Questioning the tunnel vision

Assessing the frames and governance of California's WaterFix megaproject

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LUCSUS
Lund University Centre for Sustainability Studies

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Abstract

Over the last century, large-scale water megaprojects have become a globally widespread method of addressing water scarcity by moving water from areas of water surplus to deficit. The U.S. state of California is a megaproject pioneer, having constructed two infrastructural systems in the mid-1900s that transfer water as far as 640 kilometers to satisfy agricultural and urban growth. While these projects have provided economic and social benefits, these gains have come at substantial ecological cost while being unevenly distributed across society. California's recent proposal to build a new megaproject called WaterFix is therefore puzzling: why does the government continue to propose megaprojects despite their known social and ecological consequences? Looking through the lenses of political ecology, frame theory, and related concepts of governance, I answer this question via the WaterFix case to assess the sustainability outcomes potentially produced by the ideas (frames) and governance mechanisms underlying the project's proposal. Via dual streams of investigation—frame and interview analysis—I conclude that the government's very conceptualizations of problems and solutions are problematic for long-term sustainability. This is because they lead to a privileging of economic rather than environmental or collective interest, while they promote a techno-scientific logic that depoliticizes decision-making. Furthermore, unsustainable solutions like megaprojects are seen as economically and politically favorable due to the influence of financial incentives, undemocratic processes, and other mechanisms of governance. Government frames and governance mechanisms are therefore found to be both influential and interrelated, with frames having a more influential role in shaping not only governance arrangements, but how societal solutions are sought. Consequently, frames merit special attention in further academic research and practical decision-making, particularly in contexts in which similar large-scale infrastructure or governance arrangements exist or are planned.

Keywords: Water megaprojects, political ecology, frames, governance, sustainability, California

Word count: 13,999

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1 Introduction

1.1 The mega-problem

Water is a necessary precondition for life. Historically civilizations have settled close to water sources to satisfy their drinking and agricultural needs (Kummu, de Moel, Ward, & Varis, 2011). But water has not always been abundant; irresponsible use, increased demand from population growth, and climate variability have contributed to conditions of water scarcity (Molle, 2008). This has led human societies to transport water from areas of water surplus to deficit since as early as 2500 B.C. (Meador, 1992). More recently, as population and economic growth have increased water demand (World Water Assessment Programme, 2012), scientific and technological advancements have enabled attendant increases in water transfer projects to meet this demand (Molle, Mollinga, & Wester, 2009). These megaprojects—defined here from a water infrastructural standpoint as temporary projects involving "large investment commitment, vast complexity (especially in organisational terms), and long-lasting impact on the economy, the environment, and society" (Brookes & Locatelli, 2015, p. 58)—now exist all over the world (Meador, 1992). As symbols of the 'hydraulic mission' paradigm of water management, they continue to be proposed by governments as a way to increase water supply for development and urban use (for examples see Crow-Miller, 2015; Islar & Boda, 2014). However, while they provide social and economic benefits, they also cause ecological degradation by altering water flows and modifying habitats (Meador, 1992), and they pose risks to human health (Vera Delgado, 2015).

The U.S. state of California has been constructing water megaprojects to deal with water scarcity for nearly a century. Motivated by needs of expanding metropolises such as Los Angeles and economic benefits of a growing agricultural sector (Hanemann, Dyckman, & Park, 2015), the state government constructed two megaprojects in the mid-1900s: the Central Valley Project (CVP) and State Water Project (SWP). Today, these large-scale conveyance systems move water up to 640 kilometers from dams in the humid north of the state via canals to arid agricultural and urban areas in the south (Bureau of Reclamation, 2017). They have helped supply growing urban areas while supporting the development of one of the world's most prolific agricultural regions (California Department of Food and Agriculture [CDFA], 2016).

But, as with other megaprojects globally, these have had ecological and social consequences. Water released from CVP and SWP dams travels through and is pumped out of the California Delta, an estuarine ecosystem that has been so altered, it now contains only 3% of its historical wetlands

(Whipple, Grossinger, Rankin, Stanford, & Askevold, 2012). The altered river flows caused by these megaprojects entrain and kill fish, resulting in numerous species being designated as threatened or endangered (see U.S. Environmental Protection Agency [EPA], 2010a). Furthermore, large-scale agricultural development made possible by the CVP and SWP has led to over-extraction and chemical pollution of groundwater (Pannu, 2012). This has caused the desiccation and pollution of wells and even piped water in nearby communities, leading to economic and health-related consequences for thousands of rural residents, many of whom are poor and tragically work on the very farms polluting their water (Pannu, 2012). In response to some of these consequences, the state has taken measures to update its environmental laws and initiate other environmentally conscious programs (Hanak et al., 2011). However, given the continuing deleterious effects of these megaprojects, current conditions are not sustainable by any measure.

Despite these well-known consequences, the California government recently proposed a new megaproject called WaterFix. The vision of this $15B project is to install two large tunnels underneath the Delta and a new pumping system to reduce altered river flows (Department of Water Resources [DWR], 2015b). The government presents the project as a way to restore the Delta ecosystem while improving the reliability and amount of water supply (California Natural Resources Agency [CNRA], 2017). However, it is very controversial, with virtually no environmental groups in support, and other groups undecided. If constructed, it will greatly affect the environmental, social, and economic conditions of the state for many years to come.

The impetus for this thesis comes from my desire to better understand the underlying reasons why controversial water megaprojects like WaterFix continue to be proposed in California. Arriving at such an understanding first requires a theoretical approach that I describe, after which I present the research aims I seek to achieve in this thesis.

1.2 Theoretical introduction

The most publicized research into the government's approaches for dealing with water scarcity-related problems tends to focus on practical water management strategies and policy (see Public Policy Institute of California, 2015) or economic considerations (see UC Davis Center for Watershed Sciences, 2016). Little research has been done on the basic assumptions and ideas underpinning the government's decisions, and what limitations they might have. However, as Kallis (2008) asserts, in cases of water scarcity, "taken-for-granted ideas and concepts delimit how a problem is conceived and what solutions are sought" (p. 103). Therefore, if existing solutions are problematic, it is critical to

understand and judge their supporting ideas to see how they might contribute to problems or delay more sustainable pathways.

Frame theory (described further in section 4.2) provides a lens through which to identify and analyze these taken-for-granted ideas. Frames are webs of concepts through which people derive meaning, and are communicated by various, often powerful actors, through language (Reese, 2009). A key characteristic of frames is that they define problems and solutions, influencing what sustainability pathways a society undertakes (Beland Lindahl, Baker, Rist, & Zachrisson, 2016). In this way, some frames become more dominant than others, becoming the "motorways that channel current mainstream and development efforts" (Leach, Scoones, & Stirling, 2010, p. 5), to the exclusion of other understandings and pathways. When it comes to solving water scarcity-related problems, the California government can be seen as sponsors of the dominant frames, as it has defined the problems that water megaprojects are intended to solve since the early 1900s (Carroll, 2012).

Decision-making is not only influenced by frames, but also by governance, broadly defined by Leach et al. (2010) as "the intersection of power, politics and institutions" (p. 65). According to Atkinson, Held, and Jeffares (2010), governance is composed of rules and actor groups that, together, produce mechanisms leading to particular societal outcomes. California's governance system can be characterized similarly: various actors and rules shape not only megaproject proposals but the state's overall water decision-making (Pannu, 2012).

Atkinson et al. (2010) argue that when examining how governance addresses a sustainability problem, it can be helpful to employ two complementary but methodologically separate 'streams of investigation', one focusing on language and ideas (frames), and the other on actors' decision-making processes (mechanisms). Both can enhance understanding of how particular courses of action come about—a starting point for this thesis.

1.3 Aim and research questions

The aim of my research is to understand how the California government justifies, and what governance mechanisms underlie, its decisions to pursue ecologically and socially problematic water projects. With the bases of these decisions better understood, I then seek to assess their possible outcomes so that any shortcomings can inform academic research and practical decision-making.

Given that WaterFix is a new megaproject with a role in potentially shaping California's environmental, social, and economic conditions for centuries, I use it as a case study to answer this overarching

research question: *Why does the California government continue to propose water megaprojects in spite of their known ecological and social consequences?*

This leads me to the following two sub-questions:

RQ1: How does the government frame problems and solutions in the case of WaterFix?

RQ2: What governance mechanisms influence the proposal of WaterFix?

Answering these questions in tandem will provide a starting point to judge WaterFix's potential sustainability-related shortcomings in terms of both the ideas underlying and the mechanisms influencing its proposal. This knowledge may be relevant in other contexts in which large-scale water infrastructure solutions or similar water governance arrangements exist.

1.4 Contribution to Sustainability Science

While California's government paid little heed to nature in its original megaprojects by prioritizing development, it has since tried to strike a 'coequal' balance between environmental and economic needs (Delta Stewardship Council, 2015). Implicit in this choice is a particular notion of sustainability, that development and environmental well-being can go hand in hand, which Miller (2013) calls 'universalist' sustainability. My core research, however, applies a different, 'procedural' definition of sustainability, a "methodological-oriented approach that focuses on how sustainability comes to be defined and how pathways are developed to pursue it" (Miller, 2013, p. 284). In my thesis I focus on the latter: how particular sustainability pathways are developed through frames and mechanisms influencing the latest California water megaproject.

My thesis also employs a *critical research* approach in sustainability science. In this approach, the researcher scrutinizes the institutional frameworks and processes that underlie decisions, while exploring the possibility of alternative societal choices (Jerneck et al., 2011). Employing critical research enables me to identify and analytically question the frames and mechanisms influencing WaterFix, while setting the stage for subsequent *problem-solving research* "to reap the benefit of seeing beyond . . . [their] boundaries" (Jerneck et al., 2011, pp. 78-79). In this sense, my thesis sets the groundwork for problem solving-focused researchers to guide and effect change based on the relevant and problematic aspects I identify.

1.5 Thesis roadmap

In the next section, I situate the WaterFix project in its broader historical context of water development in California. I explain the state's geography, hydrology, and climate; its history of state-implemented water megaprojects; and their resulting ecological and social problems. Then, I describe the WaterFix

case itself, explaining its intended purpose and how it has been criticized. Following that, I elaborate on my theoretical approach of frames, which draws from principles of political ecology, and also how they relate to governance mechanisms. These theories lead me to my joint methods of frame analysis and interview analysis that answer my research questions. I then present these analyses' results before using these to inform an assessment of the sustainability-related implications of WaterFix. Finally, I formally answer my overarching research question, reflect on my theoretical and methodological approaches, and conclude by summarizing my study and pointing to directions for future research.

