

PERCEIVED SOCIAL, ECONOMIC, AND ENVIRONMENTAL COSTS/BENEFITS OF A  
FARGO-MOORHEAD DIVERSION PLAN

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**Title**

Perceived Social, Economic, and Environmental Costs/Benefits of a Fargo-Moorhead

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Diversion Plan

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**By**

Andrew John Kubas

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The Supervisory Committee certifies that this *disquisition* complies with North Dakota State University's regulations and meets the accepted standards for the degree of

**MASTER OF SCIENCE**

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## ABSTRACT

Flooding has long been an issue in the Red River Valley of North Dakota and Minnesota. Recently, leaders in the Fargo-Moorhead metropolitan area called for a permanent solution to the annual flooding woes. This solution took the form of a proposed diversion channel, an extensive ditch designed to divert a portion of the Red River west of the metro in order to lower river levels in the urban core during flooding events.

This project seeks to understand how residents in the Fargo-Moorhead community perceive the costs and benefits of the diversion plan when compared to current strategies that are in place. The purpose of the research is to understand how various flood mitigation strategies are perceived by local residents and whether or not positive and negative perceptions are a result of place-based linkages to different parts of the metropolitan area.

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## CHAPTER 1. PURPOSE AND OBJECTIVES

### 1.1. Introduction

The Fargo-Moorhead metro area is plagued by annual flooding from the Red River of the North. After experiencing harsh flooding in April of 2009, members of the community began discussion concerning solutions to the annual floods. As a result, local leaders recently chose to implement a “diversion plan”—an extensive ditch designed to divert a portion of the river west of Fargo in order to save the core cities. This decision, however, will create an “urban-versus-rural” conflict. Saving the urban core will come only at the expense of many rural communities: the diversion channel will destroy and force many family farms to relocate.

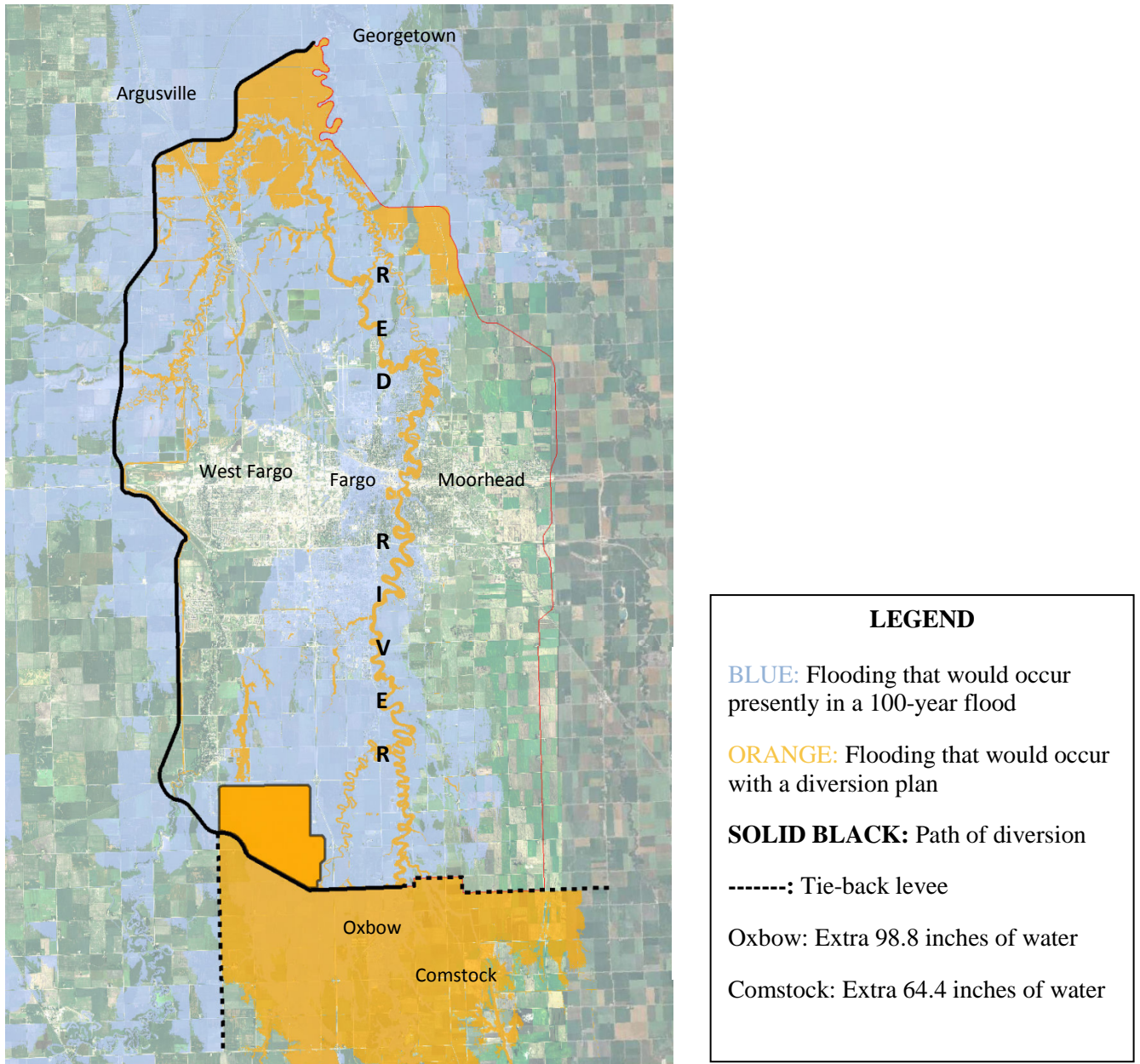
The diversion plan is a complex solution to annual flooding problems. It is a large-scale project that requires skills and input from several areas of expertise within the community: engineering, sociology, community development, economics, politics, emergency management, meteorology, and many others. The diversion is being touted as a permanent solution to annual flooding. However, many issues surrounding the diversion have not been explored in depth. Two such issues will be explored in this paper. First, despite the fact that other flood risk management techniques have been utilized with varying levels of success, little attention has been given to any flood mitigation strategy other than the diversion. Second, the implications of the diversion plan have not been studied through both an urban and rural lens. Whereas local leaders, government officials, and the Army Corps of Engineers have compiled numerous reports, scoping documents, and cost-benefit analyses, all of these sources of information have drawn conclusions based on examining the region as a whole; none have addressed the urban and rural communities separately. Thus, this paper will aim to examine how the diversion relates to other flood mitigation strategies utilized in the Fargo-Moorhead area and the impacts it will have

on urban and rural areas separately. The purpose of this project is to devise a qualitative interview form that will serve to develop a quantitative instrument used for gauging how urban and rural residents feel about implementing a diversion plan in spite of current flood projects and possible alternatives that exist as permanent flood mitigation strategies.

## **1.2. Problem Statement**

The greater Fargo-Moorhead community is particularly susceptible to spring flooding from the Red River of the North. Almost every spring the Red River floods due to geographic determinism. The river flows to the north and spans hundreds of miles simultaneously. As a result, while southern parts of the river experience the spring thaw, ice and snow melt into the river and flow north. Rather than flowing freely in the river, the melted ice and snow flow into temperatures that are still below freezing and water expands outward on frozen surfaces rather than downstream on a normal trajectory. After a major flooding event in 1997, many new flood fighting techniques were implemented; however, none of them provided permanent protection.

In 2008, local leaders first suggested that a permanent flood protection plan would be best for the community. After flooding in 2009, 2010, and 2011, residents and leaders from Fargo and Moorhead called for permanent flood protection. Ultimately, a “diversion plan” was chosen to combat flooding. This plan utilizes an extensive 36-mile long, ½-mile wide, 30-foot deep ditch built on rural farmland west of the metro area to alleviate flooding during a major flooding event (Figure 1.1). Water that is diverted into the ditch rejoins the naturally flowing river roughly 15 miles north of the metropolitan core near the town of Georgetown, Minnesota. This plan is being heralded as a permanent solution to flooding problems in Fargo-Moorhead. From a sustainability standpoint, these claims are bold: they imply that flooding will no longer



**Figure 1.1** The Diversion Plan as it Relates to Flooding in Fargo-Moorhead

be an issue for the community and thus will allow for continued growth which will make the community all the more viable. However, some externalities arise from this plan. For example, upstream communities face substantial flooding that they do not experience presently: some communities will receive over 8 feet of water during a flood event. Downstream communities also face flooding that will only be resolved via ring-dikes, a mitigation strategy that leaves individual homes as “islands” in a flood.



The costs and benefits that emerge from a diversion plan vary significantly from place to place depending on the location of a community in the greater Fargo-Moorhead area. Thus, the goal of this project is to understand how the perceived costs and benefits of a diversion plan differ from community-to-community in the region. This project will utilize interviews and documentary data analysis to better understand where the perceived benefits and where the perceived costs are most likely to take place. Although the plan is said to bring net benefits to the entire community, it appears as though a majority of those benefits are enjoyed by the core cities at the expense of the rural periphery. This project will seek to understand if this statement is true.

### **1.3. Objectives**

The core issues surrounding the diversion plan stem from a complex relationship between geographic determinism, policymaking, and various competing forms of local capital. This paper will seek to explain these issues—and their implications on both communities—via four main objectives.

Objective 1: to understand the viability of the diversion plan and why it is being considered in light of other flood mitigation strategies. To fully comprehend the role the diversion will play in flood prevention, it is important to analyze its size, scale, and how it will be utilized. Furthermore, this objective will outline how the diversion relates to plans that are presently in place to combat the 2011 (and future) flood events. The goal of this objective is to better understand how the diversion plan will work and why it is necessary in spite of other pre-existing flood prevention strategies.

Objective 2: to examine the impacts a diversion will have on rural and urban areas separately. This objective will analyze how urban and rural areas are benefited or adversely

impacted by the construction of a diversion channel. The goal of this objective is to distinguish between the efficiency and equity of the diversion. Presently, the argument is being made that—since the diversion brings “net benefits” to the community—it should be constructed. However, breaking down the community into urban and rural classifications will allow for a better understanding of *which* groups are affected by the construction of a diversion and *where* those impacts occur regionally.

Objective 3: to explain how social, economic, and environmental factors shape feelings towards a diversion plan. Community development theory suggests that a “triple bottom line” defines the overall sustainability of a community. The “triple bottom line” consists of social inclusion, economic viability, and ecosystem health. This study will aim to answer whether factors relating to the triple bottom line influence feelings about a diversion or vice versa—whether the diversion ultimately impacts the triple bottom line. Ultimately, the goal of this objective is to distinguish how different communities of interest and communities of place view the role of the diversion in the community.

Objective 4: to explore whether or not there are viable alternatives to a diversion that are mutually beneficial for both the rural and urban populations. This paper will analyze three flood mitigation strategies—the diversion plan, future without project condition (no action), and non-structural measures. The goal of this objective is to acquire qualitative data concerning possible alternatives to a diversion and use the data to create an instrument measuring feelings about alternatives that will be administered via a questionnaire.

#### **1.4. Research Questions**

In order for this study to properly analyze the diversion plan, the following research questions must be addressed. Questions one and two will be the core of this study.

(1) How do the perceived costs and benefits of the diversion plan differ between urban and rural members of the community?

(2) Are there viable alternatives to a diversion plan?

All other questions are peripheral and—while important in helping shape the understanding of how the proposed diversion plan is perceived by residents—are not the focus of this study. The other questions feed in to the first two and contain key elements of social inclusion, economic viability, and ecosystem health. The literature review will explain the extent to which these questions have been answered by currently available resources. This study will fill the current gaps (or lack of answers) that surround many of these questions.

(3) How was a diversion plan chosen as the best method for flood risk management?

(4) What social issues have played a role in the diversion being the best flood prevention method?

(5) Why is a diversion considered economically viable but current flood mitigation strategies—which have required millions of dollars—are not seen in nearly the same light?

(6) Why are the environmental implications of the diversion rarely discussed?

(7) How would a diversion plan impact rural and farming communities?

(8) Do the environmental impacts of a diversion plan affect urban and rural residents similarly?

(9) What role will eminent domain play during the construction of the diversion?

(10) How will the diversion plan be funded?

(11) What communities of place are directly impacted by the diversion?

(12) What communities of interest are directly impacted by the diversion?

This study will be important to the community in the following ways. It will provide a fair analysis of the diversion plan and its impacts on the greater Fargo-Moorhead community. Whereas other reports have looked exclusively at the metropolitan area as a whole, this study will analyze the relationship that the diversion plan will have with both urban and rural areas. This information can then be used to determine if the diversion plan truly is beneficial for all members of the community.

Additionally, this paper will reveal the political and social processes used in determining the diversion plan as being most beneficial for the community. Knowing how such a decision was made on behalf of the entire community will better allow residents to determine if local leaders did in fact act in the best interest of the community. Knowing how policy- and decision-making processes are made in the Fargo metropolitan area can serve as an outlet for community members to become more involved in issues surrounding the immediate community. This study will be important because it may challenge community members, groups, and organizations to engage in progressive participation. This study will improve public awareness regarding the diversion plan and may help improve community cohesion.

This study will also be significant in regards to better understanding alternatives to the diversion plan. Presently, very little attention has been given to flood risk management strategies other than a diversion. This study will assess the viability, protection, and implications of alternatives to a diversion. This information can be used to affirm if a diversion or some other alternative is the best option for flood protection in Fargo-Moorhead.

Finally, this study will examine numerous perceived costs and benefits associated with constructing a diversion. The costs and benefits that stem from the study—whether perceptions relating to dollars, environmental concerns, ecological impacts, or social justice—can serve as a

model to be used and studied by the community. Presently, very few studies have explored the farmland, individual property owners, funding options, and many other aspects relating to the diversion. This study will address the areas in which present research lacks in order to better understand the true perceived costs associated with implementing a diversion.

## CHAPTER 2. LITERATURE REVIEW

Flooding from the Red River of the North impacts thousands of Fargo-Moorhead residents annually. To prevent further flooding, members of the community recently explored many flood risk management strategies. One such strategy that has emerged in the forefront is that of a diversion plan—an extensive ditch designed to divert a portion of the river west of Fargo in order to save the core of the two cities. Although flooding generally affects only those in the core cities of Fargo and Moorhead, the diversion plan will—directly and indirectly—impact all of the nearly 200,000 residents that comprise both Cass and Clay counties. With the possible construction of a diversion looming, numerous reports, scoping documents, cost-benefit analyses, assessments, and articles have been written in response to the diversion plan. This literature review will survey seventeen sources and their significance and relationship to many issues surrounding the diversion plan. This chapter analyzes, critiques, and discusses existing examples of diversion plans, community groups and individuals explicitly in support of a Fargo-Moorhead diversion, those against, unbiased policy and engineering studies addressing Fargo-Moorhead diversion possibilities, and economic and funding issues that stem from a diversion. Finally, this chapter outlines the gaps in the literature.

### **2.1. Diversion Plan Strategies Used Elsewhere**

Historically, diversion channels have been used as a flood mitigation strategy mostly during the 20<sup>th</sup> and 21<sup>st</sup> centuries. Diversion plans have been implemented in many parts of the world: the Netherlands, Northwest China, the Mississippi River Delta, the Australian wetlands, the Colorado River Basin, and the Northern Red River Valley have all utilized diversions with varying levels of success and failure. This section will analyze how other areas have used diversion channels as flood risk management strategies.

Passfield (2001) outlines the Red River Floodway, a diversion channel constructed to protect the city of Winnipeg, Canada from spring flooding. Passfield effectively analyzes the history of flooding in Winnipeg, paying particular attention to the inundation that occurred in 1826, 1852, 1861, 1882, 1904, and 1916 (2001).

A majority of Passfield's work focuses on the "Great Winnipeg Flood of 1950" which became the single worst flood in the city's history. The 1950 flood inundated 10,500 homes, covered roughly one-tenth of the city, and forced over 100,000 people to evacuate their homes in the single greatest mass exodus in Canadian history (Passfield, 2001). The 1950 flood ultimately created a lake 75 miles long by 24 miles wide south of Winnipeg. With the river over flood stage for 51 days, the 1950 Winnipeg Flood became one of the greatest natural disasters in Canadian history and one of the most catastrophic events seen in Canada to that date in terms of flood damage, persons dislocated, and economic impact (Passfield, 2001).

Passfield contends that—"shocked by the severity of the flood damage, the magnitude of the population dislocations, and the high costs of the 1950 flood"—federal and provincial governments experienced a dramatic change of attitude (2001: 3). Rather than regarding flooding as a purely local problem to be addressed by the affected municipalities, federal and provincial government advocated in favor of long-term flood management.

As a result, it was recommended that a 26-mile long ditch be built to the East of Winnipeg from St. Norbert to Lockport in order to alleviate spring flooding (Passfield, 2001). After overcoming various policy delays, the project was started in 1962 and completed in 1968. The decade immediately following 1968 saw the mean annual discharge of the Red River of the North increase by 80% compared to the flooding averages from 1915-1968 (Passfield, 2001). Passfield explains that in 1969, 1970, 1974, and 1979, substantial flooding was experienced in

the Red River Valley south of Winnipeg—costing millions of dollars in damage—yet Winnipeg escaped unscathed thanks to the Red River Floodway project (2001).

Passfield concludes by arguing that the Red River Floodway has saved the city of Winnipeg many times over. In the 29-year timeframe he studied, the floodway was used 20 times, including “the Flood of the Century” in 1997 when the project yielded a cost-benefit ratio of roughly 1:40, an almost priceless return (Passfield, 2001). Ultimately, Passfield contends that the Red River Floodway has silenced its critics, established the viability of a diversion plan, the efficacy of its design, and its inestimable worth in cost-benefit terms (2001).

The article from Passfield serves as an excellent case study for successful river diversions. Passfield articulates that policy attitudes can be changed over time and funds can be successfully generated for flood risk management strategies. Furthermore, the Manitoba Royal Commission—the entity in charge of approving flood mitigation strategies—dealt with an urban-versus-rural conflict that is similar to that presently being experienced in the Fargo-Moorhead area. Whereas Fargo-Moorhead leaders have yet to thoroughly investigate the impacts a diversion will have on urban and rural areas separately, the Manitoba Royal Commission single-handedly approved the Red River Floodway—on account that it would be beneficial to both urban and rural residents—while simultaneously disapproving the Ste. Agathe detention basin on account of the fact that it would cause much of rural Southern Manitoba to be severely flooded (Passfield, 2001). Clearly, Passfield identifies a policy framework, economic implications, and social impacts that stem from a situation remarkably similar to that currently being experienced by the Fargo metropolitan area. This passage will be valuable when analyzing costs, benefits, funding, and social issues concerning the Fargo-Moorhead diversion strategy.



Burn and Goel (2001) and Simonovic and Li (2003) reaffirm the benefits that the Red River Floodway has had on the city of Winnipeg, but caution against its role as a permanent solution to inundation. Burn and Goel assert that the Red River Floodway “has prevented flood damages in the city of Winnipeg on numerous occasions” (2001: 356). However, Burn and Goel also evaluate the flood event that took place in the Red River Valley in 1997. The 1997 flood forced the Red River Floodway to operate at close to its maximum capacity—implying that a larger flood event would result in substantial flood damages within the city of Winnipeg (Burn and Goel, 2001).

Ultimately, Burn and Goel set out to identify what the actual risk of flooding is in the Red River Valley at Winnipeg. Although no specific number is given, Burn and Goel make two startling conclusions. First, despite the efforts of the Red River Floodway, “the flood risk could still be unacceptably high” (Burn and Goel, 2001: 361). Second, “it is indeed possible that the risk of newly constructed flood control infrastructure being inadequate for a future flood event may be unacceptably large” (Burn and Goel, 2001: 361). This idea is reiterated by Simonovic and Li when they contend that “there is approximately a 37% chance that this reliable capacity of the flood protection system in Winnipeg will be exceeded at least once in the next 50 years” (2003: 363). Clearly, given changing weather patterns and uncertainty about flooding in the future, a diversion should never be heralded as a permanent solution.

Kingsford (2000) examines river ecology and impacts of water resource development in floodplain wetlands in Australia. Kingsford examines one area in particular—the Macquarie River—and the ecological impacts that river diversions have had on the region. Along the Macquarie River are nine dams, eight weirs, four diversion channels, cuttings, groynes,

regulators, and siphons (Kingsford, 2000). Unlike the Red River Floodway, the Macquarie River utilizes diversions to supply water for irrigation, industry, and towns.

Nonetheless, the ecological impacts the diversions have had are immense. For example, the diversions have reduced the Macquarie Marshes to “at least 40-50% of their original size” (Kingsford, 2000: 117). Additionally, increased “low flows” of water have significantly eroded river channels (Kingsford, 2000: 117). The changes in water flow have also dramatically altered the natural habitat of many species. Species richness of water-birds in the Macquarie Marshes steadily declined over an 11-year period (Kingsford, 2000). Furthermore, change in water flow has resulted in smaller colony sizes and less frequent breeding of colonial water-birds, a decline in the area of river red gum by 14%, a decline in water couch by 40%, the near extermination of floodplain eucalyptus, the elimination of several hundred hectares of coolabahs, and has put many mature trees in poor health (Kingsford, 2000).

As a whole, Kingsford’s findings serve an important point in the development of this paper: in general, diversions have ecological consequences. Although these consequences vary significantly from region to region, the Army Corps of Engineers explicitly stated in their “*Scoping Document*” that there are serious environmental issues that need to be addressed further in the North Dakota diversion project. Kingsford’s passage reaffirms the caution made by the Army Corps of Engineers: ecological and environmental impacts of diversion channels can be devastating and must be investigated further.

Smith et al (2000) find similar environmental consequences after examining the Gabčíkovo Barrage System (GBS), a hydroelectric power system built on a section of the Danube River between Hungary and Slovakia. Originally, the two countries collaborated on a goal to utilize the river for hydroelectric power for both nations. However, the Hungarian

government—“citing a need to protect the public”—backed out of the GBS pact on account of potential adverse environmental impacts (Smith et al, 2000: 138).

Upon learning that Hungary no longer wanted to be involved with the GBS project, Slovakian officials felt the need to complete the project unilaterally using a new design that “circumvented Hungarian territory” and thus “made Hungarian cooperation unnecessary for the plan to work” (Smith et al, 2000: 138). The new plan—completed in 1996—utilized a 58 kilometer diversion of the Danube River in order to generate hydroelectric power.

The focal point of the paper addresses the environmental and ecological implications that have resulted from the diversion. It is important to understand that the diverted portion of the Danube River in Slovakia is upstream of Hungary. So despite the fact that the Hungarian government withdrew its support of the project, Hungary still faced the environmental and ecological consequences that the diversion created. Smith et al concluded that plant vegetation was damaged, forestry and wildlife habitat were depleted, tree diversity would decrease over time, and that Hungarian crop production decreased by 10-15% in the Szigetköz region of Hungary (2000).

Smith et al reaffirm Kingsford’s message that diversion channels create extensive environmental and ecological consequences. Since no two ecosystems are identical, the consequences differ dramatically from place to place. The research performed by Smith et al parallel with the Fargo-Moorhead community in the following way. Whereas Slovakia benefitted from a diversion at the expense of Hungary, the proposed Fargo-Moorhead diversion plan will benefit the core cities at the expense of rural farming communities. Smith et al provide an excellent case study that closely mirrors that which will be experienced in the Fargo-Moorhead area.

## **2.2. Community Groups and Organizations Favoring a Diversion Plan**

Numerous sources have explicitly stated that the community has a need for a diversion plan. This section will outline those in favor of bringing a diversion to the Fargo metropolitan area. Ackerman (2009) outlines the economic benefits that would stem from the construction of a diversion plan. Ackerman discusses the “Flood Protection Coalition for the F-M Community,” a group comprised of mostly Fargo and Moorhead businessmen. Ackerman indicated that a diversion would allow development and investment in the community—which is the fundamental concern of the newly formed group. Additionally, the passage reveals that the diversion plan will be particularly beneficial for Fargo, Moorhead, and West Fargo. In other words, it will provide adequate protection for the larger cities in the community—those with vested interests in expanding economic development. Furthermore, the article postulated that the diversion channel could follow the path of the Winnipeg diversion: it could not only protect the city from flooding, but could allow alfalfa to be grown in the dry channel to keep rich farmland in use and provide feed and biomass for fuel.

Whereas Ackerman made convincing points in support of a diversion, it must be noted that his contentions stem from a background filled with support of similar programs. Ackerman—aside from occasionally contributing to the Fargo Forum—is a lawyer whose firm frequently takes on cases that support the practice of eminent domain. Since a majority of the land on which the diversion will be built will be acquired via eminent domain, Ackerman is particularly biased in his support of a diversion. Furthermore, Ackerman is a contributor to the “National Eminent Domain Blog” and openly praises the diversion plan as being a step forward for flood control.

Despite his obvious bias, Ackerman does an excellent job articulating the sentiment left behind by businessmen and business owners in the region. One thing is certain: the Fargo-Moorhead economy is among the strongest in the nation. Not only has it been growing for years, but it is expected to continue to grow for years to come. If the diversion channel works as planned, it will allow for continued growth in areas that would have otherwise been inundated. This will make land that would have otherwise been previously unavailable accessible to development and economic growth. This article reflects the interests of the business owners and the economic opportunity that could be enjoyed by Fargo-Moorhead metropolitan residents if the diversion channel is constructed.

Karnowski (2010) indicates that the diversion plan has support from both residents and local leaders. Throughout the article, Karnowski interviews residents, city commissioners, state senators, and other local leaders in order to gauge how much support for the plan exists within the community. As a whole, respondents are firm in their answers that flooding needs to get fixed and must be avoided every year (Karnowski, 2010).

In addition to highlighting support from prominent individuals, Karnowski also delves into the historical connection between the Winnipeg diversion and the possible North Dakota diversion plan. Karnowski suggests that the successful plan in Winnipeg could be experienced in Fargo as well. The passage concludes with the sentiment that any plan other than the diversion would not offer the protection its citizens want (Karnowski, 2010).

The passage by Karnowski indicates that there is widespread support for a diversion—even among political leaders. The article fits into the study as a whole in that it names particularly influential leaders and their openness to support the diversion plan strategy. Moreover, part of the article's foundation is built upon the success of the Winnipeg diversion

plan constructed in the 1960s. Looking at the history and success of the Winnipeg diversion can be paralleled with Ackerman's article. Karnowski's article reaffirms the sentiment left behind by Ackerman: history shows that diversions can work—and because of this fact—numerous individuals in the community support a North Dakota diversion for varying reasons.

Kolpack (2010) further reveals that leaders in prominent positions support a North Dakota diversion project. Kolpack's article interviews Fargo mayor Dennis Walaker, Minnesota representative Morrie Lanning, Minnesota state senator Keith Langseth, and North Dakota national senator Kent Conrad and indicates how all have given support for a North Dakota diversion.

Although the article briefly touches on the fact that rural towns will suffer dramatically from a diversion, the majority of the article focuses on the benefits that arise from constructing a diversion. The article insists that a North Dakota diversion plan will provide sufficient flood protection and will be a great investment. As a whole, the article reiterates the message left by Karnowski: not only is there support for a diversion from many members of the community, but there is support from local leaders and those with political authority and influence. The efficacy of these politicians can make or break the diversion. Both Karnowski and Kolpack indicate that these leaders have the political clout to make the diversion a reality. With their support and growing support from the extended community, this article pieces together the idea that there is adequate backing in the metropolitan area to implement a diversion in the near future.

Aside from articles in favor of a diversion, there are also community groups that advocate for the plan. One such group is that of the "FM Flood Control" group comprised of a group of concerned citizens. The group's website—[www.fmloodcontrol.com](http://www.fmloodcontrol.com)—lists their fundamental belief as "the only way to truly protect the FM area is a diversion." The group also created two

youtube videos outlining how a diversion works and why it is beneficial to the extended community.

Although the website provides accurate information, it is clearly tilted towards the benefits of a diversion channel. Furthermore, the website is the brainchild of the Flood Protection Coalition for the F-M Community, so it has direct economic and business interests. Although it is heavily biased and focuses extensively on the benefits enjoyed by the core cities, it does an excellent job articulating the importance of protecting the cities of Fargo, North Dakota and Moorhead, Minnesota. The message promoted by the group goes hand-in-hand with the business and economic interests listed in the article by Ackerman.

Another group actively involved in bringing a diversion to the community is the Metro Flood Study Work Group. This 11-member committee was given the authority to choose what type of flood risk management strategy should be implemented into the community. The panel of officials includes Fargo City Commissioners, Moorhead City Council Members, Cass County Commissioners, Clay County Commissioners, the Cass County Water Resource District Manager, and the Buffalo-Red River Watershed District Manager. Ultimately, the panel voted unanimously on March 18<sup>th</sup>, 2010 to recommend a North Dakota diversion channel be built to protect Fargo-Moorhead.

Whereas it can be argued that the panel is comprised of experts, it should be noted that a clear majority of those serving in the group represent residents in the core cities of Fargo, North Dakota and Moorhead, Minnesota. For these experts, their constituents are almost exclusively residents living in just the two cities. The panel lacks comparable representation from rural farming communities that lie downstream of the proposed diversion. These rural towns and communities—like the core cities—will be directly impacted by the diversion plan. Since their

concerns are not sufficiently represented by the Metro Flood Study Work Group, the panel should not serve as the optimal voice for flood risk management.

