IT'S THE PROCESS, NOT THE PROJECT: THE ROLE OF SOCIAL CAPITAL IN ADAPTIVE CO-MANAGEMENT IN NORTHWEST MINNESOTA

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ABSTRACT

Changing behavior to improve water quality must be endogenous, arising from a balancing or integration of self-interest and shared interests. The subject of this study is the public who are not organized, affiliated or represented by any government agency or special interest group. Property owners living upstream and downstream of a water management control structure were surveyed to determine experiences and opinions about that project. Respondents supported the project, but expressed greater support for the process used to develop the project. The adaptive co-management process used to develop the project built a social organization including norm-based processes, shared goals, and a framework for continuous learning. The resulting social framework provides the opportunity for the individual to modify self interest and to accept the shared interest of the process. Long-term monitoring is recommended to measure ecological and organizational performance of the project.

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CHAPTER 1. INTRODUCTION

1.1. Summary

This study examines land owners' experiences and opinions about management of water resources in the Red River Basin of Northwestern Minnesota through examination of secondary sources and a mail survey. Flooding is the watershed management issue for this study. Flooding is a ubiquitous problem for Northwestern Minnesota. The Red River of the North has experienced multiple major floods. Flooding also occurs in the watersheds of Minnesota's tributaries to the Red. Flooding causes damages to agricultural fields and operations and also impairs the biology of the region's surface waters.

In 1998, local, state and federal government put in place a mediation agreement to guide the process to build projects. The agreement specifically sought to address both flood damages and natural resources in the design process in order to build collaboration across multiple authorities and interests. The survey asks about a specific project built in one of the Red's tributaries. Results of the survey are triangulated with two secondary sources: the mediation agreement that created the project development process and with secondary socio-economic data about the residents of the project area.

Successful watershed management occurs when both the ecological and social dimensions of the watershed are addressed. Linking the natural and human components must occur on several levels: the shared knowledge base; the process used to put management in place; as well as the communication system which monitors, evaluates, and adapts the process. Linking the natural and human components requires a motivating force to activate the parts. It is the premise of this study that it is the citizen who activates the link and forces the adjustments in knowledge, process and adaptation. Further, the role of citizens is defined by the degree to which the management system can successfully integrate the multiple interests at play in the system. The adaptive co-management

framework is intended to build a system where self interests and shared interests can be integrated to become joint interests. The focus of this study is not on how the individual players – or classes of players make decisions – but on whether the individual players believe that the system is empathetic to them, and their habits, experiences, and costs.

Agencies have a role. At the local level, the watershed district designs, builds and funds the project. At the state level, the Pollution Control Agency and the Department of Natural Resources are concerned with the water quality of the state's waters and the health of the state's wildlife. At the national level, the U.S. Army Corps of Engineers is concerned with the integrity of the nation's waters. The agencies' interests are defined by statute and rule, and therefore, the perspective of the agencies is fixed. The citizen acts to achieve his or her interest and thinks about the future. The future-oriented perspective drives the watershed management system. As the citizen activates the link, it is empathy that moves the citizen. The citizen must believe that the system will hear his or her voice and concerns. If the parts of the system are built to accommodate the citizen, the citizen will believe that the relationship engenders empathy.

This study examines the role of the property owner in a watershed management system in Northwestern Minnesota. The property owner is not affiliated with any group, organization or agency representing his or her interest. Yet, this person is critical to the success of watershed management for two reasons: first, because it is the goal of the watershed management system that the property owner apply land management practices that minimize problems; and second, because the property owner pays for the government agencies managing the watershed at various levels through taxes, either on property at the local level, or through income and sales at the state and federal level.

Involving the public is a tenet of watershed management. Despite this imperative, few watershed management programs discuss how to identify the public who needs to be involved, how to recruit

the public to the process and to the actions required of management, and how to incorporate them into the process. Using the lenses of the community capitals framework, systems thinking and the adaptive cycle, this study examines how the public or stakeholder moves the linked ecological and social systems to action that resolves environmental problems. The necessary components for that are the following elements: an independent knowledge base; a decision making process that accommodates multiple interests; a norm-based approach to goal setting; and a commitment to adaptation. With those in place, the public recognizes that they can be heard. Their interest is not so much the outcome as it is their belief that the system will hear them.

Empathy is the act or capacity to understand or be aware of another's feelings, thoughts, or experiences either past or present, without having those feelings, thoughts or experiences fully communicated in an explicitly objective manner. The adaptive co-management process necessarily involves all players in the system from the beginning and does not bring in an affected group at the end of a technical study, for example. This study is specifically concerned with the experience of those who are most affected by that process but who have the least ability to participate in the decision making of the process. For this study, the issue of empathy is the degree to which the members of the unaffiliated public believe that the system views them with empathy. Their concern is, "Will I be heard?" and "How do I want to be treated?" They understand that their self interests must be balanced or integrated with the shared interests of the various communities in which they operate. What is important to them is that there is a forum for integrating interests and generating a joint interest.

A watershed management process that accommodates the multiple and divergent viewpoints expressed by a watershed's residents helps to build the perception in the unaffiliated public that the system is empathetic towards them. Believing that the system is open to hearing from them is a step toward building social capital, in the sense that it is using an existing resource – the people who must

live with the watershed management decisions - to invest in the community's well-being and its future. The First Law of Thermodynamics states that every action has an effect. In this study, the concern is the social impact of the effect of the process to develop multi-purpose flood damage reduction projects in farm country.

Figure 1 below illustrates how the Mediation Agreement sets the frame for the study. The secondary data collection identifies the citizens and the mail survey expresses their attitudes. The three together produce a set of recommendations for the managers of the process.

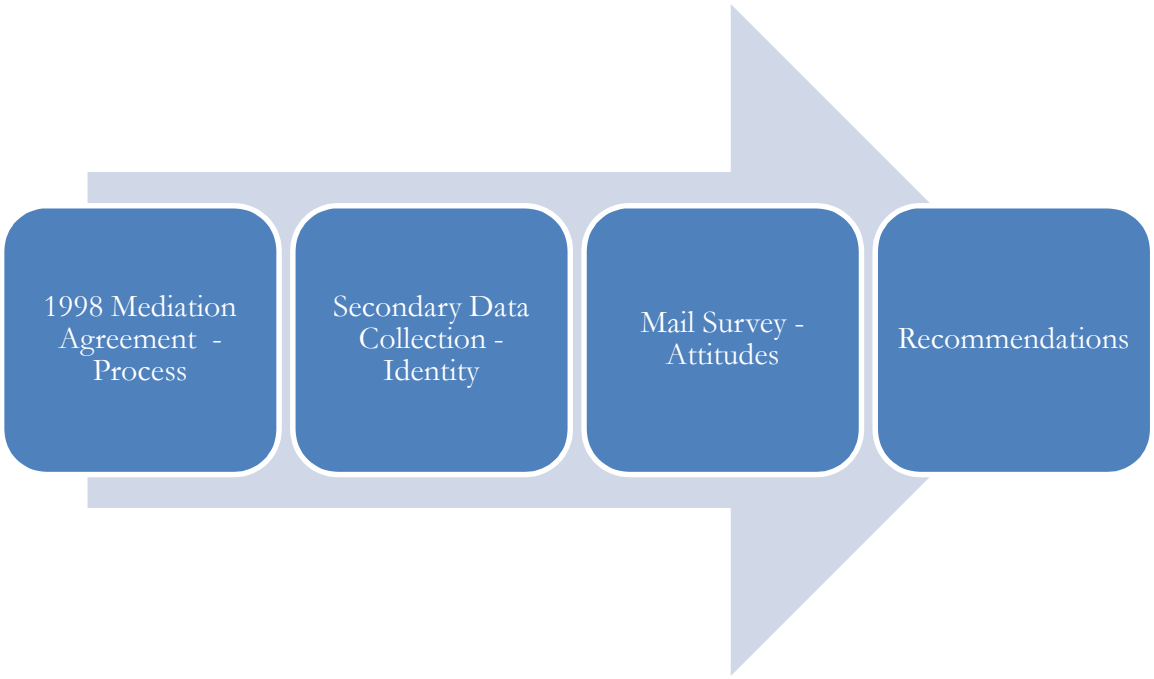

Figure 1. Flow chart of research design.

1.2. The Red River Basin

Two landscapes intersect in the Red River Basin: the Red River bordered by flat riparian lands lying 30 to 60 miles east of the river; and the sandy hills that rise above it running north to south. These sandy hills are the remnant beach ridges of glacial Lake Agassiz, formed as the lake gradually receded over thousands of years. Once drained, the former lake bed became a wet meadow, dotted by ponds, wetlands and marshes. The former beach ridges became sandy hills covered in hardwood forests with defined stream channels and lakes. Water drains from both the sandy hills and the clay soils to the Red River of the North. Water from both contributes to flooding during a spring snowmelt or a summer rainstorm. The two intersect but are not mutually dependent; controlling one does not necessarily reduce the problems caused by the other.

The Red River of the North lies in unusually flat terrain and it flows north towards Lake Winnipeg. These two circumstances, plus the fertility of the soils of its basin, are at the heart of any consideration of management of its natural resources. "The Red River Basin is a complex hydrologic system which behaves largely as it pleases" (Krenz, 1993, p. 99). Another observer described the effect of flooding in the Red graphically: "Think of the Red River Valley as a long, nearly invisible scratch on a large tabletop. Now imagine pouring a bucket of water on it" (Grinde, 1997, p. 4).

In the spring, runoff from melting snow can fill the river and back up onto adjacent lands and up the channel of contributing waterways. This flooding is exacerbated when the north-flowing river runs into ice downstream. It takes more than three weeks for the water to thaw from its southern headwaters at the confluence of the Bois de Sioux and Ottertail Rivers to its northern confluence at Lake Winnipeg, and it has caused billions of dollars of damage in the process. In short, the Red River of the North is geologically and topographically destined to flood any year when precipitation and snow fall amounts are average or above average. The geological and

topographic conditions contributing to this certainty are: the timing of river discharge with spring thaw; the effects of thawing ice jams; the fact that the river flows through the bed of glacial Lake Agassiz; and finally the fact that the gradient of the river decreases, as it moves downstream towards the Canadian border from five inches per mile at Fargo, to 1.5 inches per mile at Drayton (Schwert, 2009).

The Red River Valley and its larger basin is a relatively young landscape, from a geological perspective. The glaciers the created Lake Agassiz occupied the region 10,000 to 15,000 years ago. The Red River itself meanders across the lake bed composed of clay soils for about 400 miles, flowing north to its confluence with Lake Winnipeg. The Red River is fed by a dozen smaller rivers flowing west from the basin's Minnesota uplands and across the flat lake bed. These streams contribute up to two-thirds of the Red's flow. Before European settlement, the lands that once were the ancient lake bed were a mosaic of prairies, wet meadows and shallow marshes. "Early surveys described township-sized marshes and rivers that 'became diffused and lost' within them" (Miller, 2001, p. 9).

> This complex geological and topographical setting creates a hydrological variability across the basin, meaning that runoff from the watershed may or may not contribute to flooding on the mainstem Red River of the North The relatively flat Red River basin with its many depressional storages does not readily lend itself to evaluation based on the typical hydrological concepts on which most watershed models are based. Instead, detailed data collection and analysis of runoff characteristics of a number of small basins in the Red River basin are needed. (Miller, 1984, p. 44)

1.3. Surface Drainage Changed the Red's Hydrology

Surface drainage of the flat, wet lands of the basin began after the Civil War and was promoted especially by railroads. Regional drainage plans were proposed at conventions held in Crookston in 1886, again in 1900, and at Grand Forks in 1906. An additional study was funded by landowners in 1918. The 1886 survey proposed draining 808,600 acres. Between 1890 and 1920, "many millions of dollars" had been spent on open ditching, typically set one mile apart (Miller, 1984, pp. 22-3). The

result of this activity was that "every county in the valley on both sides of the river had systems of big drainage ditches built largely in the first 25 years of this century" (Miller, 1984, p. 24). In the years before World War II, the ditch system was neglected, perhaps due to dry conditions at the time.

Ditching and ditch improvement began again in the 1950s, 60s and 70s. It was during this time that Minnesota passed the statute authorizing establishment of watershed district and developed the process for drainage authority. By the end of that period, every mile of ditch benefitted 125 acres in the Red River Valley (Miller, 1984, p. 24). The landscape of the Red River Basin was transformed in the process, with nearly 70 percent of the land surface in row crop production.

The surface drainage was accomplished by channelizing or straightening existing streams or channels; by-passing existing channels to connect tributaries to larger rivers; or by using farm equipment to "scrape" drains to direct flow on farm fields in early spring. Channelization, or surface drainage, led to construction of more channels and deepening, widening and cleaning existing drainages. This was the dominant management stragegy to reduce flooding, but it was not satisfactory. The channels tended to fill in; the channels themselves often flooded, and there was a strong presumtion that creating channels sent water faster downstream to the mainstem Red River. For example, in recent years, the mayor of Fargo visits watersheds upstream of the city in late winter and early spring, to view conditions and anticipate flooding in his town.

In Minnesota, the state, counties and municipalities each exercise authority to drain lands for agricultural production. "Associations" of interested persons were initiated to address drainage and flooding beginning in 1870. A "Congress" of persons interested in water management convened annually until 1909. The "Tri-State Flood Control Association" convened in Fargo until 1919. The first discussions on upstream water retention progressed through these organizations. A "Tri-State Commission" was organized in 1937 and functioned until 1948. The installation of more than forty

water control structures for flood damage reduction, water supply, and hydro-power was accomplished in this time period.

In 1955, the Minnesota legislature authorized the formation of Watershed Districts to manage water in a holistic manner. Eleven districts have been formed in the Red River Basin. The authorizing statute provides the watershed district with authority to manage flood damages as well as water quality. The enabling legislation for watershed district is comprehensive:

> To conserve the natural resources of the state by land use planning, flood control, and other conservation projects by using sound scientific principles for the protection of the public health and welfare and the provident use of the natural resources, the establishment of watershed districts is authorized under this chapter.
>
> A watershed district may be established for any of the following purposes:
>
> (1) to control or alleviate damage from flood waters;
>
> (2) to improve stream channels for drainage, navigation, and any other public purpose;
>
> (3) to reclaim or fill wet and overflowed land;
>
> (4) to provide a water supply for irrigation;
>
> (5) to regulate the flow of streams and conserve the streams' water;
>
> (6) to divert or change all or part of watercourses;
>
> (7) to provide or conserve water supply for domestic, industrial, recreational, agricultural, or other public use;
>
> (8) to provide for sanitation and public health, and regulate the use of streams, ditches, or watercourses to dispose of waste;
>
> (9) to repair, improve, relocate, modify, consolidate, and abandon all or part of drainage systems within a watershed district;
>
> (10) to control or alleviate soil erosion and siltation of watercourses or water basins;
>
> (11) to regulate improvements by riparian property owners of the beds, banks, and shores of lakes, streams, and wetlands for preservation and beneficial public use;
>
> (12) to provide for hydroelectric power generation;
>
> (13) to protect or enhance the water quality in watercourses or water basins; and
>
> (14) to provide for the protection of groundwater and regulate its use to preserve it for beneficial purposes (Minnesota Statutes 103D.201 accessed on-line Feb. 28, 2012).

1.4. Impoundments are a Preferred Alternative

In the late 1970s, watershed district managers began looking at another way to manage excess surface water other than channelization or surface drainage. They argued that storing spring

floodwater in impoundments as an alternative to surface drainage would protect farm fields but minimize downstream flooding. The state of Minnesota provided funding for a timing analysis of floods from the tributaries to determine whether retaining peak flows in the tributaries will reduce flood damages on the mainstem. The study author described the rationale: "While runoff volume may be high from a particular area in the drainage basin, if this runoff reaches the Red River either before or after flood conditions are present, it does not cause damage" (McCombs, May 1984, p. 13).

The study recommended a "basin-wide" approach where impoundments in the tributaries would contribute collectively to an overall reduction of the peak flow of the Red River at Emerson, Manitoba, where it crosses the border between the United States and Canada. The report set a target: reducing peak flows by 20,000 cfs at Emerson would mitigate flood damages on the Red River of the North. This could be accomplished by asking each watershed to contribute to reaching this goal. The study explained:

> Past efforts in dealing with the flooding problem concentrated solely on the effects of single projects on local areas or sub-basins, but neglected the overall basinwide objective. The Corps of Engineeers, Soil Conservation Service, Watershed Districts, Soil and Water Conservation Districts and others have constructed impoundments, dams, levees, channels and other flood control structures in an attempt to alleviate the flooding problem. Unfortunately, these efforts are developed for a specific area and can result in inadequate consideration of the basinwide effect of these structures on flood damage reduction. As a result, it is likely that certain areas may not realize the full poential of flood damage reduction which might otherwise be attainable had it been possible to coordinate them under a management plan.The process of seeking prompt solutions to meet the water resources needs is also hampered by the fact that the basin crosses several political boundaries (McCombs, 1984, p. 6).

A series of impoundments in the beach ridge or upper portion of the watershed would mimic the natural conditions of puddles, ponds, wetlands and marshes that once covered the Red River Basin. Therefore, adding storage, and gating the release of the stored water, provide ecological benefits, such as habitat for migrating waterfowl and shorebirds to rest and feed in the spring and fall. It would also reduce streambank erosion and sedimentation in the water, a persistent condition

throughout the Red and an impairment to water quality. In a letter, Jerome Deal, president of the Bois de Sioux Watershed District, described the benefits of impoundments:

> Impoundments have been identified as a preferred means of addressing the flooding problem when compared to the traditional method of increasing channel capacity. It is locally viewed as a fairer solution in that it does not move the problem downstream. It can also provide multiple benefits related to wildlife, recreation, stream flow maintenance and water quality, all of which are of concern within the watershed (St. Paul, 1996, p. G-271).

The Red River Watershed Management Board was formed by the Minnesota State Legislature in 1976, for the purpose of "instituting, coordinating, and financing projects and programs to alleviate flooding and to assure the beneficial use of water in the watershed of the Red River of the North and its tributaries." Another 33 projects were proposed to address the impacts of flooding by reducing peak discharges and stages on downstream ditch systems, tributaries and the Red River mainstem. Organizers noted that each project would have specific purposes and needs which may include reducing erosion, improving water quality and providing fish and wildlife habitat. The Red Board and its member Watershed Districts made an explict commitment to multiple benefits of impoundment projects.

1.5. The Generic Environmental Impact Statement

By 1993, the Red Board and its member Watershed Districts had proposed more than 30 projects designed to reduce flood damages at various locations. Concern about the cumulative environmental impacts of these projects lead the Minnesota Department of Natural Resources and the U.S. Army Corps of Engineers to seek an environmental impact statement (EIS) identifying environmental effects. The two agencies examined whether the proposed projects, collectively, would reduce peak floods on the Red River of the North, and whether the proposed projects, collectively, would cause environmental harm. A large technical team studied effects of projects on "cultural resources, flood flows and hydrology, fish, wildlife native plants and their ecosystems, socio-economic

resources, tribal trust resources and water quality" (US Army Corps of Engineers, July 1994, pp. 7-8). The resulting multi-volume EIS took three years to complete.

The EIS found that 33 projects "would have little noticeable effect on Red River flooding, but they could cause small environmental damages, that, taken together, could add up to 'significant' environmental harm" (Grinde, 1997, p. 5). The Red River Watershed Management Board objected to these conclusions and the individual findings, and sued in district court. In April 1997, after record snow falls and early rains, the Red River was devastated by a record flood – the largest on record since 1897.

In May, the Minnesota Legislature appropriated funds for a mediation process to resolve the crisis, and in 1998, after eight months of meetings and negotiations, the parties signed the Red River Basin Flood Damage Reduction Work Group Mediation Agreement. The agreement set forth goals for reducing flood damages and enhancing natural resources. The agreement set forth a process for developing projects designed to anticipate concerns from the beginning. Furthermore, it set forth a permitting process designed to overcome traditional barriers.

> The keys to this new approach are clearly identified goals, comprehensive watershed planning, early consultation and collaboration on flood damage reduction projects among stakeholders, and a cooperative approach to permitting of those projects (FDRWG Agreement, p. 2).

1.6. The 1998 Red River Basin Flood Damage Reduction Mediation Agreement

In May 1997, the Minnesota Legislature authorized funding for a "mediation" process to attempt resolution of the disputed issues that were addressed in the EIS, led to the court challenge, and resulted in gridlock on permitting issues. The agreement laid out a set of guiding principles that all sides would agree to follow in developing, designing and reviewing projects. The 1998 Flood Damage Reduction Mediation Agreement was adopted by local and state governments to provide a regional response to flooding.

The agreement itself is brief, just under 30 pages in length. It is organized in eight parts, including background on the conflict, goals for flood damage reduction, goals for natural resources, the comprehensive watershed planning process intended to serve as the vehicle for coordinating the two sets of goals, the proposed project review and permitting process, how the Work Group proposes to govern itself, funding needs and signatures. The agreement sets forth eight broad goals and principles for flood damage reduction:

These goals reflect the Work Group's efforts to identify the key interests associated with flood damage reduction and make these interests the focus for policy choices. The goals reflect the differing perspectives of Work Group stakeholders that were examined and debated during the source of the Work Group's deliberations. They also reflect the difficult choices faced by the Work Group in setting realistic yet meaningful goals (Work Group, 1998, p. 6).

The eight flood damage reduction goals adopted by the Work Group are:

1. Prevent loss of human life.
2. Prevent damage to farm structures, homes and communities.
3. Reduce damage to farmland by:
    a. Providing protection against a ten-year summer storm event for intensively farmed agricultural land;
    b. Maintaining existing levels of flood protection when consistent with a comprehensive watershed management plan; and
    c. Providing a higher level of protection, e.g., 25-year event, when feasible at a minimal incremental cost.
4. Reduce damage to transportation.
5. Reduce damage to water quality, including direct and chronic impacts, from floodwaters coming into contact with potential contaminants.
6. Reduce environmental damage caused by flood control projects.
    a. When advancing a project that requires a permit, select the least environmentally damaging (or most environmentally enhancing), feasible and prudent alternative that accomplishes the water management goal.
    b. Design projects or packages of projects that provide net natural resource enhancement.
    c. A planned response to a flooding problem should take into account natural resource benefits, as well as negative impacts, in a watershed context (beyond the immediate project site).
7. Reduce social and economic damage.
8. Reduce damage to natural resource systems caused by flooding (Work Group, 1998, pp. 6-7).

