a threat, it was unexpected, it was something new, with no past experience, no early warnings, and without preparation in advance. Officials, for instance, did not know the rain harvesting demand and the time of drought onset; in consequence, it was a crisis with significant levels of uncertainty. Williams et al. (2017) make two distinctions in the way crises have been understood, crisis as an “event” and crisis as a “process.” Results showed that public officials mainly characterized the crisis as an event and the residents characterized it as a gradual socio-historical process. According to Williams et al. (2017), there are many implications in the way the crisis is understood; for instance, if the crisis is perceived mainly as an event, officials will neglect socio-historical analysis that aims to understand how the crisis was produced in the first place. Also, officials will determine a limited amount of time in which a response can be made, no regional or global connections are made to find causes and solutions, and officials imply there was a "normality" before the crisis that needed to be brought back.

The crisis was framed differently by residents. They framed the crisis as a long-lasting problem related to tourism activity, where social issues like justice were predominantly named. People explained how the cause of the crisis was more social than natural. The focus was directed to the unequal distribution of water, where tourism was the primary beneficiary. According to affected people, the government and private water companies were the main actors responsible for this crisis, and thus, they had the power to end it. Residents believed a social-drought caused the crisis; in other words, a drought caused by the inadequacy of the private water company to produce, distribute, and allocate water resources among different sectors within the island.

Overall, the way interviewees talked about the water crisis in San Andrés reveal weaknesses and injustices in the current water system, including frequency, production, coverage, quantity, and distribution. Also, it shows that residents, mainly Raizales, have a high dependency on rainwater harvesting and the aquifer. Overall, there are significant levels of uncertainty about drought, and a general unawareness of how the water system works.

Generally, participants, in both groups, believed that the crisis did not emerge from a single, distinct event; instead, it comes from multiple factors. Additionally, participants exposed the high levels of complexity that the water management system has and how multiple factors influenced the crisis, all affecting the crisis response and its organization. For instance,

- People get water in various ways.

- There are two different production systems to supply water to different sectors and with different water production capacity.
- There is a differential water distribution by sectors.
- There is an unknown touristic and resident water demand.
- There is a new kind of tourism, *posadas nativas* (native inns), affecting the water resources, mainly in the rural area.
- There is a disconnect between private companies that supply water (including Veolia and water truck companies) in both normal and challenging times with the public institutions responsible for responding to the crisis.

Public officials, from their perspective, explained that the water crisis was caused by the Niño phenomenon that has induced drought conditions since approximately 2013 (in this year, there was a reduction of precipitation, but it was not officially classified as the El Niño phenomenon). This reduction affected the aquifer water tables and that, combined with high rates of water extraction, produced a domino effect reducing water availability and increasing saltwater levels in multiple wells. This, in turn, caused water shortages. At the same time, people ran out of water because their cisterns and wells ran dry, and the aqueduct did not deliver water equally and frequently (according to the agreement, every 20 days) was still not sufficient.

While all of this was happening, in the north part of the island, tourism and commerce were only slightly affected. Government instructions and the water

agreement ensured that the tourism sector was affected as little as possible by the crisis. Indeed, big hotels reported they did not suffer from the lack of water.

It has been noted in this research and corroborated by other scholars (Guerrero, 2020; Khan, 2019; James, 2020) that the allocation of water in San Andrés to tourism is a conflict-ridden process between some residents and the tourism industry. Residents perceived that the crisis did not represent any threat to the tourism industry. Indeed, the priority in water delivery by Veolia and the government over residents has undermined the residents' water access. In this crisis, decisions over water resources, such as who will have access to, or control over water, have led to structural conditions of inequality and injustice in the access to water (Castro, 2007).

The impacts of the crisis have evoked a variety of emotions like desperation, upset, anger, and distrust, which have instigated multiple protests among residents. During the crisis, there was a high level of political activity where people tried to show how strongly they felt about the lack of water, and tried to influence decision-makers; they became involved in protests aimed at changing the island's water policy. In this vein, petitions, negotiations, and persuasion between public officials and community leaders were the primary strategy to end the multiple protests.

In line with Swyngedouw (1999) stakeholders displayed different power relations around water resources access; socio-natural relations of domination and subordination, and of access and exclusion in which the abandonment of historical traditions linked to water and to its uses were suggested. Boin and 't Hart, 2003;

Kendra, Knowles, and Wachtendorf, 2019; Menga and Swyngedouw, 2018, claimed that modernization is changing the society-water resources relationship, making it more difficult to respond to a new complex and intricate crisis, such as the water crisis, in an arena of competition for power. For instance, the water modernization process in San Andrés was established to distribute water mainly to the touristic areas, and establishing higher water prices in rural areas, which the poor and ethnic minority groups could not afford, leaving them without adequate or acceptable compensation measures.

Finally, the water crisis revealed deeper problems connected with critical issues in other water policy domains. They exposed flaws in existing prevention and preparedness water arrangements, which could have, but did not, trigger intense examination of institutional structures.

5.4 Conclusions

This chapter aims to know how different stakeholders understand and construct the water crisis. It describes and analyzes the voices from public and private officials and residents (Raizales and non-Raizales) in areas affected by the crisis.

This chapter reveals that between these two broad groups, the water crisis was far from being constructed in a similar way. Even though there were differences between these two, there were also commonalities: conflict, violence, protests, and negotiations being crucial for the crisis evolution. The crisis impacts named by participants includes water contamination, restriction on well water exploitation

reducing the private water availability, and disruption of people's lives regarding employment, school, and household chores.

On one side, public officials named multiple causes of the crisis, including the inefficiency of the private water company to produce and distribute water, mass tourism, overpopulation, lack of technology to desalinate water, a weakening of cultural water storage techniques, corruption, and negligence. Inequalities also were mentioned, but with less frequency and less emphasis. They acknowledged that there were water inequalities but they do not equate them to water injustices. Despite acknowledging this variety of causes, public and private officials primarily framed the crisis as a sudden "event" triggered by the El Niño phenomenon and a drought since 2013. The severity of the crisis was determined by the nature of the threat, the El Niño phenomenon. According to some officials the crisis could not be anticipated. It was considered unexpected and isolated in space and in time; officials focus on the short term and neglect longer-term considerations.

Conversations with public and private officials in some cases resulted in each side blaming the other. These defensive strategies of blame avoidance, at the end, only served to prolong the crisis by moving it to the political sphere (Boin, 't Hart, Kuipers, 2018).

On the other side, residents, also, pointed out multiple causes, including mass tourism, drought, deforestation, and lack of planning. However, they principally framed the crisis as a long lasting social "process" produced by injustice in water

frequency, distribution, and quantity. For them, the drought stops being a solely natural phenomenon, and became a creation of the private water company –Veolia.

According to the above mentioned, this study confirms that crises occur in increasingly complex and contradictory environments which is why crisis management, in turn, requires greater knowledge, participation, and specialization. A logical conclusion in this chapter seems clear: it is central to find ways to reconcile community and institutional views for adequate water crisis management. In this vein, conflict resolution and participatory strategies of process decision-making can promote collective, peaceful, and inclusive understanding of the crisis.

Finally, it is believed that this chapter can be helpful in at least five ways: 1) highlights the value in the analysis of crisis understandings for diverse stakeholders. 2) stresses the importance of understanding the resident's knowledge as a way of a better understanding of what happens on the ground. 3) corroborates the strong influence of traditional perspectives on perceptions of crisis as solely natural in the water crisis. 4) shows that injustices play a fundamental role in the creation of the crisis, increasing vulnerability to natural hazards, and affecting the risk perception of drought. 5) strengthens the idea that governmental actors need to reach out to residents and effectively communicate with them in order to enhance coordination and coherence in water crisis response.

Chapter 6

FRAMING THE WATER CRISIS RESPONSE

Crisis response involves actions and commitments immediately after an emergency begins. It includes the way the crisis is framed, which affects the crisis response actions and helps determine whether a crisis reoccurs in the future or never actually ends. There is an intrinsic connection between the framing and crisis response processes; the first guides the selection of the options that comprise the crisis response. According to Jessop (2012), when a crisis occurs, the actions taken depend on the ideas lying around, which helps to shape the nature and outcome of crisis-management and crisis responses.

The framing of the community that is affected by the crisis helps responders make sense of experiences and provides a road map for decision making. It also shows the variety of windows of opportunities open or close by the crisis. Due to multiple factors, opportunities for change longstanding community problems rarely occurs (Boin, McConnel, and 't Hart, 2008; Stern, 2009; Bellamy, Head, 2014). Some of these factors are: 1) the way the water crisis is understood and portrayed by crisis managers, 2) the paradigm and management strategy used during crisis response (e.g., conservative; technocratic), 3) political and economic dominant interests behind the crisis, and 4) the participatory process involved in the crisis response.

Because of the complex nature of crises, and the serious threats they pose, understanding crises and its implications requires multiple lenses. There are a variety of actors responding to the crisis simultaneously and framing the crisis differently. On one hand, there are the crisis managers that have to determine how threatening the events are, to what or whom, what operational and strategic parameters are going to apply, and how the situation will develop in the period to come (Boin, 't Hart and Kuipers, 2018). On the other hand of the crisis response, there are the people who are being directly affected by the crisis, who at the same time are responding to the crisis, at home, in the neighborhood, and on the streets. In this sphere individuals develop diverse coping strategies which are a major component in the survival of the community in the face of a lack of water.

This chapter describes and analyzes how two broad stakeholder groups, the institutional voices (public and private officials) and residents (Raizales and non-Raizales), framed the water crisis response. Overall, under the “crisis response” umbrella category, institutional voices’ emerging themes include crisis coordination, water trucking distribution, and operational conflicts. These institutional officials portrayed their crisis response as timely, appropriate, and useful. Results show that their crisis response framing tends to be conservative, relying on technocratic solutions. For residents (Raizales and non-Raizales), on the other hand, the emerging themes include protests against water injustice, water trucking, relationships with neighbors, and everyday responses to the lack of water. Findings show that the 2016 water crisis response was framed by the people affected as unsatisfactory and

momentary. Generally, it is argued that crisis response notions are presented as a strategy to justify water resource control, appropriation, and water exclusion through technology.

This chapter reviews key findings and raises issues that are not fully addressed by the predominant water-related crisis response literature, such as framing the crisis response, revealing simultaneous conflicts among officials and residents, uncovering dominant paradigms, and showing the lack of understanding between officials and residents. Ultimately, this chapter sheds light on how people, who at the same time are responding to the crisis at home, in the neighborhood, and sometimes in the streets, develop diverse coping strategies for community survival in the face of a lack of water.

6.1 Officials' voices

6.1.1 Crisis response framing

Crises create the space for multiple interpretations about both how was the crisis response and what steps were taken to resolve the crisis. Crises' experiences gradually merge into a dominant narrative. In this sense, overall, officials in San Andrés frequently claimed that the water crisis response was successful, timely, appropriate, and effective. The congress representative linked the institutional response with the local government determination to call the national government attention to change the plans that they had for the island; also, the congress

representative highlighted their efforts exposing the sense of urgency of the crisis, he said,

The response was not only successful; they [the national government] recognized their mistake. For example, Findeter³ had a prolonged work plan, and we [the congress representative and the governor] gave it a sense of urgency, we told them "vea esto no da espera" [this can't wait] and they rearranged the budgetary items that were for other things that were not important at this time.

Focusing on reaction time and the protests, the firefighter in chief said, "we resolved each roadblock [barricade] immediately," and he believed "the crisis was well managed." He explained, "I would say that the national government had an immediate response to the crisis. The National Risk Management Unit and the presidency had an adequate, appropriate and effective response." However, he indicated that "if we just had more water trucks, we would deliver water more frequently to the community."

In the same line, the Veolia construction engineer said, "the response was appropriate with the resources they [the local government] had. The Civil Defense director put more emphasis in the way all institutions come together to respond to the crisis. She said, "the response was timely," and she added, "we [local institutions] all

³ Institution that finance infrastructure projects that focuses on promoting regional and urban progress by granting credits to both public and private entities. It carries out the construction, expansion, and replacement of infrastructure corresponding to the drinking water and primary sanitation sector in San Andrés island.

joined to provide a prompt solution and the solution was faster with the National Risk Management Unit support.” However, the Civil Defense director said, “we need more resources to be able to deliver water to the entire community, we need another water truck, the two trucks we have are not enough and there is a long line of people asking [and waiting] for water.”

Among the private companies that were interviewed were hotels and water truck companies. Most of the hotels interviewed did not suffer the crisis; they solved their water access with desalination and purification plants. On the contrary, water truck companies claimed to have been affected by the crisis; a water truck owner explained,

We participate [in the crisis response] by giving the water service in the best possible way, but everything has a limit, and at that time, we only had a single vehicle and a single well to supply water, that is, we had a limited amount of water and minimal times. I only had a single driver and I hardly could rest any day.

The water truck owner expressed dissatisfaction with the crisis response he said, “the government response was just to buy a desalination plant.” Private water truck companies were not part of the official crisis response. An owner of a water truck company indicated that, “no governmental institution had any kind of approach to us, at least not with this company.” However, the water truck owner explained that even if the government had call them, his company could not have been part of the emergency response as they were having difficulties. He said,

During the crisis we only had one vehicle and we only had one well to supply water. If the government had supported truckers in the purchase of

trucks or supported us to get environmental permits to implement desalination, I think the crisis would not have been so severe.

In line with these assertions, another water truck owner recounted that,

In previous years, when there have been droughts, it was normal for CORALINA [environmental authority] to call us to help in these crises, and that was normal. When there are fires or catastrophes they call us, and we provide free water and even water transportation to the neighborhoods, but this time they never called us, nor asked for any services.

Some officials named negative aspects of the institutional response, they indicated that the local government used a reactive approach when responding to the crisis. They believed that institutions could have been more proactive, eliminating or reducing the water problems before they could appear and by designing a more integral and comprehensive response. The Civil Defense director claimed that “we cannot stop climate change, but we can face it in different ways if we had an early warning system; perhaps, I would have been more prepared.” The public services secretary said,

I believe that we should not wait for the streets to be blocked. For example, suppose Proactiva [Veolia] identifies that it has not delivered water for more than 28 days to the community. In that case, Proactiva [Veolia] has to be proactive and go and deliver water to them. I believe we [local government including public services secretariat and risk management office] must be more proactive than reactive.

The environmental corporation official held their response to the crisis was timely and proactive, contrary to the other local institutions, “we were the ones who raised the first alarm informing to the community and to the local government about the results of [high levels] conductivity [salt content] of the wells.” The environmental

corporation official claimed, “[the response] it is not about reacting and attending only to the moment, but there must be a well-structured and executed plan for the medium and long term.” The environmental corporation official explained,

The response should have been the combination of three components: The first and most important would be to initiate a robust program of sustainable consumption that everyone begins to be responsible for the water resource. Second, implement technologies that allow us to take advantage of the water supply that exists, and what we have is saltwater. Thus, we would not have any water problem in San Andrés because we are surrounded by water. Third, the government must design a very solid public policy to regulate water management on the island.

The government secretary indicated that the response was agile and without the State of Public Calamity declaration, it would not have been possible. He explained the crisis response in the following way, “first, the water claims of the community sectors began; second, it was the agile response given by the local government, and we felt that the only way to give an agile response was through the State of Public Calamity official declaration.” He added, “the Public Calamity was declared so that the contracts and the national government's support would be more expeditious.” In the same vein, the Veolia construction engineer said, “the declaration of the State of Public Calamity helped expedite the purchase of desalination plants; what I understand is that resources can be released and then the local and national government can put resources together.”

The first extraordinary meeting to study the enactment of a State of Public Calamity was held on April 14, 2016. The government secretary said, “immediately I noticed there were multiple protests; so, I called an extraordinary Consejo de Riesgo

(Risk Management Council).” In this meeting participated institutions like the Police, Navy, water resources management organizations like Veolia (Proactiva), the public services secretariat, and the environmental corporation CORALINA, but no community leaders or private water truck company owners were included. According to the minutes, telephone meetings were taken in advance among presidential delegates, the Water Vice-minister, the National Risk Unit, and the government secretariat.

As a result, on April 15, the local government declared a State of Public Calamity (Gobernación departamental de San Andrés, Providencia y Santa Catalina, 2016). Despite the broad range of actors represented, interviewees and the minutes revealed remarkable convergence by most of them on a single overarching frame to enact the State of Emergency, ‘the El Niño phenomenon is affecting the islands water supply, mainly to people that collect rainwater; therefore, there is a high demand of water that is becoming unmanageable, becoming a situation of public order; in which there was an urgency to find new methods to produce water.’ This assumption was expressed through four dominant themes in the minutes:

- 1) The crisis became a situation of public order. The government secretary said,

In the last two weeks, there have been a series of public demonstrations with road blockades in Linval and Cove sectors, Brooks Hill neighborhood, Atlántico neighborhood and Back Road neighborhood, and there are warnings from other sectors that protests may continue blocking the roads.

- 2) The lack of rain in relation to the Niño phenomenon impacted the aquifer water recharge, causing the salinization of the wells, reducing the amount of water

extracted and contributing to water supply and demand imbalance. The Veolia construction engineer said, “the availability of water from the wells has decreased due to the Niño Phenomenon and their salt content has increased. In the same vein, the environmental corporation official said,

There is an increase in the salinity of the wells and it has been necessary to close some of these; if this adverse climatic phenomenon continues, wells such as those of Duppy Gully will also have to be closed [affecting the water softening plant production].

- 3) The lack of rain, due to the Niño phenomenon, has affected, principally, the rain harvesting community in the island. The Veolia construction engineer said, “this water deficit affects people who are normally water self-sufficient [not connected to the aqueduct].”
- 4) The main solution is to produce water, the Veolia construction engineer said, “it is urgent to find new ways to produce water.” Desalination was portrayed as an efficient, modern and high-tech method that can overcome water scarcity in the island.

Officials frame the crisis as a water supply problem, in which the solution was centered on technology investment; there was a broad agreement about the necessity to request technical and financial support from the central government, including the acquisition of water trucks, hoses, motorized water pumps, plastic tanks and new desalination plants. In this way, the overall framing combines elements of scarcity with temporary technical solutions, and technological optimism for ending the crisis.

Different technical work sessions were developed with Proactiva (Veolia), the public services secretariat of the local government, the environmental corporation CORALINA and the energy production company SOPESA, to study the viability of the acquisition and installation of a desalination plant to mitigate the deficiencies in the water service. Concerns behind the technical reports were the plant production capacity (10 to 25 liters per second), the location of the plant, and the site for water extraction (the sea or coastal wells), the power system required, the additional infrastructure needed (storage tank, pipelines, impulsion system) and the economic costs. Eventually, the decision taken was to buy two desalination plants (25 and 50 liters per second), a total of 75 liters per second of water for the island.

The crisis response was marked mainly by technical solutions. According to the crisis response action plan the three activities that receive major financial inversion are desalination water distribution equipment (water trucks), desalination plant acquisition, and the construction of a logistic center to prepare and respond to natural disasters.

In May 15, 2017 there was another Risk Council meeting to discuss and agree to a return to normality and officially end the State of Public Calamity. The minutes indicated that the community, especially the Raizales, has lowered its demand for emergency water supply. The return to 'normality' was declared on August 14, 2017, through Decree 0340. Officially the State of Public Calamity lasted one year and four months. According to the interviewees in 2018, officials manifested that there were no significant institutional or technical transformations, some phrases that suggest this

were: *estamos en las mismas* (we are in the same situation), *a la fecha todavía no se le ha dado solución* a la crisis (to date no solution has been provided), *nosotros seguimos igual que en el 2016* (we are in the same place as in 2016), *las plantas desalinizadoras no se han puesto a funcionar todavía* (the two new desalination plants have not yet been put into operation), nosotros, los bomberos, continuamos distribuyendo agua (we, the firefighters, continue distributing water). To date (October, 2020), firefighters continue distributing water by truck during dry periods.

6.1.2 Crisis coordination

In public calamities or state of emergency declarations in Colombia, it is most common that the central government takes the lead; the San Andrés water crisis was not an exception. According to officials, there was a centralization in the decision-making crisis response. The risk management office coordinator explained that “in Bogotá [Colombian capital], they told us that by having an emergency declaration, they could come to the island easier and thus supply the community with water.” The Veolia construction engineer illustrated this with the following narrative:

The leadership was taken by the National Risk Management Unit. Officials from Bogotá came and helped with the crisis because they are the ones with all the experience. They took the lead on what to do in an emergency. In coordination with the government secretary, the governor, the environmental authority, and Proactiva we sat down at a table and began to review what we could do, and we considered their ideas about what to do in the emergency. For example, they said that an emergency office must be created and it was done. In other words, they guided and we followed.

Also, the environmental management coordinator in CORALINA said, “they [officials from the National Risk Management Unit] were the ones who led all the meetings and guided the plans during the crisis response.” It seems that the coordination of the crisis was characterized by a top-down structure, a hierarchical traditional coordination mechanism usually used in public administration.

One of the first steps taken by the central and local governments was establishing a coordination group capable of constituting containment mechanisms and planning and managing actions to deal with the crisis (Boin and Bynander, 2014). In the water crisis, the organization used for coordination and cooperation among institutions was the *Consejo Departamental de Riesgo* (Regional Council for Risk Management) (Law 1523, 2012). This council is an entity of coordination, consulting, planning, and monitoring which has the responsibility to guarantee the effectiveness and coordination of the risk management processes.

When asked about the coordination during the crisis response the majority of officials pointed out two levels of coordination, between local and central government, and among local institutions. Overall, officials expressed that coordination was good at both levels. The quotations given below illustrate how interviewees responded similarly in the way they perceived the crisis coordination efforts and pointed out some of the factors that, in their view, made coordination successful.

The government secretary underlined that obtaining resources from the central government for the purchase of the desalination plants was indicator of a successful coordination. He said,

We had a good coordination with the central government because they understood our problems. For instance, the coordination was so good that an agreement was signed among the local government, the Ministry of Housing and Water, and the Risk Management Unit to buy the first plant of 25 liters per second and with support from Findeter, the central government promised to buy the second plant of 50 liters per second.

Emphasizing that coordination between local and central government was established through good communication between the congress representative and the governor, the congress representative held,

Initially there was no joint agenda; there was no coordination. But now you have to start coordinating. I believe that [now] a difference is being made, and the local government is telling the central government what serious problems are. For this, it was essential to have a governor who understands and aligns with the congress representative; now, we have a unified message.

Furthermore, the quotations given below exemplified some of the elements of a proper local coordination pointed out by officials, including: overcoming concerns of the Raizales community, achieving the main goal of providing water to the community, and that being from San Andrés makes an official more devoted to the task. The congress representative said that “despite all the problems with the ethnic community [Raizales], I find [the coordination efforts] acceptable [2016].” Also, the government secretary indicated that “coordination among local institutions was almost the same as with the central government, it was good, we are supplying the community with water [2016].” For his part, the public services secretary explained that,

Coordination was excellent because the government secretary is from San Andrés, *él se puso la camiseta del gobierno* [he put on his government hat]. He strongly supported all the coordination with firefighters, with the Civil Defense; everything went very well, and there was no inconvenience.

However, some cases of weak communication between local organizations were evident. In a coordination meeting, two months before the crisis, the environmental corporation warned that “this year [2016] will be different [there will be significant water problems, especially with wells (Rojas & Guerrero, 2014)]”; this message was not taken into account by the other organizations at the meeting. This quote also suggests that this crisis could have been avoided.