### **2.3. Community Groups and Organizations Opposing a Diversion Plan**

Aside from those who support the diversion plan, there are those who explicitly oppose it as well. This section will outline those in the community openly opposed to bringing a diversion to the Fargo-Moorhead community. Barrett (2010) recently outlined some of the downstream impacts that would be created by the diversion. His article indicates that farming towns lying downstream of the Red River would see a dramatic increase in flooding levels on account of the diversion. The passage interviews the mayor of Hendrum, Minnesota, Curt Johannsen and reveals his worries that a diversion will turn Hendrum into an island (Barrett, 2010).

Furthermore, the article quotes Minnesota state representative Kent Eken as being in support of flood protection, but only with methods that do not devastate communities downstream of the river.

The passage does an excellent job outlining the projected costs associated with building a diversion and the burden that will be placed on local residents to raise the funds. However, the article is clearly critical of saving the core cities at the expense of the downstream rural communities. The passage references on multiple occasions the marginalization that will occur to the small farming towns if the diversion plan is pursued.

As a whole, the article fits into the greater picture in that it provides relevant data and firsthand analysis as to how a diversion will dramatically alter the lives of rural downstream communities. It provides insight into the reality that there are costs associated with the diversion—costs that appear to stem from sheer geography rather than anything else.



Gunderson (2010) contends that a diversion plan will make flooding much worse for downstream communities. His report argues that an irresolvable issue is at hand: farmers are unwilling to give up land for flood storage or construction of a diversion and urban residents are unwilling to continue with flooding in the status quo. As a result, the report at one point advocates that a federal basin authority be brought in to implement flood control that benefits *everyone* and not just urban or rural interests.

This news report is relevant to the subject being explored in that it reveals a crucial point: flood risk management is pertinent to the entire Red River Valley, but the diversion plan is only pertinent to the cities of Fargo and Moorhead. Whereas a diversion plan may solve the existing problems for the core cities, it does not resolve any of the problems experienced by surrounding communities in the Red River Valley. In order to create strong community cohesion, both sides of the discussion must be taken into account. It is inherently unfair to marginalize one group at the benefit of another. Because of this reality, this report reveals the need to take all vested interests into account prior to making an infrastructural decision of this magnitude.

In a separate report, Gunderson (2009) examines some of the social implications associated with building a diversion. The diversion ditch itself will measure 36 miles in length and require over 6,500 acres of farmland on which to be built (Gunderson, 2010). Gunderson interviewed Mark Fossum, a farmer living on land where the proposed ditch would rejoin the Red River. Fossum articulated his fears if the diversion plan is built. Fossum said he is worried about how the diversion will force his family to move, give up its farm which has been part of the family for generations, lose their livelihood, and struggle to rebuild elsewhere (Gunderson, 2010).

Gunderson's report sheds light into new areas concerning the diversion. Gunderson highlights the social implications associated with relocating families, losing livelihood, and the sentimental value that could potentially be lost by families who have owned the same land for literally generations. Gunderson delves into the reality that a project of this size has never been built in the region. Because of this reality, the report implicitly concludes that there is a need to reassess the impacts the diversion will create on the extended community. The sheer scale of this project shows the need to carefully understand all of the impacts that will stem from the diversion—both good and bad—on account of the fact that they will touch many lives and numerous communities simultaneously.

Kolpack (2009) outlines the hesitation many rural residents have regarding a diversion. The passage interviews Georgetown, Minnesota mayor Traci Goble and Perley, Minnesota mayor Ann Manley. Both are under the impression that the diversion plan would dramatically alter their way of life for the worse.

As the article indicates, the sentiment in the area favors flood protection for Fargo-Moorhead, but not at the expense of the rural towns. Furthermore, the article interviewed Diane Ista, a manager with the Wild Rice Watershed District. Ista revealed that residents in Ada, Borup, Felton, Halstad, Hendrum, Perley, and Shelly are actively organizing an opposition group called the Red River Downstream Impact Work Group (Kolpack, 2009).

This article contributes to the diversion topic in that it further shows the concerns of rural and downstream residents. It represents the need for negotiation between rural and urban citizens. Whereas there is agreement that flood risk management is needed to improve the Red River Valley, there is discord between what type of management should occur. This article reaffirms the need for compromise and negotiation in order to create strong community cohesion.

Nowatzki (2010) reiterates the idea that the loss of personal property and land will be devastating for private landowners. His article followed Tom Beaton, a farmer living in the country just west of West Fargo, North Dakota. After the Army Corps of Engineers drew up their plans for a diversion, Beaton noticed that the diversion ditch would plow right through his farmstead. With the diversion ditch running directly through the heart of his farm, Beaton suggested that it would be nearly impossible for his two sons to take over the farm. For Beaton, the diversion presents a “lose-lose” situation. Either he is allowed to keep his land with the diversion running through it—an option that essentially renders his farm useless and makes it impossible for his sons to take over—or his land and property succumb to eminent domain and he is forced to relocate and start all over.

The reality is that Tom Beaton is just one of many farmers facing a similar situation. Both the diversion and eminent domain threaten to take away their land, property, and farms. These individuals are essentially being forced to move their families and relocate. Since nearly all of these individuals belong to farming families, agriculture is essentially the only economic skill they have acquired throughout their lives. In terms of the larger picture, this article is vital because it represents the historical and sentimental value placed on the land and property owned by farming families. It proves that there is a sense of pride and history in the land that may be disrupted if the diversion is ultimately constructed.

#### **2.4. Policy and Engineering Studies Relating to Fargo-Moorhead Diversion Plans**

Thus far this literature review has examined sources biased with “pro” or “anti” diversion plan sentiment. It should be noted, however, that there are also many sources that take a neutral stance on the diversion and aim simply to educate the general public via policy and engineering education. The Army Corps of Engineers (2009) released a “*Scoping Document*” containing data

directly relating to the diversion plan. This “*Scoping Document*” focused exclusively on providing an environmental impact statement for the Fargo-Moorhead metropolitan area. The environmental impact statement extensively evaluated eighteen issues in particular: downstream water quality, downstream and upstream water quantity, the Buffalo River Aquifer, social issues, economic issues, flood fighting, environmental issues, wetlands, land use and floodplain growth, downstream erosion and sedimentation, cultural resources, fish passage, flooding, down river aquatic resources, the Fargo Southside Project, downstream recreation, natural resources along entire impacted area, and slope stability along the Red River corridor (Army Corps of Engineers, 2009).

This 217 page document has become the foundation for many articles, projections, and community meetings. It is the basis for most of the estimates concerning increased flooding levels for downstream communities. The document also addresses concerns and questions from literally hundreds of community members. The Army Corps of Engineers does a sufficient job of answering most of the questions and presenting the concerns of community members to the public. As a whole, the “*Scoping Document*” addresses potential environmental impacts, publicly discusses concerns from the community, and professionally projects some of the problems and benefits that will emerge via the construction of a diversion. This document will be a cornerstone for future research and the baseline for future estimates and projections.

The Army Corps of Engineers (2009) also released a separate “*Alternatives Screening Document*.” This study focused exclusively on the Fargo-Moorhead metropolitan area’s flood risk management. The study—which was completed in December of 2009—emphasized three key areas. First, it outlined in detail the processes used by the Army Corps of Engineers when analyzing the Fargo-Moorhead area. Second, the document extensively addressed eleven

methods of flood risk management that would be beneficial to the region. Finally, the Army Corps of Engineers made a recommendation as to what was the best flood risk management strategy based on their screening results.

This document is vital to this research project because—like its “*Scoping Document*” counterpart—it has become the basis for numerous projections and estimates concerning the impacts of a diversion. What separates this document from all of the others is that aside from examining just estimates and making predictions about a diversion, it goes a step further and studies a number of other alternatives to prevent flooding as well.

The “*Alternatives Screening Document*” outlines eleven flood risk management strategies and highlights the effectiveness, environmental impacts, cultural resources, social impacts, acceptability, implementability, cost, risk, separable mitigation, and cost effectiveness of each strategy (Army Corps of Engineers, 2009). The eleven alternatives studied are as follows: future without project condition (no action), flood barriers, diversion channels, non-structural measures, flood storage, tunneling, bridge replacement or modification, interstate 29 viaduct, dredging and widening the Red River, wetland and grassland restoration, and cut-off channels (Army Corps of Engineers, 2009).

What especially separates this document from all other literature about the diversion is that the Army Corps of Engineers concluded their report by recommending which flood risk actions should be taken by the Fargo-Moorhead community. Ultimately, the Army Corps of Engineers concluded that two of the strategies—future without project condition (no action) and diversion channels—should be explored in further detail (Army Corps of Engineers, 2009).

Because of this conclusion made by the Corps, it has been the basis for why the diversion channel has been studied extensively and debated thoroughly by community members. This

recommendation made by the Army Corps of Engineers single-handedly altered the debate within the region as to what is the best flood risk management strategy. Because of this fact, this document will play a vital role in developing this research project: it explains how the community arrived at the present path of debating the diversion.

The Army Corps of Engineers (2010) also contributed a valuable resource via a presentation to the City Engineers Association of Minnesota. This presentation outlined partners, funding, the planning process, goals, risks, alternatives, and the preliminary results that have emerged after studying the diversion plan. What makes this source unique from all others is that it was the first to have a timeline listed concerning the Fargo-Moorhead metropolitan diversion plan study.

This presentation draws on extensive research, climate and hydrologic records, and other Red River Basin studies in order to create compelling arguments about not only the need for flood risk strategies, but the specific need for a diversion plan as well. The presentation was made in an absolutely professional manner and it was evident that all aspects were researched thoroughly. What was perhaps most beneficial about attending the presentation is that Craig Evans and Aaron Snyder—the two lead project coordinators from the Army Corps of Engineers—made their contact information available to the general public and were more than willing to accept questions and responses from those who sought further information. These two project leaders will be valuable resources as this project continues into the future.

## **2.5. Economic and Funding Issues**

The West Fargo Pioneer and the Red River Basin Commission recently published articles concerning funding for the diversion. Funding is perhaps the one area of the diversion plan that has the most uncertainty associated with it. Thus far, the project is estimated to be \$1.9 billion.

Of this, roughly \$844 million will come from federal funding. In addition to these sources, the state of North Dakota has pledged roughly \$300 million to the diversion plan effort.

Furthermore, Minnesota's former Governor Tim Pawlenty has stated that the state of Minnesota will most likely contribute another \$110 million. Yet another \$200 million will come from a Fargo flood project sales tax approved by voters last year. Finally, \$10 million will come from Cass County's mill levy.

However, this leaves about \$436 million unaccounted for. This financial burden will rest almost solely on the shoulders of local citizens. Thus far, two main options have been discussed to raise the remaining \$436 million.

Reuer (2010) indicates that the first option is a sales tax. The tax that has been discussed will be a half-cent sales tax that covers Cass County, North Dakota. It is estimated that over the course of the 20-year sales tax, \$220 million dollars will be raised (Reuer, 2010). It is predicted that the average household in Cass County will spend between \$44 and \$48 per year in the sales tax (Reuer, 2010).

Schmidt (2010) reveals that the half-cent sales tax has received support from multiple groups in the community. Both the Coalition for Cass County Flood Protection and the Fargo-Moorhead-West Fargo Chamber of Commerce have endorsed the sales tax. Nowatzki (2010) explained that during the midterm election, Cass County voters voted on—and approved—the sales tax.

The sales tax, however, was not unanimously supported. Schmidt (2010) analyzed how one group—the “No Blind Tax Committee”—was formed to encourage voters to vote “no” on the sales tax measure. Nowatzki (2010) revealed that only those in the immediate Fargo metropolitan area heavily favored the tax. In a complete contrast, voters in Argusville, Arthur,

Buffalo, Casselton, Kindred, Leonard, Mapleton, and Page all opposed the tax with at least 60 percent of the vote (Nowatzki, 2010).

These facts are vital to this project because they indicate that there is not universal support for funding a diversion plan via a sales tax. This shows that there is not strong community cohesion concerning the economic implications that a diversion plan may bring to the metropolitan area. These articles prove that—in terms of funding—the project still has a long way to go before it is widely accepted in the community.

The second option being discussed is a special assessment. The proposed special assessment covers all properties in both Cass County and Clay County. The preliminary numbers show that each individual would have to pay an annual assessment of \$203 over a 25 year timeframe. Commercial properties would have to pay \$1,092 for 25 years. Over time, it is estimated that slightly over \$205 million would be raised.

The passages have been the leading voice thus far when it comes to funding plans that focus solely on the diversion. Their estimations and analysis about a sales tax will prove to be vital when discussing the economics surrounding the diversion. The diversion project is a large-scale endeavor, thus it will require large-scale funding to become a reality. This article provides some insight as to how the community can fund the project to turn what is currently just a possibility into actuality.

## **2.6. Gaps in the Literature**

Ultimately, one can conclude that the diversion plan is a particularly unique issue being addressed by the community. The diversion plan will have social, economic, and environmental implications that must be studied thoroughly. Unfortunately, a thorough investigation of these implications has not been made for both urban and rural areas separately—literature thus far has



focused extensively on examining the region as a whole. After examining this literature review, it is clear that there are many biases in favor and against a diversion. Many of these biases stem from rural, urban, farming, and non-farming backgrounds. In order to fully understand the benefits and consequences of a diversion, it is vital to address these backgrounds separately and understand how the diversion will impact all of these interests. It seems as though two vital areas are missing when analyzing the diversion. First, urban and rural interests are not being examined separately. Second, very few social, economic, and environmental consequences have been studied in depth. A more thorough investigation of the adverse impacts and benefits of the diversion plan must be given to these three areas. Addressing these two key parts of the diversion will allow the community to better understand the influence that the project will have on the community and its many diverse interests.

## CHAPTER 3. THEORY

The diversion plan, its social, economic, and environmental implications, and other factors can be studied using various theoretical lenses. These theories capture several ideas that are pertinent to the implementation of a diversion plan. This chapter will outline the Community Capitals Framework (CCF), Integrated Coastal Zone Management (ICZM) theory, resiliency theory, and the applications they have to the diversion plan.

### **3.1. Community Capitals Framework (CCF)**

The Community Capitals Framework analyzes community development efforts. What separates the CCF from other theories of development is that rather than focusing on a community's need it identifies “the assets in each capital (stock), the types of capital invested (flow), the interaction among the capitals, and the resulting impacts across capitals” (Emery and Flora, 2006: 20). Flora and Flora contend that the Community Capitals Framework is best expressed when assets are invested to create new resources (2008). These new resources are best thought of as capital. In all, Flora and Flora explain that there are seven types of capital which can be utilized by a community: “natural, cultural, human, social, political, financial, and built” (2008: 17).

Emery and Flora argue that assets and new resources can continually be created. Assets can build upon other assets as capital created from an initial development strategy and can be utilized to create additional capital (Emery and Flora, 2006). Emery and Flora define this process as “spiraling-up”—when assets gained by the community increase the likelihood that other assets will also be gained (2006: 22). Spiraling-up occurs when the following takes place within a community: outside expertise is paired with internal wisdom, youth become involved,

entrepreneurship grows, cultural capital increases, and philanthropy provides funding for more leadership, new businesses, and recruitment of youth (Emery and Flora, 2006: 22).

The Community Capitals Framework can be applied to the diversion plan in that it can demonstrate if investing in certain assets (human, financial, built capital) result in increased assets among those capitals as well as the other four capitals. Additionally, when applying the CCF to the diversion plan, it will also be a guide in determining if the Fargo-Moorhead community is indeed “spiraling-up” via the diversion plan decision.

Furthermore, Flora and Flora (2008) indicate that the Community Capitals Framework can also be utilized to identify if a community is adversely impacted by a community development policy or decision. Flora and Flora suggest that “when one type of capital is emphasized over all others, the other resources are *decapitalized*, and the economy, environment, or social equity thus can be compromised” (2008: 17). In light of this statement, the Community Capitals Framework will aid in effectively identifying if a diversion plan helps the Fargo-Moorhead community “spiral-up,” “decapitalize,” or encounter a combination of the two community experiences.

The Community Capitals Framework will involve various organizations and parts of the community. These groups will provide varying assets to the diversion plan in order to make it come to fruition. As these assets accumulate, the Community Capitals Framework will analyze their successful (or poor) transformation to capitals and the positive (or negative) impacts they bring to the metropolitan area. The following section will outline the key players in the community bringing assets to the diversion plan.

### **3.1.1. The Army Corps of Engineers**

The Army Corps of Engineers is arguably the most influential entity related to the diversion plan. The Corps utilizes human capital—unique knowledge, skills, and abilities related to engineering—in order to recommend the best flood mitigation strategy for the community. The Army Corps of Engineers also relies on pre-existing built capital to serve as a model for the Fargo-Moorhead diversion strategy; the Corps uses other channels and diversions in order to accurately gauge the effectiveness and the feasibility for a diversion channel in the Fargo community. The Army Corps of Engineers also mobilizes both bridging and bonding social capital. The Corps links experts outside of the community (flood experts, engineers, environmental experts) with knowledgeable and skilled locals (watershed district managers, city council members, city commissioners). Presently, these assets are already being mobilized and will continue to be utilized in the future.

### **3.1.2. The Metro Flood Study Work Group**

The Metro Flood Study Work Group is an eleven-member panel comprised of Fargo City Commissioners, Moorhead City Council Members, Cass County Commissioners, Clay County Commissioners, The Cass County Water Resource District Manager, and the Buffalo-Red River Watershed District Manager. In March of 2010 the panel was given the authority to choose the best flood mitigation strategy for the Fargo metropolitan area. After receiving recommendations from the Army Corps of Engineers and input from concerned citizens, the panel voted unanimously to approve a diversion plan.

The Metro Flood Study Work Group has utilized social capital as its main method of achieving flood protection. The group has combined local knowledge and input with outside expertise in order to make an informed decision regarding flood protection. Furthermore, the

group has emphasized cultural capital—in the form of flood prevention and flood fighting techniques—to mobilize locals to have support for the diversion plan. The Metro Flood Study Work Group will serve as a key example of whether the community “spirals up” or “decapitalizes” on account of this decision; although many members of the community supported the decision made by the panel, there were also many who adamantly opposed it. The group will serve as an example in the Community Capitals Framework of whether assets can effectively build upon assets—even in instances of heavy opposition from some parts of the community.

### **3.1.3. Politicians**

Politicians will play a very influential role in bringing a diversion channel to the region. Politicians have very unique assets—efficacy, clout, power—that are vital in acquiring the finances necessary to fund a diversion. State representatives, state senators, governors, national senators, and national representatives from both North Dakota and Minnesota will be necessary in order to acquire funding for the project. Thus far, the project has had bipartisan support. As a whole, politicians will use their assets to mobilize political and financial capital.

### **3.1.4. Taxpayers**

Like politicians, tax payers will play an important role in bringing the diversion plan to fruition. As mentioned in Chapter 2, federal, state, and local funding will not account for 100% of the costs related to the diversion. Ultimately, the local burden for funding the diversion will be roughly \$690 million. The general public will be using their assets—money in the form of finances raised from taxable goods—to help fund the diversion. Without this source of revenue, the diversion cannot exist.

### **3.1.5. Concerned citizen groups**

Concerned citizens will influence the success of the diversion plan. Concerned citizens represent many different views and walks of life. Concerned citizen groups rely primarily on human and social capital in order to promote their message. These groups vary immensely: some favor a diversion while others adamantly oppose it. Urban residents, rural residents, farmers, business owners, those in favor of expansion, watershed managers, environmentalists, property owners, and taxpayers all have very different ideas and opinions concerning the diversion. Like the Metro Flood Study Work Group, these groups will serve as an example of whether or not assets can build upon assets despite opposition or whether community cohesion deteriorates in times of conflict.

### **3.1.6. Individuals with property and land lying in the path of the diversion channel**

Another important group to the diversion plan is those individuals with property lying directly on the path of the proposed diversion ditch or landowners with property in the staging area. These groups face a unique situation not encountered by anyone else: they must give up land in order for the diversion to be constructed. As a whole, the diversion plan will require 6,500 acres of farmland on which to be built. In addition to the farmland, it is currently estimated that “several hundred or thousands of residents would need to be relocated” via “fee acquisitions” (FEIS, 2011: 302). These homes and farmsteads will have to be removed in order for the plan to be constructed. All of these properties and land will be acquired via eminent domain.

For those individuals who live or work on the path of the proposed diversion ditch, they face an altogether unique challenge that is unmatched by any other group related to the issues surrounding the diversion plan. The diversion plan will require that assets from these

individuals—natural capital (land) and built capital (homes, barns, irrigation systems, septic systems, electricity grids)—be acquired in order for the diversion plan to be implemented. These individuals are different from any other stakeholder in that their assets will be taken, transformed into built capital, and will literally become the diversion channel used in times of flooding. Without full cooperation from this group, the diversion plan could be delayed for months or years.

Clearly, there are many ways that the Community Capitals Framework can be applied to this research. The ideas behind the Community Capitals Framework will guide the direction of this research project. This framework will help explain the behaviors, decisions, trends, and ultimate improvement or deterioration of the community.

### **3.2. Integrated Coastal Zone Management (ICZM)**

Integrated Coastal Zone Management (ICZM) is a relatively new process for managing coastal areas in an attempt to ensure sustainability. Although intended specifically for oceanic coastal areas, it can be broadly applied to any area where water meets land. The fundamental idea behind ICZM is that coastal communities rarely prepare for the worst case scenario until *after* it happens. Locally, cities such as Grand Forks in 1997 and Bismarck in 2011 are examples that epitomize this statement.

Wilson and Wiber (2009) define integrated coastal management as a “process that unites government and community, science and management, sectoral and public interests in preparing and implementing an integrated plan for the protection and development of coastal ecosystems and resources” (560). In terms of applying ICZM to community-based projects, Wilson and Wiber (2009) define ICZM based on four distinct components:

- (1) It “should build on community based management plans;”

- (2) It “should include the integration of cultural, social, economic, and environmental spheres;”
- (3) Its “processes should be inclusive of anyone who has a stake in affected resources; and”
- (4) The “community adjacent to local resources should have a real say in the management of these resources and be able to share their experiences in a meaningful way with managers” (563).

According to ICZM, the success of a project is contingent upon two factors. First, communities must feel empowered. Empowerment takes place through project ownership, organizational credibility and a wider understanding of community needs and values (Wilson and Wiber, 2009). Second, external agencies must come to the table prepared to negotiate with communities (Wilson and Wiber, 2009). If these two steps take place, ICZM suggests that better methodologies for predicting, preventing, and repairing natural disasters will be utilized by the community.

Many parallels can be drawn between ICZM and the proposed diversion plan. For example, the diversion plan is being heralded as a permanent solution to flooding. If this statement is accurate, it suggests that the Fargo-Moorhead community is taking the necessary precautions and acting in a manner that prevents the “worst case scenario;” an approach ICZM would advocate. Moreover, issues embedded within the diversion plan align well with ICZM. For example, there are community-based flood mitigation plans in the status quo, numerous stakeholders have been invited to attending meetings to share concerns regarding the diversion, and a variety of communities with diverse stakeholders are directly adjacent to the resource. By



analyzing how the diversion plan parallels the four key components of ICZM, this project will reveal the extent to which empowerment and negotiation are established.

### **3.3. Resiliency Theory**

Resilience, in its simplest form, is the “capacity of a material or system to return to equilibrium after a displacement” or, alternatively, the “speed with which homeostasis is achieved” (Norris et al, 2007: 127). When applied at the community level, resilience can be thought of as “a process linking a set of adaptive capacities to a positive trajectory of functioning and adaptation after a disturbance” (Norris et al, 2007: 130). Walker and Salt (2006) contend that a “system with little resilience is vulnerable to being shifted over a threshold into a new regime of function and structure” (141).

At its core, resiliency theory suggests that as the levels of resilience within a community diminish its susceptibility to change subsequently increases. Thus, the more resilience that is found within a community the better: the community will be more prepared for a sudden, unexpected change.

According to Walker and Salt (2006), diversity within the community is synonymous with resiliency via a concept they introduce as “response diversity” (145). The idea behind response diversity is straightforward: communities that have higher levels of diversity in plants, animals, and the landscape are more likely to adapt and overcome change. The logic behind this argument is simple: a community with more traits in the gene pool will have a greater likelihood of surviving change.

Resiliency theory draws many parallels to the Red River diversion plan. Norris et al (2007) contend that resilience is contingent upon both “the resources themselves and the dynamic attributes of those resources” (135). Thus, one can argue that resilience in the Fargo-

Moorhead community will be largely dependent upon the importance of the resources that will be used when moving forward with the diversion plan. Many resources are required for the diversion plan. Private property, farmland, farmsteads, natural capital, financial capital, homes, and entire sections of rural communities will be forever altered once the diversion channel is in place. Examining the diversion plan through the lens of resiliency theory will create a better understanding of whether the community has strengthened or deteriorated.

Ultimately, Norris et al (2007) conclude by arguing that “resilience is a process that leads to adaptation, not an outcome, not stability” (144). Understanding the diversion plan via resiliency theory will reveal if the Fargo-Moorhead community perceives that it will adapt to the diversion plan successfully or if it will respond poorly.

## CHAPTER 4. METHODS

This study analyzed a majority of the Fargo-Moorhead metropolitan area. It included two states, multiple cities, and many rural communities. The diversion channel could potentially impact policy not just in the United States, but in Canada as well. Decisions made concerning the diversion plan will both directly and indirectly influence many parts of the community. This chapter will analyze the methods in which data were acquired for this study and how the data related to the diversion plan and the different demographics of the community.

The research questions outlined in this study focus on how the perceived costs and benefits of the diversion plan differ between urban and rural communities and whether or not viable alternatives to the diversion have support from local community members. The research questions place emphasis on the implications and benefits that stem from implementing different flood prevention techniques. In terms of policy, this study seeks to explain how a diversion plan was chosen, why it is considered the best flood mitigation strategy, if viable alternatives exist, and how economic issues such as funding and eminent domain will be resolved. In regards to implications, this study aims to clarify the perceived costs and benefits that result from the diversion in terms of social, economic, and environmental issues. Costs and benefits will be explored through both an urban and rural lens.

In order to adequately answer these research questions, different types of data must be obtained. Data from interviews and documents were used in this study. A mixed method approach was used to collect and analyze these data. Mixed method approaches collect and analyze both qualitative and quantitative data, mix the two forms of data, give priority to one or both forms of data, use these procedures in a single study or in multiple phases of a program of study, frame these procedures within philosophical worldviews and theoretical lenses, and

combine the procedures into specific research designs that direct the plan for conducting the study (Clark and Creswell, 2010).

The diversion was studied via two phases. The first section of this research project will be known as “Phase I.” Phase I consisted of the development of an instrument used to measure how local residents believe the costs and benefits of the diversion will affect them directly. Phase I relied heavily upon qualitative interviews to gauge what concerns and expectations locals have. Although Phase I predominantly used qualitative interviews, it was supplemented with documentary data analysis in order to best understand how residents believe the diversion plan will impact their lives. Phase II will test the instrument in order to determine quantitative values of the issues surrounding the diversion. Phase II will sample a portion of the Cass County, North Dakota and Clay County, Minnesota population. The sample will receive a survey which—based on the qualitative responses generated by the instrument in Phase I—will ask individual respondents to measure potential costs and benefits from the diversion via Likert scales and ranking/ordering. These responses will generate quantitative data as related to the diversion. Phase II is outlined in further detail towards the end of this chapter.

#### **4.1. Interviews**

Interviews were the primary data source for Phase I of this study. Mayors, city administrators, city commissioners, county commissioners, business owners, urban residents, and rural residents were interviewed for this study. A total of 13 interviews were conducted. Nine initial interviews gathered information from local government officials. Following those interviews, four more were conducted with local residents involved with either the diversion plan or annual flood fighting. The initial nine individuals were randomly selected using a stratified sample. The sample was created by gathering contact information for individuals from the Army

Corps of Engineers, politicians, members serving on the Metro Flood Study Work Group, local citizen groups, affected farmers, affected landowners, public leaders, Cass County officials, Clay County officials, City of Fargo contacts, City of Moorhead contacts, and City of West Fargo contacts. All individuals were from the Fargo-Moorhead metropolitan community; only residents from Cass County, North Dakota and Clay County, Minnesota were interviewed. The initial sample frame consisted of 65 individuals. After these interviews were conducted and the contact list was exhausted, invitations for interviews were extended to members of local groups such as the MnDak Upstream Coalition and those actively involved in flood prevention, flood mitigation, and annual flood fighting efforts. From these invitations, four more contacts were included and serve as the basis for the thirteen interviews that make up the qualitative data used in this study. Interviews took place at a location chosen by the interviewee for convenience. Appendix A provides a sample of the instrument that was used during interviews to acquire data along with a list of potential questions that may have been asked to the various interviewees.

