Planning Assistance to States Program

Minnewaukan, North Dakota

Minnewaukan Flood Risk Reduction Alternative Analysis

Date: September 17, 2010

U. S. Army Corps of Engineers

St. Paul District

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I. Purpose

The purpose of this study/report is to evaluate alternatives for flood risk reduction for the city of Minnewaukan, North Dakota, and provide possible recommendations as to which alternative or combinations of alternatives seem most viable for a long-term solution.

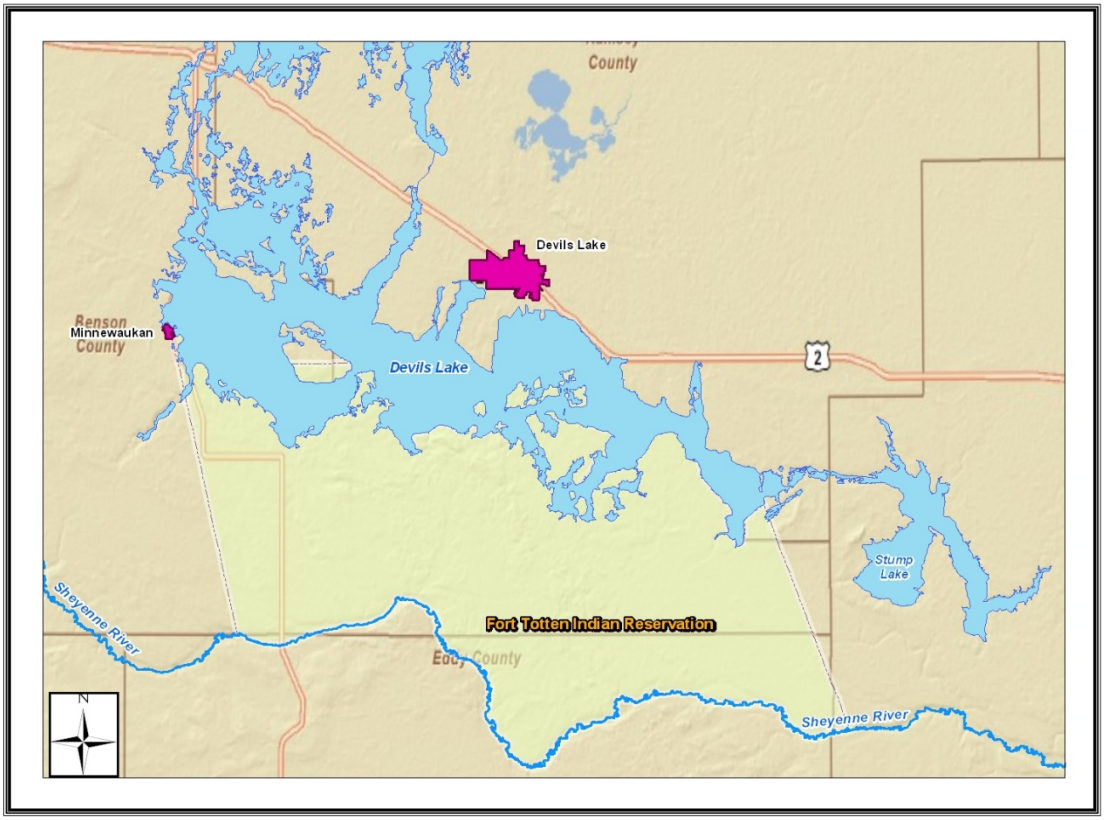
II. Authority

Section 22 of the Water Resources Development Act of 1974, Public Law 93-251, as amended (42 U.S.C. 1962d-16), authorizes the Secretary of the Army, acting through the Chief of Engineers, to assist the States in the preparation of comprehensive plans for the development, utilization and conservation of water and related resources of drainage basins, watersheds or ecosystems located within the boundaries of the State.

III. Background/General Information

The Devils Lake watershed is a closed basin that consists of approximately 3,800 square miles. Devils Lake is at elevation 1451.76 (as of August 19, 2010), after rising over 28 feet in the past 18 years, and 2 feet this spring. In 2001, Devils Lake began flowing into Stump Lake, and the two lakes have now equalized and act as one system. The current overflow elevation of Devils Lake is 1458. (Note: All elevations referenced in this report use the NGVD 1929 datum.) At elevation 1458, Devils Lake water will begin to flow into Tolna Coulee, which leads to the upper portion of the Sheyenne River.

Minnewaukan is a small community with an approximate population of 320. It is located along the northwest shoreline of Devils Lake in Benson County, North Dakota. Minnewaukan has a combination of commercial and residential properties and covers approximately 250 acres. It is also the county seat for Benson County, employing 75 people. The courthouse, constructed in 1901, is listed on the National Register of Historic Places. Minnewaukan is also the location of the Benson County Social Services and the County Highway Department. Minnewaukan's public school serves grades K-12 and has approximately 240 students of which approximately 80 percent are Native American. Many of the students travel from the Spirit Lake Nation Reservation located to the south of Minnewaukan. The school employs over 60 people. It is also important to note that the school is located on Spirit Lake Nation Reservation Lands. Homes in the city begin first floor flooding at elevation 1453.8.



Devils Lake area map

In the last few years, several homes and a church have been bought out or relocated. The city's latest concern is for its water tower and school that are beginning to be affected by rising lake levels. The school, which is located on the east side of town and now on the shore of Devils Lake, is a primary concern. The First Floor Elevation (FFE) of the school's gymnasium is at elevation 1454.5. The building's boiler room is located on this floor. Because of the school's proximity to the lake, wave action is a major concern this year and for years to come. The school's parking lot is approximately 2.5 feet above the lake's current water surface elevation. Erosion to the school parking lot is anticipated from the large waves Devils Lake can produce. Currently the parking lot has been closed to bus traffic due to large areas of pavement failure from saturated soils.

Pavement failure near school as a result of saturated soils

IV. Past and Current Actions in Minnewaukan

A. Past

In 1995, the city's sewage treatment lagoons were relocated to higher ground above elevation 1463 in anticipation of rising lake levels.

In 2003, Barr Engineering Company performed an infrastructure protection study of the Devils Lake area for the Corps of Engineers. The report evaluated six flood risk management alternatives for Minnewaukan:

- No protection or relocation.
- Relocation of all structures below elevation 1468.
- A raise of top of levee to elevation 1468.
- One incremental levee raise; relocation of all structures below elevation 1464.
- Two levee raises (incremental).
- Two incremental levee relocations.

The infrastructure study identified that the only alternative with a benefit-cost ratio greater than 1 was an incremental levee raise. This analysis assumed a wet future scenario and had a benefit-cost ratio of 1.17.

After the findings in the Barr Engineering infrastructure protection study, the city requested a reconnaissance level study from the Corps of Engineers to determine if there was a Federal interest in the construction of a levee to protect the city. The reconnaissance study identified a

potential Federal interest. The Corps pursued executing a cost share cooperation agreement with Minnewaukan to complete a feasibility study. The cooperation agreement was never executed because the city could not secure funds for its portion of the feasibility study costs.

In the last 2 years, the city's most pressing concern with the rising lake levels and rising water table was infiltration and subsequent failure of its sewer system. Over the last 2 years, the city successfully completed lining its clay sewer pipes and raising three lift stations above elevation 1458 with assistance from the Corps of Engineers' North Dakota Environmental Infrastructure Section 594 program. The newly lined sewers are performing well with minimal groundwater infiltration into the system.

In the last 2 years, approximately 12 structures have been relocated, and 8 more are expected to be relocated this year. These structures have been either been demolished or moved out of the city, reducing the city's tax base. Approximately 7 homes in the city still have the Federal Emergency Management Agency (FEMA) endorsement program and are eligible for buyouts.