The Work Group also adopted a set of principles "intended to guide the efforts of policymakers and project proponents to implement these goals through the comprehensive watershed planning process and project planning, design, and permitting" (Work Group, 1998, p. 8). The principles are:

- Reduction of overland flooding is needed; any solution will probably require on-site and upstream solutions.
- Water resources problems should not be passed along to others. A solution for a watershed should not create a problem upstream or downstream.
- Water should be stored/managed as close to where it falls as is feasible and practical.
- A systems approach should be used to manage the timing of flow contributions from multiple minor watersheds.
- Projects should be consistent with comprehensive watershed management planning.
- Project cost responsibilities should be negotiated project-by-project based on flood damage reduction and natural resource benefits.
- The responsibility for mitigation of negative environmental and cultural impacts rests with the project proponent.
- If costs are incurred in connection with a project to produce an environmental gain for the project as a whole, it may be appropriate for alternative sources of funding (in addition to project money) to be used for that gain.
- Existing laws and procedures should be the basis for compensation to landowners adversely affected by a change in the existing condition.
- Incentives should be developed to encourage landowners to voluntarily manage their land to achieve flood damage reduction and natural resource goals in order to avoid the need for additional regulatory controls.
- A natural resource project should not exacerbate flooding (Work Group, 1998, pp. 8-9).

Finally, the mediation agreement sets forth a set of strategies for achieving the flood damage reduction goals. The strategies are a combination of structural and non-structural activities that could be used to achieve the flood damage reduction goal. Structural activities include dams, impoundments, levees and river corridor restoration. Non-structural goals include buffer strips, retirement of agricultural lands, and best management practices. The agreement notes that "a combination of strategies may be needed to maximize the effectiveness of any particular strategy" (Agreement, 1998, p. 5).

The agreement's natural resources goals were "intended to provide a clear statement from state, federal and tribal agencies of goals for natural resource management in the Basin" and provided agencies the opportunity "to be proactive and explicit in indentifying their goals." The purpose of the natural resource goals are:

1. To provide specific information about resource management objectives for incorporation in Watershed District comprehensive plans
2. To assist Watershed Districts to seek balanced, integrated projects that serve multiple objectives and will provide flood damage reduction and natural resource and water quality improvement
3. To facilitate permit decisions by having clearly stated natural resource and flood damage reduction goals
4. To identify the benefits to natural resources that flood damage reduction activities can achieve. Such benefits should be recognized, quantified, and accounted for in evaluating net natural resource loss/gain.
5. To promote clarity and agreement about the relationship between potential impacts on natural resources and impacts on flooding for individual flood damage reduction projects
6. To provide guidelines for mitigation when damage to natural resources will occur as a result of flood damage reduction action. To the extent that specific natural resource goals are articulated, acceptable mitigation can be more easily and realistically defined and identified.
7. To promote appropriate cost allocation for projects according to potential benefits (Work Group, 1998, p. 13).

Natural resource goals were presented and a set of defining objectives under each goal:

1. Manage streams for natural characteristics.
2. Enhance riparian and in-stream habitats.
3. Provide a diversity of habitats (size, shape, connectivity) for stable populations to thrive over a long period of time.
4. Provide connected, integrated habitat including compatible adjacent land uses.
5. Enhance or provide seasonal flow regimes in streams for water supply, water quality, recreation and support biotic communities.
6. Provide recreational opportunities.
7. Improve water quality.
8. Protect groundwater.
9. Manage lakes for natural characteristics (Work Group, 1998, pp. 14-18).

Finally, the mediation agreement lays out a process for developing projects. It begins with comprehensive watershed management plans to be completed by the watershed districts and the agencies. At the same time, the process named a Technical and Scientific Advisory Committee

which was charged with answering the research questions associated with impoundments. This group has prepared 14 papers which address effectiveness of agricultural best management practices and biological effects of flood bounce on wetlands, for example. The process also required monitoring of project effectiveness to determine performance and to guide adaptation.

> The project team should conduct construction monitoring and post-construction monitoring for the purpose of ensuring compliance with design parameters and measuring the effectiveness of the project in meeting the hydraulic and environmental goals initially identified. It includes responsibilities for maintaining and communicating the data developed during the monitoring process. All these activities will be defined during the permit process and incorporated in project permits (Work Group, 1998, p. 25).

Monitoring is proposed as a tool with two purposes: that the projects achieve what was intended in design and that the project is achieving its flood damage and natural resources goals. As such, it is consistent with definitions of evaluation, which investigate both the merit and the worth of a process. Russ-Eft and Preskill (2009) name the commonalities of evaluation: a systematic process, conducted as a planned and purposeful activity, not as an afterthought; that collects data; and the results are used to improve knowledge, enhance decision making, or to determine if the process is working. "It is a means for gaining better understanding of what we do and the effects of our actions in the context of society and the work environment" (Russ-Eft and Preskill, 2009, Kindle locations 287-288).

Monitoring provides for organizational learning, by forcing the organization to document results, develop findings, assess performance and to adapt. It links the outcome with future actions by addressing the questions: did we get what we want? What should we do next time? And, it is also a way to bring the unaffiliated citizen into the environmental management process, either as a participating in monitoring, or as a participant in the assessment and decision making steps associated with monitoring.

All participants come together each March in an "early coordination" conference where ideas for addressing specific problems are presented and vetted. Projects are developed in a team convened by the watershed district composed of all stakeholders. The agreement laid out steps for developing a project with or without an environmental impact statement. It also addressed steps required by permit requirements of state and federal agencies. The U.S. Army Corps of Engineers is not a part of the project development team since it "must protect its regulatory independence" (Work Group, 1998, p. 20).

The 1998 Red River Basin Flood Damage Reduction Work Group Mediation Agreement, born out of conflict, creates a process that establishes an independent knowledge base, and links agencies across scope and scale by establishing communication and collaboration. The agreement starts with a thorough vetting of potential project goals and objectives. It assumes that all participant stakeholders will develop specific plans for further defining those goals in terms of their own operating mission, authority and responsibility.

Fourteen projects have been built since 1997 and about a dozen more are in design or construction stages. These projects are intended to control floods at various locations of the Red River of the North basin. Projects are intended to reduce the impact to agricultural land of the 10-year flood in the spring. Between 1998 and 2010, about $12 million has been spent in the region for developing and designing projects, researching disputed questions and setting up plans for each watershed.

1.7. Bois de Sioux Watershed District

Bois de Sioux Watershed District is a local unit of government, organized in 1988 pursuant to Minnesota States 103E, to manage the hydrologic basin drained by the Bois de Sioux River, and its tributary, the Rabbit River, in northwestern Minnesota.

The confluence of Bois de Sioux River and the Ottertail River form the headwaters of the Red River of the North. The Bois de Sioux drainage basin includes lands in Minnesota, North Dakota and South Dakota, for a total area of 1,936 square miles. A little over two-thirds, or 1,414 square miles, of this drainage area is in Minnesota and is organized as the Bois de Sioux Watershed District. Three of the beach ridges that mark the extent of the former Lake Agassiz are closest to the Red River here and carry the same names as towns in the watershed: Campbell, Tintah and Norcross.

> Prior to development, the landscape of the district consisted of a mosaic of prairie lands and wetlands with networks of prairie streams coursing throughout. This landscape supported an abundance and diversity of fish and wildlife resources. The landscape throughout the watershed has been extensively altered, primarily to improve agricultural production. While the agricultural lands have been highly productive, much of the natural landscape values once present in the watershed have been replaced with agricultural economic values. Most of the original prairie landscape has been cultivated and many of the original wetlands have been drained. Many of the original streams have been channelized and riparian corridors have been diminished or lost. Settlement and development of this landscape for intensive agricultural production has dramatically reduced the quantity and quality of the natural landscape features. Most of the remaining grassland and wetland are confined to small islands and disconnected strips of habitat within the agricultural landscape. Similarly, waterways have been ditched, straightened, and their hydrographs have been altered while lakes have been drained or their shorelines developed (District, 2003, p. 38).

The Tintah Slough was a large wetland located in the beach ridges about 20 miles east of the Red River of the North, and near the junction of Grant and Traverse counties, and the present location of the town of Tintah. Tintah is a Dakota word for prairie and there are other Tintah Sloughs in the Red River Basin. It was drained – but never fully – for farming years ago. But the organizers of the Bois de Sioux Watershed identified it as a location for storage of flood waters, and named the project not for the slough, but for the township – North Ottawa of Grant County – in which it lies. A 1971 study identified the problems:

> Major problems of concern to local residents appear to be flooding and the general lack of adequate outlets for drainage. The main channels lack capacity to handle flood flows. This causes floodwaters to back into and flood large areas of agricultural land. Roads, bridges, and culverts are subject to flooding; buildings have also been damaged by floodwaters. During the field review it was estimated that approximately 49,000 acres of

crop and pasture land would be flooded by a five-year flood. The estimated average annual flood damage to crop and pasture land is $235,200; other agricultural damage, $11,800; road and bridge damage, $9,200; and urban damage, $500, for a total of $261,000. The majority of the floodplain is presently being cropped which constitutes a high damage area (Task Force II, 1971, pp. 80-81).

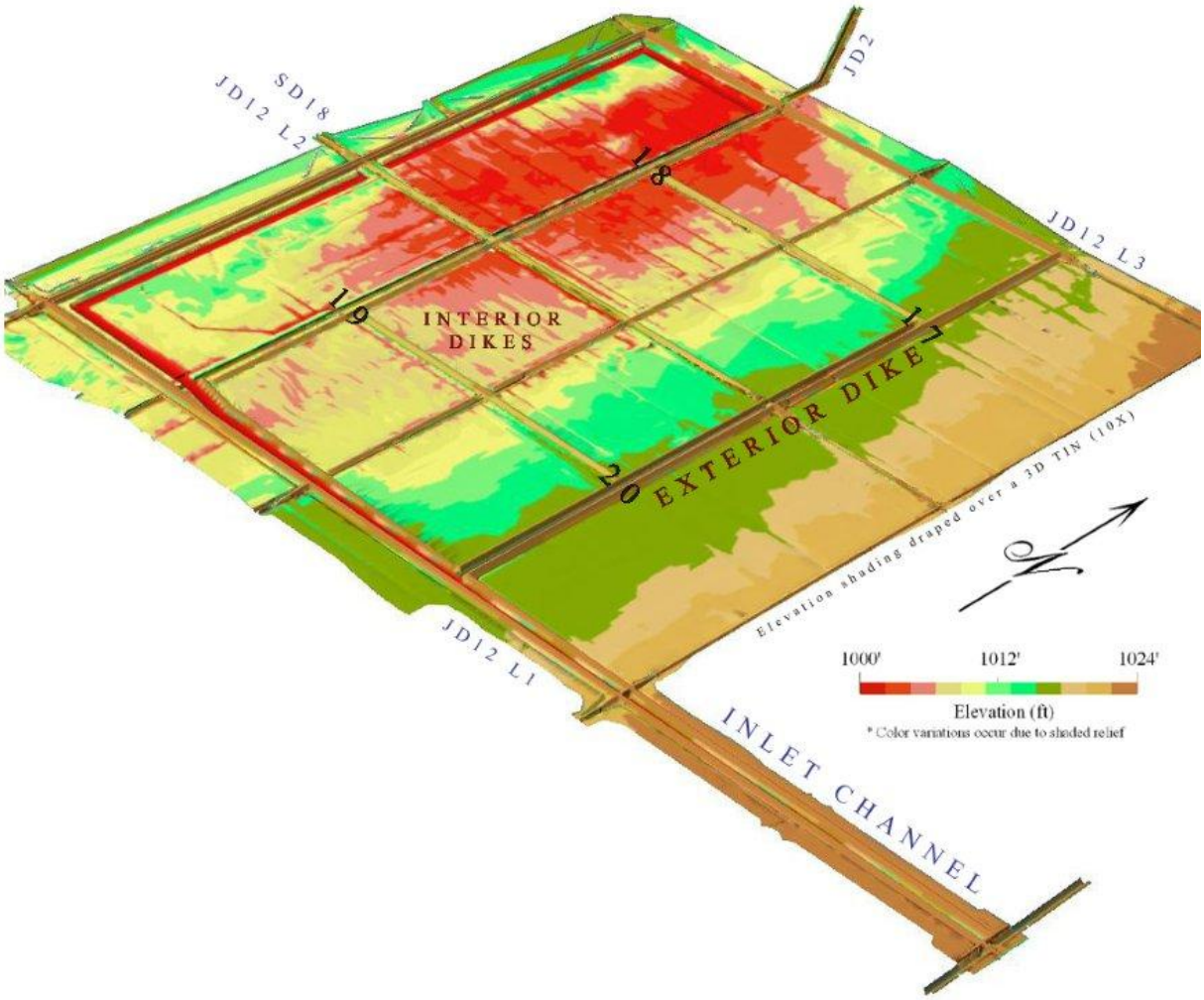

Figure 2. Schematic of the North Ottawa Impoundment Project (District, 2003, p. 230).

The North Ottawa Impoundment Project is a significant part of the watershed district's long-term flood damage reduction strategy. The district had proposed building an impoundment in the area in the 1990s, in partnership with the U.S. Fish and Wildlife Service in order to provide habitat

for waterfowl. It was one of the impoundments reviewed in the 1996 Generic Environmental Impact Statement. The impoundment was determined to have value for wildlife habitat and recreation.

1.8. The North Ottawa Impoundment Project

The North Ottawa Impoundment Project is located in Section 18 of Grant County, east of Judicial Ditch 2 (JD 2). It collects water from the six lateral ditches draining to JD2, and lies across the northern of these laterals, numbered 1 through 3. The North Ottawa Impoundment Project also outlets to Judicial Ditch 12 (J D12), which runs parallel to Minnesota State Highway 9. It drains about one-third of the Rabbit River watershed, an area of 126 square miles which straddles the glacial moraines, beach ridge and lake plain ecosystems of the southeastern corner of the Red River Valley. Figure 2 above is a schematic of the impoundment showing the inlet channels on the east and north, and the elevation of the lands within the project footprint.

The impoundment holds water during spring thaw, which reduces downstream flooding on fields, at the small city of Tintah, and on the Rabbit River. Since the project controls a substantial area of the Rabbit River watershed, the project's effects should be felt downstream all the way to the Rabbit's confluence with the Bois de Sioux River (Charles Anderson, District Engineer, Personal Communication, August 16, 2011).

The process of developing the North Ottawa Impoundment was deliberately intended to identify and address multiple benefits. Project developers took into account hydrology, water quality and biology in designing the project, resulting in reduced flood damages, improved water quality and enhanced habitat for migrating shorebirds and waterfowl. Managers of the Bois de Sioux Watershed were aware of the critical role played by property owners and requested a survey to examine experiences and opinions of those living or owning property near this flood damage reduction impoundment project.

1.9. Themes from the Introduction

This introduction presents several themes that emerged from the research and that are of particular interest to this study. These themes pertain to the natural and social conditions of the Red River Basin and its management. These themes help to illuminate the issues and purpose of this study.

First, the natural setting of the Red River of the North, its watershed, its Minnesota tributaries and the watersheds associated with those streams create a unique hydrological scenario. Flooding is almost inevitable, but not predictable. An area within a watershed may experience flooding, but that flood may not reach the Red River of the North. Or, it does reach the Red River of the North and contributes to flooding at some of the cities on the Red. Human alteration of the landscape for row crop agriculture typically increases the volume of water draining from fields to surface waters. In the watersheds draining to the Red River of the North, practices that mimic the landscape's natural functions can delay the delivery of spring melt and runoff to the mainstem Red River and reduce the flooding response. Whether or not the spring runoff of a particular watershed actually contributes to flooding on the Red is complicated by overall water levels in the Red, contribution from other watersheds, and current precipitation. In 1997, these conditions all led to extreme floods: heavy snow pack and large contributions from every watershed; high levels in the Red River, and additional spring precipitation. Together these factors created the extreme flood of 1997. But the absence of one or two of these factors reduces the possibility of flooding. What's important for managers is addressing the parts of the system – storage in the contributing watersheds – that can be managed. Management must focus on function, not specific outcomes, since the inherent variability makes specific outcomes unpredictable.

Second, the residents of the Red River have established several organizations and approaches to manage watersheds to reduce flood damages. These approaches balanced the uncertainties of

climate and topography by addressing management from both a local and basin-wide perspective. For example, the organization of watershed districts was intended to work collaboratively to meet a goal for reducing peak flows at Emerson, Manitoba. This institution connected scale and scope by linking individual watersheds to the entire Red River Basin, and by linking flood damages with environmental benefits such as water quality improvements and wildlife habitat enhancement.

Third, the agencies changed their approach in the Red River Basin, first working with the watershed districts to design and build projects. For example, the Minnesota Department of Natural Resources (DNR) supported establishment of the Red River Watershed Management Board, assigned a staff hydrologist to work exclusively with the board which set the terms of the position in Minnesota statute in 1983. Flood damage reduction projects were built in the Red River Basin in the 1950s, 1960s and 1970s by the U.S. Corps of Engineers under Public Law 566.

Yet, in the early 1990s, the state of Minnesota joined the U.S. Army Corps of Engineers when it put the 33 requested project permits (under Section 401 of the Clean Water Act) in abeyance. The federal and state agencies determined that the number of projects made it necessary to review potential projects effects cumulatively, not individually. The resulting Generic Environmental Impact Statement looked at cumulative effects of all projects, not individual projects. From the Corps's and the DNR's perspective, this bifurcation of roles can be explained; however, these differing roles are due to interpretation of statute and are probably more confusing than clarifying to the watershed observer.

Finally, the individuals who managed the watershed districts and the Red River Watershed Management Board have a long record of participation in watershed management issues. For example, Jerome Deal is the president of the Board of Managers of the Bois de Sioux Watershed District who requested the survey at the heart of this study be conducted. He was also president of the Board of Managers in 1995 when the Board made comments on the Generic EIS. The longevity

of players in the basin suggests that personal relationships are especially important to watershed management in the Red River Basin.

In short, the complicated natural setting of the Red River Basin has been paired historically with an institutional arrangement designed to accommodate multiple interests. The roles of the state of Minnesota and the U.S. Army Corps of Engineers are driven by rules and are not consistent at an organizational level, and relationships are important for the representatives of the Red River Watershed Management Board.

1.10. Statement of the Problem

Under the adaptive co-management approach, the success of watershed management in Minnesota's Red River Valley depends on the ability of managers to work from a complex systems thinking perspective and assure that learning and adaptation are byproducts of the process. The watershed management system includes those who live within the area and who make a living from the landscape, as well as those who are empowered by local, state and federal government to manage the resources of the watershed.

This study focuses on individuals owning property at or near a flood damage reduction impoundment project. These individuals have a pivotal, albeit unorganized and informal, role in the watershed management process. It is their land and farming operations that are affected by spring flooding, and it is they who pay a share of the project's costs through local property tax levies. Government natural resources management is challenged by the fact that it does not easily accommodate the property owner or the citizen who is not affiliated with a local agency, organization or special interest group. Moreover, state and federal governments address natural resources management issues in a way that focuses on short-term solutions, assumes competition and fragments interests, responsibilities and information. Government prefers to work towards a specific endpoint, such as setting an overall reduction in peak flows of 20 percent, or setting an

overall reduction in phosphorus of 50 percent over 1973 levels, to use two examples from natural resources management in the Red River Basin.

Therefore, the development of a government process that seeks to foster long-term solutions, promote cooperation and align interests, responsibilities and information represents a new direction for managers. What assures that the new system will achieve its goal of long-term solutions, cooperation, joined – not multiple and potentially competing - interests? It must be the people who live and work in the watershed, who are building norms for the community, by "collaborating, forming groups, developing a united view of the shared future, forming collective identify and engaging in collective action" (Flora and Flora, 2008, p. 117). This study then attempts to understand what stakeholders think about the outcome of the process – the impoundment – and what they think of the process itself. Their support of the project can be considered a finding that the managers have created a process that the unorganized public believes includes them.

1.11. Purpose of the Study

The purpose of this study is to measure the experiences and opinions of the residents of the townships upstream and downstream of North Ottawa Impoundment Project in order to understand their experiences with flooding and their opinions about the project and the process used to develop the project. Managers were especially interested in whether property owners understood and supported the goals of the project, especially the fact that it was intended to deliver multiple benefits.

The survey is intended for use in other northwest Minnesota watersheds administering projects and activities in accordance with the Red River Basin Flood Damage Reduction Mediation Agreement of 1998. The results of the survey will be used to support the following work efforts:

1. Development of project monitoring to measure long-term performance of flood damage reduction projects;
2. Evaluation of project performance in reducing flood damages and enhancing natural resources benefits;
3. Evaluation of flood damage reduction work group processes, and
4. Process to engage the local community, or unaffiliated stakeholder, in continued monitoring of the project.

1.12. Significance of the Research

The process outlined in the 1998 agreement itemized the following elements of the new process as including "early consultation and collaboration on flood damage reduction projects among stakeholders, and a cooperative approach to permitting of those projects" (Agreement, 1998, p. 1). This approach is intended to stand in contrast to the traditional top-down, bureaucratic approach. This approach is intended to be long-term, holistic, inclusive, and adaptive over time. By profiling the stakeholders and by asking their opinions about the process, the watershed district has tools and information to help it accommodate those who need to be involved with the process, but for whom establishing a formal process is counterproductive. This is especially important because the watershed districts – which are charged with administering the 1998 agreement – have not set up a formal evaluation of it. This study concludes with recommendations for how to establish that evaluation.

A goal of this study is to create a model for evaluation to be used in other watersheds in Northwest Minnesota that enables participants to appreciate the various systems involved in watershed management. In short, the purpose is to find that interests differ, but can be aligned. The Red River Basin Flood Damage Reduction Mediation Agreement was founded in the belief that a healthy farm economy and a sustainable environment can co-exist.