2 Context

2.1 Basic geography, hydrology, and climate of California

California is geographically diverse (Figure 1). In the center stretching longitudinally is the Central Valley consisting of two smaller valleys: the Sacramento (north) and the San Joaquin (south). Running alongside both valleys to the east is the Sierra Nevada mountain range (Sierras). While the valleys used to flood in spring (Kelley, 1998), they now encompass one of the most globally productive agricultural regions, accounting for two-thirds of U.S.-consumed fruits and nuts (CDFA, 2016). At the northern end of the Sacramento Valley begins the Sacramento River, the largest river in California by volume (Laćan & Resh, 2016). It flows south, collecting water from tributaries fed from the northern Sierras. East of the San Joaquin Valley begins the San Joaquin River, flowing from the mountains into the valley before turning north. Both rivers eventually arrive at the California Delta, an estuarine ecosystem that connects these freshwaters to the Pacific Ocean.

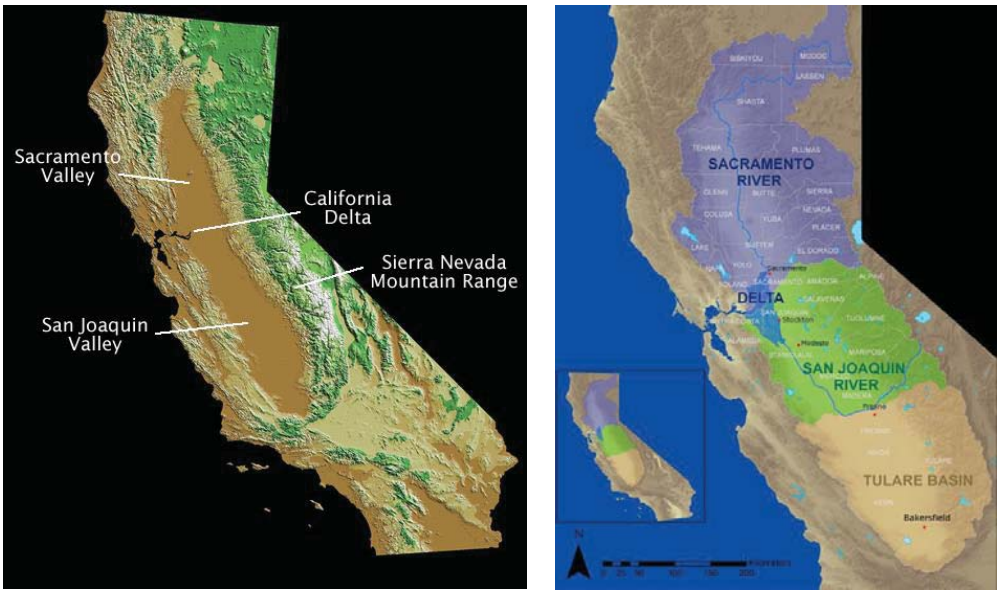

Figure 1. *Left:* Elevation model of California. Adapted from U.S. Geological Survey (n.d.). *Right:* Sacramento and San Joaquin River watersheds flowing into California Delta (Integrated Ocean Observing System, 2017).

California's population is over 38 million (Christian-Smith & Heberger, 2015) with large, coastal urban centers (Figure 2). Approximately 18 million people live in the greater Los Angeles area (World Population Review, 2017) south of the San Joaquin Valley. Over 7 million live west of the Delta, in the Bay Area region of San Francisco and surrounding cities (Bay Area Census, 2017). The state's population is expected to reach 44 million by 2030, with the majority of growth in urban areas (Johnson, Hill, & Cuellar Mejia, 2016).

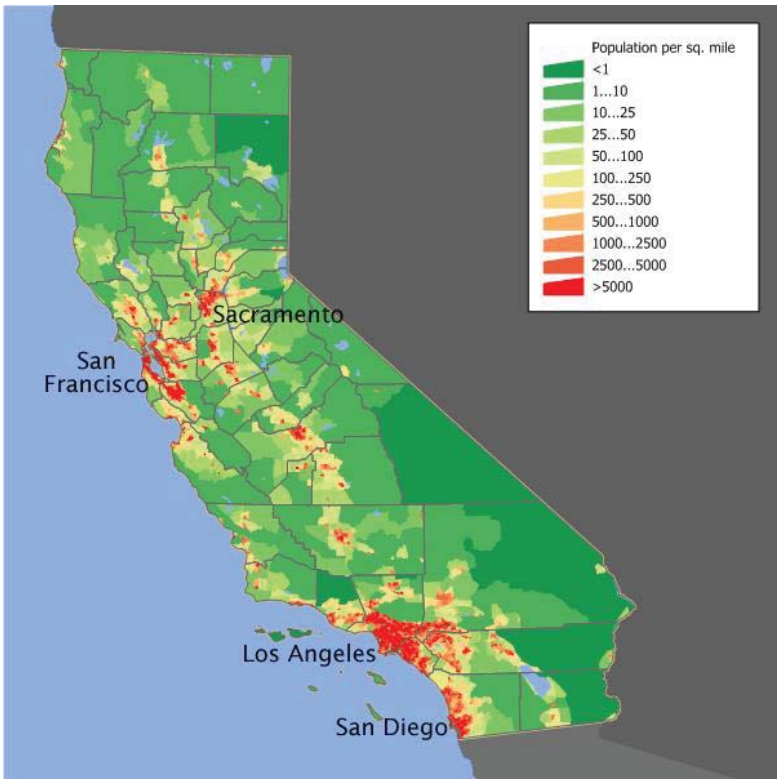

Figure 2. Population density of California. The Los Angeles and San Francisco areas are the most populous urban centers. Adapted from Irwin (2011).

California is characterized by spatial variations in climate and precipitation (LaDochy, Medina, & Patzert, 2007) (Figure 3). Northern California has a mostly cold-summer Mediterranean climate, with some regions receiving as many as 400 centimeters of rain annually (PRISM Climate Group [PCG], 2017). Conversely, southern California is primarily composed of semi-arid climates that receive comparatively little rain (PCG, 2017). There is therefore a spatially inverse ratio of precipitation to people: "nearly 75% of the available water originates in the northern third of the state, while 80% of the demand occurs in the southern two-thirds" (Nickles & Lauer, 2015, p. 2). Furthermore, much of the state's agriculture is in the south, in the San Joaquin Valley, where there is little rainfall.

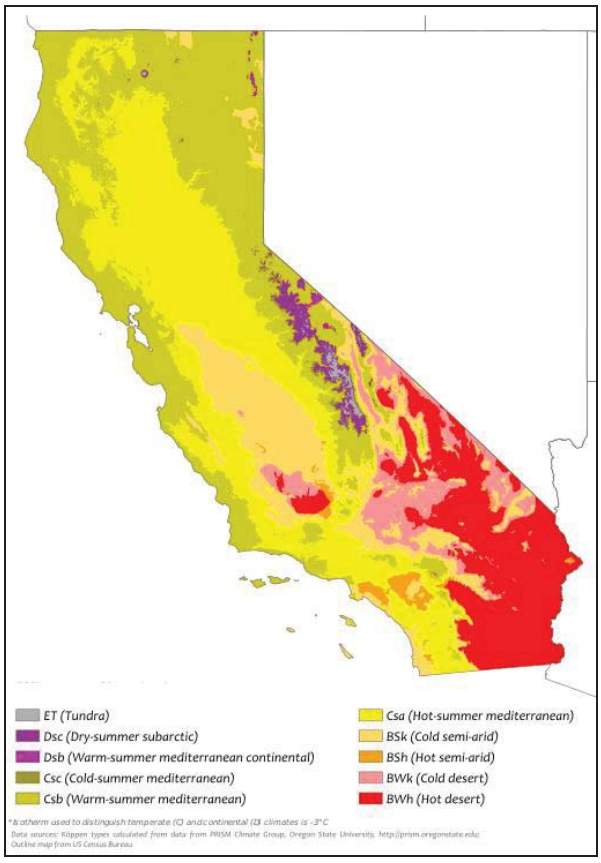

Figure 3. Köppen climate types of California (Peterson, 2016). Mediterranean climates in the north produce more precipitation while more arid climates in the south produce less.

California experiences periods of meteorological drought, indicated by a number of days annually with precipitation below a certain threshold (Wilhite & Glantz, 1985). These droughts have varying durations and intensities, with reprieve often coming from global temperature fluctuations that produce wet El Niño and La Niña weather patterns (Lassiter, 2015). Evidence suggests that dry and wet cycles will become more varied and extreme in California due to climate change (Ault, Cole, Overpeck, Pederson, & Meko, 2014).

2.2 Pre-history of megaprojects

While separation between people and water sources in California would have been a challenge a few centuries ago, it has since been rendered unproblematic by the state and federal governments' alteration of the environment to serve human needs. It began in the mid-1800s with reclamation, a federal government-promoted concept asserting that swampland should be reclaimed in order to civilize it from nature's savagery, and improve it to make it profitable (Carroll, 2012). The Sacramento Valley was primarily swampland, which California acquired from the federal government and sold to farmers (Kelley, 1998). Profits first funded the drainage of water, and then levee installation to ensure only necessary water reached the newly arable land (Carroll, 2012). Consequently, "agriculture quickly

became the centerpiece of the government's economic policy" (Carroll, 2012, p. 10), a precursor to its role today.

Redirecting water resulted in private agricultural benefit, but also numerous public problems such as desiccation in some areas and flooding in others (Hanak et al., 2011). The government, touting new metering technology and engineering expertise that had progressed during the levee-building period, stepped in, making "the case for a systemic, state-coordinated approach informed by science" (Carroll, 2012, p. 14). This led to new regulations and the construction of the 1911 Sacramento Valley Flood Control Project, which today routes floodwater downstream of Sacramento via a complex system of channeling infrastructure (DWR, 2010).

Simultaneously, to meet demand from increasing population, farmers consolidated into organized groups to pool financial and water resources (Stene, 2015). The 1887 Wright Act cemented these local and regional groups into irrigation districts, launching "an era of local governmental development and control of water resources" (Hanak et al., 2011, p. 30). Over time, these districts expanded to urban municipalities, becoming increasingly consolidated and powerful, and playing a major role in future megaprojects and their governance.