B. Current

The city has received a State of North Dakota Community Development Block Grant (CDBG) to construct a 3-foot-high earthen wave break along the edge of the school parking lot to dissipate wave energy and reduce wave runup. The wave break will be constructed between Devils Lake and the existing parking lot and will be approximately 800 feet long. Riprap will be installed on the lake side of the berm to reduce erosion and break waves. The wave break is only designed to help prevent erosion and further deterioration of the school's parking lot; it will not provide flood protection. Currently the school is not experiencing any major problems except for the parking lot deterioration. The finished floor elevation of the main part of the school is 1458. The gym and boiler room are lower at elevation 1454.5. Currently, no water is seeping into the boiler room and the gym floor is not experiencing any visual water damage. Recently, the Minnewaukan School District has applied for a $7.2 million Impact Aid Program for Emergency Situations from the North Dakota Department of Public Instruction, with $6 million of that total in the form of a grant. The grant would be used to build a new school on higher ground. A decision on the grant is expected in September 2010.

The city also has great concern that the water tower's foundation may be failing as a result of the increased groundwater elevation and saturated soils. In 2010, the city received $300,000 from the North Dakota Environmental Infrastructure Section 594 program to pursue the relocation of the water tower. The city is in the process of installing a Global Positioning System (GPS) system on the tower to monitor the tower's movement to verify concerns. No action has been taken under this program while the city considers various options such as embankment construction or relocation. Once the city determines its course of action, the Corps will work with the city under the Section 594 program to facilitate the water tower relocation or address other similar critical water supply needs with the appropriated funds.

During summer 2010, the city is planning to remove and cap three fire hydrants surrounded by water and not accessible by the fire department for use. The city is also raising some sewer manholes to avoid overflow into the structures if the lake should continue to rise.

With the rising lake and groundwater levels, water infiltrating into basements has become a significant problem throughout the city. Based on conversations with city officials, approximately 99 percent of all homes and businesses have sump pumps. A handful of homes that previously never needed sump pumps had to have sump pumps installed this year because of the rising groundwater levels. Some homeowners are experiencing buckling in basement foundation walls due to groundwater, and one home has experienced a severe mold problem. Basement infiltration from the rising lake is not covered by flood insurance.

The city is also concerned about its sewer and water systems. Many sections of pipe are under water. If these lines were to break, they would be hard to locate and fix, which could have a devastating effect on the city's infrastructure system. The city's sewage lagoon is a closed cell system that relies on evaporation. If a sewer line were to break and a significant amount of lake water were to enter the system, the city could only pump for a few days before the lagoon would fill. The overflow for the lagoon goes directly into Devils Lake. At a public meeting on February 25, 2009, the city stated that its sewer system could fail leaving homes too high to be bought out under FEMA's flood insurance program uninhabitable. City officials would like to participate in a buy-out program if its sewage system should fail, but to date no programs have been identified that fit this situation. The city has sent out a letter to surrounding towns and other locals to see if they may have some services they can provide on a temporary basis if the city's sewer or water system were to fail.

Telephone and electric services have experienced some problems due to lines being under water. Utility poles that are being surrounded by water now have to be relocated. The costs of some of these improvements are incurred by the city.

V. Flood Risk Reduction Alternatives

A. No Action or Without Project

If the lake rises to elevation 1458, many additional structures will be affected:

- **Residences** – The majority of residential property at risk in the city is located between elevations 1456 and 1463. Approximately 47 residential structures and 3 apartment complexes are below elevation 1458.
- **Public School** – The lowest floor elevation of the Minnewaukan school is 1454.5. The gymnasium and boiler room are at this elevation. The main floor of the school is at elevation 1458.0.
- **County Highway Department** – The Benson County Highway department garage has a finished floor elevation of 1455.9
- **County Social Services Building** – The Benson County Social Services building has a finished floor elevation of 1456.6
- **Commercial and Municipal Properties** – Similar to private homes, the majority of commercial and municipal properties at risk are between elevations 1456 and 1463. Five commercial properties are identified below elevation 1458.

Other structures located above elevation 1458 may also be affected by wave runup and increased groundwater elevation. These structures may also need to relocated or demolished.

With the current situation in Minnewaukan, many homes, businesses, etc., will be forced to relocate out of town because high buildable ground within the city limits is not available for construction or relocation. With residents and business owners being slowly forced out of the city, the tax base will continue to decline until the city of Minnewaukan is no longer a viable community.

Refer to Appendix A (City of Minnewaukan Inundation Map)

Economics

Economic damage from inundation of Devils Lake at Minnewaukan takes the form of total loss of structure value. This total loss results from the more permanent nature of the lake level flooding as opposed to riverine flooding in which repairs can be made after floodwaters recede and property values recover. When lake levels finally do recede, the affected structure is assumed to be beyond repair and is of no practical use. In this sense, damages are limited to the first damage-causing event and the lake can no longer cause further damage as levels may repeat their rise in the future.

FEMA conducted a structure inventory around the perimeter of Devils Lake in 2000. This inventory included the town of Minnewaukan. Data collected included structure type, ground and first elevations, and estimated structure value. This inventory serves as the basis for evaluation of flood damages by lake elevation. As the lake has risen in recent years, some buildings have been relocated or removed altogether. In addition, the St. Paul District performed a more accurate survey of structure elevations (ground and first floor) in December 2008. The inventory has been updated to account for these changes. The table below presents cumulative structure values by ground elevation. Total loss is assumed once the lake level comes into contact with the structure at its ground level.

Table 1: Structure Value by Ground Elevation - Minnewaukan, North Dakota

Property Value by Ground Elevation - Minnewaukan, ND					
Elevation	Residential	Commercial	Public	Total	Cumulative Total
1452	83,900	-	-	83,900	83,900
1453	-	-	18,200	18,200	102,100
1454	21,800	15,200	138,900	175,800	277,900
1455	684,500	139,800	-	824,300	1,102,200
1456	380,700	-	9,100	389,800	1,492,000
1457	892,000	219,400	356,200	1,467,600	2,959,600
1458	1,283,000	672,900	199,000	2,154,800	5,114,400
1459	618,000	395,600	1,032,300	2,046,000	7,160,400
1460	1,749,000	-	1,072,400	2,821,500	9,981,900
1461	1,024,400	-	-	1,024,400	11,006,300
1462	1,213,300	-	21,100	1,234,400	12,240,700
1463	799,000	120,600	1,999,800	2,919,400	15,160,100
1464	1,014,400	1,067,400	1,276,900	3,358,700	18,518,800
1465	91,500	1,435,600	436,300	1,963,400	20,482,200
	$9,855,500	$4,066,500	$6,560,200	$20,482,200	

Note property value = structure value and lot value; lot value estimated to be approximately 1 percent of structure value (based on information from Benson County Tax Equalization Office)

B. Construction of an Earthen Embankment to Protect the City of Minnewaukan

Hydraulics and Hydrology (H&H)

Design Criteria

After evaluating Dam Safety Criteria (DSC) and Levee System Evaluation (LSE) criteria, the St. Paul District recommends Minnewaukan homes and businesses be protected to elevation 1466.0. This elevation accommodates the Probable Maximum Flood (PMF) with minimum freeboard, the one-half PMF with design freeboard, and the 1-percent event with design freeboard. As adopted for the city of Devils Lake, North Dakota, Embankment Project, the PMF inflow volume is 2,880,000 acre-feet; therefore, one-half PMF is 1,440,000 acre-feet, the 1-percent event is 1,270,000 acre-feet, starting lake level is elevation 1458.0, and freeboard for wave action is 3.0 feet.

