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The benefits and burdens of flood control policy in the United States on humans and ecosystems: can one policy allow humans and ecosystems to thrive?

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Abstract: Floods are beneficial to nature but can be destructive to humans. For centuries humanity has attempted to control nature and specifically rivers and their flooding. After looking at a history of river management in the United States, an examination of both the burdens and benefits of flood control policy in the United States will explore its capacities to preserve and protect human life and ecosystems. These goals are assumed to be the current values of society. Future policy options are explored: business as usual, small changes to the systems, and implementation of a new system and worldview. Current progressions do not appear to be enough to meet the values of preserving life and protecting ecosystems. While a full scale paradigm shift is socially and political unfeasible at this time, small changes to the system might change the trajectory to meet our goals.

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There is a natural cycle to the river. It ebbs and flows. It moves. It floods. This is part of the life of a river. It is the natural way of things. It has been this way for thousands and even hundreds of thousands of years. It is the way of the river. Enter Humans. A species bent on dominating nature and forcing it to submit to our will. People have settled along lakes and rivers for tens of thousands of years for a variety of reasons that often include the benefit of fertile floodplain soils and water for crops (Merritts et al. 2014, 284). As a direct drawback to humans, this same process that replenishes the land, which includes flooding and deposition of sediment in floodplains, causes destruction to human settlements in the flood plain (Merritts et al. 2014, 284). Land use practices in watersheds are closely connected to the damage and loss of life that flooding can bring (Merritts et al. 2014, 284). Where some were able to recognize the value of the river's life (think Ancient Egyptians recognizing the agricultural benefits of the Nile flooding), most attempted to mold the river to fit their desires.

This is the story of human attempts to tame the river in the United States (U.S.). The control of nature. This is the story of a species' refusal to allow nature to run its course. What have we done to our rivers? What are the goals? What are the effects? What does this say about our species, our destiny, and our future? Are we destined to experience the spoils of a great triumph over nature? Or are we doomed to suffer its wrath and beg for mercy?

An examination of both the burdens and benefits of flood control policy in the United States will examine its capacities to preserve and protect human life and ecosystems. What do past and current policies preserve? What policies might accomplish these two goals?

I. Introduction- Why examine flooding?

"I keep going to the river to pray 'cause I need something that can wash all the pain... I keep going to the river..." *Ghost* (Henderson et al. 2014)

Flooding is one of the most destructive forces on Earth, causing more property damage and death than the sum of all damages and fatalities from tornadoes, earthquakes, and wildfires (Merritts et al. 2014, 284). It is the most common and damaging natural disasters in the United States (Calil 2015). Historically in the U.S., floods have caused more economic loss than any other natural disaster (Calil 2015). Flooding has also been a factor in most of the declared disasters in the U.S. (Calil 2015). Flooding has also become more frequent and more damaging over the last fifty years (Merritts et al. 2014, 284). The average annual damages for floods have increased from \$46 million to \$19 billion from the 1960s to the 1990s (Merritts et al. 2014, 284). Flooding of the Mississippi River in 1993 alone caused more than \$16 billion (\$28 billion in 2013 dollars) in damage (Merritts et al. 2014, 284). In 2001, flood losses in the U.S. reached \$8.41 billion (Calil 2015).

The floodplain itself is a natural part of rivers and it becomes the channel for a stream during a high-water event (Merritts et al. 2014, 284). When the stream channel cannot contain all the water from an event such as heavy rains, snow melts, or dam failures, this results in a flood (Merritts et al. 2014, 284).

Water, rivers, and flooding have been a central part of the history of humans. They have also become a central feature in the development of the U.S. One cannot hope to understand the history of this nation, its settlement patterns, or its way of life, without understanding its relationship to water, rivers and flooding.

II. Human attempts to tame the River- A brief history of floodplain management and policies

Essays (Let Us Try)- Motto of the U.S. Army Corps of Engineers

People have always molded nature to fit their desires. This was no less the case with rivers. People living in the U.S. altered rivers from the very beginning.¹ Much of the alteration was done at a local level with no grand organization at the federal level. A host of factors converged to change the balance of power in floodplain management that would eventually see the federal government, through the U.S. Army Corps of Engineers (USACE or the Corps), take the predominant role in floodplain management. It also helps to understand the stark difference between our nation 200 years ago and today. Especially in the early days of our country, the most effective and efficient way to defend our nation was to move

¹ Note that this discussion focuses on the United States as a nation and omits discussion of Native Americans and their relationships with rivers prior to colonial settlement. Indeed, this discussion picks up roughly around the birth of the United States.

troops via water (McCool 2012, 26). So at the beginnings of our nation, Thomas Jefferson authorized the Corps (McCool 2012, 27).

In fact, “engineering projects and legal agreements have remade nearly every river in the United States and have shaped expectations around the world about how governments should control the environment” (O’Neill 2006, xi). But this federal dominance was not always the case, it fact it arose from a local plea for the federal government to take a larger role in flood control. As discussed in *Rivers by Design: State Power and the Origins of U.S. Flood Control* by Karen O’Neill, businessman advocated for flood control as a program of economic development (2006, xii). This development happened over decades stemming in 1840s and 1870s where recipients of swampland grants joined together with merchants in the 1870s to organize river conventions demanding federal flood control aid (O’Neill 2006, xvi). The 1830s and 1840s saw local landowners forming levee boards where they coordinated flood control at the local level for their area of concern (O’Neill 2006, 40). Also, from the 1840s to the 1910s river improvement conventions were a common occurrence that included levee district managers, businessmen, and politicians (O’Neill 2006, 45). These gatherings often resulted in letters and requests to the state and national governments for action on river improvement (O’Neill 2006, 45). This was the start of the formal organization that would build the backing and local power to secure federal assistance. Different geographic regions of the United States began to vie for projects to fit their needs. An example was the Mississippi River Improvement Convention in 1845 which called for connecting the Great Lakes to the Mississippi River along with improvements to it and other western rivers (O’Neill 2006, 46-67). A counter convention occurred in 1847 in Chicago, with officials attending from most of the northeastern states (O’Neill 2006, 47). As members of congress from areas such as the lower Mississippi Valley gained more clout in the House and Senate, river projects became a priority (O’Neill 2006, xvii). Note that much of these conventions before the Civil War did not call directly for flood control aid, but were more focusing on river development to help their interests (O’Neill 2006, 46).

It is relevant to point out that while the lobbying for federal involvement in river development and flood control was occurring, the states and local government did not stand still. Some states created their own states agencies and levee districts. States that passed levee district laws in the 1850s included Arkansas, Mississippi, Missouri, Kentucky, Tennessee, and Louisiana (O’Neill 2006, 52). These laws involved creating state agencies to direct grants for levee building or creating regulations regarding levees and financing (O’Neill 2006, 53). In summary, the 1800s up to the Civil War saw the federal government setting general land and development policies, mainly in response to demands from the states and regions; it was not a national system of infrastructure (O’Neill 2006, 55).