Officials from both urban and rural areas were interviewed in order to obtain a balanced perspective from the community. Seven government officials from the urban communities of Fargo, North Dakota, West Fargo, North Dakota, and Moorhead, Minnesota were interviewed in this study. In addition to the government officials, two residents from urban backgrounds were questioned for this project. Two government officials from rural towns were interviewed to understand the competing perspective of feelings towards the diversion plan. Aside from these officials, the researcher also spoke to two rural residents directly affected by the diversion plan in order to gain their understanding of its impacts.

All interviews were audio recorded, transcribed, and codified via emergent theme content analysis. Atlas.TI software version 5.1 was utilized to organize interviewee responses. Atlas.TI

software was also used to produce thought maps indicating how respondents linked costs and benefits to various social, economic, and environmental issues. Appendix C provides all of the thought maps that were used in this study. All recordings and transcriptions were safeguarded to protect the privacy of all individuals that gave responses during this study.

Interviewees were neither paid nor rewarded for their responses. The section of this paper labeled “ethical issues” outlines steps that were taken to protect the privacy of all respondents.

#### **4.2. Documentary Data**

Documentary data include government documents, newspaper articles, and materials distributed throughout the community that relate directly to the Fargo-Moorhead diversion plan. The majority of documentary data used in this study was obtained from the Army Corps of Engineers and the *Fargo Forum*. These two sources have been the leaders in covering issues with the Fargo-Moorhead diversion plan. Two key documents from the Army Corps of Engineers—the “*Alternatives Screening Document*” and “*Scoping Document*”—helped direct the interview protocol. These two documents outlined what flood mitigation strategies were considered and ultimately studied as possible flood fighting techniques to be used by the Fargo metropolitan area. The Army Corps of Engineers plans to release more documents as more studies and analysis takes place regarding the diversion plan.

In addition to the documentary data analysis that was performed to direct the interview protocol, this method was also utilized to fill an initial gap from rural respondents. This gap was filled via two sources: blogs and letters of support/concern. Blogs are a relatively new source of documentary data. Blogs from two rural sources—the Stop the Fargo Dam Project and the MnDak Upstream Coalition—were studied to understand how members from these two entities

perceive the ways in which the diversion will impact their lives. Furthermore, letters from rural residents to the “*Final Environmental Impact Statement*” released by the Army Corps of Engineers were analyzed to understand the types of costs and benefits that other rural residents believe will stem from the diversion. Documentary data was analyzed using emergent theme content analysis. The themes that emerged were then compared to interview data in order to further analyze any patterns that may have developed in the diversion plan.

### **4.3. Timeline**

January 2011: Identification of initial stakeholder contacts.

February 2011: Thesis proposal meeting with committee members.

March – July 2011: Initial interviews and data collection.

Purposive sampling will be utilized in order to determine which residents are chosen for interviews. A purposive sample targets the individuals thought to be most central to the research questions. A sample frame for this project has been created by the research team. This sample frame has the contact information for these individuals. The contact information includes the names, titles, phone numbers, e-mail addresses, and addresses for those most central to the project. Those individuals being interviewed will be randomly selected from the sample frame.

June – July 2011: Analysis of interviews, additional data collection.

July – November 2011: Additional interviews, documentary data analysis.

December 2011: Analysis of data.

December 2011 – January 2012: Findings and discussion write up of Phase I.

January 2012: Phase II Instrument issued.

February 2012: Analysis of instrument data

March 2012: Phase II findings, discussion, and conclusion write up.

April 2012: Thesis completion and defense.

#### **4.4. Data Analysis**

Triangulation refers to “the traditional view that quantitative and qualitative research might be combined to triangulate findings in order that they may be mutually corroborated” (Clark and Creswell, 2010: 62). Triangulation utilizes multiple methods in a study to cross examine results. The idea behind triangulation is that if different methods lead to the same results, the researcher can have more confidence in the findings within the study. This study will utilize triangulation in order to establish if multiple methods result in the same results—which produces more confidence—or if multiple methods result in clashing results—which may lead to reframing questions and reconsidering methods used during the data acquisition process.

#### **4.5. Methodological Issues**

Methodological issues will arise on account of the differences between the rural and urban communities. There is a stark contrast in lifestyle between those living in the core cities and rural communities in the Fargo metropolitan area. Whereas the economy of the core cities is defined by services, education, and heavy-duty agricultural machinery production, the economy in the rural communities immediately surrounding Fargo-Moorhead is based almost exclusively on agriculture.

With different economies and lifestyles come different government philosophy and political ideology. Since this study will rely heavily on interviews, these differences will create skewed data due to personal priorities, interests, and subject matter knowledge.



In addition to different lifestyles, economies, philosophies, and ideologies, the two areas have dramatically different experiences when it comes to flooding and proximity to river water. Whereas the cities of Fargo and Moorhead experience annual flooding from the Red River during the spring thaw, rural communities lying upstream of the river rarely experience the same levels of flooding. Because the proposed diversion plan will bring dramatically increased levels of flooding to rural communities, it is believed that answers regarding feelings, support, and opposition to a diversion plan will stem largely from emotion, experiences, and proximity to flooding rather than objective, neutral responses.

#### **4.6. Phase II**

Thus far, this chapter has identified methods relating directly to Phase I of this project. It is equally as necessary, however, to understand how Phase II relates to this project. Phase II will test the instrument created in Phase I in order to create quantitative data from the qualitative data obtained in Phase I. Phase II will consist of a survey and questionnaire two to one double-sided page in length. The front page of the survey presented a map of the Red River Valley, the current path of the Red River, and the area in which the diversion plan is proposed to be placed. The map included a legend highlighting features such as tie-back levees, channels, other rivers, and depths of flooding expected in the metropolitan area. The reverse side of the questionnaire had 37 statements in which respondents were encouraged to “strongly agree,” “strongly disagree,” or fall somewhere in between with on a scale of one to five. In addition to these 37 statements, the survey also asked respondents to provide four demographic responses: their age, gender, zip code, and the amount of time they have lived at their present location. Respondents were asked to reply to statements that identified possible social, economic, and environmental costs and benefits that may arise with a diversion in place. These three areas were treated

equally: six statements concerning costs and benefits were assigned to each of the three social, economic, and environmental focal points. The thirty-seventh question asked respondents to rank their level of support for the diversion on a scale of one to five. With the exception of the portion of the survey that related to demographic information, Likert scales were exclusively used to gauge sentiments of the survey-takers. These data acquired from this survey is what was used to create quantitative data.

The survey was taken by 115 current students at North Dakota State University. Thirty-six respondents were from a Sociology of Organizations and Work (SOC 233) class. 79 respondents were from a combination of the Natural Resources Management Capstone and Seminar class (NRM 491/690) and the Natural Resources and Agrosystems class (NRM 225). In addition to answering questions about the diversion plan, respondents provided information concerning their age, gender, zip code, and time spent living at their present location. Knowing these factors allowed the researcher to test the results across different groups. Results in this study were tested by the type of class that the student was enrolled in, but future uses of the instrument can examine differences across urban/rural, town/town, town/city, city/city, male/female, age group, permanent/new residents, and many other interfaces. Phase II adhered to all IRB requirements.

#### **4.7. Ethical Issues**

Some ethical issues arose in relation to interviewee privacy and informed consent. Public leaders and officials are much more known and accessible to the public. Therefore, all respondents were given codes to ensure anonymity during the interview and transcription process. All interviewees were given a four-character code and were quoted using their unique codes rather than a name basis. This study will protect identifiable information to the fullest.

In all research projects, the areas of beneficence, nonmaleficence, and justice must be addressed thoroughly. Beneficence refers to actions that encourage the wellbeing of others. Beneficence aims to prevent and remove all possible harms in a research study and improve the situation of those being studied. In research projects, this means taking the most ethical approach in all aspects of the study. In terms of this project, all research methods and methods of acquiring data will promote wellbeing rather than harm. All research methods will comply with IRB and NIH standards.

Nonmaleficence refers to the idea that—first and foremost in research projects—one should do no harm. The idea behind nonmaleficence is that—in some research instances—it is better to not do something or do nothing at all rather than take a risky action that may cause more costs than benefits. Although it is highly unlikely that such instances will arise in this project, this study will avoid all potential harm to its interviewees.

Justice is a principle that examines who receives the benefits of a research project and who bears its burdens. In order to provide justice in a research project, the researcher must thoroughly strategize how potential subjects are selected in order to avoid skewed data from easy availability, compromised positions, and manipulability. Throughout this project, the selection of research subjects will be scrutinized by the researcher in order to guarantee that the costs and benefits of the research are shared equally across communities.

The North Dakota State University Institutional Review Board will be used as a guide to guarantee that all potential ethical issues are taken into consideration (Appendix B). Steps will be taken to ensure that privacy concerns are met and that instances of identifiable information are reduced as much as possible.

## CHAPTER 5. PHASE I FINDINGS

The purpose of this project is two-fold and is being developed in two distinct phases. The first phase devised a qualitative interview form that was used to obtain perceived costs and benefits of two distinct situations regarding flood mitigation in the Fargo-Moorhead metropolitan area. The first scenario highlighted the diversion plan and asked respondents to list the costs and benefits they believed would occur for three categories: social, economic, and environmental issues. The second situation also asked respondents to indicate perceived social, economic, and environmental costs and benefits. However, rather than discuss issues surrounding the diversion plan, respondents provided answers to present flood prevention techniques such as using sandbags, dikes, levees, and buyouts to fight annual inundation.

The second phase, which will be discussed later in this paper, used the responses from Phase I to develop a quantitative instrument that will be used to gauge how residents weigh issues relating to flooding and the two mitigation situations presented to them. This project measures the perceived costs and benefits of two altogether different flood fighting techniques in both a qualitative and quantitative way. It is believed that—based on where one lives within the Fargo-Moorhead community—perceptions towards the two situations will be significantly different; this study aims to either reaffirm or dismiss this belief.

Interviews were the primary source of data acquisition for Phase I. Thirteen focused, half-hour long interviews were conducted between June 1<sup>st</sup> and November 15<sup>th</sup>, 2011. Nine initial interviews were conducted with local government officials. Following the interviews with government officials, four interviews were conducted with local residents involved in flood mitigation strategies. Only those from Cass County, North Dakota and Clay County, Minnesota were interviewed for this study. Interviews were audio recorded, transcribed, and codified via

emergent theme content analysis. Atlas.TI software version 5.1 was used to organize interviewee responses. Appendix C shows thought maps that were produced using the Atlas.TI software. The thought maps represent a qualitative way to understand the relationships between costs and benefits of the two situations presented to interviewees.

In addition to data from interviews, documentary data analysis was performed to fill an initial gap from rural respondents. Concerns from two blogs—the Stop the Fargo Dam Project and the MnDak Upstream Coalition—and letters/responses from rural residents to the “*Final Environmental Impact Statement*” released by the Army Corps of Engineers were studied to understand perceived costs and benefits from rural residents. Documentary data analysis also helped direct the interview protocol. The “*Alternatives Screening Document*” and the “*Scoping Document*” released by the Army Corps of Engineers were analyzed to understand what flood mitigation strategies were considered and ultimately studied as potential flood fighting techniques to be used in the Fargo-Moorhead community.

### **5.1. Phase I: Interview Data Analysis**

Responses from interviews suggest that there are three competing visions at play regarding the diversion plan (Table 5.1). As expected, due to increased flooding upstream and continued flooding issues downstream, rural interviewees do not want a diversion plan and do not have one in use presently. Similarly, urban respondents want a diversion on account of the flood protection it provides to the core cities, and also do not have a diversion presently. West Fargo interviewees, however, present an alternative vision that must be taken into consideration. Unlike rural and urban respondents, interviewees in West Fargo currently have flood protection from the Sheyenne River Diversion, a channel that was put in place in the 1990s to divert water from the Sheyenne River and provide 500-year flood protection to West Fargo citizens. Like the

**Table 5.1** Three Competing Visions Relating to Red River Diversion Plan

Three “Competing Visions		
	Want a Diversion	Do Not Want a Diversion
Have a Diversion	??	West Fargo
Do Not Have a Diversion	Fargo, Moorhead (“Urban”)	Upstream, Downstream (“Rural”)

responses from rural interviewees, West Fargo respondents are also opposed to the Red River diversion due to where the channel will be placed. The Red River diversion will be placed just west of the city limits of West Fargo. Its placement completely limits where West Fargo can develop into the future and many West Fargo leaders believe that it will not allow for continued growth—both economic and demographic—heading into the future.

It should be noted that the results which appear in the following tables and analysis are relative to the number of times they were mentioned by interviewees. It should be stressed that the number of interviewees were low in number. The numbers presented in the following pages *cannot* be generalized or extrapolated to fit the greater resident population. These numbers are only suggestive of the relative importance for these particular interviewees.

### **5.1.1. West Fargo results**

West Fargo respondents believed that there were more costs than benefits with both scenarios (Table 5.2, Table 5.3). It should be noted that West Fargo respondents identified more total costs with the second and third scenarios than with the diversion plan scenario. This is likely due to the fact that West Fargo residents have a unique situation: they have experienced the impacts of their own diversion—and thus can candidly speak of the benefits and drawbacks it brought to their community—and can simultaneously oppose the new Red River diversion plan on account of the limitations it will bring to the city and its ambitions for future development. For example, one West Fargo respondent indicated that having “the diversion will put limits on the developable area” (Interviewee Code NDA2, Page 3, Line 1). The reality is that the

**Table 5.2** West Fargo Perceived Costs and Benefits of Scenario 1: Diversion Plan

<b>Perceived Costs and Benefits of Scenario 1 (Diversion Plan): West Fargo Counts; n=2</b>		
	<b>COSTS</b>	<b>BENEFITS</b>
<b>SOCIAL</b>	8	8
<b>ECONOMIC</b>	8	1
<b>ENVIRONMENTAL</b>	1	2

proposed Fargo-Moorhead diversion channel will be placed just miles west of the current Sheyenne River diversion. The result is that West Fargo will no longer be able to grow in a westward direction. Due to other city limits and natural boundaries, West Fargo’s future development will be severely limited.

**Table 5.3** West Fargo Perceived Costs and Benefits of Scenarios 2 and 3: No Diversion

<b>Perceived Costs and Benefits of Scenarios 2 and 3 (No Diversion): West Fargo Counts; n=2</b>		
	<b>COSTS</b>	<b>BENEFITS</b>
<b>SOCIAL</b>	14	3
<b>ECONOMIC</b>	15	6
<b>ENVIRONMENTAL</b>	1	3

In terms of the costs and benefits of using a diversion plan as a permanent flood mitigation strategy, West Fargo respondents identified the greatest numbers of costs and benefits relating to social issues. Of the social issues, the fact that some communities will be wiped off the map was the biggest concern identified by respondents; it was mentioned on four occasions (Table 5.4). As one interviewee put it, “they [upstream rural communities] will be gone! The whole community will be gone!” (NDA2, 2: 40). This is a particularly interesting statement to make given the fact that a similar situation took place in the 1990s during the erection of the Sheyenne River diversion. Just as rural farmland will be needed for the path of the Red River diversion, so too was rural land required for the Sheyenne River diversion to be constructed. In regards to other issues, all other social, economic, and environmental costs were evenly dispersed and mentioned only one or two times. West Fargo respondents still identified more costs than benefits—particularly in economic issues—when asked about keeping the status quo via scenarios 2 and 3 (Table 5.5).

**Table 5.4 West Fargo Interviewee Results of Scenario 1: Diversion Plan**

<b>Perceived Costs and Benefits of Scenario 1 (Diversion): West Fargo Results; n=2</b>		
	<b>COSTS</b>	<b>BENEFITS</b>
SOC.	<ul style="list-style-type: none"> <li>-Some communities will be wiped off the map (4)</li> <li>-Farmers flooded deeper and longer (1)</li> <li>-Diversion limits where WF can develop (1)</li> <li>-Bridges/transportation in WF affected (1)</li> <li>-Negatively impacts emergency vehicles (1)</li> </ul>	<ul style="list-style-type: none"> <li>-People won't worry about flooding (2)</li> <li>-Diversion can provide extensive population growth (2)</li> <li>-Diversion can provide extensive housing growth (2)</li> <li>-Protects the most people possible (1)</li> <li>-Protects FM; most people work in FM (1)</li> </ul>
ECON.	<ul style="list-style-type: none"> <li>-\$1 million local share (1)</li> <li>-Home buyouts to make reservoir (1)</li> <li>-Upstream businesses wiped out (1)</li> <li>-Diversion limits where WF can grow (1)</li> <li>-Substantial maintenance costs (1)</li> <li>-\$1.7 billion to build (1)</li> <li>-1/2 cent sales tax (1)</li> <li>-Waiting costs more than \$1.7 billion with inflation (1)</li> </ul>	<ul style="list-style-type: none"> <li>-Residents won't worry about losing money from fighting flood (1)</li> </ul>
ENV.	<ul style="list-style-type: none"> <li>-Wetlands would be impacted (1)</li> </ul>	<ul style="list-style-type: none"> <li>-Takes away water from FM metro (1)</li> <li>-Wildlife minimally impacted (1)</li> </ul>

**Table 5.5 West Fargo Interviewee Results of Scenarios 2 and 3: No Diversion**

<b>Perceived Costs and Benefits of Scenarios 2 and 3 (No Diversion): West Fargo Results; n=2</b>		
	<b>COSTS</b>	<b>BENEFITS</b>
SOC.	<ul style="list-style-type: none"> <li>-Requires sandbagging time (3)</li> <li>-Provides a lesser level of protection (2)</li> <li>-Community shuts down to fight flood (2)</li> <li>-Schools shut down (2)</li> <li>-Puts stress on residents (2)</li> <li>-Destroys neighborhoods and community cohesion via buyouts (2)</li> <li>-No guarantee people can relocate in area (1)</li> </ul>	<ul style="list-style-type: none"> <li>-We don't sandbag; no lost time (1)</li> <li>-When we do sandbag, it's to help FM; community cohesion (1)</li> <li>-Bought out areas can be turned into green space (1)</li> </ul>
ECON.	<ul style="list-style-type: none"> <li>-Will still require buyouts (3)</li> <li>-Costs time/money to fight flood for two weeks during the spring (3)</li> <li>-People don't spend money when they are worried (2)</li> <li>-Businesses won't locate in FM for fear of flooding (2)</li> <li>-You may lose jobs (1)</li> <li>-You may lose value of homes (1)</li> <li>-Loss of tax base (urban) (1)</li> <li>-Why should WF have to pay for something only benefitting FM? (1)</li> <li>-FM didn't pay for our diversion, why should we pay for theirs? (1)</li> </ul>	<ul style="list-style-type: none"> <li>-\$1.7 billion can be spent on other mitigation (3)</li> <li>-Costs less than a diversion (1)</li> <li>-No maintenance costs (1)</li> <li>-Businesses may choose to locate in WF in favor of FM (1)</li> </ul>
ENV.	<ul style="list-style-type: none"> <li>-Sandbags often create contamination (1)</li> </ul>	<ul style="list-style-type: none"> <li>-Not affecting floodplains (1)</li> <li>-Not affecting wetlands (1)</li> <li>-Green space can flood naturally (1)</li> </ul>

Among the greatest concerns for West Fargo residents are lost time due to sandbagging, the fact that buyouts still must take place for scenarios 2 and 3 to be realized, and the lost time



and money that result from fighting the flood for two weeks. Perhaps the sentiment of one West Fargo interviewee sums it up best: “people are getting tired of sandbagging” (NDM9, 2: 37-38). As the interviews progressed, this belief seemed to resonate with all respondents interviewed. The biggest benefit expressed by West Fargo respondents is that the money which would have been spent on the diversion plan can instead be spent on other flood mitigation strategies to protect the region.

**5.1.2. Urban results**

Urban residents had an expected result: respondents indicated that there were more benefits with a diversion and more costs without one (Table 5.6, Table 5.8). Urban residents paid particular attention to economic issues. In the words of one urban interviewee, the diversion is “a must to save the economic vitality of the region, [of] which we are the hub” (NDC8, 1: 26). When it came to the diversion plan scenario, benefits outweighed costs by a 28 to 26 ratio (Table 5.6). Many of the economic benefits discussed by urban respondents appear to be directly linked with one another. For example, one can argue that saving the economic hub of Fargo-Moorhead will attract new businesses to locate in the area which will then provide for continued economic growth and will play a role in keeping housing values strong (and so forth). Based on this perception, urban residents have a lot to gain with a diversion plan in place as a permanent flood prevention strategy.

What is perhaps most interesting about the perceived costs and benefits of a diversion plan from urban residents is that costs were greater than or equal to benefits for both social and

**Table 5.6** Urban Perceived Costs and Benefits of Scenario 1: Diversion Plan

Perceived Costs and Benefits of Scenario 1 (Diversion Plan): Fargo and Moorhead Counts; n=7		
	COSTS	BENEFITS
SOCIAL	6	6
ECONOMIC	15	18
ENVIRONMENTAL	5	4

**Table 5.7** Urban Interviewee Results of Scenario 1: Diversion Plan

<b>Perceived Costs and Benefits of Scenario 1 (Diversion Plan): Fargo and Moorhead Results; n=7</b>		
	<b>COSTS</b>	<b>BENEFITS</b>
SOC.	<ul style="list-style-type: none"> <li>-Downstream and upstream communities unfairly impacted (2)</li> <li>-Buyouts will alter neighborhoods (1)</li> <li>-7,000 acres of farmland needed (1)</li> <li>-Project takes 10 years to build; people can't sell homes (1)</li> <li>-Creates urban-versus-rural conflict (1)</li> </ul>	<ul style="list-style-type: none"> <li>-Calls for less home buyouts than not having a diversion (2)</li> <li>-Protects 1/5 of all North Dakotans (1)</li> <li>-Population will not worry about flooding (1)</li> <li>-Reduces mental stress (1)</li> <li>-Provides a safe, non-floodable community (1)</li> </ul>
ECON.	<ul style="list-style-type: none"> <li>-1/2 cent sales tax (5)</li> <li>-Calls for some home buyouts (3)</li> <li>-Project takes 10 years to build; people can't sell homes (2)</li> <li>-Diversion alone won't work; you need to pay for other measures as well (1)</li> <li>-Downstream communities will be forced to buy flood insurance (1)</li> <li>-7,000 acres of farmland needed (1)</li> <li>-Requires annual maintenance (1)</li> <li>-\$1.7 billion (1)</li> </ul>	<ul style="list-style-type: none"> <li>-Most of the \$1.7 billion will be spent locally (3)</li> <li>-Saves the economic hub of FM (2)</li> <li>-New businesses will want to locate here (2)</li> <li>-Provides continued economic growth (2)</li> <li>-Will keep housing values high (2)</li> <li>-\$1.7 billion is less than \$6 billion (2)</li> <li>-Saves money from the cost of annual flood fight (1)</li> <li>-Metro homes no longer pay flood insurance (1)</li> <li>-Homeowners get fair price for buyout (1)</li> <li>-Money spent locally = Multiplier Effect (1)</li> <li>-Requires annual maintenance = more jobs (1)</li> </ul>
ENV.	<ul style="list-style-type: none"> <li>-Fish passage (3)</li> <li>-Diversion crosses 4 rivers (1)</li> <li>-Destroys animal habitats (1)</li> </ul>	<ul style="list-style-type: none"> <li>-Wetlands will be preserved (1)</li> <li>-Wildlife minimally impacted (1)</li> <li>-Erosion will decrease (1)</li> <li>-Engineered to avoid marina problems (1)</li> </ul>

environmental issues. In terms of social issues, urban respondents identified an equal number of costs as benefits with implementing a diversion channel as a permanent flood mitigation strategy. When it came to environmental issues, urban interviewees actually suggested that there would be more costs—five total—than benefits—four—with a diversion. This realization proves an important point. First, the claim that the diversion will provide net benefits to the area may need to be broken down not just by urban/rural designation, but by type of benefit as well. For urban respondents, economic issues were so prevalent that they skewed the overall perception of whether or not a diversion channel would be beneficial to the community. If economic issues were not taken into consideration, the diversion plan would actually have net costs and negative impacts as perceived by urban officials who are, presumably, those that want the diversion plan the most.

**Table 5.8** Urban Perceived Costs and Benefits of Scenarios 2 and 3: No Diversion

Perceived Costs and Benefits of Scenarios 2 and 3 (No Diversion): Fargo and Moorhead Counts; n=7		
	COSTS	BENEFITS
SOCIAL	35	6
ECONOMIC	41	5
ENVIRONMENTAL	9	5

In a complete contrast, urban residents indicated that there were a substantially higher number of perceived costs associated with keeping the status quo (Table 5.8). Urban responses show that costs outweighed benefits in Scenarios 2 and 3 by a ratio of 85 to 16. The five issues most commonly associated with maintaining the status quo as perceived by urban respondents are as follows: houses need to be bought out; residents are tired of sandbagging; businesses do not want to locate here for fear of flooding; residents will continue to worry about flooding; and buyouts will harm neighborhood and community cohesion (Table 5.9). Interviewee MNM3 stated that the Fargo-Moorhead community “isn’t even being considered” by some businesses as a viable place to locate on account of fears about annual flooding (2: 35). According to interviewee NDC3, there is “a fear impact” that stems from worrying about flooding: which leads to “anxiety issues” and an overall sense of worry and apprehension in the community (2: 25; 2: 28). Clearly, urban responses indicate that there is a stark contrast in the perceived costs and benefits of having a diversion plan and using present flood mitigation strategies.

Unlike implementing a diversion plan, urban residents identified the greatest number of benefits of maintaining the status quo with social issues. Urban respondents suggested that current flood fighting techniques unite the community via sandbagging efforts each spring. Furthermore, responses show that if these strategies were to be carried out in the future, urban residents believe that the fear element would be greatly reduced and that land which was previously flooded can be reallocated for beneficial uses, such as recreational trails or green spaces.

### 5.1.3. Rural results

Rural residents had an unexpected result. Whereas one would expect rural respondents to identify more costs than benefits with a diversion and more benefits than costs using current flood fighting methods, rural respondents actually identified more costs than benefits in all of the scenarios presented to them (Table 5.10, Table 5.12). In terms of implementing the diversion plan as a permanent flood mitigation strategy, rural responses indicated that the cost-to-benefit ratio was 39:10 (Table 5.10). Unlike West Fargo and urban respondents, rural responses placed an equal emphasis on social and economic issues (Table 5.11). One such issue that was

**Table 5.9** Urban Interviewee Results of Scenarios 2 and 3: No Diversion

<b>Perceived Costs and Benefits of Scenarios 2 and 3 (No Diversion): Fargo and Moorhead Results; n=7</b>		
	<b>COSTS</b>	<b>BENEFITS</b>
<b>SOC.</b>	<ul style="list-style-type: none"> <li>-People are tired of sandbagging (9)</li> <li>-Buyouts harm community cohesion (7)</li> <li>-Residents will worry about flooding (6)</li> <li>-Population decline (5)</li> <li>-People are tired of flooding (1)</li> <li>-Some houses become islands; dangerous during emergencies (1)</li> <li>-Bought out families may not relocate here (1)</li> <li>-Students may not want to stay here (1)</li> <li>-Potential students may not want to stay here (1)</li> <li>-Intentionally putting people in peril (1)</li> <li>-Impossible to save everyone with sandbagging (1)</li> <li>-Students had to miss school (1)</li> </ul>	<ul style="list-style-type: none"> <li>-Community comes together to sandbag (2)</li> <li>-There's no worrying if the river is left to flood naturally (2)</li> <li>-Land can be used for recreational trails (1)</li> <li>-84% of Moorhead families that were bought out relocated elsewhere in Moorhead (1)</li> </ul>
<b>ECON.</b>	<ul style="list-style-type: none"> <li>-Houses need to be bought out (11)</li> <li>-Businesses don't want to locate here for fear of flooding (7)</li> <li>-A 500-year flood would cost us \$6 billion (5)</li> <li>-Annual flood fighting costs \$10 million, we would eventually pay the equivalent of a diversion (5)</li> <li>-Lose tax base (5)</li> <li>-Economy would be devastated during flood (3)</li> <li>-Homes required to buy flood insurance (2)</li> <li>-Homes depreciate in value (1)</li> <li>-Businesses may leave community (1)</li> <li>-Other retention strategies are costly (1)</li> </ul>	<ul style="list-style-type: none"> <li>-Saves the community \$1.7 billion (3)</li> <li>-With federal assistance, a typical (\$10 million) flood is easy to fight (1)</li> <li>-Buyout moving expenses are covered by the city (1)</li> </ul>
<b>ENV.</b>	<ul style="list-style-type: none"> <li>-Erosion will increase (3)</li> <li>-"Sluff" bank (2)</li> <li>-River widening (1)</li> <li>-River structure will weaken (1)</li> <li>-Sedimentation will occur (1)</li> <li>-Mold in flooded areas (1)</li> </ul>	<ul style="list-style-type: none"> <li>-River (and tributaries) flow naturally (4)</li> <li>-Farmland will thrive (1)</li> </ul>

**Table 5.10** Rural Perceived Costs and Benefits of Scenario 1: Diversion

Perceived Costs and Benefits of Scenario 1 (Diversion): Rural Counts; n=4		
	COSTS	BENEFITS
SOCIAL	16	4
ECONOMIC	16	4
ENVIRONMENTAL	7	2

presented on multiple occasions was the fact that—in one rural community, due to the proposed alignment of the diversion plan—“the Catholic church would not rebuild” after it becomes destroyed to make room for the path of the ditch (MNM1, 8: 20). Many of the social costs identified by rural respondents appear to be directly linked to one another. For example, one can argue that home buyouts likely lead to the fact that no businesses and entrepreneurs are willing to locate to the area on account of its uncertain future. This, in turn, has led to gradual population decline which, eventually, will have a direct impact on the Kindred School District’s enrollment numbers and taxable properties.