2.3 The megaproject era

While discussions of north-south transfers of water had occurred in 1858 (Hanemann et al., 2015), the state did not have financial or technological resources to do it at the time (Carroll, 2012). In the 1920s, the idea reemerged due to slowing benefits of reclamation. Agricultural production had increased, but demand from population growth outpaced supply, particularly after droughts in 1920 and 1924 (Hanemann et al., 2015). In 1933, voters approved California's first megaproject called the Central Valley Project (CVP). The Great Depression had weakened the state's financing abilities, so the federal government funded the project through the Bureau of Reclamation (Nickles & Lauer, 2015), which still manages it today. CVP's centerpiece is Shasta Dam, now the headwater of the Sacramento River (Dunning, 1993). The dam's primary purpose, in addition to generating electricity and providing flood control, is increasing water supply (Nickles & Lauer, 2015). Water is stored for controlled release, particularly during the summer dry season when San Joaquin Valley farmland needs it most (Dunning, 1993). After release, it flows down the Sacramento River and through the Delta, where it is diverted, pumped out, and transported up to 188 kilometers, mainly to farms in the San Joaquin Valley (Nickles & Lauer, 2015) (Figure 4).

The CVP alone was not enough to satisfy water demand. By 1950, California's population had grown from 6.9 to 10.6 million and the CVP conveyed water primarily for agriculture rather than drinking

(Hanemann et al., 2015). Los Angeles government agencies, having already constructed several controversial intra- and inter-state aqueducts to supply a growing population, still had difficulties satisfying demand (Nickles & Lauer, 2015). In 1960, voters approved California's second water conveyance megaproject, the State Water Project (SWP), damming the Feather River at Oroville near the northern Sierras (Cook, 1971). The government also passed a bill establishing the Department of Water Resources (DWR), whose mission was to design, build, and manage the SWP (DWR, 2017a). Today the DWR owns the SWP but also manages California's water more broadly (DWR, 2017a).

As with the CVP, water released from the SWP's Oroville Dam travels down the Sacramento River and into the Delta before it is pumped out. It travels 640 kilometers—nearly half the longitudinal distance of California—before supplying primarily municipal uses of over 20 million people in the greater Los Angeles area (CNRA, 2017) (Figure 4).

Figure 4. Map of CVP and SWP (Dogrul, Kadir, Brush, & Chung, 2016).

To distribute water according to law, the DWR negotiated contracts with 30 water districts, which by this time had come to represent large agricultural and urban interests (Hanak et al., 2011). Due to these contracts, district authorities came to be known as 'water contractors'. Interestingly, SWP contracts were based on future projections of water availability and accounted for double the water that could be supplied, under the assumption that the SWP would have several phases of development (Hanak et al., 2011). These phases never happened, creating legally produced conditions of scarcity and conflict that still persist today (Hanak et al., 2011).

Of all water arriving in California, approximately 50% remains in the environment or goes out to sea, 40% goes to agriculture, and the remaining 10% goes to urban uses (Mount & Hanak, 2016). Benefits of the CVP and SWP have included much economic prosperity and well-being for California's citizens. Hydropower generation and enhanced water supply have greatly contributed to the state's industrial and agricultural production as well as economic growth (Nickles & Lauer, 2015). They have also enabled drinking water provision, improving quality of life for most of the state's inhabitants (Nickles & Lauer, 2015). However, these projects have resulted in numerous ecological and social consequences.

2.4 Ecological and social consequences arising from CVP and SWP

2.4.1 Degradation of the Delta ecosystem

As the CVP and SWP hub, the Delta is no longer the diverse and extensive wetland system it once was, and has undergone substantial ecological degradation. The clearest sign of this is fish species decline, in particular the Delta smelt, which has been placed on the federal threatened species list (EPA, 2010a). CVP and SWP operations have changed natural water flow, salinity, and temperature, disorienting smelt and other fish from migratory patterns and pulling them into project pumps (Dunning, 1993) (Figure 5). Furthermore, agricultural production enabled by the CVP and SWP, both inside and outside the Delta, has harmed Delta species through chemical runoff (Dunning, 1993).

Figure 5. *Left:* Photo of SWP's Harvey Banks Pumping Plant pumping water out of the Delta (DWR, 2017b). *Right:* Photo of fish killed by the pumps (Bacher, 2011).

Terrestrial Delta species have also been affected, mainly through habitat disruption. Over 50 plants, 17 invertebrates, 10 birds, and 9 mammals are listed as 'species of concern' (CalFed, 2017). Others are even more imperiled, such as the salt marsh harvest mouse, endangered since 1970 (EPA, 2010b).

Impacts to the Delta have also affected people. Low-income communities conducting subsistence fishing have fewer food sources and are at greater risk of mercury exposure (Shilling, White, Lippert, & Lubell, 2010). Recreational and commercial fisher economies have been diminished (Nature Conservancy, 2016), including this year when portions of the salmon fishing season are closed off the California coast (Duggan, 2017), affecting thousands of livelihoods. Indigenous tribes have also been impacted, as salmon reductions threaten their traditional roles as fish protectors (Dallman, Ngo, Laris, & Thien, 2013).

2.4.2 Exploitation and pollution of the Central Valley

The combination of megaproject water deliveries, farm subsidies, and reduced limits on property size has led to the growth of Central Valley agribusinesses (National Research Council, 1989) at the expense of local ecosystems and neighboring residents. These companies operate industrial-scale farms, often with intensive animal farming or monoculture crops that leach chemicals such as nitrates into the soil, infiltrating the water table (Pannu, 2012). During drought years when the CVP and SWP deliver less water, farmers have over-exploited aquifers to maintain production (Pannu, 2012). This has been exacerbated by a recent trend of planting lucrative tree crops such as almonds that must be irrigated year-round (Palomino, 2014).

Groundwater over-extraction has led to land subsidence, as many as eight meters in some places, leading to permanent reductions in aquifers' storage capacity (NASA, 2017). Reduced amounts of water are less able to dilute nitrates, making their concentrations toxic to humans (Pannu, 2012). Hundreds of communities surrounding the farms, many of them poor laborer localities, have found that their well or piped water has either disappeared or is no longer safe to drink (Pannu, 2012). Some are forced to pay for bottled water as well as related health costs (Balazs & Ray, 2015; Pannu, 2012). Tragically, many work on the very farms causing the problem, thereby contributing to private benefit at their own cost.

Intensive irrigation practices have also freed selenium from soils, discovered in the 1980s to have devastated wildlife in a Central Valley wildlife refuge (Dunning, 1993). Selenium and other toxic substances have also made their way back to the Delta, where they are recirculated through the system (Mount et al., 2012). According to Harris (1991), many people have been adversely affected by selenium poisoning due to these farms' irrigation practices.

It is important to note that these consequences are not entirely due to the CVP and SWP megaprojects. Groundwater over-extraction, for example, also occurred because of inadequate groundwater management laws, while irrigation-related problems could also be attributed to insufficient limits on fertilizer and pesticide use. However, the presence and growth of these farms, which have led to these consequences, would not have been possible without the construction and continued operation of the CVP and SWP.

3 The WaterFix case

3.1 History of WaterFix

The basic concept on which WaterFix is based—of moving water around rather than through the Delta—originated in the 1940s. San Joaquin Valley farmers found that CVP supply could not meet demand (Cook, 1971) while they also desired higher-quality water from north-state rivers (California Water Impact Network, n.d.). A canal circumnavigating the Delta would have increased both the amount and quality of divertible water. Several were proposed, but the state decided benefits did not exceed construction costs (Cook, 1971). The proposal resurfaced in the 1970s, called the 'peripheral canal', but was voted down in a 1982 public referendum. The proposal's defeat, according to Gwynn, Thompson, and L'Ecluse (1983), was partly due to changing environmental values in the electorate.

These changing values have been reflected in numerous state and federal laws requiring authorities to limit environmental impacts of development, making megaprojects less attractive due to higher costs. Pertinent to WaterFix, at the federal level this includes the 1969 National Environmental Policy Act (NEPA) and 1972 Clean Water Act. At the state level it includes the 1970 California Environmental Quality Act (CEQA). Changing values have also led to the creation of state agencies designed to balance environmental, social, and economic considerations, including the State Water Resources Control Board (SWRCB), which will ultimately decide if WaterFix is permitted. Similarly, the 2009 Delta Reform Act established the Delta Stewardship Council (DSC), a state agency whose mission is to further 'coequal goals' "of providing a more reliable water supply for California and protecting, restoring, and enhancing the Delta ecosystem" (DSC, 2015, para. 3).

Over the last decade, the existence of these laws and agencies, combined with the continued decline of threatened fish species and a prolonged meteorological drought, has resulted in legal impositions on how much water the CVP and SWP can transport (DWR, 2015b). This has reduced water deliveries to water contractors and the agricultural and urban users they represent. In 2004, a Delta levee collapsed, bringing to statewide attention the potential fragility of the Delta levee system and the

impacts this might have on water supply (Bulwa, Hallissy, Lucas, & Fagan, 2004), especially given the likelihood of earthquakes and extreme climate change-related weather (Hanak et al., 2013). These factors, in part, led the DWR in 2009 to propose the Bay Delta Conservation Plan, which has since been undergoing a lengthy environmental review process, and today has been rebranded to WaterFix.

3.2 WaterFix proposal

WaterFix would create three new points of diversion north of the Delta on the Sacramento River (Figure 6), each protected by special screens to keep fish inside (CNRA, 2017). Rather than allow all water to flow through the Delta to the problematic pumps, WaterFix would transport legally permissible quantities of water *under* the Delta via dual 10-meter wide, 50-kilometer tunnels (DWR, 2015b). It would also construct new, modernized pumps to transfer the water south without reversing San Joaquin River flows (DWR, 2015b). The existing pumps would still be operational when necessary to modulate water flows or enhance supply.

The project is estimated to cost approximately $15B and would be funded by water contractors who would benefit (DWR, 2015b), mainly the largest in the San Joaquin Valley and greater Los Angeles area. A key benefit for funders is that when flows are high—for example during extreme rain events—the large tunnels can legally transport more water to southern agricultural and urban areas (CNRA, 2016b).

Figure 6. Proposed WaterFix layout (Metropolitan Water District, 2017). Two 50-kilometer tunnels would transport water under the Delta.

3.3 Approval process

The approval of WaterFix now depends on several factors. First, the Bureau of Reclamation will need to confirm the project conforms to federal laws such as NEPA, based on several scientific reviews still in progress (CNRA, 2016b). Then, the DWR will need to approve the final environmental impact report (EIR), indicating that it abides by CEQA and other regulations (CNRA, 2016b). The SWRCB will then ultimately decide whether to grant the permit required for the project to proceed (DWR, 2015b). Agricultural and urban water contractors will also need to sign an agreement confirming funding (DWR, 2015a).