Other coordination problems were suggested by officials concerning difficulties with establishing each institution’s responsibility. The director of the National Civil Defense explained, “there was not enough clarity regarding the competencies of each institution in the face of drought.”

6.1.3 Emergency water trucking

Water trucking is one of the most common emergency responses during drought situations, and is intended to rapidly provide water supply to affected populations (Peters 2015). It is widely considered as a temporary measure and non-sustainable solution due to high costs and the lack of quality control; also, it is considered an insecure method of moving water (Peters 2015, Williams, 2016). It is known as a precarious effort for an institution that aims to provide consistent water in sufficient quality and quantity. Overall, water trucking embraces four broad steps: 1) extracting and storing water; 2) logistical planning of distribution routes; 3) dispatching water trucks to the people in need; and, 4) guarantying water quality.

In San Andrés the immediate crisis response consisted mainly in water trucking distribution. Each time a protest popped up the local government started distributing water by water trucking. In 2016, there was more than 8,666,660 liters distributed among neighborhoods. In 2017, there was more 285,070 liters distributed (Colombian Civil Defense Report, 2017). In March, 2018, there were new protests for water in the Loma and Brooks Hill neighborhoods, and more than 200,000 liters were distributed. In March, June, and July 2019, there were multiple protests in Flower Hill, Atlántico, Barkers Hill, and Schooner Bight distributing also resulting in water distribution by the government.

During the water crisis, the immediate response, at the operative level, was done mainly by firefighters, Colombian Civil Defense, the risk management office, and operators from the private water company (Veolia). On April 2, 2016, when the first protest for the lack of water started, the chief firefighter said that “we [firefighters and water private company] rapidly analyzed the situation and defined routes to distribute water among people affected.”

In San Andrés there are differences in the way people collect water; some households have a cistern or have small tanks, and there are communitarian cisterns in some neighborhoods. Some houses have a cistern close to the street and some are far; so, firefighters may require extra hoses for some cases. These differences influenced the amount of water delivered by house and neighborhood and firefighter water emergency strategy. As it can be seen in the illustrative narrative below by the National Civil Defense operator, “there are neighborhoods that have community

cisterns, others have tanks of 1,000 or 2,000 liters or others have tin buckets that they cut to store water because they have nothing else; the operation is fast if they have large tanks or cisterns and is slow when they have small buckets.

The National Risk Unit (UNGRD) gave three tanks of 5,000 liters each that the risk management office and firefighters called “communitarian water tanks.” The chief firefighter explained that, “the person who runs out of water goes to the communitarian tank and is supplied with water from the tank [2016].” Firefighters and the risk management office decided which places require these types of tanks, prioritizing the areas in greater need for water. Neighborhoods that benefitted were Elsie Bar and Barkers Hill, both mainly Raizales’ neighborhoods. Regarding that the majority of Raizales have large cisterns, providing water directly to their cisterns is much more efficient, rather than requiring people to collect water from the tank and take it using smaller water tanks to transfer it to their cisterns. This suggest that the delivery of these few plastic tanks could have been directed to families without cisterns and the necessity to consider the traditional way Raizales collect water.

For its part, during the emergency the private water company (Veolia) operator was very clear to state that, “we only follow our contract.” During the crisis, “we only distributed water among our subscribers” and “we sold the water to the government for them to distribute among non-subscribers.” The Veolia director clarified that, “the problems that arose during the crisis were in the rural area and most of those who protested did not have aqueduct service.” This implies that the private company did not believe that it was their responsibility for distributing water for the entire island.

In this sense, the government took full responsibility for the crisis response. Trucks used during the emergency belonged to public institutions (e.g., police, air force, army, civil defense, firefighters). The task of distributing water was divided in two: the subscribers and the non-subscribers. The risk management office coordinator with the chief firefighter coordinated and scheduled the water truck routes, and they indicated to which neighborhood and which family to deliver the water. “We took the decision to give between 1500 and 2000 liters of water per family. Then, we selected the sectors to deliver very rationed water.” “the community leaders in each neighborhood helped us to know which house needed the water.”

Additionally, a procedure was implemented for people asking for water. The person in need of assistance called to the firefighter or the risk management office, gave the number ID and they put it on the list and, then, sent the water to the person who was not a subscriber. The areas that most requested water are the hilly parts of the island, including Barkers Hill, Courthouse, El Cove, Loma-Lynvall, Loma Barack, Orange Hill, and also, the south part of the island.

According to the chief firefighter and the risk management office coordinator, the distribution of free water has become another technical and financial burden for them. A firefighter said that, “this is becoming something unmanageable [2016].” Instead of decreasing the demand for water is increasing, “now people only want free water [risk management office coordinator.” The risk management office claimed, “firefighters extinguish fires; they don't supply water.”

In this respect, water trucking has become a routine activity for firefighters for respond to the occurrence of crises. The chief firefighter complained,

Now [2016] all the calls that we receive is telling us that if we don't give water to them, this week they will block the road. Just ten minutes ago, I received a call from the Courthouse neighborhood saying that 'if we don't have water this week, we will block the street'.

Supplying water during and shortly after an emergency demands more personnel and to have a response protocol in place. Currently, every year firefighters are distributing water in different parts of the island. A firefighter explained, "right now [2018] we have about 50 firefighters and in 2016 we had 25. Now we have a new water truck [2018]." He added, "after what happened to us [in 2016] I think now we are ready." The firefighter explained that "what we do is that the people who are in need of water come to the station and in there we have a check list where we write down the names and dates, so we went from there to deliver the water." However, after two years of the crisis the government has not developed a water response plan or a quick guide and system for delivering water. The crisis response activities have not been documented, nor is there a systematic record of families at risk.

6.1.4 Conflicts during the crisis response

During the task of distributing water, multiple conflicts were experienced by officials. First, officials named, as a central conflict, the use of water on the island by tourists. According to James & Barrios (2020) tourists used almost double the water per capita than residents. This imbalance in water consumption generates conflicts

among residents against the government, the private water company, and the tourism industry. According to the risk management office coordinator, there is not enough water to supply the residents' basic needs; therefore, water has become a contested resource.

Second, in Loma Lynval, Barkers Hill, and Sagrada Familia neighborhoods, there were problematic situations concerning the quality of the water given by firefighters. A woman from Barkers Hill said, "there was a comment [rumor] that the water given by firefighters was not potable water, that it was taken from the Rock Hole well [a traditional well, recognized for having low quality water], so we did not accept that water truck." A woman from Sagrada Familia said, "a firefighter who brought us the water [unofficially] told us not to accept it, because it was from the Rock Hole well." Further, she added, "so, we did not receive that water, and people got very angry about it, because they [firefighters] were cheating on us."

The risk management office personnel explained, "that was not true, what happened is that the water that firefighter truck regularly uses to extinguish the fire is from Rock Hole well not from Veolia" and he said, "they did not believe us; however, we gave them the water and we left."

Firefighters were complaining about the lack of trucks to supply water during the response; maybe the available trucks were used for both purposes: extinguishing fires and distributing water. In this case, the trucks must be disinfected before being used and obtain a disinfection certificate; likewise, the water must be analyzed to be certified.

Third, there were conflicts concerning the conditions of the cisterns, and the sequence of distribution and the amount of water given per family. During the water trucking operation, the risk management coordinator explained that “in some cases, we had to clean and rehabilitate some water storage systems [tanks and cisterns],” and thus create an additional burden for the firefighters as they have to take the ‘water distribution time’ to clean various cisterns. Also, he explained that,

We alerted the truck operators to check first the cisterns’ condition before pouring the water, and if the cistern was dirty, they could not deliver the water. Although people demanded that we have to put the water there, we did not, and we asked them: do you know how much it costs to transform the water into drinking water?

A firefighter operator said that, “we did not deliver the water to the places where the cisterns were dirty; I think people wanted water but they didn’t want to clean their cisterns. This suggests that it is essential that cisterns must be periodically cleaned and disinfected by the owners and even more so before a dry season. Over time, microbial growth, sediments, and sludge can accumulate in the cistern, or insects and debris may have fallen in.

Another critical conflictual situation was that “some people thought that we [firefighters] gave more water to some households than others, or that we did prioritize some houses [chief firefighter].” The chief firefighter illustrated this situation with the following example:

One night, while we were supplying water in Sagrada Familia neighborhood, we saw women fighting. They were afraid that we would not be able to give water to the entire neighborhood. Then, those who had organized the protest began to demand that they must be first, and those who did not protest should not receive water; for example, the leaders of the protest in the

Sagrada Familia neighborhood wanted to force us not to give water to three or four families because those three or four families disagreed with making the protest, they insulted them. Nevertheless, we gave water to everyone; first to those who were complaining, after to the others. It was not easy.

The chief firefighter manifested that “in several protests, for example Barkers Hill, we had to run, we had to start the firetrucks and run away because the situation became risky for us.” Although people were upset with Veolia, they started blaming the firefighters, too. The chief firefighter explained that, “they [residents] saw us as a part of Proactiva [Veolia] and they treated us badly.”

Water trucking operation alleviated the needs of more than 14,000 people affected by the crisis. However, it generated new conflicts or revealed old ones that hinder or impede the emergency water supply. During the water trucking distribution, conflictual situations were around uses of water, water source and quality, and priority and selection of the water benefits.

To this point, firefighters needed to increase their ability to undertake water trucking immediate relief operations. Also, in cases of internal conflict among residents, it is important that operations include people who mediate and help to solve and if that fails, it is important that the authorities contribute to lessen these conflicts.

6.2 Residents' voices

6.2.1 Protests

Protests began in Raizales neighborhoods in response to problems in the access to water; later on, non-Raizales neighborhoods joined these social demonstrations.

Eleven protests occurred in 2016, two more protests in 2017 and 2018, four protests in 2019, and one protest in 2020. A man from Loma Barack explained why the protests happened, “we have been without water for a long time, what happens is we used to not complain, we do not scream, until it is the moment when we cannot stand it anymore.” A man from Loma Linval indicated “in San Luis sector they do not protest because they get water all day and every day [like the touristic area]. The water does not arrive here [El Cove] because here there are no hotels.”

Protests became for residents the only mechanism to make the government listen to their problems. A participant from Loma Cove said, “the only language they listen is when you protest, when you become violent, when you become aggressive.” Throughout history, Raizales have developed a cultural resistance to preserve their ethnicity at the local, national, and international levels. Raizales have fought multiple battles to protect their territory; disputes have been around access to land, natural resources, and the low participation of the Raizals in commercial activities (Velásquez, 2020). In 2016, they were fighting another one for their water rights; a community leader of the Barkers Hill and Loma Barack protests’ said, “people is

defending their rights,” and he added “people [Raizales] understand the water is theirs, that’s why, they are defending their rights.”

A woman from Barkers Hill neighborhood mentioned, “we all gathered and decided to protest because you cannot live without water. So, we decided that we were going to stay on the streets, even if it would be for a month.” Multiple protests occurred simultaneously and were located mainly in the hilly part of the island where there are mainly Raizales neighborhoods; also, the San André’s aquifer water recharge area and the water softening plant are located. A woman from Loma Claymont recounted, “water is born here on the hill, in Duppy Gully, here, is the aquifer; before, the few people who used to live here supplied themselves with water and we hardly suffered from water. Mainly, there are few water wells in the higher parts of the island; this is because the wells must be deep enough to reach groundwater, a costly activity. In this sector, the water access is mainly rainwater, some parts have aqueduct service every 20 days, and they purchase water trucks.

A man from Loma Barack explained, “first La Loma Cove started the protests, then Barkers Hill, then Perry hill, and Orange Hill, and some people from the San Luis sector also joined the protests.” Religious leaders accompanied most of the Raizales protests. An interviewee from Loma Barack explained, “the pastor supported us because we had four to five months without water.” In fact, a pastor from Loma Cove said, “well, it was a rough moment because we have to stand with the people and for the people, and what people wanted was water.” The pastor added,

In almost every [Raizal] protest, you will find a pastor who goes there and tries to talk; this is according to the area [where the church is located]. I had two protests to face and deal with. You just go out and see what happens and try to find solutions.

One of the primary motivations for making protests was the lack of water.

Situation that was connected with frequent expressions of deeper concerns about injustices in water distribution. A non- Raizal woman from Sagrada Familia neighborhood said, “we tried to stop trucks from different companies. The idea was that we could get water anyway.” A man from Loma Claymont said, “whenever there are protests it is because there is no water.” He added,

They [Veolia] sent water everywhere except for La Loma; then, people get upset; Besides, the water trucks did not want to sell us the water; one could offer them 200 thousand pesos and said no. The water was given to the hotels because their [water trucks and Veolia] priority is to give the water to the hotels. Meanwhile, people without a drop of water.

There were also others motivating factors behind the protests such as the political one; a man from Loma Barack explained, “people throw stones, block the streets, set fire, and throw all kinds of pests against the government, but for me, the worst thing of all, besides the drought, is to have a continental [non-Raizal governor] ruling an ethnic territory.” To this respect, there is prejudice within Raizales against people who are not Raizal, especially in public official’s managerial positions, who would represent the ‘colonial historical structure.’ Gonzalez (2016) stated that the participation of Raizales in the public departmental bureaucracy continues being very small and decisions continue being made in Bogotá, without taking into account the particularities of the geographical context or the real needs of the population, this has

generated daily tensions, in which Raizales also see with mistrust people who is non-Raizal. However, the stress for water resources pushes both groups to organize protests to call government attention strategically. Non-Raizales neighborhood also joined the protests, Atlántico and Sagrada Familia neighborhoods were an example of this. A woman from Sagrada Familia neighborhood explained,

It all started in the Cove sector because they did not receive water, and then the other neighborhoods also ran out of water. In this neighborhood, we have been almost a month without receiving water [from the aqueduct], and since the Cove and Barack people began the protests, we also began making protests to support the cause, and we can all benefit.

She further noted that they protested to block water trucks leading to the touristic area by saying that,

The water trucks come from the south and have to go through the hilly parts or San Luis sector. The idea is that no water truck could transport water to the center, where the hotels are. However, it was impossible to close all the routes, and they were able to leave.

In 2016, interviewees claimed that the protests worked successfully to call the government's attention. An interviewee from Barkers Hill explained, "If we had not made protests, things would continue like this [without water], through the protest [we made] people from Bogotá came and committed to us [gave them water], so the demonstration was good." Regarding the "success or failure" of the protests; this depends on the type of demands raised by Raizales, the government's willingness to listen, the allies Raizales got it (non-Raizales) and in overall the political support they received; these factors can trigger the possibilities protests success or failure.

There were various negotiations between the governor and neighborhoods; some of these negotiations were written down and signed. For instance, the Barkers Hill neighborhood on April 20, 2016 asked four main points: (1) water service must be provided every week through the pipe networks [no water trucks], and the desalination plants should be installed urgently. (2) When the maintenance of the pipe networks is necessary, it must include the Raizals who live in La Loma. (3) Overpopulation has to be strategically controlled, through the reduction of illegal and displaced persons residing in the islands. (4) Built a recreation center for the Barkers Hill community. Raizales petitions revealed there were protesting for the lack of aqueduct service in their neighborhoods, the lack of participation within the private water company contracts, and the urgent need of desalination to solve their water problems.

In 2018, these Raizal claims remained unresolved, in which Residents are in the same vulnerable condition. Protests may have a transformative potential; however, in this case, there was not significant changes and they continue making protests every year.

6.2.2 The official crisis response

In general, residents, both Raizales and non-Raizales, expressed being dissatisfied with the government's response, mostly, they felt that it was not enough. A resident from Barkers Hill said, “the government is doing something, I cannot say nothing, because they are doing something (Barkers Hill); a man from Loma Cove indicated

It was partly good, but partly bad. There was a [minimal] solution with the water trucks, but I don't think that the water they send us is healthy, and I don't think it is fair for us; for example, there are two wells on the hill which is where they [Veolia] take the water, we are closer to the wells than they (tourists) and we do not have access to water.

In a more resigned tone, another participant from Barkers Hill said, “the government is doing something, they did not do what one expected, but they did something.” There is a general feeling among residents that the government did not fulfill what they promised.

Criticizing the temporary solutions by the government, an interviewee from Sagrada Familia neighborhood explained that “the government only attended the moment, they did not solve the real problem; they just wanted to stop the protests.” Residents claimed that ‘nothing has changed.’ An interviewee from Barkers Hill neighborhood explained, “they [the government] gave us a tank, then, they fill it up when they wanted to, not when we needed it.” A woman from Barkers Hill neighborhood said “during the crisis they [firefighters] began coming every fifteen days and filled the tank with water, but [after a while] they stop coming back.”

A recurring theme in the responses is references to the installation of three water tanks of 5,000 liters’ capacity in two Raizal neighborhoods, Barkers Hill and Elsie Bar. The interviewees in these neighborhoods reported that the government use these tanks only during the crisis and never used them again. Interviewees believed that the installation of tanks were not the best solution, instead, they prefer to receive water in each house's cistern, “moving small tanks back and forth is a heavy task.”

The issue here is that the government did not determine in advance whether tanks are a solution that fits the local necessities; they never asked the community what kind of solution will work for them. There are some non-Raizales neighborhoods that do not have cisterns in the houses, and perhaps the communitarian tanks would be more suitable. Moreover, a resident made a comment about the way the tanks were installed, that they were not intended to store rainwater too, since the tanks were separate from the houses. This suggests the necessity for the government to consider adapting the communitarian tanks for use in the rainy season as well as the dry seasons.

Residents continue demanding attention and criticizing the breach of the promises made by the government, they do not know how far they will endure this situation anymore. An interviewee from Loma Cove said, “they promise a desalination plant, but nothing happens yet.” An interviewee for Loma Barack claimed that the government's response was a lie, it was a hoax, and it does not surprise me [Loma Barack].” Another interviewee from Barkers Hill said, “here in Colombia everything is blah blah blah they only speak and do nothing.”

The majority of the participants located in the hilly and south part of the island manifested having the same water problem in 2018 as in 2016. According to the responders, even worse, the first semester of the year, the private water company even more severely limited the water to these areas, and they reported in 2018 have been approximately one month without water.

6.2.3 Private water trucking during the crisis

As stated previously in the chapter, water trucking is a coping mechanism for water emergencies. For some residents, commercial water truck providers continue to be the key option when facing difficulties in accessing water as a result of dry periods or failures in water supply service. Also, some residents consider water trucks as their fallback during a water shortage. A quote from la Loma neighborhood illustrated this, “what I would do would be to store water in my tanks, if I end up run out of water, I will ask to my neighbor as they are my family, if this does not work, I will buy water from a water truck.”

The private market played a role in the crisis response by potentially mitigating the water crisis's impacts. Although during the crisis, the water trucking private sector provide water resources on a paid basis, they provided goods and services critical to the response. Water truck companies had a vital responsibility during the water crisis response, as they were one of the first responders when water was scarce. In 2016, some of the water truck owners claimed they needed to stop deliveries because of excessive demand. A water truck owner manifested to have difficulties in supplying water because “it was chaotic; so, we could not deliver water to everyone who called us.” Some truck companies were affected by direct or indirect consequences of the crisis deepening the impacts of the crisis on residents. Some water truck companies had well-water exploitation restrictions, and they had to buy desalted water to continue their operations, which increased the water price. The experience of a woman who lives in Little Hill neighborhood was, “we began to run out of water, and even with the

money we were not getting water trucks,” and she added, “I was in line for fifteen days so that a water truck could come to my house.”

With a different viewpoint, some residents complained about the water truck service. They manifested that something was wrong during the crisis; while interviewees suffered for lack of water, people saw water trucks carrying water to the hotels. They perceived that the priority of truck owners was the hotels and they must comply with them because of their contracts. Trucks companies have semi-annual or annual contracts with hotels, because they pay higher prices and provide the security of a repeat customer. On the contrary, residents sometimes call them, sometimes not; consequently, residents do not represent steady incomes.

Another issue was that participants said a considerable increment of the water truck prices rose from \$80,000 to \$200,000 (Colombian peso), approximately a 250% increase. There was price gouging. Interviewees frequently complained about the price increment, and some residents said not to be able to pay the higher price. In this vein, one of the obstacles to get water for people was the lack of purchasing power. As such, the situation was also a crisis of livelihoods and a lack of price monitoring structure for regulating water truck prices. A community leader in Barkers Hill neighborhood said,

This is a financial problem because most people are unemployed, so they can't construct a cistern and cannot pay for water trucks; [even if they do work] they only make a minimum salary they can only pay for school for their child.

Finally, another point that will contribute to understanding the higher demand and higher prices during the crisis is that there was general knowledge among the residents about who sells “good and bad” quality water and this knowledge may lead to a higher demand for the few trucks that sell the “good” water quality. A woman from Sagrada Familia illustrated this in the following quote,

All water trucks do not have a “good water.” For example, one water truck company puts much chlorine in the water; in Orange Hill neighborhood, there is a well that has the worst water on the island; what a horrible thing! Some people told me never to buy water for that water truck. So, we cannot buy water from all water trucks because you do not know what kind of water they will bring you. So, the consumption by us is quite costly. When it starts to rain, we take a rest from buying water trucks.

Also, recently, the government classified water truck companies according to a water quality risk index and from the total of 37 truck tankers, 21 were classified as medium to high risk; therefore, only 16 truck tankers had an acceptable quality of water (Gobernación del Archipiélago de San Andrés, Providencia y Santa Catalina, 2020). The risk quality index may lead to a higher demand for the few trucks that sell a low-risk water quality.

6.2.4 Relationships and networks to cope with the lack of water

The majority of the residents who had experienced the crisis highlighted the relationship with neighbors to overcome the water crisis. As it happens in disasters, individuals’ capacities to respond to crisis were strongly connected to their social capital (e.g. relationships and networks) (Törnös, 2015). A person from Los

Manguitos' neighborhood said, "if my neighbor does not have water neither do I" and she added, "when I have to buy a water truck I share the water left over with the closest neighbors" and she added, in this way, "if I go through a drought again, I can ask my neighbors for water."

The majority of the participants saw an essential fallback in their neighbor's capacity to get and maintain water in their cisterns. Törnös (2015) found that strong bonding and bridging ties (e.g. friendships with neighbors) promote capacities that make it easier for people to cope with hazards and recover from disasters. In this manner, relations with neighbors can enhance the capacities to be resilient. A man from Natania neighborhood said,

We [the neighbors] talked about the crisis and we decided that we need to keep our cisterns full of water all the time, in case anyone has a problem we help each other; the idea is to make all the neighbors aware that they must keep the tank full. Natania is a cool neighborhood, people collaborate a lot.

Interviewees made emphasis in how neighbors played a central role to cope with the crisis, as they, almost every day, share, buy and sell water through small tanks or large hoses. Also, they said to know who in the neighborhood has the biggest cistern and who is willing to freely or sell water in difficult times. Residents mentioned there were multiple meetings that took place in each neighborhood to discuss and collect money in order to pay a water truck delivery to share. The

⁴ Interview conducted in 2018

relationships with the neighbors were often described in ways that can be categorized as informal ties.

Interviewees constantly complained about the cost of the water because it created an important economic impact for their daily life. Some of them bought small quantities from other neighbors who have large cisterns. They explained how these large cistern owners resell the water using hoses or small tanks. There are differences among neighbors in the access to water that led to the generation of a type of stratification of power within neighbors, based on the water capacity of each neighbor.

During water crisis response, social capital was manifested through the creation and strengthening of interpersonal ties. During the interviews, the type of social capital identified was in both weak and strong ties. The first (weak) was seen in neighborhoods in which the micro market of water they created allowed them to get water according to their daily economic capacity. People could buy small amounts of water frequently and did not have to depend on large, but erratic, deliveries from water trucks.