Flooding is the dominant water resource issue for northwestern Minnesota. Just as too much water in the spring hurts fields, roads and farmsteads: flooding also exacerbates conditions that impair water quality. Agriculture is a significant segment of the economy of northwestern Minnesota. However, it tends to be viewed as a bad actor with respect to water resource issues. This project asks the people who live and use the watershed whether this approach is possible and reasonable. Their responses will be used to shape future plans for balancing flood mitigation and environmental enhancement, and to evaluate the performance of the North Ottawa project.

CHAPTER 2. LITERATURE REVIEW

This study explores experiences and opinions of property owners to a flood damage reduction project. A literature review was conducted to understand the nature of watersheds and the management of watersheds; how social systems link to watershed management, and the role that the citizen plays in the management process. This review also examined community capitals and adaptive co-management as potential frameworks for understanding the linkage of watersheds and social systems and the role of the public in the Red River Basin.

2.1. Community Capital as a Framework

The community capitals framework is a useful approach for this study, especially because it assumes that natural and human resources of a community are necessarily linked. Communities have seven distinct resources or assets, and as the community invests in these assets to create new resources, they become capitals (Flora and Flora, 2008). Natural capital is represented in the physical setting of the community, its geology, topography and hydrology. It is the foundation for the other capitals: cultural, the way people "know the world" and how to act within it.; human, the skills and abilities of people; social capital, the connections between people and organizations or the social glue that make things happen; political, access to power and power brokers; financial, financial resources, and built capital, the infrastructure that supports the community (Emery, 2006).

Social capital is also the system of networks, relationships and behaviors that develop among people and actors. It helps to understand how individual property owners act, as well as how representatives of agencies act. For Coleman (1988), social capital is a resource available to an individual that helps that person take action. Social capital is evidenced in obligations and expectations between people – reciprocity – and the perception of trustworthiness. Putnam defined social capital as a triad of trust, norms of reciprocity and networks (Sabatier et. al, 2005, p. 186). Sabatier distinguishes between social capital as civic engagement, that is, "the collective behaviors

facilitating a democratic and civil society" and social capital applied to "collaborative watershed management. For the latter, social capital is concerned with collective action among policy elites and the negotiated agreements and implementation of those agreements. Sabatier posits that consensus-based agreements and project implementation "should be more common and extensive in partnerships that exhibit high trust, norms of reciprocity and extensive social networks" (Sabatier, Focht, Lubell, Trachtenberg, Vedlitz and Matlock, 2005, p. 189).

Focht and Trachtenberg (2005) examine the role of trust in watershed management. They define trust as "willingness to defer to the competence and discretion of others to manage risk on their behalf" (Focht and Trachtenberg, 2005, p. 86). They further identify "social trust" as "stakeholders' judgments of the trustworthiness of other stakeholders" and "official trust" as "stakeholders' judgments of the trustworthiness of policy officials." Stakeholders may defer participation in processes where either type of trust is present, or be vigilant where trust is absent. These dimensions of trust contribute to stakeholders' vesting a process with legitimacy. These authors note that demise of social capital is the result of the failure of trust and legitimacy.

Focht and Trachtenberg's application of social capital is useful but it overlooks the role of the individual in the watershed management process. It is the individual who must implement the strategies that will achieve the goals of the agreements. Without that person's involvement, the process fails. Before that person can determine if he or she trusts the process, or the players, or if the process is legitimate, that person has to believe that participation benefits his or her interests. Sheeder and Lynne (2011) argue that social capital arises from the shared interests that are the result of individual's integrating self interest with shared or community interests. The creation of joint interests, where multiple interests are aligned and not competing, establishes social capital. Empathy is the first step in establishing social capital. To the extent that the individual believes he or she will be heard, or that the other understands what it is like to walk in his or her shoes, they can

acknowledge that the system is empathetic to them. The next step is the recognition of shared interests, and from here, the individual moves to sympathy, that is, a willingness to act on behalf of a shared interest of the community that may or may not directly benefit the individual's self interest. The duality of the self interest and shared interest is integrated in the individual. "We might describe this conservation farmer as ***Homo empathicus,*** tempering the tendency to maximize entropy (and profit, wealth, which comes from so doing) with empathy/sympathy-based interests" (Sheeder and Lynne, 2011, p. 439).

2.2. Understanding Individual Actions

Watershed management guidance states that the public must be included in the watershed management process (EPA – list under USEPA, 2002; Graf , 1999). An outcome of this approach is the contention that actors must be persuaded to admit the inadequacy of their world view and replace it with one consistent with that of the watershed's managers. For example, "If farmers are to go beyond the status quo of their current practices, they must believe their current actions are inadequate and seek additional solutions" (Morton and Weng, 2009, p. 85). Using Flora's model of social control, Morton and Weng posit four levels of "control" for motivating farmers to choose conservation practices that improve water quality: force, economic, social pressure and internalization. Individual internalization is based on knowledge, values and beliefs about water and actions needed. "Beliefs about the seriousness of water quality issues are critical motivators for acting" (Morton and Weng, 2009, p. 86). This approach states that social control, that persuades farmers to give up their beliefs, is a necessary step for watershed managers.

But, from where does the belief come? How do farmers decide that water quality is a "problem" for them? They likely know that water quality is a problem for others, especially officials with state and federal agencies charged with water quality management. The only way that farmers will accept water quality is a problem for them is if they are willing to put themselves in the "shoes of the

other", in this case the downstream user. In short, they must be empathetically predisposed and therefore willing to consider the position of others. But, before the farmer can show empathy for others in the system, he or she must believe that the system is empathetic towards his or her position. If the farmer believes that the system has defined his position as "wrong" it is more likely that he will become defensive and embedded in his position, and reluctant to change. Better to eliminate the issue of defining appropriate behavior and focus on creating a process that accommodates and integrates multiple points of view.

Given the understanding of reciprocity and trust, it is unrealistic to expect actors to adjust internal beliefs and values based on an agency's determination that they are wrong, especially when that solution may be costly or difficult to implement. Farmers are more likely to operate from an empathetic perspective. Extension services and natural resource agencies began providing farmers decision support systems started in the late 1970s. By the late 1990s, it was clear that farmers did not value these systems. The difference is that objective knowledge from the external source is not consistent with the subjective knowledge, which normally guides the actions of farmers in familiar situations – local, personal, and social environments (McCown, 2005). The apparent value of decision support systems for farmers was as an aid for learning - learning is rather "the use of research products (including software) by intermediaries in situations of farming practice using processes that generate experiences in which farmers construct personal, subjective knowledge that is relevant to practical action" (McCown, 2005, p. 11). McCown proposed an alternative theory for understanding decision making in which purposeful managers make subjective sense of their situations and use their knowledge and agency to 'cause' meaningful and satisfactory actions. Intervention, in keeping such a view, assumes a facilitative role in which scientific models are used to support farmers' sense-making in conditions of uncertainty and ambiguity.

At issue is the farmer's degree of discretion and agency. Sheeder and Lynne (2011) use an empathy/sympathy model to map the movement from an internal belief to an act that implements a shared interest, or moving from empathy to sympathy. In this way, the individual's dual interests of self and shared are integrated into a joint action.

> A human's ability to sympathize is characterized as the ability to buy into a specific group ethic. Individuals first can project themselves into the state of mind of specific groups (i.e., empathize) and then choose to become "in sympathy with" the group if the group ethic and goals align with the individual's (evolving) goals. However, it needs to be emphasized that the act of empathizing does not automatically lend itself to sympathy. Becoming in sympathy with a group is still an individual choice that can be accepted or rejected, but empathizing does provide important information to the individual that aids in the decision making process. So, it is proposed that all farmers have the ability to empathize (albeit we expect substantive heterogeneity), but it is unlikely that all farmers have become in sympathy with others that use water downstream, with the extent to which empathy and sympathy are operant having substantive implications for policy and programs applied in the area (Sheeder and Lynne, 2011, p.444).

This study is intended to recommend approaches for state and local government to use in managing watersheds. It is a premise of this study that it is not an appropriate role for government or agency staffers to attempt to influence, persuade, or change the minds of individuals. It is appropriate for government and agency staffers to provide a management process that is inclusive and accommodating to all stakeholders, where decisions are made at the table with all participants. Government management agencies may choose to "nudge," making small changes in context (Thaler and Sunstein, 2008, Introduction, Kindle Edition), such as rearranging the presentation of food in a school cafeteria so students see vegetables first, and dessert last. "Policies and programs need to be specifically designed to nudge farmers into new habits that reflect an empathy-sympathy-based evolution of a shared common cause" (Sheeder and Lynne, 2011, p. 449).

This study examines citizens' response to that process, not how they decide to act within their own part of the process. Their perception that the system accommodates them, that they have a

chance to be heard, is a necessary foundation for their participation. Expecting that their voice will be heard is a precondition for establishing an empathetic relationship.

The issue of particular interest in this literature review is how citizen stakeholders can invigorate political, social and civic processes necessary to manage complex watersheds. Review of the literature suggests the citizen stakeholders invigorate a management process by providing a vision of future, memory and knowledge of the setting, and a tolerance for change and diversity.

2.3. Understanding Watersheds

A watershed is defined as "topographic unit within which apparent surface water runoff drains to a specific point on a stream or to a water body, such as a lake" (Griffith, 1999, p. 667). But the definition can be problematic, and sound almost tautological: "Watersheds are defined by the 'waterscape', the combination of the hydrology and topography of the landscape, and they are ubiqutous units that can be seen as the physical foundation of the nation" (Graf, 1999, p. 2).

A watershed is a useful unit for organizing management of its resources because it represents a distinct location where relevant processes can be measured and managed in isolation from larger landscape influenences. A watershed is a device that divides the landscape into manageable parts. It can be as small as the area draining to a lake or a wetland, or it can be aggregated up to all the land area draining to the Mississippi River, which covers more than two-thirds of the land area of the United States. Typically, watershed management is measured at the major watershed level, which is defined by the U.S. Geological Survey and the Natural Resource Conservation Agency, and typically occupies a drainage area is between 500 to 1000 square miles. Watershed management activities are typically performed at a subwatershed level, less than 100 square miles in area. The actual area is a measure that reflects the potential for improvement and is determined based on the geological setting, soils, topography, surface waters and land use. Rivers cannot be separated in theory or practice from the lands they drain (Stanford, 1996).

The relationship between subwatersheds and major watersheds is significant for this study. "Watershed management may be successful for certain purposes at the small scale (for example, erosion control), and transmit changes to the larger system (for example, through changes in sediment yield)" (Graf, 1999, pp. 46-7). Yet, any cumulative change – for good or bad – from a small watershed to its larger basin occurs in a non-linear fashion. Causality, like water, generally flows downstream, but it finds its own path to do so.

The temporal scale is another dimension for considering natural and human processes in watersheds. The temporal scale is described by frequency and magnitude of events. The greater the frequency, the lesser the magnitude (Graf, 1999). The infrequency of damage-causing events is contrary to the focus of people, and regulators, which usually is focused on the short-term. "At the scale most often addressed in watershed managemment, decades, three vital components of physical watershed systems are likely to respond as dependent variables: the drainage network morphology, hillslope forms, and the discharge of water and sediment. These three variables are most susceptible to management" (Graf, 1999, p. 48). The geographic setting and the time scale govern watershed processes. An effective management structure for watersheds has to be able to provide links between the small and the large watershed and to recognize how human and natural processes can accelerate the magnitude and frequency of events that may disrupt a watershed.

2.4. Managing Watersheds

"Watershed management should be an integrated, holistic, problem-solving strategy used to restore and maintain the physical, chemical, and biological integrity of aquatic ecosystems, protection human health and provide sustainable economic growth" (Graf, 1999, p. 15). Stanford and Poole propose an "iterative protcol for involving scientific research and synthesis and public opnion in adaptive ecosystem management." (Stanford and Poole, 1996, pp. 743-744). The protocol

is built from the concept of establishing a common knowledge base that becomes the basis for the management system, but that is reviewed and adapted through monitoring, evaluation and research.

Ecosystem processes and responses are more complicated and intractable than physical phenomena. But, complexity should not be used as an excuse for precluding synthesis of available ecological information, identification of uncertainties and risks, use of relevant scientific information to weigh alternatives (i.e., basic science and monitoring), and implementation of management actions in an adaptive, learning fashion. Nor is complexity an excuse for dismissing the strategic importance of ecosystem function to human well-being (Stanford and Poole, 1996).

Stanford and Poole (1996) proposed a protocol for ecosystem function, which Stanford et al, (1996) later applied to rivers. This approach is based on knowledge, the synthesis of information and public opinion, a management strategy based on the synthesis, and a process that reviews the performance of the system and adapts accordingly.

> 1. Review and synthesize existing information. By agreeing on a common pool of empirical information at the outset, the process is rooted in fact.
> 2. Define the ecosystem based on available science.
> 3. Identify goals based on scientific synthesis and public values.
> 4. Develop a peer-reviewed management strategy. Given a common knowledge base from step 1 and a set of goals from step 2, scientists and managers should be able to design a single strategy (rather than competing alternatives) to meet the identified goals.
> 5. Implement considered management action. Proceed upon consensus that: (1) the proposed strategy will meet the goals, and (2) the associated risks and consequences are acceptable.
> 6. Conduct research. New information must be used to improve the management strategies and policies to redefine the ecosystem, and alter the management action if warranted.
> 7. Go back to Step 1. The process is iterative and therefore adaptive over the long term to environmental change, new information, and changing societal goals (Stanford et al, 1996, pp. 743-744).

2.5. Co-Management of Watersheds

A management process that has not developed a defensible body of knowledge detached from the managing institutions runs the risk of "goal inversion" where organizational goals take

precedence over conservation or ecological goals (Yaffee, 1997). The result is bad decisions that prolong conflict and avoid resolution.

In many cases, appropriate responses (additional studies to verify results, program changes, new management directions) are suppressed in favor of inappropriate responses (ignore the data, eliminate monitoring, reassign the investigator). This pattern reflects an inherent institutional tendency to dampen disorder to nondisruptive levels (Graf, 1999).

The tendency of institutions to make poor choices results from five behavorial biases, evident at the individual and organizational level, and reinforced – partly for good reasons in policy (Yaffee, 1997). The biases are short-term rationality, competitive behavior, and fragmentation of interests and values, responsibilties and authorities, and information and knowledge (Yaffee, 1997). Organizations can adopt behavior-sensitive practices that address the natural behavioral biases. These practices should focus on recognizing that the agency's behaviorial biases have benefit, and what's needed is to balance the advantages of short-term and long-term thinking. In short, the problem is "because an integration of these choices and values is not made or forced by the decision making process" (Yaffee, 1997,p. 333).

The 1998 Mediation Agreement addresses these biases by laying out goals for both flood damage reduction and natural resource enhancement, by defining a decision making process that emphasizes sharing and communication, and by establishing a normative bottom line. The agreement provides a forum for moving from mulitple interests, which could be considered competing, to joint interests. The joint interest forum bebins with normative statements with which all parties can agree. For example, in this case, such normative statements are the need to reduce flood damages to agricultural operations and the need to protect water quality.

One result of doing so is to build resilience and adaptive capaicty, argue Berkes, Colding and Folke (2003). "Resilience, the capacity to lead a continued existence by the ability to incorporate

change, stresses the importance of assuming change and explaining stability, rather than assuming stability and explaining change" (p. 352). Four capacities or competencies need to be nurtured to build resilience:

- Learning to live with change and uncertainty;
- Nurturing diversity for reorganization and renewal;
- Combining different types of knowledge for learning, and
- Creating opportunity for reorganization toward social-ecological sustainability (Berkes, et al, 2003, pp. 354-355).

Organizations with these capacities offer the individual the opportunity to participate in a system that will respect the individual's self interest as it seeks to generate a shared interest. Learning that comes from a variety of sources, valuing the resident's experience as well as the scientist's expertise, is a forum where players can practice empathy and learn from each other, both how the scientist validates and how the lay person observes. In the shared learning forum, the participants are also learning to "walk in each other's shoes." The routine participation of individuals in a management process that dedicates itself to looking at all sides of a problem builds resilience, the ability of the process to withstand shocks and changes.

A second result of adopting an approach that integrates the behaviorial biases of agencies with other stakeholders is to introduce learning into the management process. The cycle of learn, plan, do and adapt is based in part on a complex systems thinking view of organizations and behavior. The adaptive capacity model of ecosystem management relies on learning by doing. It focuses especially on change. Panarchy is a theory proposed by Gunderson and Holling (2002) to explain how social systems respond to changes in the ecological system. It is the capacity for adaptive change in the social institutions that is a critical variable. Thus, Berkes (2009) adds co-management to the adaptive capacity, co-management being the sharing of power and responsibility between government and local resources users.

Acknowledging the role of the unaffiliated citizen stakeholder – who is affected by watershed management decisions but is not likely to have a say in those decisions - is significant. The work of Berkes (2009) examined how indigenous knowledge can be synthesized with science to improve management: "In many cases, the different actors need to work and think together, and deliberate to generate new knowledge or make sense of knowledge from different sources" (p. 1695). Bridging science and local knowledge can be accomplished by organizations expressly developed to serve that purpose. These organizations can "provide an arena for knowledge co-production, trust building, sense making, learning, vertical and horizontal collaboration, and conflict resolution" (p. 1695).

Yaffee's (1997) remedy for behavioral biases that lead to bad decisions is similar to the resilience bulding strategies of Berkes (2009):

> The solution to all of these behavioral biases is some measure of integration between the needs of the present and the future, competitive and cooperatie behaviors, differing interests and values, dispersed responsibilities and authoirty, and information and knowledge…The task of crafting behavior-sensitive policy is not easy, nor is there a single solution. Instead a continued process of experimentation, monitoring and evaluation, and informed change, is most likely to overcome the behavioral problems of natural resources policies and institutions (Yaffee, 1997, p. 336).

Armitage, Berkes and Doubleday (2007) define the features of adaptive co-management as:

- Shared vision, goal, and/or problem definition to provide a common focus among actors and interests
- A high degree of dialogue, interaction, and collaboration among multi-scaled actors
- Distributed or joint control across multiple levels, with shared responsibility for action and decision-making
- A degree of autonomy for different actors at multiple levels
- Commitment to the pluralistic generation and sharing of knowledge
- A flexible and negotiated learning orientation with an inherent recognition of uncertainty (p. 6).

These are the features that a successful adaptive co-management system must have if it hopes to persuade the unaffiliated citizen that his or her voice will be heard and valued in the process. This process acknowledges that it provides the setting, but the individual provides the energy to move the process.

2.6. Crafting a Vision for Watershed Management

People who live at the mouth of a river often do not think of the river's headwaters and neither do the people living at the mouth think of the headwaters. Barham (2001) says that to think in terms of watershed requires a change in human perspective. The positive side of this change is boundary coherence, and the negative side, "the watershed rule."

Boundary coherence occurs when we align our behavior with the limits of the natural environment in which we live. "It is an effort to set those limits geographically, physically on the landscape as objects of both contemplation and action, as well to set them mentally in terms of our shared concepts about the environment" (Barham, 2001, p. 187). The farmer who restores the wetlands on the edge of his corn field is aligning boundaries, rather than continuing to fight against the wetland by farming through it.

On the negative side, watershed rule is "nondemocratic, authoritarian, and exclusionary process of social control, exercised to meet a perceived need to address environmental sustainability" (Barham, 2001, p. 189). The example is the protection of the source of New York City's drinking water in the Adirondacks. People and communities were moved in the 1800s and even in the 1960s, to build reservoirs for the city's water. The problem is "the potential for these (watershed) approaces to sap the effectiveness of existing democratic channels of communication in the interest of finding more efficient *technical* solutions" (Barham, 2001, p. 189).

If watershed management is truly the integration of human actions and natural settings, and if it is the way we have decided to deliver the public good of clean water, then developing a deliberative structure is critical:

> To use a water metaphor, authority, funding, research and new scientific approaches can all be poured from existing social and 'political containers' into the watershed boundary. But we can't be certain that the processes of democratic deliberation that were associated with the older containers will be poured along with the rest or separated out and cast aside unless we give this careful and constant attention (Barham, 2001, p. 190).

2.7. Themes from the Literature Review

The literature review supports the conclusion that the role of the individual is pivotal in the system of watershed management. Watersheds are complicated by several natural and human processes. Management of those processes requires collaboration of a variety of agencies, organizations and individuals. The participation of the individual is at the core of the efforts, since his or her participation assures that desired practices are implemented. The participation of the individual is an expression of selfish interests to improve farm operations. It is also an expression of shared interests, since flood damages are reduced not just on one, but on other downstream farms. And, the shared interests fall to other participants in the system: reducing flood damages improves water quality, which can benefit fish habitat or downstream water users. The interests accumulate: just as the placement of an impoundment in the upper watershed helps reduce floods downstream and improve water quality, the investment in selfish interests leads to achievement of shared interests at a local scale and then at a more regional scale, so the gain in social capital is cumulative. As the individual engages in the practices selected collaboratively, experience is gained, and from experience, knowledge emerges.

"Where water is concerned, we see at best the shadow of democracy," writes Donald Worcester in his report of John Wesley Powell's "lost vision" of watershed management (Worcester, 2003, p. 62). "There is a danger in the watershed concept that it could become the exclusive concern or province of technical experts," Worcester continues. "Our democratic traditions tell us that each resident of each watershed should have both the knowledge and opportunity to influence the making of those rules." Social capital is built upon the choice of the individual to act to achieve a shared interest, and that choice is built on the individual's decision to mitigate self interests for a shared or community interest.

CHAPTER 3. THEORY

This study uses theory as a lens to examine property owner opinions about a flood damage reduction impoundment project and the process used to develop an impoundment in their location. Theory helps to explain three aspects of the situation: (1) the conflict that led to the Mediation Agreement in 1998; (2) the finding that property owners expressed a more robust support for the process used to develop the project than they did for the project; and (3) illuminates a gap in the two theoretical approaches, which is the role of the unaffiliated citizen or stakeholder.

The unaffiliated public is not defined in terms of a specific role in most guidance for watershed management. And, more importantly, no process for identifying them, recruiting them or involving them in any formal way is set forth in watershed management guidance. Yet critical variables of the management process, including integration of local knowledge and science, a decision making process that fosters collaboration, trust, adaptive capacity, and goals based in community norms as well as meeting statutory requirements, can only occur if the unaffiliated public is incorporated into the process. It is possible to assemble the parts of a watershed management process, but the process is static without the interests of the community to drive it.