3.4 Criticisms

While the government endorses the project, there are a multitude of concerns, which are condensed and summarized below.

First, there is substantial uncertainty in how the project would impact the ecosystem and species it is supposed to protect, placing it in potential violation of laws such as NEPA and CEQA (see Natural Resources Defense Council [NRDC], 2015). While it would likely reduce fish entrainment at the pumps, it would not eliminate it entirely (see Contra Costa Water District [CCWD], 2015). It would also alter river flows, resulting in unknown ecosystem outcomes such as further fish perturbation (see EPA, 2015). Furthermore, it could reduce water quality for in-Delta farmers and residents, harm fisher livelihoods (see Delta Protection Commission, 2015), and alter groundwater re-infiltration regimes north of the Delta (see County of Sacramento, 2015). Detailed modeling has been conducted to gain more certainty, but its results have been criticized with claims that the models' basic assumptions are flawed (see CCWD, 2015; County of Sacramento, 2015). If fish populations do not increase, then environmental regulations may continue to limit the amount of transportable water, thereby limiting short-term gains of the project.

Second, the financial cost of the project is very high, forcing increases in water bills among ratepayers, some of whom are economically disadvantaged (see Environmental Water Caucus, 2015). Potential project cost overruns would worsen this burden. Furthermore, capital could instead go towards local supply-side technologies, such as graywater recycling, with far fewer socioecological impacts and more immediate benefits (see NRDC, 2015).

Third, the tunnels' diameters have been criticized as too large, which could lead more water to be transported south in spite of environmental regulations (Meadows, 2015). Hanak, Mount, and Gray (2016) have proposed reducing the scope to one tunnel, but this would require new environmental reviews and delay implementation.

Finally, if WaterFix increases transported water by 25% as the government claims it might (CNRA, 2016b), this could lead to more socio-ecologically problematic development. Higher supply could enable more urban development in southern California and agricultural growth in the Central Valley. In turn, this would create ongoing demand increases, recreating the very problem of water scarcity that WaterFix intends to solve (see Central Delta Water Agency, 2014). This also means that consequences of previous megaprojects, such as the pollution of rural groundwater, could continue into the future.

4 Theoretical background

4.1 Political Ecology

Political ecology is an interdisciplinary research field seeking to "address the condition and change of social/environmental systems, with explicit consideration of relations of power" (Robbins, 2012, p. 20). In line with sustainability science, it examines human-environment interactions and uncovers how problematic conditions arise as a result of broader systems and power dynamics (Robbins, 2012). While in other fields the social-environmental relationship is often seen as disconnected, political ecology views it as an interconnected system (Robbins, 2012). Swyngedouw (2009) views water as facilitating these interconnections, both physically through human use and socially through the influence that water exerts on social systems and relations of power. Because these relations are generally unequal and often lead to conflict, political-ecological research on water focuses on the drivers of socio-ecological change (Swyngedouw, 2009).

One of political ecology's core objectives is to critically question the assumptions behind societal decision-making (Forsyth, 2003), a process that Gezon and Paulson (2005) refer to as the analysis of how the socio-environmental relationship is understood. These understandings are often taken for granted and depend on unique social and political contexts (Stott & Sullivan, 2000). In this thesis I investigate both taken-for-granted understandings (frames) and their socio-political context (governance mechanisms).

Regarding frames, Forsyth (2003) argues they are "woven into both the formulation of scientific explanations of environmental problems, and the solutions proposed to reduce them" (p. 1). It is therefore by examining frames that I can "challenge dominant interpretations of the causes of environmental degradation and contest prevalent prescriptions for solving such problems" (Gezon & Paulson, 2005, p. 2) in California's water paradigm. Swyngedouw (2009) agrees, calling on researchers to investigate arguments that promote particular pathways of water management. Using a political-

ecological perspective, my research takes a normative approach (Robbins, 2012), exposing and assessing the frames and mechanisms that influence water decision-making in order to open the possibility for alternative perspectives to take hold.

4.2 Frame theory

Frames live in the same theoretical family as discourses (Lindekilde, 2014) and, as such, are defined as structures of meaning used by people to order and explain the world (Hertog & McLeod, 2001). They are communicated verbally and in writing via symbols—through metaphors and other linguistic devices (Reese, 2009). They are constructed by actors with certain goals and motivations, though not always consciously (Reese, 2009). Consequently, frames are never neutral; they favor a particular explanation of the world by selecting and elevating certain concepts so they are more salient or memorable (Entman, 1993). This filtering of concepts means that other interpretations are excluded. Indeed, "[m]ost frames are defined by what they omit as well as include" (Entman, 1993, p. 54).

Frames "organise experience and they bias for action" (Beland Lindahl et al., 2016). Not only do frames select and promote concepts that represent a particular understanding of the world, but they also prescribe solutions based on this understanding. In a particular frame, only a limited set of solutions is logically possible or preferable (Hertog & McLeod, 2001). Therefore, frames involve uneven distributions of power, both in terms of the resources available to the actors that sponsor them (e.g., financial, institutional, etc.), and the frame's outcomes which are often spread asymmetrically across society (Beland Lindahl et al., 2016).

One way frames operate is by evoking certain narratives (Hertog & McLeod, 2001), stories that identify problems, elaborate on their consequences, and prescribe solutions (Roe, 1994). Inside narratives there are latent interpretations of the world, such as definitions of system boundaries, or assumptions about what kind of knowledge best solves problems (Leach et al., 2010). Similarly, narratives often assign responsibility, whether blaming an actor for a problem or exalting another as the wielder of the solution (Hertog & McLeod, 2001). This has real effects, for example on participation, in selecting which actors are included and when (Hertog & McLeod, 2001).

As discussed in section 1.2, when frames are examined in a governance context as they are in this thesis, it can be helpful to additionally look at other governance aspects, such as actor arrangements and decision-making processes to understand how they influence particular pathways (Atkinson et al., 2010). After all, frames may bias decisions, but they cannot execute them. Dryzek (2002) refers to these 'executing' aspects of decision-making as the governance 'hardware', and discursive elements such as frames as the 'software', claiming that both merit attention in research. Leach et al. (2010)

focus on how the two interact. For example, mechanisms can shape frames because, when institutions enact mechanisms, they create certain social structures that frames must reflect in order to make sense (Leach et al., 2010). Conversely, frames can shape governance, for example by implying who has the supremacy to address problems, thereby reinforcing power dynamics (Leach et al., 2010). While Atkinson et al. (2010) and Dryzek (2002) do discuss how frames and governance interact, it is their notions of these concepts as separate but complementary units of analysis that guide my research. This is not to say that frame-governance dynamics are not important, but rather that before these can be understood, their basic elements must first be identified, which is what I do in this thesis.

The focus of my research is on what dominant frames exist, how through narratives they interpret problems and solutions, how they delineate systems, and how they define the roles of various actors and types of knowledge in the WaterFix case. I also seek to understand what governance mechanisms influence decision-making. It is my hope that applying frame theory and exploring governance processes in this case will lead to new understandings not only in how water problems are conceptualized by the government, but also how governance mechanisms work to influence related decision-making. With this knowledge created, I seek to assess these frames and mechanisms in terms of 'procedural' sustainability, providing the groundwork for society to question dominant pathways by engaging in what Robinson (as quoted in Miller, 2013) describes as a "discussion about desired futures that's informed by some understanding of the ecological, social, and economic consequences of different courses of action" (p. 284).

4.3 My ontological position

4.3.1 Frame theory and critiques of social constructionism

Frame theory evolved from cognitive psychology and anthropology (Van Gorp, 2007), leading its scholars to assume certain ontological premises. The most common is social constructionism, which holds that the social reality we perceive is not separate from us. Rather, we play an active role in shaping it ourselves, continually constructing and reconstructing it over time (Bryman, 2012). We construct reality partially through language (Burr, 1995), meaning that how frames define concepts shapes the social world. The language of a frame is therefore a form of action with a 'performative' role in society; each frame "brings with it, or invites, a different kind of action from human beings" (Burr, 1995, p. 3).

Social constructionism sees the essence and consequences of frames as subjective, rejecting the notion that there is an external 'truth' to be known outside of our interpretations (Burr, 1995). It does not accept that knowledge can be derived from objective observation. Some scholars see this as a

weakness: are social constructions, such as institutions, not real, with no real effects on the world (Proctor, 1998)? And, more practically, how can decisions be made if our versions of reality cannot rely on some kind of external truth (Burr, 1995)? This would mean that we ask "questions that will never, of course, be resolved once and for all" (Proctor, 1998, p. 354).

4.3.2 Critical realism

Critical realism responds to this weakness of social constructionism, positing that there is an external, knowable reality while at the same time acknowledging the role of the social world in shaping that reality (Bryman, 2012). Even though ideas may come about via social structures, these ideas and social structures are real and have real social and material effects (Proctor, 1998). Knowledge is "in fact the result of interaction between subject and object" (Proctor, 1998, p. 361)—the result of the back-and-forth between (and among) the social and material worlds. Consequently, we can examine claims to knowledge—in this case frames—and determine which "explanations are more adequate representations of reality than others" (Proctor, 1998, p. 361).

With this description of critical realism in mind, I argue that when it comes to assessing sustainability pathways based on a procedural definition of sustainability—that is, a discussion about the consequences of potential pathways—there are observable truths to be known. We can observe and measure tangible effects of agricultural runoff on rural residents, such as the number of nitrate-related illnesses in a particular California community. As Dickens (1996) reminds us, "[t]here are real differences between how people construe fishes, but this is a wholly different matter from how a fish is physically constructed" (p. 73). In addition, we can examine the social structures—such as frames and governance mechanisms—that produce those effects. If they are discovered problematic, this opens the possibility to change them "so that inequalities and injustices may be counteracted" (Bryman, 2012, p. 710). Therefore, in line with procedural sustainability and political ecology, critical realism is normative, helping us view the world in a way that informs collective discussion about desirable societal pathways.

5 Methodology

5.1 Research strategy and design

In line with critical realism and the socially constructed nature of frames, my research strategy is qualitative. I employ a case study research design (Bryman, 2012), choosing as my case the WaterFix megaproject. Case studies are particularly helpful when conducting research from a critically realist position, as they can expose the "generative mechanisms that are responsible for observed regularities

in the social world and how they operate in particular contexts" (Bryman, 2012, p. 74). In the WaterFix case, the generative mechanisms are the frames and governance mechanisms operating to justify and influence the project.