The latter (strong) can be seen with more or less daily encounters, mutual help and support around necessity of water; neighbors connected in a form of friendship in which they help each other in case of the lack of water.

Social capital in Raizales and non-Raizales neighborhoods is a central component of resilience. Various studies have shown that local social connections regularly serve as ‘first responders’ in disaster situations well ahead of professional

and formal institutional operations (Quarantelli & Dynes, 1977). Crisis response can thus be seen as a type of collective action on the neighborhood level (Törnös, 2015).

6.2.5 Everyday responses to the lack of water

When asked about what residents did when water was scarce, they started sharing experiences about what they did to save water. A first group of measures consists in actions to reduce water demand. During the crisis, residents tried to reduce their daily water consumption by measuring the minimum amount of water needed for bathing – half bucket, to wash two motorcycles one bucket, and reducing the amount of baths to only once a day.

A second group of actions was oriented to increase water supply, which were at the core of the strategies used by the interviewees to face water scarcity. This include optimizing the use of available resources. Some people recycled air conditioner water. The air conditioning system cools the warm air and humidity forms condensation in the unit. The water is normally drained to the sump pump or a drain system. One can produce as much as twenty gallons of water each day when the air conditioning system is used continually. A resident from Little Hill neighborhood said,

I realized that the water I collected from my air conditioner I can used to flush the toilet two or three times a day; so, every night I collected a good amount of water; now I do it all the time even if I have water. [Little Hill, 2016]

Others reused water from from bathing, washing clothes, and cooking to flush the toilet and to water plants. They also increased the storage capacity of the house by increasing the size and number of cisterns and tanks in the house.

A third group of measures is related to sharing a well and the electricity costs of groundwater extraction. Some small communities (25 to 40 people) share a well through a primitive aqueduct network. Neighbors split the associated costs of pumping and also carefully planned their wells operations to optimize energy costs. This also confirmed that cooperation among neighbors was crucial to mitigate and adapt to water shortages.

Residents recognized that there are differences among them regarding access to water and, consequently, the impacts of the water crisis. For instance, a person who lives close to the street (where there is strong water pressure from aqueduct) and has a big cistern could have been only one month or less without receiving water; people who highly depend on rainwater, not connected to the aqueduct, or live in the hills, could have been three to four months without receiving water.

In line with the above, having access to water depends on five key factors:

1. Having a cistern and its size: As one person noted, “neighbors with water during the crisis were the ones who had big cisterns or good social networking to get water before others.”
2. Social networking: Participants explained the importance of having connections in order to buy in a group for water truck delivery, have micro market access, and to ask a friend for free water.

3. Having access to transportation: Since participants frequently needed to transport bottles and small buckets of water.
4. Aqueduct access: This included having access and connection to an aqueduct to ensure water at least every 15 to 20 days.
5. Location: The majority of people situated in the rural areas do not have an aqueduct. Participants located close to the street have better water pressure and also have better access to receive water from the water trucks.
6. Knowledge and historical relationship with the island: They know where the old wells are.
7. Personal or family income/wealth: The water truck companies increased the price from approximately 80,000 to 130,000 Colombian pesos, thus constructing a cistern requires significant economic investment.

6.3 Discussion: Crisis response analysis

Overall, public officials claimed that the water crisis response was timely, agile, appropriate, and useful. This perceived success of the crisis response by officials consisted of effectively managing to convey a sense of urgency to the national government, obtaining technical and financial resources from the national government, resolving roadblocks rapidly, and organizing an interinstitutional union to distribute water trucking efficiently. The water crisis was an opportunity for inter-level communication and for obtaining financial resources under time pressure.

Officials stated that a centralization approach and a top-down style were used in the crisis, and the National Risk Management Unit took the lead. However, crisis operations require a multi-organizational response that demands lateral coordination, not only top-down command and control. Boin and 't Hart (2003) argue that centralization is a popular expectation, a myth, and a shared belief. It indicates that the public officials in the water crisis wanted to show that there was a leader providing clear direction to manage the crisis appropriately; but organizations may not experience success in crisis response if the characteristics of the crisis do not correspond to the assumptions of a crisis management team (Hale, Hale, & Dulek, 2006). In the end, both lateral and vertical coordination were used during the water crisis response in a multi-actor coordination process both at the strategic and operative level.

There were two levels of coordination between the local and national governments, and among local public institutions. Officials expressed that coordination was good at both levels. Factors such as obtaining resources from the central government to purchase the desalination plants and fluent communication between the national and the local government were some indicators named as example of successful coordination. Aspects that marked the coordination among local institutions were solving conflicts with the Raizales community, achieving the primary goal of providing water to the people affected, and that officials at the head of the crisis were from San Andrés, which presumably may an official more devoted to the task.

The formal coordination mechanism used by those officials involved in the crisis response was *Consejo Departamental de Riesgo* (Regional Council for Risk Management) which is an intergovernmental council that integrates multiple institutions at different levels. The council was used for coordination, consultation, planning, and monitoring. The Council members decided and approved the State of Public Calamity declaration, which became a fundamental legal and formal basis for local public officials to request technical and national financial assistance and for an agile response. This declaration revealed that the crisis exceeded the local response capabilities, and as such it was a necessary step for the response process. The Council was the political space to make sense and define the crisis response action plan. Afterward, technical sessions were held to study the viability of the acquisition and installation of a desalination plant to mitigate the water service deficiencies. Head (2014) suggests that usually under water crises conditions, the government turns first to technical experts who shapes the orthodox paradigm of solving problems through large technological infrastructure projects.

The majority of officials framed the crisis as a water supply problem caused by the reduction of precipitation caused due to the Niño phenomenon and a drought (chapter 5). Disaster scholars like Hewitt (1983) have suggested that a framing like this is part of the hazards tradition dominant paradigm, which has prevailed in disaster studies, in which the occurrence, features, and causes of the disaster depend primarily upon the nature of the hazard (e.g., flood, drought). Patrick, Syme, Horwitz, (2014) state that when a problem is framed as insufficient water supply, technical solutions

will be favored. In the San Andrés crisis, the immediate response was temporary emergency water trucking distribution, desalination expansion to increase water production and frequency, and aqueduct pipeline rehabilitation. In this sense, the crisis response framing combined natural scarcity elements with technological solutions to increase water production.

It is common in water-related crises that technology and science are called upon to solve a water supply problem in which natural causes have been blamed and technological development has been preferred; the framing is ruled by water experts, scientists, and engineers, and solutions are inclined to the water supply side. The water crisis response overlooked socio-historical aspects and demand management strategies. According to Head (2014), this is the traditional engineering-based paradigm, which associates technocratic decision-making processes in addressing increasingly complex water problems like water crises. This paradigm has been ineffective because engineering expertise alone could not guide future water policy directions to tackle complex and ‘wicked problems’ like water crises; therefore, recurrent water crises might be expected in the future (Head, 2014). Crises are multidimensional, and the reduction of water production is only one of the many factors that originate the crisis. This chapter raises this matter and makes a call for noticing that the complexity of the water crisis cannot be hidden under one natural phenomenon.

One of the main negative aspects of officials’ crisis response was the reactive approach used by the local government and the lack of implementing a more integral

and comprehensive response. The reactive approach focused on relief and rehabilitation in the post-crisis scenario; on the contrary, a proactive approach would emphasize prevention, mitigation, and preparedness. In this sense, this research reveals that officials still focus on a reactive approach for crisis management, perhaps due to limited resources and knowledge which undermine officials' ability to carry out the necessary tasks concerning prevention and mitigation. However, some officials did recognize the importance of moving away from a reactive to a more proactive approach in crisis management. Some officials emphasized that achieving a proactive approach means focusing on comprehensive responses.

Findings revealed that during the crisis response, there were simultaneous and multilevel conflicts. While officials at the strategic level were solving the roadblock protests, at the same time, other conflicts occurred and were solved at the operative level by firefighters. During the water trucking operation, conflictual situations between firefighters and residents were around the water emergency source, water quality, and priority and selection of the water recipients. These problematic situations hindered emergency water operations. Results implied that crisis response requires a focus on an effective conflict resolution approach for implementing collaborative and inclusive solutions. This study agrees that crises are processes that can intensify both social solidarity and social conflict.

The State of Public Calamity officially ended on August 14, 2017 (Decree 0340, 2017). However, it was found that officials and residents reported, in 2018, the same conditions as in 2016. The results suggest that the crisis response did not lead to

a reform or a significant improvement in water access for residents, both Raizales and non-Raizales. The crisis in San Andrés became a new normal and to date (October, 2020), firefighters continue distributing water by truck during dry periods. Water became a routine activity for firefighters responding every time a roadblock occurred. It is central to distinguish the broad type of management strategy adopted by officials to understand why a crisis reoccurs or never ends. Findings showed that a conservative approach prevailed in the crisis response, in which the status quo was maintained; the preexisting institutions' policies remained, and the focus was on incremental improvement rather than a radical redesign, and there were no lessons learned from the process that was adopted (Boin, 't Hart, Stern, and Sundelius, 2016). Moreover, the water crisis was framed from the hazard point of view; in this sense, it was considered unforeseeable and external, a situation where there is no one to blame. As a result, according to this framing there was not a clear need to change institutional structures because the crisis was not due to human error.

The crisis was not an opportunity for change for all. It was an opportunity for the private water company to continue being the primary water operator on the island for another 15 years, having more water to distribute and sell, and to increase the company infrastructure with two additional desalination plants. The way the crisis response was managed displayed the political and economic power held by the private water company, a situation that makes room for future research about water politics, around questions over who is granted the privilege to make sense of this crisis and why it is they and not others. The literature explains that in some cases, what is a crisis

to some may be an opportunity to others; usually, crises do provide direct benefits to some economic sectors, mostly during the response and recovery phases (Boin, Mcconnel and 't Hart, 2008).

Another critical finding was that the crisis response was marked by a 'one size fits all' solution. Each group (Raizales and non-Raizales) displayed a different level of vulnerability and capacity to cope with water shortages and drought. Generalizations by the government about how people get water and a lack of understanding of their differential vulnerability made institutions misallocate the emergency water. For instance, institutions provided storage tanks to the community who already have cisterns in their houses.

The medium to long term response consisted of two new desalination plants to increase water surplus; however, regarding that there are differences in the access to water by sector and by neighborhood, this solution was supposedly to be for all but mainly was directed to residents with aqueduct service, as the desalted water will be distributed mainly through the aqueduct network. That is to say, it would be central for implementing diverse solutions for a diverse society to construct communitarian aqueducts and cisterns, new pipelines, and promote rain harvesting programs. Only purchasing desalination plants is not solving the water problems of many communities. There was a lack of evaluation about who were the people affected by the crisis and their water access characteristics, as it prevailed the immediate and temporary solutions. Overall, Raizales and non-Raizales expressed being dissatisfied with the government's response, mostly, they felt that it was not enough. They

highlighted that the government implemented temporary solutions as officials just wanted to stop the protests. To put it in another way, while desalination investments have an important role to play in water industry development, there was a notable absence of ‘inclusive’ solutions that recognized the role of residents in creating sustainable demand, supporting residents without aqueduct service, promoting Raizales traditional rain harvesting customs, and increasing aqueduct service provision.

Before and during the official’s crisis response efforts, residents were dealing and coping with water shortages. Results suggest that resident’s main response to the crisis was the protests. It was found that religious leaders played an important role in the development of the protests and as conflict solvers between the government and the Raizal community. Since 2016 there has been a rise in protests involving residents demanding better access to water. The crisis pushed Raizales to call the government attention and fight for their water rights, and subsequently the non-Raizales residents joined the protests. It seems that the protests gained power in part because of how the water crisis has highlighted inequalities between urban and rural areas in the island. Protests may have a transformative potential; however, there were no significant water access changes, and residents have continued making protests which only ended temporarily when firefighters delivered water.

Residents used various mechanisms to respond to the lack of water, including reducing water use and storing water. In particular, the response to the water crisis was strongly connected to resident’s social capital. There was a strong neighbor

relationship, and to cope with water shortages, they helped each other through the cisterns and combining funds to buy from water trucks together; this helped residents cope and reduce the crisis's adverse effects. These results are in line with research done by Törnös (2015), which indicates that strong bonding ties (e.g., family groups, friend groups, and friendships with neighbors) promote capacities that make it easier for people to cope with hazards and recover from disasters.

6.4 Conclusions

This chapter has sought to answer how different stakeholders framed the crisis response and analyzes whether there was a change in the water situation by 2018. Public officials framed the immediate response as successful; it was considered an opportunity for inter-level communication and obtaining national financial resources during this time pressure. The national and local government portrayed the crisis as a supply-side crisis that could only be resolved by securing additional drinking water supplies; thus, reinforcing the technocratic paradigm. There were no considerations nor actions to counteract socio-historical and water injustices factors that played an essential role in the water crisis framing by residents. No efforts were made to transform or analyze inequitable and unsustainable water arrangements, nor to evaluate the tourism impact and prioritization in water access; there was a prioritization of technical solutions over engaging local social, economic, and political problems. The crisis response did not expose the status quo as problematic, and it did

not open the door for water policy changes. A conservative management strategy and a technocratic paradigm were used in the crisis response.

On the other side of the crisis response are the voices of residents, Raizales, and non-Raizales. Roadblock protests were the main social action used by residents to call government attention that a water crisis was happening. Petitions revealed residents were protesting for the lack of aqueduct service in their neighborhoods, the lack of participation within the private water company contracts, and the urgent need of desalination to solve their water problems; in 2018, these claims remained unresolved. Residents highlighted how water truck private companies, their cisterns, and neighbor relationships were crucial to coping with water scarcity. During the crisis response, residents relied on their social capital by sharing and requesting water resources. The water crisis response was characterized by both conflict and consensus.

Broadly, residents expressed dissatisfaction with the official crisis response. They perceive that institutions' reaction only implemented temporary solutions; therefore, residents' water access problems remained the same. Voices of residents implied that the way water policy decisions were made stopped making sense for them, and they wanted a change. However, making sense of the crisis and subsequent decision-making in the response stayed within the domain of the personnel of the government agencies and the private water company, hindering the opportunity for change.

The official crisis response was marked by a 'one size fits all' desalination solution not acknowledging the community differential vulnerability. There were

generalizations by the government about how people get and want their water provision, which excludes some residents for emergency water. Each resident group (Raizales and non-Raizales) has different characteristics and capacities to cope with water shortages and drought. For instance, some residents do not have aqueduct; so, they will not receive the desalted water.

Finally, multiple voices showed how making sense of the crisis required a participatory process and how there is an intrinsic relationship between the interpretation and the response activities made during the crisis. The water crisis did not result in an opportunity for a change in the islander water access. A conservative approach and a technocratic paradigm were applied, resulting in a never-ending crisis. Given that the water crisis conditions are likely to worsen, this chapter calls for more research initiatives that challenge unequal power relations within the island. Indeed, reframing the San Andrés water crisis's dominant narratives is fundamental to finding lasting solutions, and crisis managers need to move beyond the water supply side and instead take a more demand management side, and also a sociological and historical standpoint.

Chapter 7

DESALINATION EXPANSION TO END THE WATER CRISIS

Desalination is the apparent emancipation of human society from water resource scarcity (Williams and Swyngedouw, 2018).

The current struggle over water resources makes a call for new strategic directions, which now are focusing mainly on water efficiency and the implementation of new technologies. Science and technology are regularly called upon to solve the environmental problems that were created by humans. Descartes (1968, as cited in Redclift, 1984) defined “technology as the application of scientific ideas to the environment, providing us with the knowledge ‘by which we may be able to make ourselves masters and possessors of nature’.” Now, in the context of climate change, in which droughts are happening more frequently, and more intensely, groundwater extraction is limited, and water contamination is rising, desalination is seen as a crucial water crisis response (March, 2015; Scheba & Scheba, 2018; Williams & Swyngedouw, 2018).

Since the 1950s, the problem of providing water in industrialized countries has been understood as an engineering challenge to be solved through the construction of complex and highly technological infrastructure systems (Head, 2014). Desalination is one of the most noticeable technological advances concerning access to new water

resources. Currently, desalination is a source of water supply being used for more than 14 islands in the Caribbean, such as in Barbados, Grand Cayman, and the Virgin Islands.

The shift to desalination has been relatively fast in the last decades, although the understanding of public perceptions, the aspects that influence attitudes towards this water supply option and its implications are in their beginning (Heck et al., 2016). For example, many issues have been less explored concerning the distributional consequences of desalination, like the uneven access to the technology and the water produced (March, 2015).

In the 1960s, the San Andrés government created two different water provision systems, one in the north-urban (desalination plant) and the other in the south-hilly-center-rural area (softening plant). These two systems have been maintained to date, and today, they not only differ geographically, but also in the water treatment system used, sources of water (Aquifer San Luis and San Andrés, respectively), and in their water production capacity (desalination 42.4 L/s for 2019; softening plant 14.4 L/s for 2019).

During the 1980s, the first desalination plant was constructed to provide water to the more populated area, the north-urban area, which had become the main tourist zone. In the 1990s, after suffering multiple technical problems, the plant was reconstructed (Intendencia Especial de San Andrés, 1992). Later, in 2006, a new desalination plant was purchased to provide water to the commercial and touristic area through the operation of Proactiva (now Veolia). In 2016, as a response to the water

crisis, together with the central and local governments, two new desalination plants were purchased. In 2019, Veolia was awarded an additional 15 years to operate the water infrastructure (e.g., desalination plants) and provide potable water and sewerage services. The water crisis in San Andrés has led to possibilities of the expansion of desalination as a means of water provisioning.

There is strong support for desalination by most participants and urgency concerning the necessity to install more desalination plants. The participants have faith that desalination will produce more water and consequently end the crisis. However, this chapter argues that this technological expansion will serve to exacerbate existing unequal social conditions. While stakeholders perceive a definite solution, this, in turn, serves to delineate a path of greater dependency and uneven water access.

In this vein, this chapter examines in what way and why most interviewees (2016 and 2018) perceive saltwater desalination as the primary solution to ending the water crisis. The goal is momentarily putting aside the debate about whether the water crisis was caused by humans or by natural causes; instead, it focuses on the way different stakeholders talk about desalination. This chapter delves into the complex and often hidden connections among water, technological advancement, and crisis, addressing through the voices of different stakeholders the deepening processes of appropriation of water resources by powerful actors and the parallel dispossession of weaker or marginalized social groups. Eventually, it is crucial to keep in mind that the reasons people used to justify their support for desalination are numerous, complex, situational and misinformed.

7.1 Institutional voices: engineering as a water crisis solution

In 2016, public officials cited the unprecedented severity of the drought and the El Niño phenomenon as the reason the desalination plant was the ‘keystone’ of the water crisis response. As the coordinator of the risk management office said, “there is no other alternative than a desalination plant for the island” and “if we fail to get the desalination plants, every year we will suffer water crises.”

A decisive element in the consolidation of desalination as a crisis solution was the declaration of the water crisis as a local State of Public Calamity; this declaration identified the El Niño phenomenon as the leading cause of the crisis. The declaration provided new and increased political, technical, and financial support behind desalination, while further restricting the space for other alternatives (Scheba & Scheba, 2018).

The State of Public Calamity authorized the San Andrés local government to request assistance in developing intervention measures to be aided by the central government and water experts. In less than a month after the first water shortage protest, on April 26, 2016, the Household, City and Territory Ministry signed an agreement with the local government for the start-up of a new desalination system and a water pipeline. The agreement included an investment of 7.5 billion Colombian pesos COP (approximately 2 million USD equivalent), of which three million Colombian pesos COP (approximately \$800,000 USD equivalent) were contributed by the Household, City and Territory Ministry (El Isleño, 2016).

In making sense of the crisis and decision-making process for the water crisis response, the differences between public and private actors were not always sharp (see chapters 5 and 6). Significantly, the crisis response process relied on a range of government and private water experts, including engineering and environmental consultants who were involved in the analysis of the business plan to source funding, and in writing technical reports on desalination technology (Gobernación del Departamento de San Andrés, Providencia y Santa Catalina, 2016b).

During the interviews, almost all officials expressed the urgent need for a technological solution to increase the amount of water produced. Multiple times they stated that desalination is the most efficient way to produce water. The environmental corporation official explained that one of the crisis causes was the lack of technology implementation to use seawater to produce fresh water; he explained, “we are on an island surrounded by the sea, we should not have water problems.” In the same vein, the congress representative manifested that “we have a limitless source of water that is the sea” and “we can use the sea without risking the aquifer.” The coordinator of the water management office in the environmental corporation suggested putting desalination first as a crisis response in order to protect the aquifer, since the groundwater extraction rate must be reduced to prevent further aquifer depletion and reduce the risk of saline intrusion. The environmental corporation engineer explained,

Some of the wells at the Duppy Gully plant [softening plant] are already running out of water, and if La Loma depends on this aqueduct, another source should be considered. In the future the Duppy Gully plant should be retired; as far as I am concerned, we have to desalinate sea water.

An owner of a water truck company, also, supported desalination saying,

I believe that what is needed are desalination plants and they should produce enough water and these waters should go through the pipeline and it should reach each house through the pipeline to guarantee the physical-chemical but also bacteriological quality of the water and that at that moment we will be happy that we will no longer need water trucks on the island.

Interviewees agreed that desalination is the only solution for securing water

access in San Andrés, and thus, it is the only way out from the crisis. It is believed that it is the best option for the island, and also the best water quality, but changing the way Veolia is extracting the water, not from the coastal wells but directly from the sea.

The public service secretary explained that desalination might have a favorable impact on the water frequency issue, which was contentious during the protests. He said, “this change [increased water frequency] depends on the water production capacity because now it is technically impossible, but when we have a new desalination plant, the water frequency will increase.”

The maintenance managers from different big hotels spoke optimistically, from their own successful experience, about desalination; they said that during the crisis, the hotels were supplied with water from their own small desalination plants and did not suffer in the crisis. One manager suggested that “the government must install two or three desalination plants to have a good water production and be able to give water to everyone, including tourists and neighborhoods alike.” Additionally, some expressed that they have been working for 25 years with their own desalination plant,

and “the only problem would be if the machinery is damaged or there is no energy or fuel to run the plant.” In contrast small hotels owners claimed in 2016, having problems with access and quality of water. So, with a similar perspective and emphasizing the significance of the water quality for tourists, the owners of small hotels want to have the possibility to get their own desalination plant, and they have included in their plans buying and installing a plant.

7.1.1 Desalination plant operation and its beneficiaries

The installation of additional desalinations plants in the island, and the access to desalted water by different social groups or sectors, have been problematic. In 2018, the first desalination plant of 25 liters per second capacity was purchased and installed, but not operated. The public services secretary explained that “efforts were made with the central government, they gave us a desalination plant that was installed on the private water company’s property, but after three months it is still not operating [2018].”

The plant’s operation had some administrative and technical problems related to who was going to operate the plant. The risk management office coordinator indicated that “we have some drawbacks because we do not have local personnel on the island able to operate the plant; so, the plant has to be managed by Veolia [instead of the government].” The public services secretary said, “we are entering in a conflict with Veolia because they do not want to operate the desalination plant until the government provides the economic resources for the operation [2018].” This was the

beginning of a series of tussles and negotiations between the government and Veolia.