The first theory posits that the individual is a rational actor, seeking to advance his or her interests within the context of experiences, relationships, values and beliefs of that individual's life. This is a broad theoretical construct that combines economic (Olson, 1971) and social (Coleman, 1988) aspects of human action. Individual actions occur at several levels in watershed management: the base is the property; next is the local government which governs land use, then the state which is responsible for the collective well-being of the resources and finally, the nation which protects the integrity of its surface waters. There are several sets of actors at play in any community setting. Their actions are driven by interests but governed by identity, relationships, trust and norms, which exist

for each setting. Thus, a set of interests and norms drives the individual, the state agency staffer as well as the federal bureaucrat.

How does the adaptive cycle theory apply to individual actions, local government, state government and national government, and especially to their interactions? Holling and Gunderson's (2002) model of adaptive capacity shows the cycle moving from exploitation to conservation, then released by an event and reorganized. The cycle explains change in a system, and the actor is challenged to identify and manage the points of change. Figure 3, below, illustrates the adaptive capacity cycle.

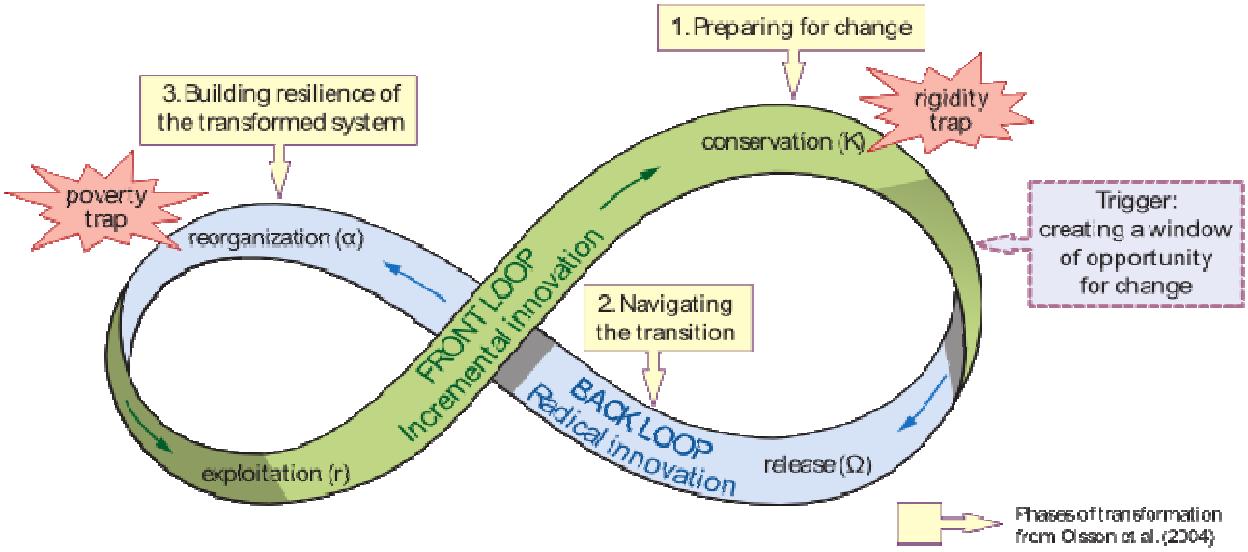

Figure3. Holling's adaptive cycle (Gunderson and Holling, 2002).

The adaptive cycle posits that both the ecological and social process cycle through reorganization and release, with an alpha phase of exploitation and an omega phase of conservation.

This cycle moves at alternate speeds and can be accelerated by unexpected change. Resilience is the ability of the systems to readjust to change; adaptive capacity enhances resilience. How does the adaptive cycle apply to the systems at play in the Red River Basin? The following describes the systems of the individual, the state and national governments.

The individual farms. Snow melt and spring rains cause floods. The individual adapts by sandbagging, plowing snow, building a dike, or re-planting a field. The individual complains to watershed district about the flooding. The watershed district responds to the individual's complaint. An impoundment project is built. The spring flood is stored, and the farmer farms.

The state agency is charged with meeting the state's mandate to protect water quality. It monitors waters of the state. Many do not meet water quality standards. The state must bring the waters into compliance with standards but the state does not have the authority to regulate the way farmers farm. The state seeks to persuade farmers to farm in ways that keep fields rough or vegetated or provide for storage of peak floods. The state prefers to see buffers and land out of production, that's a short-term solution. The farmers do not want to limit land available for production. The two sides disagree.

The federal agency is charged with achieving the nation's mandate to protect the integrity of its water bodies. A permit is required for the discharge of dredged or fill material into waters of the U.S. The nation wants the watershed district to present alternatives to the impoundment because that is its practice. The nation wants the watershed district to think about the problem the way it does. It does not have a process that accommodates the problems from the farmer's perspective. The nation also prefers its own data and expertise to that of the state. The nation wants the watershed district to mitigate the damage caused by building the impoundment but it is not sure how to quantify this. The three sides disagree.

In the examples above, at the alpha stage of Holling's diagram, the individual farmer exploits the landscape for benefit. Farming continues and practices become rudimentary. A flood occurs, wiping out early planting and sending gullies of water through a bare field. The farmer changes practices in response to flooding. It is represented as an omega point. Reorganization of operations to anticipate flooding or its effects is the response.

What does theory tell us about how the three examples can navigate the adaptive cycle? For the individuals working for the national and state agencies, it is important to promote sharing of information by establishing a joint information clearinghouse in order to define one knowledge base that both state and nation use. Next, it is important to find ways to address agency mandates but to build collaboration and communication with other agencies, to foster cooperation, not competition. What is needed is a feedback loop, where achieving specific targets are measured according to agency requirements, but evaluated continuously to understand performance of the system. Mitigation requirements should be defined in response to findings from monitoring and assessment so that a scale of desirable outcomes can be established. For example, the U.S. Army Corps of Engineers requires any changes to wetlands be mitigated. However, there is no guidance for how that mitigation occurs. It becomes a case-by case analysis, without local context, and therefore, without validity in the eyes of the individuals affected by the requirements. It becomes a barrier to moving ahead. Establishing normative guidelines for what is desirable for wetlands in the local setting would assure both that ecological goals are met and that project proposers have clear measures for designing projects. It is imperative that the norms are reviewed regularly, especially as results of monitoring, assessment and research suggest adaptations.

The state's role in the adaptive cycle could be to research cumulative effects in order to quantify contribution of land area per ecological conditions and land use to downstream water quality issues, and work with watershed districts to apply the findings as targets for water quality improvement.

Both the national and state responses to the adaptive cycle represent aspects of co-management, which is "some institutionalized arrangement for intensive user participation in decision making" (Berkes, 2009, p. 1693). It rises to the level of a theory because it expresses the construct of "learning by doing" in an institutional context. Co-management is power sharing, institution building, process, problem sharing and governance, Berkes argues, and can also foster innovation and conflict resolution. In all cases, the energizing force is the interplay between the agencies and organizations. Ideally, co-management acknowledges the biases that create barriers and seeks to find a balance. Competition between agencies can lead to turf battles, or it can lead to the honing of skills and abilities at the individual and organizational levels. Redundancy in management provides a check and balance that should enhance accountability (Yaffee, 1997). "Successful co-management is a knowledge partnership," Berkes concludes. And power sharing is the result, rather than the starting point of co-management (Berkes, 2009, pp. 1698-1699).

The individual is a critical player in the adaptive cycle because one, he or she is implementing the solutions which cumulatively either improve or impair water quality. Secondly, this group is paying for changes, through taxes on specific projects, or through taxes generally which fund the operations of local, state and federal government. Solutions have to be consistent with the interests of the individual. Following Olson (1971), the individual is likely to engage in action when "that the optimal amount of a collective good for an individual to obtain, if he should obtain any, is found when the rate of the gain to the group, multiplied by the fraction of the group gain the individual gets, equals the rate of increase of the total cost of the collective good" (p. 24). For example, many farmers are installing subsurface tile drainage. The cost of installing drains is subsidized by tax policy and increases in crop production as wet soils can be sustain a crop. Farmers in the Red River Basin increasingly perform this function themselves by sharing equipment with neighbors. In this example, the benefits achieved from additional drainage exceed the costs, especially when the farmers can

share costs. The point is that farmers make decisions about costs and benefits in order to maximize their operations. Government managers may have concerns about the downstream effects of subsurface tile drainage, but because farmers can share costs, drainage happens before government responds. Watershed districts have addressed the immediate concern by imposing a shared normative bottom line: limit the size of drain tile to reduce downstream impacts. In this way, the individual's action is weighted against the costs to himself, the shared costs of using his neighbor's equipment, and the limits to consider downstream impacts.

This study proposes that the Red River Basin flood damage reduction process offers farmers the opportunity to share internal beliefs and knowledge about managing floods through other groups of individuals operating in the same watershed. The watershed group, whose agenda is farmer-landowner-citizen determined, has a greater chance of avoiding the polarized standoff that can occur from top-down agency driven decisions about land management. This does not mean they work in isolation, but in a cooperative–collaborative partnership with federal and state conservation programs. In short, the mediated agreement provides a deliberative framework that permits ideas to be considered equitably. Most importantly, it acknowledges that a complex project in the landscape must be inherently flexible. Long-term goals remain static, but the process to reach those goals varies from year to year, based on natural and economic conditions. An intense summer rain storm may blow out part of a dike; water quality problems will spike and the harm must be repaired. Crop prices fluctuate, as do the costs of inputs such as seeds, fertilizers and other chemicals. Climate and landscape conditions are issues that every farmer addresses each season, and each day of the season. Minimizing the extremes is the goal, in order to maximize the normal.

CHAPTER 4. METHODS

4.1. Overview

This study uses a mixed methods and mixed mode research design. The study uses secondary and quantitative sources. Secondary sources describe the conditions of the area under consideration and to help the watershed planning team suggest indicators for measuring performance. A mail survey was distributed to quantify the experiences and opinion of property owners with flooding and the impoundment project. The purpose was to determine the experience and opinions of property owners living near or downstream of the North Ottawa Impoundment project, and the process used to develop the project. The project was the first built under the Red River Valley's Flood Damage Reduction Mediation Agreement, which put in place a process that balanced the need to reduce flood damages to agricultural lands while maintaining or enhancing ecological functions of the landscape. Determining attitudes will help evaluate performance of the North Ottawa Impoundment Project and with planning for future projects.

4.2. Research Design and Hypothesis

This project analyzes experiences and opinions of property owners living downstream of a flood damage impoundment by examining the framing document that created the process, using demographic and economic data to profile the property owners, and the results of a mail survey which specifically documents their opinions. Watershed managers who requested the study wanted to know if respondents supported the project and the process used to develop. They wanted to know if property owners were familiar with the goals of the project and the purpose for advancing multiple interests. The literature review suggests that individuals will mitigate self interest in favor of a shared interest if the shared interest is developed in a forum that assures participation, shared knowledge, learning and collaborative decision making. The study must demonstrate that the 1998 Flood Damage Reduction Mediation Agreement provides a deliberative frame, that the property

owners of the North Ottawa Impoundment Area were pre-disposed to civic engagement and acting on behalf of shared interests, and that the respondents supported the process used to develop the North Ottawa Impoundment project because it accommodates their interests.

4.3. Dependent and Independent Variables

The dependent variables describe knowledge, attitudes and behaviors associated with the impoundment project. These were the responses to questions addressing support for the project, benefits of project goals, and approval of multiple goals. The independent variables of this study are those that describe the facts associated with the respondents: location of land owned, place of residence, problems encountered as a result of spring flooding, actions taken as a result of spring flooding, observations around the project, and encounters with the watershed district. A goal of the project was to determine if there was an association between the independent variables and the dependent variables. The research design hypothesized that support for the project would be less important than the support for the process used to develop, build and operate the project.

4.4. Socio-Economic Profiles

The purpose of the social-economic profile is to determine conditions, situations or realities that affect the ability or willingness of individuals, institutions or organizations in the area to manage watershed conditions. The relevant conditions are population, density of population, age, income, and education. An additional set of measures are typically used to demonstrate the willingness of residents to engage in community activities. These measures include voting, participation in volunteer monitoring programs, distance from a population center (usually the local high school) and access to the Internet via broadband service.

Data were collected from easily available sources and reported by township and collectively for the North Ottawa subwatershed. Data from these sources is accessible to anyone willing to look; it

is free, does not require special training to access it, can be used to describe a variety of conditions. Data sources for the socio-economic profiles include: Agricultural Census (2007); Economic Profile Systems – Human Dimensions Toolkit from www.headwaterseconomic.org; and American Community Survey (2009); Minnesota Secretary of State; and Minnesota Pollution Control Agency.

4.5. Content Analysis of the Mediation Agreement

The process for developing the North Ottawa Impoundment Project, and projects like it, was laid out in the 1998 Flood Damage Reduction Work Group Mediation Agreement. In order to verify that the Agreement embodied the variables, constructs and framework advanced by Coleman (social capital), Olson (collective action), Holling and Gunderson (adaptive cycle) and Berkes (co-management), a content analysis was performed.

Key variables from the theory were listed. The Mediation Agreement was examined and when the variable was detected, either in the same language or similar language, the page was noted. A table of results was produced.

4.6. Survey Instrument

A mail survey of 280 property owners with parcels located adjacent to and downstream of North Ottawa Impoundment was conducted from October 13, 2011 through November 30, 2011. The survey instrument was developed and shared with the Bois de Sioux Watershed's managers and advisors in August and September. Reviewers included:

- Watershed Unit Project Managers, MPCA-Detroit Lakes
- Board of Managers, Bois de Sioux Watershed District

- North Ottawa Project Team, Bois de Sioux Watershed, a team of resource management professionals and citizens appointed by the Bois de Sioux watershed to manage the North Ottawa project.

The survey consisted of 16 questions. Seven questions asked about facts providing categorical or nominal information about the respondent's experience with flooding. The fact questions asked for the following information:

- Location in the subject area of parcels owned by respondent (Q1)
- Whether or not the respondent actually lived in the subject area (Q2)
- Problems experienced by the respondent due to spring flooding, before and after North Ottawa were constructed (Q3)
- Actions taken by the respondent in response to spring flooding, before and after North Ottawa was constructed (Q33)
- Whether the respondent kept records associated with flooding (Q4)
- Whether the respondent had ever contacted the Watershed District (Q13)
- Whether the respondent had ever attended a Watershed District meeting (Q14).

Seven questions asked about the respondents' opinions, providing continuous data:

- Whether the respondent supported the project before construction, and why (Q5)
- Whether the respondent supported the project after construction, and why (Q6)
- Who benefits from the project goals (Q7)
- Agree/disagree with reasons for using multiple goals (Q8)
- Compatibility of wildlife goals (Q9)
- Observations about the wildlife aspects of the project (Qs10, 11, 12).

A final question (Q15) asked for open-ended comments about the project. The survey is attached as Appendix 2. The open-ended responses are attached as Appendix 3.

A pre-survey focus group of three property owners was held in Wendell, Minnesota, near the North Ottawa Impoundment Project on October 10, 2011. The participants were from North Ottawa Township, Grant County. A letter describing the survey was sent to the respondent list about October 10. A follow-up post card was generated, but mailed with the survey by the mail service. A second follow up postcard was sent November 1.

4.7. Sample

The effect of flooding on private property is a main focus of the survey. Therefore, county property tax rolls were used to identify respondents. The extent of the survey area was determined in consultation with the watershed district administrator and consulting engineer. The project is located about 10 miles from the Red River of the North. The project affects about one-quarter of the flows of the Rabbit River. Therefore, in order to understand the experience and opinions of property owners relative to the project, it was determined that the survey should be sent to all property owners owning land on either side of the Rabbit River, from the project location in North Ottawa Township all the way to the Rabbit River's confluence with the Bois de Sioux River.

The list of property owner names was provided by Computer Professionals Unlimited, located at Morris, Minnesota, which serves as a data manager for the three counties (Grant, Traverse and Wilkin). The lists were provided in MS Excel. The lists were reviewed and the following types of property were removed:

- Sections outside the affected area
- Property held by public institutions or agencies, including US Government, State of Minnesota, Bois de Sioux Watershed District, the counties, townships and cities

- Property held by railroads and utility companies

and remaining parcels were consolidated so there was one name per mailing address.

There are approximately 4,000 parcels in three counties and 10 local subdivisions of the area affected by the North Ottawa Impoundment. The list of parcels was reduced by selecting the property owner by name, and eliminating multiple parcels. The list was further reduced by allowing only one respondent for individuals owning property in each of the three counties. Finally, the three counties' on-line parcel search tool was used to identify parcels within one section of the Rabbit River. The final list had 151 parcels for Grant County, owning property in six townships; 75 parcels in Wilkin County, owning property in three townships and one small city, and 54 parcels in Traverse County, owning property in one township and one small city, for a total of 280 parcels, with 54 percent from Grant County; 27 percent from Wilkin County and 19 percent from Traverse County.

Table 1. Location of respondents in study sample and population

Location	Study Sample		Population	
	N	%	N	%
Grant County	35	62.5	151	54
Traverse County	6	11	54	19
Wilkin County	15	27	75	27
TOTAL	56	100	280	100

A three- or four-wave survey was planned (Dillman, 2009). The plan was to mail an advance letter, the survey, a reminder postcard, and possibly mail additional copies of the survey.

North Dakota State University (NDSU) provided printing, duplication and mailing services. The complete survey was delivered to the NDSU Printing Center on September 24, 2011. An advance letter was the first wave and was mailed October 10, 2011. The survey was mailed October 14, 2011. Press releases about the survey were sent to the local newspapers, at Wheaton, Campbell and nearby Fergus Falls, Minnesota. A letter about the survey was sent to the town boards, city councils, county

boards of commissioners and soil and water conservation districts. The letters advised that interviews or focus groups with local government officials would follow the survey.

Ethical issues were considered. The survey did not ask for demographic or economic information about respondents. It was known that some of the potential respondents had disagreements with the Bois de Sioux Watershed District. It was important to keep respondents' name and address private.

The survey was submitted to the Institutional Review Board for approval and the approval letter is attached as (Appendix 4). Respondents were told that their rights would be respected. Individual surveys were identified numerically. Numbers were recorded when the survey was received on an Excel spread sheet that was kept apart from the completed surveys. The completed survey was not associated with an individual parcel owner.

4.8. Statistical Analysis

Data were entered into Professional SPSS format for data analysis. Univariate and several bivariate statistics were calculated. Due to licensing issues between SPSS and the Minnesota Pollution Control Agency, the data files became unavailable during the analysis. In order to continue the work, data were entered into MS Excel 2007 which provided the opportunity to produce a code book for the survey and responses and to verify the accuracy of the data entry. Univariate statistics, including mean, median, mode, standard deviation, and bivariate statistics, such as correlation coefficients, were calculated using the Data Analysis Toolpak feature of MS Excel. Once the licensing issues were resolved, the bivariate statistics were calculated in SPSS.

CHAPTER 5. FINDINGS

This study developed a socio-economic profile of the North Ottawa subwatershed using secondary data sources and administered a mail survey of property owners above and downstream of a water impoundment to explore experiences and opinions about the construction of the project and the process used to develop the project. Results of both inquiries are presented below, compared and contrasted and then interpreted.

This approach follows the convergence model of mixed methods triangulation (Creswell & Clark, 2007). In this model, quantitative and qualitative data are collected separately and the different results are converged during interpretation. This model is used to confirm or corraborate results. "The purpose of this model is to end up with valid and well-substantiated conclusions about a single phenomenon" (Creswell, 2007, Chapter 4, p. 65, Kindle edition).

5.1. Results of the Secondary Data Collection

The secondary data collection reveals that the population is quite low, that farming is the dominant land use, and it comprises a third of the personal income for the affected area. Slightly more than half the private land is classified as nonfarm homestead by the county tax assessor in 2011. This data are reported by township annually by the Minnesota Department of Revenue. Rural residents who do not farm constitute a fraction of the land ownership.

The survey area lies partly in three counties, and covers 10 townships and two small cities in the subwatershed. The counties, townships and cities are:

- Grant County: Delaware, Elbow Lake, Gorton, Lawrence, North Ottawa and Stony Brook
- Traverse: Tintah City and Tintah Township
- Wilkin: Brandrup, Campbell and Champion and Campbell City

Using 2009 American Factfinder (US Census Bureau), the total population of those local units is 1,233 living in 498 households. The lowest population was 19 for Tintah Township and the highest was the City of Campbell with 233 residents.

Median age for the residents of the subwatershed is 45.5 years, with the lowest median age in Brandrup Township, Wilkin County, and the highest in Tintah Township, Traverse County. Residents under 20 years in age comprise 28.5 percent of the population; residents between the ages of 20 and 65 are 55 percent; and residents over 65 comprise 16 percent of the population.

The population is educated, with 92 percent achieving a high school degree or equivalent; 14 percent have studied post secondary. There are 969 residents over age 16 that could be in the labor force. Of these, 643, (or 66 percent) are in the labor force. There are 326 residents (33 percent) who are not in the labor force. Median household income is $57,375, roughly equivalent to the median household income in Minnesota. The median household income for Traverse County was much lower than the other locations in the subwatershed.

Voting is a measure of civic engagement. Using records from the Minnesota Secretary of State, voting participation in the townships of North Ottawa Impoundment Project exceeded Minnesota's in both 2010, a low turnout year, and 2008, a high turnout year.

Two-thirds of total employment for the three counties is from wage or salary jobs; 37.7 percent of total employment is proprietors, which is how farmers report their income. The number of proprietors (a measure of economic growth) has been declining since 2000, probably as the number of farms has declined. Farm employment has declined 12.5 percent for the years 2001 through 2009; employment categories increasing in that time period are wholesale trade, professional and technical services, administrative and waste services, finance, real estate, educational services although government jobs also declined. Most of the land in the subwatershed is in row crop agriculture (88-92 percent). The average size of farm is: 476 acres in Grant County; 684 acres in

Traverse County and 993 acres in Wilkin County; the average age of farmers is higher than the median age for the total population, 57.4 years for Grant County; 56.5 years for Traverse and 54.8 years for Wilkin County.