I choose WaterFix as my case for several reasons. First, it is the latest megaproject in a succession of California megaprojects. If my aim is to understand why the government continues to support such projects, then WaterFix provides the best vantage point to do so because its proposal is informed by the latest conceptions of water scarcity and management. Second, the project has long-term, statewide implications, with the potential to dramatically affect environmental, economic, and social conditions for years to come. The difference between the project's approval and rejection, therefore, implies very different sustainability outcomes for the state.

5.2 Research methods

Following from the qualitative research strategy and case study research design, my methods include literature review, frame analysis, and interview analysis.

5.2.1 Literature review

I conducted a literature review to obtain information about California's historical water management, and to better understand the state's natural systems (hydrology, ecology, climate, etc.) and social structures (governance, economy, etc.). Literature included books, peer-reviewed journal articles, policy documents, newspaper articles, legal documentation, state websites, and other governmental reports such as environmental impact statements. I also attended a conference called Water Workshop 101, a one-day event including state officials, legal experts, and scientists explaining basic concepts and challenges in California's water management. This provided knowledge that helped inform my literature review.

5.2.2 Frame analysis

Using frame theory, I employed the method of frame analysis to answer my first research question: *How does the government frame problems and solutions in the case of WaterFix?* The unit of analysis my case study required (Silverman, 2010), I defined as *the most current government-published text, video, or speech that comprehensively interprets the problems and related solutions that WaterFix provides*. My final analysis included a) the government's official WaterFix website, b) the 2015 EIR's executive summary, c) a two-minute government-released YouTube video, d) a contract between the state and water contractors potentially funding the project, and e) transcripts from my interviews with five state and one federal employee (see section 5.2.3; see also Appendix A for more information on media).

I analyzed these media, drawing mainly from the frame analysis method of Hertog and McLeod (2001) due to its methodical enumeration of research steps. Since it originated from social sciences, the method omits several objects of analysis better suited to socio-environmental contexts, leading me to augment the method with additional objects of analysis (described later in this section). The authors encourage such synthesis of methods: "it is essential that researchers outline their own approaches to frame/framing study in detail" (p. 141).

Due to limitations of computer analysis hindering my ability to answer my research question, I conducted the frame analysis myself. Computers have two limitations: they can neither identify concepts that have been excluded from text, nor do they possess the cultural-analytical competence of a human being (Hertog & McLeod, 2001).

The frame analysis of Hertog and McLeod (2001) consists of two primary steps:

1. The first step is identifying the narrative, defined earlier as a 'problem-consequence-solution' plotline. At the core of the narrative is usually a conflict between two sides. Depending on how this is portrayed, the frame might attribute responsibility—assigning blame for the problem and either tacitly or explicitly communicating who is best suited to provide the solution. My analysis identifies the narrative, its plotlines, conflict, and attributions of blame and responsibility.
2. The second step is detecting themes of language, metaphors, and other linguistic devices. These comprise the frames and also distinguish them from each other, though there might be overlap or interactions between frames which strengthen them. Determining the relative strength of frames is difficult since everyone interprets text differently; however, it can be estimated by assessing salience, accomplished by examining text's "placement or repetition" (Entman, 1993, p. 53). My analysis therefore identifies the most salient frames and how they depict problems, solutions, or both.

As explained above, I adapted my analysis using frame theories better tailored to socio-environmental contexts. Leach et al. (2010) emphasize the importance of 'system' frames, as how the system is portrayed influences problem definitions and solutions. I also drew on the work of Ransan-Cooper, Farbotko, McNamara, Thornton, and Chevalier (2015) who, inspired by Foucault's (1982) description of knowledge as a function of power, argue that knowledge is another key frame component. My analysis therefore looks at depictions of both the system and what types of knowledge are privileged.

Finally, one concern Hertog and McLeod (2001) emphasize is the possibility that researchers conducting frame analysis will do so in a vacuum, labeling frames independently of each other without

cohesion, thereby hindering the development of the research field as a whole. To remedy this, they recommend that researchers first identify the most commonly found frames across social research to see how their frames fit. I discovered a paper by Boydstun, Gross, Resnik, and Smith (2013) that offers a typology of frames, against which I eventually compared the WaterFix frames I identified.

5.2.3 Interview analysis

I employed interview analysis to answer my second research question: *What governance mechanisms influence the proposal of WaterFix?* Analysis was based on interview transcripts from 12 participants, some of whose I also used for frame analysis (explained in section 5.2.2). Travel constraints forced me to hold interviews over the phone or Skype, with each lasting between 30 and 90 minutes. Except in instances when I did not receive consent, I recorded all interviews and transcribed them for later analysis.

I recruited participants purposively, allowing my research questions to guide my sampling of interviewees (Bryman, 2012) that were representative of categories I identified as having a stake in WaterFix. Sampling was opportunistic, as many participants referred me to additional contacts (Bryman, 2012). I followed Bryman's (2012) ethical considerations, ensuring that interviews were voluntary and anonymous, and that I was straightforward about my objectives. Interviewees were state employees working directly or indirectly on WaterFix, or non-state actors informed of the project through their professional capacity. State departments represented were DWR and Bureau of Reclamation. Non-state entities included environmental, legal, farming, and consulting groups. When citing interviewees, I refer to them as: DWR1-5, Reclamation, Consultant1-2, Farmer, Lawyer, and NGO1-2 (see Appendix B for interviewee profiles).

Interviews were in-depth (Ragin & Amoroso, 2011), as I explored perceptions of WaterFix and reasons for its proposal. Interviews were also semi-structured (Bryman, 2012) as I developed an interview guide with list of questions but varied their order and phrasing depending on the conversation flow (see Appendix C). This made them flexible; in addition to covering topics as guided by my research questions, I also probed other topics as they arose, adding detail to the findings.

I analyzed the transcribed interview text using qualitative data analysis. I employed open coding, which involved reviewing each transcript, identifying concepts, and grouping them into categories (Bryman, 2012). In some cases, quotes overlapped concepts, leading me to place them in multiple groupings. From this, themes emerged enabling me to answer my second research question about governance mechanisms influencing the WaterFix proposal.

5.3 Limitations

There are potential limitations to my methods, in particular regarding frame analysis. My choice to conduct the analysis myself rather than use a computer opens the research to bias, as I enter with certain assumptions and understandings of California and sustainability. As a California native, I have been exposed to certain frames my whole life, making it more difficult to expose and assess them outside of my own pre-ordained views. It is therefore possible that my analysis looks different from that of others; after all, "different researchers will construct very different frames from the same material" (Hertog & McLeod, 2001, p. 154). Finally, my review of Boydstun et al.'s (2013) frame typology prior to analysis could have prompted me to seek frames rather than identify them organically. However, I acted according to the method's instructions, and also identified frames outside the typology, indicating some level of independence and objectivity.

6 Analysis

My analysis is structured into two sections aligning with my two research questions. As mentioned in section 4.2, these correspond to the two research streams identified by Atkinson et al. (2010) as the ideas behind decision-making (frames) (section 6.1) and governance decision-making processes (mechanisms) (section 6.2).

6.1 How does the government frame problems and solutions in the case of WaterFix?

I structure this section first in terms of the government's narrative—the problems, consequences, and solutions—addressing within these how conflict is seen, responsibility assigned, and knowledge portrayed. Then, by examining placement and repetition of language, I identify the most salient frames and how they depict problems, solutions, or both. Finally, I look at how the system is understood.

6.1.1 Narrative

Problem

The fundamental problem the government identifies is "the increasingly significant conflict" (DWR, 2015b, p. ES-4) between the Delta's ecological health and humans' water needs across the state. The source of this conflict is a flawed system, referred to as an *out of date*, *unreliable*, *unsustainable*, and even *unnatural* statewide network of water conveyance. Compounding the problem is risk from pressures mostly outside the government's control: earthquakes, as well as extreme flooding, drought, and sea level rise exacerbated by climate change, all threaten the system's stability, thereby intensifying the conflict. Water scarcity is rarely mentioned or is seen as a natural phenomenon, demonstrated in the government's description of drought: "The recent historic drought has only made

matters worse" (DWR, 2015b, p. ES-1). Ultimately, the problem that needs to be addressed is both environmental degradation and a potentially disrupted water supply from factors mainly outside the government's control.

Responsibility for the problem is not attributed directly to anyone; in fact, no blame is assigned at all. While previous governments were responsible for constructing the problematic infrastructure, blame is assigned to a historical period; the megaprojects were "designed and built long before the 'environmental era'" (DWR, 2015b, p. ES-1).

Consequences of the problem

The problem's consequences are expressed in two ways: social and environmental. Social consequences of disrupted water supply are articulated primarily as economic hardship and secondarily in terms of human health. The economy would be at risk due to reductions in jobs and business growth as well as increases in food and water prices. Human health would be threatened by water contamination if Delta levees were compromised. Environmental consequences would be further threatening of species and continued ecological degradation in the Delta.

Proposed solution

From these problems and consequences, a clear solution emerges. If the fundamental problem is conflict between ecosystem and human needs that originates from an outdated and unreliable statewide system, then the logical solution is for the government to make the system newer and more reliable to resolve the conflict. External pressures that could affect the system, such as earthquakes and climate change, further compel an urgent 'WaterFix'. This leads to the government's final prescription: "the proposal to implement a fundamental, systemic change to the current system is necessary" (DWR, 2015b, p. ES-5).

6.1.2 Problem/Consequence frames

The government characterizes the problems and consequences that WaterFix intends to address via three frames: security, economic interest, and morality.

Security

Boydstun et al. (2013) define the security frame as "an action or a call to action that can be taken to protect the welfare of a person, group, nation sometimes from a not yet manifested threat" (p. 4). Problems and consequences in this frame are characterized by the government with words such as *risk, crisis, threats, disruption, failure, critical, vital,* and *urgent*. The Delta is depicted as in crisis, threatening "an interruption of water exports for as long as several months or even years" (DWR,

2015b, p. ES-1). Quotes from experts emphasize the need to safeguard the system to protect economic stability (an appeal to an 'economic interest' frame described next). Risk is also emphasized: water supply, infrastructure, endangered species, and the Delta are all labeled at risk, necessitating an urgent response.