As a way to clarify the situation the public service secretary explained,

It was like giving a gift to the water company, but they do not have a way of sustaining it because the cost of operating the desalination plant can reach more than 400 million Colombian pesos per month [approximately \$100,000 USD equivalent]; so, Veolia is concerned about the maintenance and operation costs of the plant; therefore, those costs must be assumed by the government. [2018]

Regarding the agreement terms and operation costs, the Veolia director explained this situation in the following way:

In the contract, it was not established that the operator [Veolia] would receive a new infrastructure. Including a new infrastructure [desalination plant] requires a water rate recalculation. Therefore, we modified the contract to increase its length and to add more infrastructure. The start of the desalination plant operation means additional 3,000,000,000 Colombian pesos [approximately \$800,000 USD equivalent] annual operational costs. The current water rate for one water cubic meter is 14,900 Colombian pesos. If I charged the 3,000,000,000 Colombian pesos annual operational cost, the community would not be able to pay for this water. Therefore, we reached the following agreement: Veolia will not raise the water rate for the next two years, and the local government will assume the water operational costs.

At the end of 2018, the local governor and Veolia signed an amendment to the water agreement, Otro Si No. 9, in which it was stated that the company would continue being the water operator in the island for another 15 years and the company will operate the two new desalination plants (25 L/s and 50L/s).

Additional to the administrative tasks, some technical work has been necessary for the installation of the second desalination plant and the delivery of the desalted water to people affected by the crisis. An engineer from Veolia argued that “our future is desalination” and he added,

It will help to mitigate the consequences of the drought that occurred in 2016, but it is necessary to build water pipelines to connect the north-urban aqueduct sector to the south-rural aqueduct sector to distribute the desalted water to the rural areas.

Along the same lines, the coordinator of the water management office in the environmental corporation explained that for people to receive the desalted water from both desalination plants, “it still depends on the construction of a large storage cistern in La Loma.” Currently, several works are missing for the second plant to start its operation: the construction of wells, pipes for water delivery (from wells to plant and from plant to storage tank), and furthermore, the desalination plant has not yet arrived in San Andrés [August, 2020]. Moreover, the coordinator of the water management office in the environmental corporation said,

Let's say that the first plant [25L/s] is going to produce water, but this water is not enough, the other desalination plant [50L/s] is needed [to supply water to the hilly parts]. The problem with the other plant [the one that has not been installed yet] concerns how to extract water. A study revealed that it is no longer possible to continue extracting water from the coastal-aquifer-wells in that area [where Veolia has the other desalination plants, Lox Bight], because salinization of the aquifer [San Luis] could be generated.

On the whole, officials anticipated that to put the two desalination plants in operation, it is necessary to work, in advance, on various technical and political steps that took more time than they planned. For example, officials referred to different tasks:

1. Determining budget allocation
2. Defining the type of saltwater that would be used: directly from the sea or close to the coast

3. Obtaining environmental corporation authorization for water extraction and installation
4. Starting negotiations among the local government, central government, and the private water company to determine who is going to operate the plant
5. Defining the changes in the water contract concerning water frequencies and water rate per liter

The political and technical system in which the crisis occurs usually impose unique challenges, in this case, technical knowledge about the water management system and expertise in desalination technologies played a significant role. The implementation of desalination technology is not an easy task; generally, it includes the following steps: seawater intake system, water pre-treatment system, energy recovery system, chemical dosing system, cleaning system, and monitoring system. The director of Veolia said, “the governor, at that time, told me, you are the technicians, the government does not have desalination technicians.” In consequence, Veolia took the lead in technical meetings recommending and operating the desalination plants.

The government promised adequate water service to all people affected by buying two desalination plants. In the short term, they promised to purchase, in November 2016 (seven months after of the declaration of State of Public Calamity), one desalination plant of 25 liters per second capacity, which in reality was installed in December 2018, two years later, and put into operation in 2019. In the medium term, they promised to purchase another desalination plant of 50 liters per second capacity

by November 2017, but in reality, it has not yet been installed as of August 2020. The desalination plant of 50 liters per second required additional works such as well construction and water pipeline conduction.

In this vein, during the water crisis, managers need to do more than expose the crisis effects and causes, they need to learn about the steps necessary to take in order to purchase, install, and distribute desalted water among people affected. In 2018, a desalination solution become an unfulfilled promise, and many resident's interviews asked, "why the government has not yet put the plant to work?" All of which is to say, that according to some officials and residents, the government did not fulfill, promptly, their promise to end the crisis, and it continued having problems with desalination plant installation and operation.

Among official's statements there was no clarity about how desalted water will reach people without aqueduct service since efforts have been concentrated on the existing aqueduct pipeline. To distribute the desalted water to the affected people, aqueduct subscribers and non-subscribers, it would be necessary to increase the aqueduct coverage in rural areas and to connect the north and south-center aqueduct sectors of the island. The Veolia director said, "the water agreement established that the company will only deliver water where there are water pipelines." The congress representative explained that "we have problems with aqueduct networks, water is not reaching all neighborhoods because there are no water pipelines, so we also have to design a strategy to give water to those neighborhoods [without aqueducts] in a different way."

Decisions concerning water distribution and quantity continue being under the company discretion. The coordinator of the water management office in the environmental corporation indicated, “they [Veolia] have an amount of water flow authorized, and they can deliver this water to whomever they want; they have made the decision to send it mainly to tourism, which is a commercial matter [2018].” In the same line, the public services secretary said,

Well, the tourist, unlike the resident, has water 24 hours a day. Not necessarily because the company has water availability, but because the hotel sector itself is concerned about giving tourists 24-hour service. A hotel can pay up to 50 million pesos a month [approximately \$14,000 USD equivalent] to ensure water for its tourists. [2018]

Regarding the above mentioned, as a result of multiple operative and technical problems and lack of enough aqueduct coverage, in the years to come the desalted water will be mainly distributed among aqueduct subscribers and it will not be available 24 hours per day.

7.2 People affected voices: We cannot wait until the rain comes

Most residents believed that their water concerns would be solved through desalination, and in 2016, they seemed relieved. However, a more in-depth analysis revealed many limitations and drawbacks of this technology. Its implementation may not be significant today, but it may become problematic in the future. To explain this assertion, this section starts by showing how people talk about desalination.

Many interviewees acknowledged various causes of the water crisis like historic drainage, tourism, inequality, and aqueduct technical deficiencies; however, there is some form of optimism for desalination. The majority of residents talk about desalination as the best option to produce more water on the island. A woman from Sagrada Familia neighborhood in 2016 explained, “I hope the crisis will not happen again since the governor said he is going to buy another desalination plant to get more water.”

Residents highlighted that it will be free from climate variations and that the government has promised to bring a desalination plant that is going to solve all their water problems. A Raizal minister from the Loma Cove Baptist Church said,

We are on an island surrounded by water, and desalination is the ideal solution, we do not need to wait until the rain comes. For example, the tourist ships get water from the sea. This island is like a big ship in the ocean. Instead of taking everything from the earth, we need to get it from the ocean. [2016]

During the interviews in 2016 and 2018, just two participants highlighted the possible adverse environmental effects of desalination. A man from Loma Cove neighborhood said, “each coin has two sides: if you will bring me a desalination plant you will also bring me an environmental problem.” A young woman from Sagrada Familia neighborhood thought that “the current plant pollutes a lot and if they bring two more plants it will be worse for the island. I mean, the cure could be worse than the disease.” Neither person named specific environmental problems. Only one interviewee expressed that desalination is the wrong solution, and he did not accept desalination as an option. He said, “it is the wrong solution for the crisis. The problem

is overpopulation, not the lack of water. The solution is to remove people from the island.”

Overall, people understand that desalination removes salt from water, but they did not understand in detail all the technical and logistical expertise involved. A woman from Barkers Hill seemed to believe that she could desalinate water at home. She said,

If the El Niño phenomenon comes [again], I don't know what we are going to do. We have to take sea water and boil it, remove the salt and use it. Thank God we always have seawater, and to survive, we must use it.

The fact that people in San Andrés know relatively little about desalinated water and how it is produced seems to favor desalination acceptance. According to Lopez-Gunn et al. (2008), water desalination's environmental disadvantages are not commonly understood, leading to (uninformed) support for desalinated water. If people have experience using desalted water, they are likely to know more about the negative environmental impacts of desalination and become more reluctant to embrace it.

During the interviews in 2018, most residents continued to see desalination as the best option to solve the ‘continuous crisis.’ These phrases were common: “is the best option,” “the only solution,” “is the way to end the crisis,” “what we need is to produce water.” An expression that was frequently heard in both 2016 and 2018 interviews was “we are surrounded by water we should not suffer from water scarcity.”

Indeed, desalination was portrayed as a conflict and risk-free solution to the water challenges in the island. However, an interviewee from Loma Cove said, “they promise a desalination plant, but nothing happens yet.” The water crisis continues, people did not have water, and the desalted water has not yet reached all neighborhoods affected.

7.3 Discussion: Desalination to end the water crisis?

Among the majority of participants, there is strong support for installing two new high-technology reverse-osmosis desalination plants as the primary official crisis response to end the water crisis. Positive perceptions of desalination might be founded on participant’s previous experiences. This is in line with King et al. (2012) ‘s findings, which relate positive support to past experiences using desalination plants in Australia. In this sense, the historical recount of the water management on the island in Chapter 4, shows that San André’s islanders have a long history producing and receiving water from desalination plants since the 1980s. Moreover, maintenance managers of various hotels have reported that their company suffered no water problems because they have desalination plants; therefore, successful experiences by well-known hotels on the island could play a vital role as a risk-free desalination experience.

Besides, small island societies, like San Andrés, tend to have a strong cultural heritage, sense of identity, and sense of place (Kelman, 2010). The Raizales, who have the strongest historical ties with the island, showed positive thoughts and support for

desalination expansion. Raizales, who do not perceive the desalination plant as a threat to their place identity (the meaning and significance of a place for their inhabitants), tend to have positive attitudes towards installing the plants. Results from Heck et al. (2016) concerning Californian's perceptions of desalination, differ from these findings, in which the authors claim the predictor of place attachment and perception of desalination as a threat to place identity correlated significantly and negatively with support for the plant.

Findings show multiple reasons public and private officials indicate their support for desalination; specifically, the results of this study include six motivations:

1. There is no other alternative to desalination.
2. It is necessary to end and not to repeat the water crisis.
3. It is the best solution to increase the amount of water supply.
4. It is necessary to use the ocean that surrounds the island, a limitless supply of water.
5. It is the way to conserve the aquifer from overexploitation and saline intrusion.
6. It will provide quality water for everyone in San Andrés.

In addition, the majority of all officials perceive desalination as a fundamental water technology to produce more water resources to mitigate the impacts of the prolonged drought, which began in 2013 and the El Niño phenomenon of 2015-2016, as the motivation for the Decree of the State of Public Calamity in 2016. Usually, water crises are framed as naturally caused and require a technological solution; this is the case of the ongoing California drought crisis in which Heck et al., (2016) reported

that most (71%) California residents show high levels of support to desalination since people felt their water sources threatened for a drought. Similar crisis framing and response were found in the Sedgefield and Knysna, Western Cape, South Africa drought crisis (Scheba & Scheba, 2018), and Queensland, Australia drought crisis (Head, 2014).

This study is consistent with the literature that discusses political ecology perspectives. According to the study done by Williams and Swyngedouw (2018), blaming a natural hazard (e.g., drought) for the water crisis is a dominant narrative in which desalination is considered the ‘only’ option to supplement and augment water resources. The authors said that this narrative is usually presented by the water services industry, like Veolia, and by influential engineering experts to favor technological responses to a water crisis, justifying “the enormous financial and considerable socio-ecological costs of building and operating desalination plants (p 9).” Scheba and Scheba (2018) explained that among these powerful actors are state officials, politicians, businesses, and affluent residents who use a range of communication and legal tools to enforce their crisis solution. Indeed, on April 15, the San Andrés local government declared a State of Public Calamity citing the main cause of the crisis to be the El Niño phenomenon (Decree No. 170, 2016). In this research, these powerful actors were found to be the central and local government, and the private water and tourism industry, which created the political space, structure, and defined and legitimized desalination as the best solution, although omitting the historical roots of the water crisis.

Moreover, Redclift (1984) argues that the use of technology is justified by the dominant powers as privately and socially profitable, creating a suitable environment for the permanency and expansion of the technology. In this case, the San Andrés government created this environment that led to the private company's continuity and permanence. The San Andrés local government provided the upfront financial resources, physical infrastructure, the land for operations, and the technology to the water company to produce more water. The crisis response was an opportunity for the private water company to continue being the water operator on the island for another 15 years, increasing the company infrastructure with two additional desalination plants.

In crisis literature, researchers refer to this dynamic as “crisis as an opportunity” that benefits some economic interests (Boin, ‘t Hart, Stern, & Sundelius, 2016); in this instance, the preservation and support for Veolia. Therefore, it is central to investigate who will benefit and why from the crisis because this ‘opportunity’ may affect the understanding and response of government and private business actors. Crises are extremely political; therefore, it is vital to understand not only public official's performance but also how they affect the distribution of societal and natural resources across different groups and sectors in the society (Estes, 1983). When dominant actors refer to a crisis, an automatic question is: whose crisis are we talking about? (Boin, ‘t Hart, & Kuipers, 2018).

Williams and Swyngedouw, (2018) argue that this dominant narrative rests on three core assumptions that fit with the research findings. The first deals with the way

the water crisis was framed (chapter 5). Officials framed the crisis as a problem of physical water scarcity caused by the El Niño phenomenon and a drought. Second, officials cast doubt on the traditional forms of water supply used on the island (rain harvesting and well water extraction), which they claimed are not enough to cope with the growing demand, opening the doors for alternative water solutions. Officials, with residents in agreement, mention the progressive abandonment of Raizal traditional rain harvesting, with less than 42% of households collecting rainwater, and mention groundwater contamination, making the use of 93% of wells a high-level risk. Third, the ocean is presented as a limitless water source free from social conflicts, climate changes, and precipitation variability.

For their part, residents, both Raizales and non-Raizales, considered desalination as a rainfall independent and a logical solution for an island surrounded by seawater. Residents were inclined to believe that desalination will solve water distribution inequalities by increasing water frequency in aqueduct service and compensating for the reduction of water resources by tourism. Despite the optimism of residents, Redclift (1984) and March (2015) argue that desalination technology does not solve inequalities; instead, it maintains and creates new ones.

Findings and related studies show how desalination maintains and deepens water inequalities. The first desalination plant was installed in the 1980s, creating two separate water markets: a desalination plant producing an expensive, available, and high-quality water, and a softening plant with a lower-price and lower quality and supply of water. Although both types of water complied with the same water

regulation norms and quality criteria, this created perceived inequalities derived from the quality of the two types of water, and variances in water shortages. Residents now prefer water from a desalination plant. Moreover, while officials in their crisis response consider both aqueduct subscribers and non-subscribers, the medium and long-term response, by desalination expansion, excludes non-subscribers from the solution, maintaining water inequalities. For example, there is a low aqueduct coverage (60%), and according to the Veolia director, only Botton House neighborhood was prioritized for aqueduct expansion, and the activities of rehabilitation and reduction of water leaks are implemented in the existent aqueduct pipeline; therefore, the desalted water will be mainly distributed among aqueduct subscribers. There was no clarity about how desalted water will reach people without aqueduct service. Finally, according to Amendment no. 9 of the water agreement, the water frequency in La Loma neighborhood will improve, from every 20 days to once per week, constrained by the water availability of the Duppy Gully softening plant and until the desalination plant, of 50 L/s capacity production, will start its operation (as of October 2020, the plant has not started its operation). This modification continues showing unequal treatment to La Loma, and people without aqueduct service, in comparison with other sectors on the island, especially the north end (commercial and touristic zone). In this sense, findings reveal that the desalination expansion will not solve the unequal distribution of water, and tourism and commerce will continue being the primary beneficiaries. This contradicts the way residents understand and support desalination expansion.

Ribeiro and Shand (2008) argue that desalination can introduce new societal risks. Desalination is not a simple technological solution for resolving old injustices. It is incapable of restructuring a system defined by social inequalities and environmental degradation (Ribeiro & Shand, 2008; Williams & Swyngedouw, 2018); instead, it represents a techno-political strategy for enduring conflicts and tensions related to water governance (Williams & Swyngedouw, 2018; Scheba & Scheba, 2018).

Throughout most interviews in the present study, concerns about the safety, costs, socioeconomic, political, and environmental problems of desalinated water were not often cited and participants considered desalination as a low-risk technology. Indeed, the study done by Alhakami and Slovic (1994), has shown that there is a strong inverse relationship between risk and benefit judgments, affecting decision-making process. The authors claim that “when people consider an activity or technology beneficial, they may, to be consistent, also tend to view the technology as having low risk” (p 1088). In this sense, if the primary information about desalination highlights its benefits, this, in turn, leads to a low-risk perception of desalination. The authors conclude that “it might be possible to change perceptions of risk by changing perceptions of benefit, and to change perceptions of benefit by changing perceptions of risk (p 1096).”

King et al. (2012), who study public attitudes to desalination in Australia, stated that this lack of perceived risks is associated with a lack of familiarity with the technical desalination process. Residents in the present study talk about this technology enthusiastically, but perhaps their technical knowledge of it was minimal.

Overall, residents showed acceptance concerning what the government has planned and promised on the multiple protests-table-negotiations done to end the water crisis. Indeed, during the interviews, there were only two residents who expressed general concerns about desalination expansion. However, there is a broader range of potential impacts and risks of desalination technology, including inducing urban growth, greater privatization of water supplies, and increasing water prices (Feitelson & Rosenthal, 2012; McEvoy & Wilder, 2012; March et al., 2014). Also, there are multiple environmental impacts concerning feed water intake, loss of biodiversity, and impacts to marine ecosystems (March, 2015). For example, most desalination plants require a high demand for fossil fuels, which means high greenhouse emissions and fossil fuel dependence, which contradict climate change mitigation guidelines. Also, increasing energy demand may put pressure on the energy sector, affecting its capacity to provide service, and the water company may become more vulnerable to energy price variability and energy availability (Cooley & Heberger, 2013 in: Williams & Swyngedouw, 2018). Therefore, desalination has been characterized as a maladaptation strategy to climate change, causing indirect impacts such as ocean acidification and sea level rise (Heck et al., 2016; Fragkou, 2018).

Results show that behind the crisis response is the idea to replace ground water by desalted water. Stemming from this argument, there has been a shift of islanders' attention from rainwater and groundwater to desalted water. In this vein, this research sheds light on the reconfiguration process of islanders' social relations to water and implications promoting the abandonment of traditional forms of access to water.

Williams and Swyngedouw (2018) claim that the ocean's consumption has meant a shift in society's relationship with the biophysical world; therefore, the mentality that is growing is that there are no exploitation limits and water scarcity will be no longer possible. Results show that the future that is being sought for San Andrés is a water resource-abundant island with no water limits, which means enhancing the island's carrying capacity, and consequently, no limits for tourism growth (WCED, 1987; Swyngedouw, 2013; Swyngedouw & Williams, 2016). This just reveals a contradiction between residents' views that desalination will solve their water problems; however, they apparently do not realize that it may also cause rapid expansion of tourism, with various negative consequences.

Findings in this research should be taken into account when considering answer how islanders gradually are losing their water resources autonomy, in which water flows are now more controlled by the private company through technology, infrastructure, and government connections. Shiva (1991) calls for uncovering the dangers of technology in which the global North has promoted ideological domination by increasing scarcity, inequality, and dependency. Redclift (1984) explained how technology leads to dependence on foreign specialized companies, impoverishing an already poor society. Technology requires specialized knowledge, which is usually absent in the place where it is implemented. The operation is replicated from the industrialized countries without sufficient local participation, which results in ill-suited attempts. These notions are in line with the situation in San Andrés; the risk management coordinator indicated that there are no qualified local personnel able to

operate the plant; therefore, he claimed that Veolia, a French world leader in desalination, must operate the plant with outside personnel.

Finally, four years after the official declaration of the State of Public Calamity (2016), the government has not fulfilled its promise to end the crisis and only one desalination plant is operating. Indeed, implement this technological solution is not an easy task and requires additional infrastructural work involving more time than planned.

The results show that officials favored desalination as a solution and either an unaware or of not focus on socio-historical aspects of the crisis. Residents also support desalination as a solution but also focus on issues of water justice. Studies on desalination and observations on the ground in San Andrés suggest that positive ideas behind desalination and promises about improving water access, mitigating the effects of the El Nino phenomenon, and water justice might not be compatible.

7.4 Conclusion

In concluding, it is central to return to the question with which this chapter began: why the majority of participants', officials and residents, frame desalination as the first and best solution for the water crisis? Some of the influential factors identified for this strong support include the historical presence of desalination on the island, the sense of threat of the island's water resources, the consideration of the ocean as a limitless and accessible water source, the low-risk perception of the desalination technology, and the lack of familiarity of the desalination technical process.

Particularly, the strong support professed by officials to desalination rests primarily on the view that desalination is a fundamental water technology to produce more water resources to mitigate the impacts of the prolonged drought and the El Niño phenomenon. This was a dominant narrative by some powerful actors, like Veolia, that permeates the water crisis response. The crisis was considered natural in which technological solutions were nevertheless reinforced in a society that has been historically affected by the subtle effects of desalination. The premise behind this technology is to solve present and future islanders' water needs, which gains consensus in the majority of the participants with a slight difference. Residents, Raizales and non-Raizales, hold faith that desalination will make them free to wait for the rain, increase the water supply frequency, and mitigate the impacts of tourism growing water demand.

The San Andrés water crisis displays its political character and the necessity for desalination expertise knowledge. The crisis creates the political space for water experts to promote the idea and implement desalination expansion as the best and only solution for the island. The declaration of the State of Public Calamity and government efforts to coordinate and negotiate crisis solutions served to legitimize this dominant narrative, while further restricting the space for other local alternatives. This is demonstrated by the fact that Veolia has two new desalination plants and continues to be the operator of the aqueduct and sewerage service; however, residents continue having problems accessing water. The crisis allows the company to extend its corporate control over more water resources, not only groundwater but also seawater.

On top of that, there are potential implications raised by desalination that were revealed in the findings. Some of these implications have been outlined by critical scholars from the political ecology perspective (Redclift, 1984; Shiva, 1991; Williams & Swyngedouw, 2018; March, 2015; Scheba & Scheba, 2018; Fragkou, 2018; Feitelson, 2018).

First, it is widely believed by participants in this study that desalination is a risk-free solution that will reduce vulnerabilities to water-related hazards. This optimism is contradicted by related studies that shows it leads to environmental problems, becoming a maladaptive strategy. Second, it is assumed that desalination is a conflict-free solution. However, desalination may detonate new struggles among different users over the new surplus of water bringing new social complications. This, of course, depends on how San Andrés society structures and defines the use of this water. Ensuring that desalted water will be used by people affected and not for tourism growth it is necessary to have an explicit mechanism that determines the use of the desalted water (McEvoy, 2015). Third, desalination technology is fostering a lack of recognition of natural water limits; the idea is maximizing water security by maximizing water consumption, rather than addressing management/governance problems, inequalities in water allocation, and the reduction of water demand by mass tourism. Fourth, it is believed that desalination will enable greater autonomy over water resources; however, technological transfer leads to technological dependence. Islanders will not have control over water; instead, water will be controlled by the

foreign company, and this might be the root of a new social struggle to get the right to manage the water resources.

Finally, the attempts to solve the water problems in San Andrés by desalination do not take into account the collateral consequences generated by this new modern solution. San Andrés is moving toward to a technological water dependence, disconnected from traditional local forms of collecting water, in which the social and environmental problems, the lack of sustainability, and the high ecological costs that desalination may produce are invisible.