Economic issues were equally as important to rural interviewees. Rural respondents paid particular attention to issues surrounding farming and agricultural activity. Responses show that the ability to continue farming is very important to rural residents. This appears to be directly linked to housing and property values: according to rural respondents, if a property is no longer able to be farmed, it depreciates in value substantially. Since there is so much uncertainty surrounding rural farming communities if the diversion is implemented, it may explain why property values have declined in the status quo and why they are expected to continue to decline in the immediate future.

In terms of utilizing no action or non-structural measures as flood prevention techniques, rural respondents revealed that these strategies, too, have more costs than benefits. The cost-to-benefit ratio was 46:9 (Table 5.12). Rural residents suggested that—under scenarios 2 and 3—

**Table 5.11 Rural Interviewee Results of Scenario 1: Diversion**

Perceived Costs and Benefits of Scenario 1 (Diversion): Rural Results; n=4		
	COSTS	BENEFITS
SOC.	<ul style="list-style-type: none"> <li>-The church won't rebuild (3)</li> <li>-Population decline (2)</li> <li>-Nearly impossible for farmers to relocate (2)</li> <li>-Homes forced to be bought out (2)</li> <li>-You will take away a historical aspect of city (1)</li> <li>-You will take away homes that have been in family for generations (1)</li> <li>-You still need other flood fighting techniques beyond a diversion (1)</li> <li>-We don't want Fargo to grow exponentially (1)</li> <li>-Bought out properties can only be used as parks or recreation (1)</li> <li>-Kindred School District enrollment declines (1)</li> <li>-No one will want to develop in a part of the metro with such uncertainty (1)</li> </ul>	<ul style="list-style-type: none"> <li>-Allows our (rural downstream) community to grow (2)</li> <li>-Allows Fargo to grow as big as it wants to (1)</li> <li>-May result in more parks and recreational opportunities (1)</li> </ul>
ECON.	<ul style="list-style-type: none"> <li>-Home values have declined (3)</li> <li>-FM economy hurt because rural residents will boycott ½ cent sales tax (3)</li> <li>-No guarantee federal funds will exist (2)</li> <li>-Buyouts reduce tax base (2)</li> <li>-Won't be able to farm (2)</li> <li>-Attorney fees to fight diversion (1)</li> <li>-Crop/Flood insurance does not cover costs from man-made structures (1)</li> <li>-Urban cities pay \$12,000/month to promote pro-diversion message (1)</li> <li>-Still need to pay flood insurance (1)</li> </ul>	<ul style="list-style-type: none"> <li>-We can improve development (3)</li> <li>-Fargo citizens no longer pay for flood insurance; will save money (1)</li> </ul>
ENV.	<ul style="list-style-type: none"> <li>-Will create sluffing (3)</li> <li>-Will likely create more erosion (1)</li> <li>-Where do all the animals go? (1)</li> <li>-Loss of topsoil during flood (1)</li> <li>-Must cross tributaries and bridges (1)</li> </ul>	<ul style="list-style-type: none"> <li>-Diversion will push water away faster (1)</li> <li>-Will reduce the time that downstream communities are "islands" (1)</li> </ul>

issues surrounding flooded road networks, the need to sandbag, and fears concerning future flooding were most prevalent (Table 5.13). One rural respondent recounted the time in 2009 when—due to spring flooding—all of the local roads “were closed off for 6 weeks” making travel more time consuming and difficult during emergency situations (MNM2, 2: 9).

Above and beyond difficult driving conditions in rural areas that stem from annual spring flooding, rural respondents also mentioned on numerous occasions the impacts that ring-diking has on the community. Ring-diking is the practice of forming a circle (or “ring”) of sandbags around a piece of property in order to ensure that it is dry during a flood event. Ring dikes result

**Table 5.12 Rural Perceived Costs and Benefits of Scenarios 2 and 3: No Diversion**

<b>Perceived Costs and Benefits of Scenarios 2 and 3 (No Diversion): Rural Counts; n=4</b>		
	<b>COSTS</b>	<b>BENEFITS</b>
<b>SOCIAL</b>	22	6
<b>ECONOMIC</b>	16	2
<b>ENVIRONMENTAL</b>	8	1

in properties that are “islands” during severe flooding. The impacts of ring dikes were noted on numerous occasions. Some respondents revealed that, when a home is ring-diked, emergency services are not able to reach it. Similarly, schools or other important properties that are ring-diked shut down during the flood event and are rendered useless during that timeframe. The “island effect” forces residents to stock up on medical supplies, groceries, and energy sources in order to guarantee that the occupants will survive the flood. This requires extra income and

**Table 5.13 Rural Interviewee Results of Scenarios 2 and 3: No Diversion**

<b>Perceived Costs and Benefits of Scenarios 2 and 3 (No Diversion): Rural Results; n=4</b>		
	<b>COSTS</b>	<b>BENEFITS</b>
<b>SOC.</b>	<ul style="list-style-type: none"> <li>-We still need to sandbag (7)</li> <li>-Roads remain under water for prolonged periods of time (6)</li> <li>-Residents worry about flooding (3)</li> <li>-Emergency services are impacted (2)</li> <li>-Some homes need to be relocated (1)</li> <li>-Buyouts reduce number of people who can help fight flood (1)</li> <li>-Community becomes an “island” (1)</li> <li>-Schools shut down (1)</li> </ul>	<ul style="list-style-type: none"> <li>-Farmers come together and lend equipment (2)</li> <li>-Sandbagging creates community cohesion (1)</li> <li>-Neighboring communities band together to fight the flood (1)</li> <li>-Land can be used for green space (1)</li> <li>-Most homes upstream are above 500-year level; won’t flood anyway (1)</li> </ul>
<b>ECON.</b>	<ul style="list-style-type: none"> <li>-Local businesses suffer during the flood (3)</li> <li>-No tax revenue from bought out homes (3)</li> <li>-Homeowners must pay flood insurance (2)</li> <li>-Some buyouts are still necessary (1)</li> <li>-Farmers use clay for levees; fields get damaged (1)</li> <li>-Grain elevators are under water (1)</li> <li>-\$2.7 million locally for buyouts (1)</li> <li>-Costs for sandbags (1)</li> <li>-Costs for water pumps (1)</li> <li>-Some farmers are building \$30,000 - \$40,000 levees to protect their own land (1)</li> <li>-People use vacation time to fight flood (1)</li> </ul>	<ul style="list-style-type: none"> <li>-Money used for diversion can be spent on other flood mitigation strategies (2)</li> </ul>
<b>ENV.</b>	<ul style="list-style-type: none"> <li>-Erosion is presently an issue (3)</li> <li>-Fields slowly move in (1)</li> <li>-Trees are lost during flooding (1)</li> <li>-Fish are caught in dips when river recedes (1)</li> <li>-River debris left on roads (1)</li> <li>-Silt and topsoil issues (1)</li> </ul>	<ul style="list-style-type: none"> <li>-Better fishing (1)</li> </ul>

preparation time in order to ensure that one can live safely and comfortably during the weeks that a home can be at “island stage.” Clearly, rural residents identified a majority of drawbacks under both scenarios; neither was considered preferable to the other.

## **5.2. Additional Theme: Personal Element**

Beyond identifying costs and benefits that pertain to the entire metropolitan area as a whole, interviewees revealed that one other theme emerged as well: personal connections to the costs and benefits that stem from the proposed diversion channel. Interviewees identified ways in which the diversion plan personally affected their lives. They provided examples that were unique from person to person and altogether different from the issues presented at the community level. Embedded within the personal issues discussed by interviewees were three common areas: time, property, and finances.

Since the focus of this project is to understand perceived costs and benefits as they relate *to the community as a whole*, it is not practical to provide in-depth analysis of how the personal element shapes the diversion plan discussion. The personal element should be recognized as an important theme to consider—albeit a much smaller theme when compared to the community-wide costs and benefits. Issues mentioned via the personal element have been incorporated into the thought maps throughout Appendix C.

## **5.3. Phase I: Documentary Data Analysis**

Documentary data analysis was performed to fill a gap left behind by rural respondents. Three documents were analyzed in this process. Two blogs—one from the Stop the Fargo Dam Project and one from the MnDak Upstream Coalition—were studied to have a better understanding of the perceived costs and benefits of a diversion plan by rural residents. In



addition to the blogs, the “*Comments to the Final Feasibility Report and EIS*” released by the Army Corps of Engineers was also studied via documentary data analysis.

Unlike interview data, documentary data analysis only pertained to one of the scenarios: implementing a diversion plan. Since documentary data analysis was used to fill the gap and create a proportionate number of rural responses, responses from these three sources are overwhelmingly from a rural point of view.

Documentary data analysis was performed as a tool to enhance the mixed methods approach. It was utilized as a way to see if perceived costs and benefits are uniform across West Fargo, urban, and rural backgrounds.

**5.3.1. West Fargo results**

West Fargo responses were limited from the documentary data analysis. This is likely due to the fact that only three documents studied took a West Fargo perspective. In all, only two total issues were raised by West Fargo residents. The results are somewhat similar to interview data in that the perceived costs of the diversion plan outweigh the perceived benefits, but substantial conclusions regarding any parallels should not be made on account of the small sample that was worked with. It should be noted that the issues that were discussed during the documentary data analysis were comparable to perceived issues brought up during interviews. West Fargo interviewees discussed the negative impacts that the diversion would have to farmland and farmers. Furthermore, West Fargo interview responses showed uncertainty

**Table 5.14** Perceived Costs and Benefits of Scenario 1: West Fargo Documentary Data

<b>Perceived Costs and Benefits of Scenario 1: West Fargo Documentary Data</b>		
	<b>COSTS</b>	<b>BENEFITS</b>
SOC.	None (0)	None (0)
ECON.	-Destroys productive farmland (1)	None (0)
ENV.	-Crosses multiple rivers (1)	None (0)

stemming from the fact that the diversion will cross multiple roads and bridges—an idea that goes hand-in-hand with the fact that the channel will also have to cross multiple rivers as water is diverted into the channel and heads northward. Although no substantial conclusions can be made from the documentary data analysis, it is interesting to note how, despite limited responses, there are parallels between issues brought up by West Fargo residents in interviews and issues brought up after surveying three documents.

### 5.3.2. Urban results

Documentary data analysis of urban responses show comparable results to those obtained from interviews. Just as benefits outweighed the costs for urban interviewees, so too do perceived benefits outweigh costs for urban responses from documentary data. The benefits of the diversion outweigh the costs by a ratio of 22:12. It should be noted that just as urban responses from interviews showed precedence towards economic issues, documentary data analysis reveals the exact same trend. Moreover, every issue that was presented in the documentary data analysis was discussed in interviews. Whereas the fact that the diversion will save the economic hub and will cost less than damages from a 500-year flood were mentioned in interviews by urban respondents twice, respectively, they were mentioned 13 and 9 times, respectively, in the documents that were studied. Furthermore, references to destroying productive farmland, the \$1.7 billion price tag, issues with fish passage, and the need for the

**Table 5.15** Perceived Costs and Benefits of Scenario 1: Urban Documentary Data

<b>Perceived Costs and Benefits of Scenario 1: Urban Documentary Data Results</b>		
	<b>COSTS</b>	<b>BENEFITS</b>
SOC.	None (0)	None (0)
ECON.	-Destroys productive farmland (7) -\$1.7 billion (3)	-Saves the economic hub (13) -500-year flood would cost \$10 billion (9)
ENV.	-Fish passage (1) -Crosses multiple rivers (1)	None (0)

structure to cross multiple rivers were all presented by urban respondents during the interview process.

Clearly, there are a number of parallels that can be made between perceived costs and benefits from urban residents when it comes to both interview and documentary data. This is an example of how one method can be used to complement and reaffirm the other. It reveals how—despite using different methods—one can still arrive at the same conclusion.

### **5.3.3. Rural results**

In terms of documentary data analysis, rural residents had the highest number of responses. This is to be expected given the fact that the documents studied were from predominantly rural sources. As expected, rural responses from documentary data analysis show that the perceived costs of a diversion plan greatly outweigh the perceived benefits. This is comparable to the data obtained from interviews in which the perceived costs of the diversion plan outweighed the perceived benefits by a ratio of nearly four-to-one. In fact, after surveying the documents, not one social, economic, or environmental benefit was mentioned by a rural resident. Moreover, even the proportion of social, economic, and environmental costs are similar. In interviews, rural residents identified 16 social, 16 economic, and 7 environmental costs if a diversion channel is built. This 2.28:2.28:1 ratio is analogous to the 3.19:3.19:1 ratio that stems from 31 social, 32 economic, and 10 environmental issues that were brought up during documentary data analysis.

Furthermore, a majority of the perceived costs brought up by rural residents in the documentary data were also discussed during interviews. This once again reaffirms the mixed methods approach and suggests that different methods can lead to the same result. Results from

**Table 5.16** Perceived Costs and Benefits of Scenario 1: Rural Documentary Data

Perceived Costs and Benefits of Scenario 1: Rural Documentary Data		
	COSTS	BENEFITS
SOC.	-Impacts school districts (13) -Destroys farmland (9) -Farmers can't relocate (3) -Loss of community cohesion (3) -Roads/Travel impacted (1) -Leads to population decline (1) -Slows emergency vehicles (1)	None (0)
ECON.	-\$1.7 billion (10) -Loss of tax base (10) -Declining property values (5) -No crop insurance available for man-made floods (5) -Some rural businesses forced to relocate (1) -Hinders future rural economic development (1)	None (0)
ENV.	-Crosses multiple rivers (4) -Creates unstable soils (3) -Impacts fish passage (2) -Carbon impact due to loss of trees (1)	None (0)

the documentary data reveal that rural residents are concerned about the same issues, whether they are presented in writing or a face-to-face format.

#### **5.4. Combination of Findings: Use in the Instrument**

The results of both interview data and documentary data analysis revealed two important themes. First, regardless of what method was used, the same issues were discussed by the three different demographics. West Fargo, urban, and rural respondents listed perceived costs and benefits that were either identical or comparable to one another in both interviews and in documents available within the community. Second, two altogether different methods resulted in the same conclusions. This reaffirms the results and lets the methods build on one another.

Phase II of this project will use an instrument to provide a quantitative element for measuring perceived costs and benefits and how certain issues are weighted by different parts of the community. In order to create that instrument, the responses from two qualitative methods—interviews and documentary data analysis—were combined to create a list of the most common costs and benefits perceived by Fargo-Moorhead residents.

Table 5.17 provides a chart of the perceived costs and benefits that were discussed most often in the interviews and documents as they relate to implementing the diversion plan. The frequencies for which each issue was mentioned are provided in parentheses.

Table 5.18 is a chart highlighting perceptions about costs and benefits as they relate to Scenarios 2 and 3: taking “no action” and/or using “non-structural measures.” The list was created based on costs and benefits that were discussed the most in interviews and documentary data. Like Table 5.17, the frequencies of each issue are indicated inside parentheses.

The issues emphasized in Tables 5.17 and 5.18 will serve as the foundation for the instrument and will be a baseline for measuring the perceived costs and benefits in a numerical way. Phase II will discuss quantitative measurements of costs and benefits for the issues presented throughout this study.

**Table 5.17 Combined Frequencies of Perceived Costs and Benefits—Scenario 1: Diversion**

<b>Costs and Benefits to be Used for Instrument: Scenario 1 (Diversion)</b>		
	<b>COSTS</b>	<b>BENEFITS</b>
SOC.	<ul style="list-style-type: none"> <li>-Impacts school districts (14)</li> <li>-Destroys farms and farmland (9)</li> <li>-Communities wiped off map (6)</li> <li>-Church won't rebuild (3)</li> <li>-Loss of community cohesion (3)</li> <li>-Homes must be bought out (2)</li> </ul>	<ul style="list-style-type: none"> <li>-Reduces mental stress and worry about flooding (4)</li> <li>-Allows rural (downstream) communities to grow (2)</li> <li>-Calls for less home buyouts than not having a diversion (2)</li> <li>-May result in more parks and recreational opportunities (1)</li> <li>-Protects 1/5 of all North Dakotans (1)</li> </ul>
ECON.	<ul style="list-style-type: none"> <li>-\$1.7 billion (14)</li> <li>-Reduced tax base (12)</li> <li>-Property values have declined (8)</li> <li>-Destroys productive farmland (8)</li> <li>-1/2 cent sales tax (6)</li> <li>-No crop insurance for man-made floods (6)</li> </ul>	<ul style="list-style-type: none"> <li>-Saves economic hub of FM (15)</li> <li>-\$1.7 billion is less than 500-year flood (11)</li> <li>-Most of \$1.7 billion spent locally (3)</li> <li>-Improves FM development opportunities (3)</li> <li>-New businesses will want to locate here (2)</li> <li>-FM residents no longer pay flood insurance (1)</li> </ul>
ENV.	<ul style="list-style-type: none"> <li>-Fish passage (6)</li> <li>-Crosses multiple rivers (6)</li> <li>-Creates unstable soils (4)</li> <li>-Creates sluffing (3)</li> <li>-Carbon impact due to loss of trees (1)</li> <li>-Will create more erosion (1)</li> </ul>	<ul style="list-style-type: none"> <li>-Wildlife minimally impacted (2)</li> <li>-Pushes away water faster (1)</li> <li>-Reduces amount of time downstream communities are “islands” (1)</li> <li>-Wetlands will be preserved (1)</li> <li>-Engineered to avoid marina problems (1)</li> </ul>

**Table 5.18** Combined Frequencies of Perceived Costs and Benefits—Scenarios 2 and 3: No Diversion

<b>Costs and Benefits to be Used for Instrument: Scenarios 2 and 3 (No Diversion)</b>		
	<b>COSTS</b>	<b>BENEFITS</b>
SOC.	<ul style="list-style-type: none"> <li>-Requires sandbagging (19)</li> <li>-Residents will worry about flooding (9)</li> <li>-Buyouts harm community cohesion (7)</li> <li>-Roads remain under water for a long time (6)</li> <li>-Population decline (5)</li> <li>-Schools shut down (3)</li> <li>-Community shuts down to fight flood (2)</li> <li>-Some homes become “islands” (2)</li> <li>-Emergency services impacted (2)</li> </ul>	<ul style="list-style-type: none"> <li>-Sandbagging results in community cohesion (4)</li> <li>-No fear if river floods naturally (2)</li> <li>-Land can be used for recreational trails (2)</li> <li>-Farmers band together and lend equipment (2)</li> <li>-Most upstream communities are above 500-year level (1)</li> </ul>
ECON.	<ul style="list-style-type: none"> <li>-Requires buyouts (14)</li> <li>-Lose tax base (9)</li> <li>-Businesses won’t locate in area for fear of flooding (9)</li> <li>-500-year flood would cost billions (5)</li> <li>-Annual flood fighting costs \$10 million (5)</li> <li>-Must buy flood insurance (4)</li> <li>-Economy devastated during flood (3)</li> <li>-Costs time/money to fight flood (3)</li> </ul>	<ul style="list-style-type: none"> <li>-\$1.7 billion can be used on other mitigation (5)</li> <li>-Costs less than a diversion (1)</li> <li>-Saves community \$1.7 billion (1)</li> <li>-Typical flood can be easily fought/paid for with federal assistance (1)</li> <li>-Buyout moving expenses covered by city (1)</li> </ul>
ENV.	<ul style="list-style-type: none"> <li>-Erosion will increase (6)</li> <li>-Creates “sluff” bank (2)</li> <li>-Sandbags create contamination (1)</li> <li>-Sedimentation will occur (1)</li> <li>-Mold in flooded areas (1)</li> <li>-Silt and topsoil issues (1)</li> </ul>	<ul style="list-style-type: none"> <li>-River can flow naturally (4)</li> <li>-Not affecting floodplains (1)</li> <li>-Not affecting wetlands (1)</li> <li>-Green space can flood naturally (1)</li> <li>-Farmland will thrive (1)</li> <li>-Better fishing (1)</li> </ul>

## CHAPTER 6. PHASE II: A PROCESS FOR TRANSFORMING DATA

Chapter 5 focused on how nominal level qualitative data was obtained for this study and the role it played in developing the items used in the quantitative instrument. This chapter will outline the process used to transform nominal level qualitative data to quantitative data that can be used for various statistical analyses. The chapter will focus extensively on answering the following question: how does one create a quantitative instrument from qualitative interview data?

There are eight steps within a process that were used to quantify costs and benefits stemming from qualitative interview data (Table 6.1). By no means is this the only process for transforming data. However, it should be noted that the process identified in Table 6.1 takes place in a logical, sequential order. The steps are meant to build and expound on one another; you cannot complete Step 6 until you have completed Step 5. Similarly, it would be impossible to pretest an instrument if transcription has not yet taken place.

Steps one, two, and three of this process were identified in the methods section (Chapter 4) of this paper. Step four, which determines which issues will be tested in the instrument, was discussed in Chapter 5. This chapter will explain the importance of steps five through eight and how they were utilized in this study.

**Table 6.1** A Process for Transforming Qualitative Data to a Quantitative Instrument

<b>Process</b>
1. Obtain Qualitative Interview Data
2. Transcribe Interviews
3. Codify
4. "Pull" Items
5. Draft(s) of Instrument
6. Pretest Instrument
7. Run for Disquisition
8. Use in Separate Discipline

Step five involves writing multiple drafts of the instrument. In order to create a powerful instrument, it must have three key components. The first component revolves around one central question: how is the researcher going to approach the issues? There are three ways a researcher can create an instrument to approach issues: the instrument can be specific to the project, completely generic, or designed for uses in multiple disciplines.

If an instrument is designed in such a way that it approaches issues that are completely specific to the project, survey questions are generally framed in a way that elicits targeted responses. The survey/questionnaire will generally have no immediate use in related fields and will not be useful in different industries.

When an instrument is planned to be completely generic, it highlights questions and issues that can be paralleled to related fields as well. For example, in terms of this project, questions could be posed in such a way that they relate to issues concerning flooding or sandbagging in addition to the diversion plan. The goal of designing a completely generic instrument is to ensure that it not only obtains answers to the issue at hand, but that it can also be applied to other similar fields that may benefit from the research.

Instruments aimed for multidisciplinary use are perhaps most powerful. They are created in such a way that certain terms or phrases within the questionnaire can be “swappable” with altogether different issues. For example, if the instrument used in this study were to replace the term “diversion plan” with “oil development in western North Dakota,” it may elicit satisfactory results explaining some of the costs and benefits that oil development has brought to that part of the state. Ensuring that all survey components are “swappable” can be difficult, however, and the questionnaire must be crafted accordingly.



The second component in creating a powerful instrument is to ensure that there is balance in the number of items that are asked. If an instrument is weighted in one direction, it may not garner results that are truly representative of the beliefs of respondents. Similarly, if an instrument focuses on one particular theme, valuable data regarding other themes may be lost. For the purposes of this study, 37 questions were asked. A total of six questions referenced perceived costs and six questions referenced perceived benefits for three separate themes: social, economic, and environmental issues. This guaranteed that each theme had an equal number of costs and benefits being asked to respondents. The 37<sup>th</sup> question asked respondents to rate their level of support or opposition to the proposed diversion plan. In addition to these core questions, simple demographic information was obtained. This information included age, gender, zip code, and amount of time the respondent has lived at their present location.

The final component in creating a useful instrument is to include response direction within the questionnaire itself. Direction can be attained via Likert scales, ranking and ordering, or asking respondents to provide feeling thermometers for specific issues. Direction ensures that perceptions towards issues can be described as positive, negative, neutral, or somewhere else in the middle. For the purposes of this survey, Likert scales were used in a range of 1 to 5. The scale worked as follows: 1=Strongly Agree, 2=Agree, 3=Neutral, 4=Disagree, and 5=Strongly Disagree. Having these five intervals allows for various statistical analyses that can be used to quantify attitudes and perceptions towards specific issues. In addition to direction, demographic data were obtained to determine correlations between age, gender, location, and time lived at the present location. A sample of the instrument that was used can be found in Appendix D.

The sixth step was to pretest the instrument. This was done in a SOC 233: Sociology of Organizations and Work. Thirty-six North Dakota State University students took the

questionnaire during the pretest. The purpose of pretesting the questionnaire was to determine if any questions were outliers—meaning that an overwhelmingly large percentage of respondents either answered the question the same way or left it blank altogether on account of not knowing or refusing to answer the question being asked.

Upon pretesting the instrument, it was determined that no questions were major outliers. The sample of students from the SOC 233 class had expected results: with respect to correlations between the six cost/benefit areas and overall support for the diversion plan, the sample of students had the exact values one would expect. This will be discussed further in Chapter 7. Because the results were as expected, the instrument was not altered when ran in two additional classes.

The seventh step is to run the instrument for this thesis. The instrument was given to two separate classes of students in natural resources management. The first class was NRM 491/690: the Natural Resources Management Capstone and Seminar class. The second class was NRM 225: Natural Resources and Agrosystems. A total of 79 students took the questionnaire between these two courses. The purpose of the seventh step is to prove that the instrument not only has a practical application, but that it also has academic merit and can be used as a valuable tool for advancing knowledge about the perceptions of issues that directly relate to the diversion. This step is pertinent only to disquisitions in that it demonstrates how the standards and requirements for earning a graduate degree are met.

The eighth and final step is to apply the instrument across disciplines. This step pertains only to instruments that were framed to be generalized and applicable in other disciplines beyond just the one being studied. The eighth step serves to validate that the instrument has broad applicability and a purpose in other disciplines as well. In terms of this particular instrument, it

is tentatively planned for use in a project measuring the costs and benefits of oil development in the seventeen western North Dakota oil counties. Its use in that project is contingent upon thesis deadlines and the oil county project's deadlines lining up with one another.

### **6.1. Validity and Reliability**

It is important that any instrument be both valid and reliable. This portion of Chapter 6 will aim to explain the validity and reliability of the instrument and its use with the proposed Fargo-Moorhead diversion project.

Validity relates to the extent with which a study accurately measures what the researchers set out to measure. There are three types of validity that must be studied in terms of this project. The first is face validity. Face validity refers to how a procedure appears and whether or not said procedure seems as though it will work reliably, is well designed, and will acquire the appropriate data. For the purposes of this instrument, face validity relates to the interviews that were conducted, their codification and transcription processes, and all of the steps outlined in this chapter which transformed nominal level qualitative data into a measureable instrument.

Convergent validity suggests that—when gathered independently—some measures should be related. For example, there should be a positive relationship between those who actively sandbag and those who strongly agree that they are tired of sandbagging. Similarly, there should be a strong correlation between those from zip codes representing Oxbow, Hickson, Christine, and other upstream communities and those individuals answering that they do not support the diversion plan.

Discriminate validity contends that there will be no relationship between measures which, in theory, should not be related. For example, there should be no relationship between gender and the probability of paying flood insurance after the diversion plan is implemented. Paying for

flood insurance is not contingent upon gender, but rather is predetermined by one's proximity to the floodplain.

Reliability refers to the accuracy of the measuring instrument itself. Two types of reliability were examined in this study. Equivalency reliability relates two tests with one another to understand relationships and associations between the groups. Equivalency reliability will be established by both pretesting the instrument and running it for the purposes of satisfying thesis requirements. This will provide two datasets with which to test correlation coefficients between various independent and dependent variables. Having multiple datasets to study will allow the researcher to understand if there are similar relationships between two very different groups.

Internal consistency examines how instruments analyze the same characteristics and qualities. For the purposes of this study, the instrument is consistent because it asks respondents to provide an equal number of responses to costs, benefits, social, economic, and environmental issues. No single issue or side is given preference to another.

## CHAPTER 7. PHASE II FINDINGS: QUANTITATIVE DATA ANALYSIS

In order to obtain quantitative data, the questionnaire was tested in three separate classes at North Dakota State University. In total, 115 valid responses from students provided the data for analysis. These students came from various educational backgrounds, although all were enrolled in either SOC 233, NRM 225, or NRM 491/690. It can be said that the data obtained from the sociology class best represents the general population. Data from the two natural resources management classes is a better example of data that would be obtained from natural resources management officials. Thus, the data can be viewed from three lenses. First, one can analyze data from the standpoint of the general population. Second, the data can be manipulated by testing just the natural resources management classes; this would be indicative of specific results from those who work closest to natural resources management issues. Finally, the data can be viewed by addressing all 115 valid responses.

The questionnaire itself asked questions regarding different components of three separate concepts as they relate to the proposed Fargo-Moorhead diversion plan. The three concepts, as previously noted, relate to the perceived social, economic, and environmental costs/benefits that may arise if the diversion plan is constructed. Six costs and six benefits were asked as the different components that made up the three concepts. Respondents were asked to strongly agree or strongly disagree on a component via a Likert scale ranging from one to five. Respondents were told that they could skip any question they did not feel comfortable with or ignore any questions they did not know the answer to.