There are 675 farmers in Grant County; farming is the primary occupation for 326 of these; the remaining 349 farmers list "other" as primary occupation. Farming is the primary occupation for 266 of Traverse County's 479 farmers, while 213 have another primary occupation. Farming is the primary occupation for 281 of Wilkin County's 428 farmers; 147 have another primary occupation.

The average market value of farm products is $153,000 for Grant County farms; $232,276 for Traverse County farms, and $304,901, for Wilkin County farms. The average expense for farm production was $121,955 in Grant County, $190,932 for Traverse and $254,073 in Wilkin. The average income per farm was $53,751 in Grant, $77,543 in Traverse and $92,890 in Wilkin. Average government payments were $9,691 in Grant, $12,281 in Traverse and $14,659 in Wilkin.

Minnesota Department of Revenue reports numbers of parcel per property tax classification for the townships and cities of the North Ottawa Subwatershed. Of approximately 4,000 parcels in the 10 townships and two cities, 1,543 (38.5 percent) are classified as Farm Homestead; 2,166 (54 percent) are classified as NonFarm Homestead and 190 (4 percent) are classified as Homestead.

5.2. North Ottawa Landowner's Survey Results

Response rate was 20 percent with 56 surveys returned. Of the 56 respondents, 35 (62.5 percent) were from Grant County, eight (14 percent) were from Traverse County and 13 (23 percent) were from Wilkin County. This response followed the order of the sample where Grant County represented 54 percent of sample; Wilkin represented 27 percent of the sample, and Traverse Country represented 19 percent of sample. But proportionately, Grant County respondents were overrepresented, whereas the other counties were underrepresented.

The Board of Managers of the Bois de Sioux Watershed District authorized a phone survey in an attempt to increase response rate to 100 respondents. In developing the phone list, it became clear that many of the respondents were more than 85 years of age and the mail address was a nursing home. Although these individuals own the land, it is likely rented to someone else, who may or may not have seen the survey. It may be possible to argue that the sample was higher than anticipated since a number of the respondents were not likely to respond. This survey identified property owners and not farm operators. Secondary data found that farmers were the predominate land owning group for the area, and that owners would have knowledge of the effects of floods, even if they were not involved in making decisions about daily operations. An alternate approach would be a drop-off survey (Salant, 1994) that targets farm operators could be distributed, to on-farm shops and collected in a week or ten days.

5.3. Descriptive Statistics of Responses

The first question asked respondents to indicate on a map where they owned property in the subwatershed. Sixty-three percent of respondents indicated that they owned property in Grant County and of these, 30 percent owned property in North Ottawa townships. Next, respondents were asked if they lived in the area represented on the map. Forty percent said they lived in the subwatershed area; 34 percent said they did not live in the subwatershed area. Figure 4, below, shows location of respondents by township or city and by county. The locations are displayed on the horizontal axis following the hydrological order, from west to east. This illustrates that the greatest proportion of respondents came from the upstream, eastern part of the area at North Ottawa Township, Grant County, and the downstream, western end of the area, at Brandrup Township, Wilkin County.

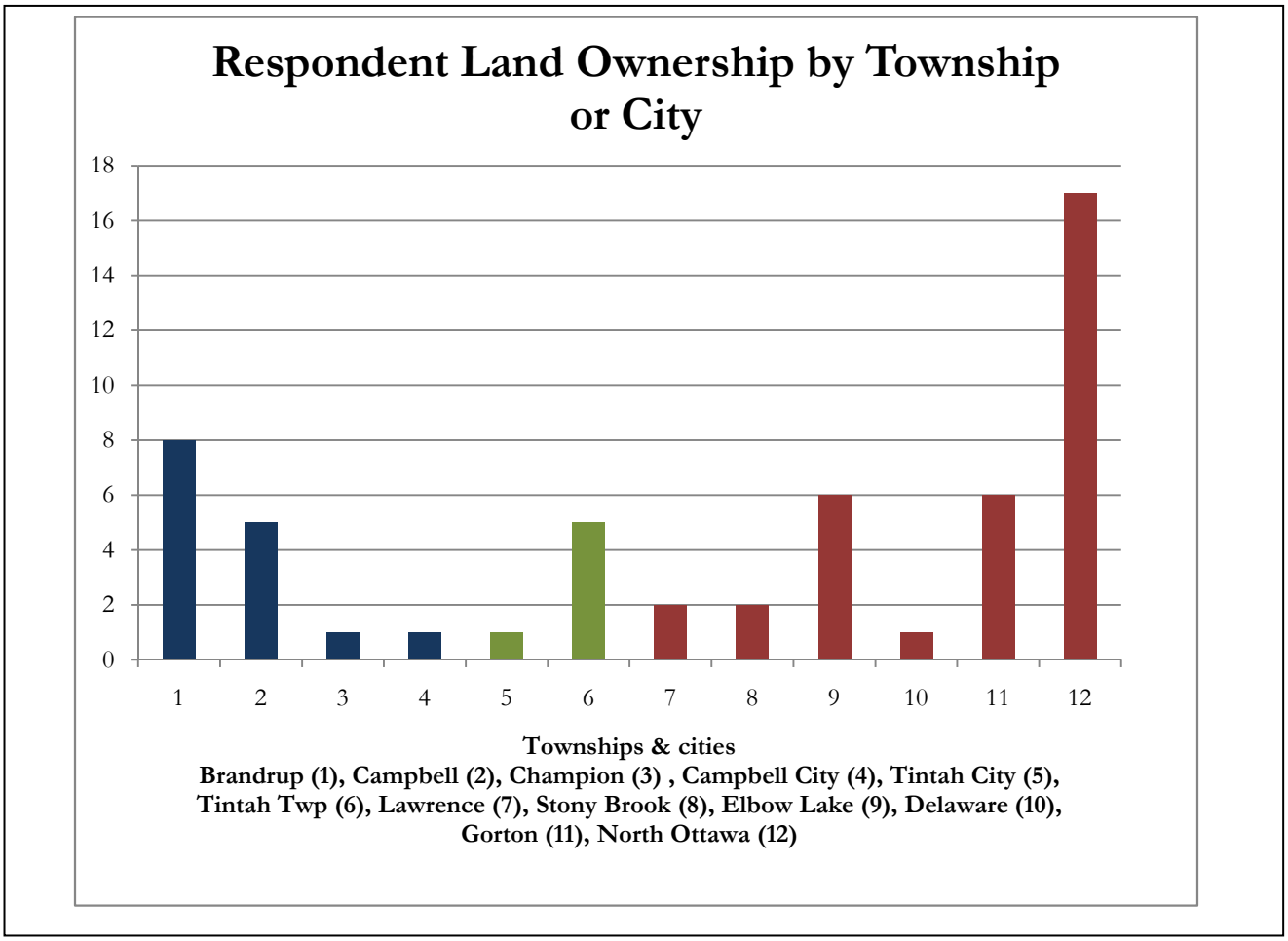

Figure 4. Respondents from west (Wilkin County) to east (Grant County).

Respondents were then asked about 11 types of problems that they could experience on their property due to spring flooding, before North Ottawa was built, after North Ottawa was built, or if they had never had these problems. These problems or conditions were: planting, stream or ditch, fields, culverts, private roads, public roads, home, garage, other buildings, well or septic system. Respondents said that the third and fourth choices – fields and culverts – were selected the most, with 23 percent and 24 percent, respectively, selecting these problems. This question attempted to document the extent of problems associated with spring flooding before and after construction of North Ottawa Impoundment Project. Most respondents said that the problems existed before, and not after, construction of North Ottawa Impoundment.

Then, respondents were asked what actions they had taken in response to flooding, both before and after the construction of North Ottawa Impoundment Project. Sandbagging and replacing crop inputs (seeds, fertilizers or chemicals) were the actions selected most frequently. Respondents were asked whether they kept records of spring flooding. If the response was affirmative, the respondent was asked about nine specific types of records: rain gauge, stream gauge, rainfall events, photos, floods, ice out and planting date, home insurance claims, crop insurance soil surveys. About one-quarter (24 percent) of respondents said they kept records associated with flooding, with rain gauge selected by 13 respondents, or 23 percent. "Photographs" was the record type selected with the second most frequency.

Respondents were then asked specifically if they supported the project before construction of the North Ottawa Impoundment Project. Exactly half the respondents (28) reported that they supported the project before construction, or 2007. Respondents then were provided the opportunity to provide open-ended comments for supporting or not supporting North Ottawa before construction. Twenty-nine respondents provided answers which were sorted into four categories:

- Cost of project, a negative opinion about the project
- Loss of land, which was a negative opinion about the project, or
- Effectiveness of project, a positive comment, or
- Effectiveness of project, a negative comment:

Typical examples of negative comments about effectiveness were respondents who cited specific examples of how the project had not worked. Three of the 29 respondents wrote non-specific comments in the space. Seventeen of those providing open-ended comments reported on the project's effectiveness. "We thought it would stop flooding" and "water retention makes sense"

are examples of positive comments on the project's effectiveness. Another respondent spoke to the issue of effectiveness, but explicitly stated that the project should be primarily intended to provide relief for agricultural flood damages.

> "I supported the impoundment as a flood control system and not for wildlife enhancement. I am a hunter and sportsman and believe that wildlife enhancement will result in time in the region as a result of the impoundment but should not be the major purpose. The protection of property & crops is predominate."

Those who did not support the project before construction cited cost or loss of farmland in their comments: " took land out of production & every dollar made gets spent 7 more times in a community," and "big waste of money & too much land taken from tax base of township that has to high taxes and too few people to share it!!!!"

Table 2. Coded open-ended responses support for project before construction (Q5A)

Category	Participants (N=29)	Percent
Cost – con	5	17
Loss of land	3	10
Effectiveness – pro	13	45
Effectiveness – con	3	10
Not Coded	5	17
TOTAL	29	99

The next opinion question asked respondents whether they supported the North Ottawa Impoundment Project after it was constructed. The pre-survey focus group participants suggested that the question of support be specified to before construction and after construction. One participant said he was aware of people, including him, who had opposed the project in concept, but supported it in practice. Twenty-nine (52 percent) respondents said they supported North Ottawa after it was constructed, that is, one more than those who stated they supported it before construction. Seven respondents provided open-ended comments, and of those, half expressed support. Responses were sorted into the same four categories used for the previous question about project support: cost of project, loss of land, effectiveness of project, as positive or negative.

Typical examples of negative comments about effectiveness were respondents who cited specific examples of how the project had not worked. Most of the comments (five out of seven) were positive about the project's effectiveness. Appendix 3 is the list of open-ended responses.

Table 3. Coded open-ended responses to support for project after construction (Q6A)

Category	Participants (N=7)	Percent
Cost – con	1	14
Loss of land	0	0
Effectiveness – pro	5	71
Effectiveness – con	1	14
TOTAL	7	99

Respondents were then asked their opinion of who benefitted from the five original project goals. Responses included three broad interest categories in the subwatershed area: farmers, downstream residents, our environment and no one. Care was taken to identify the categories of who benefits. The North Ottawa project was intended to reduce flood damages locally as well as to to reduce downstream floods, in the small city of Tintah, and downriver on the Red River of the North at Wahpeton and at Fargo.

Respondents were asked to identify who benefits from each of the five goals. Thirty-two percent of the respondents said that farmers and downstream residents benefitted from the project goal of storing 16,000 acre-feet of excess or flood water each spring. Figure 5 below illustrates responses.

Twenty-three percent of respondents said that farmers and downstream residents benefitted from the project goal of reducing spring floods at the city of Tintah. Figure 6 below illustrates responses. It should be noted that the second highest response was "no one" benefits from achieving this goal, which was slightly higher than the number choosing not to answer the question.

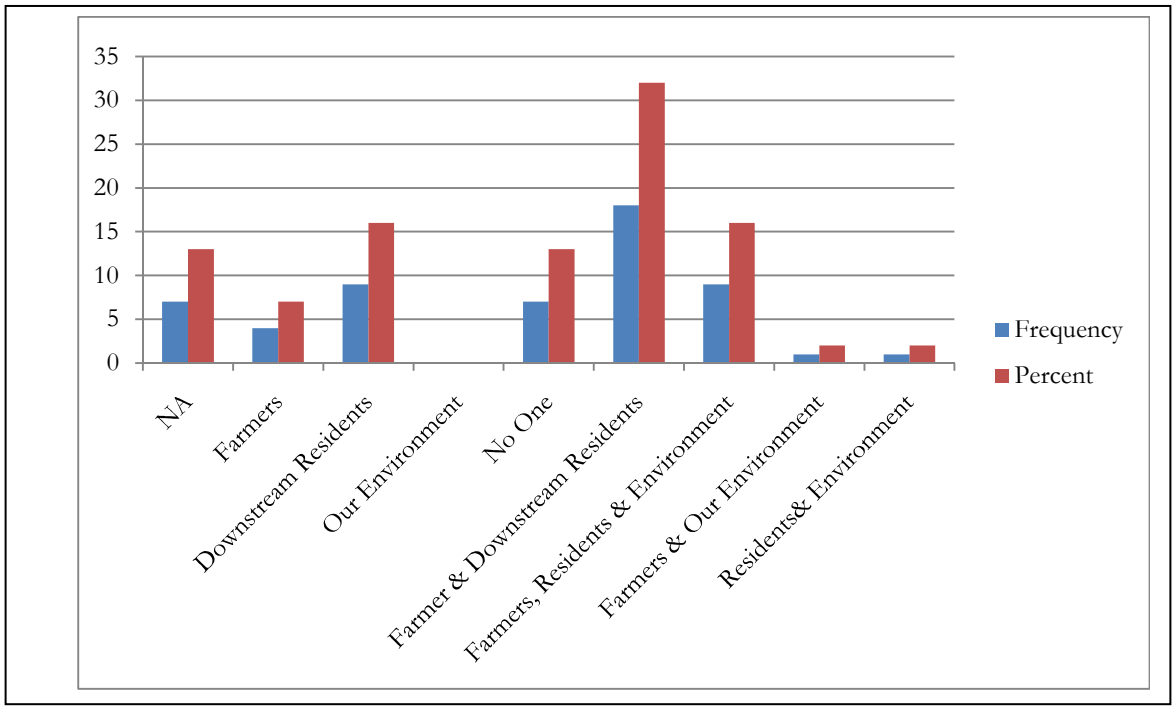

Figure 5. Who benefits from storing spring flood water (Q7A)?

Twenty-three percent of respondents said farmers and downstream residents benefit from achieving the project goal of augmenting low flow in the summer months. Twenty-three percent of respondents said that farmers and downstream residents benefitted from this goal. Figure 7 below illustrates responses. Thirty percent of respondents said our environment benefits from achieving the project goal to improve water quality, 23 percent of the respondents selected no one. Figure 8 below illustrates responses. Thirty-eight percent of respondents said that our environment benefits from achieving the project goal of enhancing wildlife habitat. Twenty-seven percent selected no one. Responses are illustrated in Figure 9.

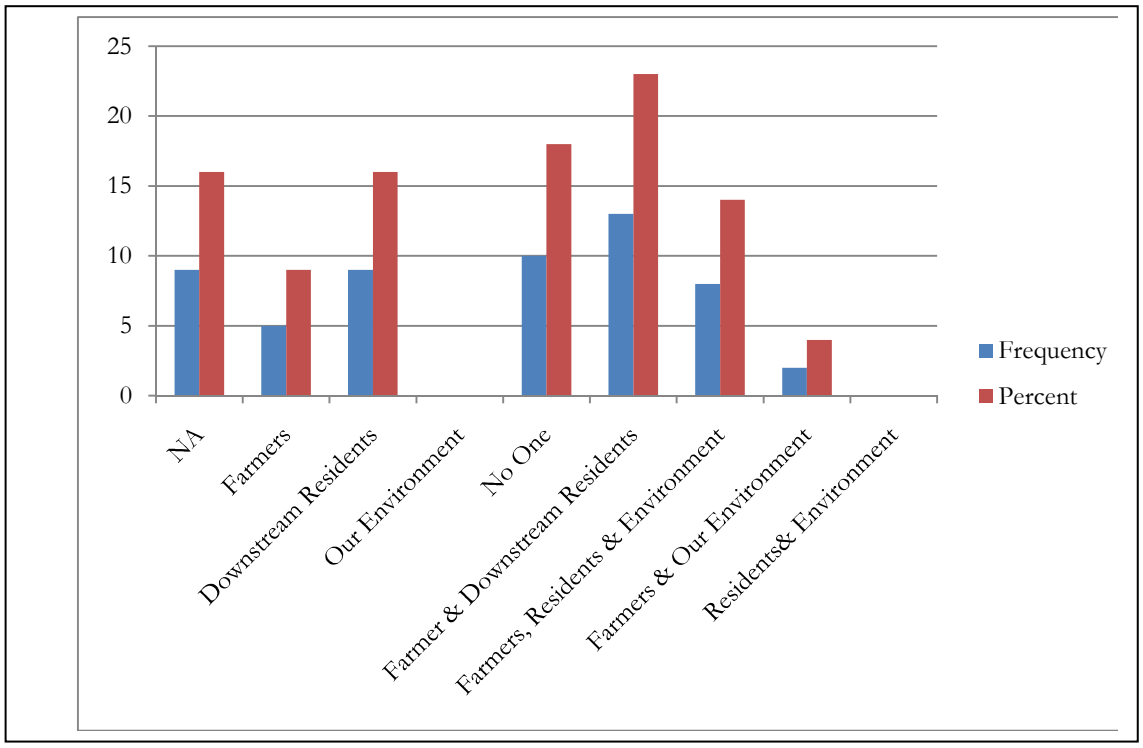

Figure 6. Who benefits from reducing floods at Tintah (Q7B)?

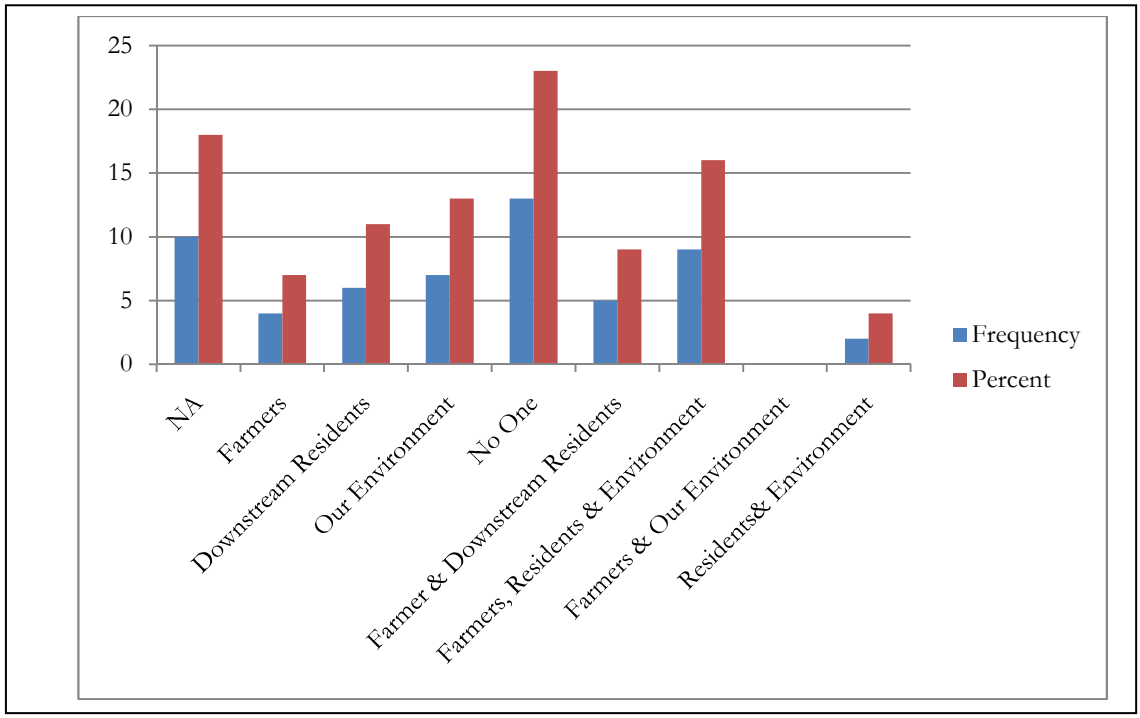

Figure 7. Who benefits from augmenting low flow (Q7C)?

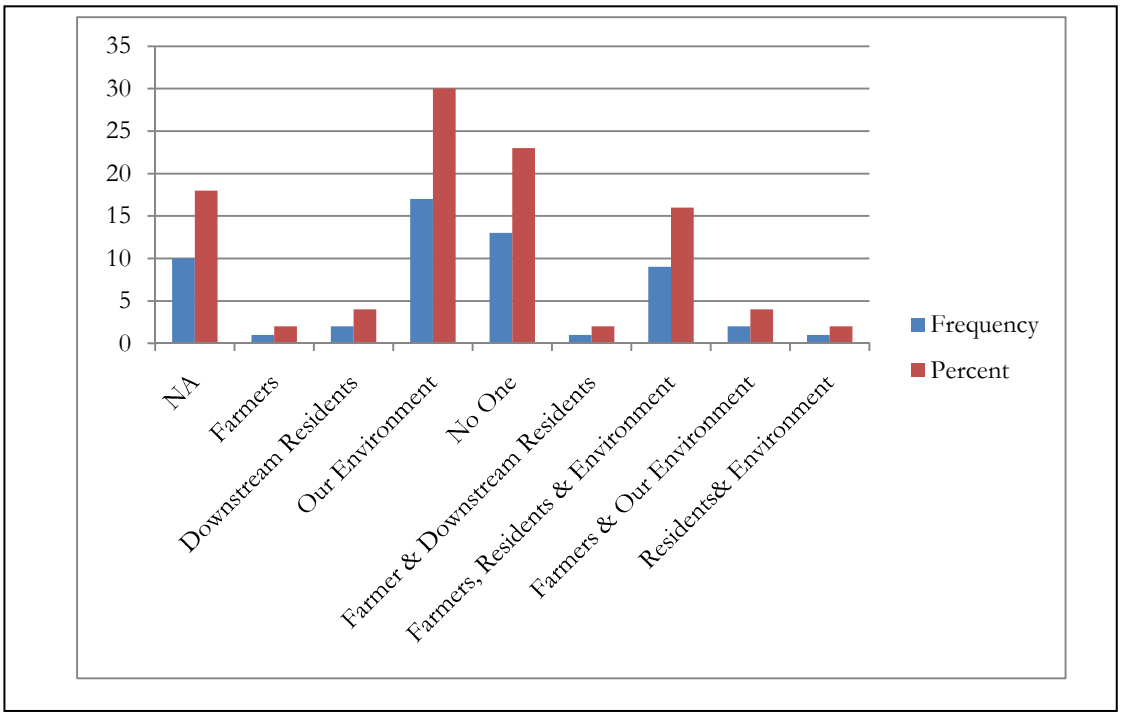

Figure 8. Who benefits from restoring water quality (Q7D)?