Chapter 8

RECOGNIZING WATER INJUSTICES IN THE WATER CRISIS

“The greatest of all social injustices is to drive people off its lands and to deny people its waters (Vojinovic and Abbot, 2013)”

Crises uncover injustices and preexistent social processes of the society affected. San Andre’s water crisis was not marked by absolute scarcity, but instead, there were different forms of water injustices that were created and maintained through decisions on infrastructure development, politics, and economic negotiations. Water is a natural element that is required for life and cannot be replaced. Its uniqueness enhances the need for an emphasis on justice and unjust outcomes in the configuration of water crises (Neal, Lukasiewicz, and Syme, 2014). Water injustices result from a long historical process of creating unsafe conditions, in which some individuals or sectors have been pushed more and more to live at risk (Wilhite, 2005).

In current practice, there is clear evidence that there is a lack of interaction between social aspects and engineering in water-crisis-management, which is one of the significant obstacles for solving problems associated with water problems. As stated in the previous chapter, this can be primarily explained by the technocratic paradigm's dominance. This paradigm holds the idea that a crisis can be overcome and put under control by implementing engineering measures alone (Vojinović and Abbott, 2012).

Moreover, crisis studies nowadays focus on organizations' functioning and managerial tasks, excluding highly decision-relevant information; for instance, it does not include diverse stakeholders' voices and knowledge. That is to say that crisis studies need the knowledge that comes from the people on the ground.

Environmental justice deals mainly with the distribution of environmental benefits and the burdens people experience. Water (in)justices involve both quantities and qualities of water, the modes of accessing and distributing water, the meanings and knowledge that shape water control (Zwarteveen and Boelens, 2014 p14).

According to Zwarteveen and Boelens (2014), water justice is based on principles of fairness, equity, participation, and justice. In the context of water crisis, justice means:

1. Maximizing welfare, maximizing the benefits of drought mitigation measures according to stakeholder-defined values.
2. Fairness, water resources should be used fairly and efficiently in terms of spatial scales (sectors) and time (now and in the future).
3. Everyone has the right to be safeguarded from the effects of droughts and other social actions related to the lack of water.
4. Public policy should include equity principles encouraging sharing risks and protecting the most vulnerable.

Environmental justice operates through three main concepts: distributive justice, procedural justice, and interactional (Wutich et al., 2013). Distributive justice i concentrates on outcomes and how water is shared by group members and is also based on community norms such as needs, desires, and required outcomes (Wutich et

al., 2013). Procedural justice is defined as the fairness of the political, legal, market, and other processes that determine the allocation of harms and benefits (Bornstein and Poser, 2007). Interactional or recognition justice deals with fairness in social and interpersonal interactions, conduct, and treatment related to discriminatory practices in micro-level interpersonal interactions and systems that can become unjust (Wutich et al., 2013)

According to the above mentioned, this chapter is concerned with the social construction of water injustice by diverse stakeholders. Central for this study is understanding how water injustices are embedded and situated in the 2016 San Andrés water crisis. In this vein, some of the questions answered in this chapter are: 1) How do different stakeholders frame water justice concerning the water crisis? 2) To what extent perceptions of water justice focus on distributive, procedural, and interactional issues?

Findings are presented in three areas: first, people affected framing of water justice and the water crisis; second, how public officials and private personnel talk about water justice issues during the water crisis, and finally, an analysis and a summary is presented. All findings in this chapter are derived from the empirical data collected through semi-structured interviews.

Finally, the chapter contributes to the overall argument by showing that water injustice is also a contributing cause of this contemporary crisis. Furthermore, it highlights how water injustice is being normalized among public officials in which the majority recognized the problem in some way, but did not take action.

8.1 Framing water justice: people affected voices

People in the neighborhoods affected raised awareness of the broader issues linked to water, highlighting their perceived right to water and sanitation in the face of dispossession, exclusion, and inequity (Sultana, 2018). Many interviewees stressed their concern for the well-being of the Raizales and non-Raizales faced with the continuing drought and dependency of the community on the aqueduct service and rain harvesting. In this section, interviewee conceptions of fairness or justice and equity are reported and analyzed.

This analysis is done taking into account that fairness and justice are subjective terms that rely on a judgment about deservedness, proportionality, and equity. Equity and equality are two approaches that are used to produce fairness. On one side, equity is usually understood as giving everyone what they need to be successful. On the other side, equality is treating everyone the same.

This means that when it comes to putting new infrastructure in place, what people consider to be the most ‘fair’ distribution is not necessarily the most ‘equal’. Furthermore, this is particularly important because sometimes large public infrastructure tends to be built where it is the most technically, scientifically, economically, environmentally and politically appropriate, but it is not located according to the community interest and necessities, and the sense of what they think is fair (Syme, Nancarrow, and McCreddin, 1999 p 51).

Participants' views about the relationship between fairness and water access were centered on equality issues. The majority of participants used “unfair and

unequal” as words to express what they perceived. The researcher heard multiple times interviewees saying, “why do some parts of the island have 24-hour access to water and others do not?” A participant from Loma Cove explained, “the population on the island has grown, also, with tourism, the water ends up in the hotels; the private water company forgets the local community.” For most people, the fundamental issue was the belief that their water had been taken away by the government with no prior warning and no compensation.

The majority of respondents perceived human activities, not natural changes, as the cause of the water crisis. There were, however, some other perspectives about the crisis. A few of those interviewed thought that central issue was that there had been insufficient rainfall and this was a time of severe drought.

8.1.1 Interviewee conceptions of “fairness” and “justice”

When participants were asked about how they perceive water injustices, their responses fell into various themes (see table 14). The goal here is not to present a full range of potential fairness conceptions. Nor is it to present a quantitative evaluation of responses. Rather, to show the expressions and equity and equality principles that emerge from the empirical data.

Table 15 Interview fairness themes in relation to the access to water

Interview Fairness themes	Responses
1. Fairness as consideration and respect: treating people in a fair and respectful manner	<p>“They forget the local population, it is the hotels who have priority; “Here there is no water all the time because we are the residents” (Court house)</p> <p>“We want they [government, Veolia] to not leave us in a last place, when we also need the water (Clymont).”</p>

2. Fairness as doing the right thing	Because of tourism and over population, the government switch the water to go to the town every day and we only receive water every 25 days. What they are doing to the people is not right it is discrimination, abuse, from the Colombia states, meaning national government (Barkers hill)
3. Fairness as everybody gets the same amount, frequency, and quality of water	“Everyone should have the same amount of water (Los Almendros) “The water should be supplied first to the houses because one is from San Andrés, and later to the tourists who do not know how to take care of the water (Sagrada Familia) “If we already know how many liters of water we produce per year, then they should divide it equally among all (Natania)”
4. Fairness as needs being met	“If there is any priority, I would think that it would be the older, the poor, they need more water (Barkers Hill)”
5. Fairness as consideration of the sociohistorical land tenure in the island.	“I think water first for Raizales and then the others (non-Raizales and tourists) (San Luis) We are the owners of the island and we must have priority in our land (Clymont)
6. Fairness in relation to spatial locations: fairness between people living in different sectors and neighborhoods.	“the water that is under my house (aquifer) is not for me, but is for the tourists who come and take our resources and leave.”

The first theme contains interviewee responses in which fairness is related to how people are treated. Responses in this theme were fundamentally concerned with how the government and Veolia treat the residents. It is about fairness between different groups of people living on the same island.

The second theme concerns responses that involve morality. When the government prioritizes tourism and commerce for water allocation, it has a differential and unfair treatment. At this point, the focus is on discrimination against Raizales.

Particularly, it is critical to point out that minimal amounts of water are supplied to Raizales who live in the rural areas. Water from shared resources have

been unequally divided. Moreover, during more than 15 years, no aqueduct infrastructure has been developed for rural neighborhoods; also, the water grid's existing infrastructure with high water loss levels had not been upgraded until 2019. Water allocation for islanders was determined in the 1950's when the national and local policies decided to invest in the development of the aqueduct mainly to the north part of the island. This situation continued in 2005 when it was legitimized in the water agreement signed with Proactiva (Veolia) that there would be water allocation differences between the urban and rural areas on the island. Besides, demand for water has increased due to population growth since the water agreement was signed.

The third theme, the most common expressions, were related to the egalitarian principle of justice, which suggests that everyone should be treated equally. Those with this perspective believed that all tourists and residents (Raizales and non-Raizales) should have access to water with the same frequency, quantity and quality.

The fourth theme refers to recognizing that on the island there are people who are more vulnerable and need more water than others. Those with this perspective believed the poor and the most vulnerable should receive water first. These expressions were related to the equity principle of justice.

The fifth theme concerns the consideration of the sociohistorical land tenure and cultural issues in relation to water in the island. It is about the government having a greater understanding of cultural issues in water allocation. Participants perceived inequalities because the government did not consider the sociohistorical process in the island where they have cultural, spiritual, emotional, and physical links with water.

Raizales have typically been excluded from access to natural resources, and negotiations with the state have been systemically unequal. According to the participants' responses, the seeds of the water crisis have existed for several years, but this time they decided to do something, they were hoping for a change in their access to water, but that did not happen, as they said the water was provided by water trucking operations whose interventions lasted for 3–4 months until the rains arrived. This left the situation unresolved.

The sixth theme considers fairness concerning spatial locations, thinking about the spatial dimension as a valid category of analysis to interpret the conditions that cause injustice. It is a call to rethink the problems of water from the spatial point of view. For most participants, water trucks took water from “our land [aquifer located in rural and hilly part]” multiple times “to give it to tourist enterprises [located in the urban north part].” They said, “the water that is under my house (aquifer) is not for me, but is for the tourists who come and take our resources and leave.” The researcher observed that the areas that do not have water 24 hours per day are the hills and the south part of the island, which are areas mostly inhabited by the Raizales, and by poor neighborhoods.

To this point, sociohistorical context is critical when considering differences in water access and exposure to water-related hazards like drought in different parts of the island. In the 1950s, San Andrés started a gradual displacement of Raizales to the South and Center-Hilly part of the island. This displacement has been intimately linked with the development of tourism and commerce that have involved

reorganizing the territory based on tourism's needs as the prevailing economic activity (tourism constitutes more than 60% of the economic activity in San Andrés). It also means that the public infrastructure like aqueduct has been directed mainly to this area; with tourism developments, water has become subject to competing demands. There is a low aqueduct coverage in hilly rural areas, and Raizales have faced problems constructing deep wells to reach the water table levels and extract groundwater; therefore, they depend mainly on their rain harvesting traditions for water supply. In this vein, water access in San Andrés is linked to the area where you live and the economic capacity to build a house with a cistern and a well.

In general, participants' views about the existence of the unequal distribution of water fell into two main categories, the ones who believe water should be for all (mostly non-Raizales), and the ones who believe water should be first for the historical claimants of the water (Raizales). The first group believed that inequity in water service violates their cultural norm "water is for all" and the second group argues "the water is ours not theirs, people in the north get water all the time, we don't." A Raizal man from Barkers Hill indicated that:

The owners of the water are the black people, and people from San Andrés are black; the white people who live down there (in the north and plain part) have water, and we, who live up here (high hill parts of the island), the owners of the water, we do not have water, the water is located up here in La Loma not in other parts.

However, both groups think that the water crisis was caused by human activities, not as the result of natural forces; therefore, they think a water crisis will occur again in the future.

8.1.2 “The water is not reaching all people”

The most salient participants’ comments were about distributive justice; some argue for an equal share of water, and others saw their group as a priority. The comments focused on three core themes: 1) water scarcity; 2) water quality; and 3) water storage. First, many expressed the differences in getting water by different sectors (North, the high hill area, south), neighborhoods (Obrero, Barkers Hill, Cove), and houses on the island. As one woman, who lived for 16 years in Barkers hill, in the high part of the island, explained, “the water is not reaching all people, some sectors get it others no, one house gets it and the one next to me not” and she said “there is not any drought, you can get water in the island; and she questioned, so, why some areas do not have water?

A resident of high hill area said, “the most affected people is we who live in La Loma, and this is because they give water to the tourists, trying to provide good water service.” A participant explicitly claimed, “I think the water distribution is unequal and irresponsible, all the water is given to the hotels, the big monopolies, but we, the people who live in the island, we run out of water.”

Second, there is general knowledge among the community that there are differences in water quality, whether from the water company, rainwater, or from the domestic wells. A few participants made comparisons between the quality of the water they used to receive and the water they received during the water crisis response. They believed that the water from the private water company is better than from other sources. Therefore, they continuously requested the water from the company and

nothing else. A participant said, “the water from the private water company has a good quality, we can use it for cooking.” They expressed that during the water crisis response, “the water that the firefighters were delivering was not safe, they wanted to give us water from the Rock Hole well [well known for its poor quality].” In neighborhoods where no Raizal people live, comments referred to rainwater, “we collect rainwater only for house chores not for cooking because the roof is dirty.” Participants perceive that water that comes from the desalination plant has better quality.

Third, traditionally the cisterns have been used for storing rainwater, and almost every house in Raizal neighborhoods had their own cistern. The use has changed slightly, and they collect water from the private water company or mix both types of water. Currently, only 45% of the people on the island have a cistern. Participants expose the importance of having cisterns in the house, they frequently say, “what is helping me to survive is the rainwater.” In times of dry season, drought, or water shortages, cisterns potentially help people to cope with these situations. Water storage involves capturing and holding water from the house’s roof that might ordinarily be lost as runoff and making it available for later use. The participants indicate that having a cistern depends highly on the conditions of the house: space, location, economic capacity, and cultural habits. They said, “I do not have a cistern because where I live does not have enough space.” Another participant explains, “I have to ask my neighbors for water, they do have water, they have cisterns! Sometimes they give it for free or sometimes I have to pay.” They illustrated the

economic differences among individuals, a woman from Little Hill clarified, “some individuals have more economic capacity than others to get water, the inequity can be observed in different aspects, including the size of the cisterns.”

Complementarily, during the fieldwork, was observed differences among participants in getting and storing water. Some community members have more opportunities to build a cistern, buy water tanks, or pay water trucks to get more water than others. According to Wutich et al. (2013), distributive justice is absent when an individual or group acquires a disproportionate amount of water.

8.1.3 “They agreed to provide water every 20 days for us”

Procedural justice is about the rules and considerations in which public water systems distribute water to provide a supply of safe drinking water to consumers. These rules are decided by governance bodies and public policies and agreements between the government and private water companies. Perceptions of procedural justice were predominately negative; comments were numerous and centered firmly on two core themes: 1) infrequency in water distribution is unjust; and 2) the strong dependency on the water trucks vendors, where prices and the waiting time was unfair.

First, multiple complaints were heard about the number of days without receiving water and the differences in the frequency between neighborhoods and houses. Some reported 15, 25, 30, or 40 days waiting for the private water company to deliver water. Some expressions that signify this situation are: “15 days without water is very serious,” another participant said, “I have been one month and two weeks

without water, it was too much time for me,” “in this neighborhood, they put water every twenty or more days and when they put it is only for two hours, and it is not enough.” Some severe cases can be observed when people express that they have not had water from the aqueduct since five years ago. They want a change in the water continuity service and they feel they cannot persist without water so many days. A woman from Buenos Aires neighborhood indicates, “I hope we can have water in less time, we went to the private water company and the government officials said: there is an agreement where it was established that we only can have water every 20 days.”

Procedural justice is the idea of fairness in allocating water resources; in this case, participants feel that the water service’s lack of continuity violates normative expectations for fair, orderly, and predictable service distribution. A man from Barkers Hill proposed changes in how water frequency is established, looking for a fairer share of water. For example, he said, “what they (private water company) need to do is give water to one part on Tuesday and to the other part on Thursday, not Tuesday and Thursday to the same part, they need to give water to both areas, not only one.”

Second, several participants thought that the informal procedures in water distribution were unfair, explicitly pointing out the ones the water trucks are using to deliver water. Because there is no rainwater and no water from the aqueduct, they have to rely almost entirely on the water truck companies. Two subthemes were observed in their comments: time and price. A woman from Little Hill neighborhood says “I had to wait more than 15 days until my turn to get water finally”, another explains “sometimes they said Saturday morning, and I wait but they never come.”

Participants expressed how the water trucks are the ones who decided when residents can receive water and how much they have to pay for it. The trucks made changes in the agreements whenever they wanted. The inadequacy of local rules regulating the distribution of the water emerged as a core theme, and the community wants to achieve the actual needed amount of water as opposed to what the company believed they needed.

Finally, interactional justice concerns had less relevance to evaluations of justice in the water crisis. In the interviews, interactions with neighbors around water were about neighbors asking for water, establishing business relationships around the people's capacity to store water, and conflicts between them when they asked people who have water but will not give it to them. A woman in Buenos Aires neighborhood explained, “when the water is over I have to go to the corner where my neighbor can give me water, sometimes they sell it to me, sometimes they charge me 500 Colombian pesos per small tank.” The relationship is friendly, but it depends on the quantity of water needed, the neighborhood's demand, and, ultimately, the neighbor's willingness to give water to others. During the crisis, people who had big cisterns or good networking were able to get water before others. One of the cistern owners says, “I have the third biggest cistern in the neighborhood, so people used to come to ask me for water, they know who has the more oversized cisterns. Sometimes I can, sometimes I cannot, and they have to understand if I cannot give them water.”

8.2 Water injustice in expressions of public and private officials

During the interviews, officials rarely mentioned injustice issues concerning the water crisis response or cause. However, through a content analysis it was revealed that some of their expressions could be connected with a water justice framework. Officials used phrases and words that distinguished procedural and distributional forms of injustice. Officials who were closer to the ‘decision-making-table’ were inclined to talk about procedural justice issues. Water justice comments were frequently discussed concerning three justice principles linked to water distribution. They are: the principles of proportion (person's water supply is perceived to be in proportion to several dimensions such as utilization of the water resource, effort, deservedness, and strength of claims for water), equality (which suggest that everyone should be treated equally and received water equally), and the needs principle (the person who has a greater need should receive higher rewards or outputs -water). Moreover, justice issues were found at different levels or individuals that show a shifting (one department to another or one person to another) of water resource authority during the water crisis and over decisions affecting water justice. During the crisis, the authority over water resources varied, and during that time, community leaders, firefighters, and the government secretariat became the new actors who decided who can get water, and how.

8.2.1 Water distribution during the crisis response

During the crisis, there was a reorganization of water distribution. All water trucks own by public institutions were made available to deliver water through different neighborhoods affected. There were two emergency water distribution operations: a public one done by the firefighters, the risk management office, and the Civil Defense, and a private one done by Veolia which distributed water to its subscribers only. The local government bought the emergency water from Veolia (desalination plant), and the decisions about water distribution were the charge of the firefighters and community leaders. The public services secretary explained,

The risk management office did the water truck routes and water delivery coordination with firefighters, they coordinated the distribution logistics, checked what homes do not have water, and based on the Veolia water distribution schedule, firefighters delivered the water. [2016]

Firefighters played a critical role in the crisis response. They were the ones who decided how water emergency supply would be done, which sectors and institutions can apply for it, and who at the end can get water. As an immediate response, they delivered water to residents who made the protests; later on, the risk management office and the fire department implemented protocols for water distribution to residents without aqueduct service. To organize and select the water recipients, firefighters required that residents call the firefighter office or the risk management office and give their name, ID number, and neighborhood; then, they organized the water distribution plan. However, the firefighter in chief said, “some people thought that we [firefighters] gave more water to some households than others,

or that we prioritized some houses [2016].” The chief firefighter illustrated this situation with the following example:

One night, while we were supplying water in the Sagrada Familia neighborhood, we saw women fighting. They were afraid that we would not be able to give water to the entire neighborhood. Then, those who had organized the protest began to demand that they must be first, and those who did not protest should not receive water; for example, the leaders of the protest in the Sagrada Familia neighborhood wanted to force us not to give water to three or four families because those three or four families disagreed with making the protest, they insulted them. Nevertheless, we gave water to everyone, first to those who were complaining, after to the others. It was not easy.

Many issues of justice occurred in the context of the relationship between firefighters and residents. Generally, decisions over water allocation by firefighters were influenced by four aspects. First, water trucks and personnel capacity to deliver water. The Civil Defense operator illustrated this with the following quote: “the community does not understand that we are delivering water a little slowly with the water truck and people get upset, what happens is that everyone wants water at the same time and it is not possible (in 2016 the Civil Defense only had one water truck).” For his part, the firefighter in chief said, “the truth is that the exhaustion of human resources was high, we could continue to do it only if we could increase the personnel and vehicles.”

Second, the state and storage capacity of the household cisterns. A firefighter operator explained, “we did not deliver water to the places where cisterns or tanks were dirty. People wanted water, but they did not want to clean their cisterns [firefighter operator, 2018]. He added, “every time we visited a house, we saw that

residents could have a plastic tank or a cistern [with different storage tank capacity]; but, we tried to give each one the same amount of water.

Third, the water request protocol. This mechanism was used to organize the multiple water requests, and guided firefighters' operations, but both firefighters and residents complained about it. On one other side, a woman from Barkers Hill described the procedure as unnecessary, "they [firefighters] tell me to call the fire department office; when I call, they explained to me that I have to register my name, ID number, my address, and family numbers; they asked me to do too many procedures before to give me water [Barkers Hill, 2018]. A woman from Loma neighborhood said, "for example, I went to the fire department, and I had the name of four houses that need water; then, the fire department delivered water to those houses, but if your name is not listed, then they will not give you water [Loma, 2018]." A man from Court House claimed, "I am not particularly eager to chase people for water, that is, you have to follow a protocol to get water, and I do not have time for that [non-Raizal, Court House, 2016]. On the other side, the firefighter in chief said, "now all the calls we receive are 'if you don't bring me water this week, we [residents] will block the road'."

Fourth, community leaders. During the crisis, multiple community leaders emerged, guiding the firefighters water distribution. The firefighter in chief said,

There were ministers, leaders of community action boards, and other leaders who arose during the crisis. When we arrived in a neighborhood, leaders began to call us for water; they said: 'I am a leader of that sector and I need water too', then we went with the water truck, and they told me which houses needed water and which did not. In each neighborhood, we were

looking for these leaders. The leaders, who emerged within the social demonstrations, helped us in this way.

The researcher observed some favoritism by community leaders during water distribution. For example, in Loma Barack and Barkers Hill neighborhoods, a community leader directed the firefighter’s efforts mostly to close family and friends, casting doubt on the firefighters’ fairness and inclusivity. In this case, favoritism distorted procedural justice and distributive justice in a negative way, excluding some residents from water. There were some water-related power imbalances within and amongst social groups in neighborhoods. Leaders occupied a power position that allowed them to exert disproportionate influence over the water distribution process (Emami, Bjornlund and Johnston, 2015).

Public officials tried to apply justice principles in their distribution task. Officials mentioned words and phrases related to distributive justice in terms of the needs principle (wherein outcomes or resources are allocated based on individual need) and concerning the principle of equality, which express equal concern with the well-being of all.

Principle	Quotes
Needs	The risk management coordinator said, “my responsibility was to coordinate the water trucks together with the Fire commander, and we checked that the water was being supplied to the people who need it.” In the same line, personnel for the Civil Defense claim, “we go and deliver water to the neediest neighborhoods.”
Equality	Officials move between one principle and the other. Officials want to ensure that all people in need have water. Sometimes officials found households with big cisterns and some time they have to deliver water in small tanks, “what is important to us [Civil Defense personnel] is that everyone can get water.” The firefighter commander said we “tried to give each one [household] the same amount of water.”