Freeboard and Protection from Waves

The design freeboard of 3.0 feet is chosen for all embankment sections of the project. Freeboard is determined from the Wind Induced Height (WIH), which was calculated using local equations and the Shore Protection Manual. This analysis is the same as used by the city of Devils Lake Embankment Project. A range of beach slopes were analyzed for embankments susceptible to a large wind fetch, with the assumed 6H:1V slope the WIH is 3.0 feet and required W_{50} stone weight is 175 pounds (Table 1). Wind fetch length is determined from the

average length of nine swaths covering 24 degrees (Figure 1). Embankment sections that are susceptible to the fetch described in Figure 1 are Levees 4A, 4B, 4C, and 4D; therefore, Levees 4E and 4F require lesser protection from waves. Previous studies by Barr Engineering called for D_{50} of 9 inches, which is approximately equivalent to W_{50} of 50 pounds; this level should be sufficient for 4E and 4F embankment sections. The levee reaches 4A through F are outlined in the Barr Report in Figure 4.4-1. (See Appendix I for additional Information.)

Table 2: Wind Induced Height and Protection from Waves Analysis

		F	H	**Slope**	S	R	**Wind**	**W_{50} min**
	Wind	Fetch	Wave	**Beach**	Wind	Wave	**Induced**	**Stone**
	Direction	Length	Height		Setup	Runup	**Height**	**Weight**
Location		miles	ft.	**H:1V**	ft.	ft.	**ft.**	**lbs.**
Minnewaukan	E	6.0	3.6	**3**	0.4	5.1	**5.5**	**350**
Minnewaukan	E	6.0	3.6	**4**	0.4	3.8	**4.2**	**262**
Minnewaukan	E	6.0	3.6	**5**	0.4	3.1	**3.5**	**210**
Minnewaukan	E	6.0	3.6	**6**	0.4	2.6	**3.0**	**175**

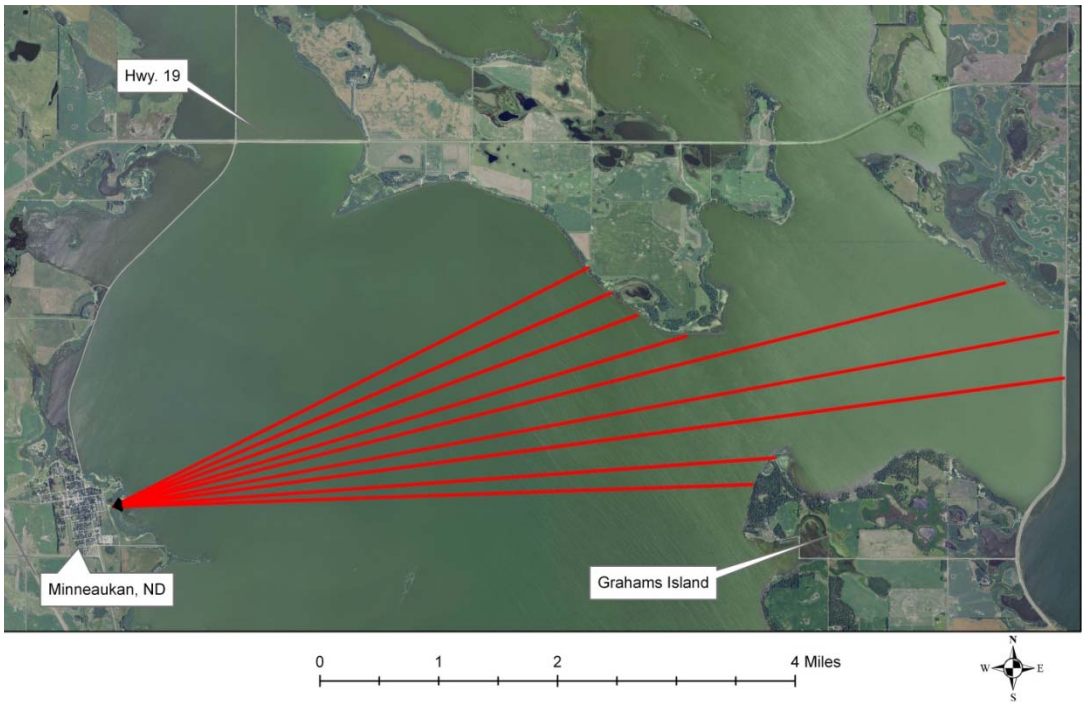


Figure 1: Wind Fetch Swath

Lake Level during Construction

The estimated lake level during construction is not provided by the Corps of Engineers, because this assumption puts risk on the construction contractor. However, for estimating purposes, the Corps uses the 6-percent (15-year) probability lake elevation. This elevation was used for

geotechnical analysis for the construction of the city of Devils Lake embankments and would also be applicable to Minnewaukan. The U.S. Geological Survey (USGS) has developed the probability tables, which have been updated on a quarterly basis. At the time of design, the most up-to-date probability table has been used. The 6-percent (15-year) probability was selected to balance risk and costs during construction; this criterion is the standard for constructing cofferdams.

The earliest year for construction to begin in Minnewaukan is 2012. Interpolating from the current USGS probability table below, the 6-percent probability for 2012 is elevation 1455.9 (Table 2). Waves should be considered; therefore, an additional 1.5 feet should be included for the construction of temporary structures or cofferdams. Temporary structures or cofferdams during construction should be built to elevation 1457.4.

Table 3: Devils Lake Flood Probabilities

Cumulative flood elevations for Devils Lake for 2010–19, based on USGS stochastic model runs made May 21, 2010. [State outlet capacity 100 cubic feet per second]

Year	Cumulative exceedance probability, in percent						
	90	50	20	10	5	2	1
2010	1,451.7	1,451.8	1,452.2	1,452.4	1,452.6	1,452.9	1,453.1
2011	1,451.7	1,452.1	1,453.0	1,453.9	1,454.8	1,456.1	1,457.0
2012	1,451.7	1,452.2	1,453.6	1,454.8	1,456.2	1,457.8	1,458.6
2013	1,451.7	1,452.2	1,453.9	1,455.4	1,456.9	1,458.7	1,459.7
2014	1,451.7	1,452.3	1,454.2	1,455.9	1,457.5	1,459.1	1,460.1
2015	1,451.7	1,452.4	1,454.4	1,456.3	1,457.9	1,459.7	1,460.4
2016	1,451.7	1,452.4	1,454.6	1,456.4	1,458.2	1,459.8	1,460.5
2017	1,451.7	1,452.5	1,454.8	1,456.6	1,458.5	1,460.0	1,460.7
2018	1,451.7	1,452.5	1,454.9	1,456.9	1,458.6	1,460.1	1,460.8
2019	1,451.7	1,452.5	1,455.0	1,457.0	1,458.8	1,460.2	1,460.9

Geotechnical Feasibility

Since the Barr Engineering study was completed in 2003, the design considerations of the levee alternative have been changed. One significant change is that the proposed *levees* will now be classified as *dams*; therefore, a different design criterion applies. The report *Design Criteria and Project Considerations, Devils Lake Flood Risk Management Project, U.S. Army Corps of Engineers St. Paul District, 21 December 2009,* was used as a guideline for Minnewaukan's embankment requirements. One major change brought about by this new designation is that a 50-foot vegetation-free zone beyond the toe of the embankment must be maintained for embankments taller than 13 feet. Embankments shorter than 10 feet only require a 15-foot vegetation-free zone and heights between 10 and 13 feet are transitional. The majority of the

proposed Minnewaukan embankment is higher than 13 feet and therefore requires a 50-foot vegetation-free zone. Other changes in assumptions for the embankment design are documented below.

Alignment

The levee alignment as defined in the Barr Engineering report has been used for this report. Due to limited time, this alignment was not optimized for current lake conditions and encroachment requirements. A 50-foot vegetation/encroachment-free zone is required for this embankment that had not been previously identified (see Appendix B). Using the existing alignment with the 50-foot clear zone, approximately five structures will possibly need to be relocated or removed on the protected side of the embankment: the school bus garage, the Benson County Highway Department building, two barns and a shed. If the proposed alignment were pushed lakeward, cofferdam construction costs would likely increase, but fewer structures would need to be removed. Optimization of the alignment should be completed based on the 50-foot vegetation-free zone requirement and expected water levels at the time of final design.