By the 1880s, Congress had guided the Army Corps of Engineers to use navigation program appropriations to assist levee districts on the lower Mississippi (O’Neill 2006, xvii). Congress did eventually create a flood control program for the Mississippi and Sacramento rivers in 1917, and later extended the program to all navigable rivers in 1936 (O’Neill 2006, xiii).² After large floods of the

² Note that much of the early discussion at the federal level about these sorts of river improvements centered about whether the Constitution even allowed for it (O’Neill 2006, 45). This is important to note as the powers of the federal government that we take for granted today were not always so strongly established.

Mississippi in 1928, Congress committed the U.S. government to completely redesigning the Mississippi and Sacramento river system to control floods (O'Neill 2006, xix). The economic development focus was a big driver, with other considerations often put at the back of the line. For example, on the lower Mississippi River, federal flood control aid built levees and allowed farmers to plant crops in areas that were formerly swamplands (O'Neill 2006, xiv). They then allowed freed African Americans and recent European immigrants to work those lands (O'Neill 2006, xiii). While the risk of flooding from levee break remained, this risk was passed onto those laborers (O'Neill 2006, xiii). Thus, the flood control program encouraged planting in the areas susceptible to flooding (O'Neill 2006, xiii).

The end of the Civil War brought new calls for federal aid for projects like flood control assistance as a means to help the economically depressed South (O'Neill 2006, 56-57). The demand for aid from the South increased as generous aid for infrastructure was given to the North (O'Neill 2006, 61). The pre-war river conventions and advocacy for river improvements reemerged after the war, but now there was an emphasis on flood control, especially for the lower Mississippi River (O'Neill 2006, 61). Examples of lobbying by interests groups included the governor of Louisiana, Louisiana Sugar Planters' Association, the Mississippi legislature, and Mississippi levee district boards (O'Neill 2006, 61). Their main thrust was that local and state governments did not have the money to maintain levees, so Congress should take the levee system of the Mississippi River into federal control (O'Neill 2006, 62). But before such federal aid was to come, Congress had to be convinced that the levees could help improve navigation (O'Neill 2006, 64). Eventually, as the Civil War changed expectations of the federal government and allowed it to intervene in resources development, Congress would start to provide support for levee aid in the 1880s (O'Neill 2006, 66). Note that around that time, beyond lobbying from the Mississippi River region, there was also a coalition from the Sacramento River Valley in California (O'Neill 2006, 80-81). The cooperation between the two campaigns helped to create more momentum for federal aid (O'Neill 2006, 81).

The USACE thus developed a niche as the first federal agency to oversee development decisions among the multiple levels of the federal government, local businesses, and local officials (O'Neill 2006, 22). It also led to a shift at the state and local level as "...landowners, merchants, and officials began to organize their local economies and their congressional delegations to compete against other locals for positions in the national economy" (O'Neill 2006, 25). With the expansion of the U.S. westward, supporters of river development argued that the U.S. government should enable commerce and settlement along waterways in the west, if it was going to claim that territory (O'Neill 2006, 27). So make no mistake that the history of floodplain management in the U.S. is a history of the development of our country. The justification for early floodplain management and control by local organizations and the USACE was to encourage economic development. This may have been under the guise of navigation, but that was ultimately to aid development and settlement in areas.

Much of the early origins of river development were billed as being for navigation and economic development. The flood control aspect came later. However, not until the 1920s were there claims that the government had a duty to protect lives (O'Neill 2006, 128). After floods in 1927, with the 1928 Flood Control Act, the Corps of Engineers changed to take on flood control to go along with its navigation work (O'Neill 2006, 128-129). "In retrospect, the 1927 flood was a unique event but one that was used

effectively to argue that flood control as a general function was a national concern” (O’Neill 2006, 149). The expectation was now created that the Federal Government respond to all large flooding disasters (O’Neill 2006, 129). Much of the basic plans approved in the 1928 Flood Control Act and projects built for the Sacramento River and Mississippi Rivers are still in use today (O’Neill 2006, 146-147). This was a sign of a new era and paved the way for the New Deal, since it required the federal government to actively intervene in local and regional economic development (O’Neill 2006, 146-147).

The Army Corps had come to favor a levees-only policy by the 1920s (O’Neill 2006, 132). “According to the commission, concentrating the water into the main channel would force the river to scour out its own channel and increase the channel’s carrying capacity” (O’Neill 2006, 132). But, it is important to keep in mind that the Corps were not so eager to take on its new flood control duties. Many Corps officials continued to insist they should focus on navigation improvement and some even argued against official undertaking flood control duties (even as this work was already occurring in the Mississippi) (O’Neill 2006, 113).

With President Franklin D. Roosevelt, there were a new wave of federal projects managed by new and old agencies. The federal government intervened in state and local affairs like never before. One example, the Tennessee Valley Authority (TVA) was designed to operate autonomously from Congress and the President (O’Neill 2006, 150-151). The agency was created to provide electricity, promote development, and conserve natural resources (O’Neill 2006, 151). With the creation of the Public Works Administration (PWA) in 1933, many projects relating to water would commence: for high dams, waterway improvements, and flood control (O’Neill 2006, 153-154). The TVA would concentrate on developing the Tennessee River Valley. It is during this era that other agencies entered the picture in flood control to compete with the USACE. President Roosevelt organized the National Resources Board, and committees within it, one of which began to draw up plans for the Mississippi Valley (O’Neill 2006, 159). The Department of the Interior, the Bureau of Reclamation, as well as the PWA and the Works Progress Administration (WPA) also entered into the mix (O’Neill 2006, 159-160). Competition would be direct between the USACE and the Bureau of Reclamation, especially in California’s Central Valley and the Missouri Valley (O’Neill 2006, 169). However, in 1940s, Congress continued to expand the work of the USACE, adding more rivers to their purview and authorizing them to add park and recreation areas at reservoirs as well as sell water (O’Neill 2006, 170-171). In the 1950s and 1960s, environmental considerations began to enter into consideration (O’Neill 2006, 171). This continued after the 1969 National Environmental Policy Act in the 1970s and 1980s, where the criticism focused on the high dams (O’Neill 2006, 171).

These dams flooded river canyons, sterilized portions of the inland waters, disrupted fish mating runs, and diverted water from many natural areas. The Corps also attracted criticism for directing stormwater so quickly to the sea, through concrete-lined channels and culverts. This design reduces a river’s average volume, so that salts become concentrated in the river. In areas with intensive flood control systems, local water agencies often have to divert other sources of water for agricultural and municipal use, at great environmental and economic cost. (O’Neill 2006, 170-171).

There are parts of the political structure in the U.S. that hamper effective land use planning such as the lack of coordination (O'Neill 2006, 172-173). Floodplain use is under local and state governments and they often do not restrict development in these areas (O'Neill 2006, 173). Congress approves the federal flood control systems but does not require the state and local governments to restrict building (O'Neill 2006, 173). Thus even after the levees are built, the areas still remain vulnerable to flooding (O'Neill 2006, 173). In a cyclical fashion, the residents and farmers in the flood plain often then mandate more levee and pumping projects (O'Neill 2006, 173). Additionally, since 1973 the federal government has subsidized construction in floodplains through its National Flood Insurance Programs (O'Neill 2006, 173). This false sense of security can lead landowners to think that the risks involved in living in flood plains can be estimated and recovered (O'Neill 2006, 173). This may not be the case. The payouts themselves are often too low to cover the full losses (O'Neill 2006, 173).