Differences in attitudes and perspectives about whether water is a right or is a commodity in a market are found in the concerns of some public and private officials

about the implications of giving free water. The risk management office said, “this [water distribution operation] is becoming problematic because we are giving free water.” He added, “residents are getting used to the fact that we have to deliver them water. They no longer want to collect rainwater.” The Veolia director put in evidence differences between company interests and resident’s affordability to pay for water; the Veolia director argued,

I have noticed that since 2016 they [local government through firefighters] have been giving free water to the people who call saying they need water, which I think is the wrong way to go. They are sponsoring illegality and a non-payment water culture; so, what we need is all entities to pull in the same direction, because what we want is sustainable management of the water provision services, and sustainability does not mean that the government gives everything free, the community has to meet their obligations.

The public service secretary explained that “residents hope that the state will solve and pay for their water consumption, and although they can connect to the aqueduct, they do not do so, because they know that the bill is very high, so, they prefer to make an illegal connection.

Ultimately, how the water system and the emergency water operations were managed lead to multiple benefits and multiple harms, and dissatisfaction among residents; which reveals the necessity to implement justice approaches in water operations.

8.2.1.1 The effects of the crisis on tourism

The existence of tourism in San Andrés has meant that an additional number of people require freshwater for drinking, hygiene, cleaning, food provision, and recreation. In San Andrés, this additional demand has led to water stress. In the north part, where tourism and commerce is located, the crisis was felt only slightly. The risk management office coordinator explained, “[during the crisis] Veolia was providing normal water service, there was never an interruption of the service in the tourist sector.” When the researcher asked officials to identify the areas in need of water, the firefighter pointed out mainly neighborhoods and some schools located in the rural area. They did not mention the north part of the island.

To further investigate issues of water justice between tourists and locals during the water crisis, interviews were conducted with big and small hotel personnel. Maintenance personnel from big hotels like Aquarium, Los Delfines, and Sunrise Beach manifested they had not suffered any water problem in 2016. They explained that they obtained water from several sources: aqueduct, rain harvesting, ground water, and their hotel-owned desalination plants. For instance, maintenance personnel from the Aquarium Hotel explained that “we have two desalination plants, each one produces 130 cubic meters per day, we also receive water from the water company more or less 200 cubic meters, and when it rains we also collect rainwater.” Indeed, having a diverse range of water sources improves water supply security to hotels. For example, the aqueduct's development and groundwater wells in the island are mainly located in this area. The public services secretary indicated that “the hotel sector is

concerned with giving 24-hour water service to tourists. A hotel can pay 50 million Colombian pesos (12900 US dollars) per month to secure water for its tourists.” In fact, the tourism industry paid for desalination plants, cisterns, and the construction of wells.

The impacts of the crisis were uneven, the rural areas being the most affected. There are profound differences in the access to water between the north-urban and the south-rural part of the island. Residents, mainly Raizales, do not enjoy the development of enough water infrastructure to ensure safe drinking water. The environmental authority coordinator of the water project explained, “everything in San Andrés has been built based on tourism. Decisions concerning water were made for the tourism sector, who has aqueduct coverage? Who have more wells? Who has sewerage service? The tourism sector.”

The majority of public officials identified inequalities in water access in the island, but they did not link this situation with the water crisis suffered by residents. Their main cause of the crisis, for them, was the reduction of precipitation due to the El Niño phenomenon. The firefighter in chief said,

I think there is no equity in San Andrés. Those who have the water are the people from the north part of the island like the hotels that pay for water; and you know that the water is owned by a private company and that company is going to sell it to the part of the island that pays the most. I think that Veolia and the people who manage the water in San Andrés have a duty to make new pipes and pass the water to areas where the water does not currently reach. I believe that water should be for everyone.

According to the water agreement signed in 2005, the north part of the island receives water from the aqueduct every day. The Veolia director said, “well, when we

look at the volumes supplied to the hotel sectors, we realize that consumption is higher than in the residential sector. Clearly, more water is being delivered to these sectors.”

In the following quote the Veolia director explained in more detail how water resources are distributed and that the water agreement is the legal mechanism used to established differences between the urban and the rural areas.

The contract was made by the national government, taking into account the culture of rainwater management, which is very good in La Loma sector [hilly part and where Raizales live] and the water supplied by the company is only to make up shortfalls. [Since 2004] It was never thought of having a 24-hour service in all sectors and with potable water. I would say that the contract is unequal because there are some areas that have water 24 hours a day and others once every 20 days. The other thing is that they were seeking to guarantee water consumption of large customers [like hotels] so that they could provide for a subsidy to [lower socioeconomic] strata one, two, and three. There must be a balance, because if I give all the water to strata one, two and three, who covers the subsidy imbalance? The local government does not have the resources to cover everything.

Contrary to this view, the Veolia construction operator explained that the differences in water distribution on the island are not related to equity issues, instead there are technical problems related to the low water production of the softening plant and the separation between the two aqueduct systems (north and south),

The distribution of the water depends on the technical conditions that exist on the island; for example, the desalination plant is the one that is producing the most water but it can only give water to the north and there is no way for the water plant to reach the Loma. So all the water from the desalination plant is distributed in the north. That connection between the north and the south has already been made with the new desalination plant that was installed. But let's say that north and south are two separate systems. So as Duppy Gully has the lowest flow rates, water was sent every 20 days and as the desalination plant has more capacity, it can be given once a week. It is a technical issue.

Tourism in San Andrés is an area ripe with issues related to water injustices (e.g. dispossession and displacement) that reflect the unequal distribution of power. Tourism development has resulted in appropriation of water supplies to the detriment of residents' water needs (James, 2020; Guerrero, 2020).

8.2.2 Procedural justice: participation, information, and ability to pay

The next paragraphs described three significant procedural justice elements, named by public and private officials, participation, information, and ability to pay.

8.2.2.1 Participation

Officials believed there was little community participation in the water allocation decision-making process. The official in charge of the environmental corporation water project said, "I think in the water agreement [contract between the government and Veolia] the community was the last factor taken into account in water allocation decisions, the community did not participate in these decisions."

Participation in the decision-making process recognizes that the affected community has enough capacity to understand and to propose solutions around water difficulties; so, an exclusion in water allocation decisions is detrimental. Information and participation will empower people in water solutions and allow the local community to evaluate their water situation based on their own experiences and local characteristics. Participation means that people's contribution to water allocation should be present from the water allocation's basic steps and be continuously revised.

Accordingly, public official's attention is necessary for ensuring community involvement in water decision-making processes.

A planning process requires including the identifiable beneficiaries as well as the groups impacted by the outcome; if a participative planning process is consistent throughout, participants might accept the planning process as fair, even if they are not satisfied with the outcome (Emami, Bjornlund and Johnston, 2015). When social groups are excluded from the water allocation making-decisions process this become an unjust process; for example, the Raizales in San Andrés.

8.2.2.2 Information

Another significant factor in procedural justice is the information taken in the water allocation decision-making process. Gross (2008) explains that information is needed from experts to explain or justify the water allocation decisions and people's knowledge, understanding, and expectations. Relevant technical information is a necessary but not sufficient condition for making informed evidence-based decisions. If the information is not accurate or is incomplete, the chances of a poor and unjust decision are amplified.

According to the above mentioned, during the interviews, mainly two kinds of information were named that influence the water allocation decision-making process:

- 1) Estimation of household water demand, assuming unvarying and unchanging rainwater storage per household.

Basic water consumption is the amount of water that meets the essential needs of a family. Officially in Colombia, it is established at 20 m³ of water consumption per month and per user. However, in 2005, when the contract with Veolia (Proactiva) was signed, the basic consumption value for San Andrés was lowered to 8m³; this amount of water is well below than the one set by the National Regulatory Commission; this issue undoubtedly generates an inequality with respect to the recognized basic consumption compared to the rest people of the country.

The private water company and the government may be using data concerning traditional practices in a questionable way. The official in charge of the environmental corporation water project explained that “they [private water company and the government] determine the water frequency, amount, and distribution in the island taken into account the rain harvesting traditions of Raizales.” Moreover, the private water company manager explained that “to calculate how much additional water the community would need for a monthly supply, it was taking into account the rain harvesting culture and wells which the community has.”

However, regarding the considerable heterogeneity among household storage capacity, precipitation variability, and deficient information about well ownership and water production, it is problematic to include rain harvesting cultural tradition in the water basic consumption estimations. For instance, rain harvesting has multiple factors that restrain and modified the amount of water storage in each household. Traditions are dynamic and people are free to harvest or not water; also, not all people in a neighborhood have the same economic capacity to build and maintain cisterns and

waterspouts; moreover, the household location and its size restrain the constructions of cisterns. In this sense, the environmental corporation engineer strongly disagrees with these decisions. He argued that “water storage is a decision you make regarding your economic and technical capacities; it is not rigid and is emergency water for drought conditions.”

2) Lack of data concerning climate change predictions

Rainfall is changing and climate change predictions stated that the archipelago will suffer a reduction of precipitation of 30.20% (2011-2040), 32.78% (2041-2070), and 33.01% (2071 -2100) (IDEAM, PNUD, MADS, DNP, CANCELLERÍA, 2017). However, the risk management office coordinator said “islanders have not realized that climate change is real, (2016).” The environmental coordinator of the water project said, “The environmental corporation has carried out studies to be able to make adequate decisions about water, including the behavior of the San Andrés aquifer in the face of climate change scenarios (2018).” Precipitation and aquifer projections were not taken into account in the water contract nor in its amendments.

In this matter, there were various comments made after the signing of the contract by the Colombian Civil Defense and the private water company directors in relation to the lack of inclusion of information concerning climate change predictions, drought, and population and tourism growth projections on the island in order to allocate water resources in the future. The director of Veolia explained, “what happens is that when the contract was signed [2005], the issue of climate change was not as evident as it is now, and that is where the problems begin in San Andrés. Climate

change has affected the rainfall; therefore, the aquifer is not being recharged with rainwater (2018).

8.2.2.3 Ability to pay

Another issue in which procedural justice emerges is related to stakeholders' ability to pay. The public services secretariat stated that the water supply distribution on the island is unjust because it is based on the differential economic capacity of the tourist and residential sectors, in which there is a problem in the payment for the water service by locals. Water service on the island is expensive; thus, people often refuse to pay the bill. According to the Water Resources Plan (CDM Smith - INGESAM, 2016), there is a high reluctance of users to connect to the water system legally, due to the high cost of the water service and the possibility of using alternative water sources, such as wells, rainwater, and the purchase of water by tank car.

A woman from Los Almendros neighborhood said, "look at the water distribution schedules: touristic district 24 hours, Sarie Bay neighborhood 24 hours, Almendros neighborhood twice a week for 4 hours each time, and district La Loma once every 20 days" and she added, "what it is happening is because the touristic district pays the billing and the residential sector does not."

In this point, Neal, Lukasiewicz, and Syme (2014) argue that the privatization of water drives prices beyond an individual's ability to pay, and as a result, there is an exclusion of some stakeholders to water. The authors claim that it also denotes the

government and private water company's lack of ability to utilize the infrastructure and technology necessary for effectively producing and distributing water for all users.

Economic power relations determined the decision-making over water allocation; thus, more water was given to those who can pay more to sustain the poor's water costs. This economical formula might have legitimized that the poor would receive less water than the tourists, hotels, and upper-class sectors on the island who can pay their water. The private water company director claimed that in the water agreement, an economic balance was being sought, "it was necessary to ensure that large customers consumed water so that they could take on the subsidy of the lower strata." It seems that the government considered a water restriction, by reducing the frequency and quantity of water delivered to residents, as a benefit for the them.

8.3 Discussion

Findings showed that residents (Raizales and non-Raizales) had a sense of injustice in how water resources have been managed on the island. Residents illustrated six diverse conceptions of injustice. 1) injustice as they felt not being treated fairly and respectfully; 2) injustice as the government is not doing the right thing and it is discriminating against the Raizales; 3) injustice as residents felt that some people on the island are not getting the same amount, frequency, and quality of water; 4) injustice as water needs are not being met; 5) injustice as Raizales felt being historically excluded, as the national and local government has been not considered the sociohistorical land tenure they have in the island; 6) injustice concerning spatial

locations, residents noticed differences in water access between north and hilly and south parts of the island.

Results showed that distributive justice was the primary concern for residents; however, distinctions between the elements of distributive justice and procedural justice were not sharp and clear from the perspective of the people involved: in their concerns, they were worried about an overall injustice in water management.

Residents perceive procedural justice was violated through the lack of frequency and amount of household water supply, pricing gouging by the water truck companies, and the water delivery schedule. Overall, findings show that people affected see the water situation as extremely unjust.

Based on Raizales framings, results showed a systemic construction of social and water injustices and a continuous physical act of dispossessing Raizales from land and water resources that they believe is theirs. On the other hand, non-Raizales were concerned about their physical household conditions, in which road access for trucks carrying water is difficult. There were multiple complaints about not having cisterns, wells, or enough tanks to collect and store water.

Results revealed the connection between current water injustices with the history of the water supply system in San Andrés. Residents were more exposed and more susceptible to water shortages, and they lacked the capacity to face a reduction of precipitation due to the Niño phenomenon and a drought.

Public and private officials acknowledged water inequalities on the island; however, during the crisis response there were no actions taken to address this

problem. Also, they did not link water inequalities with the causes and effects of the crisis. Public and private officials were clear that the Veolia water agreement signed in 2005 established differences in water allocation among sectors on the island. This agreement became an excuse to avoid taking responsibility for problems of access to water on the island.

Officials highlighted elements of the decision-making process on water allocation. Three main procedural justice themes were found:

1. Officials reported that the community participation in decision-making process was absent.
2. The government did not consider differentiated household water demand (e.g. per season, household, and cultural characteristics) or climate change projections about precipitation reduction and climate variability in its decision-making process. It seems that the government and the private water company both assumed that the community could survive on a combination of three sources, rain, well water, and aqueduct. However, they never forecast the possibility that rainwater and well water sources would be severely reduced.
3. More water was given to the ones who could pay more, like the tourism industry.

During emergency operations, officials mentioned words and phrases related to distributive justice in terms of a needs principle (wherein outcomes or resources are allocated based on individual need) and concerning a principle of equality (which express equal concern with the well-being of all).

There were different time framings and levels of water injustices exposed during the crisis. Findings reveal water injustices in the past and in the present. Officials and residents exposed water-power-dynamics at different levels during the crisis response. At the high level, the national and local government and Veolia subscribed to a water agreement defining the broad water distribution of the aqueduct service on the island, which delineated Veolia's participation in water trucking emergency operations. At the medium and operative levels, firefighters and Civil defense personnel had the authority over emergency water allocation. At the low level or community level, community leaders decided where the water resources were delivered.

Implications of these results are related to recognizing injustice dynamics in emergency response to manage them in a proactive way. In this way (at least some of) the potential injustices could be recognized before they occur. Notably, this is especially relevant when examining how emergency water will be managed in the future, how much water must be distributed by household, what procedure will provide for a just selection of recipients for emergency water allocation? How should the relationship be between firefighters and community leaders for the delivery of water?

Tourism in San Andrés is an area full of water injustices (e.g., dispossession and displacement) that reflect an unequal distribution of power. Tourism development has resulted in the appropriation of water supplies to the detriment of residents' water needs. The crisis exposed uneven impacts, vulnerabilities, and water inequalities.

There always has been water in the north part of the island where tourism and commerce are located. The most affected people were the ones who were located in the south and hilly parts of the island, people who depend mainly on rainwater, the ones who have more difficulty constructing wells, the ones who are not connected to the aqueduct, and residents who are mainly part of the ethnic minority group, the Raizales.

Finally, this study shows the need to better understand and integrate water justice into crisis studies. It becomes imperative to reinforce and encourage action in the face of enormous struggles against water injustices across cultural groups. In this study, water and crisis managers are encouraged to think and examine the different forms of injustices across scales, levels, and geographical spaces. Islanders, mainly Raizales, have strong water connections, with water playing a vital role in communities' cultural, spiritual, emotional, and physical well-being. A crucial step in improving water access is to ensure that people's values and interests in water are better recognized and more clearly integrated into water allocation decision processes.

8.4 Conclusion

Central in this chapter is to understand how water injustices are embedded and situated in the water crisis. In this vein, some of the questions answered are 1) How do different stakeholders frame water justice? 2) To what extent perceptions of water justice focus on distributive and procedural issues?

Overall, participants exposed fairness and injustice issues affecting the access to water and creating unsafe conditions for some sectors and individuals on the island. During the crisis the access to enough water resources and the costs and benefits were distributed unequally, with the tourism and commerce benefitting more than residents on the island.

Residents, Raizales and non-Raizales, perceived inequalities in their access to water resources with less water than the touristic industry, which resulted in a crisis. Raizales felt historically excluded from their land and natural resources, and Non-Raizales felt excluded for their socioeconomic situation. Residents were inclined to mentioned distributive justice's issues, exposing different water injustices happening before and during the crisis response. Injustices were linked to the water-power-transfer at different levels: at the national, at the local, and at the community level. In this sense, residents claimed being engaged in multiple concurrent water injustices layers. Public and private officials identified procedural injustices in the water supply, but they did not connect this situation with the causes and effects of the crisis. Overall, the water agreement was pointed out as the mechanism that established these water inequalities.

Four central arguments were largely made in this chapter. First, the water crisis has less to do with water availability and more to do with water distribution inequalities and uneven infrastructural development. Second, water has become a commodity to be sold to consumers to profit; the residents have become consumers who purchase a commodity rather than citizens with a water right. Third, the crisis

response maintained diverse forms of inequalities in water management through the crisis response. Fourth, it was the poorest and most vulnerable that suffered the most significant impacts in this crisis; water injustices affected the access to water and created unsafe conditions for residents that are less capable of resisting and coped with water-related hazards.

Finally, this study revealed the connections between climate change, water injustices, and tourism based on extraction and exploitation. It reveals diverse stakeholders (residents and officials) perspectives on justice in a crisis context. The knowledge gained through this chapter should prove valuable to those seeking to integrate principles of equity and fairness into crisis and water management.

Chapter 9

CONCLUSIONS

A scientific research is never ending in its quest for knowledge” “none of us should presume to have all the answers" (Alexander 2005, p. 97).

This research answers how individually and collectively diverse stakeholders give meaning to the water crisis in San Andrés Island. Precisely, this research addresses how people perceive and talk about the nature and causes of the water crisis, the crisis response, the desalination technology as the leading solution proposed, and water injustices issues involved in the crisis. This study is one of the very few describing and analyzing the water crisis in San Andrés Island using a social constructionist perspective. It brings together work related to traditional and alternative literature in crisis studies, political ecology, and environmental justice for results analysis. By using and fusing this literature, it is believed that this research is in a better position than previous research to contribute to understanding the San Andrés water crisis.

Results are of global and regional significance exposing the critical overlaps and convergence among scarcity, tourism, inequality, technology, and climate change. As is happening in other parts of the world (e.g. São Paulo, Cape Town, Bali, Cuba, St. Vincent), San Andrés’ water crisis is linked to the local politics and inequalities that mark the San Andrés water supply system and the tourism industry. Particularly,

this study brings the following issues sharply into focus: the high percentage of losses in the water supply network, conflicts of interest between tourists and residents, water inequalities in the water operation contract signed with the water company, Veolia, implications for alternative sources of water such as desalination technologies, and the value of rainwater harvesting traditions of Raizales.

This study suggests that the focus in crisis studies must be expanded beyond the organization-centric view and listen to the voices of the people affected to identify the different social roots of the crisis. The social constructionist approach allows the researcher to produce deeper and alternative understandings of the crisis, and approaches like environmental justice and political ecology offer a fruitful understanding of water injustices in San Andrés. This study began in 2016 with an exploratory study of the water crisis; subsequently, in 2018, fieldwork was carried out again to identify new insights and delve into continuing injustices issues related to the crisis on the island.

Findings show that there is a general acceptance among participants that a water crisis was and is a reality, and there is a strong support for desalination implementation as the best way to solve the crisis. However, views from public and private officials and residents, Raizales and non-Raizales, vary considerably in the way the crisis was framed and in seeing connections with water injustices in the crisis configuration. Residents exposed that the crisis is rooted in the past, creating differential geographies of water access on the island. Interviews in 2018 revealed that the water crisis is moving progressively towards the future but with no early end. In other words, the crisis was not a short-term explosive emergency but is a much more durable and persistent circumstance (Vigh, 2008).

Participants' experiences and the literature review makes possible to outline some of the San Andrés crisis characteristics. The water crisis is a multidimensional social process, with historical background, rooted in both water and socioeconomic governance systems at different scales, which has resulted in a significant decline in freshwater availability, provoking harmful and differential effects to individuals, households, and community. It has significant levels of uncertainty concerning both the causes and the potential consequences. The crisis provoked tense situations in which conflict and solidarity were intertwined.

According to the participants' voices, the water crisis in San Andrés island displays multiple features and subjacent conflicts and misunderstandings that needs a more inclusive and alternative crisis understandings and framework. There was no one cause, instead there were multiple interconnected and sometimes untraceable causes that may go beyond the present time and local scale (Kendra, Knowles, and Wachtendorf, 2019). Participants recognized that the crisis was the sum of a variety of interconnected factors: 1) Global changes influencing climate variability like the Niño phenomenon that in turn become a severe drought; 2) Global commercial industries impacting the water resources on the island, like mass tourism increasing water demand and water enterprises having inappropriate water agreements to produce and distribute water; 3) Deficient technology implementation in the island to desalinate water; 4) Overpopulation; 5) Loss of traditional water storage techniques; and 6) Water injustices.

The participation and reproduction of critical and socio-historical processes are a central part of the water crisis severity and management. Historically, San Andrés has lived through multiple socioeconomic pressures, in which the native ethnic

minority group, Raizales, have been especially vulnerable and marginalized. Some of the main impacts are their social exclusion from tourism, commerce, public services like water supply, the impoverishment of traditional economic sectors (e.g., agriculture and fishery), and displacement to the center-hilly south part of the island, which have constituted fundamental pieces in the water crisis. There has been a backdrop of decades of latent conflict against the national and municipal policies that become evident during the crisis. In addition, the crisis response replicates these previously existing social structures giving priority to the touristic zone.

The crisis took the form of the societal and natural relationship of islanders with nature. The continuous depletion and contamination of water resources on the island has predominantly been perpetrated in this crisis, first the groundwater and now seawater resources, in which the government is putting the water industry before people and water conservation. Crisis managers through the crisis response allowed the water industry to simultaneously exhaust, pollute, displace, and privatize sources of water on the island. Although these decisions are claimed to benefit the entire community and promote aquifer conservation, there is inequity disfavoring the Raizales and the poor, and the managers do not take into account the desalination ecological impacts. The understanding of the crisis is around production and consumption of commodities where nature is basically used as a tradeable commodity (Machado 2011, Byrne et al, 2002). The idea of natural limits is minimized because improved technologies can enhance the carrying capacity of the island for tourism.

The causes of the water crisis extend beyond geopolitical frontiers. Tourism industry, water privatization dynamics, and the desalination technology are global forces that have transformed San Andrés society economically, culturally, and

environmentally, creating risky conditions mainly for Raizales and poor neighborhoods. At one side, tourism is impacting and transforming the lives of people, including aspects such as inequality, economic and physical displacement, sociocultural change, and resource depletion. For instance, tourism consumes resources that have been created through millions of years of geological processes on the island, and in doing so, it is created socio-environmental impacts and new risks for islanders' society. Since the 1950s in San Andrés island, national and local government put economic factors over sociocultural ones, and it has promoted the aqueduct system primarily for the touristic and commercial area. Raizales were displaced from the economic touristic benefits, given low priority from the water supply aqueduct, and therefore move to outlying zones distant from the center. On other side, water privatization has led to inequalities in water quantity and distribution, as well as the abandonment of traditional forms of water management on the island. The introduction of private interests into water public services radically impacted the access for islanders. For example, privatization created parallel water systems in which one system (desalination plant) mainly serves higher-income people and the tourism industry, while another with lesser quality and quantity (softening plant system) serves lower-income people and Raizales. In this research, it is argued that the impacts of water privatization are more far-reaching than just monetary costs.