Cross Section

The cross section has been changed since the Barr report to reflect the city of Devils Lake embankment design. These changes include a landside embankment slope of 3.5H:1V, a 20-foot top width, a modified sand drain, a thicker riprap section, and a 4-inch thick layer of coarse aggregate on the top of the embankment. Based on stability analyses of the city of Devils Lake design, embankments with 3.5H:1V slopes may be required. In addition to creating more stable slopes, the flatter slopes would also be more favorable for maintenance and inspection.

The sand drain was raised to be 1 foot above the design water surface of elevation 1463 and is required for all embankments that act as more than freeboard (i.e., those taller than 3 feet). In addition, the sand drain was changed to have 1.5H:1V slopes and a 3-foot thickness to be consistent with the city of Devils Lake embankments. Riprap thicknesses were increased for *Levees A, B, C, and D* as a result of recalculated W_{50} sizes as described previously. The riprap chosen to meet this W_{50} has a thickness of 30 inches and a bedding thickness of 15 inches. Riprap and bedding thicknesses for *Levees E and F* were assumed to be 18 and 9 inches, respectively. The 4-inch thick layer of coarse aggregate was added to the cross section to accommodate vehicle access on top of the embankment. For quantity purposes, settlement of 1 foot was assumed; therefore, the final height of the embankments would be at elevation 1467.

Construction Considerations

With the rise in lake levels since the Barr report, a cofferdam will be required for construction of the majority of embankment. The top of cofferdam elevation is based on a water level of 1457.4 as described previously. The cofferdam was assumed to have 7H:1V slopes, a 20-foot top width, and a ground elevation at the centerline 1 foot lower than that of the embankment.

All utilities that would cross the embankment alignment would also need to be relocated to either go around the proposed embankment or pass through the freeboard or high ground portion of the embankment.

Groundwater Conditions behind an Embankment

As part of the Devils Lake Roads Acting as Dams Environmental Assessment, the U.S. Department of Transportation conducted an evaluation of potential effects on groundwater levels resulting from changes in the water surface elevation of Devils Lake. The analysis used well and water level data obtained from the North Dakota State Water Commission. It was determined that groundwater conditions were highly variable based on location, but a few observations were apparent:

1. Aquifers connected to the lake may become more closely connected (shorter hydraulic connection) because the lake is expanded, which would mean that the water surface elevation would become closer in absolute terms. In other words, for those locations with a connection, those connections would be enhanced.
2. Aquifers unconnected to the lake would likely remain unconnected. However, some lake level threshold may exist at which a connection becomes newly established.
3. Based on observed well variation, effects of equalization should become apparent relatively quickly (i.e., within a year).

Although the results were highly variable and no conclusions may be broadly applicable relating water levels in the lake with wells tapping these similar formations, it should be noted that wells located near the lake appeared to be closely connected with the lake. Wells further from the lake showed little evidence of connection to the lake. This relationship varies based on distance, depth and local recharge/losses.

In short, the construction of an earthen embankment may not help resolve groundwater problems associated with rising lake elevations.

Cost

The estimated cost for the construction of an embankment to protect the city of Minnewaukan is approximately $47.9 million. This estimate was based on the 2003 Infrastructure Protection Study, Devils Lake Area, Barr Engineering Company, and indexed from 2001 to 2011. This estimate is intended to provide a rough order of magnitude amount.

The cost of the embankment increased dramatically from $17.6 million estimated in the Barr report. The cost increase is primarily a result of inflation of costs for materials, the inclusion of costs for cofferdam construction, the costs of additional impervious material due to widening the top of the embankment, widening and extending the internal sand drain and a thicker riprap section. The overall design was modified to match what is currently being constructed for the city of Devils Lake.

Economics

The embankment would have a top elevation of 1466 which, accounting for wave runup and design inflows to the lake, would provide a level of protection to elevation 1463. Given the elevation of the natural outlet at Tolna Coulee of 1458, this elevation is assumed to be the maximum that Devils Lake can attain. At this design the embankment would prevent potential damage of $15,160,000 (see Table 1). These are the damages that would be prevented by a levee project and are thus claimed as flood risk management benefits.

Implementation Costs - Total cost to implement the embankment alternative amounts to $53,743,000 which includes $47,919,000 for project costs, $2,108,000 for interest during construction, and $3,716,000 for operation and maintenance costs.

Implementation Cost and Benefit-Cost Ratio (Embankment)

Project costs	$47,919,000
Interest during construction (IDC)	2,108,000
Operation and maintenance	3,716,000
Total investment	53,743,000

Operation & Maintenance Cost
Annual O&M estimated as 0.5% of construction cost

Construction cost	$36,843,000
	0.005
Annual O&M	184,215
Annual O&M over 50 years expressed in Present Value terms (annuity factor for 50 years at 4-3/8%)	20.171
Present Value of Annual O&M	$3,715,800

Calculation of Interest During Construction (Embankment)

Interest rate 0.04375

Year	Embankment project costs	Years to base	IDC Factor	IDC
1	$23,959,500	1.5	0.06634	$1,589,000
2	23,959,500	0.5	0.02164	519,000
	47,919,000			2,108,000

Benefit-Cost Ratio (Embankment)

Damage Reduction Benefits	$15,160,000
Total Costs	$53,743,000
Benefit-cost ratio	0.28

Environmental Effects

Current land uses within the area of a potential embankment appear to be mixed residential, commercial, and potentially industrial and rural residential and agricultural outside of the city. Land use does not appear to have changed significantly over time. Minnewaukan has been essentially the same size since the 1950's, with the exception of a few additional residences and nonresidential properties. Surrounding land use is generally made of scattered rural residences, tree-covered land, and agricultural fields and has not significantly changed since the 1950's.

One potential environmental concern with the construction of embankments and some structure relocations is the presence of hazardous, toxic, and radioactive waste (HTRW). The 2003 Barr report (see References) identified the potential existence of HTRW with the construction of an embankment and the relocation of structures. A complete HTRW assessment would be required during the planning phase for an embankment alternative.

Another environmental concern would be impacts to wetlands, specifically filling and draining activities related to the construction of an embankment. A review of the National Wetland Inventory data and recent aerial photography was used to estimate potential wetland impacts for an embankment alternative. A rough estimate of impacts is 10 acres of wetland loss. This estimate did not include wetlands on the lake side of the embankment that would be affected by rising lake levels. A wetland determination would be completed during the planning phase for an embankment alternative. In addition to determining the acreage of wetland impacts, consideration for avoiding and minimizing impacts would also be required. A wetland impact compensation plan would be developed for any unavoidable wetland impacts. Compensation for wetland impacts would likely be in the form of purchasing wetland bank credits or wetland restoration. Costs for credits or restoration can vary widely, but a reasonable estimate for either of these options is about $10,000 per acre.

If an embankment project was planned and constructed without the direct assistance of the Corps, the Corps' Regulatory office in Bismarck, North Dakota, should be contacted to obtain a Section 404 permit.

Cultural Resources

Construction of an earthen embankment around the city would protect its two National Register of Historic Places-listed (Benson County Courthouse and Grace Episcopal Church) and one National Register-eligible (Harriman House at 241 Main Street East) historic properties. The National Register eligibility status of all other buildings and structures over 50 years old in Minnewaukan has not been evaluated; therefore, additional historic properties might need to be protected. Those buildings and structures over 50 years old in the embankment footprint and 50-foot vegetation free zone footprint would need to have their eligibility evaluated prior to their relocation or demolition. Any that were determined eligible to the National Register would need to be mitigated through preparation of measured drawings, large format photographs, and building histories prior to their removal. An archeological survey of the embankment alignment and related construction area would also be necessary.

City of Minnewaukan Concerns

At a project meeting in Minnewaukan on July 22, 2010, Minnewaukan's mayor and city council opposed the construction of an earthen embankment to protect the city. The city has many concerns with this option.