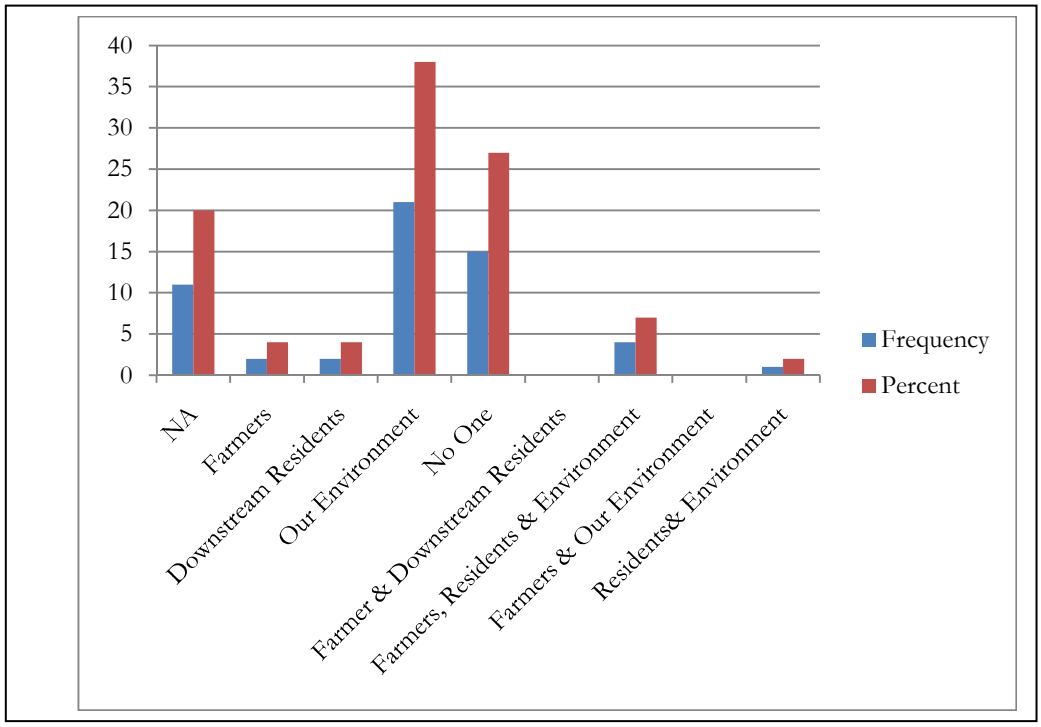

Figure 9. Who benefits from enhancing wildlife (Q7E)?

The next set of questions asked respondents about reasons why the multiple benefits approach was used and about their support for five statements why the approach is important.A Likert scale of strongly agree to strongly disagree was used for responses. First question was degree of agreement with the statement that multiple goals are okay if they result in alternate funding for projects. Twenty-eight respondents selected strongly agree or agree, equal to 50 percent of respondents. Response is illustrated in Figure 10.

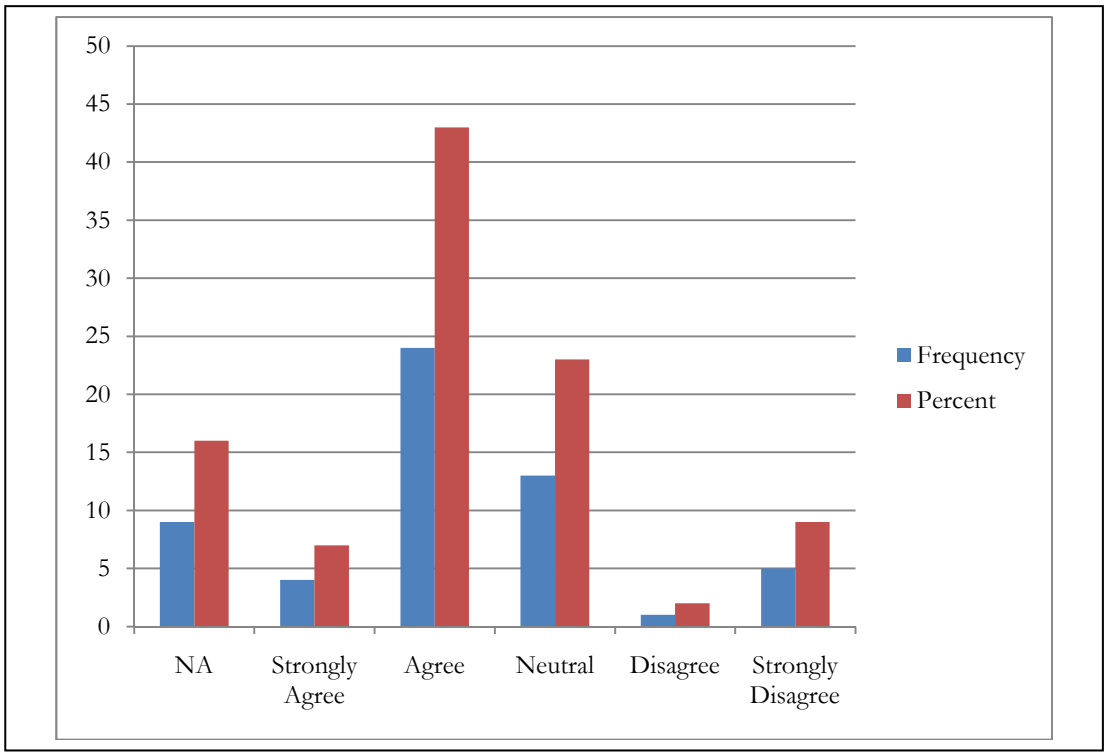

Figure 10. Multiple benefits provide alternate funding (Q8A).

More than two-thirds of respondents agreed or strongly agreed that multiple goals were okay if they result in different views being heard and considered in the process. More than two-thirds of respondents, (37 or 67 percent) selected strongly agree or agree for that statement. The response is illustrated in Figure 11. More than half the respondents strongly agreed or agreed with the statement that multiple goals were okay because it accommodates multiple interests. Responses are illustrated in Figure 12.

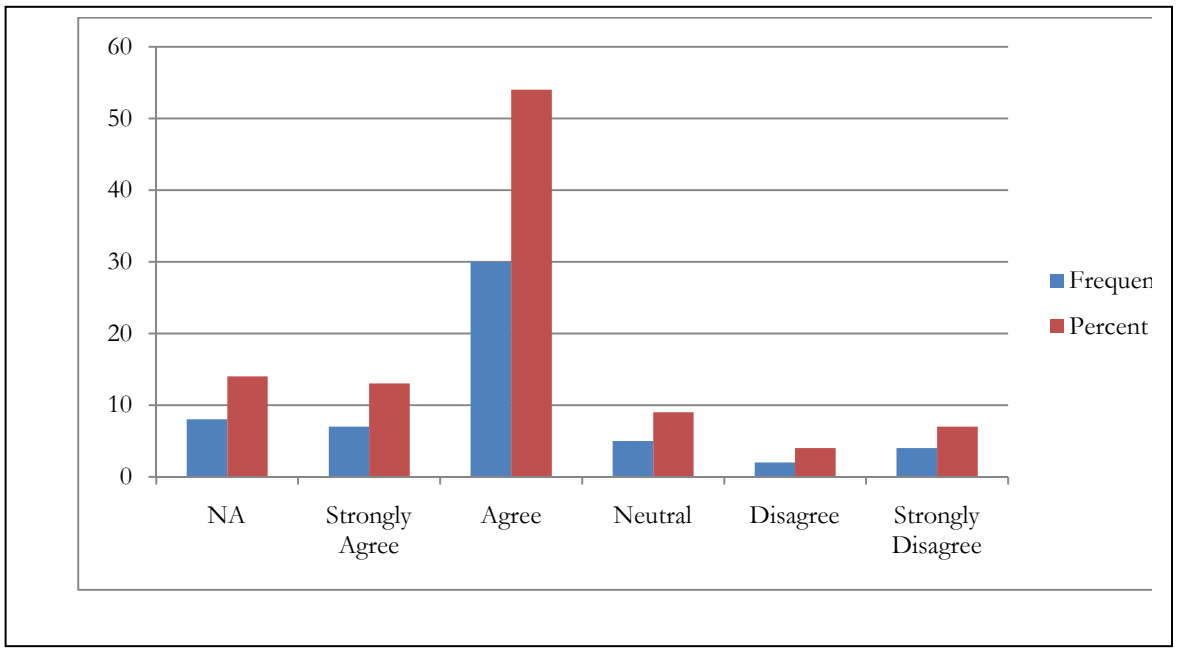

Figure 11. Multiple benefits allow different views (Q8B).

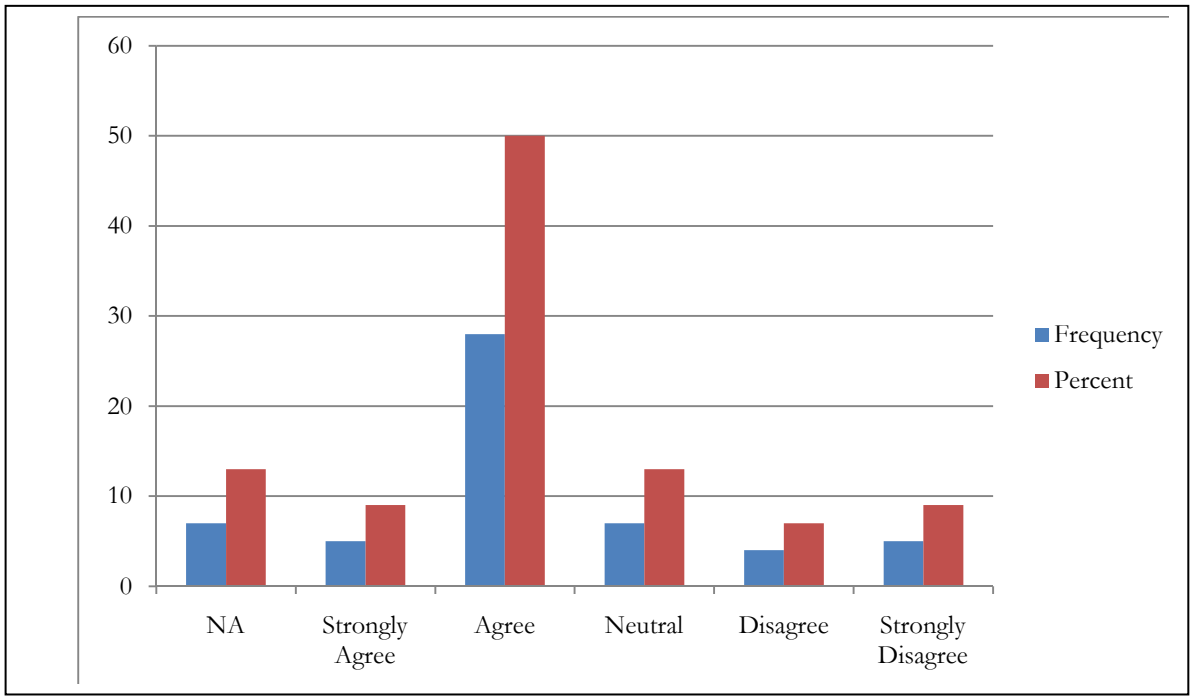

Figure 12. Multiple benefits accommodate multiple interests (Q8C).

More than half the respondents strongly agreed or agreed with the statement that multiple goals were okay because it provides for consensus. Responses are illustrated in Figure 13.

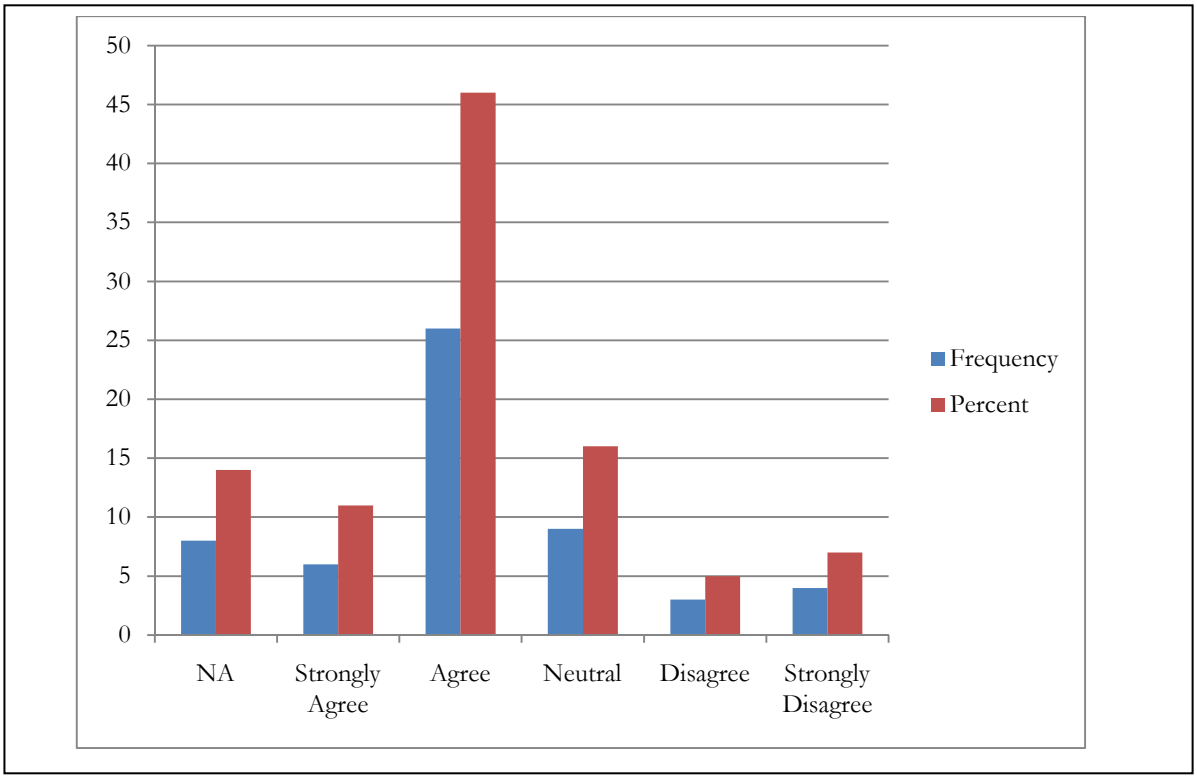

Figure 13. Multiple benefits enable consensus (Q8D).

Finally, respondents were asked about their agreement if multiple goals are okay if they provided for improvements over time. More than half the respondents (30 or 53 percent) selected strongly agree or agree. Responses are illustrated in Figure 14 below.

Managers and staff of the Bois de Sioux Watershed District asked that questions be included that asked about opinions about wildlife and waterfowl at the North Ottawa Impoundment Project. There were four parts to this question.

First, respondents were asked their degree of agreement with the statement that waterfowl and farming are not compatible. On the Likert scale, about one-third of the respondents (16 or 29 percent) selected neutral. Nineteen respondents or 34 percent selected disagree or strongly disagree.

Respondents were asked about the statement, if "managed properly, farming and wildlife can co-exist". Slightly fewer than half the respondents (27 or 48 percent) selected strongly agree or agree.

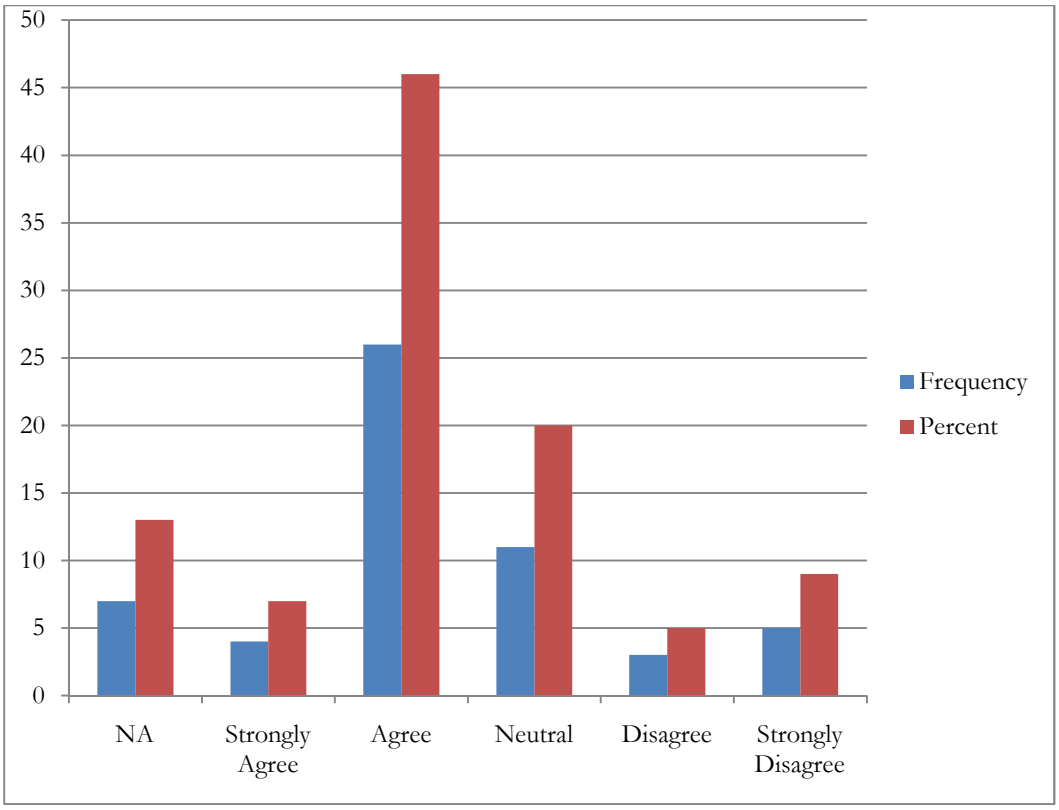

Figure 14. Multiple benefits allow for improvement over time (Q8E).

Then, respondents were asked if visitors to the wildlife refuge at the North Ottawa Impoundment Project would reduce privacy for residents. Thirty-eight percent of the respondents selected neutral. Respondents were also neutral on the question whether they agreed with the statement that visitors to the wildlife refuge would improve the economy. Thirty-two percent of the respondents selected neutral. Finally, respondents were asked their degree of agreement with the statement, "I enjoy watching the waterfowl." Forty-nine percent selected strongly agree or agree. The next three questions asked specific questions about respondents' observations at the North Ottawa Impoundment Project.

On these questions, thirty respondents, or 54 percent, said they had not observed an increase in visitors since the North Ottawa Impoundment Project became operational. Thirty-two or 57 percent

said they had not noticed an increase in migrating waterfowl in the spring since the project became operational. Yet, thirty-one or 55 percent of the respondents said that wildlife depredation of crops was about the same since North Ottawa became operational.

Respondents were asked two questions about their contact with the Bois de Sioux Watershed District. Forty-eight percent reported that they had contacted the office to inquire about a permit. More than one-third (34 percent) stated that they had attended a meeting of the watershed district to discuss watershed planning.

Respondents were asked to provide their thoughts and concerns about the North Ottawa Impoundment Project. About half, or 27 of the 56 respondents, provided comments. Comments were sorted into the same four categories used for the previous open-ended responses about support for the project. Typical examples of negative comments about effectiveness were respondents who cited specific examples of how the project had not worked.

Table 4. Coded responses of open-ended responses about the project (Q15)

	Participants (N =27)	Percent of N
Cost – con	3	11
Loss of land	1	4
Effectiveness – pro	10	37
Effectiveness - con	12	44
Not coded	1	4
TOTAL	27	100

5.4. First Order Bivariate Analysis of Responses

This survey is intended as a one-time measure of experiences with spring flooding and an impoundment project, and opinions about the process used to develop that project. Bivariate measures are used to measure association between the variables. This is important in determining the reliability and validity of the survey results. Correlation was defined as follows:

Table 5. Correlation defined

Results	Strength of Correlation
+/- 0.0 - .24	Weak
+/- .25 - .49	Moderate
+/- .40 - .74	Strong
+/- .75 – 1.0	Very Strong

Pearson's correlation was performed on the multiple responses in project goals, multiple benefits, and waterfowl and farming. Tables 6, 7, and 8 illustrate the results of that correlation.

Table 6. Pearson correlation project goals (Q7)

	Q7A - Store	Q7B - Reduce	Q7C - Augment	Q7D - Restore	Q7E - Enhance
Q7A – Store	1	.679**	.523**	.425**	.406**
Q7B – Reduce		1	.520**	.648**	.629**
Q7C – Augment			1	.460**	.503**
Q7D – Restore				1	.811**
Q7E – Enhance					1

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

A relationship exists between the answers associated with flood damage reduction (A, B, and C), and with the answers associated with environmental benefits (D and E). For example, the relationship between responses to store spring floods (Q7A) and reduce downstream floods (Q7B) was strong (r = .679) while the relationship between store spring floods (Q7A) and restore water quality (Q7D) is moderate (r =.425). Strongest relationship was found between the two responses for environmental goals (Q7D), restore water quality and (Q7E), enhance habitat (r = .811). Strong relationship was also found with reduce downstream floods (Q7B) and all other goals. Table 7 shows results of Pearson's correlation for Question 8, which asked respondents about the advantages of using a multiple benefit approach to designing projects. Strongest relationship was found between responses alternate funding (Q8A) and allows different views (Q8B) and alternate

Table 7. Pearson correlation multiple benefits (Q8)

	Q8A – Alternate Funding	Q8B – Different Views	Q8C – Multiple Interests	Q8D - Consensus	Q8E - Improve
Q8A - Alternate funding	1	.932**	.725**	.889**	.638**
Q8B -Different Views		1	.697**	.902**	.670**
Q8C -Multiple Interests			1	.721**	.869**
Q8D –Consensus				1	.680**
Q8E –Improve					1

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

funding (Q8A) and enables consensus (Q8D) (r = .932 and r = .889). The relationship between different views (Q8B) and enables consensus (8D) was also very strong (r = .902).