Modern floodplain management

The options for dealing with floods basically boil down to moving to higher ground or building a wall (a dam is also a wall). The U.S. has historically decided to build walls (McCool 2012, 166). These included the common ways to control the flow of water of dams, artificial levees, and floodwalls. Dams allow water to be released from a reservoir impoundment upstream of a dam at a controlled rate (Merritts et al. 2014, 290). This can create space to capture future rain or snowmelt events and can prevent streams from spilling onto their floodplains downstream of the dam (Merritts et al. 2014, 290). In addition to flood control, dams are built for stowing irrigation water, navigation, public water supply, recreation, and hydroelectric power generation (Merritts et al. 2014, 287). Interestingly enough, the building of a dam purposefully causes a flood upstream in order to diminish the risk of flooding downstream (Merritts et al. 2014, 290). As of 2009, there were at least 84,000 dams in the United States (based on the National Inventory of Dams), with about 8,100 of them being consider major dams, with a height of 15m or more (Merritts et al. 2014, 290). There may be many smaller dams that are not included in the former dam count (Merritts et al. 2014, 287).

Constructing artificial levees along a stream channel can increase the height of channel banks and allow the stream to transport higher flows being spilling into a flood plain (Merritts et al. 2014, 294). The levees can also be constructed out on the floodplain to allow even high flows volumes to be conveyed (Merritts et al. 2014, 290). Then development would not occur in that area (Merritts et al. 2014, 290). So it is important to understand that levees purposely confine water and increase its velocity turning it in a roaring rush of water that deteriorates levees, scours the bottom of the river, and comes out at the end of the levee in a fierce flow (McCool 2012, 166-167). So it is a bold attempt to control nature and confine something that does not wish to be confined. "Every levee is an act of faith- in God, in nature, and the Corps. Flood 'control' is essentially an act of bravado, raising a middle finger toward the upstream and gambling on man rather than nature" (McCool 2012, 167).

Another component contributing to development of floodplains has been the National Flood Insurance Program (NFIP). This program was created in 1968 in response to a demand for private insurance, in the wake of a series of enormous flood losses (Calil 2015). This was viewed as an alternative to the engineering solutions and provides insurance to communities if they agree to establish

and enforce standards for land use and flood control for development in the areas prone to flooding (Merritts et al. 2014, 287). The Federal Emergency Management Agency (FEMA) defines Special Flood Hazard Areas (SFHAs) within a floodplain (Merritts et al. 2014, 287). These SFHAs are the areas that would be inundated by the 1 percent annual probability flood (Merritts et al. 2014, 287). FEMA uses the SFHAs to create a Flood Insurance Rate Map showing flood elevations and flood-risk zones to guide local planning (Merritts et al. 2014, 287). Note that the 1 percent annual probability flood actually has a 26 percent chance of occurring within the time span of a typical 30-year mortgage (Merritts et al. 2014, 287). Also, human activities such as urbanization can increase the frequency of 100-year floods (Merritts et al. 2014, 287). It would be logical to prohibit development within SFHAs but that does not always happen (Merritts et al. 2014, 287). FEMA just requires any new construction within these areas to have its lowest floor above the elevation of the 1 percent annual probability flood (Merritts et al. 2014, 287). This is where the elevated buildings on pilings come in, or using the first floor as parking, common sites along the coasts of the United States.

Thus one of the objective of the NFIP was to encourage communities to adopt risk-minimizing measures by promoting floodplain management regulations that would ultimately lower the flood risk of a community (Calil 2015). In reality, this did not occur and many flood-prone areas in the U.S. have been and are currently being developed (Calil 2015).

Overall, the Corps' main thrust of building structures has remained (O'Neill 2006, 173). Even environmental restoration projects are still engineering works (O'Neill 2006, 174). So called river "improvements" are now the very hazards that we thought to have been avoided. "Environmental goals fit poorly into this system for distributing projects" (O'Neill 2006, 184). But they have recently been added to the flood control program (O'Neill 2006, 185). Ecologists say that this goal works best if plans are coordinated across boundaries, which is often hard to do with the current system (O'Neill 2006, 185). It has been politically hard to justify spending for nature-centered goals over the human centered ones (O'Neill 2006, 185). Such projects attempt to "redesign river hydrology, change federal and state government bureaucracies, counter the protests of current project beneficiaries, and reduce local politicians' incentives to attract construction funds intended to make rivers into aqueducts" (O'Neill 2006, 185). Thus this is no easy task. The flood control program remains a land development program, although it does have goals of public safety and ecological restoration (O'Neill 2006, 185). So the three goals are now economic development, human safety, and now ecological functions (O'Neill 2006, 186).

III. Policy Analysis- Where do we go from here?

An effective policy analysis does not aim to label a certain policy as good or bad. It would instead aim to evaluate a given policy and its alternatives on an agreed upon set of criteria. What are those criteria? On a societal level, one might evaluate a policy against the values of society. It would not be logical to automatically claim that all dams are bad or that levees are horrible. The context is the set of values a society has decided will guide their decision making. If a key value is environmental preservation, then the chosen policy might look different that if the main societal value is economic development. So the policy analyst is tasked with identifying the feasibility and consequences of each

option, whereas the policy maker decides which policy to implement, thus ultimately deciding winners and losers (Lackey 2006). Here we will attempt to evaluate the different policy options and make a choice based on the anticipated values of society today. The set of values our nation has today in regard to river policy is different than the set of values during the 1800s or 1900s when much of the river development in this country occurred. Today, the emphasis is on preserving ecosystems and human life. Those values should dictate the future policies regarding rivers in the United States.

The history of floodplain management in the United States can be thought of as a grand experiment in the short-sightedness of humans. When working on a certain problem, we do not focus on problems that do not exist, we have a singular focus (Dorner 1996, 58). We do not anticipate the challenges that will be created *down the road* by our actions. Choices are made to solve the current problem which can create more problems in the future (Winograd 2010). Also, we are making decisions without complete knowledge of the situation, as at the time of early river development, where the complex relationship of rivers and ecosystem health were not understood or fully considered.