O&M – The first concern is the long-term operation and maintenance of the embankment and pumping facility. The high annual cost of pumping interior drainage and the continued maintenance and inspection of the embankment and pumping station will be an immense hardship for the city because of its limited funding and tax base.

Groundwater – The construction of an embankment would protect the city from the rising lake but would not necessarily alleviate the groundwater problem. Groundwater in the city has become a growing problem over the last few years, and with the rising lake elevations it will likely become worse even with the construction of an embankment. Rising groundwater levels may lead to more residents being forced to leave town.

Loss of additional structures – To keep the cost of construction down, the embankment would need to be primarily on high ground. In doing this many structures in town would have to be removed for construction of the embankment. Because the city has a very limited area to relocate structures, these people would likely leave town. This exodus will continue to add to the loss of tax base and the removal of the very structures the city is trying to protect to make a long-term viable community.

Lead Agency

The Corps of Engineers would likely be the lead agency in the construction of an earthen embankment. These projects are typically cost shared with the non-Federal sponsor.

VI. Partial or Total Relocation of the City of Minnewaukan

The city of Minnewaukan is located on approximately a 400-acre parcel of land. According to FEMA's 2003 structure inventory, updated by the Corps in 2010, 292 structures are in the city of Minnewaukan. This number does not account for structures built after this year as well as structures recently demolished or relocated because of the rising water levels. According to the NGVD 1929 first floor elevation datum, 104 structures are at elevation 1458 and below.

Table 4: Structure Inventory

Structure Type	1458 and below	1458-1460	1460 and above	Total
Residential	50	34	58	142
Commercial	5	1	17	23
Public	6	2	7	15
Churches	0	2	1	3
Schools	1	0	0	1
Sheds/garages/barns	38	13	36	87
Unidentified	4	9	8	21
Total	104	61	127	292

A. Potential Relocation Sites and Plans

During the July 22, 2010, meeting in Minnewaukan, the mayor stated the city's desire is to conduct a phased partial to complete relocation of the city due to the rising water. Based on a preliminary review, it appears the most suitable location for this movement is located 0.4 mile southwest of the current city. The potential site is located west of Highway 281 and south of County Road 19. The lowest point in elevation is 1464, and the majority of the site is well above elevation 1470. This area also appears to have a minimal amount of wetlands that would have to be worked around or mitigated because of construction activities. This site would allow the city to conduct a partial relocation without moving the entire city miles away and allow a close connection to the existing portion of the city during the phased relocation.

The proposed site offers enough land for a complete relocation as well as room for future expansion. The proposed site has a total acreage of 418 acres. A three-phased approach to the city relocation was suggested. The first two phases would create a denser Traditional Neighborhood Development (Grid Pattern) over a 234-acre parcel of land. It is assumed throughout the relocation that not all nonresidential structures would be moved due to structural integrity or nonusable structures such as grain structures or silos. The complete relocation of the city would occur during Phase II. Phase III is intended for future residential and business expansion of the city. (Refer to Appendix C for complete relocation concept plan with future expansion.)

It is the intent of the first phase or partial relocation to first identify those structures that are currently or in the immediate future at risk for flooding. Those structures would have a first floor elevation of 1458 and below. Additional structures above that elevation may be included because of special circumstances such as groundwater saturation and wave runup. Currently, 104 structures have been identified as at-risk structures. The Phase I or partial relocation plan includes a 107-acre parcel of land. The school is planned to have approximately a 15.5-acre piece of land that includes football and baseball fields. This phase is designed to accommodate 0.5-acre lots per residential structure. These lots are slightly smaller than the existing lots within

the city. Some key recommended structure relocations and infrastructure installments include relocating the school, complete infrastructure installation of water/sewer, road networks and a new water tower. It is recommended that a new sanitary force main be connected to the existing sewage treatment lagoons northwest of the current city. The Phase I relocation can also stand alone as a partial relocation of the city. Structures that are in danger of flooding have a location to which to relocate while still using the existing portion of the city that is on higher ground.

The second phase of this proposal would complete a total relocation of the city. The remaining structures would be relocated into a 127-acre area directly south of the first phase. A total of 189 structures in Minnewaukan are above the 1458 floor elevation. The second phase of the proposed plan is consistent with the road network and lot layout of the first. It must be noted that 18 commercial and 9 public structures are proposed to move during this phase. Many of these structures are of larger size and would be more difficult to relocate. Phase 2 could be implemented over a longer period of time or on a structure-by-structure basis by moving buildings that are experiencing problems because of the rise in lake levels. (Refer to Appendix D for Phases 1 and 2 concept plan.)

The proposed final phase is for the future expansion of the city. The final phase consists of a 425-acre piece of land that incorporates a larger town center, more space for residential housing, a possible hotel, and more commercial and public space. The plan also incorporates 35 acres of “Community Supported Agriculture.”

B. Cost

The estimated cost total for a two-phased relocation of the entire city is $105.4 million. The estimated cost for Phase 1 or partial relocation, which includes all structures at or below elevation 1458, is $41.0 million. The cost of Phase 2 to remove the remaining structures above 1458 is $64.4 million. This estimate was based on the 2003 Infrastructure Protection Study, Devils Lake Area, Barr Engineering Company, and indexed from 2001 to 2011. This estimate is intended to provide a rough order of magnitude estimate amount.

The cost estimate does not address any cost associated with the relocation of an occupied personal residence or a business. Public law 91-646 requires that any displaced persons or business are entitled to relocation expenses. For planning purposes the associated costs for a residential move are estimated at $27,000 per household and up to $10,000 per business. Further analysis would be needed to accurately estimate these costs; however, a very rough estimated indicates that it could approach $5 million for a complete relocation of the city. This cost would only be incurred if people are forced from their business or home. If people receive FEMA buyouts because of their home or business flooding, other methods of compensation may apply.

No cost data was produced for Phase 3 of the relocation plan because it is only necessary for future expansion and growth of the city and not relevant to relocation of the existing city as a flood risk reduction alternative.

A detailed breakdown of estimated costs can be found in Appendix F.

Details on estimated costs for cultural resources can be can be found in Appendix G.

C. Economics

For a complete relocation, given the elevation of the natural outlet at Tolna Coulee of 1458, it is assumed the maximum lake elevation that Devils Lake can attain is 1463. At this elevation relocation would prevent potential damages of $15,160,000 (see Table 1). These are the damages that would be prevented from the relocation project and are thus claimed as flood risk management benefits. Phase 1 or a partial relocation project involves moving structures at or below an elevation of 1458. Damages prevented for this portion of the plan amount to $5,114,400.

Implementation Costs - Relocation of the city would be conducted in two phases: the first for those structures at or below an elevation of 1458 and the second for the remaining structures. The cost of the total relocation plan amounts to $110,015,000 and includes $105,380,000 for project costs and $4,635,000 for interest during construction. Phase 1 or partial relocation plan costs are $42,804,000 and include project costs of $41,000,000 and interest during construction costs of $1,804,000. Implementation costs, including interest during construction, are shown below.

Implementation Cost and Benefit-Cost Ratio (Complete Relocation)

Project costs	$105,380,000
Interest during construction (IDC)	4,635,000
Total investment	110,015,000

Calculation of Interest During Construction (Complete Relocation)

Interest rate 0.04375

Year	Relocation project costs	Years to base	IDC factor	IDC
1	$52,690,000	1.5	0.06634	$3,495,000
2	52,690,000	0.5	0.02164	1,140,000
	105,380,000			4,635,000

Benefit-Cost Ratio (Complete Relocation)

Damage Reduction Benefits	$15,160,000
Total Costs	$110,015,000
Benefit-Cost Ratio	0.14

Implementation Cost and Benefit-Cost Ratio (Phase 1/Partial Relocation)

Project costs	$41,000,000
Interest during construction (IDC)	1,804,000
Total investment	42,804,000

Calculation of Interest During Construction (Phase 1/Partial Relocation)

	Interest rate	0.04375		
	Relocation	Years	I.D.C.	
Year	Project Costs	to base	Factor	I.D.C
1	$20,500,000	1.5	0.06634	$1,360,000
2	20,500,000	0.5	0.02164	444,000
	41,000,000			1,804,000

Benefit-Cost Ratio (Phase 1/Partial Relocation)

Damage Reduction Benefits	$5,114,000
Total Costs	$42,804,000
Benefit-Cost Ratio	0.12

Note: Total costs for the Phase 1/Partial relocation option do not include costs for flood proofing measures to structures on higher ground.