Another key point found is that there has been a rapid proliferation of desalination technologies around the world that has impacted San Andrés. The spreading use of this technology has been justified and promoted by an emerging and increasingly dominant narrative, prioritizing technological responses to water scarcity challenges. The introduction of this new water source on the island has not only

allowed more potable water resources, but it has also subtly altered the socio-environmental conditions for the islanders. It has led to new power struggles in San Andrés island, in which one part of the island is supplied with fresh water, and the other with desalted water, resulting in the creation of distinct waterscapes and conflicts. Far from offering an unproblematic water supply solution, it represents a technical solution that is a high energy-consuming and, therefore, high greenhouse producer; in this sense, it may inadvertently increase vulnerability to the very issues it attempts to solve (Williams & Swyngedouw, 2018).

The water crisis can be considered a “newer crisis” that combine elements of traditional, mainly natural, hazards in conjunction with social vulnerabilities, in which the division between nature and society has become increasingly blurred. The crisis does not confine itself to a particular policy area; this is what was observed in the water crisis, in which sectors such as tourism, water management, drought, the Niño phenomenon approaches, and socioeconomic arenas were interacting in the pre, during and post-crisis stages. For instance, tourism, the main economic activity on the island, a high water-demand industry, increases vulnerability and generate crisis conditions. Simultaneously, there was a significant reduction of precipitation which demands a warning system and a protocol in place to respond appropriately.

The crisis was a missed opportunity for change. While the San Andrés water crisis reveals multiple problematic issues in crisis configuration and management, this did not result in a radical break with the existing policy structures. The outcome of a crisis can open the door for new opportunities and changes; however, in this case, changes did not occur. The way the water crisis was understood and portrayed by organizational leaders influenced the maintenance of the status quo. So, too, did the

approach and paradigm used during crisis response (e.g., conservative; technocratic), political and economic interests (e.g., tourism, water as a commodity), and the lack of participatory process of the broader community in crisis management. In this way, the water crisis was not an opportunity for change at all; instead, it was an opportunity for the private water company to continue being the water operator on the island for another 15 years, having more water to distribute and sell to the touristic industry, and for the expansion of the company infrastructure with two additional desalination plants.

Along with this broad conclusion, the following five sub-sections contain the concluding remarks for each chapter and indicates the importance of research findings for water crises studies. At the end, there is a section that discuss possible future research areas and limitations.

9.1 Constructing the water crisis

Participants agreed that the water crisis has multiple causes; however, there were differing and sometimes opposing views in how they construed the nature, characteristics, and causes of the crisis. Some of the common characteristics named by both public and private officials, and residents (Raizales and non-Raizales), were conflict, solidarity, protests, and negotiations. However, there were essential differences between these two groups.

On the one hand, public officials framed the crisis as a sudden and external event triggered by the Niño phenomenon and the drought. This framing had multiple implications in the way the crisis was managed. This narrative neglects the historical dimensions of the crisis, focusing instead on the lack of rainfall, and climate change impacts (Scheba & Scheba, 2018). Officials determined a limited amount of time in

which a crisis response can be made as defined by what the law regulates, and not by what happened in the neighborhoods; no regional or global connections were made in order to find causes and solutions, and officials implied that there was a “normality” before the event happened. Based on these assumptions, it is argued that the way public officials framed the crisis created the space for water experts and engineers to lead the water crisis management.

On the other hand, the majority of participants in the neighborhoods affected framed the crisis mainly as a social “process” produced by injustices in water allocation. In the past, there have been problems in water access, therefore this situation was not new. This time they were tired and desperate with the water situation on the island. They saw multiple times the private company and water truckers supplying water to the hotels, while they were without water in their cisterns. Although some participants recognized that it had not rained for more than six months, they believed that there was water on the island, but not for them. Some participants argue that the drought stopped being solely natural and became a creation of the private water company –Veolia.

In sum, it was found that there is a discrepancy between the public official framing of the crisis as being primarily natural and the multidimensionality of the crisis revealed in this research. The crisis was caused by overlapping of reduced rainfall, increased demand in the tourist season, failures in water supply service, and injustices in water amount and frequency on the island. Residents suggested that there was water on the island but not for some sectors. Their attitude was in favor of addressing and solving the social roots of the crisis.

Consequently, it is central to find ways to reconcile residents' and institutional views of the crisis, and to recognize the voices of the people affected need to be heard to understand the complexity of the crisis. Local knowledge is necessary to orient the crisis response, and a participatory process that has to be done cyclically.

In short, there is the strong influence of traditional and technocratic perspectives in framing the water crisis as solely natural and external. Water injustices play a fundamental role in the water crisis, and influence the perception of drought in residents, diminishing the naturalness of the hazard as a critical factor. Social vulnerability factors often absent from crisis analysis played a role in San Andrés, (e.g., variety of water sources, water injustice issues, and externally imposed decisions from the central government). Public officials need to reach out to residents and effectively communicate with them through participatory processes to enhance coordination, coherence, and, in the end, manage the water crisis response appropriately.

9.2 Framing the water crisis response

This chapter seeks to answer the question: how did different stakeholders frame the crisis response in 2016 and analyze whether there was a change in the water situation in 2018? First, it is described the insights from the public and private officials' conversations, and later on, it is summing up the resident's opinions. There are significant differences between these two groups since some are sharing what they did while fulfilling their crisis response duties, whereas the other group explained how they responded through their daily experiences to survive the crisis. Studying these two views contributes to an inclusive understanding of how the crisis was experienced,

identifies measures taken during the water crisis, and reveals, once again, the need to create channels of dialogue for better crisis management.

Public officials framed the immediate response as successful: it was coordinated, prompt, appropriate, and useful. It was considered an opportunity for inter-level communication and for obtaining national financial resources under time pressure. Officials described their experience under three frames which occurred simultaneously: coordination, emergency water trucking, and conflicts. The crisis was portrayed as a supply-side crisis that could only be resolved by securing additional water supplies, and desalination was identified as the most appropriate, and only solution for the crisis, thus, reinforcing the technocratic paradigm. The focus was on continuing distributing water by trucks and producing water to being distributed mainly through the aqueduct pipeline, which only has 50% coverage; definitive long-term solutions were not found for those who are not connected to the aqueduct. The crisis response did not acknowledge the status quo as problematic, and did not open the door for water policy changes. It is argued that a conservative management strategy and a technocratic paradigm were used in the crisis response.

The immediate and operative response, done by firefighters, the local risk management office, and the Colombian Civil Defense, was mainly distributing emergency water among both aqueduct-subscribers and non- subscribers. This task generated additional conflicts, including claims by people about the water use imbalance between the touristic industry and island residents, accusations about the quality of the water distributed by firefighters, problematic situations about the unsanitary conditions of some cisterns, and decisions taken by firefighters about the sequence and amount of water given per family.

For firefighters distributing water became a new routine task, and every year since 2016 they have distributed water to people and institutions in need during the first half of the year. On the island, water trucking continues being a life-saving emergency intervention. However, it is a temporary solution, expensive, and has consumed a large sum of human and technical resources. Moreover, water distribution has generated additional administrative and technical burdens for firefighters, which sometimes hinders their primary task, which is to put out fires.

The response to the crisis cannot be framed only from the organizational point of view, and residents in neighborhoods affected were responding in different ways when the crisis happened. The majority expressed general dissatisfaction with the institutional crisis response. They perceived that institutions reacted and implemented temporary solutions that did not respond to their reality, and that it was not a sustainable solution. Therefore, everything remained the same in 2018 as in 2016. Residents highlighted that roadblock protests were their main social action used to call government attention that a water crisis was happening. They claimed that water truck companies, their cisterns, and neighbor networks were crucial to cope with water scarcity. Overall, the crisis response was seen as a type of collective action at the neighborhood level (Tornos, 2015).

The crisis response is critical because it has the potential to reduce the likelihood of further effects significantly and to reduce the recovery time. The two years following 2016 were devoted to desalination expansion. There were no considerations or actions to counteract the sociohistorical and economic factors that played an essential role in the water crisis. No efforts have been made to transform or analyze inequitable and unsustainable water arrangements, or to evaluate the tourism

impact on water access. Drought response protocols were not formulated, nor were advanced rainwater capture systems projects implemented. The water crisis in San Andrés has become a cyclical and ongoing crisis in which people continue to struggle to access water. It is argued that public officials, guided by the water experts and engineers, framed the water crisis as nature-induced, urgent, and devoid of history to create the socio-political space for desalination technology expansion to emerge as the best solution.

Ultimately, findings showed that the traditional water paradigm took control over the crisis response, and the water experts were the ones who decided what would be the best solution for the water scarcity problem. Technology played and will continue playing a central role in the configuration and prolongation of the water crisis; its impact on individual and community autonomy is having a negative effect on the capacity to cope with water-related crises. This technological transfer is the root of a new social struggle for the right to manage the island's water resources.

9.3 Desalination expansion to end the water crisis

This chapter investigates why the majority of participants, officials and residents, frame desalination as the first and best solution for the water crisis. This chapter contains essential lessons that discuss the way the water crisis was solved, which at the same time deepened social and environmental problems in some sectors. It argued that this crisis revealed the political and economic actors behind the solution and created the necessary opportunity for their plans to become a reality.

There is a growing consensus in San Andrés island around the use of desalination to address water scarcity in relation to three related “natural” hazards, drought, Niño phenomenon, and climate change. Some of the influential factors

identified for this strong support include the historical presence of desalination on the island, the sense of threat of the island's water resources, the consideration of the ocean as a limitless and accessible water source, the perception that desalination technology is low-risk, and the lack of familiarity with the desalination technical process.

The consensus around desalination was captured in the way officials made sense and responded to the crisis, which combined a “natural” crisis, an immediate sense of urgency with a representation of desalination as a preemptive and necessary response to the water scarcity. Public official's beliefs about desalination rested on the following rationales: 1. There is no other alternative to desalination; 2. It is necessary to end and not to repeat the water crisis; 3. It is the best solution to increase the amount of water supply; 4. It is necessary to use the limitless supply of water in the ocean that surrounds the island; 5. It is the way to conserve the aquifer from overexploitation and saline intrusion; 6. It will provide quality water for everyone in San Andrés.

The support for desalination by hotel managers and water truck companies was informed by their experience. The hotel maintenance managers argued that desalination would help the local government give water to everyone, including tourists and neighborhoods alike. They assumed this solution would not generate many additional problems, so it would be easier for the government to manage. Residents also agreed that desalination was the ideal solution as they would not need to wait until rain comes for water, there would be more water production, and it would reduce conflict for water resources.

Accordingly, in less than a month after of the state of emergency was declared on April 15, 2016, desalination expansion was adopted as a remedy or solution to the island crisis. Indeed, expert opinion (from Veolia), technical reports, and budget calculations were part of the main decision-making process discussing the crisis response, and it was promoted a technological fix to an economic and environmental problem (Scheba and Scheba, 2018). The short time (11 days) between the declaration and the purchase decision for a plant suggests that perhaps there was a prior political process and negotiations that had already assumed a largely technocratic response to the water crisis. Thereby, the water crisis became an opportunity for profitmaking for the private water company (Veolia). In the name of the water crisis, the company officially expanded its water infrastructure, and in consequence, its corporate control over more water resources, not only groundwater but also seawater, for an additional 15 years while the government continue to ignore the social root causes like water injustices.

On top of that, there are potential implications raised by desalination that were revealed in through this study . Several of these implications have been outlined by critical scholars from the political ecology perspective (Redclift, 1984; Shiva, 1991; Williams & Swyngedouw, 2018; March, 2015; McEvoy, 2015; Scheba & Scheba, 2018; Fragkou; 2018; Feitelson, 2018). Problematic is the reduction of San Andrés' autonomy over water resources. This could be the root of a new social struggle for the right to manage water resources. Desalination could also prove a maladaptive strategy to cope with the effects of climate change on water resources as it is a fossil fuel dependent technology and it will generate a high level of greenhouse emissions and impact the marine ecosystem. Furthermore, tourism growth may follow, increasing

need, through a perception of unlimited natural resources. Also problematic is an increasing the reliance on technical expertise, impeding the possibility of opening up participatory decision-making by locals, and on foreign technical expertise. Additional emerging concerns include increasing prices for water supply, the abandonment of traditional forms of collecting and storing rainwater, and potentially and exacerbation of unequal access to a fundamental human right.

The crisis, instead of reducing water injustices through the technology expansion, will contribute to exacerbate the differences between groundwater and desalted sources of water. This study highlights how a critical understanding of our human-environment-technology relationship is fundamental for a more sustainable approach to water crisis management. It is a contribution to the body of scholarship that seeks to understand if and how society can manage and regulate technology to reduce risk and vulnerabilities.

Finally, by analyzing the crisis and desalination solution, this research argues that the fundamental problem in the water crisis may have never been the water availability, but is, rather, likely about the technical failures to produce water, the inequitable, and unjust access to desalinated water and the economic interests behind these injustices.

9.4 Recognizing water injustices in the water crisis

Central in this chapter is understanding how water injustices are embedded and situated in the 2016 water crisis. Some of the questions answered are: 1) How do different stakeholders frame water justice concerning the water crisis? 2) To what extent perceptions of water justice focus on distributive, procedural, and interactional issues?

Residents, Raizales and non-Raizales, perceived inequalities in their access to water resources compare with the touristic industry, which resulted in a crisis. Raizales felt they were being historically excluded from their native land and its natural resources, and non-Raizales felt being excluded due to their socioeconomic situation.

Findings show that residents framed water injustices under six themes.

- 1) Participants want to be treated fairly and respectfully.
- 2) The government and the private company should do the right thing and not discriminate against the Raizales.
- 3) Everybody should get the same amount, frequency, and quality of water.
- 4) There are some individuals (e.g., the older, the poor) that need water first.
- 5) The government and the private company should consider the Raizales sociohistorical land tenure on the island when making decisions over water resources.
- 6) Fairness among different sectors and neighborhoods on the island.

This research found that distributive justice was the primary concern for residents as they frequently pointed out that there is a disproportionate difference in the amount of water supply to the touristic sector versus the neighborhoods. Moreover, residents exposed different water injustices happening before and during the crisis response. Injustices were linked to the water-power-transfer at different levels: at the national, at the local, and at the community level. In this sense, residents manifested being engaged in simultaneous water injustices layers. In contrast, public and private officials admitted procedural injustices in the water supply, but they did

not connect this situation with the causes and effects of the crisis. Three main procedural justice themes were found:

1. Officials cast doubt about the community participation in the water allocation decision-making process.
2. The government did not consider differentiated household water demand (e.g. per season, household, and cultural characteristics) or climate change projections about precipitation reduction and climate variability.
3. During the crisis, more water was given to the ones who could pay more.

Overall, the water agreement was pointed out by participants as the mechanism that established the water inequalities. Connecting this chapter with Chapter 4 that describes the water agreement, the following five points illustrate how the water agreement perpetuated, intensified, and legitimized historical water injustices for residents and mainly for Raizales.

First, the agreement was limited to the existing unequal aqueduct infrastructure and networks in place before 2005. Therefore, after 15 years of operation, only 3.71 km of the aqueduct network has been expanded; the contract indicators were mainly for sewage service expansion and not for the increment of aqueduct service coverage. In the 1960s, the aqueduct was first constructed for the touristic zone. Second, the San Andrés communities did not participate in the revision and modification of the contract signed in 2005 with Veolia, and no public accountability meetings were required. Third, since 2005, the contract established explicitly that the northern part of the island would have water 24 hours a day from day 0 of the signing of the contract (2005), while the districts within the La Loma sector will have only water once every 20 days. As established Amendment number 9, La Loma will only be supplied one

time/week (8 hours of tap volume) in the 2019-2020 period (It is projected that by 2035 La Loma will have only a 12-hour supply per day). Fourth, in 2005, when the contract was signed, the consumption value established for residents (8m³ per month and per user) was well below the one set by Colombian Regulatory Commission (20m³ per month and per user), which undoubtedly generated inequities with respect to the recognized basic consumption for the rest of the people of Colombia. Indeed, the operator only committed to maintain the availability of potable water that satisfied a subsidized consumption of up to 8 m³ per month and per user. Fifth, this inequitable water distribution was ratified in 2008 with the contract Amendment number 6 and Amendment number 9.

This study maintains that the agreement established more water for the northern sector in order to receive higher water prices and warrant monetary contributions to subsidizing water cost for lower economic strata. To that end, the contract has legitimized that the poor and Raizales would receive less water than the tourists, hotels, and upper-class sectors on the island. Even though this was a restriction on the water for some sectors, the government portrayed it as a benefit for those sectors that were subsidized. Moreover, it seems the government calculations about basic water consumption (8m³) assumed homogenous rain harvesting storage capacity, done traditionally by Raizales, for all residents on the island, in which some households do not have the opportunity to construct a cistern or do not have this traditional custom. In other words, the arrangement seems to say ‘the Raizales already have some water, so let’s give them less.’

The worst impacts affect the poorest and most marginalized members of society first, and these injustices in access and control over water further increase their

vulnerability. Overall, the water crisis reveals the continuous violation of the Raizales' rights to participate in the processes of water resource management and in the definition of initiatives that facilitate their access to water. This situation has intensified past tensions and has provoked some rejection of the centralized service provided by Veolia. It is clear that this situation reveals and constitutes a cultural, historical, and economic barrier to the future use of water on the island.

According to participants, injustices in water access were embedded in the pre-, during, and crisis response phases. This research calls attention to the need to recognize the relevance of water justice criteria (e.g., equality, proportionality) to public and private officials' emergency activities. In short, justice principles can be used to analyze and perhaps change emergency rules which can be themselves a source of injustice.

Ultimately, the crisis revealed significant gaps in municipal water agreements, which reflects insufficient regulatory attention for building and maintaining water infrastructure, and inadequate public policy tools for responding to emerging risks to public water supplies. This research contributes to the awareness that some sectors on the island not only suffer from the lack of water access but also did not enjoy the same degree of protection from water-related hazards (e.g. drought) as that provided to tourism.

9.5 Recommendations and lessons learned

According to officials, there were difficulties in information flow, information access, transparency, and monitoring. The San Andrés congressional representative manifested that “Yes, there were alerts and the local government repeatedly did not take action; [he asked] how is it possible that the population in the island doubles and

tourism triples, and I did not realize that our own water production remains static and also that 50% of produced water is lost” [2016].

Indeed, during the crisis, the information did not flow systematically among institutions, not only because there were coordination problems but also because crucial information was not available for the decision-making process. Information flowed asymmetrically through organizations, resulting in a partial understanding of the situation and a delay in being aware of what was happening. Some institutions did not know what to do in drought scenarios; there were no protocols for preventing and managing such a crisis. Officials acted reactively and were overwhelmed by the crisis. Throughout the interviews, officials and residents pointed out information that they believed necessary to take into account and monitor monthly to prevent a new water crisis, information that could become warning signs or at least give insights about which sectors are more prone to suffer water shortages or scarcity. In the future, the following kinds of information and measures would be useful in preventing and coordinating crisis situations:

1) Implementation of a water information system

Information about past drought impacts on the island, which officials currently lack. At the heart of public policy, preparation and action plans, and forecasting is the evaluation and records of past drought events experiences. This aspect is central because it can foresee the physical and social impacts and identify the main aids and necessary response actions.

Information about the arrivals of tourists monthly and per season: tourism is increasing while the water resources remain static and producing the

same amount of water; therefore, it is vital to monitor the changing water demand.

Well water salt conductivity data in real-time is necessary to monitor and integrate into one system.

Information about neighborhoods' socioeconomic factors and water producing capability characteristics (e.g., with or without aqueduct service). Particularly, information about the social and physical characteristics of illegal neighborhoods. In San Andrés Island, there are several illegal settlements, many of which constitute entire neighborhoods without roads or public services. Informal land occupation processes have occurred mostly due to income inequality and avoidance of violence.

- 2) There is a need for more comprehensive approaches for coping with water issues to prevent new crises. Some of the types of measures that could be taken are behavioral incentives for water conservation, rain harvesting monitoring, restructuring government water agreements, water demand management, the development of preventive plans and protocols related to the Niño phenomenon and drought, and the inclusion of early warning systems.
- 3) Neighbor relationships were one of the most critical forms of resilience used by residents in the face of a lack of water during the crisis. Crisis, water, and drought management programs should emphasize and work on strengthening the social infrastructure within communities to promote resilience. Social capital is necessary to orient the crisis response.
- 4) Information transparency, which involves providing information that people and organizations want and need. For instance, the private water company must share

specific information related to aqueduct water cutbacks service and coverage limitations, water amount and frequency by district and neighborhood. Also, in the event of a water crisis, firefighters must respond quickly and honestly about water trucking distribution schedules so that people are prepared to receive water in their cisterns and tanks.

- 5) In this research, it was evident that the crisis response requires engineering expertise and knowledge over the water management system and needs to consult the people affected to gain knowledge about the sociocultural factors of the exposed community. A crucial step in improving water access is to ensure that people's cultural values, customs, and interests are better recognized and more clearly integrated into the water allocation decision processes. It is recommended to strengthen continuous participatory processes in water, drought, and crisis management.
- 6) The government and the private water company should calculate the water consumption differently, by dry and wet season, precipitation projections, and water district differences, including differences in household water storage capacity. Analyzing the water supply on the island should be an ongoing exercise. The tourism that happens in the urban and rural space generate a high demand for water, in addition to the basic needs of the population, which creates a complex picture of competition for water (Soriano et al., 2016).
- 7) It is recommended to implement an early rain harvesting program that includes construction, pre-cleaning inspection, and maintenance of cisterns before the dry season starts; this will enhance islanders' societal resilience in difficult situations due to the lack of water.

- 8) The government must consider implementing measures to minimize price gouging by creating, retaining, updating, and otherwise maintaining a pricing history process, and creating procedures to approve price increases. The government needs to pass and enforce anti-gouging laws.
- 9) Conflicts between the residents and firefighters during water trucking distribution operations require rethinking the emergency water provision done by firefighters. As water trucking has become a routine task for firefighters, it is central to have specific and detailed plans in order to achieve equal coverage and fair water emergency distribution. Lastly, evaluate the possibility of implementing a water trucking emergency supply through vouchers, which is an alternative that can be used with the commercial water trucking market.
- 10) The inclusion of justice principles within the area of crisis management necessitates a complete rethinking of current work practices and a shift of focus from an organizational and managerial-centric view to the recognition of stakeholders' power. This calls for crisis practices that incorporate principles of justice, participation, harmony, and health that are continuously sought to reach just crisis management. Thus, the focus of the crisis manager's efforts should be not only to supply water but also to differentiate between just and unjust practices.
- 11) Lastly, the unique characteristics of this crisis require a broad and multidisciplinary understanding. With that in mind, it is necessary that public officials, especially risk management officials, move from concentrating in a specific discipline to utilizing a broad knowledge of factors.

9.6 Future research

This research has led to useful results and conclusions on water crisis understanding and management; however, it has also uncovered many areas that need additional study.