So we must actually admit a problem that needs fixing in order to move forward with a policy analysis (Winograd 2010). Even as a society we might be reluctant to admit failure for that means we admit our understanding of the conditions was inadequate (Dorner 1996, 69). But we should not despair, as this was and is a complex problem. There are many interrelated variables that increases the complexity and “places high demand on a planner’s capacity to gather information, integrate findings, and design effective actions” (Dorner 1996, 38). This is also what many researchers have called a wicked problem. Such problems involve a range of values held by various stakeholders, each with different interests and needs (Shindler & Cramer 1999, 29). And when politics and society become involved, the solution can be hard to work through without an overriding social ethic (Shindler & Cramer 1999, 29).

a. The eightfold path to more effective problem solving

There are many different ways to undertake a policy analysis. One approach has been selected here based on the author’s experience with this method. Eugene Bardach’s book *A Practical Guide for Policy Analysis: The Eightfold Path to More Effective Problem Solving* describes an eightfold path for formulating effective policy to solve problems. This will be implemented (as much as is applicable) in relation to the policies of river development in the United States. The steps in the eightfold path are: (1) define the problem, (2) assemble some evidence, (3) construct the alternatives, (4) select the criteria, (5) project the outcomes, (6) confront the trade-offs, (7) decide, and (8) tell your story (Bardach 2009). Analysis of three policy options will be undertaken by progressing through the eight steps in a similar manner as the author did in a previous paper *A policy of stuff: examining the consumer culture in our modern developed society* (Winograd 2010). The three options will be similar to those from that paper, but will be tailored to floodplain management. Those options can be summarized as: (1) business as usual, (2) incremental changes, and (3) a new system (Winograd 2010). The analysis of these options is unique to our specific topic of river management.

1- Define the problem

The initial step is to define the problem. This is the impetus for the future work and provides direction (Bardach 2009, 1). A problem definition can help determine deficiency and excess; this might involve too much or too little of something or something being too big or too small or growing too fast or slow (Bardach 2009, 1-2). In the context of our topic, this might be: flood control policies in the United States are causing too much loss of life and are too damaging to ecosystems. Or more formal: flood control policies in the United States exacerbate the loss of human life and harm the functioning of ecosystems. This begs the statement: we need a policy that would prevent the loss of human life and allow ecosystems to thrive. So certainly the notion that we are going to address this problem must mean that there is something wrong, which people can disagree on (Bardach 2009, 3). People might not agree with this and might say that there is not a problem (Bardach 2009, 3). However, we are making the value judgment that we anticipate society would make. If society does not have human life and ecosystem health as values, then the chosen policy would be different. In fact, then we might not even have a problem to discuss. So it is not that the policy option chosen is the “best” one in some absolute sense. It is a policy that best fits our chosen goal.

It is important that our problem definition should not include an implicit solution introduced by semantic carelessness (Bardach 2009, 7). Does our problem do this? The problem states that our current flood control policies exacerbate the loss of human life and harm the functioning of ecosystems but it does not appear to present the solution. So it does not seem that we have an implicit solution here.

2- Assemble some evidence

Besides spending a great deal of time thinking about the problem, the other important activity is research: assembling the evidence (Bardach 2009, 10). This is the important stage to gather the information to support the different policy options. Note that time itself is always the enemy in this scenario. There is always a deadline so researching and evidence gathering cannot go on forever. So recognizing the time constraints might not allow enough time to perform a research effort that would satisfy a careful academic researcher, we must still press on and attempt to do a satisfactory job of assembling evidence (Bardach 2009, 10). In the end, an effort was made to effectively find and dissect the relevant information to educate a policy evaluation and recommendation (Bardach 2009). The research involved in this master’s case study included roughly three main research thrusts. The first cast a wide net of various articles and books related to the topic. This led to a large number of sources to sift through. In digesting that information, the focus of this paper was narrowed. This led to a second research exercise to find the research more closely fitting the topic. A third research endeavor focused on finding sources referred to in other articles as well as articles read for previous graduate school classes at Oregon State University.

3- Construct the alternatives

In examining the different policy options, we want to be sure to have a few different alternatives to choose from that might combat the problem. Bardach recommends that the first policy choice always be “let the present trends continue undisturbed” which is not a choice of “do nothing” but more along the lines of “not decide” and let the world proceed as it would (2009, 17). So this option could change the

problem as there might be some “natural change that affects the scope of the problem” (Bardach 2009, 17).

The next policy option will be making significant changes to the current system. While the structure of the system will remain, there will be fundamental changes at appropriate intervention points. This will involve steps such as new legislation for river restoration projects and the implementation of new regulations favoring ecosystems. It might also involve new pilot projects to implement new and novel ways of handling flooding. This option is different from policy option one is that we are accelerating the pace of change and implementing new solution that might not have otherwise emerged in the “business as usual” scenario.

The third option will involve the implementation of a completely new system. This would involve a paradigm shift in America’s attitude towards rivers and completely new priorities for river projects. Ecosystem management might be embraced as the official federal government policy across all agencies, or the American people might demand new priorities in river management. It is a much more fundamental change than an incremental change reference in the earlier two policy options. This is large and painful change meant to completely reorient priorities.

4- Select the criteria

Maintaining objectivity, we look to our values to decide which option best fits. This is where the criteria used to evaluate the policy are important. Society’s values will be used to “judge the goodness of the projected policy outcomes that are associated with each of the alternatives” (Bardach 2009, 27). So in a sense the problem definition has revealed our values: preventing loss of life and preserving ecosystems. If our concern was river development, then our problem would discuss a concern with river development. So our main criterion is “whether or not the projected outcome will solve the policy problem to an acceptable degree” (Bardach 2009, 26). In our case, solving the problem is a river and floodplain management system that prevents the maximum loss of life practicable and establishes healthy, functioning ecosystems.

So where did the selected values come from? It is important to explore this notion, as it may seem that the criteria were pulled out of the air. The main goal of river management was once for economic development. If a policy analysis was performed 200 years ago, that would be the main criteria and thus the chosen policy would be different. Today the concerns are more along the lines of protecting lives and property and having a functioning ecological system to allow people and the environment to thrive.

There is a gross disjuncture between what America has done to its rivers and what Americans want from its rivers. Nearly all of our rivers are developed, dammed, diverted, dried up, or dirtied. But increasingly Americans want rivers that are clean, free-flowing, teeming with fish and wildlife, and inviting for sports and recreation. People want living rivers, not dead rivers. To achieve that, it will be necessary to restore a lot of river miles and preserve the small fraction of our rivers that are still relatively pristine. (McCool 2012, 8).

People have a drastically different notion of rivers and their purpose than they did 200 years ago. People increasingly do not want a navigation channel, but a real river. People want an ecosystem that functions and allows current and future life to thrive. “The need to reserve free-flowing rivers, representing different geomorphic settings and biomes, has now been accentuated, and the rehabilitation of degraded rivers has been initiated in many countries” (Dynesius and Nilsson 2005, 753).

Over the years, rivers have had many political meanings and many economic uses. Only some of them are relevant to us now. The Mississippi and Sacramento rivers were vital highways to the interior, sources of great fortunes, and symbols of regional identity. They were transformed politically into national rivers. Now they are simply two links in a national transportation system that has declined as road and rail systems have grown. Recreational boaters rather than barges now dominate portions of these two rivers. Farming along these rivers is lucrative for farm owners in some areas but not in others, and as always, it provides a poor living for farm laborers. Gold mining now centers in the open-pit and underground mines of Nevada and South Africa, not in California. Suburban development is the fastest growing form of land use in the Sacramento Valley. Although the Mississippi and Sacramento rivers remain important to regional identity, they no longer dominate their regions’ economies or politics. (O’Neill 2006, 178).

So the goal will be to find a policy that allows humans to thrive (by reducing loss of life and property) and allows ecosystems to thrive (by restoring them to proper ecological functioning). A policy that does not achieve these two goals is not a policy that should progress to implementation.