D. Environmental

The relocation site is primarily in agricultural production. Upon a review of the National Wetland Inventory data and recent aerial photography, it also appears that the site may have numerous wetlands. Because of the nature of the available wetland information and the disturbed characteristics of the relocation site, the total acreage of wetlands that may be present on the site is uncertain. Because of this uncertainty, a range of potential acreages is presented in the table below. Similar to the embankment alternative, a thorough wetland determination would be required during the planning phase of a relocation alternative. In addition to determining the acreage of wetland impacts, consideration for avoiding and minimizing impacts would also be required. It is likely that the total acreage of wetland impacts could be greatly reduced through avoidance measures. A wetland impact compensation plan would be developed for any unavoidable wetland impacts. Compensation for wetland impacts would likely be in the form of purchasing wetland bank credits, or wetland restoration. Costs for credits or restoration can vary widely, but a reasonable estimate for either of these options is about $10,000 per acre.

If a relocation project were planned and constructed without the direct assistance of the Corps, the Corps Regulatory office in Bismarck should be contacted to obtain a Section 404 permit.

Table 3: Estimated Wetland Acreage in Relocation Area by Phase

Relocation phase	High estimate acreage	Low estimate acreage
1	16	5
2	14	3
3	22	19
Total	**52**	**27**

Similar to the embankment alternative, an HTRW analysis would be required during the planning phase of a relocation alternative.

E. Cultural Resources

Only part of the proposed 450-acre city relocation area in the E½E½, Section 21 and the SW¼ and SW¼SE¼, Section 22, Township 153 North, Range 67 West, Benson County, has been previously surveyed for cultural resources (ref. Bluemle, 2002, *Highway 281 Reroute: A Class II and III Cultural Resources Inventory, Benson, Ramsey and Towner Counties, North Dakota*). A Phase I cultural resources investigation of the remainder of the proposed relocation area (approximately 337 acres) would be necessary prior to its development for that purpose.

Relocation of the entire city would adversely affect two historic properties listed on the National Register of Historic Places: the Benson County Courthouse (32BE12, listed 1978) and Grace Episcopal Church (32BE32, 210 C Avenue South, listed 1994). It would also adversely affect a third historic property that has been determined eligible for inclusion on the National Register: Harriman House (32BE34, 241 Main Street East). The National Register eligibility status of all other buildings and structures over 50 years old in Minnewaukan has not been evaluated, so additional historic properties may be affected as well. Evaluation of their National Register eligibility would need to be conducted prior to their relocation. Documentation in the form of measured drawings, large format photographs, and building histories of all National Register listed and eligible buildings would be necessary to mitigate the adverse effects to them prior to their relocation or demolition.

Partial relocation of the city would affect all buildings below elevation 1460. The National Register-listed Benson County Courthouse and the National Register-eligible Harriman House are located above this elevation and would not be affected. The National Register-listed Grace Episcopal Church is located between elevations 1458 and 1460 and would likely need to be relocated or flood proofed. All buildings and structures over 50 years old that are below elevation 1460 feet would need their National Register eligibility evaluated. Mitigation documentation (drawings, photographs, histories) for Grace Episcopal Church and any other buildings determined eligible to the National Register would need to be completed prior to their relocation, flood proofing, or demolition.

F. Infrastructure

Currently no infrastructure is located in the vicinity of the proposed relocation area. All utilities, roads, etc., will have to be constructed as part of any relocation plan. It is anticipated that the city's existing sewer lagoons can still be used. A new sanitary force main will have to be installed from the new relocated portion of the city to the lagoons.

The installation of a new waterline from the city's existing water service well to the relocation area will need to be installed. It is also anticipated that the city will need a new water tower. The water tower would need to be designed to serve the area of relocation, potential future development, and the portion of the city above elevation 1458. The ground elevation at the existing water tower is approximately 1457.

North Dakota Telephone Company (NDTC) has a switching facility in the downtown portion of the existing city. Based on the conversations at the July 22 meeting in Minnewaukan, the switching facility can remain at that location as long as power is supplied to the building. The cost savings will be great if this switching station does not have to be relocated for a partial or phased relocation. NDTC also stated that it will be able to supply telephone service to the proposed relocation area.

With any type of phased relocation or partial relocation plan, sewer, water, telephone, and electric service will need to be maintained in the existing portion of the city while providing service to the relocation area. As the lake levels rise and structures are relocated, utilities within the existing city will need to be capped, removed, or properly abandoned so they do not jeopardize the utilities that will remain in use by the functioning portion of the city.

G. Lead Agency

FEMA would likely be the lead agency in a partial or total relocation of the city. FEMA has a wide variety of programs for relocating both individual homeowners and cities. Many other organizations at both the State and Federal level have programs that may be able to assist.

H. Potential Organizations, Grants, and Programs that Can Assist in Relocation

The organizations listed below have either grant programs or offer loans that may be applicable for many different aspects of a potential relocation. These programs have not made any commitments to date but could provide potential support.

Federal Emergency Management Agency (FEMA)

FEMA has five different programs that provide funds to States and local communities to reduce the loss of life and property from natural hazard events:

- Hazard Mitigation Grant Program (HMGP).
- Pre-Disaster Mitigation (PDM).
- Flood Mitigation Assistance (FMA).

- Repetitive Flood Claims (RFC).
- Severe Repetitive Loss (SRL).

Additional information on the purpose, priority, and eligibility for each of these five programs can be found in Appendix G.

FEMA also has a program called Emergency Support Function 14 (ESF-14). ESF-14 is a long-term community recovery program that works through the State to help identify and coordinate potential sources of recovery funding and provide technical assistance in the form of impact analysis and recovery planning support where appropriate. ESF-14 is designed to expedite, leverage and increase the effectiveness of Federal and other long-term recovery assistance through collaboration and coordination among Federal and State agencies and local communities.

To qualify for any FEMA assistance programs, Benson County needs to have an approved hazard mitigation plan in place. Benson County is in the process of drafting one.

Corps of Engineers North Dakota Section 594 Environmental Infrastructure Program

This program authorizes the Corps to provide design and construction assistance to non-Federal interests for carrying out water-related environmental infrastructure and resource protection and development projects. Projects may include wastewater treatment and related facilities; combined sewer overflow, water supply, storage, treatment and related facilities; mine drainage; environmental restoration; and surface water resource protection and development. The program is currently cost shared 75 percent Federal and 25 percent non-Federal sponsor. Projects are identified in the annual appropriations bill.

U.S. Small Business Administration (SBA)

SBA can help with financing for small businesses that are interested in relocating. SBA also provides low-interest disaster loans to homeowners, renters, businesses of all sizes and private non-profit organizations to repair or replace real estate, personal property, machinery and equipment and inventory and business assets that have been damaged or destroyed in a declared disaster. These options are only available if the President declares a disaster.

U.S. Department of Agriculture (USDA) Rural Development

USDA Rural Development has a wide variety of loan and grant programs applicable to the relocation of Minnewaukan:

- Business Loans and Grants.
- Cooperative Grants and Other Programs.
- Single-Family Housing Loans and Grants.
- Multifamily Housing Loans and Grants.
- Community Facilities Loans and Grants.
- Electrical Loans and Grants.
- Telecommunications Loans and Grants.