Solutions to this insecurity are characterized by words such as *protect, safeguard, improve,* and *modernize*. Upgrading the system with a "state-of-the-art solution" (CNRA, 2017) that relies on "science, technology and innovation" (CNRA, 2017) would make the state "safe from an earthquake and rising ocean levels" (California WaterFix, 2016). It would also launch the recovery of threatened fish species.

Economic interest

Boydstun et al. (2013) refer to the economic interest frame as "[t]he costs, benefits, or monetary/financial implications of the issue (to an individual, family, community or to the economy as a whole)" (p. 4). The government's version characterizes the problem's consequences as statewide impairment of *economy, growth, jobs, businesses, revenues, income, prosperity, financial stability,* and ability to *produce* needed *goods and services,* while keeping food and water *prices* down. It focuses primarily on water's importance to maintaining statewide economic prosperity, but it also appeals to individuals. For example, it mentions "potential losses of business revenues and employment" (DWR, 2015b, p. ES-10) but also the threat of "job loss, higher food and water prices" (CNRA, 2017).

The solution to economic instability caused by lack of water is to improve supply reliability, the benefits of which are also expressed in economic terms. According to the website (CNRA, 2017), WaterFix is an "economically smart solution" that will create "increased efficiency" and ensure continued "business growth and job creation". The project is portrayed as not only preventing economic loss, but also contributing to economic gain via temporary job growth—perhaps a way of justifying the project's financial cost.

Morality

The third frame is morality, a perspective "compelled by religious doctrine or interpretation, duty, honor, righteousness or any other sense of ethics or social responsibility" (Boydstun et al., 2013, p. 4). The government communicates this frame with words such as *predators, harmful, damaging, suffering, trapping, strand, delicate, beautiful, depend,* and *families*. There is a moral obligation to protect "a delicate and beautiful ecosystem" (California WaterFix, 2016) while securing the water that "25 million people depend on" (CNRA, 2017). Water is even morally personified in one sentence, described as something "we are leaving behind" (CNRA, 2017).

6.1.3 Solution frames

In addition to framing the problem in certain ways, the DWR also uses four solution-oriented frames to justify WaterFix: scientification, collective interest, 'the only solution', and compliance.

Scientification

The scientification frame prioritizes scientific and technical knowledge and expertise to solve problems. This expertise is embodied by the DWR and Bureau of Reclamation, the agencies who would manage the project, who use "collaborative science and adaptive management to address uncertainties and make adjustments over time" (CNRA, 2017). Project supporters include "engineers, scientists, [and] water experts", who endorse "a science-driven upgrade to our aging water system" (CNRA, 2017). The scientification frame can be seen as an explicit promotion of the type of knowledge privileged by the government.

Collective interest

The collective interest frame appeals to the need for everyone to find common ground for the collective good. The government communicates this frame through the repetition of words such as *we* and *our*, and by referring to the level of the entire state. For example, the governor states that "central to the life of our state is water" (CNRA, 2017) while the video emphasizes the need for "freshwater to grow our food and provide fresh drinking water to Californians" (California WaterFix, 2016). Perhaps nothing symbolizes this frame better than a pro-WaterFix opinion piece in the San Diego Union-Tribune, written by then-DWR director Mark Cowin (2016), entitled *Unity needed for statewide water solutions*. He proclaims, "As one state, we either find water solutions together or we will collectively suffer the grave consequences" (para. 3). While this article was not officially part of my frame analysis, it is an example of a powerful resource that privileges government frames.

'The only solution'

'The only solution' frame implies there is only one solution to the problem. The governor, for example, endorses WaterFix by urging that "we need a real solution" (CNRA, 2017). The project is also frequently compared with inaction: the website states that "[t]he cost of doing nothing is too great" and "[t]he status quo is unsustainable" (CNRA, 2017). Even in the EIR, the baseline plan against which WaterFix is compared is called the "No Action Alternative" (DWR, 2015b, p. ES-9). When alternative solutions are framed either as not real or inactive, WaterFix becomes the only solution.

Compliance

The final solution-oriented frame is compliance—the justification of project activities because they comply with environmental regulations. This frame is concerned with upgrading the system while

adhering to "a stable regulatory framework, consistent with statutory and contractual obligations" as well as "the requirements of state and federal law" (DWR, 2015b, p. ES-5). It provides legal justification for its proposal and may be intended to alleviate concerns that water diversions might exceed legal limits.

6.1.4 System frames

The government frames the system in two ways: in terms of scale and domain. The system's scale is the state of California, placing WaterFix in the realm of statewide interest. The system's domain is portrayed as infrastructural: "Simply put, the overall system as it is currently designed and operated does not appear to be sustainable from an environmental perspective, and so the proposal to implement a fundamental, systemic change to the current system is necessary" (DWR, 2015b, p. ES-5). This system is seen as separate from the environment, which also makes it easier to repair. The system's infrastructural nature is reinforced through plumbing metaphors used by the interviewed DWR employees. *"It is a broken system . . . The plumbing is backwards"*, states DWR2. *"I agree with the location of the plumbing change"*, notes DWR4.

6.2 What governance mechanisms influence the proposal of WaterFix?

The analysis revealed six mechanisms: 1) the relationship between water contractors and the state, 2) water contractor incentives, 3) undemocratic practices among public entities, 4) weaknesses of environmental laws, 5) a technocratic DWR culture, and 6) use of financial resources by water contractors to further their interests.

6.2.1 Relationship between water contractors and state

According to interviewees, water contractors play an influential role in decision-making for the state's infrastructure that they manage. In the case of WaterFix, according to DWR4, it originally started during conception of the project, *"with the state water contractors being in charge of the document . . . because they funded it, they decided well they need to be the lead, so it was not independent. Normally . . . we would hire our own consultant to do the document"*. This implies that contractors strongly influenced the terms of the WaterFix project from the beginning. This represents a departure from the mid-2000s, when there was more open collaboration with other agencies. According to DWR4, *"they went from a very open, transparent . . . governance of all the agencies working together to a very tight ship of the Department of Water Resources and the state water contractors basically calling all the shots kind of in private"*. These claims have historical relevance; in 1994 there was a 'backroom deal' between the DWR and contractors in which the rights to a Central Valley aquifer

intended for a water district were given to private entities that still control more than half the aquifer today (Stroshane, 2000).

Several interviewees also mentioned that contractors have additionally affected decision-making by paying some government employee salaries through 'special funds' outside the state's budgeting system. This might influence the state's actions in terms of what research is funded and studied. *"When I worked at Oroville . . . my check came from the water contractors . . . If you ask someone at Oroville who they work for, they say they're an employee of the state of California. But they know where the money comes from"* (DWR2). This is echoed by DWR4: *"Most of them are really good scientists but, you know, who's paying your bills? And you're allowed to study what you're told to study, and it kind of colors what you do"*. While these salaried employees are generally natural scientists working on the CVP and SWP, they participate in environmental studies that determine WaterFix's compliance with environmental acts such as CEQA, influencing its ultimate fate. As DWR4 summarizes WaterFix, *"from the get-go it's been very uncomfortable about the funding and who is doing the document and who is doing the studies"*.

6.2.2 Water contractor incentives

Water contractors' economic incentives may make WaterFix a more financially attractive option than installing regional recycling systems. Because they buy water from the government and make revenue by selling it to ratepayers, they benefit from high demand (NGO2). If the value of demand drops below the amount it costs to manage and distribute water, they lose money. This, according to NGO2, has made it difficult for some contractors to stay solvent and has slowed others' efforts to reduce demand and pursue regional self-reliance. If WaterFix would indeed result in greater supply, more water could be used for developmental purposes, improving contractors' bottom line.

Water contractors may also have less risk funding WaterFix because they have historically outsourced some costs of megaprojects' risk to taxpayers. This was seen in the recent failure of the emergency spillway at Oroville Dam, the fixing of which water contractors did not fund in 2005 (Serna, 2017). Putting himself in contractors' shoes, DWR2 identifies one reason they might defer maintenance: *"The longer we don't resolve these issues, that's just money we bank and collect interest"*. Another way contractors' financial responsibility is outsourced is through the state's ownership of project infrastructure. Consequently, the state is responsible for funding and implementing emergency plans. This reduces contractors' incentive for upkeep, since the infrastructure is *"powered by those who don't spend the money, who pass on the deferred maintenance and costs to the next generation and are rewarded by those who pay the bills"* (DWR2). The situation is exacerbated by the geographic

separation between the districts that contractors represent and the infrastructure they manage, meaning they and their ratepayers are not necessarily directly harmed by problems. As DWR2 states, *"the reason the emergency spillway in Oroville isn't lined with concrete is that it's not in southern California. They don't suffer the risk"*. As long as the full costs of megaprojects are not reflected in the price tag, they will be more attractive to water contractors.

6.2.3 Undemocratic practices among public entities

Some governance processes may limit the voice of WaterFix opponents in decision-making. For example, the agency that ultimately decides whether to permit WaterFix, the SWRCB, consists of 5 board members, many of whom have been appointed by the current governor. Some interviewees expressed concern that these people might be excessively influenced by the governor who has been a vocal megaproject proponent since the 1970s. In fact, numerous interviewees called WaterFix his 'legacy' project (NGO1; NGO2; Farmer). Several raised doubt about SWRCB board members' impartiality considering they were not democratically elected. This holds true for the Delta Stewardship Council as well: *"There are seven members of that council, six of whom are appointed by the governor . . . And, you know, what are you going to do? I mean the process is pretty much controlled by the governor"* (Farmer). These undemocratic appointments may also influence what scientific research is conducted, causing NGOs such as the Nature Conservancy to push for independent scientific reviews in parallel (DWR4).

6.2.4 Weaknesses of environmental laws

Weak interpretation and enforcement of environmental laws may motivate water contractors to fund the project, in the hopes of receiving more water. According to DWR4, the SWP has never fully satisfied the California Endangered Species Act, meaning it lacks legal permission to harm any endangered species through operations. Environmental groups have consequently sued DWR, but in the meantime it has been allowed to continue operations without punishment. Permits *"aren't that firm and if you violate them, you don't go to jail. I mean, it's a civil court case. They would say you did blah blah blah, and you know meanwhile fish are being taken at the pumps"* (DWR4). Moreover, even if WaterFix adheres to federal laws, conditions can change. For example, the new federal administration could modify laws: *"You know the endangered species act, we could have Congress rewrite the federal one, you know there's talk of that. There's talk of eliminating the federal Endangered Species Act entirely"* (DWR4). Nor are state laws always followed, for example if the government decides there is an emergency. *"They put a pipe over the Richmond San Rafael bridge because Marin County had no water . . . And without any CEQA or anything"* (DWR4). Ultimately, if laws can be breached with little or

delayed recourse (i.e., litigation), there is a precedent that WaterFix could be constructed and operated similarly in the future, to the benefit of contractors.