It is important to note that we will be looking to the outcomes of the different policy options and not the alternatives themselves (Bardach 2009, 26-27). We will look for outcomes that best satisfy our criteria or value, and that will be the recommended option.

Bardach discusses some other commonly used evaluative criteria in addition to the main notion of trying to solve the policy problem to an acceptable degree (2009, 26). These include notions of efficiency, equality, equity, freedom, community and process values (Bardach 2009, 27-33). He also discusses some practical criteria of legality, political acceptability, robustness, and improvability (Bardach 2009, 33-36). While there are many other criteria that can be considered, that is beyond the scope of this policy analysis. This policy analysis will only focus on trying to solve the policy problem and the actual feasibility of each option, that is the likelihood of it being implemented in today’s world.

5- Project the outcomes

Now as we look to the outcomes of each of the scenarios, we must take care to recognize that we are projecting into the future and ensure that we are realistic and not overconfident about our conclusions (Bardach 2009, 38).

Option 1: Let the present trends continue undisturbed

What will happen if current trends continue? How will the problem develop? This is the first option where we do not attempt any intervention but allow the system to progress.

The future of the Corps of Engineers is likely about saving America's rivers, from damage done by past Corps projects, as well as other factors (McCool 2012, 26). The old days, when the Corps shaped giant rivers without concern for the environment, are over (McCool 2012, 26). The Corps has slowly adapted to a new and additional mission of environmental protection and restoration. For example, a massive restoration is underway in the Florida Everglades. One portion of this project involves restoring the Kissimmee River. The ultimate goal of that project is to restore the river to its natural watercourse (McCool 2012, 37). It is still a massive engineering project with lots of new structures required such as bridges, box culverts, flood gates, and enlarged channels (McCool 2012, 37). Of course, complete restoration is not possible, as there is too much development, but the restoration still takes place around the structures in place (McCool 2012, 37). So this is certainly novel and innovative approach to restoration that should be applauded, but these sorts of projects are balanced by the array of other Corps' projects that still embody the Corps' history (McCool 2012, 42-43). In a sense, it can be considered different agencies, the parts that restore and the parts that continue the history of large river projects (McCool 2012, 43).

While the Corps has embraced an additional mission, they have never abandoned their tradition of larger water projects (McCool 2012, 43). Into the 1990s and early 2000s, the Corps still relied on its planning rules that utilized a cost-benefit formula which practically guaranteed a favorable decision for the big construction projects while at the same time undervaluing other alternatives (McCool 2012, 44). So it had become clear that "...some of the nation's waterways do not meet even the most imaginative test of economic rationality, so applying such a standard would require the Corp of Engineers to abandon its archaic tradition of clearing sawyers and snags and find something else to do (such as repairing the damage done by past projects)" (McCool 2012, 46). However, unfortunately it has been hard to get legislation through Congress to fundamentally change the Corps. In the early 2000s, a variety of bills failed and did not pass Congress (McCool 2012, 45-47). This can be primarily attributed to the "entrenched, well organized, and connected" recipients of the projects which includes the politicians bringing home pork and the interests receiving that benefit (McCool 2012, 26). When the 2007 Water Resources Development Act did pass it was filled with lots of projects for interests all over the country (McCool 2012, 48-49). It also brought about some changes to the Corps' mission. It was now required to focus more on restoring and protection ecosystems and promote sustainable development (McCool 2012, 49). The cost-benefit analysis now had to be more sound and equally consider nonstructural alternatives (McCool 2012, 49).

So there is certainly progress towards a policy that restores ecosystems but the entrenchment of interests in water projects still exists. So while the 2007 WRDA did not completely change the Corps into some sort of river restoration agency, it did further their development towards new goals (McCool 2012, 51). It appears that the Corps will continue on their current ways of spending as long as Congress continues to tell it to and provide the funds (McCool 2012, 50). Change at the agency and congressional levels are needed to bring about larger scale change (McCool 2012, 50). There is much work to be done. So, option one does not significantly help restore our river ecosystems. There are possible steps that can

lead us down a new path, but that would require interventions that are not part of option one. A hopeful step of “Eliminating projects that do more harm than good would help direct water agencies such as the Corps toward a more useful and productive role while assisting the nation in restoring its rivers and maintaining those projects that actually make sense” (McCool 2012, 51). So it may not necessarily be that the Corps is the problem, but more specifically it is Congress that “manages water by earmarks” (McCool 2012, 171). This is a direct barrier to any sort of long-term floodplain management (McCool 2012, 171). This hampering of our goal means this option does not solve our problem to a significant degree.

The Corps of today is clearly helping with restoration such as helping southern Louisiana (McCool 2012, 185). At this point, for many areas the best we can hope for is remedial restoration because we have done too much and there are many established interests that would not easily be extinguished (McCool 2012, 186). One cannot reverse the effects of 100 years of levees and dam building overnight (McCool 2012, 186). In some cases, the Corps still claims it has in under control, as the Mississippi Valley Division of the Corps claims control the floods of the river as it main mission (McCool 2012, 187).

As previously discussed, the Corps’ main thrust of building structures has remained (O’Neill 2006, 173). Such projects and “progress” are not so easily undone:

Despite such changes, we are culturally, physically, and politically constrained by past decisions about these and other rivers. Government river projects have made some uses possible and other uses difficult or impossible. Concrete-lined flood channels prevent the natural resupply of groundwater. Levees deprive wetlands of water and prevent rivers from depositing fertile silt alongside their channels. Political expectations and political constituencies have been built around such river projects and in turn sustain those projects and resist new social and environmental goals. (O’Neill 2006, 179).

So the current trends do point towards that consideration of ecosystems while river projects continue. There does not seem to be an indication that loss of life and harm to people will trend downwards as we continue into the future. We must look to other paths forward.

Option 2: Incremental changes to the system

There are certainly changes going on to our current system of river management, but option two would involve more change being instituted with a larger magnitude and pace than current trends indicate. The previous discussion section regarding option one mentioned possible interventions in the system to change the natural development of policies. This might involve directing the Corps to ensure that its projects work to restore rivers and not undertaking projects that are not worthwhile. There are successful pilot projects that can be implemented on a larger scale. Scientific research has advanced our understanding of river ecosystems and shed light on ways to improve ecosystem functions and lessen the impact on humans. These sorts of projects and knowledge need to be applied to new policies and recognized as a viable path forward. For example, even though it is unrealistic in many places to completely restore a river ecosystem, managed floods can be used to partially restore them (Molles et

al. 1998). Many people are now examining how restoring large river-floodplain ecosystems can help reduce future flood damage (Sparks 1995). Our understanding of the benefits of flooding has dramatically increased since the commencing of many of the large river projects in our nation's history. We understand that "flooding creates and nurtures far more diverse and complex habitats than exist when floodwaters are controlled" (Haeuner & Michener 1998, 75). It has been established for decades how the interaction of the water and land, through the flood pulse, helps to create and maintain productive and diverse river ecosystems (Molles et al. 1998 citing Junk et al. 1989, Bayley 1995). This flood-pulse is basically the "principal driving force responsible for the existence, productivity, and interactions of the major biota in river-floodplain systems" (Junk et al. 1995).