After all of the data was obtained, it was analyzed by both individual components and by totals. For example, Pearson correlations and 2-tailed significance values were calculated for each individual component as they related to the other components within their concept.

Moreover, the six components were also summed on a scale of six to thirty to provide totals for each concept. These concepts (labeled appropriately as “TOT”) were also analyzed via Pearson correlations and 2-tailed tests of significance in order to better understand relationships, validity, and the reliability of the instrument. When analyzing all 115 responses, a multi-variable linear regression model was used in order to provide both  $r$  and  $r^2$  values to better understand the strength of the instrument.

### **7.1. Expected Results**

Prior to analyzing the three datasets, one should understand what is expected during the quantitative data analysis. Within the six components should be strong positive relationships between each component of each concept. In other words, one should expect that if one “strongly agrees” with an economic cost, it should be more likely that one will “strongly agree” with another economic cost. Similarly, if one “strongly agrees” with an economic benefit, it should be more likely that one will “strongly agree” with a separate economic benefit.

What is unknown, however, is if any relationships will emerge between concepts. Does disagreeing with economic benefits lead to a higher propensity to agree with economic costs? Theoretical questions such as these should be explained during the data analysis.

Moreover, one can expect to find certain results when analyzing the total values of the three concepts and their relationship to the overall support of the proposed diversion plan. Table 7.1 appropriately summarizes these expectations. The relationships should be straightforward: as one tends to believe there are more costs associated with the diversion, correlations among DIVSUP37 (the variable which measures overall support for the diversion plan) should be negative. Similarly, as one tends to believe there are more benefits associated with the diversion plan, correlations to DIVSUP37 should be positive. Ultimately, overall support towards the

**Table 7.1** Expected Correlation Values of Totals and Overall Diversion Support

	SCTOT	SBTOT	ECCTOT	ECBTOT	ENCTOT	ENBTOT	DIVSUP37
SCTOT	1	-	+	-	+	-	-
SBTOT		1	-	+	-	+	+
ECCTOT			1	-	+	-	-
ECBTOT				1	-	+	+
ENCTOT					1	-	-
ENBTOT						1	+
DIVSUP37							1

proposed diversion plan should alternate between negative and positive values for the costs/benefits of the three core concepts. One would expect that as more costs are perceived, there will be a negative correlation between costs for that particular concept and overall support of the diversion. Similarly, as more benefits are perceived for that concept, the correlation between those benefits and the overall level of support for the diversion should be positive. Similarly, within the concepts themselves, correlations should be positive between costs and costs, positive between benefits and benefits, negative between costs and benefits, and negative between benefits and costs.

## **7.2. General Public (Sociology) Results**

Quantitative data from a sociology class at NDSU—a sample representative of the general population—revealed mixed results. Social, economic, and environmental concepts were analyzed by costs and benefits. Six questions were addressed within each of the concepts. Some of the questions had strong positive correlations and were statistically significant at the 1% level. Other issues, however, showed little-to-no relationship and were not statistically significant. Ultimately, when analyzing the totals of the costs and benefits, the sample from the sociology class had results that closely mirrored that which should be expected in Table 7.1. The social, economic, and environmental quantitative results from this sample will be explained further in the remainder of this chapter.

### **7.2.1. General public (Sociology) results: social costs**

In terms of social costs, the sample from the sociology class had mixed results. It appears as though question two—which related to the diversion plan potentially destroying family farms and farmsteads—has the strongest relationship with the other social cost questions being asked. Question two had a positive correlation with all other five questions. Three of these were significant at the 1% level, and one was significant at the 5% level. Moreover, the correlation between question two with questions three, four, and five was .794, .700, and .694, respectively; values which suggest that how one perceives the destruction of farmland is likely to play a role in determining how one views the destruction of neighborhoods, churches, and community cohesion.

Although there were multiple instances in which questions had strong positive correlations and were statistically significant, there were also instances in which no substantive relationship was observed between questions. For example, question one—which asked respondents to rate whether they were concerned that the diversion plan would impact their school district—had no statistically significant relationships. In fact, its relationship with the five other questions ranged in correlations from -.224 to 0.298 (Table 7.2). Correlations between -.500 and .500 are generally considered weak and not an indicator of a relationship. The fact that question one has both positive and negative correlations with the other five questions suggests that how one feels the diversion plan will impact their school district does not play a role in predicting how one will feel towards any other social costs.

The most likely reason question one was not found to be an indicator of perceptions towards other social costs is most likely due to the demographics of the sample that was asked to



**Table 7.2** Correlations of Social Costs (Sociology)

		SC1	SC2	SC3	SC4	SC5	SC6
SC1 (school district)	Pearson	1	.216	-.086	.298	.080	-.224
	Correlation						
	Sig. (2-tailed)		.206	.618	.082	.646	.190
	N	36	36	36	35	35	36
SC2 (farms)	Pearson		1	.794**	.700**	.694**	.330*
	Correlation						
	Sig. (2-tailed)			.000	.000	.000	.049
	N		36	36	35	35	36
SC3 (neighborhoods)	Pearson			1	.678**	.599**	.376*
	Correlation						
	Sig. (2-tailed)				.000	.000	.024
	N			36	35	35	36
SC4 (churches)	Pearson				1	.550**	.364*
	Correlation						
	Sig. (2-tailed)					.001	.032
	N				35	34	35
SC5 (community cohesion)	Pearson					1	.524**
	Correlation						
	Sig. (2-tailed)						.001
	N					35	35
SC6 (buyouts)	Pearson						1
	Correlation						
	Sig. (2-tailed)						
	N						36

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

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

partake in this survey. Of the 36 sociology students, a substantial majority of them were living on campus at North Dakota State University. Since the proposed diversion plan is not being placed anywhere near the NDSU campus, a majority of the students likely felt as though it would not affect their school system. The reality is that if the sample had consisted of rural residents living near the Kindred School District or near Richland County, they likely would have responded in a substantially different way: due to where the channel is being placed and the

storage area required to make it feasible, it has been estimated that enrollment in these rural areas may decline by as much as 25 percent. Had the sample consisted of a group that was much more representative of the greater Fargo-Moorhead area, it can be assumed that the results for question one would be quite different.

### **7.2.2. General public (Sociology) results: social benefits**

Much like the results of social costs, the sample of sociology students has mixed results in terms of how they perceived social benefits. Questions eight and twelve are positively correlated with all other questions and are often statistically significant at either the 1% or 5% level (Table 7.3). Questions seven and eleven have the strongest relationship (Pearson corr. = .700,  $p < .0001$ ). The questions pertain to reducing the worry that is created via flooding and utilizing the diversion as a project that can save roughly 1/5<sup>th</sup> of all North Dakotans. From this sample it can be implied that residents may be worrying about a catastrophic flood simply because it will be detrimental to a substantial part of the state—an area that is the economic hub for North Dakota.

Although strong, positive relationships were evident, there were also instances in which no significant relationship was present. Unlike the social costs, all of the social benefits had positive correlations with one another. Some questions, however, had a mixture between high and low correlations and high and low p-values. Question eleven, for example, ranged from correlations as small as .227 to as high as .700. Similarly, it had 2-tailed significance values that ranged from .000 to .184 (Table 7.3).

**Table 7.3 Correlations of Social Benefits (Sociology)**

		SB7	SB8	SB9	SB10	SB11	SB12
SB7 (no worry)	Pearson	1	.366*	.140	.223	.700**	.328
	Correlation						
	Sig. (2-tailed)		.028	.415	.190	.000	.051
	N	36	36	36	36	36	36
SB8 (rural growth)	Pearson		1	.523**	.387*	.451**	.633**
	Correlation						
	Sig. (2-tailed)			.001	.020	.006	.000
	N		36	36	36	36	36
SB9 (fewer buyouts)	Pearson			1	.403*	.355*	.491**
	Correlation						
	Sig. (2-tailed)				.015	.034	.002
	N			36	36	36	36
SB10 (trails)	Pearson				1	.227	.512**
	Correlation						
	Sig. (2-tailed)					.184	.001
	N				36	36	36
SB11 (protects 1/5 of ND)	Pearson					1	.461**
	Correlation						
	Sig. (2-tailed)						.005
	N					36	36
SB12 (no more sandbags)	Pearson						1
	Correlation						
	Sig. (2-tailed)						
	N						36

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

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

### 7.2.3. General public (Sociology) results: economic costs

Based on the results of this sample, the perceived economic costs related to the diversion fluctuate considerably in terms of correlations and significance. Of the fifteen possible links between the six questions, only one—the relationship between questions 16 and 18—was significant at the 1% level (Table 7.4). Questions 16 and 18 relate to the destruction of economically productive farmland and the inherent unfairness that crop insurance is not provide

for man-made floods, respectively. This relationship makes sense: some respondents may be opposed to losing economically productive farmland and are even further opposed to the idea

**Table 7.4** Correlations of Economic Costs (Sociology)

		ECC13	ECC14	ECC15	ECC16	ECC17	ECC18
ECC13 (anti-tax)	Pearson	1	.175	.190	.067	-.330	.427*
	Correlation						
	Sig. (2-tailed)		.322	.281	.705	.056	.015
	N	34	34	34	34	34	32
ECC14 (reduces rural tax base)	Pearson		1	.201	.225	-.158	.419*
	Correlation						
	Sig. (2-tailed)			.247	.193	.363	.015
	N		35	35	35	35	33
ECC15 (hurts property value)	Pearson			1	.385*	-.383*	.221
	Correlation						
	Sig. (2-tailed)				.022	.023	.217
	N			35	35	35	33
ECC16 (hurts farm revenue)	Pearson				1	-.258	.694**
	Correlation						
	Sig. (2-tailed)					.135	.000
	N				35	35	33
ECC17 (1/2 cent sales tax)	Pearson					1	-.145
	Correlation						
	Sig. (2-tailed)						.420
	N					35	33
ECC18 (crop insurance)	Pearson						1
	Correlation						
	Sig. (2-tailed)						
	N						33

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

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

that farmers may not even be compensated for it due to the diversion channel being a man-made structure.

Question seventeen had a negative relationship with all other economic costs. This question pertained to one's willingness to pay the ½ cent sales tax that was recently approved to

fund flood-fighting initiatives. This relationship should be negative considering the fact that it is asking a willingness-to-pay question as a cost.

#### **7.2.4. General public (Sociology) results: economic benefits**

In terms of economic benefits, results from the sample show that almost all of the correlations were positive. Only one—the relationship between question nineteen and question twenty-four—had a negative correlation. Questions nineteen and twenty-four pertained to saving the core cities from a flood and paying for flood insurance, respectively. This negative relationship suggests that as one places more importance on saving the core cities, one is less likely to pay more for flood insurance. In reality, this question may be skewed given the demographic background of those taking the questionnaire. A majority of the students who took the survey are not homeowners, thus they either pay no flood insurance in the status quo or are not familiar with the process for paying for flood insurance. Based on this information, it is logical that there was no substantial relationship between these two issues.

Results show that questions twenty-one and twenty-two have the strongest relationship with a Pearson correlation of .633. The relationship is significant at the 1% level (Table 7.5). Questions 21 and 22 ask respondents to rate their perceptions of making sure that most of the \$1.7 billion in costs are spent locally and whether or not the diversion will allow the metro area room for further growth and development. It can be argued that this is a valid relationship: one may consider spending funds locally as an opportunity to create new growth and development.

**Table 7.5** Correlations of Economic Benefits (Sociology)

		ECB19	ECB20	ECB21	ECB22	ECB23	ECB24
ECB19 (flood hurts economy)	Pearson Correlation Sig. (2-tailed) N	1   35	.357*  .036 35	.324  .058 35	.226  .191 35	.239  .167 35	-.035  .844 35
ECB20 (500-yr > costs than diversion)	Pearson Correlation Sig. (2-tailed) N		1  35	.415*  .013 35	.528**  .001 35	.353*  .038 35	.424*  .011 35
ECB21 (spend diversion costs locally)	Pearson Correlation Sig. (2-tailed) N			1  35	.633**  .000 35	.273  .112 35	.537**  .001 35
ECB22 (growth and development)	Pearson Correlation Sig. (2-tailed) N				1  35	.530**  .001 35	.386*  .022 35
ECB23 (new business)	Pearson Correlation Sig. (2-tailed) N					1  35	.128  .465 35
ECB24 (flood insurance)	Pearson Correlation Sig. (2-tailed) N						1  35

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

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

**7.2.5. General public (Sociology) results: environmental costs**

According to the sample from the sociology class, environmental costs were all positively correlated with one another. Ten of the fifteen relationships between the questions were significant at either the 1% or 5% level (Table 7.6). The two questions with the strongest correlation were questions 26 and 28. These questions pertained to the environmental consequences of crossing four rivers and the fear that the diversion may change the Red River in

such a way that it will cause some riverbanks to cave in. These two questions had a Pearson correlation of .763 and a p-value <.0001. This relationship reveals that as one is concerned about how the Red River will navigate over four of other tributaries, one is more likely to be concerned with the fact that it also may cause “sluffing” of the riverbanks, a situation in which they suddenly and immediately cave in.

**Table 7.6** Correlations of Environmental Costs (Sociology)

		ENC25	ENC26	ENC27	ECN28	ENC29	ENC30
ENC25 (fish passage)	Pearson	1	.461**	.472**	.327	.337*	.396*
	Correlation						
	Sig. (2-tailed)		.005	.004	.056	.048	.019
	N	35	35	35	35	35	35
ENC26 (crosses other rivers)	Pearson		1	.419*	.763**	.629**	.320
	Correlation						
	Sig. (2-tailed)			.012	.000	.000	.061
	N		35	35	35	35	35
ENC27 (soils)	Pearson			1	.408*	.324	.728**
	Correlation						
	Sig. (2-tailed)				.015	.057	.000
	N			35	35	35	35
ECN28 (sluffing)	Pearson				1	.550**	.298
	Correlation						
	Sig. (2-tailed)					.001	.083
	N				35	35	35
ENC29 (trees)	Pearson					1	.246
	Correlation						
	Sig. (2-tailed)						.155
	N					35	35
ENC30 (erosion)	Pearson						1
	Correlation						
	Sig. (2-tailed)						
	N						35

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

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

**7.2.6. General public (Sociology) results: environmental benefits.**

Based on the results of this sample, perceptions of environmental benefits that stem from building a diversion are much different than the five other areas studied. Unlike all of the other perceived costs and benefits, every environmental benefit was statistically significant at the one percent level (Table 7.7). Moreover, all but two of the correlations were greater than .500. This suggests that not only are relationships between the six questions positively related, but they are

**Table 7.7** Correlations of Environmental Benefits (Sociology)

		ENB31	ENB32	ENB33	ENB34	ENB35	ENB36
ENB31 (wildlife)	Pearson	1	.564**	.475**	.528**	.471**	.507**
	Correlation						
	Sig. (2-tailed)		.000	.004	.001	.004	.002
	N	35	35	35	35	35	35
ENB32 (pushes water away)	Pearson		1	.686**	.574**	.535**	.619**
	Correlation						
	Sig. (2-tailed)			.000	.000	.001	.000
	N		35	35	35	35	35
ENB33 ("island" towns)	Pearson			1	.606**	.552**	.669**
	Correlation						
	Sig. (2-tailed)				.000	.001	.000
	N			35	35	35	35
ENB34 (wetlands)	Pearson				1	.512**	.674**
	Correlation						
	Sig. (2-tailed)					.002	.000
	N				35	35	35
ENB35 (contaminatio n)	Pearson					1	.690**
	Correlation						
	Sig. (2-tailed)						.000
	N					35	35
ENB36 (mold)	Pearson						1
	Correlation						
	Sig. (2-tailed)						
	N						35

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



strongly related as well. These results suggest that all six perceived environmental benefits are in fact related to the other measures within the concept. This verifies that none of the questions pertaining to environmental benefits are outliers; they all do a sufficient job of measuring environmental benefits.

### **7.2.7. General public (Sociology) results: totals**

As previously mentioned, the quantitative analysis tests both individual questions within a concept and overall concepts with support or opposition to the diversion. In order to test the overall concepts, new variables were created. These variables represent the totals of costs and benefits within each concept. Take for example questions one through six. Each question is answered on a Likert scale ranging from one to five. For each individual respondent, answers to the six questions were summed. This resulted in total values ranging from six to thirty. These totals were created for all six concepts: social costs, social benefits, economic costs, economic benefits, environmental costs, and environmental benefits. These new variables were then tested against the 37<sup>th</sup> and final statement asked on the survey “I support the Fargo-Moorhead proposed diversion plan project.”

The results of testing the totals against diversion support went as theoretically expected. Just as Table 7.1 suggests that theoretical relationships between the variables and diversion support should alternate between positive and negative correlations, Table 7.8 reveals that this is exactly what took place. All but two of the relationships were significant at either the 1% or the 5% level (Table 7.8).

These overall results of the totals suggest that the questionnaire is a viable way of measuring perceptions of costs and benefits of the proposed diversion plan. The results reveal what one would hypothetically expect: as one perceives more costs to be associated with the

diversion plan, one's level of support for the diversion dwindles. Similarly, if one expects more benefits to arise from the creation of the diversion channel, one will be more likely to support utilizing a diversion as a flood mitigation strategy. The fact that a majority of the correlations

**Table 7.8** Correlations of Totals (Sociology)

		SCTOT	SBTOT	ECCTOT	ECBTOT	ENCTOT	ENBTOT	DIVSUP37
SCTOT	Pearson	1	-.667**	.669**	-.609**	.380*	-.665**	-.576**
	Correlation							
	Sig. (2-tailed)		.000	.000	.000	.029	.000	.000
	N	34	34	30	33	33	33	33
SBTOT	Pearson		1	-.651**	.823**	-.262	.802**	.801**
	Correlation							
	Sig. (2-tailed)			.000	.000	.128	.000	.000
	N		36	32	35	35	35	35
ECCTOT	Pearson			1	-.540**	.586**	-.538**	-.486**
	Correlation							
	Sig. (2-tailed)				.001	.000	.001	.005
	N			32	32	32	32	32
ECBTOT	Pearson				1	-.184	.801**	.721**
	Correlation							
	Sig. (2-tailed)					.291	.000	.000
	N				35	35	35	35
ENCTOT	Pearson					1	-.336*	-.370*
	Correlation							
	Sig. (2-tailed)						.049	.029
	N					35	35	35
ENBTOT	Pearson						1	.836**
	Correlation							
	Sig. (2-tailed)							.000
	N						35	35
DIVSUP37	Pearson							1
	Correlation							
	Sig. (2-tailed)							
	N							35

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

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

are greater than .500 and less than -.500 indicate that not only are the directions of these relationships accurate, but their strengths are indicative of relationships that occur purposively rather than by chance.

### **7.3. Environmental Officials (Natural Resources Management) Results**

A sample of 79 natural resources management students was obtained for quantitative statistical analysis. These students were sampled from two classes at North Dakota State University: NRM 225 (Natural Resources & Agrosystems) and NRM 491/690 (Seminar and Graduate Capstone).

#### **7.3.1. Environmental officials (Natural Resources Management) results: social costs**

In terms of social costs, the relationships between questions one, two, three, four, and five were all statistically significant at the 1% level (Table 7.9). However, of these ten relationships, only three had Pearson correlations above .500. This suggests that although statistically significant relationships exist between these five questions, they may be related based more on chance than purpose.

Questions six—which asks respondents about the unfairness that some properties will be flooded even if they do not flood presently—appears to be an outlier within the concept. It has correlations ranging from .095 to .282; numbers low enough to imply that there is not a strong relationship among it or any other issues.

These results imply that—for environmental experts—equity with regard to flooding is not a valid measure of the social cost concept. Regardless, the other five measures appear to be strong indicators of social costs. For this reason, the instrument will be used as it is currently devised, although additional research may be needed with environmental specialists to ensure

that all of the questions being asked about social cost perceptions are related with the others as part of the overall concept.

**Table 7.9** Correlations of Social Costs (Natural Resources Management)

		SC1	SC2	SC3	SC4	SC5	SC6
SC1 (schools)	Pearson	1	.316**	.330**	.362**	.392**	.173
	Correlation						
	Sig. (2-tailed)		.005	.003	.001	.001	.129
	N	79	79	78	77	74	78
SC2 (farms)	Pearson		1	.495**	.535**	.594**	.256*
	Correlation						
	Sig. (2-tailed)			.000	.000	.000	.024
	N		79	78	77	74	78
SC3 (neighbor- hoods)	Pearson			1	.494**	.456**	.095
	Correlation						
	Sig. (2-tailed)				.000	.000	.409
	N			78	76	73	77
SC4 (churches)	Pearson				1	.604**	.197
	Correlation						
	Sig. (2-tailed)					.000	.088
	N				77	73	76
SC5 (communit y cohesion)	Pearson					1	.282*
	Correlation						
	Sig. (2-tailed)						.016
	N					74	73
SC6 (buyouts)	Pearson						1
	Correlation						
	Sig. (2-tailed)						
	N						78

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

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

### 7.3.2. Environmental officials (Natural Resources Management) results: social benefits

Twelve of the fifteen relationships between social benefits were statistically significant at either the 1% or the 5% level (Table 7.10). Of the three that were not, two were linked to question eight, which asked respondents about downstream rural communities and their ability to

grow with a diversion in place. The fact that two-thirds of the relationships that were not statistically significant were associated with question eight implies that it may need to be reassessed into the larger picture of social benefits.

Interestingly, just like the general population represented by the sociology class, students from natural resources management backgrounds also had the highest correlation of perceived social benefits between questions seven and eleven (Table 7.10). Results from this sample show

**Table 7.10** Correlations of Social Benefits (Natural Resources Management)

		SB7	SB8	SB9	SB10	SB11	SB12
SB7 (no worry)	Pearson	1	.439**	.391**	.150	.692**	.447**
	Correlation						
	Sig. (2-tailed)		.000	.000	.195	.000	.000
	N	78	78	76	76	78	78
SB8 (rural growth)	Pearson		1	.208	.245*	.476**	.213
	Correlation						
	Sig. (2-tailed)			.070	.032	.000	.059
	N		79	77	77	79	79
SB9 (buyouts)	Pearson			1	.276*	.364**	.243*
	Correlation						
	Sig. (2-tailed)				.017	.001	.033
	N			77	75	77	77
SB10 (trails)	Pearson				1	.322**	.228*
	Correlation						
	Sig. (2-tailed)					.004	.046
	N				77	77	77
SB11 (protects 1/5 of ND)	Pearson					1	.590**
	Correlation						
	Sig. (2-tailed)						.000
	N					79	79
SB12 (no more sandbags)	Pearson						1
	Correlation						
	Sig. (2-tailed)						
	N						79

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

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

that the Pearson correlation was .692 and that the relationship was statistically significant at the 1% level. This may reaffirm that the relationship between worrying about flooding and protecting 1/5<sup>th</sup> of all North Dakotans may not be contingent upon background, but rather may be a perceived benefit that is shared by residents from diverse backgrounds in the Fargo-Moorhead metropolitan area.

### **7.3.3. Environmental officials (Natural Resources Management) results: economic costs**

In terms of economic costs, the sample of natural resources management students had mixed results. As a whole, eight of the fifteen relationships were statistically significant at either the 1% or 5% level. Of these, however, only one—the relationship between questions fourteen and fifteen—had a Pearson correlation that was larger than .500. This implies that a moderate relationship between small town tax revenue and property value decline exists. This makes sense: one can argue that since a substantial portion of local revenue for small towns comes from property taxes, there should be a positive relationship between those being concerned about declining property values and those being concerned that local tax revenue is diminishing. The relationship between questions fourteen and fifteen were significant at the 1% level (Table 7.11).

Question thirteen—which focuses on the tax burden placed on local residents to fund the diversion plan—has the strongest relationship to other questions. When paired with the five other questions within economic costs, it is statistically significant at the 1% level with questions fourteen, fifteen, and sixteen, and is statistically significant with question eighteen at the 5% level. It should not be ignored, however, that all of the Pearson correlations that are associated with these relationships are below .500, which suggests that the relationship may occur based on chance rather than design.

**Table 7.11 Correlations of Economic Costs (Natural Resources Management)**

		ECC13	ECC14	ECC15	ECC16	ECC17	ECC18
ECC13 (anti-taxes)	Pearson	1	.391**	.425**	.401**	-.089	.239*
	Correlation						
	Sig. (2-tailed)		.000	.000	.000	.439	.036
	N	79	76	76	77	77	77
ECC14 (hurts small town taxes)	Pearson		1	.511**	.391**	-.038	.168
	Correlation						
	Sig. (2-tailed)			.000	.000	.744	.148
	N		76	76	76	76	76
ECC15 (hurts home values)	Pearson			1	.405**	-.032	.179
	Correlation						
	Sig. (2-tailed)				.000	.785	.121
	N			76	76	76	76
ECC16 (hurts farm revenue)	Pearson				1	-.089	.265*
	Correlation						
	Sig. (2-tailed)					.446	.020
	N				77	76	77
ECC17 (1/2 cent sales tax)	Pearson					1	-.051
	Correlation						
	Sig. (2-tailed)						.664
	N					77	76
ECC18 (crop insurance)	Pearson						1
	Correlation						
	Sig. (2-tailed)						
	N						77

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

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

#### 7.3.4. Environmental officials (Natural Resources Management) results: economic benefits

Based on the sample of natural resources management students, it appears as though question 24—which references paying flood insurance—is an outlier among economic benefits. If one excludes question 24 from the analysis, there are ten possible links between questions 19, 20, 21, 23, and 23. Of these ten, nine are statistically significant at either the 1% or 5% level.

However, of these nine, only one—the relationship between questions 22 and 23—has a Pearson correlation greater than .500. Questions 22 and 23 pertain to the diversion allowing room for Fargo-Moorhead to grow and develop and its propensity to attract new businesses to the area given the fact that it will provide levels of flood protection that current businesses are apprehensive about. This relationship has a correlation of .516 and has a p-value of <.0001 (Table 7.12). It makes sense that these issues are related: if one believes that the diversion will

**Table 7.12** Correlations of Economic Benefits (Natural Resources Management)

		ECB19	ECB20	ECB21	ECB22	ECB23	ECB24
ECB19 (flood hurts economy)	Pearson	1	.483**	.192	.495**	.319**	-.064
	Correlation						
	Sig. (2-tailed)		.000	.102	.000	.005	.590
	N	77	77	74	76	76	74
ECB20 (500-yr > cost than diversion)	Pearson		1	.281*	.479**	.462**	-.066
	Correlation						
	Sig. (2-tailed)			.015	.000	.000	.578
	N		78	75	77	77	74
ECB21 (spend costs locally)	Pearson			1	.299**	.277*	-.038
	Correlation						
	Sig. (2-tailed)				.009	.016	.751
	N			75	75	75	73
ECB22 (growth and development)	Pearson				1	.516**	-.114
	Correlation						
	Sig. (2-tailed)					.000	.335
	N				77	77	74
ECB23 (new business)	Pearson					1	-.021
	Correlation						
	Sig. (2-tailed)						.857
	N					77	74
ECB24 (flood insurance)	Pearson						1
	Correlation						
	Sig. (2-tailed)						
	N						74

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

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



allow Fargo-Moorhead to grow and develop, it therefore is logical that one may believe new businesses will be willing and able to locate in the community—which is a sign of growth and development.

Based on data from this sample, questions 19 and 21 appear to have no explicable relationship. The two questions have a Pearson correlation of .192 and a 2-tailed significance value of .102 (Table 7.12). The two questions relate to the Fargo-Moorhead economy being crushed during a 500-year flood and supporting most of the \$1.7 billion in diversion costs being spent locally. It can be argued that the lack of a relationship is actually expected: the questions deal with post-flood costs and pre-flood costs, respectively. Since they deal with two competing scenarios, it makes sense that there may not be a substantial relationship between the two measures.

Question 24, which deals with paying for flood insurance, is an anomaly among the concept. Unlike all of the other questions in the concept, all relationships with question 24 have a negative correlation and none are statistically significant. This implies that question 24 may be an outlier within this particular concept of economic benefits. Much like the results from the sociology class, it can be argued that this is to be expected due to the backgrounds of those making up the sample. Of the 79 valid responses, a clear majority were from college students attending North Dakota State University. Most of these students are not homeowners and may have zero familiarity with flood insurance and whether or not their flood insurance rates will be altered with or without a diversion in place. For this reason, the question was not changed after it was pre-tested, although additional research may be required to ensure that this question appropriately measures the economic benefits concept.