- Water Loans and Grants.
- Community and Economic Development Programs.

For additional information, refer to Appendix H.

U.S. Department of Housing and Urban Development (HUD)

HUD has a wide variety of programs for community development, economic development, affordable housing, and technical assistance:

- Community Development Block Grants (CDBG) – The primary statutory objective of the CDBG program is to develop viable communities by providing decent housing and a suitable living environment and by expanding economic opportunities, principally for persons of low- and moderate-income.
- Economic Development – Economic development programs are designed to serve as a catalyst in spurring new private sector investment and job creation in communities struggling to secure the benefits of the new economy.
- Affordable Housing – HUD has three programs that bring Federal resources directly to the State and local level for use in the development of affordable housing units or to assist income-eligible households in purchasing, rehabilitating, or renting safe and decent housing.

HUD also has disaster assistance programs that provide flexible grants to help cities, counties, and States recover from presidentially-declared disasters.

North Dakota Silver Jackets Program

The Silver Jackets program has the potential to facilitate and bring together all Federal, State, local, and private organizations to find grants, loans, and other forms of funding for various portions of the relocation. These items could include housing, infrastructure, business relocations, city facilities, schools, etc. The Silver Jackets Program can work in conjunction with the Regional Development Council, Housing and Finance, and State CDBG. This program is facilitated by the Corps of Engineers.

VII. Flood Proofing Structures above Elevation 1458

A few flood proofing techniques may be applicable to structures with elevations above elevation 1458 that do not have continuous water against them.

A. Moving Utilities to the First Floor and Filling in Basements

This technique may be used for structures that are experiencing extremely wet basements as a result of rising groundwater elevations. The structures will have to be retrofitted to bring utilities (water service, furnaces, water heaters, etc.) up to the first floor. After utility relocation is complete, the basements of these structures can either be partially or fully filled based on the severity of groundwater infiltration. If groundwater infiltration is tolerable, the basement can

remain open. By moving utilities to the first floor, the risk of losing them from flooding is eliminated. For homes with finished basements, this technique could have a dramatic affect on the amount of livable area, which could be mitigated by building an addition to the home on the first floor.

B. Sealants or Coatings

Because most foundation materials are not impervious to water with the exception of some types of high quality concretes, sealants and coatings can be used to create an impervious barrier. The most reasonable approach for Minnewaukan would be to excavate around the exterior of the structure and install an asphalt-based coating or an impervious membrane to the existing foundation wall. The installation of new drain tile around the base of the foundation can also help to prevent groundwater seepage into basements and crawl spaces. This approach may not completely stop infiltration, but should keep it manageable. However, this approach has limitations. Foundation walls that have already experienced a lot of deterioration, damage, or buckling may not withstand excavation and backfill to install the coating, sealants or drain tile. For homes with basements in very saturated soils, this approach will have limitations because water pressure pushing against basement wall over time may cause the walls to fail. Structures will need to be evaluated on a case-by-case basis.

C. Wave Break

The construction of a wave break may be appropriate in some areas. The wave break should be constructed of riprap to dissipate wave energy. This alternative could be used in areas where structures would otherwise be impacted by wave runup.

Additional flood proofing measures can be found in FEMA's "Homeowner's Guide to Retrofitting, Six Ways to Protect Your House from Flooding."

Below is a list of a few buildings that would be good candidates for flood proofing if a partial relocation is the preferred option:

- Benson County Court House (cultural significance and difficulty to relocate).
- Grace Episcopal Church (cultural significance and difficulty to relocate).
- Other residential and commercial properties above elevation 1458.

D. Cost

Although the cost to flood proof structures will vary largely based on size, location and work that would be required based on each structure's needs, in most cases it should still be significantly more cost effective than relocation of the structure.

For example, the cost for a waterproof membrane around the foundation of a structure would be approximately $2.50 per square foot. For a foundation 4 feet high, 25 feet wide and 40 feet long, the area would be 4,000 square feet. This area would cost approximately $10,000 plus the cost of excavation. This amount is significantly less expensive than relocating a structure.

A more in-depth analysis will need to be performed to determine the benefit-cost ratio on individual structures to determine which ones will be good candidates for flood proofing measures.

VIII. Social Impacts

A. Short-Term

The uncertainty associated with the rising lake takes a significant toll on individuals. The slow, relentless creeping level of the lake over many years has caused significant anxiety for many lakeside residents. The anticipatory stress regarding if and when the lake would rise to threaten one's home is significant. The potential buyouts over time may weaken the resolve of some residents and divide the community regarding the best course of action under the challenging circumstances.

B. Long-Term

Relocations outside of an existing community for far distances may be a significant reduction in quality of life for those who are forced to move. Whether their property was a primary or second home, the amenities at the new location may not equal those at the lakeside location. Some residents who are forced to move may permanently leave the Minnewaukan area. This social change could have economic implications as it weakens the structure and vitality of the community and local economy. Economic implications could include reductions (1) in business activity, (2) in the local tax base, and (3) in the likelihood of business to make new investments in the area.

These long-term social impacts may be greatly reduced or even strengthened with a relocation area near the existing city of Minnewaukan. The relocation area would have new utilities, roads, etc., and be only about a ½ mile from the existing community. This alternative would allow for the community to say intact and hopefully maintain business activity, promote growth within the city and eliminate the concerns about rising lake elevations.

IX. Summary of Alternatives

None of the alternatives evaluated have a benefit-cost ratio greater than 1, however, the most viable option appears to be partial relocation of the city (all structures at or below elevation 1458) along with implementing flood proofing measures to structures on high ground that begin or currently have substantial groundwater problems. This option allows for the downtown portion of city, which contains most of the commercial structures, to stay viable and remain functioning while the structures at lower elevations relocate. It is important to note that other structures above elevation 1458 may need to be relocated depending on what the ground elevation is outside the structure and if groundwater problems worsen with the rise of the lake.

This opinion is based on the large increase in cost to construct an embankment to protect the city. The embankment is not guaranteed to solve the groundwater problems that homes are

currently experiencing and that may become worse as the lake rises; therefore, some homes may have to be demolished or relocated even if an embankment is constructed. Also, the community will have some remaining risk behind an embankment; if the embankment were to fail, the outcome could be catastrophic. This residual risk will require additional contingency planning to protect public safety.

Based on preliminary estimates, a partial relocation will have the least cost and remove structures below elevation 1458 from any chance of flooding. With the possible use of flood proofing structures above elevation 1458 if needed, many structures could stay where they are. This option also eliminates the risk associated with a community behind an embankment. The partial relocation will also give the city the opportunity to grow and be a viable community in the future if properly planned.

A. Challenges

Three major challenges need to be overcome with any type of relocation of the city. The first challenge is the short time line for planning, design, and construction. In the last 2 years (2009 and 2010), the lake has risen approximately 5 feet. If inflows to the lake continue as they have, many more structures will be in danger of flooding and many more residents could be forced from their homes. If this occurs prior to the establishment of the new relocation area, these residents may be forced to leave the city all together.

Another large concern with a relocation plan is that people who receive buyouts may choose to move to the relocated Minnewaukan or to other communities in the area. Without the support and commitment from existing residents in Minnewaukan, it will be hard to grow a new viable community.

The third challenge is the future of the school in Minnewaukan. If the school district receives the CDBG money it has applied for, it will have to decide in the near future where the school will be located. Because the school is close to the lake, construction of new facility will have to begin soon. The school superintendent did state that the district would like to keep the school in Minnewaukan but that decision will likely hinge on the city's long-term plans. The school board will likely have to decide prior to establishment and construction of a relocation area. If the school chooses to build in a different city or area it could have a huge impact on the city of Minnewaukan in terms of employment and the long-term viability of the existing city or a relocated Minnewaukan.