The floodwaters themselves assist in maintaining a key connection between the rivers and the land surrounding them (Haeuner & Michener 1998, 75). In direct relevance to humans, floods sustain and restore many of the vital services provided to humans by our riparian ecosystems such as replenishing agricultural soils with nutrients and transporting sediments that are crucial to maintaining downstream deltas (Haeuner & Michener 1998, 74). We now understand that many of the human interventions into the river threaten the vital functions of the river and ecosystem (Hale & Adams 2007, 24).

Today's researchers often emphasize ecosystem management to assist in restoring our river ecosystems. Ecosystem management is the fusing of perspectives to include ecological, socio-economic, and institutional in a combined plan for the future (Hale & Adams 2007, 24). The main goals of such a process would include a restoration of the ecosystem function and composition as well as establishing sustainability while including human dimensions, longer times scales, larger spatial scales, and a systems management approach (Hale & Adams 2007, 24). The chief goal can be said to be maintaining and recovering the biological integrity of the ecosystem (Sparks 1995, 175).

This option would increase the number of policy shifts and intervention into the system. Schemas such as ecosystem management would be part of many river projects. It is the speeding up of business as usual to look toward a future with a new orientation toward the life of the river. It is a jolt of life to rivers.

Option 3: A new system

Many countries have started to shift their paradigm from "flood defense" to "flood risk management" (Anisfeld 2010, 75). This means that they are beginning to recognize that there is no complete protection against flooding (Anisfeld 2010, 75). Even the terminology is important, as "flood defense" or "flood control" implies that we are in control of nature, which history has shown is not the case. This shift in philosophy also recognizes the benefits of flooding that might have been previously overlooked (Anisfeld 2010, 76). This new terminology brings a shift of focus away from building and beginning to deliberate more thoughtfully about land use and our vulnerabilities (Anisfeld 2010, 76). This may involve the notion that some places have to live with water, that is, be periodically flooded (Anisfeld 2010, 76). This would then require communities to adapt to this notion (Anisfeld 2010, 76). By understanding and embracing the river ecosystems we can adapt our interaction with it, as the ancient Egyptians, whose way of life capitalized on the annual flood of the Nile and the nutrients it brought

(Sparks 1995, 175). So beyond just a semantic change (the Corps have also shifted to the “flood risk management”) but embodiment of that notion coupled with action is what is needed for larger scale change.

Thus, there is precedent for large paradigm shifts to reorient worldviews towards understanding the nature of rivers: they flood. Countries have been able to recognize that some places might have to embrace water instead of viewing it as a common enemy. That is just one sort of possible paradigm shift, a full scale embracing of ecological restoration as the paradigm for river management in the U.S. could be another.

The need for a paradigm shift arises because of the failure of the current systems and the projects it has produced. The word failure is used in reference to our state goals of preventing the loss of life and preserving ecosystems. Dams would be one example. Dams dramatically impact aquatic system. Massive concrete walls are impassable barriers for fish and thus block fish migration (Merritts et al. 2014, 290). Dams also disrupt the transport of sediments (Merritts et al. 2014, 290). Streams entering reservoirs drop their sediment, altering the storage capacity of the dam (Merritts et al. 2014, 290). Changing the flow of rivers also affects streamside vegetation and the life cycles of trees (Merritts et al. 2014, 290).

Levees are another flood control structure that are not in tune with our goals. Levees can lead to a false sense of security that promotes development on floodplains (Merritts et al. 2014, 290). They can also raise the height of water in stream channels during high flow events which can lead to a worse flood if the levee fails that had the water been able to leave the channel and spread out into the floodplain (Merritts et al. 2014, 294).

Such a fundamental paradigm shift would have the potential to completely overall our orientation towards rivers. Not only would policies and laws change, but everyday interaction with waterways would be transformed. No longer would they be the medium by which we transfer waste and mold to our desires, but they would be sources of life and embraced by the community. Society would not undertake activities that harm rivers.

Stakeholders

Stakeholders are groups that can be affected by the outcome of any given policy issue (Winograd 2010). In this issue there are a variety of stakeholders: citizens, companies, governments (Winograd 2010). And of course, each will have their own viewpoint on this issue. I have already hypothesized that people generally today value a restored river and a decrease in the harm it brings to people. If that indeed is their true value, then they should be on board with solutions that carve a path toward river restoration and human safety. How about companies? Certainly companies that directly benefit from a current river project will fight to maintain the status quo. Others that are not directly connected might not have such a stake in the fight. In general, they would likely crave certainty in the policies of government so they can run their business in a climate they can predict. Theoretically government should be willing to make changes that the people demand. Unfortunately, other stakeholders are able to lobby the government to sway them towards their worldviews. But if there is significant inertia from the people, the government should move in a new direction. However, in today's complex world with

such a wide range of stakeholders, it is more likely that small, incremental changes would be implemented over drastic, paradigm shifting ones.

6- Confront the trade-offs

It is possible for one policy option to produce the best outcome under every single criterion we are considering (Bardach 2009, 52). However, if not, it is important to be clear about the trade-offs between each of the outcomes (Bardach 2009, 52). A trade-off might be a river project that improves navigation, but hurts fish species. A trade-off might involve taking something of value from one person, while giving something of value to others. These sorts of trade-offs should be weighed among the different policy options.

If we are going to recognize the values of people and society as the chief policy driver, then private interests should not outweigh the interests of society as a whole. Again, the important aspect is the values of society. “We can choose between two alternatives only if we can weigh the importance of the criteria and if we can express their relative weights in units that are commensurable across the criteria” (Bardach, 2009, 54). So we can hypothesize that option two will get us further along the goals of improving ecosystems and preserving life, but what are the tradeoffs? Well certainly the way of life that certain people are used to might have to change. If you live near a river that is impacted by river restoration, you might have to orient yourself differently to the river. People that have become used to the river being designed a certain way, a dam creating a reservoir for recreation, or providing water to farmers, will have to adapt as this way of life might not exist in the same form as they have grown accustomed to. These are the sorts of changes to people’s life that must be weighed against the overall goals and preferences of maintaining ecosystems and protecting life.

Our job is to ensure that one of the choices will be an excellent choice to take aim at solving, or mitigating, the problem (Bardach 2009, 56). So we must be in tune with reality and think very seriously about how the alternative will be adopted and the makeup of the institutions that will have the power and resources to implement the policy in the long run (Bardach, 2009, 56). This reality check is one of the reason that while option three might best reach of goals, it is not realistically going to be implemented. Option two has a greater chance of implementation given the makeup of our institutions.

7- Decide!

Now we must pick the scenario that will best solve our problem. It is also important to consider which policy has the greatest likelihood of being implemented. The “best” policy may not be feasible in the real world; thus it cannot be the chosen policy. As discussed in Winograd (2010) it is important not to underestimate that there will be bureaucratic resistance and a reluctance to change the status quo (citing Bardach 2009, 57). The best policy in our situation is policy option two.