**7.3.5. Environmental officials (Natural Resources Management) results: environmental costs**

When addressing the perceived environmental costs of the diversion plan, the sample of natural resources management students had surprising results. All fifteen relationships among the six questions were positively correlated and were significant at the 1% level (Table 7.13). Of

**Table 7.13** Correlations of Environmental Costs (Natural Resources Management)

		ENC25	ENC26	ENC27	ECN28	ENC29	ENC30
ENC25 (fish passage)	Pearson	1	.315**	.676**	.517**	.455**	.634**
	Correlation						
	Sig. (2-tailed)		.006	.000	.000	.000	.000
	N	76	76	74	73	73	73
ENC26 (crosses other rivers)	Pearson		1	.534**	.529**	.444**	.443**
	Correlation						
	Sig. (2-tailed)			.000	.000	.000	.000
	N		76	74	73	73	73
ENC27 (soils)	Pearson			1	.624**	.446**	.788**
	Correlation						
	Sig. (2-tailed)				.000	.000	.000
	N			74	72	72	72
ECN28 (sluffing)	Pearson				1	.564**	.548**
	Correlation						
	Sig. (2-tailed)					.000	.000
	N				73	72	72
ENC29 (trees)	Pearson					1	.450**
	Correlation						
	Sig. (2-tailed)						.000
	N					73	73
ENC30 (erosion)	Pearson						1
	Correlation						
	Sig. (2-tailed)						
	N						73

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

the fifteen, a majority—nine—had Pearson correlations greater than .500. This suggests that the relationships do not occur by chance but are in fact substantiated.

Of the nine, one in particular—the relationship between questions 27 and 30—had a correlation that was much larger than the others. These two questions were statistically significant at the 1% level and had a Pearson correlation of .788. This paralleled the results from the sociology class. Like the sociology class, the relationship between erosion and soils is much stronger than the other perceived environmental costs. The fact that these results were reaffirmed by the natural resources management students implies that the relationship between soils and erosion may span disciplines and may be representative of the entire Fargo-Moorhead region and not just specific subsets within it.

### **7.3.6. Environmental officials (Natural Resources Management) results: environmental benefits**

The perceived environmental benefits of the diversion were varied within the sample of natural resources management students. With the exception of question 31, the relationships between all other perceived environmental benefits were positively related and statistically significant at both 1% and 5% levels. One relationship in particular—that between questions 35 and 36—had the highest correlation of .735. This reiterated the results from the sociology class in which the relationship between the same two questions had the highest correlation among environmental benefits. The questions relate to contamination from sandbags and problems that stem from mold and waterborne illnesses.

Unlike the sample from sociology students, however, the sample from natural resources management students differed with respect to how question 31 was approached. Whereas sociology students viewed every environmental benefit as positively correlated and statistically significant, natural resources management students viewed every relationship to question 31 as having no statistical significance and ranging in correlations from -.136 to .153. The fact that the correlations consistently hover around zero implies that the question—which focuses on how the

**Table 7.14** Correlations of Environmental Benefits (Natural Resources Management)

		ENB31	ENB32	ENB33	ENB34	ENB35	ENB36
ENB31 (wildlife)	Pearson	1	.116	.008	.153	.018	-.136
	Correlation						
	Sig. (2-tailed)		.327	.951	.206	.886	.271
	N	74	73	70	70	70	67
ENB32 (pushes away water)	Pearson		1	.431**	.465**	.343**	.285*
	Correlation						
	Sig. (2-tailed)			.000	.000	.004	.019
	N		74	70	71	70	67
ENB33 ("island" towns)	Pearson			1	.459**	.610**	.557**
	Correlation						
	Sig. (2-tailed)				.000	.000	.000
	N			70	69	69	67
ENB34 (wetlands)	Pearson				1	.600**	.596**
	Correlation						
	Sig. (2-tailed)					.000	.000
	N				71	69	67
ENB35 (sandbag contaminatio n)	Pearson					1	.735**
	Correlation						
	Sig. (2-tailed)						.000
	N					70	67
ENB36 (mold)	Pearson						1
	Correlation						
	Sig. (2-tailed)						
	N						67

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

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

diversion will impact wildlife—may not be an important measure of the concept at hand. This is an important difference between the samples of sociology and natural resources management students. It shows that perceptions towards wildlife may be linked to one's background and familiarity with the subject. Whereas sociology students placed heavy importance on how the diversion plan will impact wildlife, natural resources management students did not. This

conclusion cannot be ignored as it may explain why attitudes towards wildlife differ considerably between groups in the Fargo-Moorhead metropolitan area.

### **7.3.7. Environmental officials (Natural Resources Management) results: totals**

Just as variables were created for the sociology sample to identify cost/benefit totals, so too were they created for the sample of natural resources management students. The results were satisfactory, although they did not fit the theoretical model as clearly as did the sample of sociology students. Three correlations of totals—which are highlighted by bold lettering—resulted in positive correlations rather than what one would theoretically expect: negative. However, the correlations are so close to zero—at .112, .131, and .036, respectively—that one could argue that with a larger sample size the results of the Pearson correlations could become negative.

Moreover, not all relationships were statistically significant. Whereas all but two of the relationships among totals from the sociology sample were statistically significant, in the natural resources management sample nine relationships show no statistical significance. Moreover, whereas fifteen relationships in the sociology sample had correlations either greater than .500 or less than  $-.500$ , only five relationships meet that criterion in the natural resources management sample.

As a whole, it can be argued that both samples of sociology and natural resources management students closely parallel the theoretical model presented in Table 7.1. It appears as though natural resources management students do not place as important of an emphasis on environmental costs as do their sociology counterparts. This is evidenced by the fact that all three correlations of the totals that did not fit the theoretical model were directly related to environmental costs. Although this was an unexpected result, the correlation was not strongly

**Table 7.15** Correlations of Totals (Natural Resources Management)

		SCTOT	SBTOT	ECCTOT	ECBTOT	ENCTOT	ENBTOT	DIVSUP37
SCTOT	Pearson	1	-.456**	.490**	-.343**	.022	-.377**	-.258*
	Correlation							
	Sig. (2-tailed)		.000	.000	.004	.864	.003	.047
	N	71	67	69	67	64	61	60
SBTOT	Pearson		1	-.206	.689**	<b>.112</b>	.652**	.676**
	Correlation							
	Sig. (2-tailed)			.080	.000	.358	.000	.000
	N		74	73	70	69	65	65
ECCTOT	Pearson			1	-.224	.317**	-.048	-.112
	Correlation							
	Sig. (2-tailed)				.056	.007	.699	.368
	N			76	73	71	67	67
ECBTOT	Pearson				1	<b>.131</b>	.461**	.736**
	Correlation							
	Sig. (2-tailed)					.283	.000	.000
	N				73	69	66	65
ENCTOT	Pearson					1	<b>.036</b>	-.124
	Correlation							
	Sig. (2-tailed)						.776	.326
	N					71	65	65
ENBTOT	Pearson						1	.651**
	Correlation							
	Sig. (2-tailed)							.000
	N						67	65
DIVSUP37	Pearson							1
	Correlation							
	Sig. (2-tailed)							
	N							68

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

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

**Bold:** Correlation does not fit theoretical model suggested in Table 7.1

associated in a positive direction, implying that this may have been a result of this particular sample rather than that which is truly representative of the population as a whole. Further research will be needed to verify if those who work in natural resources management fields have

a greater likelihood to view environmental costs as less important or whether this was simply a product of this particular sample of natural resources management students.

#### **7.4. All Classes Results: Totals**

When combining the results from the sociology and natural resources management classes, it reveals that a larger sample of students fits the theoretical model suggested in Table 7.1. This larger sample has expected numbers: correlations vary from negative to positive accordingly, and a clear majority of the relationships are statistically significant (Table 7.16).

Of the four correlations that are not statistically significant, all are associated with environmental costs (Table 7.16). This implies that how one views environmental costs does not play a role in determining one's perceptions towards social costs, social benefits, economic benefits, or environmental benefits, respectively. This knowledge suggests that environmental costs are either not valued as highly as other perceived issues by residents or that the instrument needs to be retooled in such a way as to garner better results from perceived environmental costs. For the purposes of this research project, the instrument will be used as it is currently devised. It should be noted that additional research is necessary in order to know how the current six questions regarding environmental costs truly measure residents' perceptions.

**Table 7.16** Correlations of Totals (All Groups)

		SCTOT	SBTOT	ECCTOT	ECBTOT	ENCTOT	ENBTOT	DIVSUP37
SCTOT	Pearson	1	-.545**	.544**	-.456**	.176	-.505**	-.403**
	Correlation							
	Sig. (2-tailed)		.000	.000	.000	.084	.000	.000
	N	105	101	99	100	97	94	93
SBTOT	Pearson		1	-.337**	.745**	-.049	.720**	.730**
	Correlation							
	Sig. (2-tailed)			.000	.000	.621	.000	.000
	N		110	105	105	104	100	100
ECCTOT	Pearson			1	-.323**	.389**	-.232*	-.238*
	Correlation							
	Sig. (2-tailed)				.001	.000	.021	.018
	N			108	105	103	99	99
ECBTOT	Pearson				1	-.015	.627**	.731**
	Correlation							
	Sig. (2-tailed)					.879	.000	.000
	N				108	104	101	100
ENCTOT	Pearson					1	-.149	-.236*
	Correlation							
	Sig. (2-tailed)						.139	.018
	N					106	100	100
ENBTOT	Pearson						1	.744**
	Correlation							
	Sig. (2-tailed)							.000
	N						102	100
DIVSUP37	Pearson							1
	Correlation							
	Sig. (2-tailed)							
	N							103

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

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

A multi-variable linear regression model was used to predict how support for the diversion is determined by the six costs and benefits addressed in the instrument. Results from the regression analysis show that the model has a strong  $R^2$  value of .705 (Table 7.17). This



**Table 7.17 Model Summary (All Groups)**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.840 <sup>a</sup>	.705	.682	.587

a. Predictors: (Constant), ENBTOT, ENCTOT, SCTOT, ECCTOT, ECBTOT, SBTOT

suggests that roughly 70 percent of the variability in this dataset is accounted for by the model. Coefficients of determination are generally thought of as how well future outcomes are predicted by the model. Based on the results from the model, the six variables used to create the model predict future outcomes successfully. Table 7.18 reveals that the model is driven by benefits more than it is driven by costs. Of the six variables tested, social benefits, economic benefits, environmental costs, and environmental benefits are significant at the 1% level. Economic costs are not statistically significant, although its significance value is .052, a number that is very close to the 5% statistically significant level. According to the model, social costs do not appear to influence how one perceives supporting the diversion plan: its significance value is .956 and has a Beta value of .005. This implies that support for the diversion plan increases only minimally based on how one perceives social costs.

As a whole, the model explains a majority of the perceptions towards the Fargo-Moorhead diversion plan. Its  $R^2$  value suggests that the model explains roughly 70% of the variability that may arise in perceptions. Moreover, when testing for overall support of the diversion plan as the dependent variable, Pearson correlations and significance values are statistically significant at the 1% level a majority of the time. This reveals that the instrument and model accurately measure relationships between the six cost/benefit variables being tested. Not only does this prove that the variables are related, but it also proves that how one perceives

certain costs and benefits may explain why they perceive other issues as either positively or negatively associated with the diversion plan.

**Table 7.18** Coefficients<sup>a</sup> (All Groups)

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	-1.298	.623		-2.085	.040
SCTOT	.001	.019	.005	.055	.956
SBTOT	.064	.024	.288	2.624	.010
ECCTOT	.049	.025	.167	1.972	.052
ECBTOT	.098	.027	.363	3.669	.000
ENCTOT	-.050	.017	-.220	-2.971	.004
ENBTOT	.076	.025	.302	3.060	.003

a. Dependent Variable: DIVSUP37

## CHAPTER 8. DISCUSSION

Results from qualitative and quantitative data reveal that the perceived social, economic, and environmental costs and benefits of the diversion plan vary significantly from group to group in the Fargo-Moorhead metropolitan area. Results from qualitative data indicated that West Fargo residents and rural residents believed there were more costs associated with the diversion plan than without one. Urban interviewees suggested that there were more benefits than costs with a diversion plan, although these results were skewed from a substantial number of perceived economic benefits. Had urban interviewees not discussed economic aspects of the diversion plan, they would have also concluded that there were more costs than benefits with the construction of the channel.

Quantitative data analysis revealed that—of the sample of 115 students at North Dakota State University—the questionnaire accurately measured the direction of the correlations between perceived costs and benefits. Analysis revealed that costs were positively correlated to other costs and benefits were positively correlated to other benefits. Furthermore, costs were negatively correlated with benefits and benefits were negatively correlated with costs. A majority of the relationships between perceived cost and benefit totals—seventeen of twenty-one—were significant at either the 1% or 5% level. Of the four that were not statistically significant, all four were associated with environmental costs.

Based on a multi-variable linear regression model that tested cost-benefit totals against overall diversion support as a dependent variable, benefits have a heavier influence on diversion support than costs do. Based on the model, neither social costs nor economic costs were statistically significant. Environmental costs, which were statistically significant at the 1% level, had a Beta value of  $-.220$ , suggesting that environmental costs are not linked to increased

diversion support. Based on results from the model, the  $R^2$  value is .705. This is a strong number that satisfactorily explains how well future outcomes will be predicted by this model.

### **8.1. Findings and Theory**

These findings can be explained in part by the theories discussed in Chapter 3. Before elaborating on how the three theories help explain the findings, it should be noted that for the purposes of this study theory is being used as a guide. This project is not theory testing; rather, it seeks to offer suggestions for theory development based on using the three theories as separate guides.

The Community Capitals Framework (CCF) analyzes stocks and flows of capitals and the resulting impacts they have across other capitals. The Community Capitals Framework focuses exclusively on assets rather than needs. In terms of this project, asking respondents to provide input about social, economic, and environmental benefits of the diversion plan generated both qualitative and quantitative data regarding what assets would be available to the Fargo-Moorhead community if the plan were to be implemented. These assets are a foundation for understanding what types of capitals are perceived to be created by the diversion channel.

Based on the quantitative data analysis, it is clear that social, economic, and environmental benefits are positively correlated with one another. The linear regression model presented in Chapter 7 revealed that benefits are the three factors that most influence diversion support. Thus, it can be argued that among this sample of respondents, perceptions are geared towards what Emery and Flora define as spiraling-up: the process that occurs when assets gained by the community increase the likelihood that other assets will also be gained in the community. This sample of 115 students showed direct links between benefits: those who believed that social benefits were going to emerge from the diversion plan were more likely to also believe that

economic and environmental benefits would be created, as well. Moreover, those who perceived that benefits would emerge from the diversion plan had a higher overall level of support for the construction of the project.

It can be argued that the links between social, economic, and environmental benefits and overall support for the diversion plan exemplify spiraling-up. Respondents clearly believe that as social benefits increase, so too do economic and environmental benefits, respectively. This fits the pattern by Emery and Flora that contends that as the community gains assets in one area (such as social inclusion) it can lead to assets in other areas (like economic vitality and ecosystem health) as well. Clearly, this is a powerful example of how the Community Capitals Framework can guide the understanding of spiraling-up.

In terms of Integrated Coastal Zone Management (ICZM) theory, some of the findings can be explained by looking through this theoretical lens. ICZM theory focuses on qualitative factors more than quantitative data. Of the four components that define ICZM, parts three and four can be explained by this project. The third component of ICZM states that project management should be inclusive of anyone with a stake in the affected resources. Part four suggests that residents living adjacent to local resources should have a say in the management of those resources and should be able to share their opinions and experiences in a meaningful way with managers.

Although this project did not test for perceptions of inclusivity or empowerment, the interview process revealed that these components have been met. Community meetings hosted by local, state, and federal agencies have invited members from all parts of the community to engage in conversation about the different impacts that the proposed channel will have on different regions of the Fargo-Moorhead metropolitan area.

The disparity between perceived costs and benefits by part of the metro area (West Fargo, urban, rural) proves that members from different parts of the community have dramatically different perceptions of the diversion plan. These perceptions are directly linked to place: only urban residents believed that more benefits than costs would arise with a diversion. Although this project did not measure feelings of inclusion or empowerment, it did reveal that community members have been actively engaged in these meetings and that different stakeholders and different residents have been invited to attend these meetings.

Resilience observes adaptation to sudden change. The instrument measured perceptions of different types of change that would be brought to the community in the event that the diversion plan is constructed. Social changes—such as destruction of farmsteads, communities, places of worship, and lessening worry and stresses of flooding—were measured. Economic changes, such as growth and development were measured to understand residents' perceptions of how life would be changed with a diversion. Similarly, environmental perceptions were measured to understand how respondents believe their lives would be changed with a diversion in place.

Resiliency cannot truly be tested until after a change occurs. After all, how can one measure the success of a community adapting to a sudden change when nothing has changed? Future research—if conducted after the diversion is constructed—could benefit this area of resiliency theory by explaining how Fargo-Moorhead residents responded to the diversion. Although resiliency cannot be tested now, perceptions of changes were tested in the questionnaire. It was undeniable that social, economic, and environmental costs and benefits are linked. Currently, it can be argued that, based on the sample obtained from the 115 responses, respondents believe in resiliency based on their level of support for the diversion. Those who

support the diversion place higher emphasis on social, economic, and environmental benefits. Thus, they believe that the community will be resilient even after the diversion is constructed: their responses to issues such as no more sandbagging, growth and development, and benefits to the immediate environment reveal that they think the community may be even stronger post-diversion. Those who oppose the diversion plan place higher emphasis social, economic, and environmental costs. Quantitative results show that they are concerned with community cohesion, funding, and soil and erosion issues that may arise with a diversion. They believe that certain parts of the metro area will not be resilient in spite of the fact that the central core may benefit.

#### **8.1.1. Suggestions for theory development**

The Community Capitals Framework can benefit from this research by taking it from theory to practice. The project measured perceptions of costs and benefits that stem from implementing the diversion plan as a permanent flood mitigation strategy. Qualitative and quantitative analysis revealed that perceptions vary by place but nonetheless are linked: one is more likely to support the diversion if one believes it will provide benefits to the area and vice versa.

However, this project solely measured perceptions of what will happen post-diversion plan. Taking this project from the theoretical—analyzing that which is perceived—to actually measuring changes in capital would provide an understanding of whether perceptions become reality. This would benefit the framework by establishing if spiraling-up is just perceived or if it will actually occur via some of the benefits listed in the questionnaire.

Furthermore, the Community Capitals Framework would benefit from testing actual changes in capital for those who viewed the diversion plan with negative perceptions as well.

For example, beyond examining if a community spirals up, Emery and Flora contend that communities can just as easily decapitalize if too much emphasis is placed on one particular asset or capital. Based on interview data one can argue that too much emphasis was placed on economic benefits and economic costs. Moreover, based on quantitative data analysis, it is clear that among those who had little support for the diversion plan, they perceived social, economic, and environmental costs to substantially outweigh any benefits.

Thus, the CCF would benefit from further researching changes in capital to better understand two scenarios. First, in the event that benefits do emerge from the diversion plan, the framework must analyze if too many economic benefits tilt three-pegged stool of sustainability. Placing too much emphasis on economic issues could actually deteriorate social inclusion and ecosystem health despite perceptions believing that economic benefits will be linked to other benefits for the community. Second, in the event that more costs than benefits stem from the diversion plan, the framework should reveal which assets are being ignored and which assets are driving the decapitalization.

Integrated Coastal Zone Management (ICZM) can utilize this project as a case study of an area preparing for a worst-case scenario prior to it occurring. Many examples exist of communities that did not create an integrated plan until after a major disaster occurred. The Fargo-Moorhead community would serve as an example of an area preparing for the worst beforehand.

This project fits seamlessly with the four components of ICZM. The diversion plan builds on the preexisting flood mitigation strategies that are in place for the greater metropolitan area. The questionnaire used in this study already includes social, economic, and environmental spheres. A cultural element could easily be integrated into the instrument to satisfy component



two of ICZM. The public meetings held by local, state, and federal levels of government agencies accounts for both the third and fourth components of ICZM. Clearly, this project meets the core components of ICZM. The response by Fargo-Moorhead residents to the proposed diversion plan can easily serve as a strong case study that represents a community attempting to preserve its sustainability via permanent measures that provide protection from worst-case scenario environmental events.

This study can offer resiliency theory an example of a community about to embark in sudden change. Although resiliency theory generally relates to unexpected change, the diversion study could provide an example of a community experiencing sudden, *expected* change. Theorists studying resiliency could examine how a community responds to controversial change. Ideas such as response diversity offered by Walker and Salt could be addressed in terms of a Fargo-Moorhead case study. Resiliency theory will benefit from studying the Fargo-Moorhead diversion plan by addressing if the community had higher, lower, or the same levels of plants, animals, and landscape before and after the diversion is implemented. Granted, this analysis cannot take place until after the diversion is constructed, but it would serve as an ideal case study of a community experiencing change and the response it has to adapting to such change.

### **8.1.2. Implications for policymakers**

Policymakers must be cognizant of the fact that sentiments towards the diversion plan vary substantially based on where one is from in the metro area. As a result, policymakers representing different constituents will have drastically different viewpoints towards flood mitigation policy.

Funding is arguably the single largest area that has not yet been addressed by policymakers. In order for the plan to move forward, it will require funding from federal, state,

county, city, and local sources. In the status quo, both the State of North Dakota and the State of Minnesota have pledged different amounts for the construction of the diversion. Cass County imposed a ½ cent sales tax and other local levees provide additional sources of revenue for the project. However, without federal funding, the project cannot move forward. Given the current state of the US economy, the latest legislative session put federal funding for the diversion at 2013 at the earliest. Policymakers must realize that without federal funding—which will account for a significant portion of the funds necessary to build the channel—no other policy should move forward. Sentiment from interview data and the questionnaire revealed that residents are concerned and frustrated with how funding will be acquired. Those in favor of the diversion are disappointed by the metaphorical red tape that must be cut in Washington, DC in order for the project to move forward. Those opposed to the diversion plan are frustrated by the fact that local government officials discuss the diversion as though it has already been given fiscal approval from federal sources. Numerous locals voiced concerns that such a plan can be discussed, outlined, planned, and detailed in depth without federal funds even being allocated. Before the project moves forward, policymakers must understand that the controversy surrounding how the project will be funded is nearly as bitter as the debate of whether or not a diversion should even be used.

### **8.1.3. Implications for practitioners**

Community development practitioners can benefit from this research. It can be used as a case study for areas experiencing an urban-versus-rural conflict. The situation provides an excellent example of a natural resources management issue that has divided the community based on location and proximity to the diversion channel.

Moreover, the instrument that was devised for this project can be used in other disciplines as well. The quantitative data analysis revealed that the social, economic, and environmental costs/benefits are directly related to one another, especially when totaled. The questions/statements asked in the questionnaire can be used as a guideline for sustainability issues that may arise when planning a new community project. The instrument is easily applicable to issues surrounding flooding, flood prevention, and natural disasters. By no means is this instrument only suitable for the diversion plan; it can easily be altered to fit other urban-versus-rural issues or other environmental cost-benefit projects.

Additionally, this project should serve as a reminder to practitioners about the power of qualitative data. It must not be forgotten that the quantitative instrument was devised based off of interview data and documentary data analysis. From those initial methods, a list of costs and benefits were provided for all three areas that define community sustainability. It is my hope that this project proves that mixed method approaches generate powerful data. It cannot be ignored that the quantitative data—which was based off of qualitative methods—fit the theoretical model of relationships between costs and benefits to overall support of a dependent variable. It is highly unlikely that this would have occurred by chance.

## **8.2. Limitations**

This project was limited in a number of ways. For example, the questionnaire was not given to a random sample of Fargo-Moorhead residents. Ideally, the sample would have been given to the general public via a simple random sample of Clay County, Minnesota and Cass County, North Dakota residents. This would have provided feedback from residents by age, gender, location, and time lived at present location. Having such a sample would have allowed this project to test for differences in perceptions by demographic information. It would have

reaffirmed if the views by urban, rural, and West Fargo residents are genuinely different or if they only appear to be divergent on the surface. Due to limited time, a very limited budget, and other constraints, a massive survey simply was not feasible.

Moreover, a large sample would have allowed the researchers to extrapolate the data to fit the entire Fargo-Moorhead metropolitan population. The reality is that although 115 valid responses were obtained, this number is not nearly large enough to make conclusions about the entire population. Thus, while the numbers, statistics, correlations, and significance values shed some light as to attitudes and perceptions of the general public, it is nothing more than results from a small sample of the population. The conclusions made in this project are not representative of the entire FM population and are only indicative of the perceptions from this particular sample.

Furthermore, it must be emphasized that an overwhelmingly large number of the 115 valid responses were from young students attending North Dakota State University. An especially large portion of the sample of students were 18 to 24 years of age, living on campus or within Fargo city limits, and had only been living at their current location between zero and four years. Thus, some of the answers that were provided in this sample may be skewed to preexisting biases within this demographic. For example, one can argue that this particular demographic does not have certain knowledge regarding property taxes, housing values, and insurance rates given the fact that a clear majority of these individuals are not homeowners. Similarly, perceptions and attitudes towards sandbagging, stress, and worry about flooding may be skewed for those who have never actually experienced a flood event. Many respondents revealed that they have lived in the area for less than one year; thus they would not have been

exposed to previous flooding events. This may have altered some of the social perceptions associated with annual flood fighting activities.

In addition to being unfamiliar with some social, economic, and environmental aspects, respondents were also candid about their lack of familiarity to the diversion plan itself. On more than one occasion respondents wrote on the questionnaire that they felt as though they did not know enough about the diversion to make an informed decision about their overall level of support towards it. Even so, most of those respondents took the questionnaire but left question 37 blank. This suggests that some quantitative answers may have been guessed rather than a true indicator of a perception.

Another limitation of this research project was the availability of local leaders, officials, and experts for interviews during the first phase of strictly qualitative research. Of the original 65 contacts in the sample frame, only nine agreed to be interviewed for this study. Perhaps such a low response rate was due to the controversial nature of the topic being studied: it is reasonable to assume that some individuals were not comfortable highlighting possible drawbacks and advantages that may marginalize residents in certain parts of the community while simultaneously improving the quality of life for residents elsewhere. Because a majority of those in the sample frame refused to be interviewed, it was necessary to contact other local groups and organizations involved in flood mitigation and/or the diversion plan. Thus, it should be emphasized that the collective group of individuals used for the qualitative portion of the research project were not all obtained at random, but some contacts were already actively engaged in planning around the diversion plan.

For the purposes of this study, only basic quantitative data was obtained. The project did not address Type I Error, Type II Error, correlations between demographics, Chi Squared

Statistics, or other measures for statistical analyses. Testing these areas as well would have reaffirmed that the questionnaire was indeed powerful and capable of measuring perceptions of costs and benefits of the diversion plan.

Another limitation of the research was the diversion channel itself. Over the course of this project the actual path of the diversion was changed at least twenty different times. Each change resulted in some residents learning that their property was going to be destroyed and other residents learning that their farmsteads and houses were going to be spared. Thus, as this project progressed, it was often difficult to pinpoint landowners that should be interviewed: some who were scheduled to be interviewed suddenly found themselves unaffected by the diversion and vice versa.

Changing the path of the diversion created issues surrounding the estimated cost of the diversion, the number of houses and farmsteads affected by it, the type of impact it had on upstream and downstream communities, the timetable for its creation, and the types of concerns that were discussed by local residents. Although it was relatively easy to sift through these changes, the questionnaire and interview protocol had to be updated accordingly. Future research must accommodate for continued changes.

### **8.3. Recommendations for Future Research**

Future research is needed in the area of understanding how perceptions are related to demographics. Are perceptions truly different between urban, rural, and West Fargo residents? In order to properly answer this question, a sample that is representative of the Fargo-Moorhead metropolitan area must be obtained.

Moreover, it will be important to see if the perpetual delay of federal funding influences perceptions towards the diversion plan. If funding is delayed any further, will residents view the

diversion plan differently? Will they favor other mitigation strategies that provide a smaller level of protection but for a price that can be built immediately? It is highly recommended that this survey be given periodically to test if sentiments change the longer that the project is delayed.

Another interesting element that was not taken into consideration is the event of a flood itself. The diversion plan flew into the local spotlight after subsequent floods in 2009, 2010, and 2011. With virtually no flooding in 2012, will residents be as vocal or opinionated about the diversion after a dry spring? Answering this question could reveal if attitudes towards any type of flood mitigation strategy (especially one as large as the diversion plan) are driven by the hype and worry associated with a flood or if they are genuinely driven by a chance to prevent floods altogether.

Future research will also benefit by using a sample that is large enough to extrapolate the data to fit the entire metropolitan area. The results of this study were based on 115 valid responses. While that provided data that gave an indication of how that sample of the population viewed the diversion, it was not a large enough dataset to fit the entire Fargo-Moorhead population. Thus, the results of this study cannot be described as representative of the entire Red River Valley. Future research must take the questionnaire to a larger scale in order to understand preliminary results of how the greater population views the diversion plan.