Table 8. Pearson correlation waterfowl and farming (Q9)

	Q9A – Compatible	Q9B – Co-exist	Q9C – Privacy	Q9D – Economy	Q9E - Watch
Q9A – Compatible	1	.156	.640**	.345**	.144
Q9B - Co-exist		1	.245	.564**	.751**
Q9C – Privacy			1	.487**	.315*
Q9D – Economy				1	.646**
Q9E – Enjoy					1

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

Table 8 shows the Pearson's correlation for the question which asked respondents about waterfowl and farming, questions that the watershed district manager requested specifically. The first two responses were contradictory: whether respondents agreed that farming and waterfowl and are not compatible, and next, whether respondents agreed that, if managed properly, farming and waterfowl can co-exist. The relationships among responses was weak (r = .156). Not surprisingly, a strong relationship was found between responses to the first question that waterfowl and farming are not compatible and a statement that visitors to the North Ottawa Wildlife Refuge will reduce my privacy (r = .640).

Spearman's correlation analysis was performed for the set of questions about who benefit from the specific project goals and the set of questions about why multiple goals are used. A moderate relationship was found between who benefits from augmenting flows in the summer and statements that multiple goals provide for alternate funding (r = .499), accommodate different views (r = .458), allow multiple interests (r = .379), enable consensus (r = .346) and provide for improvements over time (r = .254, almost weak). A moderate correlation was found between benefits of improving water quality, and of enhancing wildlife, and all reasons for supporting multiple benefits. The correlation for these questions is displayed in Table 9 below.

Table 9. Spearman's correlation multiple goals (Q7) & multiple benefits (Q8)

	Q8A-funding	Q8B-different views	Q8C – multiple interests	Q8D – consensus	Q8E - improve
Q7A - Store	.143	.193	.122	.063	.117
Q7B - Reduce	.097	.163	.091	-.009	.050
Q7C – Augment	.499**	.458**	.379**	.346**	.254
Q7D – Improve	.347**	.405**	.255	.236	.126
Q7E – Enhance	.472**	.492**	.389**	.419**	.278*

Spearman's correlation analysis for the set of questions about multiple goals and the set of questions about waterfowl and farming found a moderate relationship among responses. A moderate correlation was found between store flood water (Q7A) and waterfowl and farming are not compatible (Q9A) (r = .327). A moderate correlation was found between store flood water (Q7A) and the refuge will reduce privacy (Q9C) (r = .430). A moderate correlation was found between improve water quality (Q7C) and waterfowl and farming can co-exist (Q9B), privacy (Q9C), economy (Q9D) and watching wildlife (Q9E). The strongest (albeit still moderate) relationship was found between enhance wildlife (Q7E) and watching wildlife (Q9E) (r = .412). Results are displayed in Table 10, below.

Table 10. Spearman's correlation multiple goals (Q7) and waterfowl & farming (Q9)

	Q9A Compatible	Q9B Co-exist	Q9C-Privacy	Q9D-Economy	Q9E-Watch
Q7A - Store	.327*	.083	.430**	.267*	.195
Q7B – Reduce	.242	.219	.314*	.206	.313*
Q7C – Augment	.100	.350**	.270*	.265*	.324*
Q7D – Restore	.230	.360**	.257	.259	.363**
Q7E – Enhance	.212	.395**	.230	.226	.412**

Spearman's correlation analysis for multiple benefits (Q8) and waterfowl and farming (Q9) are displayed in Table 11 below. A strong correlation was found (r = .598) between allows different views (Q8B) and waterfowl and farming can co-exist (Q9B). A strong correlation was found between multiple interests (Q8C) and waterfowl and farming can co-exist (Q9B) (r = .533); enables consensus (Q8D) and waterfowl and farming can co-exist (Q9B) (r = .568) and improvements over time (Q8E) and waterfowl and farming can co-exist (Q9E) (r = .550).

Table 11. Spearman's correlation multiple benefits (Q8) and waterfowl & farming (Q9)

	Q9A Compatible	Q9B Co-exist	Q9C Privacy	Q9D Economy	Q9E Watch
Q8A – Alternate funding	-.001	.488**	.195	.225	.347**
Q8B – Different points of view	.114	.598**	.225	.293*	.402**
Q8C – Multiple interests	.188	.533**	.232	.283*	.421**
Q8D – Consensus	.222	.568**	.186	.237	.390**
Q8E – Improvements	.139	.550**	.212	.320*	.497**

Moderate relationships were found when multiple (Q8) was correlated with three questions about waterfowl. These questions compared respondents' opinions with the multiple benefits approach with the actual effects experienced by residents where a multiple benefit flood impoundment project is in operation. Moderate relationship was found between responses to enables consensus (Q8C) and noticed increased visitors (Q10).

Table 12. Pearson's correlation (Q8), (Q10), (Q11), and (Q12)

	Q10 Visitors	Q11 Migrating	Q12 Depredation.
Q 8A - Alternate Funding	.334*	.261	.241
Q 8B - Different Points of View	.264	.283*	.207
Q 8C - Multiple Interests	.302*	.301*	.164
Q 8D – Consensus	.337*	.116	.242
Q 8E – Improvements	.323*	.274*	.256

Finally, Pearson's correlation analysis was performed on project support before construction (Q5) and multiple benefits (Q8). A strong relationship (r = .702) was found between project support before construction (Q5) and accommodates multiple interests (Q8C).

Table 13. Pearson's correlation support before construction (Q5) and multiple benefits (Q8)

	Q8A Alt. Funding	Q8B Different Views	Q8C Multiple Interests	Q82 Consensus	Q8E Improve
Q5 - Supported project before construction	.579**	.572**	.702**	.534**	.614**

5.5. Analysis of the 1998 Mediation Agreement

A content analysis was performed on the Mediation Agreement. Concepts and variables associated with the adaptive cycle, learn by doing theory were identified and then compared to the agreement to determine which if any were present. The content analysis identified six variables and constructs associated in the literature with the adaptive cycle and co-management. Table 14 below shows the six variables in the top column and the location of the corresponding item in the Mediation Agreement. The six variables and constructs were identified as follows:

1. Shared knowledge (Stanford and Poole, 1996), (Berkes, 2009), (Armitage, 2007);
2. Collaborative process (Stanford and Poole, 1996), (Armitage, 2007);
3. Norm-based goals (Stanford and Poole, 1996)(Armitage, 2007);
4. Research (Stanford and Poole, 1996)(Berkes, 2009);

5. Peer-reviewed management strategy (Stanford and Poole, 1996)(Berkes, 2009), and

6. Vision and forward looking (Berkes, 2009).

Table 14. Flood Damage Reduction Work Group Mediation Agreement Content Analysis

1. Knowledge	2. Process	3.Norm-based goals	4. Research	5. Management strategy	6. Vision
p. 4 TSAC, p. 13 agencies' planning, p. 19 WD planning	p. 4 accommodate diverse interests pp. 19-27; p. 21, No. 3, involvement of all	pp. 6-18 "realistic, yet meaningful; p. 21 planning & goals first	P 4 TSAC p. 21, monitoring & evaluation essential	pp. 19-27; p. 21, No. 3, involvement of all; project team	p. 4 Long-term solution p. 13 proactive in identifying goals

CHAPTER 6. DISCUSSION

6.1. Triangulation of the Data Sources

This study involved a mixed mode research, following the convergence triangulation process described by Creswell and Clark-Plano (2007). In this method, qualitative (the survey) and quantitative (secondary data) are collected, analyzed and presented separately. It generally involves the concurrent, but separate, collection and analysis of quantitative and qualitative data so that the researcher may best understand the research problem. The researcher attempts to merge the two data sets, typically by bringing the separate results together in the interpretation. The purpose of this model is to develop valid and well-substantiated conclusions about a single phenomenon. This method provides construct validity for the survey results. The triangulation enables the comparison of what the respondents said with the survey with socio-economic profile that suggests tendency towards shared interests, and the assessment of the Mediation Agreement which provides a framework for developing that shared interest.

6.2. Conclusions from the Mediation Agreement Content Analysis

The content analysis of the 1998 Flood Damage Reduction Work Group Agreement showed that all variables, constructs or competencies identified by Stanford and Poole (1996) (watershed management), and Berkes (2009) (adaptive co-management) were present in the document. Moreover, the document includes an extensive list of goals with objectives that can be adjusted to fit the multiple authorities, satisfying state agency mandates as well as local needs. The Mediation Agreement stands as an example of the adaptive cycle applied to a specific location and resource concern.

6.3. Conclusions from the Secondary Data

The secondary data found that population is low, but measures of civic engagement – income, education, length of residence – were high. Residents are likely to expect that public resources will

be used to address problems affecting their location, and that the response will be mitigated by the diversity of interests found in the area. Therefore, the residents and property owners of the North Ottawa area would be expected to have a tendency towards engaging in collective action to manage the watershed for public values. In short, the population is low, but has the characteristics of a population that values using local resources to benefit the public good.

6.4. Conclusions from the Mail Survey

The mail survey found that respondents were supportive of the process used to develop the North Ottawa Impoundment Project. Respondents supported the project – about half –supported the North Ottawa Impoundment Project, before and after construction. A stronger response was recorded for agreement with statements about the process used to develop the North Ottawa Impoundment Project. Respondents were asked five questions about reasons for using a multiple goal approach to developing flood damage reduction project. The staff and managers of the Bois de Sioux Watershed District asked specifically that this question be included. The project had always been conceived as having multiple benefits, that is, it would reduce flood damages in the spring and provide habitat for migrating waterfowl in spring and fall. The Bois de Sioux staff and managers emphasized the collaborative nature of the process in their communications with the public during the project design process. The five reasons for using multiple benefits: additional funding sources, it accommodates different points of view, it accommodates multiple interests, it provides for consensus and it provides for improvements over time. Of these, the strongest responses were recorded for different points of view (Q8B) and multiple interests (Q8C) (see Table 15).

Table 15. Question 8: Number selecting multiple benefits approach

Benefits	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Q8A - Provide alternate funding?	4	24	13	1	5
Q8B - Different views are heard?	**7**	**30**	5	2	4
Q8C - Accommodate multiple interests?	**5**	**28**	7	4	5
Q8D - Provides for consensus?	6	26	9	3	4
Q8E - Provides for improvements?	4	26	11	3	5

The keys to this new approach are clearly identified goals, comprehensive watershed planning, early consultation and collaboration on flood damage reduction projects among stakeholders, and a cooperative approach to permitting of those projects. The goals are a record of the decision-making that has gone into the project, the issues considered and adopted for the project, and also are a commitment to the project's stakeholders of how the watershed district will manage the project over time.

Watershed district staff and managers also requested that respondents be asked directly about their experience with observations of waterfowl at the North Ottawa Impoundment Project. The impoundment site is also a designated wildlife refuge. Migrating waterfowl have used the site. The numbers are remarkable. Several newspaper articles have been published citing the value of the location for observing waterfowl. Therefore, Question 9 included five items about the North Ottawa Wildlife Refuge: are farming and wildlife compatible (Q9A); farming and wildlife can co-exist (Q9B); refuge visitors will reduce my privacy (Q9C); refuge visitors will help the local economy (Q9D), and I enjoy watching the wildlife (Q9E).

Table 16. Question 9: Number agreeing with North Ottawa Wildlife Refuge statements

Farming & Waterfowl	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Q9A - Not compatible	8	7	16	17	2
Q9B - Can co-exist	**4**	**23**	12	6	4
Q9C - Reduce privacy	5	5	21	13	4
Q9D -Help economy	2	8	18	12	9
Q9E - Enjoy watching	**2**	**25**	16	1	5

A strong correlation is found between questions allows different views (Q8B) and if managed correctly, farming and wildlife can co-exist (Q9B) (see Table 11). A strong correlation is found between accommodates multiple interests (Q8C), and farming and wildlife can co-exist (Q9B). The same was true for answers allow consensus (Q8D) and farming and wildlife can co-exist (Q9B), and allow improvements over time (Q8E) and farming and wildlife can co-exist (Q9B). Respondents consistently selected answers that emphasize the importance of accommodating different points of view or interests. This suggests that what is important to them is the process that is used to make a decision. Respondents were more supportive of the process than they were of the actual project. This finding is consistent with the systems perspective that management is an ongoing activity that requires adjustment over time.

6.5. Summary of Conclusions

The descriptive analysis of the survey results showed that respondents were negative about answers that could be said to describe specific interests or benefits, but positive to answers that described shared interests or benefits. For example, respondents were asked their opinions about who project goals benefit. For all five categories, very few respondents selected "farmers" alone as an answer (under 10 percent of responses). Respondents were more likely to combine answers, so that "farmers and downstream residents" was the most selected answer for who benefits from storing spring flood water and from reducing downstream floods. The most frequent answer for these questions was either no answer or "no one." In the case of the answers that dealt directly with

the environment (restore water quality and enhance wildlife habitat), respondents selected "our environment." The question asked "who benefits" from the project goal. The responses indicate that respondents were reluctant to link a specific goal with a specific beneficiary. The project meets five goals, which are collective expressions of the project's purposes. And, in the case of "our environment," it is reasonable to state that no one group benefits exclusively, but all benefit collectively. In this way, the responses to this question are consistent with a point of view that is seeking joint or shared interests from the project.

The next set of questions asked about the value of using the multiple benefits approach. These findings also indicate a shared interest preference among respondents. For example, half the respondents agreed or strongly agreed that multiple benefits approach provides for alternate funding; neutral and no answer accounted for 39 percent of responses and 11 percent disagreed or strong disagreed. This was the weakest level of agreement on these questions, however. Sixty-seven percent of respondents agreed or strongly agreed with the statement that multiple benefits are okay because it provides for different points of view to be heard, and 59 percent agreed or strongly agreed that multiple benefits allow multiple points of view. Disagreement was less than 15 percent of responses for each of these. Allowing different points of view to be heard and accommodating multiple interests are necessary to the adaptive co-management approach. Respondents' favorable view of these statements of the value of the multiple benefits approach is this study's significant finding.

Respondents were asked specifically about waterfowl and farming. Responses to these questions were consistent with other findings. For example, the first two questions were contradictory. Respondents were neutral or disagreed with the statement that "farming and waterfowl are not compatible." An equivalent number agreed with the statement "if managed properly, farming and wildlife can co-exist." Respondents were neutral about the impact of the North Ottawa

Impoundment Wildlife Refuge on their lives, and did not suggest that the new impoundment resulted in any changes in wildlife populations that they were aware of. Respondents overwhelmingly agreed with the statement, "I enjoy watching wildlife." These statements can be construed as representative of the respondent's desire to see multiple interests accommodated, but not necessarily endorsed. "I supported the impoundment as a flood control system and not for wildlife enhancement," one respondent wrote. This respondent believed that wildlife would follow the impoundment, but that "should not be the major purpose." These responses indicate that respondents are tolerant of the concept of multiple benefits, but do not want to go on record in support of a specific benefit. Multiple benefits can compete, and it is the work of the adaptive co-management process to craft the multiple benefits to joint interests. Yet, individuals will still retain their own beliefs and values. Indeed, that is the ultimate value of this system: I can hold to my belief, even when I disagree with others, and the system still accommodates me.

6.6. Convergence

The triangulation of data sources was accomplished by comparing the themes that emerged from comparing the literature review, theory and specific data products. Themes of the preparatory work was the diversity of watersheds, the existence of holistic, or basin-focused, watershed management institutions in the Red River Basin, the role of agencies, and the strong social fabric of the communities of the Red River Basin. The literature review emphasized how a collaborative process enables learning by doing and how the individual drives the cycle, by adapting to change, and moderating between interests and community norms.

The 1998 Mediation Agreement provides the framework for a basin-wide collaborative process to managing watershed issues. The socio-economic profile shows a community that is relatively stable economically, relatively well-educated, and demonstrates a practice of community involvement by very strong voting participation. This is a community that is pre-disposed to

engagement in community activities or shared interests. Finally, the results of the mail survey showed strong support for existence of measures that accommodate different points of view, multiple interests and build consensus. Respondents were supportive of the North Ottawa Impoundment Project, but expressed stronger support for the aspects of the process which focused on including them. The dynamic of the triangulation method is illustrated in Figure 15, below. The Mediation Agreement, the socio-economic profile, and the mail survey, each contribute substantive information about the framework needed to facilitate the participation of the unaffiliated public, whether the North Ottawa community might be expected to act on behalf of shared interests and specific responses to their experiences and opinions about the North Ottawa Impoundment Project.

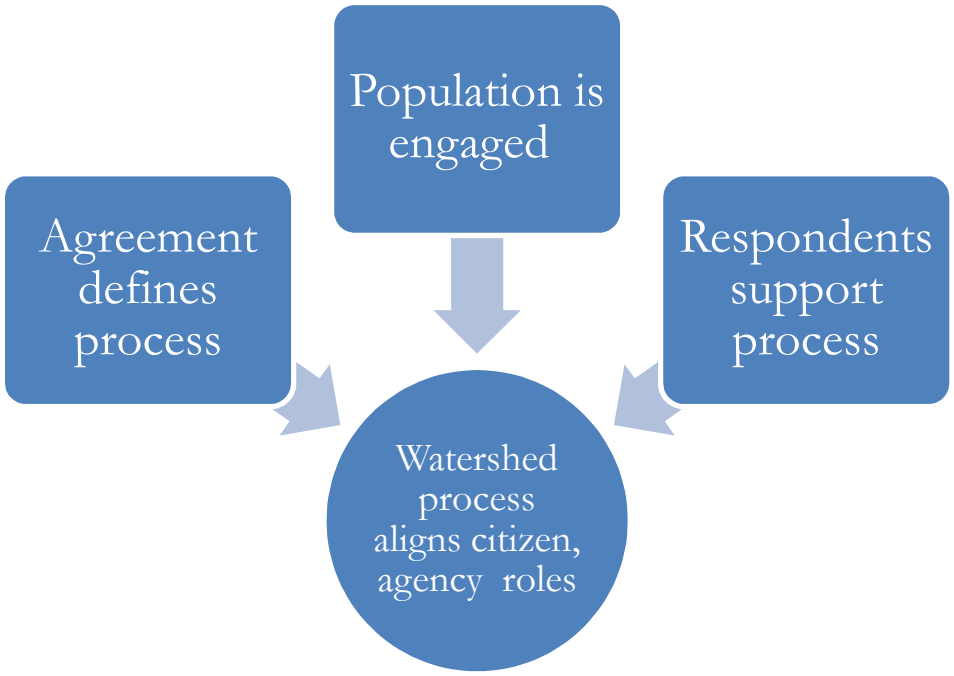

Figure 15. Schematic of the convergence triangulation method.

CHAPTER 7. RECOMMENDATIONS

7.1. Specific to North Ottawa Impoundment Project

Watershed management is a decision-making process that must anticipate and accommodate change. This study examined how respondents owning property near a flood damage reduction project experienced the project and the process used to develop it. Respondents were supportive of the *project*, but were more supportive of a *process* that intentionally accommodated the multiple interests of the watershed. Respondents also described limitations or concerns with the project. The 1998 Mediation Agreement sets up a process that is designed to be collaborative and adapt to new knowledge as it emerges. It is reasonable to expect that watershed residents and property owners want the ongoing management of the North Ottawa Impoundment Project to be an on-going discussion, between managers and themselves, and to incorporate findings of this survey. There are several things that the Bois de Sioux Watershed District can do to facilitate this continuing discussion. The follow recommendations are intended to tie the results of this survey back to the watershed district's review of the project, its operation and maintenance.

7.2. Project Monitoring

The 1998 Mediation Agreement proposed project monitoring as the means to monitor effectiveness and as a way to provide for cumulative measures of impact to the basin. A subsequent paper laid out the process for conducting this monitoring. The purpose of a project monitoring program is to measure and document the effects of a specific flood damage reduction project toward achieving the flood damage reduction and natural resource objectives defined by the Project Team and in the Red River Basin Flood Damage Reduction Work Group Mediation Agreement dated December 9, 1998 (Technical and Scientific Advisory Committee, 2003, p. 1). Project monitoring has been implemented in part, but not in full, since then. Monitoring has relied on a

based community surface water monitoring program and on hydrological measurements by local watershed districts.

Project monitoring is developed in consultation with state agencies, especially those with regulatory authority and monitoring responsibilities. Project monitoring also has to fit the project's goals and resources. Watershed districts have the ultimate authority over the monitoring plan developed for the project. Project monitoring should be consistent with the watershed district's resources. Project teams actually develop the monitoring plan, identify resources needed, and assist with implementation. Project monitoring will be cost neutral, or an effort will be made to cover costs associated with monitoring. The data that results from monitoring can be used for a variety of purposes, including documenting performance, measuring conditions over time, and assessing performance.

Monitoring follows protocols used by state agencies. This assures that results can be used in assessments by state agencies. It also assures that training and technical assistance can be provided by member agencies or the project team. Finally, using state protocols assures that monitoring is verifiable. It also links the locally-produced data to state assessment processes, which are conducted routinely as part of the state's authorities under its federal mandates, such as the Clean Water Act's water quality provisions. This is a significant and meaningful step in power-sharing, which specifically melds data from different sources in a common purpose. It redefines monitoring as a process that provides a forum for discourse among agencies with differing responsibilities and scopes. It specifically incorporates local knowledge with technical expertise.

Generation, storage and assessment of data are a key element of state agency responsibilities. It relies on technical expertise and training to be accomplished. All monitoring must be conducted within a professional and scientific framework. Staff assigned to manage that framework must have the appropriate scientific credentials. However, the act of performing the monitoring and collecting

data can be conducted by trained individuals, including high school students or community volunteers. It is likely no surprise that the Red River Basin has Minnesota's most extensive network of citizen volunteer monitors, which is an active partnership between the Watershed Districts, the Red River Watershed Management Board and the Minnesota Pollution Control Agency. Already, local River Watch student monitoring programs are monitoring water quality below the North Ottawa project. Other opportunities for citizen monitoring exist in the region.