The figure below is an outcomes matrix to summarize how each of the policy options address our main problem and other factors.

Outcomes Matrix for the Different Policy Options Related to River Management³		
	Solves the problem? (restores ecosystems and prevents loss of life)	Feasibility
Option 1: Let the Present Trends Continue Undisturbed	Slowly trends toward both goals.	Yes.
Option 2: Incremental Changes	Trends toward both goals faster than option one.	Yes.
Option 3: New System	It would appear so.	No.

8- Tell Your Story

This step in the policy analysis is about the method by which the analysis is conveyed, such as a policy paper, or presentation. In this instance both methods are being implemented.

I. The future of flood control and flood plain management

“The face of the water, in time, became a wonderful book- a book that was dead language to the uneducated passenger, but which told its mind to me without reserve, delivering its most cherished secrets as clearly as if it uttered them with a voice. And it was not a book to be read once and thrown aside, for it has a new story to tell every day.” (Mark Twain, *Life on the Mississippi*)

In whatever its form, the future of floodplain management will look different than it does today. The legacy of our past, constricts our future and leaves us vulnerable as a society.

Remember that there is not really such a thing as a flood in the natural world (McCool 2012, 167). Rivers vary intensely in volume and breadth with the changing seasons and precipitation (McCool 2012, 167). It only becomes a flood when we have built something within the area where the river fluctuates (McCool 2012, 26). So in a sense, it is man who has created the floods. We are making the choice to put ourselves in harm’s way. Our structures do not necessarily solve the problems they were intended to. Levees do not stop floods. Instead they relocate the flood and make it worse somewhere else (McCool

³ Table has been adapted from Winograd (2010) to fit the topic of this paper and the criteria being considered in this analysis.

2012, 169). Flood “control” is also a worthless term, as water can be directed, but it cannot be subjugated (McCool 2012, 169). “The best protection against floods is to minimize construction in the floodplain and instead use the floodplain for farmland, forest, parks, wetlands, habitat, a natural water filter, and floodwater dissipation” (McCool 2012, 169). That sort of statement is key to consider if we are truly to change our way of thinking. Unfortunately, “Also, people tend to have short memories and a belief that disaster always befalls someone else. But if there is one immutable law about rivers, it is that they will flood again; it’s only a matter of time.” (McCool 2012, 170).

We need to incorporate new tools and management techniques that have potential to repair ecosystems and decrease vulnerability to flooding. As discussed earlier, ecological restoration is a management tool for streams to return a degraded ecosystem to a close approximation of its condition prior to disturbance and impairment (Merritts et al. 2014, 297). This can involve recreating or repairing both the structure and ecological functions of the restored ecosystem (Merritts et al. 2014, 297).

Water development in the U.S. is fragmented across programs such as flood control (O’Neill 2006, xix). There is not really coordination through some sort of comprehensive planning (O’Neill 2006, xix). The passing of the national Flood Control Act of 1936, basically laid to rest any hopes of nationally organized comprehensive planning for natural resources (O’Neill 2006, xx).

The Corps of Engineers’ navigation and flood control programs and their state and local partners have resisted financial reforms and have addressed the ecological problems caused by engineers by proposing ever more ambitious engineering works to restore waterways. Infrastructure works and the human organizations that created those works continue to impose limits on our actions and our imagination. (O’Neill 2006, xx).

Ultimately the best outcome is a paradigm shift as discussed in policy option three. However, giving the actual likelihood of this sort of policy being adopted, the more realistic policy option involves option two with smaller changes. As discussed below, that is the sort of change our political system is more attune to.

Climate change and flooding

Most discussions of environmental issues today should include a discussion of climate change. This is a game changer that is affecting most aspects of the environment. Particularly relevant to the issue of flooding is the expected sea level rise due to climate change.

Climate change has a wide range of direct climate consequences such as changing rainfall patterns, increased frequency of extreme climate events, decreased snow-water equivalents, earlier timing of spring melt runoff, and increased average temperatures (Beever & Belant 2012, xiii). Humans are a large part to blame for these accelerated changes (Beever & Belant 2012, xiii). There are also a wide number

of changes that climate change brings to species and ecosystems.⁴ All of these changes will affect our waterways in different ways. As a general proposition, climate change will increase the risk of floods globally, but certain areas of the world might actually see a decrease in flood frequency (Hirabayashi et al. 2013). These sorts of changes should be accounted for in future policies if those policies stand a chance of being successful. Climate change is the ultimate elephant in the room that cannot be ignored.

II. Possibilities for change- likelihood of changing occurring: theories of policy development

“The greatest arrogance was the stealing of the sun. The second-greatest arrogance is running rivers backward. The third-greatest arrogance is trying to hold the Mississippi in place. The ancient channels of the river go almost to Texas. Human beings have tried to restrict the river to one course- that’s where the arrogance began.” (John McPhee quoting Oliver Houck 1989, 11).

In our world, major disasters often lead to calls for policy changes. Large flood events in the United States fit that bill and often lead to calls for policy change in this arena. How do these types of crisis events impact future policy development?

The notion of policy development relating to drinking water in the aftermath of a crisis was previously examined by this author (Winograd 2016). There is also a discussion of theories of policy development in general which can be referenced more generally for background (Winograd 2016).

*Public policy development in the aftermath of crisis*⁵

Relevant to our current discussion is the actual likelihood of any of our given policy options occurring and then solving our problem to an acceptable degree. One possible avenue for new policies to develop is a crisis event such as a major flood. So as discussed in Winograd (2016) an important question arises: how do crises disturb established policies, institutions, cultures, and practices to provide open policy windows for reform (citing McConnell 2008)? So it is helpful to our discussion to understand the particular type of change that might flow from a crisis (McConnell 2008). Will the changes be in a sense small, medium, or large? (Winograd 2016). So a small change might be something like the U.S. Army Corps changing how it implements an existing policy (Winograd 2016). Medium would be Congress passing a new law governing flood plain management (Winograd 2016). Large would be a completely new perspective on floodplain management that fundamentally changes our approach to it (Winograd 2016). If ecosystem management became the chief aim of river development agencies like the Corps and the implementation was strong, that would be quite a paradigm shift. So what is the possibility of these different kinds of changes occurring?

⁴ For a full discussion of the ecological consequences of climate change, see *Ecological Consequences of Climate Change: Mechanisms, Conservation, and Management* (Beever & Belant 2012).

⁵ This discussion is adapted from the Author’s earlier paper *Drinking Water Policy Development: Is Crisis-Driven Policy Development the Answer?* (Winograd 2016). The discussion will examine the likelihood of major or minor changes to river management policy occurring in the United States.

Winograd (2016) examines research by McConnell (2008) which examines “postcrisis change and learning.” In order to understand how much learning will take place after a crisis, it is important to understand the “policy configuration” (McConnell 2008). This involves three key connections within a political system:

1. Vertical distribution of choices across different institutional structures,
2. horizontal distribution of choices across different institutional structures, and
3. the extent to which sectoral policy choices have been stable over time (McConnell 2008).