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APPENDIX A. INTERVIEW PROTOCOL

Name of Interviewer \_\_\_\_\_ Date of Interview \_\_\_\_\_  
 Interviewee \_\_\_\_\_  
 Address \_\_\_\_\_  
 City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_  
 Phone \_\_\_\_\_ e-mail \_\_\_\_\_

*Thank you for agreeing to visit with me about the North Dakota diversion plan. The interview will take about 45 minutes. I'll ask questions about the impacts that the diversion will have on the Fargo-Moorhead community. I appreciate your candid responses and thoughts. Please feel free to NOT answer any questions with which you are uncomfortable, and you may stop the interview at any time. Neither your name nor that of your neighborhood association will be used in the final report without your written permission.*

<p><b>Potential Flood Mitigation Scenarios—Interview Form</b></p> <p>What is your role in the community?</p>    <p>(Do you have any involvement with the diversion plan?)</p>
<p><b>Scenario 1: Diversion Plan</b></p> <p>A diversion—a 36 mile long, ½ mile wide, 30 foot deep ditch—is built in rural North Dakota about 10 miles west of Fargo. Fargo and Moorhead are protected from flooding: water that would have otherwise flooded Fargo and Moorhead is sent in the diverted channel and rejoins the Red River about 20 miles north of the metro. Some downstream communities experience higher levels of flooding.</p>
<p>What do you think of this scenario?</p>    
<p>What are some of the pros and cons that this plan would bring to <i>you</i>?</p>    

<b>PROS</b>		<b>CONS</b>	
1.		1.	
2.		2.	
3.		3.	
4.		4.	
5.		5.	
6.		6.	
(Specific Questioning From List Below)			
	<b>BENEFITS</b>		<b>COSTS</b>
<b>S</b> <b>O</b> <b>C</b>	What social benefits do <i>you</i> foresee occurring in this scenario? (sandbagging, permanent protection)	<b>W</b> <b>O</b> <b>R</b> <b>D</b>	What types of social costs do <i>you</i> imagine may occur? (downstream flooding, destroying farmland)
	1.		1.
	2.		2.
	3.		3.
<b>E</b> <b>C</b> <b>O</b> <b>N</b>	Are there any economic benefits that <i>you</i> think would take place in this scenario? (no flood damages to business districts, areas that would have otherwise flooded are now dry and can be built on)	<b>W</b> <b>O</b> <b>R</b> <b>D</b>	Would <i>you</i> see any economic costs in this scenario? (funding the diversion, taxes)
	1.		1.
	2.		2.
	3.		3.
<b>E</b> <b>N</b> <b>V</b> <b>I</b> <b>R</b>	What environmental benefits would <i>you</i> enjoy from a diversion? (no erosion in city, increased irrigation?)	<b>W</b> <b>O</b> <b>R</b> <b>D</b>	What environmental impacts would <i>you</i> encounter with a diversion? (erosion, sedimentation, fish passage)
	1.		1.
	2.		2.
	3.		3.
Is this plan fair? Do you feel that some groups have not had a chance or say in the diversion project?			

<b>Scenario 2: No Action</b>		
No new flood mitigation strategy is used to fight the upcoming spring flood. Instead, the community uses the current dams, levees, dike systems, and sandbagging techniques to prevent flooding from taking place in the Fargo-Moorhead metro area. Some existing projects—Baldhill Dam, Orwell Dam, Lake Traverse—lower the flood level anywhere from 18 inches to 4 feet per project, but river levels are high enough where additional sandbags are needed.		
What do you think of this scenario?		
What are some of the pros and cons that this plan would bring to <i>you</i> ?		
<b>PROS</b>		<b>CONS</b>
1.		1.
2.		2.
3.		3.
4.		4.
5.		5.
6.		6.
(Specific Questioning From List Below)		
	<b>BENEFITS</b>	<b>COSTS</b>
<b>S</b>	What social benefits would <i>you</i> experience if no new or permanent flood prevention strategy was used? (sense of community togetherness, sense of accomplishment in helping others)	What social costs do <i>you</i> think would take place in this scenario? (not enough volunteers, community disappointment and hysteria if dikes/levees/sandbags do not hold)
<b>O</b>	1.	1.
<b>C</b>	2.	2.
	3.	3.
<b>E</b>	What economic benefits would <i>you</i> enjoy from this scenario? (saving businesses, getting paid to sandbag?)	What economic costs would possibly affect <i>you</i> if no action is taken? (miss work to sandbag, pay for flood damages to house, need to buy flood supplies)
<b>C</b>	1.	1.
<b>O</b>	2.	2.
<b>N</b>	3.	3.

<b>E N V I R</b>	What environmental benefits would <i>you</i> experience in this scenario? (no intentional alteration of species habitats)	Would “no action” have any environmental costs that immediately impact <i>you</i> ? (erosion, mold, water-borne illnesses)
	1.	1.
	2.	2.
	3.	3.
Is this plan fair? Do you feel that some groups have not had a chance or say in the diversion project?		

<b>Scenario 3: Non-Structural Measures</b>	
Non-structural measures are those that remove damageable property from flooding rather than redirecting the flood waters away from property. Non-structural measures include a variety of actions such as evacuating flood plains, relocating structures, and elevating structures above the design flood level. This scenario would buy out many homes, elevate some properties, and relocate a number of families, businesses, and one school.	
What do you think of this plan?	
What are some of the pros and cons that this plan would bring to <i>you</i> ?	
<b>PROS</b>	<b>CONS</b>
1.	1.
2.	2.
3.	3.
4.	4.
5.	5.
6.	6.
(Specific Questioning From List Below)	

	<b>BENEFITS</b>	<b>COSTS</b>
<b>S O C</b>	<p>What social benefits would <i>you</i> experience in this scenario? (no need to sandbag, buyouts eliminate flooding)</p> <ol style="list-style-type: none"> <li>1.</li> <li>2.</li> <li>3.</li> </ol>	<p>What social costs would <i>you</i> foresee with non-structural measures? (forced relocation of some families and homes, community would have to be accepting of aesthetic looks of elevated buildings)</p> <ol style="list-style-type: none"> <li>1.</li> <li>2.</li> <li>3.</li> </ol>
<b>E C O N</b>	<p>What economic benefits would <i>you</i> receive given this scenario occurs? (won't miss work for sandbagging??)</p> <ol style="list-style-type: none"> <li>1.</li> <li>2.</li> <li>3.</li> </ol>	<p>What economic costs would <i>you</i> experience with non-structural measures? (cost of elevating a home, relocation may mean more expensive home)</p> <ol style="list-style-type: none"> <li>1.</li> <li>2.</li> <li>3.</li> </ol>
<b>E N V I R</b>	<p>What environmental benefits would <i>you</i> enjoy in this scenario? (river floods naturally, no changes to species habitat, development of riparian habitat)</p> <ol style="list-style-type: none"> <li>1.</li> <li>2.</li> <li>3.</li> </ol>	<p>What environmental costs would impact <i>you</i> if non-structural measures was used as a flood mitigation strategy? (erosion near river, river would flow into areas that were previously protected by sandbags)</p> <ol style="list-style-type: none"> <li>1.</li> <li>2.</li> <li>3.</li> </ol>
<p>Is this plan fair? Do you feel that some groups have not had a chance or say in the diversion project?</p>		

Specific questions (cues, prompts)

**Scenario 1:**

(Social costs/benefits)

If you don't need to sandbag, what will you do with that extra time?

Without the need for sandbagging, will you be at work more (and have more money)?

What are your thoughts about the idea that sandbagging and flood fighting helps bring a community together? (Will the diversion change that?)

Will having permanent protection from flooding give you peace of mind?

What are your thoughts about the current flood season?

How do you feel about the downstream flooding?

Do you know anyone who will be affected by the downstream flooding?

Do you know of people who will lose their homes? (tell me about their experiences)

How do you think farmers will be affected by the diversion?

If farmers are affected by downstream flooding, will it impact your life in any way?

Do you feel that the distribution of impacts is fair? (Why not? Is it necessary?)

(Economic costs/benefits)

Is your property affected by the diversion?

What are your thoughts about home buyouts?

If no flooding occurs, how will the business district be different from the present?

If the diversion works as planned, do you foresee room for more development in Fargo?

How will areas that were flooded before be used if they are dry year-round?

How do you imagine the diversion plan would be funded?

Do you think that a tax would be implemented to raise funds for the diversion?



Would you be willing to pay a tax for the diversion?

Do you think a special assessment would be implemented to raise funds for the diversion?

Would you be willing to pay a special assessment if it meant protection from flooding?

How do you feel about property tax increases as a way to pay for the diversion?

How much do you think is an acceptable price to pay?

Would you prefer any other methods for raising funds for a diversion?

(Environmental costs/benefits)

Under this plan, would erosion still be a problem for the city?

Do you think there would be potential for increased irrigation with a diversion?

How do you think farmland a prairie will be impacted by a diversion?

What are your opinions about re-routing water onto farmland?

If a diversion is built, would there be any problems with sedimentation?

How do you think natural habitat would be affected by a diversion?

How do you think plant and animal species would be affected by a diversion?

How do you think the quality of the river water would be if a diversion were built?

How do you think the quantity of the river water would change for downstream communities?

## **Scenario 2:**

(Social costs/benefits)

Would you go out and sandbag in this scenario?

How do you think sandbagging impacts the sense of “community togetherness?”

How do you think sandbagging makes others feel? Do they feel like they are “helping” others?

With this scenario, do you think that there would be enough volunteers?

How do you think that community members would react if the dams and levees failed?

How would community members react if the sandbags were not built high enough?

(Economic costs/benefits)

Would businesses benefit from this scenario?

Would you take advantage of opportunities to get paid to sandbag?

Would this scenario allow you to continue to work during flooding season?

If this scenario didn't work effectively, would your house be damaged?

Do you have flood insurance?

With this scenario, would you have to pay for additional flood supplies?

Does this scenario differ much from what you are currently experiencing?

(Environmental costs/benefits)

Would this scenario be better for the environment since there is no intentional altering of the landscape?

Is this scenario environmentally beneficial since no species or wildlife habitat will be altered?

Does this scenario benefit the community since it saves a majority of agricultural land?

Would erosion be an issue under this scenario?

If flooding occurred, would you be concerned with mold? Other water-borne illnesses?

### **Scenario 3:**

(Social costs/benefits)

If this scenario took place, what would you do with the extra time you had from not needing to sandbag?

Are home buyouts acceptable?

Do you feel that some families may be forced to leave their property?

Is this fair if some of the property has been in the same family for generations?

Would you be ok with how the town looked if some of the houses and buildings were raised?

(Economic costs/benefits)

If you didn't have to miss work to sandbag, would this result in more money in your pocket?

How much does it cost to elevate a home?

Do you think relocation can be more expensive for a family?

How do you think funds will be raised to buyout homes?

Would you be willing to pay a tax if it meant that homes could be bought out?

Would you be willing to do an alternative method for raising funds to buyout homes?

(Environmental costs/benefits)

If the river is allowed to flood naturally, will there be any environmental consequences?

How will plant and animal species habitat be affected by this plan?

Will riparian habitat development improve in this scenario?

Would this scenario result in more erosion than we are currently experiencing?

Would areas that were previously protected by sandbags succumb to flooding?

APPENDIX B. IRB INFORMED CONSENT INFORMATION

NDSU                      North Dakota State University  
Department of Sociology and Anthropology  
107 Music Education  
NDSU Dept. 2350  
PO Box 6050  
Fargo, ND 58108-6050  
701.231.8657

**“Perceived Social, Economic, and Environmental Costs/Benefits of a Fargo-Moorhead Diversion Plan”**

Dear \_\_\_\_\_:

My name is Andrew Kubas. I am a graduate student in Community Development at North Dakota State University, and I am conducting a research project to develop a protocol to be used to gauge support and opposition from Fargo-Moorhead community members for a diversion plan as a flood mitigation strategy. The project will identify which social, economic, and environmental issues residents believe to be most influenced by a diversion. It is our hope, that with this research, we will learn more about which issues are of the utmost importance for community members and how much approval other flood mitigation strategies have from the community.

Because you are a resident/local leader/diversion expert, you are invited to take part in this research project. Your participation is entirely your choice, and you may change your mind or quit participating at any time, with no penalty to you.

It is not possible to identify all potential risks in research procedures, but the researchers have taken reasonable safeguards to minimize any known risks. These known risks include: loss of confidentiality and emotional distress.

You are not expected to get any benefit from being in this research study. However, benefits to others—the greater Fargo-Moorhead community, natural resource management experts, politicians, and other areas facing flood mitigation issues—are likely to include the advancement of knowledge, a better understanding of how flooding influences a community, and an instrument that can be utilized to gauge how other flood prevention methods are viewed elsewhere.

It should take about 30 minutes to complete the questions about how possible flooding scenarios will impact social, economic, and environmental areas of everyday life. The interview will occur at the time and place that is most convenient for you. It will be audio recorded and I will also be taking notes during the meeting. You will not be compensated for your time.

We will keep private all research records that identify you, to the extent allowed by law. Your information will be combined with information from other people taking part in the study, we will write about the combined information that we have gathered. You will not be identified in these written materials. We may publish the results of the study; however, we will keep your name and other identifying information private.

If you have any questions about this project, please call me at 612-229-2308, or call my advisor, Dr. Gary Goreham, at 701-231-7637. You can also e-mail any questions about the project to either my advisor at [gary.goreham@ndsu.edu](mailto:gary.goreham@ndsu.edu), or to me at [andrew.kubas@ndsu.edu](mailto:andrew.kubas@ndsu.edu).

You have rights as a research participant. If you have questions about your rights or complaints about this research, you may talk to the researcher or contact the NDSU Human Research Protection Program at 701.231.8908, [ndsu.irb@ndsu.edu](mailto:ndsu.irb@ndsu.edu), or by mail at: NDSU HRPP Office, NDSU Dept 4000, PO Box 6050, Fargo, ND 58108-6050.

Thank you for your taking part in this research. If you wish to receive a copy of the results, please call or e-mail me and I will forward the information to you as soon as the study is completed.

By checking this box I agree to have this interview audio recorded.

\_\_\_\_\_  
Signature of Interviewee

\_\_\_\_\_  
Date

\_\_\_\_\_  
Signature of Interviewer

\_\_\_\_\_  
Date

APPENDIX C. THOUGHT MAPS

Figure C1 Thought Map of West Fargo Costs: Diversion

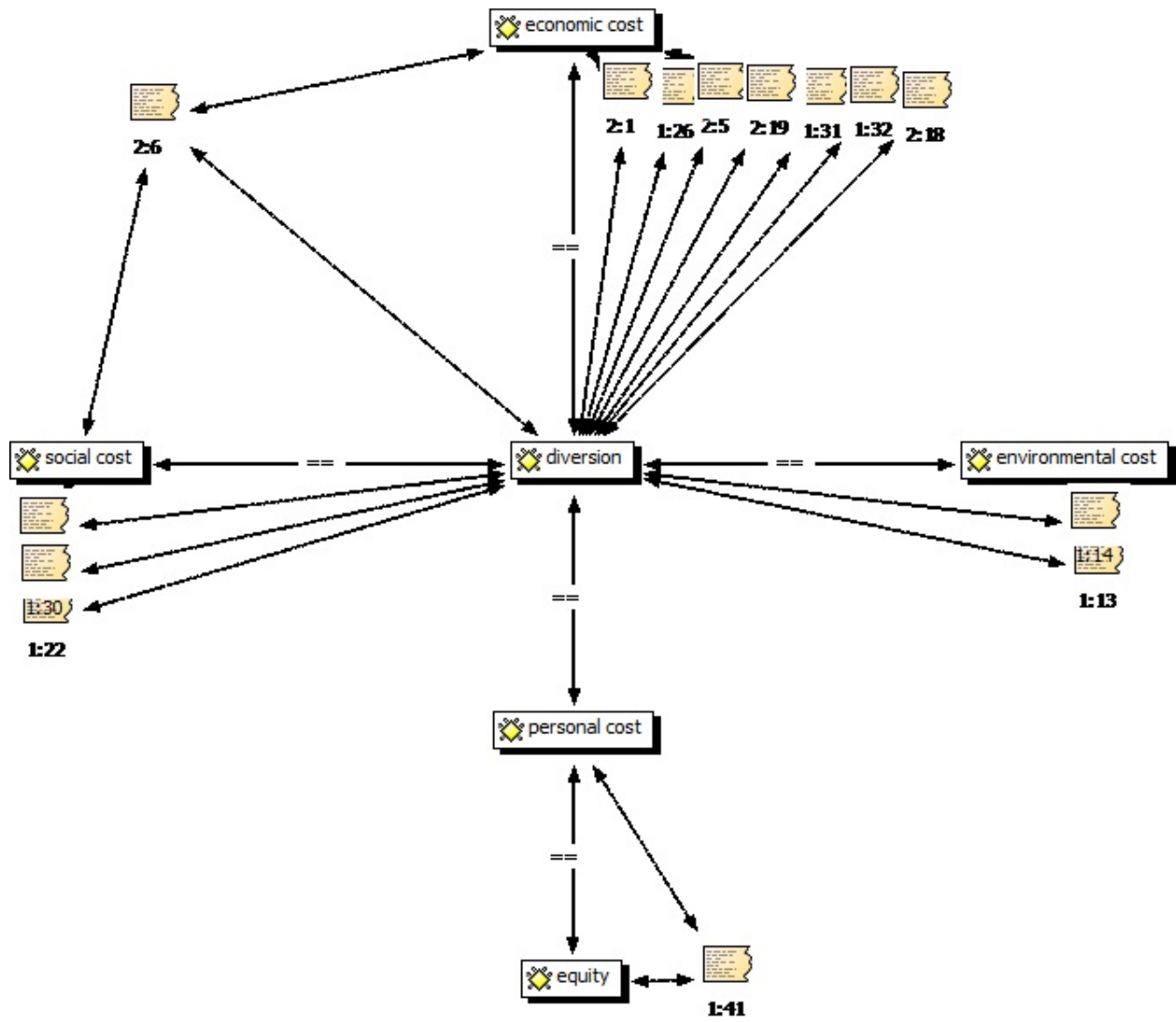


Figure C2 Thought Map of West Fargo Benefits: Diversion

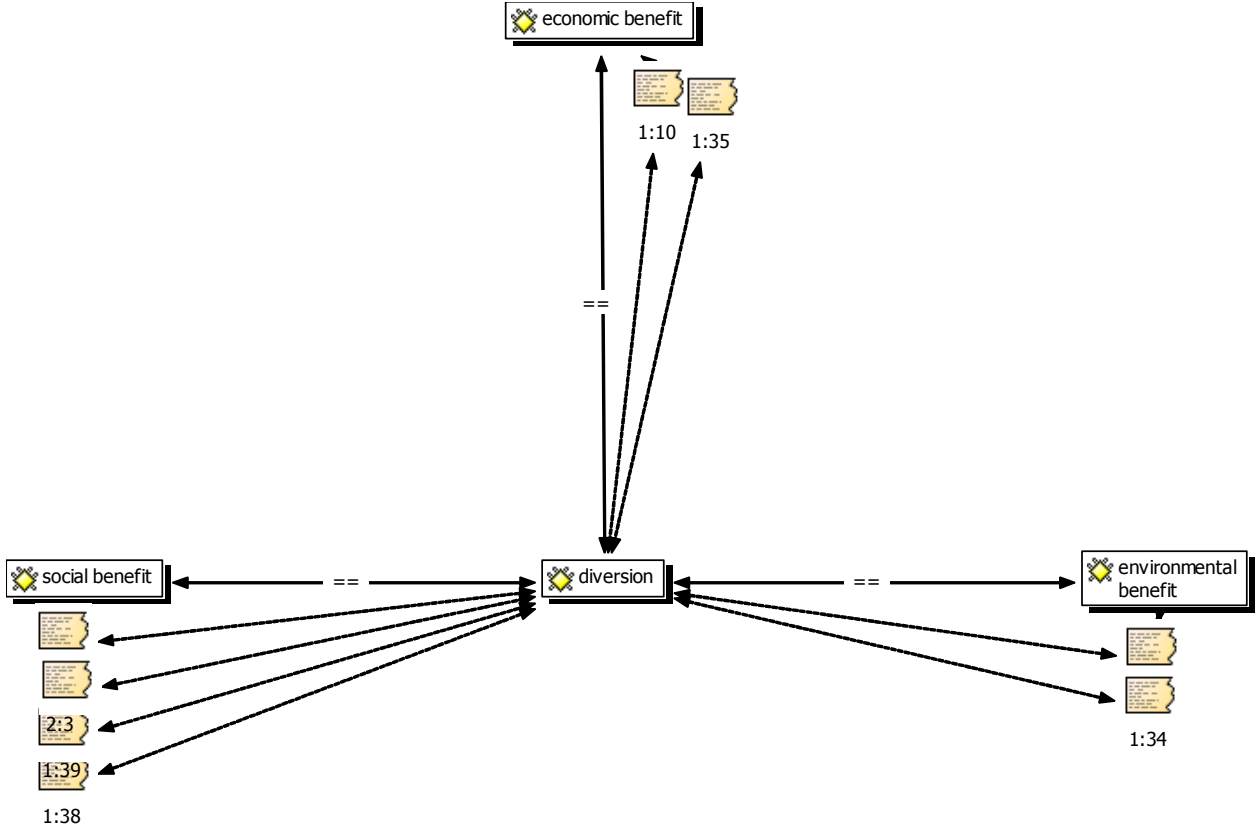


Figure C3 Thought Map of West Fargo Costs: No Diversion

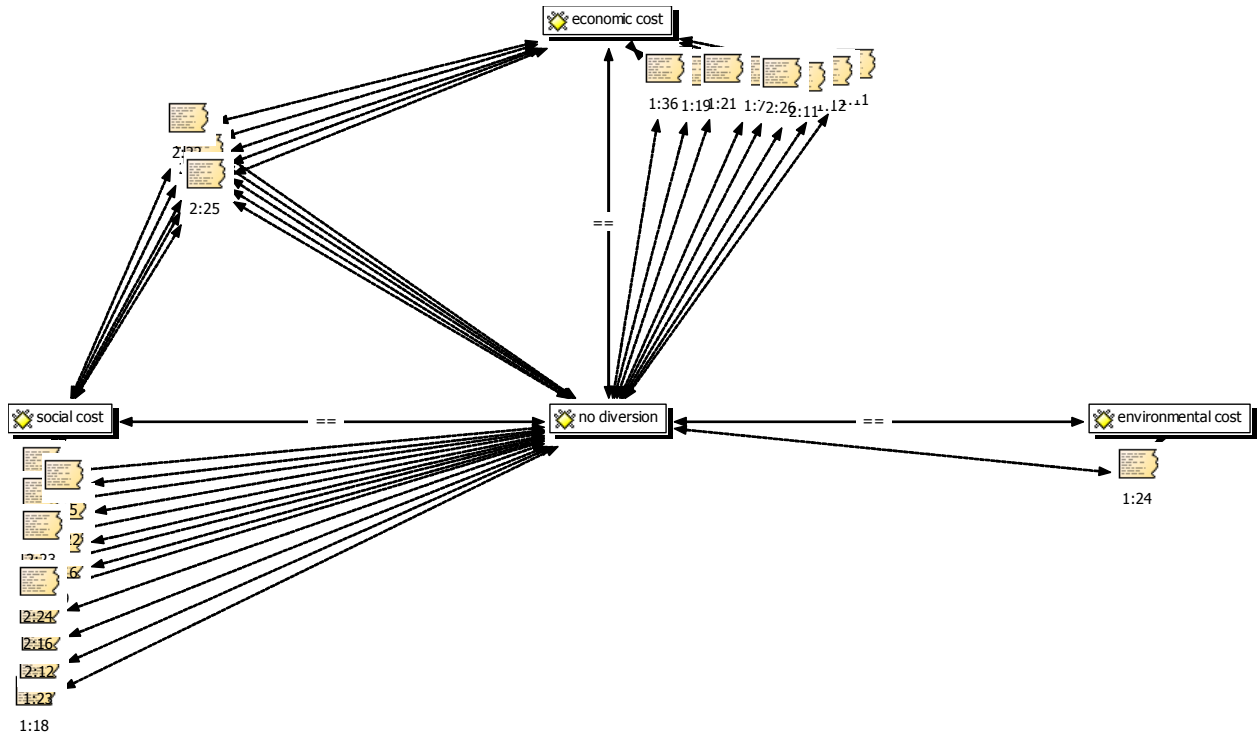




Figure C4 Thought Map of West Fargo Benefits: No Diversion

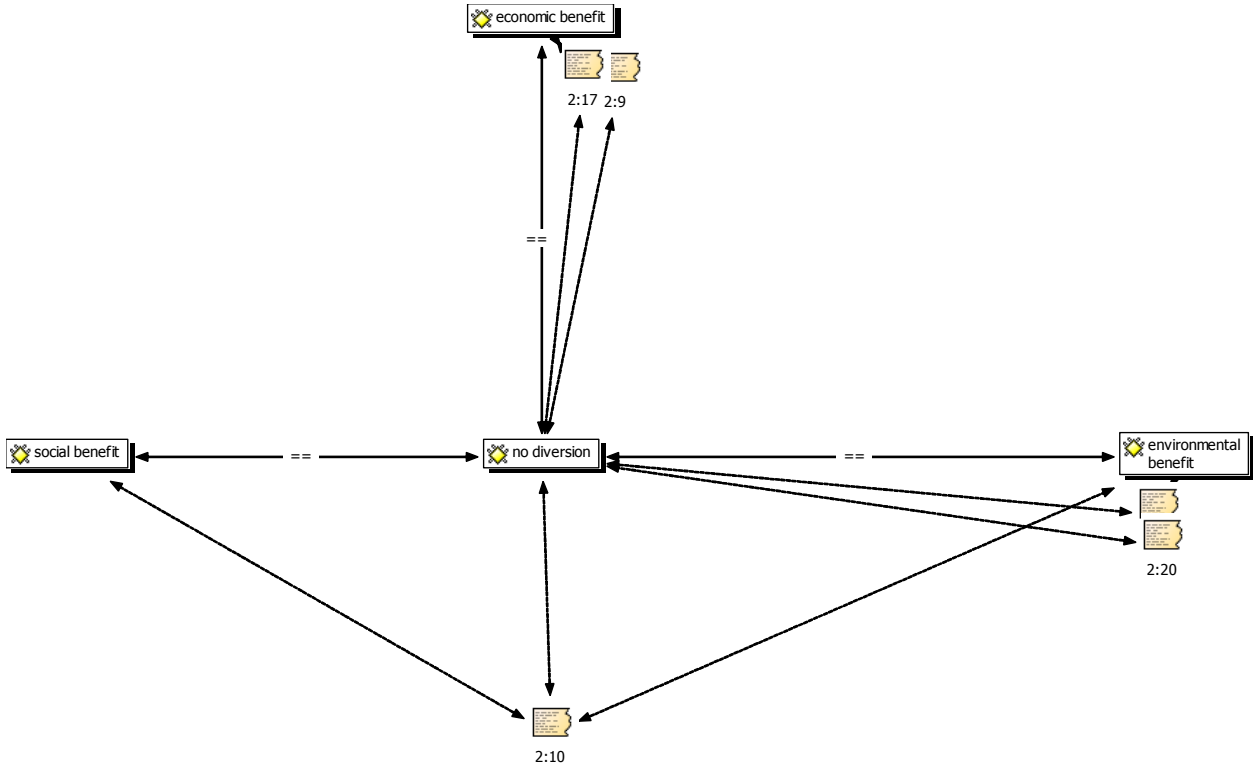
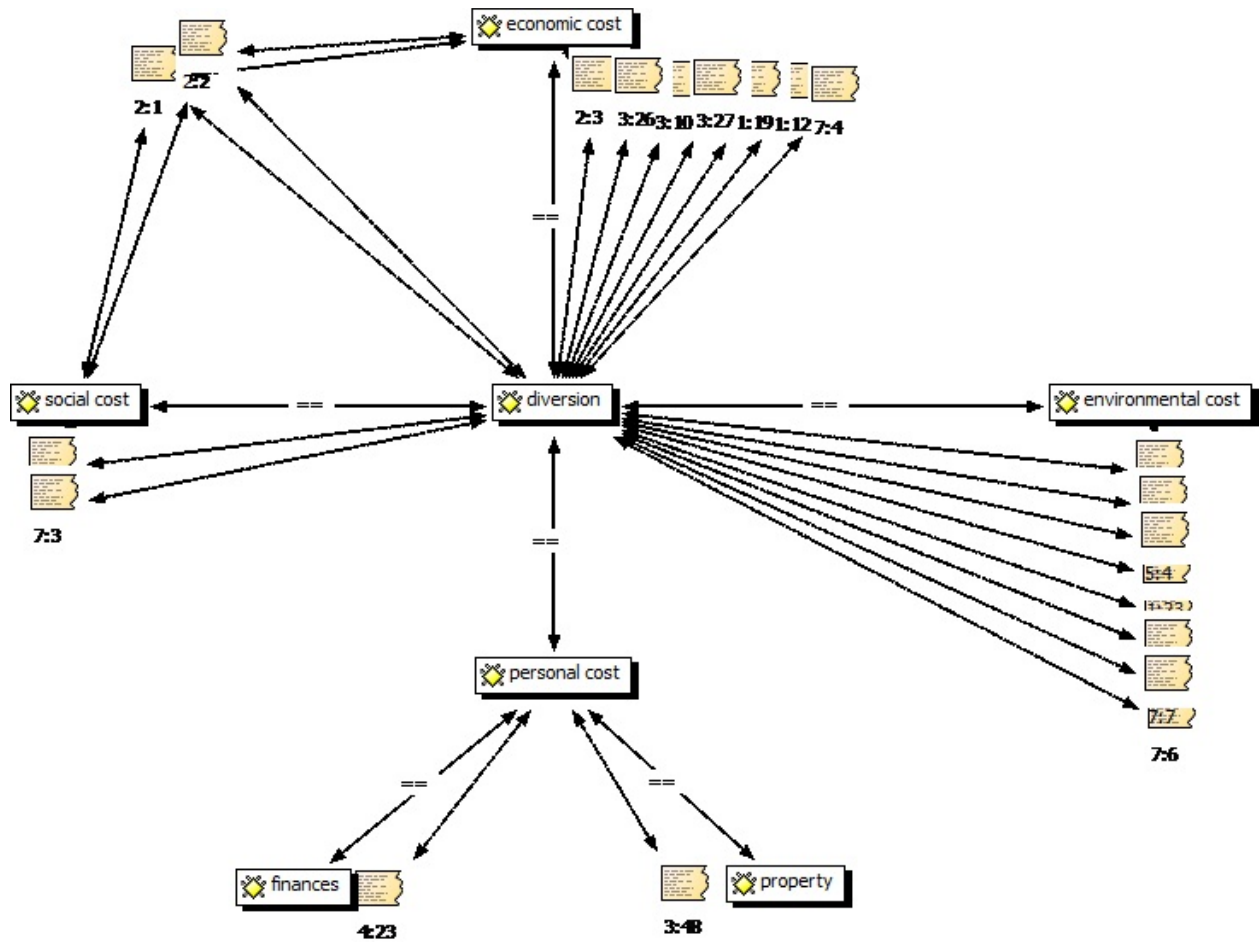