6.2.5 Technocratic culture in the DWR

The technocratic culture of the DWR might also contribute to the proposal of WaterFix. Many DWR employees are engineers or have technical backgrounds, and have influenced the agency to the extent that *"tension has always been there between anybody not an engineer. It's an engineering culture of an agency"* (DWR4). Many solutions that engineers have proposed in the past have involved transferring water directly from sources via pipes and canals. WaterFix is in the same vein: it is considered *"an optimal engineering solution. It allows you to take the most water when it would be most beneficial and most efficient to take that water"* (DWR2). However, if influential engineers focus on optimal technological solutions, infrastructure might be prioritized despite its social and ecological consequences. As DWR4 explains, environmental considerations in the DWR are *"not the mission, whereas Cal Fish and Wildlife, the mission is to protect the ecosystem"*. Indeed, the mandate of the DWR is to balance environmental and human needs. The agency "protects, conserves, develops, and manages much of California's water supply" (DWR, 2017a, para. 1) at the same time that "[b]alancing the State's water needs with environmental protection remains a long-term challenge" (para. 3). This reflects an inherent tension between ecological protection and water supply maximization.

6.2.6 Use of financial resources by water contractors to further their interests

Finally, water contractors employ strategies to influence the proposal and approval of WaterFix. Through their ownership of energy generation and water delivery operations of the CVP and SWP, and resulting ratepayer revenues, water contractors use extensive financial resources to garner influence. They affect the political process by lobbying through *"the State Water Contractors Association which is kind of a lobby type group"* (DWR4) and by donating to political campaign funds (NGO2). They also contribute money to campaigns opposing propositions that might harm their interests. One example was Proposition 53 on the November 2016 ballot, which would have required any project costing more than $2B in revenue bonds, such as WaterFix, to receive a public vote. Some contractors along with other interest groups funded anti-Proposition 53 campaigns, and it was narrowly defeated. As DWR4 recounts, *"there was a ballot initiative to make anything over X dollars subject to a public vote and that got shot down because the water guys funded that proposition to go away"*.

Furthermore, contractors have used their financial resources to strategically purchase Delta land in order to limit resistance to WaterFix. *"Metropolitan Water District within the last year or so bought*

five islands in the Delta, two of which are in direct line of the right of way of the tunnels, and would presumably reduce the number of opponents that they would have" (Farmer).

Finally, contractors are able to hire high-profile attorneys, some of whom previously worked for the government, and litigate for their interests. *"They've hired all the retired judges, the retired Bureau of Reclamation folks, I mean you can look at that revolving door. They are so moneyed, the minute somebody retires or leaves federal service, then they get hired"* (DWR4). If true, this could give contractors further advantages not only legally, but also in terms of their personal relationships with influential government employees.

7 Discussion

7.1 Analysis summary

Frame analysis has shown that the government frames the problem as a conflict between the ecological health of the Delta and the consumptive and economic needs of people, agriculture, and industry. Given that the source of the conflict is an antiquated, unnatural, and unsustainable statewide system of physical plumbing infrastructure, the government has a responsibility to upgrade and modernize it. Not doing so immediately is a moral issue, risking ecological damage in environmental terms and human misfortune mainly in economic terms, especially with the looming threat of earthquakes and effects of climate change. Everyone in the state has a collective interest to support the project because it is the only legitimate solution, is based on the latest scientific knowledge, and adheres to environmental laws.

Interview analysis has revealed that there are various governance mechanisms that influence the WaterFix proposal. These include: a) the influence of water contractors on governmental decision-making through their leading of document generation and paying some government employees' salaries; b) water contractor incentives that might influence their funding of the project, such as profiting from water sales and not being forced to pay for risk management; c) undemocratic practices within decisive government agencies—namely the appointment rather than election of agency board members—that might favor pro-WaterFix viewpoints; d) weak interpretation and enforcement of environmental laws making the project more likely; e) a technocratic DWR culture that might favor infrastructural solutions; and f) the use of financial resources by water contractors to obtain advantages in political and legal processes related to the project.

7.2 Assessing the sustainability of WaterFix

The analyses' results, through their illumination of frames and governance mechanisms influencing the WaterFix decision, allow a critical reflection of the project related to sustainability in California. They enable me to assess potential WaterFix outcomes, informing a 'procedural' discussion as to whether this particular sustainability pathway is desired by society. I conduct this assessment by examining each frame and comparing it to the potential consequences it might produce, in light of the governance mechanisms revealed to be at play.

Interpretation of conflict: The conflict the government identifies—the tension between the ecosystem and human needs—will not be solved by WaterFix. The conflict is, in fact, written into the very environmental laws and state agency mandates that inform decision-making. The aforementioned Delta Reform Act's 'co-equal goals' and DWR's mandate to balance the state's water needs with environmental protection are two examples. Until the causal relationship of the conflict is acknowledged—that is, that maximizing water supply *has led to* ecosystem degradation—it is unlikely that environmental needs will receive attendant focus.

Security frame: The state's portrayal of the Delta's ecological degradation might be alarmist, but it is not inaccurate. Moreover, the characterization that water supply interruption could devastate economies and people's well-being is likely true. That said, what is not mentioned in this frame is that these problems did not recently arise. The Delta's degradation and precarious infrastructure have existed for decades without causing the catastrophe of which the state warns, making this frame's claim for urgency dubious. Furthermore, appealing to security in economic terms neglects certain societal groups, such as subsistence fishers, farmworkers, and others who may not benefit economically as much as others. This reflects an assumption that economic and infrastructural security mean human security—but this is not the case for everyone. Finally, the notion that water security can be achieved via centralized distribution has been exposed in research as problematic (Grant et al., 2012). Even the government's new statewide water sustainability plan calls for local and regional self-reliance to achieve long-term security of water supply (CNRA, 2016a).

System frame: The system is framed infrastructurally to justify the government's implementation of WaterFix, and the interviews showed this frame may in part be due to technocratic influence. However, by defining the system as infrastructural, the government leaves certain considerations unaddressed, such as critically questioning the social mechanisms that originally contributed to the problem. More importantly, defining the system in this way impedes a more complex understanding of sustainability that would consider interrelated socio-ecological processes and their effects on

society. This lack of understanding is made clear by WaterFix's objective to increase supply. If history is any indication, this will reinforce the same problems created by previous megaprojects: agricultural and urban growth pressuring the environment and vulnerable people while increasing demand that worsens water scarcity in the future. Put another way, the government's interpretation of fixing the system seems to be a way of sustaining the unsustainable.

Scientification and compliance frames: While the government claims itself to be the wielder of the only solution, it also defers responsibility in numerous ways, depoliticizing decision-making. First, by framing water scarcity as a natural drought phenomenon, it diverts attention from the social causes of scarcity. Second, by privileging techno-scientific knowledge as the basis for decision-making, it deprioritizes public deliberation on collective issues. This is exacerbated by the science's questionable logic and integrity; it is based on the same reasoning that created the problem and, as the interviews showed, it might be influenced by certain interests that compromise the objectivity it claims to have. Third, by claiming its compliance with environmental regulations, the government places the onus of decision-making on imperfect laws. The interviews revealed these laws are not always enforced and can be interpreted in ways contrary to the collective interest. Taken together, these examples can be seen as deferrals of responsibility that assign the obligation of decision-making to the non-political realm.

Economic interest frame: The economic interest frame taps into the taken-for-granted belief in the benefits of economic growth, but raises questions about who economically benefits. Residential ratepayers and agribusinesses would pay for most project costs, but the latter are the largest benefactors because they receive tax-funded subsidies and profit from water use. Ratepayers would see higher water bills that could increase further if WaterFix's costs increase, which would particularly burden low-income people. Water contractors might disproportionately benefit, especially if the project's longer-term risks are paid by taxpayers, which the interviews revealed has a precedent in previous megaprojects. Contractors' profits would likely go towards furthering their interests, which has been shown to not always reflect those of society, for example in contractors' slow implementation of regional water recycling and reuse. Meanwhile, those who lack such financial resources are unable to influence governance in nearly the same way.

Morality and collective interest frames: The morality and collective interest frames refer to a normative and unified decision about what should be done, but they have limitations. While Californians' environmental values might be partially satisfied by recovering fish populations, several findings call into question whether the collective interest is truly served by the project. For example, certain avenues of opinion-voicing, such as referendums, have been removed from the political

process—a shift from the days of the peripheral canal when the electorate voted directly on megaprojects. If citizens cannot collectively vote, then a key aspect of social power, that of civil society, is not reflected in decision-making. Another example involves WaterFix's potential long-term consequences. The notion of collective interest is not satisfied if the environment and vulnerable people continue to be harmed. If project benefits and costs are indeed distributed unequally with little option for public recourse, then the collective interest, if it is truly collective, is to seek alternatives to WaterFix.

7.3 Why the government continues to propose megaprojects

Having assessed WaterFix's implications for sustainability, I am able to return more adeptly to my overarching research question: *Why does the California government continue to propose water megaprojects in spite of their known ecological and social consequences?*

On the one hand, the government proposes megaprojects because it subscribes to certain understandings of the world that are inherently conflictual with sustainability. Most notable are its adherence to economic growth in spite of the social and environmental costs; its narrow perception of the system as infrastructural rather than more broadly socio-environmental; and its reliance on scientific and technocratic knowledge that recreates the very problems it is supposed to solve.

On the other hand, aspects of the governance structure make water megaprojects attractive to the government. The privatization of water has created incentives for contractors to prefer funding large-scale, centralized infrastructural solutions over small-scale, decentralized, regional water recycling programs. That the government allows contractors to so strongly influence decision-making via financial resources only further biases these decisions. Meanwhile, the government can be seen as defaulting on its responsibility to be the primary decision-maker for public good; rather, it depoliticizes decision-making, pushing it to the scientific and legal arenas.

More broadly, one might argue that the state proposes megaprojects because large-scale infrastructure contributes to its stability and power (Bakker, 2010). As Swyngedouw (2009) asserts, water constitutes both material and social relations, meaning that preservation of these relations, in the form of infrastructure and the institutions that manage it, ensures the continued stability of the state. The incentives to do this might be inherent in a governance system that includes both public and private actors; the state's failure to satisfy private interests can lead to loss of investment, tax revenues, and ultimately political power, compelling the government to keep the status quo (Dryzek, 2013). The implications of this for procedural sustainability are not encouraging; if institutions of power do not open up to and democratically entertain broader points of view, they impede the societal

deliberation necessary to identify and move towards collectively shared understandings of sustainability.