B. Next Steps

- Meet with the city of Minnewuakan to discuss the report and alternatives.
- Obtain city commitments and desire for phased or partial relocation.
- Obtain land agreements for relocation area.
- Work with Silver Jackets Program to bring in appropriate programs.
- Obtain funding sources and other available programs.
- Begin city planning, environmental impacts, cultural surveys, and engineering to refine costs and identify potential problems.

- Obtain information on which structures can be relocated or flood proofed and which should be demolished.

X. References

FEMA

Homeowner's Guide to Retrofitting, Six Ways to Protect Your House from Flooding, FEMA-312, June 1998

http://www.fema.gov/

Barr Engineering Company

Devils Lake Infrastructure Protection Study, Summary of Pervious Investigations of Devils Lake Features (Sections 2.1 through 2.25), January 10, 2003

U.S. Army Corps of Engineers, St. Paul District

Devils Lake Flood Risk Management Project, Design Criteria and Project Considerations Report, December 21, 2009

U.S. Army Corps of Engineers, Coastal Engineering Research Center

Shore Protection Manual (SPM), Waterways Experiment Stations, Second Printing, 1984

United States Department of Agriculture, Rural Development

http://www.rurdev.usda.gov/Home.html

U.S. Small Business Administration

http://www.sba.gov/index.html

U.S. Department of Housing and Urban Development

http://portal.hud.gov/portal/page/portal/HUD

Appendix A

City of Minnewaukan Inundation Map

Appendix B

City of Minnewaukan Embankment Alignment Map

Appendix C

Minnewaukan Complete Relocation with Future Expansion Concept Plan

Appendix D

Minnewaukan Phases 1 and 2

Appendix E

Cost Estimates

Appendix F

Cultural Resources Cost Estimates

A) Phase I cultural resources investigation of the proposed city relocation area (approximately 337 acres) (113 acres of the total of 450 acres has already been surveyed in connection with the Highway 281 reroute project)	$ 9,200.00
B) Phase I cultural resources investigation of the proposed embankment alignment (approximately 11,200 feet long by 250 feet wide)	$10,000.00
C) Phase I inventory and recordation of all standing buildings and structures in the city of Minnewaukan that are 50 years old or older	$10,300.00
D) Phase II evaluation of National Register of Historic Places eligibility of standing buildings and structures at Minnewaukan, 50 years old or older, to be relocated, flood proofed, or removed:	
$2,500 for 1st building plus $3,000 mob/demob and travel costs	$ 5,500.00
Each additional building add $2,000, so 5 buildings	$13,500.00
10 buildings	$23,500.00
15 buildings	$33,500.00
20 buildings	$43,500.00
E) Phase II evaluation of each prehistoric or historic archeological site	$20,000.00

F) Phase III mitigation for National Register listed or eligible buildings only which are to be relocated (measured drawings, large format photographs, and building history):

Benson County Courthouse	$45,000.00
Grace Episcopal Church	$25,000.00
Harriman House	$25,000.00
Each additional eligible building/structure	$22,000.00

G) Phase III mitigation for any archeological site determined eligible to the National Register – per site (varies by site size and depth) $100,000.00

NOTES AND ASSUMPTIONS:

A) Is needed for partial or total city relocation.

B) Is needed if alternative selected is embankment at city.

C) Is needed if partial or total city relocation. Is needed for those buildings in the embankment construction area if building an embankment is the alternative selected.

D) Is needed if partial or total city relocation. Number of buildings to be evaluated for National Register eligibility depends on results of C.

E) Is needed for each prehistoric or historic archeological site found in the relocation area during survey A or for each prehistoric or historic archeological site in the embankment construction area if that alternative is selected.

F) Is needed if partial or total relocation of city. Mitigation total depends on number of buildings determined eligible to the National Register under D. Mitigation up to 1 percent of the Federal funding for the project is 100 percent Federal cost, and then cost is shared.

G) Is needed if partial or total relocation of city. Mitigation depends on number of archeological sites determined eligible to the National Register under E. Mitigation up to 1 percent of the Federal funding for the project is 100 percent Federal cost, and then cost is shared.

Appendix G

FEMA Programs

Appendix H

Untied States Department of Agriculture (USDA) Rural Development Loans and Grants

Business Loans and Grants

The Business Program (BP) works in partnership with the private sector and the community-based organizations to provide financial assistance and business planning. BP helps fund projects that create or preserve quality jobs and/or promote a clean rural environment. The financial resources of BP are often leveraged with those of other public and private credit source lenders to meet business and credit needs in under-served areas. Recipients of these programs may include individuals, corporations, partnerships, cooperatives, public bodies, nonprofit corporations, Indian tribes, and private companies.

Cooperative Grants and Other Programs

The mission of Cooperative Program (CP) is to promote understanding and use of the cooperative form of business as a viable organizational option for marketing and distributing agricultural products. CP serves cooperative members, directors, management, educational institutions, organizations, rural residents, and all others with an interest in the cooperative form of business. CP strives to assist them to effectively use cooperatives to improve their economic well-being and quality of life.

Single Family Housing Loans and Grants

Single Family Housing Programs provide homeownership opportunities to low- and moderate-income rural Americans through several loan, grant, and loan guarantee programs. The programs also make funding available to individuals to finance vital improvements necessary to make their homes decent, safe, and sanitary.

Multi Family Housing Loans and Grants

Multi-Family Housing Programs offer Rural Rental Housing Loans to provide affordable multi-family rental housing for very low-, low-, and moderate-income families; the elderly; and persons with disabilities. This is primarily a direct mortgage program, but funds may also be used to buy and improve land and to provide necessary facilities such as water and waste disposal systems. In addition, deep subsidy rental assistance is available to eligible families.

Community Facilities Loans and Grants

Community Programs provide loans and grants and loan guarantees for water and environmental projects, as well as community facilities projects. Water and environmental projects include water systems, waste systems, solid waste, and storm drainage facilities. Community facilities projects develop essential community facilities for public use in rural areas and may include hospitals, fire

protection, safety, as well as many other community-based initiatives.

Electric Loans and Grants

Providing reliable, affordable electricity is essential to the economic well-being and quality of life for all of the nation's rural residents. The Electric Programs provide leadership and capital to upgrade, expand, maintain, and replace America's vast rural electric infrastructure. Under the authority of the Rural Electrification Act of 1936, the Electric Programs make direct loans and loan guarantees to electric utilities to serve customers in rural areas.

Telecommunications Loans and Grants

USDA Rural Development continues to provide many programs for financing rural America's telecommunications infrastructure. The Traditional Telephone Loan program consists of hardship, cost of money, and guaranteed loans that finance voice telephone service. The Broadband Access Loan program provides loans for funding the costs of construction, improvement, and acquisition of facilities to provide broadband service to eligible rural communities. The Distance Learning and Telemedicine program continues its charge of bringing electronic educational resources to rural schools and improving health care delivery in rural America. Lastly, the Community Connect Grant program provides financial assistance to eligible applicants that will provide currently unserved areas with broadband service that fosters economic growth and public safety services.

Water Loans and Grants

Water and Environmental Programs (WEP) provides loans, grants and loan guarantees for drinking water, sanitary sewer, solid waste and storm drainage facilities in rural areas and cities and towns of 10,000 or less. Public bodies, non-profit organizations and recognized Indian tribes may qualify for assistance. WEP also makes grants to nonprofit organizations to provide technical assistance and training to assist rural communities with their water, wastewater, and solid waste problems.

Community and Economic Development Programs

The CEDP administers programs and initiative that promote self-sustaining, long-term economic and regional development in rural areas. The programs demonstrate how every rural community can achieve self-sufficiency through innovative and comprehensive strategic plans developed and implemented at a grassroots level. The programs stress continued local involvement and decision making which is supported by partnerships among private, public and nonprofit entities.

Appendix I

Infrastructure Protection Study, Barr Engineering Company, Feature 4: City of Minnewaukan