Figure C5 Thought Map of Urban Costs: Diversion



**Figure C6** Thought Map of Urban Benefits: Diversion

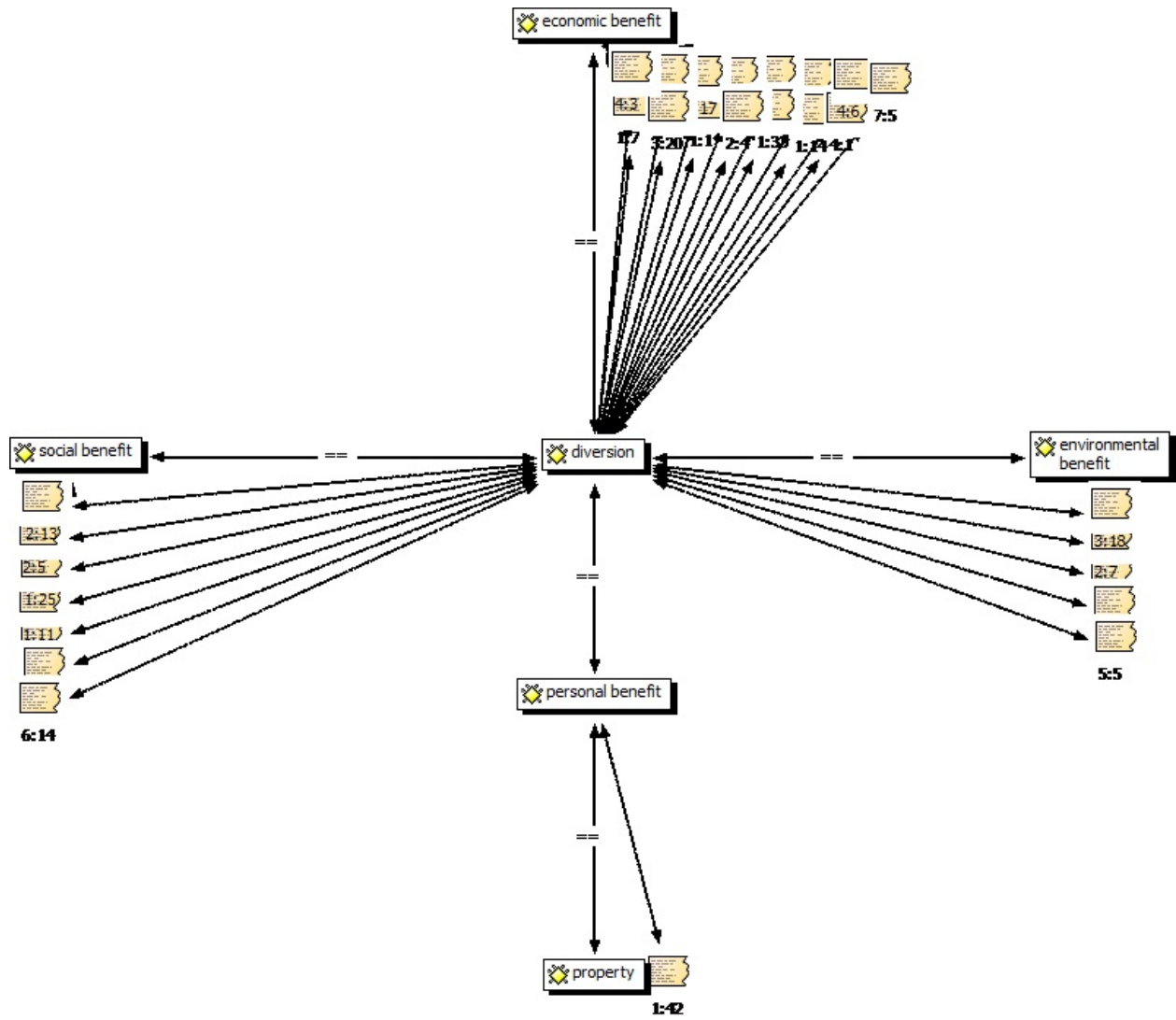
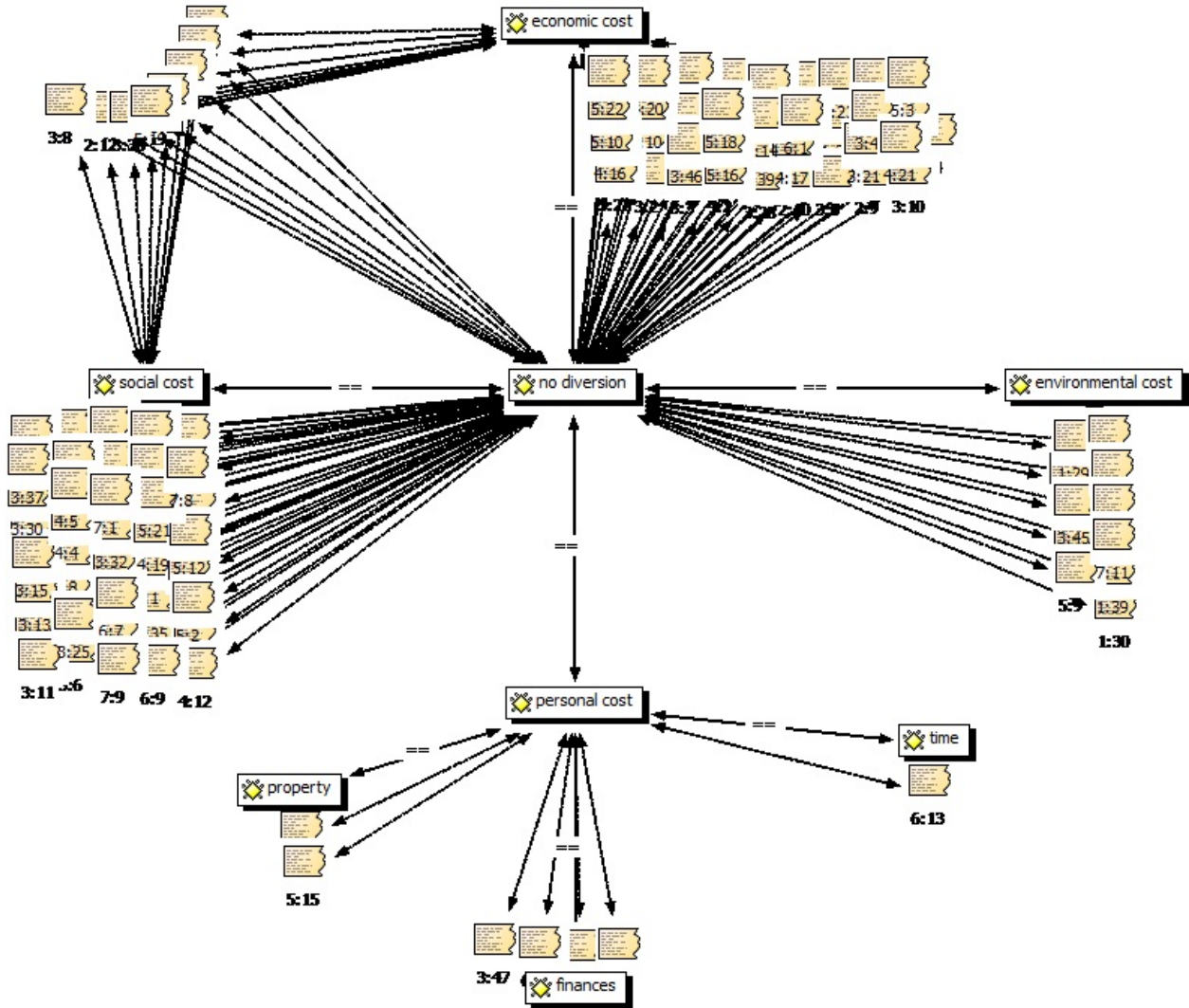


Figure C7 Thought Map of Urban Costs: No Diversion



**Figure C8** Thought Map of Urban Benefits: No Diversion

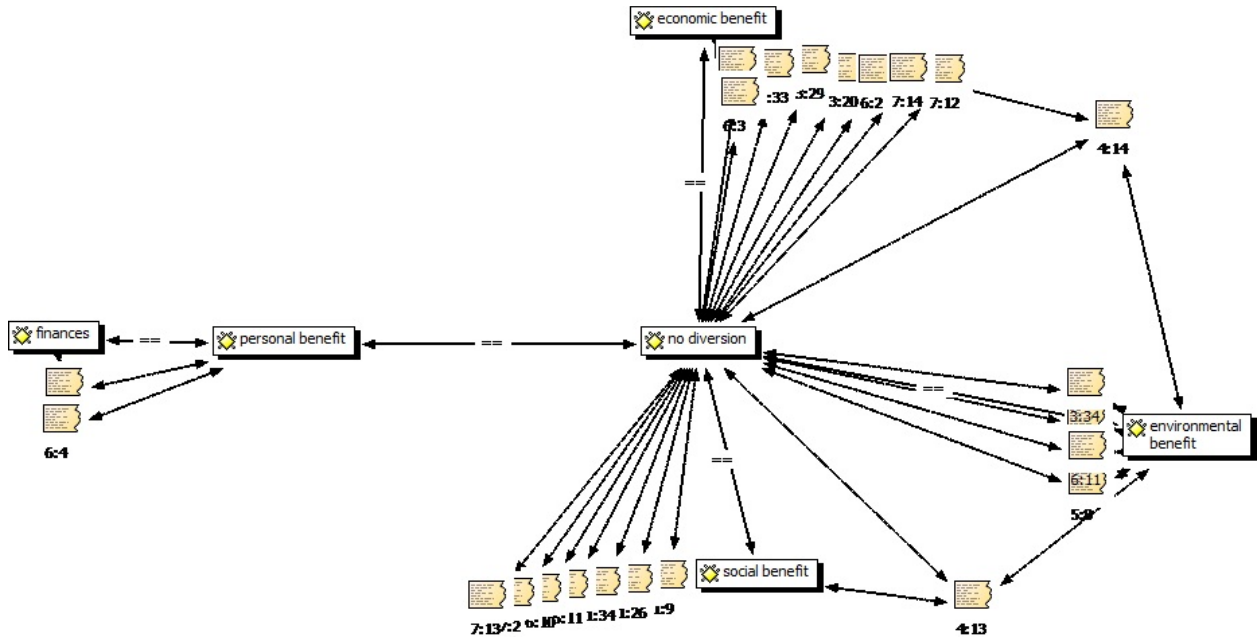
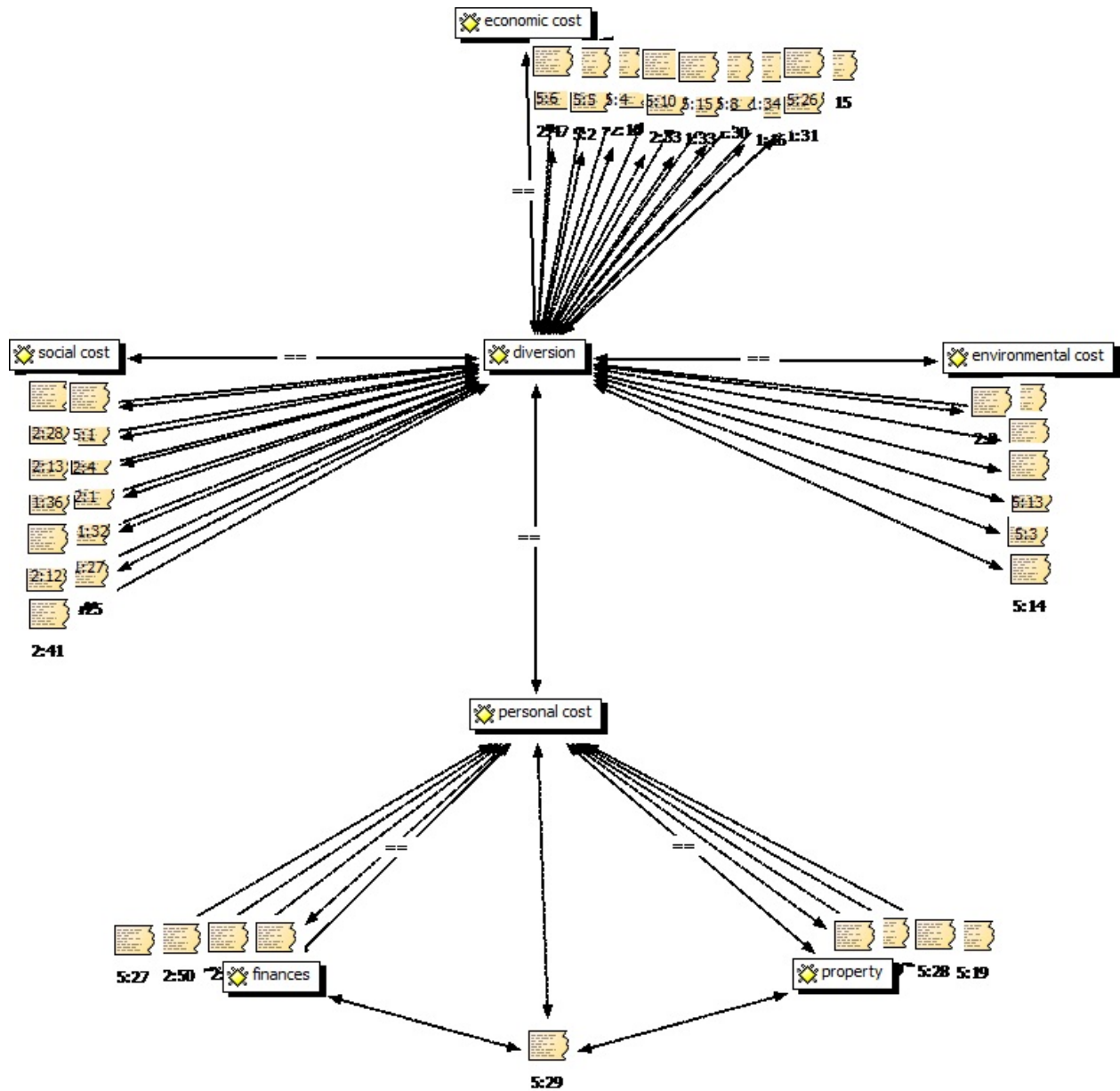


Figure C9 Thought Map of Rural Costs: Diversion



**Figure C10** Thought Map of Rural Benefits: Diversion

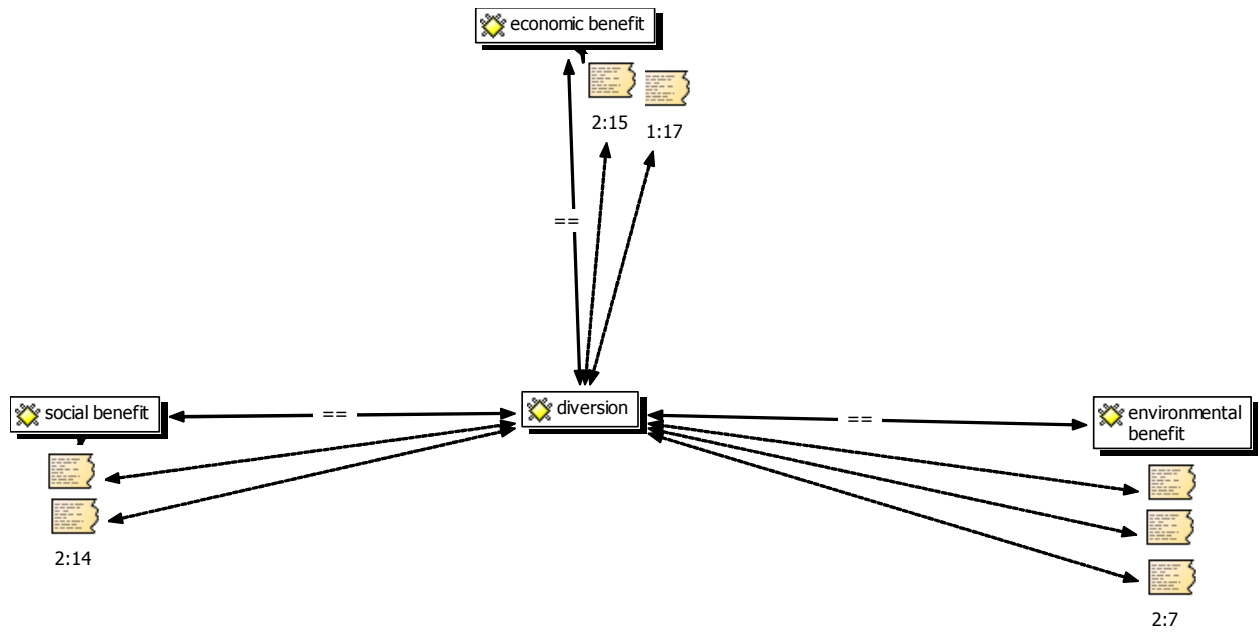
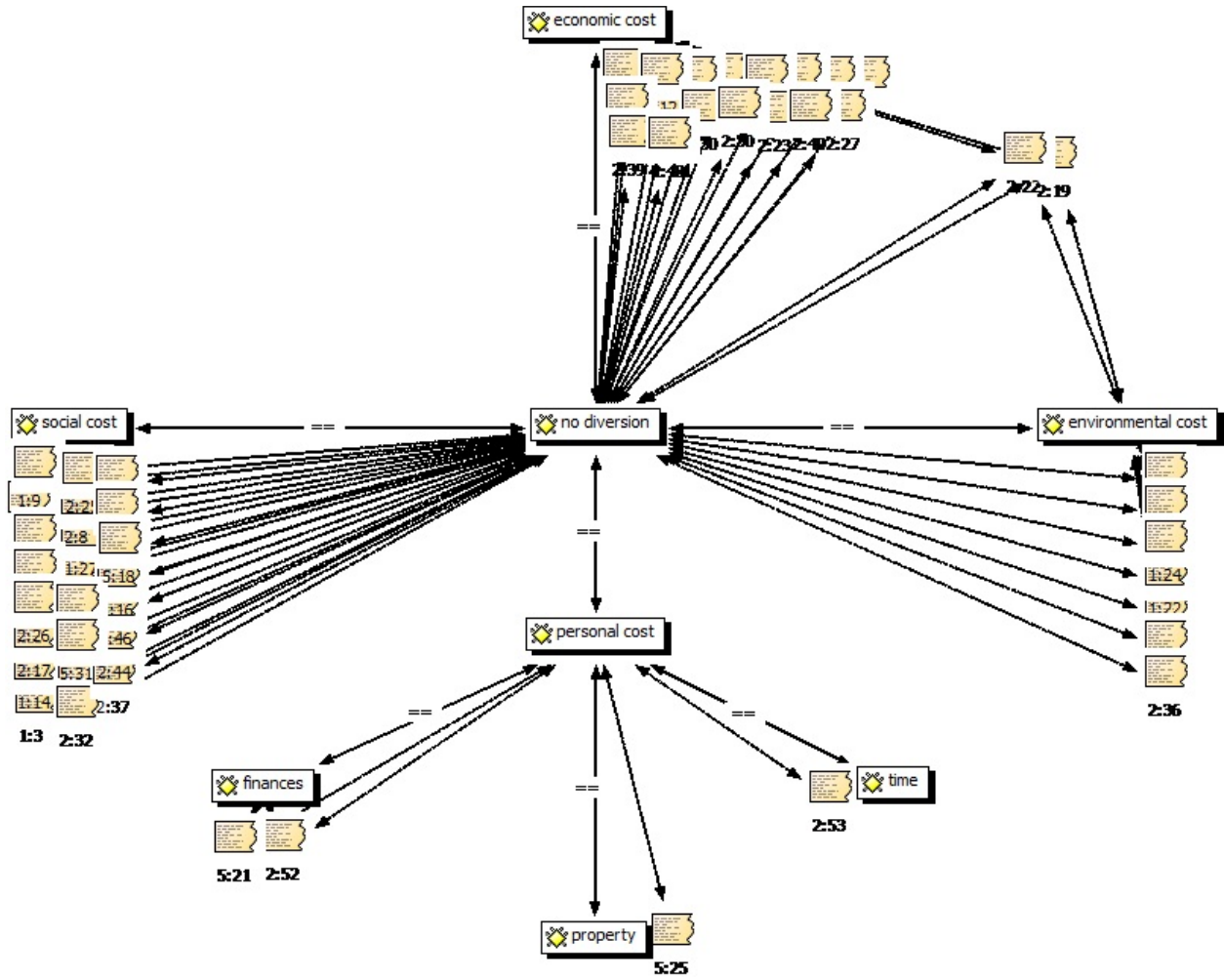
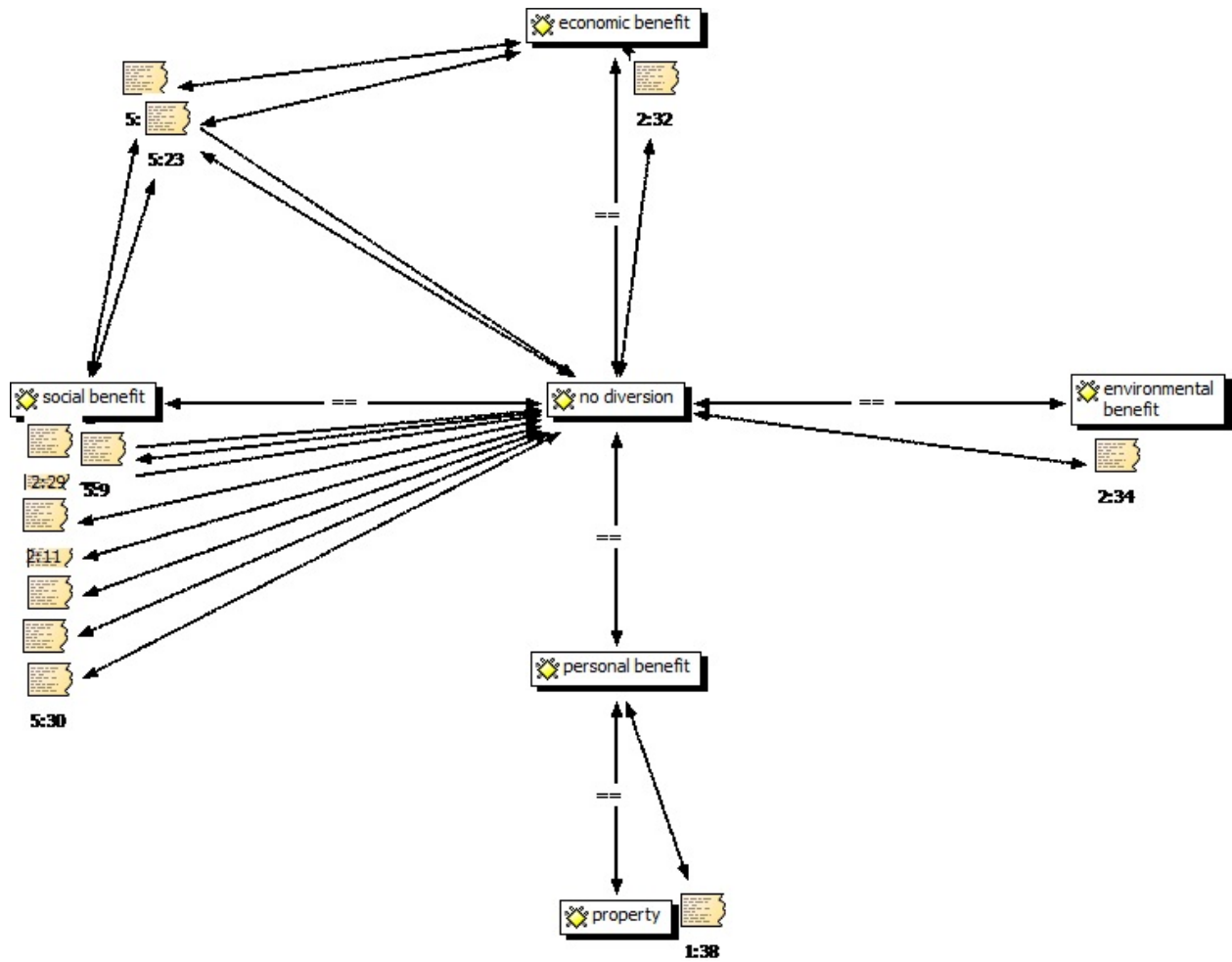


Figure C11 Thought Map of Rural Costs: No Diversion





**Figure C12 Thought Map of Rural Benefits: No Diversion**



## APPENDIX D. INSTRUMENT

		Strongly Agree			Strongly Disagree	
		1	2	3	4	5
1.	I am concerned that the diversion plan will harm my school district.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.	The diversion plan will destroy local farms and farmsteads.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.	I am concerned the diversion may destroy some neighborhoods.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.	The diversion will adversely impact churches, causing some to close.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.	The proposed diversion plan will divide the community more than unite it.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6.	It is unfair that some properties will be bought out to prevent flooding even if they do not flood presently.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		Strongly Agree			Strongly Disagree	
		1	2	3	4	5
7.	Reducing the worry about flooding is worth having a diversion.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8.	The diversion plan will allow rural communities downstream to grow.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9.	I think fewer homes will be bought out with a diversion than without one.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.	I will use the recreational trails that will be created as part of the diversion.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11.	Since the diversion will protect 1/5 <sup>th</sup> of all North Dakotans, it should be built.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12.	I support the diversion plan because I am tired of sandbagging.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		Strongly Agree			Strongly Disagree	
		1	2	3	4	5
13.	F-M taxpayers are not ready to fund the \$690 million local share of the costs.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14.	I am concerned that the diversion will reduce tax revenue for small towns.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15.	I think the diversion plan is the reason why some property values declined.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16.	Economically productive farmland should not be destroyed to make room for the diversion.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17.	I am willing to pay a ½ cent sales tax to help fund flood-fighting efforts.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18.	It is unfair that crop insurance does not cover human-made floods.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		Strongly Agree			Strongly Disagree	
		1	2	3	4	5
19.	The F-M economy would be crushed during a flood, so we must try to save it.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20.	I think a 500-year flood would cost more in damages than the diversion costs.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21.	I would support the diversion if most of the \$1.7 billion costs are spent locally.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22.	A diversion improves places for the F-M community to grow and develop.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
23.	New businesses will want to locate here if a diversion is built.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
24.	I will have to pay more for flood insurance with a diversion in place.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		Strongly Agree			Strongly Disagree	
		1	2	3	4	5
25.	It is important to understand how the diversion impacts fish passage.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
26.	I am concerned about the diversion crossing other rivers.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
27.	It is important to know how the diversion will affect soils.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
28.	I'm worried that the diversion may cause river banks to cave in.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
29.	I am concerned about how many trees will be cut down to build the diversion.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
30.	It is important to control erosion from the diversion.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		Strongly Agree			Strongly Disagree	
		1	2	3	4	5
31.	I think the diversion will minimally impact wildlife.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
32.	The diversion plan is needed because it pushes water away faster.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
33.	A diversion plan helps because it reduces the time that some towns are surrounded by water.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
34.	I favor a diversion plan because it will preserve wetlands.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
35.	The diversion plan will reduce contamination from sandbags.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
36.	Mold and waterborne illnesses will lessen with a diversion plan.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
37.	I support the Fargo-Moorhead proposed diversion plan project.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Your Age:     18-24     25-34     35-44     45-54     55-64     65-74     75+  
 Your Gender:     Male     Female  
 Your Zip Code: \_\_\_\_\_  
 Time Lived at Current Location: \_\_\_\_\_ years