So in looking to whether and to what extent there is reform after a crisis, it is helpful to examine these connections between choices in the policy arena (McConnell 2008). In looking at vertical distribution, the more divided vertically between different levels of government that choices in the policy sphere are, the lower likelihood of policy reform after a crisis (McConnell 2008). Those paradigm shifts and policy reforms will not likely happen and even small changes will also be difficult (McConnell 2008). This is the structure in the United States, where there is a vertical division of powers and responsibility for choices affecting policy are divided between different levels of government (McConnell 2008). Winograd (2016) discussed that in the aftermath of Hurricane Katrina, Louisiana’s efforts to recover and learn lessons was limited by the larger federal context within which they operated because there was heavy reliance on federal funds to rebuild (citing McConnell 2008). This sort vertical overlap can make post crisis policy changes harder to implement (McConnell 2008).

Horizontal distribution looks more at the overlap of choices within a level, with more distribution leading to a lower likelihood of policy reform after a crisis (McConnell 2008). This would be two agencies in the federal government having overlapping policies. As with vertical distribution, paradigm shifts are almost impossible, and any policy reform or fine tuning will be difficult (McConnell 2008). Our government has both vertical and horizontal distribution of power, which does not naturally orient us to large-scale policy changes following a crisis (McConnell 2008). So changes to national laws or changes in social values are harder to come by in these sorts of systems (Winograd 2016).

The last connection involves incremental reforms in any given area serving as inertia for large scale change in the wake of a crisis (McConnell 2008). Where a paradigm shift was not possible before it is now actually possible, albeit still difficult (McConnell 2008). The small changes and large policy reform are also possible (McConnell 2008). So it is possible that small, incremental changes in river development policy that build up momentum can be the background to allow large scale change in the midst of large crisis type events. The key is establishing reform momentum before the large event (McConnell 2008).

So McConnell’s notion is that our modern and complex governmental structures, with the decision making spread out among horizontal and vertical levels, can hinder post crisis change (Winograd 2016).

If there is to be large change, it will stem from a history of change and an establishment of change as part of the culture (Winograd 2016).

Application of policy development theory to River Development

As we stand today, with an understanding of McConnell's Policy Configuration Approach, I would not expect individual flooding events or hurricanes by themselves to bring about any major changes in laws or massive paradigm shifts (Winograd 2016). Policies are made in the federal system with lots of government decision making ability spread out horizontally and vertically (Winograd 2016). With these systems, the smaller, incremental change is available (Winograd 2016). This is what has transpired and the resulting legislation is usually funding for building levees or new flood control projects. Bills provide funding in the wake of disaster or set up new disaster planning programs, but not large scale changes.

When we look to McConnell's third prong of the Policy Configuration Approach this is where the hope lives for large scale change (Winograd 2016). As flooding events occur with more intensity and frequency, some sort of reform momentum might be established (Winograd 2016). Then these sorts of crises can bring about small changes in the laws that build toward larger, wholesale changes and paradigms shifts (Winograd 2016). So a large flood event in the future might lead to grand scale change if the foundation is built.

In the context of general policy development as discussed in Winograd (2016), a large flood event could create a window of opportunity that joins the three streams (problem stream, policy stream and political stream) (Kingdon 1984), and paves the way for change.

Overall we should expect small changes if any, and be weary of the possibility of large changes (Winograd 2016). Small changes might involve better cooperation among governmental bodies, or successful pilot projects in river restoration.

However, if these are part of a larger stream of events across the country, and the foundation of small change builds momentum, there is potential for larger changes in the future. While it is extremely difficult for crises to bring about national level changes in policy and social values, if the almost perfect sets of circumstances arise, it is a possibility. (Winograd 2016).

III. Reflections on humanity: Hubris or intelligence?

From the ancient Greeks we have this notion of hubris or excessive pride. In Greek plays this hubris often leads to the downfall of the tragic hero. They become blinded by their excessive confidence.

For example, even from early on, our greatest intentions can backfire. We often believe we have an understanding of nature and implement a project meant to control nature and provide some benefit to humans.

The most serious physical problems resulted from two projects that pilots and merchants promoted and that the public celebrated. These projects were intended to shorten the shipping route to New Orleans and to provide better access from the Mississippi west and south through Louisiana's Atchafalaya swamp. Steamboat inventor Henry Shreve directed both projects as the Corps' supervisor of navigation contractors in the 1820s and 1830s. Shreve first cleared the 150-mile raft of logs on the Red River near Vicksburg with his new snag boat. He then cut off a nearby meander of the Mississippi River. ...President Andrew Jackson approved about \$3 million for river cleaning, more than any other prewar president spent on rivers. But more than any other interventions, these two projects inadvertently worsened flooding and navigation conditions over the next century by hastening the Mississippi's flow into the swamp and away from its current main channel past New Orleans. Thus began a pattern that is now familiar in environmental programs. The government became increasingly committed to managing river conditions, in part to control the unintended consequences of its earlier interventions. (O'Neill 2006, 41).

Is it hubris to believe we can dominate nature? Why do we attempt to control something we do not fully understand? Throughout the history of water development, we acted with a "water hubris" where we believed water development can occur without costs and with many benefits (McCool 2012, 22). Along with that assumption came the notion that we were superior to nature and that we could do better than nature (McCool 2012, 22). Time has shown this idea to be a fallacy. We do not understand the full magnitude of our actions and we must now live everyday with the price. Still further we claimed a divine right to dominate nature and tame the river (McCool 2012, 23). All of these ideas and worldviews are old and antiquated. We undertook these projects with narrow goals in mind and our tunnel vision did not look to either side for what consequences the projects would bring. This is the sort of worldview that hopefully can be erased from our psyches. If there is going to be change at any level, our orientation towards the river cannot have these sorts of notions as a background.

IV. Conclusion

"But nature wins. Nature always wins in the end. It doesn't give up. It just keeps going." (Brouwer 2003)

The U.S. was not forced by lack of options to undertake a massive flood control operation. But a combination of factors and interests brought about the current flood control regime. The federal floodplain management policies do not seem to prevent loss of life and do not seem to benefit ecosystems. If our goals involve those two notions, then change is certainly in order.

While it is difficult to completely change the system and take a more holistic approach toward water management, change is possible. It can be slow change that builds over time to large scale change. Additionally, the frequency and magnitude of large flooding events may indeed be the pulse to spur appropriate changes to the policy machine. Since such events are likely to occur more frequently and be

more damaging to humans and our infrastructure, that will ensure the issue of flood control is not ignored by policy makers and the public.

If we are aiming to conserve river ecosystems and the biodiversity that they contain, immediate action is required (Dynesius and Nilsson 2005, 759). It is clear that the current floodplain management policies are not sustainable in the long term as flood damages continue to increase, lives continue to be threatened, and the ecological function of ecosystem continue to be degraded (Loucks et al. 2008, 550). Something must change as the status quo is not enough to solve the problem.

“Many of our rivers are wounded, but they are not dead, even if they have been dammed, drained, or poisoned. For plants and animals, extinction is forever, not so with rivers. The right combination of science, politics and enthusiasm can revive them” (McCool 2012, 14)

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