This study corroborates the assertion that the voices of people affected can significantly contribute to solve the crisis, but there is a need for research about how crisis response plans can include participation mechanisms that takes place under time pressure. More research is needed about effects of tourism on water resources in the island. Generally, studies focus on investigating the way tourism is affected by disasters and emergencies but not how this industry can contribute to the generation of risky conditions.

During the interviews it became apparent that women were the most detrimentally affected by the water crisis. It was usually their job to provide water for domestic purposes, queue to fill and carry containers and care for the sick. This calls for studies on gender perspective in the water crisis. There is a need to further investigate how gender relations affects people experiences during a water crisis, and how gender inequalities affect women in water crisis.

In this research, it is argued that desalination in San Andrés has exacerbated water inequalities at the neighborhood and household level. However, more studies are needed to explore the sociohistorical and economic implications on San Andrés society and nature. This study raises concerns about the historical role that desalination has played in addressing longer-term water demand and the implications

of the commodification of water. It is important to ask whether this technology has increased islander's resilience as well as reduce vulnerability to natural and human-induced hazards. How did the introduction of the first desalinated water into the public water supply system historically affected the water security on the island? Many questions appear as a central matter to solve: what can happen in the future if the island only uses desalination as the technology for water production? Who will decide who can get water? How will locals be involved in the operation of the new desalination plants? Will desalted water be given to the people who suffered the water crisis or continue being directed mainly to the tourists?

Finally, the information collected through the interviews could be mapped using geographical information systems, for instance, to identify the areas with the highest level of vulnerability to drought in San Andrés island. Complementing the study with additional interdisciplinary and methodological approaches, such as this, would benefit the island and broader understandings of the phenomenon at play.

9.7 Limitations

This case study provides detailed and rich qualitative information about the water crisis in San Andrés island. However, it provides little basis for generalization of the results to a broader population. Although this study concerned a very small area and population it would be desirable to determine if the findings can be replicated or applied to other small Caribbean islands.

The volume of the data collected was significant and, together with the time restrictions, impacted the depth of analysis concerning water management historical implications on water injustices' configuration. Along the same line, much more research should be done around the links among social, political, economic, and environmental consequences of desalination.

Moreover, even though the research captured experiences of a wide range of stakeholders from the water and crisis management sector, it did not include interviews with officials at the national level. Therefore, the water crisis perception from these actors and the relationship between the local and the national actors during the crisis is still unclear.

This study includes many research participants (79); however, the results are not meant to be statistically representative of the population. Instead, the goal is to generate an understanding of the perspectives and actions around the water crisis.

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Appendix A

A.1 IRB Approval Letter

DATE: October 21, 2019

TO: Carolina Velásquez

FROM: University of Delaware IRB

STUDY TITLE: [938036-4] Community Perceptions of Water Access and Availability in San Andrés Island, Colombian Caribbean

SUBMISSION TYPE: Continuing Review/Progress Report

ACTION: APPROVED

APPROVAL DATE: October 21, 2019

EXPIRATION DATE: July 28, 2020

REVIEW TYPE: Expedited Review

REVIEW CATEGORY: Expedited review category # (6,7)

Thank you for your Continuing Review/Progress Report submission to the University of Delaware Institutional Review Board (UD IRB). The UD IRB has reviewed and APPROVED the proposed research and submitted documents via Expedited Review in compliance with the pertinent federal regulations. As the Principal Investigator for this study, you are responsible for and agree that:

- All research must be conducted in accordance with the protocol and all other study forms as approved in this submission. Any revisions to the approved study procedures or documents must be reviewed and approved by the IRB prior to their implementation. Please use the UD amendment form to request the review of any changes to approved study procedures or documents.
- Informed consent is a process that must allow prospective participants sufficient opportunity to discuss and consider whether to participate. IRB-approved and stamped consent documents must be used when enrolling participants and a written copy shall be given to the person signing the informed consent form.
- Unanticipated problems, serious adverse events involving risk to participants, and all noncompliance issues must be reported to this office in a timely fashion according with the UD requirements for reportable events. All sponsor reporting requirements must also be followed.

Oversight of this study by the UD IRB **REQUIRES** the submission of a **CONTINUING REVIEW** seeking the renewal of this IRB approval, which will expire on July 28, 2020. A continuing review/progress report form and up-to-date copies of the protocol form and all other approved study materials must be submitted to the UD IRB at least 45 days prior to the expiration date to allow for the required IRB review of that report.

If you have any questions, please contact the UD IRB Office at (302) 831-2137 or via email at hsrbresearch@udel.edu. Please include the study title and reference number in all correspondence with this office.

A.2 Informed Consent to Participate in Research

Informed consent in English

Principal Investigator(s): Carolina Velasquez

You are invited to participate in a research study conducted by Carolina Velásquez of the University of Delaware. This study is in partial fulfillment of the requirements for a PhD dissertation at the University of Delaware. This form tells you about the study including its purpose, what you will be asked to do if you decide to participate and the risks and benefits of participation. Please read the information below and ask any questions you may have before you decide whether or not you agree to participate.

WHAT IS THE PURPOSE OF THIS STUDY?

The purpose of this study is to explore how people who live or work on San Andrés Island and community stakeholders perceive and talk about water access and availability on the Island. Face to face, telephone, and web-based interviews with approximately 25-50 participants. You are being asked to participate because of your experience living or working on San Andrés

WHAT WILL YOU BE ASKED TO DO?

Interviews will last approximately 30 minutes, although they may last longer if they participants wish to share more information. As part of this study you will be asked to describe your thoughts about and experiences with access to and availability of water in different parts of San Andrés, as well as the factors that you believe contribute to

water access and availability. You may choose not to answer questions if you do not wish to answer them.

CONFIDENTIALITY

Some community members and officials have been vocal in meetings and on social media regarding their views on water access and availability. As a result, your participation is not confidential. If you recommend someone else for the researcher to interview, your name may be disclosed to that potential interviewee. In reports, organization names and position titles may be used. Pseudonyms for individuals will be used. In some cases, the names of participants may be used when other public information reveals their identity, although this will not be linked to your participation in this interview. You may indicate if there is information you wish to not have attributed to you by name. Research records may be viewed by the University of Delaware's Institutional Review Board, which is a committee formally designated to approve, monitor, and review research involving humans.

STORAGE OF INFORMATION

The interview will be audio recorded and transcribed. Recordings, transcriptions, notes will be stored in an encrypted file on the researcher's computer and on a secure server at the Disaster Research Center, University of Delaware. Information may eventually be shared with collaborating researchers, provided they have a human subjects protocol in place at their institution.

BENEFITS AND RISKS

There are no direct benefits associated with participation in this research,

although the findings may eventually help decision-makers better understand and respond to water concerns on San Andrés. We do not anticipate any risks from participating in the study. Your participation is completely voluntary and without compensation. You may choose to not answer any question during the interview. You can choose to end the interview at any time or withdraw from the study at any time during the interview. If you do not take part in the study, it will not affect your relationship with the researchers or the University of Delaware.

WHO SHOULD YOU CALL IF YOU HAVE QUESTIONS OR CONCERNS?

If you have any questions about this study, please contact the Principal Investigator, Carolina Velasquez at (302) 602 5039 or csvelas@udel.edu

If you have any questions or concerns about your rights as a research participant, you may contact the University of Delaware Institutional Review Board at hsrb-research@udel.edu or (302) 831-2137.

Your signature on this form means that: 1) you are at least 18 years old; 2) you have read and understand the information given in this form; 3) you have asked any questions you have about the research and the questions have been answered to your satisfaction; and 4) you accept the terms in the form and volunteer to participate in the study. You will be given a copy of this form to keep.

Printed Name of Participant

Date

Signature of Participant

Person Obtaining Consent

(PRINTED NAME)

Date

Person Obtaining Consent

(SIGNATURE)

**CONSENT FOR ADDITIONAL USES OF VIDEO
RECORDINGS/PHOTOGRAPHS**

I voluntarily give my permission to the researchers in this study to use videos and photographs of me (and/or my child) collected as part of this research study for publications, presentations, and/or educational purposes. I understand that no identifying information beyond that contained in the video recording will be provided; however my facial features (and/or those of child) may be seen.

(Signature of Participant OR Parent/Guardian)

(Date)

(Printed Name of Participant OR Parent/Guardian)

OPTIONAL CONSENT TO BE CONTACTED FOR FUTURE STUDIES:

Do we have your permission to contact you regarding participation in future studies?

Please write your initials next to your preferred choice.

_____ YES

_____ NO

Informed consent to participate in research, Spanish

CONSENTIMIENTO INFORMADO DE PARTICIPACIÓN EN LA INVESTIGACIÓN

Investigador principal: Carolina Velásquez

Usted es invitado a participar en la investigación realizada por Carolina Velasquez, estudiante de la Universidad de Delaware de Estados Unidos. Este estudio hace parte del cumplimiento de los requerimientos en la realización de la tesis de doctorado en la Universidad. Este formato explica el objetivo de la investigación, los temas de las preguntas que harán, y los riesgos y beneficios al participar de esta entrevista.

CUÁL ES EL PROPÓSITO DE LA ENTREVISTA?

El objetivo es explorar cómo las personas que viven en San Andrés o trabajan en ella perciben y hablan acerca del acceso al agua en la isla. Se realizarán entrevistas en persona, por teléfono, y por la web, donde aproximadamente participarán entre 25 a 50 personas. Usted está invitado a participar por su experiencia viviendo en la isla de San Andrés.

QUE SE TE ESTÁ PREGUNTANDO HACER?

La entrevista durará aproximadamente 30 minutos, aunque puede tomar más tiempo si usted desea compartir mayor información. Como parte del estudio se le preguntará que describa pensamientos y su experiencia con el acceso y la disponibilidad del agua en

diferentes partes de la isla; y también los factores que usted cree influyen el acceso y disponibilidad del agua. Usted puede escoger no responder las preguntas si usted no lo desea.

CONFIDENCIALIDAD

Teniendo en cuenta que algunas personas de la comunidad que serán entrevistadas han participado activamente en reuniones públicas o en redes sociales de internet hablando sobre el acceso y disponibilidad del agua en la isla, su participación no es confidencial. Igualmente, cuando usted recomiende a alguien para ser entrevistado su nombre puede ser divulgado a esa nueva persona. En reportes, nombres de organizaciones, cargo ocupado en la institución pueden ser usados. Para personas que no trabajan en organizaciones se usarán seudónimos. En algunos casos los nombres de algunas personas entrevistadas podrían ser divulgados en medios de comunicación, aunque esta información no será conectada con esta investigación. Es importante que usted indique si usted desea que alguna información no sea relacionada con su nombre. La información que usted brinde (research records) podrán ser vistos por The University of Delaware's Institutional Review Board, que es el comité que aprueba, monitorea y revisa las investigaciones que están relacionadas con seres humanos.

ALMACENAMIENTO DE LA INFORMACIÓN

La entrevista será grabada y transcrita. Las grabaciones, transcripciones, y notas serán guardadas en un archivo encriptado en el computador del investigador y también en el Centro de Investigación de Desastres-DRC de la Universidad de Delaware. La

información, eventualmente, puede ser compartida con investigadores que colaboren con ésta investigación, siempre y cuando tengan un protocolo de sujetos humanos en su institución.

BENEFICIOS Y RIESGOS

No hay beneficios directos asociados con la participación en esta investigación; aunque los hallazgos de la investigación pueden eventualmente ayudar a los tomadores de decisiones a entender mejor y responder a la problemática del agua en la isla. Nosotros no anticipamos ningún riesgo por participar en este estudio. Su participación es completamente voluntaria y sin ninguna compensación. Usted puede decidir no responder cualquier pregunta durante la entrevista. Usted puede decidir finalizar la entrevista en cualquier momento o salir de la investigación en cualquier momento durante la entrevista. Si usted no toma parte en el estudio, no afectará su relación con el investigador o con la Universidad de Delaware.

A QUIEN USTED DEBE LLAMAR SI TIENE ALGUNA PREGUNTA O PREOCUPACIÓN?

Si usted tiene alguna pregunta o duda sobre este estudio, por favor contacte al investigador principal, Carolina Velasquez, al (302) 6025039 o al correo electrónico csvelas@udel.edu.

Si tiene alguna pregunta o preocupación acerca de sus derechos como entrevistado, usted puede contactar The University of Delaware's Institutional Review Board at hsrb-research@udel.edu or (302) 831-2137.

Su firma en este formato significa que: 1) usted es mayor de 18 años; 2) usted ha leído y entendido la información brindada en este formato; 3) usted ha sido preguntado acerca de la investigación y ha contestado a su satisfacción; y 4) usted acepta los términos de este formato y es voluntario en esta investigación. A usted se le brindará una copia de este formato para que la guarde.

Nombre del Entrevistado

Firma del Entrevistado

Fecha:

Persona que obtiene el consentimiento

(NOMBRE)

Persona que obtiene el consentimiento

(FIRMA)

Fecha:

CONSENTIMIENTO PARA USOS ADICIONALES DE VIDEOS/FOTOGRAFIAS

Yo voluntariamente doy permiso a los investigadores de este estudio para que usen videos y fotografías mías (y/o de mis hijos) tomadas como parte de esta investigación para publicaciones, presentaciones, y/o propósitos educativos. Entiendo que no se proporcionará ninguna información de identificación más allá de la contenida en la grabación de vídeo ; Sin embargo se pueden ver mis rasgos faciales (y / o las de los niños) .

(Firma del participante o padre / tutor)

(fecha)

(Nombre del participante o del padre / tutor)

CONSENTIMIENTO OPCIONAL PARA SER CONTACTADO PARA FUTUROS ESTUDIOS:

Nosotros podemos contactarlo o contactarla para futuras investigaciones? Por favor indique con sus iniciales su respuesta.

_____ SI

_____ NO

A.3 Interview Guide

Community semi-structured interview guide, 2016

Interviewer: Carolina Velásquez

General questions

1. What is your current occupation?	2. Are you over the age of 18? _____
3. How long have you been in your current home?	4. How long have you been in this part of this island? (where do you live before?)
5. How do you identify yourself? Raizal, no Raizal?	6. What community organizations are you a part of?

Water access

1. Please describe the current situation regarding water access in your house?
2. What are some of the problems you have encountered in accessing water?
Example: Cost, specific problems, solutions, causes, broadly impacts of the problem.

Perception of drought (definition, identification of drought, causes)

3. How do you define drought?
4. How do you personally determine when there is a drought versus a dry period?
5. Do you think droughts on the island are more frequent? why? (frequent, less frequent or the same)
6. Prior up to dry or drought periods do you ever received any information from the government or other organizations about what to do in this circumstances? can you describe this? and from whom?

Experience of drought

1. How does your household generally get its water? Please explain in detail.
2. During the 2016-drought period did you household have a disruption to those usual ways to getting water, if so, for how many days?
3. What do you think were the causes of this disruption?
4. Can you describe a little more your recent experience during the 2016-drought?
5. Do you think this drought gained more attention than other droughts over the island's history? If so, why?

Community response

6. Did you participate in any protest or related activities in response to the 2016-drought? if so, can you talk about this a little more.
7. Do you think the government response to the drought was appropriate? please explain.
8. Was there any negotiation between the government and your neighborhood? if so, please explain.

9. Do you think the protests made the government aware of the drought? please explain.
10. Do you think the declaration of State of Public calamity improved the government response? if so, how? if not, please explain.

Concluding Questions

11. Is there anything else you think is important for me to understand how you perceive the water access, drought, and government response?
12. Is there is anyone else that you would recommend that I speak to regarding to these issues?

Institutional semi-structured interview guide, 2016

Interviewer: Carolina Velásquez

General questions

1. What organization are you affiliated with?
2. What is your current job title or position within the organization?
3. How long have you been in your current position and with the organization?
4. How do you identify yourself?

Raizal, non- Raizal?

Water access

5. What do you think are the main problems associated with the access of water in the island? Can you please explain?

Perception of drought (definition, identification of drought, causes)

6. How do you define drought?
7. Do you think droughts on the island are more frequent, less frequent or the same? Why?
8. What do you think are the main causes of the drought on the Island?

Experience of drought (institutional preparedness and response)

9. Have you ever experienced a drought-response while working here? If yes, please describe your experience in that response. (responsibilities, procedures or protocols)
10. How would you compare the recent drought to past droughts or dry periods? (slight, moderate, severe)
11. How does your office determine when there is a drought versus a dry period?
12. How is your organization activated in a drought emergency response?
13. What do you think were the successful aspects of the organizational-response to drought? (logistical, financial, coordination)
14. What do you think were the main problems of the organizational-response to drought? (logistical, financial, coordination)
15. Was there any negotiation between the government and different neighborhoods on the island during the drought? If so, please explain.
16. Did you participate in the negotiation process? If so, what were the main points discussed? Can you explain further?

Concluding Question

17. Is there anything else you think is important for me to understand about how the organization perceives the water access, drought, and government response in the island?
18. Is there is anyone else that you would recommend that I speak with regarding to these issues?

Community semi-structured interview guide, 2018

Interviewer: Carolina Velásquez

General questions

1. What is your current occupation?	2. Are you over the age of 18? _____
3. How long have you been in your current home?	4. How long have you been in this part of this island? (Where do you live before?)

5. How do you identify yourself? Raizal, non- Raizal?	6. What community organizations are you a part of?
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Water access

19. What is your main source of water?
20. What do you think are the main problems associated with the access to water in the Island? Can you please explain?
21. Are you hopeful that the water situation in San Andrés will improve? Why or why not?

Experience during the water crisis

22. What was your experience during the water crisis that happened in 2016 and continued during 2017? Can you describe it a little better?
23. Was this crisis unexpected by you?
24. What do you think were the main factors that caused the crisis? And how? Were they natural or social, or both?
25. Have you participated in any action during the water crisis?
26. What kind of action was it (community meeting, demonstration, meeting with government officials)?

Perceptions of Justice

27. How do you define justice or fairness?
28. Do you think the water situation in the island is just/ fair or unjust/ unfair and why?

Perception of distributive justice

29. Do you think everybody receives the equitable amount of water? If not, who receives more and why? And who receive less and why? Who should receive water in the island?
30. Do you think water distributed in the island has the same water quality for everyone? If not, why not? If not, who receives better quality water?
31. Who do you believe makes the decisions about the distribution of water in the island?
32. Do you have a cistern? Do you think the capacity to store water creates conflicts among neighbors? Why?

Perception of procedural justice

33. Are you satisfied with the current water supply system? If not, what do think is wrong?
34. Who do you think established the procedures to supply water in the island?
35. Do you think the rules established for quality, distribution, and frequency are fair?
36. Do you think the water truck prices and schedule for supplying water are fair?
37. Do you think the community participates in the decision about the water allocation the island? Do you personally participate?
38. How do you think water distribution, frequency, and scheduling should be managed in the island? Do you have any method to propose? If so, please describe it.

Perceptions of interactional justice

39. During the crisis, how are your relations with neighbors, water trucks companies, and the water private company concerning water supply? Do you perceive any unfair relationship or treatment? Are there any conflicts?

Concluding Questions

40. Is there anything else you think is important for me to understand about how you perceive the water crisis?
41. Is there is anyone else that you would recommend who I speak to regarding to these issues?

Institutional semi-structured interview guide, 2018

Interviewer: Carolina Velásquez

General questions

1. What organization are you affiliated with?
2. What is your current job title or position within the organization?
3. How long have you been in your current position and with the organization?
4. How do you identify yourself?

Raizal, non-Raizal

Water access

5. What do you think are the main problems associated with the access to water in the Island? Can you please explain?
6. Are you hopeful that the water situation in San Andrés will improve? Why or why not?

7. How your organization participated in the water crisis?

Experience during the water crisis

8. Was this crisis unexpected by your organization?

9. What do you think were the main factors that caused the crisis? And how?

Were they natural or social, or both?

10. Have your organization participate in any action during the water crisis?

What kind of action was it?

Perceptions of Justice

11. How do you define justice or fairness?

12. Do you think the water situation in the island is just/ fair or unjust/ unfair and why?

Perception of distributive justice

13. Do you think that water was fairly/equitably shared among islanders during the water crisis?

14. Do you think everybody receives equitable amount of water during the water crisis response? If not, who receives more and why? And who receive less and why? Who should receive water in the island?

15. Do you think water distributed in the island has the same water quality for everyone? If not, why not? If not, who receives better quality water? Are you satisfied with quality of water that you receive?

16. Who do you believe makes the decisions about the distribution of water in the island?

Perception of procedural justice

17. Who do you think established the procedures to supply water in the island?
18. Do you think the rules established for quality, distribution, and frequency are fair?
19. Do you think the water truck prices and schedule for supplying water are fair?
20. Do you think the community participates in the decision about the water allocation the island?
21. How do you think water distribution, frequency, and scheduling should be managed in the island? Do you have any method to propose? If so, please describe it.

Concluding questions

22. Is there anything else you think is important for me to understand about how you perceive the water crisis?
23. Is there is anyone else that you would recommend who I speak to regarding to these issues?

Appendix B

B.1 Permissions

Publication 1: Making sense of the 2016 water crisis in San Andres, a Colombian Caribbean Island

Autors: Carolina Velasquez

Journal: Anais Brasileiros de Estudos Turísticos: ABET, ISSN-e 2238-2925, Vol. 8, Nº. 3, 2018, págs. 59-73

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Abstract

In October 2015, the Colombian Institute of Hydrology, Meteorology and Environmental Studies (IDEAM) declared that the El Niño phenomenon had reached severe conditions, and later, on July 13, 2016, reported that conditions had returned to normalcy. One of the affected areas was San Andres, a touristic drought-prone Colombian Caribbean island. On April 2, 2016, there were 11 road protests spread throughout the south-center of the island where the Raizales, an ethnic-minority group, and people from poor neighborhoods burned tires, blocked streets, and held up signs saying, “We need water.” That was the official beginning of the water crisis, which had by then affected 14,000 people. On April 15, the local government, for the first time in its history, declared a State of Public Calamity, attributing the causes of the lack of water to the El Niño phenomenon. The government established the El Niño phenomenon as the only trigger of the crisis, but the ways in which the community framed and understood the water crisis were overlooked. Acknowledging the importance of the community voice, this research analyzes the way people were affected and public officials made sense of the water crisis. Thirty-four semi-structured interviews were conducted in August, 2016 with a variety of stakeholders. The results show that officials were more inclined to frame the water crisis as a problem triggered mainly by technical and natural issues. On the community side, people framed the water crisis as a problem where social issues like justice predominated. This study helps to expose and understand the complexity of the San

Andres water crisis and ultimately contributes to the prevention of repeated or more severe crises.

Publication 2: The 2016 Water Crisis in San Andres Island: An Opportunity for Change?

Autores: Carolina Velásquez

Journal: *Ciencia Política*, 15(29), 73-109. <https://doi.org/10.15446/cp.v15n29.86373>

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Abstract

During the first half of 2016, the “Niño” Phenomenon reached severe conditions in San Andres Island, Colombia. On April 2, people, mostly the Raizals, an ethnic minority group, and people from poor neighborhoods started 11 road protests asking for water. The water crisis affected, differentially, more than 14.000 people. The institutional response focused on distributing free water trucking during dry periods, increasing the water frequency, and incrementing water production. This study analyzed the crisis response and explored, in the short term, whether there was a change in access to water. In August 2016 were conducted 34 semi-structured interviews and 45 in November 2018. Findings suggest that crisis response used a conservative philosophy embedded in a technocratic perspective; as a result, it is still limited water access in the way it was before the crisis. This study contributes to the understanding of the factors that influence crisis response.