For example, most farmers maintain a rain gauge to monitor precipitation. They record observations following rain events. The State of Minnesota Climatology Work Group has a weather observation network, which is always seeking new observers. The Bois de Sioux Watershed District could set up a program for property owners with rain gauges – even providing the rain gauge if needed – collect the data, report to the state, and report back annually to the property owners in the vicinity of the project. It is the double reporting – to the state and back to the property owners – that makes it co-management.

7.3. Specific to the Red River Basin Flood Damage Reduction Process

The Red River Valley is a special place, both for its unique topography, its people and the institutions they have built. The 1998 Mediation Agreement, and the engineering work performed by the Red River Watershed Management Board, creates a basin-wide vision for action. It is time to invest in this resource by providing data that demonstrates that the Flood Damage Reduction Work Group is meeting the challenge of reducing flood damages and enhancing the environment.

7.4. Conclusion

Farmers have a practice of solving problems; government has a practice of building silos to solve problems. The silos represent critical public values – clean water, soil balance, biological diversity and habitat. But, management of the silos is trumped by the need to coordinate, collaborate and to work towards the broader purpose – in this case, reducing flood damages without harming the

environment. The citizen who is not affiliated with or represented by an existing organization but who brings resources to a management issue can light the spark that links the silos. In order to do so, the citizen must calculate whether it is worth his or her time to work with the silo managers. Having a process in place that fosters social action and intentionally builds social capital is pre-requisite towards a successful process. A process designed to collaborate and build knowledge, planning, decision-making, and evaluation suggests that the unaffiliated citizen has a role and will be heard. He or she might not get exactly what they want, but they have reduced the costs of the collective action because they have been able to capitalize on government resources.

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APPENDIX 1. SOCIO-ECONOMIC PROFILE OF NORTH OTTAWA PROJECT

North Ottawa Social Economic Report
August 17, 2011

There are 10 townships and two small cities in the subwatershed, covering parts of three counties.

- Grant County: Delaware, Elbow Lake, Gorton, Lawrence, North Ottawa and Stony Brook
- Traverse: Tintah City and Tintah Township
- Wilkin: Brandrup, Campbell and Champion and Campbell City

Population Characteristics:

- Total population (using 2009 US Census estimates) is 1,233; lowest population (19) is Tintah Township, Traverse County; highest (233) is City of Campbell, Wilkin County. The 1,233 residents live in 498 households.
- Median age for the subwatershed is 45.5; lowest median age is Brandrup Township, Wilkin County; highest is Tintah Township, Traverse County.
- Residents under 20 years in age comprise 28.5 percent of the population; residents between the ages of 20 and 65 are 55 percent, and residents over 65 comprise 16 percent of the population.
- Migration is quite low, with one-tenth of the population reporting moving in the past year.
- The population is educated, with 92 percent achieving a high school degree or equivalent; 14 percent have studied post secondary.

Employment and Income Characteristics

- There are 969 residents over age 16 who could be in the labor force. Of these, 643, or 66 percent) are in the labor force. There are 326 residents (33 percent) who are not in the labor force.
- Median household income is $57,375, roughly equivalent to the median household income in Minnesota. The median household income for Traverse County was much lower than the other locations in the subwatershed.
- 62.3 percent of total employment is wage and salary jobs; 37.7 percent of total employment is proprietors; the number of proprietors (a measure of economic growth) has been declining since 2000, probably as the number of farms has declined.
- Farm employment has declined 12.5 percent for the years 2001-9; employment categories increasing in that time period are wholesale trade, professional and technical services, administrative and waste services, finance, real estate, educational services (although government jobs also declined).

Farming Characteristics:

- Most of the land in the subwatershed is in row crop agriculture (88-92 pecent).
- The average size of farm is: 476 acres in Grant County; 684 acres in Traverse County and 993 acres in Wilkin County; the average age of farmers is higher than the median age for the total population, 57.4 years for Grant County; 56.5 yars for Traverse and 54.8 years for Wilkin County.
- There are 675 farmers in Grant County; farming is the primary occupation for 326 of these; the remaining 349 farmers list "other" as primary occupation. Farming is the primary occupation for 266 of Traverse County's 479 farmers, while 213 have another primary occupation. Farming is the primary occupation for 281 of Wilkin County's 428 farmers; 147 have another primary occupation.
- The average market value of farm products is $153,000 for Grant county farms; $232,276 for Traverse County farms, and $304,901, for Wilkin County farms.
- The average expenses for farm production was $121,955 in Grant County; $190,932 for Traverse and $254,073 in Wilkin.
- The average income per farm was $53,751 in Grant; $77,543 in Traverse and $92,890 in Wilkin. Average government payments was $9,691 in Grant; $12,281 in Traverse and $14,659.

Land Value Characteristics:

- Minnesota Department of Revenue reports numbers of parcel per property tax classification for the townships and cities of the North Ottawa Subwatershed. Of approximately 4,000 parcels in the 10 townships and two cities, 1,543 (38.5 percent) are classified as Farm Homestead; 2,166 (54 percent) are classified as NonFarm Homestead and 190 (4 percent) are classified as Homestead.

North Ottawa Impoundment Project Survey

Introduction

The Bois de Sioux Watershed District is asking property owners living near and below the North Ottawa Impoundment Project about their experiences with flooding and their opinions about the project. You were mailed an advance notice of this survey Sept. 26. Your response is important because results will be used to improve flood damage reduction projects in the watershed and the Red River Valley. Results will also be used to improve operation of the project.

This research is being conducted by Molly MacGregor, a graduate student at NDSU. If you have any questions about this research or the survey, you can contact her at (218) 547-3583, or NDSU at (701-231-8908).

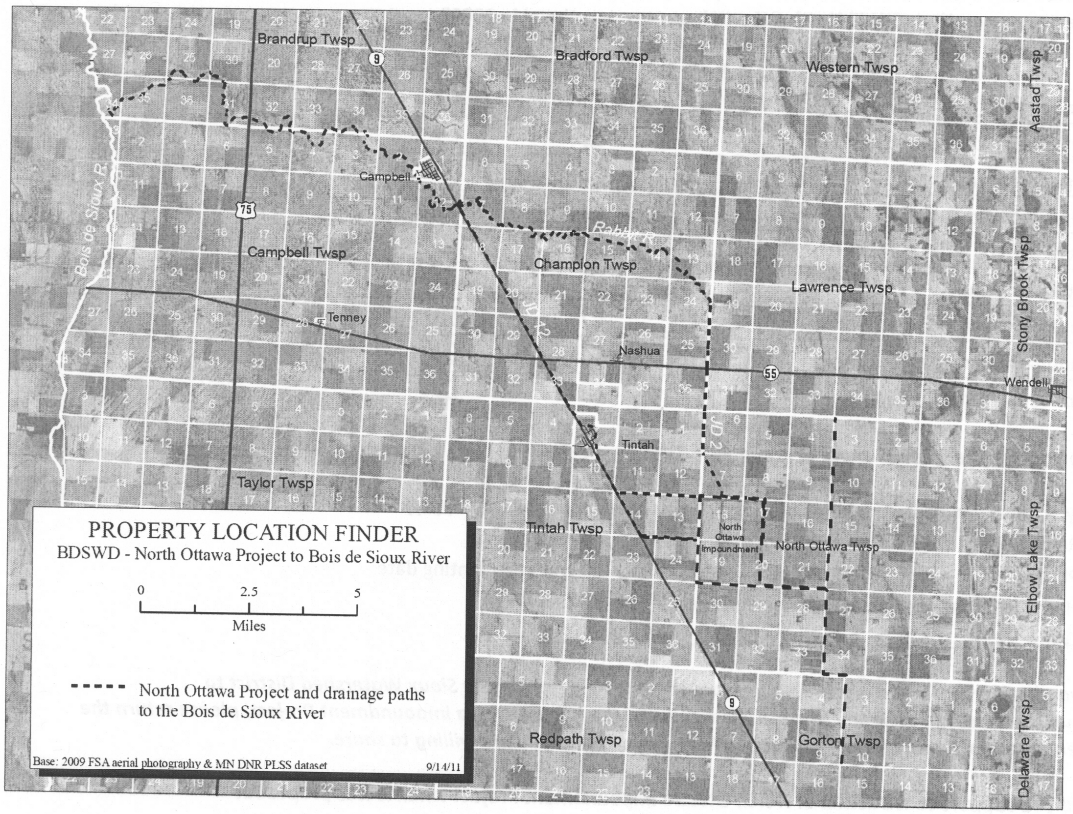
Your identity as a respondent will be protected. There is an identifier on the return envelope. This will be used to check in your response upon receipt, and the envelope will then be destroyed so the response cannot be associated with you. If you wish to share additional information or participate in a follow-up discussion about results, please fill out the enclosed postcard, indicating your preference for either participating in a follow-up discussion or sharing information, and return it to the Bois de Sioux Watershed District.

1. Please tell us where you own property in the North Ottawa area, using the map below:

A. Circle the general area(s) where you own property.

2. Mark with an "X" where you reside. If you do not live in the North Ottawa watershed, state where you do live:

_____



3. Which of the following issues associated with spring flooding were a problem for you, your property or operations, BEFORE North Ottawa was built, even once, and which have been a problem AFTER it became operational in 2009?

	Before	After	Never a Problem
A. Planting	☐	☐	☐
B. Stream or ditch	☐	☐	☐
C. Fields	☐	☐	☐
D. Culverts	☐	☐	☐
E. Private roads	☐	☐	☐
F. Public roads	☐	☐	☐
G. Home	☐	☐	☐
H. Garage	☐	☐	☐
I. Other buildings	☐	☐	☐
J. Well	☐	☐	☐
K. Sewage system	☐	☐	☐

33. Have you ever taken any of the following actions, even once, to protect your home, property or operations BEFORE North Ottawa was built, and have you taken any of the following actions, even once, to protect your home, property or operations SINCE North Ottawa became operational in 2009?

	Before	After	Never
A. Sandbagging	☐	☐	☐
B. Dirt moving to create dikes	☐	☐	☐
C. Repair to roads or driveway	☐	☐	☐
D. Repair of field gullies	☐	☐	☐
E. Crop, seed or input loss	☐	☐	☐
F. Repair to home	☐	☐	☐
G. Repair to outbuildings	☐	☐	☐
H.Equipment damage	☐	☐	☐
I. Ditch repair after flooding	☐	☐	☐

4. Do you keep records of weather conditions or spring floods? ☐ Yes ☐ No

5. If yes, please indicate the kinds of records* you keep (check all that apply):

☐ Rain gauge ☐ Stream gauge ☐ Rainfall events
☐ Photos ☐ Floods ☐ Ice out and planting date
☐ Home insurance claims ☐ Crop insurance ☐ Soil surveys
☐ Other_____

**** If you keep records, and are willing to share them to help the Bois de Sioux Watershed District to build a data base of flood effects in the vicinity of the North Ottawa Impoundment Project, please return the enclosed postcard, indicating that you have records that you are willing to share.***

6. Did you support construction of North Ottawa Impoundment Project when it was proposed?

Yes ☐ No ☐ Why or why not?_____

7. Do you support the North Ottawa Impoundment Project now?

☐ Yes ☐ No ☐ Why or why not?_____

8. Listed below are the goals of the North Ottawa Project. For each goal stated, indicate who benefits:

	Farmers	Downstream Cities	Watershed District	State	No one
A. Reduce spring flooding at Tintah by storing 16,000 acre-feet each spring at North Ottawa	☐	☐	☐	☐	☐
B. Reduce the 100 year flood at Tintah by 75 percent.	☐	☐	☐	☐	☐
C. Augment downstream flows in July and August by releasing impounded water.	☐	☐	☐	☐	☐
D. Improve water quality in the Rabbit River by reducing sedimentation.	☐	☐	☐	☐	☐
E. Enhance habitat for migrating waterfowl and shorebirds.	☐	☐	☐	☐	☐

9. North Ottawa Impoundment Project was designed to balance flood damage reduction benefits with natural resource enhancements. This multiple goal approach is intended to balance individual concerns with downstream concerns. These following questions ask you about advantages and limitations of this approach. For each statement, please indicate if you agree, disagree or don't know:

	Agree	Disagree	Don't know
A. Multiple goals are okay if it provides additional funding to build projects.	☐	☐	☐
B. Multiple goals make sense since flooding affects people differently.	☐	☐	☐
C. Multiple goals are a way of making sure everyone gets a voice in designing the project.	☐	☐	☐
D. Multiple goals are a way of working out differences before the project gets built.	☐	☐	☐
E. Multiple goals are a way of improving the project over time.	☐	☐	☐

10. As a part of the North Ottawa Impoundment Project, the North Ottawa Wildlife Refuge has been designated, and will be operated to provide habitat for migrating waterfowl enhance. Please state if you agree, disagree with the following statements, or don't know:

	Agree	Disagree	Don't know
A. Waterfowl and farming are not compatible.	☐	☐	☐
B. If managed sensibly, waterfowl and farming can co-exist.	☐	☐	☐
C. Visitors to the Refuge may reduce my privacy.	☐	☐	☐
D. Visitors to the Refuge may help the local economy.	☐	☐	☐
E. I enjoy watching the waterfowl.	☐	☐	☐

11. Have you noticed an increase in migrating waterfowl in the spring since North Ottawa became operational in 2009? ☐ Yes ☐ No

If yes, what species have you observed: _____

12. Since the project was completed in 2009, wildlife depredation of my crops:

☐ Has increased ☐ Stayed the same ☐ Has decreased ☐ I do not farm

13. Have you ever contacted the Bois de Sioux Watershed District (please check all that apply)?:

☐ Yes, to inquire about water levels
☐ Yes, to inquire about a permit
☐ No, I have not contacted the Watershed District
☐ Other (Please explain) _____

14. Have you ever attended a meeting sponsored by the Bois de Sioux Watershed District? (please check all that apply)

☐ Yes, to discuss a permit
☐ Yes, to discuss ditch maintenance and operations
☐ Yes, to discuss watershed planning
☐ Yes, to discuss flood damage reduction projects
☐ No, I have never attended a Bois de Sioux Watershed District meeting

15. Do you have any comments about the construction and operations of North Ottawa Impoundment Project that you would like to share? Please use this space to provide those comments.

_____
_____
_____
_____
_____
_____
_____
_____

Thank you for responding to this survey! When you are finished, please fold this survey, insert it in the return envelope and drop in the mail. Results will be presented to the Bois de Sioux Watershed District at its meeting Thursday, November 17, and posted on the watershed district's website. Please call Jon Roeschlein at (320) 563-4185 if you have any questions.

APPENDIX 3. OPEN-ENDED RESPONSES

Responses to Q5A: Did you support North Ottawa Impoundment Project before construction?

- Big waste of money & too much land taken from tax base of township that has to high taxes and to few people to share it!!!!
- water mgmt flood control
- cost of project didn't improve to pay watershed tax, also payed me 1/2 (of value) on land they took on my property; before the project I had water coming from the east. Now it also comes from teh north and from the south
- waste of farmland by putting in the pond
- Did not think it would work & to costly
- hoped for improvements
- West end of my section flooded with 5+ inch rain & spring thaw
- didn't think it would work
- tired of having our home, yard & buildings flooded every spring
- cost too high
- We have to have impoundment areas to accommodate extra water from farmers excessive ditching & drainage
- neither
- took land out of production & every dollar made gets spent 7 more times in a community
- It has taken to much good farmland
- does not help me
- saved alot of overland flooding
- flooding to ag land
- I supported the impoundment as a flood control system and not for wildlife enhancement. I am a hunter and sportsman and believe that wildlife enhancement will result in time in the region as a result of the impoundment but should not be the major purpose. The protection of property & crops is predominate.
- I did not know about it. This property has been rented to Jerry or Chad Berger of Wheaton as long as I have owned it.
- We thought it would help stop flooding
- water retention makes sense
- not cost effective, wrong solution for problem
- no opinion
- did not follow project
- I thought it took too much land out of production and off tax base.
- probably good for other areas
- To have less water come through through Tintah
- didn't live there, didn't know about it
- Retention is an excellent card when we are playing the flood game. Let's get a full deck!

Responses to Q 6A: Did you support North Ottawa Impoundment Project after construction?

- same as No 5
- to be help hold water back until needs to be released downstream pressure
- same reasons as question 5
- too costly took land out of production
- will not do the job intended/ help Wahpeton Fargo Millions of dollars wasted
- not sure
- less water that comes from upstream
- it took all flooding off us
- prevented flooding on land
- It helps tintah
- up to now it has not shown any benefit in the spring
- Kept water off our land
- was impoundment before construction for me
- should control overland flooding
- flooding to ag land
- generally, I favor wetlands preservation
- the cost of the district is getting high
- Gates north & south of us were opened last year and flooded our land causing late planting
- no opinion
- do not live there
- very impressed the way it was done and the good it does
- better flood control
- waste of money & time
- loss of land

Responses to Q15

- Don't know what you people are smoking but it must be some good stuff!!!!!
- NO
- I was under the assumption that during a summer rain event of considerable size the impoundment would be closed to prevent flooding downstream. This hasn't been the case and it is very disappointing because that is what we need more so than spring time flood control.
- no one in our township could even vote for or against it. Taxes are going higher every year! ruined the roads for 3yrs.
- this project does nothing to help downstream people which they sold people on. This project & similar project are being used to justify peoples jobs. A huge waste of money & manpower. Bois de Sioux board & employees should be completely cleaned out & start with new people!!!
- I would have liked it to be alot bigger and hold more water later in the year

- Good project and Ditches are improving But we need bigger culverts upstream because of increased water flow upstream because of more ditching & tiling. We need ditch cleanouts & some made bigger
- the current board needs to be better about communicating with the farmers farming the land within the impoundment. I was informed by FSA and my insurance agent after I had signed my 2011 contracts that they land was "redesignated" and I would not have coverage for "excess moisture" loss. The board was unwilling to renegotiate the contract and for that I was disappointed. Otherwise the project is good for the area farmers. x
- It works well. I hope the cattails are controlled.
- Thank you for taking the water off our farm place. Now get rid of the damn trees that you killed along the ditch
- open it up to hunting & fishing instead of a wildlife refuge
- No
- Waste of government resources took viable food source of production
- The Impoundment project has only been in service for two springs. It may or may not have made a difference in Breckenridge and Fargo. Time will tell or forces if it has helped relieve some of the water.
- We farm west of the collection ditch and this keep the water from the east off of our land
- It took too much money & space to accomplish the goals intended. Took valuable crop land to do the same thing tiling would have done with incentive for farmers to improve their land. It has provided for an entity to do taxation without representation. Valley land has very little erosion per acre because of slope and water speed. Land needs to be kept in production and public land needs to be used more effectively to the taxpayers benefit. Producing a few more ducks & geese do not provide a meal for a hungry person!
- NO
- I strongly supported the No. Ottawa impoundment. In fact, shortly after it inception I suggested that sight as an impoundment. There are two areas of concern. First is the cost. It keeps building. Secondly too much emphasis is on wildlife enhancement. The purpose of the project is flood control. There will be wildlife enhancement as a natural occurrence in the area. Such enhancement needs to be sacrificed when the system is needed to control flooding in the region. Don't forget the primary purpose and intention of the project. Thank you.
- This is a total waste of money! and it don't benefit anyone or wildlife. This is flat land. It's been flooding for 100 yrs or better. The water comes and it goes. The farmers get their crops in every year. Stop farmers from tiling potholes & swampls and wildlife will appear. We need more C.R.P. acres. If people don't like to get flooded move to higher ground. if oprs, I h
- Better late than never. Way to go.
- When Rabbit River is full and water is coming out of North Ottawa that was not to happen. I supported North Ottawa but it has to be run properly. there is room for improvement. This last July R. River was full. N.O. was not shut off.
- wrong solution for flooding not needed for wildlife habitat
- Poorly designed survey to evaluate outcomes of the "project". Section 8 not relevant to land owners only the project designers and the designer of this survey.!
- cost overruns

- I believe that this is just one, of several, that will have to be established in the area, to get somewhat of a control on spring flooding in the rabbit river area watershed,where we have large amounts of snow in the winter
- the project was very well done and the entire project when finsihed I was very impressed
- I am a home owner in Tintah and I live next to the state ditch, so any improvement to slow down the flow through town would be a big help
- I can't fill this out because I rent the land and I don't know anything about how it has affected the crops. I live in Duluth and only visit on occasion.
- I hope this is the first of more to come - to help replace the function of the lost wetlands that have been drained over the decades

NDSU NORTH DAKOTA STATE UNIVERSITY

Institutional Review Board

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Federalwide Assurance #FWA00002439

Wednesday, September 21, 2011

Dr. Gary Goreham
Sociology & Anthropology
226 Barry Hall

Re: IRB Certification of Human Research Project:

"North Ottawa Land Owner's Survey"
Protocol **#HS12044**

Co-investigator(s) and research team: **Molly MacGregor**

Study site(s): **varied** Funding: **n/a**

It has been determined that this human subjects research project qualifies for exempt status (category # 2) in accordance with federal regulations (Code of Federal Regulations, Title 45, Part 46, *Protection of Human Subjects*). This determination is based on the protocol form received 9/21/2011 and consent/information sheet received 9/21/2011.

Please also note the following:

- This determination of exemption expires 3 years from this date. If you wish to continue the research after 9/20/2014, the IRB must re-certify the protocol prior to this date.
- The project must be conducted as described in the approved protocol. If you wish to make changes, pre-approval is to be obtained from the IRB, unless the changes are necessary to eliminate an apparent immediate hazard to subjects. A *Protocol Amendment Request Form* is available on the IRB website.
- Prompt, written notification must be made to the IRB of any adverse events, complaints, or unanticipated problems involving risks to subjects or others related to this project.
- Any significant new findings that may affect the risks and benefits to participation will be reported in writing to the participants and the IRB.
- Research records may be subject to a random or directed audit at any time to verify compliance with IRB policies.

Thank you for complying with NDSU IRB procedures; best wishes for success with your project.

Sincerely,
Kristy Shirley
Kristy Shirley, CIP, Research Compliance Administrator