Comparing this study's results to others that have investigated frames and governance of large-scale infrastructure projects, I find similarities. Crow-Miller (2015) concluded that the decision to construct a new megaproject in China was framed as politically neutral to justify economic pursuits that sustain the government's authority. Similarly, Islar and Boda (2014) found that the Turkish government has justified its new megaproject by appealing to economic interests while also depoliticizing decision-making. While the geographic and political contexts of these cases are different, their broader similarities might be an indication that large-scale infrastructural solutions are problematic regardless of politics and geography. This suggests that my research findings might be relevant beyond California to other contexts in which megaprojects have been constructed or are planned.

7.4 Frames and governance

The results of this thesis demonstrate the benefits of investigating decision-making from both a frame and governance mechanism perspective. While I could have assessed WaterFix using just one of these research 'streams', the results would have painted a less complete picture of how these aspects influence decision-making towards a particular pathway, making it harder to identify areas for change. For example, frame analysis would have uncovered some project limitations, but understanding related governance mechanisms further qualified these limitations, and in some cases uncovered new ones. In fact, these mechanisms revealed the gap between how the government conceptualizes problems, and the realities of how its solutions are implemented and what consequences they might have. Governance mechanisms were alone revealing about decision-making, but identifying frames provided a better understanding of how these mechanisms might be produced and reproduced.

Thus, while not the focus of this thesis, the interrelations between frames and governance become clearer, in line with scholars such as Leach et al. (2010). Frames can influence governance—for example in the government's privileging of techno-scientific knowledge to justify its own infrastructural solutions, further cementing the existing governance system. Governance can also influence frames—seen for example in the government's allowing of water contractors to lead scientific document generation, thereby influencing what frames are conveyed to society.

Additionally, frames and governance impact outcomes in different ways. The economic interest frame, for example, is widely accepted by society and forms the basis for much decision-making. Governance mechanisms, such as the influential role of profit-seeking entities in the government, also impact decisions. But it is impossible not to see these as interrelated, and even causal, with this particular

governance mechanism enabled by the frame of economic interest. Similarly, the technocratic culture of the government would not exist without the scientification (and economic interest) frame. This can be traced back to California's history; as mentioned before, engineers gained prominence because of the concept of economic growth (Carroll, 2012). Therefore, from a critically realist perspective, the social and material effects of frames are revealed to be the most pronounced, as they have an 'enabling' role towards both governance and real-world consequences of decision-making.

Given this, it becomes critical to analyze the fundamental concepts used by societies to portray the world. Future studies, for example, might focus on critically investigating myths—the naturalized, taken-for-granted stories of a society (Essebo & Baeten, 2012)—that underpin frames (Reese, 2009). Additionally, scholarship on the concept of reframing problems (see Benford & Snow, 2000) shows promise, particularly in the context of social movements. This might be especially relevant to California, which my research showed has seen a reduced public role in certain political processes. Interestingly, the very frames the government sponsors might still be usable, such as a security frame that takes everyone's long-term security into account, or a morality frame that looks at social as well as environmental well-being. Boydstun et al.'s (2013) frame typology also points to other ways to conceptualize the problem, for example with frames of "fairness and equality" (p. 4), "quality of life" (p. 5), and "health and safety" (p. 5). Given the entrenched nature of the governance system and the dominance of existing frames, reframing can be difficult (Hertog & McLeod, 2001). However, this thesis has identified the character and limitations of these two areas in the California context, a starting point for further research on how these might be overcome to identify and follow more sustainable pathways.

7.5 Research limitations

Lastly, it is important to note some limitations of this thesis. Restrictions on time forced me to limit the number of documents to analyze and interviews to conduct. While I selected the most representative documents for frame analysis, analyzing more could have provided a more complete picture of existing frames. Similarly, my interviewees were representative of some key WaterFix actors, but not all. For example, I was unable to interview a water contractor representative, which could have provided new perspectives on these agencies' roles in decision-making. Moreover, while I used secondary research to back up interviewees' claims when applicable, I took their opinions at face value. It is possible that they held certain biases, or that I misinterpreted some of their perspectives.

Additionally, while identifying the government's frames proved insightful, I did not research alternative frames that might challenge those of the government. According to Hertog and McLeod (2001), this

can be useful because it makes explicit other perspectives and therefore courses of action that might be more societally desirable.

8 Conclusion

This thesis was inspired by my desire to understand why the California government continues to propose water megaprojects despite their known social and ecological consequences. Since most existing research on California's water problems focuses on practical water management or economic strategies, my interest was on factors that influence decision-making. I therefore looked at ideas via the theory of frames—interpretations of the world that are communicated through language and bias certain decisions—as well as governance mechanisms, to see what influence on decision-making they have. I approached these concepts via separate but complementary 'streams of investigation' (Atkinson et al., 2010), using the latest California megaproject of WaterFix as a case study. With the resulting findings, I then assessed potential shortcomings of the project in order to better inform academic research and practical decision-making, not only for California, but also other relevant contexts.

The project's biggest sustainability shortcomings are related to how it interprets problems and solutions, and are exacerbated by the governance mechanisms influencing the project. There were problematic interpretations of: a) *conflict* that deprioritize the environment, b) *security* that favor centralized large-scale solutions that fail to benefit everyone, c) *the system* as infrastructural, ignoring longer-term sustainability of the water supply and socio-ecological system, d) *responsibility* for decisions, depoliticizing decision-making, and e) collective interest as statewide economic growth rather than equal distribution of benefits for all.

The government continues to propose water megaprojects partially because it subscribes to certain understandings of the world that inherently conflict with sustainability. These include unquestioned loyalty to economic growth, narrow perceptions of the system that exclude broader socio-ecological needs, and views that privilege techno-scientific knowledge. The government also proposes these projects because they are made favorable by certain governance mechanisms. These include financial incentives that encourage centralized infrastructure, along with the influence of money in the political system and insufficient public representation.

The research revealed that following two streams of investigation on frames and governance was helpful to understand decision-making in this particular context. Frames and governance were interrelated, with frames playing somewhat of an 'enabling' role for mechanisms. Therefore, future

problem-solving research should explore the components of frames that give them power, such as unquestioned beliefs like myths. Furthermore, theories of reframing show promise, particularly those that might address the aforementioned sustainability flaws, such as “fairness and equality” (Boydstun et al., 2013, p. 4), “quality of life” (p. 5), and “health and safety” (p. 5). Considering the powerful role that economic growth, depoliticized decision-making, and technocratic expertise had in similar research, these re-framings may offer the possibility to overcome existing problematic interpretations of not only water megaprojects, but water scarcity problems overall.

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10 Appendices

Appendix A: Media used in frame analysis

Table 1. Frame analysis media along with their corresponding source URLs.

Media Used	Source URL
California government's official WaterFix website	https://www.californiawaterfix.com/
Bay Delta Conservation Plan/California WaterFix Partially Recirculated Draft EIR/Supplemental Draft EIS Executive Summary	http://baydeltaconservationplan.com/RDEIRS/0_ExecSumm.pdf
Two-minute government-released YouTube video	https://www.youtube.com/watch?v=tAFaQ9D_joI
Contract between government and water contractors potentially funding the project	http://cms.capitoltechsolutions.com/ClientData/CaliforniaWaterFix/uploads/Draft_Final_DCE_Agreement_Combined.pdf
Transcripts from my interviews with five state and one federal employee	Available by request

Appendix B: Interviewee profiles

Table 2. Government and non-government actors interviewed along with their relevance to the topic.

	Organization (Acronym)	Relevance
Government Actors	Department of Water Resources (DWR1)	Involved in climate considerations related to WaterFix.
	Department of Water Resources (DWR2)	Involved in flood control for existing megaproject operations.
	Department of Water Resources (DWR3)	Responsible for contributing to environmental compliance documents, e.g., EIR/EIS, for WaterFix.
	Department of Water Resources (DWR4)	Retired former director at DWR.
	Department of Water Resources (DWR5)	Involved in public outreach and communications for WaterFix.
	Bureau of Reclamation (Reclamation)	Involved in environmental compliance for WaterFix on federal side.
Non-government Actors	WaterFix consultant (Consultant1)	Contributes to WaterFix's organizational management.
	Environmental scientist (Consultant2)	Works with the state on various water projects, providing expertise on flood control, technical reviews, and regulatory services.
	Delta farmer and entrepreneur (Farmer)	Would be impacted by implementation of WaterFix.
	Environmental and water law expert (Lawyer)	Understands federal and state legal frameworks that impact the WaterFix proposal, construction, and operations.
	Director of environmental NGO (NGO1)	Works with various entities around California water issues, particularly north of the Delta.
	Manager of environmental NGO (NGO2)	Active in statewide organization focusing on California's water sustainability and equity.

Appendix C: Interview guide

Introduction:

Thanks so much for talking with me today. I'm doing research for my Master thesis on California water management. Given that the new proposal from Governor Brown called WaterFix is discussed a lot in the news and will have a big impact on California water, I've become interested in understanding it better—what problems it is trying to solve, how it will be constructed and operated, and what people think about it. The purpose of this interview is to get a broad sense of how you see WaterFix, its pros and cons, and how you view the future if WaterFix is implemented. I've asked to talk to you today because you are someone who has a direct stake in the project.

So that I can better remember the conversation, is it OK if I audio record our interview? I also want to let you know that you can remain anonymous if you wish. The interview should take about 30 minutes and it is completely voluntary so if you want to stop or if you have any questions, please feel free to ask me at any time.

Guiding questions:

- First, what is your role and how is it related to WaterFix?
- What problems does WaterFix intend to solve?
- What benefits do you see coming from the project? What downsides do you see?
- Why do you think the government has proposed the project?
- What is the process behind deciding the details of a project like WaterFix? How is it decided whether to go forward or not?
- Who is included in the decision-making process and at what stage?
- What else influences whether the project goes forward?
- Have any other solutions been proposed to address the problem? What are they and how have they been evaluated?
- Who supports WaterFix in California? Who is against it?
- What does the general public think about WaterFix?
- Do you think WaterFix will end up happening? Why/why not?
- Who is responsible for communicating WaterFix? How do they decide what to say? (For DWR employees, related to framing)

Thanks so much for your time today. I've learned a lot talking to you and your input will be really helpful for my thesis.